

# ENGINEERING REPORT

**Subject:** Area at the Pins- Retest  
**Date:** 1/14/16  
**Place:** International Training & Research Center  
**Present:** Danny Speranza

**Purpose:**

Repeat RG and differential RG Study, which varied the rotation rate to maintain the same rotational energy for each ball. The only difference was to line up the ball to hit the pocket and then do not change the launch conditions throughout the 20-shot test. Test is on a house oil pattern.

**Summary:**

During the previous test, we found that moving after shot 10 (before the last 10 shots) resulted in the ball hitting the pins lighter in the pocket due to the move being too large. This affected the "Area at the Pocket" results. Therefore, this was to repeat the same test but make no moves during the entire 20-shot test. For this test, we will run the same test on a house pattern, but the launch conditions are never changed for the 20-shot test. The rotation rate was, again, adjusted for the moment of inertia of the ball.

The best ball for hitting the smallest area at the pins on a house condition was the low RG, high differential RG ball. On a flat condition the high RG, high differential RG ball hit the smallest area at the pins.

**Data:**

**Test parameters**

The test parameters are the same as outlined during the previous test. Both are tests to find the performance difference due to changing the ball RG and differential RG and is conducted on a house oil pattern. The only difference is the ball path launch conditions did not change throughout this test, playing the same line for 20 shots.

