Quieter Pavement Noise Update

Open Graded Friction Course (OGFC) Test Sections

January 2009 Updated Noise and Pavement Condition Measurements

State Materials Lab and Environmental Services Office

2-9-09

Summary

Due to concerns about raveling on both the I-5 and SR 520 open graded friction course (OGFC) test sections, additional measurements were made in January 2009. Both the noise and pavement condition measurements indicate that the OGFCs are rutting in the wheel paths due to raveling[1]. The worst rutting on I-5 is in the asphalt rubber modified OGFC (OGFC-AR) section, while the worst on SR 520 is in the rubber-modified OGFC section (OGFC-AR). Noise levels have increased on all of the OGFC pavements until they are equal to, insignificantly lower, or even higher than the standard dense graded HMA, as summarized in the Tables 1 and 2.

WSDOT uses three criteria to rate pavement condition: smoothness, structural condition and rutting. Programming for rehabilitation begins when rutting reaches 10 mm (slightly less than ½ inch). While none of the OGFC test sections are rutted to 10 mm, they are close (nearly 8 mm on the I-5 OGFC-AR in Lane 1 and over 8 mm on the SR 520 OGFC-AR in WB Lane 2). Loose aggregate on the shoulders of the test sections confirms that the OGFC-AR is rutting due to raveling, not due to plastic flow or secondary consolidation. Raveling this early in the pavement life predicts a much shorter pavement life compared to the standard HMA life of 16 years in western Washington.

Continued monitoring is appropriate. The next pavement condition measurements will be taken soon after the April 1st deadline for removing studded tires. Noise measurements will continue to be collected monthly.

Table 1. Initial and current noise measurements for I-5 Lynnwood quieter pavements project.

Test Section	Pavement Type	August 2006		January 2009	
		Sound Intensity (dBA)[2]	± Control (HMA)	Sound Intensity (dBA)	± Control (HMA)
I-5	HMA	99	-	104	-
	OGFC-AR	95	-4	105	+1
	OGFC-SBS	96	-3	103	-1

Table 2. Initial and current noise measurements for SR 520 Medina quieter pavements project.

Test Section	Pavement Type	July 2007		January 2006	
		Sound Intensity (dBA)	± Control (HMA)	Sound Intensity (dBA)	± Control (HMA)
SR 520	HMA	100	-	104	-
	OGFC-AR	96	-4	104	0
	OGFC-SBS	98	-2	103	-1

[1] An increase in rutting due to physical loss of aggregate from the pavement.

[2] dBA is an A-weighted decibel scale that reflects the way human ear perceives sound levels

I-5 Lynnwood Test Sections

Date: August 2006. Currently approximately 2.5 years old.
Pavement Types: OGFC-AR (asphalt rubber modified)
OGFC-SBS (polymer modified, with an SBS polymer)
HMA Control (standard dense graded hot mix asphalt)

Test Section Analysis

The bar chart below shows the initial and current sound intensity readings for the I-5 Lynnwood test sections of open graded friction course (OGFC) and hot-mix asphalt (HMA) control section.

- The OGFC-AR was initially four dBA quieter than the control section. It is currently 1 dBA noisier than the control section.
- The OGFC-SBS was initially three dBA quieter and is now one dBA quieter.

On the I-5 Lynnwood test section, neither OGFC test section is audibly quieter than the control section, and the OGFC-AR is actually noisier than the control. Acoustical engineers generally agree that three dBA is the minimum sound level change distinguishable to the human ear.

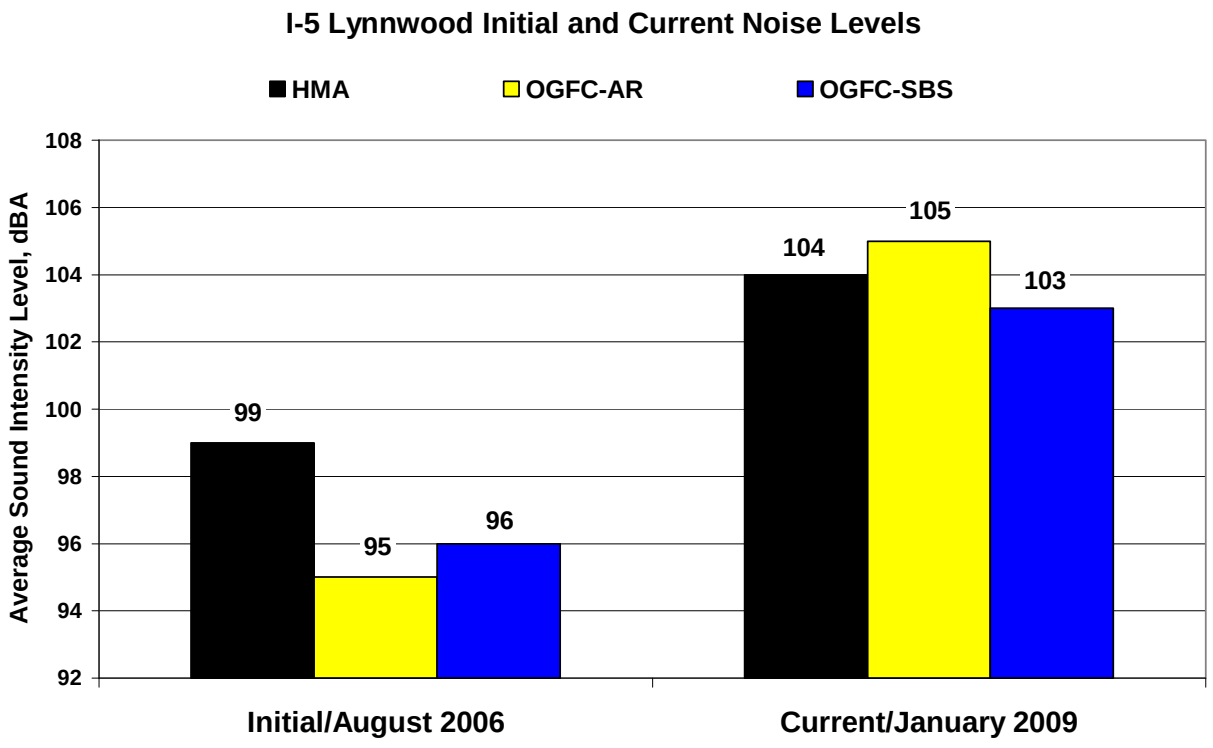


Figure 1. Initial and current sound intensity levels for I-5 Lynnwood quieter pavements.

Lane by Lane Analysis

The following bar charts show the relationship over time for the rutting measurements, ride measurements, and sound measurements for each of the lanes and each of the test sections and control section. Sets of three charts are included for each of the OGFC and control sections.

The rutting and ride measurements are generally taken twice a year, once in the fall before the beginning of studded tire season and once in the spring at the conclusion of the studded tire season. The sound measurements are taken on a monthly basis, weather permitting from initial construction to January 2009. However, there was a period from September 2008 to December 2008 when the sound measurement equipment was out-of-service and no measurements were collected.

The same colors are used for each lane on all of the bar charts. For the I-5 Lynnwood test section, Lane 1 is the outside lane and the HOV is the median lane. All of the charts use the same scale on the vertical axes.

