



**quakeWrap®**

**THE INFRASTRUCTURE INNOVATORS™**





# STRENGTHENING, REPAIRING, RESTORING DETERIORATED AND AGING INFRASTRUCTURE

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*"Fixing the tunnel from the inside with QuakeWrap not only saves us money, but is minimally invasive to our busy campus. We think it's a green solution, too."*

*— Peter Dourlein, Assistant Vice President for Planning  
Design and Construction  
The University of Arizona*



# 04

## The Innovators

Ingenuity, specialized engineers, construction teams and in-house research and development are what sets us apart from the rest of the industry.

# 06

## Engineering

Our structural engineering team provides analysis, design, and non-destructive evaluation for new construction and retrofit projects worldwide.

# 08

## Wet Layup

This basic technique for application of FRP was pioneered by Prof. Ehsani in the 1980s. Today the method is offered by many companies and has received global acceptance.

# 18

## Pipes

We offer several innovative solutions for repair of existing gravity or pressure pipes and construction of new pipelines that are unmatched in the industry.

# 24

## Piles and Columns

Our patented products offer unparalleled solutions for repair of columns, utility towers and submerged piles. These solutions have been tested and approved by various government agencies.

# 34

## Unique Products

Stay-in-place forms, SPiRe® and BraceWrap® are among the patented solutions we have developed lately. Explore how your projects can benefit from these clever products.

# 38

## Accessories

Learn about creative products and accessories that improve the quality and speed of your construction projects and lead to cost savings.

# 43

## Awards

Our turnkey design-build projects have been recognized domestically and internationally for superior products, creative engineering and high-quality construction.



WE ARE THE ORIGINAL INNOVATORS

# ENGINEERING + DESIGN + INSTALLATION = COMPLETE FRP SOLUTIONS

We are QuakeWrap, the World's #1 innovator of Fiber Reinforced Polymer (FRP) solutions for infrastructure repair and improvement. We offer professional engineering services in all 50 states, structural evaluations, design+build solutions, and experienced installation, all by our in-house FRP experts. We have developed 25 patented technologies in just the last five years, addressing the challenges facing our clients and customers.



## INTERNATIONAL EXPANSION

QuakeWrap's FRP solutions have been deployed all over the globe, and QuakeWrap, Inc. has offices in the U.S., Australia, Chile, and Puerto Rico.

25+

## PATENTS

on innovative materials and designs for repair of ports and piers, seawalls, existing pipes and the construction of new, sustainable pipelines.

OVER  
100

## ARTICLES & REPORTS

Published verifying the extremely effective repair and strengthening capabilities of QuakeWrap FRP systems.



## COMPANY GROWTH

We are one of the fastest growing businesses, thanks to our creative solutions that address the ever-growing repair needs of the aging infrastructure.



## GLOBAL CERTIFIED INSTALLERS

FRP Construction – QuakeWrap's in-house experts for FRP installation, structural rehabilitation and preservation – specialize in the repair and strengthening of infrastructures, including award-winning projects that increase structural strength and safety.





...A SMALL BUSINESS THAT HAS GROWN BY BEING A LEADER IN STATE-OF-THE-ART TECHNOLOGY AND BY EMBRACING EXPORTING AS KEY TO ITS GROWTH STRATEGY."

— U.S. CONGRESSIONAL RECORDS, 2014 INDUCTION OF QUAKEWRAP

**IN 1994, DR. EHSANI FOUNDED QUAKEWRAP, INC., A COMPANY DEDICATED TO ECONOMICAL INFRASTRUCTURE RENEWAL & REPAIR BY PROVIDING COMPREHENSIVE TURNKEY SOLUTIONS THAT INCLUDE SEALED ENGINEERING DESIGN, MATERIALS, AND FIELD INSTALLATION EXPERTISE NEEDED FOR STRUCTURAL IMPROVEMENTS USING FRP PRODUCTS.**

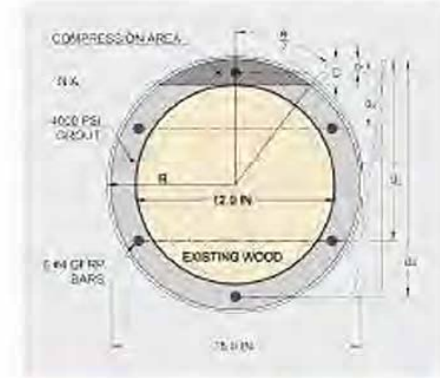
A collective knowledge of structural engineering, FRP materials and field installation puts QuakeWrap in the unique position to develop budget-friendly solutions that solve client problems. QuakeWrap solutions are usually the answer when there is no easy fix using traditional materials and techniques.

From blast-proofing U.N. headquarters in Beirut, to strengthening mile-long pipeline in the mountains of Costa Rica, to repairing corroded submerged piles for the Nigerian

National Petroleum Corporation, QuakeWrap's mission is to be the complete source for clients who seek innovative solutions for renewal of their aging infrastructure

In 2010, Dr. Ehsani left academia to devote his full attention to growing QuakeWrap, Inc. These efforts have resulted in numerous award-winning projects and creative solutions/products developed to address client needs. Among these recognitions is the 2016 American Society of Civil Engineers (ASCE) Innovation Award for the world's first green and sustainable pipe.

Today, QuakeWrap continues to be one of the fastest growing businesses in Arizona with annual expansion of more than 80% in each of the last three years. We have opened new offices in Australia, Puerto Rico, with an office in Chile scheduled to open in 2017 to serve South and Central America.



### DESIGN/BUILD MEANS GREATER EFFICIENCY

QuakeWrap's in-house design/build results in greater efficiency of delivery to clients. Any necessary changes to the design due to unexpected field conditions can be made with minimal delay.

## RESEARCH & DEVELOPMENT

QuakeWrap, Inc. is unique in that it commits between 10-15% of company revenues each year to research and development (R&D). R&D staff develop customized, turnkey solutions for complex structural repair and retrofit needs. QuakeWrap is the global leader in developing numerous technologies for repair of piles, seawalls, pipelines etc.



## PROFESSOR MO EHSANI, PHD, PE, SE Founder and President, QuakeWrap, Inc.

Dr. Ehsani is an internationally recognized expert and pioneer in the use of Fiber Reinforced Polymer (FRP) products. A Professor Emeritus of Structural Engineering at the University of Arizona, Prof. Ehsani is a visionary and creative engineer, developing numerous technologies that improve and repair infrastructure. Dr. Ehsani has been featured on CNN, The History Channel, National Public Radio (NPR), Engineering News Record (ENR) and other media for his expertise on the strengthening of structures, particularly related to earthquakes, terrorist attacks, and other potential disasters.



# QUAKEWRAP® OFFERS SUPERIOR ENGINEERING SERVICES

QuakeWrap's team of professional structural engineers specialize in applying conventional and proprietary FRP design methods in the construction industry. QuakeWrap engineers provide design services for all types of new and retrofit projects and can provide signed, sealed engineering designs in all 50 states and Puerto Rico. Our decades-long experience in the FRP industry, combined with expertise in structural engineering and field installation, give us a level of project insight that few competitors can match.

