

ELT & Associates

251 Lafayette Circle, Suite 230
Lafayette, CA 94549
Phone: (510) 295-4299
Email: rtolles@44adobe.com

Gail Sevrens – Environmental Coordinator
California Department of Parks and Recreation
Northern Service Center
One Capitol Mall, Suite 500
Sacramento, California 95814

Dear Ms. Sevrens,

Re: Rancho San Andres Castro Adobe, MND (Mitigated Negative Declaration)

As per our phone conversations, this letter is my public comment on my current concerns regarding the proposed seismic retrofitting of the Rancho San Andres Castro Adobe. The drawings I have reviewed have a revision date of 9-24-04. A copy of Sheet 2.1 is attached with a red rectangle around the detail note concerning the center cores.

Synopsis

As co-author of the Historic Structures Report (HSR) for this building, it is my opinion that the current seismic retrofit is not consistent with those recommendations. The dual goals of a seismic retrofit for designated historic structures are (1) to provide for life-safety and (2) to have a minimum effective on the significant historic fabric of the building. The adobe material itself is one of the most important elements of an historic adobe.

The current design includes 6” diameter center cores at approximately 4 feet on center with a total of 42 center cores. The preliminary design submitted as part of the HSR included 2” diameter center cores with a total of approximately 22 cores. The amount of adobe material to be removed in the proposed plan is more than 1,500 percent greater than the amount of material proposed for removal in the HSR.

The proposed design would be more damaging to the historic fabric of this building than any retrofit design for an historic adobe building, of which I have knowledge, in the last two or three decades in California. The seismic retrofit design of the Cooper-Molera Adobe was performed in the 1970’s and is the classic example with regards to preservation of what NOT to do to the historic fabric of a building. This design has greater impact on the historic adobe walls of any retrofit design with which I am familiar since the retrofit of the Cooper-Molera Adobe.

Technical Background of the Author

I am one of the co-authors of the HSR written on the Rancho San Andres Castro Adobe dated June 30, 2003. I have retrofitted many adobes in California including the Las Flores Adobe at Camp Pendleton (National Park Service) and the Castro Breen Adobe (California Department of Parks and Recreation).

I was the principal investigator for the Getty Seismic Adobe Project (GSAP), a multi-year, multi-disciplinary research project supported by the Getty Conservation Institute. The research project included background research, field studies and an extensive study of the dynamic performance of small-scale and large-scale adobe models. The goal of the research was to develop innovative seismic retrofitting techniques and to evaluate existing retrofitting techniques that were both effective in terms of life-safety and had a minimal effect on the historic fabric. The GSAP research was conducted throughout the 1990's.

I received my doctorate in Structural Engineering from Stanford University in 1989. My subject of my thesis was the study of the dynamic performance of small-scale models of adobe houses and the effectiveness of simple, cost-effective seismic retrofitting measures.

I am currently a practicing Professional Engineer in California. A large percentage of my design practice is devoted to the design and retrofit of historic adobe buildings. A copy of my CV is attached.

Technical Background

The most efficient means of improving the seismic performance of adobe buildings is to eliminate the principal modes of failure and to add tensile capacity selected areas. The type of level of intervention is significantly affected by the thickness of the walls. The out-of-plane behavior of a thick adobe wall is much better during large earthquakes than thinner walls. The walls of the Castro Adobe are very thick.

The schematic design presented in the HSR included a roof diaphragm system and small-diameter center core rods in the exterior walls of the two-story adobe building. The anchorage provided at the second floor level would only be required for preventing the floor-joists from pulling away from the walls. The interior walls on the first floor will have little impact on the overall performance of the building since these walls do not extend to the second floor.

In most adobe buildings, there are a number of options for the retrofit that will satisfy the requirements of the State Historic Building Code (SHBC). The choices typically included anchorage at the roof and floor levels and perhaps some strengthening of a roof or floor diaphragm. The strength-based analysis methods that are typical of thin-walled buildings ($h:t > 8$) are not applicable to thick-walled buildings such as the Castro Adobe.

