
Principal Investigator: Schafer, Benjamin W.

Organization: Johns Hopkins University

Submitted By:
Schafer, Benjamin - Principal Investigator

Title:
US Egypt Cooperative Research: Use of Cold-Formed Steel in Residential Housing

Project Participants

Senior Personnel

Name: Schafer, Benjamin

Worked for more than 160 Hours: No

Contribution to Project:
Ben Schafer is the U.S. PI in this US-Egypt Collaborative project. Professor Schafer oversees one post-doctoral scholar in the development of novel cold-formed steel members and framing solutions appropriate for resilient and sustainable construction in Egypt/the middle east. Professor Schafer also coordinates U.S. consulting and industry involvement with the project.

Post-doc

Name: Li, Zhanjie

Worked for more than 160 Hours: Yes

Contribution to Project:
Dr. Li serves as the primary full-time researcher at Johns Hopkins on the project. His efforts are focused on optimization in cold-formed steel framing. This optimization begins at the member level, extends to the system level, and all the way through life cycle assessment appropriate for measuring the sustainability of proposed novel cold-formed steel framing solutions appropriate for Egypt and the Middle East.

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

Egyptian Research Council
This project is a collaborative project with Egyptian researchers at the University of Cairo and the National Housing and Building Research Center in Egypt. Their part of the project is funded by the Egyptian Research Council.

Other Collaborators or Contacts
An Industrial Advisory Board (IAB) has been established for the project. The participants are Rick Haws - NuconSteel (Chair)
Research and Education Activities:
The project team (U.S. and Egypt) meets online approximately twice a month. Structural details for several multi-story archetype buildings (concrete, hot-rolled steel, and two cold-formed steel variants) have been drawn up to Egyptian architectural standards. Initial costs for these archetypes have also been established. Literature reviews on lightweight floors, fire protection, acoustics, and sustainability - appropriate for lightweight cold-formed steel framings have all been completed. Initial member-level optimization using a nearly free-form search for cold-formed steel shapes has been completed. The project team has met with the U.S. industry advisory board. The Egyptian team spent three weeks in the U.S. with the PI and his team in April 2012. A series of visits to companies and job sites in the Mid-Atlantic were facilitated by the PI to provide the Egyptian team with greater depth in the business-side and practicalities of lightweight cold-formed steel framing.

Findings:
We have determined that a conventional cold-formed steel framed building, designed to Egyptian architectural archetypes, costs significantly less (first cost) than conventional Egyptian (concrete) construction and can be built far faster. We have identified glass fiber reinforced concrete as a potential innovation with the ability to revolutionize flooring for cold-formed steel framed buildings and are performing preliminary small-scale tests. We have identified fire and acoustic as major challenges for lightweight cold-formed steel framing in the multi-story multi-family setting of the Egyptian archetypes, and through a review of the literature developed preliminary solutions. We have identified the sigma-shape as the most promising new shape for use in cold-formed steel framing, and are working to further optimize this shape. We have identified major hurdles for advancing new construction technologies in the Middle East and are developing a workshop to address these hurdles.

Training and Development:
For the JHU post-doctoral scholar: Dr. Li, this project has provided invaluable exposure to the full breath of possibilities for cold-formed steel framing and the challenges with accelerating technology uptake in the construction marketplace. This follows a highly theoretical Ph.D. by Dr. Li and thus is giving him far greater breadth in structural engineering. For the PI this grant provides a major international collaboration and has allowed him to work closely on the impact of thin-walled structures in new domains (in this case Egypt/the Middle East.).

Outreach Activities:
We have shared the project efforts with U.S. industry and engineering primarily through updates at the American Iron and Steel Institute Committee on Specifications meetings. The PI hosted the Egyptian team for three weeks in 2012. The team is planning a multi-day workshop in Egypt for next year.

Journal Publications
Books or Other One-time Publications

J. Leng, Z. Li, J.K. Guest and B.W. Schafer, "Constrained Shape Optimization of Cold-formed Steel Columns and Its Application", (2012). Conference Proceeding, Accepted Collection: Proceedings of the International Specialty Conference on Cold-Formed Steel Structures Bibliography: University of Missouri Science & Technology, Center for Cold-Formed Steel Structures

Web/Internet Site

URL(s):
http://www.ce.jhu.edu/bschafer/us-egypt-cfs
Description:
Project home page.

Other Specific Products

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Journal
Any Product
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Human Resource Development
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering
Any Conference