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Paper ID #14547

A Faculty Summer Internship Case Study

Mr. William P Manion, University of Maine

Mr. Manion is an Assistant Professor in the Construction Engineering Technology Program. Prior to his current appointment, he was an Instructor in Civil and Environmental Engineering for fourteen years. His interests include industry collaboration, alternative pathways to engineering degrees, workforce development and sustainable methods in building construction.

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This paper describes a case study of a successful summer faculty professional internship in the construction industry. The author worked for ***** Corporation, a heavy earthwork contractor, to support a new company wide effort to improve quality, planning and productivity. The purpose of this paper is to present a model for other faculty members, to inspire others to pursue similar ventures. To provide the context for the model, some activities and techniques used to study and improve construction productivity are also presented.

Key words: Professional internship, Faculty industry experience

Introduction

During summers of 2011 and 2012, the author worked for ***** Corporation, an open-shop heavy earthwork contractor based in *****. ***** Corporation employs approximately 22 field superintendents overseeing about 450 foremen, operators and laborers in the height of the summer construction season. They have four regional operations units, each with an operations manager. Total annual volume ranges between $80-100 million. Typical projects include commercial sitework, water, sewer and storm utilities, roads, landfills, airports, wind power and dams.

The author's position was officially as Project Manager, reporting to the Vice President of Operations. However, the usual work tasks were more like a consultant or general manager without having the responsibility of construction personnel oversight. Professional management intern could also have been an appropriate title.

The ***** Advantage is a company-wide program to improve quality, planning and productivity. Launched in 2011 just prior to the author's first season in the field, it comprised a number of new strategic pre-planning, job status and review meetings, task planning and new procedures and emphasis on daily and weekly production analysis. Although involved in many of the strategic meetings, the author worked primarily with production analysis and task planning in the field.

This paper is organized into a literature review, internship experiences, conclusions and recommendations. The literature review covers a few previous works related to productivity and industry versus academic experience for construction faculty. The largest section is methodology with an overview of what the author did while working for ***** Corporation, including job visits, productivity analysis tools, planning tools, a survey of superintendent activities, meetings and training.

Literature review

Faculty in Construction Management programs often have a mix of industry and academic experience. According to data presented by Reginato[1], the trend toward hiring new faculty members with doctoral degrees has reduced their respective industry experience. Once in a faculty position, one method to supplement industry experience is through a professional internship, working directly for a construction company. For a more comprehensive study, Reginato1 has a number of good references. Additional information on the mix of academic and industry experience, particularly the definition of an appropriate doctoral degree program in construction, is reported by the Associated Schools of Construction Doctoral Education Task Force[2].

Since the work performed during the internship was primarily oriented toward productivity improvements, a brief literature review was undertaken to support that effort, applying a traditional academic method to a more practical construction problem. In short, productivity improvements can be very technical, such as new tools, materials and methods. However, productivity can also be improved with changes in management style, personal behavior and even the culture of the organization. Thompson, et al.[3] describes the design and construction of a prototype scaffold that converts into a cart for improvements in productivity, as a collaborative effort with industry. Koch and Benhart[4] present the development of competencies for field supervisory personnel. They categorize competencies into either technical or behavioral. Lasker, et al.[5] describes an even more employee-oriented "high-performance management" approach, equating happy workers as productive workers.

Internship experiences

The overall mandate from upper management was fairly open ended: visit all the active projects and work with the superintendents and foremen to improve productivity and planning. Visits ranged between a few hours to a few days in succession, depending on the size of the site and the field management involved. For example, a small commercial site with one foreman might take a few hours. However, a large, remote wind power site in the mountains, with a dozen or more foremen could take two days to get around and physically visit everyone. The visit schedule was arranged largely with input from operations managers and priorities developed in weekly management meetings. In addition to visiting sites, the author attended management, handoff, job strategy and exit meetings, and assisted with annual training for field management.