## STRUCTURAL HEALTH EVALUATION

QuakeWrap offers on-site structural health evaluation services using non-invasive, laboratory, and traditional testing methods. Based on test results, QuakeWrap engineers provide a detailed structural health analysis report for a variety of industries and structures.

## NON-INVASIVE TESTING METHODS

- Ultrasonic testing for steel thickness
- Half-cell potential testing for steel corrosion
- Concrete resistivity testing
- Current active corrosion rate of steel rebar
- Epoxy adhesion bond testing (ASTM D4541)







## SAMPLE ENGINEERING CLIENTELE

### **PALO VERDE NUCLEAR GENERATING STATION**

Cooling Tower Column Retrofit

### **SALT RIVER PROJECT (SRP)**

Steel Penstock Retrofit

Conveyor Steel Deck Repairs

### **ASARCO MISSION MINE**

Corroded Steel Retrofits and Redesigns

### **PURDUE AGRIBUSINESS**

Submerged Timber Piles

### **UNIVERSITY OF TEXAS**

Cooling Station Rehabilitation

### **UNIVERSITY OF ARIZONA**

Utility Tunnel Rebuild

### **VETERANS ADMIRATION**

Hospital Upgrade Strengthening, NM

### **SALT LAKE CITY**

Culvert Strengthening

### **MISSOURI DOT**

Bridge Pier Cap Strengthening

### **TEXAS DOT**

Culvert Strengthening

### **UNITED NATIONS (LEBANON)**

Force Protection of Headquarters in Beirut

### **NIGERIAN NATIONAL PETROLEUM CORPORATION**

Submerged Piles in Jetty

### **U.S. ARMY**

Force Protection, Fort Bragg, NC

### **MGM GRAND HOTEL**

Floor Strengthening, Las Vegas, NV

### **METROPOLITAN TRANSIT AUTHORITY OF NEW YORK (MTA)**

Concrete Platforms, NY

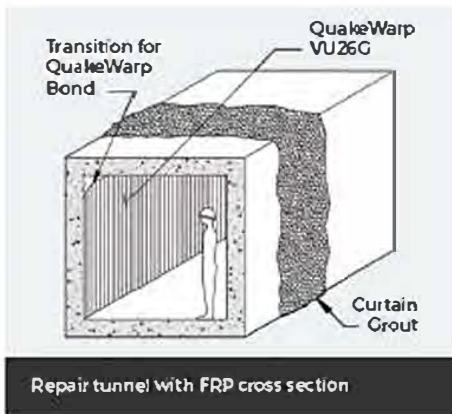
### **CROWN CASTLE**

Cell Phone Tower Strengthening

## STRUCTURAL DESIGN & RETROFITTING



- Beams, Columns, and Walls
- Utility Tunnels, Poles, and Vaults
- Pipe and Culvert Repair and New Pipelines
- Bridge Pilings and Submerged Piles
- Sea Walls and Sheet Piles
- Blast Proofing and Force Protection
- Cooling Towers, Chimneys, and Silos
- Foundations
- Seismic Protection



Repair tunnel with FRP cross section

## SERVICES AVAILABLE



- Licensed to provide sealed engineering drawings in all 50 U.S. States and Puerto Rico
- Dynamic analysis
- Current capacity evaluation
- Finite element 3D modeling and analysis
- Construction documentation development
- Shop drawing review
- Feasibility study
- Permit acquisition
- Structural damage assessment
- Quantity take-off estimate



Structural analysis model



# A QUICK OVERVIEW OF QUAKEWRAP®

Introduced in the 1980s, Fiber Reinforced Polymer (FRP) is a structural reinforcing material that is applied like wallpaper, reaching 2 to 3 times the strength of steel in 24 hours!

The QuakeWrap family of products strengthen, repair, and restore deteriorating and aging buildings and infrastructure faster and more economically than other repair or replacement solutions.



## USES & APPLICATIONS

Includes a wide range of structures and architectures

- Beams & Columns
- Blast Protection
- Bridge Piling
- Chimneys & Smokestacks
- Cooling Towers
- Culverts
- Force Protection
- Foundations
- Historic Preservation
- Manholes/Access Points
- New Pipeline Construction
- Pipe Repair
- Seawalls & Sheet Piles
- Seismic Retrofit
- Silos
- Slabs
- Submerged Piles
- Tanks
- Utility Tunnels & Poles
- Vaults
- Walls



## PATENTED REPAIR SOLUTIONS

25+ patented technologies deployed for effective infrastructure repair

- Strengthening concrete and masonry walls using QuakeWrap's Wet Layup
- Increasing roof and dome strength using QuakeWrap FRPs
- Reconstruction of columns, poles, piles, beams and pipes using QuakeWrap FRPs
- Odorless
- Repair of seawalls and sheet piles
- Manufacturing of continuous, lightweight FRP pipeline
- Repairing timber and marine piles using the PileMedic by QuakeWrap system
- Waterproof



## ENGINEERING SERVICES

QuakeWrap offers integrative turnkey design/build services

- On-site Feasibility Study
- Structural Health Analysis
- Cost Estimate
- Project Consultation
- Engineering Assistance
- Complete Engineering Design
- Material Selection
- Application Test Data
- Guidelines, Tips, and Installation Instructions
- Material and Equipment Delivery
- Complete Installation or Supervision
- Integrative Support for Contractors
- Training in Use, Design and Installation
- Software for Design with FRPs
- Contractor Certification
- Sealed Engineering Drawings in all 50 States





# QUAKEWRAP® WET LAYUP TO REPAIR & STRENGTHEN

A vast majority of existing built infrastructure does not meet the strength and ductility requirements of today's codes. Carbon FRP offers a solution for bringing these structures into compliance.

**QUAKEWRAP FABRIC SATURATED WITH EPOXY IS 2-3 TIMES AS STRONG AS STEEL. IT IS APPLIED LIKE WALLPAPER AND IS IMPERVIOUS TO MOISTURE AND OXYGEN TO PREVENT CORROSION.**

Repairs are very fast and economical. In many cases, repairs can be performed while the building remains in service.

The thin FRP sheets can be easily hidden from view or coated to maintain the original finish and architecture of the structure.



16 **Countries** 160 **Completed**



QUAKEWRAP SATURATING MACHINE USED IN WET LAYUP SYSTEM

QuakeWrap Wet Layup System is one of the most effective ways of repairing and strengthening all types of structural elements, from high pressure pipes to utility tunnels, from parking lot columns to historical architecture, and much more. Our team of experienced engineers can evaluate the existing condition of your structure and design the number of layers, type of fabric and fiber orientation, resulting in a truly engineered FRP repair solution.

QuakeWrap products are versatile and can be made to fit any size and shape. They create an encapsulating layer of FRP that results in an impervious barrier preventing oxygen ingress. This significantly reduces the corrosion rate in a wrapped structure and thus prolongs the service life of repaired elements.

## KEY ADVANTAGES

**VERSATILE** - Can be shaped to fit any size, while in the field (no need to pre-order for each size). Applied to beams, walls, slabs, tunnels and more.

