Pin Carry Study: Bowl Expo 2009

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Please turn off all cellular devices before the presentation begins. Please hold all questions until the end of the presentation.

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Introduction

- Background
- Pin Carry Study
  - Strike Classification
  - Examples
- 14 lbs. versus 15 lbs.
- Backend Study
  - What affects carry?
  - Flat Gutter COR test

Background

- What is Pin Carry?
- Definition of Entry Angle
  - Entry Angle is the angle at which the bowling ball enters the pins relative to the longitude of the lane.
- Definition of Exit Angle
  - Exit Angle is the angle at which the bowling ball leaves the pin deck relative to the longitude of the lane.

Background continued

- How extreme is 6 degrees of entry angle?
- The four pieces of string represent 0, 2, 4, and 6 degrees from left to right.
- Let's look at the next slide for a pictoral representation.

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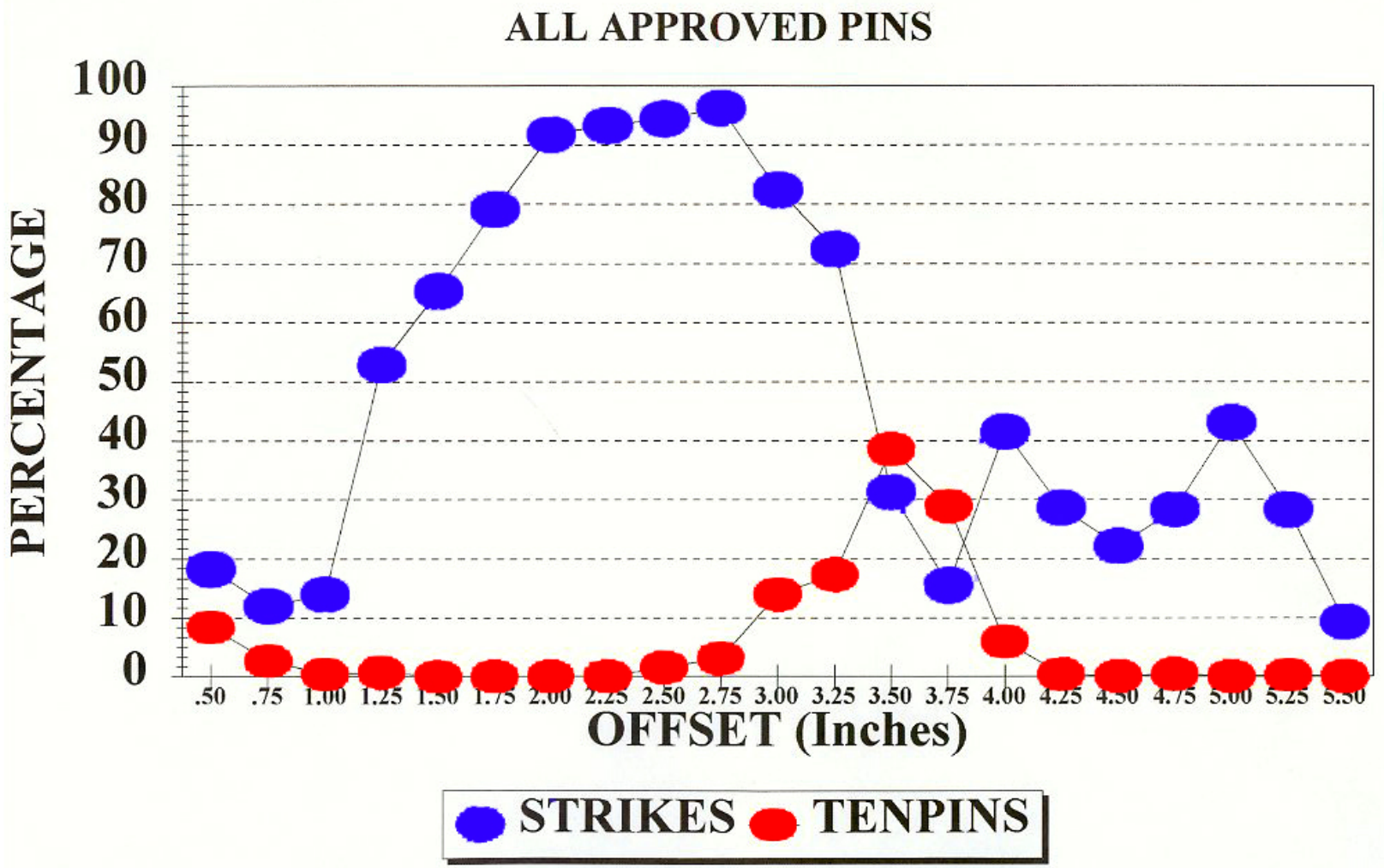
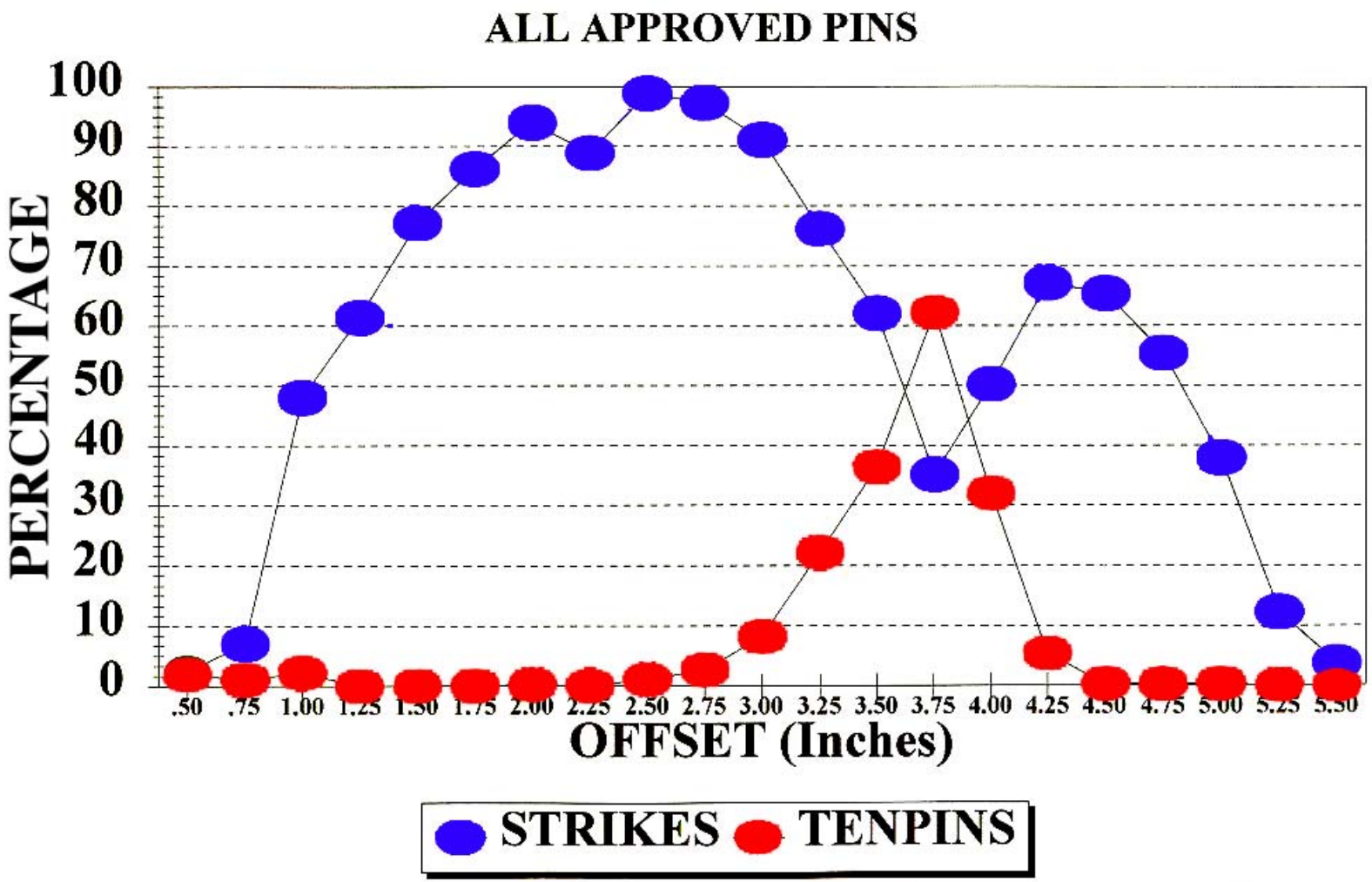
Background continued