The use of small-diameter center core rods is usually not required for the fundamental stability of a thick-walled adobe building. Nevertheless, center cores may be a very good idea for strengthening gabled-end walls, which are very susceptible to collapse during larger seismic events, or for buildings that have previous problems such as the Castro Adobe.

Based on the GSAP research of the 1990's, the use of small-diameter center core rods was the best way to stabilize a building and to reduce damage during very large seismic events. But, they are not usually essential for satisfying the minimum requirements of the SHBC.

Center cores are NOT reversible. Therefore, the size of the center core rods should be kept to a minimum size as required for the installation of the steel rods and grout. The GSAP testing showed successful performance for both grouted steel rods and for steel rods that were drilled directly into the adobe with no additional grout. Based on the successful performance of the GSAP tests, I can see no benefit to making holes a larger diameter. Quite possibly, the use of large-diameter center cores may actually result in the weakening of the adobe walls.

The seismic retrofit of at least three jobs have been completed by using both epoxy and cementitious grouts placing 3/4" rods in 2-inch diameter holes. I recommend the use of non-shrink, non-metallic cementitious grout at this time because grouts are more compatible with masonry construction and grouts are more viscous than epoxy and less likely to disappear into holes in the masonry. Center core rods were used successfully for the seismic retrofit of the gable-end walls at the De la Torre Adobe in Monterey and the Castro-Breen Adobe in San Juan Bautista. Both retrofits were designed by the author and the latter building is owned by the Department of Parks and Recreation.

If you have any further questions, please contact me.

Sincerely,

E. Leroy Tolles





CENTRAL SERVICE CENTER
21 Lower Ragsdale Drive
Monterey, CA 93940

DESIGNED UMG
DRAWN GDP
CHECKED UMG

REVISIONS	
DATE	
9-24-04	

CONSULTANT:
WJE ARCHITECTS
INCORPORATED
2222 Foothill Drive, Suite 200
Livermore, CA 94550
925.271.1100

Santa Cruz District, 184 Old Adobe Road, Watsonville, CA 94076
Rancho San Andres Castro Adobe
1st Floor Plan
Rehabilitation

