Student Learning Outcome 1

Create Written Communications Appropriate to the Construction Discipline

Introduction

CMGT 39000 - Construction Experience III is a one-credit required class that is often taken during the summer between the junior and senior years, however, students may take the class in either the fall or spring semesters. The internship is a supervised pre-professional learning experience that allows students to apply their skills and knowledge in a professional setting.

Most CM students intern with construction firms located in Indiana, however, some have internships in adjoining states, and a few on the east or west coast. CMGT 39000 requires a minimum of 400 work-hours for the internship.

CMGT 39000 is an online course that is administered through the Office of Career Services and Professional Development housing in the School of Engineering and Technology. The CM program director grades the written Work Reports. The program director visits as many interns in their place of employment each semester, as time and schedule allow.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 1, there is a report assignment that is used as Direct Measures.

1. Work Report

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 1 Report Content

Subsequent sections of this SLO Report document the following.

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Course Syllabus (which contains the Work Report assignment)
- Direct Assessment
  Work Report (rubric in Canvas)
  Graded Student Work Report (using the rubric in Canvas)
- Assessment Report for SLO 1

Indirect Measure

The Indirect Measure for SLO 1 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the course assessment report (found at the end of this SLO report).

IUPUI

SCHOOL OF ENGINEERING AND TECHNOLOGY

INDIANA UNIVERSITY–PURDUE UNIVERSITY Indianapolis

Fall 2020
CMGT 39000 - Construction Experience III (Internship)
Syllabus

Course Description:

An **Internship** is a 1-credit hour supervised pre-professional learning experience that allows students to apply their skills and knowledge in a professional setting. These experiences are designed to enhance the student's preparedness for an intended career with a business, industry, or government agency. CEMT 39000 requires a minimum of 400 work-hours. Prerequisites: TCM 22000 and TCEM 34000.

Instructor:	**Jennifer Williams**	**Dan Koo**	**Amy Wilson**
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Office Hours:	**By Appointment**	**By Appointment**	**By Appointment**

Website: www.etcareers.iupui.edu

Instructional Methods:

This is a 100% on-line course. All assignments and course materials are posted in Canvas. The primary instructional method involves a "hands-on" learning experience facilitated by your supervisor (mentor) at your place of employment.

ACCE Student Learning Outcome:

1. Create Written Communications Appropriate to the Construction Discipline. (assessed and evaluated)

Course Learning Outcomes:

- Increase Understanding of Classroom Theory through Hands-On Application.
- Gain Exposure to Potential Career Opportunities.
- Sharpen Interpersonal Skills.
- Improve Marketability by Adding Experience in the Field of Study.
- Create a "Work Report" that documents your work experience and provides insight into your personal learning.

Course Learning Outcomes in Relation to Student Learning Outcomes:

1. Create Written Communications Appropriate to the Construction Discipline.
   Create a "Work Report" that documents your work experience and provides insight into your personal learning. . (assessed and evaluated)

Methods of Assessment (Assignments):

- **Survey**
  This information is very important to our office and is used to track internship wages, trends in hiring, and in determining whether a site visit is appropriate.

- **Snapshot**
  This form collects anecdotal information about your internship or co-op experience at the midpoint of the semester

- **LinkedIn Assignment**
  This assignment is used to ensure you are making the most of your LinkedIn profile. You will be expected to create or update your profile using specific tips.

- **Site Visit (when requested by instructor)**
  After you have completed 50% of your internship or co-op work session you may be asked by the instructor to identify potential dates and times for an on-site visit by the Office of Career Services and Professional Development. Please submit date(s) and time(s) to the office via the assignment tab in Canvas so a visit can be arranged. During the visit we will want to see your work site location, a brief demonstration of your work (your time to shine and be proud of what you have completed so far), and to meet with both the student and supervisor individually.

- **Employer Evaluation**
  Your supervisor's evaluation of your performance provides important information for your career development and for the continued enhancement of the internship program. The school's Cooperative Education/Internship Program - Employer Assessment form must be used.

- **Student Evaluation**
  Self-reflection is an essential component of ensuring an internship is a good learning experience. To foster this process and provide us with valuable feedback, you are required to complete a brief online evaluation of your internship/co-op experience.

- **Work Report**
  Your work report is an important document, as it will be the primary means of evaluating your work experience. The report is a technical paper and should not be viewed as a simple narrative of your experience. It should be 6-8 pages in length and free of grammatical, punctuation, and spelling errors. The following information will assist you in the completion of your report.
  Please use the format on the following page for the development of your report.

Grade Performance Criteria:

Component	Points
Survey	50
Snapshot	50
LinkedIn Assignment	50
Site Visit (when requested by instructor)	0
Employer Evaluation	50
Student Evaluation	50
Work Report	50
Total	300

Grading:

- The work report is the culmination of your work experience. The survey and work report, in conjunction with the feedback we receive from your employer, will ultimately determine your grade.

- The work report MUST be turned in via Canvas at the date specified therein. This report will ultimately be graded by the Office of Career Services and Professional Development and the CEMT department. If the report is deemed to be less than satisfactory it will be returned to the student for revision. This will occur until the preceding requirements have been fulfilled.

- A grade of Incomplete will only be given in cases where unusual circumstances prevent the student from completing the assignments within the time limits specified in this course. Therefore, it is extremely important that all assignments are completed in a timely fashion.

Grade Distribution:

Percentage	Grade
97%-100%	A+
93%-96.9%	A
90%-92.9%	A-
87%-89.9%	B+
83%-86.9%	B
80%-82.9%	B-
77%-79.9%	C+
73%-76.9%	C
70%-72.9%	C-
67%-69.9%	D+
63%-66.9%	D
60%-62.9%	D-
0%-59.9%	F

Topical Outline:

Since this a personalized learning experience, the course topics are not standardized. Topics (work activities) for your internship learning experience must be provided in writing on the "Employer Agreement" which is signed by your supervisor.

Work Report Specific Requirements:

Typewritten
Double-spaced
1" Margins
12 Point Font - Times New Roman
Written report should be 6-8 pages in length
Due date will be posted to the assignments tab of Canvas.
All reports should be turned in via Canvas by 11:59pm on the due date.

The written reports must include the following components

Title Page: Your name
Major
Appropriate internship or co-op course number / Class number
Name and address of employing company
Start and end dates of your work experiences
The date the report will be submitted

Introduction: (approximately 1 page in length)

The introduction should give a brief overview of your work assignment. Include company name, supervisor's name, your job title, a brief overview of duties performed, and start and end dates of your work experience.

Discussion (2-3 pages in length):

Description of the employing company. Include information on major products produced or services rendered, company size, company ownership, organizational structure, etc. Description of the department(s) in which you worked including the titles of those working in your department and its function within the organization. Description of your job assignment. Describe what you did in detail, activities undertaken, and the relationship of these activities to the overall organization (reference any key contributions that you made). List and describe equipment used and projects assigned.

International Reflection (2 pages in length):

Required for all internships outside of the United States. Provide a detailed description of your cultural experience abroad. Be sure to:

- Include housing information – how you secured housing, the cost, roommate/private, transportation methods, etc.
- Include information about any medical or health-related needs while abroad.
- Describe the cultural elements of your trip and any excursions you experienced, including independent travel. Be sure to include photographs.
- Reflect on the similarities and differences of customs and societal norms.

Documentation:

Tables, charts, graphs, drawings, computer programs, photographs, etc. that help document work assignments. This information must be labeled and referenced in the discussion section of the work report. If you worked in a location that dealt with classified information, you can submit documentation in the form of photographs of you at your work station or office, graphs, descriptions or photographs that are used on the company website, or an Excel list of project names with the length of time spent on each and how that project relates to your degree or could be used as a bullet point on your resume.

Evaluation (3-4 pages in length):

A detailed description of what you learned during the work period. A list of evaluation questions are provided below (to be answered in paragraph format)

- What effect has your work experience had in your understanding of your course work?
- What specific courses and theory did you apply during your work session? Explain.
- Was the internship or co-op work session challenging? Why?
- How well did your education prepare you for the experience? What changes if any should be made?
- How appropriately did your supervisor/ company evaluate your progress?
- What was your favorite part of the work experience?
- How might your employing company improve its Co-op / Internship Program?
- What conclusions have you drawn based on your work experience that may help you in the future?

Code of Conduct:

- Students must not falsify or invent any information or data when applying or interviewing for internship or co-op opportunities.
- Students will conduct themselves in a professional (career oriented) manner at all times.
- Students will be punctual in reporting for the professional experience (on or off-campus) and will adequately notify the site and instructor about any absence.
- Students will use appropriate written and oral communication in all interactions with managers, supervisors, employees, the public and clients while at the on or off-campus sites.
- Students will participate in any orientation or testing required by the professional site.
- Students will not engage in any unethical (doing what is wrong) or illegal practices while at the professional site (on or off-campus).
- The student accepts responsibility and accountability for their decisions and actions taken when at the professional site (on or off-campus).
- Students shall maintain their role of "student in training" at all times during the term of the off-campus professional experience or on-campus class. As "student in training", they shall always take direction from instructors, professionals and managers both on and off-campus.

Work Report Assignment – 200 points

(Excerpted from Canvas Page – Fall 2020)

Purdue School of Engineering and Technology, IUPUI - Internship and Cooperative Education Program - Instructions for Work Report

Your work report is an important document, as it will be used in the evaluation of your work experience. A final grade of Satisfactory (S) or Fail (F) will be given based on the quality of your report and your work performance.

Please use the following format in the development of your report.

- Typewritten
- Double-spaced
- 1" Margins
- 12 Point Font - Times New Roman
- Written Report should be 6-8 pages in length (Excluding the Title Page and Documentation)
- Due Date will be Posted to the Assignments Tab of Canvas.
- All Reports should be turned in via Canvas by 11:59pm on the Due Date.
- A completed Cooperative Education/Internship Program - Employer Assessment form is required.
- A completed Student Assessment form is required to be filled out through qualtrics.

Reports must include the following components:

I. Title Page:
i. Your name
ii. Major
iii. Appropriate internship or co-op course number
iv. Class number
v. Name and address of employing company
vi. Start and end dates of your work experiences
vii. The date the report will be submitted

II. Introduction: (approximately 1 page in length) The introduction should give a brief overview of your work assignment. Include company name, supervisor's name, your job title, a brief overview of duties performed, and start and end dates of your work experience.

III. Discussion (2-3 pages in length): Description of the employing company. Include information on major products produced or services rendered, company size, company

ownership, organizational structure, etc. Description of the department(s) in which you worked including the titles of those working in your department and its function within the organization. Description of your job assignment. Describe what you did in detail, activities undertaken, and the relationship of these activities to the overall organization (reference any key contributions that you might have made). List and describe equipment used and projects assigned.

IV. International Reflection (2 pages in length): Required for all internships outside of the United States. Provide a detailed description of your cultural experience abroad. Be sure to:

- Include housing information – how you secured housing, the cost, roommate/private, transportation methods, etc.
- Include information about any medical or health-related needs while abroad.
- Describe the cultural elements of your trip and any excursions you experienced, including independent travel. Be sure to include photographs.
- Reflect on the similarities and differences of customs and societal norms.

V. Documentation: Tables, charts, graphs, drawings, computer programs, photographs, etc. that help document work assignments. This information must be labeled and referenced in the discussion section of the work report. If you worked in a location that dealt with classified information, you can submit documentation in the form of photographs of you at your work station or office, graphs, descriptions or photographs that are used on the company website, or an excel list of project names with the length of time you spent on each and how that project will relate to your degree or could be used as a bullet point on your resume.

VI. Evaluation (3-4 pages in length): A detailed description of what you learned during the work period. A list of evaluation questions are provided below (to be answered in paragraph format)

- What effect has your work experience had in your understanding of your course work?
- What specific courses and theory did you apply during your work session? Explain?
- Was the internship or co-op work session challenging? Why?
- How well did your education prepare you for the experience? What changes if any should be made?
- How appropriately did your supervisor/ company evaluate your progress?
- What was your favorite part of the work experience?
- How might your employing company improve its Co-op / Internship Program?
- What conclusions have you drawn based on your work experience that may help you in the future?

Work Report Rubric

Criteria	Ratings	Pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeTitle Page Complete?	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeDocumentation Included?	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeIntroduction Included?	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeDiscussion Included?	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeDid the student reflect and identify lessons? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior)	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeSupervisor's Rating (Unsatisfactory, Below Average, Satisfactory, Above Average, Outstanding, N/A)	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeWould Student Accept a FT Position	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeWas the information clear and orderly? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior)	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeDid the student use an appropriate writing style? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior)	*This area will be used by the assessor to leave comments related to this criterion.*	pts
Edit criterion description Delete criterion row This criterion is linked to a Learning OutcomeOverall, I found this report to be: (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior)	*This area will be used by the assessor to leave comments related to this criterion.*	pts

[redacted]

CMGT – School of Engineering & Technology

CMGT 39000 – 22732

TWG Construction – 1301 E Washington St
Indianapolis, IN 46202

December 2017 – Present

11/30/2020

Introduction:

I work/interned at TWG Construction which specializes in multi-family commercial building projects. My supervisor has changed a few times depending on my role in this company. As a project engineer for my current position, my supervisor is Tyler Peper. My duties performed at this company have hit the major job roles that my coursework have covered.

I started as a preconstruction intern where I took part in estimating, building bid-binders, soliciting bids, and navigating through complex drawings. After working in this position for a few months I transferred to an assistant superintendent role. This was where I gained a bulk of my experience for two years. During this time, I worked on two major projects for our company called The Whit and The Assembly. My assistant superintendent duties were helping subcontractors understand the plans, scheduling work, daily reports, and solving in field problems. After two years on some of my company's hardest projects I was hired on full time and transferred to the office as a project engineer. A project engineer is the step below a project manager in my company. They deal with the finances, scheduling meetings, contract writing, and communications between the architect/engineers. This is typically done with an RFI and must be organized and recorded for documentation. Most of my duties are maintaining the organization of the documentation along with helping the site team find solutions for problems in the field.

I have gained an experience in the three major paths that my program teaches. My favorite position that I feel my education has prepared me the most for is a project engineer. This can be a stressful but rewarding role as it prepares you to become a project manager. I started as an intern December 2017 and have continued working here through my school. I have been hired on and couldn't be happier to be in my position.

Discussion:

TWG Construction specializes in the multi-family construction industry. The two projects I mentioned before, The Whit and The Assembly were both projects I worked on. The Whit is in downtown Indianapolis and is a nine-story high rise building. This was a very complex steel structure with plenty of amenities to worry about; dog park, pool, courtyards, gym area. One of the more complex areas was the pool on the sixth floor of the building overlooking the city. I was responsible in preparing the documentation and requirements for the pool inspection. There are bonding requirements for the lighting in the pool that made this especially complicated. There were safety concerns with material types and how conductive they may be. There were also falling hazards, welding issues, and equipment safety concerns to be aware of. Overall, this was an incredible experience that not many people have the opportunity to work on during an internship. The Whit had a total cost of $60 million. After the Whit are started working at The Assembly.

The Assembly is the old model t ford plant off Washington St. This building was constructed nearly 115 years ago. This project was an entire building rehabilitation. TWG Construction wanted to utilize this building for their new headquarters. They did this by constructing the entire first floor as office space. The remaining three floors above were used as apartment units. This was a huge undertaking considering the scale and age of the building. Most of the concrete and railways that were originally in the building needed demolition. We managed to keep and utilize much of the building's original pieces as decoration. The Assembly has a reconstructed Model T sitting in our entrance lobby.

TWG Construction has separate divisions that make it a very unique construction company. Unlike most other construction companies TWG is not a general contractor. There is a development, architectural, management, and construction division. This means that the owner is in house and can make changes rapidly to any project. This can make the construction portion much more complicated. It is beneficial in some ways to have the owner, architect, and construction in house with the increased fluidity of communication. Each department has their own hierarchy.

Construction has a typical hierarchy with the president of construction, vice president, senior project managers, project managers, project engineers, and interns. Most of my experience with this company was at the lower end of the hierarchy working directly with a project manager or superintendent. These positions require you to be in many places at once, so it helps to have an assistant or project engineer for a project. My duties for each project were similar to what I stated before.

As an assistant superintendent one of the best aspects of the job was the equipment. I was certified to drive heavy machinery. You could find me moving massive "lulls" or "skid steers". It's not incredibly difficult to pick up how to operate this machinery but requires a lot of responsibility. If you are not constantly aware of your surroundings you could seriously maim or kill the people around. I spent a decent amount of time operating heavy equipment for my company and was one of my favorite activities.

Documentation:

The Whit pool area on the sixth floor. The bonding was underneath all the pavers shown around the pool.

The Whit front façade.

The Assembly around 1920's

The Assembly today after almost entirely replacing the front façade.

Evaluation:

What effect has your work experience had in your understanding of your course work? My work experience has had a substantial effect on my school coursework. I decided to join an internship experience as quickly as possible. Having the work experience/issues come up on the job only enhanced my learning experience in the classroom. It gave me the opportunity to ask knowledgeable educators about my work practices and how to better improve my experience. It also gave me a hands-on approach to everything I was reading about. In my opinion, no student in this program should wait until the very end of their college career to join an internship. One such experience involved calculating cubic yards for backfill locations. Some of my less experienced team members had to search online while I could quickly do the work and apply my education.

What specific courses and theory did you apply during your work session? Explain? Almost all my courses have affected my work experience. The toughest and most time-consuming course helped me the most. This course was cost and bidding, which was a heavy estimating class. The reason this was so beneficial had to do with understanding the plans. There is so much information that goes into a drawing set its easy to skip over notes and symbols and not understand the full scope. When estimating a project, it forces you to understand every aspect of a job. If you don't you miss out on critical information to the total cost of the project. While trying to complete my estimates and working on site was never easy, it reinforced critical learning that put me ahead of my peers.

Was the internship or co-op work session challenging? Why? The interesting part about being an intern was the evolution of it. In the very beginning being an intern was very simplistic, cold calls, clerical work, and organizing information with no responsibility. As time

went on and I learned more information I was given more challenging tasks. I only had experience with one place, but I don't regret it in the slightest. I was getting challenges faster than some of my peers who hopped around. A company always sets their initial interns onto simple work because they don't know what you are capable of. I was fortunate to grow with the company and gain responsibilities.

How well did your education prepare you for the experience? What changes if any should be made? My education and work experience were like the tango. If I was doing only one or the other, the performance wouldn't be great. Both experiences tied together to put me in a constant state of learning. This gave me an appreciation for trying to accel in my education knowing that it made a difference in my work. Most students have trouble seeing the grand picture and look at the education as simple diploma. Having to rely on your education to do your work properly you gain an appreciation for it. If I were only working, I know it would be harder to see what position I could be in. Its easy to fall into the easiest path when you have no idea what you are capable of. I would not make any changes to the program and feel that it has prepared me for my career.

How appropriately did your supervisor/ company evaluate your progress? Unfortunately, I was not able to see my performance review from this class. I have received official reviews required by my work. They have a template the defines the major points of how well you are doing. Its very constructive and allows for growth in your role without putting you down. I feel that my supervisor or company would evaluate honestly since they are required to do so on a regular basis. Whatever the results are I accept them.

What was your favorite part of the work experience? My favorite part of my work experience was getting to go on a bourbon tour. When I was initially interning at this company my team decided to go to Louisville, KY. This was meant to be a team building time, this happened with visiting several distilleries. We rented out a party bus and went with our architects, preconstruction team, and some of our management team. I was able to try bourbon out of a "whiskey thief" from an unopened cask. This was obviously not work related but showed the community/fun culture of my job. They keep a mentality of work hard and play hard.

How might your employing company improve its Co-op / Internship Program? I really enjoyed my co-op/internship experience. Its hard to nitpick something that you enjoyed. I do think if they had something to improve it would be the responsibilities. I know it takes time to understand what a person is capable of doing. However, I think my supervisors at the time should have challenged me more initially with a task to show that I can prove myself. Eventually, I was given these responsibilities but giving this opportunity to someone joining would be advised. You never know if someone's background allows for them to grow into a position faster than others.

What conclusions have you drawn based on your work experience that may help you in the future? I found that always testing yourself and asking for more can help immensely. Even if you are unprepared for a certain task you can fail and learn from it. If you wait for others to slowly give responsibility, you never test yourself. Ultimately, if you wait around for difficult tasks they will come. You can move so much farther faster if you constantly test yourself. This came with working as many hours as I could with an internship and going to school to reinforce this. I was able to get a full-time position and couldn't be happier to be where I am. One additional thing a senior told me when I was a freshman was to use google. If you don't know it, do as much research as possible to put yourself ahead of everyone else. That advice has served me very well.

Assessment

Grade out of 200

197

View Rubric

Work Report Rubric		
Criteria	**Ratings**	
Title Page Complete? view longer description	**Comments** Complete	10 / 10 pts
Documentation Included? view longer description	**Comments** Complete, add figure numbers, titles. good captions.	28 / 30 pts
Introduction Included? view longer description	**Comments** Complete	20 / 20 pts
Discussion Included? view longer description	**Comments** Complete	20 / 20 pts
Did the student reflect and identify lessons? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) view longer description	**Comments** Above Average	20 / 20 pts

Supervisor's Rating (Unsatisfactory, Below Average, Satisfactory, Above Average, Outstanding, N/A) view longer description	**Comments** Above Average	20 / 20 pts
Would Student Accept a FT Position view longer description		10 / 10 pts
Was the information clear and orderly? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) view longer description		20 / 20 pts
Did the student use an appropriate writing style? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) view longer description		20 / 20 pts
Overall, I found this report to be: (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) view longer description	**Comments** Above Average	29 / 30 pts
		Total Points: 197

Summer 2022

[redacted]

Construction Management and Technology

CMGT-390

Davis Homes 3950 Priority Way S Dr #210, Indianapolis, IN 46240

May 9th-August 5th, 2022

August 5th, 2022

Introduction

For this summer I had the wonderful opportunity to work hands on for a residential homebuilding organization. I began my internship on May 9th at Davis Homes and will be working through August 5th as an estimating intern. During my time here at Davis I initially collaborated directly with the manager of the estimating department, Eric Bernard. My first few weeks included learning the date system, ECI MarkSystem, that we use to complete all operation needs but also sales. I got to observe how Mr. Bernard releases jobs out into the field and how to do takeoffs on what data was pulling into the system as a double check. When releasing a job this is sending out the purchase orders to our vendors, so they know the correct quantities they need to order and make sure that they are getting the price that was agreed upon for the job. I was then able to start doing my own job releases and helping to answer questions for any contractors about the job. I also had the opportunity to work with the Purchasing Department. Working alongside Jeff Dohrn, Purchasing Manager, and the Director of Purchasing Sean McCutcheon, to learn how to build relationships with our sub-contractors and how to negotiate on pricing. In purchasing I also learned how to build the material our subcontractors quote out into our system so when estimating releases a job, all the material and cost is correct. Finally, I was able to work in the Data Build side of operations with Ken Dohrn, Construction Services Manager. In the Data build department, I had the opportunity to do a full takeoff of all four elevation on our new plans (that management would be rolling out in the end of August) and creating options within that plan for customization within the home. I incorporated what I learned in estimating and what I learned in purchasing to complete a full data sheet to upload into ECI with new selections of new plans for our sales team members.

Discussion

I had the wonderful opportunity to work for Davis Homes for the Summer of 2022. Davis Homes is a single-family custom home builder. Davis homes offers a wide range of unique styles of ranch and two-story homes that can be built in communities or on the lot of the customer. Bradley C. Davis, a third-generation builder, is the current CEO of Davis Homes and works along side Don Chesney, who is the current COO of Davis Homes. Davis Homes has sixty employees ranging from Sales, Operations, Construction and Financial Services. There are three types of business in our world, you have the client-driven companies, then the operationally excellent companies, and finally you have your opportunity companies. Here at Davis Homes they have an opportunity style/ organizational structure. This is because of the CEO, Mr. Davis, who is an entrepreneur at heart and is always looking for more projects to expand his company.

During my time here I had the opportunity to not only work in the Estimating Department but as well as the purchasing department and the data maintenance department which are all key components that make up Operations.

In the Estimating Department I worked alongside estimating manager, Eric Bernard. He taught me how to release jobs to our vendors and what to look for on the customers selection sheet ensuring that the purchase order had all that it needed for the field. Since I already have experience with reading construction prints, I was able to move quickly through my training and work more independently on multiple jobs. In the estimating department I also answered any questions that came in via email regarding purchase orders missing key material or if a cost was off. He also taught me how to work in our computer system MarkSystem. This is where all purchase orders are released, sales and selections are made by the customer, where data is uploaded into plans and where the Purchasing Department input their pricing for material/serviced. Mr. Bernard also took me out into the filed multiple times a month to see the various stages of construction and why it is important to send purchase orders out quickly. I learned that construction does not slow down for anyone or anything. Out in the field I got to see our concrete sub-contractors pouring a partial basement (Figure 7).

In the Purchasing Department I worked along side purchasing manager, Jeff Dohrn and purchasing director Sean McCutcheon. This was an interesting department to work with because it maintains all the costs from our vendors and inputs them into the computer system, we use called MarkSystem. Initially I would help Mr. Dohrn and input price increases from our vendors and update the purchase orders or create variance purchase orders. Variance purchase orders are created when construction has already been completed or if the original purchase order had been paid and there was additional cost. I was able to begin networking in the purchasing department not only during my communication through emails with our vendors but also when we held vendor events. This was exciting to do because I got to meet the vendors in person and observe how business is discussed in a social setting. I found this to be beneficial because we do not experience/learn this in school. Mr. McCutcheon had me sitting in on our vendor negotiation meetings towards the end of my internship. I took notes down, but I was able to witness negotiations and counter offers for varied materials and labor costs that affect our business. During these meetings we also did group takeoffs with our vendors on roofing material and concrete. The key reasoning behind this was to start doing estimates in house, rather than sending them out to quote. I was able to help create a takeoff sheet that anyone in the operations department could utilize for takeoffs on a job without having to send them out to quote.

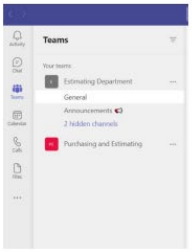
In the Data Maintenance department I worked with construction services manager, Ken Dohrn. This was the most difficult department to work in because it affects all the information

that is in the MarkSystem for the data build of all 15+ plans we offer. I did not work in this area until my last three weeks. Mr. Dohrn felt that I was ready to begin some of my own data building. So, they had eight new plans they were going to be rolling out within the next few weeks and asked me to do my own takeoff start to finish. This was very fulfilling to do because I used the knowledge I learned from the Estimating Department, such as reading prints and checking the sheet for drafting errors, and the Purchasing Department, such as reaching out to vendors for quotes on lumber and HVAC. I utilized excel and Auto Desk Design to conduct my takeoffs. After assisting on these new plans I began building options for the plans for customers to select. Options such as black interior and black exterior windows, nine foot first floors, and flooring upgrades.

V. Documentation:

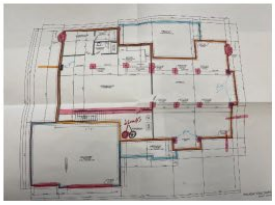
Pictured above: Figure 1. A spreadsheet I worked on in the Data Build department for a custom option for Black Exterior and White Interior Windows instead of White Exterior and White Interior Windows.

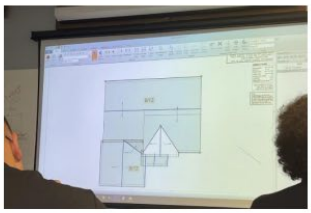
Pictured to the Right: Figure 2. The ECI MarkSystem that is used by operations and sales. This is how data is changes, imported and exported.



Pictured to the Left: Figure 3. Microsoft Team Groups that we use to communicate and share spreadsheets.

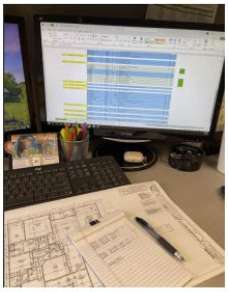
Pictured to Right: Figure 4. Construction prints for a basement. This was used to calculate the total tons of concrete and gravel needed to order when sending the purchase order out to our sub-contractors.





Pictures to the Left: Figure 5. Construction meeting on how to calculate roofing material. (Software used: Autodesk Design)

Pictures to the right: Figure 5. My workstation during a job release. This is when I review the plans and the customers selections to ensure the prints are correct. I am the last person to see these and check before they go into the filed, so it holds me accountable to find all or any errors printed by drafting. I am also looking to see if what is on the prints were paid for by the customer.



Pictured to the left: Figure 6. Even though I worked in the office my VP of Operations made sure I went into the field to see how we operate outside the office as well. This was great to see when it was a job, I helped release into the field.

Pictured above: Figure 7. Even though I worked in the office my VP of Operations made sure I went into the field to see how we operate outside the office as well. This home just finished pouring concrete and laying gravel for the basement.

Pictured to the Right: Figure 8. Vendor Lunch appreciation. I was able to meet all our vendors and start networking and building relationships face to face.

Evaluation

• What effect has your work experience had in your understanding of your course work?

I think this work experience has not only reinforced my understanding of my course work but also made me more confident when entering this field in my near future. The courses that IUPUI offers through the Construction Management degree has made me well prepared when entering my internship at Davis Homes. With the experience I have gained through this internship, and with what I have learned through IUPUIs Cost Estimating, Quantity Takeoff, and the basic understandings courses of construction such as reading construction prints, will not only help me in moving forward as estimating as a career path but providing me real life experiences to learn from. I strongly believe that if I did not complete this internship, I would have a more challenging time starting right out of college understanding these concepts in actual practice.

- **What specific courses and theory did you apply during your work session? Explain**

During my work session at Davis Homes in their Estimating department I feel that some of the specific courses that IUPUI offered that I utilized the most in my day-to-day operations were Cost Estimating, Quantity Takeoff, Strength of Materials, and Contract and Administration and Specifications. I was able to utilize Quantity Takeoff in the Estimating department when conducting Concrete takeoffs (*Figure 4*) and Roof Take offs (*Figure 5*). I was able to use the spreadsheets I created in Quantity Takeoff and share it with my department to minimize the amount of time needed to conduct a full takeoff. I used Cost Estimating in both the Estimating and Purchasing department when adding cost to my takeoff and understanding the rule thumb in construction with pricing. Contract Administration helped me understand things such as processing VPO's (Variance Purchase Order) and following a schedule for a project.

- **Was the internship or co-op work session challenging? Why?**

I felt that in the beginning of my internship it was challenging to learn ECI MarkSystem (*Figure 3*) since I have not worked with that program before. It was challenging to at first to get my voice when sitting in operation meetings and pre-construction meeting since it was mainly men, and I was the youngest person in the room. I finally about halfway through the internship I started asking my questions and providing my feedback on topics which I feel has earned me more respect from my coworkers and upper management. I am a very adaptive learner when I am enthusiastic about it, so this is what led to me working in all departments in the operation work at Davis Homes. This was challenging learning to balance three different work types and work loads from the three different managers. I did not let this stop me instead I worked hard and asked for help when I needed it.

- **How well did your education prepare you for the experience? What changes if any should be made?**

My education did an outstanding job at preparing me with what they could before entering the job field. School helps you get the baseline, and the job will teach you more and give you the experience you need for to accomplish the future. I do not feel that any changes really need to be made to the program. There are some courses that are covered by others that do not need to be apart of the program. The only change I think that could be made is adding a course that would help with understanding emotional intelligence and learning how to talk to different personality types.

- **How appropriately did your supervisor/ company evaluate your progress?**

I asked in the beginning of my internship to have at least a monthly meeting on my job performance and how I can become a better worker in estimating. We thankfully were able to meet about twice a month and discuss my performance in each department and that was typically when they would assign me more duties and responsibilities. I also was able to get a one-on-one with my COO and interview him and while in that interview he told me what he has observed and that I have tons of potential in my career.

- **What was your favorite part of the work experience?**

My favorite part of the work experience was beginning my networking in the industry and meeting so many amazing people and building relationships with them. During my internship at Davis Homes we had multiple events within the company and outside the company which has helped me like I said build relationships with coworkers and with our sub-contractors. I had the opportunity to also join in different events through residential construction such as BAGI (Builder Association of Greater Indianapolis) and the Realtor Association with a fellow coworker France Williams (*Figure 8*)

- **How might your employing company improve its Co-op / Internship Program?**

Davis did a respectable job for its internship program. I worked in the office this summer and was able to go out into the field about once a month (*Figure 6 & 7*). I would say that incorporating more time into the field even though I was there for estimating. I feel that no matter what department you are working in having field experience will always be beneficial. If I were given more time in the field, I would understand what we are doing in office better or even could help to fix something we may be missing in office.

- **What conclusions have you drawn based on your work experience that may help you in the future?**

Based on my work experience here at Davis Homes I found that I may have a passion for residential construction. I will have a challenging time before graduation deciding what path I would like to follow since I have worked in both residential and commercial projects. I have learned that I would like to be apart of a company that is close and like a family. Having a company with good ethics and culture is especially important to me, and Davis Homes has wonderful people with support that want I have. Regardless of commercial or residential I know that I will want to work towards a management role in estimating then moving to a VP in my future. Career growth will be something I will be looking in a company so I can accomplish my own career goals but while helping my company make tomorrow a better day in this industry.

Work Report Rubric (2)		
Criteria	**Ratings**	**Pts**
Title Page Complete? **view longer description**		5 / 5 pts
Documentation Included? **view longer description**		5 / 5 pts
Introduction Included? **view longer description**		5 / 5 pts
Discussion Included? **view longer description**		5 / 5 pts
Did the student reflect and identify lessons? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) **view longer description**		5 / 5 pts
Supervisor's Rating (Unsatisfactory, Below Average, Satisfactory, Above Average, Outstanding, N/A) **view longer description**		5 / 5 pts
Would Student Accept a FT Position **view longer description**		5 / 5 pts
Was the information clear and orderly? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) **view longer description**		5 / 5 pts
Did the student use an appropriate writing style? (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) **view longer description**		5 / 5 pts
Overall, I found this report to be: (Unsatisfactory, Below Average, Satisfactory, Above Average, Superior) **view longer description**		5 / 5 pts
Total Points: 50		

Course Assessment Report

Course: CMGT 39000 - Construction Experience III (Internship)

Academic Term: Fall 2020, Summer 2022 (Direct Measures)

Instructors: Career specialists in the Career Services at the Purdue School of Engineering and Technology

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 1 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). A 92% ranking was achieved for this SLO.

Term	ACCE SLO 1	Raw Score (1 – 5)	Percent
F 2021	1. Create written communications appropriate to the construction discipline.	4.5	90%
S 2022		4.36	87.2%
F 2022		4.7	94%

Direct Measures

The Direct Measure for SLO 1 was the Work Report compiled from three semesters, as indicated below. The maximum grade (points) for the Work Report is 200 during the Fall 2020 semester. The summer 2022 semester used 50 points scale as shown in the following table.

Term	N	Criteria	Average Percent	Target Percent
Fall 2020	5	Work Report	89% (177.4/200)	75%
Summer 2022	25	Work Report	93% (46.54/50)	75%

It was decided that the overall average of the total grades should be at least 75%.

The Indirect Measure (90.4 %) and the Direct Measure (91%) indicate that the target value was met. The IUPUI Course Evaluations were very positive. For example, students were asked, "Overall, I learned a great deal from this class." The composite response for the three semesters (n=25) was 3.92 on a 4-point scale.

Proposed Actions for Course Improvement:

All academic programs in the School of Engineering and Technology use the Career Center to administer their internships, whether they are required as part of the curriculum or are an elective course. The CM program requires one credit internship course as a part of the Plan of Study. The format of the course has been standardized, but there is room for flexibility, based on the needs of an academic program.

The following improvement action items can be implemented for the course:

- Educating internship students industry adopted software programs to manage field documents prior to the internship course
- Updating and archiving a weekly internship report in Canvas
- Conducting in-person employer interview
- Revising a report template to standardize the final work report
- Creating an open discussion board to share internship experience

Student Learning Outcome 2

Create Oral Presentations Appropriate to the Construction Discipline

Introduction

CMGT 44000 - Project Management Capstone requires students to work in groups to create a cost estimate, a construction schedule, a safety plan, a waste management plan, etc. for a typical construction project. Project binders and oral presentations are also required. In addition, there are several individual assignments (resume, risk management, weekly reports, etc.).

In the capstone course, construction students work as a group culminating in a final oral presentation. Each group is evaluated on their presentation (content, visual aids, etc.). In addition, each student is evaluated on their oral presentation. Each student is evaluated individually at least twice by the group industry mentor, one faculty member. Select IAB members in attendance at the presentations may also be recruited to serve as an evaluator.

Assessment Methods

For CMGT 44000 during the group presentations, each student is assessed individually on their part of the oral presentation to address SLO 2. The Direct Measure and the Indirect Measure are as follows.

- Direct - Oral Presentation (individually assessed)
- Indirect - ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 2 - Report Content

Subsequent sections of this SLO Report document the following:

Indirect Measure (ACCE Student Learning Outcome Survey)
Direct Measure
Oral Rubric (grading criteria)
Graded Student Evaluation of the Oral Presentation (using the Oral Rubric)
Assessment Report for SLO 2

Indirect Measure

The Indirect Measure for SLO 1 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the course assessment report (found at the end of this SLO report).

Direct Measure

The individual assessment of each student for the oral presentation is the Direct Measure for SLO 2 which happens on "Capstone Day" typically the last Friday of the semester. Prior to the oral presentation, much work must be accomplished to prepare each student for the presentation.

Once the groups are formed by the course instructors, each student assumes a role. The five (5) predesignated roles are: Project Manager, Superintendent, Estimator, Scheduler, and Project Engineer. Students are provided with an outline listing the responsibilities for each role. If a group has less than 5 members, one student assumes two roles. If a group has more than 5 members, the additional student(s) assumes an Assistant role to the predesignated roles.

At the half-way point of the class, students receive a detailed outline of the oral presentation and includes the following major categories: Company Identification; Project Identification & Scope; Project Administration; Scheduling; Project Costs and Finances and Closing (Summary) Statement. The outline is completed by each group and is reviewed by the course instructors and the group mentor. Several iterations of the outline occur over the course of several weeks. The outline is then converted into the oral presentation based on the following requirements.

1) Based on the team's understanding of the project requirements, drawings, and project manual, develop a verbal presentation of the project that represents the company's plan for the construction of the project.
2) Every team member must participate in the verbal presentation. It is presumed each student will present information that corresponds to his/her job title. Each member should be prepared for questions, from the guest evaluation panel, that could address each team member's area of responsibility.
3) Visual aids are required. A PowerPoint Presentation shall be used to provide a platform for presenting the information.
4) Each group will have 20 minutes to present the verbal proposal presentation. Each non-presenting group will wait in a staging area outside of the presentation room prior to their scheduled time. No group will be allowed to hear another group's presentation. Documents and information generated by each group are considered proprietary.

Approximately two weeks before the final presentation, all groups participate in a "dress rehearsal" of the oral presentation which is attended by faculty and the group mentors. Comments and suggestions from the reviewers assist the students and groups in developing the final oral presentations.

During the final presentation, each student is evaluated by at least two reviewers: the group mentor, one faculty member, and (sometimes) a member of the CM IAB. The reviewers used the individual Oral Presentation Rubric presented on the following page.

Direct Assessment Rubric

CMGT 44000 - Oral Presentation Rubric – SP 22

Mentor's Name: _____

STUDENT'S NAME: _____

NONVERBAL SKILLS	12	10	8	6
EYE CONTACT	Holds attention of entire audience with the use of direct eye contact, seldom looking at notes.	Consistent use of direct eye contact with audience, but still returns to notes.	Displayed minimal eye contact with audience, while reading mostly from the notes.	No eye contact with audience, as entire report is read from notes.
BODY LANGUAGE	Movements seem fluid and help the audience visualize.	Made movements or gestures that enhances articulation.	Very little movement or descriptive gestures.	No movement or descriptive gestures.
POISE	Student displays relaxed, self-confident nature about self, with no mistakes.	Makes minor mistakes, but quickly recovers from them; displays little or no tension.	Displays mild tension; has trouble recovering from mistakes.	Tension and nervousness is obvious; has trouble recovering from mistakes.

NONVERBAL SKILLS POINTS:_____ out of 36 points

IMENTS:

_____

_____

VERBAL SKILLS	12	10	8	6
ENTHUSIASM	Demonstrates a strong, positive feeling about topic during entire presentation.	Occasionally shows positive feelings about topic.	Shows some negativity toward topic presented.	Shows absolutely no interest in topic presented.
ELOCUTION	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student mumbles, incorrectl pronounces terms, and speaks too quietly for the audience to hear.

VERBAL SKILLS POINTS: _____ out of 24 points

IMENTS:

_____

_____

CONTENT	12	10	8	6
SUBJECT KNOWLEDGE	Student demonstrates full knowledge by answering all questions with explanations and elaboration.	Student is at ease with expected answers to all questions, without elaboration.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student does not have grasp of information; student cannot answer questions about subject.
ORGANIZATION	Student presents information in logical, interesting sequence which audience can follow.	Student presents information in logical sequence which audience can follow.	Audience has difficulty following presentation because student jumps around.	Audience cannot understand presentation because there i no sequence of information.
MECHANICS	Presentation has no misspellings or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has three misspellings and/or grammatical errors.	Student's presentation has four or more spelling and/or grammatical errors.

CONTENT SKILLS POINTS: _____ out of 36 points **TOTAL POINTS: _____ out of 96 points**

Student Work Example

(Poster Presentation and Oral Presentation PPT is available upon request)

IUPUI

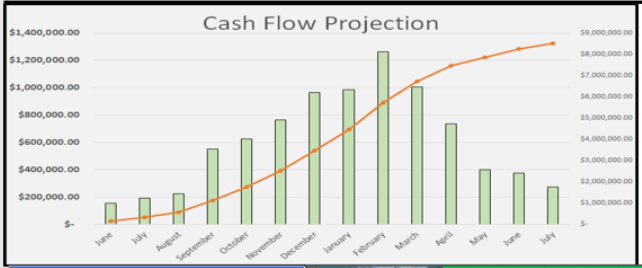
CMGT-44000 Project Capstone – 1858
SP2022

[redacted]

COLLEGIATE CONTRACTORS

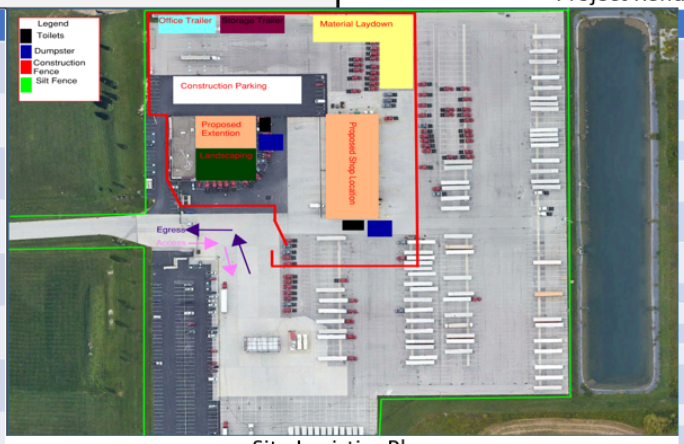
[redacted]

KNIGHT TRANSPORTATION



Project Rendering

Milestones	
Mobilization	6/6/2022
Begin Demolition	6/7/2022
Finish Demolition	6/23/2022
Begin Structural Steel	7/21/2022
Complete Structural Steel	8/7/2022
Complete Concrete Slabs	5/10/2023
Complete Asphalt Paving	7/3/2023
Substantial Completion	7/6/2023



Site Logistics Plan

Schedule of Values		
Division 1	General Requirements	$583,958
Division 2	Site Work	$555,479
Division 3	Concrete	$2,731,241
Division 4	Masonry	$188,844
Division 5	Metals	$201,811
Division 6	Wood & Plastics	$44,413
Division 7	Thermal & Moisture	$526,912
Division 8	Doors & Windows	$411,694
Division 9	Finishes	$155,714
Division 10	Specialties	$55,282
Division 11	Equipment	$8,303
Division 12	Furnishings	$1,351
Division 13	Special Construction	$501,086
Division 15	Mechanical	$604,945
Division 16	Electrical	$416,613
	Total	$8,515,825

Student Presentation Grading Example

Mentor's Name: [redacted] FAC #[redacted]4

CMGT 44000 - Oral Presentation Rubric – SP 22

STUDENT'S NAME: [redacted] Assistant Project Manager

NONVERBAL SKILLS	12	10	8	6
EYE CONTACT	Holds attention of entire audience with the use of direct eye contact, seldom looking at notes.	Consistent use of direct eye contact with audience, but still returns to notes.	Displayed minimal eye contact with audience, while reading mostly from the notes.	No eye contact with audience, as entire report is read from notes.
BODY LANGUAGE	Movements seem fluid and help the audience visualize.	Made movements or gestures that enhances articulation.	Very little movement or descriptive gestures.	No movement or descriptive gestures.
POISE	Student displays relaxed, self-confident nature about self, with no mistakes.	Makes minor mistakes, but quickly recovers from them; displays little or no tension.	Displays mild tension; has trouble recovering from mistakes.	Tension and nervousness is obvious; has trouble recovering from mistakes.

NONVERBAL SKILLS POINTS: 28 **out of 36 points**

COMMENTS: _____

VERBAL SKILLS	12	10	8	6
ENTHUSIASM	Demonstrates a strong, positive feeling about topic during entire presentation.	Occasionally shows positive feelings about topic.	Shows some negativity toward topic presented.	Shows absolutely no interest in topic presented.
ELOCUTION	Student uses a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.	Student's voice is clear. Student pronounces most words correctly. Most audience members can hear presentation.	Student's voice is low. Student incorrectly pronounces terms. Audience members have difficulty hearing presentation.	Student mumbles, incorrectly pronounces terms, and speaks too quietly for the audience to hear.

VERBAL SKILLS POINTS: 22 **out of 24 points**

COMMENTS: _____

CONTENT	12	10	8	6
SUBJECT KNOWLEDGE	Student demonstrates full knowledge by answering all questions with explanations and elaboration.	Student is at ease with expected answers to all questions, without elaboration.	Student is uncomfortable with information and is able to answer only rudimentary questions.	Student does not have grasp of information; student cannot answer questions about subject.
ORGANIZATION	Student presents information in logical, interesting sequence which audience can follow.	Student presents information in logical sequence which audience can follow.	Audience has difficulty following presentation because student jumps around.	Audience cannot understand presentation because there is no sequence of information.
MECHANICS	Presentation has no misspellings or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has three misspellings and/or grammatical errors.	Student's presentation has four or more spelling and/or grammatical errors.

CONTENT SKILLS POINTS: ~~28~~ 32 **out of 36 points** **TOTAL POINTS:** ~~86~~ 82 **out of 96 points** ✓

COMMENTS: GOOD CLEAR PRESENTATION, A LITTLE MORE ENTHUSIASM TOWARDS PROJECT, MOVEMENT & GESTURES WILL HELP SELL PROJECT, SCRIPT FELT A LITTLE READ ✓

Assessment Report for SLO 2

Course: CMGT 44000 - Project Management Capstone

Academic Terms for Evaluation: Fall 2021 & Spring 2022

Instructors: Marvin Johnson & Dan Koo

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 2 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 87% was achieved for SLO 2.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	2. Create oral presentations appropriate to the construction discipline	4.375	88%
S 2022		4.32	86%

Direct Measures

The Direct Measure for SLO 2 was assessed using the Oral Presentation Rubric (96 pts.). The average grade and percent are presented below.

Term	N	Criteria	Average Grade (96 pts)	Average Percent	Target Percent
Fall 2021	8	Oral Presentation	82.1 points	85.6 %	75%
Spring 2022	24	Oral Presentation	84.7 points	88.2 %	75 %

After the initial ACCE accreditation for the CM program, it was decided that an overall average of the total grades should be at least 75%.

For the Fall 2021 semester, the Indirect Measure was 88% and the Direct Measure was 85.6%. Assuming an equal weight for indirect and direct measures the composite grade was 86.8 % indicating that the target value was met.

For the Spring 2022 semester, the Indirect Measure was 86% and the Direct Measure was 88.2%. Assuming an equal weight for indirect and direct measures the composite grade was 87.1 % indicating that the target value was met.

There were more than 40 attendees at the final presentation and included IAB members, faculty, former students and guests. Verbal response from the audience can be summed up in just one comment. “The presentations just keep getting better every year.”

Proposed Actions for Course Improvement:

The complete Faculty Course Assessment Report for CMGT 44000 is included in the appendix for the Quality Improvement Plan. The following proposed actions documented here relate specifically to SLO 2 - Create Oral Presentations.

After discussions with the faculty, group industry members, and IAB members, the course instructors propose a few modifications for the following course offering.

- Solicit comments from the reviewers on suggestions for improving the rubric.
- Minor wording changes in the rubric and upgrade point values.
- Distribute the rubric to the reviewers a week before the presentations.

Student Learning Outcome 3

Create a Construction Project Safety Plan

Introduction

CMGT 42000 - Safety and Inspection is a study of safety regulations, practices, policies and procedures required for construction sites and projects. Topics include: accident investigation, record keeping, OSHA reporting requirements, inspections. Identification of hazardous conditions, and hazard analysis and safety plans.

This course prepares students for challenges they may experience in the construction workplace, including issues of ethics and corporate responsibility. Students will have the tools necessary to promote safety and build a consensus for safety in their organization.

Assessment Methods

For CMGT 42000, two methods of assessment are used for SLO 3, Direct and Indirect.

- Direct - Safety Plan
- Indirect – ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 3 Report Content

Subsequent sections of this SLO Report document the following.

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessment
    - Safety Plan Rubric
    - Graded Student Safety Plan (using the rubric)
- Course Assessment Report

Indirect Measure

The Indirect Measure for SLO 3 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 3 (found at the end of this SLO report).

Direct Assessment

Direct Measures

The Direct Measures for SLO 3 are assignments that include:

1. Safety Plan - Once the assignment of the Safety Plan was presented and class feedback given during scheduled time, the final safety plan was finalized by the student and relevancies and completions of areas were determined by the course instructor and then modified by means of a class discussion. The final safety plans were determined and graded. Students then had to submit in proper formatting required descriptive information (see areas topics of safety plan) into practical construction project specifications. Students had to document project safety measures, communication understanding / strategies and "lessons learned."

Graded Student Work

The assignments are not "marked up" since these assignments were graded in Canvas. The grading criteria for each assignment have not been created in Canvas (yet). The course instructor completed the grading for each assignment using the grading criteria. The grading criteria and any instructor notes were sent to the students via the "Comment" section in Canvas using "SpeedGrader." An example of how it looks in Canvas is shown after the grading criteria for the first two assignments. The "Comments" in Canvas do not reproduce well, which is why just the "graded" grading criteria is provided for the last three assignments.

The following pages of this report contain the student work (Safety Plan) and the completed grading rubric that was used to grade the student Safety Plan.

Student Assignment Rubric (100 points)

Criteria	Exceptional 16-20	Average 11-15	Below Average 6-10	Poor 0-5
Company Information: Name, Logo, Mission, Vision and Strategy are clearly identified				
A clear company commitment to safety and health is documented				
A detailed plan to encourage worker participation is described				
A section identifying the risks of potential hazards is included				
A detailed safety education and training plan is provided				
A complete program evaluation and Improvement plan is described				
A multi-employer (subcontractor) communication section is clearly identified				
Safety plan contains title page and table of contents. Each section is well documented with individual detailed action plans pertaining to specific industry				
Proper spelling, grammar and punctuation are used throughout. Font and spacing support overall neatness				
Safety plan contents are clear, concise and complete				

SAFETY PLAN

Name: [redacted]
Industry: General Contracting/Construction, Building, Transportation, and Utilities
Location: Indianapolis, IN – SR 37, I465
Size: 500+ employees
Mission Statement: To lead the construction services industry by offering clients the highest level of internal expertise, safety, a fully integrated suite of services and a family approach to business.
Vision: Providing high standards of ethics, quality, and safety while operating a fair balance of responsibility, profitability, and citizenship.
Business Strategy: Through the three divisions Walsh Construction, Archer Western, and Walsh Canada, Walsh Group aims at providing infrastructure in the safest way possible, as safety and efficiency is our goal. Walsh Group is a General Contractor that deals with both vertical and horizontal construction, mainly dealing with public works.

Safety Program:

I. MANAGEMENT LEADERSHIP
   1. Communicate your commitment to a safety and health program:
      a. Safety is our culture. Protecting the lives of our clients, employees, subcontractors, and the public is our greatest value and guides our philosophy.
      b. Our leaders recognize their responsibility to establish and maintain exceptional worksites.
      c. Our commitment is proven and demonstrated through our award-winning safety performance and guided by a Core Safety Program.
   2. Define program goals:

a. Training: Training provides leaders with the knowledge and understanding of he tools that maintain safety systems and processes.
b. Planning: Planning identifies hazards and risks of major operations then allows for detailed evaluations. Planning minimizes risk while improving quality and operations.
c. Measuring: Accountability is critical to success. Each project manager's safety performance is measured annually to a higher level of performance, they have to get a higher level of relating.
d. Relating: Each project team member is obligated to conduct weekly interventions with trades persons. These interventions are a powerful tool that builds trust and creates a holistic working environment.

3. Allocate resources:
    a. Estimating team will work with Safety to properly budget labor rates and safety equipment materials.
    b. There will be adequate management/supervisors to ensure at least one competent person is overseeing a site.
    c. Safety team will be responsible for creating required safety review meetings, safety recap presentations, safety statistics, and guiding the program holistically
    d. Safety team and project managers will be responsible for training of all employees of safety requirements, training for tools and equipment, and means and methods of working while being safe.
4. Expect performance:
    a. Recognize and reward employees for undergoing training programs. Employees that hold an OSHA 30 will be given 2% bonuses at the end of the year.
    b. Management team expected to conduct random inspections on the jobsite.
    c. Conduct bi-weekly team meetings on the job site to discuss upcoming potential safety hazards on-site and provide briefing for safety expectations and procedures for upcoming tasks.
    d. Conduct bi-annual companywide presentation for safety awareness and education. A quick 10 question quiz will be conducted following the safety presentation.

II. WORKER PARTICIPATION

1. Encourage workers to participate in the program:
    a. Prior to the start of project, a member of the safety team will meet with the management crew of the project to discuss safety specifics for the job. Crew members will be encouraged to offer suggestions, concerns, past experiences, etc.
    b. Each project management team will conduct meetings with each crew on-site to discuss specific safety procedures and training for upcoming work.
    c. Each employee will be given a copy of the company safety plan and is encouraged to review OSHA guidelines.
    d. Employees are encouraged to email a member of the safety staff with any ideas they may have at any time that may improve the safety of Walsh employees and subcontractors.
    e. Crew teams will be provided lunch each quarter provided work done with no injuries.
2. Encourage workers to report safety and health concerns:

a. Implement a phone app for PMs to report near misses, injuries, illnesses, etc. and also to conduct inspections.
b. Set up safety hotline where any employee can call anonymously to report unsafe conditions with no repercussions to said employee. Calls will be investigated immediately
c. Create a "speak up" initiative that allows ALL workers to speak up in the event of potential hazards without worry of retaliation and encourage employees to participate with posters, hard hat stickers, and other marketing means

3. Give workers access to safety and health information:
    a. Job Hazard Analysis are performed and documented for each jobsite, and are discussed prior to the start of work with the crew as well as posted in the site trailer or other common area
    b. Incident investigation reports are sent via email to all employees ASAP after an incident occurs, detailing the type of accident, and what field circumstances led to the accident and how it can be prevented
    c. Manufacturer and OSHA required safety information is available to workers in a common area, such as the site trailer (SDS's, equipment manufacturer recommendations, etc.)
4. Involve workers in all aspects of the program:
    a. Allow any interested employees to get involved with the Safety Committee
    b. Offer pay incentive for labor teams to undergo safety training and be a part of the Safety Committee.
    c. Treat semi-monthly Safety Review Meetings as a round table where any employee can voice ideas, opinions, concerns
    d. Encourage employees to communicate their ideas to the Safety team at any time via email, or a personal meeting
5. Remove barriers to participation:
    a. Bi-monthly, all team members will organize meeting during regular hours and discuss safety.
    b. Project leaders will be reported and investigated if safety concern is dismissed after employee showing concern.
    c. Anonymous safety tip line is available at any time for employees to voice their concerns anonymously if they choose.
    d. Safety team will provide timely feedback for employee's inquiries.

III. HAZARD IDENTIFICATION AND ASSESSMENT

1. Collect existing information about job site hazards:
    a. Results of JHA's will be analyzed to determine trends for different types of work.
    b. Before beginning work, PM teams and safety teams will meet to discuss possible job site hazards. Job site hazards will then be relayed to project teams prior to work.
    c. Results of JHA's from previous projects will be analyzed and compared to current projects.
    d. PM team and Safety Committee will conduct meeting minutes and notes will be cc'ed to the Safety team
2. Inspect the job site for safety hazards:
    a. Safety Handbook will clearly define the minimum number of regular inspections for varying work.

    b. Barriers must be in place to protect workers and civilians from oncoming traffic.
    c. All employees must be wearing proper safety equipment: hardhat, high-vis, safety glasses, etc.
    d. All heavy equipment teams will be given proper communication devices.
    e. Inspections will be conducted using Procore and follow the same protocol, with sections for notes.
    f. Cranes and other heavy equipment will be inspected daily for proper foundation and outrigging, mechanical concerns, and to ensure that the lift has been approved by the engineer on staff.
    g. All means of ingress and egress will be inspected.
3. Identify health hazards:
    a. Heavy vehicle transportation and movement.
    b. Pedestrian vehicle transportation.
    c. Excavation, trenching collapse.
    d. Improper ingress and egress in trenching systems.
    e. Misuse of PPE, exhaustion, exposure to extreme heat or cold, working in dangerous weather,
4. Conduct incident investigations:
    a. If an accident should occur, all work in the area will cease immediately and the employee must be screened for first aid or emergency response. Safety Director will be notified as soon as possible after affected employees are screened and stabilized.
    b. The Safety Director will respond immediately to the scene and begin taking photographs and speaking to witnesses to understand the situation that led to the incident. The Director will continue to investigate until the situation is clearly understood. Work will not resume until investigation is complete.
    c. The Safety Director will determine the root cause of the incident. Training programs will be conducted to review safety before work begins. Safety Director will send an email to all Walsh management detailing what happened and how to avoid it from happening again.
5. Identify hazards associated with emergency and routine situations:
    a. Discuss and host training on the hazards and remedial protocol of trenching collapse, worker injury from heavy equipment, and injury from weather
    b. Host regularly scheduled emergency drills with safety teams and ensure all project teams follow their emergency protocol and procedures.
    c. Train field Operations staff on weather emergency protocol and ensure all staff is clear on what weather constitutes a stop work (i.e. lightning, flooding)
6. Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control:
    a. Hazard trenching collapse. Level of threat to workers: moderate danger to workers. Interim control: Ensure that proper means of ingress and egress are established. Ensure that all trenches meet OSHA standards according to slope of trench, and all workers in the trench are protected by means of trench box.
    b. Hazard of worker injury from heavy equipment. Level of threat to workers: Moderate to high. Interim control: ensure barriers are in place to separate the job site from pedestrian traffic. Ensure that all workers are aware of the dangers of working near heavy equipment and have full understanding of the blind spots of

heavy equipment. All heavy equipment operators shall be given proper communication devices. All workers are wearing proper PPE such as high-vis, hard hats, steel toe boots, etc.

c. Hazard of injury from weather. Level of threat to workers: low to moderate. Interim control: all workers must have a basic understanding of the dangers of weather and conditions in which they should not be at work. Weather hazards are more prevalent in thunder/lightning storms, heavy gusts of wind, flooding.

IV. HAZARD PREVENTION AND CONTROL

1. Identify control options:
    a. During the safety meeting prior to the start of work, workers will be encouraged to offer their input on safety measure's feasibility and effectiveness, as well as offer other safety strategies they believe would prove beneficial.
    b. Daily meetings will be held prior to daily work to stretch and discuss tasks of the day, as well as safety concerns
    c. Safety team will evaluate and record employee's ideas that are submitted through email and pitched to PM teams during semi-monthly safety recap meeting and implement as appropriate.
    d. For projects beyond Walsh's typical scope that present complex safety hazards, Safety team should consult with other professional safety organizations
2. Select controls:
    a. Hazards due to heavy equipment will be suppressed by requiring certification/licensing for each operator and isolating on-site crew members from the lift area, as well as conducting daily inspections of the equipment. To protect workers and pedestrian traffic, barriers must be in place when constructing near traffic. To protect workers from moving heavy equipment, proper training will be given to each worker to ensure proper understanding of blind spots, and to avoid radius of equipment when in use.
    b. Hazards due to excavation and trenching will be suppressed by abiding by the OSHA standards on trenching and will meet the required slope and support systems required to protect workers in the trench. Proper means of ingress and egress according to OSHA must also be established and inspected before use.
3. Develop and update a hazard control plan:
    a. The highest priority is safety training. When there are a lot of moving parts on site it is easy to forget surroundings and basic safety procedures. Each employee will be given extensive training of protocol and procedures, understanding the hazards on the job site, how to prevent hazards from occurring, and how to respond to a hazard or emergency.
    b. The next highest priority is machine safety. First, barriers must be in place to protect pedestrian traffic from onsite equipment and workers. Inspections before daily use must be done on all equipment to ensure that there are no hazards to employees.
    c. The following priority is trenching safety. Hazards are prevalent when equipment is working above, and soils are likely to collapse without proper safety equipment.
    d. With the implementation of new controls, the Safety team will track the effectiveness and discuss during semi-monthly meeting
4. Select controls to protect workers during non-routine tasks and emergencies:

a. PMs will monitor the weather daily as well as be able to identify emergency weather situations and be trained on procedure to keep workers safe during these events
b. In case of injury on site, trained employees will give first aid response if needed, and emergency transportation to a hospital will be provided if needed. First aid kits will be provided and stored in the job site trailer.
c. It is up to each employee to monitor their sickness and gauge whether or not their illness will become a hazard to fellow employees. If employee is visibly sick, it is the responsibility of fellow workers and the management team to respond by sending the employee home or to medical care and investigate if other employees have been contaminated.

