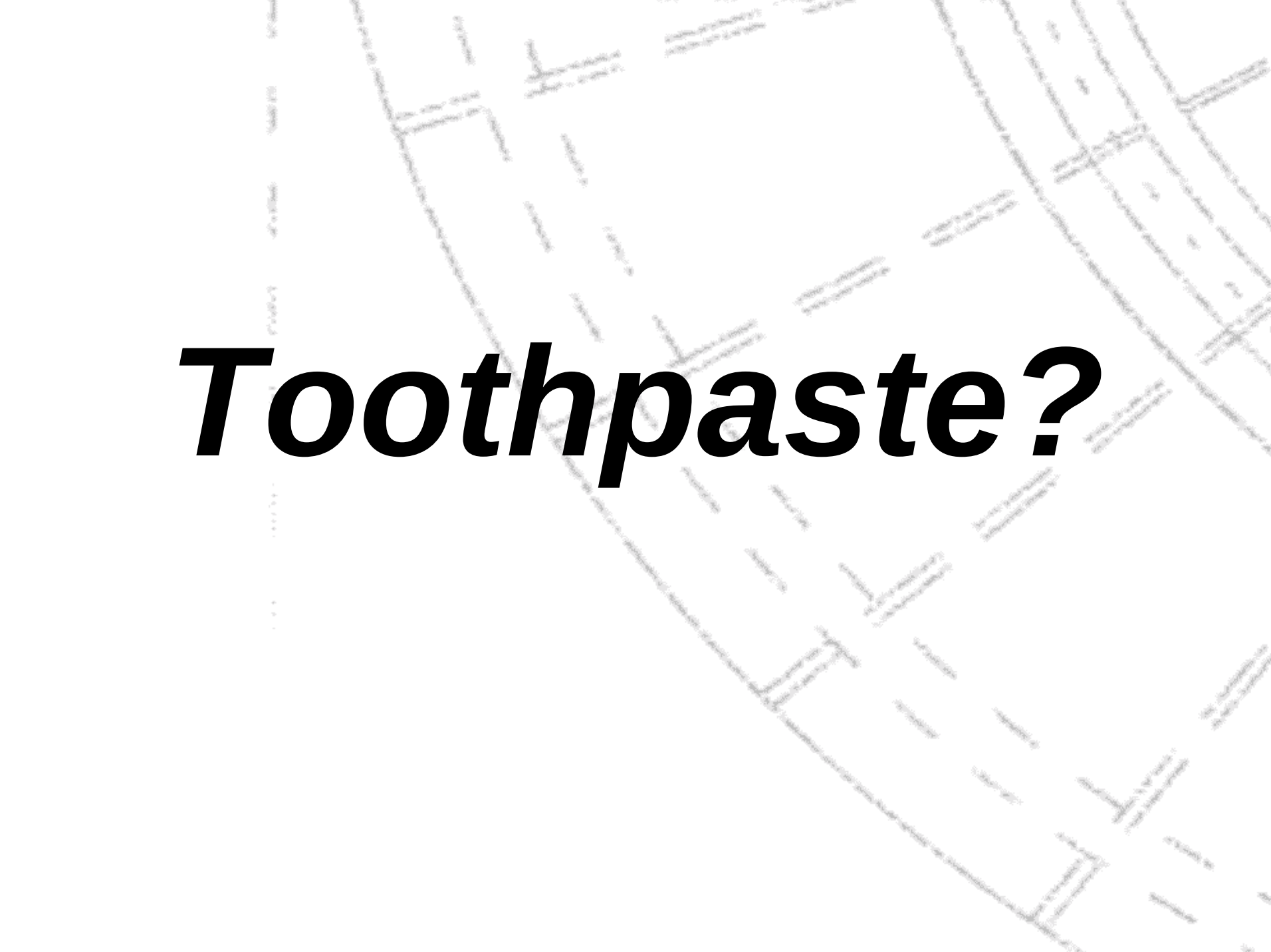
High Impact – High Abuse Gypsum Wall Board


Beer?


Toothpaste?

Beer & Toothpaste

- *What Do Beer and Toothpaste have to do with Gypsum*?

Course Objectives

- What is Gypsum?
- Fire Resistance of Gypsum
- High Abuse – High Impact GWB
- Test Methods
- Design Solutions
- Other References

What is Gypsum?

- Gypsum is a common mineral rock that is easily mined or quarried since it is generally found close to the surface of the earth. Gypsum deposits are found all over the world and experts feel that they are a result of seas which once covered the land. States with the largest quantity of gypsum deposits in the U.S. are NY, MI, IA, TX and CA.

Synthetic Gypsum

- Another type of gypsum is **Synthetic Gypsum** which is a by-product of cleaning the emissions of coal burning power plants.
- When the coal burns, Sulfur Dioxide (SO2) is captured in the coal stacks so it is not released into the environment.
- By chemically combining a slurry of limestone (calcium carbonate) and water with the SO2, high purity gypsum is formed

Synthetic Gypsum

- Synthetic gypsum is safe, environmentally friendly and 100% recycled

Gypsum Wallboard

How is it manufactured?

