BASF

The Chemical Company

Mechanical Properties of Floor Surfaces

Evaluating Product Performance Criteria

Mechanical Properties of Floor Surfaces

On the surface, nothing beats BASF floor systems.

The first dry shake floor hardener was invented by Mr SW Fleisheim who founded the Master Builders company in 1910. He realised that industrial floors had to face special challenges, and with that in mind, he pioneered the use of special aggregates (carborundum or malleable iron) for high impact and load situations.

Refined over the past 80 years, this technology has resulted in the development of BASF's world-leading floor hardener technology. Improvements in wear characteristics, aesthetics (through the use of colour) and energy savings (using light reflectivity) have made BASF's products the 'floors of choice' for many industries.

Your BASF Technical Representative can assist you with selecting a flooring system that's right for your industry.

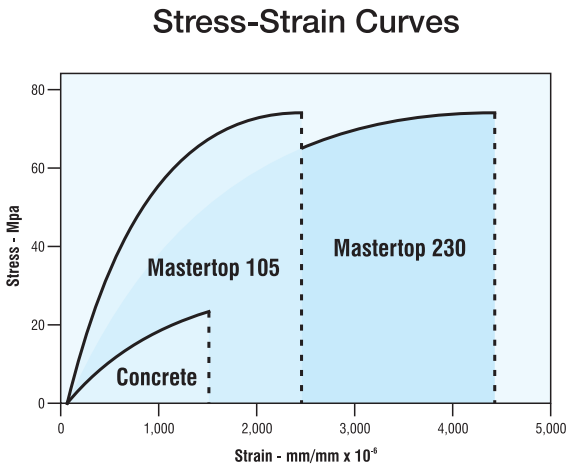
Toughness

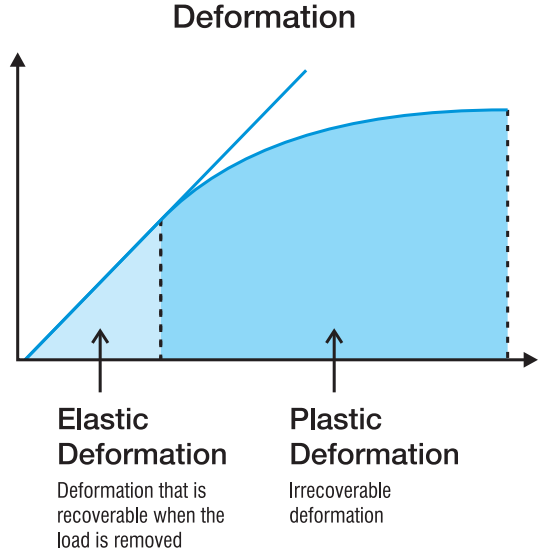
The abrasion test method by which the wearing characteristics of a floor surface can be tested was developed to aid in the choice of floor materials required for commercial, institutional and industrial environments.

Heavy industrial traffic, however, results in more than just abrasion. Impact from a variety of sources can impose a heavy strain, and the ability of the floor to withstand common stresses has a significant bearing on the life and serviceability of the floor surface.

When determining the stress/strain correlation of a floor material, TOUGHNESS is the measure defined as 'the area under the stress/strain curve' and is the energy absorbing (straining) capacity of the material before rupture. Virtually any material can be tested for toughness. What this test shows is a given material's ability to strain when subjected to stress. For example, glass has a relatively high compressive strength, but will not strain to any degree. Rubber, on the other hand, may have a low compressive strength, but an excellent ability to strain.

The evaluation of toughness is conducted by placing a 75mm x 150mm cylinder of test material into a compression device and measuring the amount of length change to the point of failure. The amount of deformation divided by the original length indicates the compressive strain of the specimen.





Abrasion Resistance

The most demanding internationally accepted method of testing abrasion resistance in ASTM C779 *'Abrasion Resistance of Horizontal Concrete Surfaces'* is Procedure A – Revolving Disks.

This apparatus provides an abrasive action on the samples by means of the flat faces of three revolving disks. These disks are driven slowly along a circular path over the sample, while themselves being spun at a higher speed. Abrasive grit (silicon carbide) is fed onto the circular tracks and sits between the faces of the revolving disks and the surface being tested.

Depth of wear measurements are taken in microns (1/1000 of a mm) from several points around the abraded track and averaged. The average depth of wear is measured at 30 minute intervals for the duration of the testing.

