



Arnold Schwarzenegger  
*Governor*

# ATTACHMENT #10 CONCRETE SLAB DEMONSTRATION HOMES PLAN

*Prepared For:*  
**California Energy Commission**  
Public Interest Energy Research Program

*Prepared By:*  
Gas Technology Institute

PIER FINAL PROJECT REPORT

June 2005  
CEC-500-2007-035-AT10





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# Concrete Slab Demonstration Homes Plan

## Task 4.1 Report

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(GTI Project No. 15485)

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California Energy Commission

Contract No. 500-03-013

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June 2005

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## **Task 4.1 – Concrete Slab Demonstration Homes Plan**

### **Background**

The first technical task (Task 2) of the “Energy Efficient Mold-Resistant Building Assemblies and Construction Practices for California Homes” project was to perform a situation analysis of mold problems and state-of-the-art methods of addressing these problems in the residential new construction market in California. The overall goal of Task 2 was to identify the most challenging mold problems facing California builders and recommend potential solutions for detailed laboratory evaluation and possible use in demonstration homes to be built by the two participating builders. Based on discussions with Commission staff, the project team, Project Advisory Committee (PAC) members, and building industry experts, the highest value areas for this project to address with laboratory testing were drainage plane design options (especially around windows), concrete slab installation practices and materials (especially vapor retarder location and fill materials), and drying times for built up wall assemblies.

This focus was intended to provide defensible, repeatable results that advance the understanding of overall wall system performance. Components and subsystems have been tested for mold growth and impact of moisture by building scientists, universities, and manufacturers. The recommended focus built on that testing to provide a better understanding of the behavior of the entire wall assembly as well as collect unique data on the performance of wall cavities and materials as a part of a complete assembly. This approach also allowed flexible and innovative configurations of materials and installation methods to be tested using a combination of available test protocols and new test methods developed specifically to meet project goals.

Laboratory tests and protocols developed in conjunction with project team members, builders, PAC members, Commission staff, and industry consultants were summarized in the Laboratory Evaluation Test Plan (Task 3.1). The test plan provided the initial framework for laboratory evaluations. Based on experience gained during the performance of laboratory tests, the project team updated test goals, protocols, facilities, and test matrix to maximize the value of each test. Under Tasks 3.2 through 3.4, the project team performed a systematic laboratory evaluation of conventional and innovative residential building materials, assemblies, and construction practices identified in Task 2.4. Task 3 laboratory evaluations were designed to provide experimental evidence of moisture loading, propensity for mold formation, and potential performance improvements associated with innovative building assemblies and construction practices. These tests generated empirical data using existing and newly developed test protocols intended to permit replication by other testing organizations and to provide a technical basis for demonstration home design recommendations, builder guidelines, and future revisions to Title 24 energy efficiency standards. Under Task 3.7, the project team worked closely with the participating builders and manufacturers to identify and recommend mold-resistant building systems and construction practices that participating builders will use in the Task 4 demonstration homes.

### **Goal**

The goal of Task 4.1 was to generate drawings and specifications necessary to incorporate innovative assemblies and construction techniques into the demonstration homes.

### **Scope**

The scope of Task 4.1 was to provide input to participating builders as they develop plans and specifications for the demonstration homes that incorporate innovative assemblies and construction techniques into the demonstration homes. Designs include identical building assemblies to compare

costs, and different assemblies to demonstrate a larger number of innovations. The deliverable for this task is the builder design drawings and specifications for each demonstration home.

## **Approach**

The project team reviewed the list of recommended building assemblies and construction practices identified in Task 3.7 with the participating builders and manufacturers to identify any necessary changes to the builder's current drawings and specifications. Based on interactions with the participating builders, all demonstration home recommendations will be handled in the field without modifying architectural drawings and specifications or changing engineering reports. Builders will coordinate with code inspectors, contractors, and product manufacturers to obtain the necessary materials and detailed installation instructions, integrate into construction schedules, and provide sufficient information for code compliance. The final as built drawings will reflect field changes as required by the building officials.

John Laing Homes Inland Division will build two concrete slab demonstration homes built as a part of the Secret Garden development in Chino, California. In addition, 2 baseline homes will be monitored to help evaluate the impact of concrete slab installation procedures and materials on concrete slab performance.

For field modifications, participating manufacturers will provide sufficient technical information and on-site support to ensure a successful installation and to provide incremental installed cost data. Data acquisition system specifications for the concrete slab demonstration homes were developed by the project team in conjunction with participants from the concrete industry.

## **Concrete Slab Homes Plan**

Table 1 provides information on the materials and installation practices for the two John Laing Homes Inland Division ACI 302.1 Concrete Slab Demonstration Homes. Demonstration home concrete slabs will be installed in accordance with ACI 302.1R-04 "Guide for Concrete Floor and Slab Construction." Based on discussions with concrete industry participants, materials used in conjunction with the ACI 302.1R-04 installation method include:

- Stego® Wrap 15 Mil Class A Polyolefin High Performance Vapor Retarder
- Confilm® Evaporation Reducer
- HydraCure™ Curing Cover
- EMACO® R320 CI Pocket Form Filler
- Concrasive® Paste LPL Pocket Form Filler

Appendix A contains technical information obtained from manufacturers' websites for these materials.

John Laing Homes Inland Division plans to use the ACI 302.1 installation method for vapor retarders and buffer materials on two homes with different floor plans. The ACI 302.1 method will be compared to their standard practice on two baseline homes using their normal concrete contractor.

