Report Prepared by:

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A Message from the Forum Chair

Dr. Makarand (Mark) Hastak, P.E., CCE
Professor and Head, Division of Construction Engineering and Management,
Professor, School of Civil Engineering,
Purdue University, West Lafayette, IN, USA.

GLF-CEM 2012 was organized and sponsored by the Division of Construction Engineering and Management, College of Engineering, Purdue University. I would like to thank all delegates who made this event possible and congratulate them for the success of this forum. I would also like to thank our Executive Committee members for providing their invaluable support in making this event successful. Thank you for giving me the honor to continue as the Chair for the GLF-CEM. I am looking forward to working with you in bringing the forum to the next level.

I am glad to announce that all the brainstorming sessions that occurred at the GLF-CEM 2012 have successfully ignited fresh thoughts for the future of GLF-CEM. We have accomplished the previously stated objectives of establishing a body of academic leadership in the area of construction engineering and management to discuss and share issues of common concern in research, teaching, academic administration, and opportunities for collaboration.

The events and their outcomes are documented in this report for your reference and use in future discussions.

Sincerely,
Makarand (Mark) Hastak
Chair, GLF-CEM
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<tr>
<th>Name</th>
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<tr>
<td>Dr. Simaan Abourizk</td>
<td>Professor of Civil Engineering and NSERC IRC in Construction Engineering, Canada Research Chair in Operation Simulation, Department of Civil and Environmental Engineering, University of Alberta, Edmonton, Alberta, Canada.</td>
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<tr>
<td>Dr. Irtishad Ahmad</td>
<td>Professor and Chair, Dept. of Construction Management, Civil and Environmental Engg., Florida International University, Miami, FL, USA.</td>
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<td>Dr. Raid Al-Aomar</td>
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<td>Dr. Stuart Anderson</td>
<td>Professor, Zachry Dept. OF Civil Engineering, Texas A&amp;M University, College Station, Texas.</td>
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<td>Dr. Chimay Anumba</td>
<td>Department Head and Professor, Architectural Engineering, The Pennsylvania State University, University Park, PA, USA.</td>
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<td>Dr.-Ing. Hans-Joachim Bargstädt</td>
<td>Dean, Faculty of Civil Engineering, Bauhaus-University Weimar, Weimar, Germany.</td>
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<td>Prof. Dr.-Ing. Fritz Berner</td>
<td>Professor and Chair, Institute of Construction Management, University of Stuttgart, Stuttgart, Germany.</td>
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<td>Dr. Leohnard Bernold</td>
<td>Associate Professor, School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia.</td>
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<td>Dr. Hans Bjornsson</td>
<td>Professor, Engineering Systems and Management, School of Technology Management and Economics, Chalmers University, Sweden.</td>
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<td>Dr. Jesus M. de la Garza</td>
<td>Vecellio Professor, Construction Engineering and Management, Department of Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA, USA.</td>
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<tr>
<td>Dr. Fletcher (Bud) Griffis</td>
<td>Professor, Department of Civil Engineering, Polytechnic Institute of NYU, Brooklyn, NY, USA.</td>
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<td>Dr. Carl Haas</td>
<td>Professor and Canada Research Chair in Construction and Management of Sustainable Infrastructure Department of Civil And Environmental Engineering, University of Waterloo, Waterloo, Ontario, Canada.</td>
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<tr>
<td>Dr. Makarand (Mark) Hastak</td>
<td>Professor and Head, Division of Construction Engineering and Management, Professor of Civil Engineering, Purdue University, West Lafayette, IN, USA.</td>
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<td>Dr. Chang-Taek Hyun</td>
<td>Professor, Dept. of Architectural Engineering, University of Seoul, Seoul, Korea.</td>
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<td>Dr. Charles T Jahren</td>
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<td>Dr. Edward J. Jaselskis</td>
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<td>Dr. Osama Moselhi</td>
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<td>Dr. Eddy Rojas</td>
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<td>Dr. Janaka Ruwanpura</td>
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<td>Prof. Dr.-Ing. Rainer Schach</td>
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<td>Dr. Lucio Soibelman</td>
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<td>Dr. Koshy Varghese</td>
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<td>Dr. Xiangyu Wang</td>
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Information Modelling (BIM), School of Built Environment, Curtin University, Perth, WA, Australia.

