

# Quieter Pavement Noise and Pavement Performance Update

December 2010

## Introduction

The quieter pavement test sections on I-5, SR 520 and I-405 are monitored for performance by periodic measurements of sound intensity level, rutting in the wheel paths and ride. The sound intensity level or noise is measured monthly, weather permitting, and the rutting and ride are measured twice each year, once in the fall before the advent of the studded tire season and once in the spring at the end of the studded tire season.

Rutting on asphalt pavements is caused by either wear or compaction of the pavement in the wheel paths due to heavy loads. There is no evidence that the thin OGFC pavements are rutting due to compaction and that raveling is the major cause of the rutting. Pavement wear in asphalt pavements is called raveling, which is the loss of the aggregate or rock particles from the glue (asphalt binder). Raveling comes as a result of the abrasive effects of vehicle tires on the pavement surface. This abrasion is especially severe from vehicles equipped with studded tires or chains during the winter. Open graded pavements tend to be more susceptible to raveling because they are not as strong as conventional pavements due to the presence of the many voids in their structure. Pavements that are rutted are programmed for rehabilitation when the rutting reaches 10 mm (slightly less than ½ inch).

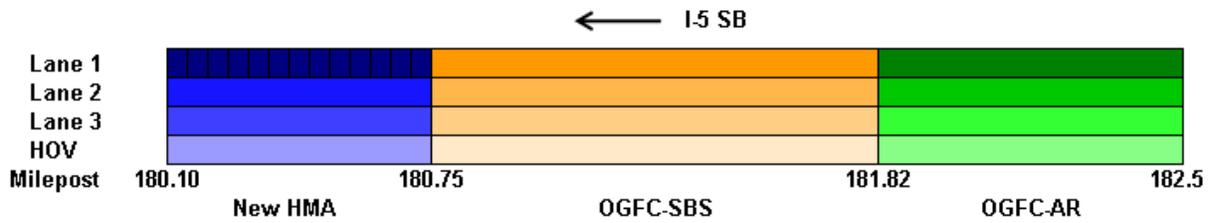
The ride of a pavement is a measure of its smoothness or roughness. Ride is evaluated by measuring the amount of up and down motions a vehicle makes as it travels the roadway. Ride can be adversely affected by pavement rutting if it roughens the surface of the pavement or causes bumps or dips.

## I-5 Lynnwood Test Sections

**Date:** August 19-20 and 25-26, 2006.  
**Pavement Types:** OGFC-AR (asphalt rubber modified)  
OGFC-SBS (polymer modified, with an SBS polymer)  
HMA Control (standard dense graded hot mix asphalt)

### Plan Map:

The plan map below shows the orientation of the lanes. Lane 1 is the outside lane and the HOV the inside or median lane. The colors used for each lane and each pavement type are used throughout the lane by lane comparison that follows.



### Lane by Lane Analysis

The following nine bar charts show the relationship over time for the rutting measurements, ride measurements, and sound intensity level measurements for each of the lanes and each of the three test sections. The time of the sound intensity level measurements used in the comparison match as close as possible to the same month and day as the rutting and ride measurements intervals.

### I-5 Lynnwood OGFC-AR Measurements (Figures 1-3)

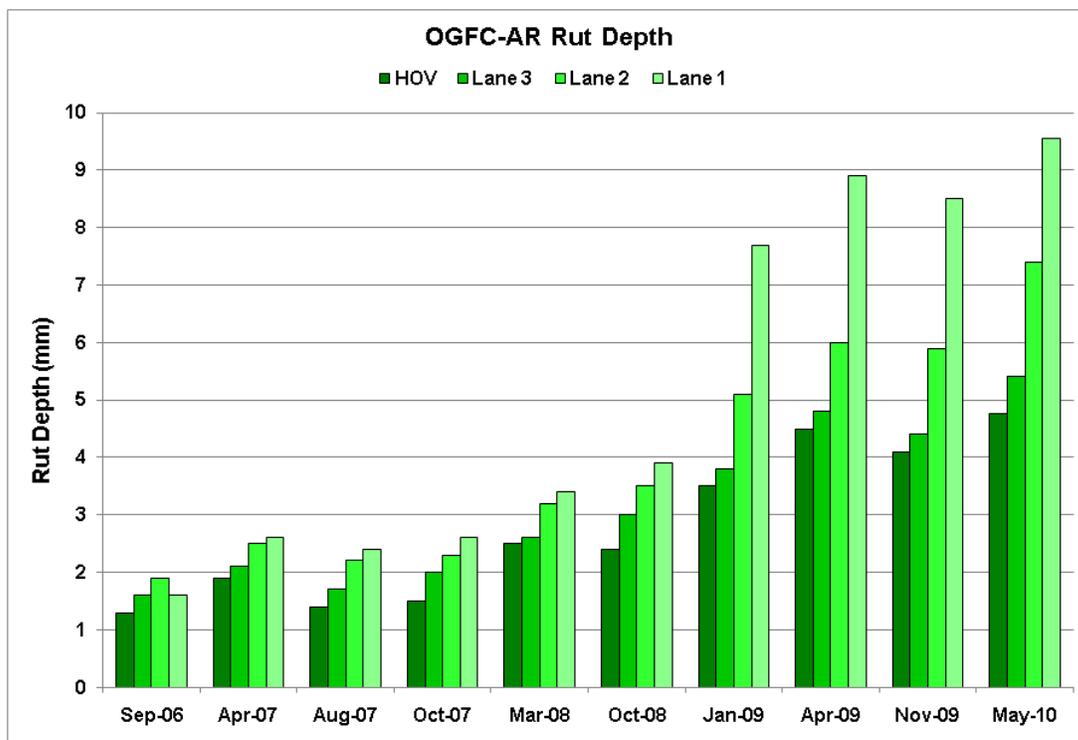


Figure 1. Note the big jump in rut depth for Lane 1 in January 2009 due to harsh winter weather which caused an increase in the use of studded tires and chains. The peak rut depth of 9.5 mm measured in May 2010 is half the total depth of the pavement.

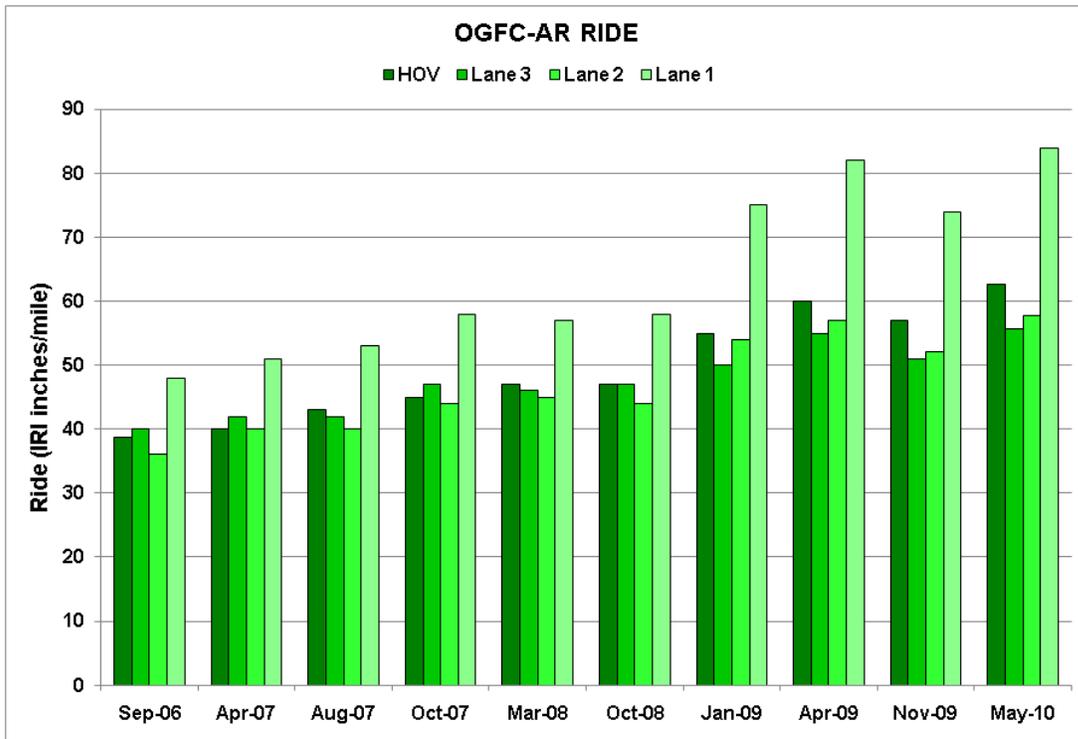


Figure 2. The jump in rut depth is matched by a jump in the ride or roughness of lane one in January 2009. This would indicate a link between roughness and rutting. The other lanes, in contrast, show a gradual incremental increase in roughness.

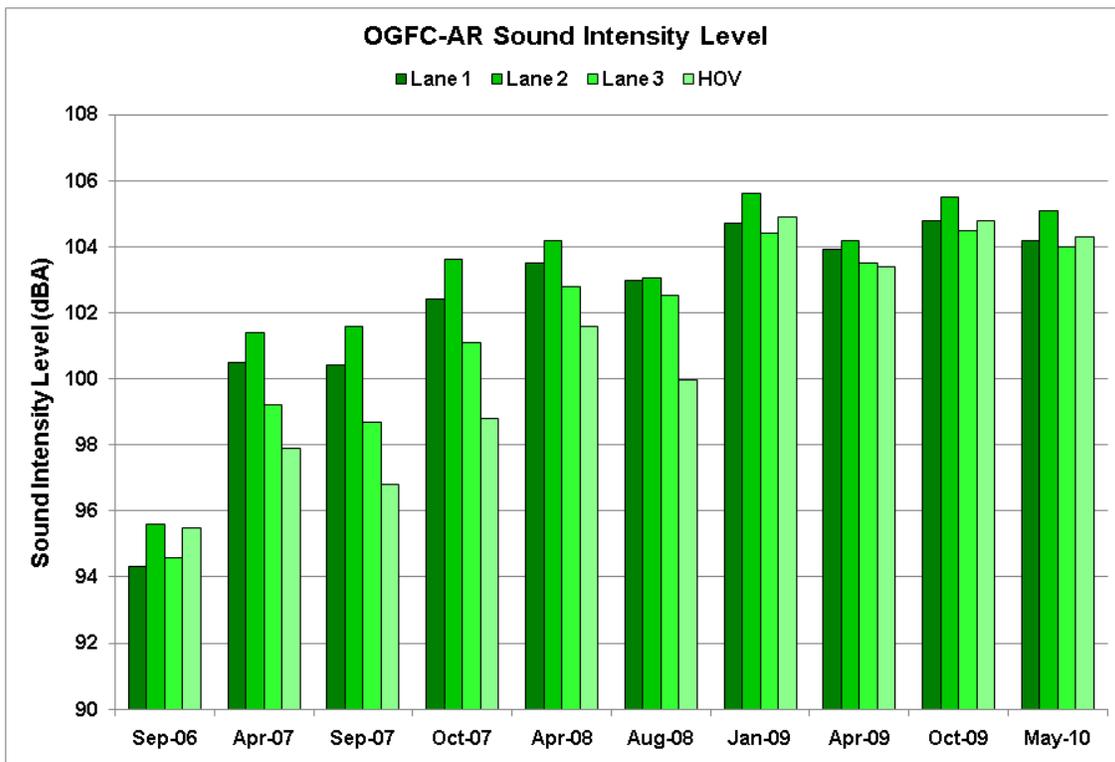
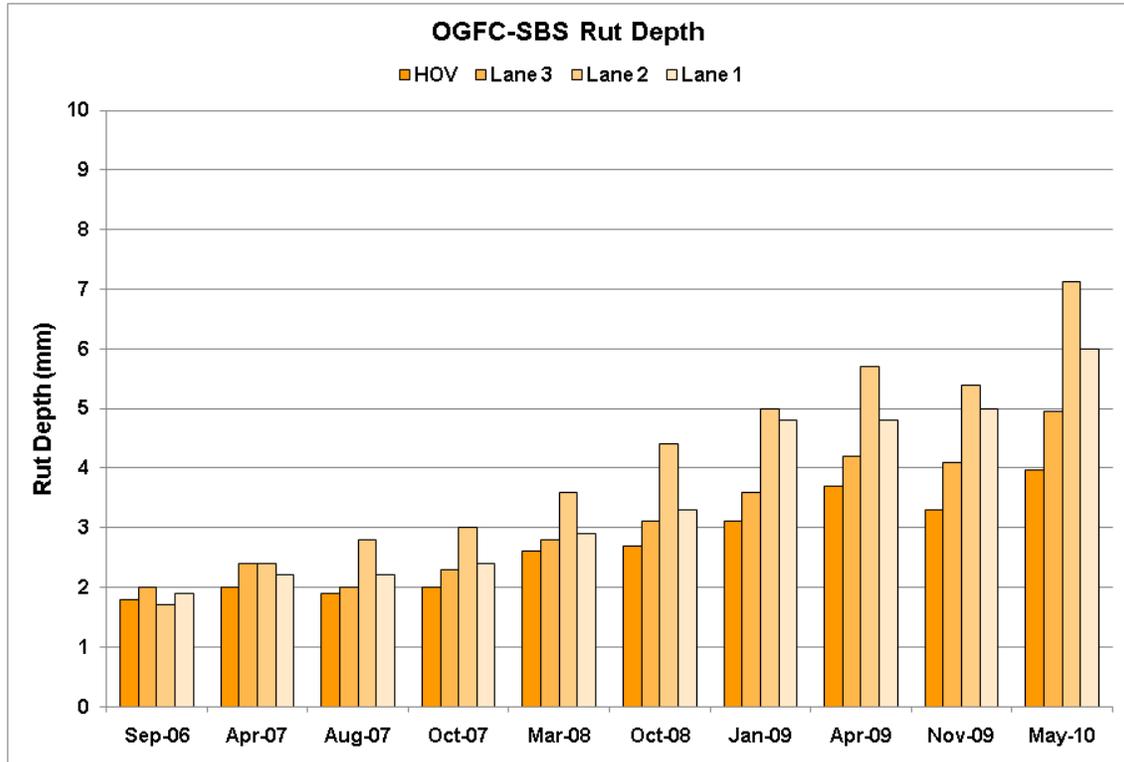