**IMPERVIOUS** - Creates a barrier for moisture and oxygen, the two leading causes of corrosion.

**PROLONGS SERVICE LIFE** - Sealing your structure with FRP brings the corrosion process to a near-halt, prolonging the life of the repaired elements.

## UNIQUE FEATURES

- Patented products and solutions for almost any structural repair
- Over 20 years experience repairing and restoring degraded infrastructures
- Retrofitted repairs increase load capacity when traditional construction methods are unavailable
- Cures in 24 hours, even in water

## THE BENEFITS

- Two-to-three times stronger than steel
- Lightweight, corrosion proof
- NSF/ANSI Standard 61 certified for potable water
- Faster and more economical than conventional repair



NSF Certified



# INVISIBLE REPAIRS FOR HISTORIC PRESERVATION

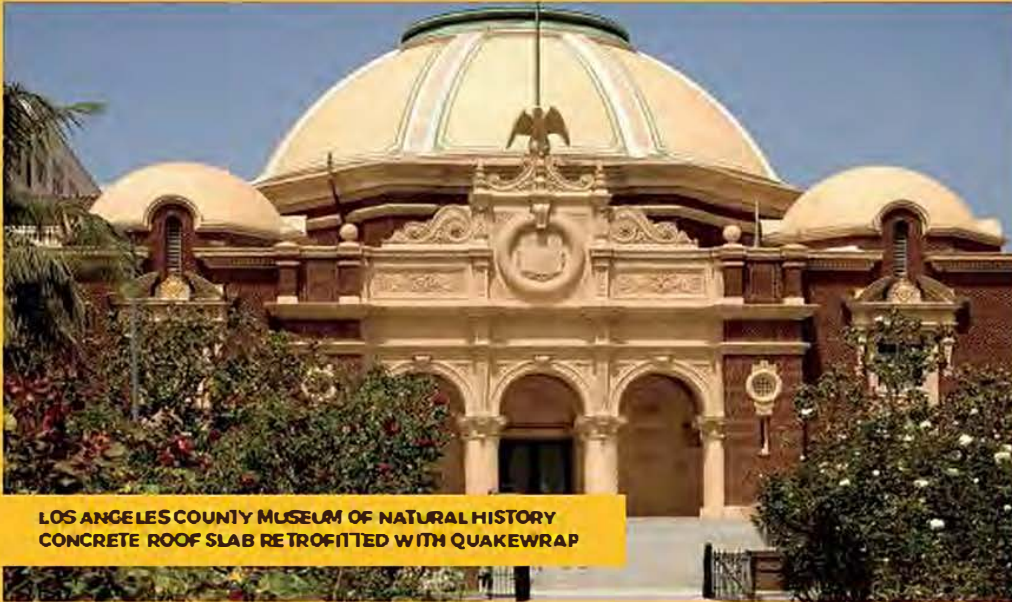
YOUR CREATIVE PROBLEM-SOLVING AND PROACTIVE MANAGEMENT COMPLEMENTED THE ADVANCED COMPOSITE MATERIALS WHICH QUAKEWRAP BROUGHT TO BEAR ON A CHALLENGING AND ULTIMATELY VERY SUCCESSFUL PROJECT.

– DON C. WEBB, PROJECT MANAGER

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY/CORDELL CORPORATION  
LOS ANGELES, CALIFORNIA

## KEY FEATURES OF QUAKEWRAP®

- Adds no weight to existing structure
- Reinforcing material is invisible and does not impact aesthetics
- Strengthens beams, columns, & floors



LOS ANGELES COUNTY MUSEUM OF NATURAL HISTORY  
CONCRETE ROOF SLAB RETROFITTED WITH QUAKEWRAP



HISTORIC FOX TUCSON THEATRE UNREINFORCED MASONRY  
WALLS CONVERTED TO SHEAR WALLS WITH QUAKEWRAP



VA MEDICAL CENTER, TUCSON, AZ



ALCATRAZ NATIONAL PARK, SAN FRANCISCO, MASONRY SMOKE STACK RETROFITTED WITH QUAKEWRAP



FAST & ECONOMICAL

# CORROSION REPAIR

QuakeWrap® FRP solutions form an impervious barrier that stops oxygen flow and moisture exposure to original construction, virtually halting the corrosion process in its tracks. Once QuakeWrap engineers determine the loss of reinforcement steel from corrosion, they will design a custom FRP solution that replaces the damage and returns the structure to its original strength. In many cases, the damaged structure can also be strengthened to levels above and beyond the original capacity.

## FEATURES AND ADVANTAGES



- Corrosion repair can be completed while the structure remains in service
- Provides strength for additional loads
- Greatly reduces future rate of corrosion
- Repair without enlarging cross section of member
- Restores original strength or increase to higher strength level
- Creates impervious layer to moisture and oxygen reducing future corrosion rate



**QUAKEWRAP WET LAYUP FRP SUCCESSFULLY REPAIRS MINING STRUCTURE IN NEW MEXICO**





QUAKEWRAP.COM

WORKERS REPAIRING THE INTERIOR WALL AND FLOOR OF A TANK  
IN A COPPER MINE, NACÓZARI, SONORA, MEXICO

SOLUTIONS FOR INTERNAL & EXTERNAL

# TANK REPAIR

Liquid storage tanks in water, sewer, chemical and oil industries often corrode and lose their capacity. Spraying tanks with polyurea or other coatings will only enhance their appearance, it will not address loss of capacity due to corrosion. QuakeWrap engineers can design an appropriate FRP system that will restore the original capacity of the tank, or increase its capacity to higher levels.

In some cases, repairs can be performed from outside, while the tank remains in service. When applied to the interior surface of the tank, the FRP liner serves as an impervious moisture barrier that will significantly reduce the corrosion rate of the tank.

## TANK RESTORATION FEATURES



- Applicable to all materials (steel, concrete, fiberglass, wood, etc.)
- Sealed engineering calculations and drawings by licensed PE in all 50 states
- Restore the original strength or increase to higher strength level
- Creates impervious layer to moisture and oxygen, reducing future corrosion rate
- Changing the number of FRP layers along the height of tank can reduce repair cost
- Repairs are fast with minimal downtime
- Connecting pipes and fittings can often remain in place during repair
- Virtually no change in the wall thickness of the tank





UNIVERSITY OF ARIZONA UTILITY TUNNEL REPAIR

ENGINEERED SOLUTIONS FOR REPAIR & STRENGTHENING OF

# VAULTS & UTILITY TUNNELS

Underground vaults used by gas and electric companies – as well as utility tunnels – are among the buried infrastructure that are rapidly approaching the end of their service life. The warm and damp climate is ideal for corrosion of these elements, many of which are directly under roads and pose a safety hazard to the traveling public. QuakeWrap engineers can provide unique strengthening solutions to bring these structures to safe conditions.

