

Record: 1**Title:** Enhancing Pavement Smoothness.**Authors:** Swanlund, Mark**Source:** Public Roads. Sep/Oct2000, Vol. 64 Issue 2, p20. 3p. 1 Color Photograph, 1 Graph.**Document Type:** Article**Subject Terms:** *PAVEMENTS
*ROADS -- United States**Geographic Terms:** UNITED States**Company/Entity:** UNITED States. Federal Highway Administration**NAICS/Industry Codes:** 237310 Highway, Street, and Bridge Construction
238990 All Other Specialty Trade Contractors**Abstract:** Deals with pavement smoothness enhancement on highways in the United States (U.S.). Findings of a survey conducted by the U.S. Federal Highway Administration (FHWA) on what highway users expect from road pavements; Details on the pavement smoothness program of the FHWA; Strategies critical to achieving a smooth highway network.**Full Text Word Count:** 1546**ISSN:** 0033-3735**Accession Number:** 3784647**Database:** Academic Search Premier**ENHANCING PAVEMENT SMOOTHNESS**

Back in the "good old days" and simpler times of the early 20th century, the traveling public was happy just to have a paved surface to keep them out of the mud. In fact, the objective of early federal highway legislation was simply to get the farmer out of the mud, making it easier to get produce and goods from farm to market. Today, however, highway users demand a higher standard; "passable" is not good enough. They want a pavement surface that provides a smooth, comfortable ride; they expect a safe highway facility; and they want to get where they are going, on time, meaning they do not want to sit in traffic.

How do we know this? In 1996, the Federal Highway Administration (FHWA) commissioned a national survey of frequent highway users that asked questions about what they wanted in their highway "product." The public very clearly stated that road condition was their top priority, followed by safety and reducing congestion.

In addition, research has shown that, over time, smooth roads cost the owner/agency less and reduce the operating expenses of the highway user. So, not only do our customers want smooth roads for comfort, smooth roads cost less for both the owner/agency and the user. With our customers demanding smooth pavement, which also makes economic sense, FHWA's task is clear -- to work with the state highway agencies and other highway owners to improve pavement smoothness.

Today, emphasis is on measurable goals. Therefore, we had to find a way to measure our progress toward improving road condition. Fortunately, in the highway business, the best way to quantify pavement condition is to measure pavement smoothness. The state highway agencies already collect pavement smoothness data on

the major roadways in this country, so tracking that information should tell us if we are making progress in improving road conditions and how much progress is being made.

With a clear mandate from our customers and a means of measuring progress, FHWA set a performance goal to significantly improve the measured smoothness of the major highways in this country by 2008.

Pavement Smoothness Initiative

To improve the smoothness of the national highway network, state highway agencies must not only rebuild existing rough pavements, but they must perform timely, effective maintenance on their portion of the network that currently meets the smoothness goals. This is not an easy task. An effective pavement-smoothness program requires a comprehensive approach with smoothness as a goal from the very start. To accomplish this objective, a smoothness program should have the following components:

Processes that identify the best projects to maintain and improve pavement smoothness on the total highway network.

- A method for specifying pavement smoothness during initial construction.
- A method for measuring pavement smoothness during initial construction.
- Tools for contractors to build smooth pavements.

Why is there an emphasis on the initial smoothness of the pavement? Does it relate to pavement smoothness over the life of the pavement? Yes! Research has shown that roads built for smoothness stay smoother longer. Table 1 illustrates the improvement in pavement life with improved initial smoothness.

Because the nation's highway users want smooth roads, FHWA implemented a Pavement Smoothness Initiative. This initiative is a joint effort between FHWA, state departments of transportation, and the paving industry. The initiative contains emphasis areas that address the components of an effective pavement smoothness program. The smoothness initiative will:

- Showcase management practices that help achieve smooth highway systems.
- Develop a specification for measuring pavement smoothness at initial construction.
- Conduct a demonstration of the latest pavement-profile-measuring equipment.
- Share best practices for building smooth pavements.