<u>OGFC-AR Measurements (Figures 2-4)</u>

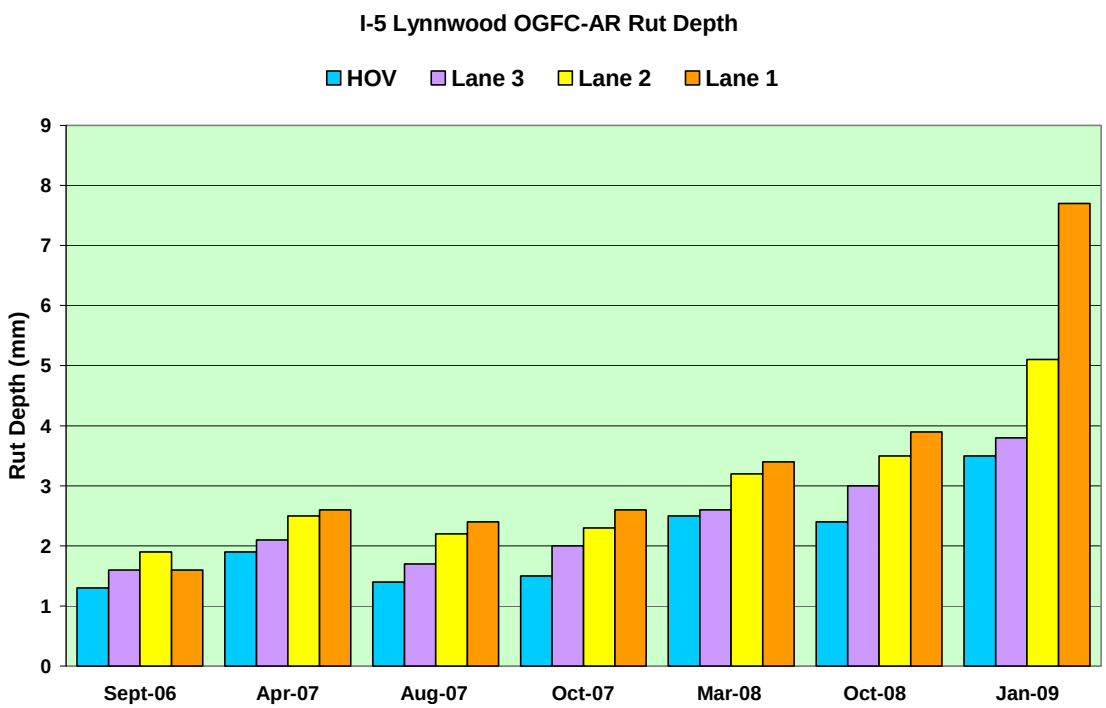


Figure 2. There is a large increase in the rut depth for Lane 1 between the October and January 2009 measurements.

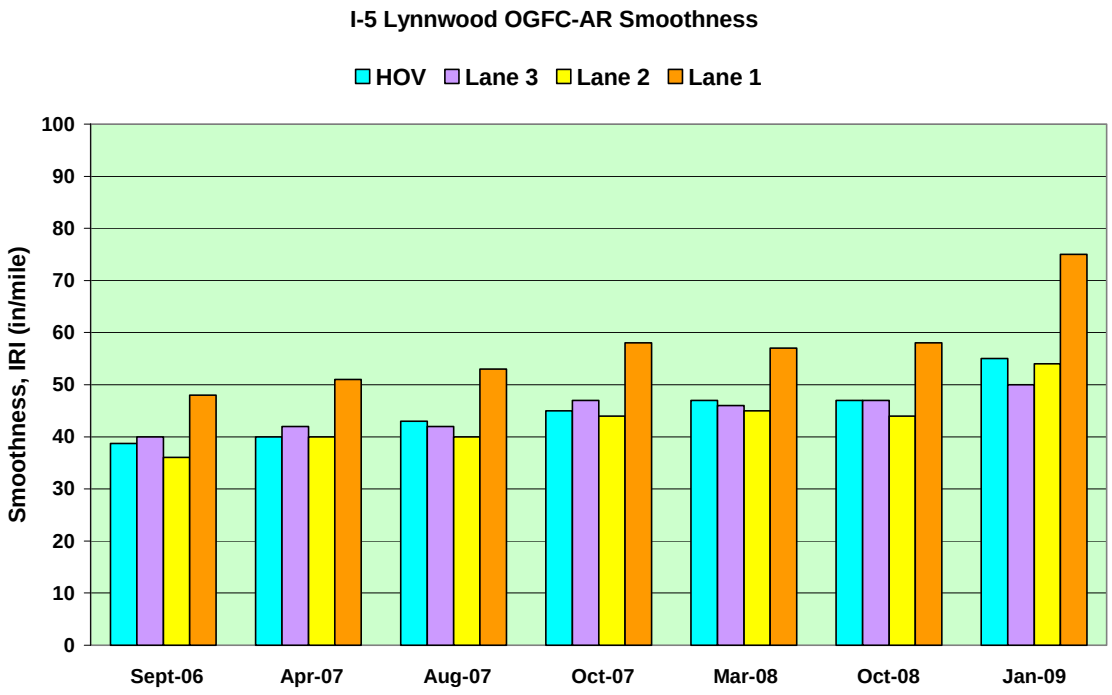


Figure 3. There is a large increase in roughness for Lane 1 in the January measurement, other lanes show smaller increases.

