

A Look Back at the Next Generation Concrete Surface (NGCS): 2007-2021

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 Larry Scofield, PE
 Director Engineering and Research-IGGA
 Director of Pavement Innovation - ACPA



Presentation Outline

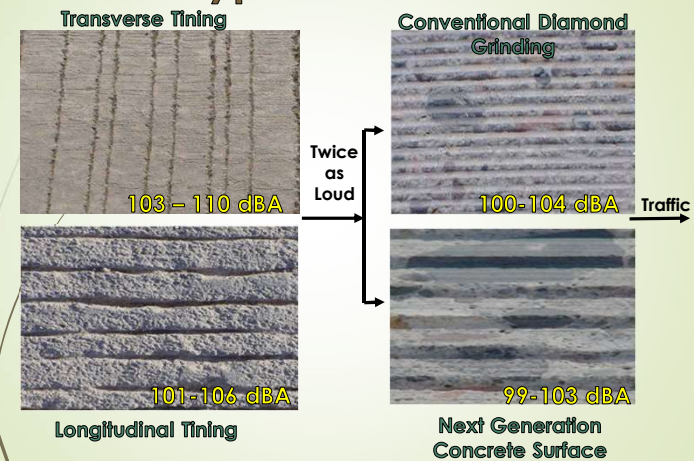
- What Is a Quiet Concrete Pavement
- History of NGCS Development
- Use of NGCS
- Noise Performance of NGCS
- Frictional Performance of NGCS

What Is a Quiet Pavement?

NCHRP 10-67—Texturing Concrete Pavements (NCHRP Report 634) (ARA-2009)

Noise Level (OBSI – dBA)	
Low	<102
Fairly Low	102 To 104
Moderate	104 to 106
Fairly High	106 to 108
High	>110

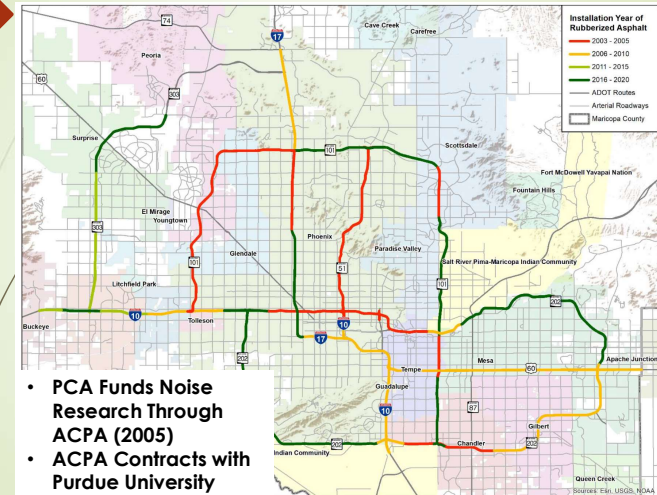
Concrete Texture Types and Typical Levels



What is NGCS?

- The Next Generation Concrete Surface (NGCS) is the most recent new concrete texture introduced in the past 20 to 30 years.
- It was conceived as more of a manufactured texture whose properties are consistent and predictable because of the flush grind pass
- Represents the quietest non-porous concrete texture developed to date. At the time of construction, the NGCS is typically 99 dBA in noise level and has a typical range up to 103 dBA over time.

The Noise Heard Around the Industry!



Purdue Noise Research for ACPA



Surface Texture

- Innovative New Concrete Surface Textures
- Diamond Ground Textures: Effect of Blade and Spacer Width, Grind Depth, and Custom Blades
- Effect of Longitudinal Grooving: width and depth
- Effect of Tire Type
- Friction
- Rolling Resistance

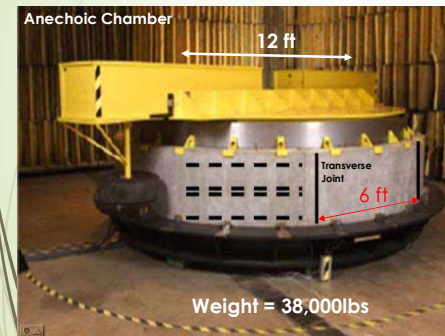
Transverse Joint Effects On Pavement Noise

- Opening Width
- Sealed or unsealed
- Faulting: Fault Level, step-up or step-down fault

Note That Prior to 2005:

