BDA 412-03 | JANUARY 2020

POLYMERIC OVERLAY PROJECT CONSIDERATIONS

Reference: IDM 412-3.02 Bridge Deck Preservations Techniques and Considerations

BDA 100-02 Sample Bridge Plans – Bridge Thin Deck Overlay

Note: An example calculation for estimated construction duration is provided in a sample spreadsheet.

BRIDGE CONDITION CONSIDERATIONS

- Polymeric overlays (synonymous with thin deck overlays or epoxy overlays) are considered preventative maintenance, not rehabilitation. The intent of this treatment is to prevent the intrusion of chlorides into the bridge deck, not to mitigate existing chlorides.
- Bridge decks with existing spalls and/or delaminations greater than 5% of the deck area are typically not good candidates for polymeric overlays. Excessive, wide cracking may also be an indication that a rigid overlay is a better treatment, if feasible. The anticipated amount of deck patching cannot exceed 10% when the work is being performed as preventative maintenance, per INDOT's programmatic agreement with FHWA. The applicability of a polymeric overlay should always be coordinated with the district Bridge Asset Engineer.
- Surface milling and hydrodemolition are not performed with polymeric overlays. Therefore, chloride laden concrete will not be removed and any delaminations must be detected by sounding or other non-destructive testing methods.
- Partial or full depth bridge deck patching will be done using jackhammers and is more labor intensive than when hydrodemolition is utilized.
- Polymeric overlays are only 3/8" thick and can't be used to correct deficient cross slopes or other surface irregularities.
- Polymeric overlays are sensitive to moisture and shouldn't be used where water is anticipated to wick through cracks, such as bridge approach slabs or other slabs on grade.

CONSTRUCTION CONSIDERATIONS

- Polymeric overlays cure relatively quickly, which makes them suitable for short-term closures. However, construction times can be greatly affected by other activities and weather.
- When an overlay is being installed on a two-way road under phased construction, the preferred method of maintaining traffic is by use of portable signals. Flagging operations are discouraged as the typical construction duration will extend beyond one working shift and can exceed the amount of daylight hours in a day.
- Polymeric overlays must be installed only on concrete that has sufficiently cured. It's reasonable to assume that freshly poured conventional concrete will need to cure for at least 28 days prior to polymeric overlay installation.
- Rapid set cementitious materials can be used for partial depth patching. The overlay can be installed after the moisture content of the patches is below 5%, or 75% relative humidity. It's reasonable to assume that rapid set cementitious materials may be overlaid after 2 days of curing, and possibly as early as 24 hours after placing the patch.

- Polymeric overlay material can be used for partial depth patching up to about 2.5" thick. This patching can be done immediately prior to the overlay installation. Patching to depths greater than 2.5" with polymeric overlay material should be avoided as excessive heat is generated at those depths that can negatively impact bond strength and result in reflective cracking.
- Bridge decks must be completely clean and free of contaminants such as paint lines and asphalt prior to overlay installation. There is often asphalt within the bridge deck tines that will need to be removed by hand grinding, which is a time consuming operation.
- Installing polymeric overlays within a roadway resurfacing project may result in equipment tracking asphalt materials across the bridge decks. It's critical that all contaminants are removed from the bridge deck prior to overlay placement. This may require multiple phases of cleaning and surface preparation.
- Polymeric overlays that are constructed in phases should allow for approximately 3 ft. of overlap between the phases. The free edge of a polymeric overlay is typically not constructed as a perfectly straight edge, and the subsequent phase will need to slightly overlap the previously constructed phase. This means that the temporary traffic control devices will need to shift approximately 1 ft. plus the width of the device between phases.
- Polymeric overlay material can be used to repair minor spalling at IA joints. However, it's critical that the joint is saw cut and sealed after the overlay has sufficiently cured. Spalling deeper than 2.5" should be repaired using other materials.
- Bridge expansion joint repair or replacement typically involves some amount of nosing work. Similar to bridge deck patching, sufficient cure time will need to be provided prior to overlay installation. Bridge joints or raised pavement markers that are not being replaced as part of the contract should be taped over to protect them from the overlay material.
- Moisture testing is currently specified as ASTM D4263, which requires a plastic sheet to be taped to the bridge deck for 16 hours in order to make a qualitative determination on the presence of moisture. This is typically done on the shoulders so that traffic can remain on the bridge during the 16 hour period.

CONSTRUCTION SEQUENCE

1. **Sounding and Patching Deck**
    a. Duration – Varies based on amount of delaminations and patch cure time. It's reasonable to assume a typical deck can be sounded by chain drag at a rate of 5,000 SFT/hr. Rapid set patching materials should be used where closure time is critical. It's reasonable to assume that 100 SFT of patches can be made in an 8 hour shift. The bridge can be opened to traffic once the patches have cured, which is typically 2 hours after placement.
    b. Patching – Polymeric overlay material can be used for shallow partial depth patches. However, patch depths greater than 2 ½ inches should not be performed using polymeric overlay material, as the material generates excessive heat during the curing period which can result in poor bonding and reflective cracking. Using polymeric overlay material for partial depth patches is also expensive due to the cost of the material.