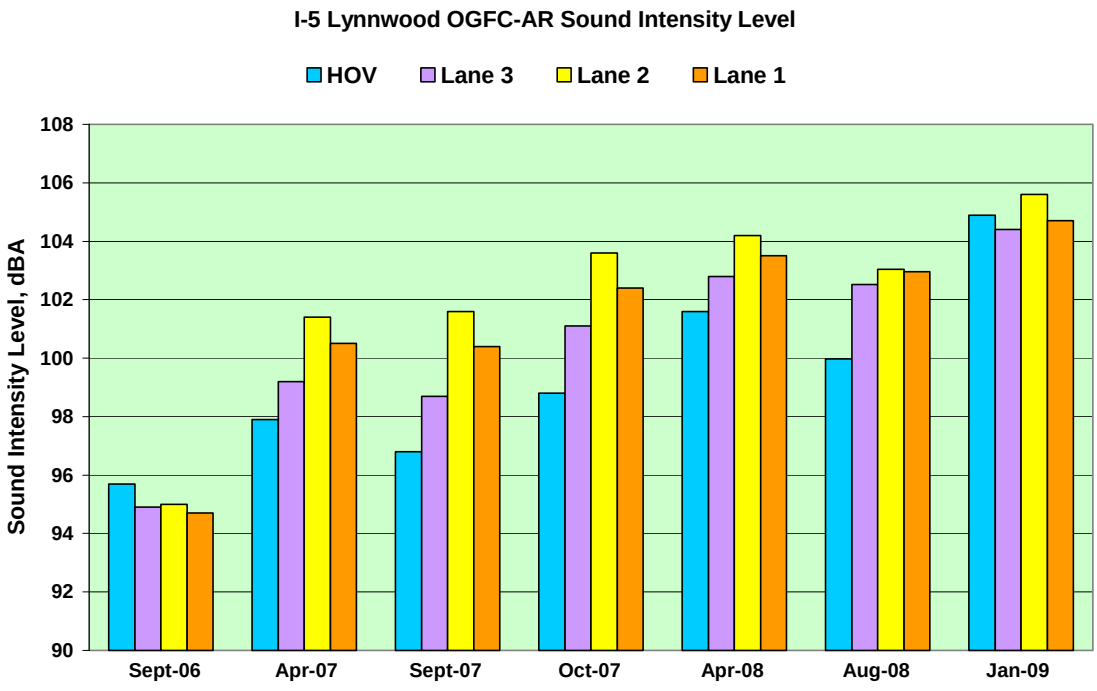
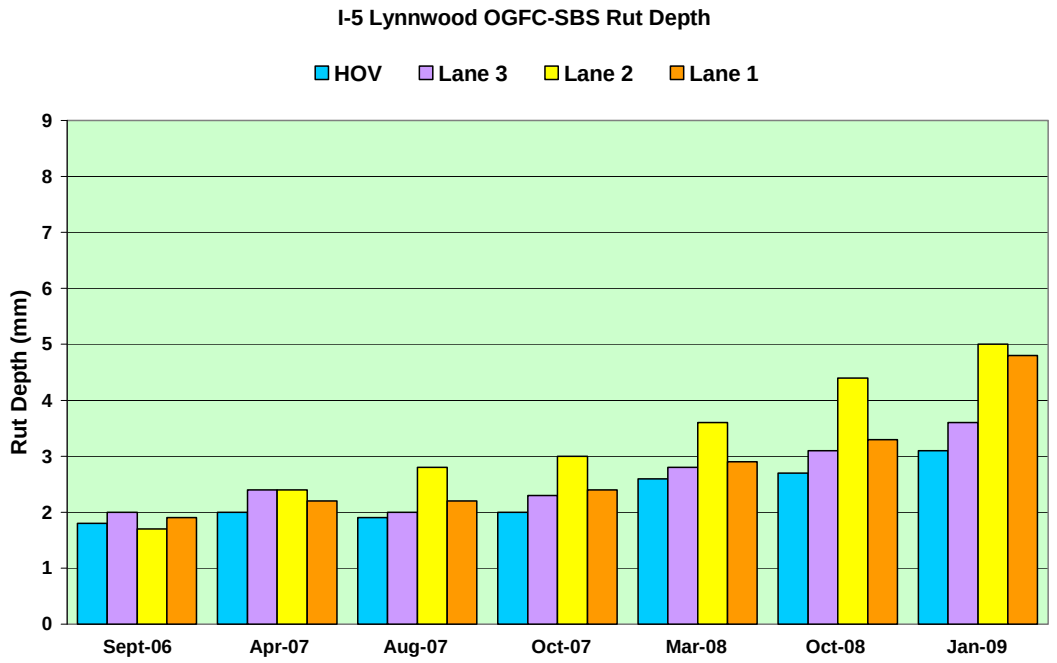


Figure 4. All lanes show a general increase in dBA level with time. Note that in less than 2.5 years, the noise levels have grown from about 95 dBA to about 105 dBA.

OGFC-SBS Measurements (Figures 5-7)



Figures 5. There is a general increase in the rut depth with time for all lanes, though relatively small.

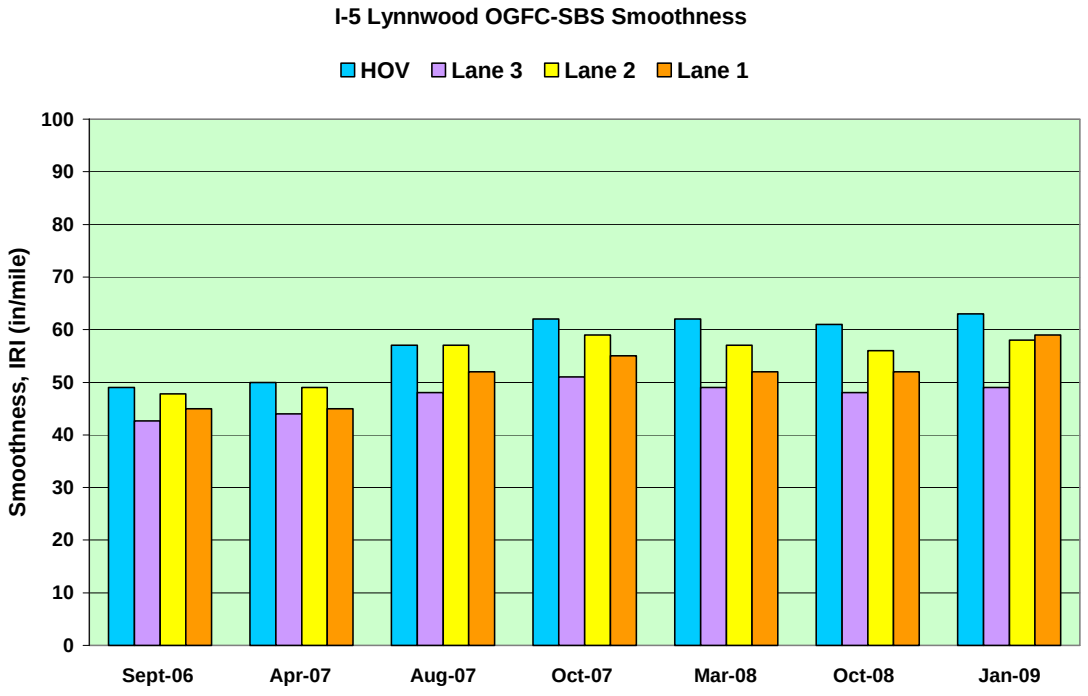


Figure 6. There is a gradual increase in roughness over time, but no large changes in January 2009 for any of the lanes.

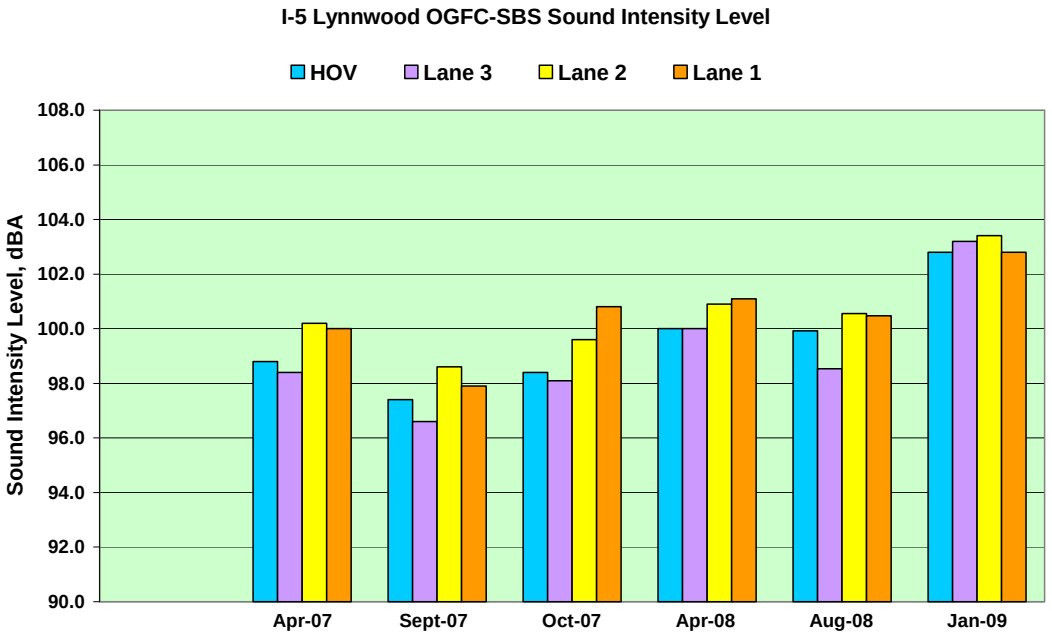


Figure 7. There is a general increase in dBA level for all lanes over time, and a fairly significant increase between the August 2008 and January 2009 measurements. Average noise levels have increased from about 99 dBA in 2007 to about 103 dBA in 2009.