- No Standard Noise Test Tire
- No Standard OBSI Test Method

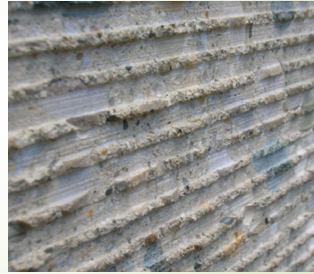
Purdue Research-- Tire Pavement Test Apparatus (TPTA)



TPTA Test Grind Surface Result: NGCS is 3 dBA Quieter than CDG

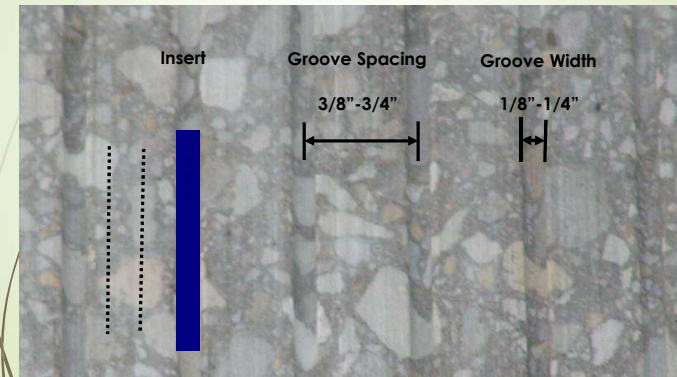


Purdue Texture
(NGCS)

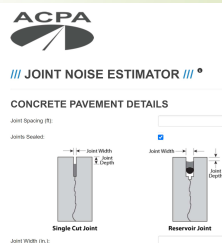
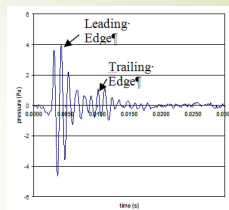
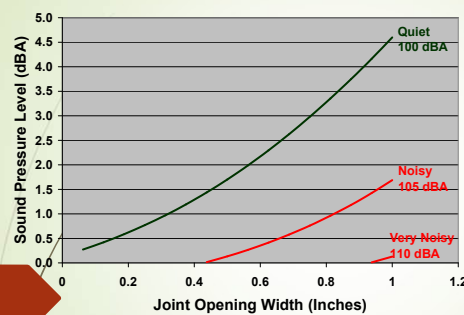


Conventional
Diamond Grinding

Effect of Groove Spacing, Width, Depth, Insert

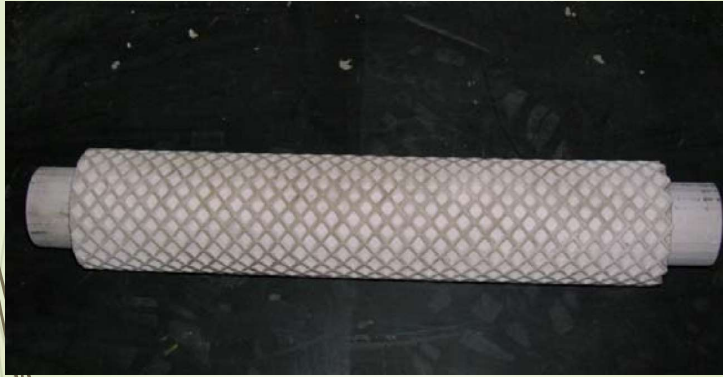


Impact of Joint Width Opening on Overall Pavement Noise

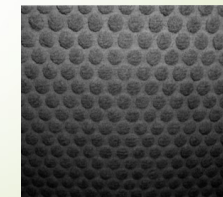
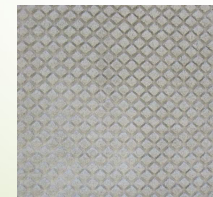
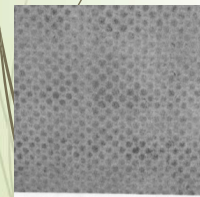
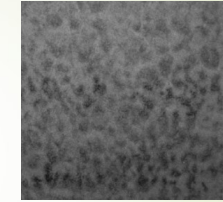
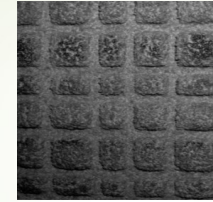
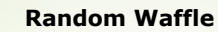
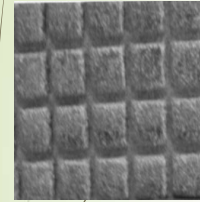