(Chain drag. Image retrieved from https://fhwaapps.fhwa.dot.gov/ndep/DisplayTechnology.aspx?tech_id=16)

2. **Moisture Testing prior to overlay placement**
    a. Duration – ASTM D4263 requires the plastic sheet to remain taped to the surface for 16 hours. This test may be performed on the shoulders in order to maintain traffic on the deck during the test.
    b. Contractors will often use hand held qualitative moisture meters to obtain quick readings of moisture content. The industry standard for acceptable moisture content is less than 6%.
    c. As a rule of thumb, if it hasn't rained in the 24 hours prior, a bridge deck will likely have sufficiently low moisture content by mid-morning.
    d. Moisture content can vary based the location on the deck. Readings should be taken in shaded areas adjacent to concrete bridge railings.

(ASTM D4263 moisture test. Image retrieved from http://www.astmd4263.com/)

3. Shot Blasting and Surface Preparation

a. Duration – Approximately 10,000 SFT to 40,000 SFT of bridge deck can be shot blasted in an 8 hour shift, with higher production rates requiring additional costs due to multiple crews and larger equipment. After shot blasting, hand grinding is required adjacent to bridge railings where the shot blasting equipment can't access. Hand grinding is also required to remove any contaminants that remain after shot blasting. There will often be asphalt within the bridge tines that requires removal by hand grinding. It's reasonable to assume that hand grinding can be performed at a rate of 2,000 SFT/hr on the gross deck area, or 200 SFT/hr based on actual locations requiring hand grinding, beginning after the completion of shot blasting. Hand grinding may be started immediately after shot blasting, so this activity may be started before the entire deck has been shot blasted. The work area on the bridge must remain closed to traffic from the beginning of shot blasting until the final coat testing.

b. On larger bridges, it's possible to begin the test patches and the installation of the overlay behind the surface preparation. However, it's critical that the surface preparation be completed sufficiently far ahead of the overlay so that the installation of the overlay isn't delayed due to surface preparation. This could result in an unwanted transverse cold joint in the overlay. Cold joints are acceptable provided they're constructed properly and preapproved by the Engineer.

c. Surface roughness testing currently requires the use of International Concrete Repair Institute (ICRI) roughness chips to compare the prepared deck roughness to the required roughness level of 5 through 7.

(Shot blasting. Image retrieved from https://shotblastinc.com/shot-blasting-uses/)

(Insufficient shot blasting – surface remains smooth and tines are present)

(Correct shot blasting – rough surface and tines removed)

4. **Test Patches**
    a. Duration – The time required to perform the test patches varies greatly based on deck temperature, as shown on the cure time table of the RSP. It's reasonable to assume that the test patches will require 12 hours to perform during normal construction temperatures.
    b. 1 1/2 ft by 3 ft test patches are required for every span and every 600 sq yds, whichever is smaller. For overlays constructed in multiple phases, the test patches are only required on the initial phase.
    c. The RSP requires the test patches to be performed in the wheel paths and the same equipment that will be used for the final application is required to be used for the test patches.

(Test patch and pull-off testing prior to overlay installation)

5. **Application of Overlay**
    a. Duration – It's reasonable to assume that each lift can be placed at a rate of 2,000 SFT/hr to 7,500 SFT/hr, with higher production rates requiring additional costs due to multiple crews and larger equipment. The second lift will have a slower production rate than the first due to the additional epoxy thickness and application of the aggregate. Each lift is required to be cured for the minimum times listed on the RSP, which vary based on deck surface temperature. It's reasonable to assume that the first course will require 2 hours to cure and the second course will require 3 hours to cure, not including application times.
    b. The overlay is required to be installed within 24 hours following the shot blasting and surface preparation.
    c. If a deck has cooled during the night to a temperature below the dew point, moisture will form on the deck and the overlay cannot be placed until the deck is sufficiently dry.
    d. The minimum required quantity of epoxy applied at each course is specified on the chart given in the RSP and should be monitored throughout the application.
    e. Polymeric overlays are not allowed to be installed between October 15 and April 1. The air temperature is required to be between 55°F and 90°F, and the deck temperature must be between 60°F and 100°F at the time of application.

(Application of first course, second phase)

(Application of second course, second phase)

6. Final Coat Testing

a. Duration – The pull-off tests are required to be performed after the second course has cured and the excess aggregate has been removed, but cannot be performed when the deck surface temperature is above 90°F. It's reasonable to assume that each pull-off test will require approximately 10 minutes to make the cores, 30 minutes to 1 hour for the adhesive to cure, and 10 minutes to perform the pull-off test. A minimum of one test per 75 ft is required for each 24 ft width of deck. The total time required for final coat testing can be estimated as 20 minutes times the number of tests, plus 60 minutes of curing time. Damage from the testing is required to be repaired using the same epoxy and aggregate as the overlay.

b. Failing pull-off tests will require overlay removal and replacement to the extents of the failing test locations.