

EN 14904: Introduction to Performance Types

*This article provides an introduction to the optional performance types found within EN-14904. These performance types or categories will allow owners and architects to select floors from a much wider performance range than DIN allowed. Performance types have the potential to allow sports specific surface selection, and allow performance to be specified in a wider range of economic levels. For a description of the performance criteria presented in this article readers should refer to **EN 14904: Performance Criteria and Requirements**. (Document Number EN-001).*

This article is a follow-up to **EN 14904: Performance criteria and requirements**. (Document Number EN-001), in which the performance criteria from EN 14904 (2006) are outlined. If you have been involved in selecting a sport surface you may have more than likely been exposed to performance evaluations. An example would be the 'DIN' standard that has been widely used to promote, market and specify indoor sports surfaces in North America since the mid 1980's. This article will explain how a new European Standard (EN-14904) is used to measure and categorize sports surface performance.

1. System Classification

It seems appropriate to first outline the systems covered under the standard.

In General there are four types of systems covered under EN-14904 ^[1]:

- Area Elastic Systems - Systems with wood playing surfaces fall into this category. This category gets its name because an area significantly larger than the contact point is put into motion during impact.
- Point Elastic Systems - Synthetic playing surfaces installed on concrete fall into this category. This category gets its name because only a small contact area, or point, is displaced during an impact.
- Combination Systems - Synthetic playing surfaces installed over a resilient wood subfloor fall into this category. They represent a combination of area and point elastic systems with the point elastic portion forming the playing surface.
- Mixed Systems - This is a system that produces an area indentation between those

of area and point elastic floors. Mixed systems are, at this time, almost exclusive to the German sports surfacing market.

2. General Performance Requirements

Unlike DIN, within the EN 14904 all systems have the same broad performance requirements. These broad performance requirements are shown in Table 1.

Table 1: Requirements for EN 14904 (2006)^[1]

	Requirements
Force Reduction (min)	25% < FR < 75% (Range +/- 5% of Average)
Ball Rebound (min)	90% < BR (Range +/- 3% of Average)
Vertical Deformation (mm)	StVv < 5 mm
Area Indentation (max)	Not Measured
Rolling Load	1500 N
Slip Resistance	80 < SR < 110

EN 14904 does place some emphasis on uniform performance. As Table 1 shows, force reduction must have an average value between 25% and 75%, and all test points must produce a force reduction within +/-5% of the average. Likewise, ball rebound must achieve a level greater than 90%, with all points falling within a range of +/-3% of the average.

Vertical deformation levels must be less than 5.0 mm, with no range specified. Rolling load has been slightly modified from DIN 18032-2 and now requires all playing surfaces to sup-

port the same 1500 N (335 lbs). In the past synthetic surfaces only needed to support 1000N (224 lbs)^[2,3].

3. Introduction To Performance Types

While the EN allows a wide range of performance values, it also provides a system by which systems with similar performance can be categorized, or typed. This is accomplished through the optional 'Types' listing found in Appendix B of the standard. This section provides an introduction to these types.

One fundamental question that should be considered is "Why are these 'types' necessary?" First, there is not scientific evidence to support a claim that a certain performance level clearly separates safe floors from unsafe floors. The second reason stems from the wide range of economic and cultural preferences represented within the EU. Some member countries, such as Germany, had a very strict testing program. Other member countries, such as Slovakia, had little if any testing requirements. The optional 'types' included in EN 14904 allow more economically developed countries to require higher performing floors, while allowing less economically developed members to obtain an affordable floor offer some degree of comfort.

Another question that should be addressed is "How will these types benefit North American athletes and facilities?" Under DIN 18032-2^[2, 3] a floor either passed or failed. This meant that a facility only had 2 categories of floors to choose from. Under the new types introduced in EN 14904 manufacturers can now develop, and facilities can specify, systems that offer performance that has been optimized for a specific sport or activity. It is very likely that manufacturers will start to dedicate more of their research and design budgets to performance levels that previously failed DIN 18032-2, but will now meet the broader requirements of EN 14904.

3.1. Force Reduction Types

Appendix B of EN 14904 outlines the optional 'types' of force reduction that a sports surface may provide. Table 2 shows the optional types for point elastic and area elastic

sports surface systems, and Table 3 shows the same information for combination and mixed elastic systems.

Table 2: Optional Force Reduction Types shown in EN 14904 for Point and Area Elastic Systems

	Point Elastic	Area Elastic
Type 1	$25 \leq FR < 35$	
Type 2	$35 \leq FR < 45$	
Type 3	$45 \leq FR$	$40 \leq FR < 55$
Type 4		$55 \leq FR < 75$

One of the first things that you notice about the optional types is that not all of the allowable performance levels are included in these types. For example an area elastic floor with a force reduction of 35% would meet the broad standard of providing a force reduction between 25% and 75%, however it would not fall into any of the optional type categories.

Table 3: Optional Force Reduction Types shown in EN 14904 for Combination and Mixed Elastic Systems^[1]

	Mixed Elastic	Combination Elastic
Type 1		
Type 2		
Type 3	$45 \leq FR < 55$	$45 \leq FR < 55$
Type 4	$55 \leq FR < 75$	$55 \leq FR < 75$

4. Vertical Deformation Types

Appendix A of EN 14904 outlines the optional 'types' of vertical deformation that a sports surface may provide. Table 4 shows the optional types for point elastic and area elastic sports surface systems, and Table 5 shows

the same information for combination and mixed elastic systems.