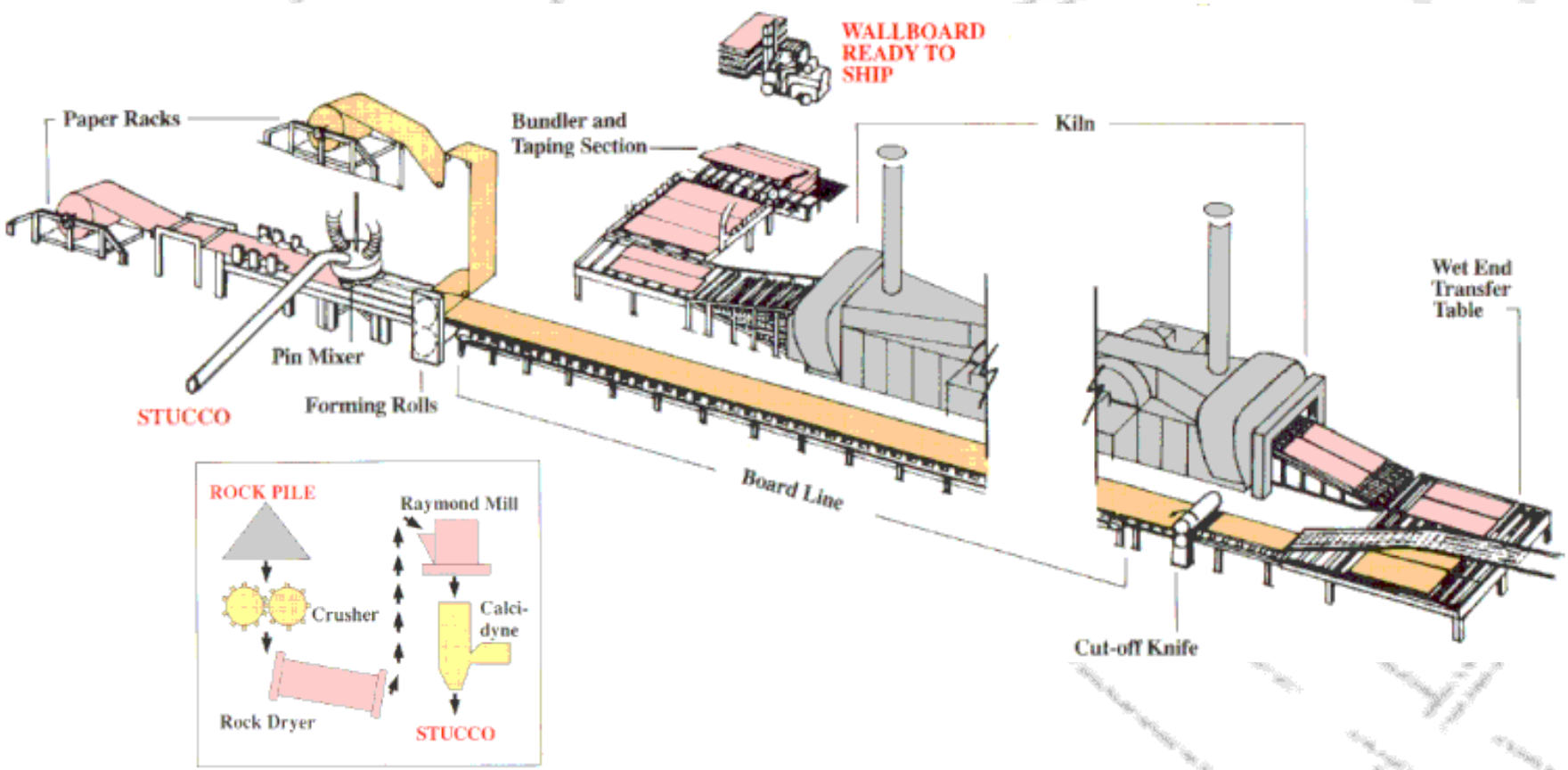
Manufacturing GWB

- Gypsum rock is mined , crushed, dried and ground to a fine powder
- The powder is ‘calcined’ to drive off the remaining Chemically combined water. (This produces a product commonly called ‘plaster of paris’ or ‘stucco’)
- The calcined gypsum is mixed with water and other ingredients to form a slurry which is fed between 2 continuous rolls of paper.

Manufacturing GWB

- As the paper slurry sandwich moves down the conveyer line, the gypsum re-hydrates and returns to its original rock state.
- The board is cut to the desired length and dried further before shipping.