HMA Control Section (Figures 8-10)

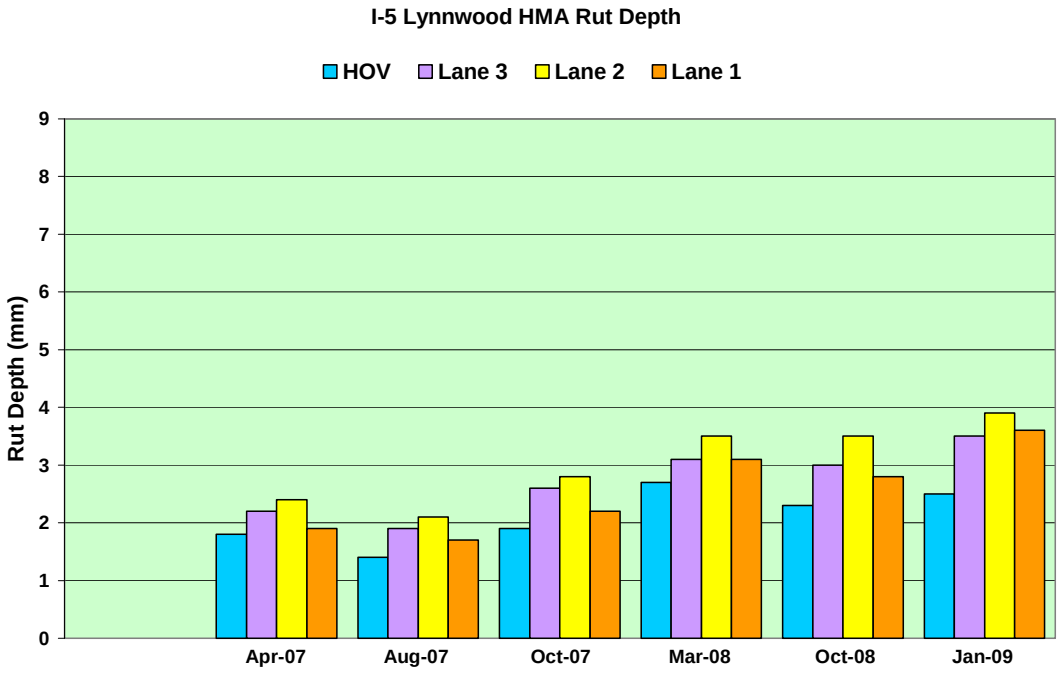


Figure 8. There is a slight increase in rut depth with time, however, still generally low levels of rutting.

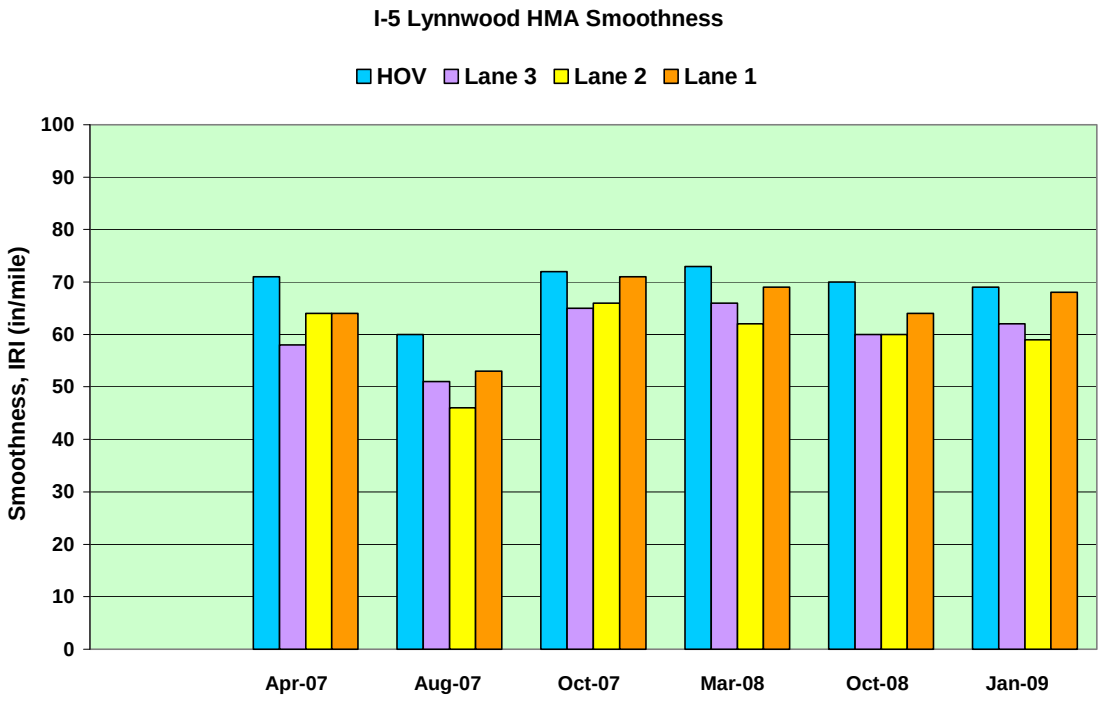


Figure 9. Very little change in roughness for any of the lanes over time.