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<td>27</td>
<td>Dr. Jan Wium</td>
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**Observers**

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<tr>
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<tr>
<td>28</td>
<td>Dr. Andrew Bates</td>
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<td>29</td>
<td>Dr. Daniel Castro</td>
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<td>30</td>
<td>Dr. Dae Hyun Koo</td>
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<td>31</td>
<td>Dr. Boong Yeol Ryoo</td>
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**Delegates from Industry and/or Research Institutions**

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<tr>
<th>Name</th>
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<tr>
<td>1 Mr. Dana Bres</td>
<td>Research Engineer, Affordable Housing Research and Technology Division, Office of Policy Development and Research, US Department of Housing and Urban Development.</td>
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<tr>
<td>2 Mr. Wayne Crew</td>
<td>Director, The Construction Industry Institute, The University of Texas at Austin.</td>
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<tr>
<td>3 Mr. Tom Kudele</td>
<td>Sr. Project Manager, ExxonMobil Campus Project.</td>
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<tr>
<td>4 Mr. Jeffrey Lemna</td>
<td>Director of Corporation Training, Walsh Construction.</td>
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<tr>
<td>5 Dr. Tommy Nantung</td>
<td>Manager for Pavement, Materials, and Construction Research, Indiana Department of Transportation, Division of Research and Development, West Lafayette, IN, USA.</td>
</tr>
<tr>
<td>6 Dr. Steve Thomas</td>
<td>Associate Director, Construction Industry Institute, Austin, Texas, USA.</td>
</tr>
<tr>
<td>7 Dr. Konstantinos P Triantis</td>
<td>Program Director, Civil Infrastructure Systems Program, Civil, Mechanical, and Manufacturing Division, Engineering Directorate, US National Science Foundation.</td>
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## GLF-CEM 2012 Agenda

<table>
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<tr>
<th>Saturday May 19th, 2012</th>
<th>4:00pm to 6:30pm</th>
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<tr>
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<td>7:00pm to 9:00pm</td>
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<td></td>
<td>New Members Presentations</td>
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<td>Reception</td>
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<th>Sunday May 20th, 2012</th>
<th>6:30am to 7:30am</th>
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<td>Breakfast &amp; Registration</td>
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| 7:30am to 9:45am | ➢ Business Activities/ Meeting |
|                 | ■ Introduction of Officers/ Executive Committee Members |
|                 | ■ GLF-CEM Organization By-Laws |
|                 | ■ Report from Executive Committee |
|                 | ○ Road map |
|                 | ○ GLF-CEM 2013 in Hong Kong |

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<thead>
<tr>
<th>8:45am to 9:00am</th>
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<tbody>
<tr>
<td>Session-1</td>
<td>Delegate Presentations in Individual Workshop Groups</td>
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<td>9:00am to 11:30am</td>
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<tr>
<td>Session-2</td>
<td>Group Discussion on Individual Workshop Objectives</td>
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<tr>
<th>12:30pm to 1:45pm</th>
<th>Lunch w/ Speaker: Dr. Hans Bjornsson</th>
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<tr>
<td>Session-3</td>
<td>Presentations by Workshop Groups</td>
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<td>3:45pm to 4:45pm</td>
<td>Panel Discussion/ Question-Answer Session</td>
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<td>4:45pm to 5:00pm</td>
<td>Closing/ Concluding Remarks</td>
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<th>Banquet w/ speaker Mr. Wayne Crew</th>
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Overview

This forum is intended to bring together professors from leading universities around the world who play a leadership and/or administrator role in their respective programs. The objective of this forum is to establish a body of academic leadership in the area of construction engineering and management to discuss and share issues of common concern in research, teaching, academic administration, and opportunities for collaboration. The first meeting, targeted for a small focus group of select individuals, was designed to be a brainstorming session to establish the mission, membership criteria, and goals for such a body. Twenty eight (28) delegates joined hands together to put the foundation blocks for establishing the GLF-CEM during the first meeting. At the request of the membership, GLF-CEM 2012 was organized in conjunction with Construction Research Congress (CRC 2012) from May 19-20th, 2012 at Purdue University. The format and agenda for the second meeting was different than the first meeting. The theme was “Graduate Program and Industry Collaboration.” Executive committee members decided the theme based on the outcome of group discussions done during the first meeting. The second forum was mainly organized in three sessions- new member presentations, three workshops and a panel discussion. All new delegates, who could not attend GLF-CEM 2011, were asked to provide a factsheet documenting the CEM programs at their respective universities before the forum. The guidelines for factsheet and all the program factsheets submitted by delegates can be found in the forum proceedings. They also made presentations highlighting these details as well as a few unique features about their programs on May 19th. They also shared their concerns on different issues such as lack of sustainable funding, unavailability of resources, high ratios of students to faculty, and making over a completely new program.