- Two main studies in the past on Entry angle and Weight of the ball versus Scoring
  - Both studies used Bowl Score to complete the studies
  - The studies were first published in the mid 1990s.
  - The studies were done using an Ebonite Gyro
- The studies showed that as one increases entry angle and weight of the bowling ball one increases Percentage of strikes

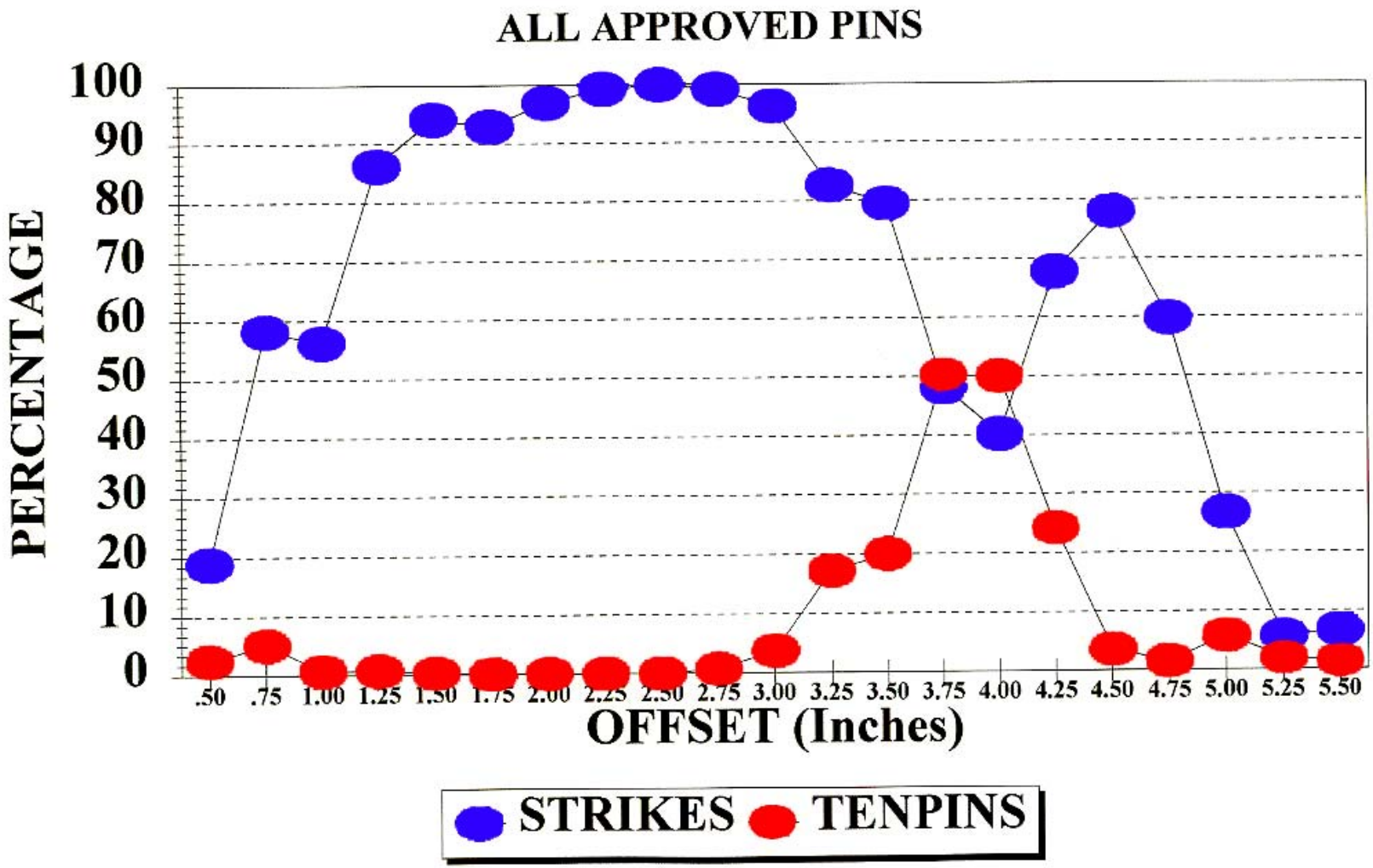
2 DEGREE ENTRY ANGLE



4 DEGREE ENTRY ANGLE



6 DEGREE ENTRY ANGLE



Background continued

- These studies were cutting edge at the time, however with modern day bowling ball cores, this area needs to be reinvestigated.
- The start of this is the Pin Carry Study
  - Future Studies will look at Entry and Exit Angles
    - Core Shapes
    - RG Numbers

Strike Classification

- 208 High Speed Videos have been analyzed
- Trends in pin carry with respect to how the ball enters the pocket
- Three main categories of strikes are established

Strike Classification

- Light Pocket Strike or Three Pin Strike
- Solid or Classic Pocket Strike
- High Pocket Strike

Bowler Types

- 3 types of bowlers were used in the study
  - Speed Dominant
  - Rev Dominant
  - Balanced
- 3 different balls were also used during testing
  - A high total differential symmetrical ball
  - A low total differential symmetrical ball
  - A high differential, high intermediate differential ball.