Figure 3. All lanes show a large increase in sound intensity level between the initial readings in September 2006 and the April 2007 readings, a period of only eight months. The average sound intensity level for all lanes has increased 9 decibels from September 2006 to May 2010. The OGFC-AR was removed by diamond grinding in late 2010 due to excessive raveling and rutting.

## I-5 Lynnwood OGFC-SBS Measurements (Figures 4-6)



Figures 4. There is a general increase in the rut depth over the measurement period with no large jumps as was observed in the OGFC-AR section. Lane 2 shows the most rutting in contrast to the OGFC-AR section where Lane 1 had the highest rut depth readings.

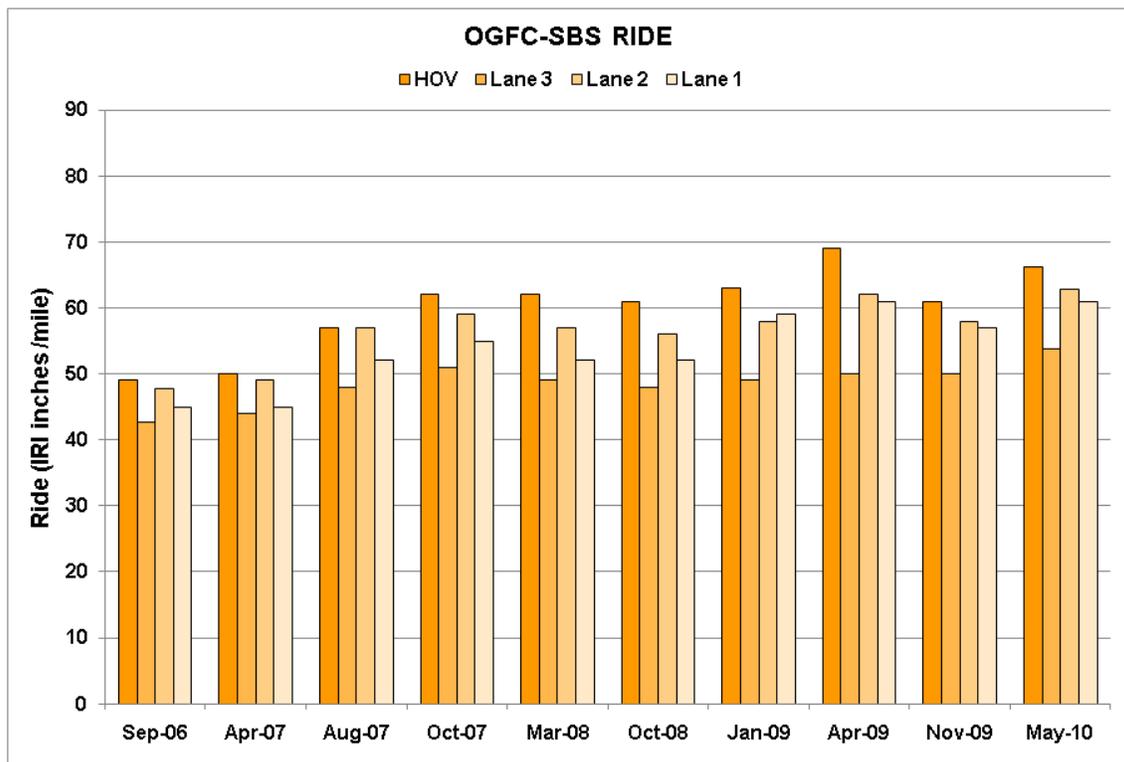


Figure 5. There is a very minimal increase in roughness over time for the OGFC-SBS.

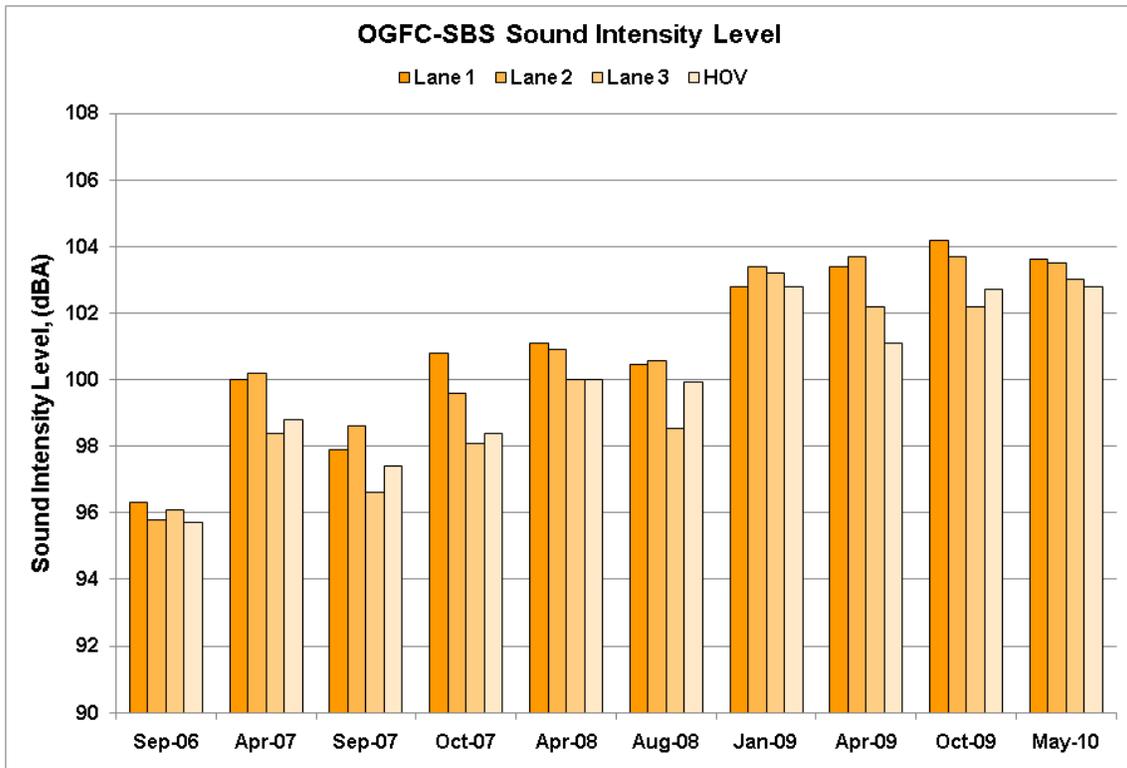


Figure 6 There is large increase in the sound intensity level between the initial readings in September of 2006 and the April 2007 readings, a period of only eight months. Another large increase occurs between the August 2008 and January 2009 readings reflecting the harsh winter of 2008-09. The average sound intensity level for all lanes has increased 7 decibels from September of 2006 to May of 2010.

### I-5 Lynnwood HMA Control Section (Figures 7-9)

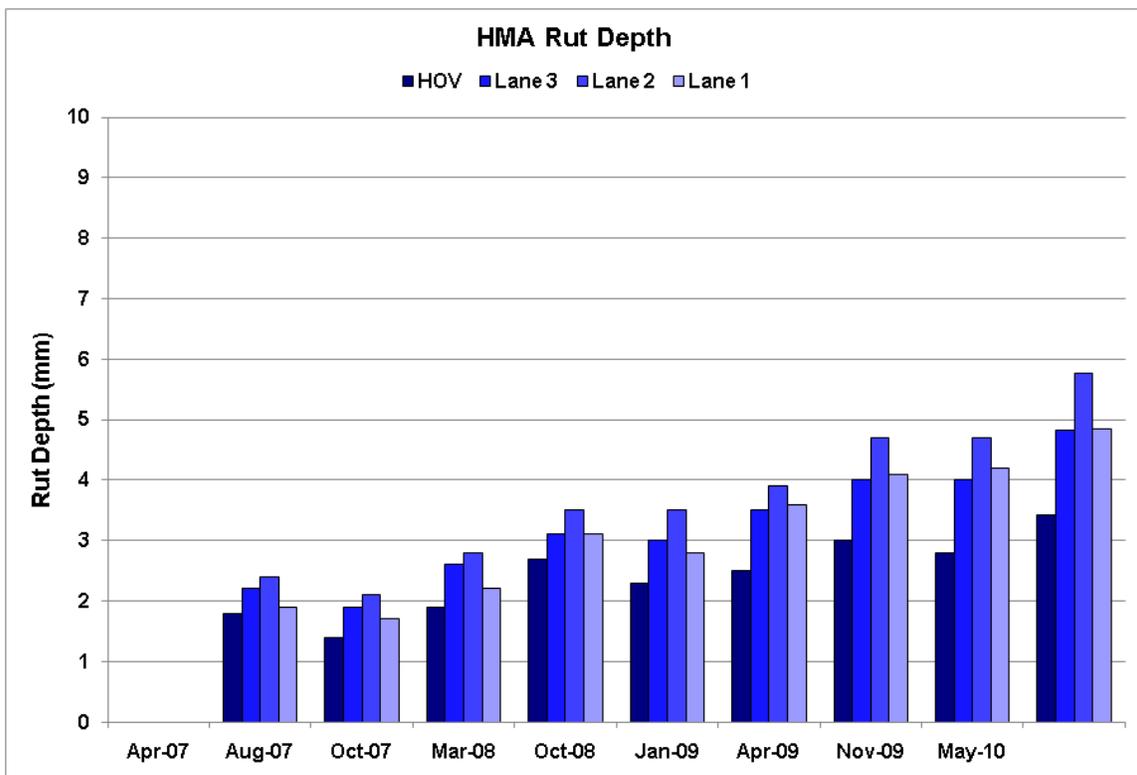


Figure 7. A slight increase in rut depth with time but no large increases as was observed with the OGFC-AR. The rutting in the HMA section is similar in pattern to the OGFC-SBS.