Foam Inserts in Longitudinal Grooves





Uniform Waffle

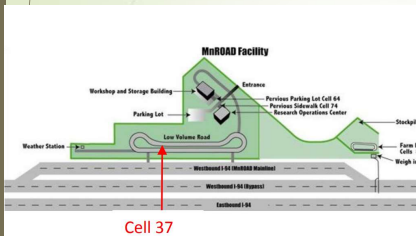


Circle

Diamond

Spheres

TPTA Proof of Concept Testing at MnROAD



Mn ROADS Test Center(Courtesy MnDOT)



Diamond Surfaces, Inc. Grinding Unit with 2 ft Head

Constructed 18" Strip of NGCS, CDG, and Left Transverse Tining

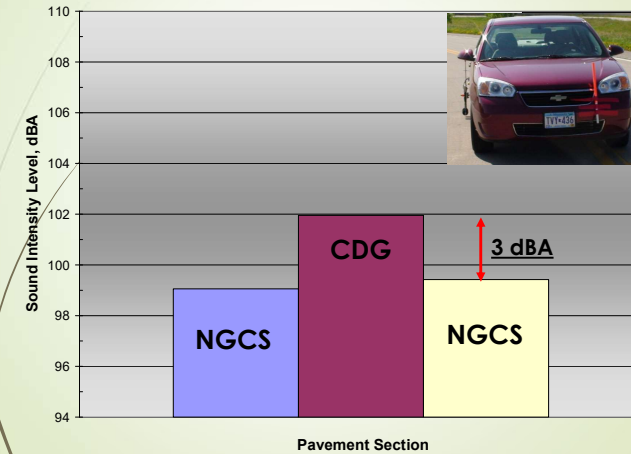
Proof of Concept Testing Comparing Different Textures



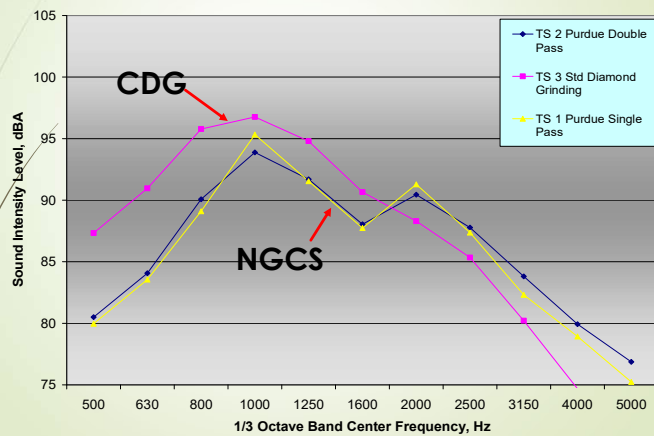
MnROAD Low Volume Road Test Strip Layout



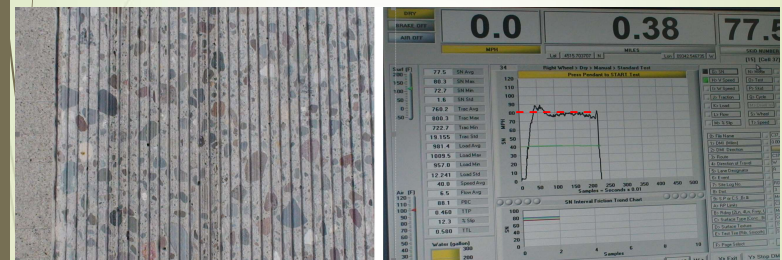
MnROAD Test Strip Noise Results (OBSI- dBA)



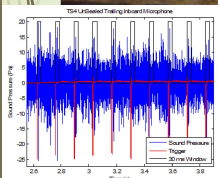
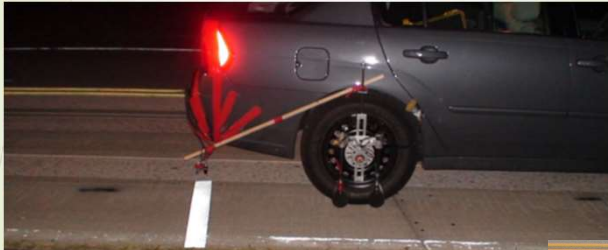
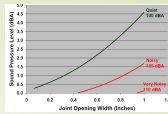
MnROAD 1/3 Octave Spectrum Results



