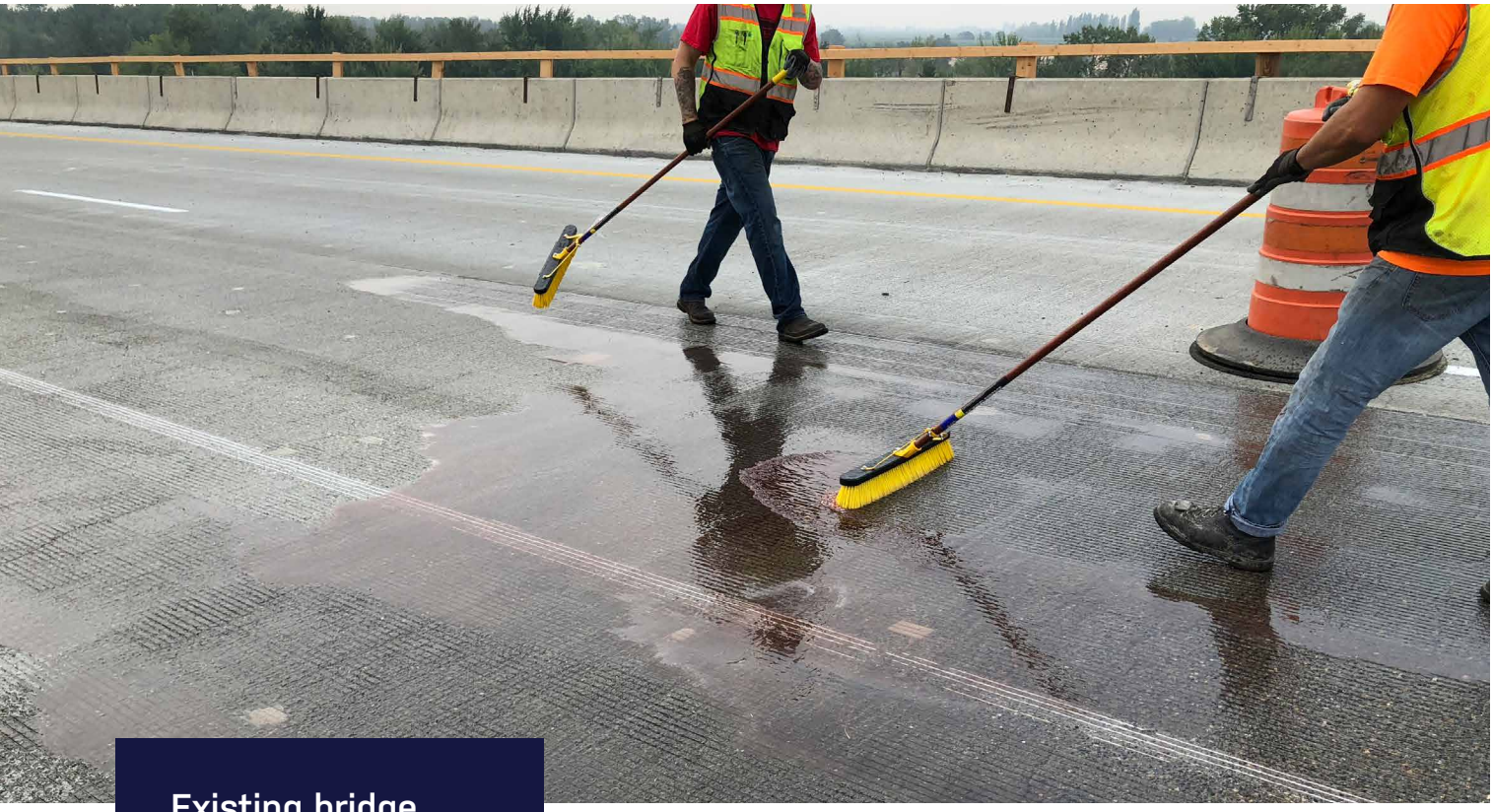
BRIDGE REHABILITATION IN THE PACIFIC NORTHWEST:

Considerations & Challenges for Overlay Material Selection & Design

KWIKBOND POLYMERS

Bridge rehabilitation in the Northwest region of the United States faces several significant challenges reflecting the unique characteristics and environmental conditions of the area.