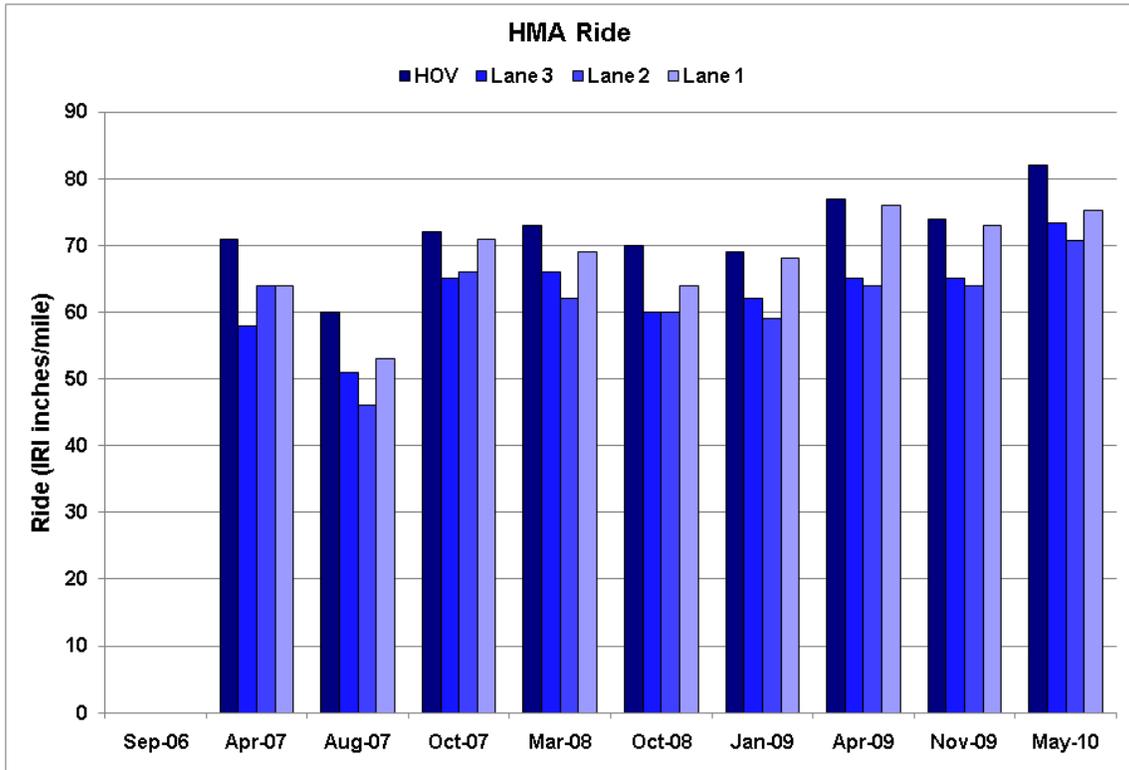


Figure 8. Very little change in roughness for any of the lanes over time. There were no ride readings for the HMA section in September of 2006.

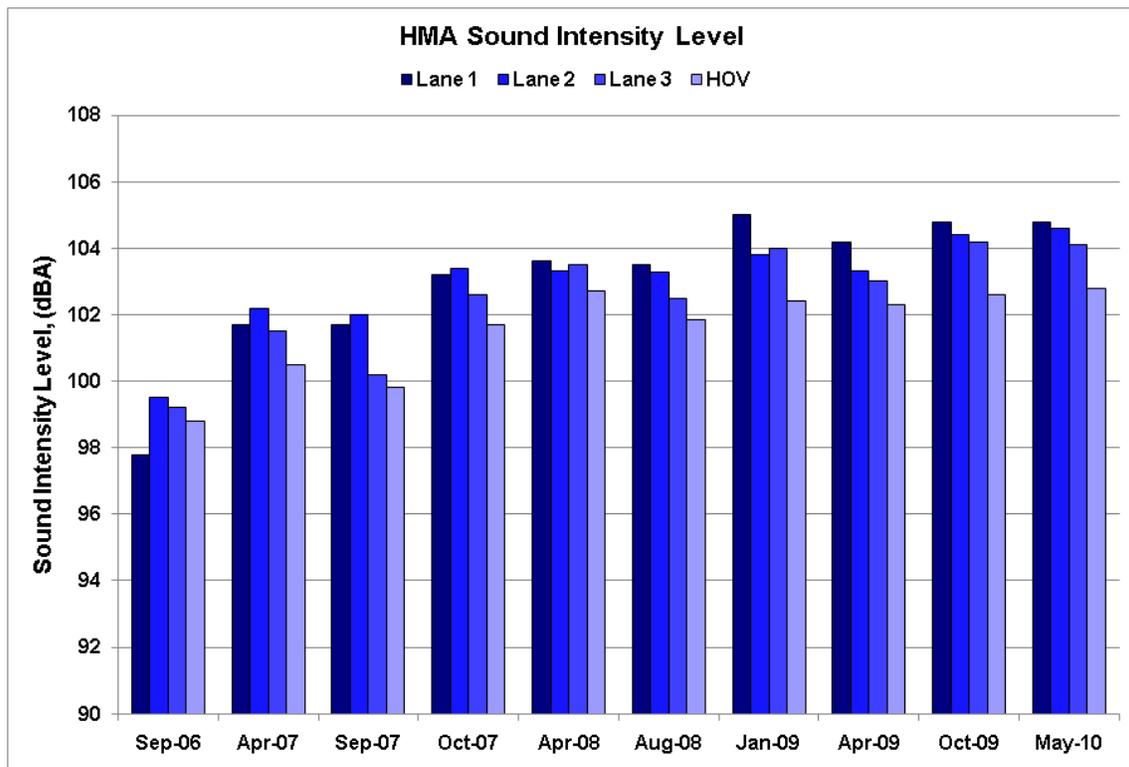


Figure 9. There is an increase in the sound intensity level between the initial readings in September of 2006 and the April 2007 readings, a period of only eight months. However, the increase is only about an average of 2 decibels in contrast to the OGFC sections which increased about 4 decibels. The average sound intensity level for all lanes has increased 5 decibels from September of 2006 in May of 2010.

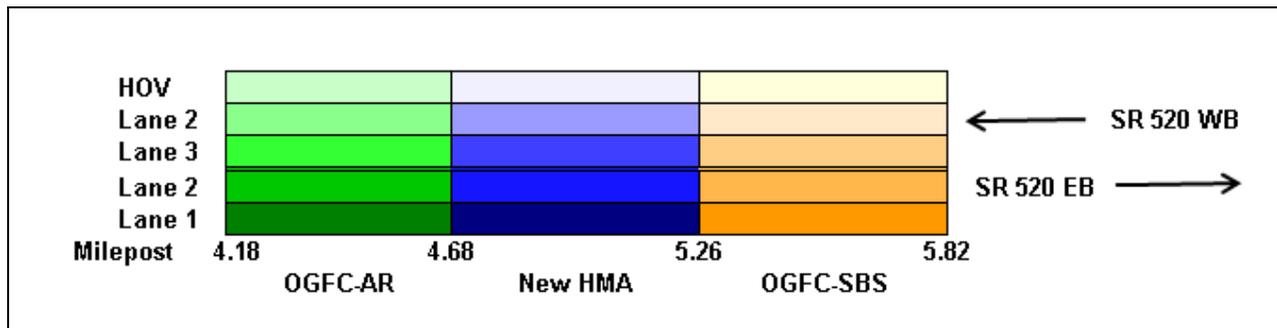
## SR 520 Medina Vic. Test Section

**Paving Date:** July 14-15, 2007

**Pavement Types:** OGFC-AR (asphalt rubber modified)  
 OGFC-SBS (polymer modified, with an SBS polymer)  
 HMA Control (standard dense graded hot mix asphalt)

### Plan Map:

The plan map below shows the orientation of the lanes. Lane 1 is the outside lane and Lane 2 the inside or median lane in the eastbound direction. In the westbound direction the HOV lane is the outside lane and Lane 3 is the inside or median lane. The colors used for each lane and each pavement type are used throughout the lane by lane comparison that follows.



### Lane by Lane Analysis

The following nine bar charts show the relationship over time for the rutting measurements, ride measurements, and sound intensity level measurements for each of the lanes and each of the test sections and control section. The time of the sound intensity level measurements used in the comparison match as close as possible to the same month and day as the rutting and ride measurements intervals.

### SR 520 Medina OGFC-AR Measurements (Figures 10-12)

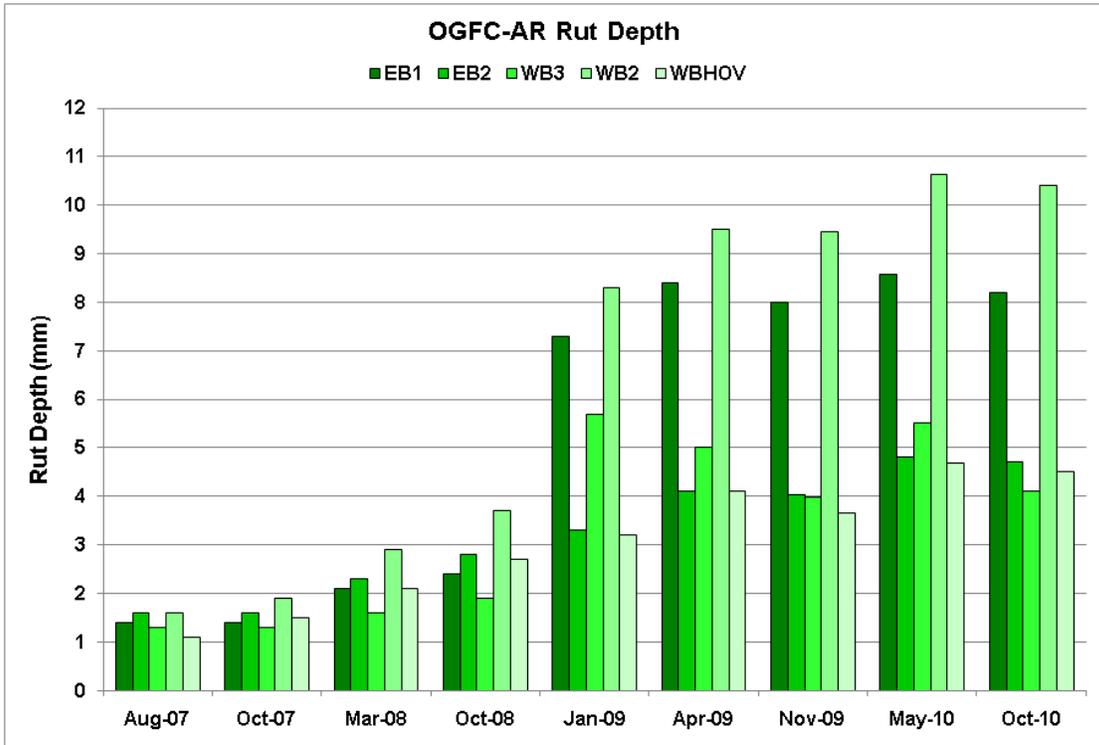


Figure 10. There are large increases in rut depths for EB1 and WB2 during the winter of 2008-09 as evidenced by the jump in the January 2009 readings. EB1 and WB 2 are the most heavily used lanes.

