

Pavement

**NOVEMBER 2014**

**Project Title:**

Surface Treatment Macrotexture  
and Bicycle Ride Quality

**Task Number:** 2550

**Start Date:** February 4, 2013

**Completion Date:** March 3, 2014

**Product Category:** Improved technical  
standard, plan, or specification

**Task Manager:**

Joe Holland  
Senior Research Engineer  
[t.joe.holland@dot.ca.gov](mailto:t.joe.holland@dot.ca.gov)

## Effect of Pavement Surface Treatments on Bicycle Ride Quality

*Using different surface treatments can reduce vibration and  
improve ride quality*

### WHAT WAS THE NEED?

Caltrans uses chip seals as a preventative maintenance strategy to extend a pavement's service life and to protect against water intrusion and oxidation. Chip seals, also called seal coats, are constructed by distributing a thin base of hot bitumen or asphalt onto an existing pavement and then embedding graded aggregate into it. Although the aggregate is rolled to create a smooth surface, it has a rougher texture than a typical asphalt surface, causing increased vibration for bicycles and rolling resistance for both vehicles and bicyclists.

In 2012, Caltrans placed a chip seal on about a 20-mile stretch of State Route (SR) 1 between Cambria and the Monterey County line. Shortly after completion, bicyclists alerted Caltrans about the poor ride quality. In response, Caltrans evaluated different chip seal treatments and techniques to reduce vibration and improve the ride quality.

### WHAT WAS OUR GOAL?

The goal was to address the impact of chip seals on bicyclists and evaluate various means to improve the ride quality.



*Bicycle  
instrumented  
with  
accelerometers*



### WHAT DID WE DO?

Caltrans, in partnership with the University of California Pavement Research Center (UCPRC), evaluated the pavement surface texture and compared it to bicyclist surveys regarding ride quality and actual bicycle vibrations measured with mounted accelerometers. The researchers set up test sections on SR 198 in Monterey using different treatments applied to the existing 3/8-inch chip seal, similar to the chip seal on SR 1. They also assessed the effectiveness of different techniques to smooth the texture, such as using steel rollers during chip seal construction and additional rubber-tired rolling after construction. Each section was evaluated for bike riding quality by cyclists via surveys and measured bicycle vibrations.

### WHAT WAS THE OUTCOME?

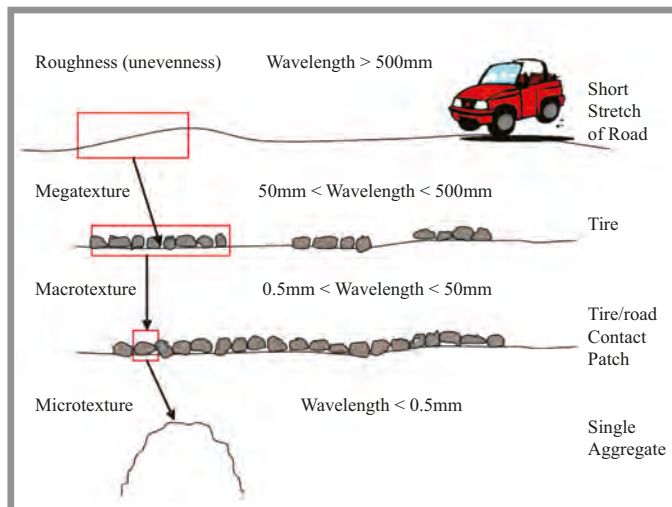
The surface texture and vibration values of the test treatments on SR 198 measured lower than the untreated chip seal section. Cyclist surveys taken on the test sections also indicated acceptable rides as correlated to surface texture and vibration levels. Additional rubber-tire rolling months after construction seemed to produce only a small reduction in vibration. Based on the results of this study, specific vibration levels, pavement surface texture values, and bicycle riding quality models were established. Caltrans and the UCPRC will leverage this work by performing similar research for urban pavement treatments and bicycles.

### WHAT IS THE BENEFIT?

By adding an additional surface treatment, it is possible to construct a chip seal that offers cyclists a smoother ride. Transportation agencies can continue using the cost-effective chip seal treatment to preserve pavements while maintaining a bicycle-friendly surface.

### LEARN MORE

To view the complete report:  
[www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2013-07.pdf](http://www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2013-07.pdf)



Pavement surface texture components and their wavelengths (500 mm = 1.64 ft, 50 mm = 0.164 ft or 2.0 in., 0.5 mm = 0.02 in.)



Measuring the pavement macrotexture with a laser texture scanner



Instrumented vehicle with inertial profiler