5. Implement selected controls on job sites
    a. Weather logs will be tracked through Procore and will be communicated to the entire project team. Logs displaying poor and dangerous weather will be exhibited as evidence if workers are mandated to work during it.
    b. Employees that wish to be first aid certified will be trained by safety professionals. Training will be paid for and provided by the company. First aid kits will be serviced monthly, ensuring that all first aid apparatus will be properly provided.
    c. In the case of Covid-19, employees will be subjected to a thermometer test to gauge a fever. If showing symptoms, employee will be sent home and surrounding employees must take a negative Covid test to ensure safety. If sick, workers are prohibited from working until two negative Covid tests, or two weeks following the first positive test. All other minor sickness will be gauged by severity by the employee in question and the PM team.
6. Follow up to confirm that controls are effective:
    a. Surveys will be conducted with anonymous response to accurately gauge employee's reaction and perceived effectiveness of the controls
    b. Records of accidents and near misses will be kept before and after implementation to see results with a true metric
    c. During monthly meetings, workers will be asked how they feel about the safety measures and if they feel that anything could be done differently or better. Feedback about safety plan will be timely sent to the safety team.

V. EDUCATION AND TRAINING

1. Provide program awareness training:
    a. Every new hire will receive the training defined in the Safety Handbook. There is basic safety training for all employees, and specialized safety training that is designed for specific roles and duties. Safety training will include how to properly wear PPE in addition to general rules of thumb of safety on the job site.
    b. Workers will be required to maintain their OSHA 10 status at all times, workers who maintain an OSHA 30 will be eligible for safety bonuses.
    c. Safety refreshers will take place following accident on site. All employees may be subject to random safety quizzes at any point on the job. If safety quizzes are failed, employee cannot resume work until properly trained and fully understands safety protocol.
    d. Subcontractors are expected to uphold their own safety protocol, but will be subjected to training if PM team feels safety is lacking.

2. Train employers, managers, and supervisors on their roles in the program:
    a. Upper management will be expected to set an example while in the field and follow all protocol that field laborers do.
    b. Upper management will be expected to be familiar with their responsibilities as outlined in the OSH Act, as well as techniques for recognizing hazards and ways to avoid them.
    c. If employees feel as the PM team does not properly uphold safety regulations or concerns, employees are welcome and encouraged to send anonymous messages expressing their concern to the upper management and safety team.
    d. Upper management will need to maintain an OSHA 30 certification.
3. Train workers on their specific roles in the safety and health program:
    a. Different training programs will be designed to accommodate the unique needs of working in different departments at Walsh Group.
    b. PM teams that are responsible for on site inspections must be properly trained on Procore, as reports and inspections will be transmitted through Procore.
    c. All employees will be given the tools they need to readily recognize hazards associated with Walsh's work and have a broad understanding of how to prevent them. All employees are encouraged to approach management with any safety questions or concerns.
4. Train workers on hazard identification and controls:
    a. Workers will be made aware of some common sources of hazards associated with the work: overexertion, improper PPE, exposure to heat and cold, traffic and heavy equipment safety, trench and excavation safety, improper use of hand tools, pinch points, etc.
    b. Workers will be trained on control measures such as PPE, proper handling of tools, weather emergency procedures, avoiding areas around heavy equipment, and the hierarchy of controls
    c. Workers will engage in the daily huddle / morning stretch where safety considerations for the day will be mentioned.

VI. PROGRAM EVALUATION AND IMPROVEMENT

1. Monitor performance and progress:
    a. Safety team is responsible for compiling statistics on type and severity of incidents, including near misses and hazards identified during inspections. PM team is responsible for logging reports and random site inspections.
    b. Response rate and number of employee suggestions is logged.
    c. Safety team is responsible to evaluate the time taken by PM to correct after a hazard is identified or an incident occurs.
2. Verify that the program is implemented and is operating:
    a. Is the number of incidents on site going down?
    b. Are the required number of inspections and toolbox talks being completed and logged in Procore?
    c. Are the hazard control measures still be followed and having a positive effect on worker's safety?
3. Correct program shortcomings and identify opportunities to improve:
    a. Would changes in equipment, materials, key personnel, or practices improve the safety of Walsh's workers?
    b. Do Employee incident rates show progress from the year before?

c. Are employee safety suggestions being evaluated and or implemented?
d. What changes would more effectively address the issue of improving Walsh's employee's health and safety.

VII. COMMUNICATION AND COORDINATION FOR EMPLOYERS ON MULTIEMPLOYER WORKSITES

1. Establish effective communication:
    a. Involve trades/employees on site with the daily huddle and stretch. Use this opportunity to discuss the potential hazards onsite across all trades on the jobsite
    b. Project management is responsible for following the procedures set by the General Contractor to exchange information about hazards and controls implemented amongst all trades
    c. Project management is responsible for distributing information from General Contractor pertaining to hazards that could occur as a result of non-routine procedures or emergencies, so all employees are aware
    d. Safety team is responsible for frequent check-up on project teams to discuss any safety issues.
    e. For each project, there will be adequate supervision/management staff available that there will always be a competent person available to make decisions and resolve day to day issues

CMGT 42000 Spring 2022 –Graded Safety Plan Rubric (Example) Student: [redacted]

Criteria	Exceptional 16-20	Average 11-15	Below Average 6-10	Poor 0-5
Company Information: Name, Logo, Mission, Vision and Strategy are clearly identified	**20**			
A clear company commitment to safety and health is documented	**20**			
A detailed plan to encourage worker participation is described	**20**			
A section identifying the risks, evaluation, and assessment of potential hazards is included	**20**			
A detailed safety education and training plan is provided	**20**			
A complete program evaluation and Improvement plan is described	**20**			
A multi-employer (subcontractor) communication section is clearly identified	**20**			
Safety plan contains title page and table of contents. Each section is well documented with individual detailed action plans pertaining to specific industry	**17**			
Proper spelling, grammar and punctuation are used throughout. Font and spacing support overall neatness	**18**			
Safety plan contents are clear, concise and complete	**20**			

Course Instructor Comments:

- Great company details! Mission statement content good, best if abbreviated to 1-2 short sentences.
- Table of contents would add additional organization and structure. Excellent content in each area of safety plan, including specific details relevant to your company's industry.
- Excellent use of technology within plan, ie. phone app
- Very effective communication plan
- Use caution while using acronyms, new employees may be unfamiliar.
- Overall, great plan!

Meyer Najem Construction

Construction Project Safety Plan

Table of Contents

SAFETY PLAN

Name: Meyer Najem Construction
Industry: General Contractor
Location: Fishers, IN
Size: 125 employees
Mission Statement: Its our mission to serve our clients at the highest level possible. For us, that means digging deep (literally and figuratively) to understand our clients' vision, and together, bring that vision to life.
Business Strategy: Crafting and creating personal relationships with our clients to make repeat customers. At MNC we know that having a safe, cost effective, and on schedule project is the ultimate goal for an company, and we are proud to say that is normal here at MNC. Our company has a team mentality and has since it was established back in 1987

Safety Program:

MANAGEMENT LEADERSHIP

Communicate your commitment to a safety and health program:

1. Email detailing the safety program with both a broad overview and explicit details about the safety practices that will be followed sent 2 times per year and within first 2 weeks of employment for new hires
2. Safety Director / Safety staff will meet with crews to discuss the implications of the safety program and specifics that relate to the specific project prior to start of work
3. Estimating team will be trained and directed to include safety in the estimate for every new project

Define program goals:

1. Host semi-monthly company-wide safety recap from Safety Director. Discussion will include a presentation over statistics gathered from the field, areas of improvement, safety concerns, praise, etc.
2. Increase the number of safety inspections performed by MNC employees on site to catch possible safety hazards early. Minimum requirements for safety inspections will depend on project size and/or contract amount and be detailed in Safety Handbook
3. Reduce injuries and accidents involving heavy equipment to zero by enforcing a review of every section lift with the engineer(s) on staff prior to performing the lift

Allocate resources:

1. Estimating team will work with Safety to properly budget labor rates and productivity to align with demands of performing work safely
2. Safety team will be responsible for creating required safety review meetings, safety recap presentations, safety statistics, and guiding the program holistically

3. Marketing team will work with Safety to create propaganda to encourage workers to engage in the safety culture of MNC and follow the proper procedures

Expect performance:

1. Reward employees for conducting jobsite safety inspections by conducting a draw from a quarterly prize pool for employees who exceeded their required number of inspections
2. Conduct company-wide semi-monthly meeting where all employees will have an opportunity to voice their ideas, and exemplary employees will be recognized
3. Reward crews with excellent safety performance with a special event, such as a catered lunch

WORKER PARTICIPATION

Encourage workers to participate in the program:

1. Prior to the start of work, a member of the safety team will meet with the crew of the project to discuss safety specifics for the job. Crew members will be encouraged to offer suggestions, concerns, past experiences, etc.
2. Employees are encouraged to email a member of the safety staff with any ideas they may have at any time that may improve the safety of MNC
3. Have a separate committee of volunteer Operations and Manufacturing team employees that will work closely with the Safety team to bridge the gap between field and office

Encourage workers to report safety and health concerns:

1. Implement a phone app to report near misses, injuries, illnesses, etc. and also to conduct inspections
2. Set up safety hotline where any employee can call anonymously to report unsafe conditions. Calls will be investigated immediately
3. Create a "speak up" initiative that allows ALL workers to speak up in the event of potential hazards without worry of retaliation and encourage employees to participate with posters, hard hat stickers, and other marketing means

Give workers access to safety and health information:

1. Job Hazard Analysis are performed and documented for each jobsite, and are discussed prior to the start of work with the crew as well as posted in the site trailer or other common area
2. Incident investigation reports are sent via email to all employees ASAP after an incident occurs, detailing the type of accident, and what field circumstances led to the accident and how it can be prevented
3. Manufacturer and OSHA required safety information is available to workers in a common area, such as the site trailer (SDS's, equipment manufacturer recommendations, etc.)

Involve workers in all aspects of the program:

1. Allow any interested employees to get involved with the Safety Committee

2. Treat semi-monthly Safety Review Meetings as a round table where any employee can voice ideas, opinions, concerns
3. Encourage employees to communicate their ideas to the Safety team at any time via email, or a personal meeting

Remove barriers to participation:

1. Semi-monthly, all employees will have an opportunity to meet during regular hours and discuss safety
2. Anonymous safety tip line is available at any time for employees to voice their concerns anonymously if they choose
3. Safety team will provide timely feedback for employees inquiries

HAZARD IDENTIFICATION AND ASSESSMENT

Collect existing information about job site hazards:

1. Results of JHA's will be analyzed to determine trends for different types of work
2. Surveys will be sent out to employees occasionally to glean more precise information and honest opinions
3. Safety Committee meeting minutes and notes will be cc'ed to the Safety team

Inspect the job site for safety hazards:

1. Safety Handbook will clearly define the minimum number of regular inspections for varying work
2. Inspections will be conducted using a cell phone app and follow the same protocol, with sections for notes
3. Cranes and other heavy equipment will be inspected daily for proper foundation and outrigging, mechanical concerns, and to ensure that the lift has been approved by the engineer on staff

Identify health hazards:

1. Every project will have a Project Specific Safety Plan
2. Heavy machinery will be carefully controlled to prevent accidents, and all employees will be extensively trained on how to avoid injuries heavy machines
3. All employees will be given proper PPE (gloves, masks, boots, etc.) to protect them when needed and the area will be monitored with permanent machines that test oxygen levels and detect harmful gases

Conduct incident investigations:

1. If an accident should occur, all work in the area will cease immediately and the Safety Director will be notified as soon as possible after affected employees are screened and stabilized
2. The Safety Director will respond immediately to the scene and begin taking photographs and speaking to witnesses to understand the situation that led to the incident. The Director will continue to investigate until the situation is clearly understood
3. The Safety Director will determine the root cause of the incident. Witnesses may be asked if they have any suggestions to avoid a similar incident

occurring. Safety Director will send an email to all of MNC detailing what happened and how to avoid it from happening again

Identify hazards associated with emergency and routine situations:

1. Host regularly scheduled emergency drills with office staff and elect wardens who will ensure everyone in their area is following the proper procedure of the drill
2. Train field Operations staff on weather emergency protocol and ensure all staff is clear on what weather constitutes a stop work (i.e. lightning)

Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control:

1. Hazard of heavy equipment failure/lost load impact: low rate of instance, extreme danger to workers. Interim control: all lifts will be reviewed and approved by engineer on staff, employees will be directed to stand clear of the lift while it is ongoing, all heavy equipment operators will have a supporting crew member standing by to direct them
2. Hazard of struck by, back over by mobile machinery, level of threat to workers: intermediate rate of instance, substantial danger to workers. Interim control: train employees to recognize the blind spots of mobile machinery and post visuals in common areas, train employees to exercise extreme caution when near mobile equipment and to be constantly aware of their surroundings, consider implementing an alarm system that will trigger in the cab of equipment when a worker is within a certain range

HAZARD PREVENTION AND CONTROL

Identify control options:

1. During the safety meeting prior to the start of work, workers will be encouraged to offer their input on safety measure's feasibility and effectiveness
2. Safety team will evaluate and record employee's ideas that are submitted through email and pitched during semi-monthly safety recap meeting and implement as appropriate
3. For projects beyond MNC's typical scope that present complex safety hazards, Safety team should consult with other professional safety organizations

Select controls:

1. Hazards due to cranes and lifting equipment will be suppressed by requiring approval for each lift by the engineer on staff and isolating on-site crew members from the lift area, as well as conducting daily inspections of the equipment
2. Hazards due to moving equipment in the field will be suppressed by training employees to remain aware of their surroundings and giving workers a device that communicates with the moving equipment and sounds an alarm whenever a worker is within a certain range

Develop and update a hazard control plan:

1. Highest priority is ensuring lift is done safely. An engineer(s) will be on staff with a major part of their job description being to review lift plans and make changes if necessary. Not only is a failed lift an immense liability for the safety of the crew, but also at immense cost if the lift is damaged. Daily inspections of the equipment and confirmation that the lift has been approved will be carried out by the project manager or superintendent
2. Next highest priority is purchasing the system that will serve as the alarm for crew members in moving equipment's range. MNC hopes to implement this technology by April 2023. The number of close calls/near misses will be recorded before and after as well as anonymous surveys of the crew members to track the effectiveness of the system will be used.
3. With the implementation of new controls, the Safety team will track the effectiveness and discuss during semi-monthly meeting

Select controls to protect workers during non-routine tasks and emergencies:

1. Workers will monitor the weather daily as well as be able to identify emergency weather situations and be trained on procedure to keep workers safe during these events
2. Through regularly scheduled drills, office employees will not be caught unaware in the event of an emergency situation in the office

Implement selected controls on job sites

Follow up to confirm that controls are effective:

1. Surveys will be conducted with anonymous response to accurately gauge employees reaction and perceived effectiveness of the controls
2. Records of accidents and near misses will be kept before and after implementation to see results with a true metric
3. During tool box talks, workers will be asked how they feel about the safety measures and if they feel that anything could be done differently or better

EDUCATION AND TRAINING

Provide program awareness training:

1. Every new hire will receive the training defined in the Safety Handbook. There is basic safety training for all employees, and specialized safety training that is designed for specific roles and duties
2. Workers will be required to maintain their OSHA 30 status at all times
3. 1New safety measures will be discussed with all employees at implementation and training provided as necessary

Train employers, managers, and supervisors on their roles in the program:

1. Upper management will be expected to set an example while in the field and follow all protocol that field laborers do
2. Upper management will be expected to be familiar with their responsibilities as outlined in the OSH Act, as well as techniques for recognizing hazards and ways to avoid them
3. Upper management will also need to maintain an OSHA 30 certification

Train workers on their specific roles in the safety and health program:

a. Different training programs will be designed to accommodate the unique needs of working in different departments at MNC
b. Since reporting and inspections will be conducted through a phone app, training for that app will be provided to all employees
c. All employees will be given the tools they need to readily recognize hazards associated with MNC's work and have a broad understanding of how to prevent them

Train workers on hazard identification and controls:

1. Workers will be made aware of some common sources of hazards associated with the work: overexertion, exposure to heat and cold, improper use of hand tools, pinch points, etc.
2. Workers will be trained on control measures such as PPE, proper handling of tools, weather emergency procedures, when to avoid areas (such as during lifts), and the hierarchy of controls
3. Workers will engage in the daily huddle / morning stretch where safety considerations for the day will be mentioned

PROGRAM EVALUATION AND IMPROVEMENT

Monitor performance and progress:

a. Safety team is responsible for compiling statistics on type and severity of incidents, including near misses and hazards identified during inspections
b. Response rate and number of employee suggestions is logged
c. Field management is responsible to evaluate the time required to correct after a hazard is identified or an incident occurs

Verify that the program is implemented and is operating:

1. Is the phone app being utilized as desired?
2. Are the required number of inspections and tool box talks being completed and logged in the phone app?
3. Are the hazard control measures still be followed and having a positive effect on worker's safety?

Correct program shortcomings and identify opportunities to improve:

1. 2Would changes in equipment, materials, key personnel, or practices improve the safety of MNC's workers?
2. Are the performance indicators still relevant to MNC's safety demands?
3. What changes would more effectively address the issue of improving MNC's employees health and safety

COMMUNICATION AND COORDINATION FOR EMPLOYERS ON MULTIEMPLOYER WORKSITES

Establish effective communication:

a. Involve all trades on site with the tool box talk and/or daily huddle and stretch. Use this opportunity to discuss the potential hazards onsite across all trades on the jobsite

b. Subcontractor is responsible for following the procedures set by MNC to exchange information about hazards and controls implemented amongst all trades
c. Subcontractor is responsible for distributing information from MNC pertaining to hazards that could occur as a result of non-routine procedures or emergencies so all employees are aware

Establish effective coordination:

1. Subcontractor is responsible for following procedures and distributing information from MNC
2. For each project, there will be a superintendent(s) available to make decisions and resolve day to day issues

CMG 42000 Fall 2022 –Graded Safety Plan Rubric Student: Student

Criteria	Exceptional 16-20	Average 11-15	Below Average 6-10	Poor 0-5
Company Information: Name, Logo, Mission, Vision and Strategy are clearly identified	**20**			
A clear company commitment to safety and health is documented	**17**			
A detailed plan to encourage worker participation is described	**18**			
A section identifying the risks, evaluation, and assessment of potential hazards is included	**20**			
A detailed safety education and training plan is provided	**19**			
A complete program evaluation and Improvement plan is described	**19**			
A multi-employer (subcontractor) communication section is clearly identified	**20**			
Safety plan contains title page and table of contents. Each section is well documented with individual detailed action plans pertaining to specific industry	**20**			
Proper spelling, grammar and punctuation are used throughout. Font and spacing support overall neatness	**20**			
Safety plan contents are clear, concise and complete	**20**			

Course Instructor Comments:

Student submit a well written Safety Plan! All areas of concern were identified and when appropriate mitigated to the extent possible on safety preplanning.

Course Assessment Report

Course: CMGT 42000 - Safety and Inspections

Academic Term: Spring 2022

Instructors: Mark Steinhofer

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 3 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An average 88% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
S 2022	3. Create a construction project safety plan	4.2	84%
F 2022		4.59	92%

The Indirect Measure for SLO 3 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). An 84% ranking was achieved for this SLO and xx% in the Fall 2022 term.

Direct Measures - Assessments and Evaluations

The Direct Measure for SLO 3 was to create the Safety Plan. Students learn various subjects related to construction safety including OSHA regulations and practices. Students' learning objective is assessed by a final report to create a safety plan.

Term	N	Criteria	Average Percent	Target Percent
Spring 2022	18	Report	95.1	75
Fall 2022	20	Report	95	75

The maximum grade (points) for the Work Report is 100. The table below shows the average grade 95% in the percentage exceeding target percent (75%).

Proposed Actions for Course Improvement:

1. **Integrate OSHA 30 hours certification.** The material covered in CMGT 42000 closely aligns with the requirements necessary for OSHA 30 certification. It would be beneficial for the CM program to integrate OSHA 30 training for future offerings of CMGT 42000. As many of the students are either interns in the construction industry or work in construction in a different capacity, this is also a recommendation on behalf of the students. ➔**the course instructor is qualified to deliver OHSA 30 hours certification and the students receive at the end of the semester.**

2. **Adjust time allotment for safety presentation from 20-30 minutes to 15-20 minutes per student.** Although the longer time allotment worked well with smaller class sizes in the past, it was necessary to use additional sessions to accommodate the time necessary for 35 presentations. Students could adequately cover their safety topic in 20-15 minutes. Overall, the students not only gained knowledge from their own safety research, they were also able to learn from their peers and also participate in the peer valuation process. ➔ **the instructor revised student presentations**

3. **Upgrade safety plan grading rubric**. Refine criteria and provide students a detailed version of specific expectations. ➔ **The course uses an upgraded rubric for the report evaluation.**

4. **Integrate case studies** by analyzing current safety violations under investigation. Students will predict outcome based on OSHA CFR 1926 standards. This project will give students the opportunity to learn through inductive reasoning and team based learning. Teams will work together to investigate and determine the cause of the safety breach. ➔ **the instructor included case studies in the updated course materials.**

5. **Invite industry safety program managers**. Students will benefit from interacting with safety professionals in the classroom. Schedule four speakers per semester from four different construction disciplines to provide a real life connection between classroom work and industry application. ➔ **the instructor is an active and certified OSHA trainer for industry professionals.**

Student Learning Outcome 4

Create Construction Project Cost Estimates

Introduction

SLO 4 – Create Construction Project Cost Estimates is assessed and evaluated in CMGT 31000 – Cost Estimating using one Lab Assignment and the student's Term Project. Students are provided with a set of prints for both assignments and are required to create a quantity takeoff for identified divisions as well as a cost break down for material, labor and equipment, including markups.

Assessment Methods (additional information in the Direct Assessment section of this report)

Indirect Measure
ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures
For SLO 4, two methods of direct assessment are used in CMGT 31000.

1. Concrete Estimate Lab
2. Final Project Estimate and Bid (term project)

SLO 4 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
  - Explanation and rubrics (grading criteria)
  - Graded student work (using the rubric)
- Assessment and Evaluation for SLO 4

Indirect Measure

The Indirect Measure for SLO 3 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 3 (found at the end of this SLO report).

Direct Assessment:

In CMGT 31000, each lecture is dedicated to addressing the key elements necessary to create a cost estimate. The Direct Assessment consists of a lab assignment (custom designed to provide students and opportunity to create cost estimates covering multiple divisions for a given project throughout the semester) and a final group project (represents a culmination of lab experiences, creating a cost estimate and submitting a bid on a project similar to the labs).

The lab assignment was to create a concrete cost estimate for the given project. The grading criteria used for this assignment is given on the following page.

WALL FOOTING COST SUMMARY	AVAILABLE POINTS
Formwork	4
Concrete (3,000 psi)	4
Continuous Rebar	4
Rebar Ties	4
Rebar Dowels (Typical)	4
Rebar Dowels (Entry)	4
Total Cost	2
SLAB COST SUMMARY	
Formwork	4
Concrete (4,000 psi)	4
Welded Wire Mesh	4
Vapor Barrier 20' x 100' roll (6" lap)	4
Total Costs	2
Linked Formulas	6
Total Points	50

A graded student example is included in this report.

A Final Group Project was introduced at the midpoint of the semester. Students were assigned the task of creating a new cost estimate and submitting a completed bid on a new construction project similar to the project introduced in the lab. The grading criteria used for the assignment is given below.

Bid Form	5
SV Form G702 (AIA) Application for Payment	2
SV Form G703 (AIA) Continuation Sheet	5
Summary Sheet	10
Detail Sheet (Material, Labor, Equipment Costs and Activity Duration)	50
General Requirements	5
Concrete Take off	11
Masonry Take off	19
Metals Take off	5
Thermal Protection Take off	1
Door and Windows Take off	2
Finishes Take off	3

Plumbing Take off	8
HVAC Take off	9
Electrical Take off	9
Earthwork Take off	2
Bid Format	4
Total Points	**150**

The following pages of this SLO report include the:

Graded Student Lab and Graded Final Project
Course Assessment Report for SLO 4

Sample Student Work – Concrete Lab

Complete the following concrete takeoff and pricing (both tabs) of the in-class project using RSMeans data provided. Use 5% waste on material only, 18" lap on continuous rebar, 6" lap on vapor barrier 20' x 100' roll,3" coverage on all reinforcing, and 8" lap on 8' x 20' WWF.

Footing Takeoff

						FORMWORK		CONCRETE (3,000 psi)			CONTINUOUS REBAR							
Footing Mark	Length	Width	Thickness	Number of Footings		Formwork Quantity		Volume of Concrete	Total Concrete		# of Bar Rows	Size	Unit Weight	Standard Bar Length	Bar Lap	Total Number of Std. Bars	Combined Rebar Length	Total Combined Weight
	(feet)	(feet)	(feet)	(each)		(sfca)		(cubic feet)	(cubic yards)		(each)		(lbs/ft)	(ft/ea)	(feet)	(ea)	(feet)	(lbs)
Foundation	378.00	4.00	1.00	1.00		756.00		1512.00	56.00		4	#5	1.043	20	1.50	82.00	123.00	128.29
12' Overhead Entrance	12.00	4.00	1.00	5.00														
8' Overhead Entrance	8.00	4.00	1.00	1.00														
Door Entrance	3.33	4.00	1.00	2.00														
Columnn	7.00	7.00	1.25	2.00		28.00		61.25	2.27									
Total						**784.00**			**58.27**									

centerline is adjusted by 12" for each side, 6" off of each end, you have only taken a total of 6" off to calculate your centerline

combined rebar length is 82 pieces x a 20' bar

foundation formwork is off just because your centerline is off, the column footing formwork is off because you have the permiter of the 1 footing

but you need to multiply it by the depth of the footing and then x 2 column footings

REBAR TIES	"transverse"							REBAR DOWELS							
Spacing	Size	Unit Weight	Number of Rebar Ties	Rebar Tie Length	Total Rebar Length	Total Weight		Dowel Location	Spacing	Size	Unit Weight	Length of Footing Based on Location	# of dowels per spacing	Total # of dowels	Dowel Length
(inches)		(lbs/ft)	(each)	(feet)	(feet)	(lbs)			(inches)		(lbs)	(feet)	(each)		(feet)
12	#5	1.043	382	3.50	1337.00	1394.49		center	48	#5	1.043	303.33	1	80	4.25
								center	48	#5	1.043	60.00	1	20	3.33
								center	48	#5	1.043	8.00	1	3	3.33
								center	48	#5	1.043	6.67	1	4	3.33
10	#5	1.043	32	6.50	208.00	216.94									

Slab on Grade

concrete volume, 2 column footings

Slab Location	Length	Width	Thickness		FORMWORK	CONCRETE (4,000 psi)	
					Formwork Quantity	Volume of Concrete	Total Concrete
	(feet)	(feet)	(feet)		(sfca)	(cubic feet)	(cubic yards)
Main Floor	98.00	88.00	0.50		372.00	4312.00	159.70
Entries	74.67	1.00	0.67		74.67	49.78	1.84
4" Column Footing Gap	7.00	7.00	0.33	2.00		32.67	1.21
Total					**446.67**		**162.76**

remember the block wall forms the main area of the slab so no formwork is necessary

remember to run the entry form a little beyond each opening

WELDED WIRE MESH

Type	Welded Wire Mesh Panel Dimensions		Lap	Panel Coverage Area	Area of Slab	# Panels	Total SF of Panels
	(feet)	(feet)	(feet)	(sqft)	(sqft)	(ea)	(sqft)
WWF	8.00	20.00	0.67	141.78	8624.00	61.00	9760.00

Vapor Barrier

Type	Vapor Barrier Roll dimensions		Lap	# Rows	# Columns	# Rolls	Total SF of Vapor Barrier
	(feet)	(feet)	(feet)	(ea)	(ea)	(ea)	(sqft)
6 mil	20.00	100.00	0.50	4.51	0.98	5.00	10000.00

watch rounding up before waste is added, if you round up to full panels or full rolls, then after waste you would roundup to another full panel and roll. For example if you had 4.5 rolls * 1.05 is 4.725 but because you round up you are already at 5 rolls so once you add waste are you going to order 6 rolls?

WALL FOOTING COST SUMMARY

Item	Unit	Quantity	Waste %	Material Cost per unit	Total Material Cost	Labor Cost per Unit	Total Labor Cost	Equipment Cost per unit	Total Equipment Cost	Subtotal		
Formwork	(sfca)	784.00	5.00%	$ 6.85	$ 5,638.92	$ 3.99	$ 3,128.16	$ -	$ -	$ 8,767.08	→	3.5/4
Concrete (3,000 psi)	(cy)	58.27	5.00%	$ 142.50	$ 8,718.43	$ 16.30	$ 949.78	$ 0.47	$ 27.39	$ 9,695.59	→	3.5/4
Continuous Rebar	(tons)	0.06	5.00%	$ 940.00	$ 63.31	$ 825.00	$ 52.92	$ -	$ -	$ 116.23	→	3.5/4
Rebar Ties	(tons)	0.81	5.00%	$ 940.00	$ 795.24	$ 825.00	$ 664.72	$ -	$ -	$ 1,459.96	→	4.0/4
Rebar Dowels (Typical)	(each)	80.00	5.00%	$ 2.30	$ 193.20	$ 4.82	$ 385.60	$ -	$ -	$ 578.80	→	4.0/4
Rebar Dowels (Entry)	(each)	27.00	5.00%	$ 1.80	$ 51.03	$ 3.66	$ 98.82	$ -	$ -	$ 149.85	→	4.0/4
									Total Cost	$ 20,767.51	→	2/2

SLAB COST SUMMARY

Item	Unit	Quantity	Waste %	Material Price per unit	Total Material Cost	Labor Cost per Unit	Total Labor Cost	Equipment Cost per unit	Total Equipment Cost	Subtotal		
Formwork	(sfca)	446.67	5.00%	$ 6.85	$ 3,212.65	$ 3.99	$ 1,782.20	$ -	$ -	$ 4,994.85	→	2.5/4
Concrete (4,000 psi)	(cy)	162.76	5.00%	$ 148.50	$ 25,377.92	$ 21.00	$ 3,417.90	$ 6.65	$ 1,082.34	$ 29,878.15	→	4.0/4
Welded Wire Mesh	(CSF)	97.60	5.00%	$ 14.25	$ 1,460.34	$ 25.00	$ 2,440.00	$ -	$ -	$ 3,900.34	→	3.5/4
Vapor Barrier 20' x 100' roll (6" lap)	(sq)	10,000.00	5.00%	$ 3.73	$ 39,165.00	$ 10.65	$ 106,500.00	-	$ -	$ 145,665.00	→	3.5/4
									Total Cost	$ 184,438.34	→	2/2
		sq is a square = to 100sf										
										Correct Links		6/6
												46.0/50

Sample Student Work – Final Project

143.95/150	leave these cells alone
4.0/4	project format
5.0/5	

	Bid Form		
Owner:		Project:	
West Street Video		West Street Video	
Jenny Tutone		211 NE Revere Ave	
P.O. Box 3534		Bend, OR 9701	
Bend, OR 9701			
Dear Sirs:			
Having carefully examined the bid documents including the plans, specifications, and other related documents; visted the proposed site of the work; and being familiar with other conditions surrounding construction of the proposed project including the availability of material and labor, the undersigned proposes to furnish all labor, material, equipment, supplies, tools, transportation, services, licenses, fees, permits, sales tax, and so forth required by the bid documents for the sum of			
$ Four Hundred Seventy One Thousand, Three Hundred Fifty Nine and 99/100 Dollars			$ 471,359.99
The undersigned also agrees to complete the work in 150 calendar days.			
We acknowledge the following addenda:			
Enclosed is a bond, as required, in the sum of 5% of the bid.			
This bid shall remain good for 60 days after the bid opening.			
Respectfully Submitted:			
		Company: L&B Construction	
		By: Student	
		Address: 420 University Blvd	
		Indianapolis, IN 46202	
		License No 5213457	
		Date: 12/8/2021	

2.0/2 ←leave this cell alone

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA DOCUMENT G702

TO OWNER:	Blockbuster	PROJECT:	West Street Video	APPLICATION NO:	147258369	Distribution to:	
				PERIOD TO:	7/28/2022	☐	OWNER
						☐	ARCHITECT
						☐	CONTRACTOR
FROM CONTRACT	L&B Construction	VIA ARCHITE	Steven Peterson	PROJECT No	123456789	☐	Accounting
Remit Address:	420 University Blvd						
	Indianapolis, IN 46202			CONTRACT DATE:	1/28/2022		
CONTRACT FOR:	Jenny Tutone						

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet. AIA Document G703, is attached

1. ORIGINAL CONTRACT SUM.....	$	471,359.99
2. Net change by Change Orders.....	$	-
3. CONTRACT SUM TO DATE (Line 1 +/- 2)...	$	471,359.99
4. TOTAL COMPLETE & STORED TO DATE.... (Column G on G703)		
5. RETAINAGE:		
a. 5.00% % of Completed work (Columns D + E ON G703)		
b. 5.00% % of Stored Material (Column F ON G703)		
Total Retainage Line 5a + 5b		
6. TOTAL EARNED LESS RETAINAGE.....		
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate).....		
8. CURRENT PAYMENT DUE.....		
BALANCE TO FINISH, INCLUDING RETAINAGE Line 3 less Line 6.....		

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by owner		
Total approved this month		
TOTALS		
NET CHANGES by Change Order		

The undersigned Contractor certifies that to the best of the Contactor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for the Work which previous Certificates for Payment were issued and payments received from the Owner, and that current payments shown herein is now due.

CONTRACTOR:

By: Date:

State of:
County of:
Subscribed and sworn to before me this day of

Notary Public:
My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observation and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED $ 471,359.99

Attach explanation if amount differs from the amount applied for. Initial all figures on this application and or the Continuation Sheet that are changed to conform to the amount certified.

ARCHITECT.

By: Steven Peterson Date: 1/28/2022

The certificate is not negotiable the Amount Certified is payable only to the contractor named herein. Issuance and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

5.0/5 ←leave this cell alone

CONTINUATION SHEET AIA DOCUMENT G703 PAGE 3 OF 5 PAGES

AIA Document G702 APPLICATION AND CERTIFICATE FOR PAYMENT.
containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 147258369
APPLICATION DATE: 1/28/2022
PERIOD TO: 7/28/2022
ARCHITECT'S PROJECT NO: 123456789

A	B	C	D	E	F	G		H	I
ITEM NO	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D+E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED	TOTAL COMPLETED AND STORED TO DATE	% (G / C)	BALANCE TO FINISH (C-G)	RETAINAGE (IF VARIABLE RATE)
1	GENERAL REQUIREMENTS	$ 203,169.93							
2	Reinforcing Steel	$ 1,924.29							
3	Cast in place concrete	$ 16,521.06							
4	Masonry Anchroage & Reinforci	$ 7,439.23							
5	Masonry	$ 63,813.81							
6	Structural Steel	$ 6,561.23							
7	Joist and Deck	$ 18,226.89							
8	Erection	$ 13,848.61							
9	Rigid Insulation	$ 2,447.07							
10	Doors and Windows	$ 11,240.11							
11	Finishes	$ 29,228.53							
12	Plumbing	$ 33,067.41							
13	HVAC	$ 23,531.94							
14	Electrical	$ 36,729.20							
15	Grading and Excavation	$ 164.43							
16	Rigid Paving	$ 3,446.25							
	TOTAL	$ 471,359.99							

9.5/10 ←leave this cell alone

I provided headings, but you will need to complete this table including, subtotals, totals, OH and Profit, Example on page 299 Figure 26-6

CODE	DESCRIPTION	MATERIAL	LABOR	EQUIPMENT	SUBCONTRACT	TOTAL
01-1000	**GENERAL REQUIREMENTS**					
01-1000	GENERAL REQUIREMENTS	$ -	$ -	$ -	$ 187,859.39	$ 187,859.39
03-000	**CONCRETE**					
03-200	Reinforcing Steel	$ 871.62	$ 907.66	$ -	$ -	$ 1,779.28
03-300	Cast in place concrete	$ 11,600.31	$ 3,259.23	$ 416.52	$ -	$ 15,276.06
04-000	**MASONRY**					
04-200	Masonry Anchroage & Reinforcing	$ 3,226.03	$ 3,652.59	$ -	$ -	$ 6,878.62
04-200	Masonry	$ 27,985.98	$ 30,211.61	$ 807.33	$ -	$ 59,004.91
					double counting material tax	
05-000	**METALS**					
05-100	Structural Steel	$ 6,066.79	$ -	$ -	$ -	$ 6,066.79
05-200	Joist and Deck	$ 16,853.35	$ -	$ -	$ -	$ 16,853.35
05-900	Erection	$ -	$ -	$ -	$ 12,805.00	$ 12,805.00
07-000	**THERMAL AND MOISTURE PROTECTION**					
07-210	Rigid Insulation	$ 1,286.20	$ 976.46	$ -	$ -	$ 2,262.66
08-000	**OPENINGS**					
08-0000	Doors and Windows	$ 8,796.47	$ 1,596.60	$ -	$ -	$ 10,393.07
09-000	**FINISHES**					
09-0000	Finishes	$ 19,793.65	$ 7,232.27	$ -	$ -	$ 27,025.91
22-000	**PLUMBING**					
22-0000	Plumbing	$ 23,186.01	$ 7,389.50	$ -	$ -	$ 30,575.51
23-000	**HVAC**					
23-0000	HVAC	$ 12,573.20	$ 9,185.42	$ -	$ -	$ 21,758.62
26-000	**ELECTRICAL**					
26-0000	Electrical	$ 12,585.02	$ 21,376.33	$ -	$ -	$ 33,961.35
31-000	**EARTHWORK**					
31-2300	Grading and Excavation	$ 115.76	$ 11.82	$ 24.46	$ -	$ 152.04
32-000	**EXTERIOR IMPROVEMENTS**					
32-1300	Rigid Paving	$ 2,387.66	$ 791.89	$ 7.00	$ -	$ 3,186.55
				Subtotal		$ 435,839.11
				Overhead	5.00%	$ 21,791.96
				Subtotal		$ 457,631.06
				Profit	3.00%	$ 13,728.93
				Total		$ 471,359.99

49.45/50 ←leave this cell alone

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
03 00 00 CONCRETE															
03 20 00 Reinforcing Steel															
Footings															
#4-20' rebar	0.33	tons	5.00%	$ 940.00	$ 329.66	15.238	5.09	$ 54.14	$ 275.55			2.10	0.16	$ 605.21	0.50/.5
#5-3'6" rebar	0.06	tons	5.00%	$ 940.00	$ 57.65	15.238	0.89	$ 54.14	$ 48.19			2.10	0.03	$ 105.84	0.50/.5
#6-5' rebar	0.25	tons	5.00%	$ 940.00	$ 244.61	15.238	3.78	$ 54.14	$ 204.46			2.10	0.12	$ 449.07	0.50/.5
#5-9"x27" dowels	90	ea	5.00%	$ 1.62	$ 153.31	0.060	5.40	$54.24	$ 292.64			231.70	0.39	$ 445.96	0.50/.5
#6-9"x27" dowels	12	ea	5.00%	$ 2.33	$ 29.37	0.070	0.84	$60.14	$ 50.55			160.90	0.07	$ 79.92	0.50/.5
3/4"x9" anchor bolts	12	ea				0.063	0.76	$47.79	$ 36.27			126.50	0.09	$ 36.27	0.40/.4
Sale Tax			7.00%	$ 57.02											0.05/.05
03 30 00 Cast-In-Place Concrete				3500psi?											
12"x24" cont footing (F1)	16.99	cy	5.00%	$ 142.50	$ 2,541.78	0.400	6.80	$40.75	$ 276.90	$ 1.18	$ 7.98	120.00	0.14	$ 2,826.66	0.45/.5
66"x66"x18" footing (F2)	5.04	cy	5.00%	$ 142.50	$ 754.36	0.400	2.02	$40.75	$ 82.18	$ 1.18	$ 2.37	120.00	0.04	$ 838.91	0.45/.5
48"x48"x12 footing (F3)	1.19	cy	5.00%	$ 142.50	$ 177.33	0.400	0.47	$40.75	$ 19.32	$ 1.18	$ 0.56	120.00	0.01	$ 197.21	0.45/.5
5" concrete slab	47.25	cy	5.00%	$ 148.50	$ 7,367.94	0.492	23.25	$42.68	$ 992.31	$ 13.52	$ 314.23	130.00	0.36	$ 8,674.49	0.50/.5
Finish concrete slab	3,046.00	sf				0.014	42.64	$44.29	$ 1,888.52	$ 2.14	$ 91.38	1,715.00	1.78	$ 1,979.90	0.40/.4
Sale Tax			7.00%	$ 758.90											0.05/.05
04 00 00 MASONRY															
04 05 19 Masonry Anchorage & Reinforcing															
#4-20' rebar	1,581.16	lbs	5.00%	$ 0.47	$ 834.92	0.018	28.46	$47.22	$ 1,343.98			450.00	3.51	$ 2,178.90	0.50/.5
#5-4' rebar	375.48	lbs	5.00%	$ 0.47	$ 198.27	0.012	4.51	$ 49.17	$ 221.53			650.00	0.58	$ 419.80	0.50/.5
#5-5'6" rebar	1,938.94	lbs	5.00%	$ 0.47	$ 1,023.85	0.012	23.27	$ 49.17	$ 1,143.97			650.00	2.98	$ 2,167.82	0.50/.5
#6-4' rebar	72.10	lbs	5.00%	$ 0.47	$ 38.07	0.012	0.87	$ 49.17	$ 42.54			650.00	0.11	$ 80.61	0.50/.5
#6-5'6" rebar	396.53	lbs	5.00%	$ 0.47	$ 209.38	0.012	4.76	$ 49.17	$ 233.95			650.00	0.61	$ 443.34	0.50/.5
#6-6'-6" rebar	58.58	lbs	5.00%	$ 0.47	$ 30.93	0.010	0.59	$48.00	$ 28.12			800.00	0.07	$ 59.05	0.50/.5
#6-10'-6" rebar	473.13	lbs	5.00%	$ 0.47	$ 249.83	0.012	5.68	$ 49.17	$ 279.15			650.00	0.73	$ 528.98	0.50/.5
#6-12'-6" rebar	168.98	lbs	5.00%	$ 0.40	$ 75.94	0.010	1.69	$48.00	$ 81.11			800.00	0.21	$ 157.05	0.45/.5
5/8"x6" anchor bolts	94	ea	5.00%	$ 3.35	$ 353.79	0.062	5.83	$47.74	$ 278.24			129.00	0.73	$ 632.03	0.50/.5
Sale Tax			7.00%	$211.05	if you have taxes listed separate here you also have it built into your cost number above with waste, want to be careful not to double count										0.05/.05

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
04 20 00 Masonry															
8x8x16 heavy block	441.33	sf	5.00%	$ 2.62	$ 1,214.11	0.100	44.13	$44.20	$ 1,950.69			400	1.10	$ 3,164.80	0.50/.5
3500 psi concrete grout	418.00	sf	5.00%	$ 1.21	$ 531.07	0.047	19.65	$ 4.26	$ 83.60	$ 1.91	$ 37.62	680	0.61	$ 652.29	0.50/.6
8x8x16 split-face block	2,436.44	sf	5.00%	$ 4.71	$ 12,049.44	0.133	324.05	$44.36	$14,375.02			300	8.12	$ 26,424.46	0.50/.5
8x8x16 end block	170.67	sf	5.00%	$ 5.18	$ 928.44	0.133	22.70	$44.36	$ 1,006.93			300	0.57	$ 1,935.37	0.50/.5
8x8x16 lintel block	52.00	lf	5.00%	$ 2.80	$ 152.88	0.071	3.69	$44.08	$ 162.76			565	0.09	$ 315.64	0.50/.5
8x8x16 bond beam block	1,271.00	lf	5.00%	$ 2.80	$ 3,736.74	0.071	90.24	$44.08	$ 3,978.23			565	2.25	$ 7,714.97	0.50/.5
8x8x8 bullnose (1/2 block)	49.78	sf	5.00%	$ 5.18	$ 270.79	0.133	6.62	$44.36	$ 293.69			300	0.17	$ 564.48	0.50/.5
8x8x16 bullnose block	49.78	sf	5.00%	$ 5.18	$ 270.79	0.133	6.62	$44.36	$ 293.69			300	0.17	$ 564.48	0.50/.5
Mortar	227.20	cf	5.00%	$ 5.55	$ 1,324.01									$ 1,324.01	0.10/.1
3000 psi grout vertical	2,358.00	sf	5.00%	$ 1.21	$ 2,995.84	0.047	110.83	$44.04	$ 4,881.06	$ 4.26	$ 471.60	680.00	3.47	$ 7,876.90	0.50/.5
3000 psi grout horizontal	1,280.63	lf	5.00%	$ 1.13	$ 1,519.46	0.023	29.45	$43.91	$ 1,293.43	$ 3.91	$ 115.26	1,400.00	0.91	$ 2,812.89	0.50/.5
Prolite	914.25	sf	5.00%	$ 1.21	$ 1,161.55	0.047	42.97	$44.04	$ 1,892.50	$ 4.26	$ 182.85	680.00	1.34	$ 3,054.05	0.50/.5
Sale Tax			7.00%	$ 1,830.86											0.05/.05
05 00 00 METALS															
05100 Structural Steel															
Footing Delivery		would not apply waste to all													
3/4"x9" anchor bolt	12.00	ea	5.00%	$ 4.38	$ 55.16									$ 55.16	0.20/.2
Structural Steel Delivery															
TS5x5x3/8 column 14'7"	978.69	lbs	5.00%	$ 1.31	$ 1,346.18									$ 1,346.18	0.20/.2
W16x36-39'4"	78.67	lf	5.00%	$ 51.68	$ 4,268.55									$ 4,268.55	0.20/.2
Sale Tax			7.00%	$ 396.89											0.05/.05
05200 Joist and Deck															
18k3-19'4"	734.67	lf	5.00%	$ 5.79	$ 4,463.10									$ 4,463.10	0.10/.1
4'x40' 18 gage deck	3,080.28	sf	5.00%	$ 3.49	$ 11,287.69									$ 11,287.69	0.10/.1
Sale Tax			7.00%	$ 1,102.56											0.05/.05
07 20 00 THERMAL PROTECTION															
72100 Thermal Insulation															
R-13 Batt Insulation	3367.10	sf	5.00%	$ 0.34	$ 1,202.06	0.006	20.20	$48.33	$ 976.46			1,350	2	$ 2,178.52	0.50/.5
Sale Tax			7.00%	$ 84.14											0.05/.05

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
08 00 00 DOORS AND WINDOWS															
081213 Hollow Metal Frames													show enough decimal spaces to see duration		
3'-0" x 6'-8" HM Frame	5	ea		$ 149.00	$ 745.00	1.000	5.00	$49.50	$ 247.50			16	0	$ 992.50	0.50/.5
081313 Hollow Metal Doors															
3'-0" x 6'-8" HM Doors	5	ea		$ 480.00	$ 2,400.00	1.000	5.00	$49.50	$ 247.50			16	0	$ 2,647.50	0.50/.5
084313 Storefront Systems															
Storefront System (Is it just the glass?)	216	sf		$ 23.50	$ 5,076.00	0.107	23.11	$47.66	$ 1,101.60			150	1	$ 6,177.60	0.50/.5
Sale Tax			7.00%	$ 575.47											0.05/.05
09 00 00 FINISHES															
092900 Gypsum Board															
5/8" Dryw all	3367.10	sf	5.00%	$ 0.40	$ 1,414.18	0.017	57.24	$48.24	$ 2,761.03			965	3	$ 4,175.21	0.50/.5
096816 Sheet Carpet															
40oz Carpeting	323.53	*sy*	5.00%	$ 45.00	$ 15,286.99	0.107	34.62	$45.70	$ 1,582.08			75	4	$ 16,869.07	0.50/.5
093013 Ceramic Tiling															
6"x6" Glazed Ceramic Tile w/thin set	196.80	sf	5.00%	$ 3.59	$ 741.82	0.091	17.91	$41.32	$ 739.95			175	1	$ 1,481.77	0.50/.5
096513 Resilient Base															
4" high 1/8" rubber straight base (difference?)	279.33	lf	5.00%	$ 1.14	$ 334.35	0.025	6.98	$46.40	$ 324.02			315	1	$ 658.37	0.50/.5
4" high 1/8" rubber base outside corners	6.00	ea	5.00%	$ 2.27	$ 14.30	0.025	0.15	$46.40	$ 6.96			315	0	$ 21.26	0.50/.5
099123 Interior Painting															
Dryw all 1 coat sprayed primer	3367.10	sf	5.00%	$ 0.06	$ 212.13	0.003	10.10	$40.00	$ 404.05			2,750	1	$ 616.18	0.50/.5
Dryw all 2 coat latex paint rolled	3367.10	sf	5.00%	$ 0.14	$ 494.96	0.010	33.67	$42.00	$ 1,414.18			800	4	$ 1,909.15	0.50/.5
Sale Tax			7.00%	$ 1,294.91											0.05/.05

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
22 00 00 PLUMBING															
221113 Domestic Water Piping															
Water Supply Piping															
1/2" type L copper water line	99.4025	lf	5.00%	$ 3.54	$ 369.48	0.099	9.841	$61.62	$ 606.36			81.00	1.23	$ 975.83	0.50/.5
1/2" ball valve (main shutoff)	1	ea	5.00%	$ 12.75	$ 13.39	0.364	0.364	$35.03	$ 12.75			22.00	0.05	$ 26.14	0.45/.5
1/2" pressure reducing valve	1	ea	5.00%	$ 435.00	$ 456.75	0.333	0.333	$61.56	$ 20.50			24.00	0.04	$ 477.25	0.50/.5
221316 Sanitary Waste/Vent Piping															
Waste/Vent															
4" diameter cast iron pipe	129.99	lf	5.00%	$ 35.00	$ 4,777.13	0.291	37.83	$55.67	$ 2,105.84			55.00	2.36	$ 6,882.97	0.50/.5
2" diameter cast iron pipe	36.57	lf	5.00%	$ 21.00	$ 806.46	0.254	9.29	$55.71	$ 517.52			63.00	0.58	$ 1,323.98	0.50/.5
2" cast iron p-trap	2.00	ea	5.00%	$ 148.00	$ 310.80	1.000	2.00	$55.50	$ 111.00			16.00	0.13	$ 421.80	0.50/.5
2" cast iron floor drain	1.00	ea	5.00%	$ 310.00	$ 325.50	1.000	1.00	$55.50	$ 55.50			16.00	0.06	$ 381.00	0.50/.5
221400 Facility Storm Drainage															
Storm Drain Piping															
4" cast iron pipe	174.48	lf	5.00%	$ 35.00	$ 6,412.16	0.291	50.77	$55.67	$ 2,826.58			55.00	3.17	$ 9,238.74	0.50/.5
4" clean out	2.00	ea	5.00%	$ 280.00	$ 588.00	1.333	2.67	$61.89	$ 165.00			6.00	0.33	$ 753.00	0.50/.5
4" roof drain	2.00	ea	5.00%	$ 375.00	$ 787.50	1.333	2.67	$55.51	$ 148.00			12.00	0.17	$ 935.50	0.50/.5
224200 Commercial Plbg Fixtures															
Fixtures/Finish Plumbing															
Water closet, china	1.00	ea		$ 485.00	$ 485.00	2.759	2.76	$55.45	$ 153.00			5.80	0.17	$ 638.00	0.50/.5
Lavatory, china	1.00	ea		$ 139.00	$ 139.00	2.963	2.96	$55.69	$ 165.00			5.40	0.19	$ 304.00	0.50/.5
Single handed faucet w/drain	1.00	ea		$ 198.00	$ 198.00	1.201	1.20	$61.62	$ 74.00			6.66	0.15	$ 272.00	0.50/.5
Electric tankless water heater	1.00	ea		$ 5,175.00	$ 5,175.00	4.000	4.00	$61.75	$ 247.00			2.00	0.50	$ 5,422.00	0.50/.5
Shutoff valves	4.00	ea		$ 186.00	$ 744.00	0.500	2.00	$62.00	$ 124.00			16.00	0.25	$ 868.00	0.35/.5
Supply lines	3.00	ea		$ 27.00	$ 81.00	0.308	0.92	$62.18	$ 57.45			26.00	0.12	$ 138.45	0.50/.5
Sale Tax			7.00%	$ 1,516.84											0.05/.05

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
23 00 00 HVAC															
230000 HVAC															
5 ton, 4,000 cfm rtu	2.00	ea		$ 4,375.00	$ 8,750.00	28.521	57.04	$ 56.10	$ 3,200.00			0.56	3.57	$ 11,950.00	0.50/.5
Supply															
24"x18"x30" metal duct	35.00	lbs	5.00%	$ 0.56	$ 20.58	0.098	3.43	$57.33	$ 196.63			245	0.14	$ 217.21	0.50/.5
24"x18" x 24"x12" metal T (6" returns)	33.50	lbs	5.00%	$ 0.56	$ 19.70	0.098	3.28	$57.33	$ 188.20			245	0.14	$ 207.90	0.50/.5
24"x12" metal duct	204.00	lbs	5.00%	$ 0.56	$ 119.95	0.098	19.99	$57.33	$ 1,146.07			245	0.83	$ 1,266.02	0.50/.5
24"x12" metal end cap	8.00	lbs	5.00%	$ 0.56	$ 4.70	0.098	0.78	$57.33	$ 44.94			245	0.03	$ 49.65	0.50/.5
12" dia metal duct	153.94	lbs	5.00%	$ 0.56	$ 90.52	0.098	15.09	$57.33	$ 864.82			245	0.63	$ 955.34	0.50/.5
9" dia metal duct	37.70	lbs	5.00%	$ 0.56	$ 22.17	0.098	3.69	$57.33	$ 211.79			245	0.15	$ 233.96	0.50/.5
6" dia metal duct	28.27	lbs	5.00%	$ 0.56	$ 16.63	0.098	2.77	$57.33	$ 158.85			245	0.12	$ 175.47	0.50/.5
12" dia insulated flexible duct	28.00	lf	5.00%	$ 5.25	$ 154.35	0.160	4.48	$43.66	$ 195.58			100	0.28	$ 349.93	0.45/.5
6" dia insulated flexible duct	10.00	lf	5.00%	$ 3.11	$ 32.66	0.062	0.62	$ 57.13	$ 35.42			260	0.04	$ 68.08	0.50/.5
T bar mount 24"x24" diffuser w/damper	10.00	ea		$ 134.00	$ 1,340.00	0.800	8.00	$ 58.13	$ 465.00			10	1.00	$ 1,805.00	0.50/.5
Return															
24"x24"x24" metal duct	32.00	lbs	5.00%	$ 0.56	$ 18.82	0.098	3.14	$57.33	$ 179.78			245	0.13	$ 198.59	0.50/.5
24"x24" x 24"x12" metal T (6" returns)	36.00	lbs	5.00%	$ 0.56	$ 21.17	0.098	3.53	$57.33	$ 202.25			245	0.15	$ 223.42	0.50/.5
24"x12" metal duct	48.00	lbs	5.00%	$ 0.56	$ 28.22	0.098	4.70	$57.33	$ 269.66			245	0.20	$ 297.89	0.50/.5
24"x12" return air grille	24.00	ea		$ 37.00	$ 888.00	0.444	10.66	$58.56	$ 624.00			18	1.33	$ 1,512.00	0.50/.5
Exhaust															
Exhaust fan	1.00	ea		$ 95.00	$ 95.00	0.909	0.91	$53.36	$ 48.50			22	0.05	$ 143.50	0.50/.5
3" dia flexible duct	10.00	lf	5.00%	$ 1.20	$ 12.60	0.040	0.40	$57.48	$ 22.99			400	0.03	$ 35.59	0.50/.5
Other															
Insulation	500.41	sf	5.00%	$ 0.22	$ 115.60	0.046	23.02	$49.13	$ 1,130.93			350	1.43	$ 1,246.53	0.50/.5
Sale Tax			7.00%	$ 822.55											0.05/.05

ITEM	QUANTITY	UNIT	Waste	MATERIALS $/UNIT	MATERIALS COST	LABOR LHR/UNIT	LABOR LHR	LABOR $/LHR	LABOR COST	EQUIPMENT $/LHR	EQUIPMENT COST	Crew Daily Ouptut/Unit	Duration in Days	TOTAL	
26 00 00 ELECTRICAL															
260000 Electrical															
Power Service															
400 amp main service panel 30 circuits	1.00	ea		$ 1,700.00	$ 1,700.00	23.529	23.53	$ 56.31	$ 1,325.00			0.68	1.47	$ 3,025.00	0.50/.5
12 gage black wire	17.46	clf	5.00%	$ 10.65	$ 195.29	0.727	12.70	$56.40	$ 716.03			11.00	1.59	$ 911.32	0.50/.5
12 gage white wire	17.46	clf	5.00%	$ 10.65	$ 195.29	0.727	12.70	$56.40	$ 716.03			11.00	1.59	$ 911.32	0.50/.5
12 gage ground wire	17.46	clf	5.00%	$ 10.65	$ 195.29	0.727	12.70	$56.40	$ 716.03			11.00	1.59	$ 911.32	0.50/.5
10 gage black/red wire	1.58	clf	5.00%	$ 16.70	$ 27.69	0.800	1.26	$56.88	$ 71.85			10.00	0.16	$ 99.54	0.50/.5
10 gage white wire	0.79	clf	5.00%	$ 16.70	$ 13.85	0.800	0.63	$56.88	$ 35.93			10.00	0.08	$ 49.77	0.50/.5
10 gage ground wire	0.79	clf	5.00%	$ 16.70	$ 13.85	0.800	0.63	$56.88	$ 35.93			10.00	0.08	$ 49.77	0.50/.5
EMT 3/4" conduit	1,680.37	lf	5.00%	$ 2.54	$ 4,481.55	0.089	149.55	$56.74	$ 8,485.88			90.00	18.67	$ 12,967.44	0.50/.5
#10-3 armor cable	0.20	clf	5.00%	$ 121.00	$ 25.41	5.000	1.00	$56.60	$ 56.60			1.60	0.13	$ 82.01	0.50/.5
#12-2 armor cable	4.80	clf	5.00%	$ 46.00	$ 231.84	3.478	16.69	$56.64	$ 945.60			2.30	2.09	$ 1,177.44	0.50/.5
1 gang switchbox (switch & outlet)	37.00	ea	5.00%	$ 3.55	$ 137.92	0.296	10.95	$56.59	$ 619.75			27.00	1.37	$ 757.67	0.50/.5
4" square junction box	84.00	ea	5.00%	$ 2.88	$ 254.02	0.400	33.60	$56.25	$ 1,890.00			20.00	4.20	$ 2,144.02	0.50/.5
1 gang floor	3.00	ea	5.00%	$ 89.50	$ 281.93	1.509	4.53	$56.66	$ 256.50			5.30	0.57	$ 538.43	0.50/.5
Power															
Switch, single pole 15 amp	4.00	ea	5.00%	$ 0.54	$ 2.27	0.200	0.80	$56.50	$ 45.20			40.00	0.10	$ 47.47	0.50/.5
receptacle duplex 20 amp	36.00	ea	5.00%	$ 7.95	$ 300.51	0.296	10.66	$56.59	$ 603.00			27.00	1.33	$ 903.51	0.50/.5
Lighting															
2x4 w/3 32 W T8	48.00	ea	0.00%	$ 69.50	$ 3,336.00	1.600	76.80	$56.56	$ 4,344.00			5.00	9.60	$ 7,680.00	0.50/.5
300 Watt metal halide (Quartz)	6.00	ea	0.00%	$ 61.50	$ 369.00	1.509	9.05	$56.66	$ 513.00			5.30	1.13	$ 882.00	0.50/.5
Sale Tax			7.00%	$ 823.32											0.05/.05
31 00 00 EARTHWORK															
31 23 00 Grading and Excavation															
4" underslab gravel, sidewalk	30.57	sy	5.00%	$ 3.37	$ 108.19	0.008	0.24	$48.33	$ 11.82	$ 100.00	$ 24.46	5,133.33	0.01	$ 5,253.34	0.50/.5
Sale Tax			7.00%	$ 7.57											0.050/.05
32 00 00 EXTERIOR IMPROVEMENTS															
32 13 00 Rigid Paving															
Sidewalk concrete	13.72	cy	5.00%	$ 148.50	$ 2,139.16	0.436	5.98	$40.83	$ 244.20	$ 1.17	$ 7.00	110.00	0.12	$ 196.32	0.60/.6
Finish sidewalk	825.50	sf				0.013	10.73	$43.85	$ 470.54			1,850.00	0.45	$ 43.85	0.40/.4
#4-20' rebar	0.0935	tons	5.00%	$ 940.00	$ 32.30	15.238	1.43	$54.14	$ 77.15			2.10	0.04	$ 994.14	0.50/.5
Sale Tax			7.00%	$ 156.20											0.05/.05