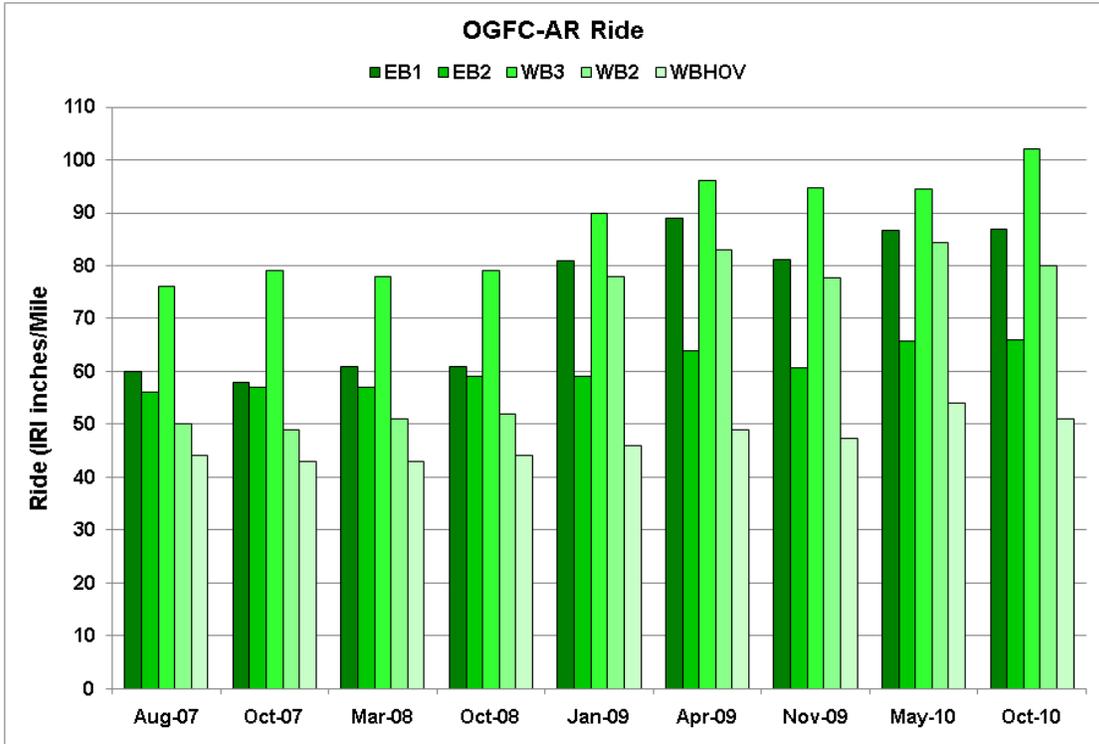


Figure 11. Smoothness measurements show an increase for EB1, WB3, WB2 between the Oct-08 and Jan-09 readings which correlate with the increases in rutting noted for EB1 and WB2.

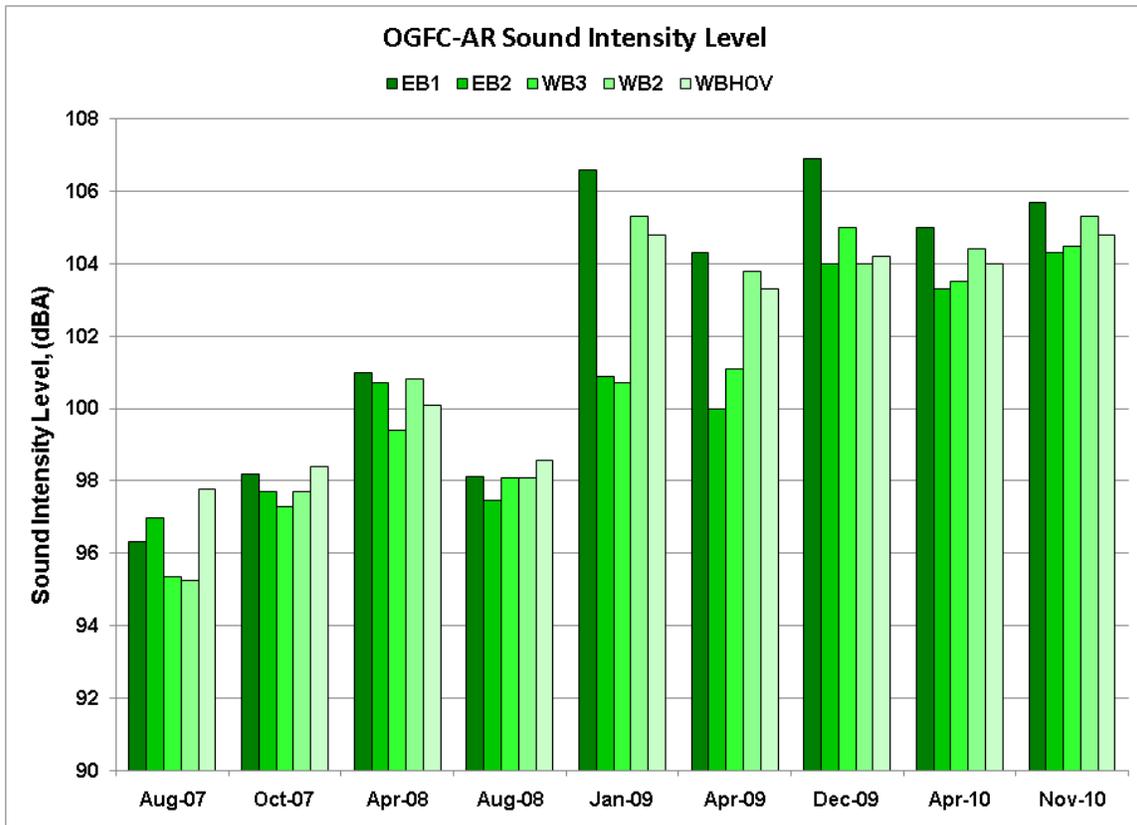


Figure 12. Large increase in sound intensity levels for EB1, WB3 and WBHOV for the January 2009 measurements. The average sound intensity level for all lanes has increased 8 decibels from August of 2007 to November 2010.

**SR 520 OGFC-SBS Measurements (Figures 13-15)**

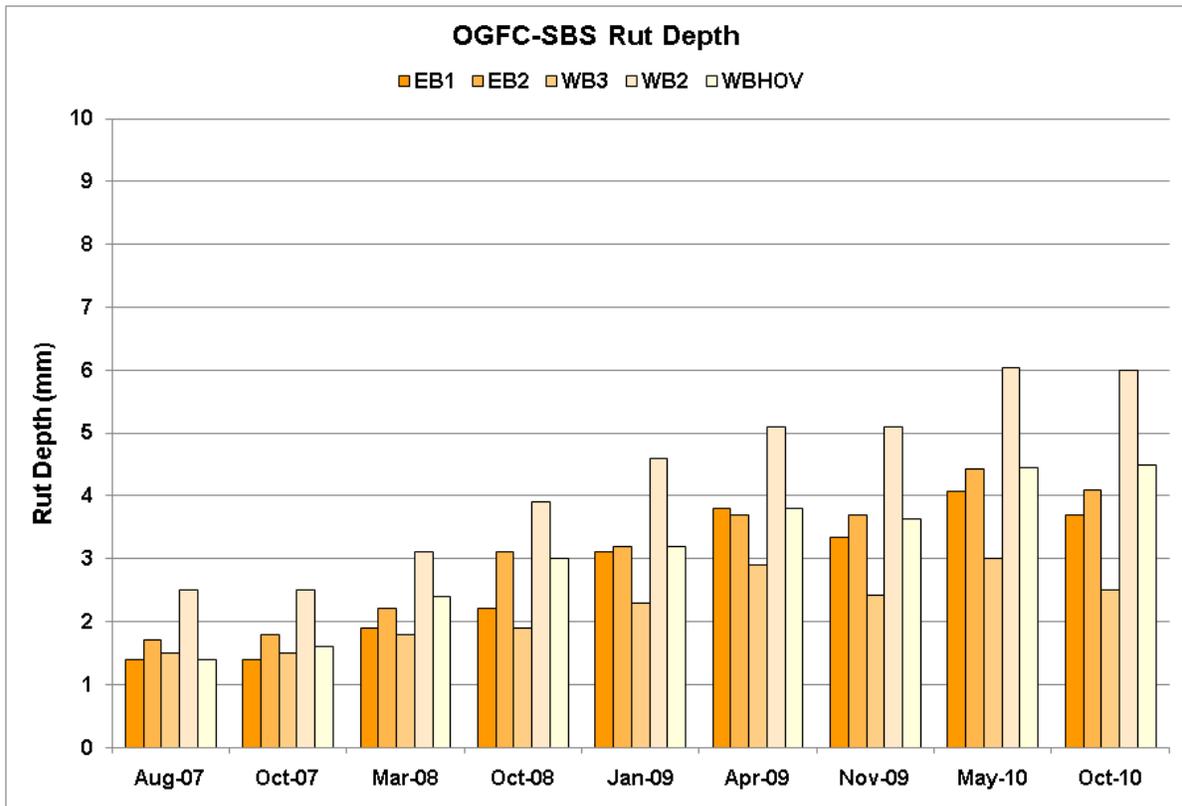


Figure 13. Very consistent gradual increase in rut depth over time.

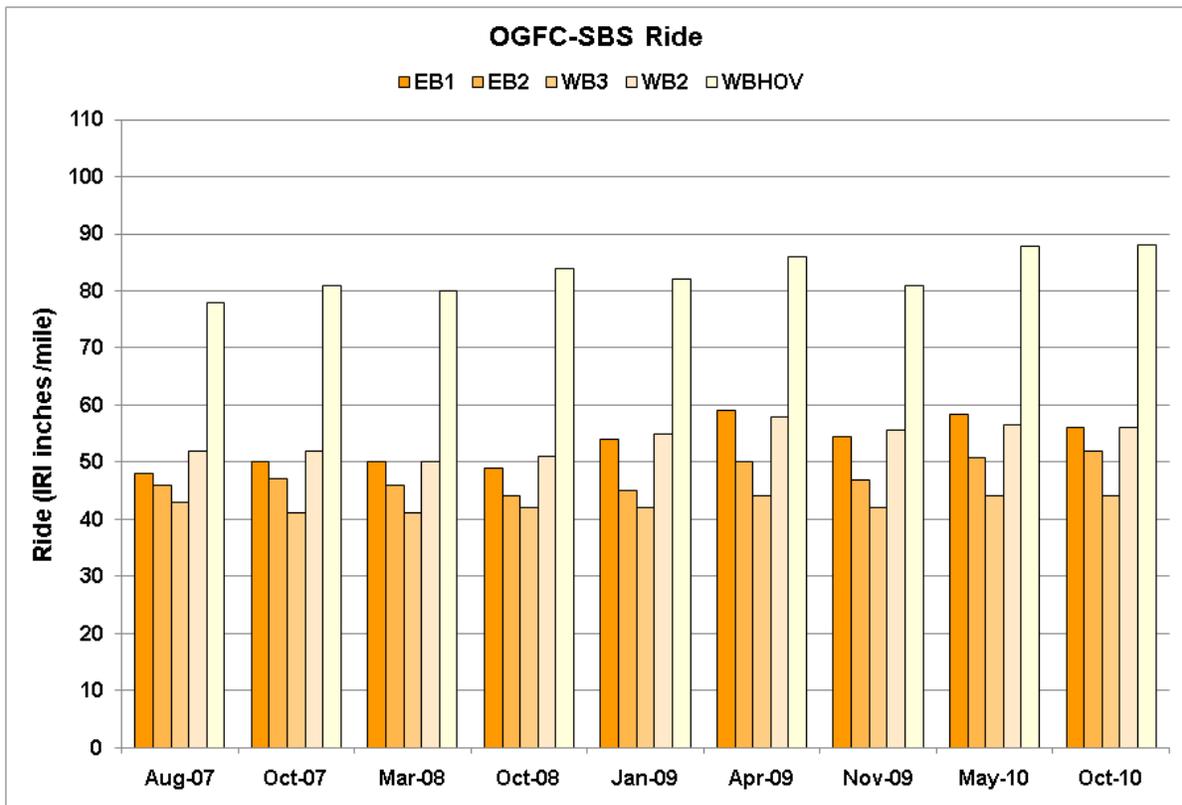


Figure 14. Very little change in roughness over time for all of the lanes.

