FRIEDMAN FAMILY VISITING PROFESSIONALS PROGRAM

Visit to Virginia Tech: April 21, 2017

This report summarizes the visit of **Mr. Jim Malley** from Degenkolb Engineers, that took place at Virginia Polytechnic Institute and State University on April 21, 2017.

ITINERARY OR AGENDA

TIME:	ACTIVITY:
8:00 AM – 9:00 AM	Dr. Roberto Leon has breakfast with Mr. Malley
9:15 AM – 9:45 AM	Thomas M. Murray Structures Laboratory Tour
9:45 AM – 12:00 AM	Student presentation on ongoing research projects
12:00 AM – 1:15 AM	Lunch with EERI Virginia Tech Student Chapter Officers
1:30 PM – 3:30 PM	Meetings with faculty members
4:00 PM – 5:00 PM	Presentation on retrofitting of 15-story building for seismic considerations
5:00 PM – 6:00 PM	Reception with refreshments
7:00 PM – 9:00 PM	Dinner with students and faculty members

STUDENT CHAPTER VISIT PLANNING COMMITTEE

LEAD ORGANIZER(S):

- Patrick O'Brian, Chapter President, pato91@vt.edu
- Dr. Roberto Leon, Professor, rleon@vt.edu
- Dr. Finley Charney, Professor, fcharney@vt.edu
- Dr. Adrian Rodriguez-Marek, Faculty Advisor, adrianrm@vt.edu
- Cole Jaconski, EERI Chapter member, colej6@vt.edu
- Kyle Polczynski, EERI Chapter Vice President, pkyle1@vt.edu

VISITING PROFESSIONAL LECTURE OVERVIEW

Lecture Abstract

The lecture was presented by Mr. Jim Malley as part of the Friedman Family Visiting Professional Program. The lecture addressed the seismic analysis and rehabilitation design of a fifteen-story steel moment resisting frame located in Oakland, California. This structure had connection details that were found to be vulnerable after the 1994 Northridge earthquake. Mr. Malley started out the lecture by explaining the importance of seismic retrofits and why they need to be added to "pre-Northridge" steel moment frames. Previous testing of these frames showed that weld connecting the beam flange to the column flange was susceptible to fracture. This presented a major issue to the building's overall structural integrity which was a major safety concern to the occupants if another earthquake was to happen. The State of California had specific seismic rehabilitation

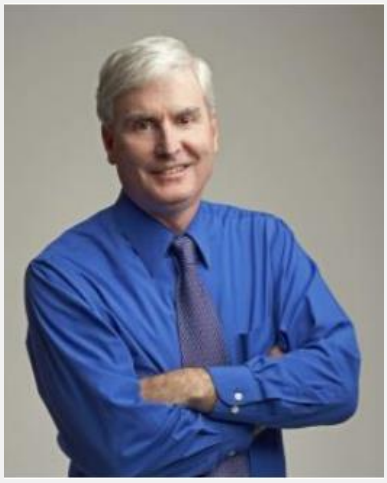
requirements that needed to be met. This resulted in a retrofit scheme that included a combination of moment connection strengthening and addition of viscous dampers.

To meet these proposed requirements, two phases of sophisticated analysis techniques were performed in the rehabilitation design. Multi-mode two-dimensional nonlinear pushover tests were performed in order to estimate the necessary connection strengthening and damping. To refine the scheme and perform final checks, nonlinear time history analyses of building frames were performed. These models included a nonlinear fiber element that approximated the fracture behavior observed in the existing connection tests and incorporated results from the test program to model the strengthened connection behavior. Mr. Malley presented these results that showed where damping mechanisms needed to be added (mostly mid-height of the building where most of the story drift was occurring).

Concurrent with the analysis portion of the work, various connection modification schemes were studied, designed, and subjected to full-scale laboratory testing. AISC/NIST design guides procedures were modified to include column and panel zone deformation that were adapted to alternate strengthening configurations. With deep column and large beam sections present, a series of four full-scale tests were performed. Mr. Malley discussed these test results that evaluated the performance of these proposed rehabilitation schemes. To illustrate these test results, Mr. Malley presented various visual aids that helped the audience understand exactly what was occurring with the connection. Mr. Malley also showed the audience a Finite Element Analysis that was performed on one of the test specimens. He also stressed the importance of being able to keep the building operational while all these retrofits were implemented.