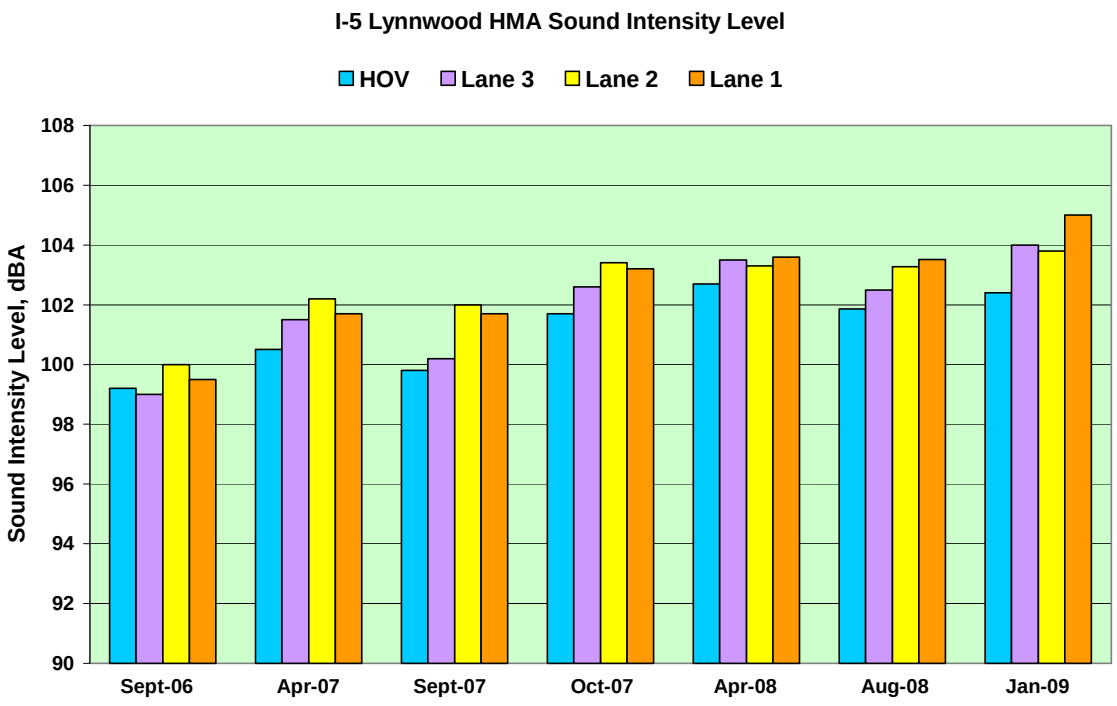


Figure 10. General increase in dBA levels for all lanes over time. Average noise level in September, 2006, was 99 dBA; in January 2009 it is about 104 dBA.

SR 520 Medina Vic. Test Section

Date: July 2007. Currently approximately 1.5 years old.
Pavement Types: OGFC-AR (asphalt rubber modified)
OGFC-SBS (polymer modified, with an SBS polymer)
HMA Control (standard dense graded hot mix asphalt)

Test Section Analysis

As shown in the bar chart below, measurements on SR 520 Medina vicinity test section show a similar trend as the I-5 Lynnwood test section.

- The OGFC-AR started out four dBA quieter than the HMA Control, but the most current measurements are equal.
- The OGFC-SBS began two dBA quieter and is now only one dBA quieter.

Obviously, neither of the OGFC pavements is audibly distinguishable from the HMA pavement at this time.

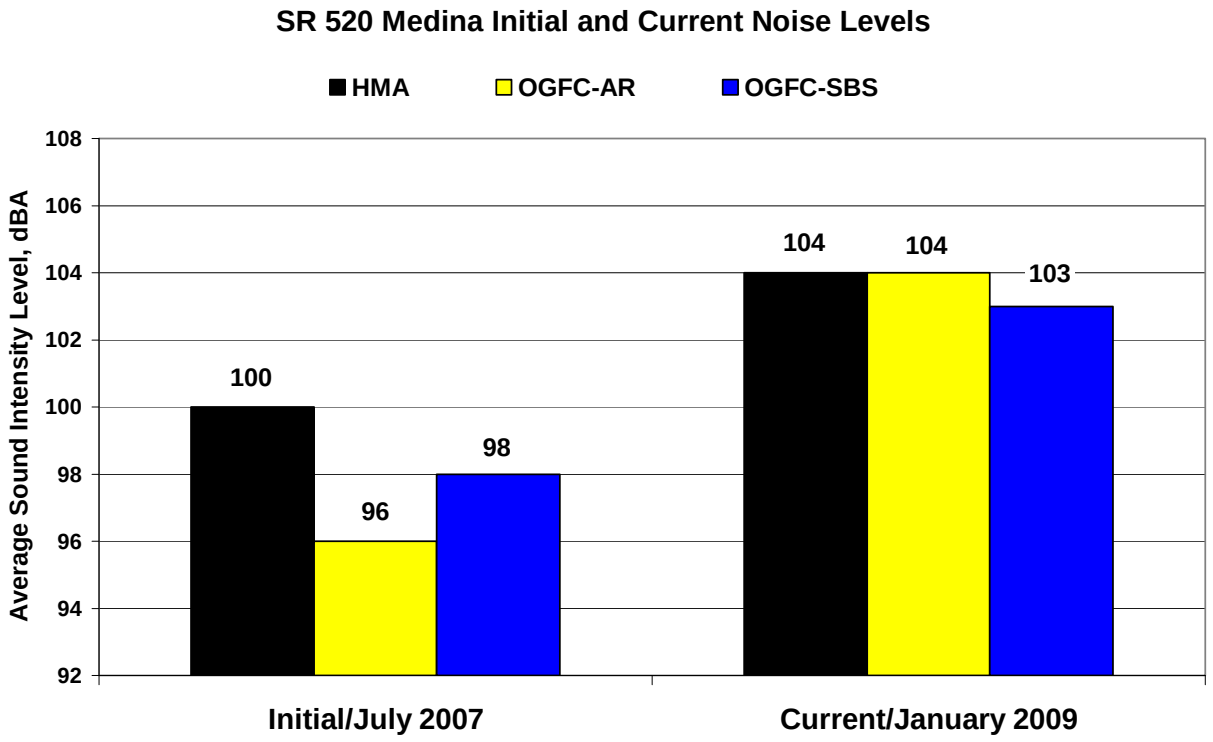


Figure 11. Initial and current sound levels for SR 520 Bellevue Vic. quieter pavements.

Lane by Lane Analysis

The SR 520 Medina vicinity test section has to two general purpose eastbound lanes, with Lane 1 the outside lane. Westbound SR 520 has an HOV lane as the outside lane and Lane 3 represents the general purpose lane adjacent to the median. All of the charts use the same scale on the vertical axes to facilitate comparisons between graphs.

OGFC-AR Measurements (Figures 12-14)

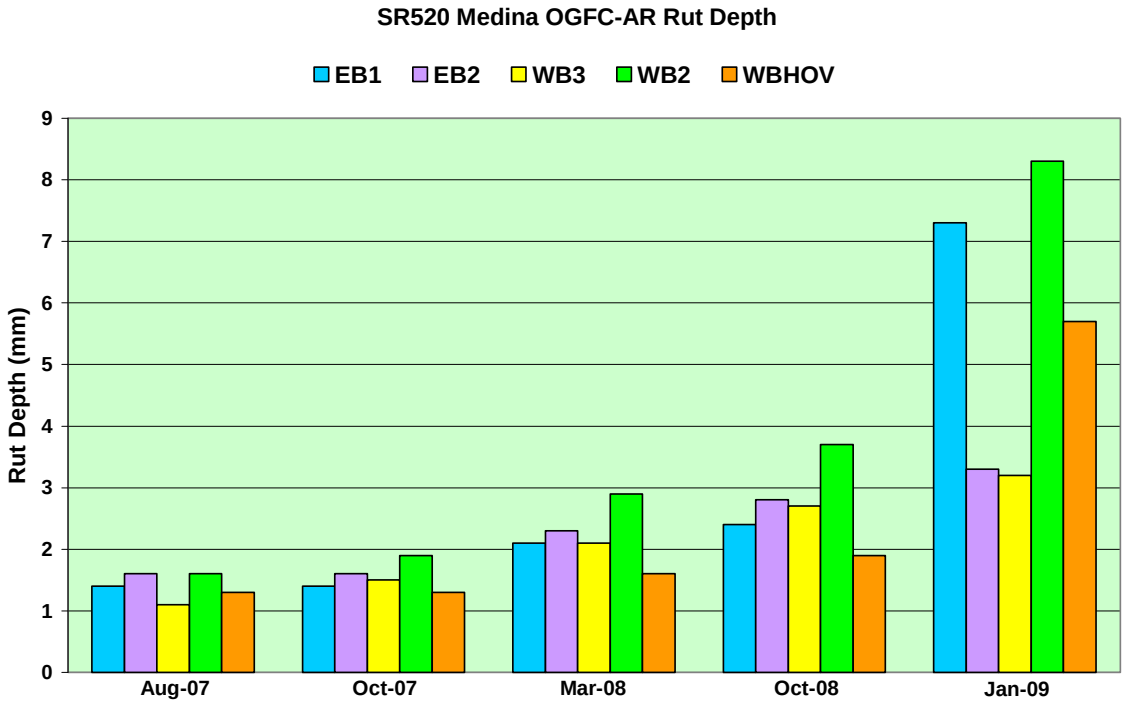


Figure 12. There are large increases in rut depths for EB1, WB2 and WBHOV from October 2008 through January 2009.