Existing bridge conditions in this region include:

AGING BRIDGE INVENTORY

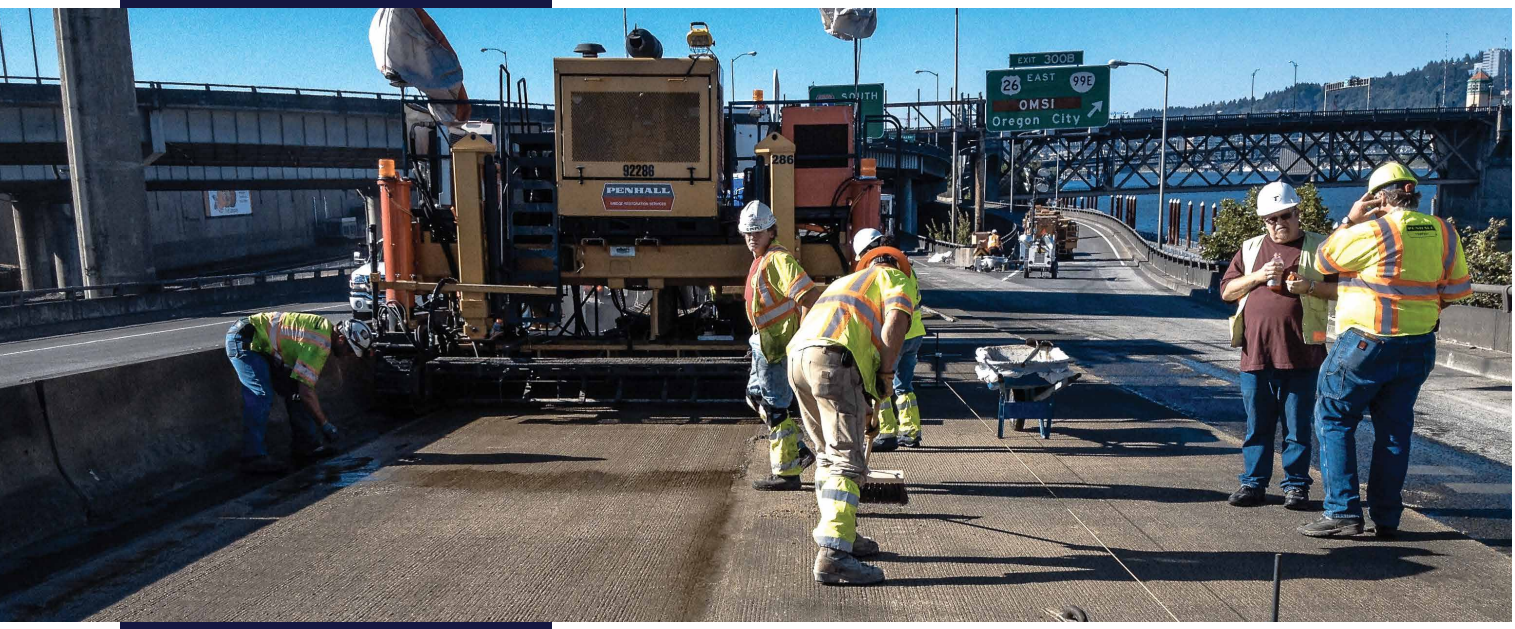
Many structures are coincidentally nearing the end of their service life. The longer a bridge has been in service, the more deterioration is present while continuously being exposed to the elements, winter treatments, and traffic abrasion.

INITIATING AND ACTIVE CORROSION

Exposure to chlorides, moisture, and oxygen through permeable existing normal-strength concrete decks coupled with a reduction in pH due to carbonation leads to increased corrosion potential and active corrosion environments.

HARSH WEATHER CONDITIONS

The Northwest is known for its harsh weather conditions, including heavy rainfall, snowfall, and coastal exposure. These conditions accelerate the deterioration of bridge materials leading to corrosion and structural damage. Frequent maintenance and repairs are necessary to counter these effects.



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AGGRESSIVE WINTER TREATMENTS

Locations with harsher weather, like in the Pacific Northwest, are more likely to experience active corrosion earlier and more frequently. The permeability, diffusion, and migration coefficients of the overlay and the selected repair materials play a larger role in the repair or preservation activity outcome than in areas with less aggressive winter treatment schedules.