## QUAKEWRAP® REPAIR FEATURES



- Designs are sealed by a Licensed PE in all 50 states
- All repairs are trenchless, requiring zero excavation
- Zero or minimal disruption to street-level traffic
- Walls and ceiling can be strengthened above original limits
- Minimal increase in member size (typically ¼ inch or 5mm)
- Flexible FRP fabric makes installation in tight spaces possible
- Ideal for spot repair of only damaged areas
- FRP serves as moisture barrier to protect walls and ceilings against future corrosion

QUAKEWRAP®

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TESTING OF QUAKEWRAP CFRP SYSTEM FOR BLAST LOADING AT A GOVERNMENT LABORATORY

SOLUTIONS FOR BLAST RETROFIT AND

# FORCE PROTECTION

Increased threat of terrorism and defense against accidental explosion are two main reasons why many government, military and industrial facilities seek force protection against blast loads. QuakeWrap carbon FRP (CFRP) reinforcement has been tested in government laboratories and is a proven protection system against severe blast loads that is trusted by the U.S. Military, the United Nations and industrial clients.

## BLAST PROTECTION FEATURES



- Sealed engineering calculations by licensed PE in all U.S. states
- Designs for all loading conditions including Progressive Collapse
- Walls, floors and columns can be retrofitted with CFRP
- Minimal increase in member size (typically ½ inch or 13 mm)
- Repairs are fast and often completed in a few days
- Finished installation can be coated, making it hardly visible





ENGINEERED SOLUTIONS FOR REPAIR OF

# CHIMNEYS & SILOS

QuakeWrap offers repair and strengthening of large structures such as industrial chimneys, cooling towers, silos and smoke stacks. Chemical solutions and gases cause rapid deterioration and corrosion of reinforcing steel in these structures. QuakeWrap engineered solutions restore the loss of capacity in these facilities and can increase their strength beyond the original values. Additionally, the impervious QuakeWrap FRP provides long-term protection against future corrosion damage.

## QUAKEWRAP® REPAIR FEATURES +

- Repairs can be done internally or externally
- Sealed engineering drawings by licensed PE provided for all states
- Minimal increase in wall thickness (typically ¼ inch (5mm))
- Lightweight FRP requires no foundation enlargement and causes little impact on the dynamic forces acting on the structure
- Repairs are fast and often performed while the structure is in service
- Ideal for spot repair of only damaged areas
- FRP will serve as moisture-barrier to protect the tank against future corrosion
- Finished installation can be painted, making it hardly visible

FRP REINFORCEMENT PRIOR TO CUTTING A 12'X74' OPENING IN THE WALL OF INDUSTRIAL CHIMNEY IN MOBILE, AL

QUAKEWRAP®

QUAKEWRAP.COM



*"The structural upgrades that were planned for the McKinley Tower Building did not comply with and detracted from the historical significance of the building and the preservation thereto.*

*The QuakeWrap method gave us the ability to utilize technologically advanced techniques with high strength carbon fibers and high-tech adhesives to achieve life safety structural integrity."*

— **Marc A. Marlow, President**  
Marlow Development Corporation  
McKinley Towers Renovation Project  
Anchorage, Alaska

THE 14-STORY MCKINLEY TOWER WAS ADDED TO THE NATIONAL REGISTER OF HISTORIC PLACES FOLLOWING ITS SEISMIC UPGRADE IN 2004 (ANCHORAGE, AK).

THE ORIGINAL NOVEL FRP SOLUTION OFFERED FOR

# SEISMIC RETROFIT

QuakeWrap was founded in 1994 — following the Northridge Earthquake, the Southern California event that killed 60 and caused widespread damage — to address the seismic upgrade needs of buildings and bridges. Seismic upgrade and retrofit of structures with FRP products is a field that has been pioneered by QuakeWrap Founder and President, Prof. Mo Ehsani, since the late 1980s.

Today, QuakeWrap engineers continue to provide seismic design alternatives using FRP products. The number of layers needed, the orientation of fibers, anchorage, etc., for structural elements such as walls, columns, beams and floors can be designed. QuakeWrap FRP can also confine brick or masonry elements, keeping them from dismantling in an earthquake.

## SEISMIC STRENGTHENING FEATURES +

- Walls, floors, beams, columns and steel braces can be retrofitted with FRP
- Minimal increase in member size (typically ½ inch or 13 mm)
- Lightweight FRP requires no foundation enlargement and causes little impact on the dynamic forces acting on the structure
- Repairs are fast and economical
- Finished installation can be coated, making it hardly visible
- Proprietary PileMedic® offers additional time & cost savings
- Proprietary BraceWrap® converts ordinary steel brace to a Buckling Restrained Brace (BRB)





ARIZONA DOT'S FIRST USE OF FRP RELIED ON QUAKEWRAP® PRODUCTS TO STRENGTHEN THE GIRDERS OF THIS BRIDGE IN PHOENIX, AZ

FAST, ECONOMICAL AND SAFER ALTERNATIVE FOR

# BRIDGE REHABILITATION

Corrosion damage, widening, increased traffic weight, and damage caused by accidents are among the reasons why many bridge girders and piers in older bridges require repair and strengthening. Carbon FRP offers an ideal solution for enhancing the flexural, shear, and axial capacity of decks, girders, piers, and pier caps in bridges.

## BRIDGE REHABILITATION FEATURES



- Strengthens beams, piers, pier caps and deck
- Provides confinement for columns
- Encapsulation prevents moisture ingress and reduces corrosion rate
- Repairs do not change the aesthetics of the bridge
- Repairs can be performed with minimal disruption to traffic



QUAKEWRAP® CARBON FRP PRODUCTS HAVE BEEN USED TO REPAIR LARGE DIAMETER PIPES IN THE NUCLEAR POWER INDUSTRY SINCE THE LATE 1990S AND CONTINUE TO PROVIDE MAINTENANCE FREE SERVICE AFTER 20 YEARS OF SERVICE.

QUAKEWRAP.COM



GLASS FABRIC APPLIED AS DIELECTRIC BARRIER ON STEEL PIPE PRIOR TO INSTALLATION OF CARBON FRP



WET LAYUP SOLUTIONS FOR

# PIPE RESTORATION

QuakeWrap® provides a complete line of products and several patented technologies for pipeline renovation that can be found at [www.PipeMedic.com](http://www.PipeMedic.com). We offer solutions for a wide range of pipe diameter sizes from 4 inch (100mm) to over 180 inches (4.5 m).

Most of these techniques are performed as trenchless, requiring zero or minimal excavation. QuakeWrap engineers will determine the number and orientation of fibers in each layer of the FRP fabric and will provide sealed engineering drawings for such repairs.



