A Future FOR THE Sport

Report on Bowling Ball Hardness Governance:

History, Research, and Competitive Impact

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Contents

EXECUTIVE SUMMARY

This report presents a comprehensive review of the history, technical research and competitive factors that informed USBC's adoption of new rules for older technology urethane bowling balls in national events.

Urethane balls, particularly those with modern coverstocks and slow oil-absorption rates, have reemerged in competitive play over the past 15 years. While these products, such as the Purple Hammer and Storm Pitch Black, provide specific performance benefits, their coexistence with reactive resin equipment has led to measurable challenges:

- **Lane pattern integrity** caused by oil carry down disrupting the intended pattern design.
- **Competitive fairness** is challenged when urethane and reactive equipment creates style imbalances.
- **Governance and compliance difficulties** in enforcing hardness specifications and preventing tampering.
- **Athlete development concerns**, particularly in youth and collegiate bowling, where reliance on urethane can discourage versatility and touch.

A historical review shows that hardness standards introduced in the 1970s remained stable for decades, with few violations, until the introduction of urethane balls manufactured near the lower hardness limit. Subsequent USBC research confirmed that urethane balls measure softer with use and can be artificially softened through tampering, with performance effects that diminish over time but are difficult to detect without immediate testing.

Pattern designers have been forced to implement increasingly complex oil pattern and format adjustments to maintain competitive equity, while incidents at national and collegiate events have highlighted the ongoing governance challenges.

USBC has implemented new approval and tournament rules as part of its governance response, while continuing to evaluate additional policy options for the future.

USBC's approach is designed to improve competitive balance, reduce governance challenges and support the long-term development of athletes, while preserving fairness across playing styles and handedness. While these measures mark a critical step forward, USBC will continue to evaluate additional governance solutions to address the evolving impact of urethane and reactive equipment on competitive balance.

Introduction

The purpose of this report is to document the historical, technical and competitive context informing USBC's evaluation of potential new rules governing older technology urethane bowling balls in national events and, potentially, across all certified competitions.

For clarity, the term *"urethane balls"* in this report refers to a subset of equipment with slow oil-absorption rates, including modern coverstock adaptations of earlier urethane technology (e.g., Hammer Purple Urethane Pearl, Storm Pitch Black). While all performance bowling balls contain some form of urethane, reactive resin balls differ in that they include plasticizers and other additives that create a porous surface. This review focuses exclusively on urethane products whose performance characteristics differ significantly from reactive resin balls in oil absorption, lane interaction and competitive impact. Future reference to these balls will be noted as, "slow oil-absorbing high-performance balls."

This report examines:

- The historical evolution of ball hardness standards and enforcement.
- Technical research on urethane ball softening and tampering.
- Competitive effects on lane pattern design and equity.
- Usage trends in youth, collegiate and professional competition.
- Policy options under consideration for future implementation.

Historical Context and Timeline: Urethane Ball Governance (1973–2025)

1973–2001: Establishment of Hardness Standards

In [1]1973, changes in competitive bowling prompted the introduction of hardness regulations for bowling balls. Following instances where ball surfaces were chemically softened, the Professional Bowlers Association (PBA) established a minimum hardness specification of 75 Shore D in 1974. The American Bowling Congress (ABC) introduced its own standard in 1976, setting the limit at 72 Shore D.

Between 1974 and 2001, these standards remained in place with minimal change. Balls measuring below these limits were removed from competition, below 75D in the PBA and below 72D in the ABC Championships. Manufacturers consistently produced balls in the 78–80D range to ensure compliance with the more stringent PBA standard, making disqualifications for hardness rare. These facts demonstrate that urethane balls of that era, as with modern urethane, tended to measure softer with use. USBC published research on this phenomenon in 2023[2].

During this period, ball technology evolved from plastic to urethane in the 1980s, followed by reactive resin in 1991. By the late 1990s, reactive resin balls had become the dominant choice in competitive play, and urethane use had declined to negligible levels. Interestingly, when urethane first entered the market in the 1980s, the PBA Player's Committee even voted to ban it from the Tour. The proposal was ultimately rejected by the PBA, and by the time reactive resin arrived a decade later, the technology boom was well underway and virtually unstoppable. In 2001, the PBA discontinued hardness testing, concluding it was no longer a meaningful enforcement measure given the rarity of violations. Similarly, at the ABC Championships, instances of balls measuring below 72D were extremely uncommon, and continued testing was deemed an inefficient use of time and resources, therefore it was removed for the 2005 Championships.

2008: Ball Motion Study

In 2008, USBC, in collaboration with World Bowling, conducted a comprehensive ball motion study[3]. At the time, urethane balls were essentially absent from competitive use, and hardness was not a significant point of emphasis. The study focused on understanding the interaction between reactive resin equipment, lane conditions and player style, with little anticipation of urethane's resurgence.

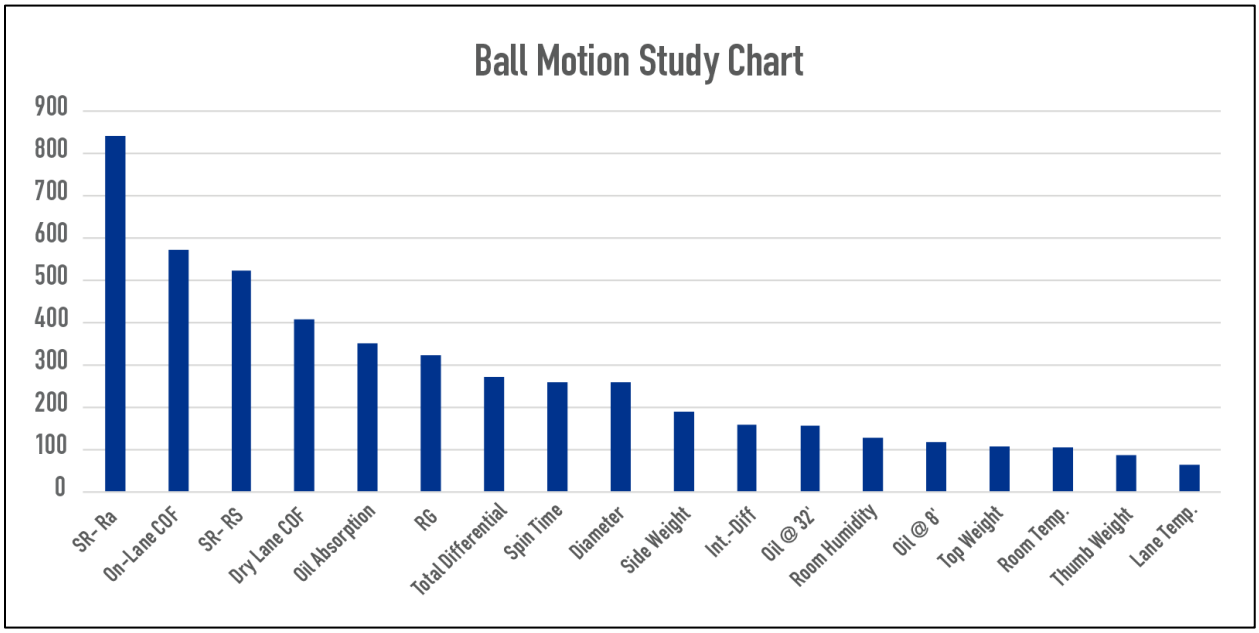

Figure 1 - 2008 Ball Motion Study Results

[1] Surface Hardness of Bowling Ball Report
[2] Old Urethane Ball Hardness Report
[3] Ball Motion Study

2009–2018: Urethane Returns

In the late 2000s, several international competitions began using lane patterns where top-level players identified that older urethane models from the 1970s and 1980s provided a smoother, more controllable transition to the pocket. On these patterns, reactive resin equipment often hooked too sharply to be managed effectively.