Manufacturing GWB



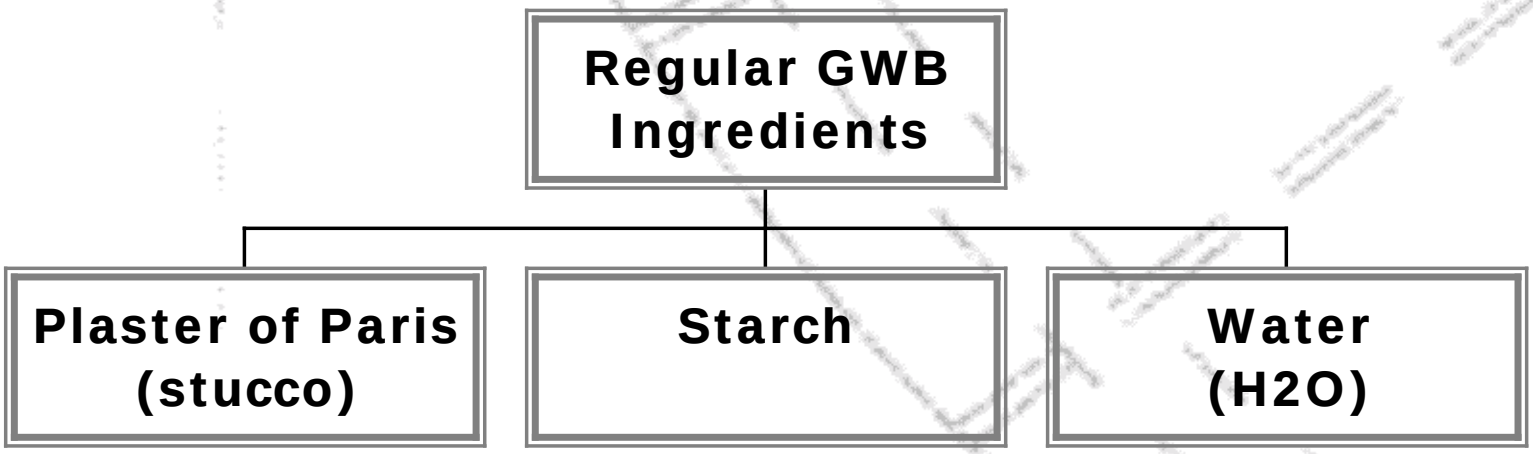
Beer & Toothpaste

- *But …What Do Beer and Toothpaste have to do with Gypsum*?

Gypsum Wallboard

What ingredients make gypsum wallboard?

GWB Ingredients



NEW ASTM Specification!

- **ASTM C1396**
  - **Now one ASTM Specification number covers all gypsum board products**
  - **ASTM C 1396 is a single 'umbrella' standard for gypsum wallboard (covers C 36- gypsum board; C 79- gypsum sheathing; C 630- water resistant backer board)**
  - **ASTM C 1396 does not make any technical changes**

GWB – Fire Resistance

- Can be described using 3 distinct terms:
- **Regular Core**
- **Type “X” Core**
- **Type “C” Core**
  - (otherwise known as improved Type X Core)

GWB – Fire Resistance

- **Regular Core**
  - All gypsum board affords a degree of natural fire resistance in a noncombustible core composed mainly of gypsum.

GWB – Fire Resistance

- **Type “X” Core**
  - E”X”tra fire resistance
  - The basic components added that give Type “X” its superior fire resistance core are:
  - Gypsum
  - Fiberglass
  - Vermiculite

GWB – Fire Resistance

- **Type “C” Core**
  - Also known as *improved* Type “X” core
  - Has superior fire resistance over Type “X” are:
  - Type “C” ingredients are manufacturer specific

Beer & Toothpaste

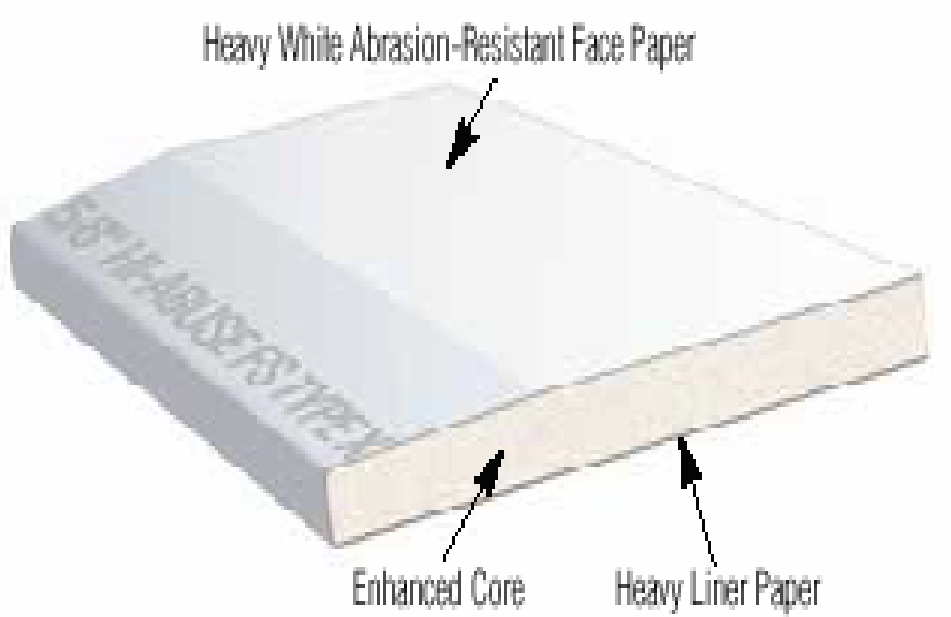
- *Do you already know what Beer and Toothpaste have to do with Gypsum*?

High Abuse
High Impact GWB

- **High Abuse**
  - Designed for use in wall assembly areas where *surface abuse* is a concern. Face of the board.
- **High Impact**
  - Designed for use where *impact/penetration* is a concern. Punch through the board.

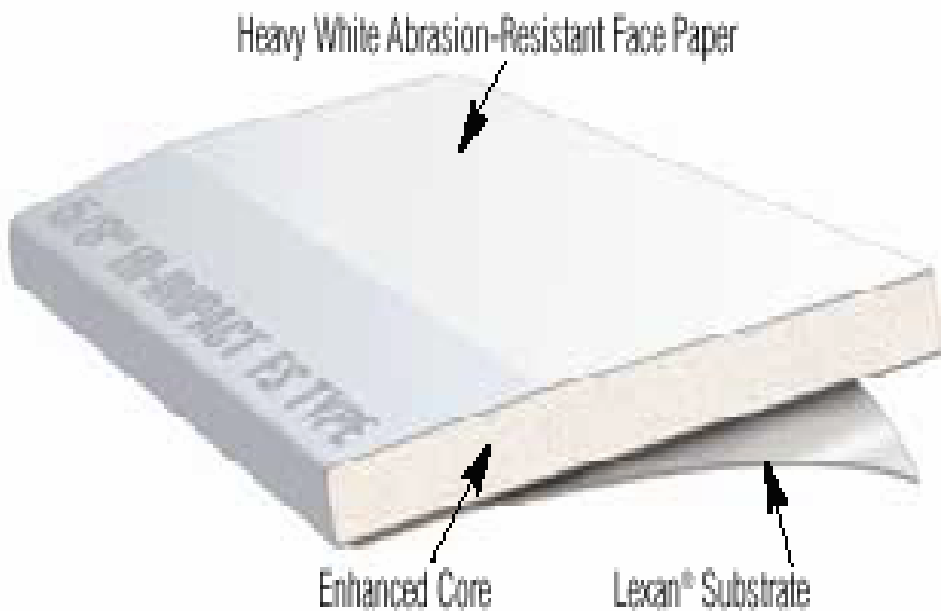
High Abuse GWB

- Enhanced core gypsum with a super abuse resistant smooth white face paper.



