



The Chemical Company

Performance of Glass Fiber Lath as a Plaster Base with Exterior Portland Cement Plaster (Stucco)

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Topics

- Exterior Portland Cement Plaster (Stucco)
- Plaster Bases (Lath)
- Glass Fiber Lath Technology
- University of Florida Study
- Codes and Standards
- Glass Fiber Lath Today

Exterior Portland Cement Plaster (Stucco)

Background

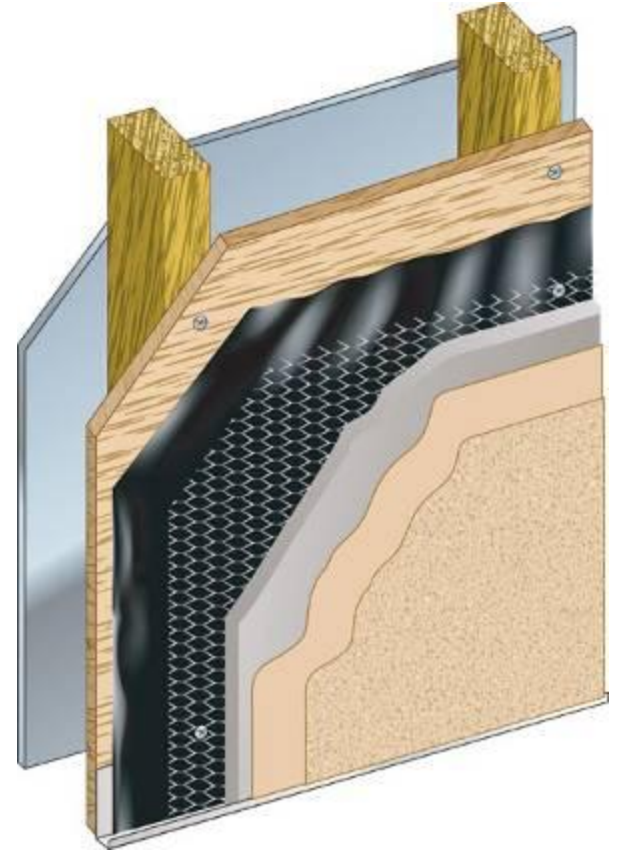
- Above grade exterior wall cladding system
- In use throughout the world since ancient times on all types of construction
- Popular due to durability, appearance and cost effectiveness



Exterior Portland Cement Plaster (Stucco)

Types of Stucco

- Base coat (cementitious)
 - $\frac{3}{8}$ " - $\frac{1}{2}$ " thick base coat...referred to as "One Coat" Stucco
 - $\frac{1}{2}$ " - $\frac{3}{4}$ " thick base coat meeting ASTM C 926.....referred to as "Three Coat" or "Traditional" Stucco
- Finish coat (cementitious or proprietary / non cementitious)



Typical Stucco Wall Assembly

Exterior Portland Cement Plaster (Stucco)

Application

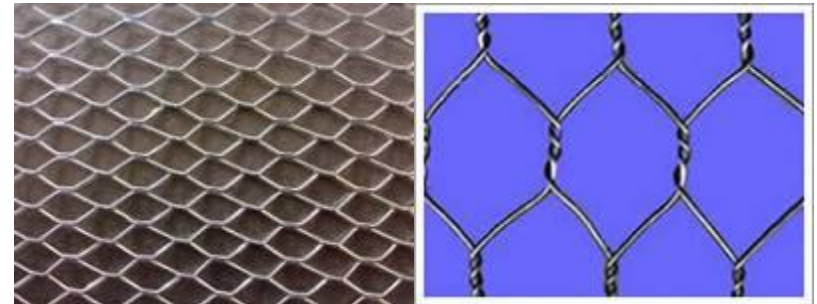
- Framed or masonry construction
- Base coat typically spray or trowel applied over a plaster base or lath...lath may not be needed on masonry construction
- Finish coats applied by spray or trowel to the dry/cured base coat



Plaster Bases (Lath)

Material Types

- Original
 - Wood lath or strips
- Second generation (current technology)
 - Primarily metal.....available in various types, weights, and configurations
- More recent technology
 - Plastic lath
 - Glass fiber lath



Plaster Base (Lath)

Desired Characteristics

- Safe and easy to handle/apply
- Cost effective & readily available
- Meet required performance
 - Durable, resist corrosion, wind, fire, etc.
- Code compliant
- ‘Stucco compatible’
 - Provide surface that receives the stucco, reinforcement, mechanical key, attachment mechanism, etc.



Installed Plaster Base

Glass Fiber Lath Technology

Glass Fiber Lath Background

- Continuous woven glass fiber fabrics produced in the 1940's
- Woven glass fabrics are used in the construction industry: drywall tape; road reinforcements; wall coverings; cement matrices such as EIFS



EIFS with woven glass fiber mesh

Glass Fiber Lath Technology

Concept

- Develop an alternative to existing plaster base technology (metal lath and netting) while addressing recognized limitations
- For One Coat Stucco applications ($\frac{3}{8}$ " to $\frac{1}{2}$ " thick stucco)
- Utilize glass fiber materials because:
 - High tensile strength and modulus
 - Resistance to heat, fire, chemicals moisture, etc
 - Low coefficient of thermal linear expansion
 - Widely available
 - Wide range of fabric forming methods
 - History in cement matrices such as EIFS
- Develop product using proprietary weaving and coating technology



Weaving Process

Glass Fiber Lath Technology

Development Objectives

- Speed/ease of handling/application
- Enhance resistance to cracking
- Safety during application
- Corrosion resistance
- Uses similar fasteners, detailing, trim accessories, etc. as metal plaster bases
- Performance at least equivalent to existing plaster base materials



Glass Fiber Lath Technology

Development

- Product design evolved quickly by empirical methods and guided by performance/application needs, dimensions, strengths, etc. of existing plaster base products as well as the desire to utilize existing fastening methods and trim.
- Properties deemed most critical include: thickness; hole opening size; tensile strength; stiffness and bending rigidity.
- Minimum thickness (furring depth) largely determined by building codes.
- Package in rolls

Numerous prototypes developed and evaluated... 'best' candidate selected for field trials.