5.0/5 ← leave this cell alone

Project:	West Street Video
Address:	211 NE Revere Ave
City/State/Zip	Bend, OR 9701

Sq. Footage	3,200.00	sf		
Duration	6.00	months	26.00	weeks

Owner:	Blockbuster
Representative:	Jenny Tutone
Phone:	765-867-5309
Fax:	812-402-4528

Bid Date:	January 28, 2022
Time:	1:00 P.M.
Location	online

Estimato	Auston Lewis
PM	Alex Banta

Architect	Steven Peterson
Contact:	Speterson@artructure.com
Phone:	317-547-5580
Fax:	812-402-4528

Project Staffing	$	135,785
Field Office Expense	$	7,457
Temporary Utilities	$	12,079
Site Control	$	3,072
Safety	$	490
Clean-Up	$	28,976
Total Project General Requiren	$	187,859
Average Cost per Month	$	31,309.90

PROJECT STAFFING

	Quantity	Unit	Percent	Duration	Unit	Unit Cost		Total	
Project Manager	1	per week	50%	26.00	weeks	2,325.00	$/week	$	30,225
Project Engineer	1	per week	100%	26.00	weeks	1,425.00	$/week	$	37,050
Field Superintendent	1	per week	100%	26.00	weeks	2,175.00	$/week	$	56,550
Clerk	1	per week	100%	26.00	weeks	460.00	$/week	$	11,960

TOTAL PROJECT STAFFING	$	135,785

FIELD OFFICE EXPENSE

	Quantity	Unit		Duration	Unit	Unit Cost		Total
Job Site Office Trailer	1	per month		6.00	months	488.50	$/month	$ 2,931
Trailer Delivery /Pickup	40	miles				11.00	$/mile	$ 440
Jobsite Storage	2	per month		6.00	months	78.00	$/month	$ 936
Field Office Supplies	1	per month		6.00	months	80.00	$/month	$ 480
Lights/HVAC	1	per month		6.00	months	160.00	$/month	$ 960
Phone/Data	1	per month		6.00	months	85.00	$/month	$ 510
Office Equipment	1	per month		6.00	months	200.00	$/month	$ 1,200

TOTAL FIELD OFFICE EXPENSE $ 7,457

TEMPORARY UTILITIES

Lighting	Quantity	Unit		Duration	Unit	Unit Cost		Total
Temporary Lighting	32.00	csf/month				17.95	$/csf	$ 574
Lighting Power	32.00	csf/month		6.00	months	0.92	$/csf	$ 177

Electrical Power	Quantity	Unit		Duration	Unit	Unit Cost		Total
Temporary Electric Power (all other)	32.00	csf/month		6.00	months	47.00	$/month	$ 9,024

TEMPORARY TOILETS	Quantity			Duration	Unit	Unit Cost		Total
Temporary Toilets	2	per month		6.00	months	192.00	$/mo	$ 2,304

TOTAL TEMPORARY UTILITIES $ 12,079

SITE CONTROL

	Quantity	Unit				Unit Cost		Total
Directional Signage	10.00	ea				25.00	$/ea	$ 250
Temporary Fence	640.00	lf				4.41	$/lf	$ 2,822

TOTAL SITE CONTROL $ 3,072

SAFETY

	Quantity	Unit				Unit Cost		Total
First Aid Kit	2	ea				110.00	$/ea	$ 220
Fire Extinguishers	2	ea				135.00	$/ea	$ 270

TOTAL SAFETY $ 490

CLEAN-UP

	Quantity	Unit		Duration	Unit	Unit Cost		Total
General Debris Dumpsters	1	per week		26.00	weeks	565.00	$/wk	$ 14,690
Daily Cleanup	3.20	msf/day		130.00	days	33.82	$/msf	$ 14,069
Final Cleanup	3.20	msf/ea		1.00	ea	67.76	$/msf	$ 217

TOTAL CLEAN-UP $ 28,976

11.0/11	←leave this cell alone							
Footings			lb/ft					
#4-20' rebar	0.334	tons	0.668					
#5-3'6" rebar	0.058408	tons	1.043					
#6-5' rebar	0.24783	tons	1.502					
#5-9"x27" dowels	90	ea						
#6-9"x27" dowels	12	ea						
3/4"x9" anchor bolts	12	ea						
12"x24" cont footing (F1)	16.98765432	cy						
66"x66"x18" footing (F2)	5.041666667	cy						
48"x48"x12 footing (F3)	1.185185185	cy						
5" concrete slab	47.25308642	cy						
Finish concrete slab	3046	sf						
F1 Footing								
Foundation Plan				Length	Width	Height	CF	CY
North Wall	80	0.3333333		79.333	2	1	158.6667	
South Wall	80	0.3333333		79.333	2	1	158.6667	
East Wall	40	0.3333333	4	35.333	2	1	70.66667	
West Wall	40	0.3333333	4	35.333	2	1	70.66667	
				229.33			458.6667	16.9876543
F2 Footing								
Length	Width	Height	QTY	CF	CY			
5.5	5.5	1.5	3	136.125	5.04166667			
F3 Footing								
Length	Width	Height	QTY	CF	CY			
4	4	1	2	32	1.18518519			
5" concrete slab								
Height	Length			Width			CF	CY
0.416666667	80	0.666666667	78.66667	20	0.66666667	18.6666667	611.851852	
0.416666667	80	0.666666667	78.66667	20	0.66666667	18.6666667	611.851852	
0.416666667	80	0.666666667	77.33333		0.66666667	1.33333333	42.962963	
							1266.66667	46.91358025
Doorways								
Height	Length	Width	QTY	CF	CY			
0.416666667	9	0.666666667	1	2.5				
0.416666667	9	0.666666667	2	5				
0.416666667	3	0.666666667	2	1.666667				
				9.166667	0.33950617			
Finish concrete slab								
Length			Width			SF		
80	0.666666667	78.66666667	40	0.666667	38.6666667	3041.77778		
Entrances								
Length	Width	QTY	SF					
3	0.666666667	3	6					
Double Brick								
Length	Width	QTY	SF					
1.333333333	0.666666667	2	1.777778					

0.916666667

#4-20' rebar

# of Rows	Size	Bar Length	Bar Lap	Total # of Bars	Combined Rebar Length	Unit Weight	lbs	tons
4	#4	20	1.5	50	1000	0.668	668	0.334

#6-5' rebar

	Size	Bar Length	# of Bars	Footing QTY	Total Rebar Length	Unit Weight	lbs	tons
	#6	5	22	3	330	1.502	495.66	0.24783

#5-3'6" rebar

	Size	Bar Length	# of Bars	Footing QTY	Total Rebar Length	Unit Weight	lbs	tons
	#5	3.5	16	2	112	1.043	116.816	0.058408

#5-9"x27" dowels

Dowel Length	Size	Spacing	Unit Weight	Length of Footing	# of dowels per spacing	Total # of Dowels
3	#5	2.66666667	1.043	229.3333333	1	90

17.0/19 ←leave this cell alone

CMU BLOCKS

	Blocks (sf)	(each)			0.888888889		lf	EA	SF
8x8x16 heavy block	441	496.50	1.333333333	6.75			654	490.5	436
8x8x16 split-face block	2436	2741.00		20.25	uble counting corners by using full perimeter of builiding, remember 1 block passes by the other				
8x8x16 end block	171	192.00							
8x8x8 bullnose (1\2 block)	50	56.00	1\2 blocks have 1\2 sf						
8x8x16 bullnose block	50	56.00		27	21	pier block does not have 4 corners like 4 corners of building			
	(lf)	(ea)							
8x8x16 lintel block	52	39.00	4' oc						
8x8x16 bond beam block	1167	875.25							
8x8x16 bond beam block	104	78.00							

CMU WALL

	Length (feet)	Height (feet)	CMU Height (feet)	CMU Length (feet)	Height Below Grade (feet)
West Wall	40	18.00	0.67	1.33	2.00
East Wall	40	18.00	0.67	1.33	2.00
North Wall	80	18.00	0.67	1.33	2.00
South Wall	80	18.00	0.67	1.33	2.00

OPENINGS

	Quantity (each)	Width (feet)	Height (feet)	Opening Space Block Reduction (each)	Entry Slab Block Reduction (each)	1/2 End Block (each)	Full End Block (each)	Lintel Block (each)
3'-0" x 6'-8" HM Doors	2	3.00	6.67	20	4.5	20	20	10
Storefront System (Is it just the glass?)	3	9.00	8.00	72	20	36	36	29
Total				92	25	56	56	39

MASONRY REBAR

	length	height	oc spacing	length per bar	lap	bars per course	columns rows	total vertical bars total hoizontal bars	total feet	total lb/ft	total lbs
#4-20' rebar	240	20	4	20	1.5	2	5	10	2367	0.668	1581.156
#5-4' rebar	240	20	2.666666667	4		1	90	90	360	1.043	375.48
#5-5'6" rebar	240	20	2.67	5.50	1.50	4.00	90	338	1859	1.043	1938.937
#6-4' rebar		20		4		1	6	12	48	1.502	72.096
#6-5'6" rebar		20		5.50	1.50	4.00	6	48	264	1.502	396.528
						inside pier height is not the same height as outside pier height					
					length	lap	how many per orientation	openings	total ft	total lb/ft	total lbs
#6-6'-6" rebar					6.5	0	3	2	39	1.502	58.58
#6-10'-6" rebar					10.50	0.00	6.000	5	315	1.502	473.13
#6-12'-6" rebar					12.50	0.00	3	3	112.5	1.502	168.98
5/8"x6" anchor bolts	240		2.666666667			94					

3.375

15.75

#4-20' rebar	H
#5-4' rebar	V
#5-5'6" rebar	V
#6-4' rebar	V
#6-5'6" rebar	V
#6-6'-6" rebar	H
#6-10'-6" rebar	V
#6-12'-6" rebar	H

#4-20' rebar		lbs
#5-4' rebar		lbs
#5-5'6" rebar		lbs
#6-4' rebar		lbs
#6-5'6" rebar		lbs
#6-6'-6" rebar		lbs
#6-10'-6" rebar		lbs
#6-12'-6" rebar		lbs
5/8"x6" anchor bolts		ea
8x8x16 heavy block		sf
3500 psi concrete s		sf
8x8x16 split-face block		sf
8x8x16 end block		sf
8x8x16 lintel block		lf
8x8x16 bond beam block		lf
8x8x8 bullnose (1/2 block)		sf
8x8x16 bullnose block		sf
Mortar		cf
3000 psi grout vertical		sf
3000 psi grout horizontal		lf
Prolite		

MORTAR

	Square Feet of Wall	Square Feet of Opening	Total Square Feet of CMU Block	Mortar Coverage	Total Mortar
	(sqft.)	(sqft.)	(sqft.)	(cf/sf)	(cubic feet)
Combined Walls	4800.00	256.00	4544.00	0.05	227.20

GROUT

	EA/course	width	height	sf
3500 psi concrete grout (courses below grade)	470.25	1.33	0.667	418.00
3000 psi grout vertical (all vertical cells with reinforcing)	96	0.67	27	1728.00
0 psi grout vertical (all vertical cells with reinforcing) opn	30	1.33	15.75	630.00
00 psi grout horizontal (all horizontal blocks with reinforc	5	240	0.666666667	778
si grout horizontal (all horizontal blocks with reinforcing)(	3	4.875	0.666666667	19.5
si grout horizontal (all horizontal blocks with reinforcing)(	3	9.375	0.666666667	56.25
Prolite (all empty cells without reinforcing)	1	4126.00		914.25

5.0/5 ←leave this cell alone

		Quantity	Length	Total Length	Weight	Total Weight	Total Weight
Description	Designation	(each)	(feet)	(feet)	(lb/ft)	(pounds)	
Column	TS5x5x3/8 column 14'7"	3.00	14.58	43.75	22.37	978.69	
Steel Joist	18k3-19'4"	38.00	19.33	734.67	7.70	5,656.93	(tons)
Steel Girde	W16x36-39'4"	2.00	20.00	78.67	29.00	2,281.33	1.14

		Length	Width	Width of Decking	Length of Decking	End Lap	Total
Description	Designation	(feet)	(feet)	(feet)	(feet)	(feet)	SF
Metal Roof	4'x40' 18 gage deck	78.67	38.67	4.00	40.00	0.50	3080.28
Footing	3/4"x9" anchor bolt	3	4	12			
		Columns	bolts per column				

2	19.33333	38.66667	3/4"x9" anchor bolt	3/4"x9" anchor bolt				
			Structural Steel Deliver	*Structural Steel Delivery*				
			TS5x5x3/8 column 14'7"	TS5x5x3/8 column 14'7"				
			W16x36-39'4"	W16x36-39'4"				
			3/4"x9" anchor bolt	3/4"x9" anchor bolt				
			Structural Steel Deliver	*Structural Steel Delivery*				
			TS5x5x3/8 column 14'7"	TS5x5x3/8 column 14'7"				
			W16x36-39'4"	W16x36-39'4"				

0.5/1 ←leave this cell alone

72100 Thermal Insulation	length (ft)	height (ft)	Total SF		
R-13 Batt Insulation	206.218	12	2474.616	3367.104	total sf
	111.561	8	892.488	runs up beyond drywall shouldn't be the same sf as drywall, drywall stops just above ceiling while insulation keeps going	

1.5/1.5 ←leave this cell alone

ID	Door Description	Qty (ea)
1	3'x7' ALUM Door (left hand reverse swing)	1
2	3'x6'-8" HM Door (right hand swing)	1
3	3'x6'-8" HM Door (left hand swing)	1
4	3'x6'-8" HM Door (left hand reverse swing)	1
5	3'x6'-8" HM Door (right hand swing)	1
6	3'x6'-8" HM Door (right hand reverse swing)	1

ID	Window Description	sf
1 & 2	store front	216

3.0/3.5	←leave this cell alone							
092900 Gypsum Board		length (ft	height (ft)	Total SF				
5/8" Drywall	sf	206.218	12	2474.616	3367.104	total sf		
		111.561	8	892.488				
096816 Sheet Carpet		total sf		total sy				
40oz Carpeting	sy	2911.81		323.5341				
		floor			wainscott			
093013 Ceramic Tiling		total sf		length ft	height ft	total sf		total sf
6"x6" Glazed Ceramic Tile w/thin set	sf	47.833		24.827	6	148.962		196.795
096513 Resilient Base		length ft						
4" high 1/8" rubber straight base	lf	279.325						
4" high 1/8" rubber base outside corners	ea	6	should include your column corners too					
099123 Interior Painting								
Drywall 1 coat sprayed pimer	sf	3367.1						
Drywall 2 coat latex paint rolled	sf	3367.1						

8.0/8	←leave this cell alone																			
	Water line should include piping in building and run to the meter (we will use copper,																			
	but in reality the main line from the meter to the structure would be PVC) Do not take off sprinkler system																			
	Sanitary Sewer line should include piping in building and run to the 5'-0" manhole at the front of the site																			
	Storm Sewer line should include piping inside the building run to the 8" storm sewer line at the front of the site																			
	22 00 00 PLUMBING																			
	221113 Domestic Water Piping																			
sink 12-18	**Water Supply Piping**		0.727	0.277	1.26										Vertical					
toilet 6-8	1/2" type L copper water line	99.4025	LF	0.213	0.187	2.753	2.833	0.46	0.46	2.487	36.467	42.1	2.664	2.202	0.41667	0.063	0.33	0.5	1.5	1.5
	1/2" ball valve (main shutoff)	1	EA																	
	1/2" pressure reducing valve	1	EA																	
	221316 Sanitary Waste/Vent Piping																			
	Waste/Vent								vert											
	4" diameter cast iron pipe	129.99	LF	3.307	1.073	0.66	42.51	80.44	0.5	1.5		Vert								
	2" diameter cast iron pipe	36.574	LF						6.617	9.207		18	1	1.75						
	2" cast iron p-trap	2	EA																	
	2" cast iron floor drain	1	EA																	
	221400 Facility Storm Drainage																			
	Storm Drain Piping									Vert										
	4" cast iron pipe	174.481	LF	39.312	22.43	49.07	0.844	1.745	42.267	18	0.41667	0.0625	0.33333							
	4" clean out	2	EA																	
	4" roof drain	2	EA																	
	224200 Commercial Plbg Fixtures																			
	Fixtures/Finish Plumbing																			
	Water closet, china	1	EA																	
	Lavatory, china	1	EA																	
	Single handed faucet w/dra	1	EA																	
	Electric tankless water hea	1	EA																	
	Shutoff valves	4	EA																	
	Supply lines	3	EA																	

8.5/9	←leave this cell alone										
	All metal duct should be taken off as square feet and converted to pou										
	23 00 00 HVAC										
	230000 HVAC										
	5 ton, 4,000 cfm rtu	2	ea			1)					
	Supply						2	1.5	2.5		
	24"x18"x30" metal duct	35	lbs	1		Side		1.5	2.5	7.5	SF
	24"x18" x 24"x12" metal T (6" returns)	33.5	lbs	2		Side		2	2.5	10	SF
length*height	24"x12" metal duct	204	lbs	3						17.5	SF
	24"x12" metal end cap	8	lbs	4				2	EA	35	SF
circum*length	12" dia metal duct	153.9	lbs	5		3)					
	9" dia metal duct	37.7	lbs	6		Left Unit		2	1	13.5	lf
	6" dia metal duct	28.27	lbs	7		side		2	13.5	54	SF
	12" dia insulated flexible duct	28	lf	8		side		1	13.5	27	SF
	6" dia insulated flexible duct	10	lf	9						81	SF
	T bar mount 24"x24" diffuser w/damper	10	ea			Right Unit		2	1	20.5	lf
	Return					side		2	20.5	82	SF
	24"x24"x24" metal duct	32	lbs	A		side		1	20.5	41	SF
	24"x24" x 24"x12" metal T (6" returns)	36	lbs	B						123	SF
	24"x12" metal duct	48	lbs	C					Total	204	SF
	24"x12" return air grille	24	ea								
	Exhaust										
	Exhaust fan	1	ea								
	3" dia flexible duct	10	lf								
	Other										
	Insulation	500.4	sf			A)					
						W		H	#side		
							2	2	4	16	SF
								2	EA	32	SF

2)			EA			6)	lf	cir. lf			8)	Over	Down	EA	Lf
Returns Part	2	0.5	4	4	SF	Right Unit	16	2.356	37.7	SF	LF	2	2	7	28
Tee	1.5	0.5	2	1.5	SF		^^^				9)	Over	Down	EA	LF
	2.5	1	2	5	SF		include				LF	2	2	2	8
Bottom	2.5	2.5	1	6.25	SF	7)	lf	cir. lf	SF			0	2	1	2
				16.8	SF	Right Unit	17	1.571	26.7					Total	10
		2	EA	33.5	SF		1	1.571	1.571						
4)		EA						Total	28.27	SF					
2	1	4		bottom dimension should be 24" x 30"											
		8	SF												

5)										
Left Unit	lf	cir. lf			Right	lf	cir. lf			
	13	3.142	40.84	SF		15	3.142	47.12	SF	
		EA	2				EA	1		
			81.68	SF				47.12	SF	
	3	3.142	9.425	SF		1	3.142	3.142		
		EA	2				EA	2		
			18.85	SF				6.283	SF	
		Total	100.5	SF			Total	53.41	SF	
							Total	153.9	SF	

B)			EA			C)				
Returns Part	2	0.5	4	4	SF	Left Unit				
Tee	2	0.5	2	2	SF	Side	2	4	16	SF
	3	1	2	6	SF	Side	1	4	8	SF
Bottom	2	3	1	6	SF				24	SF
				18	SF	Right Unit				
		2	EA	36	SF	Side	2	4	16	SF
						Side	1	4	8	SF
									24	SF
								Total	48	SF

9.0/9	←leave this cell alone							
	Units should match the units in RSMeans							
	6 feet to top of service panel, if not noted wall receptacles are 18" above floor and switches are 48" above floor.							
	1 gang switch boxes should be used for all switches and receptacles, all other boxes should be 4" junction boxes							
	10 gage wiring is on a 30-2 AMP breaker, this consists of 2 hot wires (black and red) a neutral (white) and a ground wire.							
	So you will have 4 wires running through the EMT to get to the RTU's, this wiring is not for the service outlets on the roof but for the direct wiring of the RTU's							
	26 00 00 ELECTRICAL							
6in add wire	**260000 Electrical**							
2ft add wire	***Power Service***							
	400 amp main service pa	1	ea	convert clf = 100 lf				
	12 gage black wire	17.46413	ft	clf		1370.373	horizontal conduit ft	
	12 gage white wire	17.46413	ft	clf		310	vertical	
	12 gage ground wire	17.46413	ft	clf				
	10 gage black/red wire	1.5792	ft	this is both the amount of red hot and black hot line, so it should be double what your white neutral and ground are, convert to clf				
	10 gage white wire	0.7896	ft	clf	also 4 wires would run to 1 RTU and the the other run of 4 wires would be a little longer to get to the 2nd RTU			
	10 gage ground wire	0.7896	ft	clf				
	EMT 3/4" conduit	1680.373	ft					
10ft piece	#10-3 armor cable	0.2	ft	clf		2	10 awg extra foot for service box	
10ft piece	#12-2 armor cable	4.8	ft	clf		1	10awg extra foot of each wire for junction boxes	
	1 gang switchbox (switc	37	ea	short, double check count		46	12 awg extra feet of each wire for service box	
	4" square junction box	84	ea		192	96	12awg extra feet of each wire for junction boxes	
	1 gang floor	3	ea					
	Power							
	Switch, single pole 15 an	4	ea					
	receptacle duplex 20 amp	36	ea	short, double check count				
	Lighting							
	2x4 w/3 32 W T8	48	ea					
	300 Watt metal halide (Qu	6	ea					
						56.5		

0.5/2	←leave this cell alone																	
	31 23 00 Grading and Excavation				Thickness	Length	Width	this is cf not	sf, you found volume because you x the t									
	4" underslab gravel, sidewalk	30.5741	sy		0.3333333	80	6.50	173.33	sf	19.3	sy							
					0.3333333	47	6.50	101.83	sf	11.3	sy							
										30.6	**sy**							
	32 13 00 Rigid Paving																	
	Sidewalk concrete	13.7191	cy		Thickness	Length	width							Length	Width			
	Finish sidewalk	825.5	sf	east	0.3333333	47	6.50	101.83	sf	3.77	cy			47	6.50	305.5	sf	
	#4-20' rebar	0.0935	tons	east curb	1.5	47	0.50	35.25	sf	1.31	cy			80	6.50	520	sf	
				south	0.3333333	80	6.50	173.33	sf	6.42	cy					**825.5**	**sf**	
				south curb	1.5	80	0.50	60	sf	2.22	cy							
										13.7	**cy**			the top of the curb is all part of the sidewalk that needs finished				
					length	rows	Rebar leng	Lap 18"		sticks		total length		lb/ft				
				curb	127	2	20.00	1.5		14	ea	280	lf	0.668	187.04	lbs	**0.0935**	**tons**
					centerline of curb section													

Assessment and Evaluation for SLO 4

Courses: CMGT 31000 – Cost Estimating

Academic Term: Spring 2020, Fall 2021, and Spring 2022

Instructors: Matt Ray

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 4 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An average 85% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	4. Create construction project cost estimates.	4.25	80%
S 2022		4.48	90%

Direct Measures - Assessments and Evaluations

The Direct Assessment consists of a lab assignment (custom designed to provide students an opportunity to create cost estimates covering multiple divisions for a given project throughout the semester) and a final group project (represents a culmination of lab experiences, creating a cost estimate and submit a bid on a similar project).

Term	N	Direct Assessment	Average Grade	Average Percent	Target Percent
Spring 2020	18	Concrete Lab	40/50	79	75
	19	Final Project	110/150	73	75
Fall 2021	17	Concrete Lab	40 /50	81	75
	21	Final Project	119 /150	79	75
Spring 2022	15	Concrete Lab	39/50	78	75
	16	Final Project	124/150	83	75

The course includes multiple labs, with the Concrete Lab being one example. The individual labs are submitted each week as smaller portions of a larger lab project while the Final Project includes a larger portion of a project including multiple divisions, markups and additional submissions as part of the bidding process. Individual labs combined make up 15% of the final grade while the final project alone counts for 20% of the final course grade. The final project is the culmination of the course experience and provides evidence of a student's ability to successfully create a cost estimate. An average score of 79% was achieved for the direct assessment of SLO 4 - Create Construction Project Cost Estimates for CMGT 31000.

The target for the direct assessment is that students would achieve an overall average of 75% or better based on total grades for each assessment. Both the Concrete Lab and the Final Project were greater than 78% indicating that the target value was met.

Proposed Actions for Course Improvement:
For SLO 4, students are provided with a significant amount of time in class to work on the labs as well as the final project, but students are not required to stay until the lab session is over. They have been required to stay for the instructional piece of the lab. Students commented that they wish that they were required to stay until the end of lab sections to hold them accountable. Future course sections will require students to remain in lab until their work is complete or time runs out. Student achievement on the final project is impacted by students not taking advantage of class time to work on their project. Students also requested that lab instructions be recorded and posted as a resource to refer back to when completing their work. This was implemented in Spring 2022. There was positive feedback from students that used the videos as an additional resource. Many students still preferred to email and ask questions as opposed to watching the videos. Overall, the videos had a positive impact as an additional resource for students.

Student Learning Outcome 5

Create Construction Project Schedules

Introduction

State the SLO #5 description and the associated course presented here

In CMGT 32000 – Scheduling and Project Control, there are five assignments that relate to project scheduling. Students are provided a set of plans and a detailed cost estimate, create a WBS (for the schedule), determine the costs for all tasks, and enter the information in MS Project. Construction then begins, and students enter actual construction progress and cost information in the schedule at the half-way point of the project and when construction has been completed.

Assessment Methods (additional information in the Direct Assessment section of this report)

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 5, there are three assignments that are used as Direct Measures in Fall 2021.

1. Create a Project Schedule in MS Project
2. Garage Project Work Breakdown Structure (WBS)
3. Garage Project - MS Project with Updates

During Fall 2022, there are three assignments are used as Direct Measures.

1. Lab #1 – Creating a Schedule
2. PROCORE Project – Generate a WBS
3. PROCORE Project – Generate a Schedule

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 5 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
  - Explanation and rubrics (grading criteria)
  - Graded student work (using the rubric)
- Assessment Report for SLO 5

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 5 (found at the end of this SLO report).

Direct Measures

Fall 2021: The Direct Measures for SLO 5 are assignments that include:

1. Create a Project Schedule in MS Project: based on the class exercise of a small residential construction WBS, students use MS Project to create a construction schedule.
2. Garage Project Work Breakdown Structure (WBS): The project is a 624 square foot garage with some sitework (sidewalk, driveway, and utilities). Students are given a set of design drawings with some specifications included in the drawing set and a detailed cost estimate with a Work Breakdown Structure (WBS) in the CSI MasterFormat. The deliverables of this assignment are a WBS for the project schedule (schedule tasks) and a manual project scheduling diagram.
3. Garage Project - MS Project with Updates: Once the assignment of the costs was graded and handed back, the final cost numbers were determined by the course instructor and then modified by means of a class discussion. The final cost amounts were determined and recorded. Students then had to enter that information (tasks, durations, predecessors, logic, and costs) into MS Project. The final schedule was created after the completion of construction, based on information provided by the course instructor. Students had to document project measures and "lessons learned."

Fall 2022: The Direct Measures for SLO 5 are assignments that include:

1. Lab #1 – Creating a Schedule
2. PROCORE Project – Generate a WBS
3. PROCORE Project – Generate a Schedule

Graded Student Work

The assignments are not "marked up" since these assignments were graded in Canvas. The grading criteria for each assignment have not been created in Canvas (yet). The course instructor completed the grading for each assignment using the grading criteria. The grading criteria and any instructor notes were sent to the students via the "Comment" section in Canvas using "SpeedGrader." An example of how it looks in Canvas is shown after the grading criteria for the first two assignments. The "Comments" in Canvas do not reproduce well, which is why just the "graded" grading criteria is provided for the last three assignments.

The following pages show the student work for each assignment followed by the grading criteria for that specific assignment.

Fall 2021

1. Student Work Example for Direct Measure #1: Create a Project Schedule in MS Project

Lab Assignment #2 - Create a Project Schedule in M.S. Project

Published

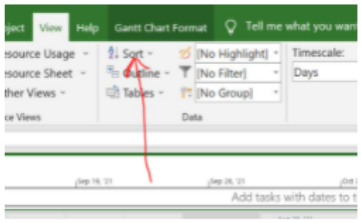
Take the attached Project Schedule generated in excel and generate a M.S. Project Schedule for submission and review.

** I prefer project files for submission, if not then pdf's, or pictures from your phone. I want to see logic, and end date.**

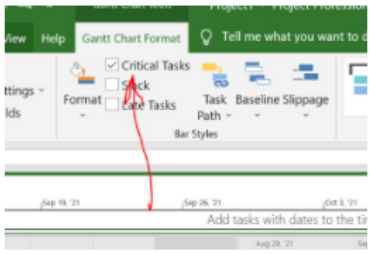
Assignment 2-1 Solution.xlsx

** Your Project file should look like this... Lab #2 - Create project from Gantt Chart.pdf

You sort your tasks by clicking sort by the Start date... (worth 1pt)



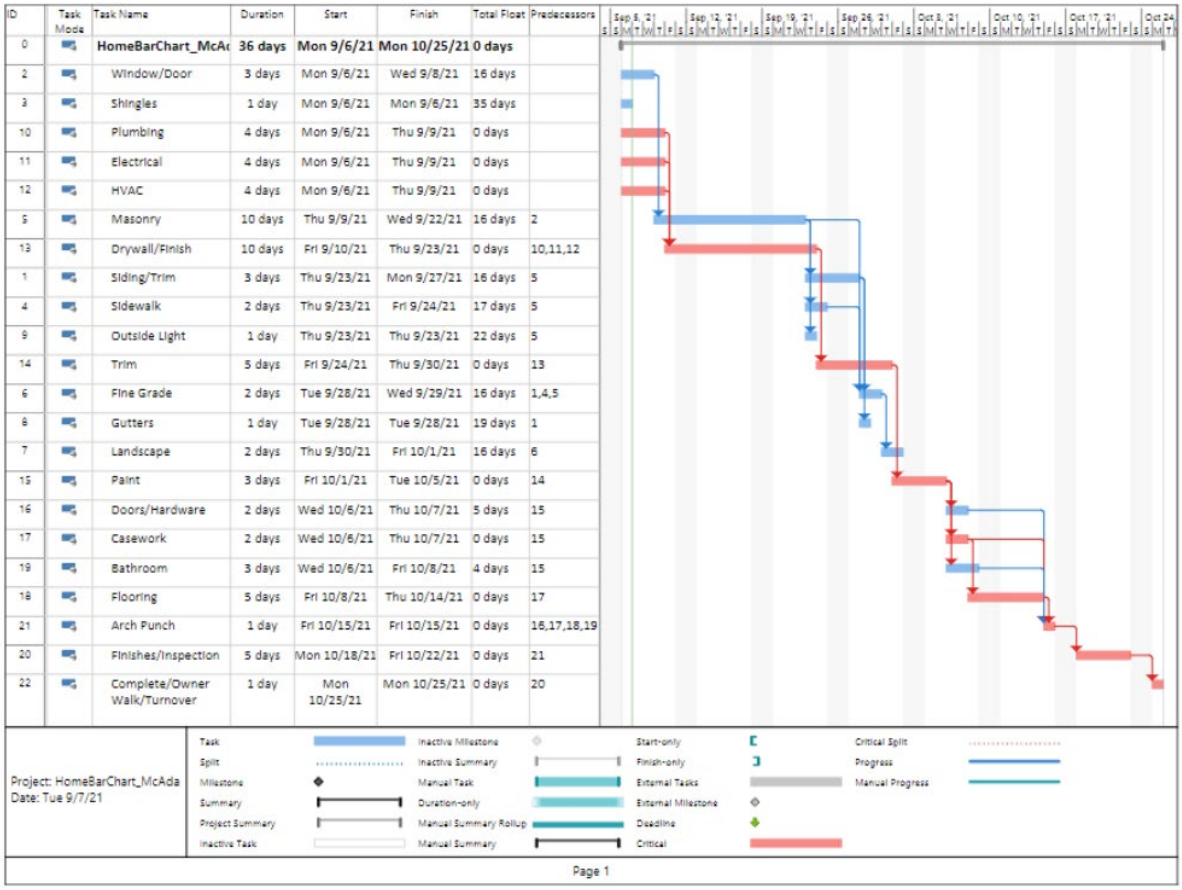
You Highlight your critical tasks by "checking" the critical tasks on the Gantt Chart Format tab... (1pt)



Points 10

Submitting a file upload

Student Submission Example



ID	Task Mode	Task Name	Duration	Start	Finish	Total Float	Predecessors
0		**HomeBarChart_McAc**	**36 days**	**Mon 9/6/21**	**Mon 10/25/21**	**0 days**	
2		Window/Door	3 days	Mon 9/6/21	Wed 9/8/21	16 days	
3		Shingles	1 day	Mon 9/6/21	Mon 9/6/21	35 days	
10		Plumbing	4 days	Mon 9/6/21	Thu 9/9/21	0 days	
11		Electrical	4 days	Mon 9/6/21	Thu 9/9/21	0 days	
12		HVAC	4 days	Mon 9/6/21	Thu 9/9/21	0 days	
5		Masonry	10 days	Thu 9/9/21	Wed 9/22/21	16 days	2
13		Drywall/Finish	10 days	Fri 9/10/21	Thu 9/23/21	0 days	10,11,12
1		Siding/Trim	3 days	Thu 9/23/21	Mon 9/27/21	16 days	5
4		Sidewalk	2 days	Thu 9/23/21	Fri 9/24/21	17 days	5
9		Outside Light	1 day	Thu 9/23/21	Thu 9/23/21	22 days	5
14		Trim	5 days	Fri 9/24/21	Thu 9/30/21	0 days	13
6		Fine Grade	2 days	Tue 9/28/21	Wed 9/29/21	16 days	1,4,5
8		Gutters	1 day	Tue 9/28/21	Tue 9/28/21	19 days	1
7		Landscape	2 days	Thu 9/30/21	Fri 10/1/21	16 days	6
15		Paint	3 days	Fri 10/1/21	Tue 10/5/21	0 days	14
16		Doors/Hardware	2 days	Wed 10/6/21	Thu 10/7/21	5 days	15
17		Casework	2 days	Wed 10/6/21	Thu 10/7/21	0 days	15
19		Bathroom	3 days	Wed 10/6/21	Fri 10/8/21	4 days	15
18		Flooring	5 days	Fri 10/8/21	Thu 10/14/21	0 days	17
21		Arch Punch	1 day	Fri 10/15/21	Fri 10/15/21	0 days	16,17,18,19
20		Finishes/Inspection	5 days	Mon 10/18/21	Fri 10/22/21	0 days	21
22		Complete/Owner Walk/Turnover	1 day	Mon 10/25/21	Mon 10/25/21	0 days	20

2. Student Work Example for Direct Measure #2: Garage Project Work Breakdown Structure (WBS)

Lab Assignment #9 - Garage Project Work Breakdown Structure (WBS)

Published

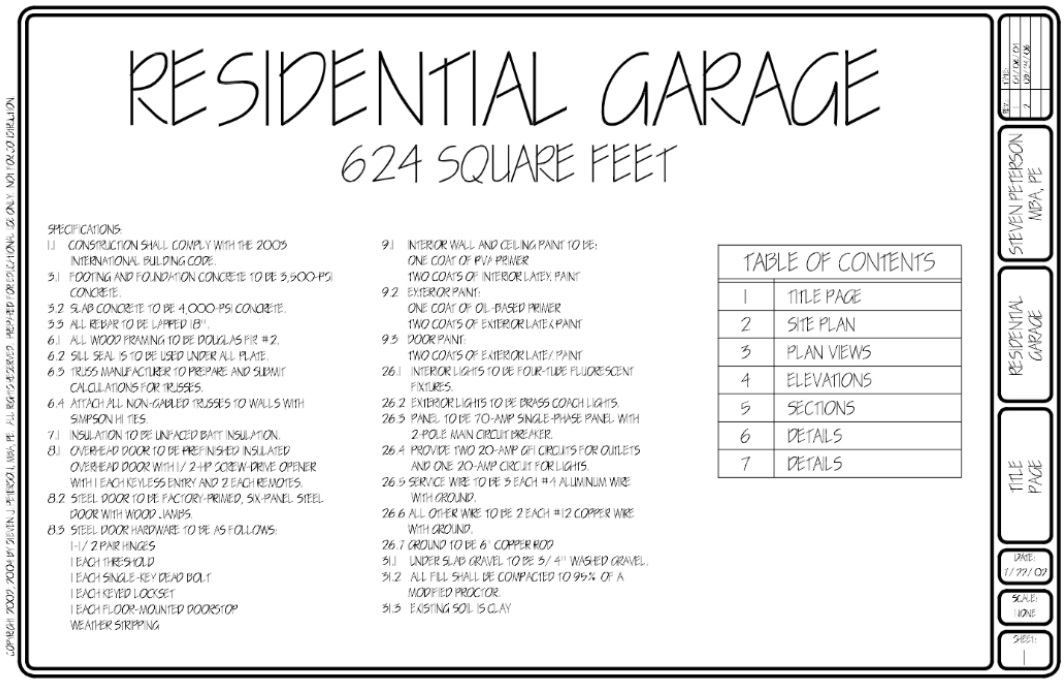
Review the attached drawings, create a Work Breakdown Structure, and submit for review.

Garage Drawings.pdf

Points 10

Submitting a file upload

Due	For	Available from	Until
Nov 15, 2021	Everyone	Nov 9, 2021 at 12am	Nov 16, 2021 at 11:59pm



RESIDENTIAL GARAGE

624 SQUARE FEET

SPECIFICATIONS:

1.1 CONSTRUCTION SHALL COMPLY WITH THE 2003 INTERNATIONAL BUILDING CODE.
3.1 FOOTING AND FOUNDATION CONCRETE TO BE 3,500-PSI CONCRETE.
3.2 SLAB CONCRETE TO BE 4,000-PSI CONCRETE.
3.3 ALL REBAR TO BE LAPPED 18".
6.1 ALL WOOD FRAMING TO BE DOUGLAS FIR #2.
6.2 SILL SEAL IS TO BE USED UNDER ALL PLATE.
6.3 TRUSS MANUFACTURER TO PREPARE AND SUBMIT CALCULATIONS FOR TRUSSES.
6.4 ATTACH ALL NON-GABLED TRUSSES TO WALLS WITH SIMPSON H1 TIES.
7.1 INSULATION TO BE UNFACED BATT INSULATION.
8.1 OVERHEAD DOOR TO BE PREFINISHED INSULATED OVERHEAD DOOR WITH 1/2 HP SCREW-DRIVE OPENER WITH 1 EACH KEYLESS ENTRY AND 2 EACH REMOTES.
8.2 STEEL DOOR TO BE FACTORY-PRIMED, SIX-PANEL STEEL DOOR WITH WOOD JAMBS.
8.3 STEEL DOOR HARDWARE TO BE AS FOLLOWS:
1-1/2 PAIR HINGES
1 EACH THRESHOLD
1 EACH SINGLE-KEY DEAD BOLT
1 EACH KEYED LOCKSET
1 EACH FLOOR-MOUNTED DOORSTOP
WEATHER STRIPPING
9.1 INTERIOR WALL AND CEILING PAINT TO BE:
ONE COAT OF PVA PRIMER
TWO COATS OF INTERIOR LATEX PAINT
9.2 EXTERIOR PAINT:
ONE COAT OF OIL-BASED PRIMER
TWO COATS OF EXTERIOR LATEX PAINT
9.3 DOOR PAINT:
TWO COATS OF EXTERIOR LATEX PAINT
26.1 INTERIOR LIGHTS TO BE FOUR-TUBE FLUORESCENT FIXTURES.
26.2 EXTERIOR LIGHTS TO BE BRASS COACH LIGHTS.
26.3 PANEL TO BE 70-AMP SINGLE-PHASE PANEL WITH 2-POLE MAIN CIRCUIT BREAKER.
26.4 PROVIDE TWO 20-AMP GFI CIRCUITS FOR OUTLETS AND ONE 20-AMP CIRCUIT FOR LIGHTS.
26.5 SERVICE WIRE TO BE 3 EACH #4 ALUMINUM WIRE WITH GROUND.
26.6 ALL OTHER WIRE TO BE 2 EACH #12 COPPER WIRE WITH GROUND.
26.7 GROUND TO BE 6' COPPER ROD
31.1 UNDER SLAB GRAVEL TO BE 3/4" WASHED GRAVEL.
31.2 ALL FILL SHALL BE COMPACTED TO 95% OF A MODIFIED PROCTOR.
31.3 EXISTING SOIL IS CLAY

TABLE OF CONTENTS

STEVEN PETERSON MBA, PE

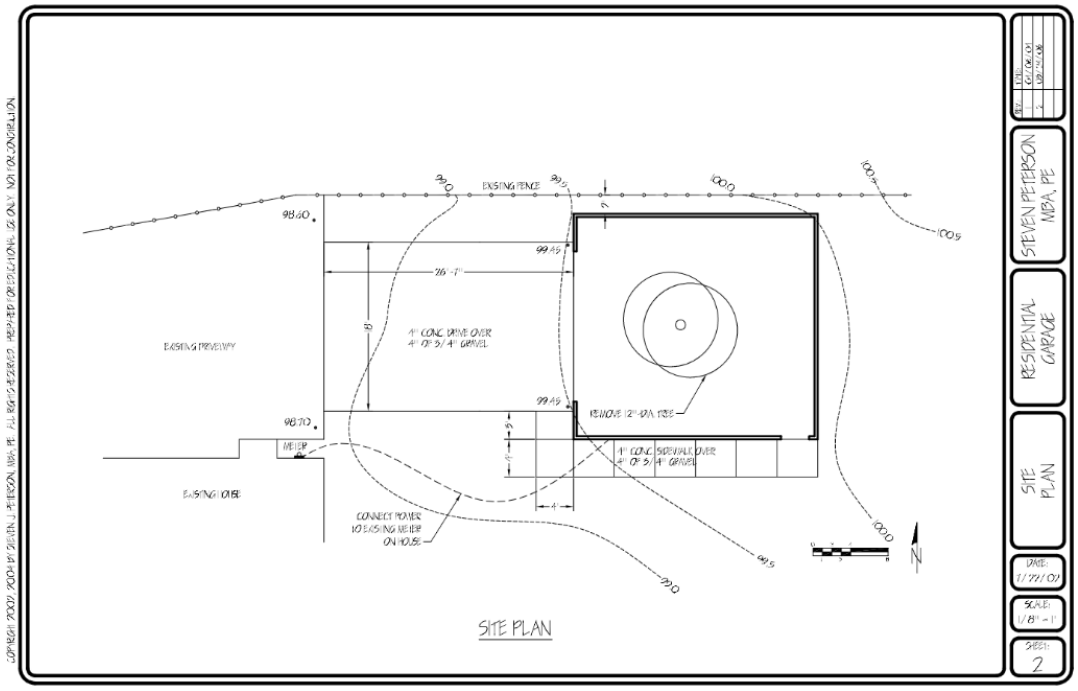
RESIDENTIAL GARAGE

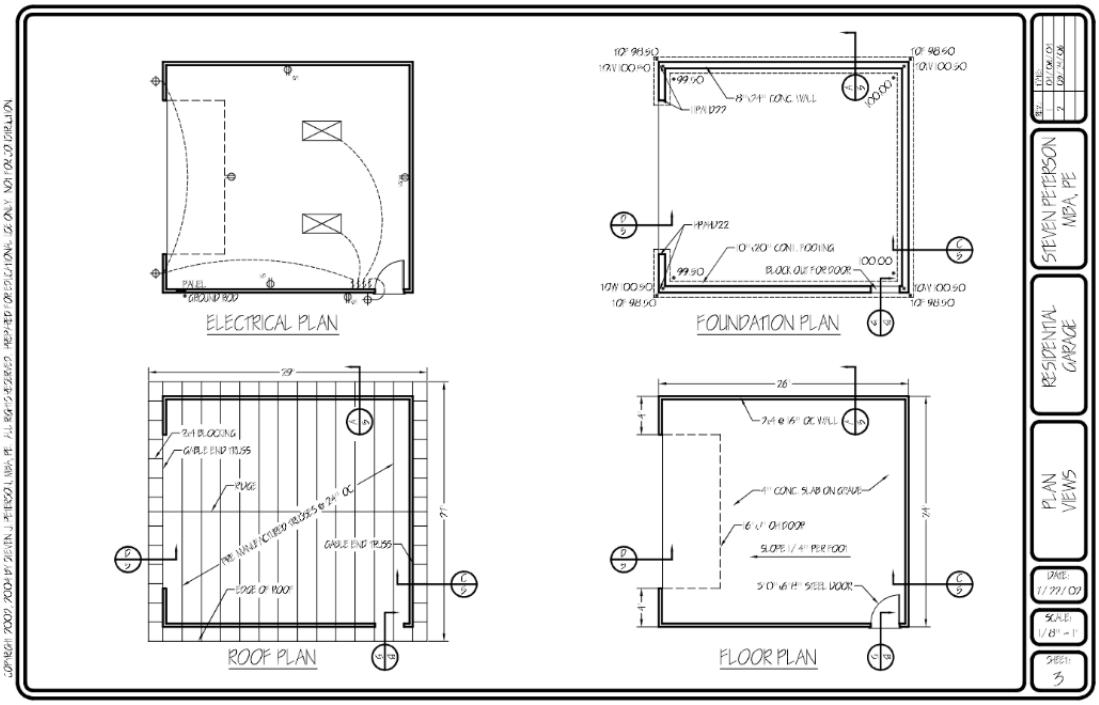
TITLE PAGE

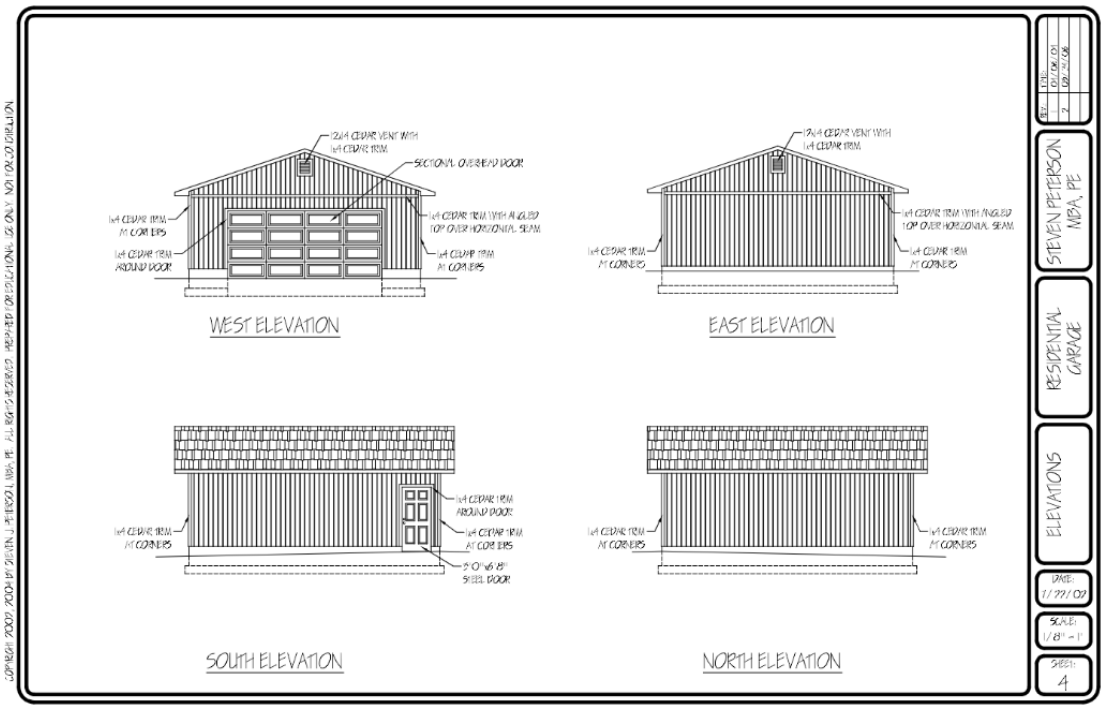
DATE: 1/22/03

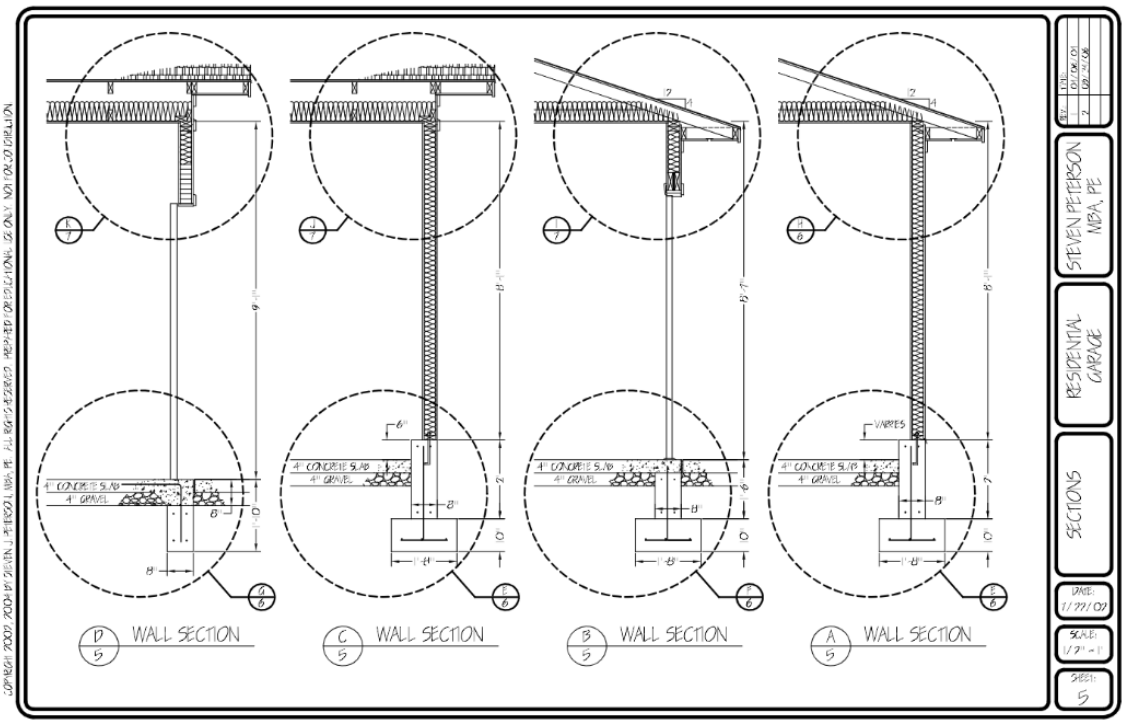
SCALE: NONE

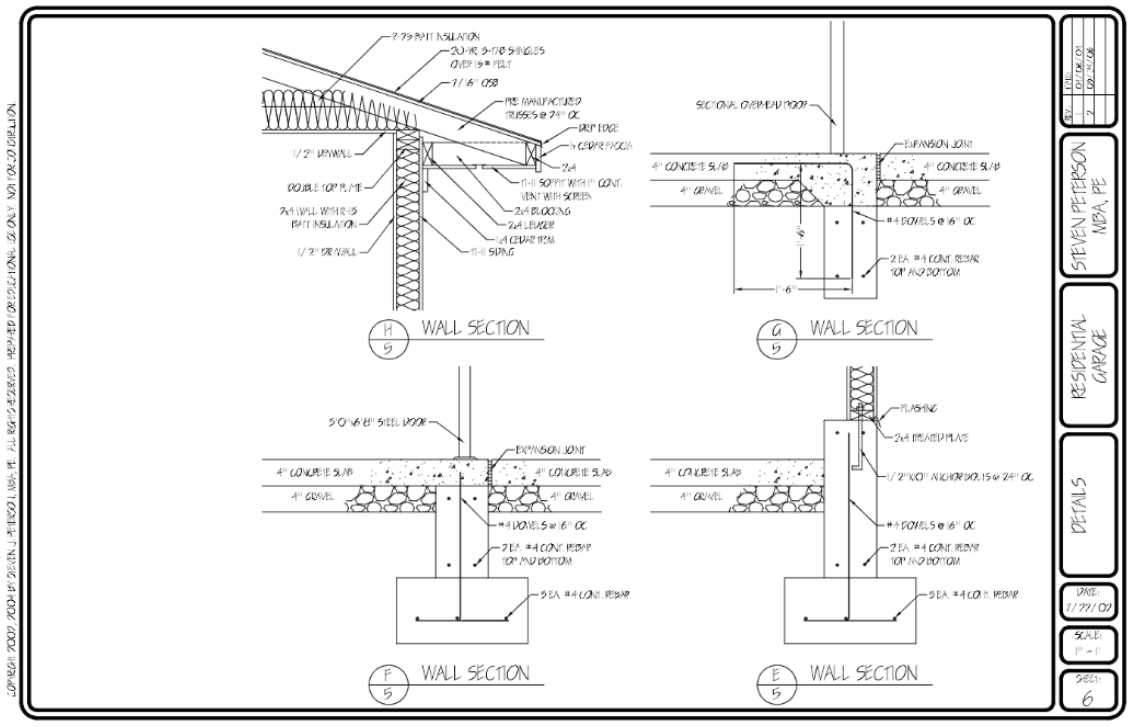
SHEET: 1

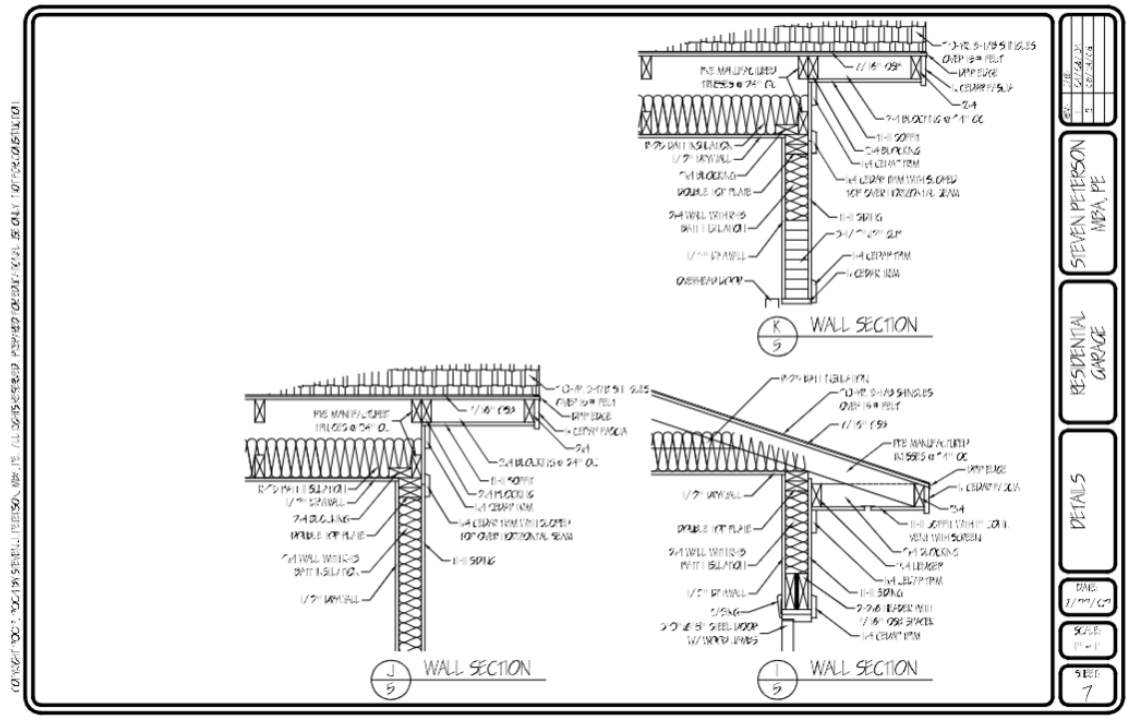

EXISTING FENCE
98.60
99.45
26'-4"
EXISTING DRIVEWAY
4" CONC. DRIVE OVER 4" OF 3/4" GRAVEL
99.49
REMOVE 12"-DIA. TREE
98.70
METER
4" CONC. SIDEWALK OVER 4" OF 3/4" GRAVEL
EXISTING POLE
CONNECT POWER TO EXISTING METER ON HOUSE
SITE PLAN
STEVEN PETERSON MBA, PE
RESIDENTIAL GARAGE
SITE PLAN
DATE: 11/27/02
SCALE: 1/8" = 1'
SHEET: 2


ELECTRICAL PLAN
PANEL
GROUND ROD
FOUNDATION PLAN
TOF 98.50
TOW 100.50
99.50
18"x24" CONC. WALL
HPAN22
10'x20' CONC. FOOTING
BLOCK OUT FOR DOOR
100.00
ROOF PLAN
29'
2x4 BLOCKING
GABLE END TRUSS
RIDGE
TYP. HALF-CUTTED RAFTERS @ 24" OC
EDGE OF ROOF
FLOOR PLAN
26'
2x4 @ 16" OC WALL
4" CONC. SLAB ON GRADE
6 MIL VAPOR
SLOPE 1/4" PER FOOT
3'-0"x6'-8" STEEL DOOR
STEVEN PETERSON MBA, PE
RESIDENTIAL GARAGE
PLAN VIEWS
DATE: 11/27/02
SCALE: 1/8" = 1'
SHEET: 3


12x4 CEDAR VENT WITH 1x4 CEDAR TRIM
SECTIONAL OVERHEAD DOOR
1x4 CEDAR TRIM AT CORNERS
1x4 CEDAR TRIM AROUND DOOR
1x4 CEDAR TRIM WITH ANGLED TOP OVER HORIZONTAL SEAM
WEST ELEVATION
EAST ELEVATION
1x4 CEDAR TRIM AROUND DOOR
3'-0"x6'-8" STEEL DOOR
SOUTH ELEVATION
NORTH ELEVATION
STEVEN PETERSON MBA, PE
RESIDENTIAL GARAGE
ELEVATIONS
DATE: 1/22/02
SCALE: 1/8"=1'
SHEET: 4


4" CONCRETE SLAB
4" GRAVEL
WALL SECTION
STEVEN PETERSON MBA, PE
RESIDENTIAL GARAGE
SECTIONS
DATE: 1/22/02
SCALE: 1/2"=1'
SHEET: 5


R-29 BATT INSULATION
20-YR 3-TAB SHINGLES OVER 15# FELT
7/16" OSB
PRE MANUFACTURED TRUSSES @ 24" OC
DRIP EDGE
1x CEDAR FASCIA
2x4
1/2" DRYWALL
DOUBLE TOP PLATE
2x4 WALL W/R-13 BATT INSULATION
1/2" DRYWALL
11-1/4 SOFFIT WITH 1" CONT. VENT WITH SCREEN
2x4 BLOCKING
2x4 LEDGER
1x4 CEDAR TRIM
11-1/4 SIDING
WALL SECTION
H
5
SECTIONAL OVERHEAD DOOR
EXPANSION JOINT
4" CONCRETE SLAB
4" GRAVEL
#4 DOWELS @ 16" OC
2 EA. #4 CONT. REBAR TOP AND BOTTOM
WALL SECTION
G
5
9'-0"x6'-8" STEEL DOOR
5 EA. #4 CONT. REBAR
WALL SECTION
F
5
FLASHING
2x4 BRACED PLATE
1/2"x10" ANCHOR BOLTS @ 24" OC
WALL SECTION
E
5
STEVEN PETERSON NCBA, PE
RESIDENTIAL GARAGE
DETAILS
DATE: 1/27/07
SCALE: 1" = 1'
SHEET: 6


20-YR 3-TAB SHINGLES OVER 15# FELT
7/16" OSB
PRE MANUFACTURED TRUSSES @ 24" OC
DRIP EDGE
1x CEDAR FASCIA
2x4
2x4 BLOCKING @ 24" OC
11-1/4 SOFFIT
2x4 BLOCKING
1x4 CEDAR TRIM
1x4 CEDAR TRIM W/ NOTCHED TOP OVER HORIZONTAL SEAM
R-29 BATT INSULATION
1/2" DRYWALL
2x4 BLOCKING
DOUBLE TOP PLATE
2x4 WALL W/R-13 BATT INSULATION
11-1/4 SIDING
1/2" DRYWALL
OVERHEAD DOOR
WALL SECTION
K
5
20-YR 3-TAB SHINGLES OVER 15# FELT
7/16" OSB
PRE MANUFACTURED TRUSSES @ 24" OC
2x4 BLOCKING @ 24" OC
11-1/4 SOFFIT
2x4 BLOCKING
1x4 CEDAR TRIM
1x4 CEDAR TRIM W/ NOTCHED TOP OVER HORIZONTAL SEAM
R-29 BATT INSULATION
1/2" DRYWALL
DOUBLE TOP PLATE
2x4 WALL W/R-13 BATT INSULATION
11-1/4 SIDING
1/2" DRYWALL
WALL SECTION
J
5
R-29 BATT INSULATION
20-YR 3-TAB SHINGLES OVER 15# FELT
7/16" OSB
PRE MANUFACTURED TRUSSES @ 24" OC
DRIP EDGE
1x CEDAR FASCIA
2x4
1/2" DRYWALL
DOUBLE TOP PLATE
2x4 WALL W/R-13 BATT INSULATION
11-1/4 SOFFIT WITH 1" CONT. VENT WITH SCREEN
2x4 BLOCKING
1x4 LEDGER
1x4 CEDAR TRIM
1/2" DRYWALL
11-1/4 SIDING
2-2x6 HEADER W/ 7/16" OSB SPACER
1x4 CEDAR TRIM
9'-0"x6'-8" STEEL DOOR W/ WOOD JAMBS
WALL SECTION
I
5
STEVEN PETERSON NCBA, PE
RESIDENTIAL GARAGE
DETAILS
DATE: 1/27/07
SCALE: 1" = 1'
SHEET: 7

Student Submission Example

Construction of Residential Garage

Permits & Drawing
Design-Layout
Plan out site

Foundation Layout
Excavate
Pour concrete
Cure

Wall Erection
Set layout
build per elevation west, east, north and south

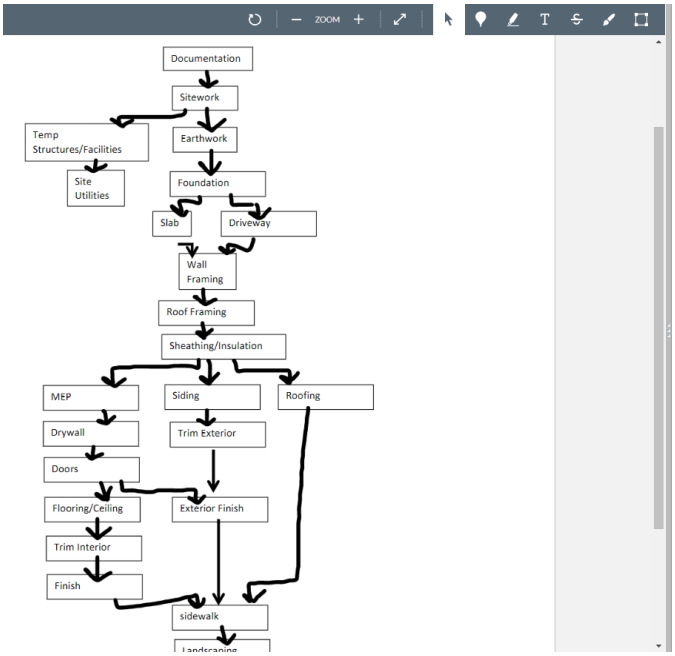
Floor Plan
Concrete slab on grade
Install steel door location/Garage door

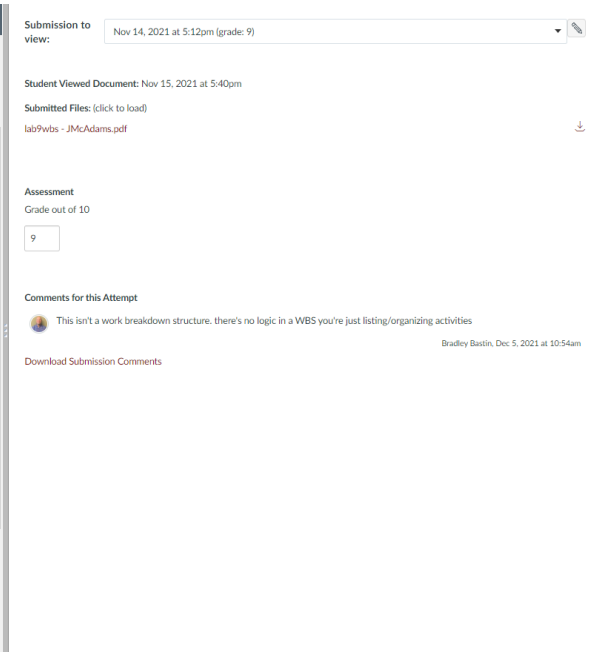
Roof
Install cable and truss
Ridge location/installation
Install cable end truss
Install shingles

electrical plan
set layout
Rough in electrical
Install terminal
Wire lights and switch

Interior
Install insulation
Install drywall
Add finishing
Add paint

Exterior
install cedar trim
install steel door
Install garage door





3. Student Work Example for Direct Measure #3: Garage Project - MS Project with Updates

Lab Assignment #10 - Garage Project MS Schedule

Published

Review the attach word document and generate the follow:

- Gantt chart
- Cashflow Report

Lab #10 - Garage Project in MS Project.docx

Points 10

Submitting a file upload

Due	For	Available from	Until
Nov 29, 2021	Everyone	Nov 16, 2021 at 12am	Nov 30, 2021 at 11:59pm

Garage Project Schedule in MS Project

Objective

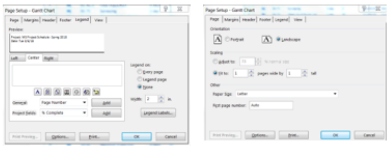
The objective of this assignment is to enter the scheduling information for a Garage Project into MS Project, create a Gantt Chart, and a Cash Flow report. Later we will update the schedule based on information from the field.