High Impact GWB

- Same as the high abuse PLUS a strong polycarbonate film bonded to the back side of the wallboard.



Fiber Reinforced GWB

- Type X gypsum board faced with cellulose fiber.

Fiber Cement & Gypsum

- Gypsum board faced with fiber cement.

High Impact High Abuse GWB

- A versatile alternative to concrete block, OSB, fiber reinforced gypsum or fiber cement/gypsum when used in:

- **Schools**
- **Public Housing**
- **Sports Facilities**
- **Shopping Centers, Malls**
- **Airports**
- **Correctional Facilities**
- **Health Care Facilities**

High Abuse GWB

- Will the walls in your prized project be subject to abuses like rubbing, bumping or scratching?
- Quality high abuse - high impact GWB must pass standard ASTM

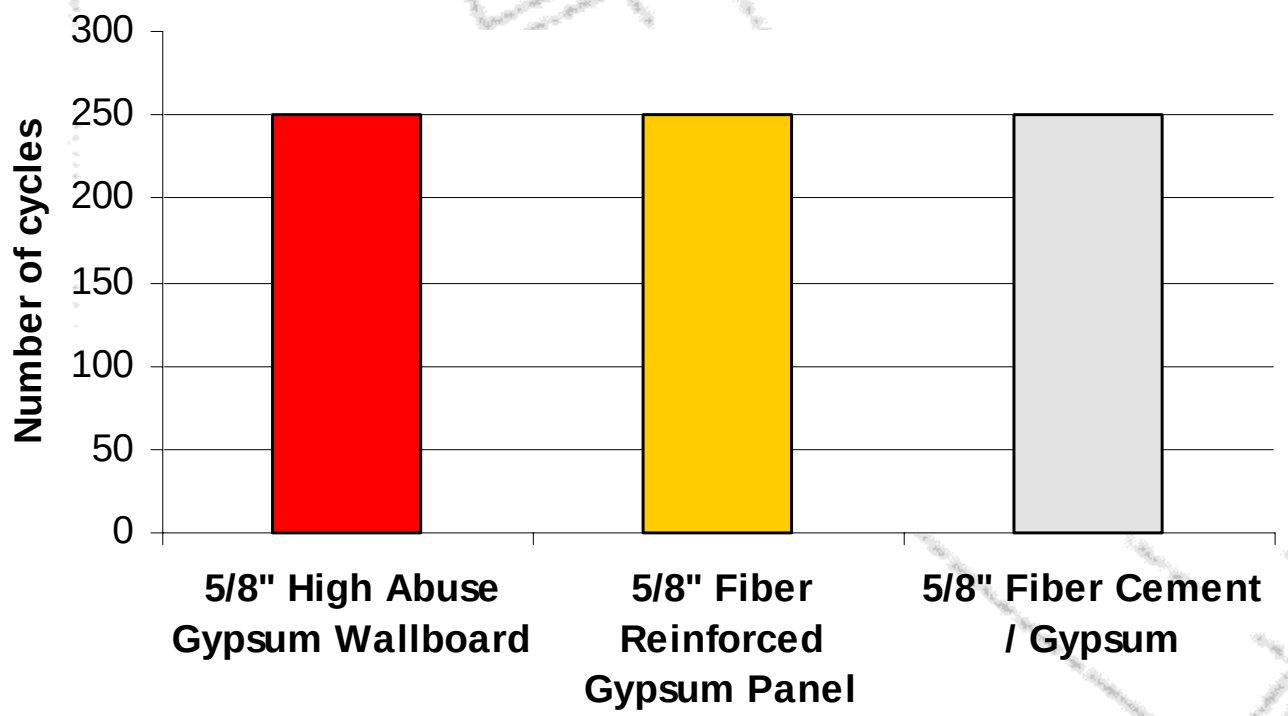
Test Methods

- Surface Abrasion:
  - **Wear to the face of the board from rubbing the surface with a wire brush. One forward stroke and one backward stroke is a cycle**
  - **Simulates the scraping motion indicative of keys or a shopping cart**