The lecture concluded with the final results of the four tests being presented and the ongoing developments of seismic retrofits to pre-Northridge steel frames. The audience of the lecture included students and faculty from Virginia Tech. After the conclusion, Mr. Malley answered questions from the audience concerning the test setup and testing procedures. Mr. Malley also included a short presentation about EERI at the end. He gave an introduction on EERI's national chapter, how he became involved, and the importance of EERI. He encouraged everyone in the audience with an interest in earthquake engineering to join.

Professional Bio



James O. Malley, S.E., is a Senior Principal with Degenkolb Engineers. He received both his Bachelors and Masters' Degrees from the University of California at Berkeley. Mr. Malley has over 30 years of experience in the seismic design, evaluation and rehabilitation of building structures. He was responsible for the analytical and testing investigations performed as part of the SAC Steel Project in response to the Northridge earthquake damage. In 2000, AISC presented Mr. Malley its' Special Achievement Award. Mr. Malley is Chair of the AISC Specifications Committee and the Past-Chair of the AISC Seismic Subcommittee. He was named the 2010 T.R. Higgins Lectureship Award winner for his work on the AISC Seismic Provisions, and in 2012 was given presented with a Lifetime Achievement Award by AISC. Mr. Malley is also a member of the AWS Subcommittee on Seismic Welding Issues. Mr. Malley was also one of the authors of the PEER Tall Buildings Institute "Guidelines for the Performance-Based Seismic Design of Tall Buildings" and is involved in the peer review of numerous tall building projects in areas of high seismic risk. Jim has served as a member of the SEAONC and SEAOC Board of Directors, and was President of SEAONC in 2000-2001 and SEAOC in 2003-2004. He was named a SEAOC Fellow in 2007 and an Honorary Member of SEAONC in 2014. He also was a member of the Board of Directors of NCSEA, serving as President in 2010-1011. Mr. Malley is also presently a member of the Board of Directors of EERI and the Applied Technology Council.

SUPPLEMENTAL ACTIVITES

Breakfast with Dr. Roberto Leon

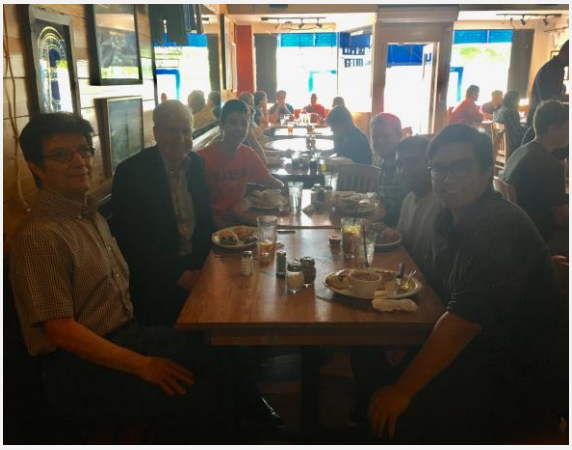
Mr. Malley met with Dr. Roberto Leon, one of the professors in the Structural and Materials department, to go over the activities for the day and discuss areas of common interest. Dr. Russel Green, a Professor in Virginia Tech Geotechnical Engineering program, also joined the breakfast to discuss earthquake engineering related research topics.

Thomas M. Murray Structures Laboratory Tour

The speaker was taken to a tour of the Thomas M. Murray Structures Laboratory, used for several ongoing research projects. The tour was directed by Dr. Leon and several students. After completing the tour of the testing facilities, several students presented their ongoing research projects relating to the field of earthquake engineering and structural design.

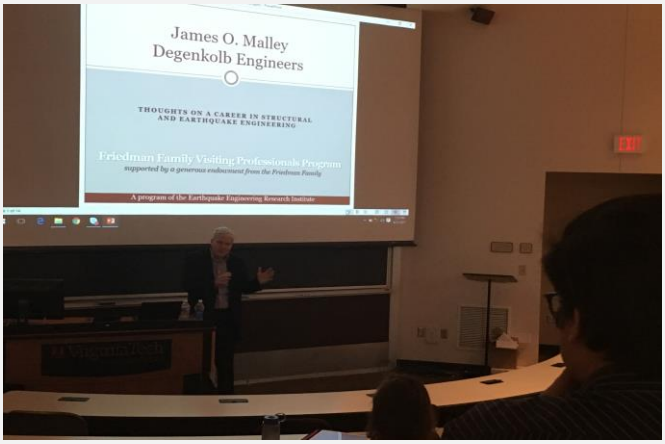
Lunch with Student Chapter Officers

Mr. Malley met with several officers from the Virginia Tech Student Chapter of EERI. The lunch took place at a local restaurant, The Cellar. The purpose of the lunch was to provide an opportunity for the officers to ask Mr. Malley questions about his personal experiences and his advice on career development. Kyle Polczynski, Patrick O'Brien, Raul Avellaneda, and Ezra Bin Arif Edwin were the officers who attended the lunch. Mr. Malley shared his personal relationship with Virginia Tech and some humorous anecdotes.



