

Adding AGC Case Studies to the Educator's Tool Chest

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Abstract: Because students majoring in construction-related fields must develop a broad repository of knowledge and skills, effective transferal of these is the primary focus of most academic programs. While inculcation of this body of knowledge is certainly critical, actual construction projects are complicated ventures that involve levels of risk and uncertainty, such as resistant neighboring communities, unforeseen weather conditions, escalating material costs, labor shortages and strikes, accidents on jobsites, challenges with emerging forms of technology, etc. Learning how to develop a level of discernment about potential ways to handle such uncertainty often takes years of costly trial-and-error in the proverbial “school of hard knocks.” There is therefore a need to proactively expedite the development of a sharpened intuition when making decisions. The AGC Education and Research Foundation case study committee was formed to address this need. Since its inception in 2011, 14 freely downloadable case studies have thus far been jointly developed by an academics and industry practitioners to help educators elicit varied responses from students about potential ways to respond when facing an actual project dilemma. AGC case studies are typically designed to focus on a particular concern and topics have thus far included: ethics, site logistics planning, financial management, prefabrication and modularization, safety, lean practices, preconstruction planning, subcontractor management, collaborative teamwork, sustainable construction, mobile technology, and building information modeling (BIM). This session will include an overview of the history and intent of the AGC case study program, as well as lively interactive demonstrations and discussions on how case studies can be used both by educators within a typical academic setting, as well as by industry practitioners seeking a novel tool for their in-house training programs.

Key words: Associate General Contractors of America (AGC), case studies, construction education

1. Introduction

Use of case studies in US higher education, particularly in management schools, has been adopted as an effective way to engage students in the classroom and meet learning objectives. Case studies are short papers about real world issues that do not have obvious correct solutions. Faculty encourage student discussion, debate, and problem solving that center on the issues of the case and help identify reasonable solutions to the issues presented. The process engages the students in the

classroom, provides an opportunity to hear multiple viewpoints from their peers, and presents an opportunity for them to generate their own opinions based on the information provided.

Case studies for education are now widely available for many disciplines with the most notable business school case studies coming from Harvard University. The educational requirements of construction programs have many similarities with management programs. However, there have been few published construction-related case studies for faculty in construction programs to draw upon in their courses.

In 2011, the Associated General Contractors (AGC) Education and Research Foundation recognized this shortcoming in construction education resources and began commissioning development of construction case studies for educational purposes. Topics from both educators and industry partners were solicited, and a committee was established to determine the most appropriate topics for case study development. The following framework was established: (1) A Request for Proposals is sent out to faculty with the suggested case study topics and the requirements for a case study; (2) The committee reviews the proposals and selects one or more teams to develop the case studies. To date, there have been 13 case studies published. These case studies are free for faculty to implement in their classroom and can be downloaded from the AGC online store. Existing case study topics include:

- Ethics in Construction
- Lean Practices in Project Management
- Leveraging Collaborative Teamwork
- Preconstruction Planning
- Subcontractor Management
- Sustainable Construction
- Mobile Technology in Construction Project Management
- Building Information Modeling (BIM) Applications in the Field
- Dynamic Construction Site Planning
- Construction Site Logistics Planning
- Construction Financial Management
- Prefabrication and Modularization of Façade Systems
- Development of Construction Site-Specific Safety Plan

These case studies, developed by faculty and industry partners, provide real-world issues that students may face in their careers. The goal of the AGC Education and Research Foundation is to create construction case studies for use in both university courses as well as in continuing professional education programs. To support this goal, the Foundation aspires to:

- Develop case studies that reflect contemporary issues faced within the industry.
- Provide support for instructors in the use of the case studies. Many instructors may have not used case studies in the classroom, or may not have expertise in best-practices related to the topic or issue, and, therefore, will likely find instructional guidance and tools helpful.

This paper provides information about how to effectively use case studies to engage construction students in the classroom, including best practices that have proven successful.