Entering the Scheduling Information for the Garage Project into MS Project

1. As shown below, create columns in MS Project, that correspond to the information in the table on page 4, "Scheduling Information for the Garage Project"
2. Copy and Paste the five (4) columns from Word into MS Project (Don't copy the # column).
3. Assumptions:
   - Costs are reasonable estimates (Total Project Cost = $35,000).
   - Inspections are "Milestone" events, Duration = 0 and Cost = 0 (Costs for inspections are included in Permits & Inspection (Costs).
4. Change all tasks from Manual Schedule to Auto Schedule. Just click on Task Mode then Auto Schedule (under the Task tab).
5. Change the Start Date (Project > Project Information)
   - Project Start Date: Tuesday, 11/9/2021.
6. Working Time: 5-Day Work Week
   - Non-Work Days: US Holidays

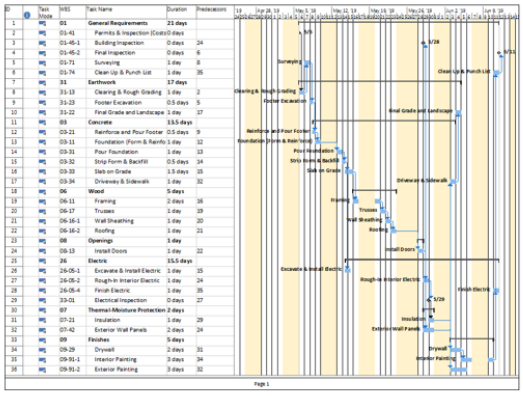
Deliverables

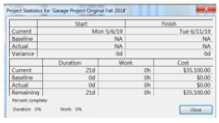
7. Gantt Chart (Task Name, Duration, Predecessor, and Cost)
   - Pdf page layout 1 page in width or:
   - Mpp file
   - Or use the Snipping Tool to capture the entire project. Here's what to do.
     - File - Print - Settings Pages 1 to 1 (refer to the figures on the following page)
     - Landscape Orientation.
     - Page Setup (at the bottom) and then under Page (tab) Fit to 1 page wide by 1 tall
     - Under the Legend (tab), Legend on: None.
     - Then you should be able to snip a picture of the entire schedule and paste into Word.



1

- Paste the entire schedule into Word, as shown below.
- Paste the Statistics box below the Gantt Chart: Project -> Project Information ->Statistics.

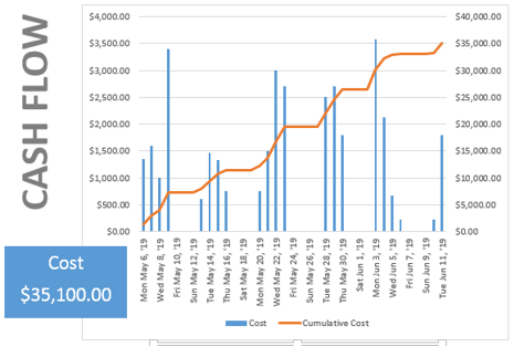




8. Cash Flow Cost Report
   - Report (tab) -> Costs -> Cash Flow.

2

- Create a Cash Flow Report that looks like the one below, except the cost will be different.

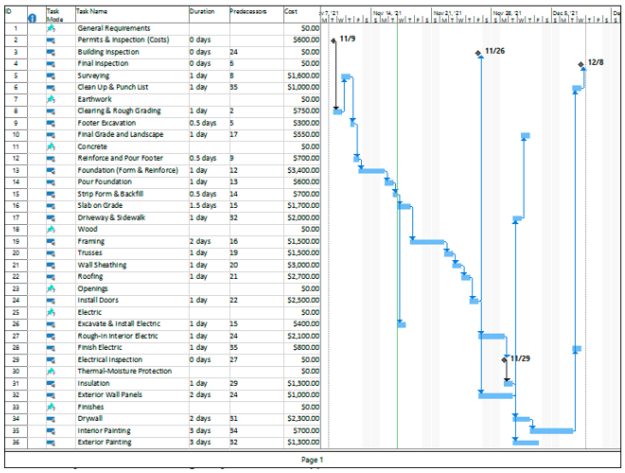


Name	Cost
General Requirements	$3,200.00
Earthwork	$1,600.00
Concrete	$9,100.00
Wood	$8,700.00
Openings	$2,500.00
Electric	$3,400.00
Thermal-Moisture Protection	$2,300.00
Finishes	$4,300.00

Scheduling Information for the Garage Project

#	Task Name	Duration	Predecessors	Cost
1	**General Requirements**			
2	Permits & Inspection (Costs)	0 days		$600.00
3	Building Inspection	0 days	24	$0.00
4	Final Inspection	0 days	6	$0.00
5	Surveying	1 day	8	$1,600.00
6	Clean Up & Punch List	1 day	35	$1,000.00
7	**Earthwork**			
8	Clearing & Rough Grading	1 day	2	$750.00
9	Footer Excavation	0.5 days	5	$300.00
10	Final Grade and Landscape	1 day	17	$550.00
11	**Concrete**			
12	Reinforce and Pour Footer	0.5 days	9	$700.00
13	Foundation (Form & Reinforce)	1 day	12	$3,400.00
14	Pour Foundation	1 day	13	$600.00
15	Strip Form & Backfill	0.5 days	14	$700.00
16	Slab on Grade	1.5 days	15	$1,700.00
17	Driveway & Sidewalk	1 day	32	$2,000.00
18	**Wood**			
19	Framing	2 days	16	$1,500.00
20	Trusses	1 day	19	$1,500.00
21	Wall Sheathing	1 day	20	$3,000.00
22	Roofing	1 day	21	$2,700.00
23	**Openings**			
24	Install Doors	1 day	22	$2,500.00
25	**Electric**			
26	Excavate & Install Electric	1 day	15	$400.00
27	Rough-In Interior Electric	1 day	24	$2,100.00
28	Finish Electric	1 day	35	$800.00
29	Electrical Inspection	0 days	27	$0.00
30	**Thermal-Moisture Protection**			
31	Insulation	1 day	29	$1,300.00
32	Exterior Wall Panels	2 days	24	$1,000.00
33	**Finishes**			
34	Drywall	2 days	31	$2,300.00
35	Interior Painting	3 days	34	$700.00
36	Exterior Painting	3 days	32	$1,300.00

Student Submission Example



ID	Task Mode	Task Name	Duration	Predecessors	Cost
1		General Requirements			$0.00
2		Permits & Inspection (Costs)	0 days		$600.00
3		Building Inspection	0 days	24	$0.00
4		Final Inspection	0 days	8	$0.00
5		Surveying	1 day	8	$1,600.00
6		Clean Up & Punch List	1 day	35	$1,000.00
7		Earthwork			$0.00
8		Clearing & Rough Grading	1 day	2	$750.00
9		Footer Excavation	0.5 days	5	$300.00
10		Final Grade and Landscape	1 day	17	$550.00
11		Concrete			$0.00
12		Reinforce and Pour Footer	0.5 days	9	$700.00
13		Foundation (Form & Reinforce)	1 day	12	$3,400.00
14		Pour Foundation	1 day	13	$600.00
15		Strip Form & Backfill	0.5 days	14	$700.00
16		Slab on Grade	1.5 days	15	$1,700.00
17		Driveway & Sidewalk	1 day	32	$2,000.00
18		Wood			$0.00
19		Framing	2 days	16	$1,500.00
20		Trusses	1 day	19	$1,500.00
21		Wall Sheathing	1 day	20	$3,000.00
22		Roofing	1 day	21	$2,700.00
23		Openings			$0.00
24		Install Doors	1 day	22	$2,500.00
25		Electric			$0.00
26		Excavate & Install Electric	1 day	15	$400.00
27		Rough-in Interior Electric	1 day	24	$2,100.00
28		Finish Electric	1 day	35	$800.00
29		Electrical Inspection	0 days	27	$0.00
30		Thermal-Moisture Protection			$0.00
31		Insulation	1 day	29	$1,300.00
32		Exterior Wall Panels	2 days	24	$1,000.00
33		Finishes			$0.00
34		Drywall	2 days	31	$2,300.00
35		Interior Painting	3 days	34	$700.00
36		Exterior Painting	3 days	32	$1,300.00

	Start	Finish
Current	Tue 11/9/21	Wed 12/8/21
Baseline	NA	NA
Actual	NA	NA
Variance	0d	0d

	Duration	Work	Cost
Current	21d	0h	$35,000.00
Baseline	0d	0h	$0.00
Actual	0d	0h	$0.00
Remaining	21d	0h	$35,000.00

Percent complete:
Duration: 0% Work: 0%
Close

CASH FLOW

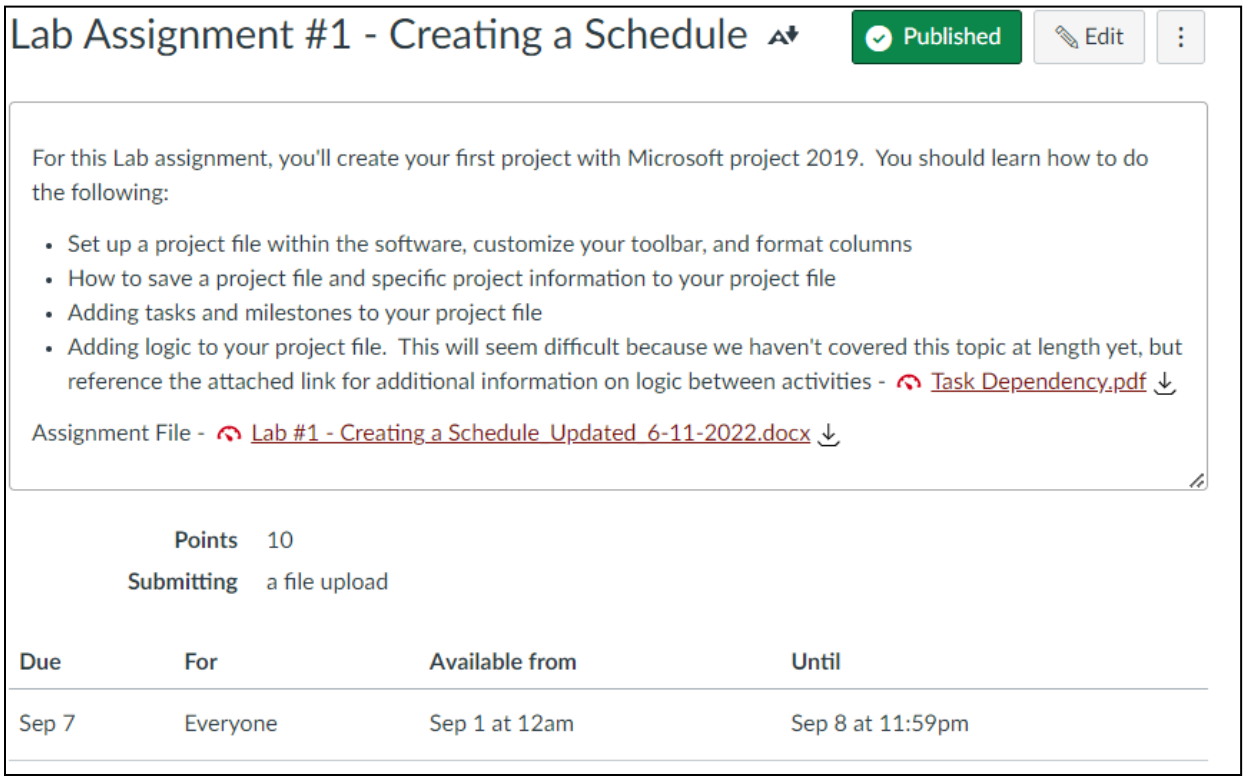
Actual Cost	Baseline Cost	Remaining Cost	Cost Variance
$0.00	$0.00	$35,000.00	$35,000.00

The chart shows the project's cumulative cost and the cost per quarter.
To see the costs for a different time period, select the Edit option from the Field List.

The table below shows cost information for all top-level tasks.
To see cost stats for all tasks, set the Outline Level in the Field List.

Name	Remaining Cost	Actual Cost	Cost	ACWP	BCWP	BCWS
General Requirements	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Permits & Inspection (Costs)	$600.00	$0.00	$600.00	$0.00	$0.00	$0.00
Building Inspection	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Final Inspection	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Surveying	$1,600.00	$0.00	$1,600.00	$0.00	$0.00	$0.00
Clean Up & Punch List	$1,000.00	$0.00	$1,000.00	$0.00	$0.00	$0.00
Earthwork	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Clearing & Rough Grading	$750.00	$0.00	$750.00	$0.00	$0.00	$0.00
Footer Excavation	$300.00	$0.00	$300.00	$0.00	$0.00	$0.00
Final Grade and Landscape	$550.00	$0.00	$550.00	$0.00	$0.00	$0.00
Concrete	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Reinforce and Pour Footer	$700.00	$0.00	$700.00	$0.00	$0.00	$0.00
Foundation (Form & Reinforce)	$3,400.00	$0.00	$3,400.00	$0.00	$0.00	$0.00
Pour Foundation	$600.00	$0.00	$600.00	$0.00	$0.00	$0.00
Strip Form & Backfill	$700.00	$0.00	$700.00	$0.00	$0.00	$0.00
Slab on Grade	$1,700.00	$0.00	$1,700.00	$0.00	$0.00	$0.00
Driveway & Sidewalk	$2,000.00	$0.00	$2,000.00	$0.00	$0.00	$0.00
Wood	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Framing	$1,500.00	$0.00	$1,500.00	$0.00	$0.00	$0.00
Trusses	$1,500.00	$0.00	$1,500.00	$0.00	$0.00	$0.00
Wall Sheathing	$3,000.00	$0.00	$3,000.00	$0.00	$0.00	$0.00
Roofing	$2,700.00	$0.00	$2,700.00	$0.00	$0.00	$0.00
Openings	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Install Doors	$2,500.00	$0.00	$2,500.00	$0.00	$0.00	$0.00
Electric	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Excavate & Install Electric	$400.00	$0.00	$400.00	$0.00	$0.00	$0.00
Rough-in Interior Electric	$2,100.00	$0.00	$2,100.00	$0.00	$0.00	$0.00
Finish Electric	$800.00	$0.00	$800.00	$0.00	$0.00	$0.00
Electrical Inspection	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Thermal-Moisture Protection	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Insulation	$1,300.00	$0.00	$1,300.00	$0.00	$0.00	$0.00
Exterior Wall Panels	$1,000.00	$0.00	$1,000.00	$0.00	$0.00	$0.00
Finishes	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Drywall	$2,300.00	$0.00	$2,300.00	$0.00	$0.00	$0.00
Interior Painting	$700.00	$0.00	$700.00	$0.00	$0.00	$0.00
Exterior Painting	$1,300.00	$0.00	$1,300.00	$0.00	$0.00	$0.00

Lab Assignment #1 – Creating a Schedule



Lab Assignment #1 - Creating a Schedule

Published | Edit

For this Lab assignment, you'll create your first project with Microsoft project 2019. You should learn how to do the following:

- Set up a project file within the software, customize your toolbar, and format columns
- How to save a project file and specific project information to your project file
- Adding tasks and milestones to your project file
- Adding logic to your project file. This will seem difficult because we haven't covered this topic at length yet, but reference the attached link for additional information on logic between activities - Task Dependency.pdf

Assignment File - Lab #1 - Creating a Schedule_Updated_6-11-2022.docx

Points 10

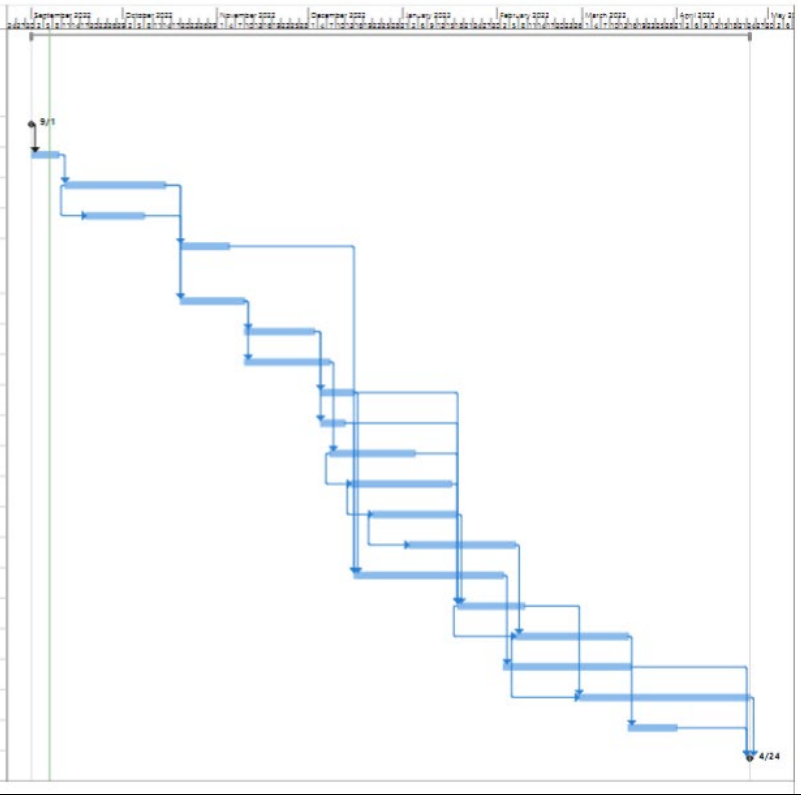
Submitting a file upload

Due	For	Available from	Until
Sep 7	Everyone	Sep 1 at 12am	Sep 8 at 11:59pm

Student Submission

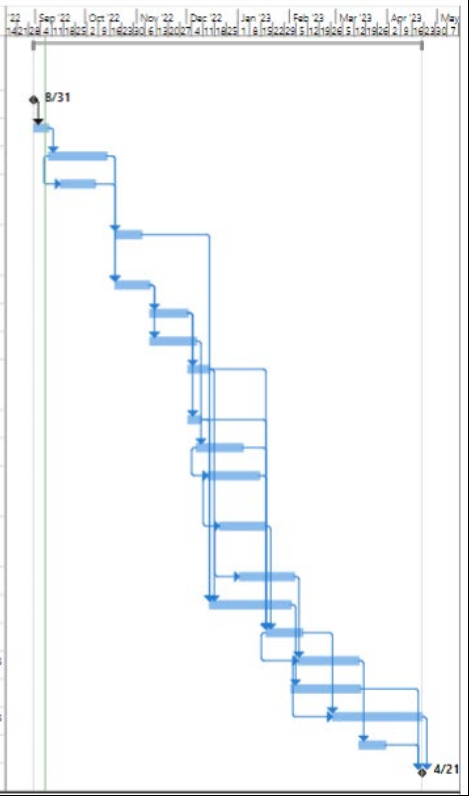
1st Submission

ID	Task Mode	Task Name	Duration	Start	Finish	Total Float
0		Office Building_CasteelCir #1	168 days	Thu 9/1/22	Mon 4/24/23	0 days
1		Notice to Proceed	0 days	Thu 9/1/22	Thu 9/1/22	0 days
2		Excavation	7 days	Thu 9/1/22	Fri 9/9/22	0 days
3		Foundation	25 days	Mon 9/12/22	Fri 10/14/22	0 days
4		Underslab Utilities	15 days	Mon 9/19/22	Fri 10/7/22	8 days
5		Backfill / Site Drainage	12 days	Thu 10/20/22	Fri 11/4/22	36 days
6		Slab on Grade	15 days	Thu 10/20/22	Wed 11/9/22	0 days
7		Exterior Walls	17 days	Thu 11/10/22	Fri 12/2/22	27 days
8		Interior Walls	20 days	Thu 11/10/22	Wed 12/7/22	0 days
9		Exterior Sheathing	9 days	Mon 12/5/22	Thu 12/15/22	27 days
10		Doors & Windows	6 days	Mon 12/5/22	Mon 12/12/22	30 days
11		HVAC Rough-in	20 days	Thu 12/8/22	Wed 1/4/23	0 days
12		Plumbing Rough-in	23 days	Thu 12/15/22	Mon 1/16/23	0 days
13		Electrical Rough-in	20 days	Thu 12/22/22	Wed 1/18/23	0 days
14		Other Rough-in	25 days	Tue 1/3/23	Mon 2/6/23	0 days
15		Masonry	35 days	Fri 12/16/22	Thu 2/2/23	27 days
16		Insulation	16 days	Thu 1/19/23	Thu 2/9/23	3 days
17		Drywall	27 days	Tue 2/7/23	Wed 3/15/23	0 days
18		Exterior Finishes	30 days	Fri 2/3/23	Thu 3/16/23	27 days
19		Interior Finishes	40 days	Tue 2/28/23	Mon 4/24/23	0 days
20		Finish MEP	12 days	Thu 3/16/23	Fri 3/31/23	16 days
21		Project Complete	0 days	Mon 4/24/23	Mon 4/24/23	0 days



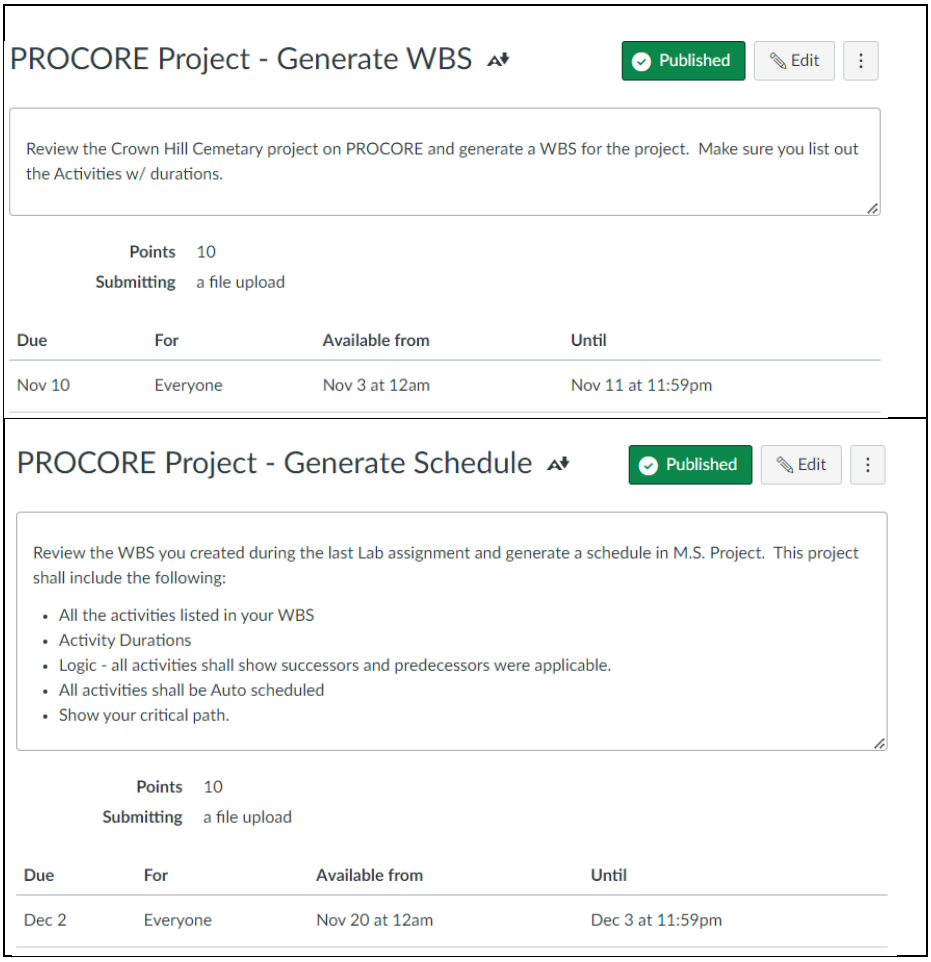
2nd Submission

ID	Task Mode	Task Name	Duration	Start	Finish	Total Float	Predecessors
0		Office Building_RichardsJ	168 days	Wed 8/31/22	Fri 4/21/23	0 days	
1		Notice to Proceed	0 days	Wed 8/31/22	Wed 8/31/22	0 days	
2		Excavation	7 days	Wed 8/31/22	Thu 9/8/22	0 days	1
3		Foundation	25 days	Fri 9/9/22	Thu 10/13/22	0 days	2
4		Under slab Utilities	15 days	Fri 9/16/22	Thu 10/6/22	8 days	3SS+5 days
5		Backfill / Site Drainage	12 days	Wed 10/19/22	Thu 11/3/22	56 days	3FS+3 days
6		Slab on Grade	15 days	Wed 10/19/22	Tue 11/8/22	0 days	3FS+3 days,4
7		Exterior Walls	17 days	Wed 11/9/22	Thu 12/1/22	27 days	6
8		Interior Walls	20 days	Wed 11/9/22	Tue 12/6/22	0 days	6
9		Exterior Sheathing	9 days	Fri 12/2/22	Wed 12/14/22	27 days	7
10		Doors & Windows	6 days	Fri 12/2/22	Fri 12/9/22	30 days	7
11		HVAC Rough-in	20 days	Wed 12/7/22	Tue 1/3/23	0 days	8
12		Plumbing Rough-in	23 days	Wed 12/14/22	Fri 1/13/23	0 days	11SS+5 days
13		Electrical Rough-in	20 days	Wed 12/21/22	Tue 1/17/23	0 days	12SS+5 days
14		Other Rough-in	25 days	Mon 1/2/23	Fri 2/3/23	0 days	13SS+8 days
15		Masonry	35 days	Thu 12/15/22	Wed 2/1/23	27 days	5,9,10
16		Insulation	16 days	Wed 1/18/23	Wed 2/8/23	3 days	9,10,11,12,13
17		Drywall	27 days	Mon 2/6/23	Tue 3/14/23	0 days	14,16SS+10 days
18		Exterior Finishes	30 days	Thu 2/2/23	Wed 3/15/23	27 days	15
19		Interior Finishes	40 days	Mon 2/27/23	Fri 4/21/23	0 days	16,17SS+15 days
20		Finish MEP	12 days	Wed 3/15/23	Thu 3/30/23	16 days	17
21		Project Complete	0 days	Fri 4/21/23	Fri 4/21/23	0 days	18,19,20



PROCORE Project: Crown Hill National Cemetery

The construction project includes the development of land within Crown Hill Cemetery for the four branches of Military Services including the Army, Navy, Marines, and Airforce. Construction will consist of site development, Columbarium's, Support building, and Committal Shelter



PROCORE Project - Generate WBS

Published | Edit

Review the Crown Hill Cemetary project on PROCORE and generate a WBS for the project. Make sure you list out the Activities w/ durations.

Points 10
Submitting a file upload

Due	For	Available from	Until
Nov 10	Everyone	Nov 3 at 12am	Nov 11 at 11:59pm

PROCORE Project - Generate Schedule

Published | Edit

Review the WBS you created during the last Lab assignment and generate a schedule in M.S. Project. This project shall include the following:

- All the activities listed in your WBS
- Activity Durations
- Logic - all activities shall show successors and predecessors were applicable.
- All activities shall be Auto scheduled
- Show your critical path.

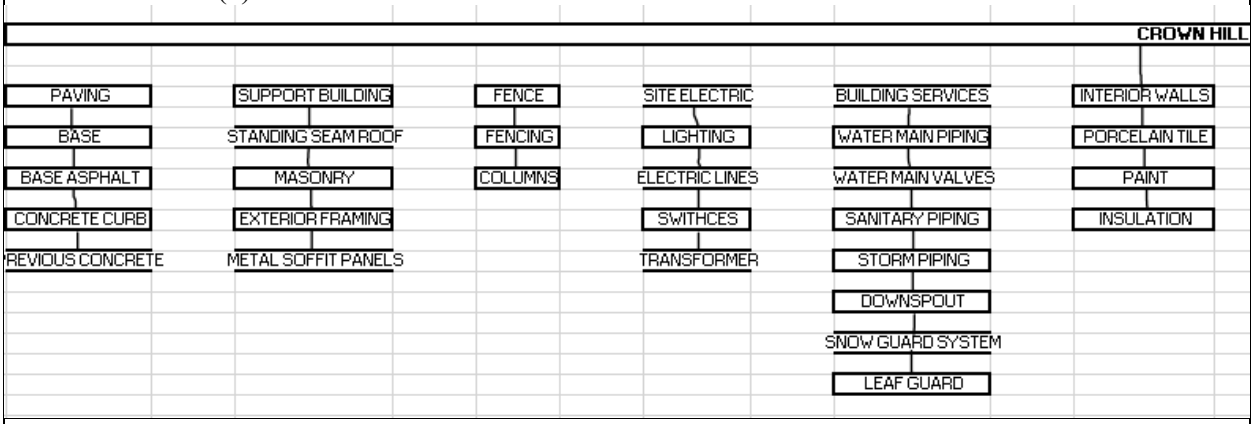
Points 10
Submitting a file upload

Due	For	Available from	Until
Dec 2	Everyone	Nov 20 at 12am	Dec 3 at 11:59pm

Student Submission

Generate WBS

Submission Part (1)



Submission Part (2)

Project WBS

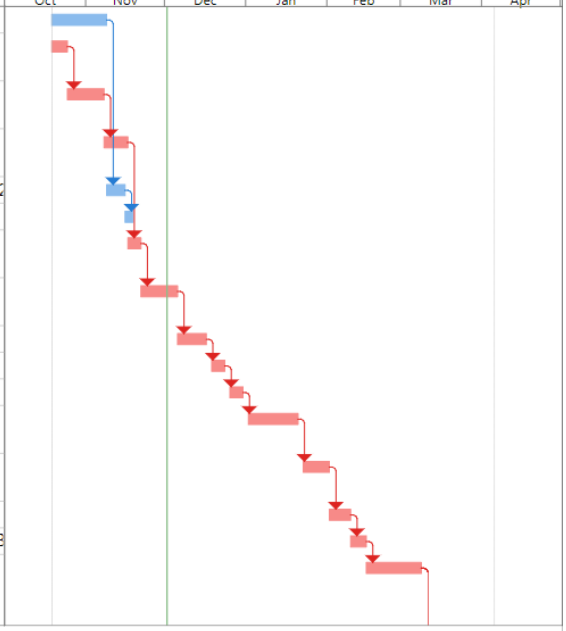
Site Work

1. Paving
    - Base
    - Base asphalt
    - Gutter
2. Pavement
    - Pervious Concrete pavement
    - Concrete Pavement Section
    - Asphalt pavement section
3. Support Building
    - Standing seam roof
    - Masonry
    - Exterior framing
    - Porch
    - Storage
    - Men's restroom
    - Women's restroom
    - Administrative
4. Curbs
    - Flush curb
    - Reverse gutter pan
    - Mountable curb
    - Concrete curb
    - PCC curbs
    - Vertical curb
    - Barrier curb
    - Flush curb
5. Joints
    - PCC joints
    - Expansion joint
    - Contraction joint
    - Grooved joint

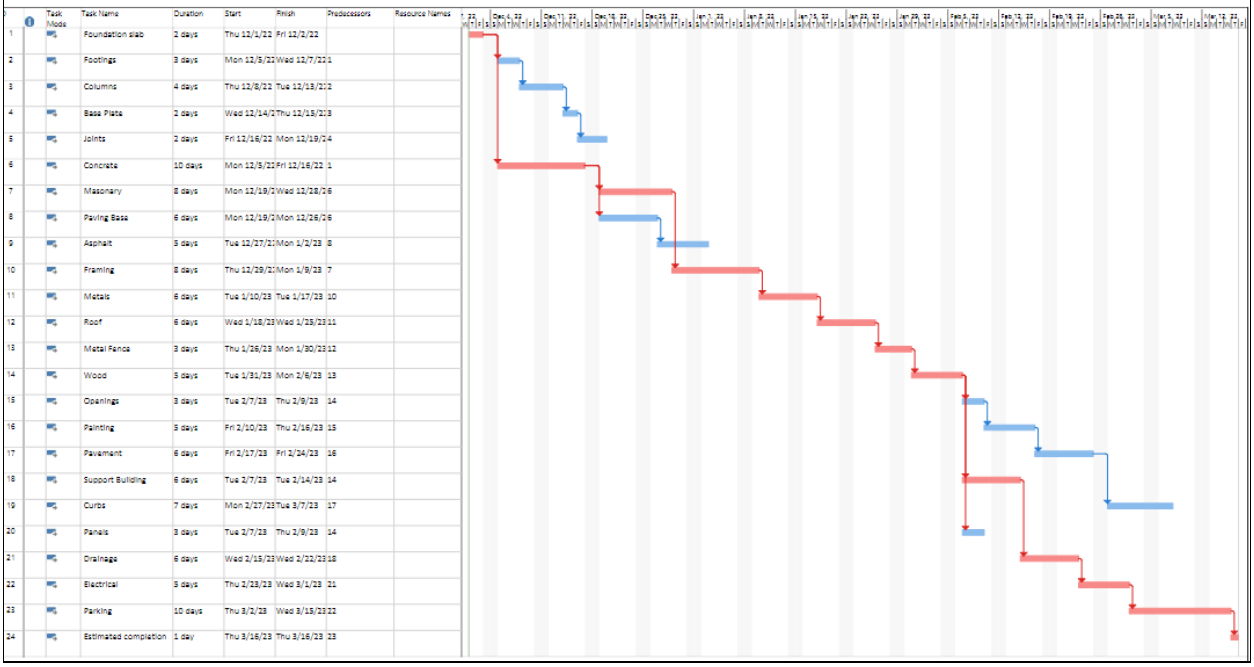
PROCORE Generate Schedule

1st Sbmission

ID	Task Mode	Task Name	Duration	Start	Finish
1		Civil Site Plan	15 days	Wed 10/19/2	Tue 11/8/22
2		Storm Drain Profile Statining Plan	4 days	Wed 10/19/22	Mon 10/24/22
5		Civil Details Grading and Drainage	10 days	Tue 10/25/22	Mon 11/7/22
6		Civil Details Sanitary Sewer and Misc Utility	7 days	Tue 11/8/22	Wed 11/16/22
3		Civil Details Paving	5 days	Wed 11/9/22	Tue 11/15/22
4		Civil Detail Site	3 days	Wed 11/16/2	Fri 11/18/22
7		Overall Civil Utility Plan	3 days	Thu 11/17/22	Mon 11/21/22
8		Civil Utility Profile Sanitary Sewer	10 days	Tue 11/22/22	Mon 12/5/22
9		Enlarged Site Plan	9 days	Tue 12/6/22	Fri 12/16/22
10		Foundation Plan	5 days	Mon 12/19/2	Fri 12/23/22
11		Framing Plans	5 days	Mon 12/26/2	Fri 12/30/22
12		Floor, Roof, Reflected Ceiling Plans	15 days	Mon 1/2/23	Fri 1/20/23
13		Interior Design Plan & Schedules	8 days	Mon 1/23/23	Wed 2/1/23
14		Elevation	6 days	Thu 2/2/23	Thu 2/9/23
15		Air Barrier Plan	4 days	Fri 2/10/23	Wed 2/15/23
16		Shelter Floor, Ceiling Plan, Roof Plan, & Slab Plans	15 days	Thu 2/16/23	Wed 3/8/23



2nd Submission



Assessment Report for SLO 5

Courses: CMGT 32000 – Scheduling and Project Control

Academic Term for Direct Evaluation: Fall 2021, Fall 2022

Instructors: Brad Bastin

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 88% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Range
F 2021	5. Create a construction project schedules	4.0	80%
S 2022		4.16	83%
F 2022		4.24	85%

Direct Measures

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	18	Project Schedule in MS Project	94%	75%
		Garage WBS	89%	75%
		Garage MS Project with Updates	86.3%	75%
Fall 2022	15	Lab #1 – Creating a Schedule	77%	75%
		PROCORE Generate a WBS	64%	75%
		PROCORE Generate a Schedule	80%	75%

The target for the overall average of the total grades should be at least 75%. The Indirect Measure was 83% and the Direct Measure was 82%. Based on the perception of graduating seniors (Indirect Measure), they felt confident in creating project schedules. The Direct Measure has been improved since the initial accreditation. Direct measures met the target value (75%) except Procore Generate a WBS assignment during Fall 2022. The instructor will revise the WBS assignment to improve the student performance for the next semesters.

Proposed Actions for Course Improvement:

The complete Faculty Course Assessment Report for CMGT 32000 is included in the appendix for the Quality Improvement Plan. The following proposed actions relate specifically to SLO 5 - Create Construction Project Schedules.

Software Program
The course uses MS project as the main scheduling software program, but the instructor plans to add Primavera 6 to meet the industry demand.

Canvas
The course materials and assessments are fully integrated into the Canvas modules.

Switching to In-person delivery
The course is currently available 100% web-based delivery option only due to the adjunct instructor's work schedule conflict. However, the instructor will resume to in-person delivery option as the schedule becomes available.

Student Learning Outcome 6

Analyze Professional Decisions Based on Ethical Principles

Introduction

CMGT 11000 - Introduction to Construction Technology introduces students to the technical aspects of reading and understanding constructions documents for the built environment. Topics include but are not limited to building code standards, drafted drawing standards, drawing scales, coordination of both vertical and horizontal drawings, CSI MasterFormat, basic drawing management, and the fundamentals of project management as it is presented within the CM program. The course develops an understanding of residential and commercial construction by interpreting working drawings. Laboratory time will introduce the student to computer aided drafting software (Revit and Navisworks) as well as hands-on construction document reading and scaling. No previous computer knowledge is necessary.

The course will also introduce the first-year student to four (4) different categories of the construction industry, specifically residential, commercial, industrial and civil / infrastructure. Each category will be presented as a career choice alternative.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

Ethics Assignment (additional information is included in the "Direct Assessment" section of this report)

SLO 6 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Course Syllabus
- Direct Assessment
  Explanation of the rubric (grading criteria)
  Graded student review questions and quiz (using the rubric)
- Faculty Course Assessment Report

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 5 (found at the end of this SLO report).

Direct Measures

The Direct Measures for SLO 6 are assignments that include:

1. In CMGT 11000, an entire lecture is dedicated construction ethics and includes case studies, a PowerPoint presentation and videos. The Direct Assessment consists of a homework assignment based on the materials presented in class and some on-line research.
2. The homework assignment included two parts: PART I - Ethics at School and in the Workplace which included several questions concerning unethical behavior and PART II - Ethics in Construction Ethics where students were required to watch five (5) on-line videos and provide responses to questions related to construction ethics, i.e., bid rigging, bid shopping, front-end loading, retainage, and courtesy bid.

Graded Student Work

The assignments are not "marked up" since these assignments are submitted and graded in Canvas. The course instructor completed the grading for each assignment using the grading criteria. The grading criteria and any instructor notes were sent to the students via the "Comment" section in Canvas using "SpeedGrader." An example of how it looks in Canvas has been provided. The "Comments" in Canvas do not reproduce well, which is why just the "graded" grading criteria is provided for the last three assignments.

The following pages show

1. the assignment
2. grading rubric
3. an example of the graded student work

Assignment

Introduction to Construction Management
CMGT 11000 SP22
Construction Ethics

March 2, 2022

Purpose
Ethics play a fundamental role in how we conduct ourselves towards our friends / family, classmates, instructors, work associates, and clients / customers. Separate from laws – which tend to be clear-cut -- ethics deal with personal subjectivity and values. Still, they're critically important as they establish the baseline of what we interpret to be right and wrong. Besides for being relevant to us as humans and students, they also play a critical role in the construction industry where we can manage / control / manipulate immense amounts of information and cash.

The following questions require that you spend some time contemplating how your understanding of ethics affects your behavior. The first section, "Personal Ethics" relate to you personally and are best answered after some serious thought. Your answers are your carefully considered opinions. The second section, "Construction Terms" require both research and your opinion.

Directions
1. Create an MS Word document and answer the following questions as directed.
2. Number your answers to correspond with the questions.
3. *Cutting and pasting content is strictly prohibited.*
4. Be sure to include
    a. Your name
    b. The name of the assignment
    c. The class
    d. The date

Deliverables
PDF document uploaded into the Canvas / Assignment.

Grading
Evaluation will be based on the apparent effort and amount of consideration given to each question. Refer to the rubric available within the Canvas assignment for more information.

Due Date
Refer to Canvas / Assignments.

Introduction to Construction Management
CMGT 11000 SP22
Construction Ethics

Personal Ethics

1) After reviewing *"Did You Bring Your Ethics to Work Today?"* (link found in the Canvas assignment) document…

    a. Have you ever done any of the ethical issues described in the Workplace Ethics Quiz, whether at work, or school, or at home?
    b. Did you learn anything about yourself concerning ethical behavior? Please explain.

2) After contemplating Question 1, what might you do differently in the future?

3) Concerning the Capstone example as presented in the lecture…

    a. if you were a group member of the student who distributed the material, what would you do? Note: this Powerpoint is available for review within Top Hat.
    b. If you were a member of the Capstone class (and not a member of that students' group), what would you do?
    c. If the course instructors became aware of this issue, what should they do?

4) Research this: What are the IUPUI policies and procedures that should be followed, by both students and course instructors concerning an incident of this nature?

Construction Terms

Each of the following terms relate to the construction industry. Do the following:

a) Define the term. Note: these definitions require research; they require factual content and ARE NOT your opinion.
b) Determine if it is ethical or unethical. What does the industry say about this? What do you think? Explain your thinking.

5) Bid Rigging

6) Bid Shopping

7) Front-End Loading

8) Retainage

9) Courtesy Bid

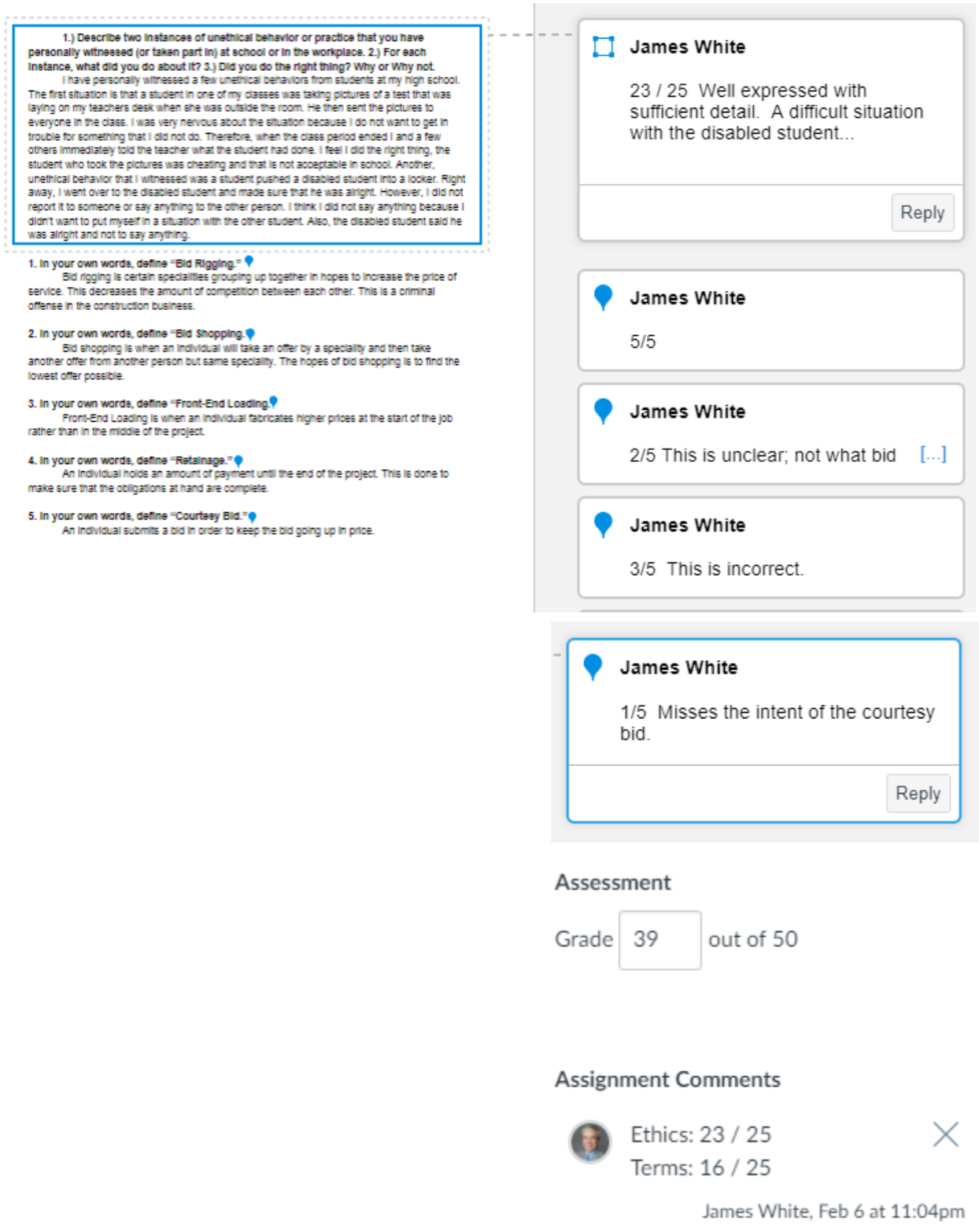
Grading Rubric

Ethics

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings					Pts
Part 1 Essay Questions	**25 pts** **A** Well considered, thoughtful response.	**20 pts** **B** Covers all of the main points.	**17 pts** **C** Marginal response, technically answers the question but displays little thoughtful consideration.	**15 pts** **D** Poor response, with little evidence of thoughtful consideration. Short, incomplete.	**0 pts** **No Marks**	25 pts
Part 2 Terms	**20 pts** **Full Marks**	**20 pts** **Terms** Each question is worth 5 points x 5 questions = 25 points. 5: full accurate response; 4: technically correct but slightly inaccurate; 3: short answer with little elaboration; 2: mostly incorrect response; 1: incorrect response; 0: no response.			**0 pts** **No Marks**	20 pts
Presentation Submitted content is professional in appearance and presentation including controlled margins, consistent spacing, consistent font size and style. Grammar including no misspellings, no missing words, no unclear or incomplete thought.	**5 pts** **Full Marks**			**0 pts** **No Marks**		5 pts
						Total Points: 50

Graded Student Work



1.) Describe two instances of unethical behavior or practice that you have personally witnessed (or taken part in) at school or in the workplace. 2.) For each instance, what did you do about it? 3.) Did you do the right thing? Why or Why not.

I have personally witnessed a few unethical behaviors from students at my high school. The first situation is that a student in one of my classes was taking pictures of a test that was laying on my teachers desk when she was outside the room. He then sent the pictures to everyone in the class. I was very nervous about the situation because I do not want to get in trouble for something that I did not do. Therefore, when the class period ended I and a few others immediately told the teacher what the student had done. I feel I did the right thing, the student who took the pictures was cheating and that is not acceptable in school. Another, unethical behavior that I witnessed was a student pushed a disabled student into a locker. Right away, I went over to the disabled student and made sure that he was alright. However, I did not report it to someone or say anything to the other person. I think I did not say anything because I didn't want to put myself in a situation with the other student. Also, the disabled student said he was alright and not to say anything.

1. In your own words, define "Bid Rigging."

Bid rigging is certain specialities grouping up together in hopes to increase the price of service. This decreases the amount of competition between each other. This is a criminal offense in the construction business.

2. In your own words, define "Bid Shopping."

Bid shopping is when an individual will take an offer by a speciality and then take another offer from another person but same speciality. The hopes of bid shopping is to find the lowest offer possible.

3. In your own words, define "Front-End Loading."

Front-End Loading is when an individual fabricates higher prices at the start of the job rather than in the middle of the project.

4. In your own words, define "Retainage."

An individual holds an amount of payment until the end of the project. This is done to make sure that the obligations at hand are complete.

5. In your own words, define "Courtesy Bid."

An individual submits a bid in order to keep the bid going up in price.

James White

23 / 25 Well expressed with sufficient detail. A difficult situation with the disabled student...

Reply

James White

5/5

James White

2/5 This is unclear; not what bid [...]

James White

3/5 This is incorrect.

James White

1/5 Misses the intent of the courtesy bid.

Reply

Assessment

Grade 39 out of 50

Assignment Comments

Ethics: 23 / 25
Terms: 16 / 25

James White, Feb 6 at 11:04pm

Assessment Report for SLO 6

Course: CMGT 11000 – Introduction to Construction Management

Academic Term for Evaluation: Fall 2021, Spring 2022, Fall 2022

Instructor: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 6 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). **An 88.5% ranking was achieved for this SLO**.

Term	ACCE SLO	Raw Score (1-5)	Percent
Fall 2021	6. Analyze Professional Decisions Based on Ethical Principles	4.5	90%
Spring 2022		4.36	87%
Fall 2022		4.59	92%

Direct Measures

The Direct Measures consists of one assignment. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	30 / 33*	Score on Ethics assignment	81.53%	75%
Spring 2022	17 / 18*	Score on Ethics assignment	84.94%	75%
Fall 2022	24 / 29	Score on Ethics Assignment	77.83%	75%

*Submitted assignment / total class enrollment at the time of the assignment

The assignment continues to evolve every semester as new case studies are introduced. As a follow-up, personal and construction – related ethical dilemmas are now presented in subsequent lectures where students are asked to respond via Top Hat questions. The purpose is to have students see how their peers respond to a given ethical situation and appreciate where their personal ethical boundaries compare to the class as a whole.

Proposed Actions for Course Improvement

The target percent was exceeded for both semesters. Because the average percentage exceeded the target percentage for both semesters, no modification to this assignment appeared warranted. All submitted work is scanned through Turn-It-In.com to ensure plagiarism is held to a minimum. Additionally, it should be noted that this assignment indicator has been recorded every semester since spring 2018. The overall linear trend possesses a slightly positive slope with the lowest recorded average occurring in fall 2020 at 75.62% and the highest average in spring 2022 at 85%.

Student Learning Outcome 7

Analyze Construction Documents for Planning and Management of Construction Processes

Introduction

SLO 7 – "Analyze construction documents for planning and management of construction processes" is evaluated and assessed in CMGT 33000 - Contract Administration & Specifications.

Assessment Methods (additional information in the Direct Assessment section of this report)

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

1. Specifications homework assignment
2. Semester project overall score
3. Semester project Executive Summary score

SLO 7 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  - Explanation and rubrics (grading criteria)
  - Graded student work (using the rubric)
- Assessment and Evaluation for SLO 7

Indirect Measure

The Indirect Measure for SLO 7 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented below and explained in the Assessment and Evaluation for SLO 7 (found at the end of this SLO report).

Direct Measures

The Direct Measures for SLO 7 are assignments that include:

1. Regarding the specifications, a homework assignment requires each student to research a randomly assigned specification section (SpecSearch). This assignment requires the student to rigorously scrutinize their assigned specification section.
2. The students are assigned a semester project which requires extensive interaction with standard construction documents such as the owner-contractor agreement, the general conditions, and the specifications. The overall score is a good indicator of how well the student was able to interact with these documents while managing them within the construction management software.
3. Additionally, within this project one specific requirement engages the student by reviewing all the documentation, determining the overall status of the project and then summarizing their findings in a written "executive" summary.

Graded Student Work

The course instructor completed the grading for each assignment using the grading criteria. The grading criteria and any instructor notes were sent to the students via

1. Markups directly on the submitted work within the Canvas / Assignment / SpeedGrader feedback function. (specification assignment)
2. A project evaluation sheet that is uploaded into the "Comments" portion of the Canvas grading (project-based assignments).

Note:
For the specification assignment the following pages show the original assignment, the grading criteria/rubric and an example of student work for each assignment.

For the project assignment the following pages show the original assignment, the grade evaluation sheet and the grading rubric (contained within the assignment). Due to the length of the student submissions (typically >50 pages), an example of a submission has not been included in this document; instead, a link has been provided.

1. Homework Assignment & Rubric: Specification Research "SpecSearch" (Spring 2022)

CMGT 33000 SpecSearch – Home Edition

CMGT 33000 Contract Administration & Specifications

Construction Management
Purdue School of Engineering & Technology
Indianapolis

Bill White, Instructor

Goal
Become more familiar with construction specifications and critical AIA documents by researching within the documents.

Instructions
1. Select a specification section from the envelope and record it.
2. Write your name on the slip and return it to the instructor.
3. Referencing the specification section you randomly received in class, answer the following questions within the spaces allotted on the form.
4. Refer to the specification "Indy South MOB Vol. 1 of 2" or "Indy South MOB Vol. 2 of 2" as found in Canvas / Resources.
5. Every specification is different so not all the questions may apply to your section. Where it doesn't apply, indicate "N/A".
6. Your response must
    a. Properly identify where you find your answer by noting its complete part, paragraph and section numbers.
    b. Include written text to answer the question.
    c. *Use your own words – do not cut and paste.*

Deliverables
1. Electronic submission of the Answer Forms which follow via Canvas / Assignments. *Print only the answer forms.*
2. PDF file format only
3. One (1) file only

Due
Refer to Canvas / Assignments.

Rubric

Item	*Point value*
Adherence to instructions	5
Appearance	5
Consistent font, margins, layout, line spacing	
Answer accuracy and detail	50
Assignments:	60 Total

Question & Answer Form		
	Your Name:	
	Specification Section:	
	Part & Paragraph #	***Specification Written Answers***
1.		What other products / sections within the project manual must your section coordinate with?
2.		Identify one example of a reference standard specification.
3.		What submittals are required?
4.		What environmental issues must be considered when installing / storing your product?
5.		What kind of experience / certification / capability must the installer have?
6.		Identify an installation requirement that could be verified on-site by visual inspection via measurement OR identify a tolerance criteria.

Question & Answer Form		
	Your Name:	
	Specification Section:	
7.		Provide an example of an installation instruction.
8.		How much extra stock is required?
9.		What product(s) / work is included in this specification section?
10.		Identify five (5) referenced standards developing organizations by their acronyms that are found within your specification section (e.g., ASTM). Identify what the abbreviation stands for and a one sentence summary description of the organization, i.e., what does it ~~do?~~, what industry(~~as~~) does it serve?

1. Homework Student Work:
Specification Research "SpecSearch" (Spring 2022)

CMGT 33000 SpecSearch – Home Edition

CMGT 33000 Contract Administration & Specifications

Construction Management
Purdue School of Engineering & Technology
Indianapolis

Bill White, Instructor

Goal
Become more familiar with construction specifications and critical AIA documents by researching within the documents.

Instructions

1. Select a specification section from the envelope and record it.
2. Write your name on the slip and return it to the instructor.
3. Referencing the specification section you randomly received in class, answer the following questions within the spaces allotted on the form.
4. Refer to the specification "Indy South MOB Vol. 1 of 2" or "Indy South MOB Vol. 2 of 2" as found in Canvas / Resources.
5. Every specification is different so not all the questions may apply to your section. Where it doesn't apply, indicate "N/A".
6. Your response must
   a. Properly identify where you find your answer by noting its complete part, paragraph and section numbers.
   b. Include written text to answer the question.
   c. *Use your own words – do not cut and paste.*

Deliverables

1. Electronic submission of the Answer Forms which follow via Canvas / Assignments. *Print only the answer forms.*
2. PDF file format only
3. One (1) file only

Due
Refer to Canvas / Assignments.