Glass Fiber Lath Technology

Field Trials

- Project criteria
 - Various locations.....NJ, PA, RI, NM, OK, WA,
 - Residential and commercial projects
 - Limited size.....2000 to 5000 SF wall area
 - Vary in complexity, details, etc.
 - Steel and wood framed structures
 - Availability (schedule, etc.)



Providence, RI

Glass Fiber Lath Technology

Typical application representative of field trials



Glass Fiber Lath Technology

Field Trials

- Data/information gathered
 - Production rates
 - Ease of handling/installation
 - Product dimensions (roll size, width, etc.)
 - Detailing
 - Pros/cons versus existing plaster bases in use
 - Impact, if any, on stucco application
 - Impact of weather barrier type (asphaltic, polymeric, etc)
 - Flatness/resistance to sag
 - Ability to serve as a key for the stucco (furring)
 - Effect of weather exposure
 - Attachment
 - Integration with trim accessories
 - Suggested modifications

Glass Fiber Lath Technology

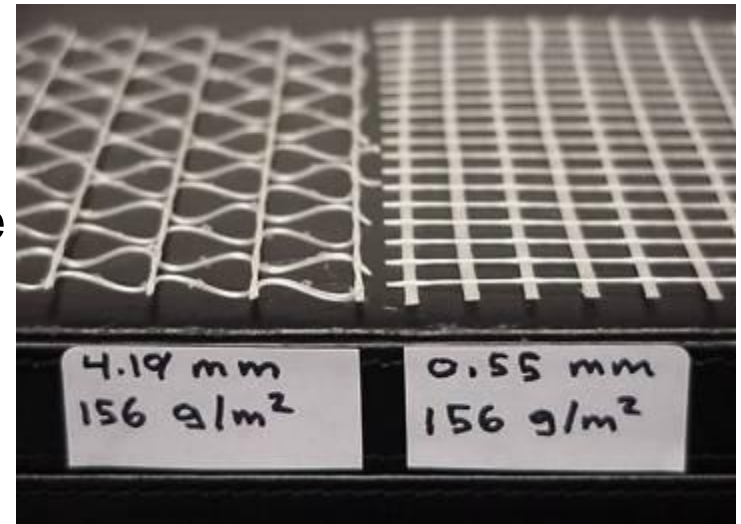
Field Trials

- Lessons Learned
 - Labor savings....typically 25% or more
 - Ease of handling and installation
 - Thickness increased/modified profile to further enhance keying
 - Safety (cutting, handling, etc.)
 - Gray color preferred (vs white)
 - Stiffer/more rigid plaster base needed over building paper than polymeric barriers
 - Increase hole/opening size to allow efficient passage of applied stucco
 - Heavier yarns/more rigid coating needed to reduce sag under wet stucco weight during application

Glass Fiber Lath Technology

Product launch

- Three dimensional, glass fiber lath plaster base that is thicker than a traditional woven fabric of the same weight
- Initial product intended for use with One Coat Stucco (max 1/2" thick)
- Later product designed for use with Three Coat Stucco (max 7/8" thick); also suitable for masonry veneer stone
- Used for vertical wall applications and solid backing (sheathed construction, etc.)
 - Product weight significantly less than existing technology



Glass Fiber Lath #1:	487 ft ² = 16 lbs
Glass Fiber Lath #2:	487 ft ² = 31 lbs
20 ga wire	487 ft ² = 42 lbs
17 ga wire:	487 ft ² = 73 lbs
Metal Lath 2.5:	487 ft ² = 135 lbs
Metal Lath 3.4:	487 ft ² = 184 lbs

University of Florida (UF) Study

- UF Rinker School of Building Construction: Gainesville, FL
- Objective: Compare various physical properties of proprietary glass fiber lath to metal plaster bases in One and Three Coat Stucco Systems
 - Mechanical and environmental testing
 - Finite Element Analysis



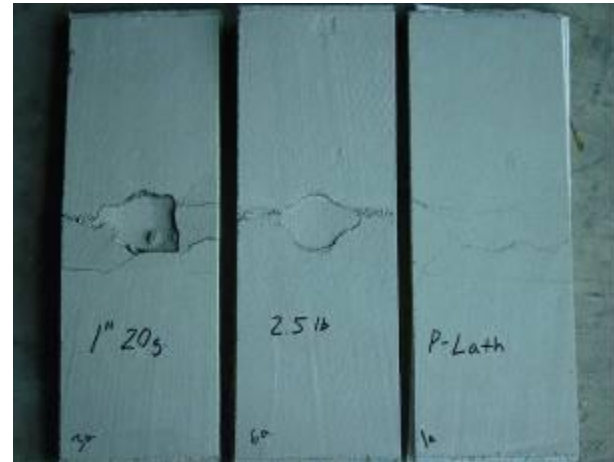
UF Impact Test #1

- Impact device: 10 lb, 3" diameter cylinder
- Single drop/impact from 16" (160 inch lbs)
- Criteria: visual observations
- 6" x 16" samples
 - ½" thick One Coat Stucco
 - Types of plaster bases
 - 1" x 20 gauge wire
 - 2.5 lb metal lath
 - Proprietary Glass Fiber Lath #1 (For use with One Coat Stucco)