2. Structure of a Case Study

The Foundation case studies originate from issues faced by construction managers on a project site. Case studies can be structured in different ways. Some provide one focal point of discussion for the entire case study while others present a series of issues with opportunities for each issue to be presented and discussed. Regardless of the case study framework, common elements to outline the issues include a **summary overview** of the case study with identified learning objectives, **background** of how the issues arose, **discussion** to provide additional details on possible outcomes, and one or more **activities** for student engagement and/or to initiate classroom discussion. The case study package also includes supporting *Instructor Notes* to facilitate the student engagement and classroom discussion.

The **summary overview** provides a brief introduction to the case study and the issues the students will need to address. The identified learning objectives describe the primary focus of the case study.

The **background** provides a context so the students can play the role of the manager trying to solve the issues. Since case studies are short, thought-provoking exercises, only critical information that supports potential solutions are included (such as the company background and the type of project). Visual content such as pictures and graphs are encouraged to convey information and reduce the amount of narrative required.

The **discussion** provides the facts of the situation to support many possible outcomes. Since a case study has multiple possible outcomes with many reasonable solutions and trade-offs among solutions, students will have to form an opinion on what they think is the best option. Often there is controversy with each solution, but there are always clear actionable steps the student can formulate to work toward resolution of the issue.

The **activities** contained in the case study set the stage for students to support their solutions and argue why they are the best solutions given the situation. Often thought-provoking questions are provided for the students to review and start to formulate their potential solutions.

In addition to the case study, instructors implementing the case study will have the benefit of *Instructor Notes*. These teaching notes will provide additional context and suggestions to facilitate leading the discussion. *Instructor Notes* include answers to activity questions, discussion points, a teaching plan, logistics, and potential solutions to the case study with pros and cons for each solution. This provides a complete package for a classroom discussion of the case study.

3. Implementing a Case Study

Implementing a case study is typically done in three parts: (1) an introduction by the instructor, (2) an initial reading assignment with activities to complete, and (3) an in-class activity and/or discussion. The expectation that students prepare prior to class is critical. It ensures that class time is not wasted in review of the written material, and more importantly, it allows students to have time to develop their own opinions on how to solve the issues presented. Assigning homework prior to class will help ensure students are well prepared for the discussion activity and holds them accountable for the reading.

The faculty must also be well-prepared for the discussion activity and must be well-versed on the details as well as the many different outcomes of the case study. *The faculty role is not to provide solutions to the issues but to moderate the discussion and empower the students to be engaged in the discussion and the process of solving the issues.* The path the students take to a solution will vary from class to class, and even the final solutions will vary, depending on how students prioritize different elements presented and interpret the context of the issues. The objective of the discussion is for the students to learn from each other and to have a voice in the determination of the chosen solutions.

In order to optimize class time to focus on case discussions, the instructor should arrive early to class to answer any student questions concerning the case study. When class starts, the instructor provides an overview of the important issues that are relevant to the case study. In addition to the overview, the learning objectives are noted to provide context for the discussion. The instructor may present this information directly or ask students to provide their thoughts and interpretation of the important issues. PowerPoint slides with key attributes of the case and learning objectives may be used to help facilitate these initial discussions.

Once the case details have been reviewed, the discussion should focus on how to solve the issues presented in the case study. The instructor should encourage participation from each student and the instructor role should be focused on moderating and facilitating the classroom discussion. This allows students to present their own views and engage with each other to determine the solutions. The instructor role is to:

- Ensure the discussion keeps moving forward by asking open-ended questions;
- Promote participation by all students;
- Document key ideas and discussion generated by the class with bullet lists of ideas, issues, suggested outcomes, trade-offs, and other considerations; and
- Provide critical feedback to solutions being presented.

Since there typically is not a single correct answer, all solutions will have pros and cons that should be discussed. The instructor should challenge the students and promote critical thinking. Critical thinking is sometimes called argumentative thinking or being the devil's advocate, so different perspectives should be encouraged. This interactive discussion where all solutions are challenged should lead to a logical solution of the issue presented.

