

15.1 Non-Skid Polymer Wearing Surface - General

Resurfacing concrete bridge decks with a non-skid polymer wearing surface consists of repair of the bridge deck and the application of the thin, flexible, multi-layered polymer bound aggregate surface. The purpose of this repair is to waterproof the concrete bridge deck, restore skid resistance, and provide a smooth riding surface.

- The Bridge Inspector must ensure that proper traffic control is in place prior to work commencement.
- The prepared surface should be clean, dry and free of foreign materials.
- Multiple layers of polymer are applied to ensure that the concrete deck is sealed.
- A broom and seed method of application is used to achieve the polymer-aggregate composite.
- A fine aggregate is seeded onto the polymer to reduce the potential for shear failure caused by differences in thermal expansion between the polymer and the concrete deck, and to provide skid resistance, protect the membrane from UV and provide durability.
- Application conditions are crucial to its success or failure due to the sensitivity of the product.
- Stable weather conditions with calm to light winds must exist prior to and during polymer application.
- There must be adequate manpower to successfully complete a pour section without interruption. Larger structures may require a number of pour sections.

15.2 Environmental Constraints

Be aware of the following environmental concerns:

- Concrete chipped from partial and full depth repairs must not be allowed to fall into the water channel.
- Ensure sandblasting operations meet all environmental requirements.
- Excess seed aggregate and debris must not be blown into the water channel.
- Before acceptance of the surface preparation and final payment the Contractor must remove and dispose of all waste material from site.

15.3 Safety

There are many safety concerns involved with polymer overlay/membrane projects. It is ESSENTIAL to have a pre-job meeting with the Contractor to discuss all the safety issues involved.

Refer to the Alberta's Occupational Health and Safety Regulation, General Safety Requirements for specific approval safety requirements:

- Part 3 Health and Safety Plan
- Part 4 Hazard Assessment, Elimination and Control
- Part 12 Lifting and Handling Loads
- Part 15 Personal Protective Equipment
- Part 16 Powered Mobile Equipment
- Riding on tailgate of truck is strictly prohibited.
- Issue "STOP WORK" order to the Contractor if necessary.

Traffic Control

The Contractor shall supply, install and maintain all necessary signing, flagging, flashing arrow boards, traffic control lights, barricades, temporary medians and other warning or traffic control devices as may be required for the safety of the public, inspection staff and Contractor's personnel.

- The traffic control plan must be submitted to the Bridge Project Engineer for review and comment two weeks prior to the pre-construction meeting.
- The Bridge Inspector must ensure that proper traffic control is in place prior to work commencement.
- The traffic control plan will be adjusted as necessary to accommodate the traffic conditions.
- The Contractor is responsible for monitoring and maintaining the traffic control devices at all times while traffic restrictions are in effect.

15.4 Preliminary Work

The Contractor shall submit to the Bridge Project Engineer a proposed schedule and work plan addressing the following:

- Crew size and number of working hours.
- Deck layout diagram including dimensions, batch sizes and calculations.
- Traffic accommodation plan when required.
- Equipment and material being used.
- All materials to be used must be approved by the Bridge Project Engineer.

15.5 Surface Preparation

Proper surface preparation is ESSENTIAL to ensure adequate bond strength between the polymer surface and deck concrete. Acceptability of the surface preparation will be determined by the vertical axis pull test. This test consists of bonding a 64 mm diameter sandblasted steel disk to the prepared substrate by using a fast setting epoxy, and pulling it from the substrate by applying a vertical pulling force. Substrate preparation will not be approved unless at least 75% of the bonded steel disk surface has retained substrate concrete.

- The deck surface should be prepared by shot blasting to remove all bond inhibitor such as concrete laitance, and to expose the coarse aggregate in the substrate concrete.
- Those areas inaccessible to shot blasting, such as the vertical face of the concrete curb should be prepared by sandblasting.
- The prepared areas shall be re-blasted in the event of rain.
- The deck is accepted as adequately dry when there is no evidence of moisture, as determined by the "Plastic Window Test".

15.5.1 Crack Repairs and Deck Patching

The extent of deck concrete removal required during deck repair will be dictated by the degree of concrete deterioration encountered. It could vary from simply sealing a crack, to total removal and replacement of an area of deteriorated concrete.

- The deteriorated concrete areas required repairs shall be determined by chain drag or other approved methods.
- The amount of concrete removed depends on the degree of deterioration.
- Concrete must be removed completely around any exposed reinforcement steel.
- Exposed rebars must be sandblasted.
- All areas to be repaired must be clean and an approved bonding compound applied to the concrete surface immediately prior to concrete placement.
- Replacement concrete must be properly consolidated.
- Deck cracks must be treated with a 100% solids silane sealer prior to shotblasting the concrete deck.
- The sealer may require up to 6 hours of drying time before applying the first layer of polymer overlay.

15.6 Batching and Mixing of Polymer

The Contractor's batching operation must be calibrated each day prior to production. Methods of batching may be either by static mixer or by premeasuring each polymer component in calibrated pails.

15.6.1 Static Mixer

When calibrating by static mixing heads, the polymer components may be deposited into two separate measuring containers, each equipped with marks for a given volume, which is time related.

- One of the material components is drawn from a disconnected feed upstream of the static-mixing head while the other is drawn downstream of the pump.
- The calibration is only approved if the quantities of each component drawn correspond to that of the manufacturer's recommendation.
- The calibration must be repeated if the change in temperature of the polymer component exceeds 5° C.