The homes will have post tensioned slabs with same-day pouring of the footings and 5" slab (considered a monolithic pour). Post tensioning rods will be 3½" below finish floor crisscrossed 3' to 4'-5" apart depending on design requirements. Cables are ½" diameter with plastic sheathing. The Stego® Wrap vapor retarder will be installed under the footing as well as the slab. It will be turned up on the outside of the footing at a height above the top of the footing sufficient to prevent water intrusion between the slab and the vapor retarder. Until the slab is backfilled and wall cast on top, the vapor barrier will be fastened to the exterior side of the wall or slab edge above the wall/slab joint line.

**Table 1 Concrete Slab Demonstration Homes Materials and Contacts**

Item	Purpose	Provider	Contact
ACI 302.1R-04	Installation Guidelines for Vapor Retarder Location, Buffer Materials, Pouring, Curing, and Drying Procedures and Materials.	Concrete Industry Consultants	Scott Tarr, Peter Craig Claudia Lezell
Stego® Wrap 15 mil Class A	Low Perm Vapor Retarder to Address SB 800 Liability Provisions for Slabs	Stego Industries	Bret Houck Matthew Blasdel
Confilm® EMACO® R320 CI Concresive® Paste LPL	Reduce evaporation rate Improved pocket form fillers for long term corrosion protection	Degussa Construction Systems Americas	Robert Gulyas
HydraCure™	Reduce Cracking During 7 Day Curing Period	PNA Construction Technologies	Nigel Parkes Bob Waggoner
Rapid RH™ Relative Humidity Sensor	Long Term Data Acquisition	Wagner/CTL	Scott Tarr Lee Eliseian

Confilm® will be applied immediately after the pour in accordance with manufacturer’s instructions to retard the bleed water evaporation rate and minimize cracking. The HydraCure™ curing cover will then be placed over the slab in accordance with the manufacturer’s installation instructions for a period of 4 to 7 days to improve the curing process and reduce cracking and curling.

Data collection for all four homes will include relative humidity and vapor emission readings. Relative humidity probes will be inserted in four cored locations in each home two to three weeks after pour. Vapor emission readings will be manually read on four slab surfaces in each home at four different times during the drying period. All readings will occur prior to occupancy. No long term monitoring is planned for these four homes after occupancy.

Appendix B contains the construction schedule for the demonstration homes. Houses 25 and 40 will use the ACI 302.1 method and materials. Houses 39 and 42 will use the contractor’s normal method. The concrete slab construction schedule for these homes is as follows:

- June 15-17, 2005 Start Trenching
- July 5-7, 2005 Install Substrate and Vapor Retarders
- July 7-11, 2005 Pour Footings and Slabs

Concrete industry and participating manufacturer representatives will provide site and weather specific vapor retarder design, installation materials, and installation procedures, as well as on site installation support.

## **Appendix A**

### **Material Data Sheets for Concrete Slab Demonstration Homes**



# Stego® Wrap 15-mil Class A

## A “true” VAPOR BARRIER

STEGO INDUSTRIES, LLC



**Vapor Retarders**  
**07260, 03300**

**1. Product Name**  
**Stego Wrap 15-mil**  
**Class A Vapor Barrier**

**2. Manufacturer**  
Stego Industries, LLC  
27442 Calle Arroyo, Suite A  
San Juan Capistrano, CA 92675  
Sales, Technical Assistance  
Ph: (877) 464-7834  
Fx: (949) 493-5165  
www.stegoindustries.com

**3. Product Description**  
USES: Stego Wrap 15-mil is used as a true below-slab vapor barrier, and as a protection course for below grade waterproofing applications.  
COMPOSITION: Stego Wrap 15-mil Vapor Barrier is a multi-layer plastic extrusion manufactured with only the highest grade of prime, virgin, polyolefin resins.  
SIZE: Stego Wrap 15-mil comes in rolls 14' x 140' or 1,960 ft<sup>2</sup>  
WEIGHT: Stego Wrap 15-mil rolls weigh approximately 141 lb.

- 4. Technical Data**  
APPLICABLE STANDARDS  
American Society for Testing & Materials (ASTM)
- ASTM E 1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
  - ASTM D 882 - Test Methods for Tensile Properties of Thin Plastic Sheeting
  - ASTM D 1709 - Test Methods for Impact Resistance of Plastic Film by Free-Falling Dart Method
  - ASTM E 96 - Test Methods for Water Vapor Transmission of Materials
  - ASTM E 154 - Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover
  - ASTM E 631 - Terminology of Building Constructions

- ASTM F 1249 - Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
- ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs American Concrete Institute (ACI)
- ACI 302.1R-96 Minimum Thickness (10-mils)

**ENVIRONMENTAL FACTORS**  
Stego Wrap 15-mil can be used in systems for the control of soil gases (radon, methane), soil poisons (oil by-products) and sulfates.

**5. Installation**  
**UNDERSLAB:** Unroll Stego Wrap 15-mil Vapor Barrier over an aggregate, sand or tamped earth base. Overlap all seams a minimum of 6” and tape using Stego Tape. All penetrations must be sealed using a combination of Stego Wrap, Stego Tape and/or Stego Mastic.

**VERTICAL WALL:** Install Stego Wrap 15-mil Vapor Barrier over the waterproofing membrane while still tacky. Mechanically fasten Stego Wrap to the wall at the top with termination bar and concrete nails. Drape Stego Wrap down across the footer and under the french drain.

**6. Availability & Cost**  
Stego Wrap 15-mil is available

nationally via building supply distributors. For current cost information, contact your local Stego Wrap distributor or Stego Industries’ sales department.

**7. Warranty**  
Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided and disclaims all liability from any loss or damage. No warranty, express or implied, is given as to the merchantability, fitness for a particular purpose, or otherwise with respect to the products referred to.