To finalize the discussion, the instructor should provide a review of the class discussion and the solutions presented. The instructor can also provide their own viewpoint, which may be based on their personal experience as well as the *Instructor Notes*. In some cases, the *Instructor Notes* will include the path or solution the contractor chose to take; however, it is always good to stress that there are other and sometimes better paths to a solution, even though it was the one the contractor chose.

Even though the case study is intended to focus on student-to-student interaction, the role of the instructor is critical. Often the preparation and execution of an in-class case study may require more effort than presenting a traditional lecture. Some tips to ensure successful implementation include:

- Develop learning objectives for the case study that fit with the overall course learning objectives. This will allow the case study to be tailored to the specific class, will provide

guidance to keep the class discussion focused on the elements that are most important, and will ensure an emphasis on the topics the students need to understand and analyze to develop their path toward a solution.

- Ensure that students are prepared and mentally present (“engaged”) in the classroom. Without the engagement of the students, the case study becomes merely a series of questions being asked by the instructor; student engagement ensures a lively discussion of the issues. Encourage the students to have ownership of the discussion, and allow dissenting views to try and encourage robust interaction.
- Establish guidelines for the discussion early on and clarify the expectations for the class. Foster a sense of inclusion. Do not let one or two students dominate the discussion, and work to engage all students and encourage input from students who are not participating in the discussion. Strategies to encourage participation may include class participation points, calling on students individually, and/or going around the room and having each student provide input.

After the discussion is completed, the instructor should conclude the class with a review of the lessons learned from the case study. A quick review of the important concepts addressed in the case study provides an opportunity to tie the case study outcomes with course learning objectives. Finalizing a class on what was learned and why it is important provides a nice closure to the class and the case study. Table 1 provides a checklist for implementing a case study.

Table 1. Checklist for Implementing a Case Study

1.	Assign a reading and a homework questions prior to presenting the case study.
2.	Prepare for the discussion activity and be well-versed on the many different outcomes for the case study issues.
3.	Arrive early to any student questions concerning the case study.
4.	Describe the learning objectives of the case at the beginning of class.
5.	Explain the importance of the topic in the case study.
6.	During the class discussion, the instructor should focus on moderating and facilitating the classroom discussion (allow the students to do the talking).
7.	Allow time for closure at the end of the class period. This should include the case solution from the instructor perspective.
8.	Provide a recap of lessons learned.

4. Example of Case Study Implementation

The ethics case study entitled “Allied Constructors: Ethics in Construction” is a well thought out case study that can easily be implemented in large and small classes. Ethics is an important topic to cover in construction curriculums, but may be difficult to address in a standard lecture format. The ethics case study provides numerous examples of how ethics can play an important role in effective work relationships with all stakeholders on a jobsite including the general contractor, subcontractors, material suppliers, owners, engineers, and safety officials.

The case study provides information and specific examples about multiple ethical and legal issues that may arise during the construction of a laboratory building at a university campus. The issues can be presented as a single case study or divided into numerous smaller case studies for discussion in shorter periods. This versatile format makes it ideal for a larger class, allowing the class to be broken up into smaller groups of students, each of which can debate and find solutions for one or more of the issues presented. Although class sizes may vary, this case study has been successfully presented in a class of approximately 40 students, with strong class participation from a majority of students. If all of the issues are addressed, the case study requires approximately two hours, which could be completed during a single lab session with smaller groups or broken up into two one-hour class periods with the larger group. The lab setting with a smaller group of students is ideal but may be difficult to implement given the increasing size of many college classes.

The case study is set up in sections and provides a short review of the situation followed by a series of questions that require an essay-type response. The case study and the questions are assigned in advance; written responses to the questions are collected before the discussion and graded to ensure the students are adequately prepared. Typically, grading is not focused on finding the correct solution, but rather to ensure the students have thought about the situation and taken the time to provide a meaningful answer. Some students may be inclined to provide a short “yes/no” type of answer which is not acceptable; these students should be graded accordingly and asked to better prepare for the upcoming class discussion (it may be appropriate to have them re-submit more thoughtful answers).