DRAWING NO.
29488.004

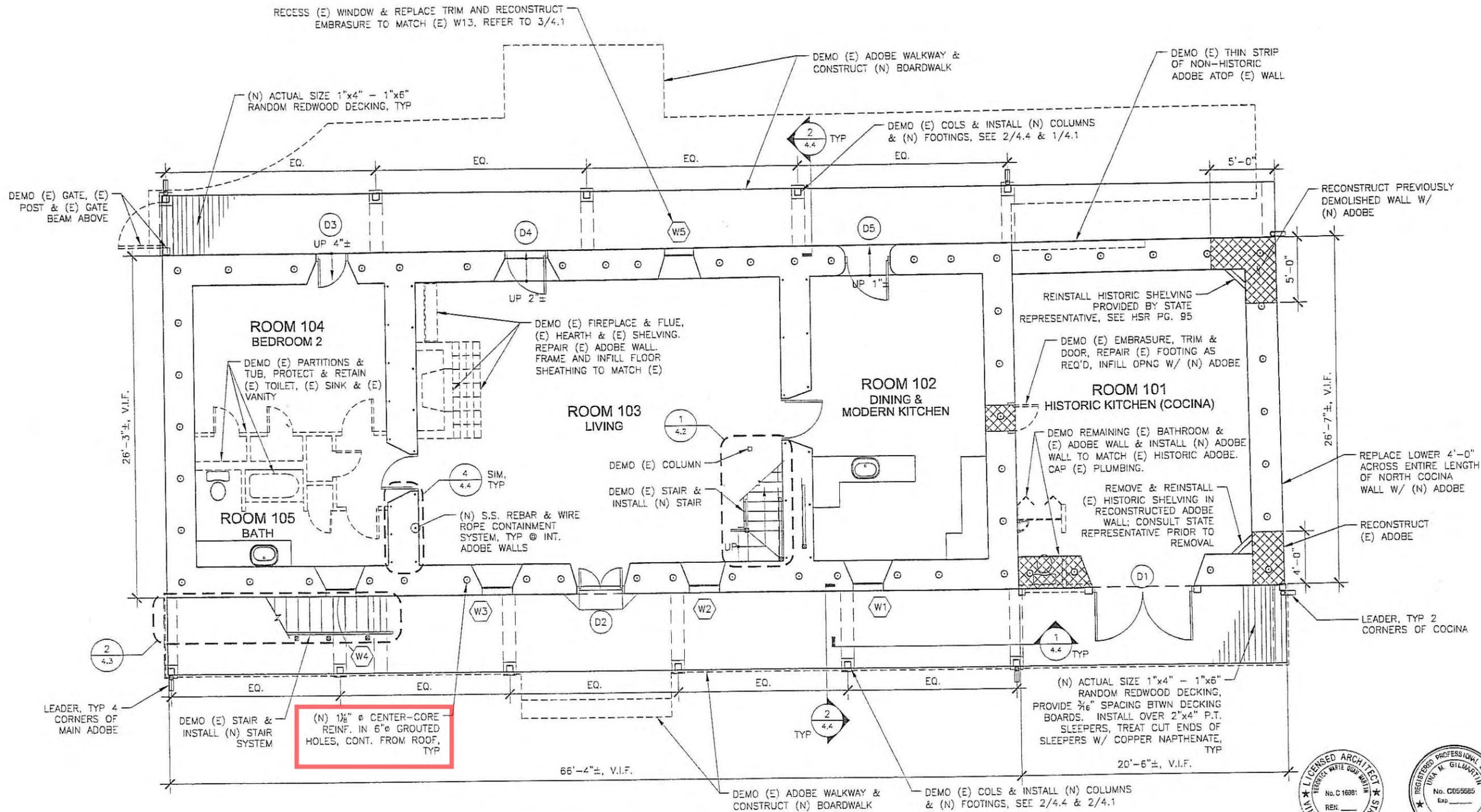
SHEET NO.
2.1
4 OF 20

Plotted: Friday September 24, 2004 1:03pm by gredlo File Name: 2-1.dwg

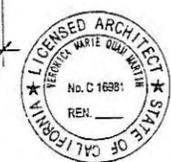
PROJECT PHASE: 100% Construction Documents

PROJECT NAME: Rehabilitation

DRAWING DATE: 09/24/04



1 1st FLOOR PLAN
SCALE: 1/4" = 1'-0" FOR 22"x34" SHEET
SCALE: 1/8" = 1'-0" FOR 11"x17" SHEET



DSA/DPR MOU * B.01 ACCESSIBILITY REVIEW
CERTIFICATION #
REVIEWER: DATE
Reviewed by: Date

CALIFORNIA STATE FIRE MARSHALL-APPROVED
Approval of this plan does not authorize or approve any omission of deviation from applicable regulations. Final approval is subject to field inspection. One set of approved plans shall be available on the project site at all times.

ACCESSIBILITY COMPLIANCE AND STATE FIRE MARSHALL APPROVAL ON FILE WITH THE DEPARTMENT OF PARKS AND RECREATION

E. LEROY TOLLES

ELT & Associates

Structural Engineering firm established 1984. Specializing in structural design and analysis of adobe, rammed earth, brick and wood buildings. Detailed knowledge of design, retrofit, analysis, and seismic testing of adobe construction. Experience with earthquake simulator shake table tests on adobe structures, dynamic analysis, finite element analysis, and laboratory and field tests.

PROFESSIONAL REGISTRATION

Civil Engineer: California C-37318

EDUCATION

Ph.D., Structural Engineering, Stanford University, 1989

M.S., Structural Engineering, Stanford University, 1982

B.S., Civil Engineering, Stanford University, 1977

PROFESSIONAL ASSOCIATIONS

Structural Engineers Association of Northern California

Major Research and Investigation Projects

Getty Seismic Adobe Project (GSAP), 1991-2002

GSAP was directed by the Getty Conservation Institute as a multi-year, multi-disciplinary investigation of seismic retrofit strategies for historic adobe buildings that are both effective in protecting life-safety and minimize the impact on a building's significant historic fabric.

