

**2012-2013 LEHIGH UNIVERSITY FACULTY GRANTS FOR INTERNATIONAL CONNECTIONS**

**TRAVEL SUMMARY  
ITALY AND ROME**

**JUNE 23 – JULY 6  
2013**

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**SUMMARY**

Host: Prof. Franco Bontempi  
Department of Structural and Geotechnical Engineering  
Sapienza University of Rome, Italy

Time of Visit: June/July 2013

Purpose of Visit: Primary purpose of the travel was to meet with Prof. Bontempi and his research team to establish international collaboration between Lehigh University and Sapienza University of Rome on the topic of blast resistance and structural integrity of structures. Secondary purpose was to establish contacts at collaborative research institutions in the region including Greece and Italy.

**PROFESSIONAL GOALS OF VISIT**

The primary goal of the visit was to develop research collaboration with Professor Franco Bontempi and his research group at Sapienza University of Rome. A focus of my research has been on the design of buildings against blast pressures and progressive collapse of structures due to intentional and accidental detonations. As part of this effort I have been able to develop research contacts with the Army, Air Force, Navy, Explosive Safety Board, and have been able to secure funding from the National Science Foundation. I have had limited opportunity to expand these efforts outside of the United States. Prof. Bontempi is well vested in this area of research and the visit with him has fostered future collaboration activities between our groups. Furthermore, the Ph.D. program in Italy allows for students to study abroad as part of their research experience. The visit allowed for further development of potential exchange program between our Universities.

Sapienza University of Rome was founded in 1303 by Pope Boniface VIII, it is the first University in Rome and the largest University in Europe: a city within a city, with over 700 years of history, 145,000 students, over 4,500 professors and almost 5,000 people are administrative and technical staff. Sapienza has wide academic offerings which includes over 300 degree programs and 250 one or two year professional courses. Franco Bontempi is Full Professor at the School of Engineering of Sapienza since 2000 and leader of the group of Structural Analysis and Design. He has been educated as Civil Engineer and earned his Ph.D. at Politecnico di Milano, Italy and has both experience in the professional and academy activities, being consultant for bridges and high-rise structures analysis and design and author of ca. 180 scientific papers on all aspects of analysis and design of structures, safety and reliability, computational mechanics, nonlinear mechanics, stochastic mechanics, structural dynamics, identification, optimization and control. All of these areas of research are in line with my area of interest and expertise.

A secondary goal of the trip was to expand research and educational activities between other universities in the region. This effort was facilitated through Prof. Bontempi and his research group. Visits to the University of Naples, the University of Milan, the Carabinieri Headquarters in Rome, and the National Technical University of Athens in Greece were arranged. Details on these efforts are discussed in the travel summary.

A tertiary goal of the trip was to visit ancient structural buildings in the region. This effort was conducted to understand the lay of the land and identify potential sites that could be visited as part of a study abroad program. Tours of roman structures in Rome, Florence and Milan were conducted. In addition tours of ancient Greek buildings in Athens and Sounion were examined. Details on these efforts are discussed in the travel summary.

## **TRAVEL SUMMARY**

Travel occurred from Sunday June 23 through July 6, 2013. The locations visited included Rome, Milan, Florence, and Naples, Italy. A side trip to Athens and Sounion Greece was also included. The summary is presented relative to the research, educational exchange, and study abroad opportunities.

## **RESEARCH AND EDUCATIONAL SUMMARY**

Research seminars were given at four Universities and at the Carabinieri in Rome. At each visit an overview of Lehigh University, the Department of Civil and Environmental Engineering, and the Structural Engineering group at Lehigh were provided. Following the research seminar a discussion on potential educational opportunities were conducted. An overview of each visit is provided below in order of the visit.