The case study works well to promote student discussion and understanding of ethical issues in the construction industry. Often without appropriate training, the students do not correctly identify ethical and unethical practices in the context of construction practice. The thought-provoking nature of these dichotomies is very helpful in engaging the students in the discussion.

In addition to debating ethical outcomes, there are many legal principles that arise from the case study of construction ethics. This provides a great opportunity for a discussion of legal issues related to construction applications. Legal principles addressed in the case study include:

- The Spearin Doctrine on contractor liability.
- Exculpatory clauses that relieve one party from liability.
- Contract clauses such as “no damage for delay” and waiving of lien rights”.
- The concept of being able to “red line” or exclude certain requirements in a contract/agreement.
- Payment methods such as “Pay if Paid”, “Paid when Paid”, and utilization of joint check agreements.
- Discussion of promissory estoppel and how an oral promise may be enforceable by law.

The *Instructor Notes* are very helpful and provides answers for all of the questions that will be discussed with the class. Instructors may wish to modify or supplement questions in the case study based on their personal experiences. In some cases, providing the answers from the *Instructor Notes* results in a very lively discussion because often students do not agree with some of the answers. One example of this is related to the concept of promissory estoppel; in promissory estoppel, a subcontractor can be held accountable for an oral quotation in some states. Since this violates many student expectations regarding the need for a written contract, it is always an interesting discussion topic.

To conclude the class, a quick review of the outcomes for each of the issues and the lessons learned is presented on a PowerPoint slide. This overview provides an opportunity to tie what was learned back to the course topics and learning objectives. For example, if it is an estimating course, the ethics of how a construction manager works with suppliers and subcontractors during the bidding process is highlighted. The case study is versatile enough to be used in many different construction management courses including: estimating, safety, construction law, and construction site logistics.

5. Accessing AGC Foundation Case Study Library

Instructors can access the published case studies at https://store.agc.org/Store/CSI/Store/Product_List_Education_Foundation.aspx. Instructors who have not already set up AGC accounts will need to “create a new account” where they will also need to create personal passwords. Creating a new account is free-of-charge. Scroll down the Education Foundation menu to find existing case studies. Once submitted to the cart, the selected case studies will be sent to the instructor’s registered email free-of-charge.

6. Conclusion

Utilizing case studies in the classroom has been shown to be an effective way to meet learning objectives and engage students in the classroom. This paper provides an overview of the use of construction case studies and some tips to make the classroom activity a success. The process of evaluating solutions through the case study process promotes critical thinking and the development of important skills for future construction managers. Construction managers are often tasked with problem-solving and must utilize input from multiple stakeholders with different objectives and opinions. To be successful, construction managers must then make appropriate decisions based on this feedback, and communicate and implement these decisions in a way that facilitates buy-in from diverse stakeholders. Being able to effectively express opinions, respectfully consider other input and differing opinions, and effectively de-escalate situations to ensure a shared vision of success are all important skills for career success in the construction industry. The Foundation recognizes the importance of case study learning and has provided a library of case studies for instructors. Information on how to access the library and obtain free copies of case studies is provided.

References

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Appendix: Catalog of Construction Case Studies (April 2022)

The Associated General Contractors of America Education and Research Foundation has funded the development of a series of construction case studies that can be used by faculty members in college and university construction education programs and construction contractors in professional education programs. These case studies are intended to supplement primary instructional materials to provide students

with opportunities to engage in critical thinking, analysis, and decision-making related to issues associated with the planning and management of construction operations.

These case studies are available for download at no cost on the AGC Book Store website (https://store.agc.org/Store/CSI/Store/Product_List_Education_Foundation.aspx). Each case study consists of two documents. The first document is the actual case study to be used by students, and the second document contains notes for the case study instructor or facilitator.