It was a three-phase program. The first phase included development of a theoretical framework for understanding the seismic performance of adobe buildings; research on currently used retrofit technologies; a survey of existing historic adobe buildings in Southwestern United States; development of a testing program plan that included materials, analytical computer modeling, and shake table tests; and, the first draft of conservation principles that would act as planning guidelines for retrofitting historic adobe buildings.

The second phase was the beginning of the testing program. It included tests on 1:5 scale adobe walls and simple four-wall buildings. The walls of the buildings had different height to thickness ratios and had been retrofitted using different techniques.

In the final phase included completion of the testing program and the final draft of the Planning Guidelines. The Engineering Guidelines were finalized after the large-scale testing program at IZIS was completed.

The 1994 Northridge earthquake also occurred during the project, which allowed for investigation of actual damage to adobe structures.

The Advisory Board included:

James Jackson, California Dept. of Parks and Recreation, Sacramento, California
Anthony Crosby, National Park Service, Denver Colorado
Edward Crocker, New Mexico Community Foundation, Santa Fe, New Mexico
Nicholas Magalousis, Mission San Juan Capistrano, Laguna Beach, California
Julio Vargas Neumann, Pontifica Universidad Catolica del Peru, Lima Peru
Wayne Donaldson, Architect, San Diego, California
Melvyn Green, Structural Engineer, Manhattan Beach, California
Helmut Krawinkler, Stanford University, Stanford, California
John Loomis, Thirtieth Street Architects, Newport Beach, California

The final report, entitled Planning and Engineering Guidelines for the Seismic Retrofitting of Historic Adobe Structures, will be published in early 2003.

Survey of Historic Adobe Buildings after the 1994 Northridge Earthquake, 1994-1996

The project was partially supported by the Getty Conservation Institute and the resulting report became one of their publications. The project team was lead by E. Leroy Tolles and included Anthony Crosby and Edna E. Kimbro. The study of earthquake-damaged adobe buildings documented in this study revealed details of their performance under stress that are essential for determining the means for retrofitting these types of structures. The publication of this research represents a comprehensive reference for documentation methods and details of damage from an earthquake to adobe buildings.

Large-Scale Testing of Adobe Buildings, 1996-1998

This research was funded by the Getty Conservation Institute as an augmentation to the basic GSAP research effort. The testing was performed at the IZIIIS institute in Skopje, Macedonia. IZIIIS was established by the government of Yugoslavia after the 1963 earthquake in that region of central Europe. The testing involved large-scale, 1:2, tests performed on two model buildings. It compared an unretrofitted structure with one that had two basic retrofit techniques research and tested in GSAP. The GSAP methods were proven successful in reducing the amount of damage suffered by the adobe walls. Results were published in the final report of the GSAP research project.

Workshop on the Seismic Retrofit of Historic Adobe Buildings, 1995

Principal organizer and editor was E. Leroy Tolles of Earthen Building Technologies with Edna E. Kimbro and Frederick A. Webster. Sponsored by the Historic Preservation Partners for Earthquake Response, the Leonis Adobe Associations, and the Getty Conservation Institute. The 10 most active architectural and engineering experts in historic adobe building construction presented their efforts in research, design, repair, retrofit, preservation, and reconstruction to the public following the 1994 Northridge earthquake. Attended by approximately 250 participants at the J. Paul Getty Museum.

Seismic Studies on Small-Scale Models of Adobe Buildings, 1982-1989

The research was funded by the National Science Foundation and conducted by E. Leroy Tolles under the direction of Professor Helmut Krawinkler at Stanford University. This Doctoral study represents a fundamental starting point for the stability-based analysis of the dynamic performance of adobe buildings that is critical to matters of life-safety. By comparison, other previous research had focused on strength and crack damage which do not themselves directly affect life-safety.