Bowler Types continued

- Despite the different bowler types, similar trends can be seen
- A special thanks to the Ebonite brands, Columbia, and Track for donating bowling balls for this study.

Characteristics of a Light Pocket Strike

- Three pin carries the Ten Pin
  - The three pin is hit in a way that it goes straight back into the nine pin and then deflects into the ten pin
- Ball exits the pin deck right of Nine pin spot

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Characteristics of a Solid Pocket Strike

- "Textbook" strike.
  - Ball takes out 1,3,5 & 9 pins
- Ball exits the pin deck just to the left of the Nine pin spot

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Characteristics of a High Pocket Strike

- The High Pocket Strike is Defined as:
  - The ball being a little more towards the head pin in the pocket
  - Due to deflection, the head pin takes out the five pin before the ball can deflect off of the pin.
  - Characterized by the ball going left off of the pin deck.

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14 Pound Ball Versus 15 Pound Ball Pin Carry Study

- Mentioned at Bowl Expo 2006 by Del Warren
  - "Maybe we can bring back true ball reaction with 14 pound bowling balls"
  - While Staff was intrigued with this solution, our initial thoughts were that testing would not show a difference.

14 Pound versus 15 Pound con't.

- 2 days, 15 shots each day with 14 & 15lb ball
- Two patterns, one house shot and the USBC Open Championships Pattern.
- Identical balls with same layouts and surfaces
- Again, we are going to classify the strikes by the three type of strikes

Game Show

- That brings us to our game show
- Guess that weight of bowling ball!
- In the following you will be shown two videos the only difference is a:
  - A 14 pound bowling ball
  - A 15 pound bowling ball
- Guess correctly and win a small prize! READY!

The Three Pin Strike

- Two pin carries the Seven Pin
  - The two pin is hit in a way that it goes straight back into the eight pin and then deflects into the seven pin
- Ball exits the pin deck left of eight pin spot

Video 1

Video 2

The Classical Strike

- "Textbook" strike.
  - Ball takes out 1,2,5 & 8 pins
- Ball exits the pin deck just to the right of the Eight pin spot

Video 1

Video 2

The High Pocket Strike

- The High Pocket Strike is Defined as:
  - The ball being a little more towards the head pin in the pocket
  - Due to deflection, the head pin takes out the five pin before the ball can deflect off of the pin.
  - Characterized by the ball going right off of the pin deck.

Video 1

Video 2

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Backend/Carry Study

- In May of 2008, USBC Equipment Specifications Committee asked staff to explore what factors affected “Carry” in the backend.
- The three main parts of the backend that were explored were:
  - Pin Deck
  - Kickback Plate
  - Flat Gutter

Backend/Carry Study continued

- The test methodology staff used for the study is as follows:
  - Staff used lane 8 in Greendale as a standard new lane installation with Brunswick products
  - Three different bowlers
    - Rev Dominate
    - Balanced
    - Speed Dominate
  - One full game on a 5 to 1 blended house shot.

Backend/Carry Study continued

- Staff included all spare shooting in the calculations
- If a pin hit a surface on consecutive strikes, it was only counted as one hit. In order to be counted as multiple hits, it had to contact one of the other surfaces in play first.
- The following video is used to demonstrate how we decided to count in the study.

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Backend/Carry Study continued

- Using this methodology, we counted every shot in a full regulation bowling game.
- These results are shown in the following slide.