Repair of joints in oval-shaped concrete culvert



Top coating of CFRP in a large-diameter PCCP

## PIPEMEDIC® FEATURES



- Sealed engineering calculations by licensed PE in all U.S. states
- Most repairs are trenchless, requiring zero or minimal excavation
- Can increase the pressure rating of the pipe significantly
- The smooth FRP lining will improve flow capacity of the pipe
- Repairs can be done internally or externally



90-year old riveted steel penstock with challenging geometry repaired with CFRP



External repair of oil pipe submerged in water using QuakeWrap

## PIPEMEDIC® BENEFITS



- Three times stronger than steel
- Repair pipe without replacing
- Fits virtually all pipe sizes and shapes
- Trenchless technology
- Non-corrosive to H<sub>2</sub>S gas
- NSF-61 Certified



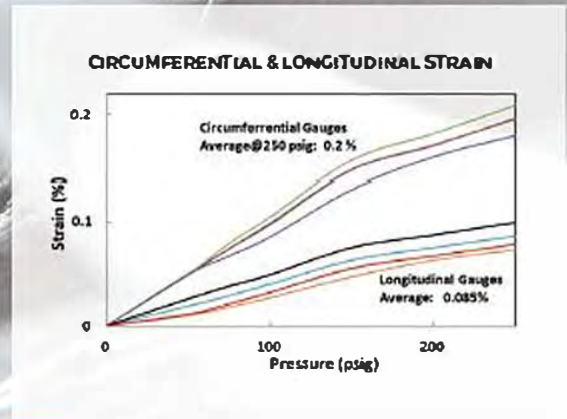
NSF Certified



PIPEMEDIC® IS THE ONLY FRP PRODUCT THAT HAS BEEN TESTED BY THE GAS TECHNOLOGY INSTITUTE AND HAS BEEN APPROVED FOR REPAIR OF PRESSURIZED NATURAL GAS PIPELINES. THE THIN LAMINATES CAN BE REMOTELY INSTALLED, ALLOWING THE PIPE TO RESIST INTERNAL PRESSURES IN EXCESS OF 250 PSI.

# SuperLaminate™

A PACKER IS USED TO DELIVER THE EPOXY-COATED SUPERLAMINATE™ TO THE POINT OF REPAIR INSIDE THE PIPE



## AWARD-WINNING TECHNOLOGY

PipeMedic® was awarded the Trenchless Technology's 2011 Project of the Year Award for the repair of a high-pressure cast iron gas main over 100 years old.



# 50<sup>+</sup> STATES

We provide sealed engineering calculations by our professional engineers in all 50 U.S. States and Puerto Rico.



## ENLARGED VIEW OF THE MICROLAYERS IN SUPERLAMINATE™

Various layers of fabric can be incorporated into a single sheet of SuperLaminate.

SuperLaminates are produced with the highest quality control under ISO 9000 certification.





# SUPERLAMINATE™: OUR INDUSTRIAL “STENT” FOR PRESSURE PIPE REPAIR

SuperLaminate is an innovative pre-manufactured laminate that contains multiple layers of carbon or glass fabric and can be used for internal repair of pressure pipes. It is manufactured under intense heat and pressure into 4' wide x 150' long (1.2 m x 45 m) rolls of extremely strong reinforcement for pipeline rehabilitation.

SuperLaminate is also very thin (<0.025 inch or 0.6 mm) providing maximum flow with minimal reduction in the host pipe's diameter. These are typically installed using a “packer” device and are suitable for diameters 6” (150 mm) and larger.



SuperLaminate™ was installed to bridge a gap



...before the repaired pipe was capped and tested under internal fluid pressure

## SUPERLAMINATE™ FEATURES +

- High pressure pipelines (500 psi [35 bar] and higher)
- Small-diameter pipe rehabilitation
- Bridging pipeline gaps or cracks
- Joints and spot repair
- Increase existing pipe's pressure rating
- Installed like a “STENT” using a packer or carrier device

## SUPERLAMINATE™ BENEFITS +

- High tensile strength
- Higher level of quality control compared to wet layup
- Ideal for small-diameter non-man-entry repairs
- Shorter downtime during installation
- Non-corrosive material
- Excellent resistance to H<sub>2</sub>S gas

## TESTED AND APPROVED BY GAS TECHNOLOGY INSTITUTE

SuperLaminates™ have been independently tested by the Gas Technology Institute (GTI) according to ASTM F-2207 standards. Three specimens with diameters of 6, 12 and 16 inches (150, 300, and 400 mm) were lined with SuperLaminates™ to bridge a 24 inch (600 mm) missing part or gap in the pipe, simulating an abandoned T or drip pot. The pipes were capped and subjected to internal pressures, exceeding 4 times the Maximum Allowable Operating Pressure (MAOP). As indicated by the strain measurements, the 16 inch (400 mm) pipe could resist a pressure of 900 psi (62 bar).

SuperLaminates are extensively used by various gas utility companies to line older gas mains. The first application of this product was to repair a 16 inch (400 mm) steel gas main for Public Service Electric & Gas Co. (PSE&G) in New Jersey. That project received the coveted Trenchless Technology Project of the Year Award.





SLIP-LINING REPAIRS WITH

# CUSTOMIZED PIPES

StifPipe® is an award-winning FRP composite pipe technology that uses a lightweight core with carbon or glass fabric reinforcement to create an extremely lightweight pipe capable of resisting heavy external loads and internal pressure.

StifPipe can be installed as a wet layup directly inside or outside the host pipe or can be pre-manufactured for installation by traditional slip-lining methods for repair of both pressure pipes and gravity flow pipes.



Insertion of StifPipe® into a Pressure Pipe Manhole at a Puerto Rico Power Plant

## STIFPIPE® FEATURES



- Pressure pipe rehabilitation
- Sanitary manholes
- Slip-lining gravity sewers and culverts
- Strengthening existing pipelines
- Joint or spot repairs
- Non-cylindrical pipe & culvert repair



StifPipe® being tested under parallel plate loading (ASTM D2412)

## STIFPIPE® BENEFITS



- A fully structural pipe
- Any shape and diameter 6" (150 mm) and larger
- Faster installation time
- Non-corroding
- NSF-61 Certified



NSF Certified



### 1 Patented Design

Our unique construction starts with an inner layer of fabric, surrounded by our patented lightweight core. Finished by an outer layer of fabric.



### 2 Custom Shapes

StifPipe® can be manufactured in any shape and size for slip-lining repair of non-cylindrical pipes and culverts or as an independent fully structural liner.





LIGHTWEIGHT STIFPIPE® IS EASILY PUSHED INTO A CULVERT BY JUST TWO WORKERS AT THIS PROJECT IN AUSTRALIA



INFINITPIPE® CAN BE USED TO CONSTRUCT NEW PIPELINES OF ANY LENGTH AND WITHOUT JOINTS TO DELIVER WATER AND OTHER UTILITIES IN DEVELOPING NATIONS.



INFINITPIPE® IS AN ON-SITE MANUFACTURED CONTINUOUS PIPE (WITHOUT JOINTS) FOR DELIVERY OF WATER AND OTHER FLUIDS WORLDWIDE.



**INFINITPIPE RECEIVED THE 2016 ASCE AWARD**

This technology has received the 2016 Innovation Award from the American Society of Civil Engineers (ASCE) as the world's first green and sustainable pipe.



**NATIONAL SCIENCE FOUNDATION**

The development of InfinitPipe® is supported through a Small Business Innovation Research (SBIR) Grant funded by the United States National Science Foundation.