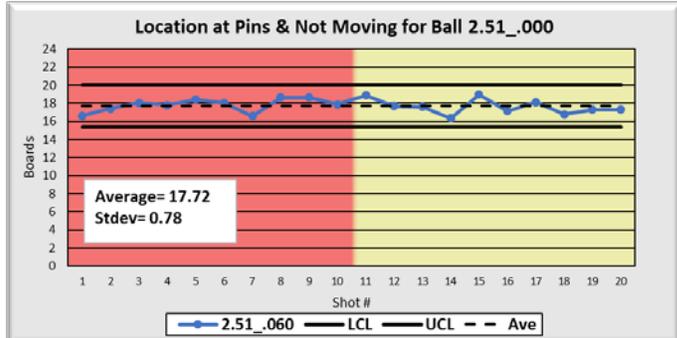
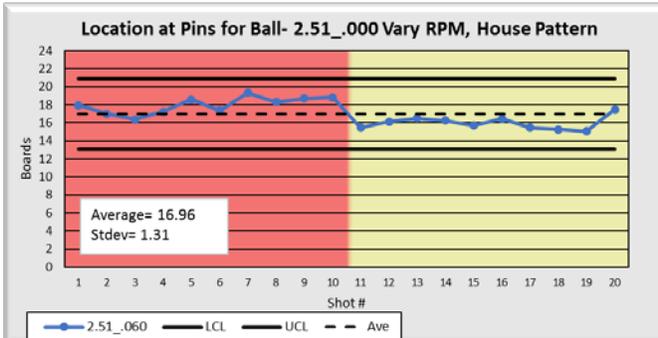
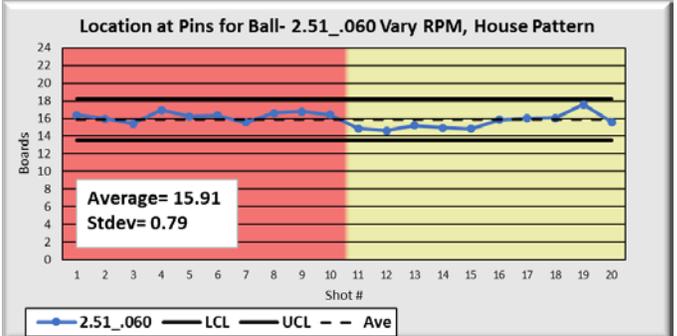
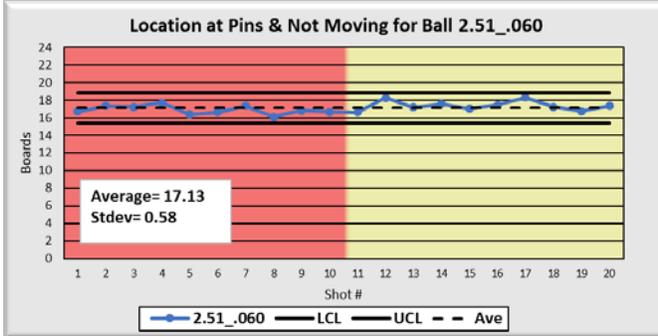
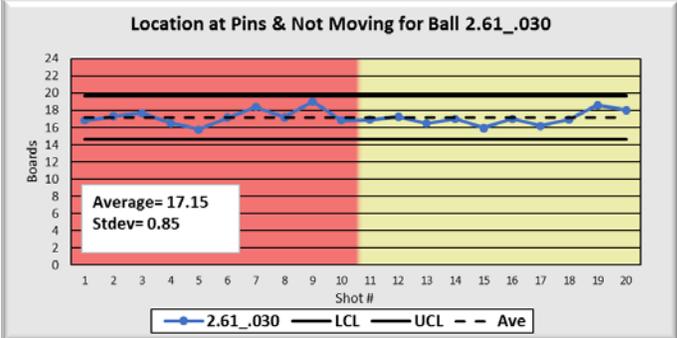
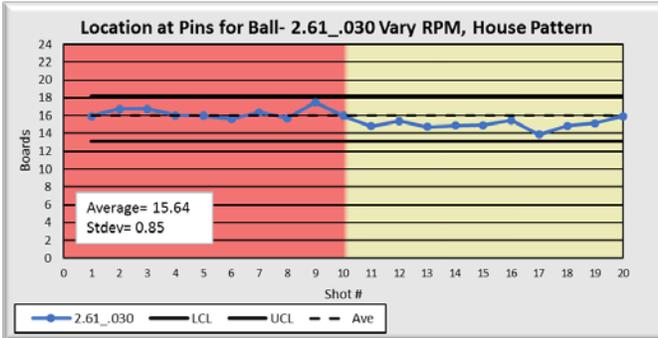
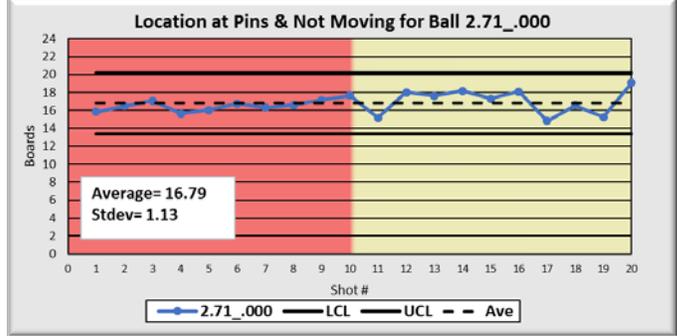
