

ENGINEERING REPORT

Subject: Adjustable Static Weight Ball With EARL

Date: 4/4/2018

Place: International Training & Research Center

Present: Tom Frenzel

Purpose: Examine the effects of +/- 3 ounces of side weight with E.A.R.L.

Summary: Using a long pin distance to minimize flare a 2~3 degree difference in entry angles can be seen when switching from -3 to +3 ounces of side weight.

Discussion:

This test was conducted to examine the effects of side weight seen in our previous bowler testing with different speed to RPM ratios.

The adjustable ball used was set up to have as close to 0 top, 0 finger, and +/- 3 ounces of side as possible. Then the ball was thrown with these settings:

Setting	For 3 Shots	For 3 Shots	For 3 Shots	For 1 Shot	For 1 Shot	For 1 Shot
Ball Speed	18	16	14	18	16	14
RPM	350	350	350	350	350	350
Laydown	23	24	25	20	20	20
Trajectory	-2.3	-2.3	-3.3*	0	0	0
Axis Rotation	50	50	50	0	0	0
Axis Tilt	10	10	10	0	0	0

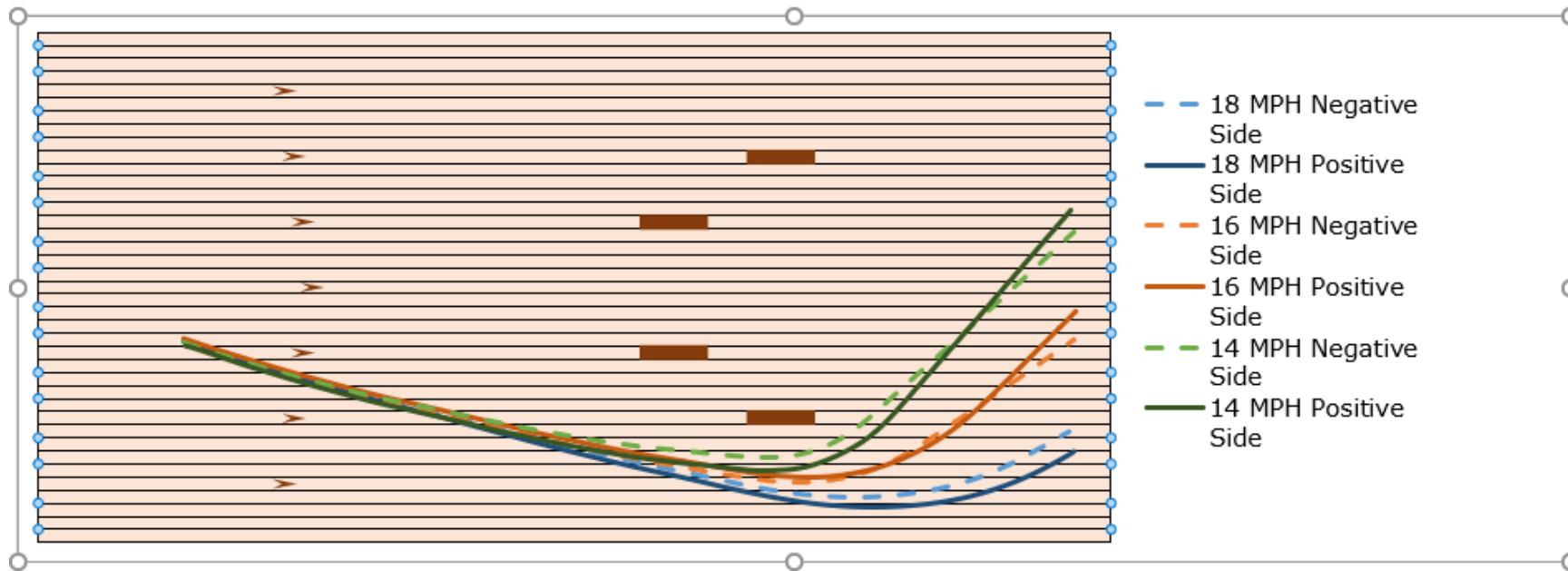
This Series of shots was first thrown with the +3 ounce of side weight orientation, then thrown again on the same oil pattern with the -3 ounce of side weight orientation. The lane was not rerun between orientations and each laydown spot finished with six total shots.