During this period, several Storm staff players requested and received permission to drill competitor-manufactured urethane balls for isolated use in international tournaments. This practice was short-lived, ending when Storm developed its own solution to meet the competitive need.

In April 2009, Storm introduced the "Natural" urethane ball at a hardness of 78D, marking the beginning of a gradual reentry of urethane technology into the marketplace.

- **March 2014**: Storm released the Pitch Black at 79.9D.
- **August 2015**: Ebonite introduced the Hammer Black Urethane at 79.39D.
- **August 2016**: Ebonite released the Purple Hammer at an approved hardness of 72.07D, the lowest hardness measurement for any approved Urethane ball in decades.
- **October 2017**: Ebonite released the Hammer Black Widow Urethane at 77.50D.

***What did this really mean for the sport**?*

Several key facts coincide with this period. The removal of the PBA's 75D specification prompted a gradual reduction in manufacturing hardness levels across the industry.

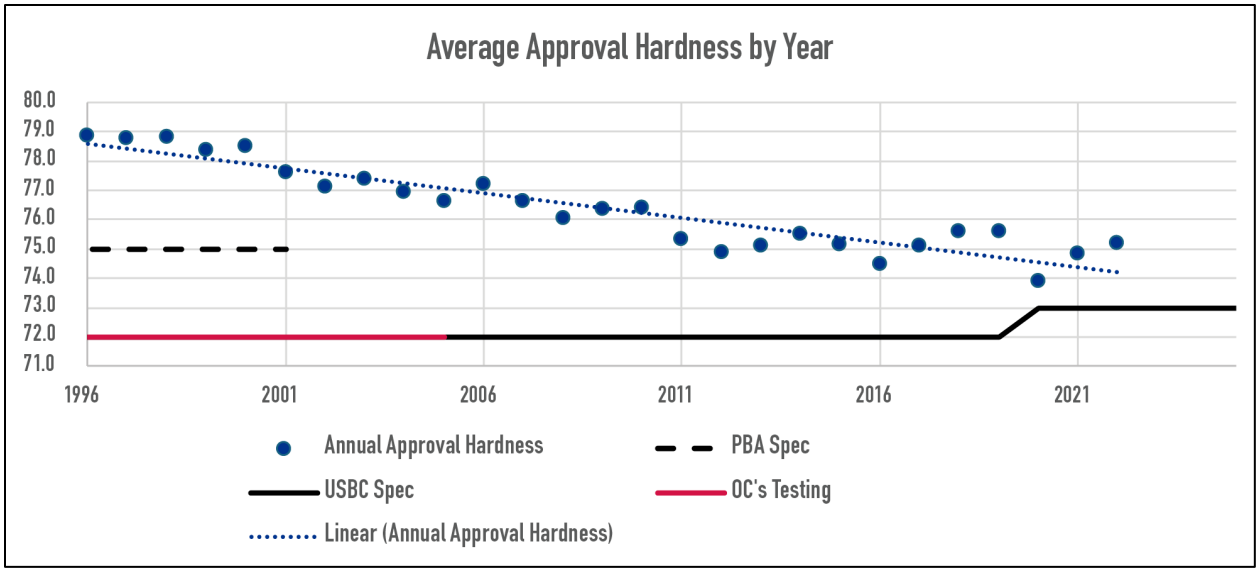

Figure 2 – USBC Average Approval Hardness by Year

Historical approval data show that it took approximately 11 years for the average hardness of approved balls to drop below the 75D threshold. No urethane balls approached the 72D level, except for one: the Purple Hammer. While this fact may not have seemed significant at the time, it effectively set a new low target point for the specification.

Because so few ball models approached the lower limit for nearly five decades, governance around hardness was not a focus and did not evolve. When the Purple Hammer was introduced, the Equipment Specifications Manual[4] contained no approval spot check process for hardness, and there were limited checks and balances in place beyond approval measurements. Industry-wide, attention to hardness had largely faded, as reflected in the 2008 Ball Motion Study, where hardness was, understandably, not included in the analysis, given the conditions at the time.

[4] Equipment Specifications Manual

However, as the historical data indicates, the conditions for a governance challenge were developing, and they came to fruition with the introduction of the Purple Hammer.

These balls entered the marketplace and were used in competitions for two years without hardness spot checks, and they were not examined more closely until 2019. This lapse in governance highlighted a weakness in USBC's oversight that has since been addressed.

2019–2020: Identification of the Issue

The popularity of the Purple Hammer grew, particularly on the PBA Tour in 2019. That year, USBC initiated research on field testing as it relates to environmental factors[5], beginning on the PBA Tour Truck, before expanding to hardness testing at the 2020 U.S. Open[6] and the 2020 World Series of Bowling[7]. These tests confirmed a phenomenon already documented in prior USBC research; urethane balls soften measurably with use.

In late 2020, USBC implemented two key changes:

1. Raised the manufacturing hardness specification for bowling balls from 72D to 73D.
2. Introduced a spot-check testing process at events to ensure future compliance.