This research included the dynamic testing of six reduced-scale adobe buildings on a shake table at Stanford University. The shaking table simulated earthquake motions by duplicating an actual recorded earthquake or synthesized earthquake motions. The severity of the earthquake motions was increased on succeeding tests until either the building collapsed or the capacity of the shaking table was exceeded. The study examined the dynamic behavior of adobe buildings and evaluated simple seismic retrofit measures that could be implemented for use in low-cost adobe housing in developing countries.

Structural Investigator, INTERTECT, 1985

Investigation of earthquake-damage to adobe buildings in Mexico City and coastal region near the epicenter of the October 1985 earthquake.

Structural Damage Investigator at SUUM Engineering, Forensic Technologies International, and Failure Analysis Associates; consulting on building damage investigations, post-earthquake damage evaluation and providing expert testimony, experimental testing, computer analysis, and computer programming.

Design Projects

HISTORIC ADOBE AND BRICK BUILDINGS

Main Residence at Rancho Camulos, Piru, California

Owned by: Owned and managed by the private non-profit Rancho Camulos Museum

Historical Designation: National Landmark Designation for the entire site "Home of Ramona"

Building Description: Main residence on the Rancho Camulos Museum 10 acre site is a 7,600 square foot, one and two story adobe building with a few stone wall additions. Built in 1852

Retrofit Description: Retrofit of entire building including roof-wall anchors, horizontal cables, vertical straps on adobe and stone walls, partial plywood diaphragm/bond beam, and concrete bond beams. Several walls were reconstructed due to collapse or severe damage from the 1994 Northridge earthquake.

Project Team: ELT & Associates Team: E. Leroy Tolles, Project Manager and Design Engineer; Historical Architect, Anthony Crosby; Edna E. Kimbro, Architectural Historian and Design Consultant

Current Status: Completed 1997

Las Flores Adobe, Camp Pendleton, California

Owned by: United States Marine Corps

Historical Designation: National Register; National Historic Landmark

Building Description: Adobe building with one and two-story sections, 1867

Retrofit Description: Project directed by the U.S. National Park Service for the United States Marine Corps. Camp Pendleton. Full Seismic retrofit of entire building using roof-wall anchors and a partial plywood diaphragm/bond beam.

Project Team: E. Leroy Tolles, Design Engineer and architects from the National Park Service. Performed in cooperation with Stephen Farneth of the Architectural Resources Group, Historical Architect

Current Status: Completed 2002

Carriage House, Camp Pendleton, California

Owned by: United States Marine Corps

Historical Designation: National Register; National Historic Landmark

Building Description: Single-story adobe building late 1800's.

Retrofit Description: Project directed by the U.S. National Park Service for the United States Marine Corps. Camp Pendleton. Full Seismic retrofit of entire building using roof-wall anchors and an existing concrete bond beam.

Project Team: E. Leroy Tolles, Design Engineer and architects from the National Park Service. Performed in cooperation with Stephen Farneth of the Architectural Resources Group, Historical Architect

Current Status: Construction in summer of 2004.

Casa de la Torre, Monterey, California

Historical Designation: Situated in the City of Monterey Old Town National Historic Landmark District; and, National Register

Building Description: Private residence of 1½ story and single story adobe walls. Built in 1849.

Retrofit Description: Retrofit using adobe anchors and center-core rods attaching the walls to a plywood diaphragm.

Project Team: E. Leroy Tolles, Design Engineer. Separately, Anthony Crosby and Edna Kimbro

Current Status: Completed in 2001

Jameson Adobe, Corona, California

Historical Designation: Local city designation

Building Description: Single story adobe residence. Built in the late 1800's.

Retrofit Description: Perimeter horizontal cable anchors to upper adobe wall and attached to roof diaphragm.

Project Team: E. Leroy Tolles, Design Engineer

Current Status: Completed 1994

Las Cruces Adobe, near Solvang, California

Owned by: California State Parks and Recreation

Historical Designation: Unknown

Building Description: Single story adobe building in state of ruin, Wood-framed roof structure built over the site to protect the ruins.

