

**Undergraduate Research Experiences in  
Construction Engineering and Management**

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Abstract

The need for providing formal education and training of construction professionals to meet the challenges of the construction industry is well recognized. An essential and integral component of the required formal education must be the research training of undergraduate civil and construction students to encourage them to pursue advanced education and research careers. With this in mind, the author developed a funded Research Experiences for Undergraduates (REU) summer training program for undergraduate civil and construction students that focuses on construction engineering and management issues and problems. This paper describes the structure of the REU program and the types of activities undertaken by the REU participants.

## 1.0 Introduction

The construction industry plays a significant role in the nation's economy. Its annual contribution to the national gross domestic product exceeds \$470 billion<sup>1</sup>. The industry faces numerous challenges and barriers that require better training of construction professionals. Consequently, providing formal education and training of construction professionals is necessary to meet future industry challenges<sup>2,3,4</sup>. Therefore, an essential and integral component of the required formal education must be the research training of undergraduate civil and construction students, encouraging them to pursue advanced education and research careers in this area. With this in mind, the author developed a Research Experiences for Undergraduates (REU) summer training program for civil and construction students that focuses on construction engineering and management issues and problems. The program was the first U.S. Construction REU site to be funded by National Science Foundation. The site is located at Western Michigan University (WMU). This paper will describe the structure of the REU program and the types of activities undertaken by the REU participants.

## 2.0 Objectives of the REU Program

Exposing undergraduate students to research and professional experiences are among the best ways to encourage them to pursue graduate studies and research. Therefore, the objectives of the REU summer program are to:

1. provide participants with the opportunity to work on construction research projects,
2. emphasize the importance of graduate education and research,
3. expose participants to the challenges facing the construction industry, and
4. provide participants with training in ethics in the construction industry.

### 3.0 Program Design

The REU summer program is designed to span a ten-week period. The program is comprised of two main components: Research and Professional Development. The activities undertaken in each component are described in the following subsections.

#### 3.1 Research Activities

The students are presented with a list of possible research projects before they arrive at the REU site. They are asked to rank these projects according to their interests. Each student is assigned a project based on their ranking before they join the program. Then, the students spend the majority of their time at the REU site researching the topic they selected. Some of the activities in this component that complement the research project include:

1. *Student-Mentor Interactions*: Participants meet regularly with their research project mentors. They also interact with graduate students assigned to their projects.
2. *Research Abstract Presentations*: Each participant (or team) is required to present to the group a project description and a plan of work at the end of the second week. The presentations are conducted in a conference format.
3. *REU Symposium*: At the end of the REU program, a symposium is organized to expose the participants to the professional conference environment. Each participant (or team) is required to prepare and present a five-page conference paper according to a set of guidelines. The papers are published in a conference proceedings.

#### 3.2 Professional Development Activities

The program is designed to include a host of professional development activities that complement the research component. These professional activities include:

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1. *Ethics Workshops:* The ethics workshop is offered over two days (five hours each). The workshop instructor utilizes a number of relevant case studies (research and practice) that are discussed and analyzed over the two-day workshop. The case studies are given to the participants before attending the workshop.
2. *Construction Engineering and Management Short Course:* The participants are introduced to basic concepts in construction engineering and management. The short course is delivered during the first week of the REU summer program. The course delivery method consists of lectures, videos, and group discussions.
3. *Site Visit to Construction Sites:* The REU participants visit a construction site twice to three times during the ten-week summer program. They are required to document each visit by a report and photographs. These reports are discussed and compared to the previous ones to analyze progress from one visit to the next.
4. *Visiting an Owner Organization:* REU participants visit an owner organization such as the Michigan Department of Transportation during the summer program. They tour the various engineering divisions that develop and administer construction projects.
5. *REU Visits to Research Centers and Laboratories:* REU participants visit one or two research centers/laboratories for a full day during the summer program. During these visits, the group tours the facilities, learns about the various research activities and projects, and meets with a number of researchers in these centers/laboratories.
6. *REU Research Speakers and Professional Conference Participation:* The aim of this activity is to allow REU participants to meet and interact with well-known researchers in the field. This activity is accomplished in two different ways. The first method is to invite a well-known researcher to visit the REU site for one full day. The second method is to take

REU participants to a professional conference where they attend technical sessions and interact with researchers and professionals.

#### 4.0 Summary and Concluding Remarks

This paper described the structure of an REU mentoring program at Western Michigan University that is focused on construction related research. The goals of this REU program are to encourage more construction and civil engineering students to pursue graduate studies and research careers, and to develop a sense of pride in their chosen professional career and field of study. The activities of the REU program discussed in this paper achieve these goals. More of these research training programs are needed to increase the number of individuals seeking graduate studies, advanced degrees, and research careers. This is particularly true in construction engineering and management, where the number of individuals seeking graduate studies does not meet the demand needed to face the significant increase in the challenges facing the industry. The REU program at Western Michigan University has been very successful and is a timely contribution to the many efforts aimed at enhancing the quality of construction education and at providing ways to face the challenges.

#### 5.0 Acknowledgements

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## Biography

OSAMA ABUDAYYEH. Dr. Abudayyeh is currently an associate professor of Construction Engineering at Western Michigan University. He was a Bridge Engineer in the Office of Structure Construction at the California Department of Transportation from 1991 to 1994. Dr. Abudayyeh earned his Ph.D. in Civil Engineering from North Carolina State University in 1991, and his M.Eng. in Civil Engineering from the University of California at Berkeley in 1987.