Minnesota State University – Mankato
Precast Studio
Annual Report 2015 – 2016

Mohamed Diab, Ph.D., Farhad Reza, Ph.D., P.E., and W. James Wilde, Ph.D., P.E.

Minnesota State University, Mankato Precast Studio

This is the second year of a program for the PCI Foundation which kicked off during the fall of 2014 at the Minnesota State University, Mankato. It is a collaboration between the civil engineering and construction management programs at Minnesota State University, Mankato and Wells Concrete Products, Inc. This program focuses on civil engineering and construction management undergraduate students, and on practicing engineers in the southern Minnesota region.

New courses in Prestressed Concrete Design and Risk Management were developed and taught for the second year, providing undergraduate civil engineering and construction management students access and understanding of unique attributes of precast concrete and to aid in their design and construction. Another important part of the program is the introduction of Building Information Modeling and how it can be shared between the engineer and contractor.

Throughout the last two years, the staff at Wells Concrete in Wells, Minnesota worked closely with the students and provided them with drawings and information on the Vikings Stadium and other nearby projects. Lectures in the classroom were supplemented with tours to the plant and jobsites, and by papers written by students as part of their coursework.

Construction Management Program

Spring 2016: CM 492 – Risk Management Seminar

This is a new course developed by Dr. Diab since fall 2014 for students participating in the PCI Studio. It provides an overview of risk management, and specifically risk associated with different stages of a project life cycle. The course provides an overview of risk analysis and identification; risk assessment; and risk mitigation. Much of the semester focuses on the construction of precast concrete projects including managing quality and inspection procedures. Construction installation techniques were discussed that could minimize construction risks and improve project cost and schedule performance.

Different class activities have been utilized in this course including student group activities and discussion, presentations from Wells Concrete professionals, and undergraduate student research projects.

Professionals Presentations to Risk Management Class

***Tammy Ferenz**, Construction Services Coordinator, **Eric Edstrom**, Field Operations Manager, **Josh Evan**, Field Engineer and **Gary Pooley**, Sales Manager, Tuesday Jan. 26th, 2016*

Professionals from Wells Concrete visited the risk management class to present and share their experiences and best practices in precast concrete construction.

In this class presentation, Gary and his colleagues discussed a wide range of information. A number of illustrated diagrams and technical charts for crane utilization and mobilization were presented. Many real-life situation photos were been shared in class to facilitate the understanding of materials. It was very informative and comprehensive session.

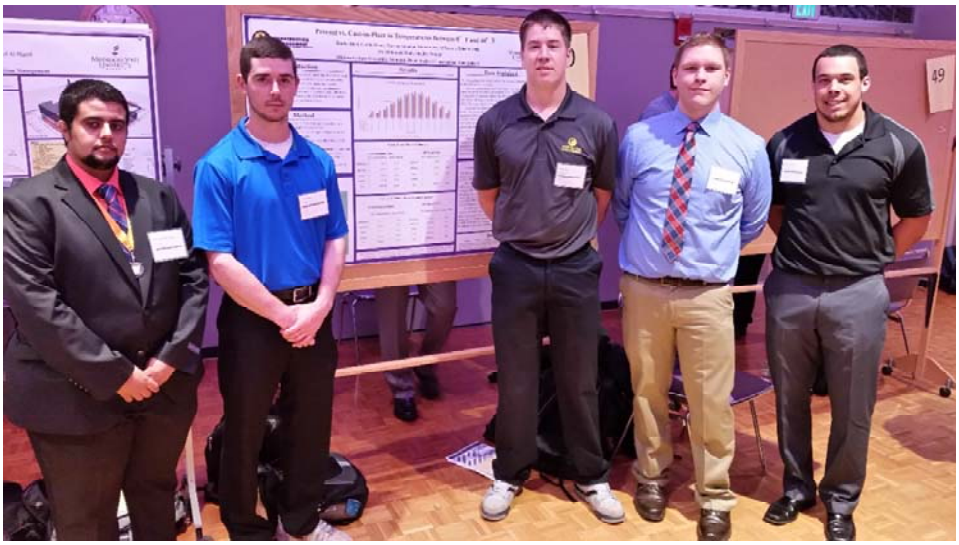
***Amro Sallam**, AIA, NCARB, Tuesday Feb 11, 2016*

Mr. Sallam presented his design collaboration work with a Swiss design firm to develop the design concept and design documents for the Orientalist Museum which situated on manmade island of the coast of the Persian Gulf and has an estimated budget of $360 Million.