Table 4: Optional Vertical Deformation Types shown in EN 14904 for Point and Area Elastic Systems

	Point Elastic	Area Elastic
Type 1	$StVv < 2.0$	
Type 2	$StVv < 3.0$	
Type 3	$StVv < 3.5$	$1.8 \leq StVv < 3.5$
Type 4		$2.3 \leq StVv < 5.0$

Table 5: Optional Vertical Deformation Types shown in EN 14904 for Combination and Mixed Elastic Systems^[1]

	Mixed Elastic	Combination Elastic
Type 1		
Type 2		
Type 3	$StVv < 3.5$	$1.8 \leq StVv < 3.5$ $0.5 \leq VD_p < 2.0$
Type 4	$StVv < 3.5$	$2.3 \leq StVv < 3.5$ $0.5 \leq VD_p < 2.0$

VD_p is the vertical deformation of the point elastic component.

5. Assigning Types to Performance

Figures 1 and 2 contain boxes that represent the performance types described in Tables 2 and 4. Figure 1 illustrates point elastic (P) types 1, 2, and 3. Figure 2 illustrates area elastic (A) types 3, and 4. Similar graphs could be developed from the data in Table 3 and 5 to graphically illustrate combination and mixed elastic performance types.

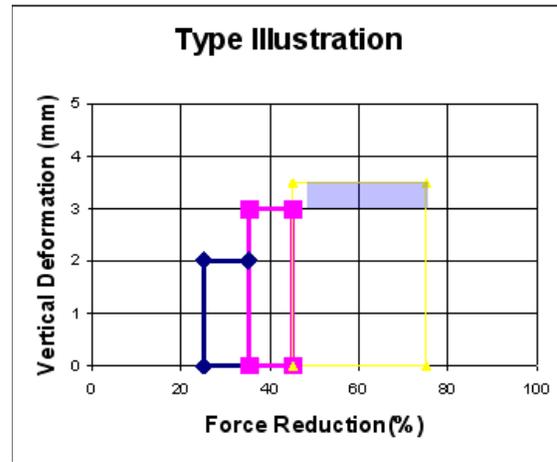


Figure 1: Illustration of Optional Point Elastic Types.

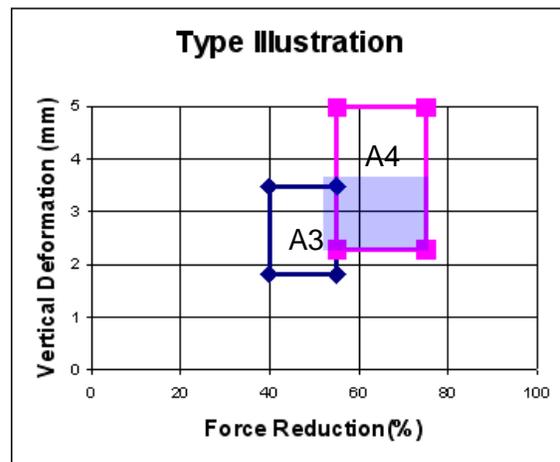


Figure 2: Illustration of Optional Area Elastic Types

The shaded blue box in Figures 1 and 2 approximate the limited performance region considered 'passing' under DIN 18032-2. The shaded boxes in Figure 1 and 2 also serve to illustrate how limiting the DIN standard was in terms of the performance combinations that it allowed.

It is currently unclear how performance types will be used in both the global and North American sports surface markets. Therefore, ASET has decided to report performance types in the following method:

- Force Reduction Type: This is based on the values used to define the optional force reduction types.
- Vertical Deformation Type: This is based on the values used to define the optional vertical deformation types.
- Overall Type: In the event that a system achieves different force reduction and vertical deformation types, ASET will assign an overall Type that is equal to the lowest optional type rating.

There will be instances where either force reduction or vertical deformation achieves a type assignment but the other property does not. In those cases and in cases where neither parameter achieves a type assignment, systems are reported as "Achieves No Overall Type."

6. Which standard is better for North America?

ASET Services has developed a position statement outlining the reasons why it supports a migration from DIN 18032-2 to EN 14904 within North America. This position statement can be found in the ASET Services' library (document number: POS-002).

6.1. EN 14904 and Safety

At this time no study or publication has been found that links a sports surface's compliance with this standard or any similar standard to a reduction in injuries. In fact, no study or publication has been found that links sports surface's compliance to any standard or test method to a reduction in injuries, other than standards designed to prevent head-injuries. There are no guarantees that a system meeting all of the requirements of this standard will reduce injuries.

Specifiers should consider EN 14904 an indicator of athlete comfort not an indicator of athlete safety.

7. Conclusions

This paper has introduced the optional performance types that are contained within EN 14904. These types will allow owners and architects to specify flooring with performance features similar to those that are currently DIN certified. In time these performance features

will allow manufacturers to develop and owners and architects to select floors with performance levels customized to specific sports or activities.

8. References

1. (2006) EN 14904: Surfaces for Sports areas - Indoor surfaces for multi-sports use - Specification.
2. (1991) DIN Standard 18032 Part II: Sports Halls, Halls for gymnastics, games and multi-purpose use. Part 2: Sports floors, requirements and testing.
3. (2001) DIN Pre-Standard 18032 Part II: Sports Halls, Halls for gymnastics, games and multi-purpose use. Part 2: Sports floors, requirements and testing.

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