

**Repair of Earthquake-Damaged
Concrete Bridge Piers with
PileMedic™**

Mo Ehsani, Ph.D., P.E., S.E.
Professor Emeritus of Civil Engineering, University of Arizona
President, PileMedic, LLC.

February 2014





PileMedic, LLC. | QuakeWrap, LLC.

2055 E. 17th Street
Tucson, AZ 85719
(520) 791-7000

QuakeWrap.com | PileMedic.com
office@quakewrap.com



This video demonstrates how the patented PileMedic technology developed by Professor Mo Ehsani can be used to quickly repair and strengthen concrete bridge piers that may get damaged in an earthquake.



**U.S. National Science
Foundation**

**California Department
of Transportation
(Caltrans)**

The project was initiated by the U.S. National Science Foundation and the California Department of Transportation (Caltrans).



**University
of Nevada,
Reno**

**Missouri
Science &
Technology
University**

**University
of Houston**

Researchers from several universities including the University of Nevada at Reno, Missouri Science & Technology University and University of Houston participated in this study.



The 24-inch by 36-inch column specimen was first subjected to cyclic earthquake motion such that three longitudinal reinforcing steel bars on each face of the column were fractured.



The objective of the study was to see if the strength of the column could be re-stored without replacing the fractured steel bars. Another objective was to identify a quick repair method that would allow the bridge to return to service in a short time.



Using a jackhammer, a 10-inch deep narrow trench was cut around the column in the foundation



A torch was used to cut the longitudinal steel bars in the foundation.



The spalled concrete was repaired to bring the column back to its original size and shape. While the researchers chose this approach, our recommendation is to wrap the PileMedic™ laminates shown on the next page around the column as formwork (without any epoxy between the layers) and fill it with grout; the laminate can be easily formed to the same shape and size of the pier. Then the laminate can be removed and used as the reinforcing material for the pier.



On each face of the column, 4 QuakeWrap® GU50C strips each 4 inches wide by 4.5 feet tall were attached above the foundation level.



QuakeBond™ J201TC Tack Coat was mixed and applied to the surface of PileMedic™ PLC100.60 carbon laminate



The PileMedic™ laminate was tightly wrapped around the column, creating a 4-ft tall 7-ply thick jacket with a total thickness of approximately 0.3 inches.



The jacket can be temporarily held together using shrink wrap or ratchet straps.



The PileMedic™ jacket was then pushed down about 10-inches into the cut trench.



QuakeBond™ 320LV Low Viscosity resin was mixed and blended with aggregate and placed to fill the trench



Using the previously positioned plastic tubes, QuakeBond™ 320LV Low Viscosity resin was mixed and pumped into the annular space.

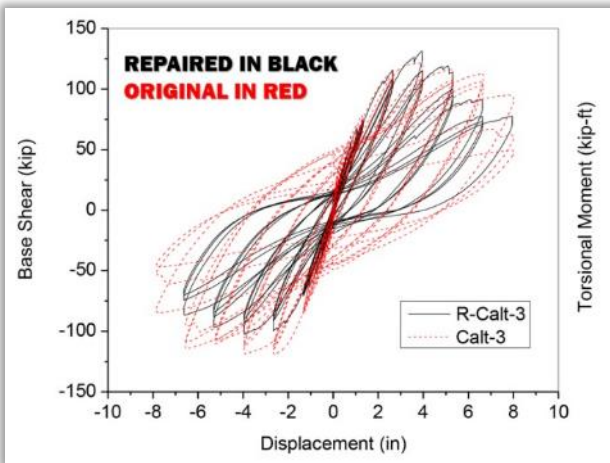
In an actual field application, this repair can be completed in less than 24 hours!



This bonded the carbon strips, the concrete column and the PileMedic™ jacket together so they could resist the applied loads simultaneously.



The repaired column was subjected to reversed cyclic loading.



The load-deformation hysteretic response of the original column (shown in red) can be compared with the repaired and strengthened column (shown in black color).

The research team leader, Professor Saiidi's comments to the Caltrans engineer are quoted below:

“..... The most significant finding of the test was that the PileMedic system in combination with carbon FRP strips effectively restored the strength of the column and most of its ductility capacity.

The jacket system failed at the column-footing interface indicating that the embedment length of 10 inch into the footing was sufficient.

This is certainly an attractive alternative to repair columns with fractured bars. It could save time and money because the fractured longitudinal bars were not replaced”

Please visit our [YouTube Channel](#) for more videos of our products.

© PileMedic, LLC | QuakeWrap, Inc, 2014. All rights reserved