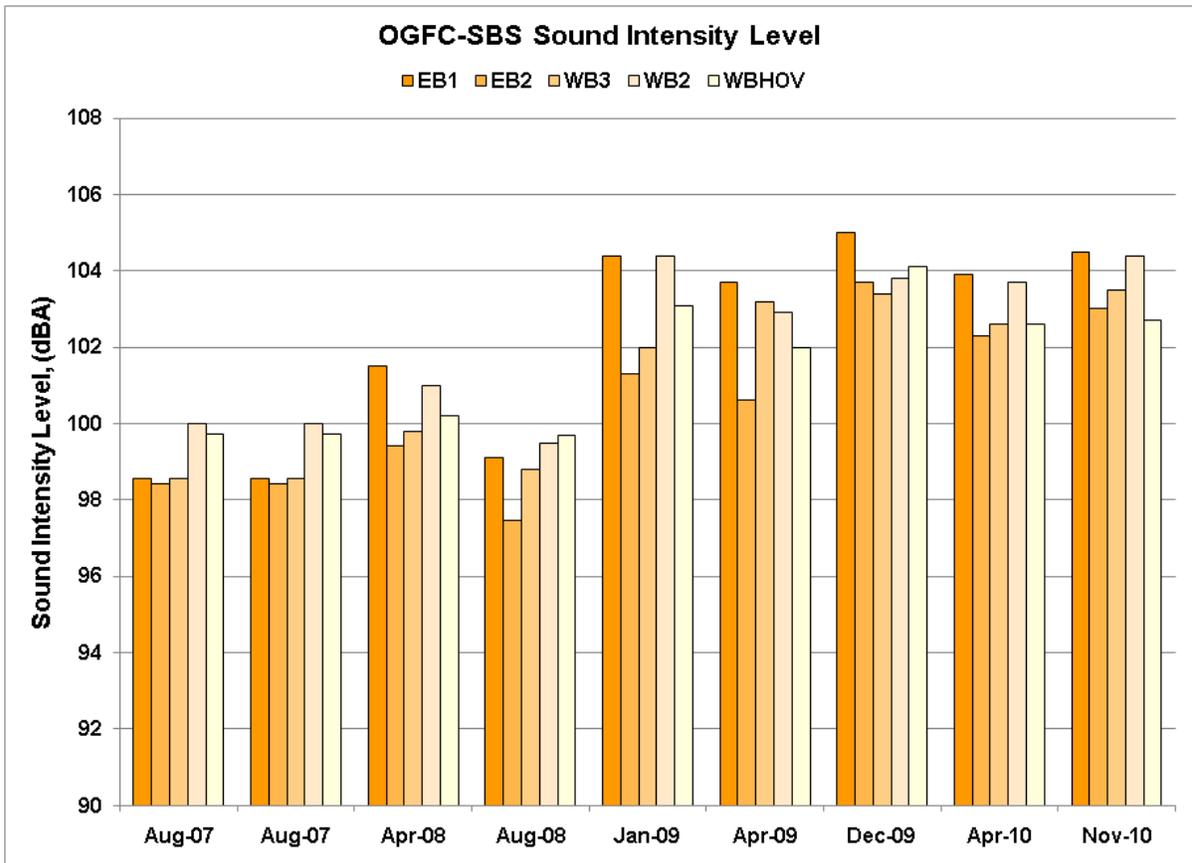


Figure 15. Increase in dBA levels in January for EB1, WBHOV, WB2 and WB3 Lanes. The average sound intensity level for all lanes has increased 4 decibels from August of 2007 to November 2010.

### SR 520 HMA Measurements (Figures 16-18)

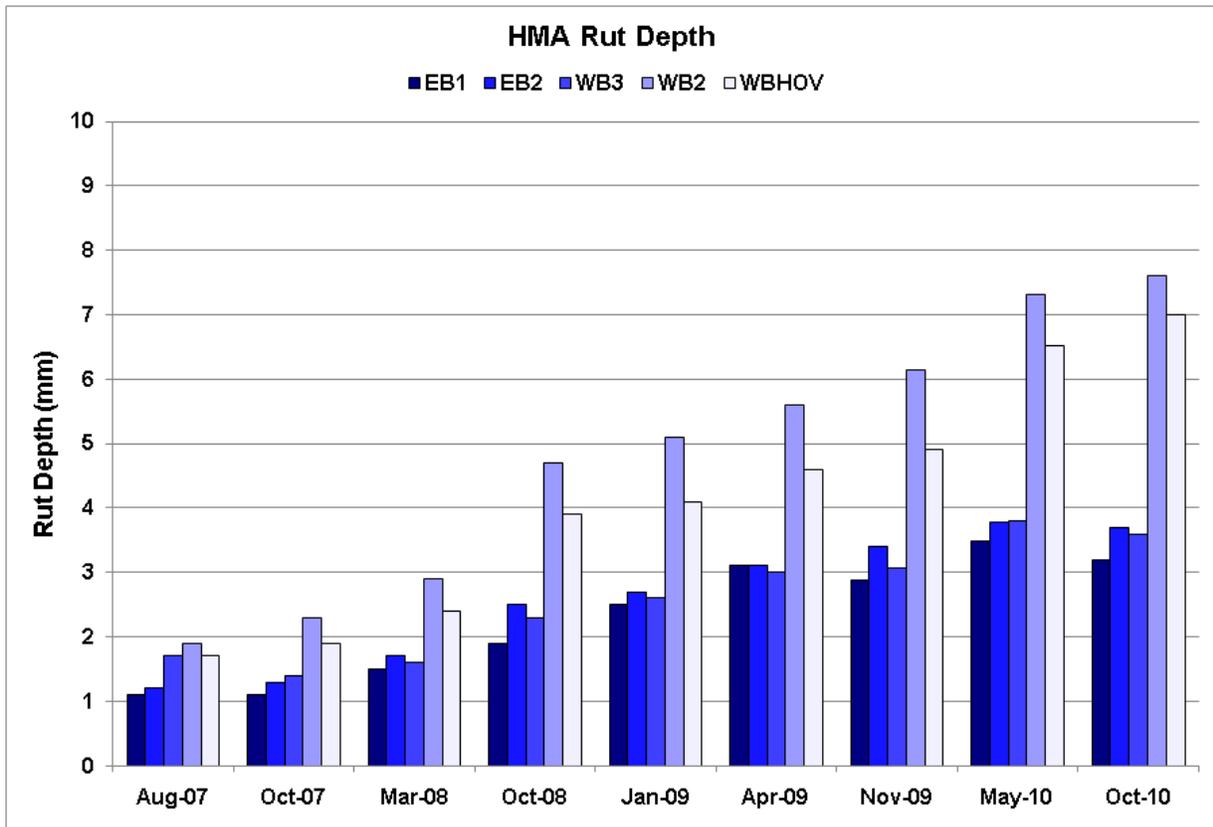


Figure 16. No significant change in rut depth from October 2008, to January 2009.

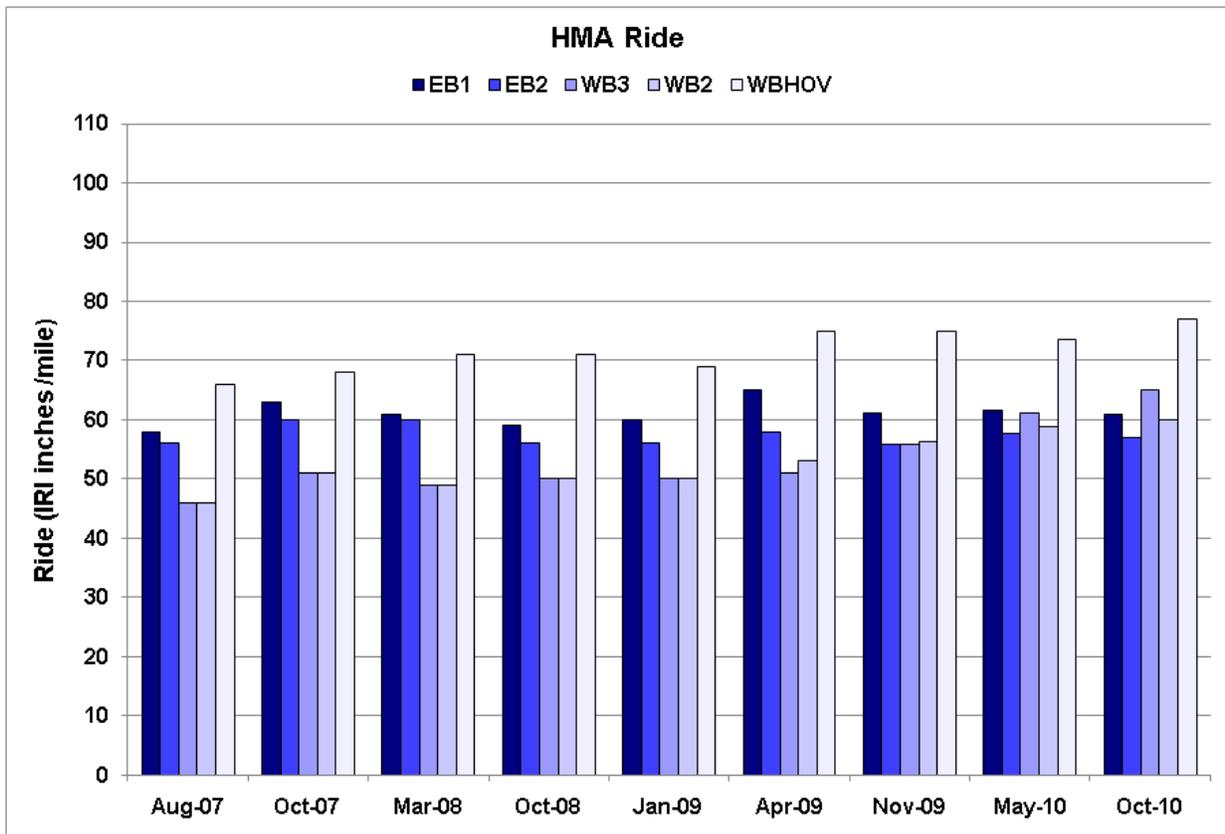


Figure 17. No change in roughness for any lane over time.