UF Impact Test #1 Results



Test Set Up



6" x 16"
Sample
Front

20 ga 2.5lb Glass Fib Lath #1

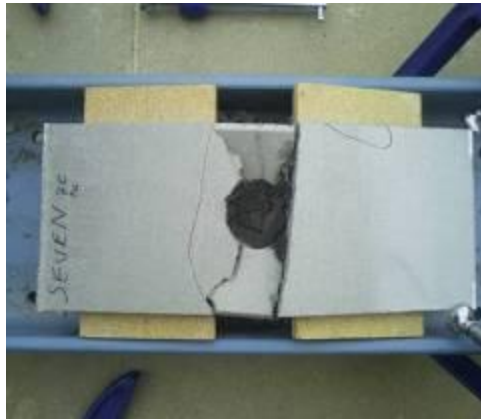


6" x 16"
Sample
Back

UF Impact Test #2

- Impact device: 10 lb, 3" diameter cylinder
- Drop/impact from 18" (180 inch lbs) until sample is completely breached
- Criteria:
 - Record number of drops and visual observations
- 6" x 16" samples
 - ½" thick One Coat Stucco
 - Types of plaster base
 - 1" x 20 ga wire
 - 1 ½" x 17 ga wire
 - 2.5 lb metal lath
 - Proprietary Glass Fiber Lath #1 (For use with One Coat Stucco)
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)

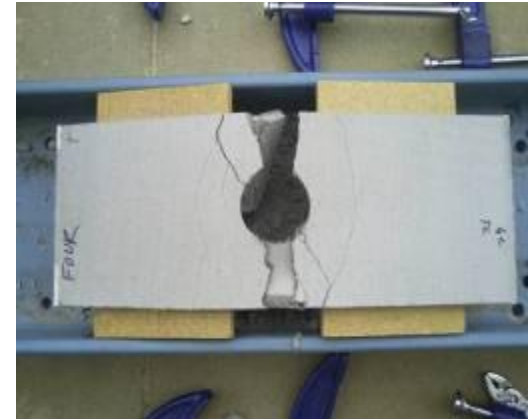
UF Impact Test #2 Results



20 ga wire (2 impacts)



17 Ga Wire (2 impacts)



2.5lb Metal lath (2 impacts)



Glass Fiber #1 (3 impacts)



Glass Fiber # 2 (4 impacts)

UF Impact Test #3

- Impact device: 10 lb, 3" diameter cylinder
- Drop/impact from 18" (180 inch lbs) until sample is completely breached
- Criteria:
 - Record number of drops and visual observations
- 6" x 16" samples
 - ¾" thick Three Coat Stucco
 - Types of plaster base
 - 1 ½" x 17 ga wire
 - 2.5 lb metal lath
 - 3.4 lb metal lath
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)

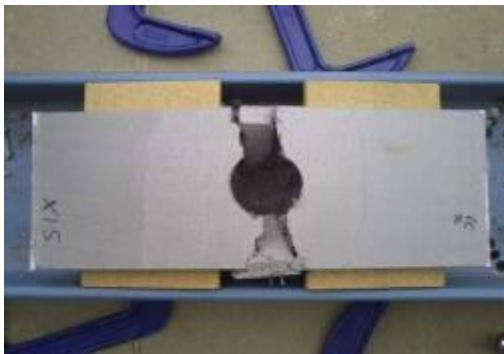
UF Impact Test #3



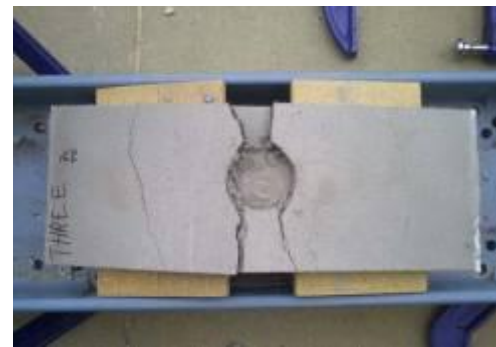
17 Ga Wire (3 impacts)



2.5lb Metal lath (4 impacts)



3.4lb Metal Lath (7 impacts)



Glass Fiber # 2 (14 impacts)

UF Plastic Shrinkage Study

Effect of flash drying on plastic shrinkage of stucco

Apparatus/Methodology

- Box with fans to promote flash drying of stucco surface
- 120 F ambient chamber temperature and 65% relative humidity
- Wet stucco placed in chamber immediately after construction
- Expose wet stucco to conditions in closed chamber for 24 hours
- Observe surface conditions



UF Plastic Shrinkage Study

Samples

- 16" x 24"
- ½" thick One Coat Stucco
 - Types of plaster base
 - 1" x 20 gauge wire
 - 2.5 lb metal lath
 - Proprietary Glass Fiber Lath #1 (For use with One Coat Stucco)
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)
- ¾" thick Three Coat Stucco
 - Types of plaster base
 - 1 ½" x 17 gauge wire
 - 2.5 lb metal lath
 - 3.4 lb metal lath
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)

UF Plastic Shrinkage Study



17 Gauge Wire

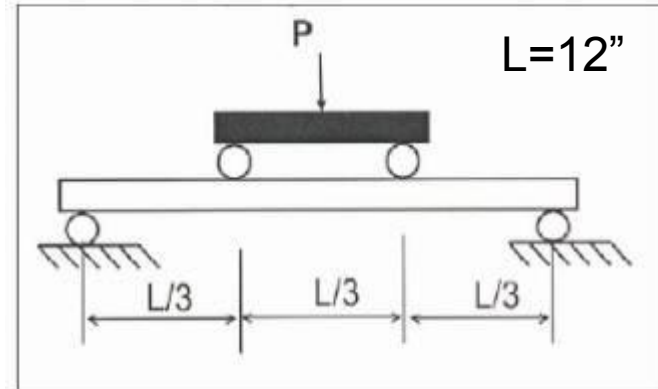


20 Gauge Wire

UF Flexural Test

Evaluate elastic limit (peak load at first crack), resilience and toughness

Constant displacement of .05 inches/minute (Instron)