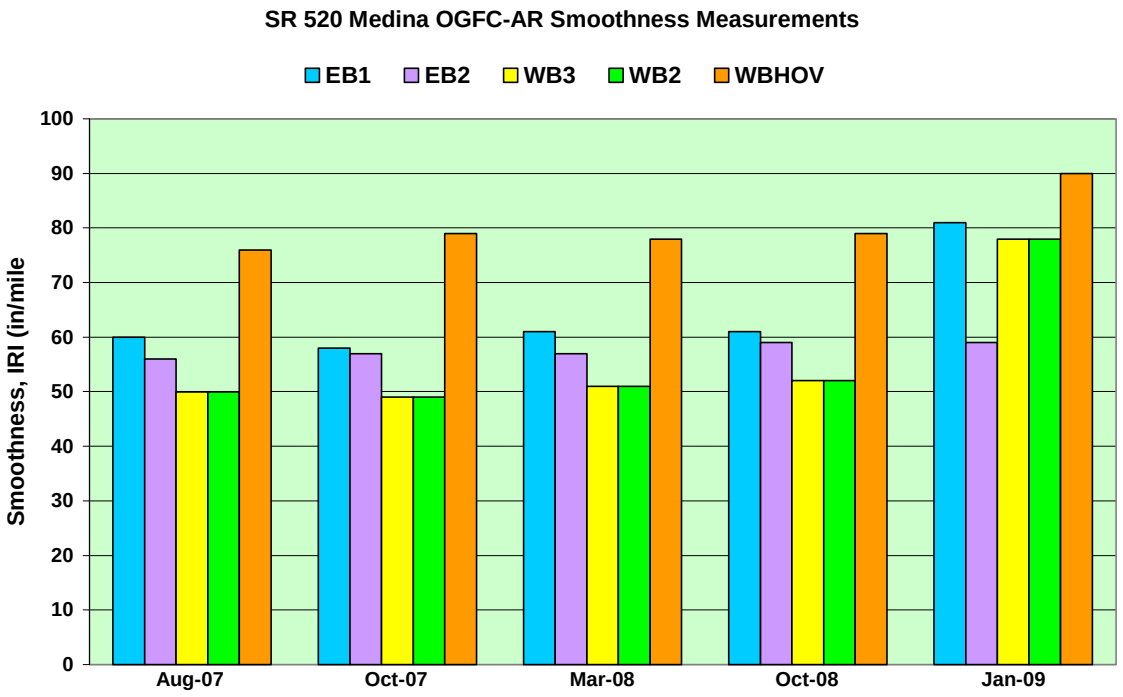


Figure 13. Smoothness measurements show an increase for EB1, WB3, WB 2 and WBHOV which correlates with the increases in rutting noted for the same lanes.

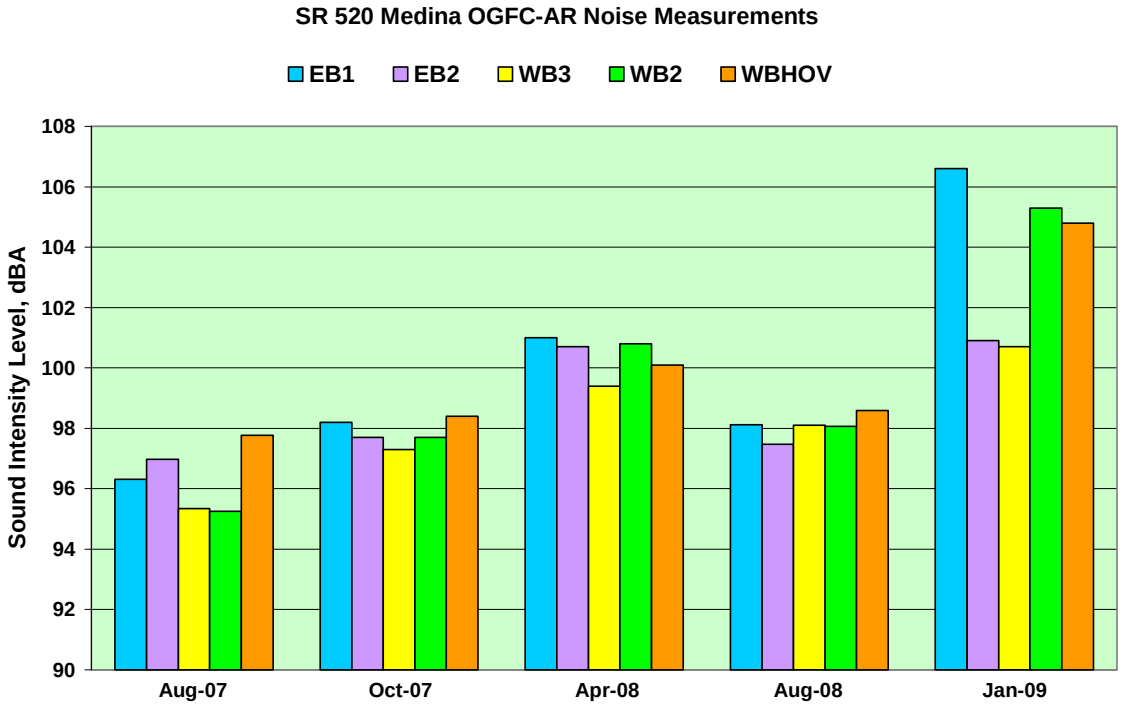


Figure 14. Large increase in dBA levels for EB1, WBHOV and WB2 for the January 2009 measurements. EB2 and WB3 do not show this same increase for January. Average noise in summer 2007 was about 96 dBA; January 2009 average is about 104 dBA.