**8. Maintenance**  
None required.

**9. Technical Services**  
Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries’ technical assistance department or via the website:  
www.stegoindustries.com

- 10. Filing Systems**
- SpecSource
  - Stego Industries’ website
  - MasterSpec

**TABLE 1: PHYSICAL PROPERTIES OF STEGO WRAP 15-MIL VAPOR BARRIER**

Property & Test	Stego Wrap 15-Mil
Underslab Vapor Retarders, ASTM E 1745 Class A	Exceeds
Water Vapor Permeance, ASTM E 96 & ASTM F 1249	0.012 perms (*0.006 WVTR)
Tensile Strength, ASTM D 882	76.6 lbf./in.
Puncture Resistance, ASTM D 1709	2445 grams
Chemical Resistance, ASTM E 154	Unaffected
Life Expectancy, ASTM E 154	Indefinite

\* WVTR water vapor transmission rate





# Stego® Tape

STEGO INDUSTRIES, LLC



**Vapor Retarders**  
**07260, 03300**

**1. Product Name**  
**Stego Tape**

**2. Manufacturer**

Stego Industries, LLC  
27442 Calle Arroyo, Suite A  
San Juan Capistrano, CA 92675  
Sales, Technical Assistance  
Ph: (877) 464-7834  
Fx: (949) 493-5165  
www.stegoindustries.com

**3. Product Description**

**USES:** Stego Tape is a low permeance tape designed for protective sealing, hanging, seaming, splicing, and patching applications where a highly conformable material is required. It has been engineered to bond specifically to Stego Wrap 10-mil and 15-mil, making it ideal for sealing Stego Wrap seams and penetrations.

**COMPOSITION:** Stego Tape is composed of a high-density polyethylene film and a rubber-based, pressure-sensitive adhesive.  
**SIZE:** Stego Tape comes in 4" wide, 180 ft. long rolls. Stego Tape ships 12 rolls in a case.

**4. Technical Data**

**APPLICABLE STANDARDS**

American Society for Testing & Materials (ASTM)

- ASTM D 1000 Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
- ASTM E 1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

**5. Installation**

**SEAMS:**

Overlap Stego Wrap 6 inches and seal with Stego Tape. Make sure the area of adhesion is free from dust, dirt and moisture to allow maximum adhesion of the pressure sensitive tape.

**PIPE BOOTS:**

- 1) Cut a piece of Stego Wrap. Width: minimum 12" Length: 1 1/2 times the pipe circumference
- 2) With scissors, cut slits half the width of the film.
- 3) Wrap boot around pipe and tape onto pipe, completely taping the base to Stego Wrap using Stego Tape.

Stego Tape should be installed above 40 °F

Note: See Stego's installation instructions for complete instructions and detailed drawings. Each user should make their own tests to determine the products



suitability for their own intended use and shall assume all risks and liability in connection therewith.

**6. Availability & Cost**

Stego Tape is available nationally via building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' sales department.

**7. Warranty**

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided and disclaims all liability from any loss or damage. No warranty, express or implied, is given as to the merchantability, fitness for a particular purpose, or otherwise with respect to the products referred to.

**8. Maintenance**

None required.

**9. Technical Services**

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries' technical assistance department or by visiting the website: www.stegoindustries.com

**10. Filing Systems**

- Stego Industries' website

**TABLE 1: PHYSICAL PROPERTIES OF STEGO TAPE**

Property	Stego Tape
Total Thickness	8 mils
Permeance	0.23 perms
Tensile Strength	25 lbs./in. width
Elongation (at break)	80%
Adhesion	35-oz./in. width
Ultraviolet Resistance	Excellent



# CONFILM®

## Evaporation reducer

### PRODUCT DATA

3 03390

**Concrete  
Curing**

### Description

Confilm® evaporation reducer helps produce high-quality concrete flatwork and reduces surface-moisture evaporation. It is especially effective in rapid-drying conditions, such as high concrete-surface or ambient temperatures, low humidity, high winds, direct sunlight, or work in heated interiors during cold weather.

### Yield

One gallon (3.8 L) of Confilm® mixed with nine gallons (34.1 L) of water yields 10 gallons (37.9 L) of sprayable solution. This diluted amount of Confilm® (1 to 9) should cover 2,000 – 4,000 ft<sup>2</sup> (186 – 372 m<sup>2</sup>) of fresh concrete.

If more than one application is being applied, e.g., in adverse drying conditions, the required quantity will increase accordingly.

### Packaging

1 gallon (3.8 L) cans  
5 gallon (18.9 L) pails  
55 gallon (208 L) drums

### Shelf Life

1 year when properly stored

### Storage

Store in unopened containers in a clean, dry area between 40 and 90° F (4 and 32° C). Keep from freezing.



### Features

- Does not affect the cement hydration process
- Eliminates or reduces crusting, stickiness, and underlying sponginess
- Allows lower slump and lower water content in concrete
- Reduces surface moisture evaporation approximately 80% in wind and approximately 40% in sunlight
- Facilitates the use of air-entrained concrete
- Surfaces remain plastic

### Benefits

- Does not alter concrete strength (early and ultimate), abrasion resistance, and durability
- Helps prevent unevenness and poor surface texture
- Facilitates proper hydration of high-strength mixes
- Reduces plastic shrinkage cracking and wind crusting
- Makes air entrainment possible in rapid-drying conditions
- Allows for longer working time in hot, dry, or windy conditions; timing of finishing is less critical, reducing overall cost

### Where to Use

#### APPLICATION

- Concrete surfaces where the evaporation rate exceeds the bleed rate
- Air-entrained and non-air-entrained concrete
- Silica-fume concrete
- Concrete containing fly ash
- All MBT® Protection-and-Repair cementitious products except Masterplate® DPS floor system

#### LOCATION

- Horizontal and vertical surfaces
- Interior or exterior

### How to Apply

#### Application

1. Agitate Confilm® before mixing with water. Depending on the application, mix Confilm® at a ratio of up to 1 part Confilm® concentrate to 9 parts water. Re-agitate mixed materials before applying.
2. Apply with a constant-pressure or industrial sprayer.