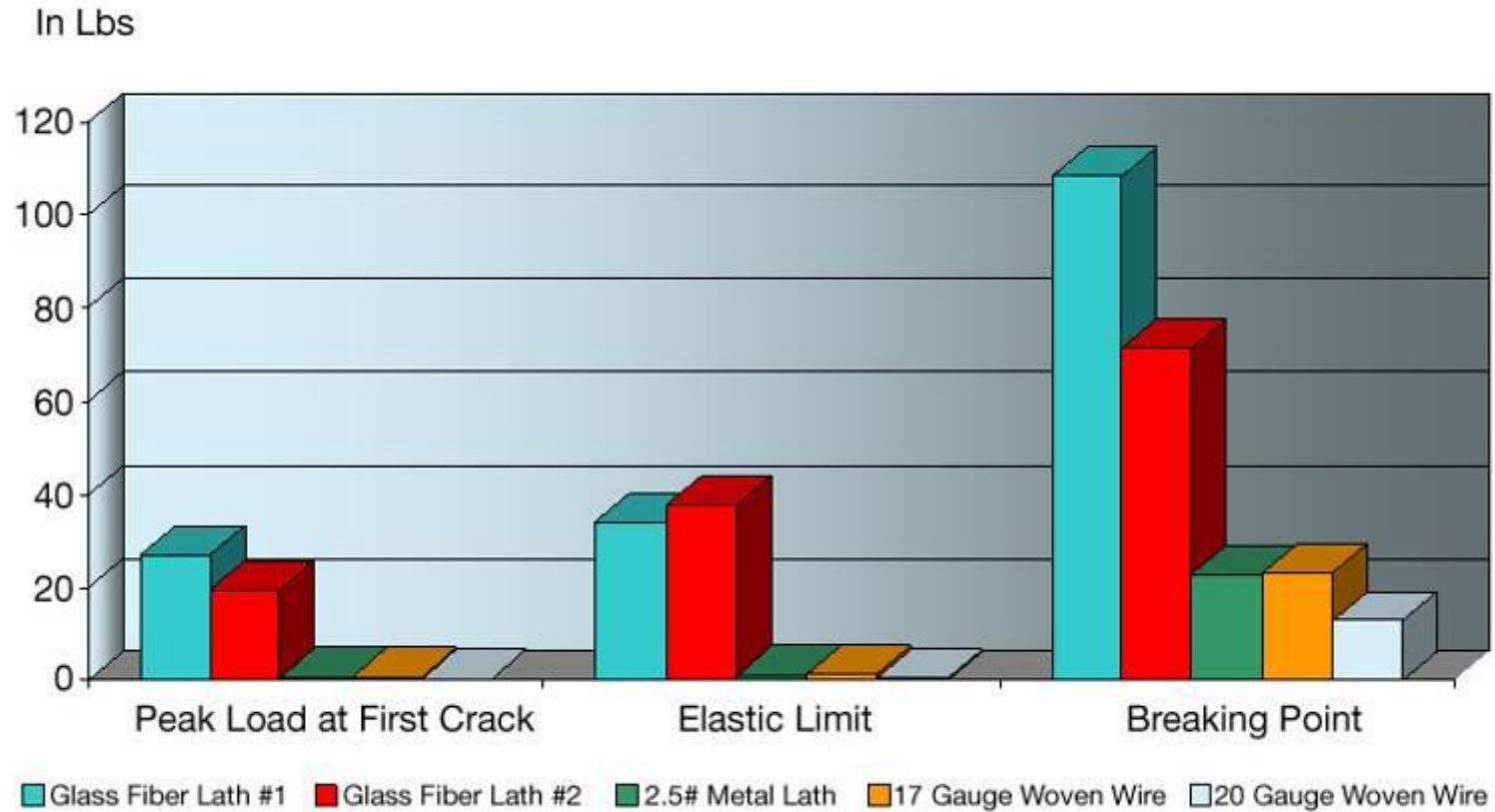


UF Flexural Test - 1/2" Stucco

Samples

- 6" W x 16" L
 - 1/2" thick One Coat Stucco
 - Types of plaster base
 - 1 1/2" x 17 gauge wire
 - 1" x 20 gauge wire
 - 2.5 lb metal lath
 - Proprietary Glass Fiber Lath #1 (For use with One Coat Stucco)
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)
- All contained transverse and longitudinal joints/overlaps (mid span)