Backend/Carry Study continued

	Raw Data				Percentage Data		
	1 Game House Pattern Contact Totals				1 Game House Pattern Percent Totals		
Bowler	**Pin Deck**	**Kickback**	**Flat Gutter**	**Total**	**Pin Deck**	**Kickback**	**Flat Gutter**
Balanced	51	47	29	127	40.2	37.0	22.8
Speed Dominate	59	54	25	138	42.8	39.1	18.1
Rev Dominate	71	55	26	152	46.7	36.2	17.1

	1 Game Sport Pattern Contact Totals				1 Game Sport Pattern Percent Totals		
Bowler	**Pin Deck**	**Kickback**	**Flat Gutter**	**Total**	**Pin Deck**	**Kickback**	**Flat Gutter**
Balanced	66	58	23	147	44.9	39.5	15.6
Speed Dominate	59	49	21	129	45.7	38.0	16.3
Rev Dominate	56	47	19	122	45.9	38.5	15.6

Backend/Carry Study continued

- From the data above, we can draw some conclusions about what on the backend affects carry.
- The pin deck has the most hits in both the house shot and sport shot testing.
- This shows that the pin deck material and installation will have the greatest overall affect on carry.

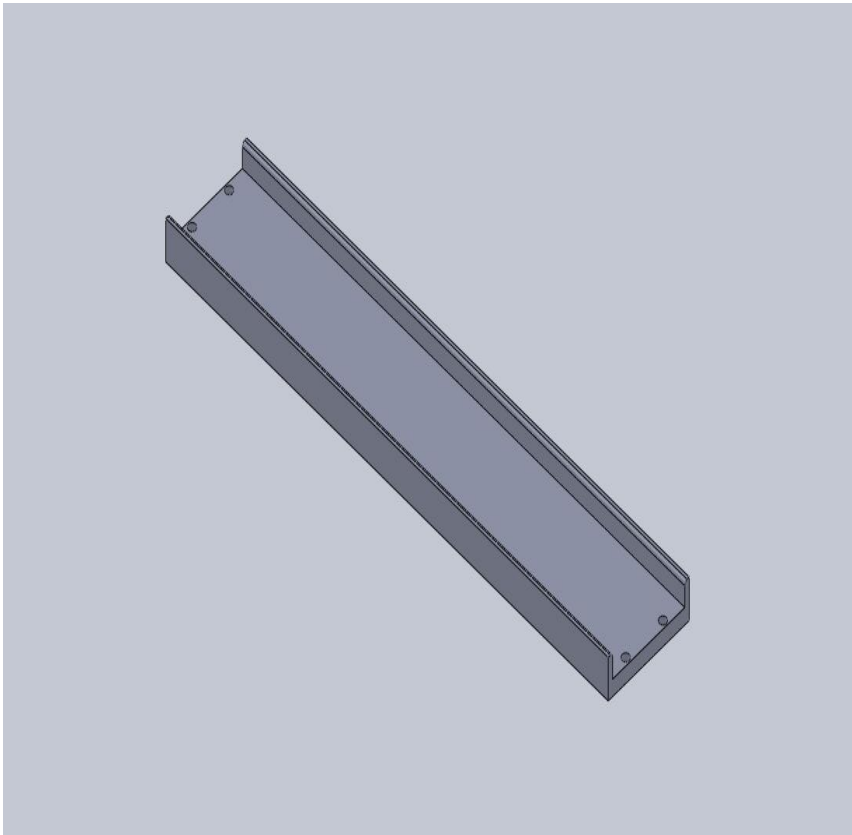
Backend/Carry Study continued

- The kickback plate has the next highest percentage of hits on the backend, very close to the pin deck.
- Finally, the flat gutter has half the hits as both the kickback plate and the pin deck.
- From this data, the pin deck and the kickback plate material and installation are the biggest contributors to carry while the flat gutter is the least significant of the three major parts of the backend parts.

Flat Gutter COR Test

- We have been asked by multiple people whether bracing under a flat gutter will enhance how well pins bounce out of the flat gutter.
- First, we will discuss the physics behind flat gutter bracing and then we will show the testing that was conducted.

Flat Gutter COR Test continued



- A flat gutter as shown to the left, is the gutter located on both sides of the pin deck in a bowling alley.
- The flat gutter that we have under lane 8 in Greendale currently is attached at four spots shown on the CAD diagram to the left.

Flat Gutter COR Test continued

- This is what it looks like under the flat gutter.
- Bracing is provided at both ends of the flat gutter for this installation.
- Additional bracing could be installed due to how solid the proprietor would like their flat gutters to be.