The launch angle for the 14 MPH shots was adjusted to keep the ball on the lane. The data was transformed in post analysis to appear as they had all be thrown with -2.3 degrees of trajectory from the 20 board.

The single shots straight down the center of the lane were also transformed to remove E.A.R.L.'s launch angle variance. There were transformed to have zero degrees of trajectory at the arrows along the 20 board.

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Average Shot Analysis:



For the shots that were thrown to curve, we averaged the three shots at each location for each side weight orientation.

This resulted in the ball paths shown above. When the ball was able to reach the roll phase there was an increase in entry angle from negative to positive side weight. However, before the ball reaches the roll phase, negative weight appears to allow the ball to begin hooking sooner. This can be seen in the 18 MPH shots. In that case the ball never reached the roll phase and the negative weight orientation out hooked the positive weight orientation.

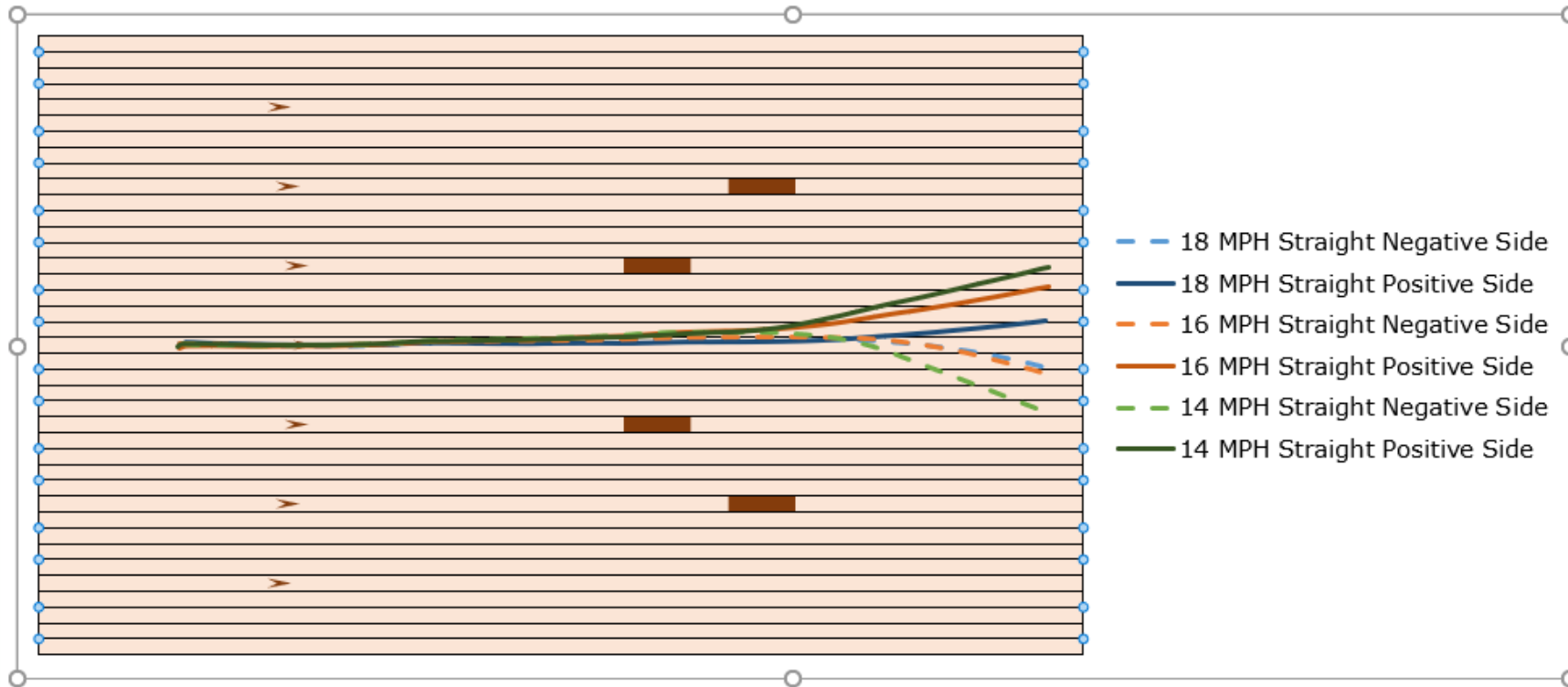
Overall there was an approximate two-degree difference in the total angle change going from -3 to 3 ounces of side weight when the ball was able to reach the roll phase.