He presented the creative solution of the design concept using Revit Modeling Software to develop different levels of Building Information Modeling (BIM). BIM was used as an important tool to facilitate the manufacturing and installation plans of the precast construction components in this project and highlighted the significance of selecting precast concrete construction method to produce high quality complex project.

Undergraduate Research in Risk Management Class, *Monday April 28, 2016*

In the Risk Management class, students were asked to explore a precast related topic to research and present in the annual Undergraduate Research Symposium at MSU on Monday April 18, 2016.



Ten of twenty-four students enrolled in this class decided to work on this assignment and in teams of five developed two posters of their findings to present in the symposium.

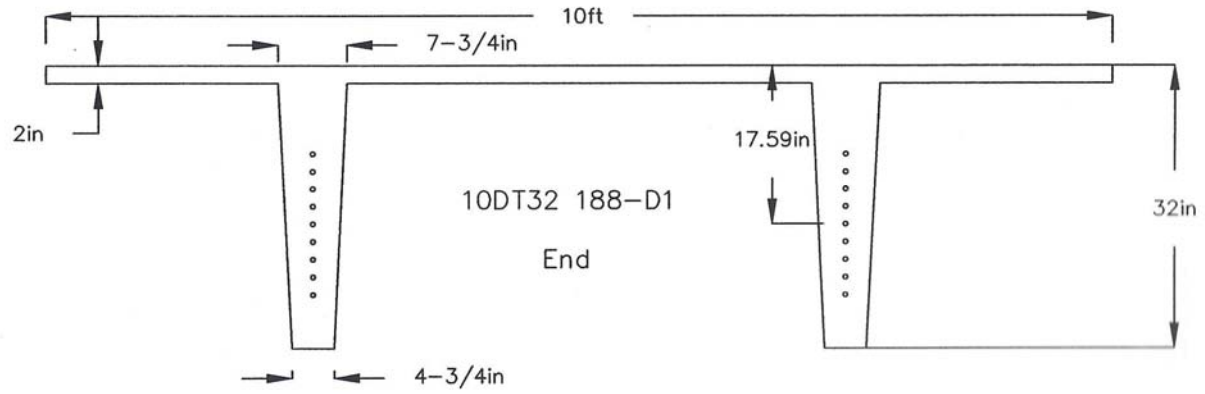
One team researched the impact of using precast vs. cast-in place to reduce the overall cost and time in cold weather especially in temperature degrees between 0° and 40° F.

The second team researched the significant schedule saving of precast concrete method in constructing the foundation walls for buildings.

Civil Engineering Program

Fall 2015: Prestressed Concrete Design:

In the fall semester, the Prestressed Concrete Design course was taught for the second time by Dr. Reza. Six students were enrolled in this course. The course covered the design of prestressed concrete structures; basic materials and prestress loss mechanisms; flexure, shear and deflections of prestressed concrete beams; and load-moment interaction curves for columns. In addition to a fundamental textbook in prestressed concrete, all the students obtained the PCI Design Handbook 7th ed. For the design project in the course, students independently designed structural components for the Microsource Plant in Shakopee, MN based on layout information from drawings provided by Wells Concrete. This was a great project for student learning as the building contained many different types of precast wall and floor components. Students designed inverted tee beams, double tee beams, hollow core plank, and columns.



Professionals Presentation to Prestressed Concrete Design Class:

Dustin Jones, *Design Engineer,* ***and Jon Feist,*** *Design Engineer, Wednesday Nov. 11, 2015*

Engineers from Wells Concrete came to class to present various design considerations and practical tips as well as demonstration of software used in the industry.

PCI Big Beam Competition, *May 18, 2016*

MSU civil engineering students participated in the PCI Big Beam Competition for the fourth year in a row. The beam was fabricated at Wells Concrete and tested on May 18, 2016. More and

more interest is being generated among students with the team size increasing considerably. This year's captain was able to benefit from having taken the Prestressed Concrete Design course.