Lecture

Mr. Malley did a presentation on the retrofit of a 15-story building for seismic considerations and the difficulties that arise when dealing with existing structures, particularly when the structure needs to remain useable during the retrofitting process. His lecture went into the design considerations and testing procedures of the different connection details that were considered for the seismic retrofit. His presentation concluded with a short presentation outlining the benefits of belonging to EERI and his own experiences taking part in the different programs offered for EERI members.



Reception

A short reception was offered directly after the lecture to allow interested students to interact with Mr. Malley. Light snacks and refreshments were provided. Several students approached Mr. Malley with questions on the specifics of his presentation and on the applications of the concepts he introduced during his presentation.

After the reception, Mr. Malley went to dinner with some of the students and Dr. Flint, Dr. Charney and Dr. Easterling.

RESULTS, FEEDBACK AND LESSONS LEARNED

• The only major challenge we faced was the schedule for the visit. It was difficult to allow for enough time for the Masters and Doctorate candidates to present their projects and also to allow for faculty to meet with Mr. Malley. This was overcome through extensive planning and efforts to keep the timeline.

• Mr. Malley's visit was extremely well received. Following his presentation, several students were very interested in his thoughts regarding the retrofitting process and the selection of energy dissipation systems for seismic considerations. Overall, we consider the visit to be a success with very positive comments from both faculty and students.

ACKNOWLEDGEMENTS

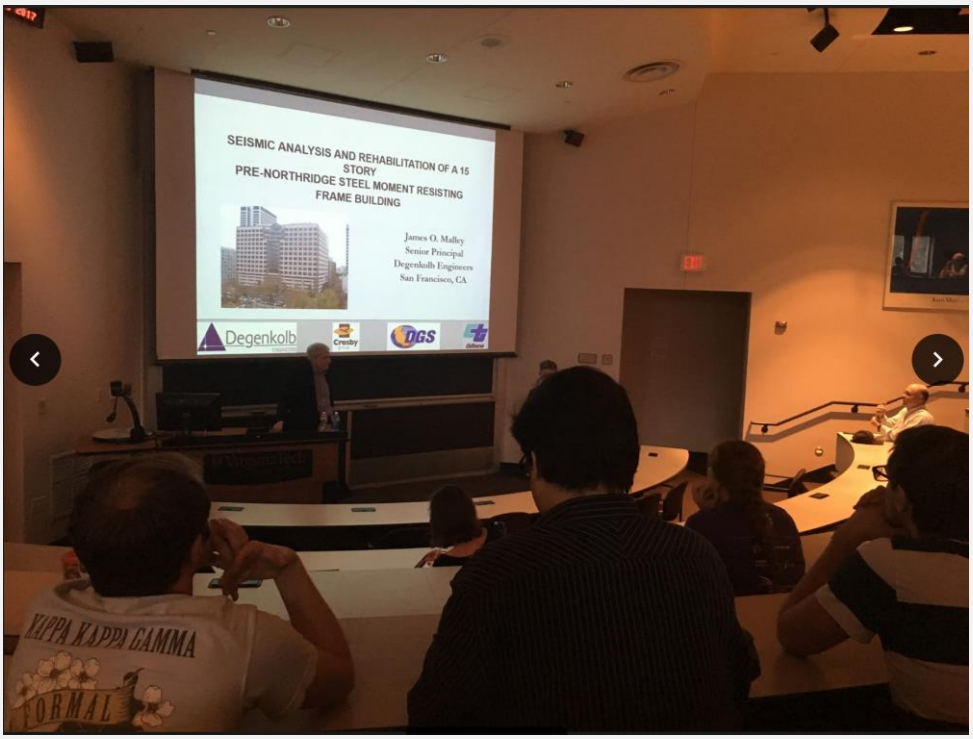
The Virginia Tech EERI Student Chapter gratefully acknowledges the support of the Friedman Family for sponsoring the travel of Mr. Malley through their Friedman Family Visiting Professional Program endowment.