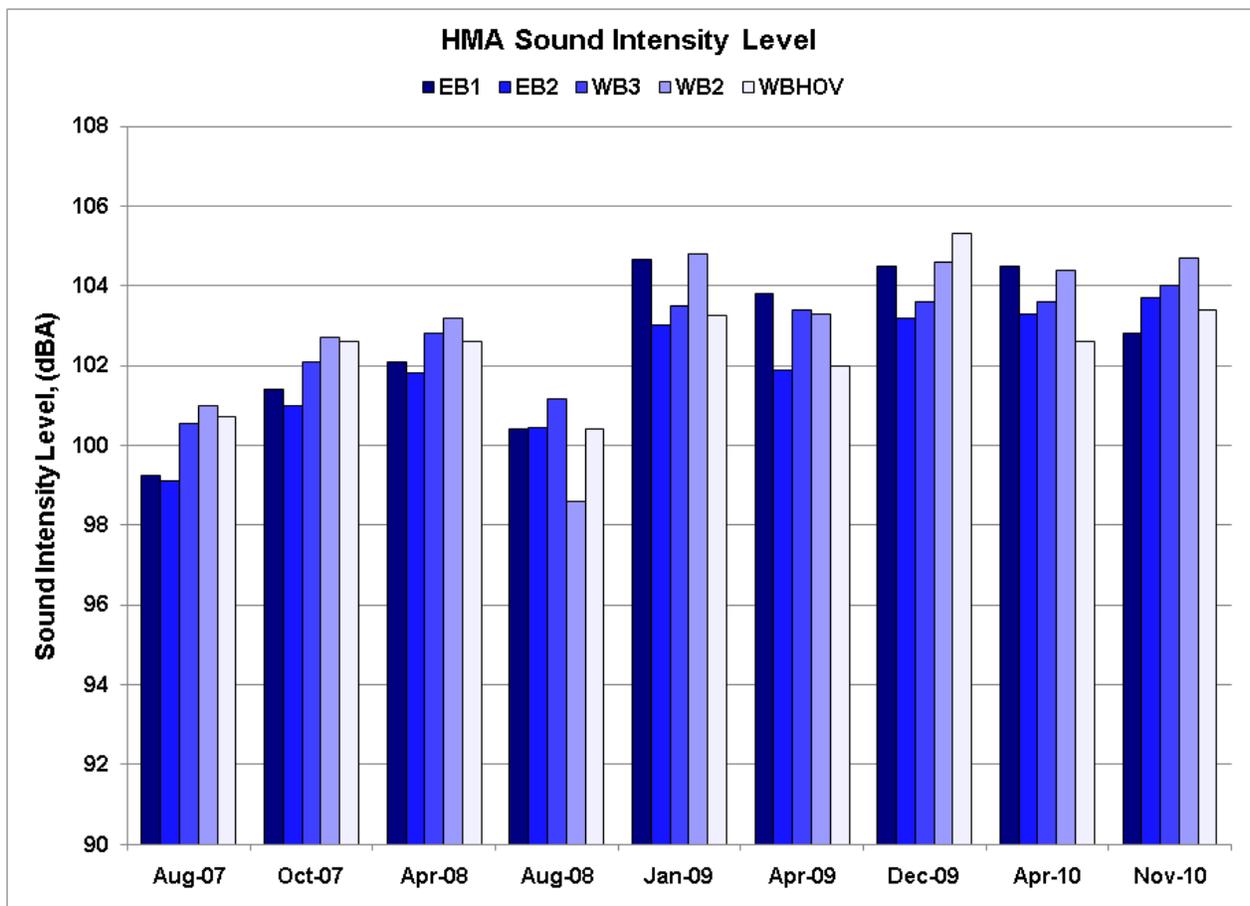


Figure 18. No large change in dBA levels for any of the lanes, just a gradual increase over time. The average sound intensity level for all lanes has increased 3 decibels from August of 2007 to November 2010.

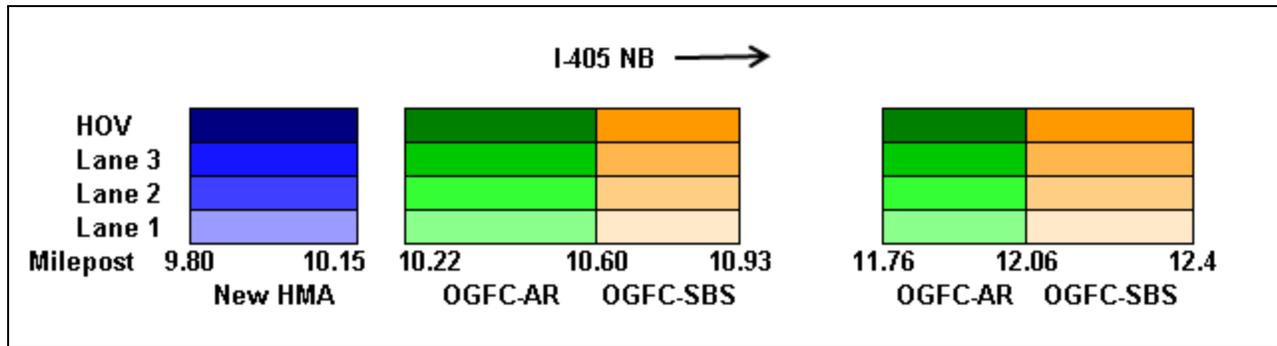
## I-405 Bellevue Vic. Test Section

**Paving Date:** August 15-16, 2009

**Pavement Types:** OGFC-AR (asphalt rubber modified)  
 OGFC-SBS (polymer modified, with an SBS polymer)  
 HMA Control (standard dense graded hot mix asphalt)

### Plan Map:

The plan map below shows the orientation of the lanes. Lane 1 is the outside lane and Lane 2 the inside or median lane in the eastbound direction. In the westbound direction the HOV lane is the outside lane and Lane 3 is the inside or median lane. The colors used for each lane and each pavement type are used throughout the lane by lane comparison that follows.



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### I-405 OGFC-AR Measurements (Figures 19-21)

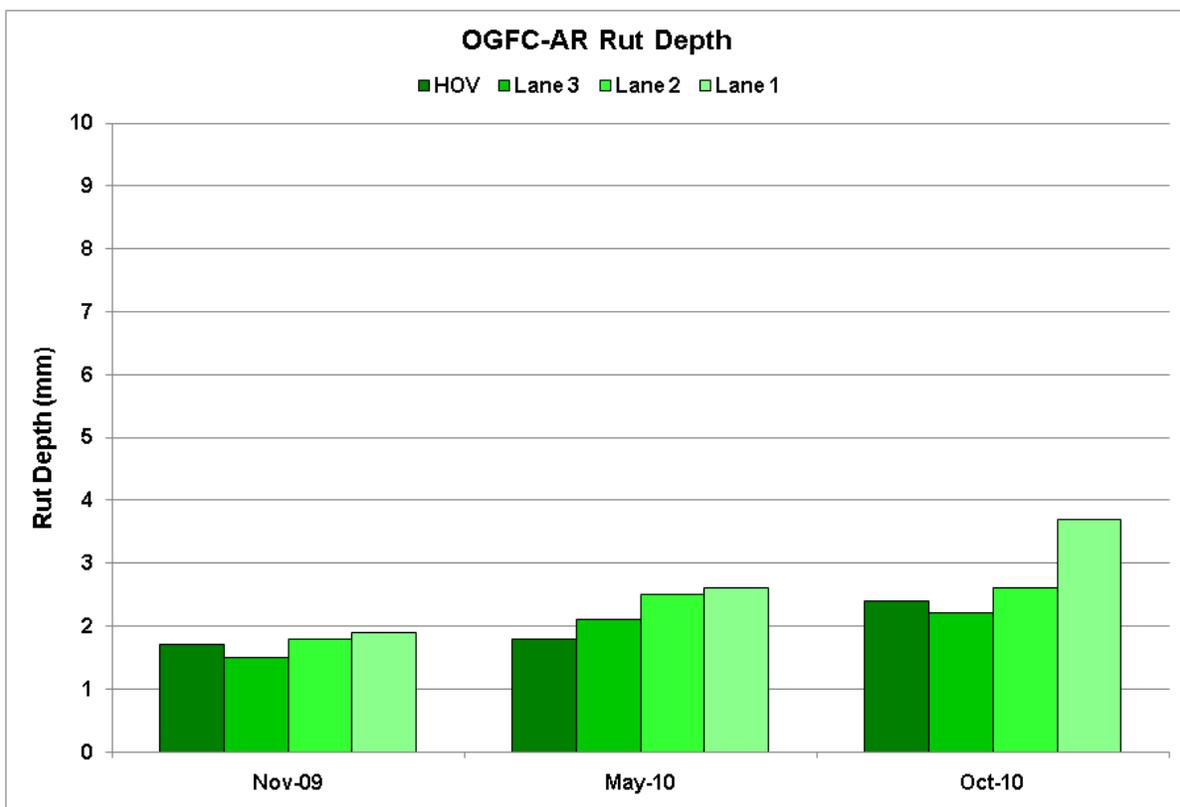


Figure 19. A very slight increase in rut depth for Lane 1 in the October 2010 measurements.

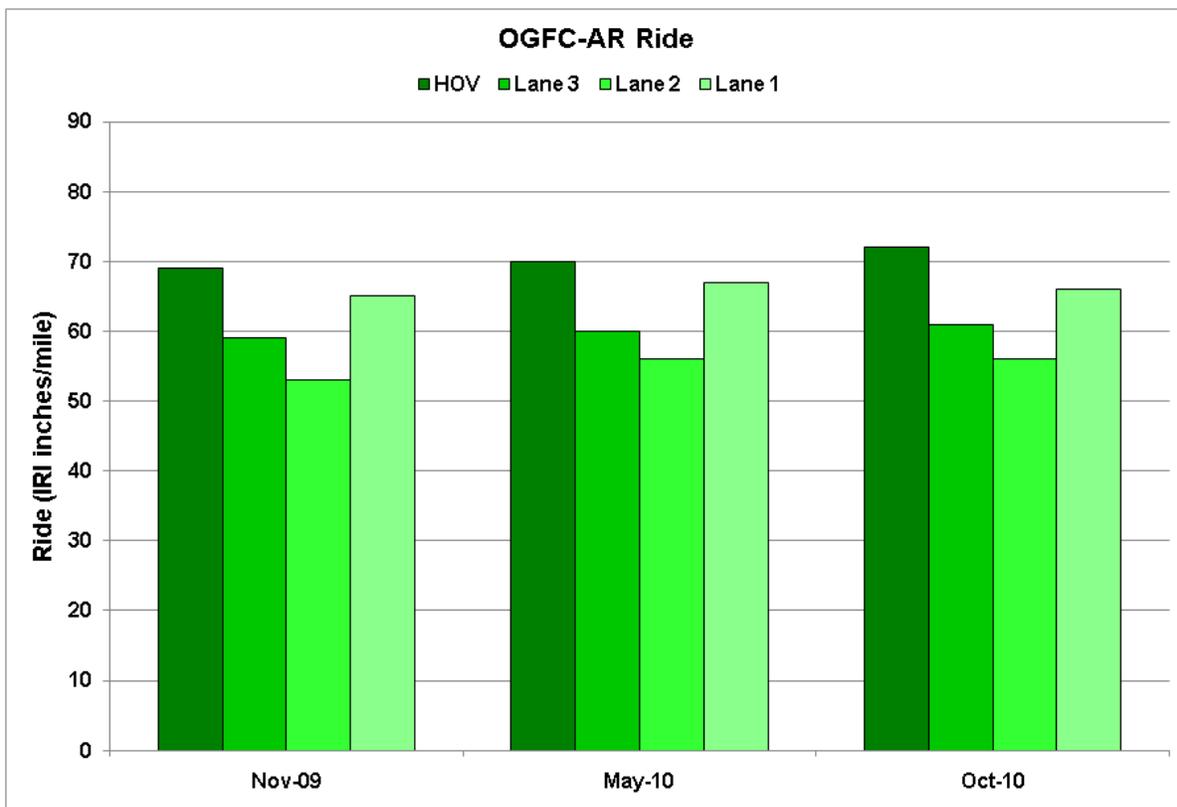


Figure 20 No trends are apparent in the ride measurements.