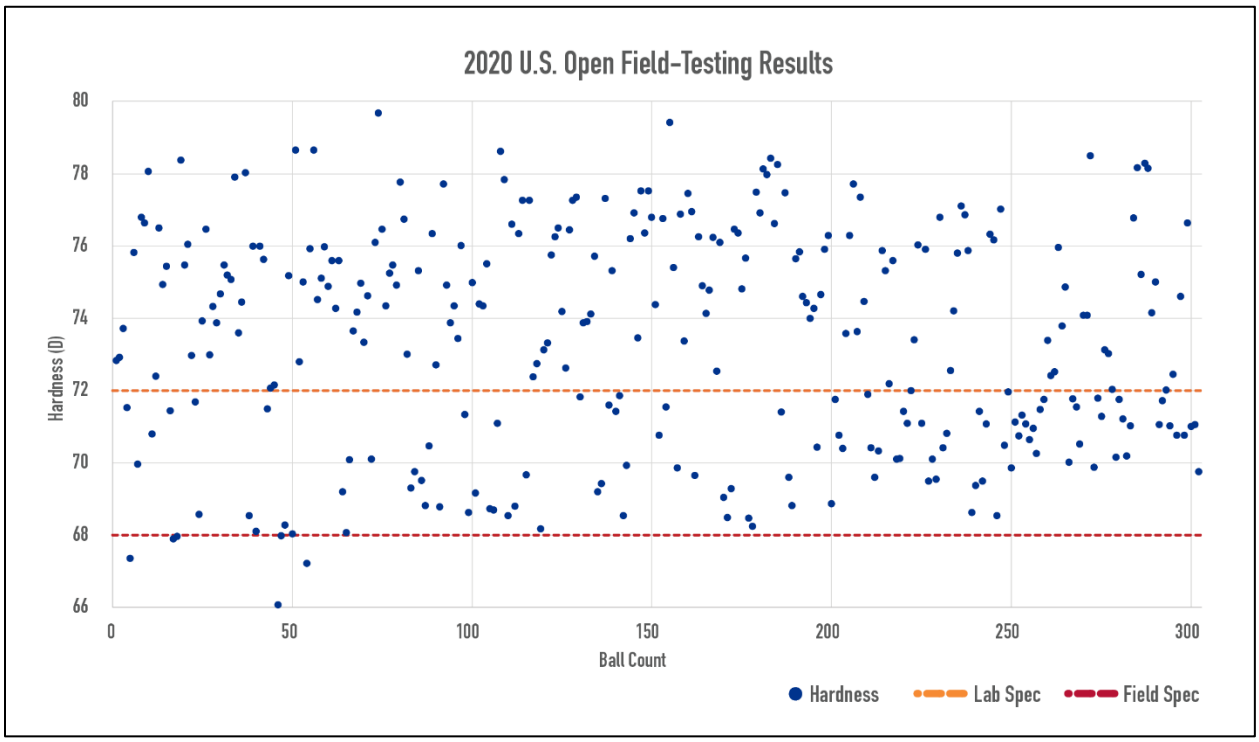

Figure 3 - 2020 U.S. Open Field-Testing Results

USBC also published in its research clarifying that while urethane balls soften naturally over time, this softening does not equate to improved performance. Artificial softening through tampering, however, can produce significant short-term performance gains.

[5] Field Testing Research on Environmental Factors
[6] 2020 U.S. Open Testing
[7] 2020 World Series of Bowling Testing

2022: Purple Hammer Investigation and Approval Revocation

In 2022, following a published account from a former Ebonite staff member, USBC investigated the manufacturing of Purple Hammer balls produced in 2016 and 2017. Interviews with more than a dozen former employees indicated that certain manufacturing practices at the former Ebonite International facility, prior to its acquisition by Brunswick in November 2019[8], may have resulted in balls falling below established hardness specifications.

Additional context from subsequent analysis is reflected in the accompanying chart.

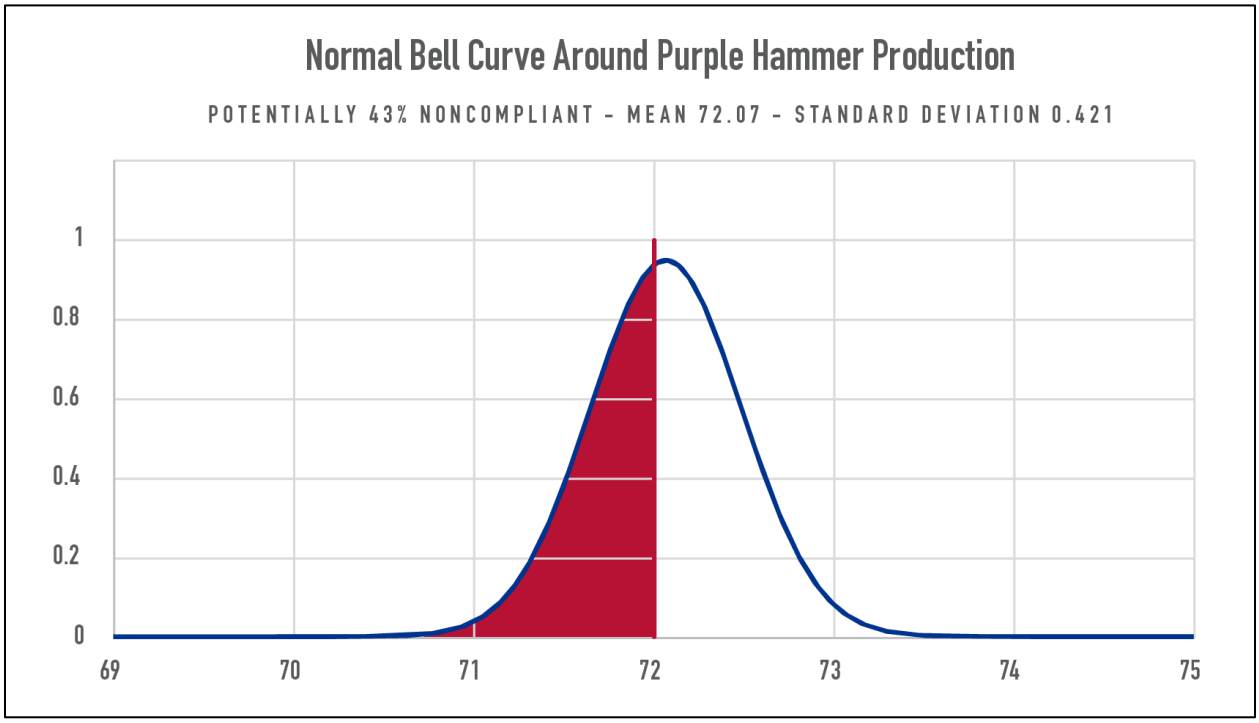

Figure 4 - Potential Bell Curve for Purple Hammer

USBC has never tested a Purple Hammer ball that was out of specification when new. By the time the issue emerged in 2019, no unused 2016 or 2017 Purple Hammer models were available for direct testing. However, statistical analysis using standard manufacturing deviation indicates that as many as 43% of the original 2016–2017 models could have measured below the hardness limit.

Additionally, the Purple Hammer was not widely used during its first two years in the market. Its popularity and competitive prominence increased significantly only after success on the PBA Tour in 2019.

On March 21, 2022, USBC revoked the approval of 2016 and 2017 Purple Hammers[9], in coordination with Brunswick. Brunswick subsequently re-submitted the Purple Hammer for approval under its own manufacturing controls, and the product has passed all subsequent spot checks.

2022: Hardness at Manufacture and Performance Impact

As documented in USBC's 2022 Ball Hardness Research Report[10], lower ball hardness at the point of manufacture can significantly affect performance. When two versions of the same urethane ball model are tested, identical in every way except for their out-of-box hardness, the softer version consistently produces a stronger overall motion.

[8] Brunswick Acquires Ebonite International
[9] USBC Revokes 2016 and 2017 Purple Hammer Story
[10] 2022 Ball Hardness Research Report

This performance difference is most evident in the midlane and backend reaction, where the softer ball creates greater friction and earlier hook potential, often translating to increased entry angle and improved pin carry.