MnDOT ASTM E-274 Friction Testing



Evaluating Joint Slap Noise Effect at MnROAD Test Strips



First Highway Installation I-355 In Chicago - 2007



UMTRI SUV ABS Braking Testing

Chicago I-355



What Does NGCS Looks Like

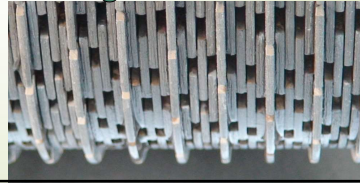
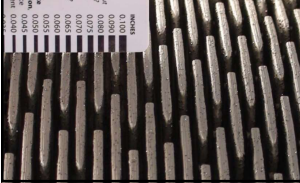


NGCS is a Diamond Grinding Procedure

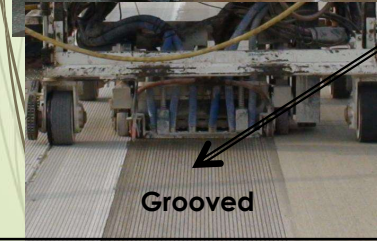


CDG

Single Pass NGCS



NGCS Construction (2 Pass)



Grooved

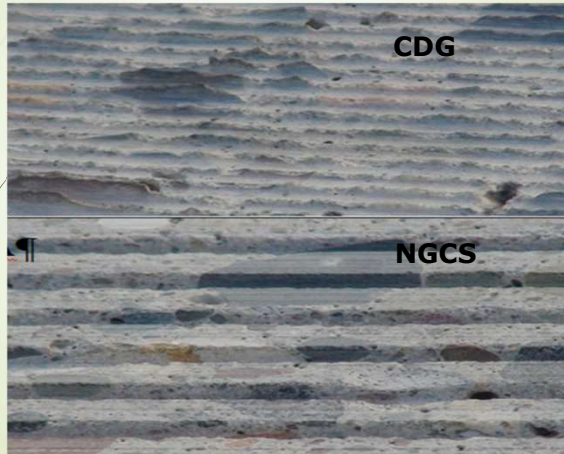
Two Pass NGCS Flush Grind Head



Two Pass NGCS Grooving Head



NGCS Compared to CDG



Back to the Future Again



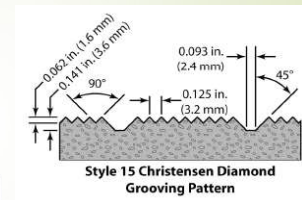
1961 Patent on First Diamond Grinder -- Concrete Bump Cutter



Back to the Future Again



Current NGCS



1960's
California
Texture

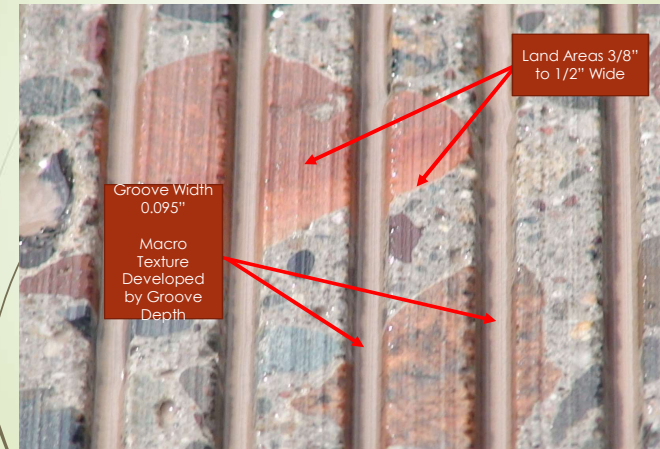


Future NGCS LITE?

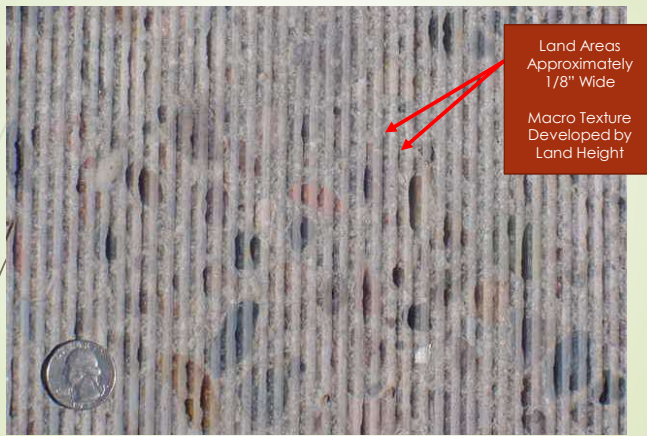
What is Important on NGCS Specs

- **Material Removal:** ¼ inch or less with NGCS head, significantly more removal should require a CDG pass first—more efficient
- **Equipment:**
 - 4 ft head
 - 35,000 lbs or more
 - Effective Wheelbase 12 or greater
 - Positive means for vacuuming the slurry pick up
- **Grooving Blades:** 0.095 ± 0.005 "
- **Spacers:** 0.035 ± 0.005 "