UF Flexural Test



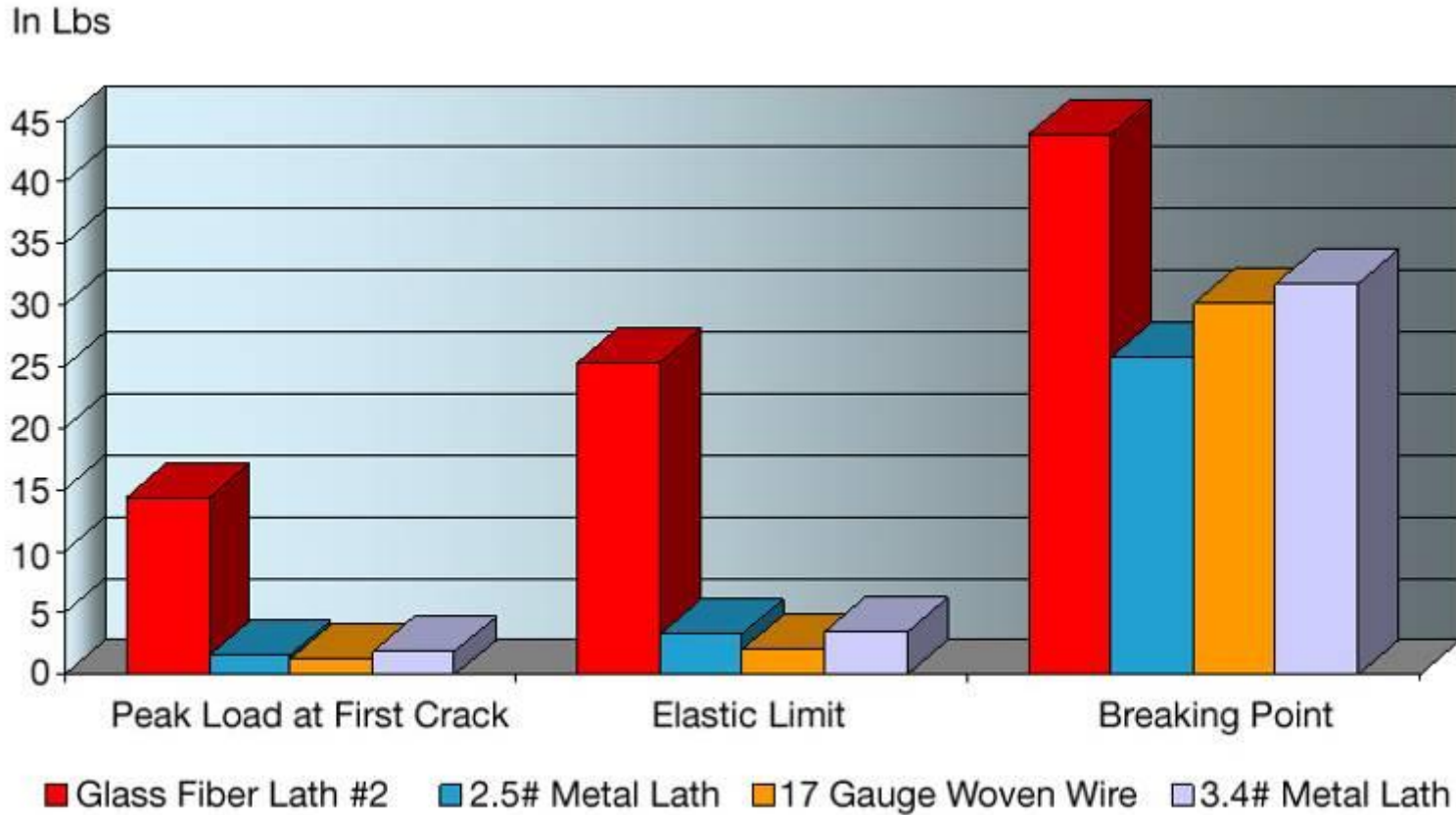
One Coat Stucco Results

UF Flexural Test - $\frac{3}{4}$ " Stucco

Samples

- 6" W x 16" L
 - $\frac{3}{4}$ " thick Three Coat Stucco
 - Types of plaster base
 - 1 $\frac{1}{2}$ " x 17 gauge wire
 - 2.5 lb metal lath
 - 3.4 lb metal lath
 - Proprietary Glass Fiber Lath #2 (For use with Three Coat Stucco and Masonry Stone Veneers)
- All contained transverse and longitudinal joints/overlaps (mid span)

UF Flexural Test - 3/4" Stucco



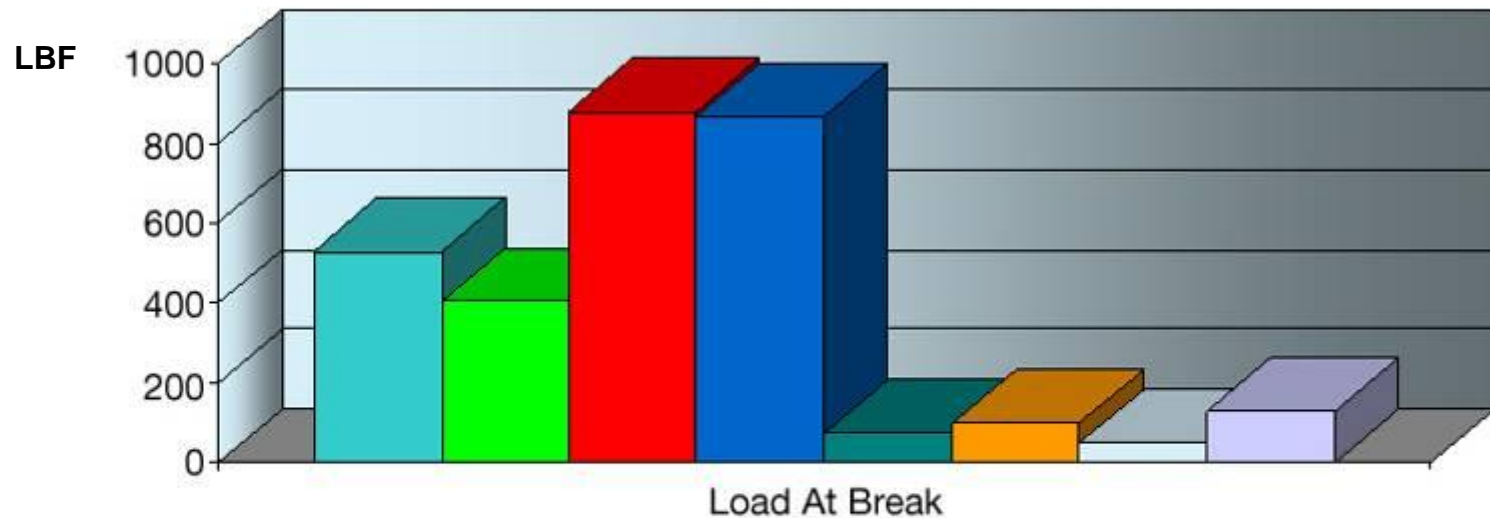
Three Coat Stucco Results

UF Tensile Test Evaluation

Samples

- 3" W x 8" L
 - 1" x 20 gauge wire
 - 1 ½" x 17 gauge wire
 - 2.5 lb metal lath
 - 3.4 lb metal lath
 - Proprietary glass fiber lath #1 (For use with One Coat Stucco)
 - Proprietary glass fiber lath #2 (For use with Three Coat Stucco and masonry stone veneers)
- Glass fiber lath tested before and after alkali conditioning
- All contained transverse and longitudinal joints/overlaps (mid span)