STRUCTURAL FATIGUE

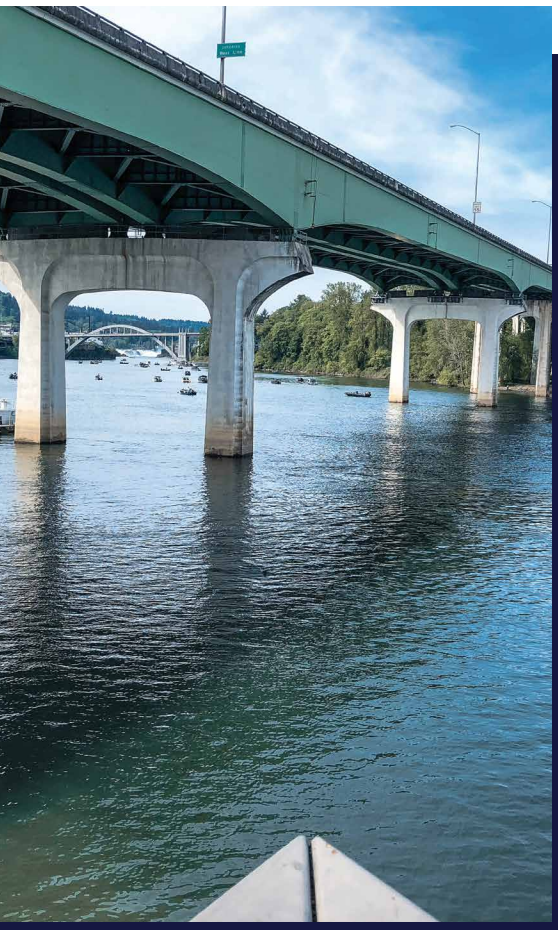
Decades of live load cycles by vehicular traffic lead to a gradual decrease in stiffness over time. This decrease in stiffness impacts load rating, moment capacity and the fatigue of the underlying structure. Reinforced concrete sections that have experienced plastic deformation from fatigue loading are also more likely to exhibit cracking and spalling on the top surface due to excessive movement and stress. These cracks and spalls become pathways for chlorides and moisture, further accelerating deterioration.

WHEEL PATH WEAR

High-traffic areas and routes with a high % of truck traffic wear more quickly over time in the wheel path, leading to undesirable ride quality, poor water dispersion, and low skid numbers from polishing. Routes that permit studded tires and chains during winter months are especially prone to accelerated wear in the wheel path.

PERCENT PATCHING

Greater degrees of deterioration in a bridge deck mean deeper and larger patches by area. Effective rehabilitation design requires not only proper material selection for the patching activity itself but also that the patching materials selected are compatible with the final overlay treatment.



SURFACE CRACKING

Various mechanisms contribute to concrete cracking, and they all fall into two categories – moving and non-moving cracks. Non-moving cracks, which are generally the result of curing shrinkage during initial construction, allow chloride and moisture ingress over time and must be addressed for long-term service life. Moving cracks are often the result of fatigue loading and will continue to deteriorate unless an overlay with a complementary sealer is placed over top.

MULTI-GENERATION OVERLAY TREATMENT

Bridges with existing overlays approaching the end of the service life of the overlay itself require special attention and unique solutions as compared to bare decks without an overlay currently installed. The Condition State and Defects of the existing Wearing Surface Bridge Management Element (BME) must be considered in tandem with the Condition State of the existing Deck/Slab National Bridge Element (NBE) to identify the best materials and designs for a potential solutions comparison to be made.

DEAD LOAD RESTRICTIONS

Bridges built to outdated standards are less poised to accommodate additional dead load than those built to current standards. In addition, phantom future 2" wearing surface design requirements impose unnecessary dead load restrictions on the designer.

REBAR HEIGHT

The top surface clear cover on existing bridge decks is often less than the current standard and frequently varies in actual conditions. Insufficient clear cover makes cracking and spalling more likely to occur. In general, the less clear cover the more likely and readily an issue like cracking and spalling will present itself.