Student Learning Outcomes

Mahad Osman (Senior)

I learned about the conservative nature of some of the equations used in structural beam design and their derivation from experimental results. Overall, it was a great experience to fabricate our own beam and be able to see the mode of failure.

Alex Fiebiger (Junior)

The biggest thing that I learned from Big Beam, is that one must always consider practical restrictions beyond those that are accounted for in design calculations, when determining the dimensions of a pre-stressed precast member to ensure an efficient and feasible product from paper to production.

Abdiweli Yusuf (Sophomore)

I learned to communicate beam drawings and pour tickets to our producer partner through the use of AutoCAD.

Abdiwahid Yusuf (Freshman)

Seeing the fabrication process of the beam was unique. I got a good understanding of the production process to turn a drawing into reality.

Samuel Agyemang (Freshman)

It was a fun experience being a part of the big beam team this year. Among the numerous things I learned was how to test the concrete for viscosity and of course some videography techniques.

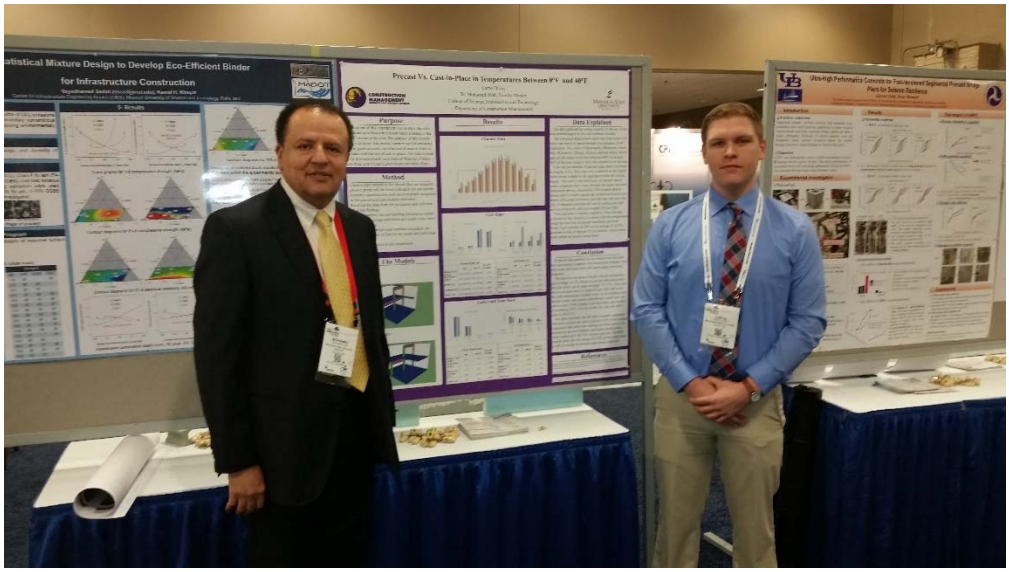
Joint Construction Management and Civil Engineering Activities:

Building Information Modeling:

The 3-cr BIM class was offered by the Construction Management Department in the Spring. The class was approved as a technical elective for Civil Engineering students and was taken by three students. Students in this class learned how to create and use BIM in the construction industry and how construction management and civil engineering students can collaborate on BIM to complete their projects successfully. Civil engineering students later utilized their BIM skills elsewhere. For example, one student utilized BIM for their Senior Capstone Design projects

PCI Convention & National Bridge Conference, *March 1-5, 2016*

One student each from the civil engineering and construction management programs joined Drs. Reza and Diab in attending the PCI 2016 Convention in Nashville, TN. They participated in the education sessions and other technical sessions to learn more about prestressed/precast concrete and network with industry professionals.
Curtis Olson a construction management student presented his poster in this convention about his undergraduate research topic; Precast vs. Cast-in-Place in Temperature between 0° F and 40°. His research is part of the Risk Management class activities where students study and investigate different construction risks. Two groups of five students each presented their research at the university undergraduate research symposium in April 18, 2016. Their research work highlights the impacts and advantages of using precast concrete in mitigating different construction risks.