# GAME-CHANGING TECHNOLOGY FOR MANUFACTURING PIPE ON-SITE

InfiniPipe® is a revolutionary technology that allows construction of an endless Fiber Reinforced Polymer (FRP) pipe on-site using the sandwich construction technique. The pipe is made with various layers of resin-saturated carbon or glass fabric that are wrapped around a mandrel and heat-cured. A spacer sheet is used to provide rigidity while reducing the pipe weight to as little as 10% of conventional pipes. The technology has received the 2016 Innovation Award from the American Society of Civil Engineers (ASCE) as the world's first green and sustainable pipe.

## INFINITPIPE® FEATURES

- New pipeline construction in any environment including developing nations
- Slip-lining pipelines and culverts
- Repair of subsea pipelines
- Water and sewer pipes
- Oil and gas pipelines
- Conduit for housing cables and other utilities



## INFINITPIPE® BENEFITS

- Built on-site to any length
- Fewer joints and less pipeline leakage
- Designed for specific project conditions and requirements
- Non-metallic, does not corrode
- Simple to install with direct trench placement or stringing along the right-of-way
- Ease of handling; InfiniPipe weighs 10% of conventional pipes
- Sustainable green technology
- Can be made in diameters of 6 inches (150 mm) and larger
- Eliminates trucking of pipe segments from factory to jobsite



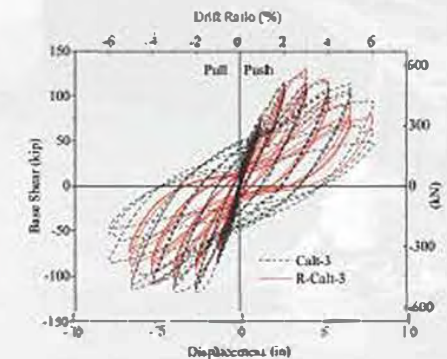
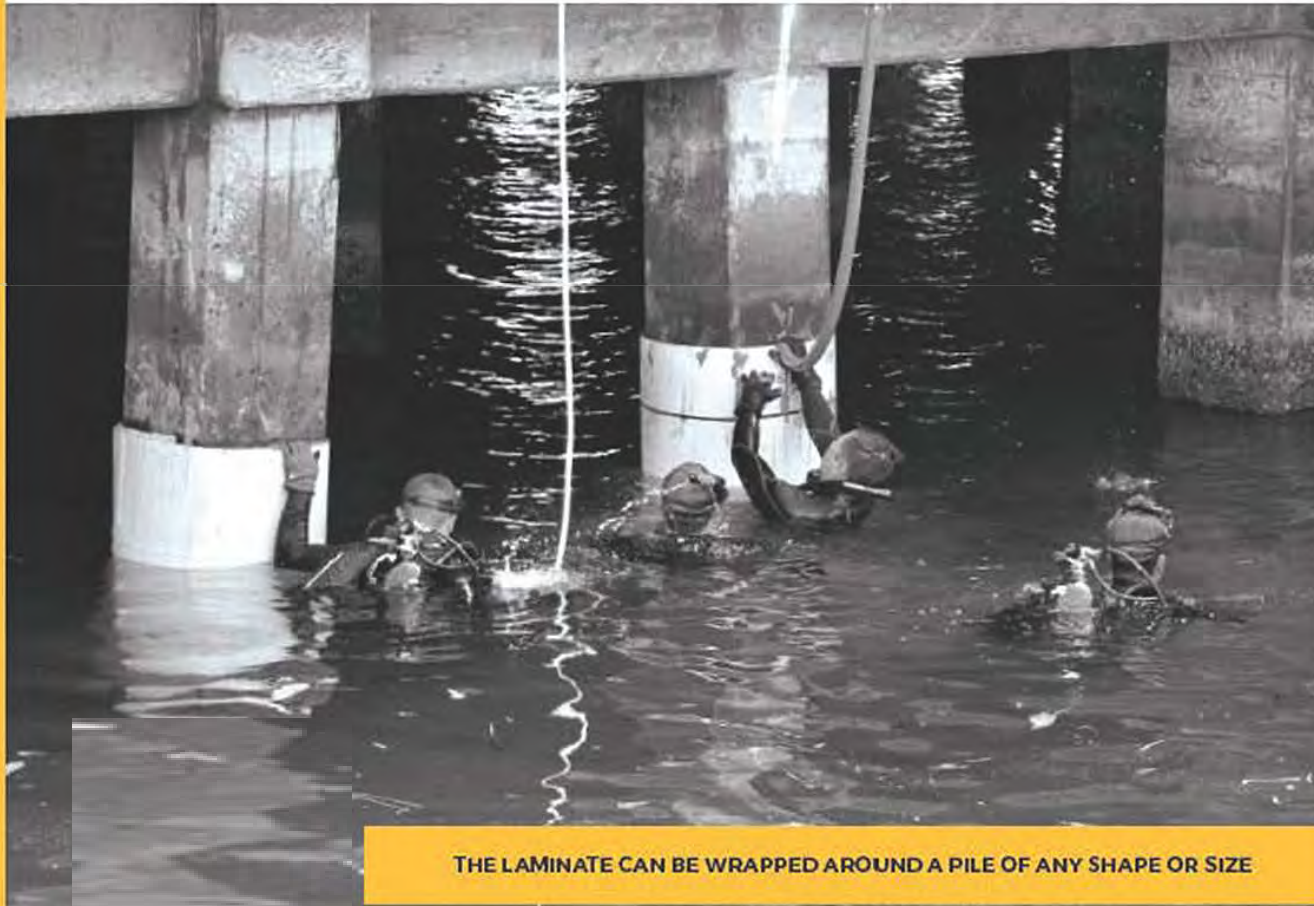
SMALLER DIAMETER PIPES CAN BE EASILY MADE FOR USE IN AGRICULTURAL PROJECTS OR IN REMOTE SITES AND DEVELOPING NATIONS



# ENGINEERED SOLUTIONS FOR STRENGTHENING AND PILE RESTORATION



PileMedic® is a patented technology developed following 25 years of research and development (U.S. Patents #8,650,831 and #9,376,782). PileMedic is a truly structural strengthening system for piles. The laminates contain fibers in two directions (*longitudinal and transverse*). When wrapped around a pile or column, the jacket creates a seamless shell around the column with tremendous confining pressure on the column. It is well known that the axial capacity of a column is proportional to the degree of confinement. So, the more layers of PileMedic are wrapped around the pile, the higher the axial capacity of the pile. The annular space between the jacket and the pile is filled with grout or resin and optional FRP or steel reinforcing bars.



Testing by CalTrans and the National Science Foundation demonstrated structural and logistic improvements offered by PileMedic® Jackets. Including repair and fast return to service for bridges and piers that may be severely damaged by earthquakes.



# THE POWERFUL BENEFITS OF PILEMEDIC®

## THE STRONGEST PILE JACKET ON THE MARKET

Tensile strengths of PileMedic laminates range between 62,000 to 155,000 psi. These strengths are anywhere from 3 to 10 times higher than other pile jacket systems used to date.

## EASE OF INSTALLATION

PileMedic jackets require little training and equipment for installation. The fact that the jackets can be wrapped around the pile above water and then pushed into water results in significantly less need for divers during the installation.