3. Confilm® forms a monomolecular film when sprayed onto the concrete surface immediately after screeding or between finishing operations (as needed). The protective shield of Confilm® usually lasts as long as the concrete remains plastic, despite succeeding floating and troweling operations. When applying MBT® Protection and Repair surface hardeners, use Confilm® after screeding and after the first floating operation, if necessary.

4. Treated surfaces are easily distinguished from untreated surfaces because of the greenish-yellow color of the film in the presence of moisture and light. The fluorescent tint of the film disappears completely upon drying. The residue remaining on the surface of hardened concrete does not impair bonding or alter color.

## For Best Performance

- Do not apply Confilm® as a final finishing aid. Do not work Confilm® into the concrete surface.
- Confilm® evaporation reducer is not a curing agent. Concrete treated with this product must still be cured.
- Degussa is not responsible for compatibility or results when Confilm® evaporation reducer is used with other manufacturers' products.
- Confilm® reduces evaporation only while concrete is plastic. It is not a substitute for early curing of hardened concrete, nor does it alter the effectiveness of membrane curing compounds.
- Protect Confilm® from freezing. Extreme cold may cause segregation, from which the product cannot be reconstituted.
- Do not allow any spills or residue of Confilm® concentrate to dry on the surface of hardened concrete. Wipe it up immediately, then rinse the surface with water. If the concentrate residue dries on hardened concrete, a reddish-brown stain may appear.
- For a detailed technical discussion about the action of monomolecular films typified by Confilm®, refer to the Journal of the American Concrete Institute, Volume 62, pp. 977 - 985.
- The following ACI documents recommend monomolecular films to prevent rapid drying of fresh concrete: ACI 302.1R, "Guide for Concrete Floor and Slab Construction"; ACI 305R, "Hot Weather Concreting"; ACI 308, "Standard Practice for Curing Concrete"; and ACI 345R, "Guide for Concrete Highway Bridge Deck Construction."
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current version.
- Proper application is the responsibility of the user. Field visits by Degussa personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

## Health and Safety

CONFILM®

### Caution

Confilm® contains aromatic hydrocarbon.

### Risks

May cause skin, eye or respiratory irritation. Ingestion may cause irritation.

### Precautions

KEEP OUT OF THE REACH OF CHILDREN. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling. Keep container closed when not in use. DO NOT take internally. Use only with adequate ventilation. Use impervious gloves, eye protection and if the TLV is exceeded or used in a poorly ventilated area, use NIOSH/MSHA approved respiratory protection in accordance with applicable Federal, state and local regulations.

### First Aid

In case of eye contact, flush thoroughly with water for at least 15 minutes. In case of skin contact, wash affected areas with soap and water. If irritation persists, SEEK MEDICAL ATTENTION. Remove and wash contaminated clothing. If inhalation causes physical discomfort, remove to fresh air. If discomfort persists or any breathing difficulty occurs or if swallowed, SEEK IMMEDIATE MEDICAL ATTENTION.

Refer to Material Safety Data Sheet (MSDS) for further information.

### Proposition 65

This product contains material listed by the state of California as known to cause cancer, birth defects, or other reproductive harm.

### VOC Content

0.1 lbs/gal or 10 g/L.

**For medical emergencies only,  
call ChemTrec (1-800-424-9300).**

## Degussa Building Systems

889 Valley Park Drive  
Shakopee, MN, 55379

www.degussabuildingsystems.com

**Customer Service** 800-433-9517

**Technical Service** 800-243-6739

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# HydraCure™ Covers

## Another Way to Protect Your Joints

### Why Cure?

PNA's reusable, reflective wet curing blankets ensure a gradual, uniform and controlled curing environment for slabs-on-ground to help maximize concrete strength. This process increases the durability of joint edges subject to solid wheeled traffic and further reduces the potential for curling. Benefits of proper curing:

- Increases concrete strength
- Improves abrasion resistance
- Reduces cracking, crazing, scaling, dusting and pop-outs

### Why HydraCure™ Covers are so Effective

Comprised of a non-woven polypropylene fabric coated with a white-pigmented polyethylene, the fabric backing traps and retains water to provide a 100 percent humidity condition below the cover. The white UV-resistant coating reflects the sun's heat away from the slab's surface, preventing excessive heat buildup and ensuring optimal drying rates. HydraCure's reflective properties make it ideal for a range of weather conditions by offering high heat and cold resistance. It can be used in outdoor and indoor environments.

### Ease of Use

- Shipped in rolls with the fabric side out, HydraCure™ covers are easy to roll out and lie flat on the slab, reducing the "blotchy" appearance created by other curing sheets.
- HydraCure™ is 50 percent lighter in dry roll weight than poly-coated burlap curing covers, making handling and placement effortless without compromising the water-retaining qualities.

### Cost-Effective

- HydraCure™ Covers can easily be rolled up, removed from the slab and reused again and again.
- Unlike poly-coated burlap products, the inorganic, non-woven fabric in HydraCure™ Covers will not rot or mildew.
- The white polyethylene coating contains a UV additive to prevent it from becoming brittle in direct sunlight.