UF Tensile Test Evaluation



- Glass Fiber Lath #1
- Glass Fiber Lath #2
- 2.5# Metal Lath
- 20 Gauge Woven Wire

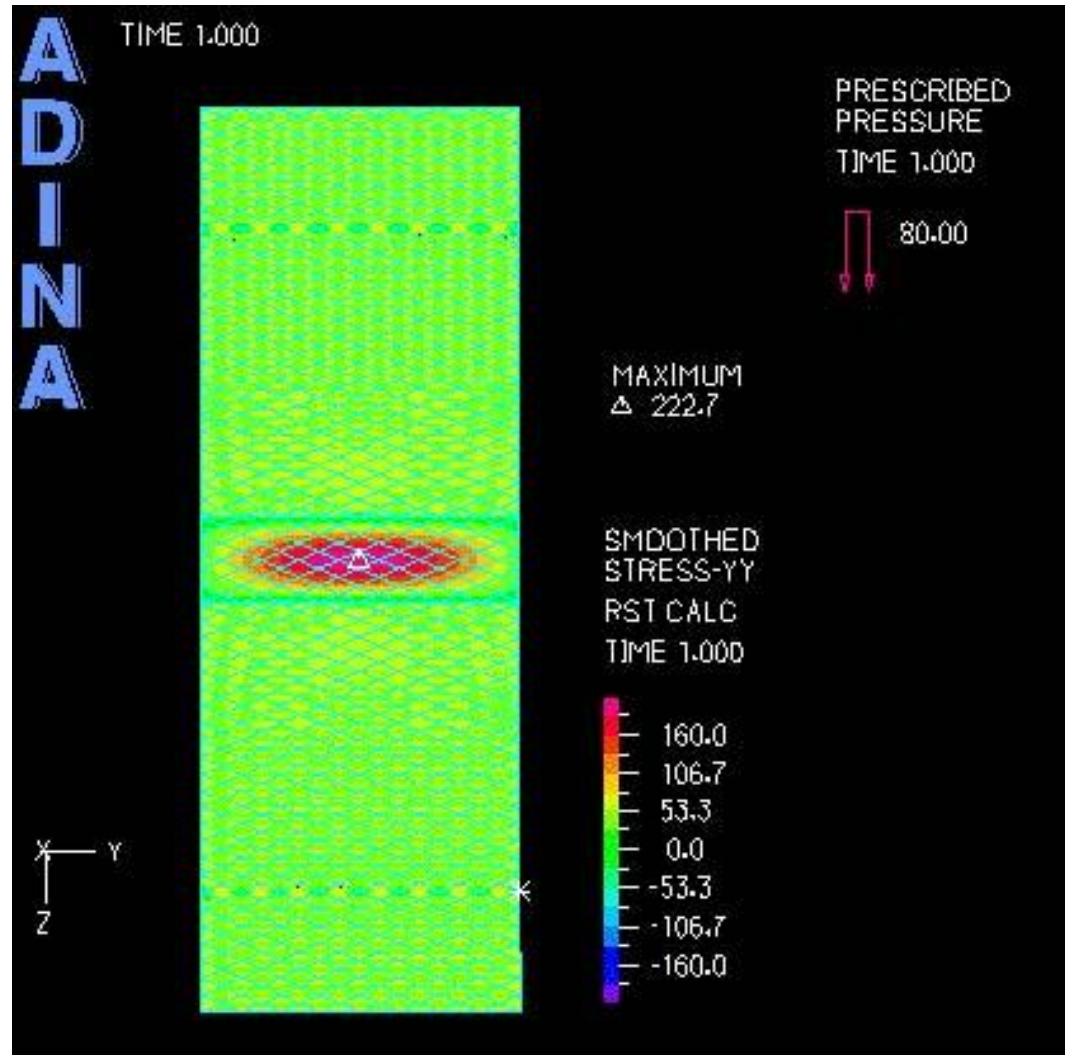
- Glass Fiber Lath #1 After Alkaline Conditioning
- Glass Fiber Lath #2 After Alkaline Conditioning
- 17 Gauge Woven Wire
- 3.4# Lath