## CONFINEMENT PRESSURE

The lack of a vertical seam means that the PileMedic jacket has the same tensile strength 360 degrees around the pile. This high confining pressure significantly increases the strength of the pile for the same enlargement size. All other pile jackets have a bolted or glued seam which becomes the weak point under loading.

## ONE SIZE FITS ALL

There is no need to order the jackets for the right shape and size in advance. A roll of laminate can be cut in the field to fit any shape or size pile. The thin, 4-foot-wide laminate can be cut in the field to wrap any shape or size of pile.

## SEAMLESS SHELL

PileMedic jackets are coated with a special epoxy paste and wrapped two or more times around the pile to create a multi-ply impervious shell. This process results in a seamless shell around the pile that will keep all moisture and oxygen out. Along the height of the pile, the jacket segments are overlapped a minimum of 4 inches and epoxied together for a watertight joint. Since water and oxygen are the primary source of deterioration in timber piles and corrosion in steel piles, the seamless construction of PileMedic brings the corrosion rate to a near halt.

## AXIAL & FLEXURAL STRENGTH

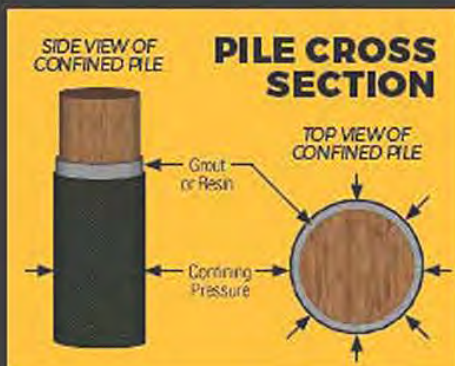
PileMedic laminates are reinforcing sheets, like a steel plate that can be designed to provide any level of axial, shear or flexural strength for the pile.

## QUICK REPAIR

Conventional jackets must be ordered in advance, manufactured to size and shipped to the job site; this causes considerable delay in repair of the damaged pile. The problem is even more severe following an event such as earthquake or explosion where the size and shape of the piles that get damaged are not known in advance. In such emergency repairs, PileMedic is the only product where a single flat sheet can be used immediately to repair piles of any shape or size. This is one of the reasons why the U.S. Army Corps of Engineers Search and Rescue Program has listed PileMedic in its Field Operations Guide as the best and fastest solution to restore the strength of a damaged column or pile.

## FULL RESTORATION OF PILE CAPACITY

Within 24 hours of completed installation, the full capacity of the pile is reached or surpassed. This has been demonstrated in a study conducted by CalTrans and NSF to restore the strength of a concrete bridge pier that was severely damaged in an earthquake.



## CONFINEMENT WITH PILEMEDIC® = 360° OF CONFINING PRESSURE!

PileMedic is the only pile jacket system that provides an all-around (360°) confining pressure. This significantly increases the strength of the pile. The strength of a typical 4000 psi concrete pile will be raised to over 5000 psi once it is wrapped with PileMedic.


UP TO  
**10x**  
STRONGER  
THAN OTHER  
JACKETS

Our product is 3-10 times stronger than all other pile jackets on the market.

## PILEMEDIC® TESTING AGENCIES







THE 45-FT. TALL TIMBER PILES IN THIS OIL LOADING TERMINAL ON THE MISSISSIPPI RIVER WERE INDIVIDUALLY ENCASED FOR REPAIR. NEAR THE TOP, EACH GROUP OF THREE PILES WERE WRAPPED TOGETHER FOR STRENGTHENING. ST. LOUIS, MO

SOLVE CHALLENGING REPAIRS OF

# TIMBER PILES & COLUMNS

Timber piles are often damaged by marine borers or other creatures that create a cavity inside the pile. Water flow and the dry-wet cycles also cause deterioration of piles in marine environments. Tests by the Nebraska Department of Roads and Tucson Electric Power have demonstrated the effectiveness of PileMedic in restoring the strength of damaged piles and utility poles. Once the pile is encased in PileMedic, a low viscosity resin is injected that will penetrate all voids and cracks in the wood, resulting in a pile that is significantly stronger than a new undamaged pile.

## PILEMEDIC® APPLICATION FEATURES +

- Increases flexural and axial capacity of the pile
- Ideal remote access sites, e.g. mountaintops, washes, etc.
- Repairs can be performed above surface or underwater
- Minimal increase in column dimensions and footprint
- No disruption of service





PILEMEDIC'S FIRST APPLICATION ON REPAIR OF STEEL H PILING WAS IN SEPT 2010 AT I-70/I-270 OVERPASSES NEAR ST. LOUIS, MO

FAST REPAIR/STRENGTHENING OF CORRODED

# BRIDGE PILINGS

Deicing chemicals, acid rain, and river crossings provide ideal conditions for corrosion of bridge piling. Extensive tests by Texas DOT have demonstrated that PileMedic is an ideal repair technique to restore the strength of corroded steel H piles. Even sections with as high as 80% cross section loss were restored to their original undamaged capacity. Repairs can be performed on full or partial height of the piling.

## PILEMEDIC® REPAIR FEATURES



- Bridge remains open to traffic during repair
- Suitable for steel, concrete and timber pilings
- Stops corrosion by eliminating oxygen supply
- Easy to install by DOT maintenance crews



H-piling with major loss of web section due to corrosion



Section after strengthening with PileMedic®



REPAIR AND STRENGTHENING SOLUTIONS FOR

# TELECOMMUNICATION TOWERS & LIGHT POLES



PILEMEDIC® APPLIED TO STRENGTHEN A TELECOMMUNICATIONS TOWER IN SOUTHERN CALIFORNIA

As consumers rely more on wireless communication, the demand for transfer of larger files calls for additional equipment to be installed. Most existing towers do not have enough reserve capacity to support such equipment. Our patented technology using PileMedic allows for fast strengthening of these towers with little increase in the footprint of the structure.

Similarly, steel light poles collect rain and moisture inside that leads to corrosion at the base and collapse of these structures. The base of these poles can be strengthened while they remain in service.

## PILEMEDIC® STRENGTHENING FEATURES +

- Minimal increase in diameter of the tower
- Repairs can be performed in congested areas with limited access
- Repairs are fast and always performed while the tower is in service
- Finished installation can be painted, making it hardly visible







RESTORE THE FULL CAPACITY OF

# SUBMERGED TIMBER PILES

Recent successes in cleaning the waterways have led to the return of marine borers and shipworms that eat away the wood in timber piles. The environmental dry-wet cycles also result in deterioration and loss of cross section in timber piles. PileMedic offers a variety of engineered solutions for repair and strengthening of these piles that include addition of reinforcing bars and filling the annular space with grout or resin.

## PILEMEDIC® REPAIR FEATURES



- Sealed engineering drawings for all 50 states
- Restore the full capacity of deteriorated piles
- Strengthen piles to carry loads beyond original design
- Underwater curing resins eliminate coffer dams

OVER 500 TIMBER PILES WERE REPAIRED AND STRENGTHENED IN THIS PORT IN CHESAPEAKE, VA



Spacers and FRP rebar attached to the pile



PileMedic® jacket installed prior to placement of grout



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## U.S. FEDERAL GOVERNMENT TESTING & IMPLEMENTATION

The U.S. Army Corp of Engineers & FEMA's Urban Search and Rescue Program singled out PileMedic® for large scale testing and implementation. PileMedic conforms to military engineering capabilities and is now the go to product for fast repair of columns and piles.



