

# 2018-2019 ANNUAL REPORT

## North Carolina State University Student Chapter of the Earthquake Engineering Research Institute



Report Date: May 16, 2019

This report summarizes the membership and activities conducted by the North Carolina State University Student Chapter of the Earthquake Engineering Research Institute during the 2018-2019 academic year.

### MISSION & GOALS

The objective of EERI-NCSU student chapter is to promote the study and practice of earthquake engineering in the university and the community, to strive to solve national earthquake engineering problems in order to protect people and property from the effects of earthquakes, to further the professional development of the students, and to improve inter-disciplinary communication.

### MEMBERSHIP

The North Carolina State University Student Chapter had a total of 22 members in 2018-2019.

### OFFICERS

The Board consisted of the following members:

Role	Name	EERI Member ID number	Email	Student Status
President	Ariadne Palma	18314	alpalm@ncsu.edu	Graduate student
Vice-President	Ishika Chowdhury	19762	lbbarcle@ncsu.edu	Graduate student
Treasurer	Christopher Price	18155	cwprice@ncsu.edu	Graduate student
Secretary	Rajprabhu Thangappa	21373	rthanga@ncsu.edu	Graduate student
SDC Advisor	Arjun Jayaprakash	18812	cwprice@ncsu.edu	Graduate student
SDC Advisor	Victor Calderon	18080	vacalder@ncsu.edu	Graduate student
Secretary	Jessi Thangjitham	30061	jsthangj@ncsu.edu	Graduate student

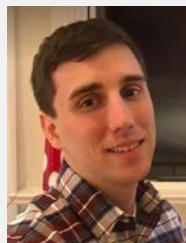
Below are photographs of each of the officers:



Ari Palma  
President



Ishika  
Chowdhury  
Vice-President



Chris Price  
Treasurer



Victor Calderon  
SDC Advisor



Arjun  
Jayaprakash  
SDC Advisor



Jessi  
Thangjitham  
Secretary



Rajprabhu  
Thangappa  
Secretary

## FACULTY & INDUSTRY ADVISORS

Advisor Type	Name	Affiliation	Email
Faculty	Dr. Mervyn Kowalsky	Professor at NCSU	kowalsky@ncsu.edu
Industry	Dr. Diego Aguirre	Practitioner with KCA	daaguirr@ncsu.edu

## MEMBERS

A complete list of members is shown below.

First Name	Last Name	EERI Member ID	Email	Status
Ajaya	Gupta	600	ajaya.gupta@ncsu.edu	Faculty
Mervyn	Kowalsky	4878	kowalsky@ncsu.edu	Faculty
Diego	Aguirre	15214	daaguirr@ncsu.edu	Practitioner
Ashly	Cabas	16774	amcabasm@ncsu.edu	Graduate student
Victor	Calderon	18080	vacalder@ncsu.edu	Graduate student
Christopher	Price	18155	cwprice@ncsu.edu	Graduate student
Ariadne	Palma Parra	18314	alpalmap@ncsu.edu	Graduate student
Arjun	Jayaprakash	18812	ajayapr@ncsu.edu	Graduate student
Graham	Gatwood	19232	gcgatwoo@ncsu.edu	Undergraduate student
Ishika	Chowdhury	19762	ichowdh@ncsu.edu	Graduate student
Swati	Patil	29948	spatil4@ncsu.edu	Graduate student
Jessi	Thangjitham	30061	jsthangj@ncsu.edu	Graduate student
Cade	Karrenberg	30243	ckarren@ncsu.edu	Undergraduate student
Jacob	Seate	30244	jwseate@ncsu.edu	Undergraduate student
John	Pandoli	30245	japandol@ncsu.edu	Undergraduate student
Taylor	Brodbeck	30246	tjbrodbe@ncsu.edu	Undergraduate student
Zach	Shurow	30538	zashurow@ncsu.edu	Graduate student
Stephen	Odom	30247	svodom@ncsu.edu	Undergraduate student
Jose	Velarde Gainza	30248	jcvelard@ncsu.edu	Undergraduate student
Luis	Aguilar	30249	leaguila@ncsu.edu	Undergraduate student
Rajprabhu	Thangappa	21373	rthang@ncsu.edu	Graduate student
Sheng-Hsuan	Lin	30552	Slin22@ncsu.edu	Graduate Student

## BUDGET & FINANCIALS

Sponsor Name/Organization	Description	Contact Person	Amount
NCSU – Department of Civil, Construction, and Environmental Engineering	Financial support for 6 undergraduate students to participate of the 2019 Seismic Design Competition	Lindsay Smith	\$7,620
NCSU – Department of Civil, Construction, and Environmental Engineering	Financial support for 4 graduate students to attend the 2019 EERI Annual Meeting	Lindsay Smith	\$5,580
NCSU – Department of Civil, Construction, and Environmental Engineering	to support food for events	Lindsay Smith	\$175

## CHAPTER ACTIVITIES

### REGULAR CHAPTER MEETINGS

#### Seminar: Seismic Performance of Short-Period Reinforced Masonry Buildings – (August 22<sup>nd</sup>, 2018)

**P. Benson Shing, Ph.D**, a professor of structural engineering at the University of California, San Diego. His research focuses on understanding and improving the inelastic behavior of concrete and masonry structures in extreme earthquake events. His presentation reviewed design code methods for masonry structures and evaluating their effectiveness for the capacity design and performance comparing it to previous analytical studies that showed that buildings designed to current codes do not meet intended performance criteria. This presentation summarizes two recent studies, supported by the Applied Technology Council and NSF, respectively, to solve this paradox. The studies have used realistic computational models, which have been validated by experimental results, including those from large-scale shake-table tests recently conducted at UC San Diego.