Surface Abrasion Test
Wire Brush

ASTM D 4977 (modified) 3M Surface Abrasion Resistance

(*more is better)*



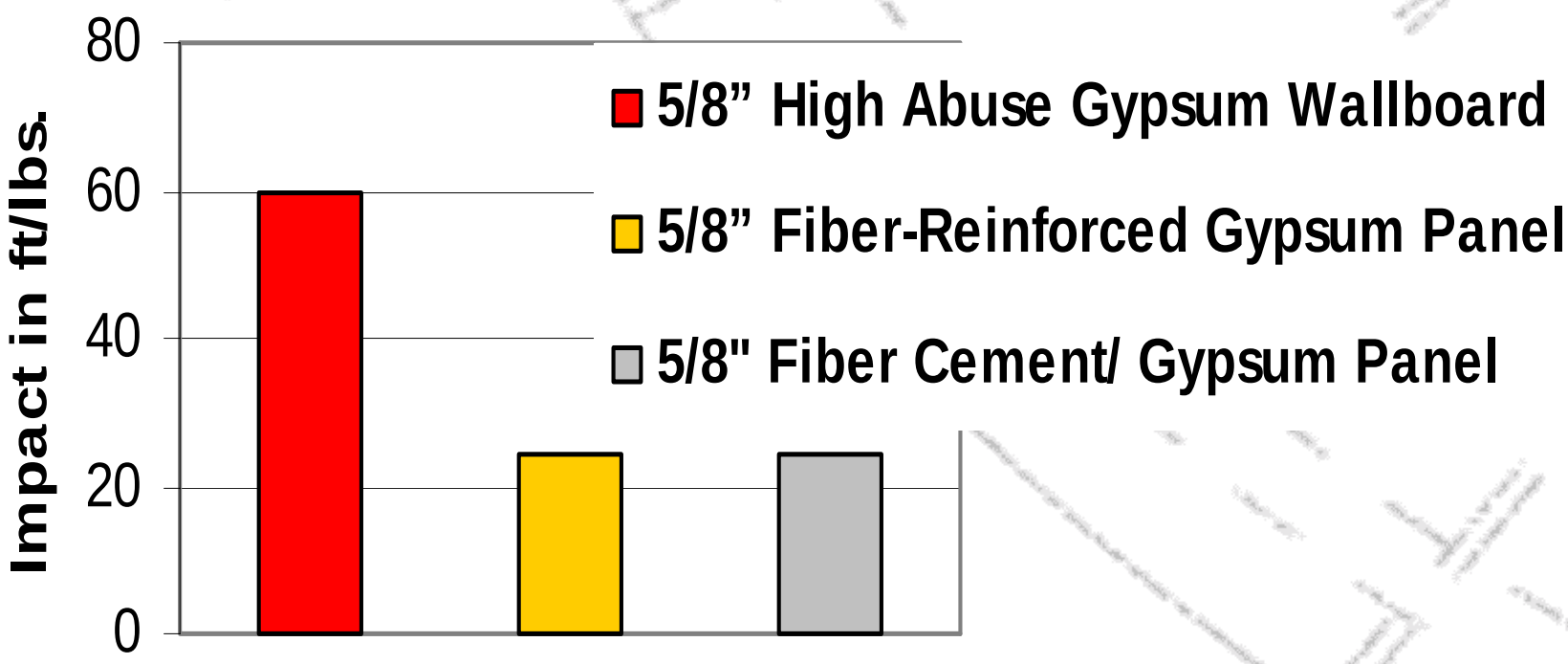
Test Methods

- Impact Resistance or Punch Thru:
  - **A large object (such as a bowling ball) is dropped from a given height until it breaks through the wallboard.**
  - **Simulates a baseball bat hitting the wall**

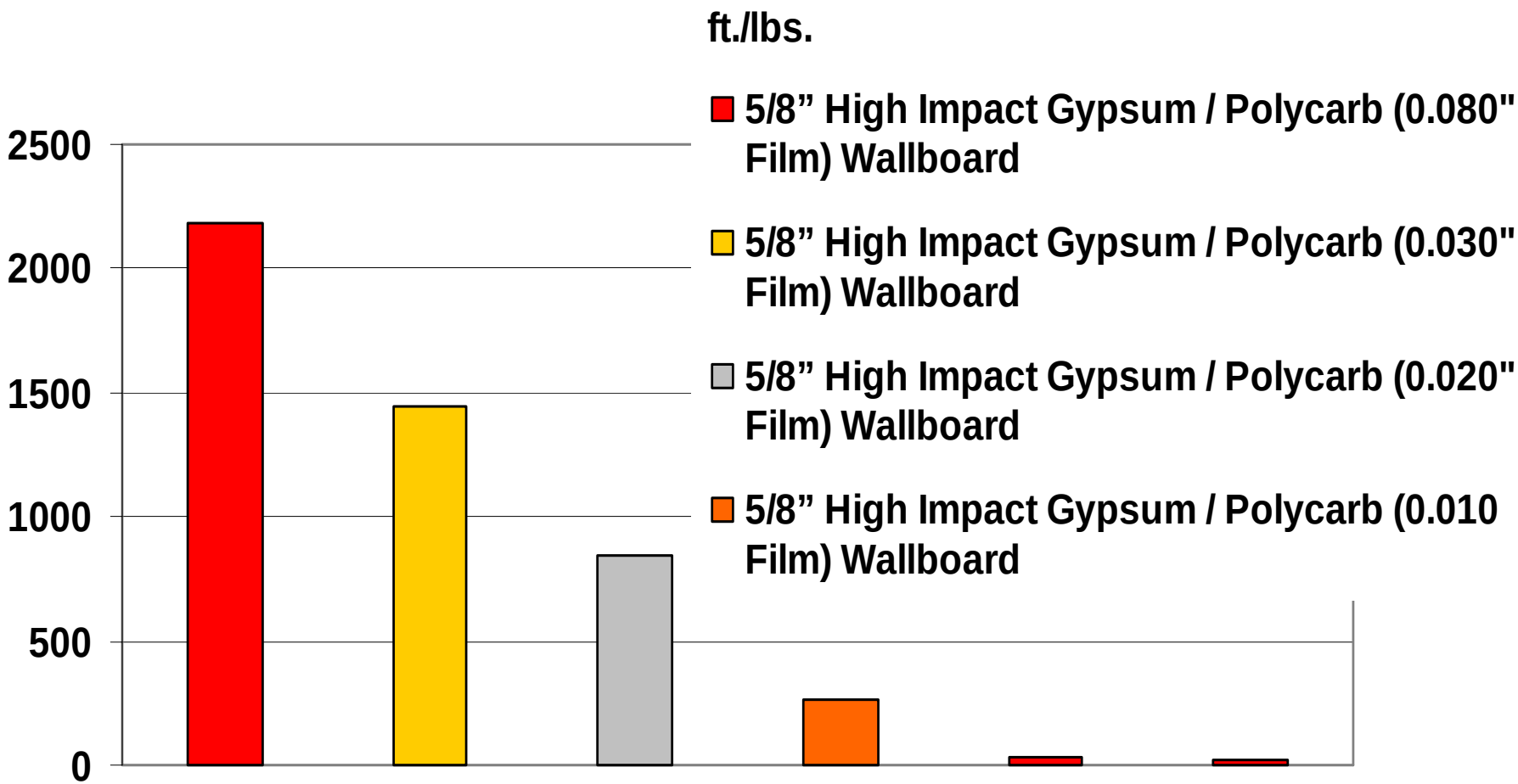
Impact/Punch Thru Test Bowling Ball Drop