In addition, three parallel workshops and panel discussion were held on May 20th. All delegates had to submit a report (outline for which was provided to them earlier) (Appendix A). The report was organized in three major sections- CEM graduate program structure, funded research and industry collaboration. Delegates were asked to submit this full report for their respective programs. All delegates were divided into three workshop groups based on their preferences and they made presentations on workshop objectives. Workshops were followed by panel discussion where industry leaders were invited to serve on the panel. Each workshop group provided specific questions that were posed to the panel.
Two distinguished speakers delivered excellent and thought-provoking speeches during lunch and banquet on May 20th. Dr. Hans Bjorsson, from Chalmers University, Sweden talked about the current approach that researchers in CEM community are following. He then discussed shortcoming of these approaches and absence of multi-disciplinary collaborations to achieve research goals. Construction industry and projects involve representatives from other disciplines for better execution and maximum impact. Thus, such approach should also be taken in research for the betterment of end users. Mr. Wayne Crew, Director of the Construction Industry Institute (CII) offered his talk titled “Will be or has been?” He presented some facts about CII and its member companies at the beginning of his presentation followed by some facts about current issues in the construction industry. He raised certain questions related to safety on the construction projects, training future project managers and asked academic community present at the banquet if they address these issues through their curriculum. He truly inspired all delegates to look into their programs, align them with what is required for future construction projects and train workforce accordingly. He left everyone with a great quote from Wayne Gretzky, a famous Canadian former professional ice hockey player- “I skate to where the puck WILL BE, not to where it HAS BEEN”.

**Workshop**

As mentioned earlier, three parallel workshop sessions were organized on the second day of the event. During the planning phase, all delegates were asked to provide their order of preference for workshops and based on that they were assigned to one of the three groups. Each group had specific objectives and related discussion points based on workshop topic. Group discussion held during GLF-CEM 2011 provided insights for certain needs and issues that this forum can address through future activities. Based on the outcome of those discussions, the Executive Committee finalized three workshop topics and objectives for each of them. Each workshop group had first 150 minutes for individual presentations followed by group discussion for last 50 minutes. Workshops were very intense and in-depth discussions showed the determined efforts made by all the delegates. Workshop groups, objectives and minutes are provided in the following section.
Minutes of Workshop Group#1 Discussion

Subject: CEM Graduate Program Structure

The objective of this workshop was to discuss what an ideal CEM graduate program (MS/PhD) structure would be, in particular:

a. Body of knowledge (including courses, etc.)
b. TA and RA experience
c. Graduate degree structure/requirements (thesis/non-thesis, etc.)
d. How to teach (teaching and learning, formative teaching)

Group Participants

Charles Jahren; Leohnard Bernold; Jan Wium; Jesus M. de la Garza; Rainer Schach; Eddy Rojas; Simaan Abourizk; Fritz Berner; Osama Moselhi; and Fletcher Griffis (Moderator).

Group Discussion

At the start of the discussion, members raised certain issues that the construction industry is facing such as cost overrun, project behind schedule etc. Members agreed that the curriculum should include courses to teach how such issues could be avoided. Students do not get enough exposure as class projects are not realistic and transparent, and may have different approach than common practices. Moreover, simulation studies are either pessimistic or optimistic, but not valid as prices are unreal. Curriculum should also include courses to develop certain skills required in the industry such as leadership, negotiation, attitude, ethic, and planning. Proactive and leadership skills are essential to succeed on actual projects. Case studies and projects should be designed to develop these skills to gain hands on experience of bidding, estimating, scheduling etc. In today’s fast paced world, it is important to review curriculum at regular interval to include latest knowledge base, best practices and updated standards used in the industry.

