



NEXT GENERATION LOW MAINTENANCE CONCRETE SURFACES

Development of the **Next Generation** low maintenance **Concrete Surfaces** (NGCS) has been a topic of research over the last three years or so by the US PCA and ACPA. Various noise measurement and surface treatment systems were compared. This testing, probably for the first time, verified that the controlling factor for the tyre-pavement noise generation was a combination of micro and macro textured surfaces, with diamond grinding as the main component.

Laboratory testing at Purdue University demonstrated the advantage of micro texturing in reducing noise levels. (Note that this also indirectly confirms RTA's requirement to use the hessian drag before tyning).

A test rig was set up for a grinding configuration that used three smaller diameter blades stacked between two larger ones and repeating the pattern across the grinding head. The taller blades were approximately 2 mm larger. This arrangement provided a single pass operation that would grind the surface smooth and also groove it at approximately 13 mm centres in one pass. The smaller blades were used to flush grind the road surface and provide micro texture, while the larger ones provided the grooves.

This principle was also tried as a two grind operation. Both surfaces produced similar results by the noise tester. Apparently, Contractors prefer the two phase operation.

Field trials were conducted on:

- Longitudinal single pass grind and groove;
- Longitudinal two pass – flush grind first and then groove;
- Conventional Diamond Grinding (CDG), and
- Random transverse tyning.

On-board Sound Intensity (OBSI) measurements were carried out with the ACPA OBSI (See PIN 34 for details). Here it should be noted that the sound intensity levels (dBA) do not correlate with our conventional measurements, as a different innovative technique is used), but are useful for the comparison of the surfaces noise characteristics.

Observations from two field trials were:

- The NGCS results were always lower than those from CDG. (av 100.1 dBA vs av 104.3 dBA);
- The NGCS results were consistent whilst the CDG ones were variable;
- The NGCS has a different spectral plot to that of CDG, in that the NGCS surface is quieter below 1000 Hz and 1600 Hz , but above 2000Hz is noisier;
- There is a significant drop in the spectrum at the 1600 Hz centre band frequency for the NGCS surface.

The OBSI testing gave the following maximum sound intensity levels:

- NGCS - 100.5 dBA
- Conventional Diamond Grinding - 100.7 dBA
- Longitudinal grooving- 102.0 dBA
- Uniform transverse tyning - 103.1 dBA
- Random transverse tyning (RTA practice) - 105.2 dBA

A further recent development is NGCS LITE to provide an economical renewable surface for the NGCS. It is intended to develop more micro texture on the "land" area (ie tops of ridges).

As part of the research, the surface friction characteristics were also measured:

	SN 40* Friction Value
• Random transverse tyned:	Ribbed tire - 51 Smooth tire - 36
• NGCS.....	Ribbed tire - av 47 Smooth tire - av 48
• CDG	Ribbed tire - av 62 Smooth tire - av 60
• NGCS LITE	Ribbed tire - 48 Smooth tire - 56

* These are American ASTM friction values using a friction trailer. SN 40 stands for **Skid Number** at 40 mph and does not equate to our Sideways Force Coefficients, but they are provided to illustrate the comparative characteristics of the surfaces. The higher the number, the better the friction.

Lessons learnt.

- 1 Currently there are no models available to show acoustic longevity (ie Deterioration Curves) for any surface type.
- 2 With the ACPA OBSI testing equipment (See PIN XXX for details), monitoring can now be started to compute "longevity curves" for selected pavements.
- 3 Testing of 17 pavements in Kansas suggests that the noise data is quite random and no trend over the 10 year testing period is discernable, eg in year 2 at one location there was a sound intensity of 102 dBA compared to a different location where there is a SI of 102 dBA after 10 years under traffic.
- 4 Smooth tire noise results are higher than the ribbed tire ones on diamond ground surfaces. (I do not see the significance in this as all vehicles have ribbed tires).
- 5 Longitudinally grooved texture exhibited an increase in friction at an angle to the direction of travel. This suggests that the grooves are providing an additional benefit for vehicles attempting to lose control as the friction increases. The random transverse grooving had the opposite effect. (This is a logical corollary).
- 6 NGCS LITE surface provides an easily renewable surface that can be "touched up" in less time and costs than the CDG surface. Only a minor amount of material has to be removed.

Source:

Larry Scofield, Director, Pavement Innovation, ACPA. Proceedings, International Conference on Preservation, Repair and Rehabilitation of Concrete Pavements. April 2009, St Louis, Missouri.