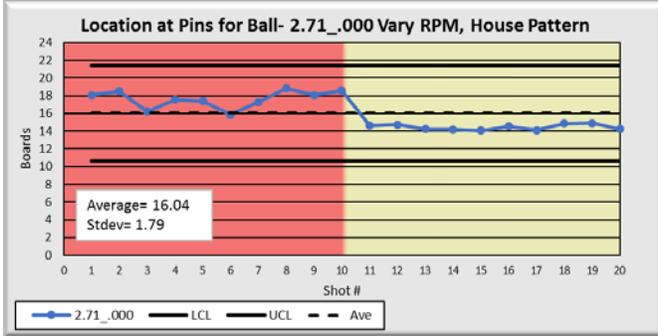
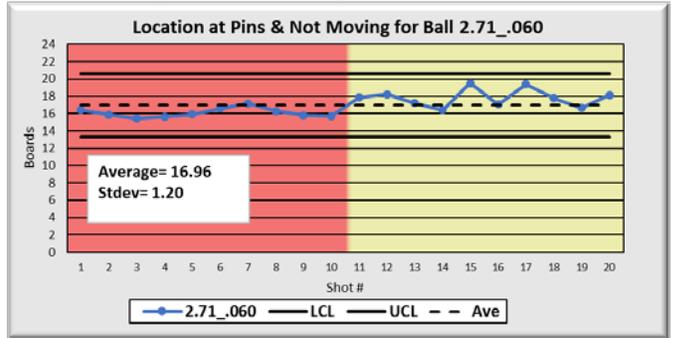
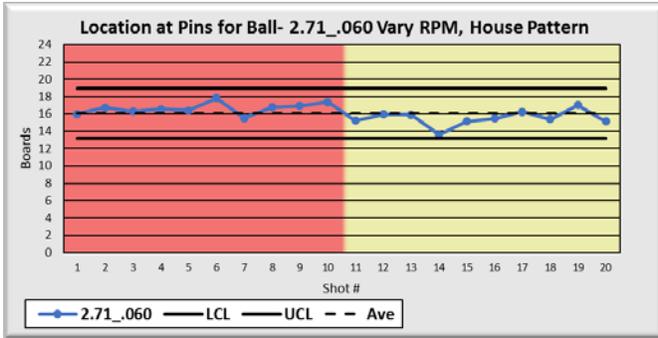
The main performance property being studied was the "Area at the Pins." The goal is to measure which ball can hit the smallest area at the pins.

