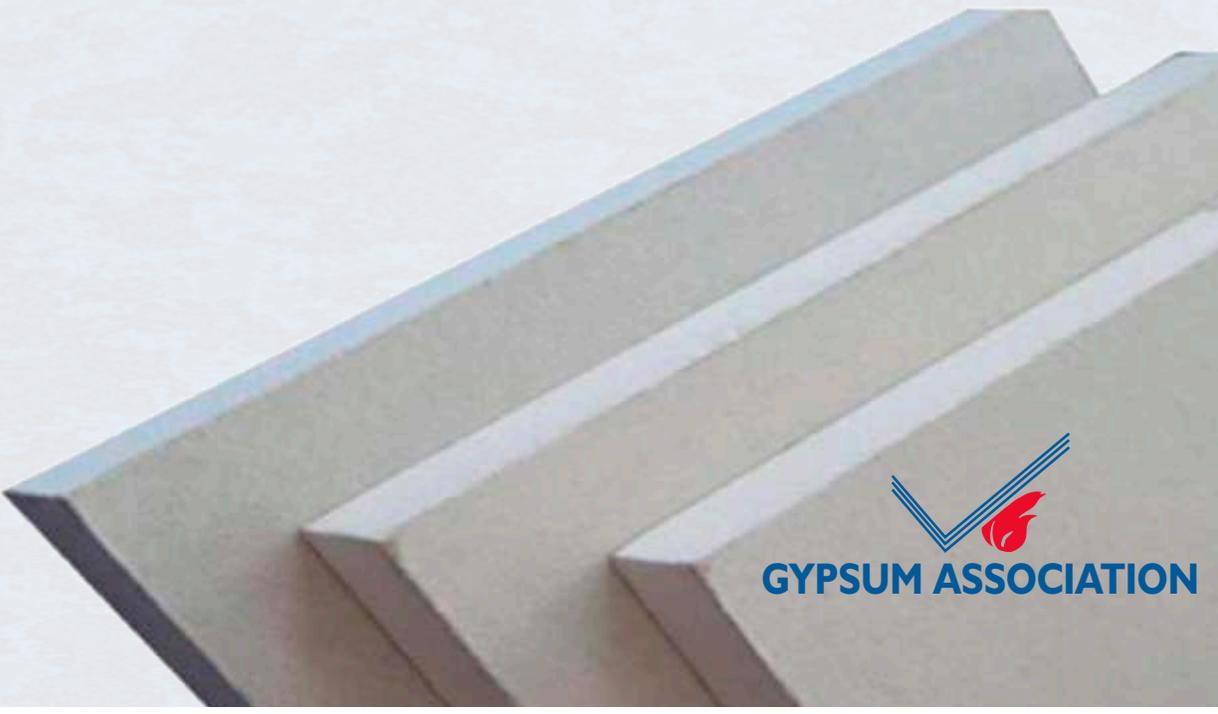


**ABUSE- and  
IMPACT-RESISTANT  
Gypsum Board**





## Areas Requiring Abuse-Resistant / Impact-Resistant Materials

Most commercial and institutional buildings have high-traffic areas where many people move through a building. Such areas include lobbies, hallways, corridors, stairways, waiting rooms, restrooms, eating facilities, and mail rooms, among many others. As people travel through these areas, they are likely to be carrying or otherwise transporting objects such as briefcases, purses, umbrellas, trays, luggage, packages, carts, and other bulky objects that bump into and scrape the surfaces of the surrounding areas.

These same commercial and institutional buildings may also have areas that are specifically designated for handling and storing packages and other bulky items; these areas include closets, basements, mail rooms, storage rooms, mechanical rooms, supply rooms, laundry rooms, kitchens, dishwashing rooms, and so on. The surfaces in these areas are often subjected to scraping and bumping by people and the objects they are handling.

It follows, then, that wall surfaces in both types of the areas described above are inherently more prone to daily wear and tear than wall surfaces in areas typically occupied by just a few people at any given moment. If the materials used to construct the walls in these areas are not more durable than materials suited for normal use, the condition of the walls quickly becomes unsightly. The building owner must either live with an increasingly shabby appearance of the building or commit additional resources to maintaining the building interior's appearance.

Often this issue is not merely one of cosmetics or aesthetics; many of the above mentioned areas require fire-rated construction to meet building code regulations. If these surfaces are sufficiently damaged, their fire-resistance is compromised, and with it, the safety of the building's occupants. Likewise, noise-attenuating building assemblies cannot maintain their sound-blocking properties if their membranes are punctured. For these and similar reasons the International Building Code requires interior exit stairways in high rise buildings be constructed using materials that meet or exceed Hard Body Impact Classification Level 3 (explained in detail later).

So, construction design professionals, building owners, building authorities and builders have several incentives to select materials that will withstand the wear-and-tear to which these areas are subjected or be faced with underperforming surfaces, maintenance costs, and safety issues.