### ***Sapienza Università di Roma***

Location: Rome, Italy

Visit Dates: Monday June 24 – Friday June 28

Presentation: Water-Driven Debris Impact Forces on Structures: Experimental and Theoretical Program

Presentation Date: June 25

***Research Opportunities.*** The effort at Sapienza consisted of a research presentation and meetings with Prof. Bontempi and his research group. This included Dr. Petrini, Dr. Crosti, Dr. Arangio, Dr. Gkoumas, and Mr. Olmati. Meetings were arranged at the University and office space was made available. Additional discussions with researchers from Cagliari and Pisa were facilitated after the seminar.

During the visit three efforts were pursued. (1) A study on the blast resistance of reinforced precast concrete walls under uncertainty was refined and completed. The work was submitted to the International Journal of Critical Infrastructures, Special Issue on International Perspectives on Full Spectrum Resilience. The research concept develops a framework for determining probability of failure to blast demands. (2) A new approach for examining robustness of precast frame building systems against progressive collapse was laid out. This effort will be conducted at Lehigh University with a new MS student in collaboration with Prof. Bontempi's research group. (3) There is interest from Prof. Mauro Sassu of the Università Di Pisa on the topic of tsunami demands on structures due to the potential for volcanic generated demands in the region.

***Potential Educational Connections.*** The University is located in the heart of Rome adjacent to the Colosseum. The undergraduate program consists of a 3 year program followed by an additional 2 year program where the students specialize. It is common that students participate in all 5 years of the program. The curriculum is very challenging and consequently the students are very prepared for graduate work in the area of Structural Engineering. It would be good to recruit students from Sapienza for both the Masters and Ph.D. level programs at Lehigh. The main contact for this is Prof. Bontempi.

### ***Carabinieri General Command***

Location: Rome, Italy

Visit and Presentation Date: June 26

Presentation: Overview on Blast Related Research Topics

**Research and Education Opportunities:** A meeting was arranged with Captain Giannicola Giovino of the Carabinieri. The Carabinieri is one of the police forces in Italy. This is in addition to the other forces such as the Polizia with the difference that it is organized on a military structure, contains special forces, and polices military in addition to civilian populations. The Carabinieri are a separate armed force of Italy. A tour of the facility and a discussion of the ongoing work of Captain Giovino was provided. His ongoing research on breach of wall panels is directly related to my ongoing research efforts and review of the effort was provided. No educational opportunities exist due to the military organization of the group; however future collaboration in research activities may exist.

***National Technical University of Athens - School Of Civil Engineering – Dept. of Structural Eng.***

Location: Athens, Greece

Visit and Presentation Date: July 1

Presentation: Development of a Blast and Ballistic Resistant Insulated Wall Panel System

**Research Opportunities.** A visit of the Engineering campus of NTUA was arranged by Dr. Gkoumas of Prof. Bontempi's group. Dr. Gkoumas accompanied us during the visit. The tour and seminar was arranged by Dr. Charis Gantes of the Institute of Steel Structures. Tours of the concrete and masonry structure laboratory, the steel structure laboratory and the earthquake laboratory were provided. The ongoing research focuses on sponsored and commercial research. The facilities were excellent, allowing for a wide variety of experimental and material evaluation. During our visit we met with Prof. Dimitrios Vamvatsikos, Prof. Chris Zeris, Prof. Constantine C. Spyarakos, and Prof. Elizabeth Vintzileou. Many of the faculty have experience with blast resistant research topics in particular Prof. Zeris and Gantes. The main potential for collaboration would exist between Prof. Zeris and my group. Prof. Zeris is currently working on confined concrete modeling of light weight concrete, fiber reinforced concretes and corrosion intrusion on axial loaded reinforced concrete elements. As a start we will be examining some of his confined concrete models and their potential for application in our blast resistant wall system study. Another possible collaboration would be to have his students visit to utilize our confined concrete setup. Prof. Vintzileou specializes in research on historic structures and is currently utilizing fiber optic gages on the Parthenon in Athens. This work is in line with the research of Prof. Pamukcu at Lehigh University.