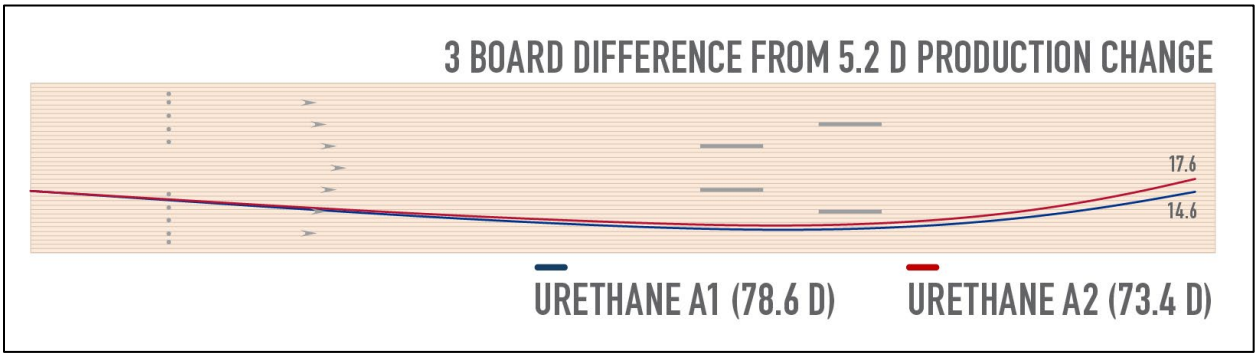

Figure 5 – Production Change to Hardness

While the effect may be subtle in casual play, it can represent a decisive competitive advantage in elite tournament environments, where small differences in motion and carry percentage can determine match outcomes.

This data underscores why hardness specifications, particularly at the time of manufacture, are critical for maintaining equitable competition. Any deviation toward the lower end of the allowable range, intentional or otherwise, has the potential to shift competitive balance in favor of those with access to softer equipment.

Third-Party Perspective: Creating the Difference (CTD) Hardness Study – Summary

Creating the Difference (CTD) conducted an independent, non-exhaustive series of tests in 2022 to explore how hardness relates to footprint and on-lane behavior, with particular attention to the Purple Hammer. Using USBC's standard operating procedure (SOP) for durometer checks, a ramp/footprint method and Specto measurements, CTD reported a loose correlation between softer hardness, larger footprint and greater speed loss; they also observed that softening the same ball (from ~73.8D to ~64.9D) produced earlier motion, more hook and a wider margin for error on a flat pattern.

CTD noted practical variables affecting readings (temperature, location on the cover, color/phasing) and reported that multiple Ebonite-made Purple Hammers in their sample measured soft, while Brunswick-made Purple Hammers they tested did not. They emphasized limitations (rolling-friction ramp vs. real play, small sample sizes) and contextualized why softer urethane can appear frequently on PBA telecasts, while acknowledging house vs. sport pattern differences.

Read the full CTD article and see the videos **here**.

2023: Expanded Research and Industry Response

USBC's 2023 research efforts included:

- Event-level spot checks at the USBC Open Championships[11].
- Study with a new measurement tool[12] for "footprint diameter," allowing correlation of hardness to physical surface deformation. Findings reinforced that natural softening of urethane does not directly impact performance outcomes.

Several key findings from the footprint research report are noted below:

- A repeatable SOP was prototyped and utilized to measure footprint diameters of bowling balls.
- A bowling ball's production hardness and footprint size are strongly correlated to one another.
- Balls that measure softer through use do not exhibit a strong correlation to change in footprint.

[11] Spot Checks at the Open Championships
[12] Footprint device report

- This study reinforces that urethane bowling balls dropping in hardness measurements through use does not impact ball performance on the lane in the same way as lower manufactured hardness.

During the same year, the PBA adopted two additional rules for the 2024 season:

1. A minimum manufacturing hardness of 78D for urethane balls.
2. A two-year age limit for balls used in PBA competition.

An FAQ[13] on that decision was published to PBA.com and shared with their announcement. While these measures improved competitive conditions for PBA professionals, USBC determined the two-year rule was impractical for its broader membership base, given the additional cost and accessibility challenges it would create. This was not the only reason USBC did not adopt the same rule at the time; further research was also required before any changes could be responsibly implemented.

2024-2025: Tampering Concerns

USBC research confirmed that soaking urethane balls in solvent can reduce hardness to extreme levels (as low as 30.7D in one test), with corresponding performance changes. Over time, hardness readings recover toward normal ranges, complicating tampering enforcement.

It appears a window exists in which artificially softened balls can be used without detection. Unless testing occurs immediately after tampering, this form of cheating with urethane balls is very difficult to prove.

Rule 17a – Unfair Tactics[14]

Rule 17a states that an individual can be charged with attempting to gain an unfair advantage in league or tournament play, if they directly or indirectly tamper with bowling balls so they no longer meet USBC specifications.

The penalty can include loss of games, any and all monetary or non-monetary awards/winnings, league removal, tournament disqualification and subject to suspension from or denial of USBC membership.

Reactive resin balls do not exhibit similar vulnerability to solvent soaking; performance and hardness are largely unaffected.

USBC has experienced two major incidents in recent years involving urethane equipment, along with several additional reports, including one on the world stage. The International Bowling Federation (IBF) modified its rules on urethane to address ball engraving issues. In another case, two USBC collegiate athletes were penalized for soaking urethane balls, and a formal protest at the Intercollegiate Team Championships (ITC) resulted in competition being delayed while a durometer was flown in overnight for testing.

USBC anticipates that incidents of this nature will likely increase over time. In any environment where competitive success can result in financial or career gain, some individuals will attempt to gain an advantage through non-compliant equipment modifications.

Testing demonstrates the effect of soaking urethane balls. In one example, a urethane ball soaked for 15 hours dropped in hardness to 30.7D, remained usable, and showed a dramatic performance increase of more than 21 additional boards of hook.

[13] PBA FAQ on Urethane decisions
[14] USBC Playing Rules

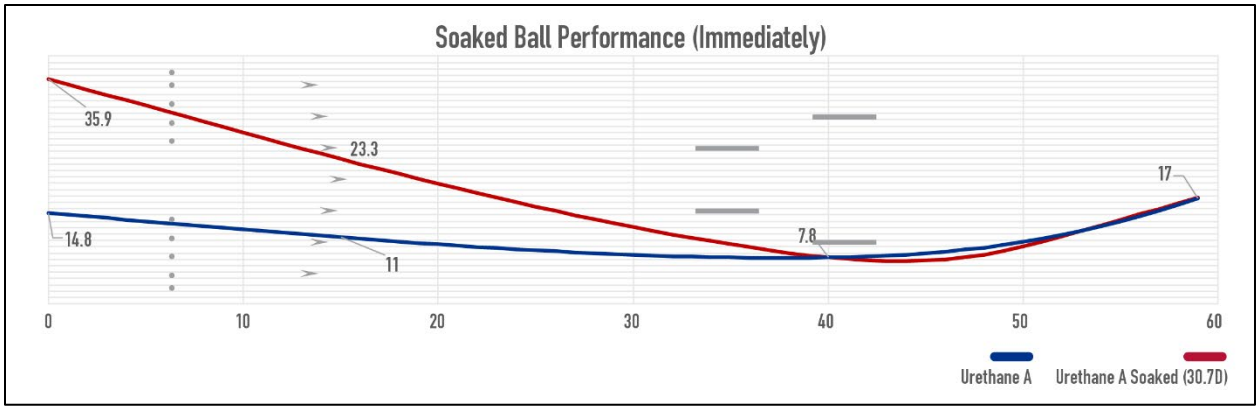

Figure 6 - Soaked Ball Test (Immediately)

One week later, the hardness recovered to 59.2D, with performance gains reduced to approximately five extra boards of hook.