Group then moved on to discuss the goals and objective of the programs. They put emphasis on incorporating lessons learned for developing programs. This could be included in courses and their presentations. Feedback from companies who hire graduates would be important to know the difference between their expectations from graduates and actual performance and the curriculum could be updated accordingly. It was pointed that members should not only discuss what to teach, but also discuss how to teach. One of the ways this could be done is by allowing students to work on material (and projects) independently, instead of instructors helping them in this process. A person who goes to academia should know how to teach likewise a person who goes to industry should learn about leadership. There should be courses on methods of teaching that encourages creativity in students.
The discussion was then lead to the structure of CEM program. About 5 Universities from the participant group have the CEM program at undergraduate level. In Germany, it is a one-year at the end that covers CEM courses but in the USA, it is longer (about 2-2.5 sometimes even since freshman year). The ABET requirement is different than Civil Engineering. So curriculum generally includes structure and some materials courses, along with construction courses. However, environmental, geotechnical, or transportation courses draw less attention. There are 15 programs that are ABET accredited across the US and it is expanding. Whereas, some programs are within Civil with provision of getting a minor in CEM. Some programs, such as the one at Iowa State, observe undergraduate structure and try to replicate good practices at the graduate level. PhD program structure is different in different universities and most of them have specific requirements in terms of courses to take and research. They also need specific courses from other disciplines to learn about their research approach and teach courses.

A matrix for the program structure was suggested by Prof. De la Garza that has two dimensions-Construction Engineering and Construction Management from one side, and research and non-research from the other side. The body of knowledge (BOK) could be devised using this matrix and decisions should be made regarding core courses. These decisions may include things like type of courses, their number and optimal BOK. The core courses may teach fundamentals of different skills for the overall development of students. It is important to observe industry practices and teach students accordingly. Moreover, core courses should be reviewed regularly to embrace latest methods and advanced technologies.

There are many important areas that could be listed in what to teach. But it is equally, may be more, important to teach how to think. So core courses should put emphasis on including problem solving skills in the curriculum. Basically, the main focus should be on how and what to teach as both these aspects are crucial as discussed earlier. It is sometimes difficult to find the exact balance as knowledge part is easy to formalize but the how part is not. It is also vital to distinguish what is the difference between civil engineering and construction. The matrix suggests competencies that need more attention than core courses. These competencies may also be designed to enhance thinking ability.

In summary, this group started with identifying issues that the construction industry is facing and how they can teach students in CEM to tackle these issues through curriculum. This lead to the material that should be taught and show students the actual picture of the industry. It was agreed that along with teaching fundamental courses related to engineering there should also be courses to enhance some skills like leadership, ethics, attitude and planning for all-round development. Moreover, along with what to teach through these courses, group members also discussed how to teach to spark up the thinking process and enable students to resolve real problems faced on site. At the end, a matrix was discussed to create the body of knowledge for CEM programs.
Minutes of Workshop Group#2 Discussion

Subject: Increasing Funded Research for Members

The objective of this workshop was to discuss how GLF-CEM can increase opportunity for funded research for member universities, in particular:

a. Identify research needs
b. Funding agencies
c. GLF’s role in increasing interaction among member universities

Group Participants

Kostas Triantis; Edward Jaselskis (Moderator); Makarand Hastak; Lucio Soibelman; Raid Al-Aomar; Tommy Nantung; Satya Kalidindi; Hans-Joachim Bargstädt; Stephen Thomas and Dana Bres.

Group Discussion

The discussion started by introduction of the participants. The agenda and the objectives of the workshop were discussed. Then, the findings of a survey related to research in CEM were presented. The survey had been deployed to faculty members in CEM programs in the U.S. and Canada. Then, each participant presented about research areas in his university. Four representatives of funding agencies (i.e., NSF, CII, HUD and DOT) presented about the current research needs and funding processes.

Current Status of Research Funding in CEM

The findings of the survey deployed to the CEM faculty indicated that the current funding sources are perceived to be sufficient for research in CEM. Most of the CEM faculty members seek funding from various sources other than NSF, CII, and DOT. Also, the CEM faculty members tend to write research proposals with co-PIs from other areas of engineering and science to conduct cross disciplinary research. The CEM faculty in the U.S. collaborates with faculty in different countries. In the context of funded research, the level of collaboration is often hampered due to administrative restrictions of the funding agencies. However, funding agencies such as DOT and Qatar Foundation encourage international collaboration.

Research Funding Sources and Opportunities

There are different sources for research funding in CEM. NSF provides funding for multi-disciplinary research studies which promote basic science. For applied research, other agencies such as DOT and Department of commerce provide research funding. To make CEM competitive for obtaining research funding from NSF, the quality of the research proposals should be enhanced and the proposals should address fundamental basic research (hypothesis
driven research). NSF also seeks proposals that promote systems thinking. Broader impact is a key component in NSF proposals. There is a great opportunity for NSF funding in multi-disciplinary areas. One of the critical success factors in getting funding for multi-disciplinary research is creating a strong research team. The members of the research team should promote integrated research tasks rather than silo-based approach.