1. Allied Constructors: Ethics in Construction

This case study exposes students to situations in construction that require ethical decision-making. It builds upon knowledge acquired through construction management education and practice. In the case study, Allied Constructors has received a contract for the construction of a laboratory building on a university campus. Several ethical dilemmas are presented together with the responses of parties involved, and students are asked to analyze the situations and propose solutions. The individual situations are grouped into four major project phases: (1) preconstruction, (2) subcontract solicitation and award, (3) project execution, and (4) project close-out. Instructor Notes are provided to assist in using the case study.

2. Lean Practices in Project Management

This case study is divided into two parts. Section 1 provides a basic introduction to the principles of lean construction, while Section 2 describes a project in which lean construction processes were implemented. If students have a basic understanding of lean construction, users of the case study may wish to skip Section 1. In Section 2 of the case study, J. E. Dunn Construction has a contract for the renovation of three student housing buildings at Pittsburg State University. Situations are presented during preconstruction and project execution. Topics addressed are supplier and subcontractor procurement, just-in-time delivery of materials, off-site prefabrication, pull planning, and analysis of the weekly work plan. Instructor Notes are provided to assist in using the case study.

3. Preconstruction Planning: Leading a Collaborative Team

This case study focuses on Oneglia Construction Company's preconstruction management process and project team collaboration. The context for the case study is the renovation of the Naugatuck Valley High School that is occupied throughout the project. The renovation must take place in phases, with part of the building occupied and part a construction zone fully separated from the building users. Representatives from the Owner, Architect, and Construction Manager describe their priorities and perspectives regarding the project. The primary teaching objective is the role of collaboration and the factors that contribute to successful collaboration. A secondary objective is practicing typical preconstruction activities which are performed collaboratively. Instructor Notes are provided to assist in using the case study.

4. Subcontractor Management

This case study involves the construction of a major academic building on a university campus. Because of the design of the building envelope, a major subcontractor on the project is the masonry

subcontractor. The case study covers subcontractor risk management from prequalification to termination and dispute resolution. It focuses on the masonry subcontractor's failure to perform and the general contractor's actions to address the masonry subcontractor's lack of performance and to mitigate the impact on the project. Topics addressed are: subcontractor prequalification, subcontractor bid evaluation and selection, subcontractor performance, surety bonds, subcontractor payment, and dispute resolution. Instructor Notes are provided to assist in using the case study.

5. Leveraging Collaborative Teamwork in Project Delivery

This case study focuses on efforts to form and lead a collaborative team of diverse professionals to ensure successful project outcomes. The context for the case study is the expansion and renovation of a hospital in Las Vegas, NV. Strategies are presented to provide insight into trends that the design and construction industry is adopting to eliminate waste and increase value during construction. A detailed description of the project setup and team development approach is provided. Group exercises are imbedded in the case study to provide opportunities for students to apply the strategies described and reflect on what they learned in the case study. Instructor Notes are provided to assist in using the case study.

6. Sustainable Construction

This case study involves the construction of a student center for a major university for which the primary goal was to deliver a highly energy-efficient facility that incorporated innovative technologies. The case study focuses on a project with aggressive goals for Energy Use Intensity, LEED certification, and Net-Zero targets. The timeframe for the case study is during preconstruction after the construction manager has been engaged. Students are exposed to the challenges of optimizing multiple sustainability and cost objectives. The case study includes multiple learning modules enabling instructors to select those most relevant for their instructional settings. Instructor Notes are provided to assist in using the case study.

7. Mobile Technology in Construction Project Management

This case study consists of six scenarios related to the use of mobile technology to manage construction operations. The scenarios are based on actual examples of different uses of mobile technology on two different construction projects carried out in two mountain resorts towns (with three scenarios from each project). Each scenario is followed by a set of questions related to that particular scenario. The case study is divided into two project phases where the mobile technology is most frequently used: project execution and project closeout. The ultimate goal of the case study is to develop critical thinking skills related to the use of mobile technology to manage construction operations. Instructor Notes are provided to assist in using the case study.