The lecture presented by Mr. Malley and the interaction with students and faculty had a very positive impact in the Civil Engineering Department, and it raised more awareness on current earthquake engineering issues. We look forward to hosting new guests from the Friedman Family in years to come.

LIST OF ATTACHMENTS

Included at the end of this report are various attachments to supplement the information included above. A list of the attachments is included below:

- Item 1, Pictures of Lunch and Guest Lecture
- Item 2, Event Flyer


SEISMIC ANALYSIS AND REHABILITATION OF A 15 STORY
PRE-NORTHRIDGE STEEL MOMENT RESISTING
FRAME BUILDING
James O. Malley
Senior Principal
Degenkolb Engineers
San Francisco, CA
Degenkolb
KAPPA KAPPA GAMMA
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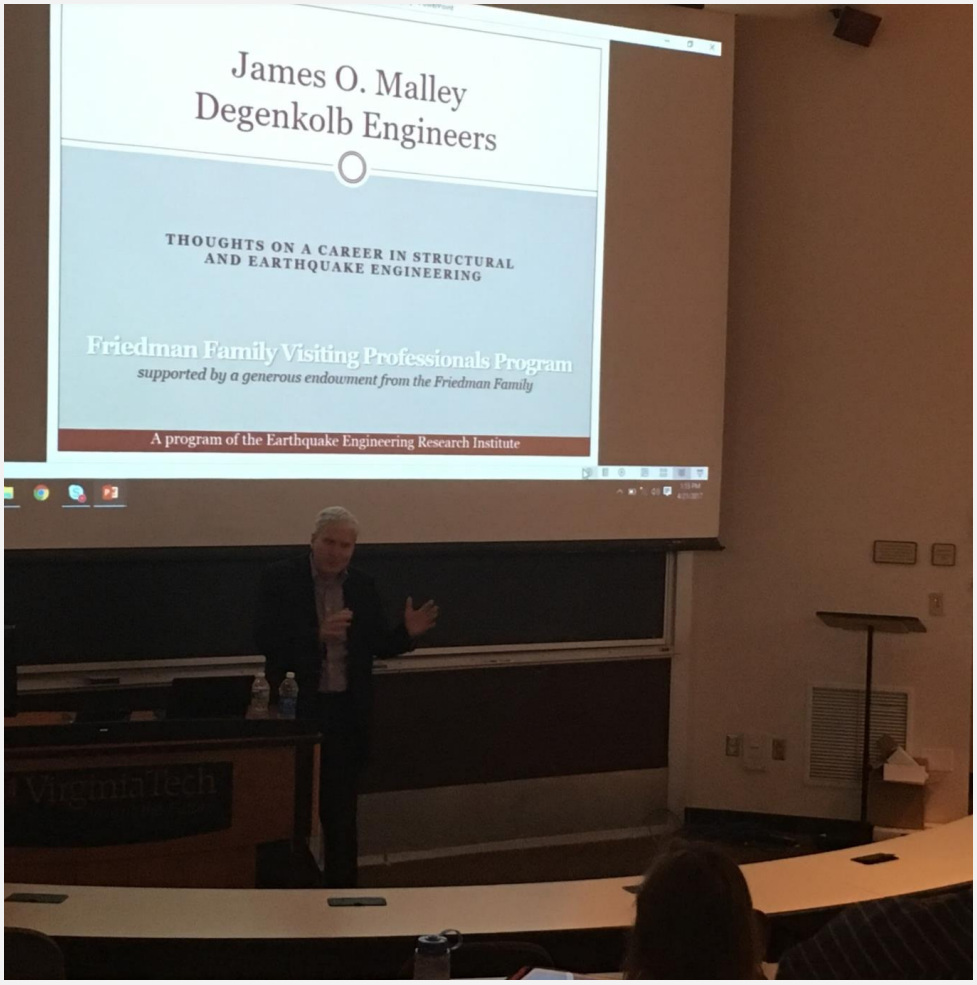

James O. Malley
Degenkolb Engineers
THOUGHTS ON A CAREER IN STRUCTURAL
AND EARTHQUAKE ENGINEERING
Friedman Family Visiting Professionals Program
supported by a generous endowment from the Friedman Family
A program of the Earthquake Engineering Research Institute
VirginiaTech