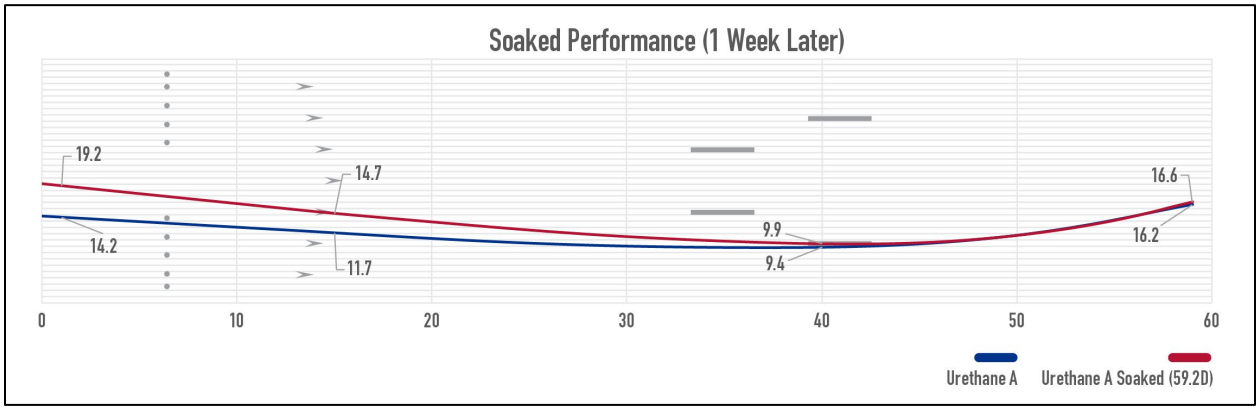

Figure 7 - Soaked Ball Test (1 Week Later)

Three weeks after soaking, the ball returned to 67D—nearly indistinguishable from its pre-soak condition.

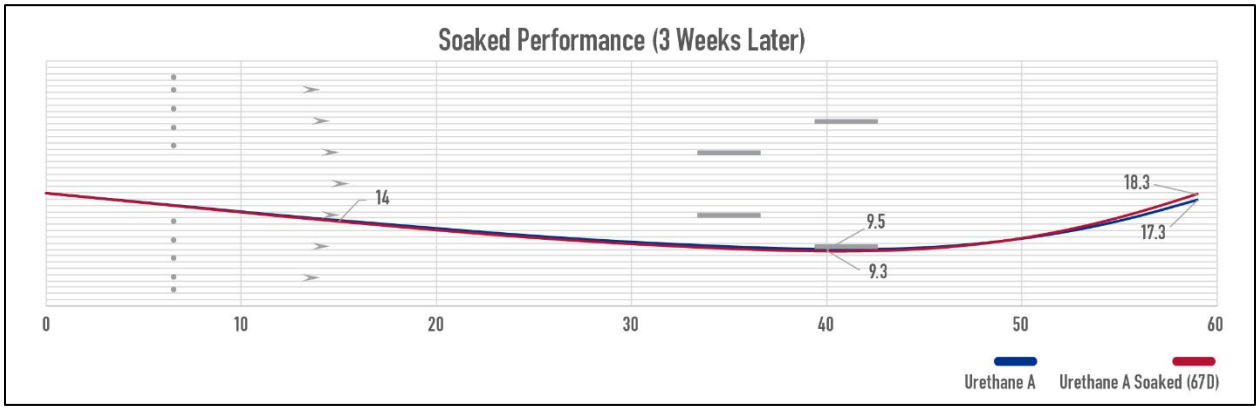

Figure 8 - Soaked Ball Test (3 Weeks Later)

The governance challenge lies in this recovery period. A player could tamper with a ball and, if not tested immediately, present equipment that measures similarly to balls that have softened naturally over time (in measurement only). In the collegiate case, the athletes' admissions were the only conclusive evidence; without those admissions, USBC could not have proven tampering.

Testing of reactive resin balls under the same conditions produced a different result. After a 15-hour soak, performance increased by only 1.7 boards, and within three days the ball measured harder than its original specification. These findings underscore that reactive resin balls do not present the same tampering risks and governance challenges as urethane.

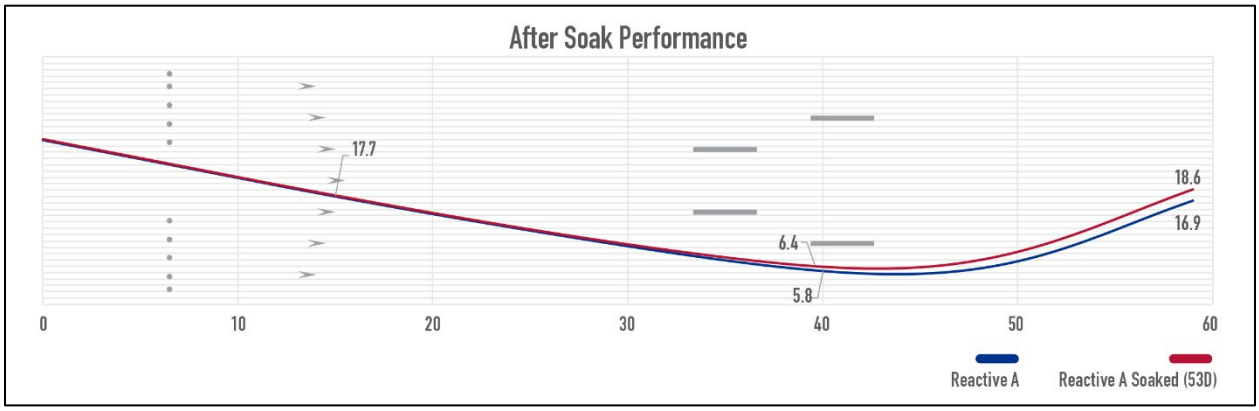

Figure 9 – Soaked Reactive Ball Test

May 2025: USBC Equipment Specifications Working Group

In May 2025, USBC brought together a cross-section of industry experts, including past ball designers that worked at manufacturing facilities, distributors, pro shop operators, past tour representatives, lane pattern specialists and past USBC leaders — to evaluate the evolving role of urethane in competitive bowling and its impact on lane conditions, athlete development and competitive equity.