Ball Speed	Side Weight	Total Angle	Difference
18.856	3	6.33	
18.746	-3	6.33	0.01
15.885	3	9.25	
15.845	-3	7.16	2.10

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13.349	3	10.15	
13.482	-3	8.49	1.67

Straight Ball Analysis:

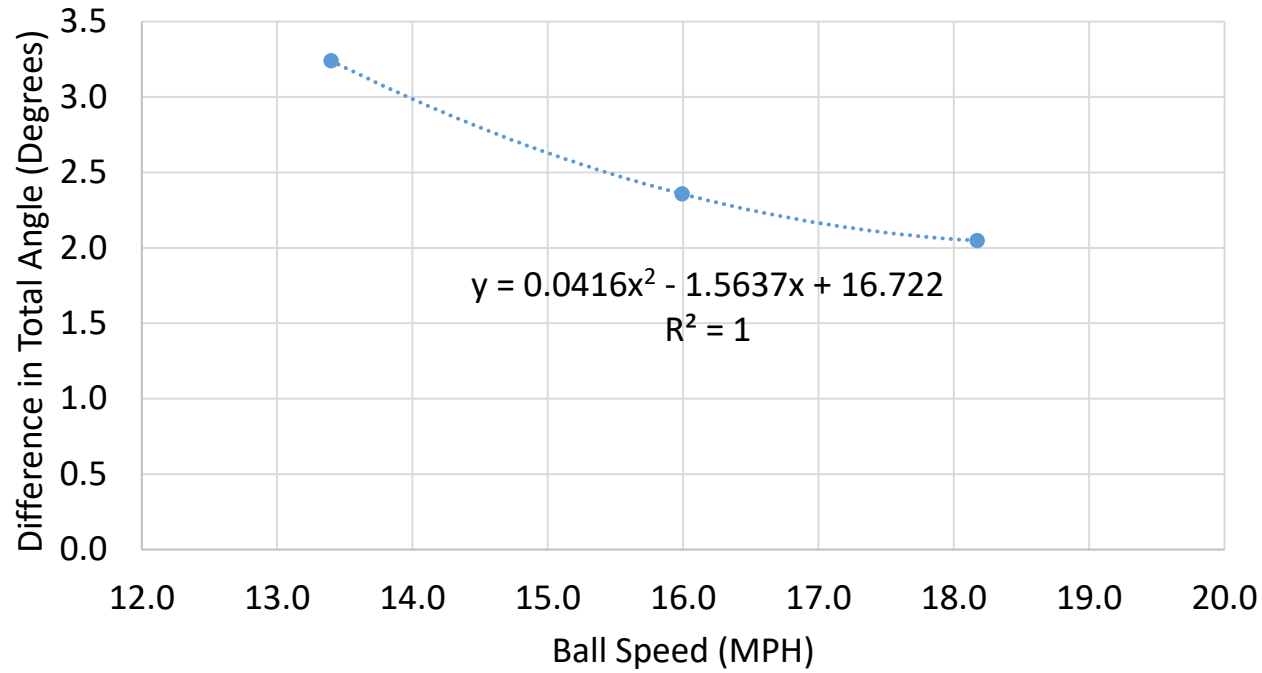


Similar to our topography research, the effects of side weight seem most apparent when the ball is thrown directly down the lane. As the ball speed is increased, the effects of the imbalance decrease.

Ball Speed	Angle Difference	Average Board Difference 58 ft
18.172	2.05	2.92
15.992	2.36	5.54
13.398	3.24	9.20

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Total Angle Difference from +/- 3 ounces of Side Weight



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Position Difference from +/- 3 ounces of Side Weight