#### Seminar: Machine Learning to Enable Image Classification of Earthquake Damage to Civil Infrastructure (September 7<sup>h</sup>, 2018)

**Anahid Behrouzi, Ph.D**, is an assistant professor of Architectural Engineering at California Polytechnic State University, San Luis Obispo. She has acted as the co-chair of the EERI Younger Members Committee as a voting member of the ACI 133 Disaster Reconnaissance Committee. Anahid discusses the progress of an interdisciplinary team of architectural engineers and computer scientists in developing a set of software tools to enable rapid post-earthquake damage classification for buildings and infrastructure. The ultimate goals of the project are to enable fast and comprehensive data visualization to be able to assess documented damage to inform the design of infrastructure systems in high seismic zones. She also described the different opportunities available for undergraduates and graduate students to get involved as part of the EERI national organization.



## Module Series: Seismic Design seminar series for SDC team (September 11<sup>th</sup> – October 25<sup>th</sup>, 2018)

Each year, the graduate student members of EERI at NC State host a special seminar series for the undergraduates interested in participating in the Seismic Design Competition at the annual meeting. This year, this series expanded to include a workshop component as part of the seminar, where students did some hands-on calculation or testing to apply the concepts learned. The series covers basic seismic design concepts that are not typically taught at the undergraduate level, and offers the opportunity for the undergraduates to learn the basic skills required to design their balsa wood tower. The series also provides graduate students the opportunity to teach what they have learned during their coursework and practice speaking to groups. The series is composed of 7 total lectures, outlined below:

1. Intro to SDC and Earthquakes: Ariadne Palma and Ishika Chowdhury (September 11<sup>th</sup>)
2. Intro to Structural Dynamics: Sugandha Singh and Christopher Price (September 20<sup>th</sup>)
3. Overview of Lateral Force Resisting Systems: Seismic Design: Diego Sosa and Diego Martinez (September 25<sup>th</sup>)
4. Introduction to Seismic Design: Arjun Jayaprakash (October 2<sup>nd</sup>)
5. Materials in Earthquake Engineering: Robyn Manhard, Jessi Thangjitham, and Gunay Aliyeva (October 11<sup>th</sup>)
6. SAP 2000 – Part I and II: Victor Calderon (October 16<sup>th</sup> and 18<sup>th</sup>)
7. SDC Logistics: Ariadne Palma (October 25<sup>th</sup>)



### Seminar: The Promise of Smart Materials in Earthquake Resistant Design (November 30<sup>th</sup>, 2018)

**Reginald DesRoches, Ph.D., F. ASCE, F. SEI**, is the William and Stephanie Sick Dean of Engineering at the George R. Brown School of Engineering at Rice University. He has also chaired the ASCE Seismic Effects Committee and the Technical Council on lifeline Earthquake Engineering. His research is highly interdisciplinary and spans micro to macro scale. He was recognized as the 2018 EERI Distinguished lecture. His presentations highlighted the application of one class of smart materials – shape memory alloys – in improving the performance of structure under earthquake loads. He presented a multi-scale and multi-disciplinary approach that explored the potential use of these materials for applications in earthquake engineering. He described the component testing, full-scale testing, and detailed analysis of the supplication of the SMA in the performance of non-ductile buildings and bridges.



### Event: Undergraduate Research Promotion (February 20<sup>th</sup>, 2019)

The Civil, Construction, and Environmental Engineering Department at NC State University has several opportunities for undergraduate students to be involved in research. This event, organized by our chapter and with the collaboration of faculty, was put together to promote these opportunities within the undergraduate student body, from freshman to seniors, focusing on the structural engineering and geotechnical engineering research areas. The UG research opportunities discussed were the following: Undergraduate Research Thesis, Undergraduate Research Assistant, Research Experience for Undergraduates (REU) program, and Research Internship Summer Experience (RISE) program. In the span of an hour, the event consisted of:

An introductory presentation to the different ways to get involved in research as a UG student;

A presentation summarizing current and past research in structural and geotechnical engineering areas;

A poster presentation by UG students and graduate students in Structural and Geotechnical Engineering research done at NC State University;

And a Q&A panel composed of professors, graduate students and undergraduate students.

This event will continue to be hosted in the coming years because it aligns with the student chapter objectives and it was successful in introducing students to research opportunities within the department that include earthquake engineering research.