The group believed that urethane meets a legitimate performance need, offering controllability when reactive balls are too strong or unpredictable, but also agreed that its growing dominance has created challenges. Heavy-surface urethane, especially in the hands of high-rev players, accelerates lane wear, complicates pattern development and may limit skill versatility in younger and collegiate athletes.

While there was no consensus on a single solution, several key points emerged:

- Urethane and reactive balls present conflicting lane transition characteristics, making coexistence at the highest levels increasingly difficult.
- Hardness specifications, oil absorption limits and clearer enforcement were viewed as viable tools for regulation.
- Many favored removing urethane from national tournaments on a defined timeline, while others urged targeted specification changes over elimination.
- Athlete reliance on urethane could narrow development pathways, creating "specialists" rather than versatile players.

The discussion reflected the complexity of the issue, balancing tradition, fairness and evolving equipment technology, and reinforced the importance of clear governance, education and data-driven decision-making to protect the sport's integrity.

July 2025: Marketplace Survey Findings

In early 2025, USBC conducted a one-question survey across email and social media channels to gauge member and public sentiment regarding the future of urethane bowling balls in certified competition. The survey was unscientific and generated 20,943 responses from a diverse cross-section of the bowling community, including national tournament participants, youth and collegiate athletes, senior competitors and general bowling audiences.

- 36.61% favored a complete ban across all certified competition.
- 17.63% preferred tighter specifications, such as raising the minimum hardness to 78D.
- 3.08% supported limiting urethane at national tournaments only.

By comparison, 38.67% supported keeping current rules, while 4% indicated the issue was not relevant to them. Segmented results showed that Open Championships bowlers were more likely than the general audience to support change, while certain smaller groups, such as PBA and PWBA participants, leaned toward maintaining urethane with tighter specifications.

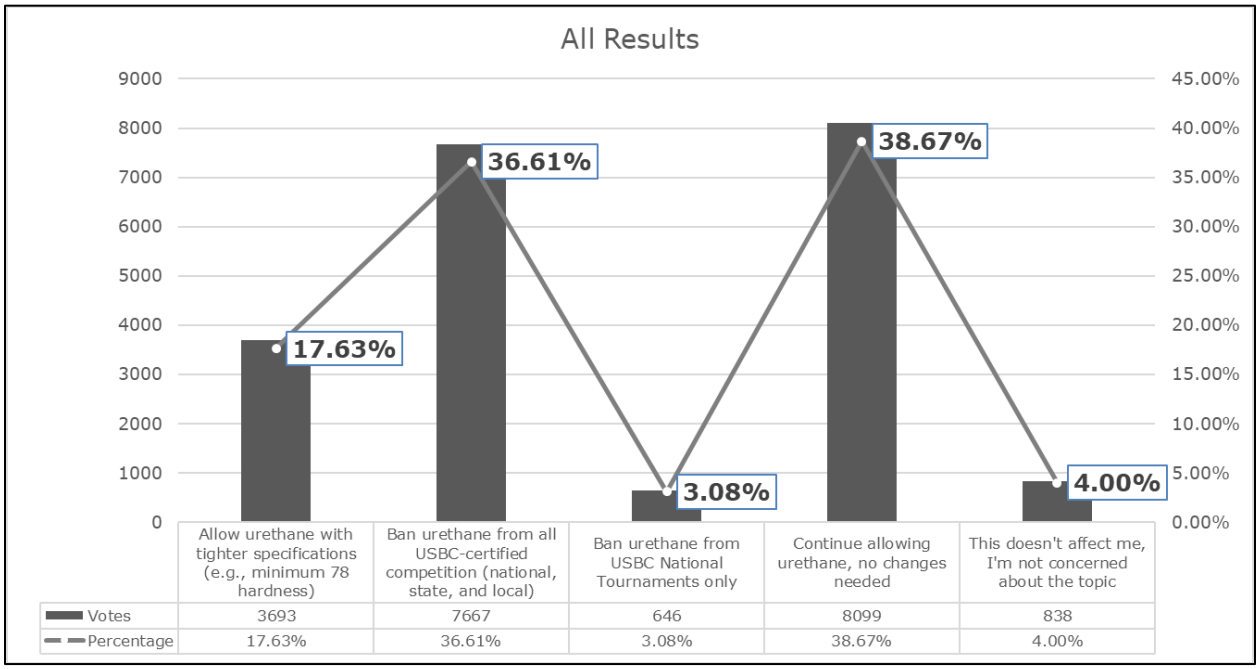

Figure 10 - USBC Poll Question Results

While a complete ban would create challenges for consumers and manufacturers, the survey results show support for USBC to take some form of action, whether through limiting at the national level or by introducing tighter manufacturing specifications.

It is important to note that this survey was not designed as a scientific poll. Instead, it was intended to serve as a straw poll, an opportunity to gather consumer sentiment, generate discussion and test how different segments of the bowling community would respond to potential changes. In that respect, the exercise accomplished its purpose: it engaged more than 20,000 bowlers, sparked widespread dialogue and confirmed that the issue of urethane governance is both visible and meaningful to the marketplace.

A full breakdown of the survey methodology and segmented results is available in the complete report[15].

Pattern Development Considerations

Veteran USBC pattern designer Nick Hoagland has identified several key challenges in delivering equitable lane patterns in today's competitive environment:

- Lane surfaces are aging rapidly.
- Bowling ball technology continues to evolve at a rapid pace.
- Maximum allowable oil volumes are already being applied per lane.
- Increased revolution rates are prevalent across the competitive field.
- Urethane balls rapidly degrade intended pattern characteristics.
- High-level bowlers are increasingly becoming specialists rather than generalists.
- Historical multi-angle pattern trees no longer provide consistent results.

[15] Survey Findings

- The industry is nearing the limits of viable oil pattern "tricks" to achieve balance.

Over the last decade, USBC has implemented various strategies to address these challenges, supplemented by similar efforts from other organizations:

Oil Pattern Design Adjustments

- Placement of oil "speed bumps" down the lane to maintain lane integrity.
- Larger left-side offsets to balance left/right equity.
- Wet-dry pattern configurations to discourage urethane use.
- Radical pattern structures designed to promote equity across playing styles.

Tournament Format and Structure Adjustments

- Reducing the number of games per block.
- Eliminating "burn squads" to limit extreme transition effects.
- Implementing hardness rules for certain competitions.
- Restricting urethane balls from being used for strike shots in select events.

Despite these measures, nuances such as left- versus right-handed play and differences between one-handed and two-handed styles continue to complicate competitive balance.

"Unsolicited opinion: whatever you and the congress can do to ensure more bowlers are playing the same game is good for the sport."

That was a quote from a one-handed left-handed top-level bowler, in a message to USBC Executive Director Chad Murphy upon learning of the potential urethane change that hit the internet in July 2025.

The point of the quote is that when urethane and reactive are being used in the same environment, bowlers are not playing the same game.

