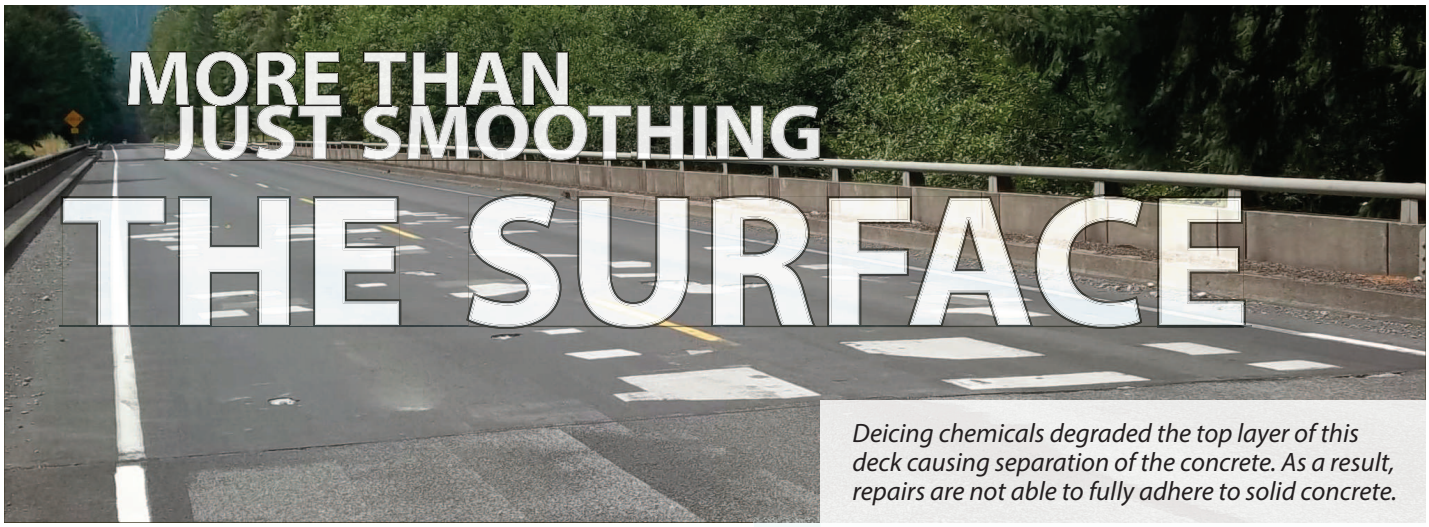
February, 2016

Bridge Notes

BRIDGE DECK REHABILITATION:



Deicing chemicals degraded the top layer of this deck causing separation of the concrete. As a result, repairs are not able to fully adhere to solid concrete.

While bridge deck rehabilitation results in smoother road sections, the primary objective is to ensure the deck supports and distributes loads to the structure. Also in combination with the wearing surface, a deck provides a protective cover sealing out moisture and debris.

ODOT maintains over 2,700 bridges and culverts with more than 38,000,000 square feet (sf) of deck. Over time, just like roadways, bridges deteriorate due to weather, studded tires, and heavy loads triggering maintenance needs for wearing surfaces and/or decks. Also, the steel reinforcement in concrete decks is susceptible to corrosion caused by deicing chemicals and marine salt spray.

Full depth failure on an I-84 bridge built in the 1950's. The failure occurred due to the deck being too thin and having insufficient reinforcement for modern truck loads.

Q | How do we determine which bridges need a deck project?

A | Bridges are inspected a minimum of every two years to monitor the conditions and to identify any maintenance issues. The inspections include checking all deck elements for distresses including concrete spalls, exposed steel reinforcement, cracking, corrosion, and other types of deterioration depending on whether the deck is concrete, steel or timber.

The amount of distress and severity, ranging from *Good* to *Warrants Structural Review* is recorded. If the distress is *Warrants Structural Review*, further steps are taken to ensure that the bridge condition does not pose a safety hazard. As part of the inspection, the Bridge Inspector may identify maintenance recommendations for Region Bridge Crews.

Potential Major Bridge Maintenance (MBM) and rehabilitation projects are also identified using the inspection data by investigating bridges with a significant quantity of elements in poor condition.

Q | What's involved in deck rehabilitation?

A | Deck rehabilitation can range from simply applying a sealing product to keep moisture out, to a deck overlay with localized repairs, or a complete deck replacement. All projects include equipment mobilization, traffic control, and material costs.

The engineering design balances the need for repair of the bridge with the needs of the traveling public. Sometimes specialized products are required for high traffic areas where an overlay needs to be constructed and the bridge re-opened to traffic within hours.

Full depth repair to I-84 bridge deck in January 2016. The deck required similar repairs in May 2015. It is currently programmed for replacement.

Q | How important is timing?

A | To prolong the service life of a bridge, major deck work should be done every 20 to 30 years, similar to replacing the roof of a house. The actual driving surface may need more frequent attention.

Delaying deck work can lead to accelerated deterioration, triggering an increase in the risk of localized failures that impact traffic and increase deck rehabilitation costs. Extensive delays can result in a "leaky deck", allowing water to move through to the bridge superstructure resulting in corrosion or other distress, much like a leaky roof letting water into an attic.

Underside of a "leaky deck" showing corrosion resulting in concrete spalling and exposed rebar.

Q | Are we keeping up with bridge deck rehabilitation?

A | Assuming a deck requires major rehabilitation about every 30 years, we should rehabilitate about 1,270,000 sf of deck a year (38,000,000 sf deck/30 years). Unfortunately, bridges require other rehabilitation like strengthening, scour protection, crack repair, rail replacement and joint repairs that may take precedence so only a portion of the Bridge Program budget is spent on decks. Starting from 2013, looking forward to what is programmed -- we are addressing about 270,000 sf of deck a year; about 21% of the need.

Are we keeping up? No. Fortunately, we are able to keep our bridges in reasonable condition addressing the most critical needs and doing spot repairs. However as the bridges continue to age, it is inevitable deterioration will continue and most likely accelerate. The Bridge Program is managed as efficiently as possible to keep the bridges in fair condition and to keep them safe and drivable; however, the list of critical needs will continue to increase as the bridge inventory ages. Not being able to address the bridges will lead to rough riding surfaces, increased repair costs, and the need to load post more bridges.

Resources

- ODOT Bridge Section 2015 Bridge Condition Report
- ODOT Bridge Inspection Coding Guide

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