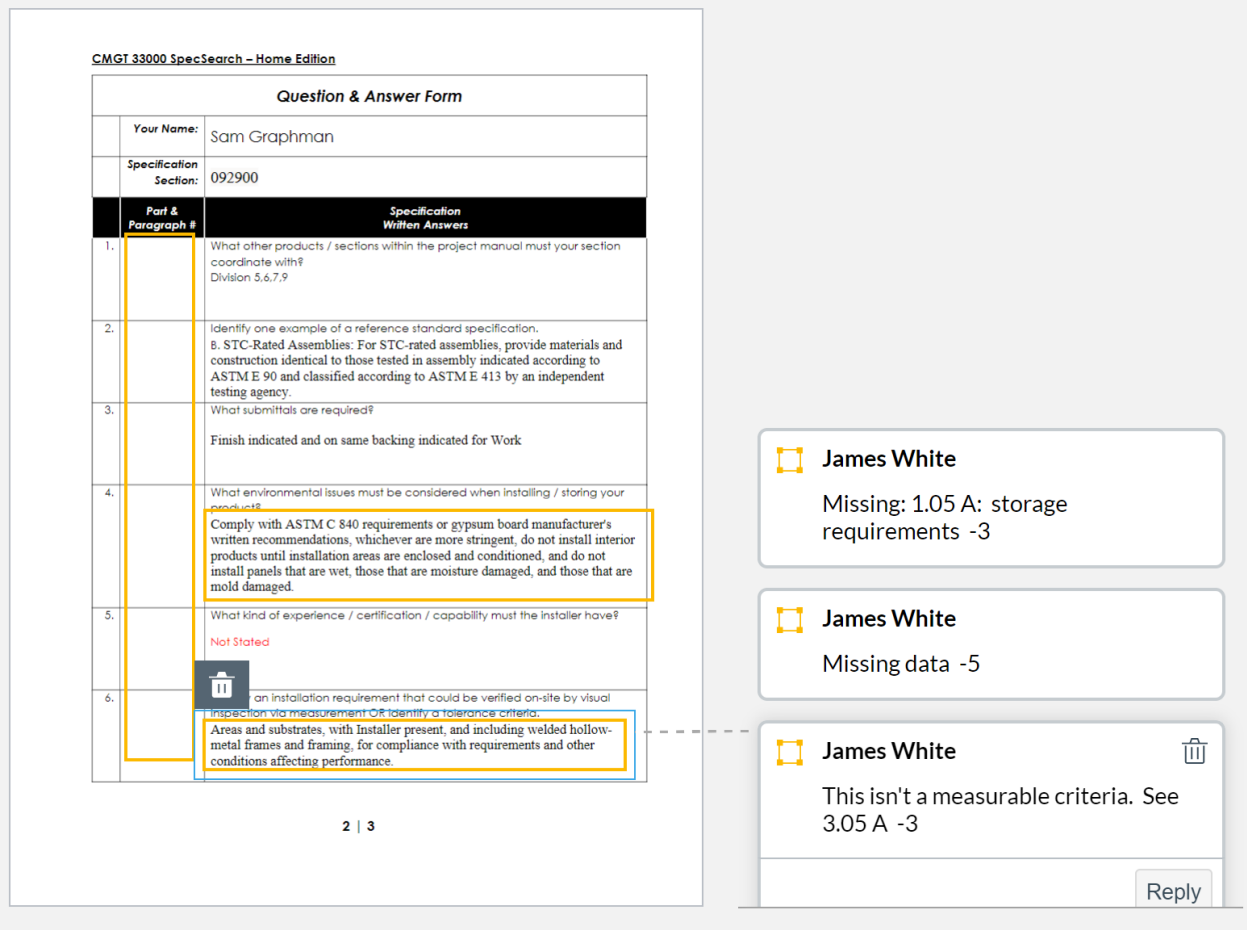
Rubric

Item	*Point value*
Adherence to instructions	5
Appearance	5
Consistent font, margins, layout, line spacing	
Answer accuracy and detail	50
Assignments:	60 Total

1 | 3

James White

Missing data



CMGT 33000 SpecSearch – Home Edition

Question & Answer Form

Your Name:	Sam Graphman
Specification Section:	092900

	Part & Paragraph #	Specification Written Answers
1.		What other products / sections within the project manual must your section coordinate with? Division 5,6,7,9
2.		Identify one example of a reference standard specification. B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
3.		What submittals are required? Finish indicated and on same backing indicated for Work
4.		What environmental issues must be considered when installing / storing your product? Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent, do not install interior products until installation areas are enclosed and conditioned, and do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
5.		What kind of experience / certification / capability must the installer have? Not Stated
6.		an installation requirement that could be verified on-site by visual inspection via measurement OR identify a tolerance criteria. Areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

2 | 3

James White

Missing: 1.05 A: storage requirements -3

James White

Missing data -5

James White

This isn't a measurable criteria. See 3.05 A -3

Reply

CMGT 33000 SpecSearch – Home Edition

Question & Answer Form		
	Your Name:	Sam Graphman
	Specification Section:	092900
7.		Provide an example of an installation instruction. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling
8.		How much extra stock is required? Not Stated
9.		What product(s) / work is included in this specification section? Type X: 1. Thickness: 5/8 inch (15.9 mm). 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling. C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces. 1. Core: 5/8 inch (15.9 mm), Type X. 2. Long Edges: Tapered.
10.		Identify five (5) referenced standards developing organizations by their acronyms that are found within your specification section (e.g., ASTM). Identify what the abbreviation stands for and a one sentence summary description of the organization, i.e., what does it do?, what industry(ies) does it serve? STC- Sound Transmission Class. They average how much sound is stopped by something

3 | 3

James White

Missing ASTM & ANSI -4

2. & 3. Homework Assignment & Rubric: Semester Project (Spring 2022)

CMGT 33000 Contract Administration & Specifications
Semester Project
Spring 2022

Construction Management
Purdue School of Engineering & Technology
Indianapolis

March 7, 2022

Purpose / Assignment Goals
A fundamental component of construction management is learning how to work / administer the myriad of details and activities that comprise a project. Because good management is dependent on thorough administration, understanding processes, retrieving information, and implementing standard procedures all contribute to a successfully managed project.

This assignment is intended to provide the student with experience utilizing project management software to set up and administer a small construction project. It affords an opportunity to interpret contracts, comprehend specifications, manipulate content, generate reports and Implement documentation. After being introduced to all these skills in our lectures and weekly labs, this project allows the student to independently apply everything that has been learned throughout the semester.

Premise
In your continuing role as project manager at IUPUI Construction you have received a new project in your portfolio: **Engineering Technology Office Suite Remodel.** The CEO of IUPUI Construction has requested a report which fully documents the project to date. He has posed questions that need to be answered. Except for the Executive Summary, he expects every answer to utilize Procore documentation.

Methodology
This assignment requires that you create and administer a new project within Procore. To set it up, you must retrieve and utilize the information contained within the documentation typically encountered in an actual project (see Resources).

This project utilizes the skills we have either already practiced in lab or we will soon practice in upcoming labs. Note: Not all questions can be answered immediately. Throughout the remainder of the semester additional information will be issued via supplemental assignments to answer some questions utilizing skills we have yet to learn.

CMGT 33000 Contract Administration & Specifications
Semester Project
Spring 2022

Questions from the CEO

1. What is your assessment (executive summary) of the current project?

   This is your written narrative that references the content listed below. It is NOT a Procore feature. Produce this in MS Word, print as PDF & include with your submitted documentation.

   Topics to include (but not be limited to):
   a. Important project events: What has happened to date, e.g., milestones achieved, critical problems resolved, etc.?
   b. Budget: status of the budget.
   c. Schedule: status of the schedule.
   d. Recommendations: proposed corrections, revisions, etc.
   e. *Note: This is NOT a review of the course or this assignment.*

2. For questions 2 – 15, refer to *Figure 1 Question Point Values.* **All these questions must be answered using only Procore documentation.**

Resources

Following are the resources you have at your disposal:

1. Semester Project Shared Folder FA20 (Canvas assignment link)
   a. AIA A101 – Owner / Contractor Agreement
   b. AIA A201 – General Conditions
   c. Construction schedule
   d. Estimate Summary
   e. Indy South MOB specifications
2. Procore software
3. Previous lab exercises

Deliverables

One multipage PDF file submitted via Canvas / Assignments which contains the following information:

1. Cover sheet
   a. Course title
   b. Term
   c. Your name
   d. Your company name
   e. Project title
2. Copy of this assignment (this document).
3. Executive Report
4. Question Content – Each question inserted as a divider, followed by your answer.

CMGT 33000 Contract Administration & Specifications
Semester Project
Spring 2022

Grading Rubric

1. Criteria
    a. Completeness – all required components that answer each question in its entirety.
    b. Accuracy & detail – forms fully executed including dates, addresses, ID numbers, information, etc.
    c. Professional execution – neat, consistent and well organized
2. Point deductions include but are not limited to:
    a. Blank / missing form entries
    b. Incorrect documentation
    c. Incorrect / missing data presented on the documentation
    d. Inclusion of extraneous or unnecessary information
3. This qualifies as an Assignment: 200 points total.
4. Refer to Figure 1 for the grading values for each component.

Due

Refer to Canvas / Assignments / Semester Project.

Question Point Values		
	Content	***Points Possible***
	Cover + Assignment + Dividers	10
1	What is your assessment (executive summary) of the current project?	25
Procore Documentation		
2	Who makes up the project team?	5
3	What does our contract with the Owner require?	5
4	What does the project budget detail look like as of today, including any internal modifications, all	20
5	What are our total commitments for this project (listed by company & amount)?	10
6	What did our competitive bid process look like?	10
7	What are the submittal requirements, including required documentation & on-site date detail for Division 9?	20
8	What applications for payment have been issued so far (full detail)?	20
9	What RFI's have been issued so far (questions and answers)?	10
10	What changes have been issued so far (full detail)?	20
11	What items have we sent outside the office (what, when & where)?	10
12	What topics are we addressing with our daily reports?	10
13	What is the schedule for the project?	10
14	What are the sections that comprise the specifications?	5
15	What did you discuss at your most recent meeting?	10
		200

Figure 1. Questions Point Values

2. & 3. Homework Student Work: Semester Project (Spring 2022)

Refer to the following link:

https://indiana-my.sharepoint.com/:b:/g/personal/wilwhite_iu_edu/EQ8aTvDJ3eBDsTolH6VgM9sB9HR8_KE3ePyvoI83CGvf0A?e=xIwa8H

CMGT 33000 SP22
Contract Administration and Specifications
Semester Project Evaluation Sheet

Question Point Values			Assessment Values	
Question	Content	Points Possible	Points Awarded	Comments
	Cover + Assignment + Dividers	10	8	Cover, dividers, missing assignment
1	What is your assessment (executive summary) of the current project?	25	19	419 words. Summarized project. No mention of budget modifications, schedule / pay app conflict and schedule / submittal requirement.
2	Who makes up the project team?	5	5	14
3	What does our contract with the Owner require?	5	1	Incorrect form; not Procore document.
4	What does the project budget detail look like as of today?	20	17	Misallocated cost code.
5	What are our total commitments for this project (listed by company & amount)?	10	10	Commitments form
6	What did our competitive bid process look like?	10	10	
7	What are the submittal requirements, including required documentation & on-site date detail for Division 9?	20	12	Missing: on-site dates for many materials, extra materials, submittal descriptions, submittal packages
8	What applications for payment have been issued so far (full detail)?	20	17	Pay app #3: CO captured but incorrect amount.
9	What RFI's have been issued so far (questions and answers)?	10	10	
10	What changes have been issued so far (full detail)?	20	17	Incorrect amount; missing OH & P.
11	What items have we sent outside the office (what, when & where)?	10	6	Missing individual transmittals
12	What topics are we addressing with our daily reports?	10	10	
13	What is the schedule for the project?	10	10	List instead of bar graph
14	What are the sections that comprise the specifications?	5	5	
15	What did you discuss at your most recent meeting?	10	8	Some uncategorized items
		200	165 83%	Notes:

1 | 1
5/1/2022

Assessment Report for SLO 7

Courses: CMGT 33000 – Construction Administration and Specifications

Academic Term for Evaluation: Fall 2020, Spring 2022

Instructors: Bill White

Evaluation of Assessment Data

Indirect Measure

The Indirect Measure for SLO 7 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey).

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	7. Analyze Construction Documents for Planning and Management of Construction Processes.	4.125	83%
S 2022		4.56	91%

Direct Measures - Assessments and Evaluations

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2020	11	SpecSearch	89.39%	75%
		Project Overall	78.00%	75%
		Executive Summary	68.36%	75%
Spring 2022	17	SpecSearch	87.41%	75%
		Project Overall	82.62%	75%
		Executive Summary	71.29%	75%

Since both the SpecSearch and Project Overall scores exceed the target score of 75%, no remedial action appears warranted. Indeed, the scores on these assignments have been tracked since fall 2017 and the linear trend line has a nearly flat to slightly positive slope, indicating that student comprehension and execution is either in line with expectations or slightly improving.

The Executive Summary continues to perform below expectations. This particular aspect of the semester project requires the student to review all of the data generated by the required content and derive conclusions. The data doesn't at first appear related but upon further thought, correlations can be made. For example the student can surmise that, based on the pay application amounts for a given month, the project must be behind schedule as the contractor is being paid for 65% work complete in one month when the project schedule indicates the same contractor should by 100% complete in the

same month. Also, submittals are clearly behind schedule which would have an adverse impact on the project schedule.

Proposed Actions for Course Improvement

The Executive Summary requires additional lecture time / in-class exercises to assist the student. Since fall 2020, additional time has been spent on internally manipulating the project budget, however instruction needs to address how project progress can be evaluated using the project management tools the course covers. While it should be noted that since fall 2020, the score has been on a positive trend (increasing from 68.36% to 71.39%) more work needs to be done.

Student Learning Outcome 8

Analyze Methods, Materials, and Equipment Used to Construct Projects

Introduction

CMGT 41000 – Equipment and Field Operations. The course covers the construction methods and materials using various types of heavy equipment, application of specific types of equipment, and analysis of field operations including equipment productivity and costs. Construction methods and applications include trenching, hauling, dozing, paving, and lifting. The course subjects include effective equipment operations for various construction materials including aggregates, soils, asphalt, and concrete.

Student Learning Outcome 8 – Analyze methods, Materials, and Equipment Used to Construct a Project is assessed and evaluated in CMGT 410000 – Equipment and Field Operation, as indicated in the ACCE SLO Matrix.

The syllabus for CMGT 41000 - Equipment and Field Operations is included in Volume II: Appendix A - CM Course Syllabi.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 8, there are three assignments that are used as Direct Measures.

1. Class quiz
2. Homework
3. Exam

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 8 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
    - Graded Student Work
        - Quiz (graded example shown)
        - Homework (examples of homework shown)
        - Midterm Exam and Final Exam (graded midterm shown)
- Assessment Report for SLO 8

Indirect Measure

The Indirect Measure for SLO 8 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). The results are presented in the course assessment report (found at the end of this SLO report).

Quiz Chapter 2 (Student Example)

Wk 03 Quiz Results for [redacted]

ⓘ Correct answers are no longer available.

Score for this quiz: **20** out of 20
Submitted Sep 10, 2021 at 11:18am
This attempt took 7 minutes.

Question 1 2 / 2 pts

Which of the following statement is not correct?

- Earthwork needs a site visit for planning.
- Planning is important to understand the scope and issues
- Planning is required to ensure efficiency and safey.
- (•) Bid is already awarded, there is not much thing the contractor can do. Planning is not required.

Question 2 2 / 2 pts

While conducting an earthwork construction planning, what items shall be considered?

- Quantity and haul distance
- Grade
- Work hazards
- Contractural and legal constrtaints
- (•) All the above

Question 3 2 / 2 pts

Earthwork planning helps to decide the means and methods.

- (•) True
- False

Question 4 2 / 2 pts

_____ excavation is the removal of materials in a limited area in preparation for a structural element. what should be in the blank?

- Mass
- (•) Structural
- Control
- Station

Question 5 2 / 2 pts

The soil volume before excavation is called ____ cubic yard.

- (•) Bank
- Loose
- Compacted
- Machine rated

Question 6

2 / 2 pts

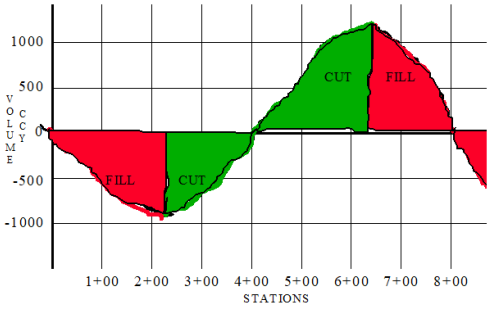
A mass curve requires to plot_____which is calculated using an earthwork volume calculation sheet.

- (●) Cumulative sum
- ( ) Adjusted fill/cut volume
- ( ) Stripping fill/cut volume
- ( ) End areas

Question 7

2 / 2 pts

As shown below figure, the mass curve line ends at -520 cy @ station 8+80. The endpoint is below the zero balancing line and descending. which of the following is correct?



- (●) Fill is descending slope
- ( ) Cut is descending slope
- ( ) Over all stations, there is more cut than fill.
- ( ) 520 cy needs to be hauled away from the stations shown above.

Question 8

2 / 2 pts

stripping volume represents_____.

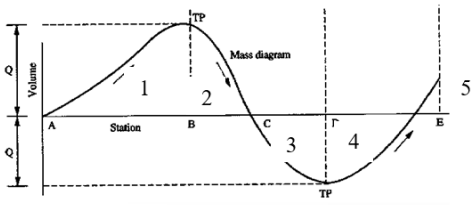
- ( ) Cut only for trial cutting operation
- (●) Removing top soils and stumps before the main earthmoving operation
- ( ) Fill only to flatten the site
- ( ) Only in cross haul

Question 9

2 / 2 pts

Identify cut and fill sections from the mass diagram.

a. 1 Fill ➔ 2 Cut ➔ 3 Fill ➔ 4 Cut ➔ 5 Fill
b. 1 Cut ➔ 2 Cut ➔ 3 Fill ➔ 4 Fill ➔ 5 Cut
c. 1 Cut ➔ 2 Fill ➔ 3 Fill ➔ 4 Cut ➔ 5 Cut
d. 1 Fill ➔ 2 Cut ➔ 3 Cut ➔ 4 Fill ➔ 5 Fill

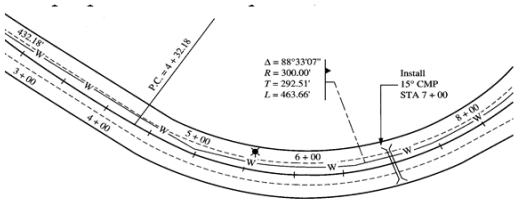


- a
- b
- c
- d

Question 10

2 / 2 pts

The drawing below is called what type of view? The view is looking down at the proposed work.



- Cross-section view
- Plan view
- Profile view
- Station view

CMGT 41000 – HW #2

1. Conditions:

Your company has just been awarded a large earthmoving contract that would be well suited for a Caterpillar 950H tire loader to load trucks with. A local rental yard said that they would supply you the loader for $55.00 per hour plus $4.70 sales tax, not including any operating costs.

To make a decision, you need to analyze what it would cost your company to purchase the loader instead of renting it. The purchase price, including sales tax and attachments, is $455,000. The project will last five years, and you are not sure that you will have work for the loader after this project; therefore, you need to plan on selling it at the end of 5 years for 30% of the purchase price ($455,000) as the salvage value.

According to the schedules that the project managers have put together, it appears that you will be able to get 1,500 hours of utilization per year on the loader during all five years, and they also anticipate 50 minute efficiency working hours.

According to the Chief Financial Officer of the company, your cost of money (interest rate for the Cost of Capital) is 6% per year, and the insurance on the loader will be 0.5% of the equipment's purchase price ($455,000) per year.

Your tire salesperson says that a set of four tires will cost $15,000.00, last 2,750 hours, and the average tire repairs will be about 15% of the tire purchase price.

The preventative maintenance schedule that your fleet is on has PM1 oil changes completed every 250 hours with oil, lube, and filter cost at $20.00 per gallon, the repair and maintenance cost is $6.00 per hour, and your throttle load factor for the loader is 60%.

The loader will be scraping the ground about 30% of the time with high wear ground engaging cutting edges that cost $850.00 per set and will last 300 hours performing this application before they wear out.

Net Flywheel Horse Power is 270 hp, and the fuel consumption rate is 0.035 gal/fwhp · hr. Engine crankcase capacity is 10 gallons and uses quantity consumed formula 2.12 on the textbook page 39. Off-road diesel fuel cost is $2.88 per gallon.

2. Problems:

1) What is the ownership cost per hour? (5 points)

2)	Purchase Price	3)	455,000
4)	Cost of tires	5)	15,000
6)	Service Life	7)	5 year
8)	Cost of Capital %	9)	6%
10)	Insurance Rate	11)	.5%
12)	Machine Hp	13)	270HP
14)	Throttle Load Factor	15)	60%
16)	Time Factor	17)	50 min
18)	Fuel Cost	19)	2.88

20) Oil & filter	21) 20
22) Crank Case Capacity	23) 10 Gallon
24) Hours between Oil changes	25) 250
26) Repairs & maintenance	27) $6
28) Lifetime of tires/tracks	29) 2750 hours
30) Tire repair factor	31) 15%
32) High wear item	33) $850
34) Operating life of high wear item	35) 300 hours
36) % of operating hours #1 application	37) 30%

455,000-15000=440,000
440,000*.30=$132,000 salvage amount
Service life = 5 years

Cost of Capital
440,000(6)+132000(4)/10
2640000+528000/10
AAI=316,800/year
316,000*.06/1500
Hourly Cost of Capital=$12.64

308,000/5*1500
308,000/7500
Hourly Depreciation = $41.07

455,000*.005=2275
2275/1500=1.517
Hourly Insurance=$1.52

Ownership Cost= $55.23

Operating Cost per Hour Calculation
Engine HP- 270
Engine- is 0.035 gal/fwhp
Cost of fuel= 2.88
throttle-.60
operating factor = 50/60=.83

.035*270*.6*.83=4.7061
4.7061*2.88=13.55/hr
Hourly fuel cost= 13.55

(270*.6*.83*.006/10)+(10gal/250)*20gal=.080676+.04
=.120676*20
Hourly Oil Cost=$2.41

1500*5=7500

7500/2750=3 sets
15000*3=45000/7500=$6
tire depreciation = $6/hr

7500*.30/300=7.5= 8 sets
8*850=6800/7500=.91z
High=$.91/hr

15000/2750=5.46
5.46*.15=.82
Tire repair cost= $.82/hr

Operating cost per hour $24.52

38) What is the operating cost per hour? (5 points)

$24.52 operating cost per hour

39) Assuming that the rental cost does not include the operating cost. What does it the actual cost of using the rental machine per hour? Include the tax for the rental ownership cost. (5 points)
24.52+55+4.70=$84.22

40) What does it actual cost to use the purchased machine per hour (ownership costs + operating costs)? (5 points)
24.52+55.23= $79.75

41) What is the most cost-effective option? Include proper rationale in your answer. (5 points)

Most cost-effective option is to buy the machine. This is because the cost of buying it hourly is $79.75 and the hourly cost to rent it is $84.22. Which is about $4.47 per hour. If we assume 1,500 work hours per year then this would be the equivalent of saving approximately $6,705 per year, $33,525 for a total of 5 years.

Grading

CEMT 330 Chapter 2 HW			
Criteria	**Ratings**		**Pts**
Calculation: ownership cost view longer description	5 to >0 pts Full Marks	0 pts No Marks	/ 5 pts
Calculation: operating cost view longer description	5 to >0 pts Full Marks	0 pts No Marks	/ 5 pts
Calculation: rental cost view longer description	5 to >0 pts Full Marks	0 pts No Marks	/ 5 pts
Calculation: purchase cost view longer description	5 to >0 pts Full Marks	0 pts No Marks	/ 5 pts
Determination: rental vs. purchasing view longer description	5 to >0 pts Full Marks	0 pts No Marks	/ 5 pts
			Total Points: 0

Cancel

Comments for this Attempt

P2: missing repair cost $6/hr.
check the numbering for the problems.

Dan Koo, Sep 11, 2021 at 5:56pm

Download Submission Comments

Midterm Exam (Student Example)

CMGT 41000 Fall 2021 Midterm Exam

Name [redacted] Points _____/300

1. What type of cost accumulates, although a machine is not in use? *(5 points)*
   a. Operating
   b. Ownership

2. This organization is responsible for administering the legislation and developing rules and regulations to implement safety in the construction industry. What is the name of this organization? *(5 points)*
   a. Construction Safety Administration
   b. The Williams – Steiger Commission
   c. Occupational Safety and Health Administration
   d. National Safety Council

3. After World War II and during the Interstate Highway Systems construction, what were the three most important developments in heavy equipment? *(5 points)*
   a. Cable systems, long conveyor systems, gas engines
   b. Hydraulic systems, rubber tires, steam power
   c. High strength steel, nylon tires, high output diesel engines
   d. Electric guidance systems, torque converter, synthetic oils

4. Which of the following is not the uniqueness of the construction industry's nature? *(5 points)*
   a. Every job is unique
   b. Large capital requirements
   c. Work is priced before the actual cost is known
   d. Labor legislation and safety regulations do hardly change and have minimum impact on the business

5. Which items are considered ownership costs? *(5 points)*
   a. Purchase Price, Fuel, Storage, Major Repairs
   b. Purchase Price, Tires, Insurance, Lube and Oil
   c. Fuel, Lube & Oil, Tires, Routine Repairs
   d. Insurance, Major Repairs, Property Taxes, Storage

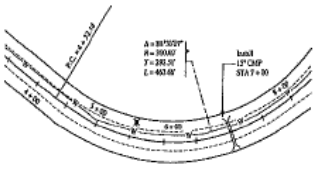
6. What is the distance in feet from station 110+50 to 365+54 *(5 points)*
   a. 25,504 ft
   b. 255 ft
   c. 47,604 ft

7. In 1919, who took a convoy across the United States to experience the condition of the nation's roads? *(5 points)*
   a. C. L. "Clessie" Cummins
   b. Dwight D. Eisenhower
   c. William S. Otis
   d. William Mulholland

8. High wear items are considered ownership costs because they substantially increase the useful life of the machine. *(5 points)*
   a. True
   b. False

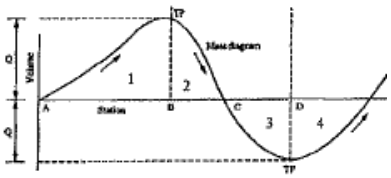
9. Rubber tires are typically considered as an operating cost throughout the life cycle of the equipment. *(5 points)*
   a. True
   b. False

10. The drawing below is called what type of view? The view is looking down at the proposed work. *(5 points)*
    a. Cross-sectional View
    b. Plan View
    c. Profile View
    d. Station View



11. What is another term for embankment? *(5 points)*
    a. Excavation
    b. Stripped material for earthen bank
    c. Fill

12. Identify cut and fill sections from the below mass diagram. *(6 points)*



   a. 1 Fill → 2 Cut → 3 Fill → 4 Cut → 5 Fill
   b. 1 Cut → 2 Cut → 3 Fill → 4 Fill → 5 Cut
   c. 1 Cut → 2 Fill → 3 Fill → 4 Cut → 5 Cut
   d. 1 Fill → 2 Cut → 3 Cut → 4 Fill → 5 Fill

13. The contracting environment has drastically changed from Historical Hard Bid to an Alternative Delivery process. Which is an Alternative Delivery process? Choose the best answer. *(5 points)*
   a. Design-Build
   b. Job Order Contracting
   c. CM@Risk
   d. All of the above
   e. None of the above

14. When earthwork volume is measured from the native location where it was excavated, it is referred to as *(5 points)*
   a. Loose cubic yard
   b. Bank cubic yards
   c. Compacted cubic yards
   d. Shrunk cubic yards

15. The efficiency factor is a percentage of an hour that the machine is utilized. If a machine works 40 minutes per hour, what is efficiency factor? *(5 points)*
   a. 1
   b. 0.8
   c. 0.75
   d. 0.67

16. Optimum moisture content (OMC) is when the water content in the soil is at the point which the greatest what can be achie *(5 points)*
   a. Plasticity (Highest)
   b. Volume (Max)
   c. Density (dry unit weight)
   d. Saturation (100%)

17. A laboratory compaction test that determines the moisture- dry density relationship in soils subject to compaction is called? *points)*
   a. Nuclear Gauge Test
   b. Sandcone Test
   c. Proctor Test

18. A mixed soil in the natural condition is composed gravimetrically as? Choose the best answer. *(5 points)*
   a. Volume of water, volume of air, volume of solids.
   b. Weight of water, weight of air, weight of solids.
   c. Volume of water and solids (dry soil) only, air has no volume.
   d. Weight of water and solids (dry soil) only, air has no weight.

19. The unit weight of a sample of soil is 81 lb/cf and the dried soil sample weight is 75 lb/cf. What is the percentage of water content? *(5 points)*
   a. 6.0%
   b. 7.4%
   c. 8.0%

20. Two of the three primary factors influencing soil density are compaction and moisture content. What is the third factor? *(5 points)*
   a. Backfilling temperature
   b. Amplitude air pressure
   c. Gradation of soil particles
   d. Shrinkage Factor of the bank to compacted

21. The machine shown right is called? *(5 points)* ➔

   a. Jumping Jack
   b. Pneumatic Tired roller
   c. Padded Single Drum Vibratory Compactor
   d. Impact Roller

22. A sheepsfoot roller is suitable for compacting sand, and its optimum depth of layer is 2 or 3 inches of a lift *(5 points)*
   a. True
   b. False

23. Vibratory plate compactors are best utilized for: *(5 points)*
   a. Compacting granular material in a confined space
   b. Compacting clay material to depths up to 35 feet.
   c. Finishing a mile horizontal length asphalt layer
   d. None of the above

24. Two factors that determine production rates of scrapers and trucks are:*(5 points)*
   a. Size of equipment and Cycle Time
   b. Payload and Cycle Time
   c. Payload and Speed
   d. Type of Equipment and Cycle Time

25. The three power measurements as described in the lectures and textbook are? *(5 points)*
   a. Horsepower, Available Power and Required Power
   b. Horsepower, Required Power and Usable Power
   c. Available Power, Required Power, and Usable Power
   d. Available Power, Rated Power, and Required Power

26. Usable power is defined as. : *(5 points)*
   a. Amount of power that can be transferred to the surface to propel a machine
   b. The power needed to overcome resisting forces and cause machine motion
   c. Power available at the drive-wheels (Drawbar) of a machine

27. Are gravimetric measurements often expressed in cubic yards (or cubic meters)? *(5 points)*
   a. True
   b. False

28. Required power is defined as:*(5 points)*
   a. The power is needed to overcome resisting forces and cause machine motion.
   b. The power provided by the power plant of the equipment
   c. The power can be transferred to the surface to propel the machine.
   d. None of the above

29. Which of the following is not correct? *(5 points)*
   a. Rimpull is a useful power for track (crawler) equipment.
   b. Tractive efficiency is a function of the weight on an equipment's drive axle and the surface on which is gripping.
   c. Poor traction may cause slippage on the surface.
   d. The coefficient of traction is the ratio between the maximum amount of pull a machine can exert before slippage and the total weight on the machine's drive wheels or tracks.

30. It is a function of the weight on an equipment's drive axles and the surface on which it is gripping. What is this called?: *(5 points)*
   a. Volumetric Capacity
   b. Rimpull
   c. Coefficient of Traction (Traction efficiency)
   d. Gravimetric Capacity

31. What factors are involved in the mechanism of rolling resistance? Choose the best answer *(5 points)*
    a. The friction of the mechanisms
    b. Tire flexing
    c. Shear through
    d. All of the above

32. The fatal injury rate for the construction industry is generally higher than the national average of all industries *(5 points)*
    a. True
    b. False

33. Which of the following is a proper safety tip for avoiding a caught-in accident? *(5 points)*
    a. Always wearing PPE while working on a job site.
    b. Standing within the swing radius of equipment is OK as long as maintaining eye contact.
    c. In an urban job site, a barricade for a crane operation is optional.
    d. All in the job site must stop working and not move while materials are moving overhead.

34. Select an appropriate heavy equipment operation practice to be safe. *(5 points)*
    a. When high wind is expected, a crane should not be operated or operate lower than the maximum allowable lifting lc
    b. The maximum loading capacity for an off-site dump truck can be applied to any conditions of the job site. The equipment manufacturers already take into account the performance handbook.
    c. Most heavy equipment has very small blind spots around the equipment.
    d. When existing underground utilities are well known to workers because of experience in nearby projects, a contract does not need to contact 811 to mark on the ground. It is just unnecessary.

35. When a trench or excavation was exposed to construction laborers, which of the following is the least appropriate practice? *(5 points)*
    a. Ladder and stairway or ramp should be installed
    b. Egress shall be within no more than 25 ft of travel for any laborers.
    c. The ladder shall not extend above the top of the excavation.
    d. Workers must not ride an excavator bucket to access or egress out of the trench.

36. Which of the following is not a typical reason for the crane accident? *(5 points)*
    a. During lifting operations, the crane gravity balance is not properly distributed.
    b. Ground for outriggers is not stable, and it causes settlement.
    c. Crane structural capacity is not sufficient to bear a load.
    d. Weather does not affect the stability of mobile cranes, but fixed cranes such as a tower crane.

37. A _____ contributes to how much companies pay each month in worker's compensation premiums. Which of the followin the most appropriate in the blank? *(5 points)*
    a. Experience Modification Rating (MOD rate)
    b. Capital cost rate
    c. Safety violation rate
    d. The bond rate in the current market

38. Before dig, the contractor must identify underground utilities. Which of the following is an incorrect match of color and type of utility?
    a. Red → Electric Power
    b. Yellow → Gas/Oil Production Lines
    c. Green → Sanitary Sewer
    d. Blue → Reclaimed Water

39. OHSA classifies soil types based on stability in a trench. Which is the most stable soil to have the highest slope angle *(5 points)*
    a. Type A
    b. Type B
    c. Type C

40. What is the name of this temporary structure? *(5 points)*
    a. Shielding (Trench box)
    b. Wooden panel mechanized shoring
    c. Benching support
    d. Temporary sidewall

Part II 100 points (Calculation: you must show your work for full credit)

Use this information for questions 41 – 44 (28 points)
This information will be used in the following four questions. You plan to purchase a scraper for $500,000. The tires for the machine cost $25,000 and you expect to keep the scraper for 5 years, after which you expect to sell it for $150,000. You anticipate you will use the scraper 1,500 hours per year and your company has a cost of capital of 10% and assuming no major overhauls. use the AAI method to calculate the following: **Show your work for full credit. If not, you only get half of the total points.**

41. What is the Average Annual Investment per year? *(7 points)*
    a. $320,000
    b. $345,000
    c. $375,000
    d. $420,000

$AAI = \frac{P(n+1)+S(n-1)}{2n}$

P = 500,000
Tires = 25,000
n = 5 years
1500 hrs/year
capital = 10%

Show your work here

42. What is the cost of capital per hour? *(7 points)*
    a. $20
    b. $21
    c. $22
    d. $23

345,000 per year / 1500 hr/yr = 230 · 10% = 23

Show your work here

43. What is the hourly cost of depreciation for this machine (except tires)? *(7 points)*
    a. $43.33
    b. $47.31
    c. $38.29
    d. $51.72

475,000 − 150,000 = 325,000 / 5 = 65000/1500 = 43.33

Show your work here

44. What is the total ownership cost per hour from the above conditions? *(7 points)*
    a. $63.33
    b. $68.31
    c. $74.72
    d. $66.33

43.33 + 23 = 66.33

Show your work here

45. You are performing a 5-mile roadway project and the earthwork specifications call for stripping the top 6 inches of soil off the project. Assuming a stripping width of 25 feet, how many cubic yards of stripping material will you have to remove for this project? *(7 points)*
    a. 36,666
    b. 12,222
    c. 25,555
    d. 146,666

5,280 · 5 = 26400 · 25 ft wide = 660,000 ft²

330,000 ft³ / 27 ft³/cy = 12,222.22

Show your work here

46. Complete the earthwork calculation worksheet included with your answer sheet. Divide CCY by 0.8 to convert to BCY. Round to the nearest integer. Because of time restrictions detailed calculations for every calculation are not necessary, but you are showing how you calculated each column might provide partial credit by allowing me to follow your work. *(14 points (one point per cell)).*

5

A	B	C	D	E	F	G	H	I	J	K	L
Station	End-Area Cut (sf)	End-Area Fill (sf)	Volume of cut (bcy)	Volume of fill (ccy)	Stripping cut (bcy)	Stripping fill (ccy)	Total cut (bcy)	Total fill (ccy)	Adjusted fill (bcy)	Algebraic sum (bcy)	Mass Ordinate
0+00	50	100	-	-	-	-	-	-	-	-	-
1+00	200	50	463	278	0	150	463 1)	417 2)	535 3)	4)	5)
1+50	500	50	1296	185	50	100	1246 6)	285 7)	356.25 8)	9)	10)

1) 463 bcy 463 - 0

2) 428 ccy 278 + 150

3) 535 bcy 428 / .8 =

4) -72 ~~ccy~~ bcy 463 - 535 =

5) _____ bcy

6) 1246 bcy 1296 - 50

7) 285 ccy 185 + 100

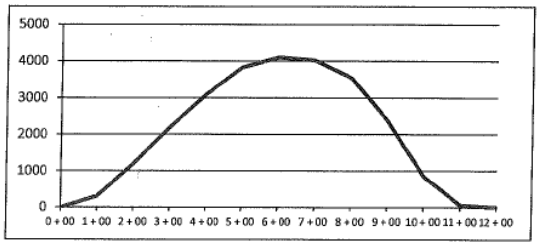
8) 356,25 bcy 285 / .8 =

9) 889.75 bcy 1246 - 356.25

10) _____ bcy

Use this information (Mass Diagram) for questions 47 – 48 (14 points)

47. What amount of material will be hauled longitudinally? *(7 points)*
    a. 1,521 bcy
    b. 4,108 bcy
    c. 5,404 bcy
    d. 2,010 bcy



48. What is the average haul distance in stations? **Area of material hauled from the mass diagram is approximately 2,540,000 sta-cy.** *(7 points)*
    a. 16+70 stations
    b. 6+18 stations
    c. 4+70 stations
    d. 0+99 stations

Use this information for questions 49 -- 54 (42 points)

You are constructing an embankment of 200,000 cubic yards of material with a required moisture content of 10% and a specified dry weight of 2500 lb/cy and is 3 miles long and placed in 6 inch lifts. The material in its bank state has a 5% water content and a dry unit weight of 2000 lb/cy.

At the fill you are using tamping foot rollers to compact the material with an 84" roller, and making 4 passes at an average of 4 mile per hour. Use this information to answer the following questions. Your company calculates production based on a 45 minute hour. Some equations are provided for your information.

49. How many gallons of water are required to complete the embankment? Must show work for credit.*(7 points)*

    a. 2,400,960 gallons
    b. 2,701,080 gallons
    c. 3,001,200 gallons
    d. 3,376,351 gallons

Show your work here

$$Water_{gal} = \frac{water\ required\ in\ lbs}{8.33 lb/gal}$$

	Borrow	Embankment
Y		
γ_d	2000	2500
w	5%	10%
γ_m	250,000	200,000

$2000 \times .5 = 1000 \cdot 200{,}000 = 200{,}000{,}000$

$\frac{250{,}000{,}000}{8.33} = 2{,}400{,}960$

$V_1 = \frac{\gamma_{d_2} \cdot V_2}{\gamma_{d_1}} = \frac{2500 \cdot 200{,}000}{2000}$

50. How many bank cubic yards will be required to complete this embankment? Must show work for credit.*(7 points)*

    a. 160,000
    b. 180,000
    c. 250,000
    d. 281,250

Show your work here

$$Shrink\% = \frac{Compacted\ dry\ unit\ weight - Bank\ dry\ unit\ weight}{Compacted\ dry\ unit\ weight}$$

$$Vol_B = \frac{Vol_C}{(1 - Shrink\ \%)}$$

$\frac{2500 - 2000}{2500} = .2$

$Vol_B = \frac{200{,}000}{1-.2} = \frac{200000}{.8} = 250{,}000$

51. How many compacted cubic yards per hour will a tamping foot compactor compact in an hour, rounded to a whole number? Must show work for credit.*(7 points)*

    a. 513 ccy / hr
    b. 599 ccy / hr
    c. 685 ccy / hr
    d. 799 ccy / hr

Show your work here

$$Compacted\_cubic\_yards\_per\_hr = \frac{16.3 \times \text{Width (ft)} \times \text{S(mph)} \times \text{L(inch)} \times eff.}{\text{No. Passes}}$$

.5 4mph 84" 45/66

$= \frac{2053.8}{4} = 513$

52. If the scrapers can deliver 1200 ccy / hr of material how many tamping foot compactors will you need assuming you would round up? *Use Q# 11 answer for calculation.* Must show work for credit.*(7 points)*
    a. 1
    b. 2
    c. 3
    d. 4

Show your work here

$\frac{1200}{513} = 2.337 = 3$

53. The fill is 120 feet higher than the cut and the haul road is 1500 feet long. You expect to have 3 inches of tire penetration along the haul road. You are using scrapers with a loaded operating weight of 200,000 lb. What is the total resistance in pounds? Must show work for credit.*(8 points)*
    a. 29,000 pounds
    b. 30,000 pounds
    c. 32,000 pounds
    d. 35,000 pounds

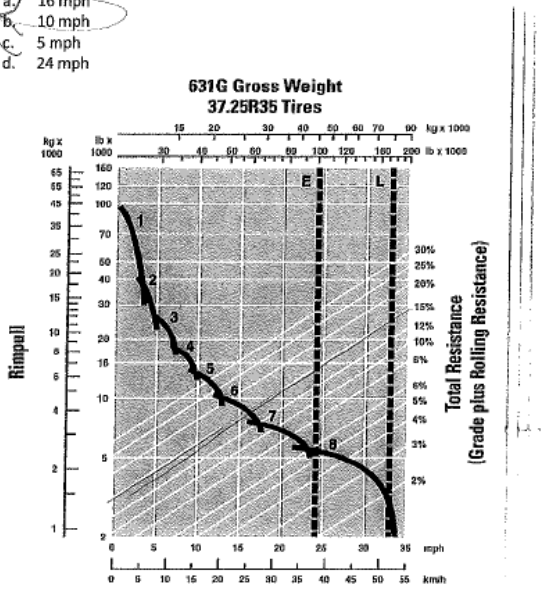
$RR = 46 + (30 \times 3in) \times \frac{200,000}{2000} = 13,000$

$GR = W \cdot \left(\frac{G}{100}\right) \qquad G = \frac{rise}{run} = \frac{120}{1500} = .08 \times 100 = 8$

$GR = 200,000 \cdot \left(\frac{8}{100}\right) = 16,000 \text{ lbs}$

$13,000 + 16,000 = 29,000$

54. You are operating a 631G scraper along a haul road with a rolling resistance of 8% and grade resistance of 7%. What speed will the scraper operate at when the scraper is fully loaded. Use the chart below? (8 points)
    a. 16 mph
    b. 10 mph
    c. 5 mph
    d. 24 mph



Assessment Report for SLO 8

Course: CMGT 41000 – Equipment and Field Operations

Academic Term for Direct Evaluation: 2021 Fall Semester, Fall 2022

Instructors: Dan Koo

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 87% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	8. Analyze methods, materials, and equipment used to construct projects	4.125	83%
S 2022		4.56	91%
F 2022		4.59	92%

Direct Measures

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	18	Quiz	86.54%	75%
		Homework	81.98%	75%
		Midterm Exam	75.22%	75%
Fall 2022	20	Quiz	89.77%	75%
		Homework	77.32%	75%
		Midterm Exam	74.49%	75%

After the initial ACCE accreditation for the CEMT program, it was decided that the overall average of the total grades should be at least 75%. The Indirect Measure was 89% and the Direct Measure was 80.89%. Based on the perception of graduating seniors (Indirect Measure), they felt confident in creating project schedules. The Direct Measure showed a different outcome. The midterm exam result is approximately at the target percent and it is considered to be met the target.

The indirect measure for SLO 8 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey).

Proposed Actions for Course Improvement:

Based on the indirect/direct measurements and IUPUI course evaluation, the course has currently met the target for the proposed student learning outcomes. However, some students do not fully understand, apply, and analyze the field operations using various types of equipment. It is mainly because the real-world job site does not perform the proper level of analysis of the equipment production, cost, and optimization of various plausible scenarios. Therefore, some students did not appreciate the value of theoretical analysis of the field operation. The course improvement is to reinforce the importance of theoretical knowledge for the analysis of field operations and brings more actual field examples performed by industry professionals so that the students can widen their view of the subject. One or two guest lectures were added to the course schedule and reinforced the course learning objectives.

The course objectives will be more specific rather than open-ended. The instructor will provide not only more specific conditions for analysis, but also open-ended problems that help an analytical thinking process.

The instructor proposes the following action items to improve the student learning outcomes:

- Inviting guest lectures who professionally plan, analyze, and make a decision on the heavy machine operations on the construction job site. ➔ implemented from Spring 2022
- Introducing a construction simulation technique to optimize the heavy machine operations in the theory and actual project job site. ➔ applying a simulation tool in future semesters
- Providing more in-class exercises to improve student's understanding of the calculation problems. ➔ added more quizzes and homework assignments to improve student learning experience and understanding

Student Learning Outcome 9

Apply Construction Management Skills as a Member of a Multi-Disciplinary Team

SLO 9

Introduction

To comply with SLO 9 - "Apply Construction Management Skills as a Member of a Multi-Disciplinary Team," students submit an individual assignment where they use role playing to understand the roles of "other" team members and to apply their construction management skills to address questions from the "other" project team participants**.**

Assessment Methods (additional information in the Direct Assessment section of this report)

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 9, there is one assignment that is also used as Direct Measure.

1. Individual Assignment for Multi-Disciplinary Team Role-Playing

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 9 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
  - Revised role playing assignment Example
  - Graded student work Example
- Assessment Report for SLO 9

Indirect Measure (refer to Volume I pages 29-30)

The Indirect Measure for SLO 9 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 9 (found at the end of this SLO report).

Direct Measure

Assignment and Student Work Example from Spring 2023

Introduction

To comply with SLO 9 - "Apply Construction Management Skills as a Member of a Multi-Disciplinary Team," students submit an individual assignment where they use role playing to understand the roles of "other" team members and to apply their construction management skills to address questions from the "other" project team participants.

The revised questions and multiple-choice answer format is the newly revised format first introduced in the Fall 2022 semester. The new format is an attempt to address many of the concerns proposed and discussed from 'Proposed Actions for Course Improvement' from previous semesters.

Assignment Specifics

Each member of every capstone group will assume the role of another team member, whose expertise is not construction management. Those roles include: the Owner, the Architect, the Engineer, the Subcontractor, and the Supplier. Note: for the 2023 spring semester, there were 21 students in the class with 3 groups of 5 students each, and 1 group of 6 students, so the numbers worked out well. Adjustments will be made in the future when there are unbalanced groups. While playing the role of another project participant (Owner, Architect, Engineer, Subcontractor, or Supplier), the students answered three (3) to four (4) questions from the point of view of the role being played. Each student provides a written justification for the answer they selected for each question.

Each capstone group has an industry mentor who also serves on the CEMT/CM IAB. The questions were developed by the industry mentors (refer to the following page). The assignments were graded by the course instructor. The grading criteria is explained below.

Grading Criteria

The assignment is worth 100 points which is included in their individual grade for the capstone course. Each question is worth three (3) points, and the rationale/justification is also worth three (3) points. Each student will be graded by the course instructor. The instructor has the option of adding or subtracting a point, if he/she believes the rationale for each answer is well or poorly documented or explained in greater or lesser detail.

Questions Asked by the Role Players

The following questions are answered by the role players (students) as if they are being interviewed by a third-party interviewer and each student must apply their construction management skills to address questions related to other disciplines.

Owner's Role Question #1:

We know the schedule is very important to this project. What do you think would be a good incentive to bring this project ahead of schedule?

A. ___ File a lawsuit against the GC/CM if the project is more than five (5) days late beyond any scheduled completion date prior to substantial completion.

B. ___ Contact the GC/CM's licensing board and request a suspension of the contractor's license.

C. ___ Request a Stop Work Order from the local permit department.

D. ___ After contracts are signed, impose liquidated damages of $1,000 per day until the project is back on its original schedule.
E. ___ Prior to signing contracts, negotiate a monetary incentive or bonus for each day the project is ahead of schedule.
Why did you select your answer?

Owner's Role Question #2:

You have prepared a comprehensive budget for this project. Under what conditions would you allow any substitutions that could reduce the cost of the project?
A. ___ All substitutions must be submitted by qualified contractors only.
B. ___ No substitutions will be allowed.
C. ___ Only the Architect can recommend substitutions.
D. ___ All substitutions must be submitted with sufficient documentation to verify compliance with specifications.
E. ___ All substitutions must be equal to the originally specified product or equipment.
Why did you select your answer?

Owner's Role Question #3:

Your project management team has forecasted your labor requirements for the project. How will you communicate your labor needs to your subcontractors, and will the labor requirements be included in your subcontractor agreements?
A. ___ After all contracts have been signed, each subcontractor will be contacted, and labor requirements will be explained in detail.
B. ___ The superintendent is responsible for labor requirements and will be instructed to update all subcontractors via email.
C. ___ The Instructions to Bidders will contain the labor requirements and all contractors must acknowledge receipt of information.
D. ___ Labor requirements for each subcontractor will be explained by the Project Manager at the Pre-Bid meeting.
E. ___ Labor requirements for each trade will be specified in the specifications, indicated on the project schedule, explained at the Pre-Construction meeting, and included in subcontractor agreements.
Why did you select your answer?

Architect's Role Question #1:

How do you ensure and maintain the quality of the materials and products delivered to the jobsite?
A. ___ Require the job superintendent to maintain a daily log.
B. ___ Review all submittals and check for compliance with the specifications.
C. ___ Before specifications are written, check the quality of materials and products during the selection process.
D. ___ Determine quality standards for this project, publish specifications that details the standards, and hold all contractors, subcontractors and suppliers accountable to the specifications.
E. ___ Review all reports submitted by the Project Engineer and report discrepancies to the Owner.
Why did you select your answer?

Architect's Role Question #2:

How do you handle change orders with your subcontractors?

A. ___ Limit the submittal and review of all change orders to the first ninety (90) days of construction.
B. ___ Inform subcontractors that no change order can be more than 1% of their subcontract amount.
C. ___ Only review subcontractor change orders on the fifteenth (15th) of every month.
D. ___ Work with the GC/CM to determine the validity and dollar amount of the change, and then issue the work directive accordingly.
E. ___ Determine the dollar amount with the Project Manager, and do not disclose this amount with the Owner.
Why did you select your answer?

Architect's Role Question #3:

What is your attitude towards sustainable (green) design and how do you think it applies to this project?
A. ___ This project is too small for sustainable design considerations.
B. ___ Sustainable design was applied to this project, but it was determined to be too expensive by the local community.
C. ___ Sustainable design options were incorporated into this project, and may be implemented in the near future.
D. ___ Sustainable design should be considered on every project, and budgets should be adjusted to allow for sustainable options.
E. ___ The geographic location of this project does not support sustainable design options.
Why did you select your answer?

Engineer's Role Question #1:

Underground construction (foundations, utilities, etc.) can present unforeseen delays. Have you developed any contingencies for this phase of the project that will help keep the project schedule on track?
A. ___ The project schedule has been distributed to all contractors; therefore, no delays will be allowed.
B. ___ The Soils Report identified all possible underground structures; therefore, no contingencies will be necessary.
C. ___ Extra time has been included in the schedule to allow for unforeseen delays.
D. ___ All contractors have been informed that they are responsible for all delays and any additional costs associated with those delays.
Why did you select your answer?

Engineer's Role Question #2:

Considering the structural components and the type of building construction, what is your experience on comparable projects?
A. ___ My experience on this type of construction is minimal, but I think the architect needs to be watched very carefully.
B. ___ Based on my years of experience, the contractors should have no issues completing this project.
C. ___ Because of the unique site restrictions, we worked closely with the Architect to design a safe and efficient building.
D. ___ This project involves a few unique features that are not typical on every project, but with our experience, we will work with the contractors to resolve any structural issues.
E. ___ All projects are the same, so the local contractors should have no problems.

Why did you select your answer?

Engineer's Role Question #3:

Storm Water Management includes the monitoring and control of runoff to the receiving waters (storm sewers, drainage ditches, streams and rivers). From a water quality perspective, how will you monitor and control the quantity of runoff from your site?
A. ___ All contractors will be required to measure and document the amount of runoff to all receiving waters or drainage structures.
B. ___ After all excavation and backfill activities are completed, all contractors will submit their erosion control plan for the remainder of the project.
C. ___ Before each measurable rainstorm, all contractors will be required to install dewatering pumps to protect their work areas.
D. ___ Before any excavation activities take place, Erosion Control measures will be installed, and drainage and inlet structures will be protected.
E. ___ The site will be regraded to direct water runoff to the neighboring properties.
Why did you select your answer?

Subcontractor's Role Question #1:

Within the subcontractor agreement that you must sign, what are the most important things you need to know about the payment schedule?
A. ___ How much I will get paid and how many times during the month I should expect payment.
B. ___ The date when invoices are due and the date when payment should be expected.
C. ___ The amount of profit that can be included on each invoice.
D. ___ The maximum dollar amount that can be invoiced prior to the start of construction.
E. ___ The dollar amount of the taxes that can be withheld from each payment.
Why did you select your answer?

Subcontractor's Role Question #2:

What do you need to do to adhere to the requirements of the project schedule (software required, level of detail, and updating)?
A. ___ Five (5) days prior to working on the site, determine the type of software required and place an order.
B. ___ Inquire about a waiver that allows the subcontractor to disregard the project schedule.
C. ___ Regardless of the software used, maintain notes and updates from each progress meeting.
D. ___ Every Wednesday, check with the superintendent for the amount of work completed the previous week.
E. ___ Submit a request to the GC/CM to install the scheduling software on our company's computer.
Why did you select your answer?

Subcontractor's Role Question #3:

What do you need to do to conform to the requirements of the project safety plan?
A. ___ Wait until there is an accident at the site before inquiring about the details of the safety plan.
B. ___ At the first progress meeting, ask the superintendent to break the safety plan down into smaller modules that can be discussed at each progress meeting.
C. ___ Make copies of the safety plan and distribute to all employees.

D. ___ Make copies of the safety plan, review the plan with all site employees, and discuss safety issues specific to the assigned work.
E. ___ Request an OSHA inspection and address any specific violations.
Why did you select your answer?

Supplier's Role Question #1:

What is the role of the contractor concerning the procurement and delivery of materials?
A. ___ The contractor must order materials a minimum of three (3) weeks prior to the scheduled delivery date.
B. ___ The contractor must furnish its own vehicles for the delivery of materials.
C. ___ The contractor should work with the supplier to establish lead times for the procurement of all materials.
D. ___ The contractor should determine scheduled price increases a minimum of five (5) days prior to the delivery date.
E. ___ The contractor should request Owner approval prior to ordering all materials.
Why did you select your answer?

Supplier's Role Question #2:

Are you expected to work directly with the subcontractors?
A. ___ Only with those subcontractors who are on schedule or ahead of the schedule.
B. ___ Only with the subcontractors who are paid up and have perfect credit scores.
C. ___ Only with those subcontractors who worked on a previous project that we supplied materials.
D. ___ The expectation is that the supplier will work with all contractors and subcontractors procuring materials from this supplier.
E. ___ Only with those subcontractors who purchased materials over a certain dollar amount.
Why did you select your answer?

Supplier's Role Question #3:

How do you monitor inventory and supplies and what role do you play?
A. ___ Inventory is not monitored unless the contractor reports a Shortage of Delivered Materials Claim within twenty-four (24) hours of the on-site delivery.
B. ___ The inventory is double-checked on the Order Confirmation Form at the time the order is processed.
C. ___ The inventory is checked when the order is placed, when the order is received at the supplier's site, and when the supplies are delivered to the job site.
D. ___ The supplier only has to notify the contractor when the order is three (3) days late.
Why did you select your answer?

Supplier's Role Question #4:

Who is responsible for unloading and stockpiling materials at the laydown site?
A. ___ The Project Engineer,
B. ___ The superintendent's foreman,
C. ___ Interns hired by the GC/CM,
D. ___ Any laborer not busy at the time of delivery,
E. ___ The supplier and the contractor, who ordered the material, should work together to ensure the materials are unloaded where they are to be stored.
Why did you select your answer?

On the following page is an example of a graded assignment from a team mentor using the grading criteria.

Graded Student Work

Applying Construction Management Skills as a Member of a Multi-Disciplinary Team

NAME: ___[redacted]___ x = correct answer DATE: 1/23/2023 SCORE: 88/100

Owner's Role Question #1:

We know the schedule is very important to this project. What do you think would be a good incentive to bring this project ahead of schedule?
A.___ File a lawsuit against the GC/CM if the project is more than five (5) days late beyond any scheduled completion date prior to substantial completion.
B.___ Contact the GC/CM's licensing board and request a suspension of the contractor's license.
C.___ Request a Stop Work Order from the local permit department.
D.___ After contracts are signed, impose liquidated damages of $1,000 per day until the project is back on its original schedule.
E. _this one__ Prior to signing contracts, negotiate a monetary incentive or bonus for each day the project is ahead of schedule.

Why did you select your answer?
I selected this answer because wanting to speed up a project is no reason to punish anyone you have contracted to complete it. Any kind a punishment from the owner to the GC would hurt the relationship. When you provide a financial benefit for the GC to complete the project earlier, both parties benefit.

Owner's Role Question #2:

You have prepared a comprehensive budget for this project. Under what conditions would you allow any substitutions that could reduce the cost of the project?

A.___ All substitutions must be submitted by qualified contractors only.

B.___ No substitutions will be allowed.

C.___ Only the Architect can recommend substitutions.

D. _this one__ All substitutions must be submitted with sufficient documentation to verify compliance with specifications.

E.___ All substitutions must be equal to the originally specified product or equipment.

Why did you select your answer?

Any substitutions that save money is a good idea. However, these substitutions might cause conflicts with other trades, the installation of different materials down the road, or even comprise the integrity of the structure. For these reasons, any substitution should verified to function of the specifications intended.

Owner's Role Question #3:

Your project management team has forecasted your labor requirements for the project. How will you communicate your labor needs to your subcontractors, and will the labor requirements be included in your subcontractor agreements?

A.___ After all contracts have been signed, each subcontractor will be contacted, and labor requirements will be explained in detail.

B.___ The superintendent is responsible for labor requirements and will be instructed to update all subcontractors via email.

C.___ The Instructions to Bidders will contain the labor requirements and all contractors must acknowledge receipt of information.

D. __this one_ Labor requirements for each subcontractor will be explained by the Project Manager at the Pre-Bid meeting. **-3**

E. _x__ Labor requirements for each trade will be specified in the specifications, indicated on the project schedule, explained at the Pre-Construction meeting, and included in subcontractor agreements.

Why did you select your answer?

How much of a labor force that is used on a project is ultimately the GC's decision. It shouldn't matter how much manpower is used, as long as the project is completely correctly and on time. However, the GC should have a realist idea of how much labor is needed and what of what type before they bid on a project. This is why these details are discussed at the pre-bid meeting.

Architect's Role Question #1:

How do you ensure and maintain the quality of the materials and products delivered to the jobsite?

A.___ Require the job superintendent to maintain a daily log.

B.___ Review all submittals and check for compliance with the specifications.

C.___ Before specifications are written, check the quality of materials and products during the selection process.

D. _this one__ Determine quality standards for this project, publish specifications that details the standards, and hold all contractors, subcontractors and suppliers accountable to the specifications.

E.___ Review all reports submitted by the Project Engineer and report discrepancies to the Owner.

Why did you select your answer?

Having the material quality laid out in the specification means that the contractors will know exactly what they need before the project has started. Therefor, there will be no way to argue otherwise if the wrong materials are used. This way any sort of dispute over what materials/products are required is eliminated.

Architect's Role Question #2:

How do you handle change orders with your subcontractors?

A.___ Limit the submittal and review of all change orders to the first ninety (90) days of construction.

B.___ Inform subcontractors that no change order can be more than 1% of their subcontract amount.

C.___ Only review subcontractor change orders on the fifteenth (15th) of every month.

D. _this one__ Work with the GC/CM to determine the validity and dollar amount of the change, and then issue the work directive accordingly.

E.___ Determine the dollar amount with the Project Manager, and do not disclose this amount with the Owner.

Why did you select your answer?

The GC will be able to provide an accurate explanation of the change order to the architect to make sure it works well with the project.

Architect's Role Question #3:

What is your attitude towards sustainable (green) design and how do you think it applies to this project?

A.___ This project is too small for sustainable design considerations.

B.___ Sustainable design was applied to this project, but it was determined to be too expensive by the local community.

C. _this one__ Sustainable design options were incorporated into this project, and may be implemented in the near future. **-3**

D. _x__ Sustainable design should be considered on every project, and budgets should be adjusted to allow for sustainable options.

E.___ The geographic location of this project does not support sustainable design options.

Why did you select your answer?

Sustainable options should always be considered for a project when possible and the budget allows

Engineer's Role Question #1:

Underground construction (foundations, utilities, etc.) can present unforeseen delays. Have you developed any contingencies for this phase of the project that will help keep the project schedule on track?

A.___ The project schedule has been distributed to all contractors; therefore, no delays will be allowed.

B.___ The Soils Report identified all possible underground structures; therefore, no contingencies will be necessary.

C. _x__ Extra time has been included in the schedule to allow for unforeseen delays.

D. _this one__ All contractors have been informed that they are responsible for all delays and any additional costs associated with those delays. **-3**

Why did you select your answer?

Extra time for delays shouldn't be added to the schedule because the bid is competitive. It makes sense for the contractors to understand what kind of delays could affect their trade and how to work through them.

Engineer's Role Question #2:

Considering the structural components and the type of building construction, what is your experience on comparable projects?

A.___ My experience on this type of construction is minimal, but I think the architect needs to be watched very carefully.

B.___ Based on my years of experience, the contractors should have no issues completing this project.

C. __this one_ Because of the unique site restrictions, we worked closely with the Architect to design a safe and efficient building. **-3**

D. _x__ This project involves a few unique features that are not typical on every project, but with our experience, we will work with the contractors to resolve any structural issues.

E.___ All projects are the same, so the local contractors should have no problems.