This figures are used to calculate the sample's 'Relative Wear Resistance' when compared to a high quality, plain-cured concrete floor which is given a base value of 100%. The higher the floor's abrasion resistance, the higher the Relative Abrasion Factor value.

Abrasion Statistics

Relative wear resistance of various floor surfaces

Relative Abrasion Factor

100 | 200 | 300 | 400 | 500 | 600 | 700 | 800

		Recommended For
• Designed Strength • Normal Drying • Better Hydration • Minimum Cracking • Minimum Dusting	**PLAIN CONCRETE 32MPa CURED WITH MEMBRANE CURING COMPOUND (AS 3799 conforming)**	
At Surface • Improved Gradation • Lower W/C Ratio • High Compressive Strength	**PLAIN CONCRETE PLUS HARD NATURAL AGGREGATE SHAKES MASTERTOP 100**	• Service Station • Decorative
At Surface • Improved Gradation • Lower W/C Ratio • High Compressive Strength Plus • Greater Thickness • Withstands High Point Loads	**PLAIN CONCRETE PLUS NON-METALLIC SURFACE HARDENER MASTERTOP 105**	• Food Preparation • Retail Stores • Factories Light Duty
At Surface • Improved Gradation • Lower W/C Ratio • High Compressive Strength • Withstands High Point Loads Plus • Abrasion Resistant • Tough, Malleable • Impact Resistant • Non-Dusting	**MASTERTOP 200 'IRON-ARMOURED' SURFACE**	• Warehousing • Manufacturing
Mastertop 230 has all Mastertop 200 Advantages ....PLUS • 4 to 12 Times Greater Thickness of Armour • Withstands Extra-Heavy Abrasion • Withstands Extra-Heavy Impact • Withstands Extra-High Point Loads • Less Dependent on Base Slab	**MASTERTOP 230 ALL-IRON AGGREGATE TOPPING**	• Transfer Stations • Foundries

Impact Resistance

Impact resistance is measured using the LA Rattler Machine (as used in ASTM C 131). The test involves placing a 50mm sample cube and nine solid steel spheres into the rotating steel drum which has a shelf plate fitted.

As the drum is rotated, the spheres and sample material move in a manner which simulates both random and continuous impact. The sample is weighed prior to the commencement of the test and again after each 500 revolutions of the drum.

The initial results of the impact resistance test using three common floor materials are shown below in terms of weight loss after each stage of the test. A mathematical formula was developed to take into account a number of key factors, including the difference in the initial unit weight of the three 50mm cube material samples.

Physical inspection of the samples following the completion of the test also provides a relative indication of how the various materials perform in an identical 'high impact' environment. The higher the level of impact resistance, the less the material sample will wear from its original cube shape.

The Engineered Properties test results can be combined to show the correlation between impact resistance and toughness. From these findings it can be seen that there is a strong relationship between the two characteristics.

Indeed, the results demonstrate that a material's straining capacity is also strongly related to both its toughness and impact resistance.

Engineering Properties Impact Resistance

	Unit Weight kg/m^3	Compressive STR MPA	Mod of E 10-4MPa	Strain $mm/mm \times 10^{-6}$	Toughness Mpa 10^{-2}	Impact Resistance $g^{-1} \times 10^{-2}$
Concrete	2325	28	3.10	1620	3	15
Mastertop 105	2527	85	3.81	2670	10	23
Mastertop 230	3555	88	2.70	4450	21	62

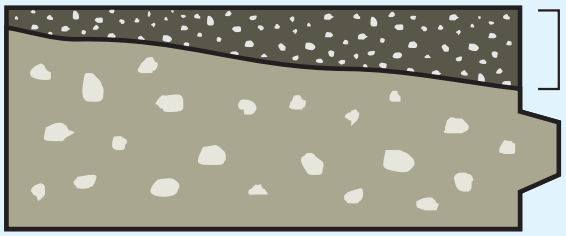
Water Absorption Rates

Plain concrete absorbs liquids 4-6 times faster than metallic aggregate hardeners and toppings.

Plain Concrete	Mastertop 100	Mastertop 200	Mastertop 230	Results
3.5	0.7	0.5	0.5	24 Hours
1.9	0.7	0.5	0.5	48 Hours
1.6	0.9	0.5	0.3	96 Hours
7.0	2.3	1.5	1.3	Total

Mastertop® 'Iron Armoured' Joints

Mastertop® 'Iron Armoured' joints greatly prolong the life of floor joints at a fraction the cost of one conventional repair. Speak to your BASF Technical Representative for more information.



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