## Abuse-Resistant and Impact-Resistant Building Products

When building professionals select materials for high traffic areas, they must determine whether the key property desired is abuse resistance or impact resistance.

Abuse-Resistant materials are generally designed to withstand abrasion, which typically occurs when hard objects are dragged along or across a surface. One obvious example of this type of damage is where hallway wall surfaces are scuffed by handcarts as delivery people rush through their routes.

Impact-Resistant materials are designed to withstand dents and punctures when directly struck with hard or heavy objects.

## Advantages of Gypsum Board Products

Historically, specifiers have chosen inherently dense and hard materials for the purpose of withstanding the damage incurred in high traffic areas. Those materials include concrete and masonry, among others. While such materials do provide protection from traffic-related damage, they present several disadvantages: they are often heavy and consequently require substantial building foundations and limit building height; they often require specialized labor to install and finish; they may contain medium to high amounts of moisture that can adversely affect the internal environment of the building; they generally require favorable temperatures to cure properly; and often they must cure, typically for periods of 28 days, before they can be finished and allow the work to progress.

### Gypsum board products offer many advantages over these other materials:

- Gypsum board products are relatively light in weight, allowing their use in lighter-weight construction and permitting their use in taller buildings (in fact, their lighter weight makes the construction of taller buildings possible).
- Gypsum board building systems can be assembled using a few tools by workers with limited construction skills.
- Gypsum board building systems can be assembled and finished relatively quickly compared to other building systems.
- Gypsum board building systems do not introduce large amounts of moisture to the building's interior or require a cure time.
- Gypsum board systems can be assembled in colder weather conditions than many other building systems.

The wide selection of gypsum board products, specifically, gypsum board abuse and impact resistant products, offer several advantages over concrete masonry units (CMU).

Additionally, gypsum products rate highly when sustainability considerations come into play. According to US Department of Energy data, a partition consisting of two layers of gypsum board applied over steel framing contains roughly 25 percent of the embodied energy (0.05 mmbtu/sf) of a CMU partition (0.19 mmbtu/sf) and contributes slightly more than 10 percent of the CO<sub>2</sub> (gypsum partition – 3.64 lbs/sf vs. CMU 32.34 lbs/sf).

## Resistance Testing

Different manufacturers use differing technologies to provide abuse and impact resistance to the gypsum board products that they offer. To evaluate the performance of these different products, a set of laboratory tests has been agreed upon by the manufacturers. The testing procedures and classification criteria for the test results are set forth in ASTM C1629, Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels. ASTM C1629 provides three classification levels in each of four different categories.

**The first category is Surface Abrasion Resistance**, which is determined using a surface abrasion test. A product's abrasion resistance classification indicates how well the tested product withstands surface abrasion, which is determined by how deeply a weighted scrub brush penetrates into the product's surface after 50 passes. A classification of 3 indicates the highest abrasion resistance; a classification of 1 indicates the lowest.

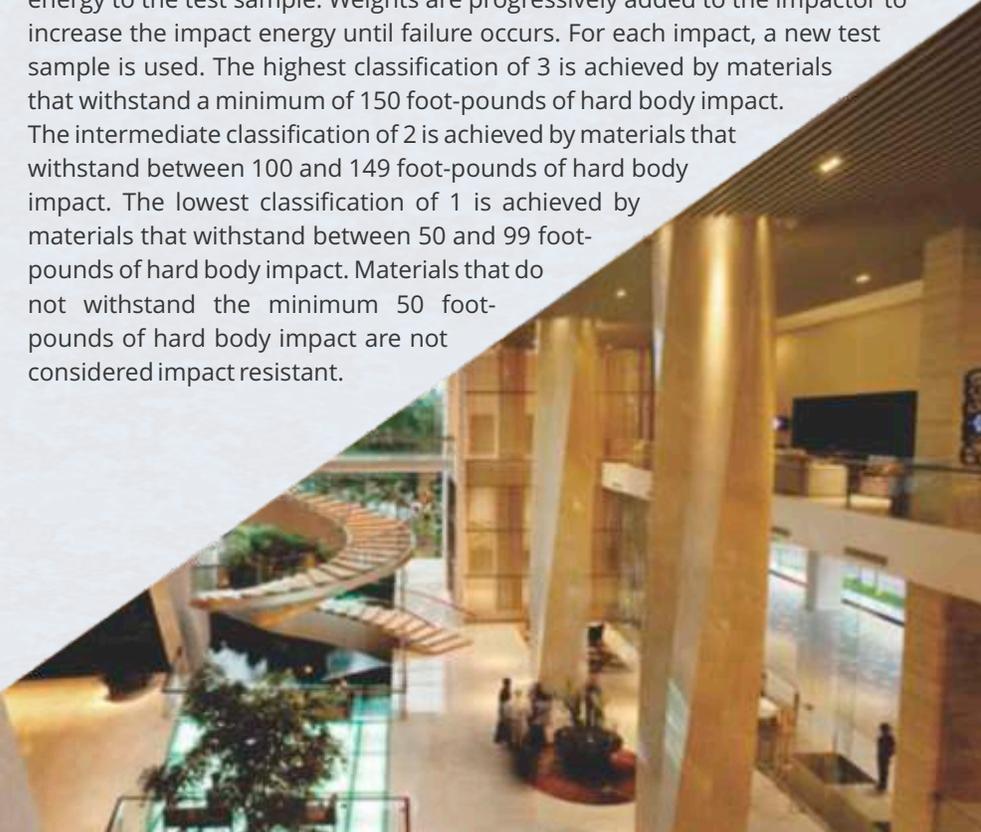
**The second category, Indentation Resistance**, is determined using an indentation test. This test conducted by measuring the impression left in the test material's surface by a 5/8-inch hemispherical projectile at 72 inch-pounds of impact pressure. Materials with the greatest impact resistance (0.0 to 0.050 inches) receive an indentation resistance classification of 3. Materials with medium impact resistance (0.051 to 0.100 inches) receive an indentation resistance classification of 2. Materials with the lowest acceptable impact resistance (0.101 to 0.150 inches) receive an indentation resistance classification of 1. Materials that exceed 0.150 inches of indentation are not considered impact or abuse resistant.