Site visit strategies

Site visits usually involved several different activities, including a job tour with the superintendent and/or key foremen, working on specific construction tasks with a crew, reviewing productivity goals, measuring current productivity, planning future tasks, and general brainstorming and troubleshooting. Over the two summers, the author visited over 40 different

projects. Most projects were visited at least two times, but many were every few weeks, and some on a weekly basis.

Job shadowing a superintendent was a great opportunity for them to verbalize their general plan and schedule in an open, non-threatening environment. The author was simply there to listen, talk about strategy and sometimes offer suggestions. Topics ranged widely from overall schedule to specific task details, equipment and management issues. After the initial project visit, following visits were more focused on specific planning and/or productivity of construction tasks. Productivity analysis sheets were developed, reviewed and revised, with the results communicated to the foreman and crew. Sometimes foremen themselves worked on the spreadsheets, but they were always involved in the productivity process and results.

A tool: productivity analysis

A number of spreadsheets were developed to help field management quickly measure task productivity. These so-called productivity analysis sheets were tested and refined over two seasons of field implementation. The spreadsheets themselves had two parts. First, crew and equipment were selected, along with budget requirements and maximum productivity goals from references such as the Caterpillar Handbook. The second part involved measurement of actual hourly productivity for comparison to the budget and productivity goals. The results were then regularly shared with the whole crew, typically on a daily basis. Ultimately the overall goal was to stimulate discussion of short-term daily and weekly productivity improvements and implement them.

Another tool: preparatory planning

A second major tool, already in use but not always effectively, was a planning form to be filled out for each individual project task. Developed by the superintendent and responsible foreman, it summarizes all the relevant details, including item numbers, contact information, plan and specification references, production targets, safety requirements, a detailed scope of work, exclusions from scope, equipment, materials tools and labor, permits, alternative activities and a sign off block for the crew. It is a very effective planning tool for field management as well as a communications tool to make sure the whole crew understands the task to be performed. It should also be revisited as crew members change and as the work progresses. The author helped review and draft many of these planning forms, especially for more difficult or unique construction tasks.

A survey: what do superintendents do in the course of their work?

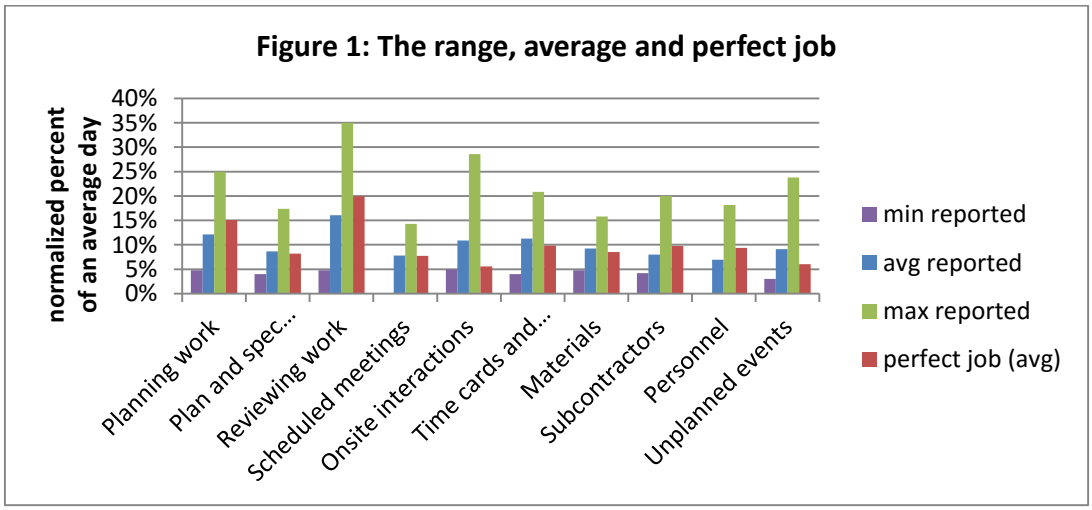
During a company-wide superintendent meeting, a survey was conducted to gather some data about the activities that occupy superintendents' time. The survey categories were developed by interviewing a number of prominent superintendents, developing a list of activities and

categorizing them. Respondents were asked to consider the middle two-thirds of a recent project, and report the percentage of their time spent on ten tasks, based on a 10-hr day and 50-hr week. To compare their priorities against the company's collective representation of a successful project, they were also asked to rate a "perfect" job, one that would be most productive and enjoyable in their opinion. The overall goal of this exercise was to initiate discussion about how superintendents' time is spent compared to what they prioritized. In the end, twenty survey responses were collected and analyzed.