EERI Friedman Family Visiting Professional Lecture

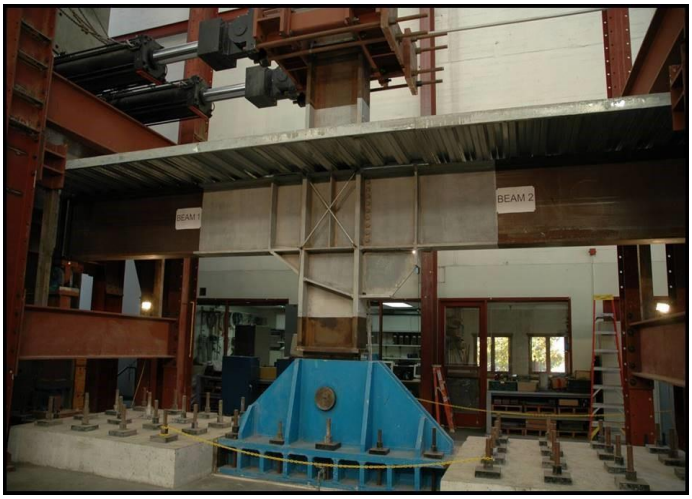
Seismic Upgrade of a 15-Story Steel Moment Frame Building - Satisfying Performance Criteria with Application of Experimental and Advanced Analytical Procedures

James O. Malley S.E., Senior Principal
Degenkolb Engineers
San Francisco, CA

Friday, April 21st, 2017
Presentation 4:00 - 5:00 pm, Torgersen 3100
Reception 5:00 pm, Torgersen 1040

Abstract:

This presentation will summarize the seismic analysis and rehabilitation design of a fifteen story steel moment resisting frame building constructed with connection details that were found to be vulnerable to fracture in the 1994 Northridge earthquake. This building is located in Oakland, California, less than five miles from the Hayward Fault.



Previous testing of the existing steel moment connections demonstrated that the beam flange to column flange complete joint penetration groove welds were vulnerable to fracture, and consequently the building presented a risk to life safety in the event of a major earthquake. Seismic rehabilitation to meet the requirements of the State of California, Department of General Services resulted in a retrofit scheme including a combination of moment connection strengthening and addition of viscous dampers.

To meet the proposed requirements, two phases of sophisticated analysis techniques were performed in the rehabilitation design. First, to estimate the necessary connection strengthening and damping, multi-mode two-dimensional nonlinear pushover analyses were performed along with single-degree-of-freedom nonlinear dynamic time-history analyses. Then to refine the scheme and perform final checks, nonlinear time history analyses of building frames were performed. These models included a nonlinear fiber element that approximated the fracture behavior observed in the existing connection tests and incorporated results from the test program to model the strengthened connection behavior.

Concurrent with the analysis portion of the work, various connection modification schemes were studied, designed, and subjected to full-scale laboratory testing. Available design procedures contained in the AISC/NIST Design Guide 12 were modified to include column and panel zone deformation and adapted to alternate strengthening configurations. Due to the deep W27 column and very large W36 beam sections present, a series of four full-scale tests were conducted in order to evaluate the performance of the proposed rehabilitation schemes.

About the Speaker:

James O. Malley, S.E., is a Senior Principal with Degenkolb Engineers. He received both his Bachelors and Masters Degrees from the University of California at Berkeley. Mr. Malley has over 30 years of experience in the seismic design, evaluation and rehabilitation of building structures. He was responsible for the analytical and testing investigations performed as part of the SAC Steel Project in response to the Northridge earthquake damage. In 2000, AISC presented Mr. Malley its' Special Achievement Award. Mr. Malley is Chair of the AISC Specifications Committee and the Past-Chair of the AISC Seismic Subcommittee. He was named the 2010 T.R. Higgins Lectureship Award winner for his work on the AISC Seismic Provisions, and in 2012 was given presented with a Lifetime Achievement Award by AISC. Mr. Malley is also a member of the AWS Subcommittee on Seismic Welding Issues. Mr. Malley was also one of the authors of the PEER Tall Buildings Institute "Guidelines for the Performance-Based Seismic Design of Tall Buildings" and is involved in the peer review of numerous tall building projects in areas of high seismic risk. Jim has served as a member of the SEAONC and SEAOC Board of Directors, and was President of SEAONC in 2000-2001 and SEAOC in 2003-2004. He was named a SEAOC Fellow in 2007 and an Honorary Member of SEAONC in 2014. He also was a member of the Board of Directors of NCSEA, serving as President in 2010-1011. Mr. Malley is also presently a member of the Board of Directors of EERI and the Applied Technology Council.