Flat Gutter COR Test continued

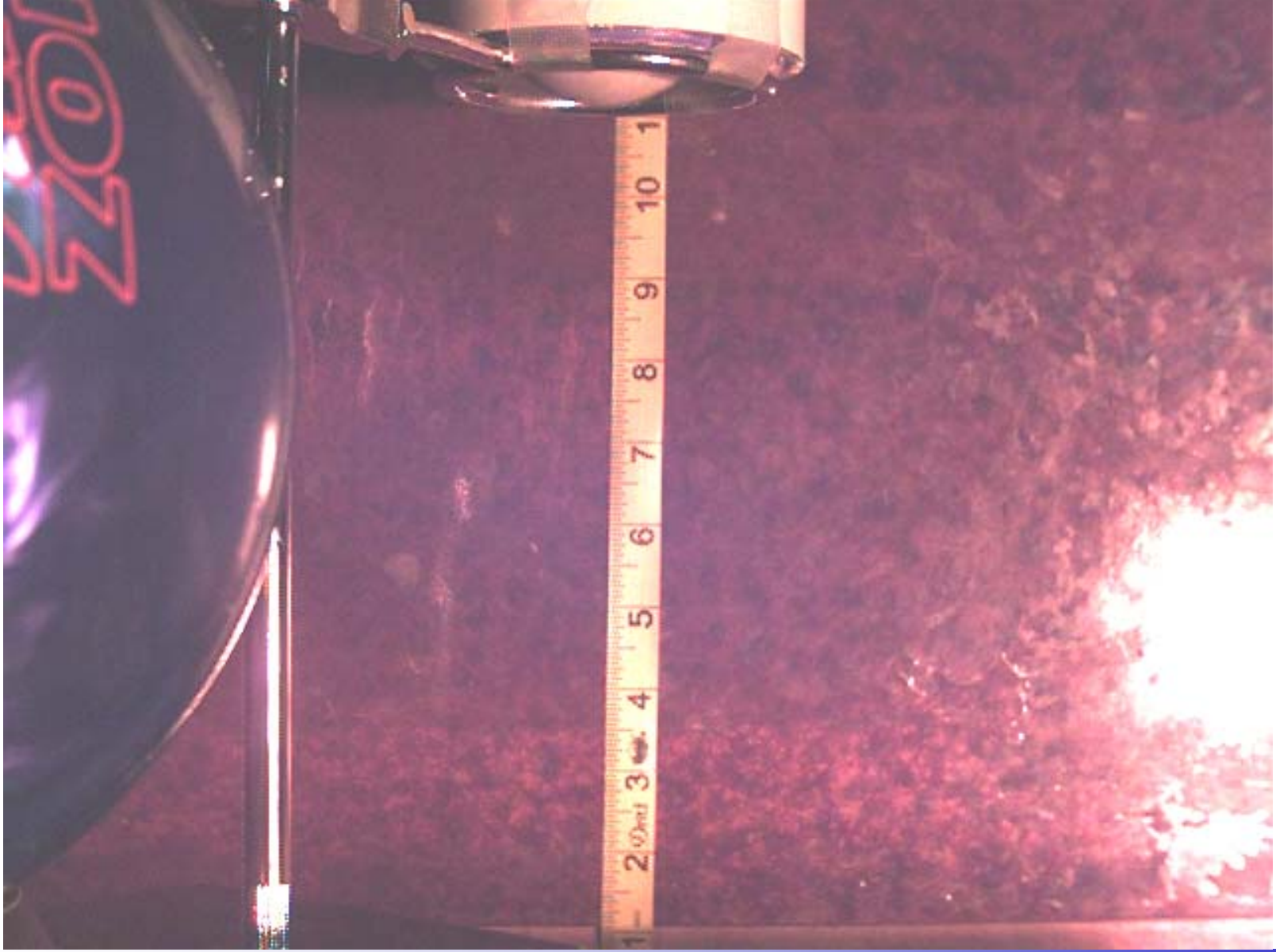
- No matter the amount of bracing or reinforcing installed one thing remains constant, the elasticity of the flat gutter will remain constant.
- As long as USBC regulations on flat gutter depth, slope, and materials are maintained, the bracing points will always be where the maximum bounce can be obtained.

Flat Gutter COR Test continued

- The testing we did was conducted on lane 8 in Greendale on the left flat gutter which you saw the picture for a couple of slides ago.
- Three bounce measurements were produced from a height of 14” over the exact middle of the flat gutter.
- The average of these three measurements were taken.