CII is the only private funding agency in CEM. CII identifies and supports research needs related to the construction industry. Industry experts work with academic faculty to write proposals. CII supports applied research that improves processes in construction industry.

HUD also supports applied research in the areas related to policy issues, disaster resilience, and energy efficiency of buildings.

DOT provides great opportunities for research funding that has not been fully explored by the CEM faculty.

- The following are examples of research funding opportunities provided by DOT:
  - State research program (80/20 matching)
  - Cooperative research programs (100% federal funded)
  - Pooled funds (100% federal funded)
  - FHWA Research programs:
    - Earmarked for designated programs
    - Innovative bridge research and development
    - Highway for life
  - University transportation centers
  - ITS
  - FHWA Training and education programs
  - Data and Knowledge management
- AASHTO SCOR:
  - Increase in size and number to address high priority national research and technology programs
  - Support management practices that ensure high quality research
- SPR Part II:
  - Allow states to address their critical transportation needs which are unique and constantly changing
  - FHWA Core Research and Technology
- University Transportation Centers (Mission: education and research)

The research areas of interest for DOT include: Construction quality, inspection errors, construction and design integration, and accelerated construction.
In addition to traditional funding agencies, the CEM faculty members seek funding from industrial companies. The key factor for obtaining funding from industrial companies is to invest time and energy to build relationship with key individuals and the company. The CEM faculty should diversify their research funding portfolio and go beyond the traditional sources of research funding.

**Future Direction of CEM Research and the Role of GLF**

To enhance the quality of NSF proposals, the CEM faculty members should be constructive when they review proposals. Senior faculty members should become mentors of the junior faculty. The CEM community should be trained regarding how to review proposals in the panels. The members of GLF should create a task force to define “what is the basic research in construction engineering and management”. Also, GLF could create a web-portal to post request for proposals and research expertise of the members to promote collaboration.

**Questions for Panel**

The following questions have been selected to be asked from the panel:

- How can GLF and CEM community help you achieve your goals—what are your biggest problems?
- How do you recommend the feedback loop between the agencies that are expecting basic research to the ones that are doing more applied research? How basic research can be picked by CII. How can CII provide basic research questions that can then be funded by NSF?
- Small companies—how to bring in inventions to small companies? Fragmented industry. How can we adopt innovations in our industry? Is the research scalable?
- Junior faculty: demands for balancing the portfolio research. How can faculty branch out to other agencies? How can the agencies attract junior faculty to explore research? What is the recommendation for faculty to diversify their research portfolio?

**Minutes of Workshop Group#3 Discussion**

**Subject: Industry Collaboration**

_The objective of the workshop was to discuss ways of increasing industry participation in a graduate program, in particular:_

a. **Industry interaction in teaching**

b. **Industry interaction in research**

c. **Industry placement and internships**

- *How to assure that graduate students get required experience?*
Group Participants

Irtishad Ahmad; Stuart Anderson; Chimay Anumba; Hans Bjornsson; Wayne Crew; Chang-Taek Hyun; Mike Kagioglou (Moderator); Tom Kudele; Jeffrey Lemna; Janaka Ruwanpura; Geoffrey Q. P. Shen; Koshy Varghese and Xiangyu Wang.

Group Discussion

The discussion started with short introductions given by each member. After the introductions and a short break, members were asked to write down their views on the important issues regarding each one of the three main points outlining the discussion. Each member’s notes were then collected, categorized under the corresponding main point and used as a starting point for the discussion.

Body of knowledge

a. Industry interaction in teaching

The discussion started with the industry representatives expressing interest to support and be involved in teaching and education. The nature of this involvement was then discussed by the group. The following points were covered.

The members expressed the importance of input from the industry in designing the teaching curriculums. Different ways of industry participation in teaching activity were proposed: the use of case studies from the industry at the various graduate and undergraduate levels was one way of adding practical knowledge to academic course, inviting industry practitioners as guest lecturers also provides students with knowledge from practical experience.

Another important issue recognized by the members for this point of discussion is the importance of establishing industry-supported courses, taught in collaboration by industry and academic professionals. The main idea is to capitalize on the synergy between operational knowledge from the industry and academic expertise from academia to develop continued training and certification programs. The following two examples were presented:
- The CII’s best practices courses which have been incorporated in academic courses at various universities.
- The AGC training programs were another option presented to be used as a model for developing the proposed continued training and certification programs.