Figure 1 shows a comparison of the actual projects to the perfect project, showing the minimum, average and maximum of all twenty results. Consider that 10% is equivalent to an hour assuming a 10-hr workday. The minimums are generally 0 to 5% (less than ½-hr per day) and the maximums vary widely. Highlights from the data include the following.

- Scheduled meetings, addressing plan and specification changes and ordering materials are approximately equal.
- Superintendents would definitely like to spend more time planning and reviewing work with the crews, in total perhaps 3/4-hr more per day.
- Interestingly, the data shows superintendents' interest in spending somewhat more time with subcontractors and personnel.
- To compensate, they would like to spend much less time in unscheduled onsite interactions with owner's reps, at least a 1/2-hr less per day, and not surprisingly, a little less time on time cards and much less on unplanned events.

Overall, the results indicated how much time superintendents generally spend on ten major categories of tasks. They were intended to help superintendents validate their own workday practices, as well as to guide where resources (if any) may be prioritized. Obviously, job conditions and requirements vary widely.



Managerial Meetings

The author participated in regular weekly management staff meetings, as well as project-specific handoff, job strategy and exit strategy meetings. The staff meetings largely influenced the author's site visit schedule, informed from progress updates by project managers and operations managers. The company productivity scorecard was also reviewed, which also helped determine the priority of site visits.

The ***** Advantage program also involved several focused meetings for different phases of each project. The author attended and contributed to a number of these, both in the field and the office. Handoff meetings are used to facilitate transfer of project information from estimating to operations. During the execution of the project, job strategy meetings are used with more field personnel to develop specific task item planning. Finally, exit meetings are used as projects are winding down, to expedite finishing final tasks and punch list items efficiently.

Training

***** Corporation also organizes a number of training sessions annually and as needed. The March pre-season superintendent and foreman training consists of 3-5 days of company updates, specific educational sessions and annual programs required by statute, such as safety, DOT, first aid and awareness. The author developed and conducted many of the educational sessions, including change and goals, anatomy of a productivity spreadsheet, activity analyses, good planning documents, situational leadership and a hands-on planning event. In addition, the author has assisted with formal and ad-hoc training of software and usage.

Conclusions

The professional summer internship provided many benefits for the author, both personally and professionally, for the University and for ***** Corporation, as summarized below. It was a great combination that helped bring us all together, closing the loop between academics and industry to improve relationships and practices in the construction profession. Finally, based on the author's experience, some recommendations for faculty to develop similar partnerships are also given.

Personally, the author enjoyed being a vital part of construction operations, as a much more consequence-driven environment than academics. Construction operations are much more intense and time-sensitive, emphasizing communication, organization and documentation with economic and long-term consequences. Instead of being the central authority in the classroom, the author was careful not to get in the way of operations in progress, often waiting for a natural or scheduled break to initiate a conversation. The experience built confidence to cover current industry practices and issues in the classroom, as well as many "real world" stories to back up educational objectives.

Professionally, the author gained a great deal of practical experience, with exposure to the current state of the industry, the many different players on project teams, and a solid sense of practical construction reality. The variety of projects provided exposure to different types of contractual arrangements in practice, including public and private clients, negotiated work, public design-bid-build, design build, and subcontracting, in both heavy civil and building oriented work. The author also gained an understanding of typical management structures, both within the company and of other companies we worked with.