When asked what would change if urethane were removed, Hoagland identified the following potential benefits:

- Shorter patterns could be used without compromising integrity and design intent.
- Shorter patterns could be applied to a wider range of events.
- Increased flexibility in pattern design at elite levels.
- Greater ease in creating successful patterns at the local level.
- Urethane specialists would adapt their scoring methods.
- Left- and right-handed players would be able to play lanes in a more similar manner.

YOUTH AND COLLEGIATE CONSIDERATIONS

Urethane use is growing in youth and collegiate bowling. This trend raises developmental concerns, as urethane's smooth motion and oil carry down effects can mask inconsistent execution, potentially hindering skill progression.

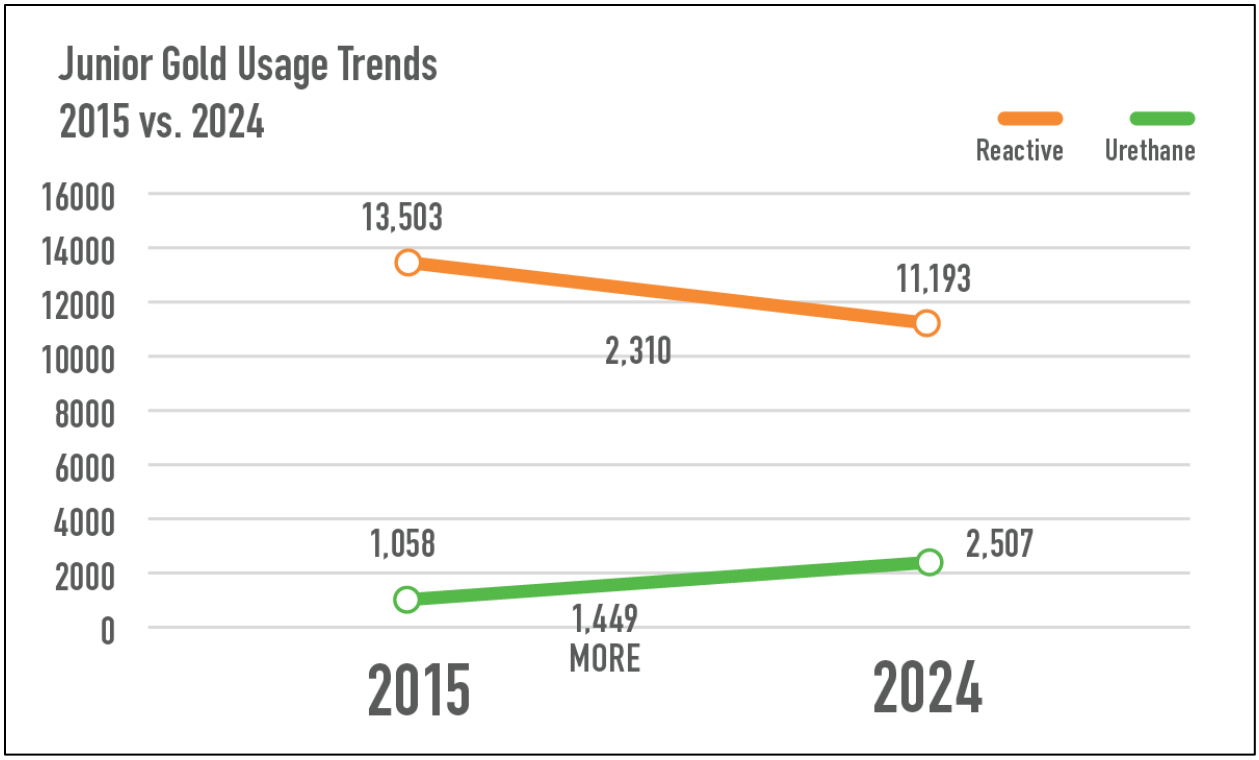

Figure 11 - Junior Gold Usage Trends 2015 vs. 2024

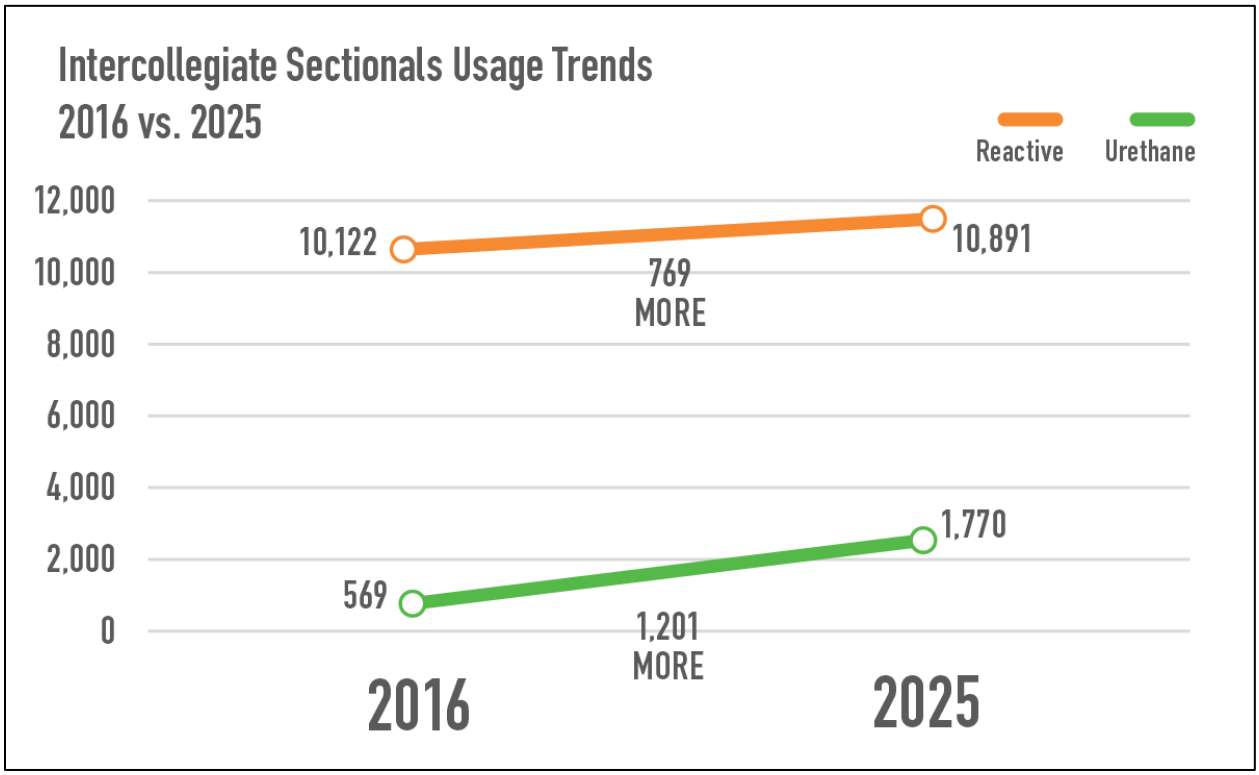

Figure 12 - Intercollegiate Sectionals Usage Trends 2016 vs. 2025

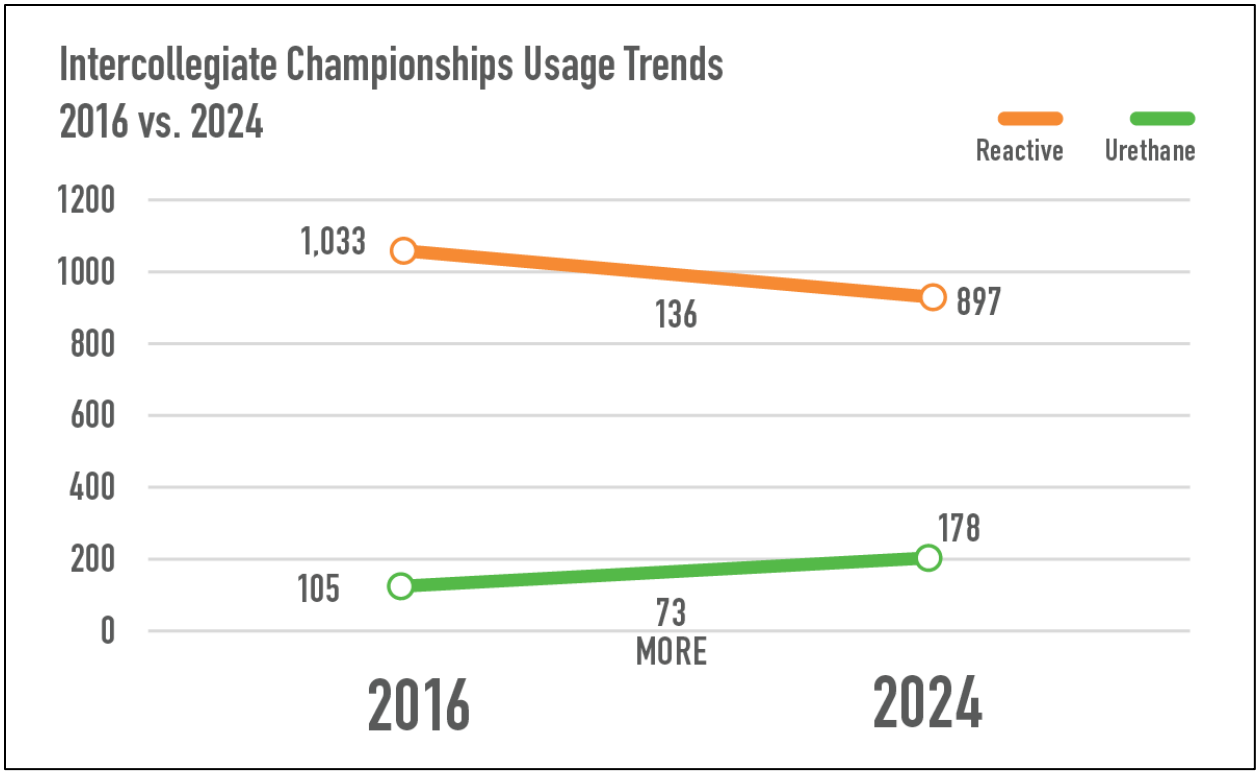

Figure 13 - Intercollegiate Championships Usage Trends 2016 vs. 2024

This upward trend reinforces broader concerns about skill development, competitive balance and the long-term effects of urethane reliance among developing athletes.

"What benefits does a urethane ball bring to the sport of bowling?

I know a negative. 99% of the people under the age of 25 have zero touch. Ball hooks too much, grab a urethane ball. Ball doesn't hook enough, grab a urethane ball.

Maybe if urethane gets banned, the youth of today will learn how to bowl again. There is so much urethane going down the lane at these events the question has to be asked, is it good for sport?

The benefits of urethane are obvious, the early pick up and smooth backend. On harder patterns, most bowlers will choose it. The over hit at the bottom of the swing is masked and less touch is needed than with reactive at times".

The message above is from Anthony Simonsen, posted to social media[16]. USBC agrees and shares these concerns, recognizing that while urethane has specific performance benefits, its widespread use in youth and collegiate play may discourage the development of versatility, touch and adaptability in emerging athletes.

Some have suggested that removing urethane from youth competition would lead to reduced participation. However, recent evidence from international competition suggests otherwise.

[16] Anthony Simonsen Facebook post

At one of the largest youth bowling events in Asia, the **U22 8th Fukuoka Summer Cup 2025**[17], which draws athletes from across the region, tournament organizers modified the rules in the current year to exclude urethane equipment. The stated purpose, as outlined in the official rules, was:

"All urethane balls will be prohibited at this tournament. This is a measure aimed at improving the competitive ability and techniques of young athletes under the age of 22."

