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Document ID: ASTM-002

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CASE-004: 10 Year old Hardwood Court Shows Significant Deterioration

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There has been very little research to determine how, or if, the performance of a hardwood court deteriorates with age and use. This is a single case study from the testing of a 10 year old installation with 2 courts that are side by side and in the same room. The courts receive extremely heavy use throughout the year. The goal was to determine if the performance of the court had been altered significantly during its current lifespan. The system had been promoted and sold as being 'DIN-1991-Certified' . The floor was not commission tested so it is impossible to know how it performed immediately after installation. The exact cause of force reduction levels that were well below those required in DIN 1991 involves speculation. Both courts showed areas of low force reduction that appear to correlate to high traffic ares in today's game. Additionally, the floor did 'crack and creak' under every step.

Introduction:

Traditionally, architects and owners have assumed that hardwood courts maintain the safety, comfort and uniformity that was present at the installation for the life of the court. This study was designed to explore the validity of that notion and to determine if high level of use can cause the performance of a hardwood court to deteriorate over time.

Note: While there are ample case studies that link Force Reduction levels to greater comfort and less stress on joints, there is no clear data linking them to safety. There also is no clear minimum or maximum for these values above or below which injuries have been shown to decrease. The owner was provided with a summary showing how their results compare to DIN 18032-2 as well as other standards such as ASTM F2772, EN 14904, FIBA and MFMA-PUR.

Testing Methods:

The surfaces were tested for Force Reduction using equipment that conforms with DIN 18032-2, ASTM F2772, EN 14904, FIBA, and MFMA PUR standards. The force reduction equipment is shown in Illustration 1.

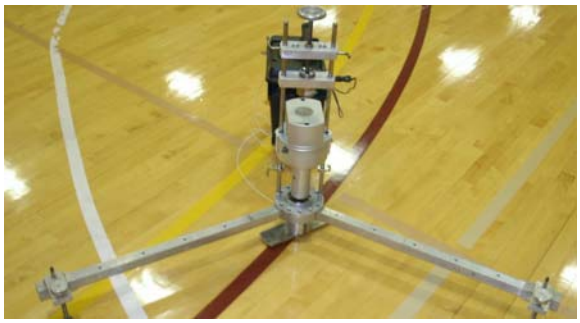

Illustration 1: Shock Absorption and Thickness Test Equipment

Detailed articles on the equipment and methods used can be found at ASET Services' Online Library, in the 'Educational White Papers' Section (http://asetservices.com/library/aset-publications/).

Force Reduction tests were taken using a grid that covered the playing surface. The two courts were located in the same room and

were side-by-side. They are labeled the 'Court A' and 'Court B' in Illustration 3. The remainder of the article will use this reference.

ASET was told by the staff that Court B was use more frequently than the Court A, with estimates that the Court B could see between 200% and 300% more use than the Court A.

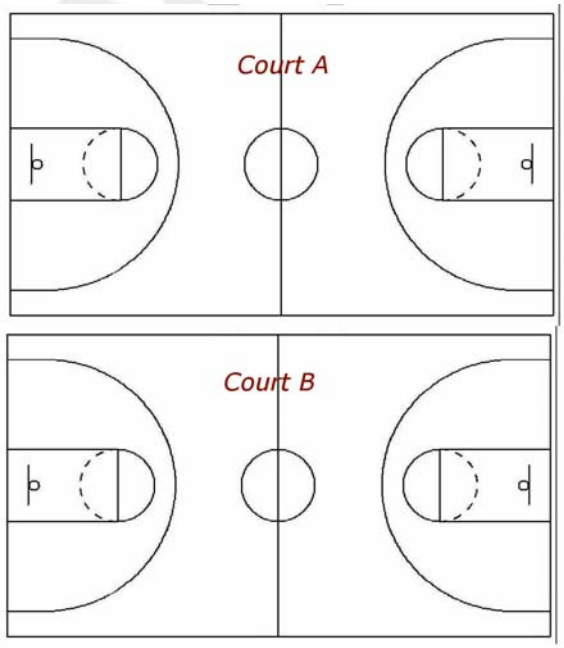

Illustration 2: Facility Layout

Determining the Original Performance:

ASET spoke with a representative from the facility and who was able to identify the system name and manufacturer. They were also able to provide the name of the system that had been specified. It was confirmed that that system was, and is, promoted as having met the 1991 version of DIN 18032-2. They were unable to locate an original specification to see if performance levels even more stringent than DIN 18032-2 (1991) were specified. ASET was unable to confirm the information provided regarding the design of the system as there were no access points available during the inspection. The 1991 version of this standard would have required the average values to meet the following requirements.

- Minimum Average Force Reduction: 53%
- There were no uniformity requirements in this standard.
- Later versions of DIN 18032-2, along with EN 14904 and ASTM F2772 require that performance be uniform to within 5% of the average value.

Results:

It should be noted that the only data available to ASET was the data collected during this recent field test, approximately 10 years after the court was installed. There is no commission data from the installation of the floor, therefore it is impossible to state definitively how much the floor has changed over 10 years. The following discussion and conclusions are based on the assumptions:

- The performance of court A and B were similar when they were new.
- The performance across each court was also similar and somewhat uniform, assumed to be within +/-5% of the average.

