Research Summary

- July 2015, ongoing
  - Cores
  - Coverstocks
  - League simulation
RG and Differential RG Findings

- 2 most hook
  - High diff RG (.060, .080)
- 2 least hook
  - Low diff RG (both .030)
- Difference
  - 3 boards
  - 1.3 degrees of entry angle
Balance Hole (BH)

- Pro Shop suggestion
- Gripping holes - small effect on differential RG
- Balance holes added .018” - .021” to the differential RG
Balance Holes

- Intended to achieve legal static weight
- Being utilized to strengthen reaction
- What if balance holes were removed?

Typical Balance Hole Layouts

What happens without balance holes?
Bowler Test
5” Pin, 3 oz. Static Weight Outside Specs

- Red line = baseline
  - 0 static weight
  - no weight hole

- Blue = 3 oz static weight
  - outside spec

- Green = 3 top, 3 thumb, 0 side weight
  - Least hooking
Bowler Test
5” Pin, Legal Today vs. 3 oz. Extra Static Weight

- Red line = baseline
  - 0 static weight
  - no weight hole
- Black = legal balls
  - Most with balance hole
- Blue = 3 oz static weight
  - outside spec
- Green = 3 top, 3 thumb, 0 side weight
  - Least hooking
Conclusion from Balance Hole Testing

• Balance holes create extra flare and hook

• This effect forces bowlers to start further inside on the lane to hit the pocket

• Balls with balance holes hooked approximately two more boards

• Key Takeaway – Removal of balance holes has most impact on reducing hook potential
Oil Absorption Test Equipment
Oil Absorption Results

- Average oil absorption time for 3 drops in fastest color
  - Fastest – 2:33 (2 min 33 sec)
  - Specification – 2:15 (2 min 15 sec) or longer.
Oil Absorption
League Simulation Study
Oil Absorption
League Simulation Study
10-Bowler Test over three days

D A Y

1. Slow oil absorption balls (average. 27.5 min)
2. Fast oil absorption balls (average. 6.5 min)
3. Slow oil absorption balls - 80% oil volume
League Simulation Study Results

• Scoring
• Starting Positions
• Moves
• Oil depletion
League Simulation Study Results

- Scoring
- Starting Positions
- Moves
- Oil depletion

<table>
<thead>
<tr>
<th>Day</th>
<th>Equipment Type</th>
<th>Group Average Score</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Slow Oil Absorption, Additional Side Weight.</td>
<td>209.0</td>
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<tr>
<td>2</td>
<td>Fast Oil Absorption, Additional Side Weight.</td>
<td>206.8</td>
</tr>
<tr>
<td>3</td>
<td>Slow Oil Absorption, with 80% oil volume.</td>
<td>208.2</td>
</tr>
</tbody>
</table>

 annonce significant difference in scoring
League Simulation Study Results

• Scoring
• **Starting Positions**
• Moves
• Oil depletion

<table>
<thead>
<tr>
<th>Day</th>
<th>Equipment Type</th>
<th>Starting position</th>
<th>Starting Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Slow Oil Absorption, Additional Side Weight.</td>
<td>29.8</td>
<td>16.6</td>
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<tr>
<td>2</td>
<td>Fast Oil Absorption, Additional Side Weight.</td>
<td>33.1</td>
<td>18.4</td>
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<tr>
<td>3</td>
<td>Slow Oil Absorption, with 80% oil volume.</td>
<td>30.5</td>
<td>16.6</td>
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</table>

☆ Fast oil absorption equipment starts further inside.
League Simulation Study Results

- Scoring
- Starting Positions
- Moves
- Oil depletion

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<th>Position Moves</th>
<th>Target Moves</th>
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<tbody>
<tr>
<td>1</td>
<td>Slow Oil Absorption, Additional Side Weight.</td>
<td>7.3</td>
<td>3.9</td>
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<tr>
<td>2</td>
<td>Fast Oil Absorption, Additional Side Weight.</td>
<td>9.2</td>
<td>5.8</td>
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<tr>
<td>3</td>
<td>Slow Oil Absorption, with 80% oil volume.</td>
<td>7.9</td>
<td>4.8</td>
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Fast oil absorption equipment causes bowlers to move more.
Oil Depletion

- Tapes from 8 ft down-lane
- Slow Oil Absorption Balls (Day 1)
- Fast Oil Absorption Balls (Day 2)
- Slow Oil Absorption Balls with 80% oil (Day 3)

House Pattern for 10 Bowler test - 8 ft

- Day 1: Slow Oil Absorption, No Balance Hole.
- Day 2: Fast Oil Absorption, No Balance Hole.
- Day 3: Slow Oil Absorption, No Balance Hole, 80% Oil.

Graph showing units on the y-axis and pins from L1 to R2 on the x-axis.
Oil Depletion

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Oil Depletion

- **Tapes from 8 ft down-lane**
- **Slow Oil Absorption Balls (Day 1)**
- **Fast Oil Absorption Balls (Day 2)**
- **Slow Oil Absorption Balls with 80% oil (Day 3)**
Conclusion from League Simulation Study

• Oil absorption had no significant impact on scoring.  
• Fast oil absorption equipment makes bowlers start further inside.  
• Fast oil absorption equipment causes bowlers to move more.  
• Oil depletion occurs where the balls touch the lane.  
• Starting deeper inside the lane, and moving more often deteriorates lane conditions quicker.
Oil Volume on the Lane

Oil Volume has Increased (Oil Manufacturers Data)

<table>
<thead>
<tr>
<th>Decade</th>
<th>Min</th>
<th>Max</th>
<th>Ave</th>
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<tbody>
<tr>
<td>1980-89</td>
<td>8</td>
<td>14</td>
<td>19</td>
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<tr>
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<td>2020-29</td>
<td>29</td>
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<tr>
<td>2030-39</td>
<td>35</td>
<td>35</td>
<td>35</td>
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Summary

• To protect bowling’s future
• USBC is eliminating balance holes – Effective Aug 1, 2020
• Setting a new specification for oil absorption

• USBC research shows these changes will
  • Slow oil pattern transition
  • Cause bowlers to move less
  • Keep the same scoring pace with lower oil volume

NO current USBC approved balls will be deemed illegal
A Future for the Sport