NGCS Texture

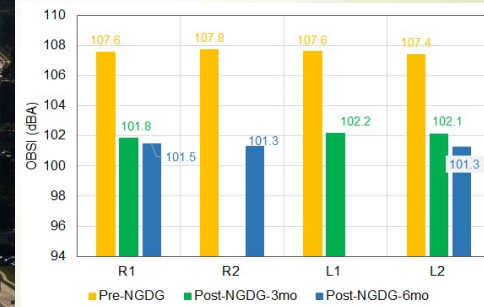
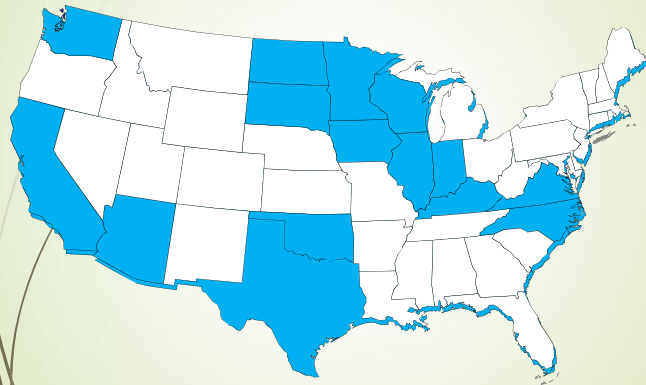


Conventional Diamond Grinding



So Where Are We Today?





Caltrans Quiet Pavement Research Findings

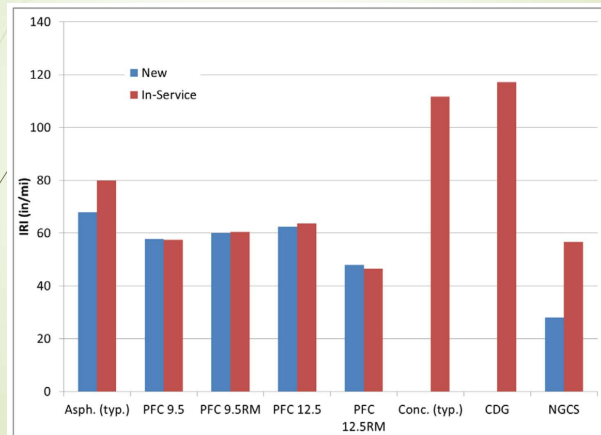
- On average, the experimental NGCS sections were quieter than the CDG sections by approximately 2 dBA
- Both NGCS and CDG textures improved smoothness substantially. The average IRI values improved from 142 in./mi before retexturing to 64 in./mi after CDG and 49 in./mi after NGCS

Virginia Quiet Pavement Research Results

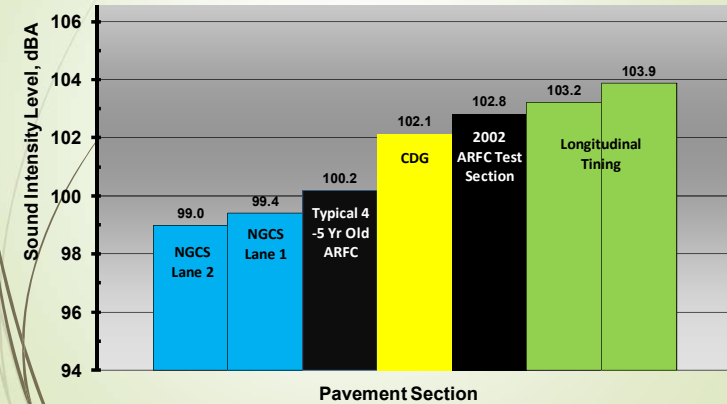
- ▶ “As of spring 2015, the difference in measured tire-pavement noise between the control surfaces and the most successful (lowest noise) quiet asphalt technology was no longer detectable with normal human hearing (3 dBA)”
- ▶ “The lowest noise concrete surface (NGCS) continues to have a noticeable (approximately 4dB) advantage over the standard concrete finish.”