An issue was raised regarding protection of company practices and how the unwillingness of companies to share their knowledge with competitors may be an obstacle facing the development of such programs.
b. Industry interaction in research
The main obstacle recognized by the members impeding collaboration of the industry in research is that the industry is mainly focused on finding solutions to current problems, while academic research usually looks for long term project funding. The members agreed that the best way to overcome this situation is for researchers to engage in resolving short term industry needs to establish a connection with the industry and at the same time communicate importance of long term needs. While academia focuses on publishing papers in academic journals, one way proposed by the members for reaching the industry and creating this interest in long-term projects is by publishing articles in professional and trade journals.

c. Industry placement and internships
The members agreed that more placement and internship opportunities are necessary for students; departments target 100% placement and 100% internships. The following methods were proposed by the members to achieve this goal: develop a memorandum of understanding for graduate student placement programs and form a steering committee tasked with managing the internship and placement process. The challenge faced for achieving 100% internships is assessing and communicating the benefits for companies achieved by supporting internship programs, e.g., that a $10,000 investment in a student over the summer will result in a $50,000 value of work.

From the industry perspective, internship programs are a method for early recruiting, to ensure suitable candidates for job positions further down the road. A question was raised regarding measuring actual retainage of internship programs. The members agreed that for companies in the industry, the designation of a program as a graduate internship program instead of a graduate research opportunity is more favorable, because the concept of internship is more tangible (i.e. the benefits from internships are more evident than the benefits from research opportunities).

Conclusion
The members concluded that academics tend to work in silos, which is not conducive to collaborative effort. To overcome this limitation, the members suggest holding one week long block courses in which experts from various fields and departments as well as industry practitioners are invited to participate, thereby creating networking channels and collaboration opportunities.

Questions for Panel
- How do you break down the barriers between industry and academia?
- What would be the main incentives for increased collaboration between industry and academia?
Action Items from the Three Workshops

Based on the workshop group discussions, the following action items were determined for GLF-CEM:

- Create a course curriculum with the help of industry experts that includes courses to better prepare students for professional career in either academia or industry.
- Define what the basic science is in CEM.
- Define strategies to promote international collaboration and multi disciplinary research.
- Train CEM community regarding how to be effective during proposal review panels.
- Create web-portal of CEM research.

Panel Discussion

A panel discussion was planned after the workshop discussions. The panel consisted of six members from research institutions and construction industry. Each workshop group raised some questions based on their group discussions and these questions were addressed by distinguished panelists. The session started with the first question asking how CEM faculty can help industry achieve its goals. The NSF program allows construction research community to lead its way into the future. Most of the funding goes to graduate support. However, the main issue for obtaining funding is the conservative panels who are not easily convinced of the proposed innovation. So the community has to challenge itself to help the program move forward. Whereas, the program manager (PM) can better lead if he/she has more information about the research. Furthermore, basic research can be increased to address the fundamental issues. It is also important to get higher quality proposals and communicate with program manager. That helps the PM to talk to other interested parties within the funding agency. PM can actually go and check the history as they represent the community and help the program to grow. From transportation point of view, Department of Transportation (DOT) funding structure is very precise that accommodates benefits and accountability. It is also not limited to the USA and emphasis is more on innovation. The academic relationship with industry should be partnership. CII is many times considered as funding source and not partners, and they look into academics as contractors. Both parties, academic community and CII, should change their approach and work as partners.
Another question that was put forward in front of the panel was how the barriers between academia and industry could be broken for the betterment of entire community. The panel suggested to identify the barriers first as both parties would often talk on different grounds. One of the barriers of research is its implementation in the actual world that is necessary for continuous improvement. Some of the other barriers are motivation to companies to participate in these efforts, different fundamental goals of these activities and how one can help the other to measure contribution to industry. In Indiana, there is Joint transportation research program (JTRP) that has broken the barrier. UTC and AASHTO have made collaborations at the national levels. The main missing link between industry and academia in the supply chain is implementing research into the practice. Both parties should also develop a mechanism to test the methods and/or technologies and work together to commercialize process.