### HydraCure™ Covers – Physical Properties

Measure		Value	Units	Test Procedure
Thickness		42	mil	ASTM D-5199
Standard Weight		78	lbs/1,000 ft <sup>2</sup>	ASTM D-2103
Tensile Grab Strength	MD TD	125 160	lbf lbf	ASTM D-1682-64 ASTM D-1682-64
Trapezoidal Tear Strength	MD TD	50 65	lbf lbf	ASTM D-4533-91 ASTM D-4533-91
Grab Elongation	MD TD	65% 55%		ASTM D-1682-64 ASTM D-1682-64
Mullen Burst Strength		330	lbs/in <sup>2</sup>	ASTM D-751-73
Water Retention		0.05	lbs/ft <sup>2</sup>	ASTM C-171
Reflectance		79%		E-1347
Unit Size		12 x 100	1,200 ft <sup>2</sup>	
Unit Weight		93	lbs/roll	
Packaging		400	rolls/truck	



## Instructions for Use

Apply resilient floor coverings, protective coatings, sealers or other special treatments after curing is complete (normally seven days).

### Step 1

Remove roll from shipping pallet.

---

### Step 2

Unroll HydraCure™ right onto the slab. Fabric mesh side should be in contact with slab surface. Coated side will be facing up.

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### Step 3

When curing is complete (normally seven days) HydraCure™ can be rolled back up with fabric side out.

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### Step 4

For optimal reuse, rinse off fabric side before folding and storing.

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**After proper placement and finishing of suitable quality concrete, curing is the single most important factor in achieving a high-quality slab.**

—ACI 302.1R-04

#### LOAD TRANSFER SYSTEMS

- ▶ DIAMOND DOWEL® SYSTEM
- ▶ LOAD PLATE BASKET™ ASSEMBLY
- ▶ PD<sup>3</sup> BASKET™ ASSEMBLY
- ▶ ROUND/SQUARE DOWELS, CLIPS & BASKETS

#### JOINT PROTECTION PRODUCTS

- ▶ ARMOR-EDGE™ JOINT ASSEMBLY
- ▶ ARMOR-EDGE™ N2E JOINT ASSEMBLY

#### HYDRACURE™ COVERS



800.542.0214

[WWW.PNA-INC.COM](http://WWW.PNA-INC.COM)

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# CONCRESI<sup>®</sup> PASTE LPL

Concrete bonding adhesive with long pot life

PRODUCT DATA

3 03930

**Concrete  
Rehabilitation**

## Description

Concresive<sup>®</sup> Paste LPL is a two-component 100% solids nonsag epoxy adhesive. It is used for vertical and overhead bonding and patching applications and for anchoring.

## Yield

Smooth surfaces:  
12 ft<sup>2</sup>/gallon (0.29 m<sup>2</sup>/L)

Rough surfaces:  
6 ft<sup>2</sup>/gallon (0.15 m<sup>2</sup>/L)

Coverage rates assume a thickness of 1/8" (3 mm). Coverage rates are approximate. Actual coverage rate will depend on texture and porosity of concrete and application method employed.

## Packaging

1 gallon (3.8 L) units

3 gallon (11.4 L) units

## Shelf Life

2 years when properly stored

## Storage

Store unopened at temperatures between 50 and 90° F (10 and 32° C) in a clean, dry area.

## Features

- Nonsag gel
- Very long working time
- Moisture insensitive
- May be extended with properly graded sand

## Benefits

- Ideal for vertical and overhead applications
- Facilitates proper application, especially in hot weather
- Bonds to damp concrete surfaces
- More economical applications

## Where to Use

### APPLICATION

- Pinning loose or broken masonry
- Bonding rigid materials like metal, concrete, stone
- Bonding flexible materials like plastics, foam, rubber
- Fairing uneven surfaces, filling gaps and joints
- Bonding fresh to existing concrete
- Grouting bolts, dowels, and rebar into concrete, stone, and masonry
- As a rigid, pick-proof security sealant use

### LOCATION

- Horizontal, vertical, and overhead surfaces
- Interior or exterior

## How to Apply

### Surface Preparation

#### CONCRETE

1. Substrate may be dry or damp, although dry surfaces product optimum results. New concrete must be fully cured (28 day minimum).
2. Remove grease, wax, oil contaminants, and curing compounds by scrubbing with an industrial-grade detergent or a degreasing compound. Follow with mechanical cleaning (refer to ASTM D 4258). Remove weak, contaminated, or deteriorated concrete by shotblasting, bushhammering, gritblasting, scarifying, or other suitable mechanical means.

#### STEEL

Remove dirt, grease, and oil with a suitable industrial-grade cleaning-and-degreasing compound (SSPC-SP-1). Remove rust and mill scale by gritblasting. Blast steel to white metal. Follow gritblasting with vacuuming or oil-free dry-air blast (refer to SSPC-SP-10 or NACE-2).

### Mixing

1. The mix ratio is 2 (Parts A) to 1 (Part B). Mix only an amount of material usable before the pot life expires. Thoroughly stir each component before mixing.
2. Measure (ratio) each component carefully and then add Part B (hardener) to Part A (resin).
3. Mix Parts A and B using a low-speed drill (600 rpm) and mixing paddle (e.g., a Jiffy mixer). Carefully scrape the sides and bottom of the container while mixing. Keep the paddle below the surface of the material to avoid entrapping air. Proper mixing will take at least 3 – 5 minutes. Well-mixed material will be free of streaks or lumps.



## Technical Data

### Composition

Concresive® Paste LPL is a two-component 100% solids nonsag epoxy.