Why did you select your answer?

Every project will have its own unique challenges. The engineer and the architect will have a close relationship because both of them are needed to make the building complete.

Engineer's Role Question #3:

Storm Water Management includes the monitoring and control of runoff to the receiving waters (storm sewers, drainage ditches, streams and rivers). From a water quality perspective, how will you monitor and control the quantity of runoff from your site?

A.___ All contractors will be required to measure and document the amount of runoff to all receiving waters or drainage structures.

B.___ After all excavation and backfill activities are completed, all contractors will submit their erosion control plan for the remainder of the project.

C.___ Before each measurable rainstorm, all contractors will be required to install dewatering pumps to protect their work areas.

D. _this one_ Before any excavation activities take place, Erosion Control measures will be installed, and drainage and inlet structures will be protected.

E.___ The site will be regraded to direct water runoff to the neighboring properties.

Why did you select your answer?

There is no an affective way to measure the amount of runoff from a site. Proven practices to protect the waterways should be put in place to prevent jobsite materials from contaminating the runoff.

Subcontractor's Role Question #1:

Within the subcontractor agreement that you must sign, what are the most important things you need to know about the payment schedule?

A.___ How much I will get paid and how many times during the month I should expect payment.

B. __This one_ The date when invoices are due and the date when payment should be expected.

C.___ The amount of profit that can be included on each invoice.

D.___ The maximum dollar amount that can be invoiced prior to the start of construction.

E.___ The dollar amount of the taxes that can be withheld from each payment.

Why did you select your answer?

Making sure the payment application is submitted on time is probably the most important step listed. If this step is not completed, I don't get paid.

Subcontractor's Role Question #2:

What do you need to do to adhere to the requirements of the project schedule (software required, level of detail, and updating)?

A.___ Five (5) days prior to working on the site, determine the type of software required and place an order.

B.___ Inquire about a waiver that allows the subcontractor to disregard the project schedule.

C. _this one__ Regardless of the software used, maintain notes and updates from each progress meeting.

D.___ Every Wednesday, check with the superintendent for the amount of work completed the previous week.

E.___ Submit a request to the GC/CM to install the scheduling software on our company's computer.

Why did you select your answer?

A different software might be used to keep track on different project but the information that needs to be record and when stays the same.

Subcontractor's Role Question #3:

What do you need to do to conform to the requirements of the project safety plan?

A.___ Wait until there is an accident at the site before inquiring about the details of the safety plan.

B.___ At the first progress meeting, ask the superintendent to break the safety plan down into smaller modules that can be discussed at each progress meeting.

C.___ Make copies of the safety plan and distribute to all employees.

D. __this one_ Make copies of the safety plan, review the plan with all site employees, and discuss safety issues specific to the assigned work.

E.___ Request an OSHA inspection and address any specific violations.

Why did you select your answer?

Safety should be top priority on site. Each employee should a clear idea of what is safe and what is not. Providing a copy of the safety plan to each employee will eliminate any excuse for not knowing something wasn't safe.

Supplier's Role Question #1:

What is the role of the contractor concerning the procurement and delivery of materials?

A.___ The contractor must order materials a minimum of three (3) weeks prior to the scheduled delivery date.

B.___ The contractor must furnish its own vehicles for the delivery of materials.

C. __this one_ The contractor should work with the supplier to establish lead times for the procurement of all materials.

D.___ The contractor should determine scheduled price increases a minimum of five (5) days prior to the delivery date.

E.___ The contractor should request Owner approval prior to ordering all materials.

Why did you select your answer?

The lead times for different materials and products could differ quite a bit. This means that it would be best for the contractor to work with the supplier so they know when to place an order to be able to get the product on time.

Supplier's Role Question #2:

Are you expected to work directly with the subcontractors?

A.___ Only with those subcontractors who are on schedule or ahead of the schedule.

B.___ Only with the subcontractors who are paid up and have perfect credit scores.

C.___ Only with those subcontractors who worked on a previous project that we supplied materials.

D. _this one__ The expectation is that the supplier will work with all contractors and subcontractors procuring materials from this supplier.

E.___ Only with those subcontractors who purchased materials over a certain dollar amount.

Why did you select your answer?

Subcontractors will be orders some materials themselves so working with the supplier is necessary.

Supplier's Role Question #3:

How do you monitor inventory and supplies and what role do you play?

A.___ Inventory is not monitored unless the contractor reports a Shortage of Delivered Materials Claim within twenty-four (24) hours of the on-site delivery.

B.___ The inventory is double-checked on the Order Confirmation Form at the time the order is processed.

C. _this one__ The inventory is checked when the order is placed, when the order is received at the supplier's site, and when the supplies are delivered to the job site.

D.___ The supplier only has to notify the contractor when the order is three (3) days late.

Why did you select your answer?

Proper inventory management will mean that it will be easy to identify any supply issues if they arise.

Supplier's Role Question #4:

Who is responsible for unloading and stockpiling materials at the laydown site?

A.___ The Project Engineer,

B.___ The superintendent's foreman,

C.___ Interns hired by the GC/CM,

D.___ Any laborer not busy at the time of delivery,

E._ _this one_ The supplier and the contractor, who ordered the material, should work together to ensure the materials are unloaded where they are to be stored.

Why did you select your answer?

If the supplier and the contractor work together on where materials will be delivers there will less waisted time moving materials around the stockpile.

Assessment Report for SLO 9

Course: CMGT 44000 - Construction Project Management (Capstone)

Academic Term for Direct Evaluation: Fall 2019, Fall 2022, and Spring 2023

Instructors: Marvin Johnson and Dan Koo

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 9 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). A 89% ranking was achieved for SLO 9.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	9. Apply construction management skills as a member of a multi-disciplinary team.	4.375	88%
S 2022		4.48	90%
F 2022		4.76	95%

Direct Measures - Assessments and Evaluations

The Direct Measure for SLO 9 was the assignment, "Applying Construction Management Skills as a Member of a Multi-Disciplinary Team." The maximum grade (points) for this individual assignment was 100 points. The table below shows the average individual grade for this assignment.

Term	N	Criteria	Average Percent	Target Percent
Fall 2019	8	Role-Playing Assignment	79.4%	75%
Fall 2022	17	Role-Playing Assignment	89.4%	75%
Spring 2023	21	Role-Playing Assignment	92.4%	75%

Since this is the initial ACCE accreditation for the CM program, it was decided that an overall average of the total grades should be at least 75%. The Indirect Measure (95%) and the Direct Measure (92.4%). Assuming an equal weight for each measure the composite grade was 94.6% indicating that the target value was met.

Overall, the student response to the questions proposed by the interviewer and based on the roles played by the students, were thoughtful and provided a depth of knowledge indicating that the students could apply their construction management skills to address the concerns from questions from other "non-construction" team members.

Proposed Actions for Course Improvement:

The complete Faculty Course Assessment Report for CMGT 44000 (previously CEMT 44700) is included in the appendix for the Quality Improvement Plan. The following proposed actions documented here relate specifically to the Multi-Disciplinary Team assignment.

There are several proposed actions that could enhance the application of construction management skills as members of a multi-disciplinary team, as outlined below and explained on the following page.

- In-class work session
- Questions related to multi-disciplinary teams at the oral presentations
- Separate meeting with group industry mentors to discuss multi-disciplinary teams

In-Class Work Session

Currently the assignment is done out of class. To possibly increase the effectiveness of the learning experience through class discussion, the assignment could be completed (or at least started in class). A third-party interviewer approach was implemented this semester, however, this format will be evaluated and assessed based on student results, faculty and IAB input.

Questions at the Oral Presentations

Prior to the oral presentations, seed questions could be distributed to industry members in attendance at the presentations. The quality of student response to questions could be documented on the rubric used to evaluate the oral presentations. Industry feedback to the student responses could also be documented.

Group Mentor Meeting

Each capstone group is assigned an industry mentor from the CM IAB. The mentor meets with the group approximately 4 or 5 times a semester to discuss project progress and to provide guidance for assembling their materials and organizing and refining their presentation materials. One of these meetings could be dedicated to a discussion of multi-disciplinary teams. Students would document the discussions and provide some response to "lessons learned."

Student Learning Outcome 10

Apply Electronic-Based Technology to Manage the Construction Process

Introduction

SLO 10 - "Apply electronic-based technology to manage the construction process" is evaluated and assessed in CMGT 11000 - Introduction to Construction Management.

Assessment Methods (additional information in the Direct Assessment section of this report).

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 10, there are two (2) assignments that are used as Direct Measures:

1. Assignment: Revit final project: Project One 6 Sheets - FINAL
2. Final Exam: 5 selected questions pertaining to BIM.

SLO 10 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  - Explanation and rubrics (grading criteria)
  - Graded student work (using the rubric)
- Assessment Report for SLO 10

Indirect Measure

The Indirect Measure for SLO 10 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 10 (found at the end of this SLO report).

Direct Measures

The Direct Measures for SLO 10 are assignments that include:

1. Revit Final Project - CMGT 11000 incorporates Autodesk Revit and Autodesk Navisworks software to introduce the student to the capabilities of digital drafting within the Building Information Modeling (BIM) framework. The student works on a simplified drafting project within Revit beginning about week 7 of the semester and proceeds to develop it, adding more information and detail every week until the project is complete (Final). The student receives weekly feedback to simulate the correction process in an architect's office. With each week's iteration, the student is expected to correct the past week's errors as they continue to layer on additional detail. The final version of this assignment brings together every aspect of the student's experience with Revit and is therefore an ideal assessment target for SLO 10.

2. Final Exam Questions - The student is also exposed to BIM via lecture presentation. While it doesn't comprise the entire content of the exam, selected questions pertain explicitly to BIM technology, offering an ideal assessment opportunity.

Graded Student Work

The course instructor completed the grading for each assignment using the grading criteria. Depending on the assessed material, the grading criteria and any instructor notes were sent to the students via

1. Markups directly on the submitted work within the Canvas / Assignment / SpeedGrader feedback function. (Revit assignment)
2. A score value. The specific content was available for review with the instructor via an appointment within office hours.

1. Homework Assignment & Rubric: Revit Final Project (Spring 2022)

Revit Project One - 6 Sheets SP22

Published | Edit

The whole purpose of reading a construction document set is to construct a building.

Using all of the information contained within the document set provided via this link, Project One 7 Sheets Revit 2022 SP22, "construct" the Project One in Revit. For this assignment, produce only sheets A1.1, A2.1, A2.2, A3.1, A5.1, A6.1.

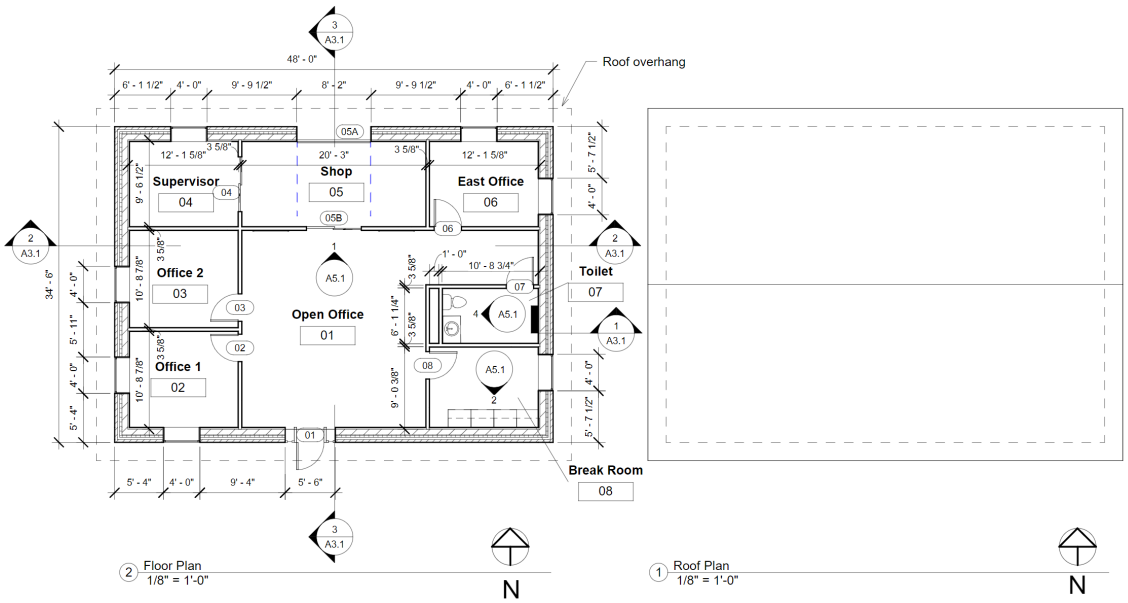
Note: The "Sundeala Notice Board Framed" (as found on the Open Office north wall) can be loaded from our Revit folder as found in our shared folder. Find the file: "Sundeala Noticeboard Framed.rfa"

The goal of this assignment is to produce documents that appear as close as possible to the provided document set. Besides for the drawing themselves, consideration must be given to:

- Scale
- Notation
- Notation layout

Directions

1. Correct the errors on your previous submission (Revit Project One - 4 Sheets FA21).
2. Add the following new content:
    - Sheet A5.1 including
        - 1 Open Office North Wall Elevation
        - 2 Break Room Interior Elevation
        - 3 Toilet Room Elevation
        - DO NOT do anything in a blue rectangle.
    - Sheet A6.1 including
        - Reflected Ceiling Plan
        - DO NOT do anything in a blue rectangle.
    - Content includes
        - Materials
        - Notation
        - Drawing titles
        - Casework (cabinets, toilet fixture, lavatory, counter tops, etc.)
        - Notice board
        - Ceiling systems
        - Light fixtures.
3. Submit one (1) pdf file containing every sheet in your set (6 sheets total).



IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Floor Plan & Roof Plan

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	---

A1.1

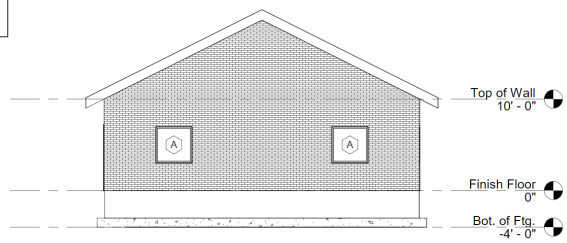
Scale 1/8" = 1'-0"

3/30/2022 12:59:08 AM

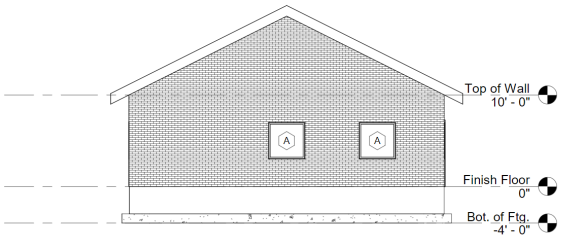
Sheet List

Sheet Number	Sheet Name	Issue Date	Current Revision Date
A1.1	Floor Plan & Roof Plan	3/30/22	
A2.1	East & West Elevations	3/30/22	
A3.1	Building Sections	3/30/22	
A2.2	North & South Elevations	3/30/22	
A6.1	Refl. Ceiling Plan & Schedules	3/30/22	
A5.1	Details & Elevations	3/30/22	
A9.1	Renderings	3/30/22	
S1.1	Foundation Plan	3/30/22	

General Notes
1. All interior dimensions to face of stud.
2. Notes shown in light blue are Revit-specific assemblies or materials.



1 East Elevation
1/8" = 1'-0"



2 West Elevation
1/8" = 1'-0"

Window

Door

Interior Elevation
Dwg # / Sht. #

Section
Dwg # / Sht. #

Room name
101
Room name & number

Revision

Wall Type

Symbols
1/4" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

East & West Elevations

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	Checker

A2.1

Scale As indicated

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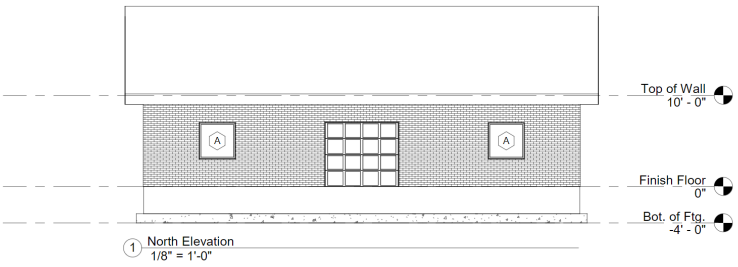
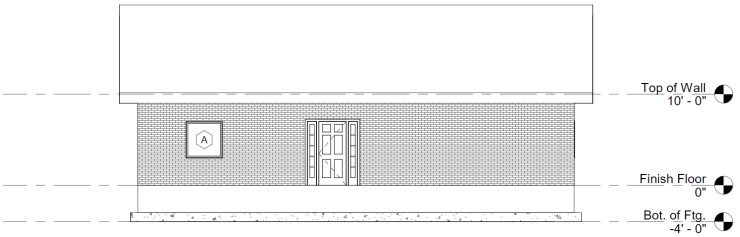


1 North Elevation
1/8" = 1'-0"



2 South Elevation
1/8" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

North & South Elevations

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	Checker

A2.2

Scale 1/8" = 1'-0"

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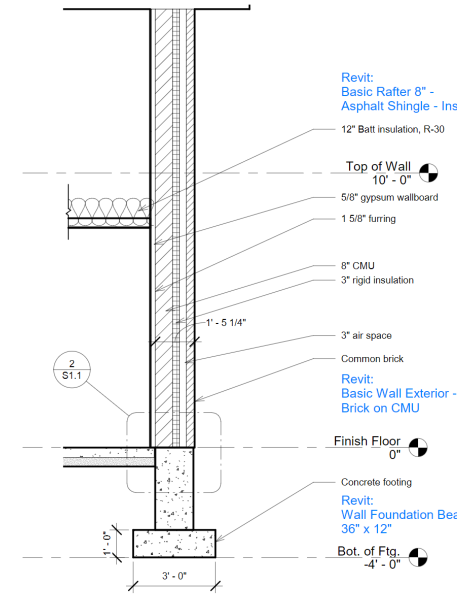
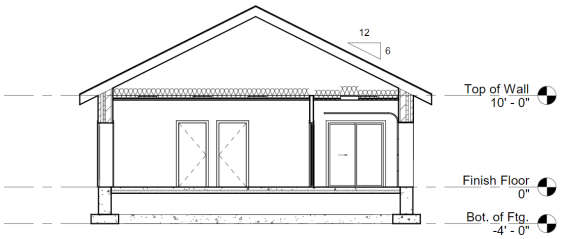
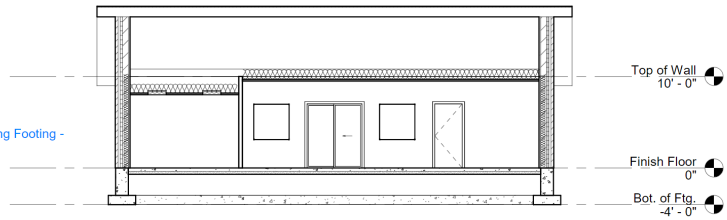


1 Wall Section East Wall
3/8" = 1'-0"



3 Transverse Building Section
1/8" = 1'-0"



2 Longitudinal Building Section
1/8" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Building Sections

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	JWW

A3.1

Scale As indicated

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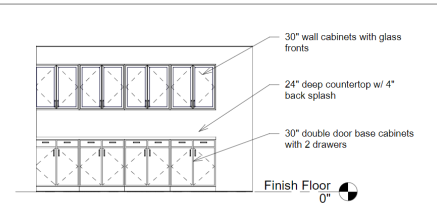
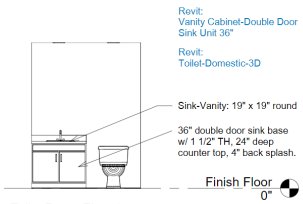
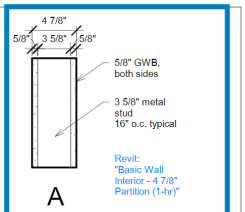


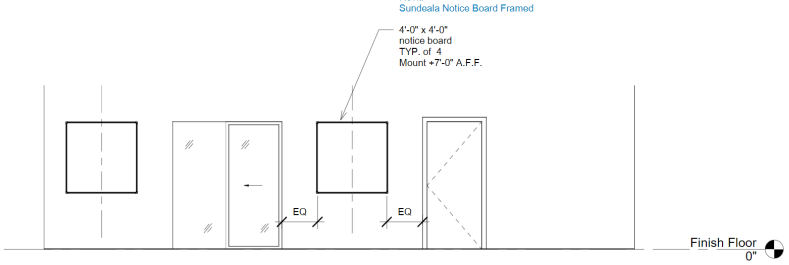
2 Break Room Interior Elevation
1/4" = 1'-0"



4 Toilet Room Elevation
1/4" = 1'-0"



Wall Types
1 1/2" = 1'-0"



1 Open Office North Wall Elevation
1/4" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Details & Elevations

Project number	CMGT11000SP22	A5.1
Date	3/29/22	
Drawn by	JWW	
Checked by	Checker	Scale As indicated

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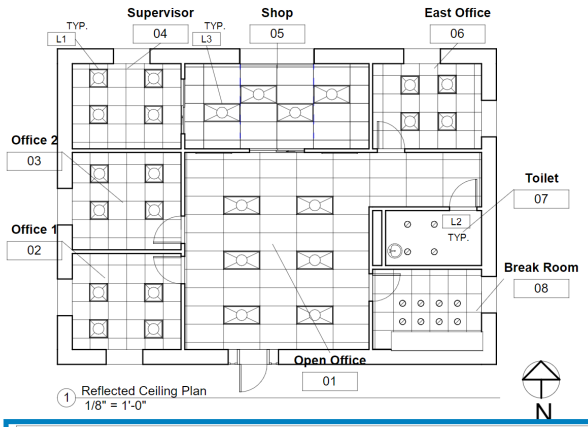


1 Reflected Ceiling Plan
1/8" = 1'-0"

Window Schedule

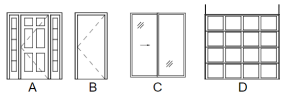
Type Mark	Height	Width	Sill Height	Description	Revit File Information
A	4' - 0"	4' - 0"	3' - 0"	Fixed	<varies>

Room Schedule

Number	Name	Wall Finish	Floor Finish	Ceiling Finish	Clg. Hgt.	Revit File Information
01	Open Office	Paint	VCT	2x4 ACT	9' - 0"	Revit File Information (Ceiling) 2' x 4' ACT System
02	Office 1	VWC	Carpet	2x2 ACT	8' - 0"	Revit File Information (Ceiling) 2' x 2' ACT System
03	Office 2	VWC	Carpet	2x2 ACT	8' - 0"	Revit File Information (Ceiling) 2' x 2' ACT System
04	Supervisor	VWC	Carpet	2x2 ACT	8' - 0"	Revit File Information (Ceiling) 2' x 2' ACT System
05	Shop	Paint	Sealed Conc.	Exposed	9' - 6"	Revit File Information (Ceiling) 2' x 4' ACT System
06	East Office	VWC	Carpet	2x2 ACT	8' - 0"	Revit File Information (Ceiling) 2' x 2' ACT System
07	Toilet	Paint	VCT	GWB	8' - 0"	Compund Ceiling GWB on Mtl. Stud
08	Break Room	VWC	VCT	2x2 ACT	8' - 0"	Revit File Information (Ceiling) 2' x 2' ACT System

Door Schedule

Mark	Width	Head Height	Elev.	Thickness	Finish	Frame Material	Fire Rating	Revit File Info
01	3' - 0"	7' - 0"	A	2"	WD	WD		Single-Raised Panel with Sidelights 36" x 84"
02	3' - 0"	7' - 0"	B	2"	WD	HM		Single-Flush 36" x 84"
03	3' - 0"	7' - 0"	B	2"	WD	HM		Single-Flush 36" x 84"
04	6' - 0"	7' - 0"	C	2"	ALUM	ALUM		Double-Door-Sliding 72" x 84"
05A	8' - 0"	7' - 0"	D	1 1/2"	ALUM	ALUM		Door-Garage-Embossed_Panel: 96" x 84"
05B	6' - 0"	7' - 0"	C	2"	ALUM	ALUM		Double-Door-Sliding 72" x 84"
06	3' - 0"	7' - 0"	B	2"	WD	WD		Single-Flush 36" x 84"
07	3' - 0"	7' - 0"	B	2"	WD	WD		Single-Flush 36" x 84"
08	3' - 0"	7' - 0"	B	2"	WD	WD		Single-Flush 36" x 84"



Door Elevations
1/8" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Refl. Ceiling Plan & Schedules

Project number	CMGT11000SP22	A6.1
Date	3/29/22	
Drawn by	JWW	
Checked by	Checker	Scale 1/8" = 1'-0"

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1 Open Office Looking Southeast
N.T.S.

2 Break Room Looking Southeast
N.T.S.

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Renderings

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	Checker

A9.1

Scale N.T.S.

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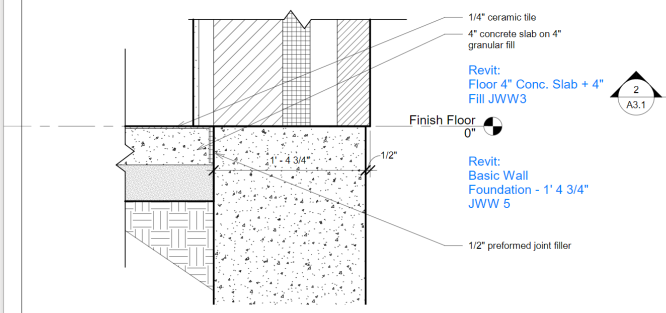
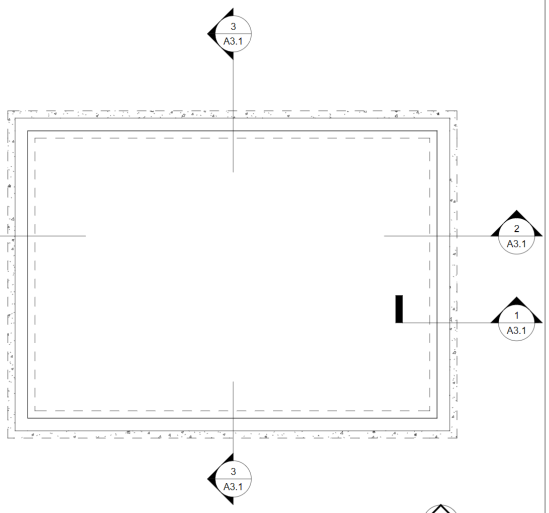


2 Foundation Detail
1 1/2" = 1'-0"



1 Foundation Plan
1/8" = 1'-0"

IUPUI

"Your Name"

Revit Project One

No.	Description	Date

Foundation Plan

Project number	CMGT11000SP22
Date	3/29/22
Drawn by	JWW
Checked by	Checker

S1.1

Scale As indicated

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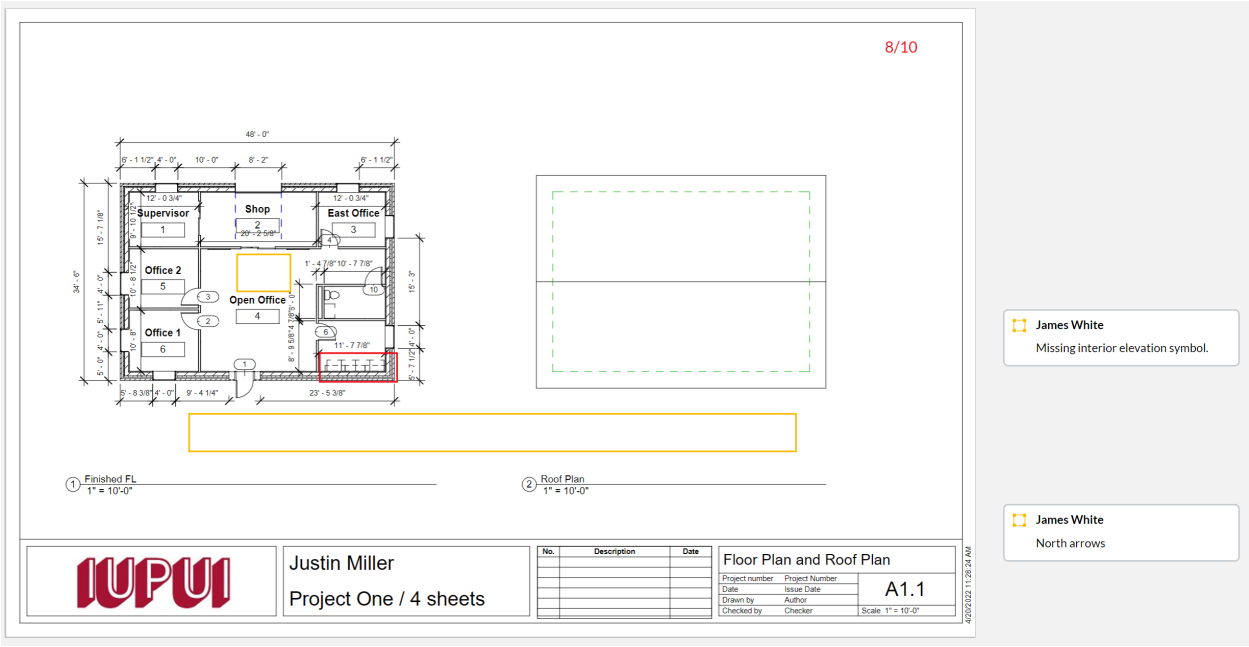
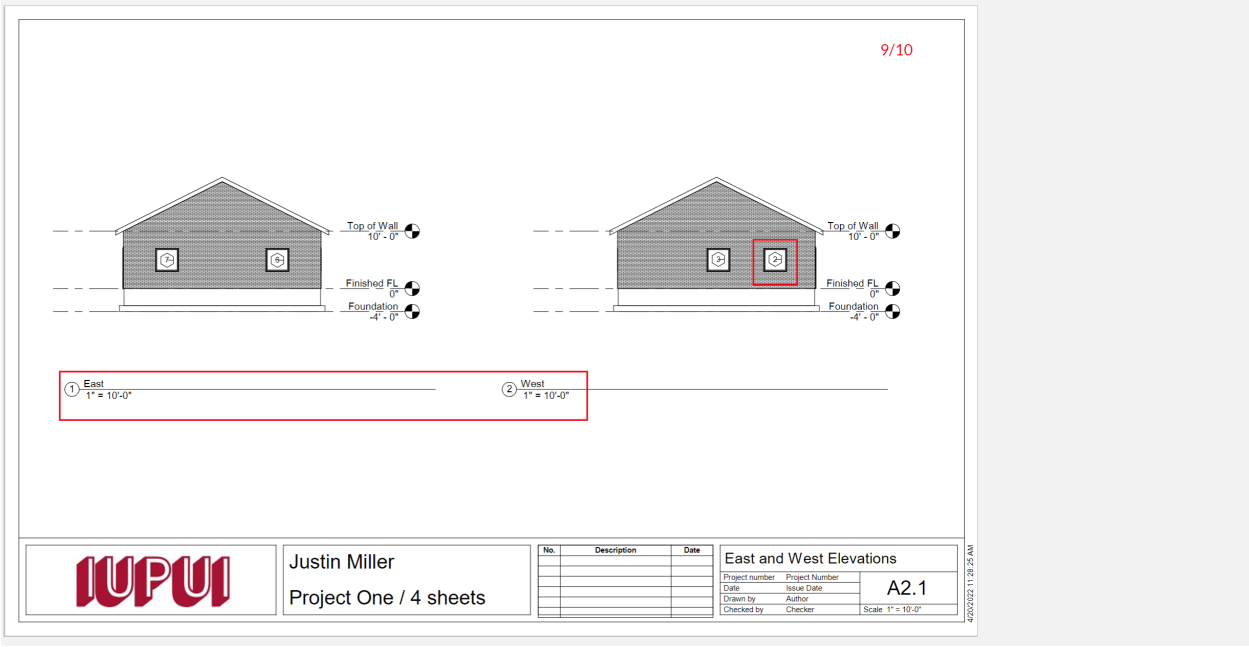
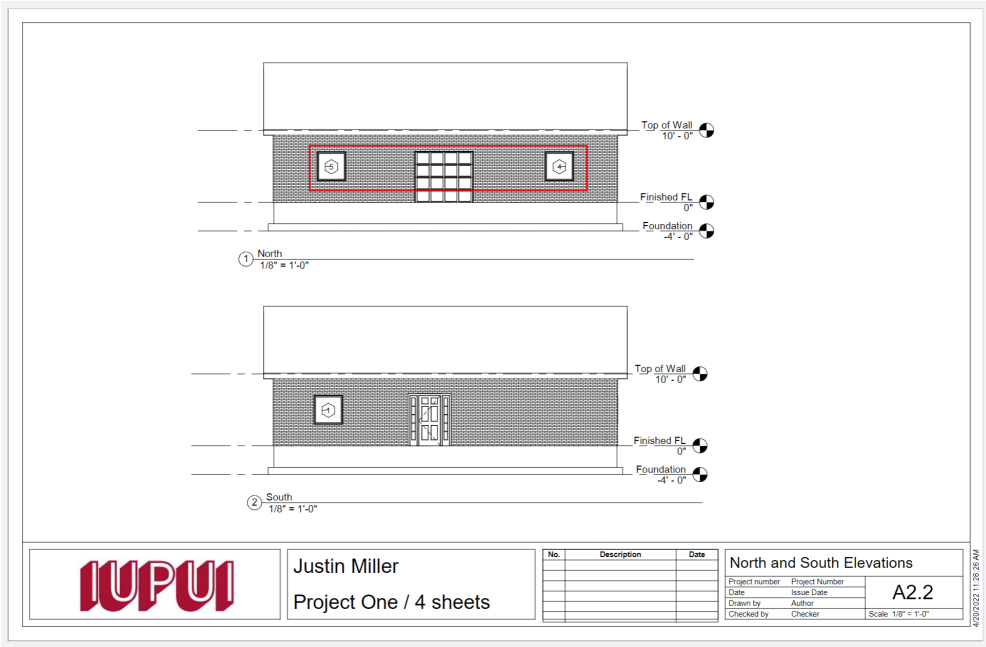
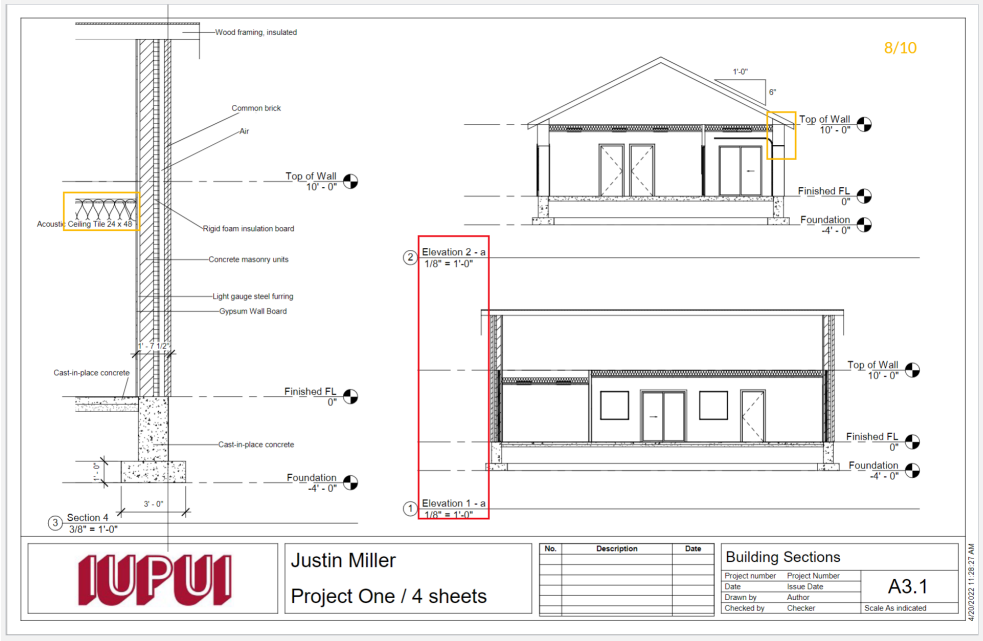
8 of 8

1. Homework Student Work:
Revit Project One – 6 Sheets (Spring 2022)



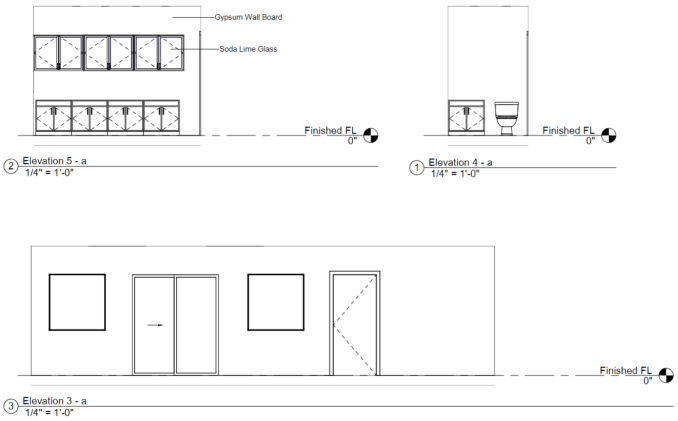






James White
Move insulation above ceiling

10/10



IUPUI	Justin Miller Project One / 4 sheets	No. / Description / Date	Details and Elevations Project number: Project Number Date: Issue Date Drawn by: Author Checked by: Checker A5.1 Scale: 1/4" = 1'-0"

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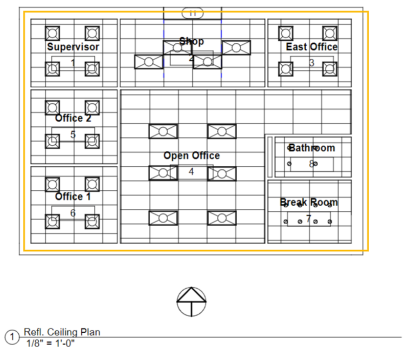
8/10



James White
Missing 2x2 & GWB ceilings

IUPUI	Justin Miller Project One / 4 sheets	No. / Description / Date	Refl. Ceiling Plan Project number: Project Number Date: Issue Date Drawn by: Author Checked by: Checker A6.1 Scale: 1/8" = 1'-0"

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2. Final Exam Questions (Spring 2022)

Attempts: 16 out of 17

What does the acronym "BIM" stand for? Fill in one word in each blank. (spelling counts!)

[B] [I] [M]

B I M

building	13 respondents	**76 %** ✓	76% answered correctly
Something Else	3 respondents	18 %	
No Answer	1 respondent	6 %	

Attempts: 16 out of 17

What does the acronym "BIM" stand for? Fill in one word in each blank. (spelling counts!)

[B] [I] [M]

B I M

information	11 respondents	**65 %** ✓	65% answered correctly
Something Else	4 respondents	24 %	
No Answer	2 respondents	12 %	

Attempts: 16 out of 17

What does the acronym "BIM" stand for? Fill in one word in each blank. (spelling counts!)

[B] [I] [M]

B I M

modeling	7 respondents	**41 %** ✓	53% answered correctly
model	2 respondents	**12 %** ✓	
Something Else	7 respondents	41 %	
No Answer	1 respondent	6 %	

Attempts: 17 out of 17

What kind of information can be incorporated within a BIM model element? Check ALL that apply.

Weight	14 respondents	82 % ✓
Thermal performance	16 respondents	94 % ✓
Power requirements	16 respondents	94 % ✓
Cost	15 respondents	88 % ✓
Occupant load	14 respondents	82 %
Specification information	13 respondents	76 % ✓

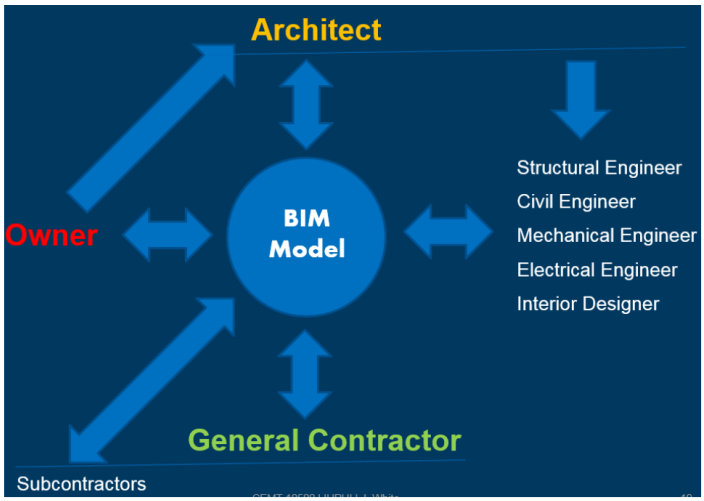
12% answered correctly

Attempts: 17 out of 17

+0.5

Discrimination Index

The following slide was presented in class. What does it depict?



The BIM construction management model.	7 respondents	41 %
The flow of information when using BIM	8 respondents	47 % ✓
A design-build method of BIM	1 respondent	6 %
The flow of information when using conventional construction documents.	1 respondent	6 %

47% answered correctly

Assessment Report for SLO 10

Courses: CMGT 11000 – Introduction to Construction Management

Academic Term for Direct Evaluation: Fall 2020, Spring 2022, Fall 2022

Instructors: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 10 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). A 76% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	10. Apply electronic-based technology to manage the construction process.	3.875	78%
S 2022		3.76	75%
F 2022		4.47	89%

Direct Measures

The Direct Measures consists of one assignment and five questions within one exam. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2020	21	Revit Project	83.02%	75%
		5 Final Exam Questions	69%	75%
Spring 2022	16	Revit Project	90.60%	75%
		5 Final Exam Questions	51%	75%
Fall 2022	29	Revit Project	71.83%	75%
		5 Final Exam Questions	46%	75%

The target for the overall average of the total grades should be at least 75%. The Indirect Measure was 81% and the Direct Measure was below the target in fall 2022. Based on the perception of graduating seniors (Indirect Measure), they felt confident in applying electronic-based technology to manage the construction process.

With the inclusion of the fall 2022 semester, the Revit software project has begun to trend slightly downward since fall 2017. However, because the previous semester (spring 2022) experienced a sharp increase, the drop for the fall 2022 semester may be a one-time anomaly. Modification doesn't appear to be warranted at this time. This performance indicator will be watched closely and should the score continue to drop for the spring 2023 semester, course/content modifications may be necessary.

The five exam questions that pertain to building information modeling (BIM) continue to be a struggle. The indicator on these five (5) questions was improving up until spring 2020 – the semester that all in-class instruction was suspended following spring break. In-class instruction continued to be disrupted until fall 2021. This decline in performance may have been affected by reducing the number of exams from four to two (midterm and final) in fall 2021. Reducing the number of exams was seen as an attempt at reducing exam anxiety for freshmen. Because of this exam reduction, students are now responsible for more material within the final assessment. The material that is covered by these questions is presented once in one lecture.

Proposed Actions for Course Improvement:

Given the poor performance on this indicator, an additional assignment – probably within Top Hat – will be created that will review the concepts that are presented within these five questions. This will afford the student more time to interact with the material and reflect on its importance.

Student Learning Outcome 11

Apply Basic Surveying Techniques for Construction Layout and Control

Introduction

CMGT 15000 - Surveying is a study of field procedures for construction and route surveying. Construction surveying including highway, street, sewer, and bridge layout. Route surveying including vertical and horizontal curves, curve design, survey for streets and subdivisions, earthwork and profiles, sections using both theodolite and electronic distance measuring (EDM) equipment, including computations of errors and coordinates and use of appropriate software.

CMGT 15000 prepares students to operate standard industry survey equipment and software with accuracy and precision of survey field data through calculations. Students gain an understanding of the role of surveying in construction and perform construction layout tasks within a group.

The surveying instruments used in this class include total station, prism pole, auto level, level rod, laser level & receiver, electronic data collector (RECON Field book), prism w/tribrach and tripod. This class is primarily a laboratory with lecture. The labs are conducted on the grounds of IUPUI and Engineering Technology (ET) Building.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 11, three is the final exam that is used for SLO 11 from CMGT 15000.

1. Direct – Lab assignments and Final Exam (Part I - Written and Part II - Practicum)

   Additional information concerning the above assignments is provided in the Direct Assessment section of this report.
2. Indirect - ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 11 Report Content

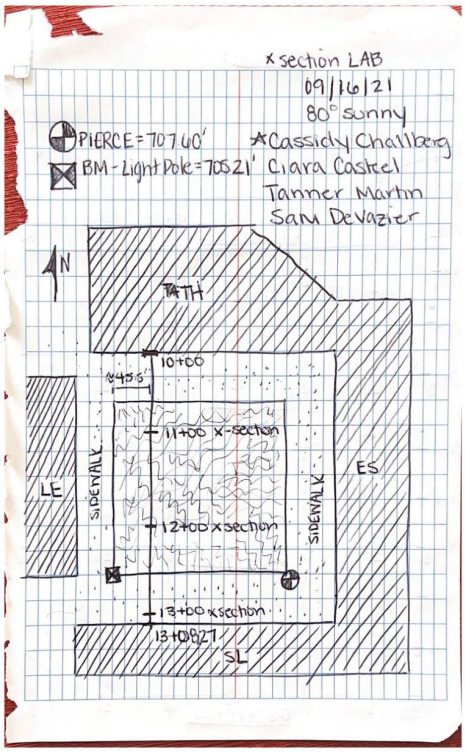
Subsequent sections of this SLO Report document the following:

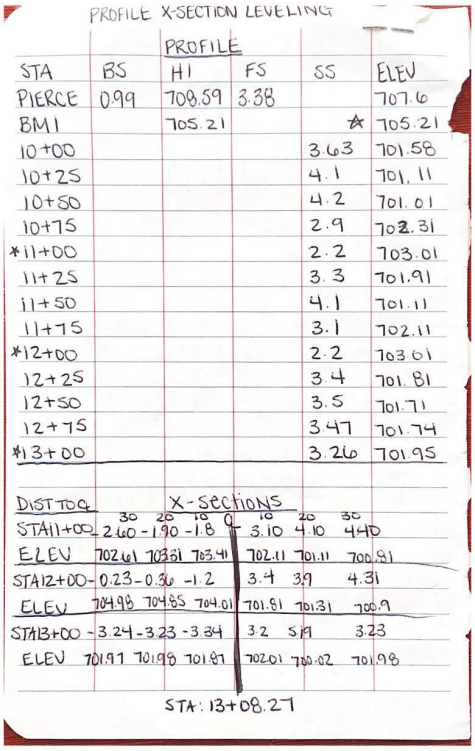
- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
  Graded student work (Final Exam)
- Assessment Report for SLO 11

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 5 (found at the end of this SLO report).

Lab Example (Leveling)





PROFILE X-SECTION LEVELING

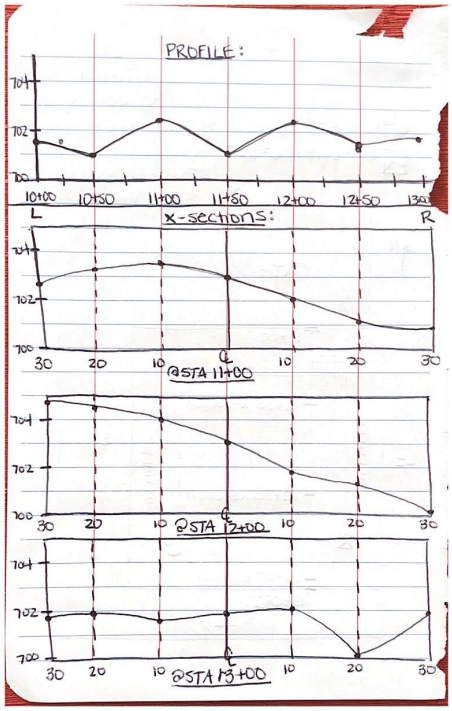
PROFILE

STA	BS	HI	FS	SS	ELEV
PIERCE	0.99	708.59	3.38		707.6
BM1		705.21		★	705.21
10+00				3.63	701.58
10+25				4.1	701.11
10+50				4.2	701.01
10+75				2.9	702.31
*11+00				2.2	703.01
11+25				3.3	701.91
11+50				4.1	701.11
11+75				3.1	702.11
*12+00				2.2	703.01
12+25				3.4	701.81
12+50				3.5	701.71
12+75				3.47	701.74
*13+00				3.26	701.95

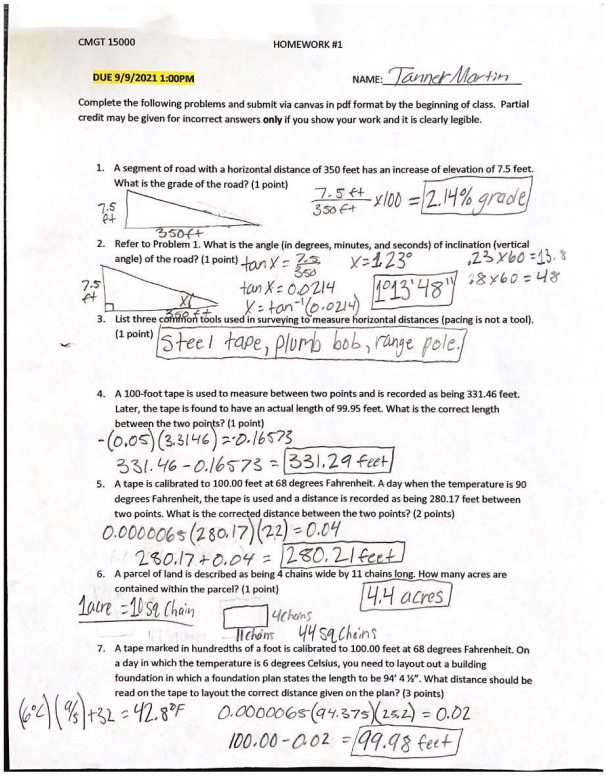
X-SECTIONS

DIST TOC	30	20	10	0	10	20	30
STA 11+00	2.60	-1.90	-1.8		3.10	4.10	4.40
ELEV	702.61	703.31	703.41		702.11	701.11	700.81
STA 12+00	-0.23	-0.30	-1.2		3.4	3.9	4.31
ELEV	704.98	704.85	704.01		701.81	701.31	700.9
STA 13+00	-3.24	-3.23	-3.34		3.2	3.19	3.23
ELEV	701.97	701.98	701.87		702.01	702.02	701.98

STA: 13+08.27



Homework Example



CMGT 15000 HOMEWORK #1

DUE 9/9/2021 1:00PM NAME: Tanner Martin

Complete the following problems and submit via canvas in pdf format by the beginning of class. Partial credit may be given for incorrect answers only if you show your work and it is clearly legible.

1. A segment of road with a horizontal distance of 350 feet has an increase of elevation of 7.5 feet. What is the grade of the road? (1 point)

   $\frac{7.5\text{ ft}}{350\text{ ft}} \times 100 = 2.14\%\text{ grade}$

2. Refer to Problem 1. What is the angle (in degrees, minutes, and seconds) of inclination (vertical angle) of the road? (1 point)

   $\tan X = \frac{7.5}{350}$ $X = 1.23°$ $.23 \times 60 = 13.8$ $.8 \times 60 = 48$

   $\tan X = 0.0214$

   $X = \tan^{-1}(0.0214)$ $1°13'48''$

3. List three common tools used in surveying to measure horizontal distances (pacing is not a tool). (1 point)

   Steel tape, plumb bob, range pole.

4. A 100-foot tape is used to measure between two points and is recorded as being 331.46 feet. Later, the tape is found to have an actual length of 99.95 feet. What is the correct length between the two points? (1 point)

   $-(0.05)(3.3146) = -0.16573$

   $331.46 - 0.16573 = 331.29$ feet

5. A tape is calibrated to 100.00 feet at 68 degrees Fahrenheit. A day when the temperature is 90 degrees Fahrenheit, the tape is used and a distance is recorded as being 280.17 feet between two points. What is the corrected distance between the two points? (2 points)

   $0.000006\text{s}(280.17)(22) = 0.04$

   $280.17 + 0.04 = 280.21$ feet

6. A parcel of land is described as being 4 chains wide by 11 chains long. How many acres are contained within the parcel? (1 point)

   1 acre = 10 Sq Chains

   4 chains × 11 chains = 44 Sq Chains

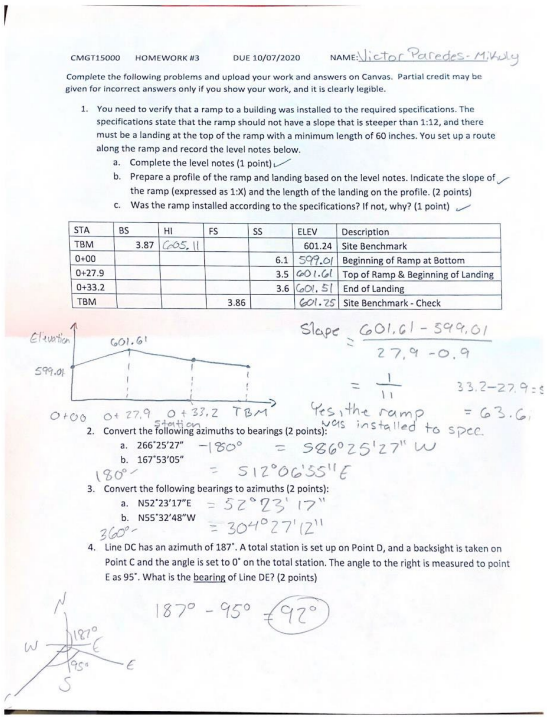
   4.4 acres

7. A tape marked in hundredths of a foot is calibrated to 100.00 feet at 68 degrees Fahrenheit. On a day in which the temperature is 6 degrees Celsius, you need to layout out a building foundation in which a foundation plan states the length to be 94' 4 ½". What distance should be read on the tape to layout the correct distance given on the plan? (3 points)

   $(6°C)\left(\frac{9}{5}\right) + 32 = 42.8°F$

   $0.000006\text{s}(94.375)(252) = 0.02$

   $100.00 - 0.02 = 99.98$ feet



CMGT15000 HOMEWORK #3 DUE 10/07/2020 NAME: Victor Paredes-Mirkly

Complete the following problems and upload your work and answers on Canvas. Partial credit may be given for incorrect answers only if you show your work, and it is clearly legible.

1. You need to verify that a ramp to a building was installed to the required specifications. The specifications state that the ramp should not have a slope that is steeper than 1:12, and there must be a landing at the top of the ramp with a minimum length of 60 inches. You set up a route along the ramp and record the level notes below.
   a. Complete the level notes (1 point)
   b. Prepare a profile of the ramp and landing based on the level notes. Indicate the slope of the ramp (expressed as 1:X) and the length of the landing on the profile. (2 points)
   c. Was the ramp installed according to the specifications? If not, why? (1 point)

STA	BS	HI	FS	SS	ELEV	Description
TBM	3.87	605.11			601.24	Site Benchmark
0+00				6.1	599.01	Beginning of Ramp at Bottom
0+27.9				3.5	601.61	Top of Ramp & Beginning of Landing
0+33.2				3.6	601.51	End of Landing
TBM			3.86		601.75	Site Benchmark - Check

Slope $= \frac{601.61 - 599.01}{27.9 - 0.9} = \frac{1}{11}$ $33.2 - 27.9 = 5.3$ $= 63.6$

Yes, the ramp was installed to spec.

2. Convert the following azimuths to bearings (2 points):
   a. 266°25'27" $-180°$ $= S86°25'27''W$
   b. 167°53'05" $180°$ $= S12°06'55''E$
3. Convert the following bearings to azimuths (2 points):
   a. N52°23'17"E $= 52°23'17''$
   b. N55°32'48"W $360°$ $= 304°27'12''$
4. Line DC has an azimuth of 187°. A total station is set up on Point D, and a backsight is taken on Point C and the angle is set to 0° on the total station. The angle to the right is measured to point E as 95°. What is the bearing of Line DE? (2 points)

$187° - 95° = 92°$

Course Assessment Report

Course: CMGT 15000 - Surveying

Academic Term: 2021 Fall Semester and 2022 Fall Semester

Instructor: Michael Conley

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 11 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). A 79.3% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Range
F 2021	11. Apply basic surveying techniques for construction layout and control.	3.625	73%
S 2022		4.0	80%
F 2022		4.24	85%

Direct Measures - Assessments and Evaluations

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Direct Measure for SLO 11 - Final Exam (Part I - Written and Part II - Practicum)
The table below shows the average grade for the Segment of class listed in the Criteria.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	21	Lab	96.64	75%
		Assignments	80.91	75%
		Final Exam (Part I - Written and Part II - Practicum)	78.96	75%
Fall 2022	13	Lab	93.21	75%
		Assignments	82.32	75%
		Final Exam (Part I – Written and Part II – Practicum)	80.57	75%

After the first ACCE re-accreditation for the CMGT program, it was decided that an overall average of the total grades should be at least 75%. The average of the Indirect Measure (85%) and the average of the Direct Measure (85.3%) indicate that the target value was met.

Proposed Actions for Course Improvement: (for Spring 2023)

1. **Improve measurable metrics on grading rubric**: Enhance evaluation of measurable metrics by improving assessments for both the lab and lecture for student expectations.
2. **Added technology capabilities**: Add GPS base/rover technology into the coursework and add quantifiable direct measurables.

3. **Upgrade grading rubric for lab grading**: Refine grading criteria and provide students a detailed version of specific expectations.
4. **Technical Drawing**: This class requires students to prepare map from collected survey data. Students have struggled on CAD drawing. We are planning to introduce civil 3D software, Trimble business center, and MicroStation drafting.
5. **Add data collection and analysis**: Data collectors are dated and do not work well in cold weather. Integrated data collection with newer total stations will help measurable workflows for technical advancement in CAD drafting and processing.
6. **Weather Contingency plan**: Weather is an issue in Indiana because of spring semester rain and snow. During snowy and rainy days, it is difficult for students to go outside to conduct lab. We are planning to prepare few lab handouts to work inside the campus buildings and tailor them to the labs they would have done outside.

Student Learning Outcome 12

Understand Different Methods of Project Delivery and the Roles and Responsibilities of All Constituencies Involved in the Design and Construction Process

Introduction

SLO 12 – "Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process." is evaluated and assessed in CMGT 33000 - Contract Administration & Specifications.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 12, there are three (3) assignments that are used as direct measures:

1. Four (4) selected questions from the midterm exam.
2. A201 General Conditions research assignment (in-lab) "It's About Time".
3. In-Lab Exercise PC01.

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 12 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  - Explanation and rubrics (grading criteria)
  - Graded student work (using the rubric)
- Assessment and Evaluation for SLO 12.

Indirect Measure

The Indirect Measure for SLO 12 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 12 (found at the end of this SLO report).

Direct Measures

The Direct Measures for SLO 12 include:

1. Four (4) selected questions from the midterm exam.
2. A201 General Conditions research assignment (in-lab) "It's About Time".
3. Contract Manager In-Lab Exercise PC01.

To capture the most meaningful assessment data from within CMGT 33000 both overall assignment grades and specific questions embedded within larger assessment instruments have been extracted. Delivery systems, roles and responsibilities are addressed in the first half of the semester. Thus the selected assessment data is drawn from either assignments occurring prior to the midterm or appearing on the midterm exam itself. Because the A201 General Conditions is such a fundamental document which defines roles & responsibilities, results from a lab exercise are included which require students to research the A201. Additionally, our textbook addresses roles & responsibilities in chapters 1 and 2; a short reading quiz that pertains to that content is included.

Graded Student Work

1. Midterm Questions & Responses (Spring 2022)

Following are four (4) questions that relate to roles and responsibilities. Because the questions were randomly drawn from a question pool, everyone in the class did not see every question.

CMGT 33000 – Midterm Exam (selected questions) (SP22)

1.

Attempts: 9 out of 9

The Owner's approach to organizing the project team is called the _____.

Contract family	1 respondent	11 %
Compensation method		0 %
Prime contract	1 respondent	11 %
Delivery method ✓	7 respondents	78 %

2.

According to your author, the builder's work is the same regardless of the chosen delivery system. Which of the following IS NOT a major phase of the construction project?

Plan ✓	8 respondents	80 %
Design	1 respondent	10 %
Bid		0 %
Construct	1 respondent	10 %

3.

From the following identify the advantages of the traditional (D-B-B) delivery method. Select ALL that apply.

Well known process ✓	18 respondents	100 %
Great owner protection ✓	16 respondents	89 %
Facilitates bidding ✓	11 respondents	61 %
Enhanced contractor / designer interaction	3 respondents	17 %
Maximizes owner-designer-builder collaboration	4 respondents	22 %

61% answered correctly

4.

Your author identifies two (2) primary types of owners. What are they? Select ALL that apply.

Public ✓	9 respondents	90 %
Government	2 respondents	20 %
Private ✓	9 respondents	90 %
Institutional		0 %

2. A201 General Conditions Research Questions & Responses (Spring 2022)

2. A201 Research Assignment "It's About Time"

This assignment is presented as an in-lab exercise. It requires the student to research the A201 to answer questions, all of which pertain to deadlines and responsibilities. Because this assessment is a fill-in-the-blank exercise, there is typically one (1) correct answer, except when students enter the incorrect figure in which case the testing software indicates "Something Else". Note: occasionally a question may have more than one (1) correct answer. The question graph will indicate this condition accordingly.

CMGT 33000 – A201 Research Assignment "It's About Time" (SP22)

1.

