RESEARCH
Oregon Department of Transportation

Research Notes

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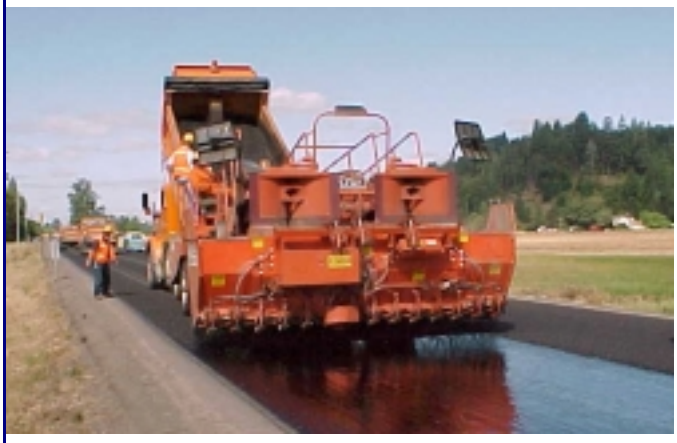
Asphalt Cement Chip Seals – How Have They Done?

Chip seals are a standard pavement preventive maintenance treatment. Most chip seals use an asphalt emulsion for the binder, but on higher volume or higher speed roads, a period of traffic control (flaggers and pilot cars) is needed to minimize chip loss on a newly applied chip seal.

Would asphalt cement chip seals do a better job of protecting the road surface? In 1999, the Oregon Department of Transportation (ODOT) joined with Lane, Clackamas, Deschutes and Lincoln Counties to find out if asphalt cement (*hot oil*) chip seals would perform better and reduce the time required for traffic control after the treatment.



Applying Asphalt Cement Chip Seals

The county road maintenance departments applied the asphalt cement chip seals on two state highways and five county roads. On the state highway sections, ODOT paid for materials and provided traffic control. ODOT's Research Group documented the construction practices, marked sites for ongoing monitoring, and reported on the early performance of the seven sections in the report, *Asphalt Cement Chip Seals in Oregon*. The report also includes best practices for materials, equipment and construction.

Inspections show that these chip seals are still functioning well. This research note presents the performance to date on the two state highway sections:

- ORE 126, MP 13.0 - 16.4 and MP 26.0 - 31.2, in Lane County east of Springfield
- US 101, MP 129.0 - 130.2, in Lincoln County south of Depoe Bay

Inspections in 2001

The chip seals were inspected in September 2001, approximately two years after construction. Chip loss and bleeding were the main focus of the inspection. Bleeding results from excess asphalt binder migrating to the surface, which reduces pavement friction and thus, the skid resistance of the road surface. The percent of roadway surface affected by bleeding was measured, along with an estimated percentage of chips retained. Average values for chip retention and bleeding are presented in the table below:

Highway or Road Name	County	Chip Retention (%)	Bleeding (%)
ORE 126 (1)	Lane	85	50
ORE 126 (2)	Lane	90	40
US 101	Lincoln	98	2

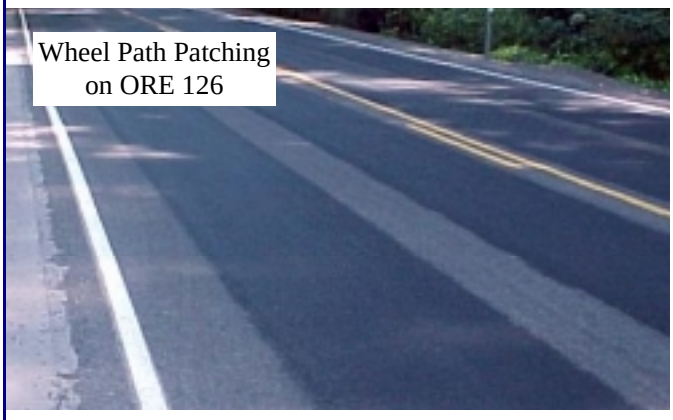
(1) MP 13.0-16.4, (2) MP 26.0 - 31.2. Does not include sections with wheel path patching, between MP 29 and 31.

On ORE 126, the chip seal at MP 13.0-16.4 had more bleeding and chip loss on the western end of

the project. Between MP 13 and MP 14.5, bleeding was extensive and chip retention was about 80%. Bleeding decreased after MP 14.5, while the chip retention increased to 90%. There were also a few small patches throughout the project. Some chip loss was also noted on the curves.

Chip loss in curves on ORE 126 (MP 26-28.5)

The second ORE 126 project beginning at MP 26 had 90% chip retention for most of the project. Bleeding was higher on the western part of the project from MP 26 to 28.5. The eastern section, from MP 29 to 31.2 had many wheel path patches. Most of the chip loss occurred in the curves.



Wheel Path Patching on ORE 126

On the US 101 chip seal, bleeding was minimal. Chip retention was also very good through most of the 1.2-mile chip seal section, except for some isolated spots under canopy shade and in the curve sections.