### Typical Properties

COMPONENT	PART A (Resin)	PART B (Hardener)
<b>Form</b>	Paste	Paste
<b>Color</b>	White	Black
<b>Mixing ratio</b> (by volume)	2	1
<b>Mixed color</b>	Gray	

PROPERTY	VALUE		
	60° F (16° C)	85° F (29° C)	105° F (41° C)
<b>Nonsag thickness</b> , in (mm)	3/4 (19)	1/2 (13)	1/4 (6)
<b>Initial cure time</b> , days, for 5,000 psi (34.5 MPa) minimum, (AASHTO T-237)	10	6	3
<b>Full cure time</b> , days (ASTM D 695)	20	10	7
<b>Pot life</b> , hrs, 1 gal (3.8 L)	2-1/2	1	1/2
<b>Open time</b>	3 hr	90 min	40 min

### Test Data

PROPERTY	RESULTS	TEST METHODS
<b>Tensile strength</b> , psi (MPa)	2,000 (13.8)	ASTM D 638
<b>Elongation at break</b> , %	4	ASTM D 638
<b>Compressive yield strength</b> , psi (MPa)	8,000 (55.2)	ASTM D 695
<b>Compressive modulus</b> , psi (MPa)	4.0 x 10 <sup>5</sup> (2.8 x 10 <sup>3</sup> )	ASTM D 695
<b>Heat deflection temperature</b> , 28 day cure, ° F (° C)	128 (53)	ASTM D 648
<b>Slant shear strength</b> , psi (MPa)	> 5,000 (34.5)	AASHTO T-237
<b>Bond strength</b> , at 14 days, psi (MPa)	1,500 (10.3)	ASTM C 882

Test Temperature: 77° F (25° C), cured 7 days. Properties listed are typical and may be used as a guide for determining suitability for particular applications.

## Application

### GENERAL BONDING

1. Deep surface irregularities can be faired with a 1-to-1 sand and Concresive® Paste LPL mix. Allow this fairing material to set. Within 24 hours, apply neat bonding agent with a trowel in sufficient quantities to fill all gaps between the mated surfaces.
2. The neat bondline thickness should be 1/32 – 1/8" (0.8 – 3 mm). Ideally, a small amount of bonding agent should extrude from the joint when the surfaces are mated and pressure is applied. Surfaces must be mated while the paste is still tacky (within the open time).

### BONDING FRESH CONCRETE TO EXISTING CONCRETE

1. The new concrete being bonded should be a relatively low-slump mix.
2. When bonding concrete containing latex polymer admixtures, check compatibility either by installing a test patch and performing a pull-off test or by conducting a laboratory slant shear test (AASHTO T-237).
3. Apply the bonding agent as described in the General Bonding section above. Lightweight concrete may require a second coat if the first coat penetrates. Place fresh concrete within the open time or while the bonding agent is still tacky. Be careful when applying the fresh concrete not to damage the bonding layer.
4. For highly irregular surfaces sand may be used to extend this material. For proper application techniques refer to Appendix MB-17: Surface Preparation for Adhesives.

### PATCHING MORTARS AND GROUTS

Use washed, kiln-dried, and bagged graded silica sand. A carefully selected blend of sands with a low void content will require less epoxy for a given volume of mortar compared to ungraded sands. A good "skip" gradation for low void content is a blend by weight of 2 parts #12 or #16 mesh to 1 part #80 or #100 mesh. When graded sands are not available, a good general-purpose sand is #30 mesh silica.

### BOLT AND REBAR GROUTING

1. Holes may be cut by either rotary-percussion drilling, followed by air blow-out with oil-free compressed air, or diamond core boring, followed by water flush. The hole must be free of water before grouting. Where holes will be precast into the concrete, cast them undersized and drill them to fit.

2. The optimum hole size is 1/4" (6 mm) larger than the bar's; larger annular spaces are less desirable.

3. Apply a measured amount of bonding adhesive into the back or bottom of the hole with a caulking gun equipped with an extension nozzle. Insert the bar, displacing the paste, then secure the bar in the center of the hole. Remove excess bonding agent from around the hole before it hardens. Use pressure grouting for holes deeper than 2 ft (0.6 m).

#### Clean Up

Clean all tools and equipment immediately with xylene or mineral spirits. Cured material must be removed mechanically.

#### For Best Performance

- Precondition all components to 70° F for 24 hours before using.
- Do not thin with solvents.
- Application temperature range is 60 to 105° F (16 to 41° C).
- Nonsag characteristics will diminish at the upper end of the application-temperature range.
- Evaluate sustained load conditions before using this product structurally above a service temperature of 105° F (41° C).
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current versions.
- Proper application is the responsibility of the user. Field visits by Degussa personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

#### Health and Safety

CONCRECIVE® PASTE LPL PART A

##### Caution

##### Risks

May cause eye irritation. May cause lung irritation and allergic respiratory reaction. May cause skin irritation. Skin sensitizer. Harmful if absorbed through skin. Refer to Material Safety Data Sheet (MSDS) for effects of repeated overexposure.

##### Precautions

KEEP OUT OF THE REACH OF CHILDREN. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel ill, seek medical advice.

##### First Aid

If breathing is difficult, move person to fresh air. If you feel ill, seek medical advice. In case of eye contact, flush immediately with plenty of water for 15 minutes and call a physician. For skin, wash thoroughly with soap. If affected by inhalation of vapor or spray mist, remove to fresh air. Ingestion: Drink two glasses of water. Then induce vomiting by taking Ipecac Syrup, salt water or by placing finger at back of throat. DO NOT give anything by mouth to an unconscious person.

For additional information on personal protective equipment, first aid, and emergency procedures, refer to the product Material Safety Data Sheet (MSDS) on the job site or contact the company at the address or phone numbers given below.

##### Proposition 65

This product does not contain materials listed by the state of California as known to cause cancer, birth defects, or reproductive harm.

##### VOC Content

0 lbs/gal or 0 g/L.

CONCRECIVE® PASTE LPL PART B

##### Caution

##### Risks

Causes eye burns. Causes skin burns. Harmful if inhaled. Harmful if swallowed. Harmful if absorbed through skin.