ASTM D 2394 modified Impact / Penetration Resistance

(more is better)



Impact/Punch Thru Test
Bowling Ball Drop



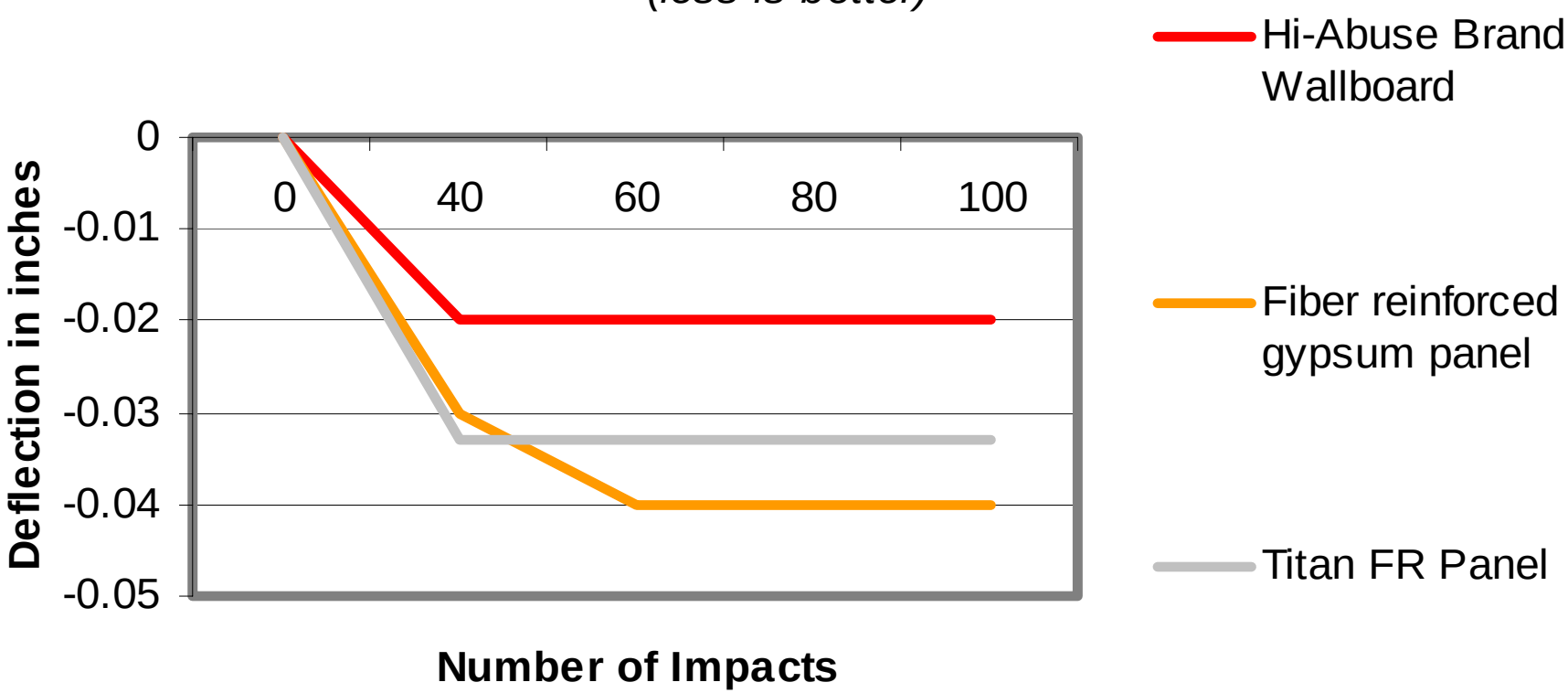
Test Methods

- Soft Body:
  - **A leather bag is filled with sand and mechanically swung into the wallboard**
  - **Simulates a person falling into a wall**