Delegates also raised their concern about how they can teach effectively and for the benefits of all parties involved- teacher, students and industry. The panel suggested flipping the teaching system by allowing students to learn on their own instead of teaching them certain aspects of the program. Instructors can work with them during lab sessions to help students in their self-learning experience. Instructors can assist students in developing logical reasoning for their decision making. One thing that could be explored is to know how everyone learns to make this practice more effective. Other disciplines may have solutions for this questions and academic community should explore these options.

Another question was raised about the how innovation could be diffused to smaller companies and making it affordable for them. One such link is already in practice where CII performs necessary research. Big companies incorporate these innovations along with existing practices. Their experiences help smaller companies in adopting innovative methods. Panel faced last question where they discussed about the incentives for increasing collaboration between academic community and industry. Academic researchers and industry people can share real data for the benefits of both. Using this data to teach certain aspects of the industry practices would help students to get familiarized with real world. Creating a master dataset to develop and share case studies, as done in management studies, would be path breaking for the learning process of the students. Interactions through research projects may provide opportunity for students to earn a position in a company. On the other side, industry is facing the problems because of weak oral and written skills of construction employees. Instructors may want to
include these skills in their curriculum along with teaching the students leadership, ethics and attitude related skills.

**GLF-CEM 2013**

During the business meeting on the second day morning, Dr. Geoffrey Shen from the Hong Kong Polytechnic University introduced his department as one of the potential hosts for the next GLF-CEM 2013 meet. Executive committee met and discussed about other options like Germany and UK. For the convenience of all the members, they decided to hold GLF-CEM 2013 in Hong Kong under the leadership of Dr. Shen. More details about this would be shared with members early in 2013.

**Acknowledgments**

PhD students from Division of Construction Engineering and Management, Purdue University have contributed by documenting the proceeding of the event and providing their input for this report. Two to three PhD students were assigned to each event including the workshop groups to document the proceedings. This report documents the Global Leadership Forum for Construction Engineering and Management Programs 2012. Their efforts during the forum at Purdue and after the event are very much appreciated. Their names are listed in Appendix B as contributors to the minutes of the meeting. The assistance provided by different people from the division of CEM and Conference Department is deeply appreciated for the success of this event.
Appendix A

Report Template

<Insert University Name> Factsheet

Suggested font- Time new roman 12 pt
Paper size- letter 8.5” x 11”

Theme: Graduate Program and Industry Collaboration

1. CEM Graduate Program Structure
   1.1. Admission Criteria
       1.1.1. Criteria (e.g. GRE, TOEFL, years of experience etc.)
       1.1.2. Acceptance rate
   1.2. Graduate degree structure/requirements (thesis/non-thesis, etc.)
   1.3. Courses required/offered
   1.4. TA & RA experience for graduate students
   1.5. Average duration to finish graduate program (MS/PhD)
   1.6. Percentage of funded students and non-funded students
   1.7. Percentage of domestic and international students

2. Funded Research
   2.1. Total graduate student enrollment
   2.2. Number of PhD students/faculty
   2.3. Number of MS (w/ thesis) students/faculty
   2.4. Number of MS (non-thesis and course only) students/faculty
   2.5. Number of doctoral degrees awarded with CEM emphasis during 2006-2011
   2.6. Number of tenure track faculty
   2.7. Number of non-tenure track faculty
   2.8. Number of endowed chairs in CEM
   2.9. Average annual research expenditures/faculty
   2.10. Emerging/breakthrough research areas pursued by faculty
   2.11. Funding agencies supporting faculty research
   2.12. Examples of collaborative research (Title, collaborators, funding agencies, etc.)

3. Industry Collaboration
   3.1. Industry interaction in teaching
   3.2. Industry interaction in research
   3.3. Industry placement and internships for MS/PhD students
   3.4. Percentage of PhD students in academia versus industry upon graduation

Note: Complete reports are included in the proceedings of the GLF-CEM 2012 and is available on the website for the forum- http://rebar.ecn.purdue.edu/glff.
Appendix B

List of Contributors

- Sanghyung Ahn – PhD Student
- Mohammed Al Qady – PhD
- Nathee Athigakunagorn – PhD Student
- Abhijeet Deshmukh – PhD Candidate
- Joseph Louis – PhD Student
- Arash Mahdavi – PhD Student
- Ali Mostafavi – PhD
- Nader Naderpajouh – PhD Candidate
- Saumyang Patel – PhD Candidate
- Xing Su – PhD Candidate
- Erik Wright – PhD Student
- Yoojung Yoon – PhD