##### Precautions

KEEP OUT OF THE REACH OF CHILDREN. Do not breathe vapor or spray mist. Avoid prolonged or repeated skin contact. Wear an appropriate, properly fitted respirator (NIOSH/MSHA approved) during and after application unless air monitoring demonstrates vapor/mist levels are below applicable limits. Follow respirator manufacturer's directions for respirator use. Do not get in eyes, on skin or on clothing. Wear suitable protective clothing. Wear suitable gloves. Wash soiled clothing before reuse.

##### First Aid

In case of eye contact, flush immediately with plenty of water for 15 minutes and call a physician. In case of skin contact, immediately wash skin with soap and plenty of water. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. Call a physician. Thoroughly clean contaminated shoes. DO NOT induce vomiting: give large quantities of water and at least one ounce of vinegar in water. GET IMMEDIATE MEDICAL ATTENTION. DO NOT give anything to an unconscious person.

For additional information on personal protective equipment, first aid, and emergency procedures, refer to the product Material Safety Data Sheet (MSDS) on the job site or contact the company at the address or phone numbers given below.

##### Proposition 65

This product does not contain materials listed by the state of California as known to cause cancer, birth defects, or reproductive harm.

##### VOC Content

0 lbs/gal or 0 g/L.

**For medical emergencies only,  
call ChemTrec (1-800-424-9300).**

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**Customer Service** 800-433-9517  
**Technical Service** 800-243-6739

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# EMACO® R320 CI

Fiber-reinforced vertical and overhead repair mortar with integral corrosion inhibitor

PRODUCT DATA

3 03930

**Concrete  
Rehabilitation**

## Description

Emaco® R320 CI is a one-component polymer-modified fiber-reinforced repair mortar containing an integral corrosion inhibitor. It is used for patching and resurfacing distressed concrete, both interior and exterior. It can be applied by low-pressure spraying or hand troweling.

## Yield

Approximately 0.46 ft<sup>3</sup> (0.013 m<sup>3</sup>), which will cover approximately 5.5 ft<sup>2</sup> (0.51 m<sup>2</sup>) at a 1" (25 mm) depth without waste.

## Packaging

55 lb (25 kg) multi-wall bags

## Shelf Life

9 months when properly stored

## Storage

Store in unopened containers in clean, dry conditions between 45 and 90° F (7 and 32° C).

## Features

- Contains an integral corrosion inhibitor
- One component; components not damaged by freezing
- Low permeability
- Low modulus of elasticity
- Sprayable
- Shrinkage compensated
- Polymer modified

## Benefits

- Protects reinforcing steel
- Allows for easy mixing and handling
- Resists moisture and chloride intrusion
- Improves compatibility for surface renovation
- Reduces labor requirements
- Reduces stress at the bond line
- Improves bond to surrounding concrete

## Where to Use

### APPLICATION

- Spalled areas
- Tuckpointing
- Building facades
- Balconies and columns
- Beam and soffit repair
- Bridges and parking garages
- Retaining walls

### LOCATION

- Vertical and overhead surfaces

### SUBSTRATE

- Concrete and masonry

## How to Apply

### Surface Preparation

#### CONCRETE

- 1 Perform surface preparation in compliance with ICRI Technical Guideline No. 03730 "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion."
- 2 Square cut or undercut the perimeter of the area being patched to a minimum depth of 1/4" (6 mm) to prevent featheredges. Do not cut reinforcement.
- 3 Chip and remove unsound and delaminated concrete to a depth of 1/4" (6 mm) or to whatever additional depth is necessary to reach sound concrete. Limit the size of chipping hammers to 15 lbs (6.8 kg) to reduce microfractures. Hydrodemolition may be used. Do not use a method of surface preparation that will fracture the concrete. Verify the absence of microcracking or bruising in accordance with ICRI Guideline No. 03732.



## Technical Data

### Composition

Emaco® R320 CI is a blend of cement, graded aggregates, fibers, dry polymer, and set-control additives with an integral corrosion inhibitor.

### Typical Properties

PROPERTY	VALUE
<b>Unit weight</b> , lb/ft <sup>3</sup> (kg/m <sup>3</sup> )	133 (2,130)
<b>Working time</b> , min	30
<b>Set times</b> , hrs (ASTM C 266)	
Initial set	1–2
Final set	3–4

### Test Data

PROPERTY	RESULTS			TEST METHODS
	1 Day psi (MPa)	7 Day psi (MPa)	28 Day psi (MPa)	
<b>Compressive strength</b>	1,800 (12.4)	5,000 (34.5)	7,000 (48.3)	ASTM C 109
<b>Splitting tensile strength</b>	350 (2.4)	500 (3.5)	750 (5.2)	ASTM C 496
<b>Flexural strength</b>	650 (4.5)	1,050 (7.2)	1,450 (10.0)	ASTM C 348
<b>Direct shear bond strength</b>	300 (2.1)	400 (2.8)	500 (3.5)	Michigan DOT
<b>Slant shear bond strength</b>	900 (6.2)	1,800 (12.4)	2,300 (15.9)	ASTM C 882, modified <sup>1</sup>
<b>Drying shrinkage</b> , %, at 28 days	0.12			ASTM C 157, modified <sup>2</sup>
<b>Modulus of elasticity</b> , psi (GPa), at 28 days	3.2 x 10 <sup>6</sup> (22.1)			ASTM C 469
<b>Freeze/thaw resistance</b> , % RDM, at 300 cycles	97			ASTM C 666, Procedure A

<sup>1</sup>No epoxy-bonding agent used; air cured in according to ASTM C 1042.