The event was a complete sellout, with no noticeable decline in participation. Athlete feedback also indicated strong support for the change: in post-event video interviews, a clear majority stated they preferred the removal of urethane from the competition.

This outcome suggests that, rather than deterring young athletes, removing urethane may be welcomed by a majority of participants, particularly when the change is positioned as a means of improving skill development and competitive equity.

PATH FORWARD

The coexistence of older technology urethane and modern reactive resin balls continues to present persistent challenges in USBC national events. Differences in oil absorption, minutes for reactive balls versus hours or never for urethane, create oil carry down, pattern distortion and style advantages that undermine competitive balance.

These effects are magnified by higher-rev bowlers and growing youth reliance on urethane, impacting both lane equity and athlete skill development. Addressing these issues requires governance solutions that improve fairness, simplify pattern design and encourage long-term versatility in athletes.

As of 2025, urethane balls with slow oil absorption represent a small fraction of total sales (approximately 6% in the U.S.). USBC has identified several potential approaches, and the USBC Board and volunteer leadership will continue evaluating these options as part of the long-term governance process.

CONCLUSION

USBC's responsibility in this area is to ensure fair and equitable competition across playing styles, handedness and equipment choices. The coexistence of urethane and reactive balls increasingly undermines that goal. Historical precedents, current research and competitive observations point toward the need for action.

In alignment with the USBC Equipment Specifications Committee and the USBC National Board, and following a comprehensive governance review by USBC staff, the following steps have been implemented:

1. **Manufacturing Standard** - Effective Dec. 31, 2025, slow oil-absorbing high-performance (urethane) bowling balls with oil absorption times over 90 minutes must be at least 78D hardness to be USBC approved for sale in the U.S.

2. **National Tournament Rules** – Effective Jan. 1, 2026, various USBC national tournaments will enforce new restrictions, either fully prohibiting slow oil-absorbing high-performance balls regardless of hardness or only allowing them if they meet the new 78D specification.

These actions mark a significant governance step to improve competitive balance and address long-standing equipment disparities. In addition to this report, USBC has issued a national press release, published a frequently asked questions document and produced an explanatory video to ensure clarity and transparency for all stakeholders.

These measures are a critical step forward. USBC will continue to monitor competitive outcomes, collect athlete feedback and evaluate future adjustments to ensure the sport evolves with integrity.

[17] U22Fukuoka Facebook page