Attempts: 16 out of 16

The Architect has [**days**] days maximum response time to respond to the Contractor's submitted Application for Payment, including either 1) issuing a Certificate of Payment to the Owner for payment or 2) notifying the Contractor / Owner in writing the reasons why the application is being withheld.

7	12 respondents	75 %	✓
Something Else	4 respondents	25 %	

75% answered correctly

2.

Attempts: 16 out of 16

The General Contractor has [**days**] days to pay his Subcontractors after receiving payment from the Owner.

7	14 respondents	88 %	✓
Something Else	2 respondents	13 %	

88% answered correctly

3.

Attempts: 17 out of 17

The Owner must furnish with [**days**] days of the General Contractor's request, information pertaining to a mechanic's lien.

15	14 respondents	82 %	✓
Something Else	3 respondents	18 %	

82% answered correctly

CMGT 33000 – A201 Research Assignment "It's About Time" (SP22)

4.

Attempts: 17 out of 17

The General Contractor may terminate the contract if the work has been stopped for [**days**] days through no fault of the GC or his subcontractors.

30	15 respondents	88 %	✓
60		0 %	✓
67		0 %	✓
Something Else	2 respondents	12 %	

88% answered correctly

5.

Attempts: 15 out of 15

In the event of a Subcontractor's contract becoming assigned to the Owner (re: Subcontractual Relations) following a suspension of the Work, the Subcontractor may request a compensation payment after [**days**] days of a suspension period.

30	11 respondents	73 %	✓
Something Else	4 respondents	27 %	

73% answered correctly

6.

Attempts: 13 out of 13

The Architect has [**days**] days to review and respond to the General Contractor's superintendent's qualifications.

14	11 respondents	85 %	✓
Something Else	2 respondents	15 %	

85% answered correctly

7.

Attempts: 14 out of 14

After a maximum of [**days**] days without receiving payment from the Owner by the date established in the Contract Documents, the General Contractor may initiate the process to stop the Work on the Project.

7	12 respondents	86 %	✓
Something Else	2 respondents	14 %	

86% answered correctly

8.

Question did not appear.

9.

Attempts: 13 out of 13

If requested by the Owner, the General Contractor has [**days**] days to provide written evidence that the Subcontractors have been paid.

7	13 respondents	100 %	✓

100% answered correctly

10.

Attempts: 15 out of 15

The General Contractor must notify the Architect / Owner of unforeseen, concealed or unknown conditions within [**days**] days of first observance.

21	14 respondents	93 %	✓
Something Else	1 respondent	7 %	

93% answered correctly

CMGT 33000 – A201 Research Assignment "It's About Time" (SP22)

11.

Attempts: 15 out of 15

The Architect / Owner has [**days**] days to review and respond to the General Contractor's subcontractor list.

14	10 respondents	67 %	✓
Something Else	5 respondents	33 %	

67% answered correctly

12.

Attempts: 16 out of 16

If anyone suffers injury or damage due to the act or omission of someone else on the job (re: Safety of Persons and Property), the injured / damaged party must provide provide written notice of such injury to the responsible party within [**days**] days after discovery.

21	15 respondents	94 %	✓
Something Else	1 respondent	6 %	

94% answered correctly

3. In-Lab Exercise 01
(Spring 2022)

CMGT 33000 Lab 01

CMGT 33000 Contract Administration & Specifications

Construction Management
Purdue School of Engineering & Technology
Indianapolis

Goals

1. Familiarize yourself with Procore environment.
2. Set up Procore / Gazelle Office Remodel.
    a. Populate data within your new project.
        i. Participants & roles
        ii. Specifications upload
        iii. Project schedule upload
    b. Upload important documents into your project.
    c. Create two (2) reports.
    d. Become acquainted with course processes and software
        i. Procore
        ii. Adobe Acrobat
        iii. File naming convention: *Lab#your last name*
        iv. Canvas submission process

Terms

- Subcontractor
- Schedule
- Specifications

Deliverables

1. Print the indicated PDF file deliverables and upload them as one combined file into Canvas / Assignments.

Initializing Procore

1. Find your Procore invitation within your official university email in-box. Follow the instructions to login.
2. Create your password. Write it down. (I am unable to retrieve your password. Use Procore's *Forgot your password?* link to retrieve it.)
3. Proceed into Procore. You arrive at the Company Level. You should see 1 project:
    a. **Gazelle Office Remodel SP22** (project #**330SP22*first 4 letters of your last name***)

Add companies & team members

4. Select Gazelle Office Remodel.
5. Proceed to Project Tools / Core Tools / Directory.

6.
7. From the dropdown menu, select the following individuals (Note: Don't pick the company alone). Ensure the permission template for everyone is correct. *Ignore the Project Role option; it will be corrected in a later step.*

	Team Members			Permission Template
1	Carlos	Bonilla	O&D Bonilla Framing, LLC	Subcontractor
2	Greg	Broady	Broady-Campbell, Inc.	Subcontractor
3	Bill	Clemons	CEP Concrete Construction Corporation	Subcontractor
4	Basil	Delacruz	Quality Interiors, Inc.	Subcontractor
5	Buck	Gazelle	Gazelle Printing Group	Owner/Client
6	Jim	Halperin	Dunder Mifflin Design	Architect/Engineer
7	Bill	Poindexter	Poindexter Excavating, Inc.	Subcontractor
8	Donald	Fisher	Insight Engineering	Architect/Engineer
9	Tim	Watkins	Steel Services	Architect/Engineer

8. Add to Project
9. "9 companies will be added..."
10. Return to Directory
11. Proceed to Project Tools / Directory
12. Select "Configure Settings" (orange gear)

PROJECT DIRECTORY

13. Assign the following roles:

	Role	Member
1	Project Manager	(you)
2	Designer	Dunder Mifflin Design
3	Owner	Gazelle Printing Group
4	Subcontractor	Broady-Campbell, Inc. O&D Bonilla Framing, LLC Poindexter Excavating, Inc. Quality Interiors, Inc. CEP Concrete Construction Corp.
5	Consultant	Insight Engineering Steel Services

14. Update *Note: if "Update" doesn't appear, select:* ← Back *Return to Project Roles to ensure your data has been saved.*
15. Export ▲ → PDF
16. **DELIVERABLE - The PDF file will be downloaded. Include this document with your submission.**

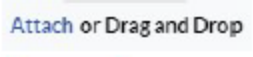
Upload prime agreement into Documents

17. Download this file onto your desktop: ***CMGT 33000 SP22*** *Lab Project A101.pdf* from the Canvas / CMGT 33000 **SP22** SHARED FOLDER link found in Canvas > Resources CMGT 33000 SP21 > Lab Resources.
18. Proceed to Project Tools / Core Tools / Documents / Gazelle Office Remodel SP22 > 05 INTERNAL DOCUMENTS. While this is highlighted, select…
19. 

pulldown menu: "Create Folder"
20. Folder Name: "00 Prime Contract"
21. 

22. 

23. Proceed to the new folder you just created.
24. 

pulldown menu: "File Upload"
25. 

or "Open" A101 file to this location.
26. 

27. The file should now appear in your Documents / 05 INTERNAL DOCUMENTS / 00 Prime Contract folder:

Upload specifications into Documents

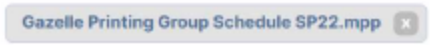
28. Download this file onto your desktop: *Gazelle Print Group 5 Section Specification* from the Canvas / CMGT 33000 **SP22** SHARED FOLDER Shared Content Folder link.
29. Proceed to Project Tools / Documents. Continue to the folder 01 Design Files > 04 Specifications.
30. Follow the same method as above to upload the specification file into this folder (steps 24 – 27).
31. The file should now appear in your Documents / 01 Design Files / 04 Specifications folder.

Upload the project schedule

32. Download this file onto your desktop: ***Gazelle Printing Group Schedule SP22.mpp*** from Canvas / CMGT 33000 **SP22** SHARED FOLDER / Shared Content Folder link. *NOTE: Do not try to open it; just download it.*
33. Proceed to Project Tools / Project Management / Schedule

34. Select: 
35. Place the previously downloaded .mpp file using one of the following:

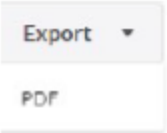
(When executed properly, the file name will appear on the screen.)



36.

37. Once processing is completed,
38. Select "Month"

You should see scheduled items appear in the current month.



39. **DELIVERABLE - The PDF file will be downloaded. Include this page with your submission.**
40. Combine all deliverables into one (1) file and upload it into Canvas / Assignments / Lab Exercise 01..
41. Proceed to Part 2 and answer the questions.

End of Lab 01

Lab 01 Procore Questions [SP22]

This is a preview of the published version of the quiz

Started: May 10 at 10:46pm

Quiz Instructions

The following questions can be answered by referencing the material you have just finished entering / uploading into your Procore project.

Question 1 1 pts

What subcontractor (contact) is responsible for Concrete - CIP? *Hint: filter directory by trade.*

- ○ Jim Halperin
- ○ Donald Fisher
- ○ Bill Clemons
- ○ Bill Poindexter

Question 2 1 pts

In the specifications, what is the name of Section 02315? [Enter it exactly as it appears.]

Question 3 1 pts

What is Buck Gazelle's phone number? [Enter it exactly as displayed.]

Question 4 1 pts

In what town is O&D Bonilla Framing located? [One word].

Question 5 1 pts

When is the Concrete portion of the work scheduled to begin?

- ○ 01/10/22
- ○ 01/14/22
- ○ 02/07/22
- ○ 03/04/22

Quiz saved at 10:46pm Submit Quiz

Assessment Report for SLO 12

Course: CMGT 33000 - Contract Administration & Specifications

Academic Term: 2020 Fall Semester & 2022 Spring Semester

Instructors: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 12 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 90.7% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	12. Understand different methods of project delivery and the roles and responsibilities of constituencies involved in the design and construction process.	4.375	88%
S 2022		4.48	90%
F 2022		4.69	94%

Direct Measures - Assessments and Evaluations

The Direct Measure consists of: selected midterm exam questions, A201 Lab Exercise "It's About Time," and a Procore lab exercise.

Term	N	Criteria	Average Percent	Target Percent
Fall 2020	11	1. Selected midterm exam questions	70.67%	75%
		2. A201 Lab Exercise "It's About Time"	86.32%	75%
		3. Procore lab exercise	96.36%	75%
Spring 2022	17	1. Selected midterm exam questions	72.34%	75%
		2. A201 Lab Exercise "It's About Time"	84.90%	75%
		3. Procore lab exercise	90.59%	75%

Overall the metrics associated with the three (3) direct measures satisfied the target criteria and therefore don't require future course content modification. The one exception, direct measure #1 "Selected midterm exam questions", while slightly below the target for both semesters, indicates an improvement trend such that course modification would appear premature. Knowledge of this slight metric deficiency will inform future lectures and appear within the midterm study guide to assist students when studying for the midterm exam.

Proposed Actions for Course Improvement:

No course modification appears warranted at this time.

Student Learning Outcome 13

Understand Construction Risk Management

Introduction

CMGT 44000 - Project Management Capstone) requires students to work in groups to create a cost estimate, a construction schedule, a safety plan, a waste management plan, etc. for a typical construction project. Project binders and oral presentations are also required. In addition, there are several individual assignments (resume, risk management, weekly reports, etc.).

The risk assessment assignment is used to assess and evaluate SLO 13 - Understand Construction Risk Management. This assignment is explained in the Direct Measure section of this report.

Assessment Methods

For CMGT 44000, two methods of assessment are used for SLO 13 Direct and Indirect.

- Direct - Risk Assessment Assignment (explained later)
- Indirect - ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 13 Report Content

Subsequent sections of this SLO Report document the following:

Indirect Measure (ACCE Student Learning Outcome Survey)
Direct Measure
Rubric (grading criteria) used to grade the multi-disciplinary team assignments
Graded Student Work using the rubric
Course Assessment Report

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 5 (found at the end of this SLO report).

Direct Measure

Construction risk management is designed to identify, plan, monitor, and control those measures needed to prevent exposure to risk. To provide students with an understanding of construction risk management an assignment in CMGT 44000, students must complete the "Risk Assessment Assignment." Twenty-seven (27) risks have been identified that could be the responsibility (i.e., owned) by the contractor, the designer, the owner, the designer, or shared by more than one party.

The students complete the assignment which is graded and returned to them the following week. During class each student is asked to explain and justify their selections for at least one or two of the identified risks. The goal of the discussions is to provide an understanding of not only who "owns" the risk, but to talk about ways to measure and control the risk.

The risk assessment assignment is completed before the multi-disciplinary team assignment to prepare students to assume the roles of "other" project team members from other disciplines. The multi-disciplinary team assignment discussion is found in the report for Student Learning Outcome 9 - Apply Construction Management Skills as a Member of a Multi-Disciplinary Team.

Graded Student Work

Grading Criteria

The following grading criteria (rubric) is used to evaluate the risk assessment assignment.

For each of the identified risks, one or more parties may be assigned to that risk. One-half (1/2) point is deducted for each incorrectly assigned risk. Each one of the 30 types of risk categories is worth .5 points. Total points = 80 (6 x 30 = 180, 80/180 = .44 rounded to .5 pts). In class each student will be asked for a justification for their selection for at least one type of risk.

The following two pages display the Risk Assessment Assignment (including the grading criteria) and a graded student assignment.

NAME:_____ **DATE:** _____

CMGT 44000 – Project Management Capstone
Construction Management Technology
Purdue School of Engineering & Technology

Risk Assessment Assignment – 80 points
Assign who is the primary perpetrator or cause of each risk. Each risk can be assigned to one, two, three or more responsible parties. All risks must be assigned to at least one participant.

Assign a ranking criteria – 1, 2, 3, 4, 5 or 6 if more than one party is also part of the risk.

	TYPE OF RISK	OWNER	ARCHITECT	ENGINEER	GENERAL CONTRACTOR /CM	SUBCONTRACTOR	SUPPLIER
1.	**Site Access**						
2.	**Subsurface Conditions**						

3.	**Quantity Variations**						
4.	**Weather**						
5.	**Acts of God**						
6.	**Financial Failure**						
7.	**Subcontractor Failure**						
8.	**Accidents @ Site**						
9.	**Defective Work**						
10.	**Management Incompetence**						
11.	**Inflation**						
12.	**Economic Disasters**						
13.	**Funding**						
14.	**Materials & Equipment-Design**						
15.	**Materials & Equipment-Delivery**						
16.	**Labor Problems**						
17.	**Owner-Furnished Equipment**						
18.	**Delays in Work**						
19.	**Environmental Controls**						
20.	**Codes & Regulations**						
21.	**Safety @ Site**						
22.	**Public Disorder**						
23.	**Union Strife**						
24.	**Errors & Omissions**						
25.	**Document Conflicts**						
26.	**Design Defects**						
27.	**Shop Drawings**						
28.	**Diversity/Inclusion**						
29.	**Tariffs**						
30.	**Contagious Disease**						

$6.5 million

Name [redacted]
Date: 3/1/18

CEMT 44700 – Construction Project Management
SPRING 2018

Construction Engineering & Management Technology
Purdue School of Engineering & Technology

68/80

Risk Assessment Assignment – 80 points

Assign who rightfully "owns" each risk. Each risk can be assigned to one, two or three responsible parties. All risks must be assigned to at least one participant.

	TYPE OF RISK	CONTRACTOR	OWNER	DESIGNER
1.	Site access	√	√	
2.	Subsurface conditions	√	√	
3.	Quantity variations	√		√
4.	Weather	√		
5.	Acts of God	√	√	
6.	Financial failure	√	√	
7.	Subcontractor failure	√		
8.	Accidents @ site	√		
9.	Defective work	√		
10.	Management incompetence	√	√	
11.	Inflation	√	√	
12.	Economic disasters	√	√	
13.	Funding	√	√	
14.	Materials & equipment	√		
15.	Labor problems	√		
16.	Owner-furnished equipment	√	√	
17.	Delays in work	√	√	√
18.	Environmental controls	√	√	
19.	Codes & regulations	√	~~notify~~ comply	√
20.	Safety @ site	√		
21.	Public disorder	√	√	
22.	Union strife	√		
23.	Errors & omissions	√		√
24.	Document conflicts	√	√	√
25.	Design defects	√		√
26.	Shop drawings	√		√
27.	DBE Requirements	√	√	√

Assessment Report for SLO 13

Course: CMGT 44000 - Construction Project Management (Capstone)

Academic Terms for Direct Evaluation: Fall 2018, Spring 2019, Fall 2019, Spring 2020, Fall 2020, Spring 2021, Fall 2021 & Spring 2022

Instructors: Marvin Johnson and Dan Koo

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 13 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 88% ranking was achieved for SLO 13.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	13. Understand construction risk management.	4.375	88%
S 2022		4.44	89%

Direct Measures - Assessments and Evaluations

The Direct Measure for SLO 13 was the "Risk Assessment Assignment." The maximum grade (points) for this individual assignment was 80 points. The table below shows the average individual grades for this assignment.

Term	N	Criteria	Average Grade	Average Percent	Target Percent
Fall 2018	15	Risk Assessment	62.8 points	78.5%	75%
Spring 2019	23	Risk Assessment	65.8 points	82.3%	75%
Fall 2019	8	Risk Assessment	69.4 points	86.8%	75%
Spring 2020	21	Risk Assessment	60.6 points	75.8%	75%
Fall 2020	11	Risk Assessment	72.7 points	90.9%	75%
Spring 2021	17	Risk Assessment	67.1 points	83.9%	75%
Fall 2021	8	Risk Assessment	67.1 points	83.9%	75%
Spring 2022	24	Risk Assessment	64.3 points	80.4%	75%

After the initial ACCE accreditation for the CM program, it was decided that an overall average of the total grades should be at least 75%.

For Fall 2018, the Indirect Measure was (88%) and the Direct Measure was (78.5%). Assuming an equal weight for each measure the composite grade was 83.3% indicating that the target value was met.

For Spring 2019, the Indirect Measure was (88%) and the Direct Measure was (82.3%). Assuming an equal weight for each measure the composite grade was 85.2% indicating that the target value was met.

For Fall 2019, the Indirect Measure was (88%) and the Direct Measure was (86.8%). Assuming an equal weight for each measure the composite grade was 87.4% indicating that the target value was met.

For Spring 2020, the Indirect Measure was (88%) and the Direct Measure was (75.8%). Assuming an equal weight for each measure the composite grade was 81.9% indicating that the target value was met.

For Fall 2020, the Indirect Measure was (88%) and the Direct Measure was (90.9%). Assuming an equal weight for each measure the composite grade was 89.5% indicating that the target value was met.

For Spring 2021, the Indirect Measure was (88%) and the Direct Measure was (83.9%). Assuming an equal weight for each measure the composite grade was 86.0% indicating that the target value was met.

For Fall 2021, the Indirect Measure was (88%) and the Direct Measure was (83.9%). Assuming an equal weight for each measure the composite grade was 86.0% indicating that the target value was met.

For Spring 2022, the Indirect Measure was (88%) and the Direct Measure was (80.4%). Assuming an equal weight for each measure the composite grade was 84.2% indicating that the target value was met.

Overall, the class discussions following the assignment added value to the basic goal of understanding risk management. This concept will be expanded in the following section, Proposed Actions for Course Improvement.

Proposed Actions for Course Improvement:

The complete Faculty Course Assessment Report for CEMT 44700/CMGT 44000 is included in the appendix for the Quality Improvement Plan. The following proposed actions documented here relate specifically to the Risk Assessment Assignment and the topic of construction risk management, in general.

It is anticipated that the topic of risk management will be enhanced in future course offerings. Documentation of the results of the class discussions is needed which will be accomplished with a follow up assignment.

The assignment will concern risk management as applied to the current capstone project. Students will be required to develop a Risk Management Plan, for example:

- Define at least five (5) risks that are owned by the contractor (i.e., construction management team) that are specifically related to the *current capstone project*.

- Create a Risk Management Plan of how those risks are monitored and controlled throughout the project.

A framework will be created to assist the students in developing the Risk Management Plan. A tentative outline of the plan is provided below. Additional insight will come from the industry mentors.

1. Risk Identification (what are the risks?)
2. Risk Responsibility (who owns the risks?)
3. Risk Assessment (what is the impact of the risks and how are the risks measured and ranked?)
4. Risk Response (what are measures for addressing the risks?)
5. Risk Mitigation (what is the contingency plan to deal with the risk should it occur?)
6. Risk Tracking and Reporting (what documentation is required?)

The Risk Management Plan will become part of the documentation for the Project Binder and part of their oral presentation. In addition, each group will create a Risk Assessment Matrix, similar to the example below, where each of their project specific risks are identified and assigned a measure of probability.

Appendix A – Example Risk Assessment Matrix

Probability of Occurrences			Catastrophic	Critical	Moderate	Minor	Negligible
Definition	Meaning	Value	(A)	(B)	(C)	(D)	(E)
Frequent	• Occurs frequently • Will be continuously experienced unless action is taken to change events	5	5A	5B	5C	5D	5E
Likely	• Occur less frequently if process is corrected • Issues identified with minimal audit activity • Process performance failures evident to trained auditors or regulators	4	4A	4B	4C	4D	4E
Occasional	• Occurs sporadically • Potential issues discovered during focused review.	3	3A	3B	3C	3D	3E
Seldom	• Unlikely to occur • Minimal issue identification during focused review	2	2A	2B	2C	2D	2E
Improbable	• Highly unlikely to occur	1	1A	1B	1C	1D	1E

Risk Levels:

- Risk is High for codes 5A, 5B, 5C, 4A, 4B, 3A
- Risk is Medium High for codes 5D, 5E, 4C, 3B, 3C, 2A, 2B
- Risk is Medium Low for codes 4D, 4E, 3D, 2C, 1A, 1B
- Risk is Low for codes 3E, 2D, 2E, 1C, 1D, 1E

Student Learning Outcome 14

Understanding Construction Accounting and Cost Control

Introduction

SLO 14 – Understanding Construction Accounting and Cost Control is assessed and evaluated in CMGT 33000 - Construction Administration and Specifications.

Assessment Methods (additional information in the Direct Assessment section of this report)
For CMGT 33000, two methods of assessment are used for SLO 14 Direct and Indirect.

Direct Measure - Student's Semester Project.

Indirect Measure - ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 14 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessment
  - Explanation and grading criteria
  - Graded student work (using grading criteria)
- Assessment Report for SLO 14

Indirect Measure

The Indirect Measure for SLO 14 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 14 (found at the end of this SLO report).

Direct Measure

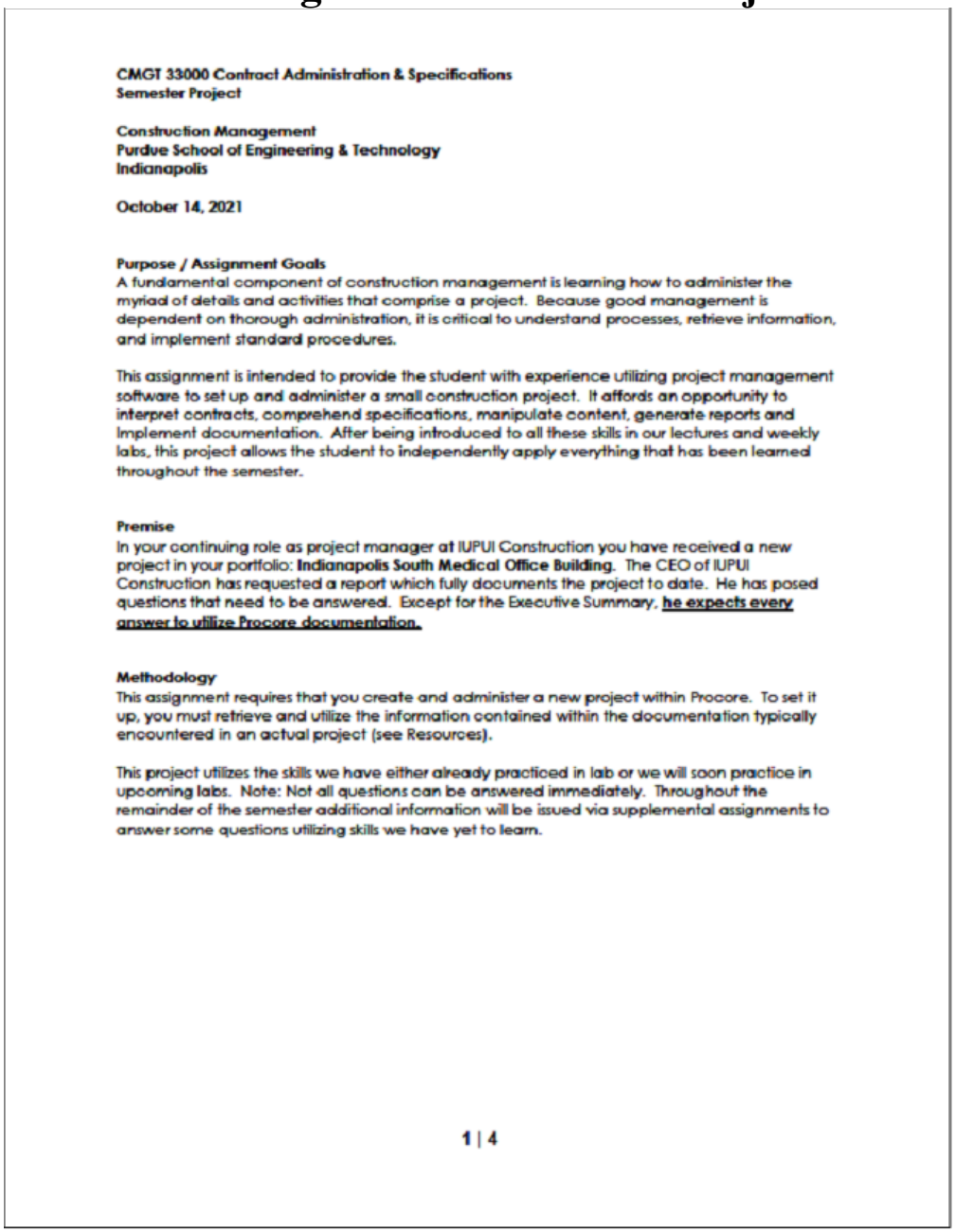
The Direct Assessment for SLO 14 consists of points received on a component embedded within the student's semester project. The semester project requires the student to create a construction project within a project management software application (Procore) by utilizing typical construction documentation, e.g., contracts, budget, specifications, general conditions, submittals, pay applications, etc. This budget management component is task #4 of 15 tasks required in the overall project. For this component, the student must

- enter the project's budget line items
- assign cost codes
- create a prime contract
- input subcontractor contracts
- document / manage change orders
- implement pay applications
- modify / balance the budget to manage cost overruns

Graded Student Work

The assignments are not "marked up" since these assignments were graded in Canvas. The course instructor completed the grading for each assignment using the grading criteria. The grading criteria and any instructor notes were sent to the students via the "Comment" section in Canvas using "SpeedGrader." An example of how it looks in Canvas is shown after the grading criteria for the first two assignments. The "Comments" in Canvas do not reproduce well, which is why just the "graded" grading criteria is provided for the last three assignments.

1. Assignment - Semester Project:



CMGT 33000 Contract Administration & Specifications
Semester Project

Construction Management
Purdue School of Engineering & Technology
Indianapolis

October 14, 2021

Purpose / Assignment Goals
A fundamental component of construction management is learning how to administer the myriad of details and activities that comprise a project. Because good management is dependent on thorough administration, it is critical to understand processes, retrieve information, and implement standard procedures.

This assignment is intended to provide the student with experience utilizing project management software to set up and administer a small construction project. It affords an opportunity to interpret contracts, comprehend specifications, manipulate content, generate reports and implement documentation. After being introduced to all these skills in our lectures and weekly labs, this project allows the student to independently apply everything that has been learned throughout the semester.

Premise
In your continuing role as project manager at IUPUI Construction you have received a new project in your portfolio: **Indianapolis South Medical Office Building**. The CEO of IUPUI Construction has requested a report which fully documents the project to date. He has posed questions that need to be answered. Except for the Executive Summary, **he expects every answer to utilize Procore documentation.**

Methodology
This assignment requires that you create and administer a new project within Procore. To set it up, you must retrieve and utilize the information contained within the documentation typically encountered in an actual project (see Resources).

This project utilizes the skills we have either already practiced in lab or we will soon practice in upcoming labs. Note: Not all questions can be answered immediately. Throughout the remainder of the semester additional information will be issued via supplemental assignments to answer some questions utilizing skills we have yet to learn.

1 | 4

CMGT 33000 Contract Administration & Specifications
Semester Project

Questions from the CEO

1. What is your assessment (executive summary) of the current construction project?

   This is your written narrative that references the content listed below. It is NOT a Procore feature. Produce this in MS Word, print as PDF & include with your submitted documentation.

   Topics to include (but not be limited to):
   a. Important project events: What has happened to date, e.g., milestones achieved, critical problems resolved, etc.?
   b. Budget: status of the budget.
   c. Schedule: status of the schedule.
   d. Recommendations: proposed corrections, revisions, etc.
   e. *Note: This is NOT your opinion of the course or this assignment.*

2. For questions 2 – 15, refer to *Figure 1 Question Point Values.*

Resources

Following are the resources you have at your disposal:

1. Semester Project Shared Folder FA20 (Canvas assignment link)
   a. AIA A101 – Owner / Contractor Agreement
   b. AIA A201 – General Conditions
   c. Construction schedule
   d. Estimate Summary
   e. Indy South MOB specifications
2. Procore software
3. Previous lab exercises

Deliverables

One multipage PDF file submitted via Canvas / Assignments which contains the following information:

1. Cover sheet
   a. Course title
   b. Term
   c. Your name
   d. Your company name
   e. Project title
2. Copy of this assignment (this 3-page document).
3. Executive Report
4. Question Content – Each question inserted as a divider, followed by your answer.

CMGT 33000 Contract Administration & Specifications
Semester Project

Grading Rubric

1. Criteria
    a. Completeness – all required components that answer each question in its entirety.
    b. Accuracy & detail – forms fully executed including dates, addresses, ID numbers, information, etc.
    c. Professional execution – neat, consistent and well organized
2. Point deductions include but are not limited to:
    a. Blank / missing form entries
    b. Incorrect documentation
    c. Incorrect / missing data presented on the documentation
    d. Inclusion of extraneous or unnecessary information
3. This qualifies as an Assignment: 200 points total.
4. Refer to Figure 1 for the grading values for each component.

Due

Refer to Canvas / Assignments / Semester Project.

Questions from the CEO + Point Values		
	Content	***Points Possible***
	Cover + Assignment + Dividers	10
1	What is your assessment (executive summary) of the current project?	25
	Procore Documentation	
2	Who makes up the project team?	5
3	What does our contract with the Owner require?	5
4	What does the project budget detail look like as of today?	20
5	What are our total commitments for this project (listed by company & amount)?	10
6	What did our competitive bid process look like?	10
7	What are the submittal requirements, including required documentation & on-site date detail for Division 9?	20
8	What applications for payment have been issued so far (full detail)?	20
9	What RFI's have been issued so far (questions and answers)?	10
10	What changes have been issued so far (full detail)?	20
11	What items have we sent outside the office (what, when & where)?	10
12	What topics are we addressing with our daily reports?	10
13	What is the schedule for the project?	10
14	What are the sections that comprise the specifications?	5
15	What did you discuss at your most recent meeting?	10
		200

Figure 1. Questions Point Values

Indianapolis South MOB
Estimate Summary Sheet

October 12, 2021

Bid Package	Specification Sections	Bid Package & Contents	ESTIMATE / BUDGET				COMMITMENTS	
			Labor	Material	Equipment	Line Total	SUBCONTRACT AMOUNTS	AWARDED SUBCONTRACTOR*
-		Temporary facilities & controls	750	750	2,250	$ 3,750		
-		Project management & coordination	40,500			$ 43,562		
-		Bonds & insurance		12,900		$ 11,748		
-		Final cleaning	1,500	225	188	$ 1,913		
1	03300	Cast-in-place Concrete				$ 52,296	$ 58,216	Creighton Concrete
2	05120	Structural Steel Framing				$ 50,746	$ 61,236	Ben Hur Construction
	05210	Steel Roof Decking				$ 13,179	$ 16,549	Ben Hur Construction
3	055100	Metal Stairs				$ 12,498	$ 14,512	R.A.D. Fabrication
4	075323	EPDM Roofing				$ 23,498	$ 25,163	CMS Roofing
5	081113	Hollow Metal Doors & Frames				$ 5,916	$ 5,549	Blair Window & Door
	081416	Flush Wood Doors				$ 8,049	$ 11,523	Blair Window & Door
	087100	Door Hardware				$ 6,325	$ 8,569	Blair Window & Door
6	088000	Glazing				$ 27,365	$ 28,497	McComb Window & Door
7	092900	Gypsum Board				$ 29,426	$ 45,123	Precision Drywall
8	093000	Tiling				$ 22,573	$ 18,736	Brothers Floor Covering
9	099123	Interior Painting				$ 18,390	$ 21,812	Quality Interiors
10	102113	Toilet Compartments				$ 1,156	$ 2,549	The Shricker Co.
11	14200	Hydraulic Elevators				$ 38,392	???	???
OH	OVERHEAD				Overhead	$ 11,123		
P	PROFIT				Profit	$ 19,095		
						$ 401,000		

*All subcontractors can be found in the company directory. NONE need to be added.

1. Homework Student Work:
Student Work Assignment - Semester Project
(p. 13 of a 65 page submission)

Indiana University - Purdue University Indianapolis
School of Engineering and Technology/799 W Michigan Street ET201B
Indianapolis, IN 46202-5160
P (317) 278-1268

Job # 330FA2101.MCAD Indianapolis South M.O.B. Remodel
East Stop 11 Road & Emerson Avenue
Indianapolis, IN 46237

Procore Standard Budget

Item	Cost Code	Category	Original Budget Amount	Budget Modifications	Approved COs	Revised Budget	Pending Budget Changes	Projected Budget	Committed Costs	Direct Costs	Job to Date Costs	Pending Cost Changes	Projected Costs	Forecast To Complete	Estimated Cost at Completion	Projected over Under
Indianapolis South M.O.B. Remodel																
00 - Procurement & Contracting Reqts.																
00-90 50 - Overhead: Overhead	00-90 50 - Overhead	Overhead	$11,123.00	$0.00	$1,200.00	$12,323.00	$0.00	$12,323.00	$0.00	$0.00	$0.00	$0.00	$0.00	$12,323.00	$12,323.00	$0.00
Subtotal 00 - Procurement & Contracting Reqts.			**$11,123.00**	**$0.00**	**$1,200.00**	**$12,323.00**	**$0.00**	**$12,323.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$12,323.00**	**$12,323.00**	**$0.00**
01 - General Requirements																
01-010 - Project Manager: Labor	01-010 - Project Manager	Labor	$40,500.00	$0.00	$40,500.00	$40,500.00	$0.00	$40,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$40,500.00	$40,500.00	$0.00
01-013 - Project Coordinator: Other	01-013 - Project Coordinator	Other	$3,062.00	$0.00	$3,062.00	$3,062.00	$0.00	$3,062.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3,062.00	$3,062.00	$0.00
01-500 - Temporary Facilities and Controls: Equipment	01-500 - Temporary Facilities and Controls	Equipment	$2,250.00	$0.00	$2,250.00	$2,250.00	$0.00	$2,250.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,250.00	$2,250.00	$0.00
01-500 - Temporary Facilities and Controls: Labor	01-500 - Temporary Facilities and Controls	Labor	$750.00	$0.00	$750.00	$750.00	$0.00	$750.00	$0.00	$0.00	$0.00	$0.00	$0.00	$750.00	$750.00	$0.00
01-500 - Temporary Facilities and Controls: Materials	01-500 - Temporary Facilities and Controls	Materials	$750.00	$0.00	$750.00	$750.00	$0.00	$750.00	$0.00	$0.00	$0.00	$0.00	$0.00	$750.00	$750.00	$0.00
01-740 - Cleaning: Equipment	01-740 - Cleaning	Equipment	$188.00	$0.00	$188.00	$188.00	$0.00	$188.00	$0.00	$0.00	$0.00	$0.00	$0.00	$188.00	$188.00	$0.00
01-740 - Cleaning: Labor	01-740 - Cleaning	Labor	$1,500.00	$0.00	$0.00	$1,500.00	$0.00	$1,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1,500.00	$1,500.00	$0.00
01-740 - Cleaning: Materials	01-740 - Cleaning	Materials	$225.00	$0.00	$225.00	$225.00	$0.00	$225.00	$0.00	$0.00	$0.00	$0.00	$0.00	$225.00	$225.00	$0.00
Subtotal 01 - General Requirements			**$49,225.00**	**$0.00**	**$49,225.00**	**$49,225.00**	**$0.00**	**$49,225.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$49,225.00**	**$49,225.00**	**$0.00**
03 - Concrete																
03-210 - Cast-In-Place Concrete: Other	03-210 - Cast-In-Place Concrete	Other	$52,269.00	$0.00	$0.00	$52,269.00	$0.00	$52,269.00	$58,216.00	$0.00	$0.00	$0.00	$58,216.00	$0.00	$58,216.00	$(5,947.00)
03-330 - Poured Concrete Basement Walls: Commitment	03-330 - Poured Concrete Basement Walls	Commitment	$0.00	$0.00	$(3,500.00)	$(3,500.00)	$0.00	$(3,500.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$(3,500.00)
Subtotal 03 - Concrete			**$52,269.00**	**$0.00**	**$(3,500.00)**	**$48,769.00**	**$0.00**	**$48,769.00**	**$58,216.00**	**$0.00**	**$0.00**	**$0.00**	**$58,216.00**	**$0.00**	**$58,216.00**	**$(9,447.00)**
05 - Metals																
05-100 - Structural Metals: Other	05-100 - Structural Metals	Other	$50,746.00	$0.00	$0.00	$50,746.00	$0.00	$50,746.00	$61,236.00	$0.00	$0.00	$0.00	$61,236.00	$0.00	$61,236.00	$(10,490.00)
05-100 - Structural Metals: Commitment *	05-100 - Structural Metals	Commitment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
05-200 - Metal Joists: Other	05-200 - Metal Joists	Other	$13,179.00	$0.00	$13,179.00	$13,179.00	$0.00	$13,179.00	$16,549.00	$0.00	$0.00	$0.00	$16,549.00	$0.00	$16,549.00	$(3,370.00)
05-200 - Metal Joists: Commitment *	05-200 - Metal Joists	Commitment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
05-500 - Metal Fabrications: Other	05-500 - Metal Fabrications	Other	$12,498.00	$0.00	$12,498.00	$12,498.00	$0.00	$12,498.00	$14,512.00	$0.00	$0.00	$0.00	$14,512.00	$0.00	$14,512.00	$(2,014.00)
05-500 - Metal Fabrications: Commitment *	05-500 - Metal Fabrications	Commitment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Subtotal 05 - Metals			**$76,423.00**	**$0.00**	**$0.00**	**$76,423.00**	**$0.00**	**$76,423.00**	**$92,297.00**	**$0.00**	**$0.00**	**$0.00**	**$92,297.00**	**$0.00**	**$92,297.00**	**$(15,874.00)**
07 - Thermal and Moisture Protection																
07-500 - Membrane Roofing: Other	07-500 - Membrane Roofing	Other	$23,498.00	$0.00	$23,498.00	$23,498.00	$0.00	$23,498.00	$25,163.00	$0.00	$0.00	$0.00	$25,163.00	$0.00	$25,163.00	$(1,665.00)
07-500 - Membrane Roofing: Commitment *	07-500 - Membrane Roofing	Commitment	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Subtotal 07 - Thermal and Moisture Protection			**$23,498.00**	**$0.00**	**$0.00**	**$23,498.00**	**$0.00**	**$23,498.00**	**$25,163.00**	**$0.00**	**$0.00**	**$0.00**	**$25,163.00**	**$0.00**	**$25,163.00**	**$(1,665.00)**
08 - Doors and Windows																
08-100 - Doors: Other	08-100 - Doors	Other	$5,916.00	$0.00	$0.00	$5,916.00	$0.00	$5,916.00	$5,549.00	$0.00	$0.00	$0.00	$5,549.00	$367.00	$5,916.00	$0.00
08-100 - Doors: Commitment	08-100 - Doors	Commitment	$0.00	$19,450.00	$19,450.00	$19,450.00	$0.00	$19,450.00	$0.00	$0.00	$0.00	$0.00	$0.00	$19,450.00	$19,450.00	$0.00
08-200 - Wood and Plastic Doors: Other	08-200 - Wood and Plastic Doors	Other	$8,049.00	$0.00	$8,049.00	$8,049.00	$0.00	$8,049.00	$11,523.00	$0.00	$0.00	$0.00	$11,523.00	$0.00	$11,523.00	$(3,474.00)
Report Grand Total			**$400,373.00**	**$0.00**	**$43,200.00**	**$444,173.00**	**$0.00**	**$444,173.00**	**$360,203.00**	**$0.00**	**$0.00**	**$0.00**	**$360,203.00**	**$142,095.00**	**$502,298.00**	**$(58,125.00)**

* Cost Code or Cost Type is missing or not on budget

Question Point Values			Assessment Values	
Question	Content	Points Possible	Points Awarded	Comments
	Cover + Assignment + Dividers	10	10	
1	What is your assessment (executive summary) of the current project?	25	20	See markups. Budget issues noted; some confusion related to schedule extension due to C.O.'s. No reference to schedule vs. pay app activity or submittal on-site dates
2	Who makes up the project team?	5	4	16 / 18 listed
3	What does our contract with the Owner require?	5	5	
4	What does the project budget detail look like as of today?	20	15	No budget modifcations attempted. C.O.'s and commited costs included. Red lines due to incorrect cost codes.
5	What are our total commitments for this project (listed by company & amount)?	10	10	
6	What did our competitive bid process look like?	10	10	
7	What are the submittal requirements, including required documentation & on-site date detail for Division 9?	20	20	
8	What applications for payment have been issued so far (full detail)?	20	20	
9	What RFI's have been issued so far (questions and answers)?	10	10	
10	What changes have been issued so far (full detail)?	20	19	Missing descriptioin on C.O. 1
11	What items have we sent outside the office (what, when & where)?	10	8	Missing transmittal detail
12	What topics are we addressing with our daily reports?	10	10	
13	What is the schedule for the project?	10	7	Not Procore documentation
14	What are the sections that comprise the specifications?	5	5	
15	What did you discuss at your most recent meeting?	10	10	
		200	183 92%	Notes:

Assessment and Evaluation for SLO 14

Courses: CMGT 33000 - Contract Administration and Specifications

Academic Term for Direct Evaluation: 2021 Spring Semester, 2022 Fall Semester

Instructors: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 14 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey).

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	14. Create a construction project schedules	3.875	78%
S 2022		4.32	86%

Direct Measures - Assessments and Evaluations

The Direct Assessment consists of a specific question embedded within the semester project. The overall assignment is for the student to create a new project within the Procore project management software application by using standard construction documentation. The student must then answer 15 questions utilizing documentation created within Procore. For this SLO question #4 asks the student to identify budget issues. The required response is for the student to produce the Procore Standard Budget and to modify it as necessary to ensure it remains balanced and that it reflects the budget-related activity within the project, including pay applications, subcontractor contracts, change orders, etc.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	17	Question #4: "What does the project budget detail look like as of today?"	80.59%	75%
Fall 2022	11	Question #4: "What does the project budget detail look like as of today?"	72.73%	75%

While this table indicates only two semesters, it can be compared to a larger data set extending across nine (9) semesters. While fall 2022 falls below target, it must be noted that this indicator was improving in the previous two semesters (fall 2021 and spring 2022). Nevertheless, because the overall trendline is pointing downward, additional class time and in-class exercises have been implemented.

Proposed Actions for Course Improvement:

Because the most recent assessment value of 72.73% falls below the target of 75%, additional class time and in-class exercises have been added to address the apparent downward trend in scores over the four year period. One in-class exercise utilizes a Microsoft Excel spreadsheet version of the Procore Standard Budget tool to simplify the data and to assist students in recognizing the consequences of budget manipulation. The outcome for spring 2023 will be monitored and should the score not improve, additional instructional modifications will be considered.

Student Learning Outcome 15

Understand Construction Quality Assurance and Control

Introduction

CMGT 35000 Materials Testing is a 2-credit hour Lab that is the Co-requisite of CMGT 36000 Strength of Materials. The Lab provides a hands-on demonstration of laboratory and field testing of structural materials to determine their mechanical properties and behavior under tensile and compressive loads. Materials included during the semester schedule are steel, aluminum, aggregate, concrete, wood, masonry, and asphalt.

At the beginning of each semester, students are required to form teams of 5 students per group/team, and all lab activities throughout the semester are performed with students in each group. Once each lab test is complete and all the necessary data is collected, each team reassembles at their desks to complete any calculations required for the lab.

After all lab activities for a specific construction material have been completed (which may take several weeks), a lab report is written, assembled and submitted to the instructor. Each group is required to submit one (1) report, but all group members are responsible for contributing data, such as, math formulas, measurements, photos, etc.

Graded Lab Reports are also utilized to assess the students' understanding of basic field applications, such as; inspecting, observing, photographing, measuring, mixing, placing, and testing. The explanations and introductions of each lab activity helps the students understand the importance of construction quality assurance and control, and what could happen when quality assurance and control are ignored or misinterpreted at the job site.

CMGT 46000 Soils and Foundations covers several ASTM standards as guidelines for the lecture and lab sessions. Lab sessions include ASTM D422 Sieve Analysis, ASTM D2487 Unified Soil Classification System, ASTM D698 Proctor Test, ASTM D1556 Sandcone Test, and others. Those ASTM standards are used to understand construction quality assurance and control for the soil materials. Lab assignments are all individual and assess the students' understanding of ASTM standards to establish quality control and assurance program in the field operations.

CMGT 43000 Jobsite Management course also includes SLO 15 related to construction quality assurance and control. A homework assignment is administered through Canvas page covering construction quality management.

Assessment Methods

For CMGT 35000 and CMGT 46000, two methods of assessment are used for SLO 15 Direct and Indirect.

- Direct from CMGT 35000 – Graded Lab Reports (Group)
- Direct from CMGT 46000 - ASTM D698 Proctor Test Report (Individual)
- Direct from CMGT 43000 – Homework #7 Quality Management and Safety Management (10 questions from the HW #7)
- Indirect – ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

SLO 15 Report Content

Subsequent sections of this SLO Report document the following.

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessment
  - Student work examples
  - Rubrics (grading criteria)
- Course Assessment Report

Indirect Measure

The Indirect Measure for SLO 15 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). The results are presented in the course assessment report (found at the end of this SLO report).

Direct Measure from CMGT 35000

All lab activity in CMGT 35000, is designed to illustrate the structural behavior of construction materials when exposed or stressed to their failure point. The destructive nature of the lab test allows students to observe how these materials react to tensile and compressive overload.

Grading Criteria for Wood Lab Report from CMGT 35000

The following grading criteria (rubric) is used to evaluate each lab activity and report.

Each report must include all report sections listed on the rubric, which are typically Title Page, Index Sheet, Introduction, Data, Results, Graphs, Photos, Calculations, Summary/Conclusion, and Appendix. All report sections must be included in each report, and in the same sequential order as listed on the rubric.

Each report section has a point value indicated from 5 points to 30 points depending on the type of lab test and report requirements. All students have access to the grading rubric prior to the scheduled lab activity.

In addition to the grading rubric, students also have access to the Lab Report Requirements form which itemizes all tables, photos, and data that should be included in each specific report.

All reports are worth 100 points except the Wood Lab Report which is worth 130 points. The Wood Lab Report is worth more because it includes more data and calculations than the other reports. For each mistake, misspelling, incorrect punctuation or any required item that is not in the report, .5 points is deducted from the total points possible. The total points earned on each report is the same number of points awarded to each student in that group. This grading process encourages each student in each group to practice quality assurance and control as it relates to their submitted work. A low grade on the report is a low grade for each student in the group.

The following pages display the Lab Report Requirements Form, the Grading Rubric, and a graded group report.

CMGT 350 Construction Materials Testing

WOOD Lab Report – Strength Testing

1. Title Page 5 pts

Include title of test, course number, group members, group number, date, etc.

2. Table of Contents **5 pts**

Indicate page numbers. Include titled separation sheet at beginning of each section.

3. Introduction 5 pts

The significance and objectives of the test. Include ASTM testing designation.

4. Data & Results (forms found on Canvas) **30 pts**

1. Shear (parallel to grain) (If time permits)
2. Tension (parallel to grain) (If time permits)
3. Compression (parallel to grain) (If time permits)
4. Bearing (compression perpendicular to grain)
5. Bending

5. Graphs **10 pts**

1. Bearing (compression perpendicular to grain): Load (y-axis) vs. Crushing (x-axis)
2. Bending: Load (y-axis) vs. Deflection (x-axis)

6. Photo Descriptions 30 pts

For each test include photos and descriptions of 1) specimen prior to loading – include relevant dimensions, 2) specimen in load fixture, 3) failed specimen showing break – include relevant dimensions

7. Calculations **20 pts**

Include all calculations required to fill out data and results sheets. ~~Include shear and moment diagram for beam (use the failure load)~~. Each group member is to include their own calculations.

8. Discussion **20 pts**

Summarize all five wood strength/stiffness tests. Then discuss the following using one paragraph per item:

~~1. Compare tensile strength to compressive strength (parallel to grain).~~

~~2. Compare compressive strength parallel to grain to compressive strength perpendicular to grain.~~

3. Type of stress (comp, tensile, shear) that caused failure in beam.
4. Compare the bending strength of your wood beam to your concrete beam (use 28-day estimated strength).
5. Give at least three reasons why your tested strength values exceeded the values given in the allowable strength design tables.
6. Provide bar graphs comparing your tested strength values (2 total).

9. Supplemental Materials 5 pts

Description of the test materials, apparatus, and procedures (you may include the information provided in Canvas). Include any other relevant supplemental materials.

General Requirements:

- **One group lab report to be submitted per team.**
- **All members are to include their own hand calculations. Use engineering paper.**
- **Use Microsoft Office software whenever possible.**
- **Include titled separation sheet for each section.**
- **Staple in upper left-hand corner with sections in order given.**
- **Include grade rubric as front sheet. This is not the Title Sheet.**

Student Work Example from CMGT 35000

CMGT 350 GROUP LAB REPORT

Lab: Wood

Group #: 1

Names: Mackenzie Grigsby ✓
Jessica Hauger ✓
Caleb Madden ✓
Cassidy Marshall ✓
Tanner Martin ✓
Kristian Nash

Date: 12/15/2022

SECTION	POSS.	SCORE
Title Page	5	5
Table of Contents	5	5
Introduction	5	4.5
Data & Results	30	30
Graphs	10	10
Photos & Descriptions	30	30
Calculations	20	20
Discussion	20	20
Appendix	5	5
Written Report	130	129.5

Wood

Strength Testing

CMGT 35000 – Materials Testing

Mackenzie Grigsby, Jessica Hauger
Caleb Madden, Cassidy Marshall
Tanner Martin, Kristian Nash

Date Performed: December 1st and 8th, 2022
Date Submitted: December 15th, 2022

Table of Contents

Introduction

Our class was tasked with designing a wood beam from ten pieces of ¼" by 1-3/8" by 30" nominal lumber. We then performed a bending test with our wood beam and compared the results to a bending test done on a 1" by 1" by 18" long pine wood specimen. All the samples were prepared according to ASTM Standard D143. This lab assignment's objective was to determine if a composite wood beam had a higher failure load than a glulam (baseline) wood beam. We also wanted to determine which style of composite beam would present the highest failure load. Finally, we wanted to determine why our composite beam was stiffer than our baseline beam. Our group designed a hollow-shaped composite beam which included three horizontal wood pieces on the top, three horizontal wood pieces on the bottom, and two vertical wood pieces on the left and right of the horizonal wood pieces. We know that wood is orthotropic, and strongest parallel with the grain, so we kept that in mind when designing our composite wood beam. The significance of this test was to recognize that wood can yield a larger load when combined and laid parallel with the grain.

Data & Results

CMGT 350 - WOOD STRENGTH TESTS

Test samples and procedures per ASTM using clear grade wood samples

Wood species tested: Simple Beam - Pine
Composite Beam - Poplar

WOOD LAB TEST	TEST DESCRIPTION	SECTION PROPERTIES			LOAD		STRENGTH		STIFFNESS	
		Area[1], A [in^2]	Section Modulus[2], S [in^3]	Moment of Inertia[3], I [in^4]	P @ failure [lbs]	P @ pl [lbs]	Test Value[14], f [psi]	Table value[13], F [psi]	Test Value[5], E [psi]	Table value[13], E [psi]
Bearing / Bending	Load perpendicular to grain of simple beam	2.25			1020		5086	775		
Bearing / Bending	Load at mid-span of composite beam	4.5			4680		23,368	1,550		

Simple Beam Test Results

Deflection [in]	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
Load [lbs]	50	140	290	430	580	720	890	950	1000	

1000 lbs occurred at 0.9 in deflection.

Composite Beam Test Results

Deflection [in]	.1	.2	.3	.4	.5	.6	.7	.8	.9	1.0
Load [lbs]	1100	2060	3140	4030	4670					

1000 lbs occurred at 0.1 in deflection.

DATA

MATERIAL

Simple: Pine

Composite: Poplar

BOARD SIZE

Simple: 1 ½ " x 1 ½ " x 30 "

Composite: 1 ½ " x 3 " x 30 " (1/6 in scale of 2 x 10's)

NUMBER OF BOARDS

Simple: 1

Composite: 10

MAXIMUM BEAM DEPTH

Simple: 1 ½ "

Composite: 3 "

RESULTS FOR COMPOSITE BEAM

SECTION DESIGN	ULTIMATE LOAD CAPACITY		DEFLECTION [in] [1]	
	Predicted [2] [lbs]	Tested [lbs]	Predicted [2] [in]	Tested [in]
		4680		0.1

[1] Deflection based on a total load of 1000 lbs

[2] "Predicted" values are "calculated" values based on your calculations (done on engineering paper)

CONCLUSIONS

Given: Beam "***B***" is the **B**aseline (simple) beam
Beam "***S***" is your **S**pecial (Composite) beam design you build

Answer the following:

The amount of material is the same in beam B and S: Yes ____ No X

STRENGTH

The CALCULATED ultimate load capacity for beam ***B*** is: 11,443.5 lbs

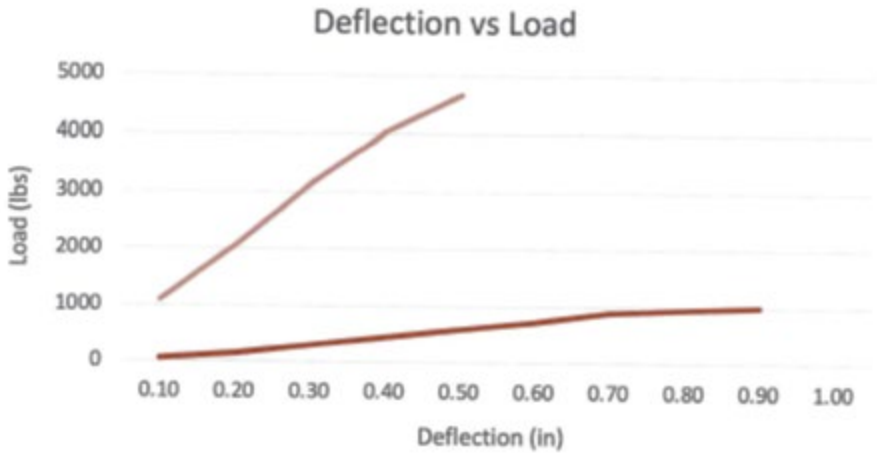
The CALCULATED ultimate load capacity for beam ***S*** is: 105,156 lbs

Based on your calculations, how much stronger should beam ***S*** be than beam ***B***. 819 %

The TESTED ultimate load capacity for beam ***S*** was: 4680 lbs

Explain in technical terms the reason beam ***S*** is stronger than beam ***B***.

Graphs



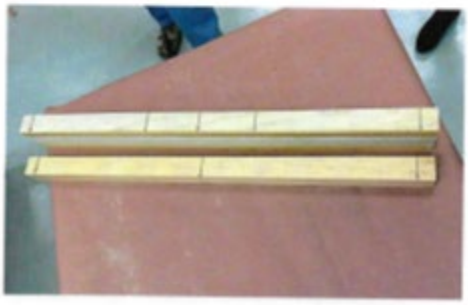
Photos

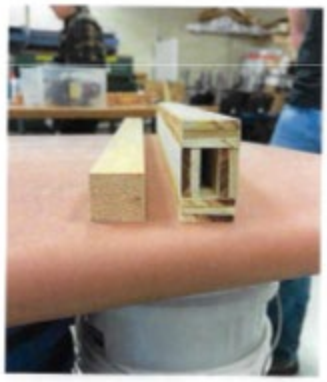
Assembling Complex Beam

This photo shows the complex beam being assembled with wood glue and clamps. The beam was assembled based upon our design and consists of 10 pieces that are 1/6th scale of 2 x 10's.

Beam Dimensions

On the top is the complex beam which measures 1 ½" x 3" x 30". On the bottom is the simple beam which measures 1 ½" x 1 ½" x 30". The marking on the beams are showing 2" in from the outsides as well as the center line on both beams. Also, the complex beam shows markings 4" from the center line on both sides.





Beams Preload

This picture shows both beams before being submitted to load. On the left is the simple beam and on the right is the complex beam.

Simple Beam in Load Fixture

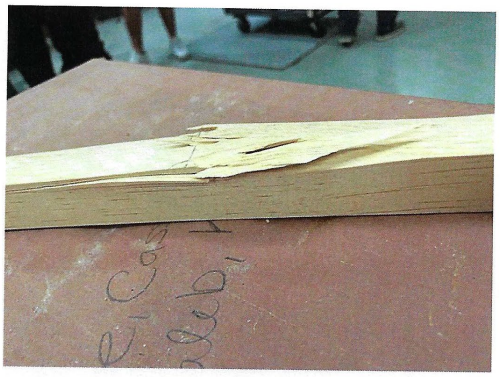
This photo shows the simple beam placed in the Forney load machine on supports. The load is applied on top of the beam via a curved wood block aligned with the center mark on the beam.

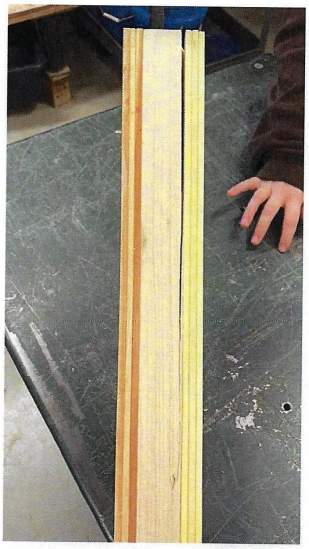
Complex Beam in Load Fixture

This picture shows the complex beam placed in the Forney load machine on supports placed 28" apart. The load is placed on top of the beam via two points that are spaced 8" apart.

Simple Beam Break

This picture shows the failed simple beam and it's break. The break can be seen at the center mark of the beam.





Complex Beam Break

This photo shows the failed complex beam where the break can be seen as a split at the seam where the pieces were glued together.

Calculations

[redacted]

Wood Calculations

AREA

$A = b \times h$

Baseline (simple) Beam: $1.5'' \times 1.5'' = \boxed{2.25\ in^2}$

Special (complex) Beam: $1.5'' \times 3'' = \boxed{4.5\ in^2}$

AMOUNT OF MATERIAL:

BASELINE (simple) BEAM: $1.5'' \times 1.5'' \times 30'' = \boxed{67.5\ in^2}$

Special (composite) Beam: 10 boards $\times 1.5'' \times 0.25'' \times 30'' = \boxed{112.5 in^2}$

Calculated Ultimate Load Capacity

$F_{org} = P/A$

Baseline (simple) Beam: $5086\ psi / 2.25\ in^2 = \boxed{11,443.5\ lbs = P}$

Special (complex) Beam: $23,368\ psi = P / 4.5\ in^2$

$\boxed{P = 105,156\ lbs}$

Percent Stronger

$$\frac{105,156 - 11,443.5}{11,443.5} \times 100 = 818.915 = \boxed{819\%}$$

BEAM S IS 819% STRONGER THAN BEAM B.

[redacted]

Wood Calculations

Area

$A = b \times h$

Baseline (simple) Beam: $1.5" \times 1.5" = \boxed{2.25\ in^2}$

Special (complex) Beam: $1.5" \times 3" = \boxed{4.5\ in^2}$

Amount of Material

Baseline (simple) Beam: $1.5" \times 1.5" \times 30" = \boxed{67.5\ in^3}$

Special (composite) Beam: 10 boards $\times$ $1.5" \times 0.25" \times 30" = \boxed{112.5\ in^3}$

Calculated Ultimate Load Capacity

$F_{brg} = P/A$

Baseline (simple) Beam: $5086\ psi = P/2.25\ in^2$

$\boxed{P = 11,443.5\ lbs}$

Special (composite) Beam: $23,368\ psi = P/4.5\ in^2$

$\boxed{P = 105,156\ lbs}$

Percent Stronger

$$\frac{105,156 - 11,443.5}{11,443.5} \times 100 = 818.915. = 819\%$$

Beam S is 819% stronger than beam B.