<sup>2</sup>ICRI Guideline No. 03733, 1 by 1 by 10" (25 by 25 by 254 mm) prism, air cured.

Results were obtained when material was mixed with 0.84 gallons (3.2 L) of water per bag and cured at 70° F (21° C). Expect reasonable variations, depending upon mixing equipment, temperature, application methods, test methods, and curing conditions.

4. After concrete removal, thoroughly abrade the roughened surface and exposed reinforcement to remove all bond-inhibiting materials such as rust, dirt, loose chips, dust, oil and grease.

5. Saturate the area thoroughly with water for several hours before placing Emaco® R320 CI.

6. Immediately before mixing, blow off or remove all excess water from repair area. Surface should be saturated surface-dry (SSD) during placement.

#### STEEL

1. Remove 3/4" (19 mm) of concrete behind the corroded reinforcing steel to provide adequate space for preparation and material placement.

2. Sandblast or shotblast corroded reinforcing steel after chipping to remove oxidation and scale in compliance with ICRI Technical Guideline No. 03730

"Guide for Surface Preparation for Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion." For additional protection from future corrosion, coat the prepared reinforcing steel with Emaco® P22 or Emaco® P24 rebar coatings.

#### Mixing

1. Use a slow-speed drill (400 – 600 rpm) with a Jiffy-type paddle or an appropriately sized mortar mixer.

2. Add 0.82 – 0.9 gallons (3.1 – 3.4 L) of clean potable water per 55 lb (25 kg) bag of Emaco® R320 CI. Pour approximately 90% of the mix water into the mixing container, then charge the mixer with the bagged material. Add remaining mix water as required for the desired placement consistency.

3. Mix to a uniform consistency, typically 3 – 5 minutes. Do not mix longer than 5 minutes.

## Application

### HAND-TROWELING APPLICATIONS

For hand troweling apply a bond coat before applying Emaco® R320 CI. Thoroughly scrub mixed Emaco® R320 CI into the saturated surface-dry (SSD) substrate with a stiff bristle broom or brush. Do not apply more of this bond coat than can be covered with the mortar before the bond coat dries. Do not retemper the bond coat. Do not dilute the bond coat with water.

### SPRAY APPLICATIONS

When applying by low-pressure spraying, use a Powercrete Pro or equivalent screw-type or piston pump commonly used for plastering. Spray applications do not require a bond coat, but surface being repaired must have a saturated surface-dry (SSD) condition.

#### VERTICAL AND OVERHEAD APPLICATIONS

Apply Emaco® R320 CI by hand troweling or low-pressure spraying in depths ranging from 1/4 – 1-1/2" (6 – 38 mm) in one lift.

#### MULTIPLE LIFTS

Scratch the preliminary lift before initial set. Apply the next lift after the preliminary lift has reached final set. If the next lift will not be placed immediately, keep the surface continually moist.

#### FINISHING

Before leveling surfaces, apply Confilm® evaporation reducer. Refer to the Confilm® product data sheet for more information. To level the surface, a wooden float may be used. Finish the final surface using a wood, plastic, or synthetic sponge trowel. If rapid evaporation may occur (e.g., in hot, dry, or windy conditions), apply Confilm® evaporation reducer.

#### Curing

1. Proper curing is extremely important; conduct it in accordance with ACI 308 "Standard Practice for Curing Concrete."
2. Apply a curing compound that complies with the moisture-retention requirements of ASTM C 309 or ASTM C 1315.
3. Do not use solvent-based curing compounds.
4. Sheeting material, wet burlap, burlen, or fog spray may be used in place of curing compounds. Minimum curing time for wet curing is 2 – 3 days.

#### For Best Performance

- Precondition these materials to approximately 70° F (21° C) for 24 hours before using.
- Protect repairs from direct sunlight, wind, and other conditions that could cause rapid drying of material.
- Do not use in applications where product will be exposed to wet or moist conditions.
- Minimum application thickness is 1/4" (6 mm). For applications greater than 1" (25 mm) in thickness, the product must be extended with aggregate.
- Do not mix partial bags.
- Minimum ambient and surface temperatures should be 45° F (7° C) and rising at the time of application.
- Do not use in sulfate-exposed environments.
- Do not use solvent-based curing compounds.
- Do not mix longer than 5 minutes.
- Make certain the most current versions of product data sheet and MSDS are being used; call Customer Service (1-800-433-9517) to verify the most current versions.
- Proper application is the responsibility of the user. Field visits by Degussa personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

#### Health and Safety

EMACO® R320 CI

#### Caution

#### Risks

Eye irritant. Skin irritant. Causes burns. Lung irritant. May cause delayed lung injury.

#### Precautions

KEEP OUT OF THE REACH OF CHILDREN. Avoid contact with eyes. Wear suitable protective eyewear. Avoid prolonged or repeated contact with skin. Wear suitable gloves. Wear suitable protective clothing. Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. Wash soiled clothing before reuse.

#### First Aid

Wash exposed skin with soap and water. Flush eyes with large quantities of water. If breathing is difficult, move person to fresh air.

#### Waste Disposal Method

This product when discarded or disposed of is not listed as a hazardous waste in federal regulations. Dispose of in a landfill in accordance with local regulations.

For additional information on personal protective equipment, first aid, and emergency procedures, refer to the product Material Safety Data Sheet (MSDS) on the job site or contact the company at the address or phone numbers given below.

#### Proposition 65

This product contains materials listed by the state of California as known to cause cancer, birth defects, or reproductive harm.

#### VOC Content

0 lbs/gal or 0 g/L.

**For medical emergencies only,  
call ChemTrec (1-800-424-9300).**

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## **Appendix B**

### **Construction Schedule for Concrete Slab Demonstration Homes**