During the previous test, the ball path was moved in after shot 10 by 1.5 boards at the foul line and 1 board at the arrows. In those charts below, it is obvious that there was drifting in the control chart for shots 11-20 after changing the launch conditions. Many of the control charts hit light in the pocket after moving on shot 11. This can be seen by eight or more data points in a row below the average, which indicates drifting. This means the ball started hitting the pocket lighter after the move on shots 11. Therefore, this test was repeated without moving after shot 10.

# ENGINEERING REPORT

Vary RPM on house pattern & move after shot 10

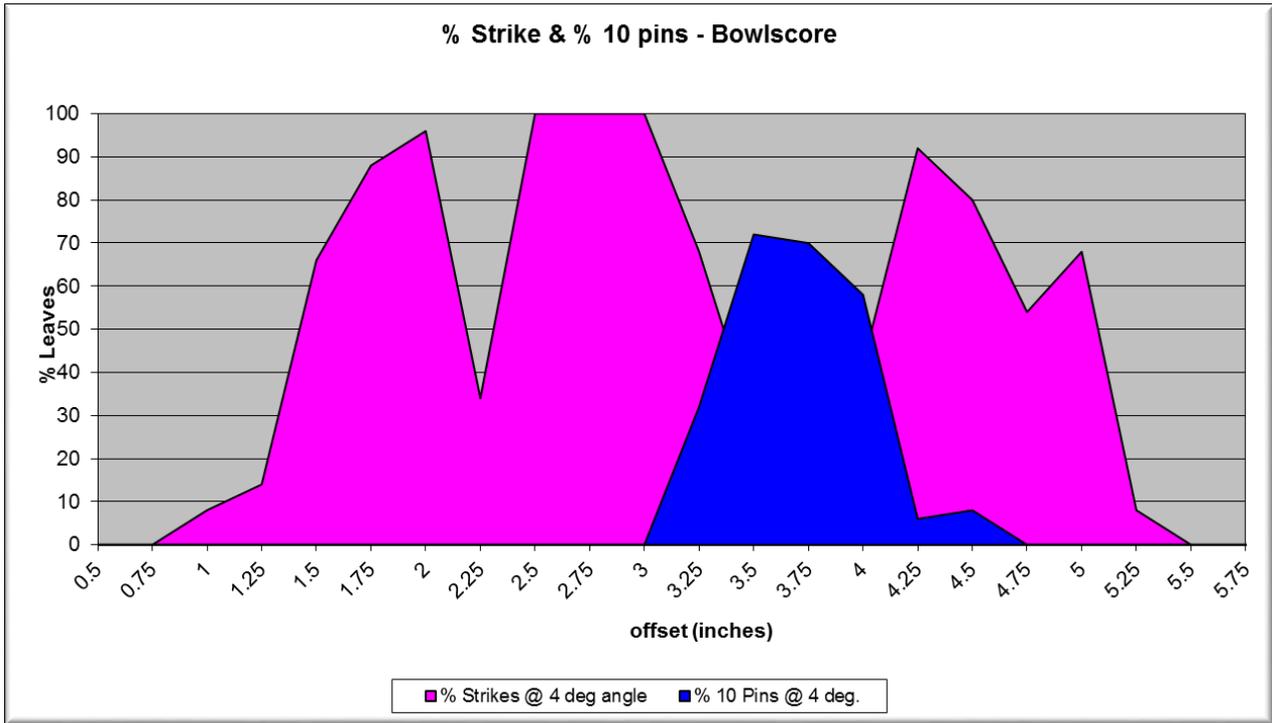
Vary RPM house pattern & no moves



# ENGINEERING REPORT

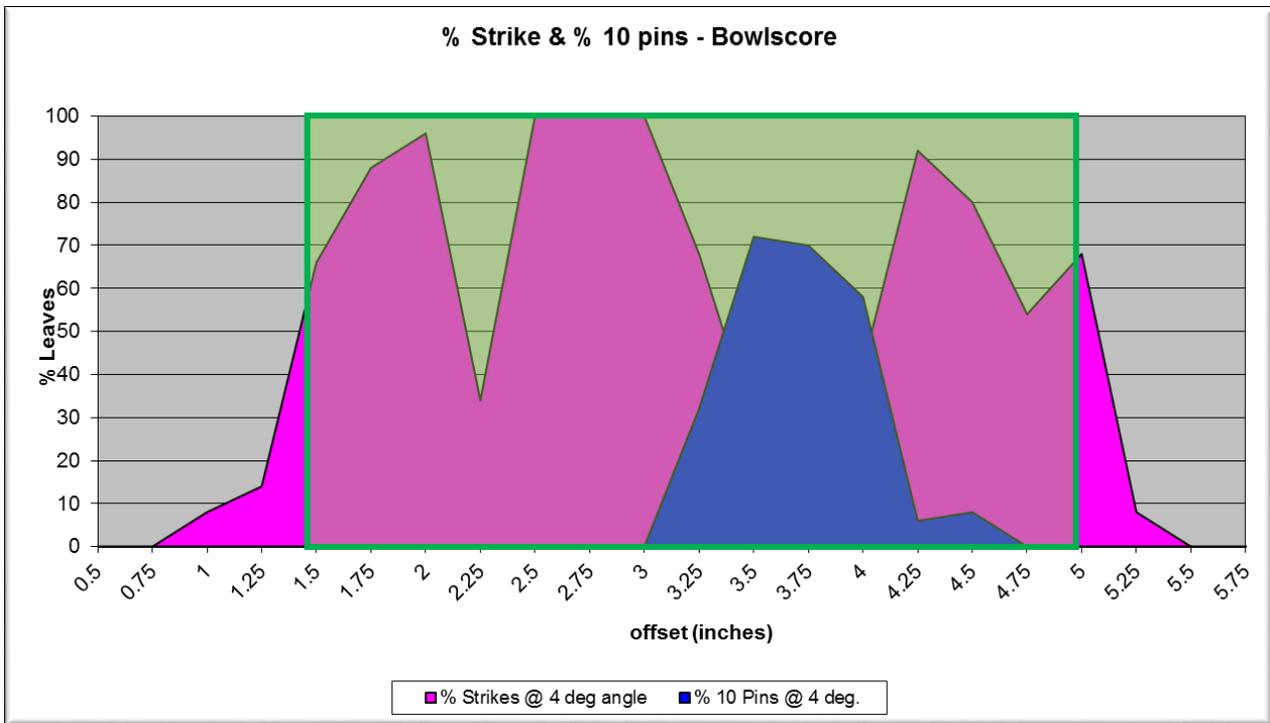
The control charts for the repeat test without making any above do not show the downward drift during shots 11-20. Some drift up slightly, as expected, from the balls hooking more as the oil in the ball path dries up. The standard deviations, which set the control limits, are smaller on three of the five balls when comparing the same ball results from moving after the 10<sup>th</sup> shot. One ball had the same standard deviation and one ball has a higher standard deviation (hit a larger range).

“Area at the Pins” during this test can be compared to the strike-pocket width measured from Bowlscore.