Management Practices

The highway roughness data collected annually by the states and reported to FHWA show that the Georgia Department of Transportation (DOT) consistently has some of the smoothest pavements in the country. Georgia DOT is obviously doing something right, and FHWA felt that others might be able to replicate the things that Georgia does to get a smooth highway network. Georgia DOT believes that four strategies are critical to achieving a smooth highway network:

- Fix pavements before they fail. Georgia has discovered that repairing recurrent minor problems before they become big problems is less expensive than total reconstruction. By getting out there early, the Georgia DOT is able to treat many more miles annually than it could if it waited for significant distress to appear.

- Use a program of preventive maintenance and preservation treatment. Georgia DOT tries to perform light maintenance work on approximately 10 percent of their network annually. They are able to maintain this treatment level over time without spending significantly more for maintenance than comparable states.
- Shorten the time between identifying a need and awarding the construction or repair contract. In many cases, Georgia DOT awards a contract within six months of identifying the project through condition surveys.
- Set and enforce strict smoothness specifications. Georgia DOT sets the smoothness bar very high. There are no incentives for exceeding the smoothness requirements, but corrective action must be taken if the pavement is rougher than specified. Historically, Georgia can expect more than 97 percent of their pavement to meet their strict requirement for smoothness.

Smoothness Specifications

FHWA is working with an expert task group representing the states, industry, and academia to develop a specification for smoothness that can be used by states across the country. Research has shown that a smoothness specification is one of the best ways to obtain improved, initial pavement-smoothness results. The specification will be written around the latest equipment for measuring pavement roughness. This new specification will help states and contractors develop a consistent approach to smoothness requirements during construction. Figure 1 shows how implementation of a smoothness specification in Wisconsin improved the smoothness results of concrete pavement compared to similar projects that did not contain a smoothness specification.

Equipment Demonstration

New devices that can measure pavement roughness reliably and objectively are being demonstrated around the country. These devices -- lightweight inertial profilers -- are a significant improvement over the standard profile-measuring equipment typically used by many states. The smoothness initiative provided an opportunity for states to test and evaluate different lightweight profiling devices. As an indicator of the interest in this area, FHWA received more than twice as many requests to participate in this demonstration than could be accommodated with the funds available. Figure 2 shows a representative lightweight profiler.

Best Practices for Construction

Once a project is selected and plans are prepared and a reliable way of measuring smoothness is developed, the project still has to be constructed smoothly, and that requires careful attention to detail. FHWA, in close partnership with state highway agencies and with paving contractors in Arizona and Kansas, developed a promotional package that highlights each state's approach to smoothness specification and shares some of the best tips used by contractors in those states to achieve great pavement-smoothness results.

Each package contains a video tape, a draft smoothness specification based on what is used in Arizona and Kansas, and promotional materials to help get the word out about building smooth pavement. The video produced by the Arizona DOT features the racing legend Richard Petty and covers asphalt pavement smoothness. The video produced by Kansas DOT features the NFL football broadcaster and former coach John Madden and covers concrete pavement smoothness.

The tools developed by FHWA with our state and industry partners provide a comprehensive approach to improving pavement smoothness across the country. Smooth pavement makes sense from an agency perspective and from the user perspective, and smooth pavement is what our customers -- the traveling public

-- demand. The question you should ask is not "Can I afford smooth pavement?" but "Can I afford NOT to have smooth pavement?"

For more information about the Pavement Smoothness' Initiative, contact Mark Swanlund at (202) 366-1323 or via email at mark.swanlund@fhwa.dot.gov, or contact David Law at (803) 253-3886 or via email at david.law@fhwa.dot.gov.