Scholarships

PCI Foundation Scholarships of $2,500 each were awarded to Nicholas Guetnzel (Construction Management) and Alexander Fiebiger (Civil Engineering). Another Wells Concrete Scholarships of $2,500 each were awarded to Mark Mahowald (Construction Management) and Bassam Al Mohamadi (Civil Engineering). Qualifications for the scholarships included participation in the full-year precast concrete program, and enrollment of the appropriate fall and spring courses related to the program.

Highlights of the MSU PCI Precast Studio

An interview with one of our recent graduates from the PCI program, Chase Radue, now working as a field engineer with Wells Concrete was published by the PCI Foundation. The interview gives a good testimonial of the successful program at MSU, Mankato. We are also pleased to announce that one of the members of our second "graduating class" of the PCI Educational Project, Mahad Osman, is working as a summer intern for Wells Concrete before heading to graduate school at the University of Minnesota. Another junior, Alex Fiebiger, who already took the BIM class and will be taking the Prestressed Concrete Design class in the fall is also working as a summer intern at Wells Concrete. Other civil engineering PCI graduates took positions with consulting firms and the Minnesota Department of Transportation. Each of these graduates may be involved in precast concrete work in the future.

Photo: Jenny Frost, Wells Concrete

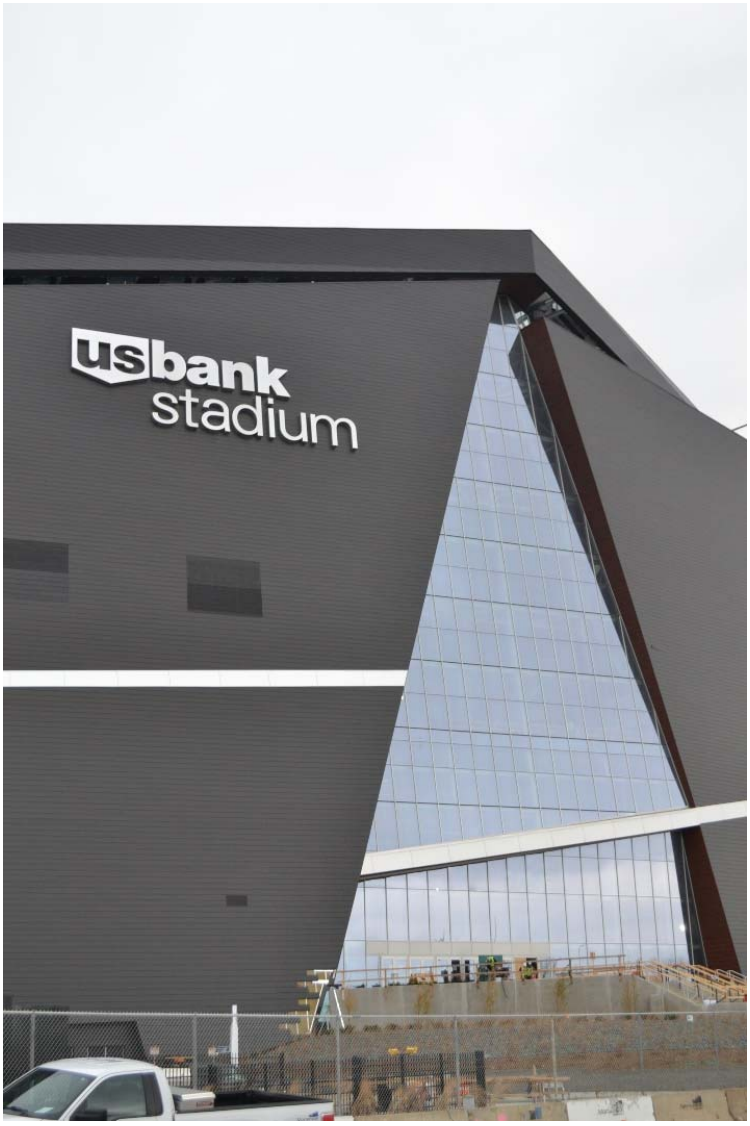
Site Visits

Several field and plant trips involving both CIVE and CM students and faculty were organized by Wells Concrete that included the following.

October 15, 2015: Prairie View Middle School, New Ulm High School, Verizon Wireless Events Center

September 24, 2015: Wells Concrete Plant and United South Central School


WELLS CONCRETE



November 5, 2015: US Bank Stadium
Minnesota Vikings Stadium