Retrofit Description: Independent damped steel framing system attached to the adobe walls to stabilize the adobe walls and protect individuals from falling debris.

Project Team: E. Leroy Tolles, Design Engineer in cooperation with M. Wayne Donaldson, FAIA, Inc.

Current Status: Design completed. Construction pending funding.

Winery, Rancho Camulos, Piru, California

Owned by: Owned and managed by the private non-profit Rancho Camulos Museum

Historical Designation: National Landmark Designation for the entire site. "Home of Ramona"

Building Description: 1½ story brick ranch building. 6,400 square feet. Built in 1867

Retrofit Description: Primary bracing system provided by concrete shear walls hidden in an attached wood shed. Diagonal steel braces between second floor framing and the roof system. Reconstructed gable end walls that collapsed during the 1994 Northridge earthquake with wood-framed walls with brick veneer.

Project Team: E. Leroy Tolles, Design Engineer. Anthony Crosby, Historical Architect.

Current Status: Design in final stages. Currently under review by building officials.

Small Adobe Residence, Rancho Camulos, Piru, California

Owned by: Owned and managed by the private non-profit Rancho Camulos Museum

Historical Designation: National Landmark Designation for the entire site. "Home of Ramona"

Building Description: Single story adobe building with interior courtyard building in 1920.

Retrofit Description: Adobe walls reinforced with small-diameter center core rods. Flat roof system with plywood diaphragm anchored to upper adobe walls with anchors and center core rods.

Project Team: E. Leroy Tolles, Design Engineer. Anthony Crosby, Historical Architect. Kirk E. Peterson, Architect

Current Status: Design in final stages of review by Building Officials.

Castro Breen Adobe, San Juan Bautista, California

Owned by: California State Parks and Recreation

Historical Designation: National Register

Building Description: Two story adobe building constructed in 1841.

Retrofit Description: Combination of center core rods and roof-wall anchors attached to a partial plywood diaphragm/bond beam.

Project Team: E. Leroy Tolles, Design Engineer in conjunction with architects from the California State Parks and Recreation

Current Status: Preliminary design report completed. Under construction in 2004.

Castro Adobe, Watsonville, California

Owned by: California State Parks and Recreation.

Historical Designation: National Register

Building Description: Two story adobe building built in 1830.

Retrofit Description: To be determined by the investigation.

Project Team: E. Leroy Tolles, Design Engineer

Current Status: Preliminary report to be completed. Design by other to be reviewed by ELT & Associates.

Main Ranch Residence, Rancho Los Alamitos, Long Beach, California

Historical Designation: National Register

Building Description: Single story adobe building with a one and two-story wood-framed building surrounding the entire one-story adobe rooms. Adobe construction in 1806.

Retrofit Description: Partial plywood diaphragm/bond beam anchored to adobe walls in current proposed design.

Project Team: E. Leroy Tolles, Design Engineer

Current Status: Alternate design submitted to museum board for consideration.

NEW EARTHEN CONSTRUCTION DESIGN

Liviakis Residence, Lafayette, California. Stabilized soil cement, 3,200 sq. ft., 2002

D'Arrigo Residence, Eugene, Oregon. Rammed earth residence, 2,400 sq. ft., 1995

Private Residence, Eugene, Oregon. Rammed earth garden structure, 120 sq. ft., 1994

Publications and Conferences

GCI Scientific Program Reports – Planning and Engineering Guidelines for the Seismic Retrofitting of Historic Adobe Structures, 210 pages. E. Leroy Tolles, Edna E. Kimbro, and William S. Ginell. The Getty Conservation Institute, Los Angeles California. 2003

GCI Scientific Program Reports – Seismic Stabilization of Historic Structures, Final Report of the Getty Seismic Adobe Project, 158 pages. E. Leroy Tolles, Edna E. Kimbro, Frederick A. Webster, and William S. Ginell. The Getty Conservation Institute, Los Angeles California. 2000