For the University, the students have the direct benefits of the personal and professional development of the author. Armed with a fresh batch of photos, video and stories, the author can provide current industry perspective with credibility from actually being there. Developing example project scenarios to teach plan reading, estimating, work breakdown structures, methods and management for the laboratory and classroom has been much easier when based on direct experiences. For example, a set of modified airport standard specifications from a real project has been used to stimulate discussion about the importance of reading construction specifications thoroughly, and how they can be misleading. The essence of the disputed language was how to quantify fill materials with different unit prices. With only a few pages, the students quickly realize the importance of wording, as opposed to just working with conventional wisdom or making assumptions. In many scenarios, the photographs are enough to describe a situation for students to understand and practice with.

There were also a number of benefits for ***** Corporation. Similar to a consultant, but less expensive and at a much more personal level, the author offered an independent opinion from outside the company. With access to research and educational publications, the author read appropriate papers, provided a larger view of the industry and applied current thinking to productivity and planning. Working in the northeast, with a short earthwork construction season, it was a short-term commitment, but the author was another management presence during a busy period. One company manager opined that the author's presence contributed to an improved safety record. Similar to Koch and Benhart[4], the upper management of ***** Corporation recognized that the industry was becoming much more competitive and were looking for ways to increase productivity. Putting the author in the field to support the ***** Advantage program showed their commitment to the program. "The productivity guy" quickly became known across the company, bringing valuable attention to the effort. The author would sometimes observe crews with a stopwatch, measuring cycle times. On one of the first occasions, this generated a considerable amount of negative radio traffic amongst the crew. About six weeks later, however, a superintendent reported that equipment operators, sometimes from different projects, were calling each other on breaks to compare cycle times.

Recommendations

Since this case study may hopefully inspire other faculty members to attempt similar ventures, a few more details and suggestions are included. First, the experience was initiated by the author without direct support or encouragement from the University, and implemented through several 12-week summer experiences negotiated between the company and the author. The author was paid a reasonable weekly salary as a company employee and compensated for travel expenses. Of course, getting the position was certainly easier because the company was very busy with a large backlog and needed help at all levels. Once hired, the challenge was for the "professor" to contribute meaningfully beyond a typical company position, but also to leverage academic research and development skills. Considering that 12 weeks is not long enough to manage a single project, identifying a way to broadly benefit the company at a managerial level over a short period of time is important. Thus, activities like training, supporting new systems and gathering data are all appropriate and significant ways for both the company and the faculty member to benefit. The faculty member can also act as a data filter between field crews and home office-level management, aggregating feedback with less fear of repercussions from direct management intervention. The author enjoyed hearing frank criticisms and suggestions from field personnel that normally wouldn't be voiced to their regular supervisors.

Overall, the author's summer professional internship experience was very successful at many levels for many stakeholders. It is hoped that it may inspire other faculty members to develop similar relationships with industry partners.

References

[1] Reginato, J.M. (2010). Education and Construction Industry Experience Desired of New Construction Management Faculty. Associated Schools of Construction, International Proceedings of the 46th ASC Annual Conference.

[2] Associated Schools of Construction Doctoral Education Task Force (2005). Investigating ASC Member's Construction Doctoral Degrees and Related Program Efforts. [WWW document]. URL http://ascweb.org/announcements/The_ASC_Doctoral_Task_Force.pdf

[3] Thompson, M., Leathem, T and Holley, P. (2012). Product Research & Development in an Academic Collaboration: A Qualitative Case Study. Associated Schools of Construction, International Proceedings of the 48th ASC Annual Conference.

[4] Koch, D.C. and Benhart, B. (2010). Redefining Competencies for Field Supervision. Associated Schools of Construction, International Proceedings of the 46th ASC Annual Conference.

[5] Lasker, G.C, Cyr-Koch, D. and Jenkins, J.L. (2009). Economic vs. Emotional Output: The Value of the Happy Worker in the Hard-Labor Market. Associated Schools of Construction, International Proceedings of the 45th ASC Annual Conference.