### Seminar: Swift Island Historic Arch Bridge Rehabilitation (March 27<sup>th</sup>, 2019)

**Nicole Brown, P.E.**, is a bridge engineer for AECOM in the Raleigh complex structures group. She earned a M.S. in Civil Engineering from North Carolina State University in 2013. Her experience includes 3D finite element modeling, seismic analysis, low impact bridge repairs and replacements, among others. She has worked on projects in multiple states including North Carolina, Virginia, South Carolina, Georgia, Alabama, Florida, and Illinois. In her presentation, Nicole described the process to rehabilitate a historic bridge, the challenges found throughout the assessment of the existing structure, and the design of the retrofit. The Swift Island Historic Bridge was built in 1927 and spans over Lake Tillery. As part of the project, the bridge needed to be widened to two lanes while preserving the arch ribs, piers and its historical and architectural character. The design included a 3D finite element model of the deconstruction and reconstruction. The most challenging parts were ensuring the capacity of the existing arches and integrating the new columns to the existing bridge structure.

### Event: NCSU Engineering Open House (March 30<sup>th</sup>, 2019)

The EER Student Chapter at NC State participated in the Engineering Open House in Centennial Campus on Saturday, March 30<sup>th</sup>, 2019. This event is targeted to incoming engineering students including freshman and transfer students. During this event, the officers and some SDC team members presented the past activities of the chapter along with a poster. In addition, they demonstrated shake table tests using the newly acquired portable shake table with building structures constructed using K'NEX building set. These sets were put together following the guidelines specified in the EERI Classroom Outreach Training Workshop session at the 2019 EERI Annual meeting. This activity let interested students that approached the chapter booth build a structure and test it immediately after. It is the hope that the chapter can incorporate this shake table test with K'NEX kits as part of the upcoming outreach activities.



## SEISMIC DESIGN COMPETITION TEAM

The NCSU-SDC team is proud to be competing for their fourth straight year at the EERI Annual meeting held in Vancouver, BC, Canada. The team is currently working on constructing and testing their design on campus before making final adjustments to ship to the conference next month. The team is led by captain Graham Gatwood and consists of a total of nine undergraduate students. Two graduate student officers also act as advisors to the SDC team, providing guidance and support for the group. Victor Calderon is the primary advisor, while Arjun Jayaprakash also provides a great deal of support to the team.

The undergraduates have shown a great amount of effort and initiative to take the concepts from the SDC module series (seminar and workshop) and apply them to the competition project. This showed initially in the design proposal written during the fall. They were in the top 10 proposals this year. As well as demonstrating commitment and dedication in the final design and construction of the balsa wood model during the spring of 2019. The team has conducted material tests of their balsa wood, which was then used to develop a SAP 2000 model of their designed structure. Overall, the team keeps improving every year and we hope to educate more undergraduates interested in earthquake engineering.



2019 SDC Team right before testing their balsa wood model at the Seismic Design Competition in Vancouver, BC.

### SDC Team Members

First Name	Last Name	EERI Member Number	Email	Role
Graham	Gatwood	19232	gcgatwoo@ncsu.edu	Captain
Cade	Karrenberg	30243	ckarren@ncsu.edu	Construction Manager
Jacob	Seate	30244	jwseate@ncsu.edu	Construction Manager
John	Pandoli	30245	japandol@ncsu.edu	Structural Design
Taylor	Brodbeck	30246	tjbrodbe@ncsu.edu	Structural Analysis
Stephen	Odom	30247	svodom@ncsu.edu	Architecture
Jose	Velarde Gainza	30248	jcvelard@ncsu.edu	Logistics
Luis	Aguilar	30249	leaguila@ncsu.edu	Material Testing

## SDC Team Financial Sponsors

A list of financial sponsors for the SDC team.

Name	Email	Amount	Note
College of Engineering NSCU		\$7,620	

## ELECTION RESULTS

An election for officers for the 2019-2020 academic year was held in May 2019. The table below shows the new officers appointed to the Chapter board who will take office in June 2019.

Role	Name	EERI Member Number	Email	Student Status
President	Jessi Thangjitham	18314	jsthangj@ncsu.edu	Graduate Student
Vice-President	Taylor Brodbeck	30246	tjbrodbe@ncsu.edu	Graduate Student
Treasurer	Zach Shurow	30538	zashurow@ncsu.edu	Graduate Student
Secretary	Arjun Jayaprakash	18812	ajayapr@ncsu.edu	Graduate Student
SDC Advisor	Diego Sosa		dasosaca@ncsu.edu	Graduate Student
SDC Advisor	Victor Calderon	18080	vacalder@ncsu.edu	Graduate Student
Outreach Director	Sheng-Hsuan Lin	30552	slin22@ncsu.edu	Graduate Student
Outreach Manager	Cade Karrenberg	30243	ckarren@ncsu.edu	Undergraduate Student

## FEEDBACK FOR EERI

The EERI Student Chapter at NC State would like to thank the EERI organization for all of its support, specifically with the EERI Distinguished Lecture Program, the Younger Members Committee (YMC) Program, and the undergraduate Seismic Design Competition. The students and faculty have come to look forward to these events each year. We have no additional requests or comments at this time.

## LIST OF ATTACHMENTS

Included at the end of this report are the flyers of the events hosted during the 2018-2019 academic year.