UF Finite Element Analysis

Samples

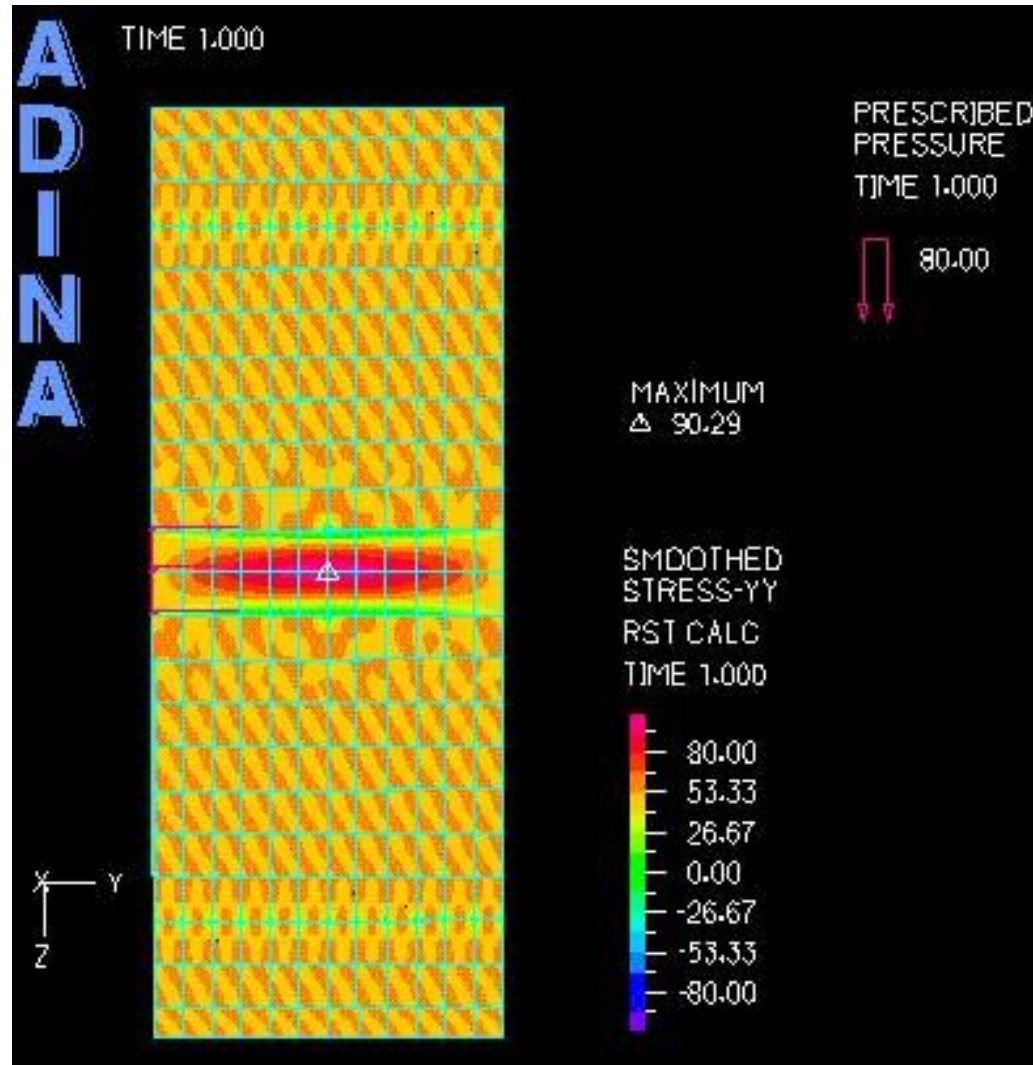
- $\frac{1}{2}$ " thick One Coat Stucco
 - Types of plaster base
 - 1" x 20 gauge wire
 - 2.5 lb metal lath
 - Proprietary glass fiber lath #1 (For use with One Coat Stucco)
 - Proprietary glass fiber lath #2 (For use with Three Coat Stucco and masonry stone veneers)
- $\frac{3}{4}$ " thick Three Coat Stucco
 - Types of plaster base
 - 1 $\frac{1}{2}$ " x 17 gauge wire
 - 2.5 lb metal lath
 - 3.4 lb metal lath
 - Proprietary glass fiber lath #2 (For use with Three Coat Stucco and masonry stone veneers)