GSAP: Getty Conservation Institute Guidelines for Seismic Retrofitting of Adobe Project—Report on Third Year Activities, E. Leroy Tolles, Edna E. Kimbro, Charles C. Thiel, Frederick A. Webster, and William S. Ginell. Proceedings of the Getty Conservation Institute, Marina del Rey, California. 1998

GSAP: Survey of Damage to Historic Adobe Buildings After the January 1994 Northridge Earthquake, 160 pages. E. Leroy Tolles, Frederick A. Webster, Anthony Crosby, and Edna E. Kimbro. Getty Conservation Institute Program Report, Los Angeles, California. 1996

“Overview of the Getty Seismic Adobe Project,” E. Leroy Tolles, Principal conference organizer, Proceedings of the Conference on the Seismic Retrofit of Historic Adobe Buildings. Presentations by 10 of the leading architects and engineers in the field of seismic retrofits of historic adobe buildings. J. Paul Getty Museum, Malibu, California. March 10, 1995

“Advances in the Seismic Retrofitting of Adobe Buildings,” E. Leroy Tolles, Charles C. Thiel, Frederick A. Webster and William S. Ginell. Proceedings of the Fifth National Conference on Earthquake Engineering, Chicago, Illinois. July 1994

GSAP: Getty Conservation Institute Guidelines for Seismic Retrofitting of Adobe Project—Report on Second Year Activities, E. Leroy Tolles, Edna E. Kimbro, Charles C. Thiel, Frederick A. Webster, and William S. Ginell. Proceedings of the Getty Conservation Institute, Marina del Rey, California. October 1993

“Seismic Retrofitting of Historic Adobes,” E. Leroy Tolles, Proceedings of the Seventh International Conference on the Study and Conservation of Earthen Architecture, Terra 93, Silves, Portugal. October 1993

“A Framework for Understanding the Seismic Performance of Adobe,” E. Leroy Tolles, et al., Proceedings of the Seismic Retrofit of Historic Buildings Conference, sponsored by the United States National Park Service, San Francisco, USA. November 1992

GSAP: Getty Conservation Institute Guidelines for Seismic Strengthening of Adobe Project – Report on First Year Activities, Charles C. Thiel, E. Leroy Tolles, Edna E. Kimbro, Frederick A. Webster and William S. Ginell. Proceedings of the Getty Conservation Institute, Marina del Rey, California. October, 1991

“Seismic Studies on Small-Scale Models of Adobe Houses, Report No. 91,” E. Leroy Tolles and Helmut Krawinkler. John A. Blume Earthquake Engineering Center, Stanford University, Stanford, California. October 1990

“Seismic Testing on Small Scale Models of Adobe Houses, Vol. VIII,” E. Leroy Tolles and Helmut Krawinkler, Ninth World Conference on Earthquake Engineering. Tokyo-Kyoto, Japan. 1988

“Performance Evaluation of Adobe Houses Through Small Scale Model Tests on a Shake Table,” E. Leroy Tolles and Helmut Krawinkler, Middle East and Mediterranean Regional Conference on Earthen and Low-Strength Masonry Buildings in Seismic Areas. Middle East Technical University, Ankara, Turkey. September 1986

“Small-Scale Model Testing of Adobe Houses,” E. Leroy Tolles and Helmut Krawinkler, Tenth CIB Congress. Washington, D.C. October 1986

“Shake Table Studies of Masonry and Adobe Houses,” Helmut Krawinkler and E. Leroy Tolles, CIB International Conference on Natural Hazards Mitigation. New Delhi, India. October 1984

Work History

Principal, ELT & Associates, Lafayette, CA. 1984–Present

Principal, Earthen Building Technologies (EBT), Eugene, OR. 1993–Present

Senior Civil Engineer, FTI Corporation, San Francisco, CA. 1986–1995
Civil Engineer, Failure Analysis Associates, Palo Alto, CA. 1982–1985
Structural Designer, William S. Kaplan, Inc., San Francisco, CA. 1979–1981
Structural Designer, Tuan and Associates, San Francisco, CA. 1980–1981