OGFC-SBS Measurements (Figures 15-17)

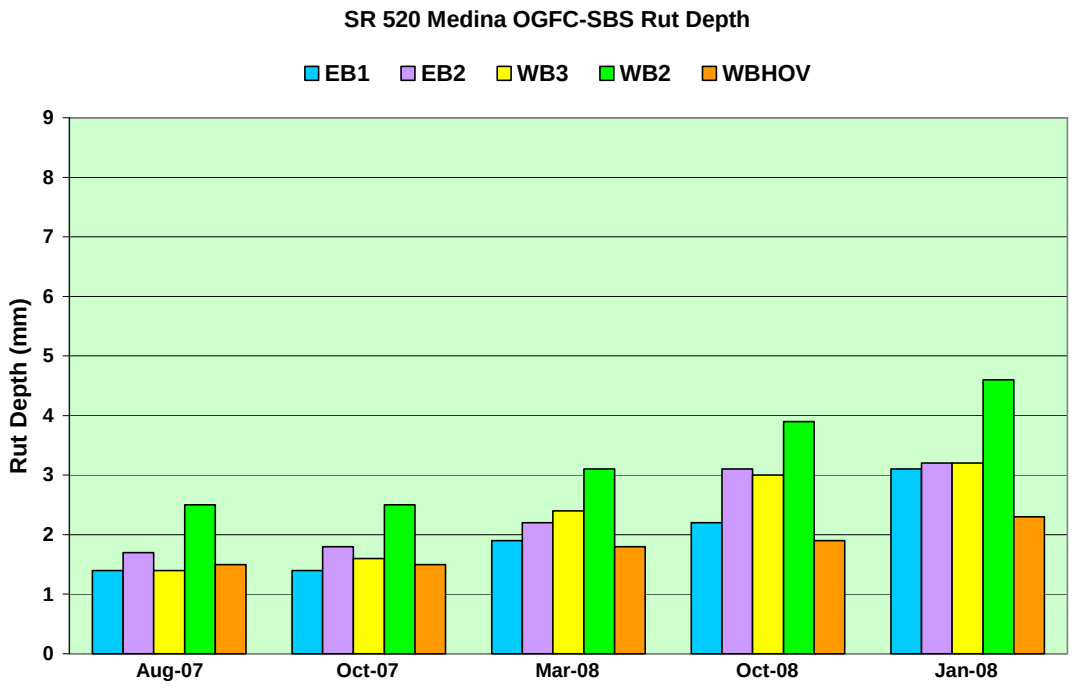


Figure 15. Very consistent gradual increase in rut depth over time.

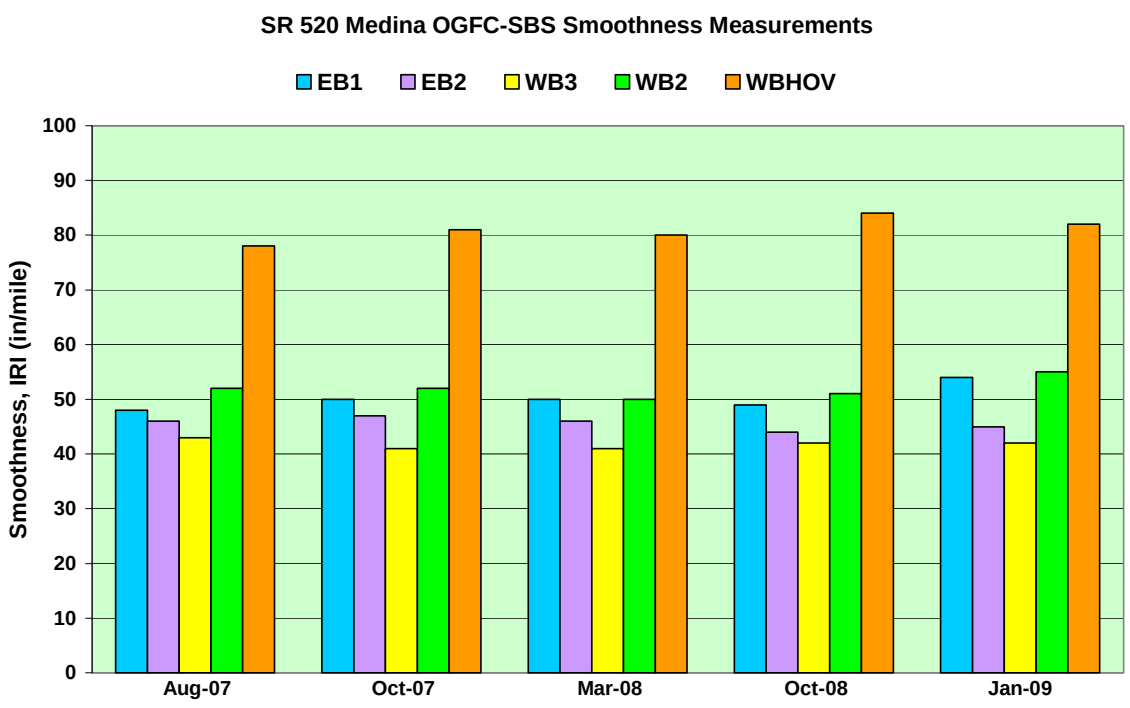


Figure 16. Very little change in roughness over time for all of the lanes.

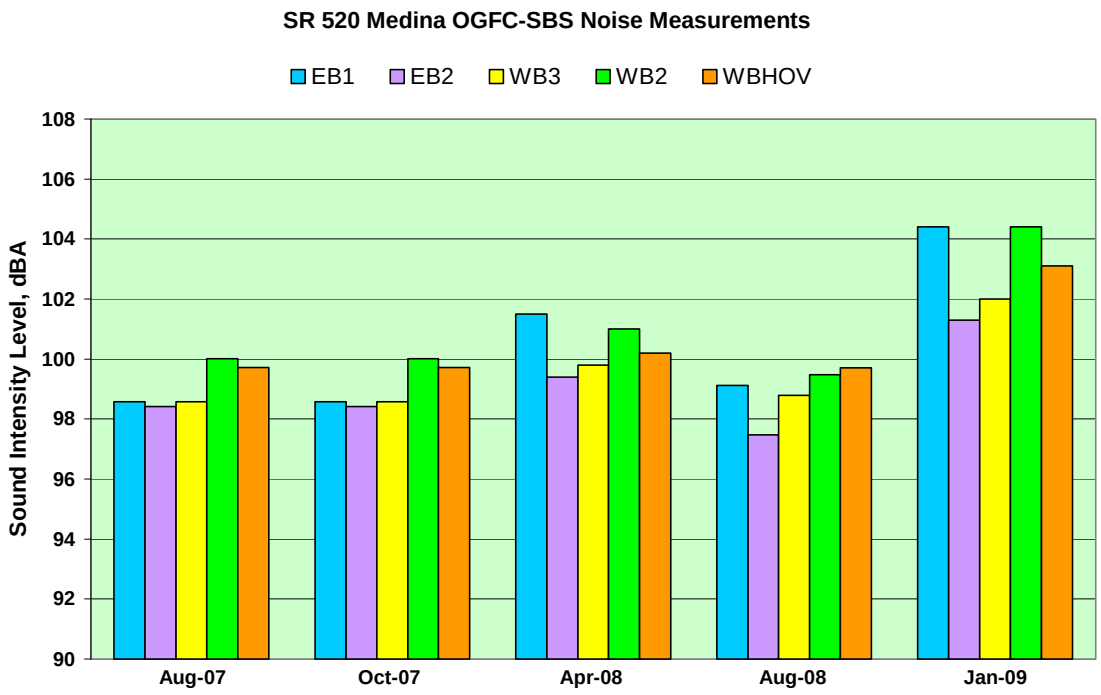


Figure 17. Increase in dBA levels in January for EB1, WBHOV, WB2 and WB3 Lanes. Average noise in summer 2007 was about 99 dBA; January 2009 averages about 103 dBA.