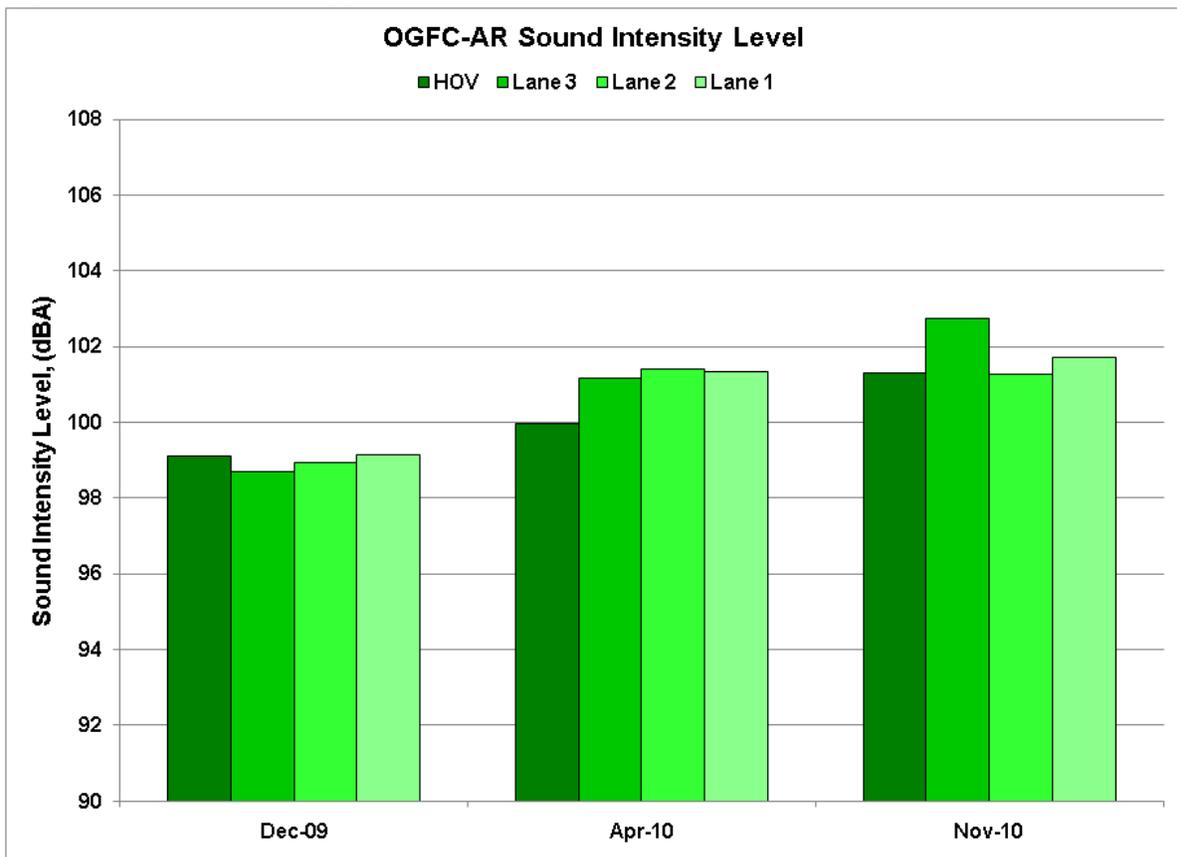


Figure 21. No trends are apparent in the sound intensity level measurements. The average sound intensity level for all lanes of the OGFC-AR section was 97 decibels right after

construction.

### I-405 OGFC-SBS Measurements (Figures 22-24)

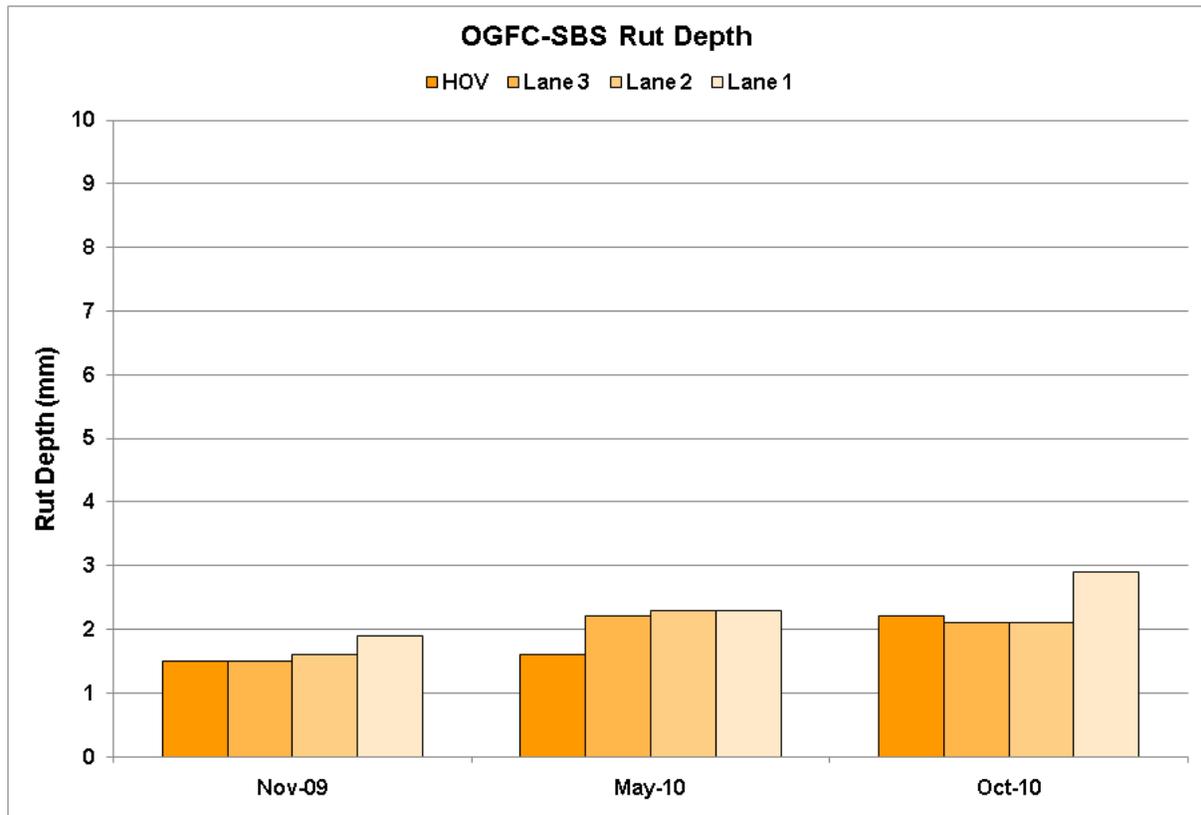


Figure 22. A very slight increase in rut depth for Lane 1 in the October measurement.

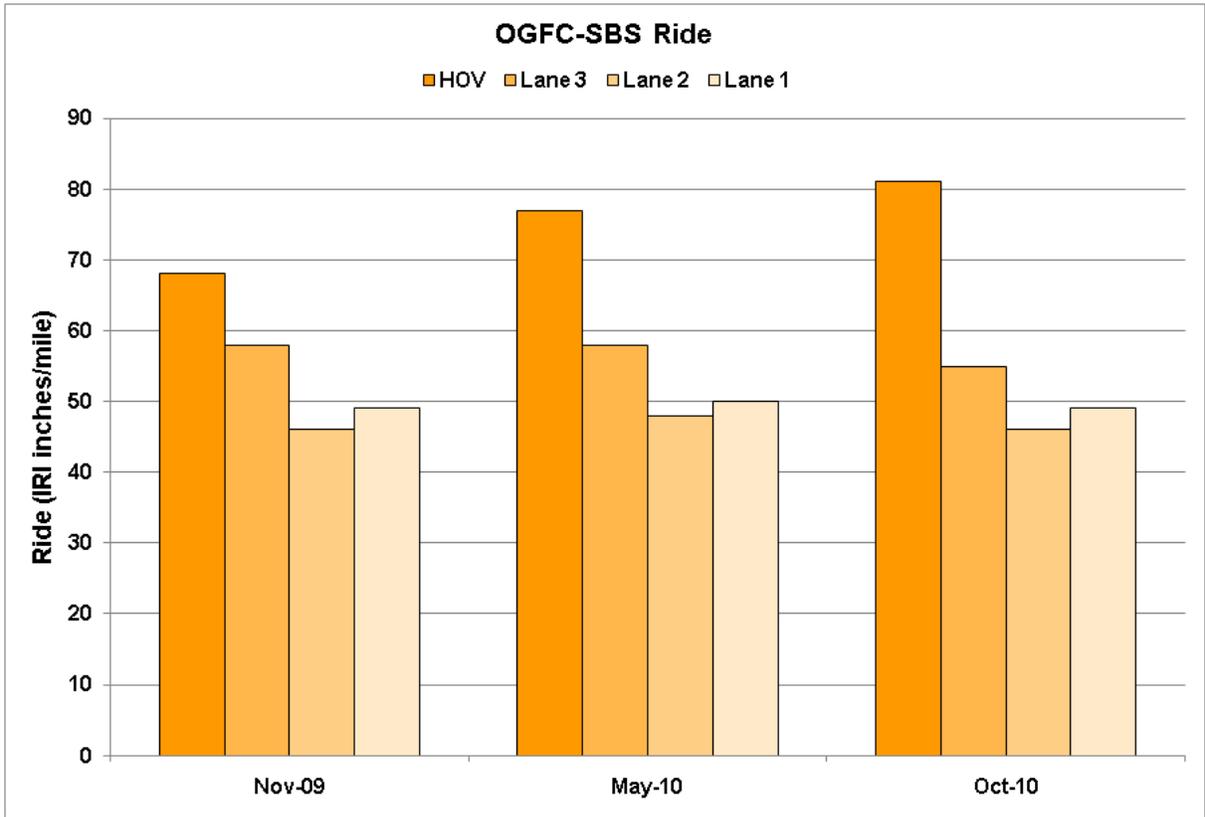


Figure 23. A gradual increase in the roughness of the HOV lane.