**Potential Educational Connections.** The University has a 5-year undergraduate program which provides excellent preparation for undergraduates with interest in Structural Engineering. On successful completion of their degree they become licensed professional engineers in Greece allowing them to legally perform engineering design. There are three levels of certification for PEs in Greece: A, B, and C. Upon graduation they are designated as A. After various types of experience they move to class B and eventually C. The students have a fairly good grasp of English; however, all undergraduate courses are taught in Greek thus making undergraduate exchanges difficult. Their graduates however would make excellent candidates for graduate school at Lehigh University. This will be pursued through Prof. Zeris and Gantes. To help facilitate the effort, information on the graduate programs will be sent during the application period to promote the Department programs. A number of graduate courses are taught in English therefore exchange at the graduate level is a possibility. Another potential opportunity that could be investigated would be to collaborate with Prof. Vintzileou on possible study abroad opportunities that would allow students to evaluate and learn about the Greek historical structures such as the buildings on the Acropolis.

***Università degli Studi di Napoli Federico II***

Location: Naples, Italy

Visit and Presentation Date: July 3

Presentation: Design for Disproportionate Collapse Prevention of Precast and Prestressed Concrete Structures

**Research Opportunities.** The main area of research is focused on the seismic performance of structures. The laboratory consists of two adjacent 2D shake tables as well as a strong floor system allowing testing of components and systems. Testing underway included masonry structure systems, steel frame elements and significant efforts on retrofitting of concrete structures. The laboratory facilities are excellent. The main topic of discussion was a potential research program on pipelines. The tentative plan based on the discussion is for Lehigh to examine US issues and design methods and Prof. Augenti and Prof. Bontempi will examine Italian issues. We are targeting the completion of a white paper for January 2015, with a paper for submittal to the IF-CRASC conference which will be held in Rome in the Spring 2015.

**Potential Educational Connections.** The campus consists solely of engineering departments. The university is setup with a 3 year basic education followed by 2 years of specialized training in structural engineering. There are approximately 500 graduates per year in the area of structural engineering. Approximately 50% go into industry after graduating while the rest go on to Masters level or PhD studies. There is an interest in sending students to Lehigh University. The main contacts are Prof. Augenti, and Dr. Parisi (a post-doctoral researcher of Prof. Augenti) .

**Politecnico di Milano**

Location: Milan, Italy

Visit and Presentation Date: July 4

Presentation: Inspection Methods & Techniques to Determine Non-Visible Corrosion of Prestressing Strands in Concrete Bridge Components

**Research Opportunities.** The visit to Politecnico consisted of the research presentation and a meeting with a number of researchers in the Department of Civil and Environmental Engineering. The main groups present were the research group of Prof. Fabio Biondini, Dr. Luca Sgambi, and other faculty of the department. Following the seminar, a tour of the research facilities was provided. They are well established for material and structural testing and have a well-equipped facility. The experimental work focuses wood frame, concrete, and steel testing. In addition, there are ongoing studies on historic structures with a focus on ties for masonry domes and arches. There was some discussion on corrosion induced damage to bridge systems and there was interest in the NDE techniques used in the seminar I gave. The main topic of our research discussion was on their ongoing work on precast concrete frame structures subjected to seismic demands. Prof. Biondini has 15 years of experience evaluating precast systems subject to earthquake demands. Based on our discussion, I will work with my contacts at the Precast/prestressed concrete institute to invite him to the 2014 PCI convention. There may be potential to conduct collaborative work on precast concrete structures.

**Potential Educational Connections.** The University has an attractive campus and engineering facilities. It is also home to Architecture Design where some of the faculty of the CEE department teach courses in structural engineering. The laboratory facilities are excellent. There is extensive and very well maintained equipment for material and component and system evaluation under high loads. As with other schools in Italy the program is rigorous making the graduates of the program good candidates for Lehigh University. The main point of contact is Prof. Biondini.

## CONTACTS

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