**Perhaps most important, installed abuse/impact resistant gypsum board partitions cost approximately 25 percent less per square foot than installed CMU partitions.**

### **The third category, Soft Body Impact Resistance**, is

determined using a soft body impact test. This test is performed with a leather bag filled with steel pellets weighing 60 pounds. The weighted bag is suspended in a swing-like fashion and released a specified distance away from the test sample. The test sample is mounted on 2-by-4 wood studs spaced 16 inches apart. The point of impact is midway between the studs at the mid-point height of the test panel. A single specimen is repeatedly impacted at the same point of impact with the "drop" distance being increased by 6 inches with each successive swing until structural failure occurs. Materials that resist a minimum of 300 foot-pounds of impact receive the highest classification of 3. Materials that resist between 195 and 299 foot pounds receive the intermediate classification of 2. Materials that resist between 90 and 194 pounds receive the lowest classification of 1. Materials that do not resist 90 foot pounds of impact are not considered abuse or impact resistant.

**The fourth category, Hard Body Impact Resistance**, is determined using a hard body impact test. The hard body impact test measures resistance to penetration of a wall panel when impacted by a rigid body. Failure in the hard body impact test occurs when an impacting head completely penetrates through the test panel or the depth of the indentation exceeds the thickness of the product being tested when measured from the face side following impact or both. A nominal 2 foot by 2 foot test sample is mounted to the test apparatus frame. A 20 pound ramming arm strikes the test sample while swinging in an arc. The impactor is released from a fixed distance to deliver a known amount of energy to the test sample. Weights are progressively added to the impactor to increase the impact energy until failure occurs. For each impact, a new test sample is used. The highest classification of 3 is achieved by materials that withstand a minimum of 150 foot-pounds of hard body impact. The intermediate classification of 2 is achieved by materials that withstand between 100 and 149 foot-pounds of hard body impact. The lowest classification of 1 is achieved by materials that withstand between 50 and 99 foot-pounds of hard body impact. Materials that do not withstand the minimum 50 foot-pounds of hard body impact are not considered impact resistant.





## Products Available

There are several approaches taken by gypsum board manufacturers to provide abuse and impact resistance to their products. Some products are conventional paper-faced products with hardened or enhanced core materials. Others include glass-mesh facings to improve abuse and impact resistance. Others include gypsum panels that have no facing material. Whatever the approach manufacturers use to achieve abuse and/or impact resistance, their products are designed to meet the requirements set forth in ASTM C1629.

**Paper-Faced abuse-resistant and impact-resistant gypsum board** products use specially engineered paper facings that withstand impact and abrasion. These products typically also incorporate denser gypsum formulations and additives that further resist abrasion and impact.

**Glass Mesh-Faced abuse-resistant and impact-resistant gypsum board** products use fiberglass mesh facings to withstand surface abrasion and impact. These products may also incorporate denser gypsum formulations and additives that further resist abrasion and impact.

**Unfaced abuse-resistant and impact-resistant gypsum board** products have no outside facing material. These panels are composed of gypsum plaster combined with fibers and other additives to create abuse and impact resistant surfaces.

Each manufacturer offers product literature describing its selection of abuse and impact resistant panels. This literature includes the test results of the applicable ASTM C1629 testing to which the panels have been subjected.



**GYPSUM ASSOCIATION**

Gypsum Association  
6525 Belcrest Road, Suite 480  
Hyattsville, Maryland 20782  
Telephone: (301) 277-8686  
[www.gypsum.org](http://www.gypsum.org)