DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Development of Recommended Guidelines for Preservation Treatments for Bicycle Routes

The research completes the second part of a previous Caltrans-sponsored study to identify pavement treatment surfaces that are more acceptable to California's increasing number of bicyclists.

Pavement

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Project Title:
Preservation

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WHAT WAS THE NEED?

This research further improves on an earlier California Department of Transportation (Caltrans) sponsored study performed in 2013 that addressed the impact of chip seal treatments on bicycle ride quality. The previous study examined a limited range of pavement surface treatment types, bicycle types, and bicycle riders.

Subsequently, it was determined that the study be extended to include the many different surface textures found statewide, a wider range of bicycle types and riders.

WHAT WAS OUR GOAL?

The research objective was to develop recommended guidelines that can be used to select pavement surface treatments for both urban and rural roads that maximize bicycle ride quality based on surface texture, combined with the effects of road roughness.

WHAT DID WE DO?

Macrotexture, roughness, and pavement distresses were measured for different preservation treatments on 67 road sections distributed in five northern California and Nevada cities (Davis, Richmond, Sacramento, Reno, and Chico) and on a number of Caltrans highway sections and county roads. Bicycle ride quality surveys were conducted with a total of

155 participants. Correlations of pavement texture, bicycle vibration, and bicycle ride quality were developed. Correlations between pavement roughness and distresses, correlations between bicycle ride quality and roughness, and correlations between pavement texture and treatment specifications were preliminarily explored.

Models for bicycle ride quality and physical rolling resistance were also developed. Long- term monitoring of pavement macrotexture for larger stone seals on State Route (SR) 2 - Los Angeles (LA), SR 1 - San Luis Obispo (SLO), and SR 198 was completed to determine how much texture is reduced by traffic.

WHAT WAS THE OUTCOME?

Major conclusions drawn from the results and analyses include the following:

- Changes in Caltrans chip seal gradation specifications have resulted in higher macrotexture values, as seen on example sections on SR 2 - LA, SR 1 - SLO, and SR 198.
- Preliminary (first study on highways plus second study on streets) results show that 80 percent of rider's rate pavements with mean profile depth (MPD) values of 1.8 mm or less as acceptable and 50 percent rate pavements with MPD values of 2.3 mm or less as acceptable.
- Most slurry seals on city streets produce high acceptability across all cities.
- A clear relationship was found between the critical aggregate's sizes (4.26 and 1.18 mm]) and MPD.
- Pavement texture generally tends to decrease over time due to traffic.
- Both the International Roughness Index (IRI) and MPD are important parameters for determining whether riders find a particular pavement section acceptable.
- There is considerable variability among people and among sections that influences what bicyclists perceive as acceptable pavement condition.
- The presence of distresses, particularly cracking, lowers the ratings that riders give to pavements.

The scope of these recommended guidelines for choosing a surface treatment specification are based solely on bicycle ride quality. The recommended guidelines also state that other criteria must be considered when selecting a surface treatment specification, including motor vehicle safety in terms of skid resistance under wet conditions, for which minimum MPD requirements should be considered, and the life-cycle cost of the treatment.

WHAT IS THE BENEFIT?

When following the recommended guidelines during the surface treatment selection process, Caltrans can establish and achieve a high level of bicycle ride quality. The continuous improvements on bicycle ride quality and bicyclists' satisfaction supports the active modes of transportation.

LEARN MORE

View the Final Report
https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/ca17-2693a-finalreport-a11y.pdf

IMAGES

Image 1: Road bicycle instrumented with accelerometers (solid red circles) and a Global Positioning System (GPS) unit on the handlebar (circle of blue dashes) used to obtain bicycle vibration measurements.

Image 2: Vehicle mounted high speed inertial profilers used for macrotexture and roughness measurements.

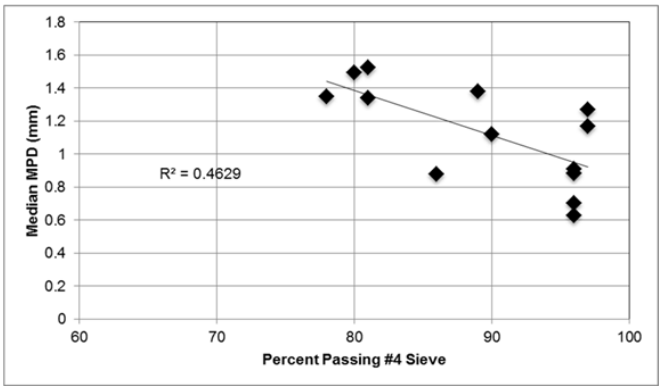

Image 3: Correlations of percent passing the #4 sieve and median MPD (mm).

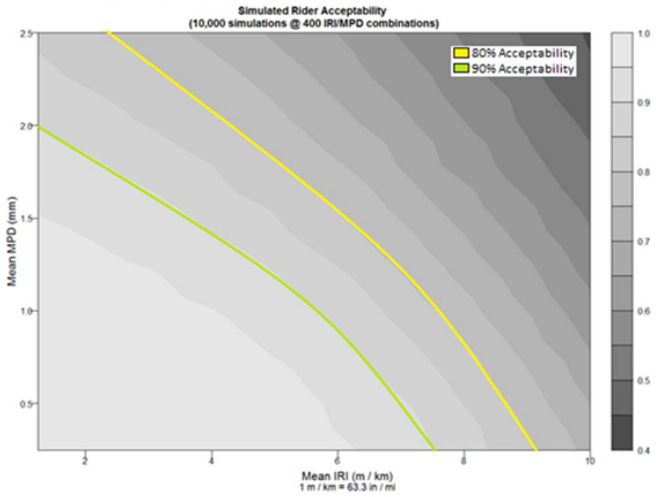

Image 4 : Counterfactual plot of the simulated predicted probability of acceptance for a simulated rider independent of gender and other influencing personal characteristics.
The yellow line represents the conditions where 80 percent of simulated riders would find the section acceptable, holding all other variables constant.
The green line represents the 90 percent boundary.