HMA Measurements (Figures 18-20)

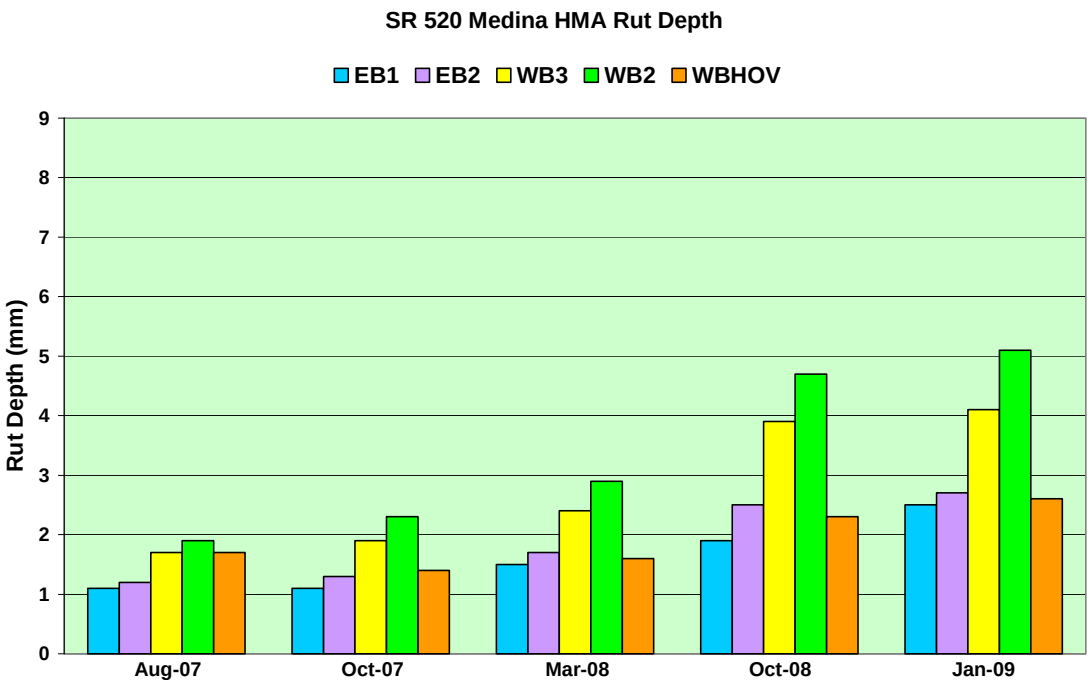


Figure 18. No significant change in rut depth from October 2008, to January 2009.

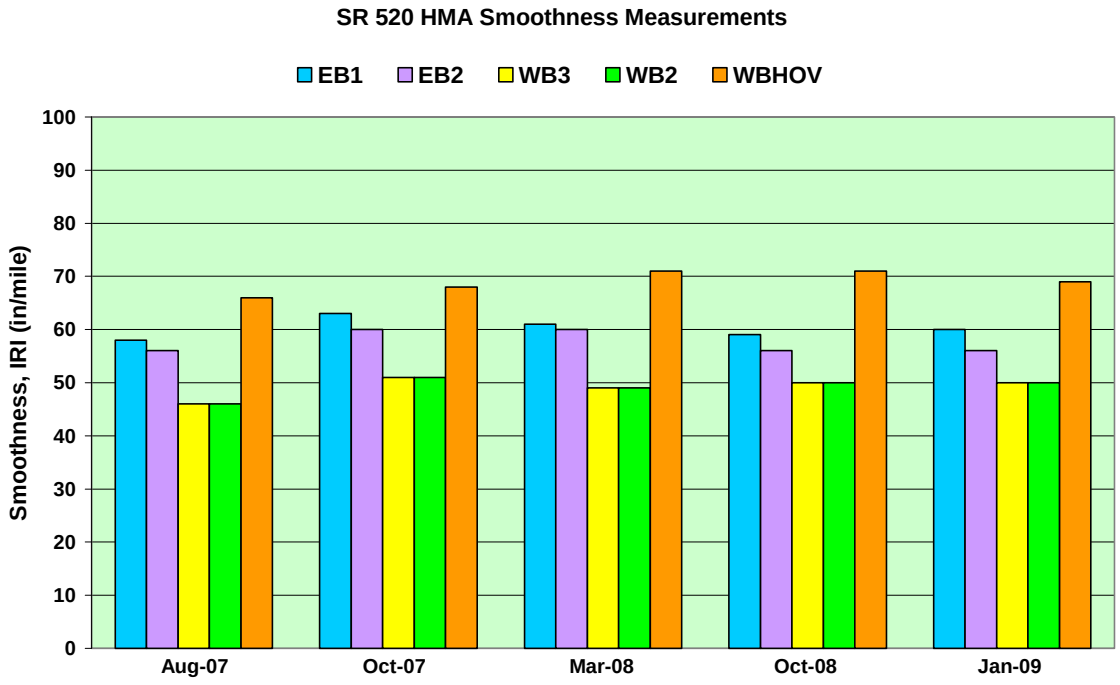


Figure 19. No change in roughness for any lane over time.

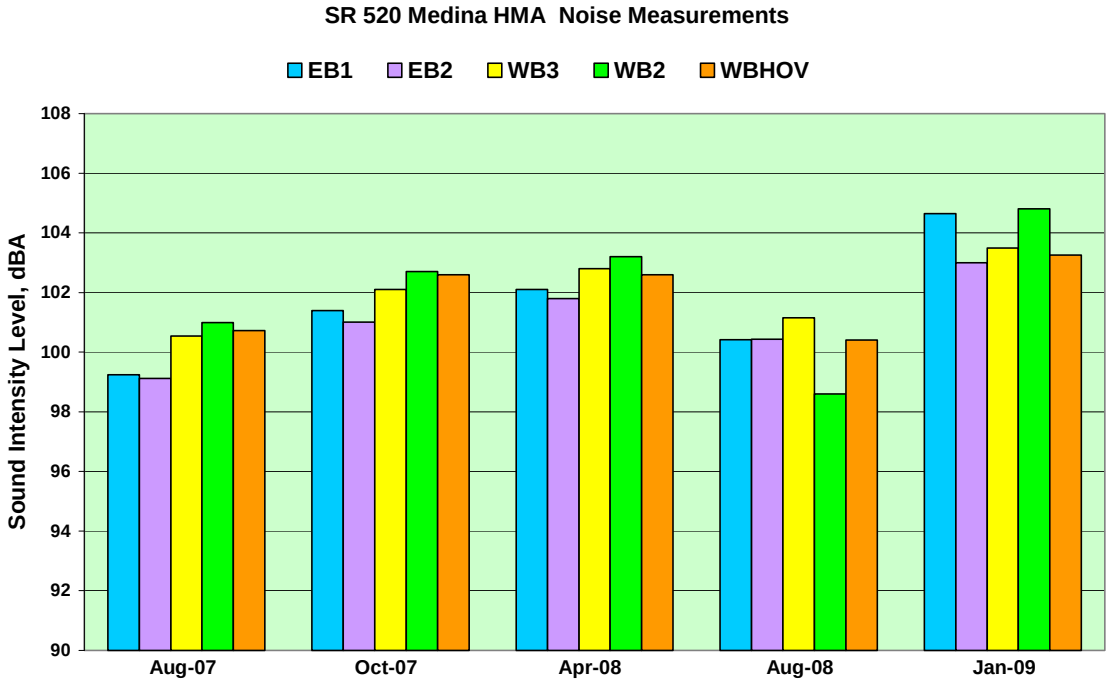


Figure 20. No large change in dBA levels for any of the lanes, just a gradual increase over time. Average noise was about 99/100 dBA in summer 2007; in January 2009, average is about 104 dBA.