<u>Force Reduction (Shock Absorption)</u>

The Force Reduction grid included three rows from the bottom to the top of the court, and seven columns from left to right across the width of the court. The first and third row were on lines established by the 3-point shooting lines, the middle row was simply located down the center of the court. A total of 21 points on both courts were tested.

The results for the Court B are shown in the Table 1 and Illustration 4. The results for the Court A are shown in the Table 2 and Illustration 5. All test points that produced force reduction levels more than 10% below the maximum value are highlighted in the tables and drawings.

Table 1

Court B Force Reduction Results						
49	57	59	61	55	56	54
41	56	49	59	38	55	46
46	55	57	59	49	59	56

Illustration 3: Force Reduction Map of Court B

The general statistics for the Court B were:

- Average = 53%
- Max = 63%
- Min = 38%
- Range = 25%
- Standard Deviation 6.3%

Seven of the 21 points tested were more than 10% below the maximum value. Two points were more than 20% below the maximum value. The cause of the low force reduction values could not be determined with certainty, but will be further explored later in this document.

Table 2

Court A Force Reduction Results						
63	61	60	61	59	57	51
53	55	50	58	39	62	53
61	61	61	61	52	59	50

Illustration 4: Force Reduction Map Of Court A

The general statistics for the Court B were:

- Average = 56%
- Max = 63%
- Min = 39%
- Range = 24%
- Standard Deviation 5.9%

Seven of the 21 points tested were more than 10% below the maximum value. One point was more than 20% below the maximum value. The cause of the low force reduction values could not be determined with certainty, but will be further explored later in this document.

Discussion of Results

The two floors exhibit similar trends with respect to the current performance.

- Both courts produced significantly lower force reduction values beneath the baskets and at the top of the 3-point arc.
- Both courts have one end where the force reduction in the two corners on the 3-point line were significantly lower than the rest of the court.

While the cause of the lower force reduction values cannot be pinpointed, ASET believes that they are consistent with use trends prevalent in today's higher-level competitive basketball.

The lower values beneath the basket were not a surprise. This area experiences significant amounts of play, and has for decades. It also experiences high loading due to the presence of several athletes within a small area. Finally, the largest athletes are most often active in this area.

Today's elite offenses often proceed down the court unopposed until slightly before the 3-point line. This same location is used for multiple 'picks' by the offense, which occur multiple times per possession. This area has a very high rate of traffic and use during today's game. Therefore, the decreased force reduction would appear to be consistent with high use.

The zone in the corners near the 3-point line is also a popular spot for today's shooters. These areas see high amounts of use during practice given that this is one of the most popular shooting spots in today's game. The lower force reduction levels in the corners of the court occurs in another highly used area of the court.

The fact that the force reduction levels are not low in all 4 corners of any court or in all corners of the 2 courts is somewhat concerning. However, these courts are used for practice and it may be that for whatever reason one end of Court A and one end of Court B experience heavier use than the other ends.

In many ways the higher levels of force reduction that beyond the 3-point line and at the half-court line experience relatively little activity during today's game and these areas appear to have maintained higher force reduction levels.

There was another indication that this court had suffered significant damage from use, and that was the fact that it was a very 'noisy' court. The floor boards 'creaked' and 'cracked' with every step. There was no place on the floor where it was quite when even just walking across the floor. The sound indicates that the effectiveness of the nails or fasteners holding the flooring down have has been compromised. This might be due to high use, or it might be use to some other geologic or atmospheric phenomenon.

What we told the client:

- That force reduction levels that varied by more than 20% were among the largest we've ever seen.
- That there are studies that suggest that improving uniformity is more strongly related to preventing injuries than increasing force reduction.
- That studies indicate that athletes 'tune' their response to a surface within 3 steps and that non-uniform surfaces require constant adjustments by their athletes.
- That their athletes probably don't even realize they are adjusting, but that they do so subconsciously and they know where hard and soft spots are subconsciously as well.

- That FIBA had established a minimum force reduction level of 50% for hardwood courts in their 2018 rules.

Conclusions:

The results from this field test seem to indicate that at least some times there may be a link between use and the deterioration of the performance of hardwood courts. The results should not be applied broadly however, and should be taken for what they are the results form a single facility. It appears that high traffic areas now produce somewhat lower than expected Force Reduction levels, resulting in lower uniformity than would be expected in a new court of this design.

Traditionally, architects and owners have assumed that hardwood courts maintain the safety, comfort and uniformity that was present at the installation for the life of the court. This instance seems to suggest that, at least sometimes, courts change over time, and that the time to change can be far less than the 35 to 50-year lifespan that is often promoted for hardwood courts.

Certainly, some system designs, and materials are less prone to damage or performance deterioration over time. ASET is always looking for existing facilities to expand the industry's knowledge about how the performance of these systems age with use and the passage of time.

Comments:

If the initial performance is not verified, owners have no way of knowing that the surface delivers the specified protection and performance levels. The lack of verification testing also makes it impossible to determine how quickly or how much the surface changes over time. For more information on performance testing of new sport surfaces and how specifications can be written to ensure that specified safety and performance levels are delivered visit: www.aset-trueperformance.com.

Contact us with any questions you have about the performance of your new or current sport or play surface.

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