8. Building Information Modeling (BIM) Applications in the Field

This case study involves the use of building information modeling (BIM) in a complex mechanical retrofit of a life science building on a university campus. Three specific field applications of BIM models are demonstrated. Activity 1 discusses the use of a BIM model in developing quantity takeoff and demonstrates the advantages of using it over manual methods. Activity 2 describes the use of a BIM model to identify design coordination issues or clashes among various design disciplines. Activity 3 demonstrates the use of a BIM model for constructability analysis. The

primary learning outcome is for students to learn the value of using BIM models in managing a construction project. Instructor Notes are provided to assist in using the case study.

9. Dynamic Construction Site Planning

This case study involves the construction of a major project located in a congested urban setting. The project includes a new city hall, a performing arts center, a massive parking structure, public spaces, and two multifamily residential structures. Activity 1 involves development of a site logistics plan for the originally contracted scope of work. Activity 2 involves the revision of the site logistics plan due to a major change in the scope of work and introduction of a second general contractor. Activity 3 involves development of strategies for addressing an unexpected construction material shortage issue. The primary learning outcome is for students to think creatively in solving complex problems. Instructor Notes are provided to assist in using the case study.

10. Construction Site Logistics Planning

This case study involves site logistics planning for the construction of an ultra-high-end commercial structure called the Moving Picture Preservation Center. The case study contains four separate student activities. In Activity 1, students are given three alternative site logistics plans and asked to select the one that would best serve the project. In Activity 2, students are asked to analyze the site topography and describe how the terrain conditions influence site logistics planning. In Activity 3, students are asked to select the best crane and crane placement for the project. In Activity 4, students are asked to select the best option for on-site storage of interior finish construction materials. Instructor Notes are provided to assist in using the case study.

11. Construction Financial Management

This case study involves the analysis of the financial condition of a construction company and the identification of issues that should be addressed to improve the company's financial condition. The case study focuses on the company's evolving strategic direction, a changing product mix, and aggressive goals for revenue growth and geographical expansion. The timeframe for the case study is approximately a 30-year period with a primary focus on performance over the past five years. The impacts of the company's strategic initiatives are investigated, the financial performance of the company is analyzed, and actions to enhance performance are explored. Instructor Notes are provided to assist in using the case study.

12. Prefabrication and Modularization of Façade Systems

This case study examines the challenges that general contractors face and the decisions that they need to make when implementing prefabrication and modularization processes on projects. The specific application addressed is the selection, fabrication, and installation of façade systems for a new retail-apartment building. The façade system used is a mix of curtain wall, window wall, and storefront installed by a design-build façade subcontractor. The case study starts with a description of types of façade systems and their construction and concludes with a discussion of project management and coordination issues. Instructor Notes are provided to assist in using the case study.

13. Development of Construction Site-Specific Safety Plan

This case study involves the development of a site-specific safety plan for a multistory commercial building being constructed in a major urban setting. The case study starts with a discussion of the organization of a site-specific safety plan including the need to identify hazards and select controls that should be implemented to lower safety risks. Then specific safety concerns related to the case study project are presented. Students are asked to address a series of issues related to each identified safety concern. Then the students are asked to complete a hazard assessment for one of the identified safety concerns. Instructor Notes are provided to assist in using the case study.

14. Construction Safety

This case study involves an analysis of a hypothetical scenario involving a fall-from-height incident. In addition to presenting a commonly experienced incident (fall from height), the case study addresses challenges such as language barriers, management of safety on a multi-employer worksite, and relevance of safety regulations and the law as they relate to construction safety. The case study starts with a description of the incident, the parties involved, the contractual relationships, the setting prior to the incident, and the relevant contextual factors. Students are asked to respond to a series of questions related to the incident. Instructor Notes are provided to assist in using the case study.