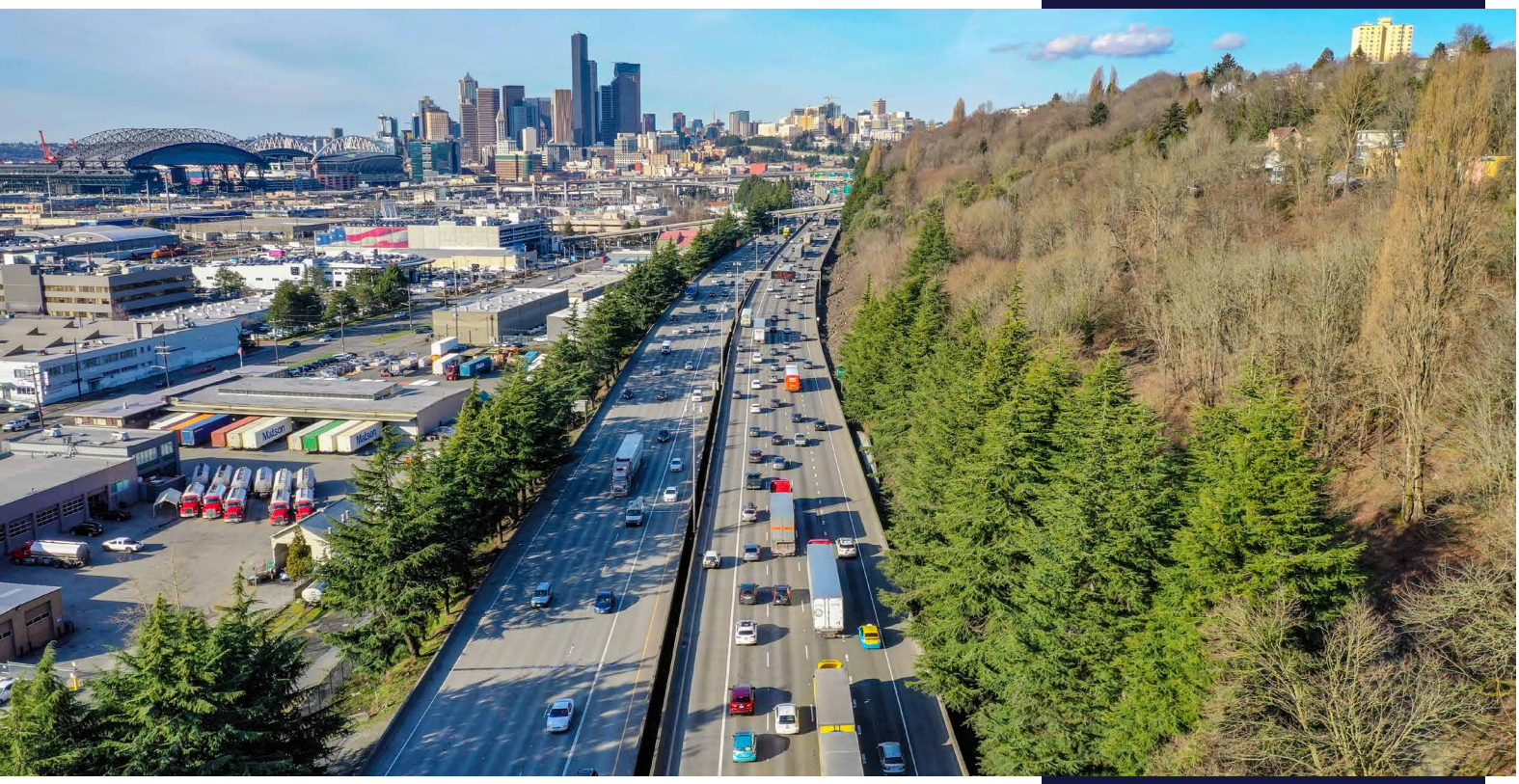
Overlay surface preparation by removal of existing material must consider depth to rebar, which can limit the method of removal selected in the design. It is well known that some removal methods are more suited to certain types of overlay treatments than others.

DECK THICKNESS

Reinforced concrete section thickness plays a major role in the overlay design and material selection process. Thicker decks depend less on the structural contribution of the overlay itself to the thickness of the deck than thinner decks. Overlays that contribute properly to the thickness of the deck must have sufficient composite action. On one hand, an overlay selected for its mechanical properties may not exhibit adequate composite action over time. On the other hand, an overlay material that reliably provides composite action might feature different and unique mechanical properties than are typical for more traditional material types. The final design often balances a variety of considerations made for strength, stiffness, allowable strain, and bond line integrity among other factors.

FRICTION DEMAND

Every overlay treatment type offers varying degrees of friction, water dispersion, ride, noise, and appearance characteristics. Each project benefits from different texturing methods depending on the conditions of that unique structure and location.



ENVIRONMENTAL REGULATIONS

The Northwest is home to ecologically sensitive areas, including rivers, lakes, and wetlands. Restoration projects must adhere to strict environmental regulations to minimize the impact on these ecosystems.

This often involves careful planning and eco-friendly construction techniques and materials. While the overlay materials are often important, the removal method often has the greatest environmental impact. Milling, hydro demolition, shot blasting, sand blasting, water saturation, and blowing off with compressed air all impact the environment in different ways and varying degrees ranging from water containment and treatment to construction noise and air quality.

THE KWIK BOND SOLUTION

To address these challenges, bridge rehabilitation projects in the Northwest require:

- Careful planning and collaboration between government agencies and engineering firms.
- A commitment to using innovative materials and techniques that can withstand the region's unique environmental conditions.

Additionally, a long-term vision for infrastructure maintenance and funding is essential to ensure the safety and functionality of the region's bridges.

ABOUT KWIK BOND POLYMERS

Kwik Bond Polymers offers proven solutions for your bridge project's preservation and rehabilitation requirements across the US and Canada. Our cutting-edge products significantly reduce downtime enabling a rapid return to traffic within just two hours. Enhance the durability of your bridge under various service conditions thanks to our outstanding impermeability and exceptional wear resistance. Elevate your bridge project with Kwik Bond Polymers.

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