15.6.2 Pre-measured Containers

Calibration may also be achieved by measuring each polymer component by using marked pails.

- Water is used to calibrate the measuring pails.
- The calibration required on the pails is marked with four screws.

The following points should be noted when batching the polymer for deck overlay:

- Fill polymer components in the respective container to the permanent mark.
- Pour polymer components into the first mixing pail and mix thoroughly according to the manufacturer's specified time.
- Transfer mixed polymer into second mixing pail for further mixing.
- Mixing time shall not be less than 3 minutes.
- Each component shall be measured to an accuracy of +/- 3% and mixed batches shall not exceed 20 litres.

15.6.3 Application of Polymer Resin

The polymer must be applied in accordance with the manufacturer's instructions, otherwise failures such as, improper gelling of the polymer, poor bond or thermal incompatibility may occur. It should also be noted that a change of deck temperature may cause out-gassing and in-gassing which results in undesirable "pinholes".

- To avoid out-gassing and in-gassing, application of the first layer shall be done during dropping deck temperatures.
- The polymer shall be spread uniformly over the pre-measured areas using a squeegee and obtaining the required depth. Spiked footwear will be permitted but only prior to gelling of the polymer.
- Spreading and leveling of fresh polymer should be completed within seven minutes of batching.
- All cold joints should be offset 100 mm from cold joints of the previous layers.
- The first layer should extend up the concrete curb or parapet face as specified.

- The longitudinal joint should be overlapped 150 mm between the first half and the second half of the overlay for each layer.
- Aggregate should be seeded uniformly into fresh polymer before gelling.
- All deficiencies should be satisfactorily repaired.
- After curing of each seeded layer, the excess aggregate should be swept and collected into old bagging for calculating of sufficient quantity of aggregate seeded.
- Application of each layer of the polymer should be done in accordance with the manufacturer's specification.
- Anchoring of overlay edges may be required for polymer wearing surfaces.
- Rough spots exceeding 3 mm in height will be ground to provide a smooth transition.

15.7 Bridge Inspector's Record

- Record all the discussions and the arrangements between the Contractor, manufacturer and the Bridge Inspector pertaining to the project.
- Fill out the polymer overlay/membrane daily report.
- Record all the survey and the calculation data.
- Record all the signage pertaining to the project.
- Check the Contractor's calculation of batch sizes and calibration.
- Record the air, deck concrete and polymer temperatures.
- Record the locations of daily pours.
- Record and label the samples of resin and cubes taken for testing.
- Record the defect areas to be repaired after inspection.

15.8 Weather

Polymer overlay work must be done in suitable weather conditions. Mixing and placing of polymer shall be done at ambient air temperatures between 5°C and 27°C.

15.9 Sealing of Concrete Gutters (Polymer Membrane Only)

Sealing of the concrete gutter is required where a paving lip is present. An approved epoxy sealer should be applied to the concrete gutter in two applications.

- The concrete surface shall be lightly sandblasted, cleaned and dried prior to sealing.
- The rate of the first application is 0.38L/m^2 , while the second application is 0.16L/m^2 .

15.10 Checklist**15.10.1 Bridge Inspector's Responsibilities**

- Review the specifications and the Special Provisions.
- Ensure that all the materials to be used have been approved by the Bridge Project Engineer.
- Chain drag, hammer sound and mark the delaminated areas.
- Survey the patching areas for quantities.
- Check the Contractor's deck diagram and calculations.
- Ensure that the deck surface is dry prior to pour and patch repairs.
- Check the signage daily.
- Seal the transverse cracks with silane sealer.
- Monitor the mixing stage of polymer and check mixing pail calibration.
- Monitor air, deck and polymer temperatures.
- Monitor moisture of deck.
- Make cube specimens for compressive strength testing.
- Perform a pull test for bond strength as required.
- Fill out the daily report.
- Check pinholes after first lift (membrane ACP only).

- Conduct final inspection prior to the Contractor moving off site.

15.10.2 Bridge Project Engineer's Responsibilities

Discuss the following items with the Contractor and the Bridge Inspector.

- Schedule
- Environmental constraints
- Traffic control
- Material approvals
- Polymer application procedures
- Repair proposals
- Final site clean up and acceptance

SECTION 15

NON-SKID POLYMER WEARING SURFACE



15-1 Deck surface preparation



15-4 Mixing



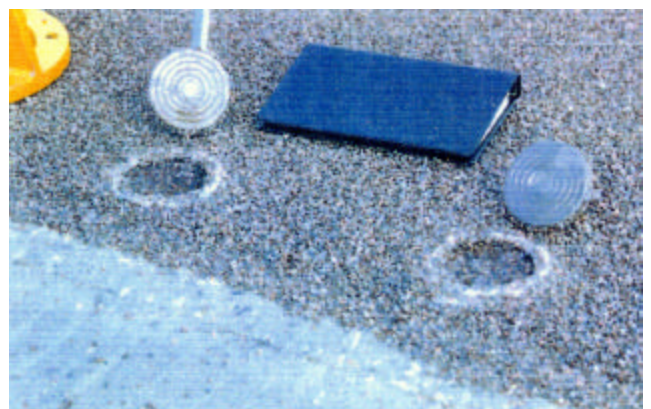
15-2 Partial depth repair



15-5 Applying polymer and seeding aggregates



15-3 Sealing deck cracks



15-6 Pull test