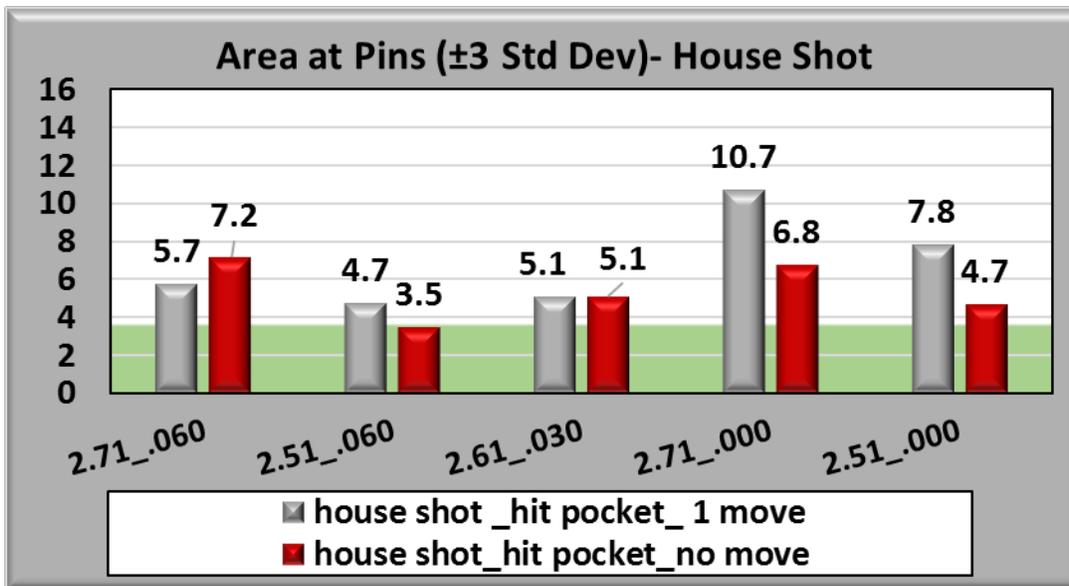
Majority of the RG, diff RG ball study results had 4-5 degrees of entry angle; thus, comparison to the 4-degree Bowlscore results. We can select a “Desired Strike Pocket Zone” as the strike pocket area containing approximately 70% strikes or more and get the chart below:

# ENGINEERING REPORT



The "Desired Strike Pocket Zone" is from 1.5" to 5" offset, or 3.5" wide area.

The chart below summarizes the "Area at the Pins" for the last two test studies, with the green background being the "Desired Strike Pocket Zone" (3.5" zone):