UF Finite Element Analysis



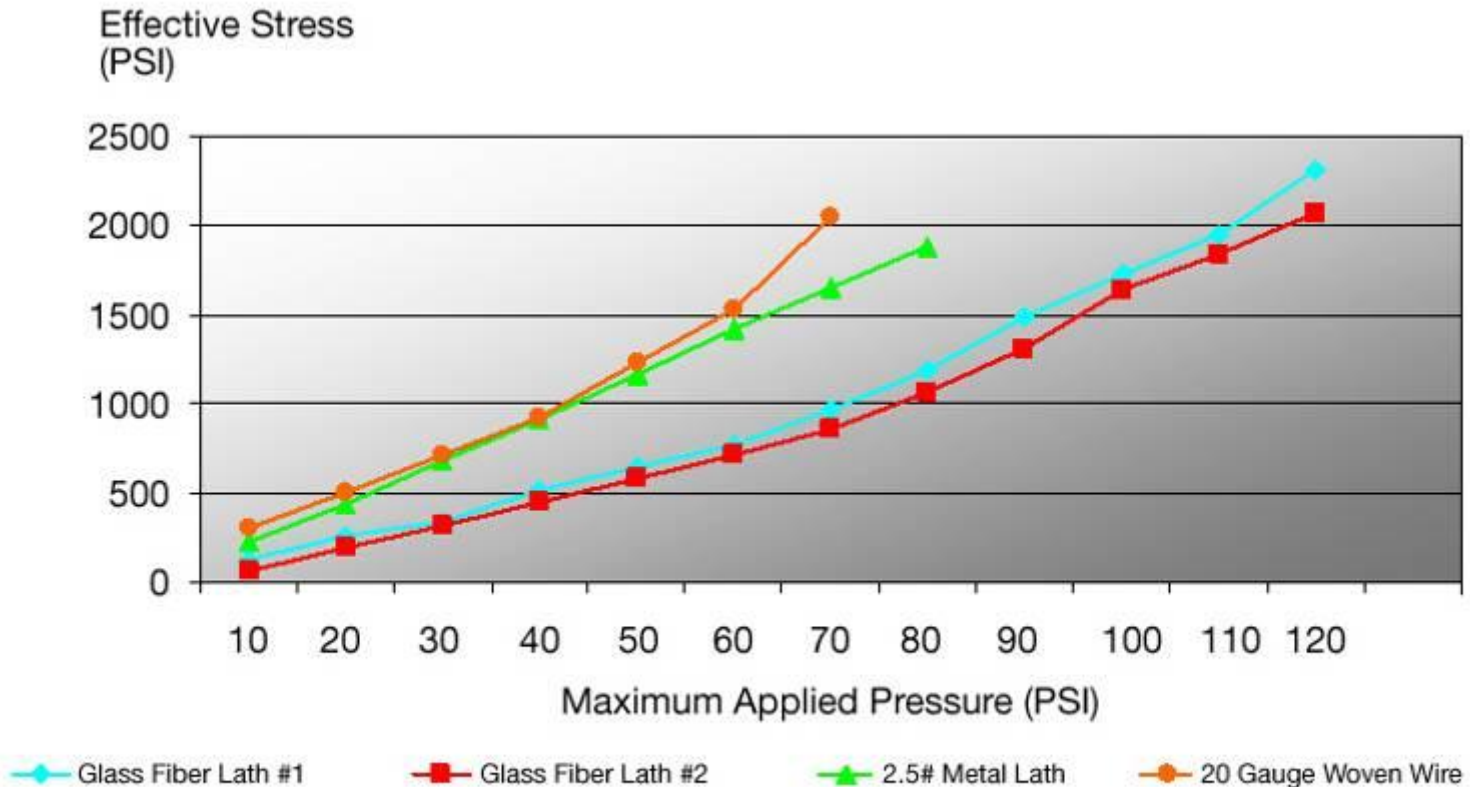
One coat stucco with 2.5 lb lath

UF Finite Element Analysis



One coat stucco with Glass Fiber Lath #1

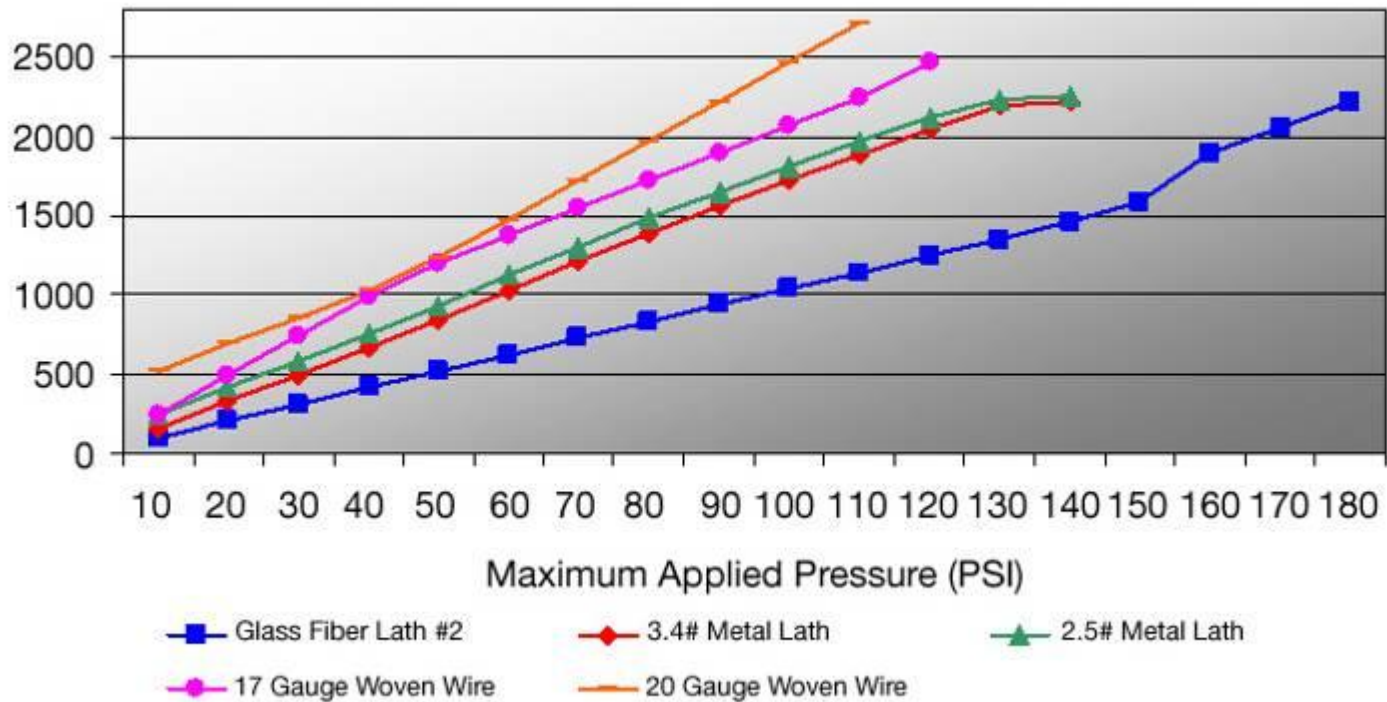
UF Finite Element Analysis



One Coat Stucco Results

UF Finite Element Analysis

Max. Effective Stress
(PSI)



Three Coat Stucco Results

Codes and Standards

International Code Council (USA)

- Acceptance Criteria for Glass Fiber Lat used in Cementitious Wall Coatings or Exterior Cement Plaster (AC 275)
 - Guidelines (performance criteria) for evaluation of glass fiber lath in One- and Three-Coat Stucco as well as masonry stone veneer
 - Transverse load, shear/vertical load, embedment, weathering, fire, racking, fastener attachment, tensile strength, etc.
 - Used to demonstrate compliance with International Building and Residential Codes



Codes and Standards

ASTM

- C11.02 Specifications and Test Methods for Accessories and Related Products
 - Non Metallic Lath Task Group developing 1) standard specification and 2) test methods
- C11.03 Specifications for the Application of Gypsum and Other Products in Assemblies
 - Non Metallic Lath Task Group developing installation standard



Glass Fiber Lath Today

Building code compliant, glass fiber lath is available and being used in Three Coat (traditional) Stucco, One Coat Stucco and masonry veneer applications

Research continues of alternative designs/configurations including use in other applications such as tile, countertops, etc.



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Questions?

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