The Virginia Quiet Pavement Implementation Program
Under Section 33.2-276 of the Code of Virginia - Final
Report - June 2015—House Document No. 13"

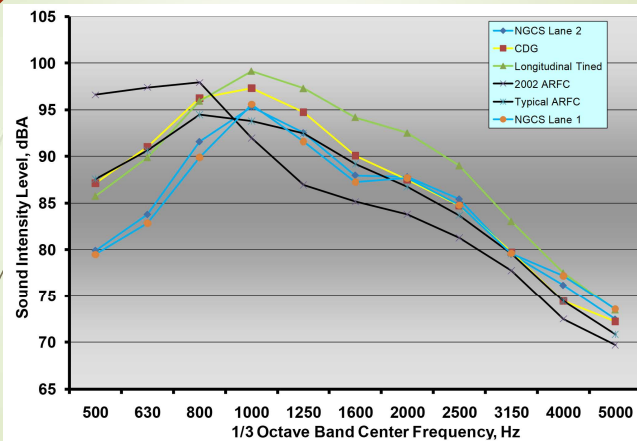
Virginia Quiet Pavement Research Results (Smoothness)



Arizona I-10 Pavement Noise Results (OBSI-dBA)

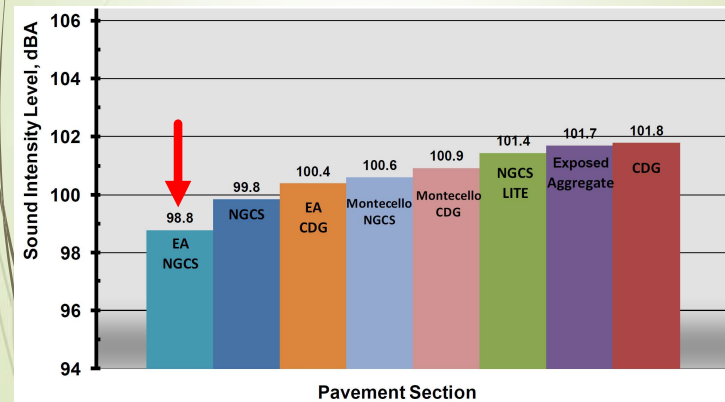


AZ I-10 Noise Spectrums



1/3 Octave OBSI Spectra for Selected AZ Surfaces

Comparison of MnROAD Test Section Noise Results (OBSI-dBA)



