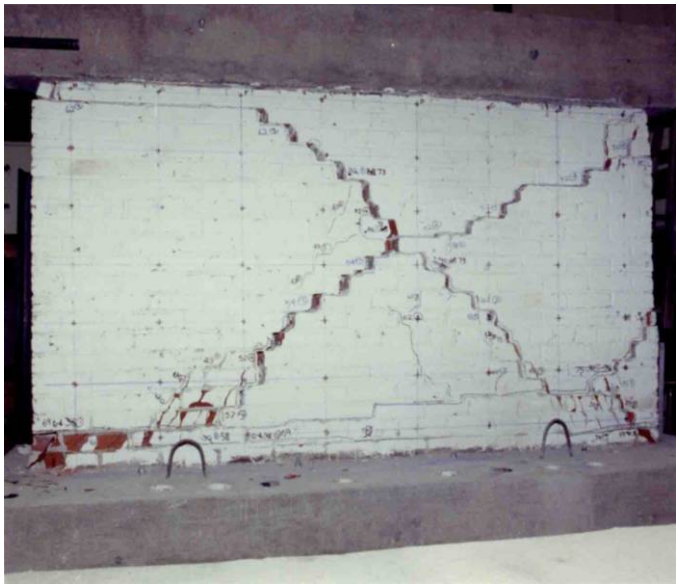
PROJECT

Repair and Strengthening of Unreinforced Masonry
Laboratory Research

CLIENT

National Science Foundation



The project investigated the effect of different repair and strengthening techniques on masonry seismic behavior.

PROJECT DESCRIPTION

Atkinson-Noland & Associates was a principal investigator on a three-year project evaluating different techniques for repair and retrofit of unreinforced masonry structures. Old masonry construction was simulated in the laboratory, and the test specimens were strengthened by installation of internal reinforcement or repaired by grout injection. The effect of the techniques on structural behavior was investigated by load testing with particular emphasis on masonry seismic response. Analytical techniques developed during the project allow evaluation of potential repair or strengthening schemes for unreinforced masonry. This project was a joint effort with the Politecnico di Milano, Milan, Italy, ZMRK of Llubjlana, Slovenia, the University of Colorado, and Atkinson-Noland & Associates.

SERVICES PROVIDED BY ATKINSON-NOLAND

- Review of techniques used for masonry repair and strengthening.
- Developed suitable cement-based grouts for injection into fine cracks (thickness of 0.007 inch) and larger voids. Thirty-five formulations were evaluated using standardized tests for flow properties, injectability, mix stability, and bond strength.
- Tested a series of masonry piers in compression, repaired resultant damage by grout injection, and re-tested to investigate effectiveness of the injection technique on restoring masonry compressive capacity.
- Used nondestructive techniques, including mechanical pulse velocity and acoustic tomography, to quantify the effectiveness of grout injection.
- Repaired a series of unreinforced masonry shear walls by injection grouting and installation of internal reinforcement following simulated seismic damage. The repaired and strengthened walls were re-tested to quantify the effects of the techniques on seismic resistance.

Atkinson-Noland & Associates
Consulting Engineers
www.ana-usa.com

2619 Spruce Street
Boulder, CO 80302
303.444.3620

32 Old Slip, 10th Floor
New York, NY 10005
917.647.9530