Table 1 -- Results of Smoothness Modeling Sensitivity Analysis NCHRP 1-31, Smoothness Specifications for Pavements)

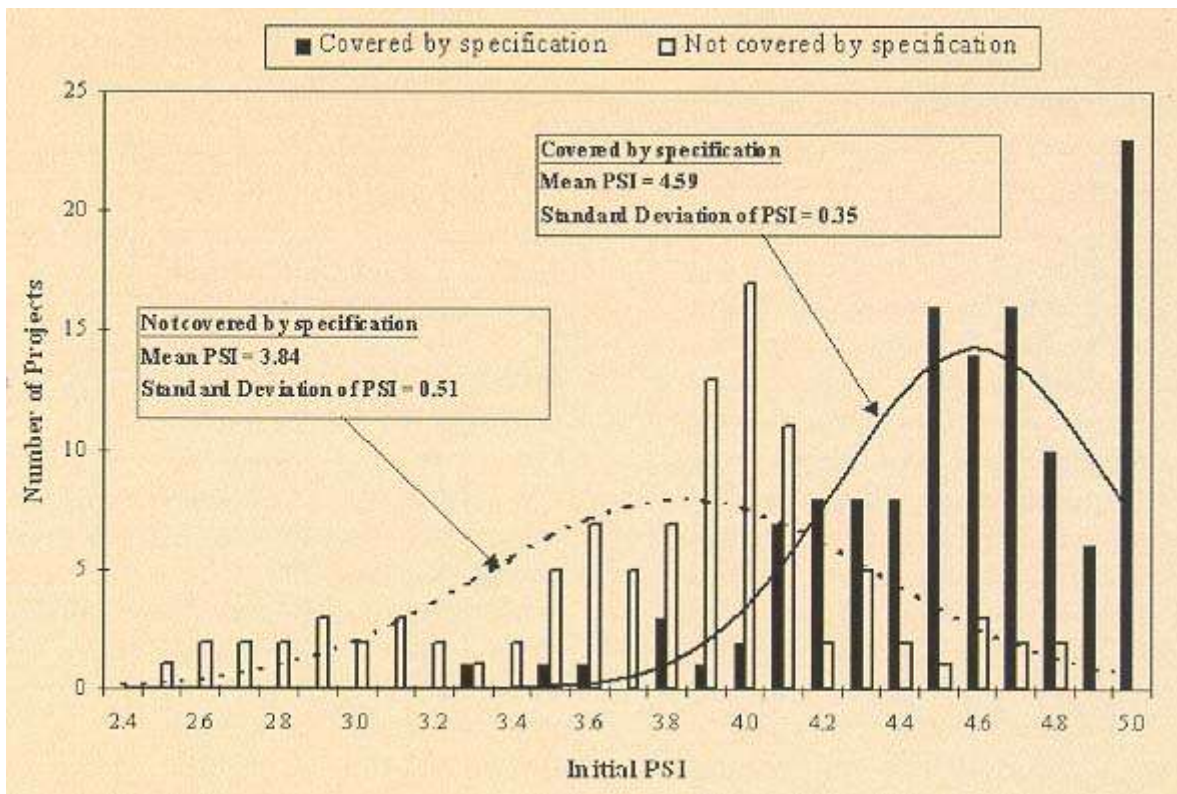
Average Percent Increase in Performance Life

A	B	C	D
Reduction in roughness	10%	25%	50%
Alabama PCC	11	28	55
Arizona PCC	7	18	36
Illinois CRC	5	11	22
Minnesota PCC	6	15	30
Illinois AC/PCC	4	9	18
Alabama AC	8	20	39
Arizona AC	3	9	18
Minnesota AC	5	11	23

PCC is portland cement concrete.

CRC is continuously reinforced concrete.

AC is asphalt concrete.



: Figure 1 -- Effect of implementation of a smoothness specification in Wisconsin, 1984 (NCHRP 1-31, Smoothness Specifications for Pavement). (The pavement smoothness index is shown on a 0-to-5 scale with 0 as the worst rating and 5 as the best.)



Lightweight inertial profilers provide more reliable profile data.

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By Mark Swanlund

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