Friction Testing



Friction Testing ASTM E274

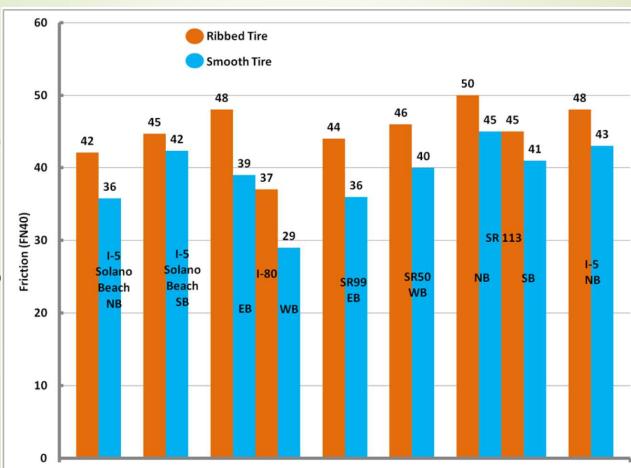
Test Speed = 40 MPH



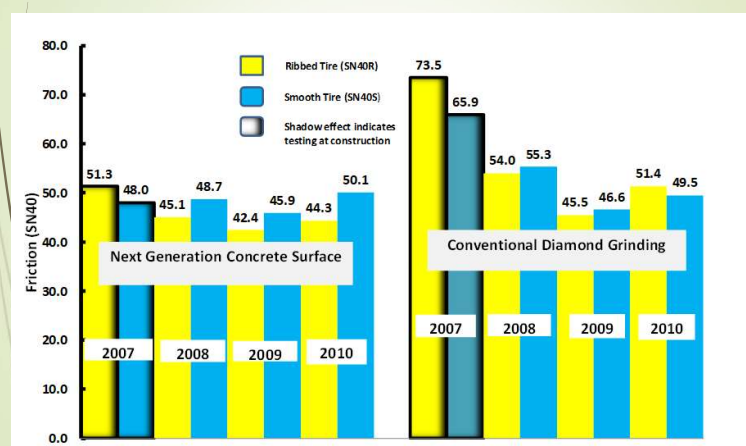
Ribbed
SN40R

SN40S
Smooth

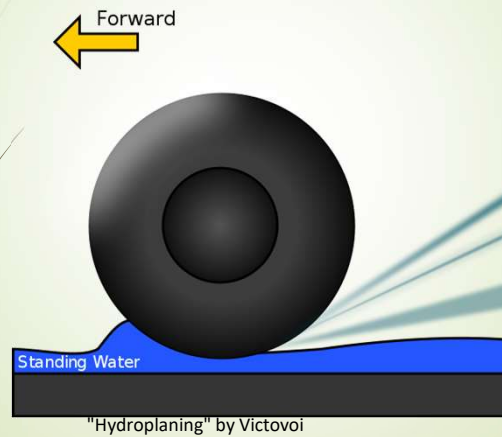
IGGA Friction Data



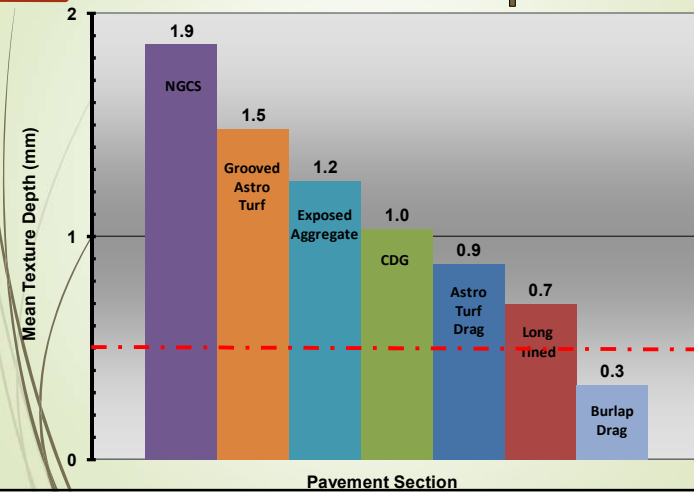
MnROAD Friction Results



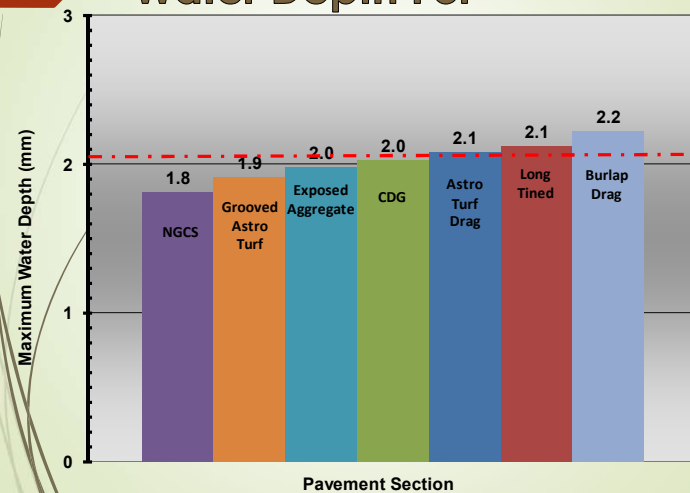
Hydroplaning



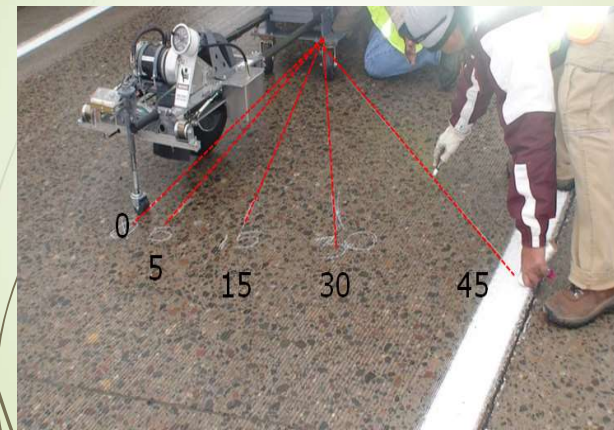
Mean Texture Depth



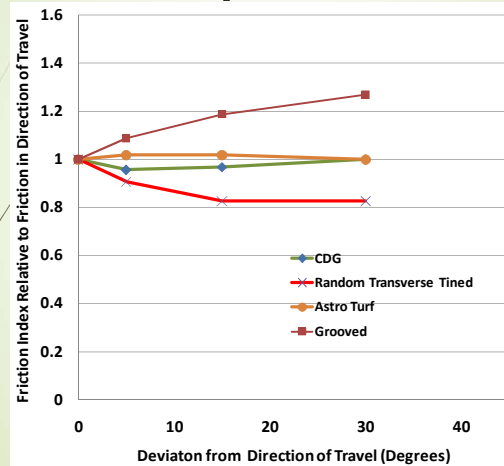
Water Depth For



Anisotropic Friction



Anisotropic Friction



Caltrans Early Report

Technical Report Documentation Page		
1. REPORT No.	2. GOVERNMENT ACCESSION No.	3. RECIPIENT'S CATALOG No.
4. TITLE AND SUBTITLE Study Of The Effect Of Grooving On Motor Vehicle Accidents	5. REPORT DATE January 1972	6. PERFORMING ORGANIZATION
7. AUTHOR(S) Darryl R. White	8. PERFORMING ORGANIZATION REPORT No.	9. WORK UNIT No.
10. SPONSORING AGENCY NAME AND ADDRESS State of California Business and Transportation Agency Department of Public Works	11. CONTRACT OR GRANT No.	12. TYPE OF REPORT & PERIOD COVERED
13. SUPPLEMENTARY NOTES	14. SPONSORING AGENCY CODE	
<p>16. ABSTRACT Grooving has proved to be one of the most cost-effective safety programs of the Department of Public Works. Grooving has contributed greatly to savings in lives, injuries and dollars for the traveling public. Fatalities are comparatively moderate in California but the accident rate is four times greater on wet pavement than on dry pavement. This is one of the problem areas for which a positive solution has been found.</p> <p>The Department of Public Works' accident experience reveals that grooving has yielded a:</p> <ol style="list-style-type: none"> 1) 20 percent reduction in total accidents 2) 50 percent reduction in fatal accidents 3) 70 percent reduction in wet pavement accidents <p>Motorcycle accident reports were reviewed from both grooved and ungrooved sections. Abstracts of these reports are given in the following pages. They show the evidence that grooves constitute a "hidden" to the cyclist.</p>		
