

**Teaching Construction Project Management
With an Historical Perspective**

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ABSTRACT

The construction techniques, successes and failures of historically significant projects are most often learned as history lessons in social studies class with little emphasis placed on the actual events, circumstances, technology and creativity that led to the success or failure of these projects. A close study of the actual history of these types of project can serve as an interesting and important teaching tool for students of construction management.

The ability to deliver course materials involved in a construction management curriculum generally encourages the instructor to develop artificial projects which serve as little or no inspiration to the students. However, when the modern techniques of construction management are applied to projects of historical note, students view these projects in an entirely new light. Projects that were learned as simple history lessons become case histories that involve the students and require them to fully grasp the process of construction on a grand scale. The students come away with two valuable assets; the use of construction management tools to assess a project and a new respect for the history of the construction industry. Further, as historical records are never quite complete or the information found in the format necessary in analyses, it requires the student to make assumptions concerning the project analysis and check these assumptions against the reality of the construction project.

Through the use of team analyses and presentation of project planning and evaluation techniques, students have become enthused about the role of the construction industry in our society.

The construction techniques, successes and failures of historically significant projects are most often learned as a history lesson in a social studies class with little emphasis placed on the actual events, circumstances and creativity that led to the success or failure of these projects. In general, projects of historical significance, such as the construction of the Pyramids, the excavation of the Panama Canal, the erection of the Empire State Building, or the building of Brooklyn Bridge represent important events in the history of construction. These projects, as well as many others, do not necessarily mark leaps in the technology of construction but rather represent the application of contemporary construction management technology of creative designers and constructors who saw the technology of their times and applied that technology to the project at hand. These were people who saw the project and refused to be deterred from their ultimate goal by problems and events of their times.

Furthermore, these were real projects. These were not academic exercises but projects that, for the most part, a student can visit, see, feel, touch, walk across and make a personal connection to those persons who actually “got the job done”. This is particularly important for engineering technology students whose strength lies in the “real world” of applications and not in the theoretical world.

Unfortunately, these projects of historical significance are often only learned as history lessons and not as demonstrations of the constructor’s craft.

Construction project management, as subject matter, is a difficult area to teach and have the students make a personal connection to the course material. Aside from the basic technical information of the principles of management, basic scheduling techniques and the use of current industry software, such as Primavera, the course material tends to be a little dry and lifeless for the student. After all, academic homework problems in Primavera are as straightforward as a Calculus I problem and always end with a nice, clean solution without any loose ends. All the information needed for the problem is in front the student in a neat package. However, that is not reality.

As one in the field knows, actual construction projects are rarely straightforward and are often accompanied by lots of loose ends. For the actual construction management professional, most projects abound in hidden problems and require judgment and approximation in order to complete the project. Construction management, therefore, is just that, management, requiring a team effort in the exercise of judgment based on the best information that is available at the time.

One solution to this dilemma would be to give a group of students an actual project to build and allow them to learn based on their success or failure. The benefit of this type of approach would be that the “real” nature would certainly hold the students’ interests. Working with actual constructors is the goal of these students and allowing them that direct opportunity would place them right where they want to be. The obvious downsides to this approach would be that it would be extremely costly to turn an actual project over to a group of students. Further, the time and effort that would be required of the students would deprive them of the time to complete any other coursework that semester. Also, their experience would be limited to the success of that particular project and they might not experience the full range of project problems. Further, monitoring and directing the students’ efforts would be an extremely difficult task for the faculty member assigned to this task.

A second solution would be to create a prototypical project for the students to complete. The instructor would prepare a sample project with all the necessary features that are desirable for the students to learn. While this is a good approach, this does require a considerable effort on the instructor's part in setting up the problem and monitoring the students' efforts. One downside to this approach is that it is difficult to get engineering technology students overly enthusiastic over a project that they know is an academic exercise. The only connection that they make with the project is that it is worth a grade and that is the only connection that is made. Also, if the project is repeated from year to year, last year's projects have an amazing way of reappearing as this year's projects, particularly if a good deal of time consuming scheduling is required.

In an effort to get the students more involved with the process, an instructional approach of allowing students to look at historically significant construction projects was adopted.

The goals of this learning exercise were many. They may be summarized as follows:

1. Team Building Skills - The students would be allowed to select their own project groups and delegate the project responsibilities among the three members of the group. The groups would also be permitted to select the project they were interested in studying. A list of acceptable projects was supplied to the students, however, with the instructor's permission, projects not on the list could also be studied. While each group would be responsible for one project report, each group member was assigned to a particular task of their choice, which, for grading purposes, would be clearly identified as their own work.
2. Project Management Skills – The students were required, as an initial project submission, to list the group members and a project plan with an accompanying schedule. This project plan did not relate to the actual construction project but rather to the group's activities, i.e., who would accomplish what and in what time frame. This schedule of the group's activity, along with a review of when these activities were actually accomplished, was to be submitted with the final project report. Also required with the final report was a critical analysis of the members of the group by the members of the group. This analysis was to be centered around the work actually performed, the technical ability of the work performed, the timeliness of the work performed and how the student could have helped the other group member become more successful. As the potential for either glowing student evaluations or outright physical conflict was great, these reviews were submitted confidentially and independently. The individual student reviews were distributed to each student at the conclusion of the class.

Each group was required to have a weekly project meeting and notes were to be taken during this meeting. Ten minutes were allotted at the end of each class session for group meetings. Additional team meetings could also be held at the team's discretion. A copy of the meeting minutes was to be submitted by e-mail to the instructor by a weekly deadline. Failure to comply with the deadline resulted in a deduction in the overall project grade.