Surface Abrasion Test Leather Sand Bag

ASTM E 695 (modified) Soft Body Impact Resistance

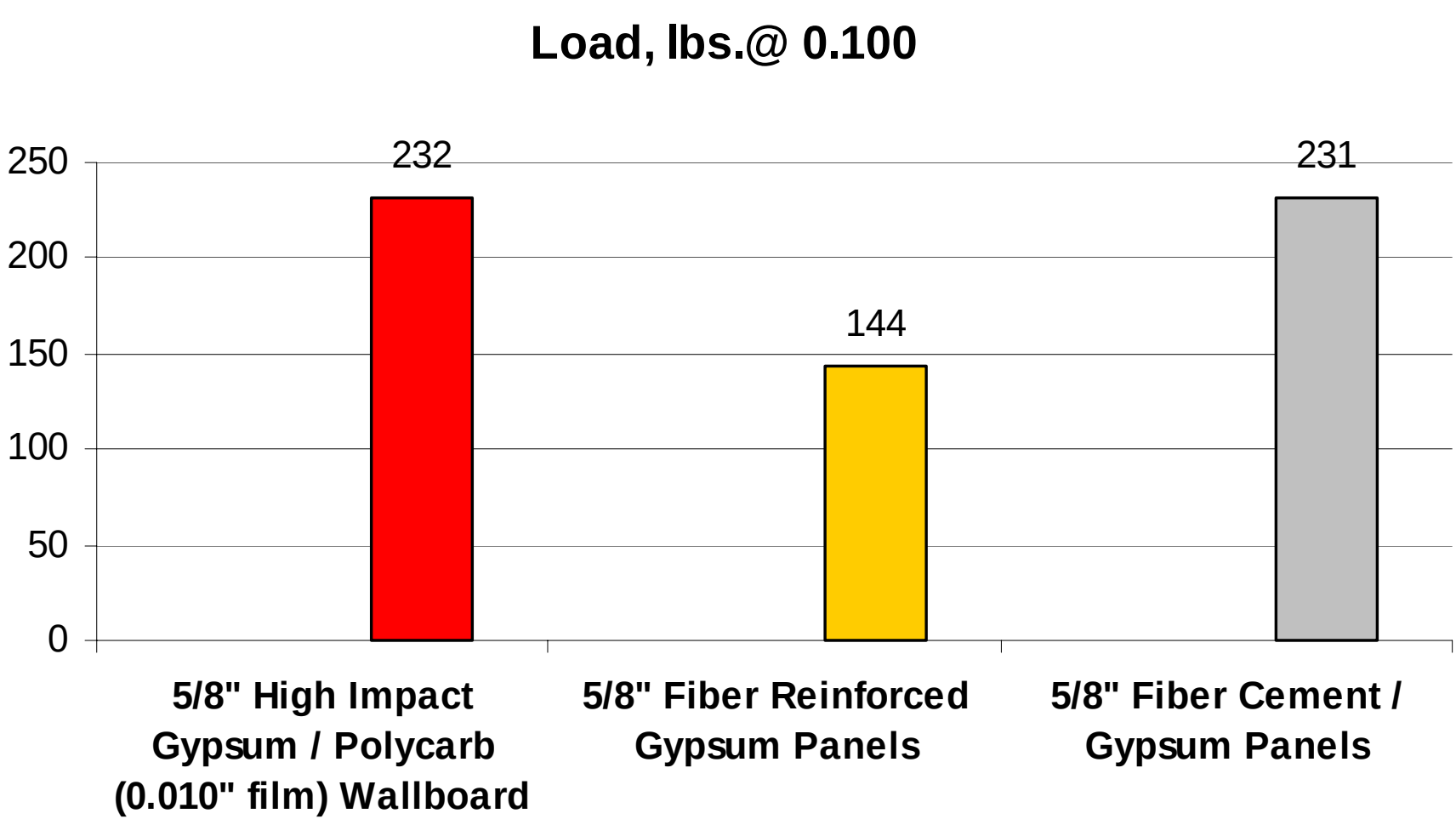
(less is better)



Test Methods

- Indentation:
  - **Involves loading a steel ball with weight until it indents the surface**
  - **Simulates a chair or utility cart bumping into a wall**