<p>17. KEYWORDS</p>		
18. No. of PAGES: 54	19. DRG WEBSITE LINK http://www.dot.ca.gov/hq/researchresearchreports/	
<p>20. FILE NAME: 72-09.pdf</p> <p>This page was created to provide searchable keywords and abstract text for other scanned research reports. November 2005, Division of Research and Innovation</p>		

NGCS Video



Announcing a New IGGA Video on the Sustainability of the Next Generation Concrete Surface

Efficient engines are only part of the story when it comes to getting more vehicle miles per gallon. How tires interact with pavement can make a big difference.

IGGA has worked with experts from the MIT Concrete Sustainability Hub to put together the above video, which highlights researchers' findings on factors that affect pavement vehicle interaction (PVI).

Watch the video to learn the science of PVI. Also discover how smooth concrete road surfaces, like the Next Generation Concrete Surface (NGCS), are not only safe and quiet, but reduce road maintenance costs and achieve sustainability in terms of lowering fuel consumption and greenhouse gas emissions.

The Results Are In: The Next Generation Concrete Surface is a Sustainable Pavement Choice

Development of Dual Probe OBSI Equipment Which is Now the AASHTO Standard

Close Proximity Trailer (CPT)



Note That Prior to 2005:

- No Standard Noise Test Tire
- No Standard OBSI Test Method



GM 2002



ADOT 2003



ACPA 2005

In Summary

- The NGCS is more of a manufactured surface designed as one more tool in the tool kit
- It has been used in 15 States and Has Been in Service for 14 Years at its Earliest Installations
- NGCS provides three features: Quiet Pavement, Smooth Pavement, and Hydroplaning Resistance
- Texas is the World Leader in the Implementation of NGCS
- South Korea Has Used NGCS the Second Most and they Use it in Tunnels

Questions



lscotland@pavement.com

www.IGGA.net