3. Technical Review – Each group was to review their project in three areas; budget, schedule and applicable technology. In each of these areas the group was required to look at what occurred, make a critique of the overall project activities as they occurred and offer suggestions on how the project could have been accomplished in a more efficient manner. This analysis would occur with current software applications, specifically Primavera scheduling software and Excel spreadsheets for financial analyses, but the project was still to be considered as being actually constructed with the technology available at the actual time of the construction of the project. With respect to budget, each group was responsible for determining the initial funding level of the project, the final budget for the project as well as the cash flow of the project as well as a suggestion for an “improved” budget. The schedule review would include the initial project schedule, an “as-built” schedule as well as a proposed “improved” schedule. The technology portion included a review of the technology available at the time of construction, a review of the actual construction techniques employed during the construction of the project as well as a review of “improved” construction techniques and methodology.

4. Presentation Skills – Each group was required to present the results of their project review in both written and oral presentations. As stated above, each group member was responsible for one aspect of the project so that assembly of the final report was essentially a matter of putting each section into a binder and submitting it. Thirty minutes was allotted to each group for the oral presentation of the project. Each group member was responsible for a ten-minute presentation of their project section so that all group members participated in the presentation. The group members were free to make their presentation in whichever format they felt was most effective. This included the use of handouts, overhead transparencies or computer generated PowerPoint presentations. Grading of the presentations was accomplished by allowing the remainder of the class to judge the effectiveness and quality of the solutions and presentations. This grade was factored in with the Instructor's impressions.

In application, the use of this teaching technique resulted in some very interesting reports and some amazing results.

Based on the experience of offering this technique over two semesters with two different groups of students, one being a day session and the other session being a night session, the results of the four project areas can be summarized as follows:

1. Team Building Skills - Without exception, all students developed quickly into groups and quickly selected projects that they apparently found interesting. The delegation of tasks for the project required only minimal mediation by the instructor. Team leaders emerged from each of the groups with little direction from the Instructor.

2. Project Management Skills – This aspect of the assignment focused on the students agreeing by consensus on how they would define and manage their own activities. Essentially they were being requested to review the management of a construction project define the tasks to review the project and manage their own time in completing a project report. In general, the initial projections of project milestones were overly optimistic and resulted in a little bit of scrambling at the end of the project. This result was not unexpected as it has been my experience that most students do this with most courses. However, it was interesting to note the students' reactions to their own schedules. With respect to group meetings, the allotment of ten minutes at the end of each class session proved to be far too short. In general students had to be asked to leave the class and reconvene their meeting somewhere else as the meetings exceeded the ten minutes provided. Occasionally these meetings became heated when one student was behind in his work. While amusing, this aspect did require a little bit of mediation on behalf of the instructor. The requirement for the evaluation of fellow students was also an interesting aspect of this assignment. Students, with the promise of confidentiality, were surprisingly candid and harsh with their classmates. The one aspect of this requirement that was not accomplished very well was the response to the question as to how they could have improved their classmates' performance. In general, this question was either left unanswered or answered without any sufficient clarity to really address the question.

3. Technical Review - This portion of the assignment presented the students with their greatest difficulty as they found that the information they were looking for was not in the form that they wished it to be in. Exact budgets and costs were, for the most part, not found as might be expected in a textbook simulation of the project. The same could be said for the review of the actual progress of construction. This was intentional and expected so that the students would have to reason their way through the information that they could locate, which was available in historical sources. This proved to be a valuable lesson for the students. Research on the Internet proved to be valuable in this regard but also revealed the problem of conflicting information found on the Internet. With respect to technical information, one student actually conducted a search of the United States Patent Office to reveal what technologies could have been available during the construction of the project he was reviewing. This was interesting in that the devices that he was suggesting were patented but not commercially available and the student was unaware that just because an item is patented doesn't mean it actually exists.

4. Presentation Skills – When the students were first given the assignment, there was a general reaction that thirty minutes was far too long for a presentation. In actuality, it proved to be far too short. The quality of the presentations was outstanding. The students got so involved in the projects and had so much information that they wanted to share that an hour would not have been sufficient. This included slides of various trips to the Brooklyn Bridge, the Empire State Building and, in the case of one night student who was on a business trip to California, slides of the Golden Gate Bridge.

The grading of the presentations by fellow students proved to be far more severe than what was provided by the Instructor.

As part of the course requirements and for class assessment purposes, the students were asked to complete a questionnaire as to the experience of working on this type of assignment. The general response was a very positive one and included a request by one student that all courses should be done this way.

A close study of the actual histories of these types of projects can serve as an important lesson for those in the construction management field. Construction project management texts and course work generally emphasize current techniques and technology that are currently available to students in their practice of this field but spend little or no time applying these present day techniques to actual projects. The student is given these tools and must await graduation to employ the knowledge learned to an actual project. While this is a valid technique, it offers little interest to the student, eager to apply his new knowledge to a real project. Further, the use of these techniques does not encourage the creativity in the aspect of construction management problem solving that the student will be required to demonstrate upon graduation.

In summary, this approach to teaching construction project management proved to be a very successful exercise. It taught the students to apply the technical knowledge they were gaining as well as to develop their team building, project management and presentation skills. This was provided in a format where they were required to work as a team but also would be recognized individually for the work that they had personally accomplished. The students became so involved in the process of discovering the past history of the projects they selected, these projects took on new life. No longer were these projects merely facts in a history book. These projects became what they really were – significant accomplishments of the construction industry and as such the students developed a new respect for these projects and the people that built them.

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