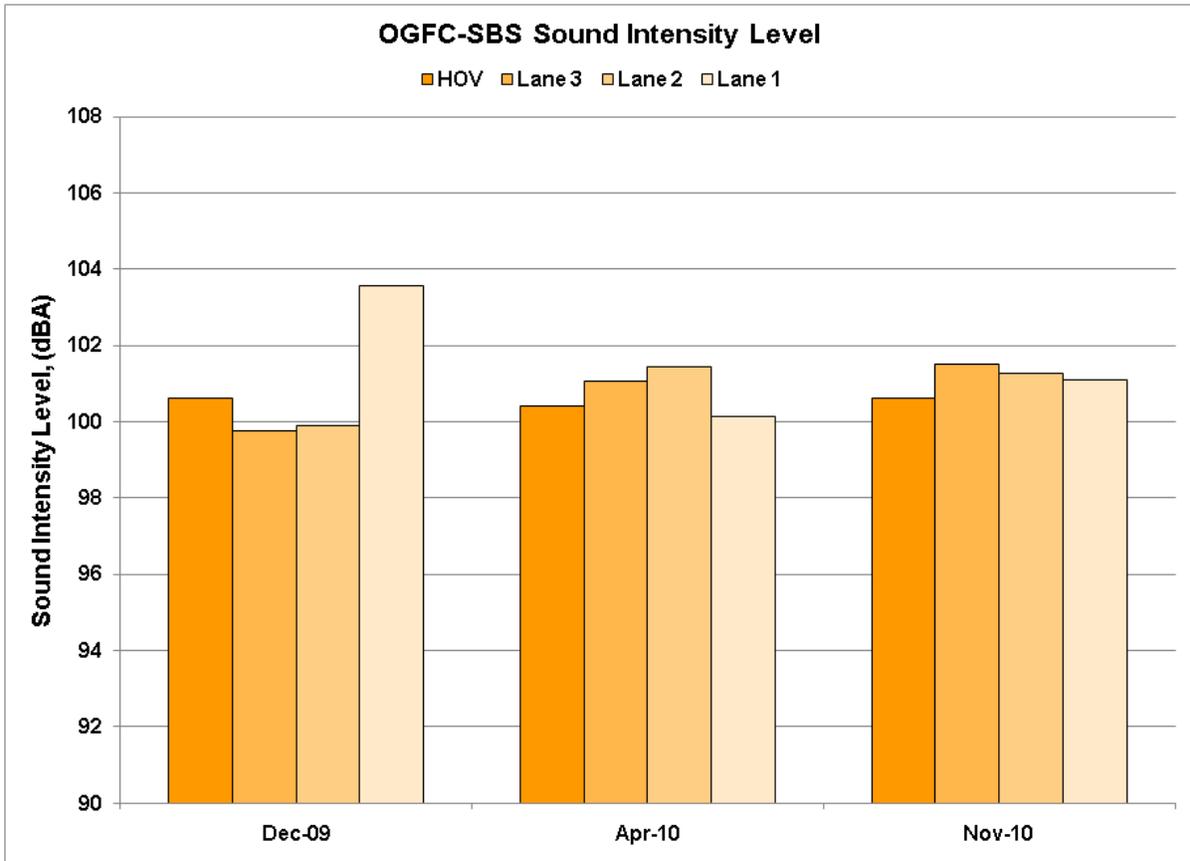


Figure 24. No trends are apparent in the sound intensity level measurements. The average sound intensity level for all lanes of the OGFC-SBS section was 97 decibels right after construction.

### I-405 HMA Measurements (Figures 25-27)

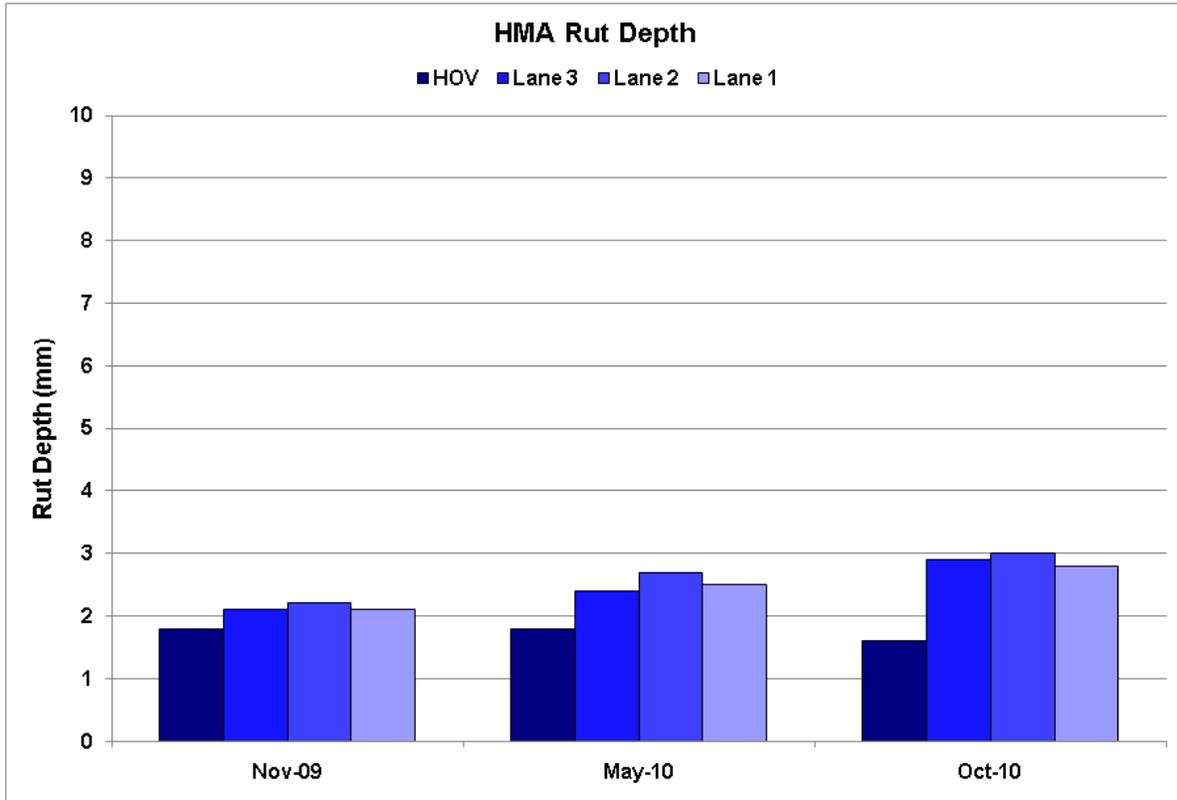


Figure 25. No trends are apparent in the rut depth measurements for the HMA.

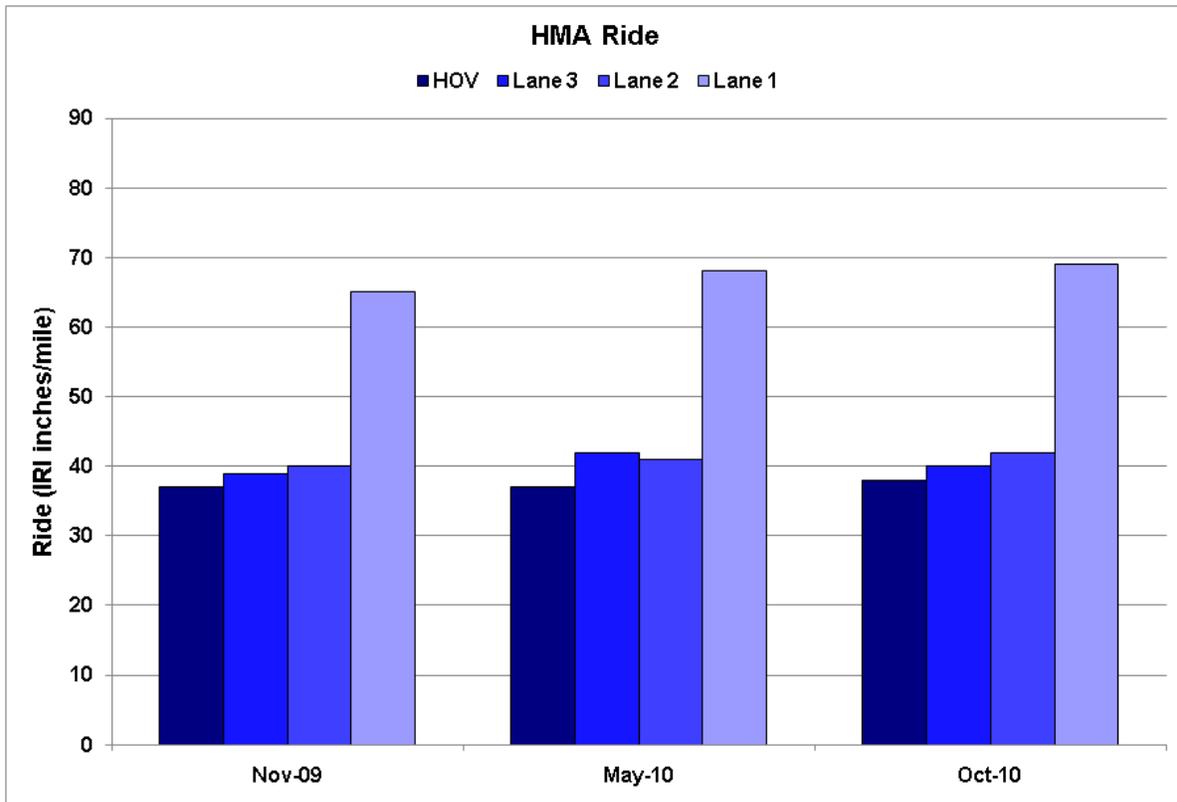


Figure 26. Lane 1 is almost twice as rough as the other lanes and there is a slight increase in this roughness for Lane 1 over time

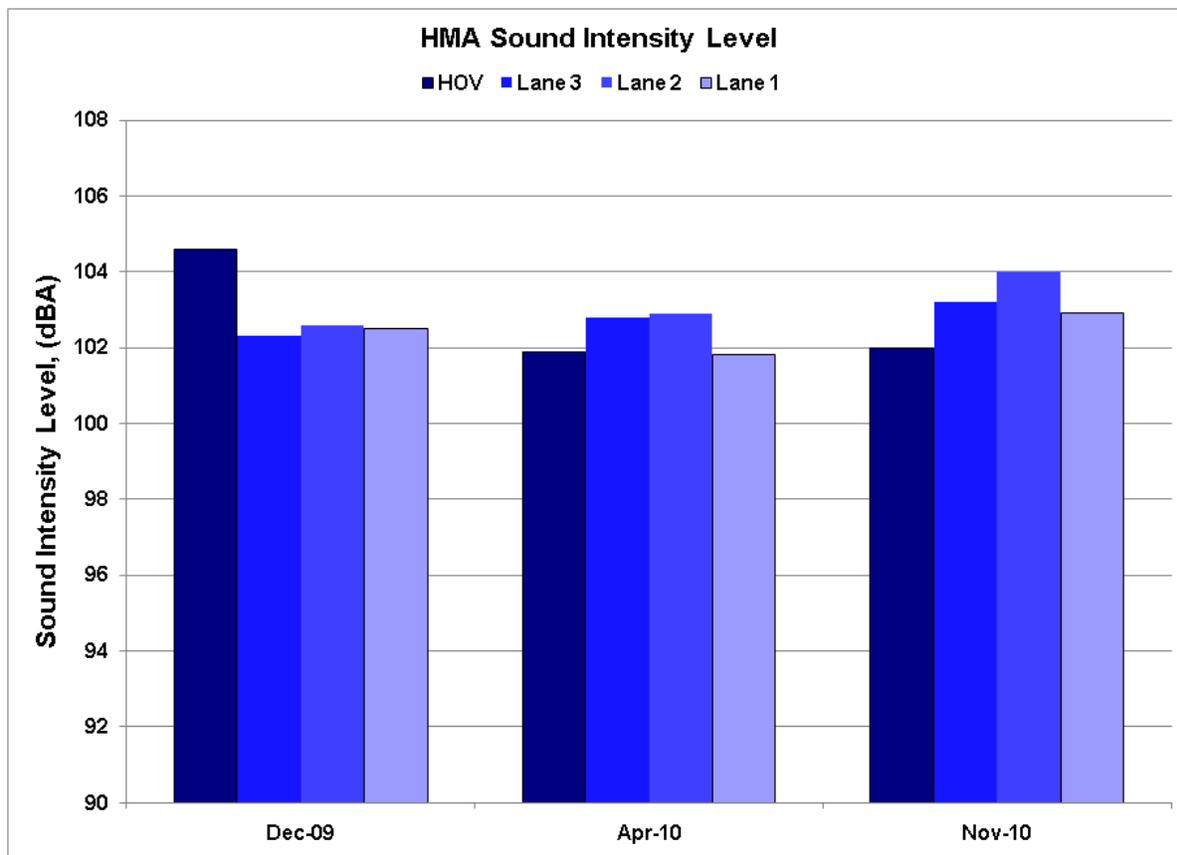


Figure 27. The sound intensity levels for the measured intervals do not show any

outstanding trends. The average sound intensity level for all lanes of the HMA section was 101 decibels right after construction.