FEMA



US Army Corps  
of Engineers.

TEST OF PILEMEDIC® AT THE U.S. ARMY CORPS OF ENGINEERS  
LABORATORY IN VICKSBURG, MS



# QUAKEWRAP® GETS RECOGNIZED AS **INNOVATORS**

**Innovation Award, American Society of Civil Engineers, 2016**

**Environmental Excellence Award of Merit, Arizona Forward, 2015**

**Success in Exporting, U.S. Congressional Record, 2014**

**Technology Leader of the Year, Arizona Technology Council, 2014**

**Excellence in Global Business, AZ District Export Council, 2014**

**Trenchless Technology Project of the Year Award, 2011**

**Award of Merit in Structural Engineering, Structural Engineers Association of Arizona (SEAOA), 2010**

**Award of Merit, International Concrete Repair Institute (ICRI), 2010**

**Southern Arizona Smart Inspiring Enterprise (SASIE) Awards Finalist, 2009**

**Trenchless Technology Project of the Year Award, (Honorable Mention), 2009**

**Outstanding Concrete Repair Project, PNM PIPE/International Concrete Repair Institute (ICRI), 2008**

**Award of Merit, International Concrete Repair Institute (ICRI), 2007**

**Award for Excellence in Structural Engineering (Retrofit), Structural Engineers Association of Arizona, 2006**

**Award of Excellence, International Concrete Repair Institute (ICRI), 2006**

**Award of Excellence in Structural Engineering (Retrofit), Structural Engineers Association of Arizona, 2004**



**6000<sup>+</sup>  
HOURS OF  
R&D PER YEAR**

The combination of engineers and laboratory space dedicated solely to research and development places us in an unparalleled position in the industry.



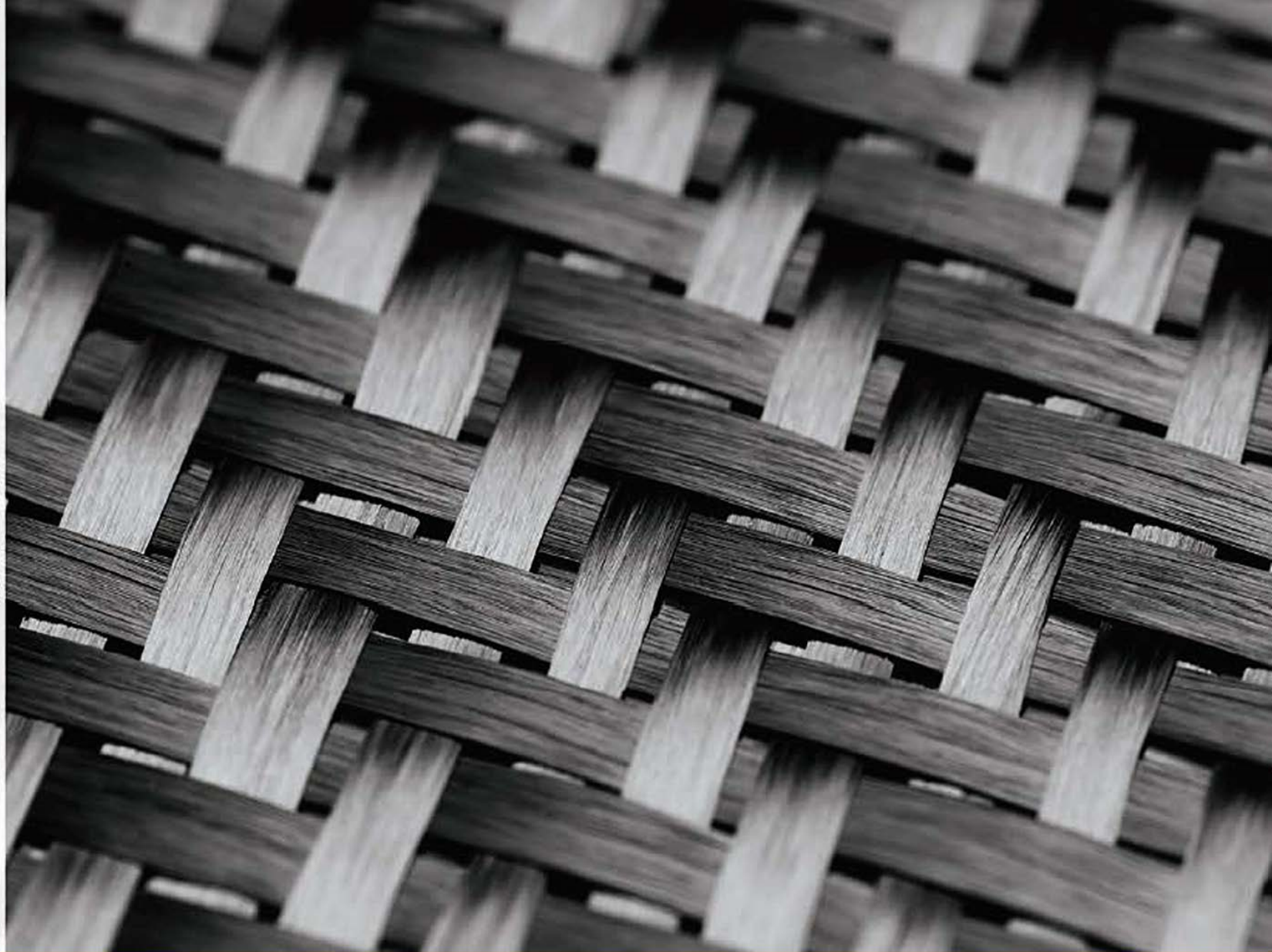
## **AWARD WINNING PROJECT**

Award of Merit from International Concrete Repair Institute (ICRI). At the El Encanto Hydroelectric Power Plant in Costa Rica, over 5,700 feet (1,700 m) of an 84-inch (2100 mm) diameter reinforced concrete penstock was repaired in just 15 days using QuakeWrap systems. Repairs were completed with access only through four existing 2x2 foot (600 x 600 mm) ports!

## **THE INFRASTRUCTURE INNOVATORS™**

QuakeWrap, Inc. is the global leader in development of proprietary technologies for the construction industry. From products for repair of submerged piles, columns, seawalls and pipes, to construction of new pipes and other accessories, we continue to introduce innovative solutions to the market. Our creativity is evident by filing an average of 5 patents per year! While many have copied the technology we introduced in the late 1980s, our more recent innovations are what confirms our standing as the world's premier innovators in infrastructure renewal.





VISIT OUR YOUTUBE CHANNEL  
TO LEARN MORE ABOUT OUR  
PRODUCTS AND SERVICES  
[www.YouTube.com/QuakeWrapInc](http://www.YouTube.com/QuakeWrapInc)



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Brisbane, Australia  
Iquique, Chile  
Tangerang, Indonesia  
San Juan, Puerto Rico

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