Flat Gutter COR Test continued

- This test was repeated at five different places on the flat gutter:
  - The two pin spot
  - Halfway between the two and four pin spot
  - The four pin spot
  - Halfway between the four and seven pin spot
  - The seven pin spot



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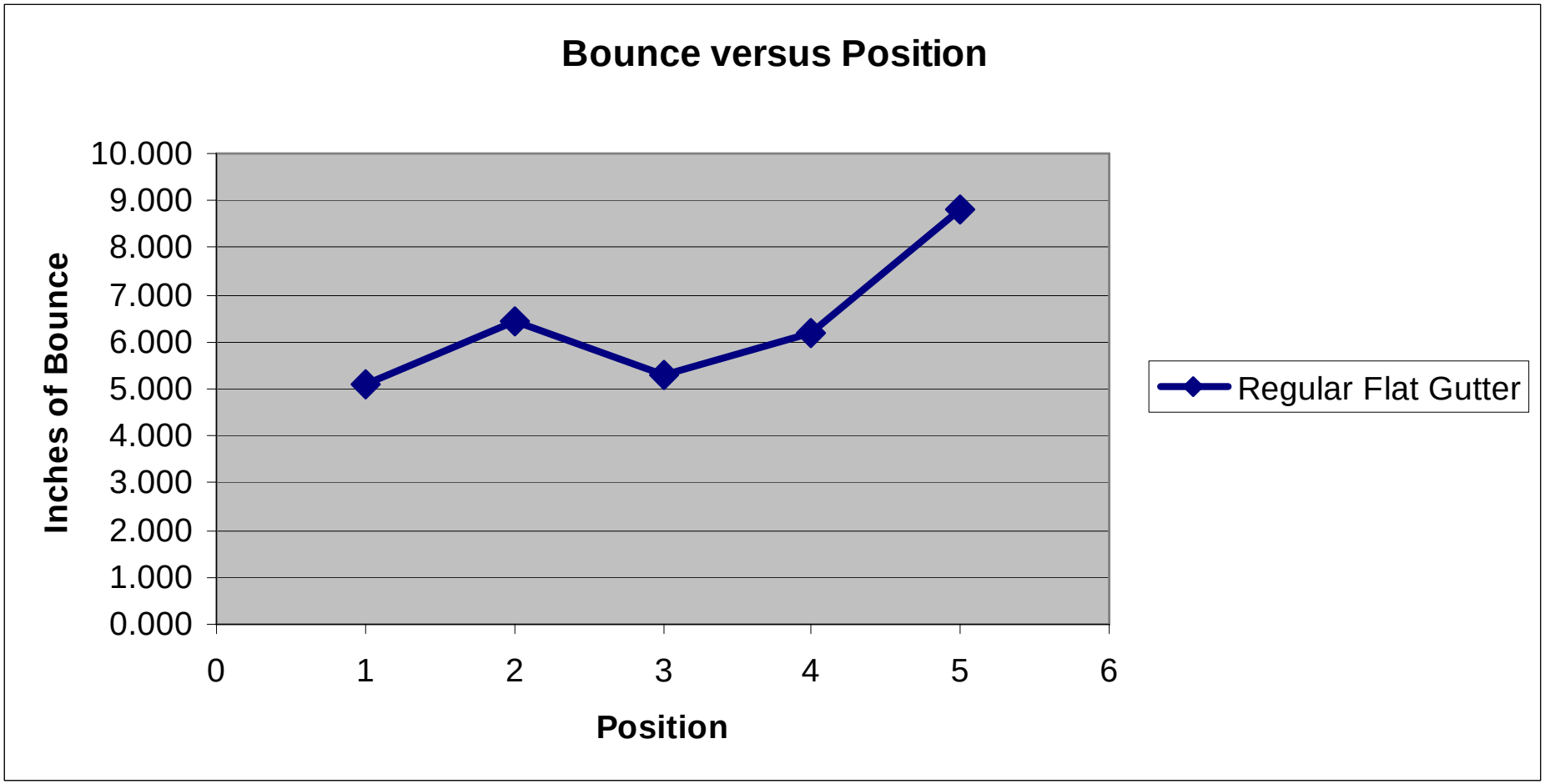
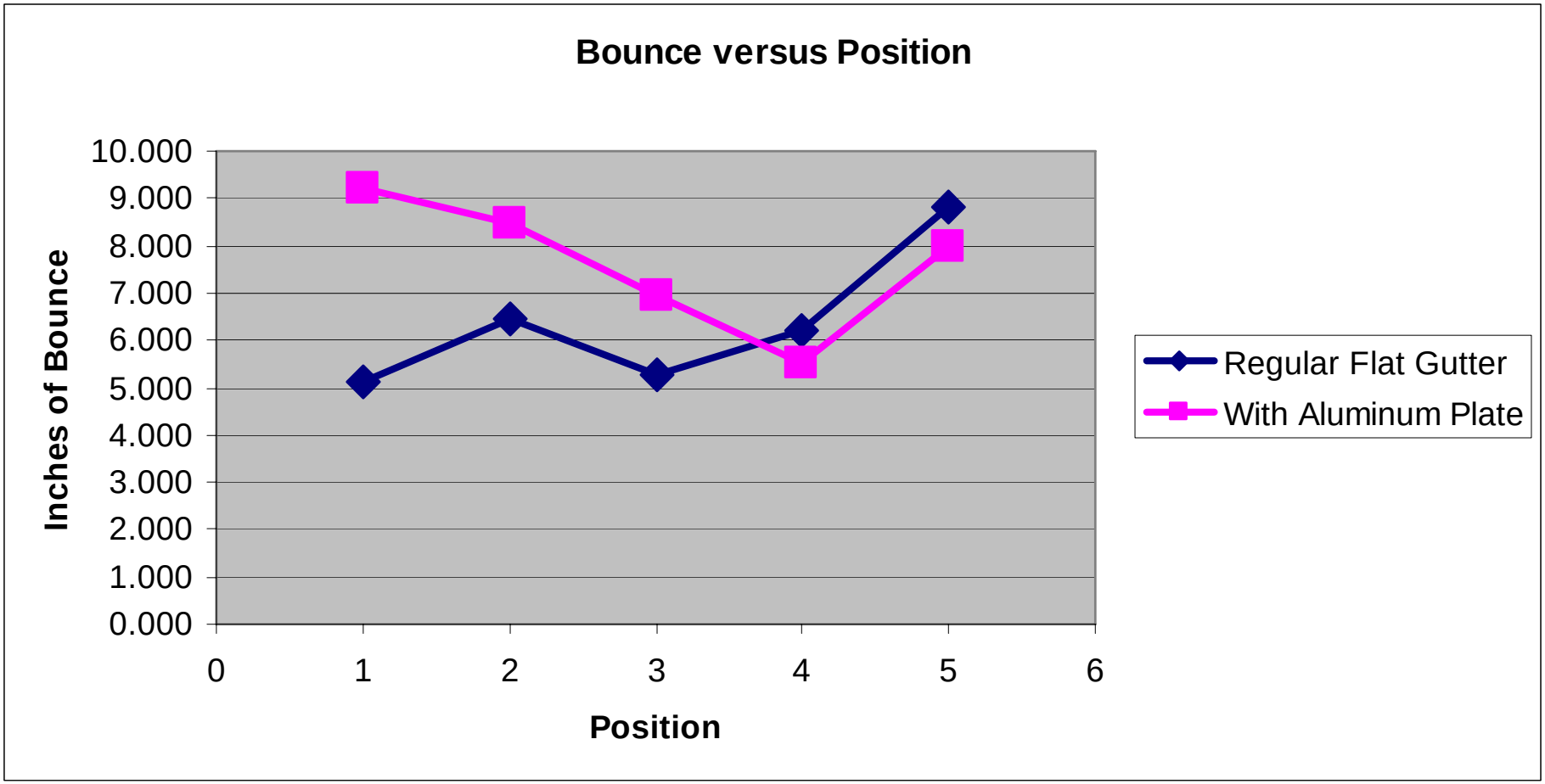
Flat Gutter COR Test continued



Flat Gutter COR Test continued

- Another test was conduted where an aluminum plate was put underneath a brace located between the two and four pin spots.
- This plate bowed the flat gutter, ½” out of specification.

Flat Gutter COR Test continued



Flat Gutter COR Test continued

	COR	COR
Position on Flat Gutter	without bracing	with bracing
2 pin	0.365	0.656
2-4 pin	0.461	0.604
4 pin	0.378	0.496
4-7 pin	0.443	0.393
7 pin	0.631	0.568
Maximum Difference		0.025
Precentage Increase		4.0

Flat Gutter COR Test continued

- The testing validates the physics in this case and shows that even when the flat gutter is bowed out of USBC Specification, the maximum increase is only 4%!
- The COR will be at the maximum value wherever the flat gutter is braced to the underlying cribbing and support structure.

Thank you all for your time and attention!

Questions?