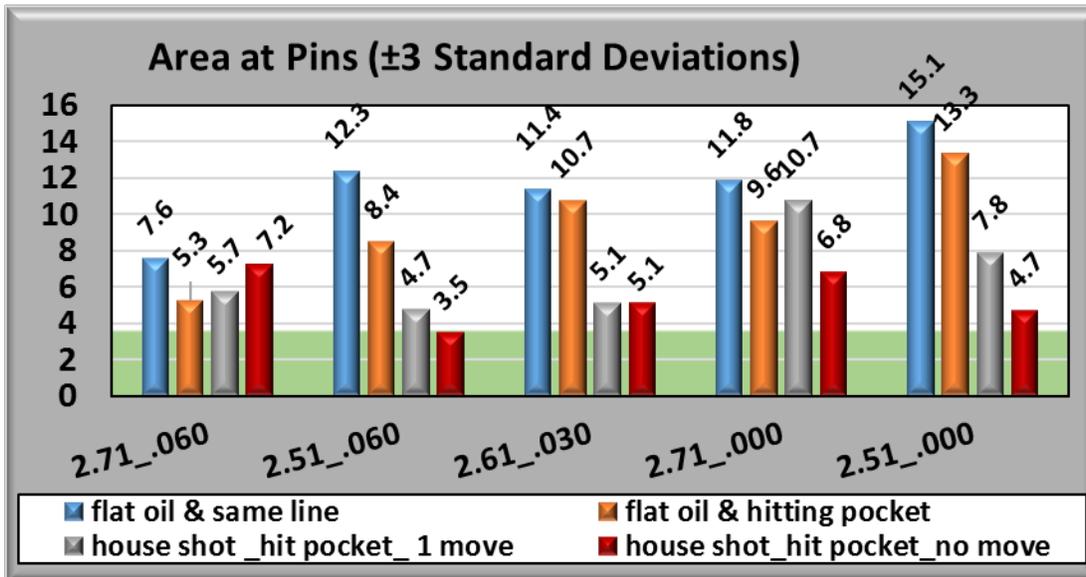


The best ball for hitting the smallest Strike Pocket Zone on a house condition is the low RG, high diff RG ball (2.51 / .060), which if lined up correctly, would be able to hit the Desired Strike Pocket Zone for all 20 shots during the test without moving (Phase 6 red bar results). The actual pinfall for the 20-shot test with the low RG, high diff ball resulted in 13 strikes and seven 10 pins, which matches the pin leaves from Bowlscore. The low RG, high diff RG ball also was the best ball for hitting the smallest pocket during the previous test where the shot was moved after the 10<sup>th</sup> shot (grey bars) when moving after shot 10.

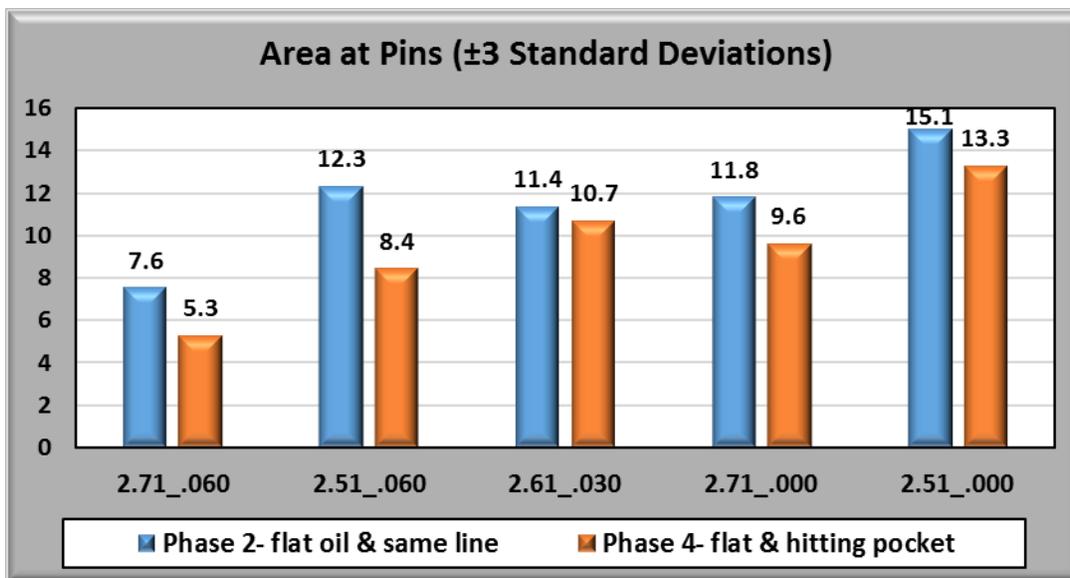
# ENGINEERING REPORT

This area at the pins is probably the most important factor in ball selection for a given oil pattern.

Below we compare the "Area at the Pins" on a flat oil pattern and on a house oil pattern:



It is expected that the "Area at the Pins" should be smaller on the house shot due to the oil steering the ball to the pocket. This is the case with the (1) low RG, high differential RG, (2) low RG, low differential RG, and (3) medium RG, medium differential RG balls. But the high RG balls shows less difference as the oil pattern changes. Below are the results for the flat oil test:



The chart above for "Area at the Pins" on a flat oil pattern shows that the high RG, high differential RG ball had the smallest area; and therefore, should be a better ball selection for this condition.

NOTE: The flat oil pattern used for these tests was a flat condition tapered from the foul line to the oil line. It was a hooking condition with 20 units in the heads and approximately 3-5 units of oil beyond 29 feet. Oil distance was 39 feet.