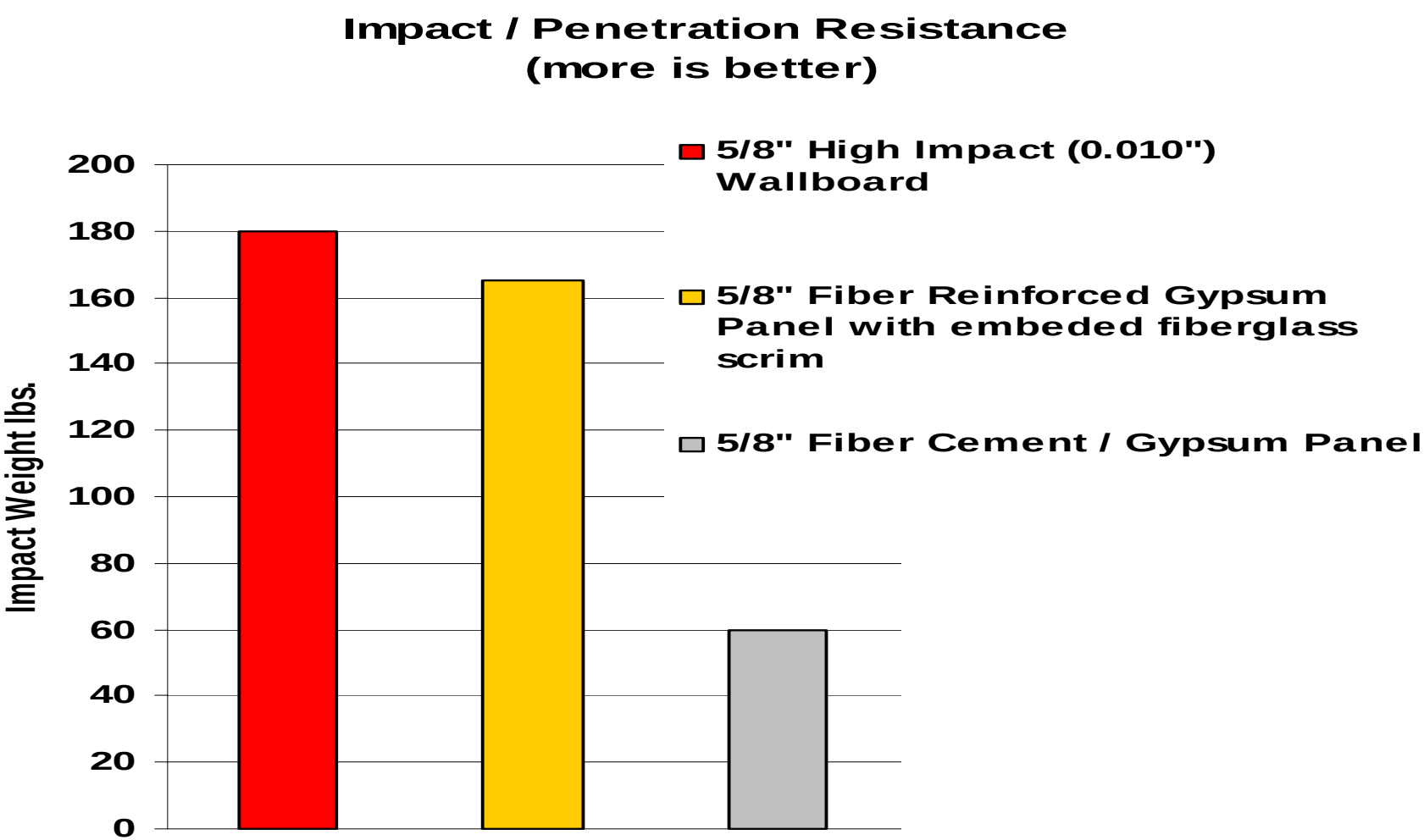
Indentation Test
Weighted Steel Ball



Test Methods

- Small Projectile:
  - **Board is impacted with a ram mounted on a pendulum which is faced with a 2 1/2” pipe cap**
  - **Simulates the impact of a Mark McGwire baseball – foul ball of course**

Small Projectile Test
Pipe Cap Pendulum



The Comparison

Impact Resistance

Impact Resistant Comparison Chart

Product	Rating (ft. lbs.)
Regular 1/2” Gypsum	**36**
8” CMU (single block at rib)	**72**
7/16” OSB with 1/2” reg. Gypsum	**144**

Impact Resistant Comparison Chart

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5/8” High Impact (0.010 polycarb backer)	**264**
5/8” High Impact (0.080 polycarb backer)	**2188**

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5/8” High Impact (0.010 polycarb backer)	**264**
5/8” High Impact (0.080 polycarb backer)	**2188**
5/8” Fiber Reinforced Gypsum (no mesh)	**24**
5/8” Fiber Reinforced Gypsum with mesh	**144**
5/8” Fiber Cement / Gypsum Panels	**24**

The Comparison

Cost

Impact or Penetration Resistance Wall Systems

Total Partition

Both sides	Total S/F Cost Installed
5/8" Type X Gypsum Wallboard	**$ 4.30**
5/8" High Abuse Gypsum Wallboard	**$ 4.85**
5/8" Fiber Reinforced Gypsum	**$ 4.90**
5/8" Type X High Impact Gypsum (0.010)	**$ 5.40**
5/8" Fiber Reinforced Gypsum (with Fiberglas mesh)	**$ 5.55**
8" Concrete Block (not reinforced)	**$ 7.50**
5/8" Type X High Impact Gypsum (0.020)	**$ 6.75**
5/8" Fiber Cement / Gypsum	**$ 7.00**

Design Solutions

Case Studies

Case Study 1

- Wayzata High School, Wayzata, Minnesota
  - **Goal**: a light-weight, durable, impact-resistant wall system for this multi-story design to minimize steel structural costs
  - **Selection**: 150,800 SF of abrasion resistance fire core GWB
  - **Reason**: save the school district money maintaining the strength & durability they were looking for. Tested 10 times more resistant to abrasion than regular veneer plaster or gypsum fiberboard.
  - **Actual Case Study: Wayzata**

Case Study 2

- Colden Hall Renovation, Northwest Missouri State University
  - **Goal**: offer an institutional client a low-cost option to masonry that was durable & maintainable
  - **Selection**: Lexan backed High impact GWB
  - **Reason**: more cost and performance-effective alternative to un-reinforced masonry concrete walls. Quick installation, Abrasion resistance.

Case Study 3

- Atlantic Shores Healthcare, State of Florida
  - **Goal**: To attain aesthetically superior walls strong enough to successfully deter patient penetration and escape.
  - **Selection**: 750,000 SF of lexan backed high impact GWB
  - **Reason**: its overall impact/penetration performance, its regular wallboard look, easy installation, and cost effectiveness (on required 20 ga studs saved 20%). Competitive products were labor intensive.
  - **Actual Case Study**: **Wackenhut**

Beer & Toothpaste

- *Beer, Toothpaste & Gypsum. Still interested*?

The Answer!

- ***Beer*** *- Gypsum is is used in the manufacturing of beer to create a smoother taste and longer shelf life.*
- ***Toothpaste*** *- Gypsum is a filler for toothpaste*

The Sequel!

- *Many other uses for Gypsum include:*
  - **Used as a packaging medium for pharmaceutical pills - good source of calcium**
  - **Soil amendment for farming**
  - **Used as an agent to improve flow-ability in enriched flour and baking soda**

It's Test Time

- Close the course window
- Return to the course header and click the "Take Test" button.