US 101 Looking North at MP 129.7

Skid Resistance Testing

Skid resistance of the asphalt cement chip seals was measured three times after construction, using the ODOT skid trailer test (ASTM E 274-90). Within each chip seal section, all measurements were above 37. In Oregon, a skid number less than 37 at 64.4 km/hr (40 mph) indicates that the pavement should be evaluated for potential skid resistance issues.

The skid numbers increased from September 2001 to March 2002. The increase can be attributed to a reduction in the amount of bleeding at the pavement surface. Loss of the excess binder at the surface, coupled with good chip retention, has resulted in an increase in skid resistance. The results of skid testing, with the mean skid number value for each section, are provided in the table below:

Skid Numbers
(Mean values for each section)

Section	Nov-99	Sep-01	Mar-02
EB ORE 126 (MP 13-16.4)	47	44	56
WB ORE 126 (MP 13-16.4)	51	43	54
EB ORE 126 (MP 26-31.6)	53	51	57
WB ORE 126 (MP 26-31.6)	53	51	57
NB US 101 (MP 129.0-130.2)	51	52	56
SB US 101 (MP 129.0-130.2)	53	49	54

March 2002 Inspection

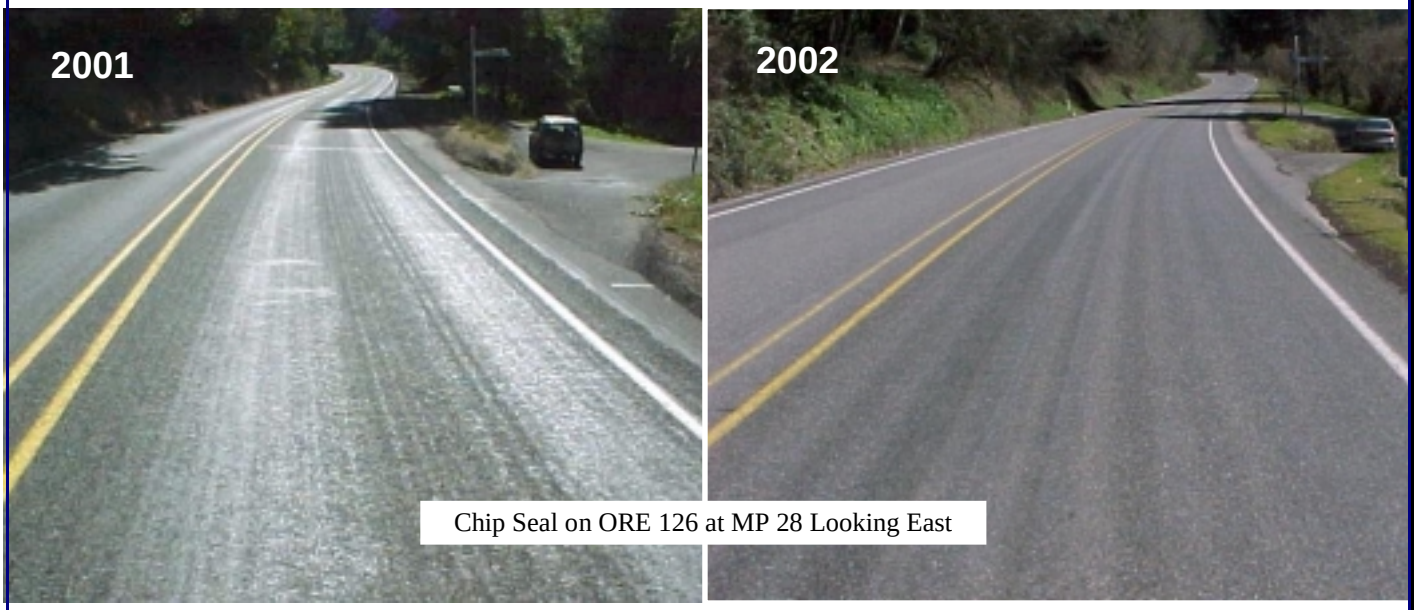
This March, a follow-up inspection found chip loss about the same, but bleeding was much less visible. In the pictures below, the left picture shows excess asphalt in the wheel path on ORE 126 in September 2001. The right image is the same location in March 2002; it shows significantly less bleeding.

On US 101, chip retention remains very high, estimated at 90% for most of the project length.

Conclusion

The asphalt cement chip seals have performed reasonably well since constructed in 1999. They remain a viable preventive maintenance option on roads where traffic impacts need to be minimized. Because the chips embed quickly, traffic may be allowed on the sealed pavement sooner than on an emulsified asphalt chip seal.

However, as was documented in the construction report, asphalt cement chip seal construction is more art than science. Initial application rates of asphalt and chips are based on prior experience, and may require adjustments based on actual field conditions.



Chip Seal on ORE 126 at MP 28 Looking East

For copies of the construction report "Asphalt Cement Chip Seals in Oregon," or for more information on research in this area,

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http://www.odot.state.or.us/tddresearch/