[redacted]

Area

Baseline (Simple) Beam: $1.5" \times 1.5" = \boxed{2.25 in^2}$

Special (Complex) Beam: $1.5" \times 3" = \boxed{4.5 in^2}$

Amount of Material

Baseline (Simple) Beam: $1.5" \times 1.5" \times 30" = \boxed{67.5 in^3}$

Special (Composite) Beam: 10 boards $\times 1.5" \times .25" \times 30" = \boxed{112.5 in^3}$

Calculated Ultimate Load Capacity

$F_{org} = P/A$

Baseline (Simple) Beam: $5086 psi = P/2.25 in^2 \rightarrow \boxed{P = 11443.5 lbs}$

Special (Composite) Beam: $23368 psi = P/4.5 in^2 \rightarrow \boxed{P = 105156 lbs}$

Percent Stronger

$$\frac{105156 - 11443.5}{11443.5} \times 100 = 818.915 = \boxed{819\%}$$

Beam S is 819% stronger than beam B.

[redacted] Wood Calculations

- AREA: $A = bh$

  Baseline (simple) Beam: $1.5'' \times 1.5'' = \boxed{2.25 in^2}$

  Special (complex) Beam: $1.5'' \times 3.0'' = \boxed{4.5 in^2}$

- Amount of Material:

  Baseline (Simple) Beam: $1.5'' \times 1.5'' \times 30.0'' = \boxed{67.5 in}$

  Special (composite) Beam = $10 (boards) \times 1.5'' \times 0.25'' \times 30'' = \boxed{112.5 in}$

- Calculated Ultimate Load Capacity

  $F_{org} = P/A$

  Baseline (simple) Beam = $5086 psi / 2.25 in^2 = \boxed{11,443.51 lbs}$

  Special (complex) Beam = $23,368 psi = P / 4.5 in^2$

  $\boxed{P = 105,156 lbs}$

- Percent Stronger

$$\frac{105,156 lbs - 11443.51 lbs}{11443.51 lbs} \times 100 = 818.915 \approx \boxed{819\%}$$

∴ Beam is 819% stronger than simple.

[redacted]

Wood Calculations

Area

$A = b \times h$

Baseline (simple) Beam: $1.5'' \times 1.5'' = \boxed{2.25 in^2}$

Special (complex) Beam: $1.5'' \times 3'' = \boxed{4.5 in^2}$

Amount of Material

Baseline (simple) Beam: $1.5'' \times 1.5'' \times 30'' = \boxed{67.5 in^3}$

Special (complex) Beam: 10 boards $\times 1.5'' \times 0.25'' \times 30'' = \boxed{112.5 in^3}$

Calculated Ultimate Load Capacity

$F_{org} = P/A$

Baseline (simple) Beam: $5086 psi = P/2.25 in^2$

$\boxed{P = 11,443.5 lbs}$

Special (complex) Beam: $23,368 psi = P/4.5 in^3$

$\boxed{P = 105,156 lbs}$

Percent Stronger

$$\frac{105,156 - 11,443.5}{11,443.5} \times 100 = 818.915 = \boxed{819\%}$$

Beam S is 819% stronger than Beam B.

[redacted]

WOOD CALCULATIONS

AREA = B × H

Baseline (simple) Beam → 1.5" × 1.5" = 2.25 in^2

Special (complex) Beam → 1.5" × 3" = 4.5 in^2

Amount of Material

Baseline (simple) Beam: 1.5" × 1.5" × 30" = 67.5 in^3

Special (composite) Beam: 10 boards × 1.5" × 0.25" × 30" = 112.5 in^3

Ultimate Load Capacity (calculated)

$F_{brg} = P/A$

Baseline (simple) Beam → 5086 psi = P / 2.25 in^2

P = 11,443.5 lbs

Special (composite) Beam → 23,368 psi = P / 4.5 in^2

P = 105,156 lbs

% stronger

$$\frac{105{,}156 - 11{,}443.5}{11{,}443.5} \times 100 = 818.915 = 819\%$$

Beam S is 819% stronger than beam B.

Discussion

Type of stress (comp, tensile, shear) that caused failure in beam.

When testing the wood to evaluate the strength of the beam sample in the bending stress test, shear compression was the cause of failure in the beam and diagonal tension failure was the cause of the other. Failure begins by initiation and development of cracks in the beam cross-section. Diagonal tension failure begins with the development of vertical crack (flexural cracks) at the bottom of the beam due to flexural tensile stress. Then, as the load on the beam increases, this crack growth both in width and length and bends in a diagonal direction as it moves to the upper part of the beam toward the loading point. After that, the last stage of shear tension failure occurs which is a sudden failure. We also experienced Shear compression failure which begins by initiation and development of cracks in the beam cross-section. Then, these cracks propagate and penetrate the compression zone of the beam, and the final stage of the failure occurs when the compressive strength is exceeded. Shear compression failure is mainly related to high amount of shear reinforcement.

Compare the bending strength of your wood beam to your concrete beam (use 28-day estimated strength).

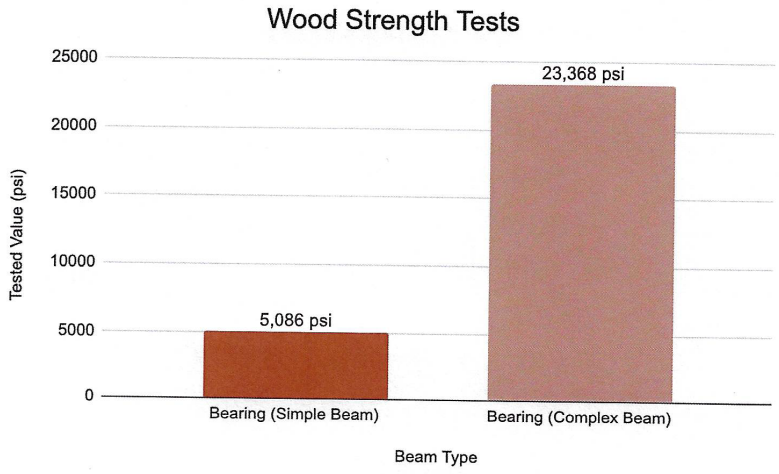
The differing characteristics between wood and concrete helps to provide distinctive roles in the construction industry for these materials. In the lab, the group had the opportunity to test the strength of a wood beam and a concrete beam with no reinforcement. Now a comparison can be made between the two. When testing the concrete beam with an area of 126 square inches, the beam failed at a load of 8000 pounds. When the composite wood beam, with an area of 4.5 square inches, was tested it failed at 4680 pounds. Where the concrete beam did withstand a heavier load, when taking into account the load per square inch, wood can carry a heavier load. Concrete is better in loads of compression rather than tension, that is why it is essential to reinforce

with mesh or rebar. Wood, on the other hand, has more flexibility in tensile loads making it a better material to be used for beams.

Give at least three reasons your tested strength values exceeded the values given in the allowable strength design tables.

Our tested strength values exceeded the values in the allowable strength design tables because our sample was defect free while the table value is for #2 grade wood. The table value has a specific margin built into account for safety issues like construction deficiencies, overloading, and material differences. And finally, the table value has a 19% moisture content, while our test sample had a lower moisture content.

Provide bar graph comparing your tested strength values



Appendix

Test Materials

The simple beam used in this lab was a piece of 1 ½" x 1 ½" x 30" (actual dimension) Southern Yellow Pine. The composite beam was composed of 10 pieces of ¼" x 1 ½" x 30" (actual dimension) Popular and was bonded together with DAP Carpenter's Wood Glue.

Apparatus

Simple Beam

The testing apparatuses used to test the simple beam included a Forney LT-0031 Universal Load Machine with an Admet Precise Digital Controller, a wood block with a curved surface, a support plate fixture, aluminum bearing plates, a 2-inch digital strain gauge, a mounting fixture for the strain gauge, a tape measure, and a steel square.

Composite Beam

The testing apparatuses used to test the simple beam included a Forney LT-0031 Universal Load Machine with an Admet Precise Digital Controller, a wood block with two curved surfaces, a support plate fixture, aluminum bearing plates, a 2-inch digital strain gauge, a mounting fixture for the strain gauge, a tape measure, and a steel square.

Composite Beam

The first step in creating the composite beam was to come up with a design using ten pieces of wood. After the design was established, the group was able to construct the beam. First individual components of the beam were put together using wood glue and the pieces were clamped together using C-clamps. Once the individual components were constructed, they were glued together to match the final design and clamped down to dry until the following Thursday. Before testing, the beam was measured for calculations. The beam was also marked in the center, 15 inches, 4 inches outward on each side of the center mark, and an inch inward from each end of the beam. Once these steps were completed, the beam was then placed in the testing apparatus and lined up. The supports were aligned with the 1-inch marks, and the two 4-inch marks on each side of the center lined up with the two curved surfaces of the wood block. The load was then applied to the beam and loads were recorded at each 1/10th-inch interval on the strain gauge. These measurements were recorded until failure, then the recorded data was used in calculations.

Procedures

Simple Beam

The first step to test the simple beam was to record measurements for calculations. The second step was to mark the center of the beam, 15 inches, and mark an inch inward from each end. This was done to line up the beam in the testing apparatus. Once these steps were completed the beam was placed in the testing apparatus and lined up. The supports were aligned with the 1-inch marks, and the center mark with the wood block with the curved surface. The load was then applied to the beam and loads were recorded at each 1/10th-inch interval on the strain gauge. These measurements were recorded until failure, then the recorded data was used in calculations.

Additional Material

TABLE 10.4 Example of Design Values for Visually Graded Dimension Lumber (2″ – 4″ thick) of Eastern White Pine[1,4]

Grade Designation	Size Classification	Design Values,[2] psi						
		Bending[3]	Tension Parallel to Grain	Shear Parallel to Grain	Compression Perpendicular to Grain	Compression Parallel to Grain	Modulus of Elasticity	Minimum Modulus of Elasticity
Select Structural		1,250	575	135	350	1,200	1,200,000	440,000
No. 1		775	350	135	350	1,000	1,100,000	400,000
No. 2	2″ & wider	575	275	135	350	825	1,100,000	400,000
No. 3		350	150	135	350	475	900,000	330,000
Stud	2″ & wider	450	200	135	350	525	900,000	330,000
Construction		675	300	135	350	1,050	1,000,000	370,000
Standard	2″ – 4″ wide	375	175	135	350	850	900,000	330,000
Utility		175	75	135	350	550	800,000	290,000

[1] Courtesy of American Wood Council, Washington, D.C.

[2] Stresses apply to lumber used at 19% maximum moisture content. When lumber is designed for use where the moisture content will exceed 19% for an extended period of time, the values shown herein shall be multiplied by certain *wet service* factors.

[3] Bending values are applicable to lumber loaded on edge. When loaded flatwise, these values may be increased by multiplying by certain *flat use* factors.

[4] For a complete list of grade designations and more detailed design values see reference (American Wood Council, 2012).

Table 10.4

Direct Measure from CMGT 46000

All lab activity in CMGT 46000, is designed to work the various soils as construction materials. Students work on the Proctor test followed by ASTM D698 to determine the proper amount of mixing water to use when compacting the soil in the field and the resulting degree of denseness which can be expected from compaction at the optimum water content. This is essential work before establishing a field quality control and assurance program for compaction.

Grading Criteria for Wood Lab Report from CMGT 35000

An individual student must participate in the test and conduct the data analysis for the Proctor test. individual report shall be prepared to meet the following requirements:

- Cover page
  - Title, Names, date, etc
- Introduction
  - Description for test and soil samples, Procedures, Reference # (ASTM)
- Main body
  - Use the given data (see next slide).
  - Minimum six data points on the graph.
  - Make your own Data Table and Proctor graph
  - Add a trend line and indicate OMC at Max Dry Unit Weight using arrows on the graph. (no need to show ZAV)
- Conclusion
  - Clearly present the maximum dry density & OMC in a sentence.

The grading criteria (rubric) is used to evaluate each lab activity and report. The following rubric is presented as an example from Fall 2022:

Proctor Test

You've already rated students with this rubric. Any major changes could affect their assessment results.

Criteria	Ratings		Pts
Cover sheet	5 pts Full Marks	0 pts No Marks	5 pts
Description of the test	5 pts Full Marks	0 pts No Marks	5 pts
Data Sheet and Result Analysis	10 pts Full Marks	0 pts No Marks	10 pts
Graph the graph clearly shows OMC and Max Dry Density. show ZAV line on the graph	5 pts Full Marks	0 pts No Marks	5 pts
Conclusion clearly state OMC & Max Dry Density	5 pts Full Marks	0 pts No Marks	5 pts
			Total Points: 30

Student Work Example from CMGT 46000

[redacted]

CMGT 460

ASTM D698 with Method A: Standard Proctor Test

11/2/2022

ASTM D 698 Method A

Test method cover laboratory compaction methods used to determine the relationship between molding water content and dry unit weight of soils (compaction curve) compacted in a 4-in. (101.6 or 152.4-mm) diameter mold with a 5.50-lbf (24.5-N) rammer dropped from a height of 12.0 in. (305 mm) producing a compactive effort of 12 400 ft-lbf/ft3 (600 kN-m/m3).

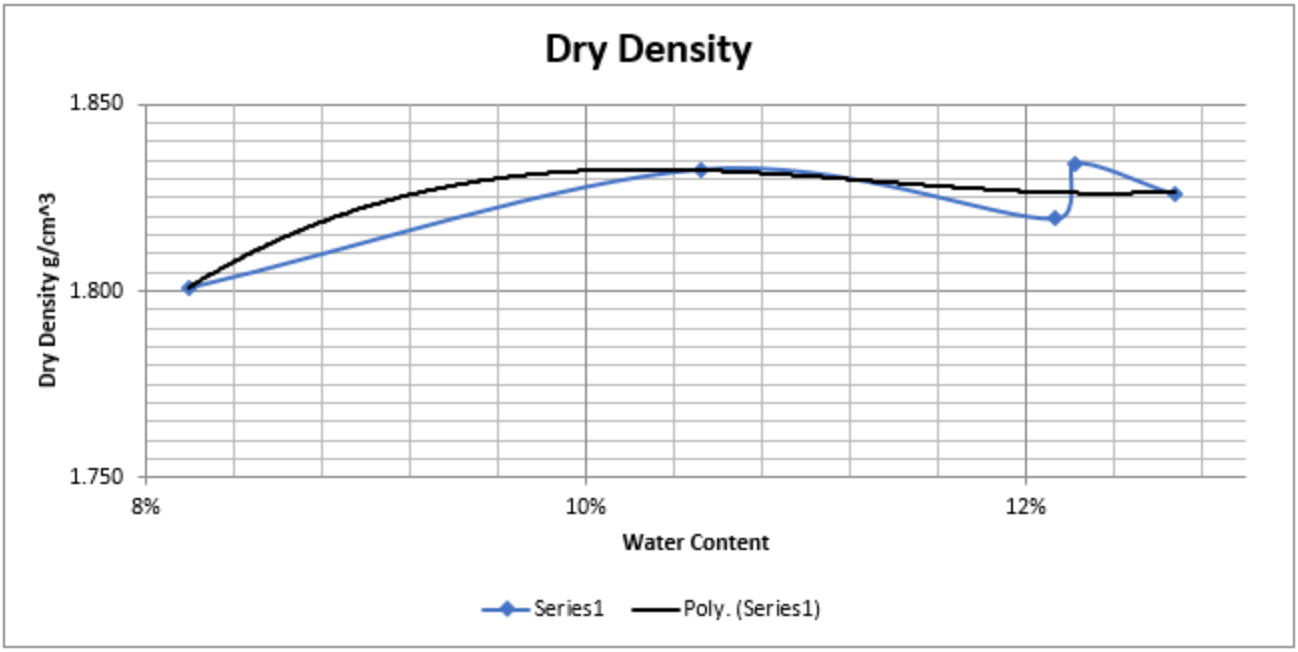
1. Take approximately 10 lbs of soil for the 4" mold. Pulverize the soil and run it through the #4 sieve
2. Determine the weight of the soil sample as well as the weight of the compaction mold with base (without the collar) by using the balance and record weight.
3. Assume the water content for the first test to be 8%.
4. Measure out the water, add it to the soil and then mix it thoroughly into the soil using the trowel until the soil gets a uniform color.
5. Assemble the compaction mold to the base, place some soil in the mold and compact the soil in the number of equal layers specified by the type of compaction method employed. The number of drops of the rammer per layer is also dependent upon the type of mold used. The drops should be applied at a uniform rate not exceedingly around 1.5 seconds per drop, and the rammer should provide uniform coverage of the specimen surface. Try to avoid rebound of the rammer from the top of the guide sleeve.
6. The soil should completely fill the cylinder and the last compacted layer must extend slightly above the collar joint. If the soil is below the collar joint at the completion of the drops, the test must be repeated.
7. Carefully remove the collar and trim of the compacted soil so that it is completely even with the top of the mold using the trowel. Replace small bits that may fall out during the trimming process.
8. Weight the compacted soil while its in the mold and to the base and record the mass. Determine the wet mass of the soil by subtracting the weight of the mold and base.
9. Remove the soil from the mold using a mechanical extruder and take soil moisture content samples from the top and bottom of the specimen. Fill the moisture cans with soil and determine the water content.
10. Place the soil specimen in the targe tray and break up the soil until it appears visually as if it will pass through the #4 sieve, add 2% more water based on the original sample mass, and remix as in step 4. Repeat steps 5-9 until, based on wet mass a peak value is reached followed by two slightly lesser compacted soil masses.

Data:

Water Content Determination						
Soil sample No.	Unit	1	2	3	4	5
Mass of empty, bowl	grams	1.2	1	1.2	1	1
Mass of bowl and moist soil	grams	21	43	31.7	33.6	40.1
Mass of bowl, and dry soil	grams	19.5	39	28.4	30.05	35.7
Mass of soil solids	grams	18.3	38	27.2	29.05	34.7
Mass of pore water	grams	1.5	4	3.3	3.55	4.4
Water content	percent	8.20%	10.53%	12.13%	12.22%	12.68%

Density Determination (Dry Unit Weight of the Soil Samples)						
Soil sample No.	Unit	1	2	3	4	5
Water content	percent	8.20%	10.53%	12.13%	12.22%	12.68%
Mass of compacted soil and mold	grams	6065.10	6137.70	6151.50	6168.70	6167.80
Mass of mold	grams	4225.70	4225.70	4225.70	4225.70	4225.70
Wet mass of soil in mold	grams	1839.40	1912.00	1925.80	1943.00	1942.10
Mold Volume	cm^3	944.00	944.00	944.00	944.00	944.00
Wet density	$Grams/cm^3$	1.949	2.025	2.040	2.058	2.057
Dry density	$Grams/cm^3$	1.801	1.833	1.819	1.834	1.826
Dry density (find unit conversion)	pcf	112.43	114.40	113.58	114.50	113.98

Data Chart: Chart changed drastically from 3 to 4 because we were adding 71 ml for the first 3 test and then add added about 20 ml the last two tests.



Conclusion:

The second and third samples we added 71 ml to the sample to increase the water content by 2%, due to the content looking to runny we only added 20 ml to try and slow do the water content percentage. Due to this we created an outliner for sample 4. Based off our graph I believe you can still see the maximum dry density is 114.55 pcf & OMC is 10.125%

Assessment

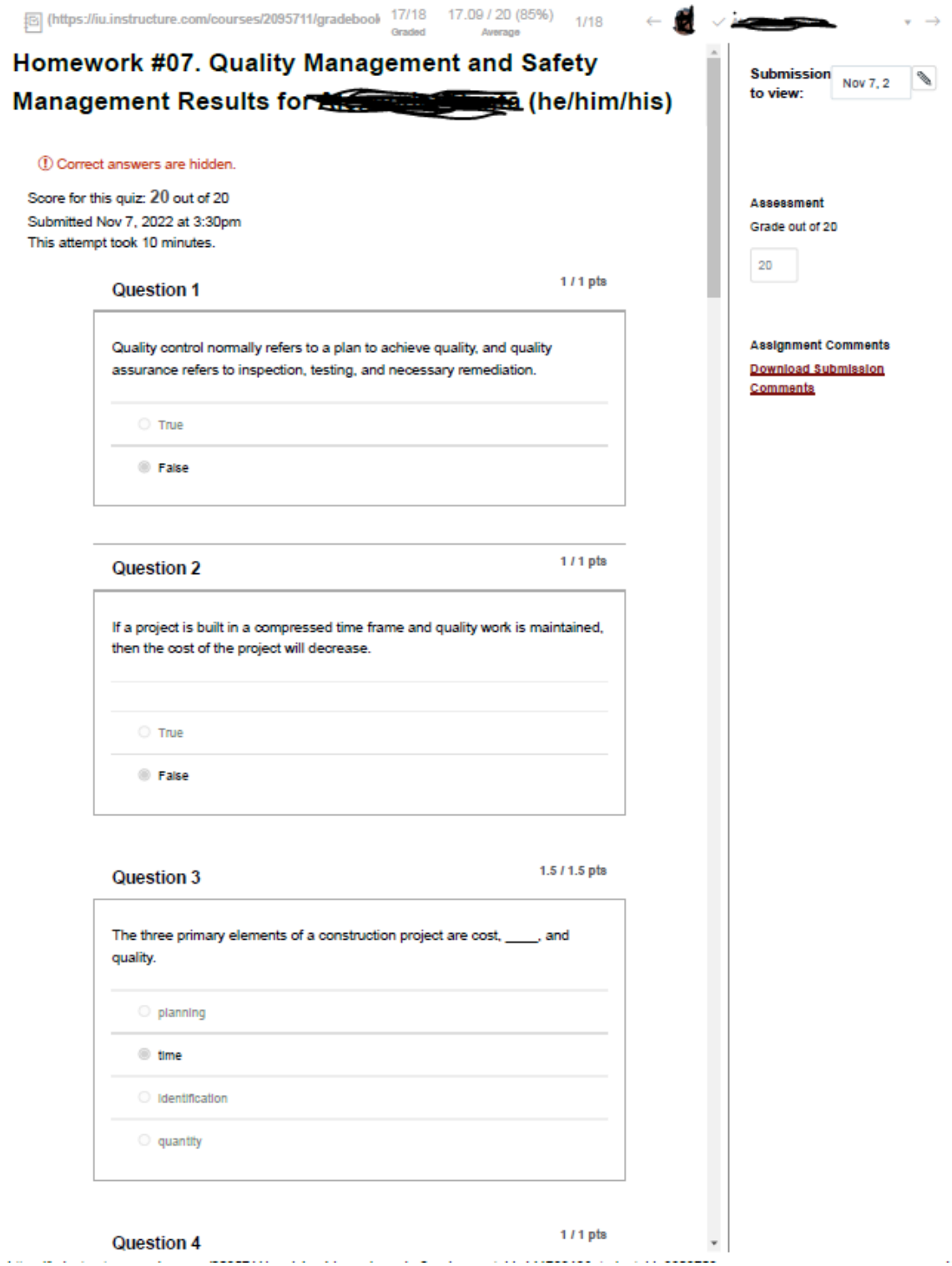
Grade out of 30

30

View Rubric

Proctor Test	
Criteria	**Ratings**
Cover sheet view longer description	Full Marks 5 / 5 pts
Description of the test view longer description	Full Marks 5 / 5 pts
Data Sheet and Result Analysis view longer description	Full Marks 10 / 10 pts
Graph view longer description	Full Marks 5 / 5 pts
Conclusion view longer description	Full Marks 5 / 5 pts
	Total Points: 30

Student Work Example from CMGT 43000



Question 4

1 / 1 pts

Who developed the concept of total quality management?

- American Society for Testing and Materials
- Dr. Edward Deming
- Dr. Phillip Brians
- OSHA

Question 5

1 / 1 pts

Most projects are subject to inspection by the _____ or building inspector.

local code authority

Question 6

1 / 1 pts

The _____ phase of a quality management program includes the full plan for the company program, as well as the plan for the particular project's quality management.

plan

Question 7

1 / 1 pts

_____ is the continuing plan of the contractor to provide quality work in every phase of the project.

Quality Management

Question 8

1.5 / 1.5 pts

The quality management program uses a continuous "____" methodology.

- Plan-Check-Do-Act
- Do-Plan-Check-Act
- Check-Plan-Do-Act
- **Plan-Do-Check-Act**

Question 9

1 / 1 pts

The superintendent should perform quality checks on the contractor's own work and the work of the subcontractors.

- **True**
- False

Question 10

1 / 1 pts

Quality, when referring to item installation, is not related to price.

- **True**
- False

Assessment Report – SLO 15

Course: CMGT 35000 – Materials Testing

Academic Terms: Fall 2021, Spring 2022 & Fall 2022

Instructor: Marvin Johnson

Evaluation of Assessment Data:

The Indirect Measure for SLO 15 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 83% ranking was achieved for SLO 15.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	15. Understand construction quality assurance and control.	4.125	83%
S 2022		4.2	84%
F 2022		4.59	92%

The Direct Measure #1 for SLO 15 was the "Wood Lab Reports". The maximum grade (points) for this individual assignment was 130 points. The table below shows the average individual grades for this assignment.

Term	N	Criteria	Average Grade	Average Percent	Target Percent
Fall 2021	27	Wood Lab Report	120.0 points	92.3%	**75%**
Spring 2022	10	Wood Lab Report	126.3 points	97.2%	75%
Fall 2022	18	Wood Lab Report	128.2 points	98.7%	75%

After the initial ACCE accreditation for the CM program, it was decided that an overall average of the grades should be at least 75%.

For the Fall 2021 semester, the Indirect Measure (83%) and the Direct Measure from the Wood Lab Reports was (92.3%). Assuming an equal weight for each measure the composite grade was 87.7% indicating that the target value was met.

For the Spring 2022 semester, the Indirect Measure (84%) and the Direct Measure from the Wood Lab Reports was (97.2%). Assuming an equal weight for each measure the composite grade was 90.6% indicating that the target value was met.

For the Fall 2022 semester, the Indirect Measure (92%) and the Direct Measure from the Wood Lab Reports was (98.7%). Assuming an equal weight for each measure, the composite grade was 96% indicating that the target value was met.

Overall, the class discussions and Labs following the Lecture assignments added value to the basic goal of understanding Quality Control and Assurance of various construction materials. This concept will be expanded in the following section, Proposed Actions for Course Improvement.

Proposed Actions for Course Improvement:

Related specifically to SLO 15 - Understand Construction Quality Assurance and Control and referring to established construction quality assurance and control standards, such as ASTM, AASHTO and INDOT, students will be encouraged to research and investigate these standards, especially as these standards relate to the construction drawings and specifications of every commercial project, and some residential projects.

The Direct Measure #2 for SLO 15 was the "Proctor Test Report". The maximum grade (points) for this individual assignment was 30 points. The table below shows the average individual grades for this assignment.

Term	N	Criteria	Average Grade	Average Percent	Target Percent
Fall 2021	18	Proctor Test	23.28 points	78%	75%
Spring 2022	16	Proctor Test	24 points	80%	75%
Fall 2022	20	Proctor Test	26.45 points	88%	75%

After the initial ACCE accreditation for the CM program, it was decided that the overall average of the grades should be at least 75%.

For the Fall 2021 semester, the Indirect Measure (83%) and the Direct Measure from the Proctor Test Reports was (78%) indicating that the target value was met.

For the Spring 2022 semester, the Indirect Measure (84%) and the Direct Measure from the Proctor Test Reports was (80%) indicating that the target value was met.

For the Fall 2022 semester, the Indirect Measure (92%) and the Direct Measure from the Proctor Test Reports was (88%) indicating that the target value was met.

Overall, the class discussions and Labs following the ASTM standards added value to the basic goal of understanding Quality Control and Assurance of various soil conditions.

Proposed Actions for Course Improvement:

Students will be encouraged to research and investigate other construction standards related to quality assurance and control for construction projects.

Course improvement will include:

1. Introduction of construction quality assurance and control (QA/QC) plan which was actually implemented in the construction project.
2. Research on the QA/QC cases that affect the construction industry
3. Examples of QA/QC in the construction documents such as contracts, specifications, and drawings.

The Direct Measure #3 for SLO 15 was "homework #7 Quality Management and Safety Management". This assessment was added in Fall 2022 and assessed in Fall 2022. This direct measure is planned for additional assessment in Spring 2023. The maximum grade (points) for this individual assignment was 20 points. The table below shows the average individual grades for this assignment.

Term	N	Criteria	Average Grade	Average Percent	Target Percent
Fall 2022	17	Homework #7	17.09 points	85%	75%

Spring 2023					

After the initial ACCE accreditation for the CM program, it was decided that the overall average of the grades should be at least 75%.

For the Fall 2022 semester, the Indirect Measure (83%) and the Direct Measure from homework #7 was (85%) indicating that the target value was met.

Proposed Actions for Course Improvement:

This assessment is relatively new to SLO #15 and it will be determined any improvement in future. Currently no improvement is implemented.

Student Learning Outcome 16

Understand Construction Project Control Processes

Introduction

Project Control can be defined as a work process using the project schedule, project costs, and resource control which includes: data gathering; status reporting; analysis; and communication of information in formats that assist in effective project management and decision making.

Student Learning Outcome 16 - Understand Construction Project Control Processes is assessed and evaluated in CMGT 32000 - Scheduling and Project Control, as indicated in the ACCE SLO Matrix. Supporting Courses include CMGT 31000 - Cost Estimating and CMGT 43000 - Jobsite Management.

The syllabus for CMGT 32000 - Scheduling and Project Control is included in this section of the Self-Study. For conciseness and document flow, the syllabi for the supporting course are found in Volume II.

Assessment Methods

Indirect Measure
ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures
For SLO 16, there are three assignments that are used as Direct Measures in Fall 2021:

1. Assignment 3-1: Activity on Arrow Diagram
2. Assignment 6-1: Resource Leveling
3. Lab 7: Project Scheduling Update

During Fall 2022, there are three assignments are used as Direct Measures.

1. Assignment 3-1: Basic Networks
2. Assignment 6-1: Resource Leveling
3. PROCORE Project: Crown Hill National Cemetery

For CMGT 32000, two methods of assessment are used, Direct and Indirect.
Direct - Individual Assignments and Exam (as explained later in this report)

SLO 16 Report Content

The following sections of the SLO 16 Report document the following.

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  Student assignments and graded student work examples
- Course Assessment Report

Indirect Measure

The Indirect Measure for SLO 5 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented in the Assessment and Evaluation for SLO 5 (found at the end of this SLO report).

Fall 2021

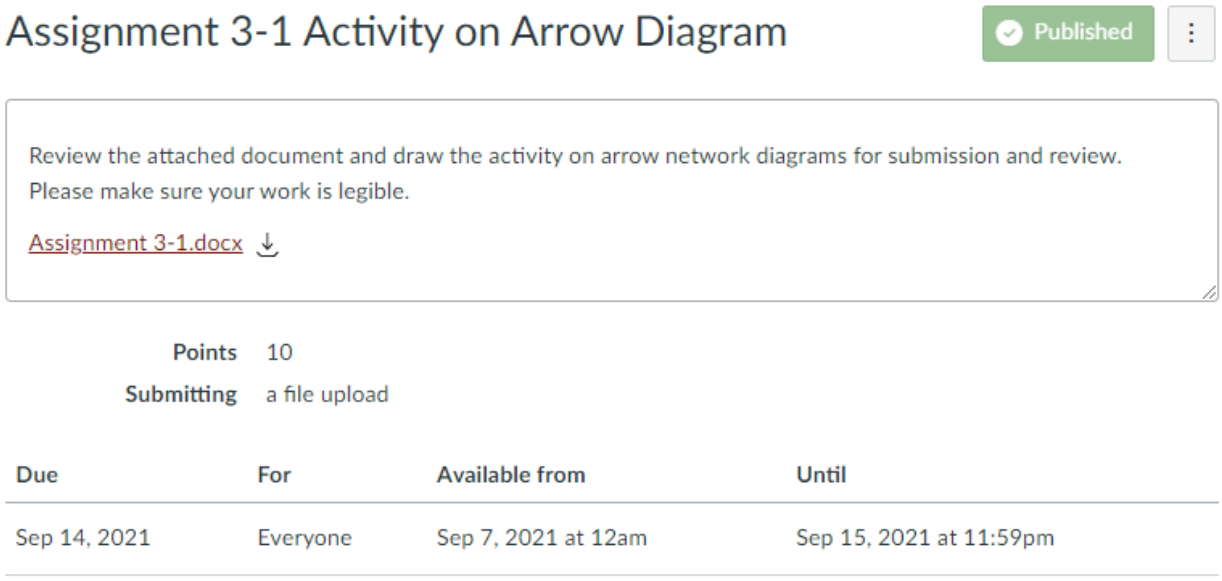
Direct Measures

The Direct Measures for SLO 16 are assignments that include:

1. Assignment 3-1: Activity on Arrow Diagram
2. Assignment 6-1: Resource Leveling
3. Lab 7: Project Scheduling Update

Graded Student Work

Assignment 3-1: Activity on Arrow Diagram



Assignment 3-1 Activity on Arrow Diagram

Published

Review the attached document and draw the activity on arrow network diagrams for submission and review. Please make sure your work is legible.

Assignment 3-1.docx

Points 10

Submitting a file upload

Due	For	Available from	Until
Sep 14, 2021	Everyone	Sep 7, 2021 at 12am	Sep 15, 2021 at 11:59pm

CMGT 32000
Scheduling & Project Control
Assignment 3-1

Directions:

Review the attached tables and draw Activity on Arrow diagrams for each of the below activities. Draw your diagrams left to right. Show all necessary dummies.

1.

Activity	Depends on	Activity	Depends on
A	—	H	B, C, E
B	A	I	F, G
C	A	J	B
D	A	K	H, I
E	D	L	H, J
F	D	M	I
G	D	N	K, L, M

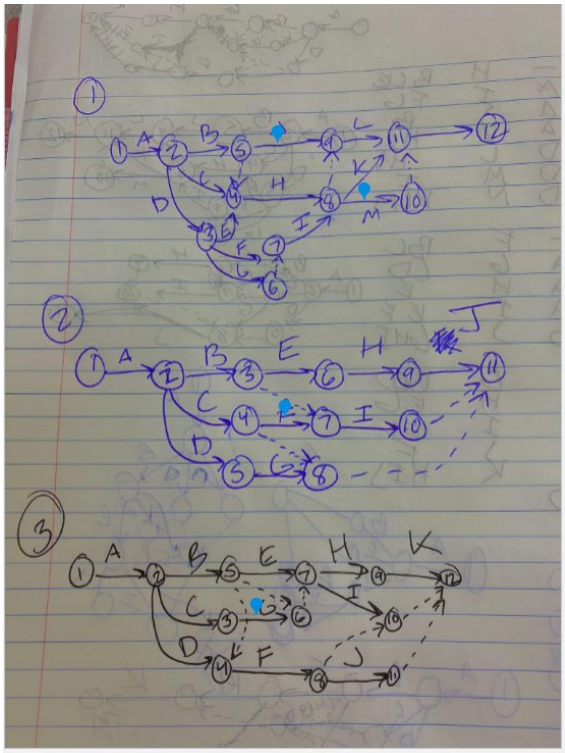
2.

Activity	Depends on	Activity	Depends on
A	—	F	B, C
B	A	G	C, D
C	A	H	E
D	A	I	E, F
E	B	J	G, H, I

3.

Activity	Depends on	Activity	Depends on
A	—	G	B, C,D
B	A	H	E, G
C	A	I	E, F
D	A	J	F
E	B	K	H, I, J
F	B, D		

Student Submission



Bradley Bastin
J follows B not B & C

Bradley Bastin
M follows I not H & I

Bradley Bastin
F follows B & C

Bradley Bastin
G Follows B,C,D

Student Viewed Document: Oct 1, 2021 at 4:32pm

Submitted Files: (click to load)

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Assessment

Grade out of 10

8

Comments for this Attempt

Download Submission Comments

Assignment 6-1: Resource Leveling

Assignment 6-1 Resource Leveling

Published

Complete exercises 1-9 in the back of this weeks reading materials. Upload your submissions for review.

Points 10

Submitting a file upload

Due	For	Available from	Until
Oct 11, 2021	Everyone	Oct 5, 2021 at 12am	Oct 12, 2021 at 11:59pm

Student Submission

[redacted] ASSIGNMENT 6-1

1. In the context of construction scheduling, what do we mean by resources?

Resources includes human labor, equipment, and materials in the context of construction scheduling.

2. What is resource allocation?

Resource allocation is the assigning of resources to a task in a schedule.

3. What is resource leveling?

Resource leveling is when resources are moved and spread out through the project within their float.

4. Why should you level resources in construction projects?

Leveling resources is necessary to keep expenses low and active crew at a constant working rate to avoid unnecessary shifts in resource use per day.

5. Do all resources have to be leveled? Why or why not?

No, not all resources need to be leveled. Materials are not leveled because of the varying amounts that can be used each day. A concrete slab might be poured the first day and may be the only concrete for the job, meaning that the material cannot be leveled for the remaining days of the project.

6. Discuss resource leveling in a multiproject environment.

Resource leveling for a multiproject environment is viable when the change is more efficient and cheaper for both projects. For example, workers may be asked to focus on one project or may switch between several depending on their skillset. There could be a bottleneck during a stage of one project where excess resources can be moved to another project to increase efficiency.

7. Can you level resources in a multiproject environment? If so, what are the factors that will influence your decision?

Resource leveling for a multiproject environment is based on the PM's experience and knowledge of the work as well as the skills of each worker, and the availability of materials and equipment. Not to mention the general convenience, cost, short/long-term need, future insights, staff, and specification.

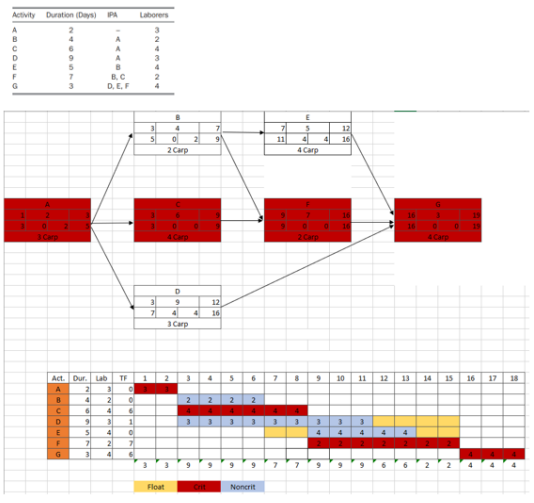
8. Two methods are used to assign a budget to an activity in the schedule. Explain both methods and mention the pros and cons of each method.

Lump-sum amounts can be assigned arbitrarily to each task. Essentially, the amount is created based on what the sales rep or procurer believes is fair for the work. Since the number may or may not have any backing to it, the actual amount used on the project is therefore a variable cost and has some form of risk. However, since the price can be whatever, it can be as inflated or deflated as is necessary per project.

In assigning the correct units of the resources to tasks, the project is more efficient. Tasks with resources can be identified and worked on easier. Specific reports can be generated easier, earned value management is easier to assess, each change can be monitored and measured on the overall schedule, calendars can be implemented easier, and resource-driven schedules can be made with this added information. However, this method takes longer and can increase in length and complicity for every additional task in the schedule.

9. In the following network, manually level your resources so that you may not use more than nine laborers per day at any time.

TASK 'E' needs to start on day 9 instead of day 7 to ensure no more than 9 workers are active per day.



Submitted: Oct 11, 2021 at 8:13pm

Student Viewed Document: Oct 24, 2021 at 2:01pm
Word Count: 540 words

Submitted Files: (click to load)
Assignment6-1JMcAdams.docx
Resource Allocation & Leveling WORK COMPLETED.xlsx

Assessment
Grade out of 10

10

Lab 7: Project Scheduling Update

Lab Assignment #7 - Updating Your Project Schedule

Published

Your superintendent and PM is out on vacation this week and you have to provide the owner of the home construction project with a schedule update. Take the below information and update your lab schedule to present to the owner.

Submit your schedule for review (pdf or project file)

Superintendent Update - Lab #7 - Schedule Update.pdf

Lab #7 word document - Lab #7 - Updating the Schedule.docx

Good Luck!

Brad

Points 10
Submitting a file upload

Due	For	Available from	Until
Oct 25, 2021	Everyone	Oct 19, 2021 at 12am	Oct 27, 2021 at 11:59pm

Updating the Project Schedule

Updating your construction project is extremely important. The Schedule is the tool you use to measure how well your team is performing against your original plan.

1. Reopen office building Lab #6. Save as Office Building (Your Name) lab #7 – Baseline Schedule > Click Save.
2. File > Info > Project Information > Advanced Properties > Title: File Name > Subject Lab #7 > Click OK

Setting Baselines

Once the project schedule is ready to go you publish it to the project team as the "official Schedule" and lock in the baseline schedule for the project. This will be the schedule that you measure your performance against. The baseline dates will serve as a reference to the original project assumptions before construction begins.

Within MS project when you set the project baseline you're memorializing all the Early Start and Early Finish dates as baseline dates. MS Project allows you to set up (11) different sets of baseline dates. The *Baseline* is used as the current project baseline, Baseline 1 should be used as the bid schedule and never touched. Baseline 2-10 can be used for new bid packages or added scope.

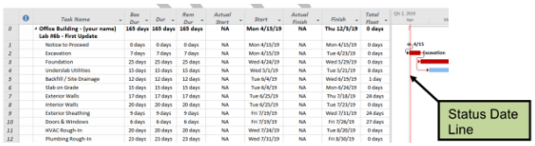
Setting Baseline

1. Set the project Baseline by > clicking Project. go to the schedule area of the ribbon > Click set baseline > Then click the "Set Baseline" Button > window will appear and click set baseline for the entire project > Click OK > Save the project
2. Confirm all the activities are not effort driven > Save the project File

Turning on the Status Date Line

The Status Dateline is the thin red vertical line that moves across the timescale to mark the status date of the project.

3. Click the Gantt Chart Format Button > and click the "Gridlines" button in the Format area of this tab
4. Select "gridlines" to open the gridlines window > scroll down to the bottom to select the Status Date > Format to a solid red line > Click "OK" and save.



Customizing the Progress Bar

We want to display progress bars with our progress update. MS Project 2016 progress bar is a tin medium blue line… Very little contract to differentiate the progress bar from the early bar (especially when printing in black & white)

5. Got to the Format Tab > Bar Styles > Click the format button to open the Pull-down bar styles window.
6. In the Bar styles window, select Progress bar then clicks into the Appearance cell of the Progress bar.
7. In the middle section of this window use the pull-down in the Shape field to select the thickest bar > Pattern Field to select the shaded bar > and in the color field select black. Leave the rest as is.

8. Save the project file

Adding Percent Complete (%Complete) to the Bars

Now we'll add the task percent complete (% Complete) to the left side of the bars on the Gantt chart.

9. Go to the Format tab > Bar Styles > Select the "Format button > verify Task name is selected
10. On the lower left side of the window select Text Tab,> click in the left-field and use the pull-down to select % Complete.
11. Repeat this step for the Critical tasks and milestone tasks.
12. Save your project File

Updating the Schedule

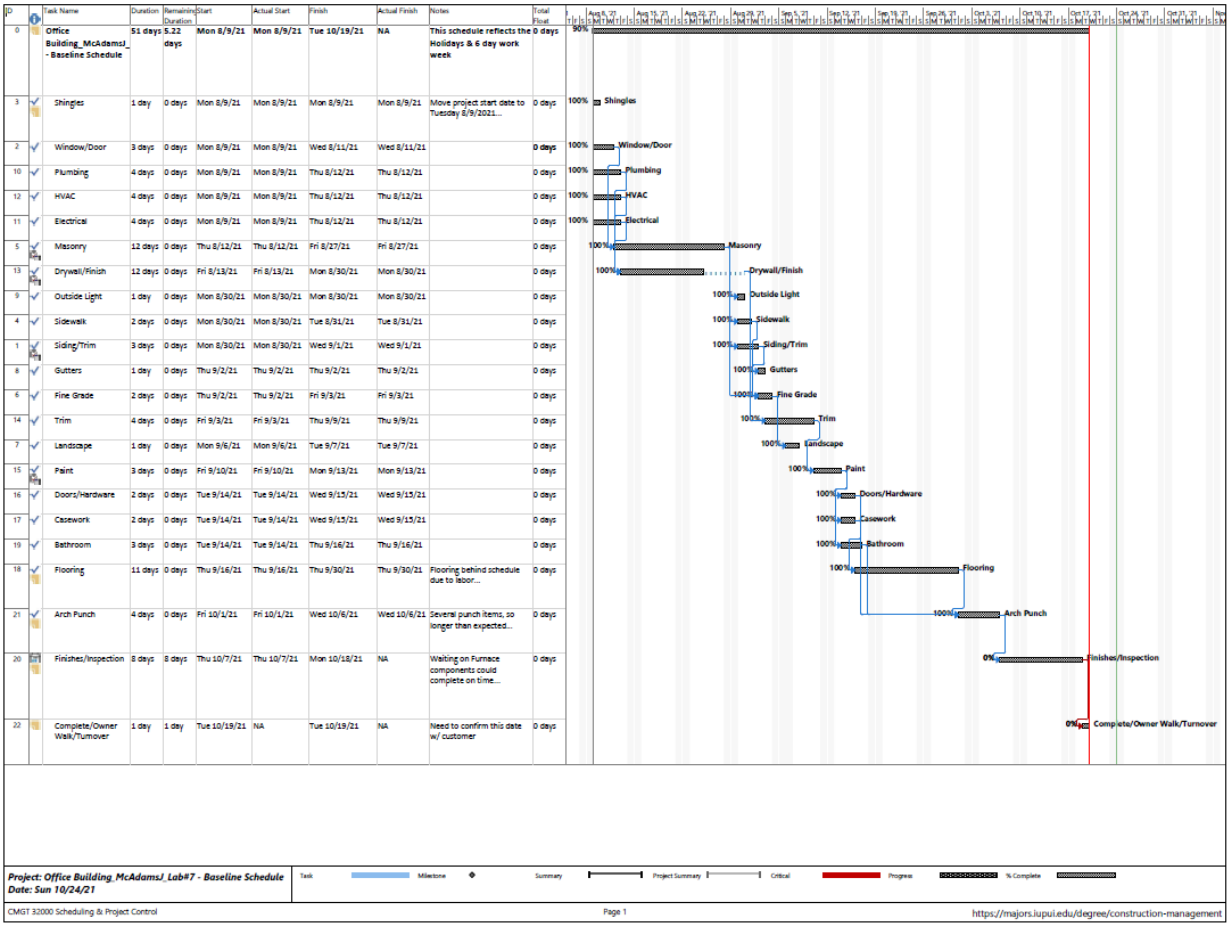
Updating your project schedule is extremely important. A benefit of a computerized CPM schedule is the ability to quickly recalculate the schedule based on how the project is progressing, changes, surprise events, shifting priorities. As a Project Manager, you'll have several copies/updates of your Schedule saved on your computer… make you save and label appropriately.

Process of Updating the Schedule:

- Update the most recent version of the project schedule. Include remarks in the Notes section
- Be consistent with Update the schedule at the same time every month, or bi-weekly.

Task Name	Duration	Remaining Duration	Start	Actual Start	Finish	Actual Finish	Notes
Lab #7 - Schedule Update	52 days	5.14 days	8/9/2021	8/9/2021	10/19/2021	NA	
Siding & Trim	3 days	0 days	8/30/2021	8/30/2021	9/1/2021	9/1/2021	
Doors & Windows	3 days	0 days	8/9/2021	8/9/2021	8/11/2021	8/11/2021	
Shingles	1 day	0 days	8/9/2021	8/9/2021	8/9/2021	8/9/2021	Move Project Start Date to Tuesday 8/9/2021
Sidewalk & Drive	2 days	0 days	8/30/2021	8/30/2021	8/31/2021	8/31/2021	
Masonry	12 days	0 days	8/12/2021	8/12/2021	8/27/2021	8/27/2021	
Fine Grade	2 days	0 days	9/2/2021	9/2/2021	9/3/2021	9/3/2021	
Landscaping	2 days	0 days	9/6/2021	9/6/2021	9/7/2021	9/7/2021	
Gutters & Downspouts	1 day	0 days	9/2/2021	9/2/2021	9/2/2021	9/2/2021	
Outdoor Lighting	1 day	0 days	8/30/2021	8/30/2021	8/30/2021	8/30/2021	
Plumbing	4 days	0 days	8/9/2021	8/9/2021	8/12/2021	8/12/2021	
Electrical	4 days	0 days	8/9/2021	8/9/2021	8/12/2021	8/12/2021	
HVAC	4 days	0 days	8/9/2021	8/9/2021	8/12/2021	8/12/2021	
Drywall & Finishing	12 days	0 days	8/13/2021	8/13/2021	8/30/2021	8/30/2021	
Trim work	6 days	0 days	9/3/2021	9/3/2021	9/9/2021	9/9/2021	
Paint	3 days	0 days	9/10/2021	9/10/2021	9/13/2021	9/13/2021	
Doors & Hardware	2 days	0 days	9/14/2021	9/14/2021	9/15/2021	9/15/2021	
Casework	2 days	0 days	9/14/2021	9/14/2021	9/15/2021	9/15/2021	
Flooring	11 days	0 days	9/16/2021	9/16/2021	9/30/2021	9/30/2021	Flooring Behind Schedule due to Labor
Bathroom tile	3 days	0 days	9/14/2021	9/14/2021	9/16/2021	9/16/2021	
Finish MEP	8 days	8 days	10/7/2021	10/7/2021	10/18/2021	NA	Waiting on Furnace Components could complete on time
Architectural Punch	4 days	0 days	10/1/2021	10/1/2021	10/6/2021	10/6/2021	Several Punch Items, so Longer than expected.
Owner walk thru & turnover	1 day	1 day	10/19/2021	NA	10/19/2021	NA	Need to confirm this date w/ Customer

Student Submission



ID	Task Name	Duration	Remaining Duration	Start	Actual Start	Finish	Actual Finish	Notes	Total Float
0	**Office Building_McAdamsJ_ - Baseline Schedule**	**51 days**	**5.22 days**	**Mon 8/9/21**	**Mon 8/9/21**	**Tue 10/19/21**	**NA**	**This schedule reflects the Holidays & 6 day work week**	**0 days**
3	Shingles	1 day	0 days	Mon 8/9/21	Mon 8/9/21	Mon 8/9/21	Mon 8/9/21	Move project start date to Tuesday 8/9/2021...	0 days
2	Window/Door	3 days	0 days	Mon 8/9/21	Mon 8/9/21	Wed 8/11/21	Wed 8/11/21		0 days
10	Plumbing	4 days	0 days	Mon 8/9/21	Mon 8/9/21	Thu 8/12/21	Thu 8/12/21		0 days
12	HVAC	4 days	0 days	Mon 8/9/21	Mon 8/9/21	Thu 8/12/21	Thu 8/12/21		0 days
11	Electrical	4 days	0 days	Mon 8/9/21	Mon 8/9/21	Thu 8/12/21	Thu 8/12/21		0 days
5	Masonry	12 days	0 days	Thu 8/12/21	Thu 8/12/21	Fri 8/27/21	Fri 8/27/21		0 days
13	Drywall/Finish	12 days	0 days	Fri 8/13/21	Fri 8/13/21	Mon 8/30/21	Mon 8/30/21		0 days
9	Outside Light	1 day	0 days	Mon 8/30/21	Mon 8/30/21	Mon 8/30/21	Mon 8/30/21		0 days
4	Sidewalk	2 days	0 days	Mon 8/30/21	Mon 8/30/21	Tue 8/31/21	Tue 8/31/21		0 days
1	Siding/Trim	3 days	0 days	Mon 8/30/21	Mon 8/30/21	Wed 9/1/21	Wed 9/1/21		0 days
8	Gutters	1 day	0 days	Thu 9/2/21	Thu 9/2/21	Thu 9/2/21	Thu 9/2/21		0 days
6	Fine Grade	2 days	0 days	Thu 9/2/21	Thu 9/2/21	Fri 9/3/21	Fri 9/3/21		0 days
14	Trim	4 days	0 days	Fri 9/3/21	Fri 9/3/21	Thu 9/9/21	Thu 9/9/21		0 days
7	Landscape	1 day	0 days	Mon 9/6/21	Mon 9/6/21	Tue 9/7/21	Tue 9/7/21		0 days
15	Paint	3 days	0 days	Fri 9/10/21	Fri 9/10/21	Mon 9/13/21	Mon 9/13/21		0 days
16	Doors/Hardware	2 days	0 days	Tue 9/14/21	Tue 9/14/21	Wed 9/15/21	Wed 9/15/21		0 days
17	Casework	2 days	0 days	Tue 9/14/21	Tue 9/14/21	Wed 9/15/21	Wed 9/15/21		0 days
19	Bathroom	3 days	0 days	Tue 9/14/21	Tue 9/14/21	Thu 9/16/21	Thu 9/16/21		0 days
18	Flooring	11 days	0 days	Thu 9/16/21	Thu 9/16/21	Thu 9/30/21	Thu 9/30/21	Flooring behind schedule due to labor...	0 days
21	Arch Punch	4 days	0 days	Fri 10/1/21	Fri 10/1/21	Wed 10/6/21	Wed 10/6/21	Several punch items, so longer than expected...	0 days
20	Finishes/Inspection	8 days	8 days	Thu 10/7/21	Thu 10/7/21	Mon 10/18/21	NA	Waiting on Furnace components could complete on time...	0 days
22	Complete/Owner Walk/Turnover	1 day	1 day	Tue 10/19/21	NA	Tue 10/19/21	NA	Need to confirm this date w/ customer	0 days

Submitted: Oct 24, 2021 at 10:21pm

Student Viewed Document: Oct 24, 2021 at 10:21pm

Submitted Files: (click to load)

Lab#7 - Updating the Project Schedule.pdf

Assessment

Grade out of 10

10

Comments for this Attempt

Download Submission Comments

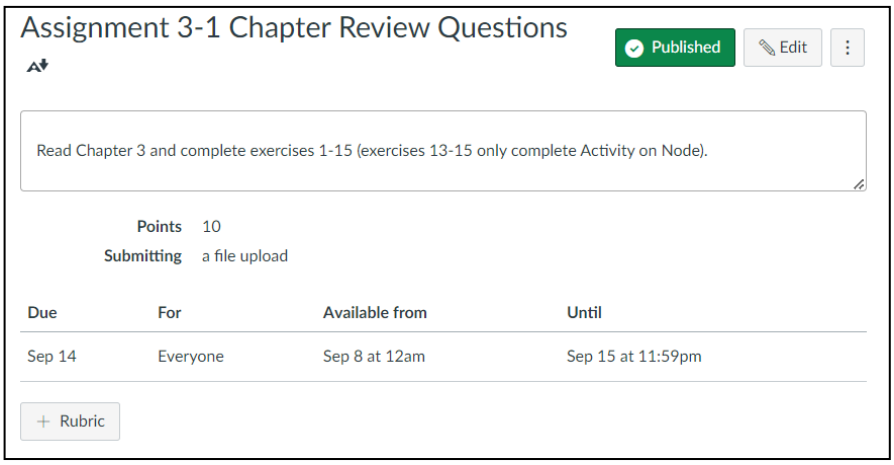
Direct Measures

The Direct Measures for SLO 16 are assignments that include:

1. Assignment 3-1: Basic Networks
2. Assignment 6-1: Resource Leveling
3. PROCORE Project: Crown Hill National Cemetery

Graded Student Work

Assignment 3-1: Activity on Arrow Diagram



- Review Questions 1-12 and quiz the student on their understanding of logic diagrams including activity on arrow diagrams (AOA) and activity on node diagrams (AON).
- Review Questions 13-15 and direct the students to draw node networks for the below projects.

Activity	IPA
A	–
B	A
C	A
D	B
E	B, C

Activity	IPA
A	–
B	–
C	A
D	A, B
E	C, D

Activity	IPA
A	–
B	A
C	A
D	A
E	B
F	B, C
G	D, E, F

Student Submission

1. Nodes are events in an arrow diagram, a start event, and a finish event

2. Each arrow connects two nodes (depicted by circles with numbers in them): the "from" node and the "to" node (pg 2)

3. A node in a node event signifies an activity, they relate to arrows

4. The lines represent logical relationships, one activity to the next essentially

5. Bar charts show the schedule in graphically whereas networks show the workflow of the project tasks

6. Arrow networks must follow events and networks are activity driven, node networks are easier to draw

7. arrow diagramming method (ADM), activity on arrow (AOA) network, or the I-J method (because activities are defined by the from node, I, and the to node, J) (pg 2)

8. Easier to draw, do not require dummy activities to fix, can accommodate lags between activities

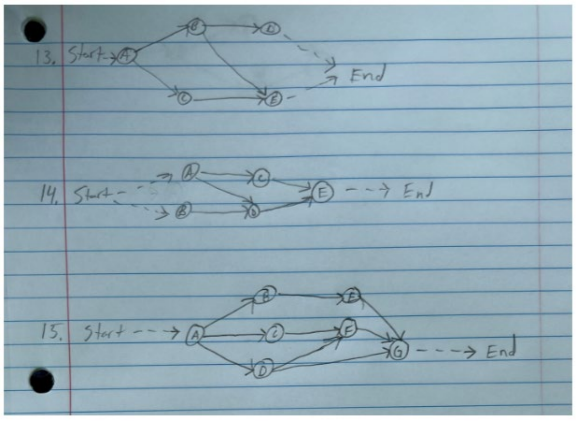
9. They depict activities and events

10. They are bar charts with logic links between activities, they provide an easy to understand graphic representation of the schedule

11. Networks show logic (i.e., the relationships or dependencies among activities). Bar charts d not. Networks can better represent large and complicated projects. Networks can estimate, or predict, the completion date of a project, or other dates, on the basis of mathematical calculations of the CPM.

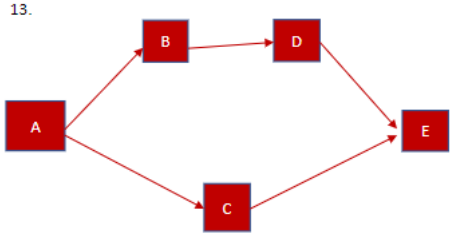
12. yes, critical path method resolves the issues that bar charts have. Mainly the lack of detail on bar charts is the main reason for the switch

13,14,15

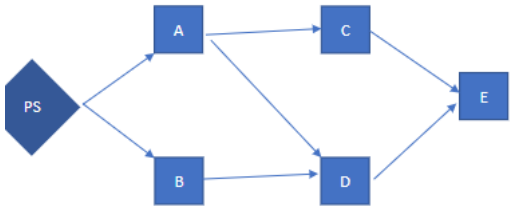


1. Nodes in an arrow diagram represent an event. Nodes are the beginning and end points of each event.
2. Arrows in an arrow diagram connect the nodes together to show the order in which events take place.
3. Nodes on a node diagram represent an activity, and
4. Lines (and/or arrows) in a node diagram are connected to the nodes
5. Main differences between bar charts and networks:
   - Networks can show the logic and relationships of the events, whereas bar charts do not
   - Bar Charts are time-scaled, networks are not.
   - Bar charts are simple and easy to prepare and understand.
   - Bar charts are more acceptable for presentations and can be loaded with more information such as cash-flow diagrams and man-hours (by-product of being time-scaled)
6. Differences between arrow and node networks:
   -
7. The other name for arrow networks is the I-J Method because each activity is identified by the two nodes that define its start and end. (For example, activity A is also shown by 10-20, B is 20-30, etc.)
8. The main advantages of node networks over arrow networks are:
   - Node networks are easier to draw up.
   - Node networks don't require dummy activities to fix the activity identity issue (easier to assemble the logic)
   - Node networks can accommodate for lags between activities without the addition of more activities.
9. The main advantage of arrow networks over node networks is that they depict activities as well as events. Node networks do not contain provisions for events. Although, this problem is overcome in node diagrams by creating milestone activities with a zero duration to represent an important event like a substantial completion of a facility.

13.



14.



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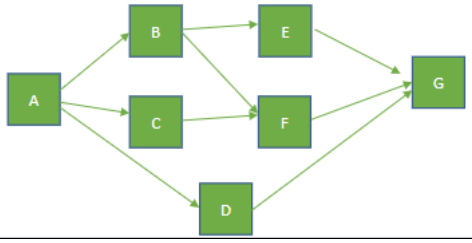
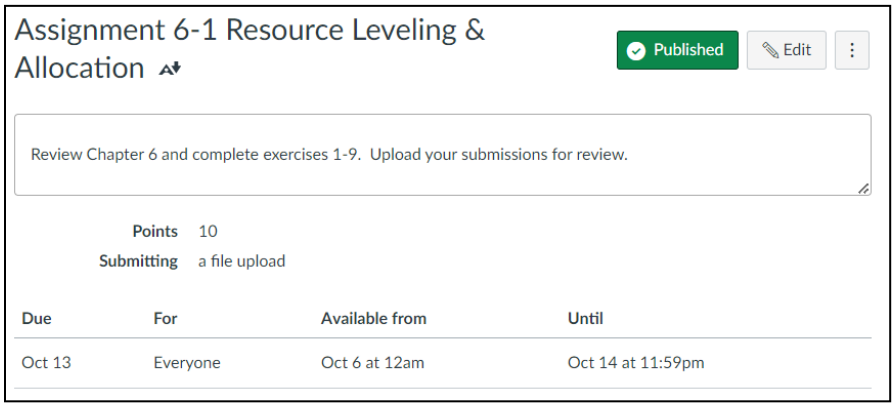


Assignment 6-1: Resource Leveling



Assignment 6-1 Resource Leveling & Allocation

Published | Edit

Review Chapter 6 and complete exercises 1-9. Upload your submissions for review.

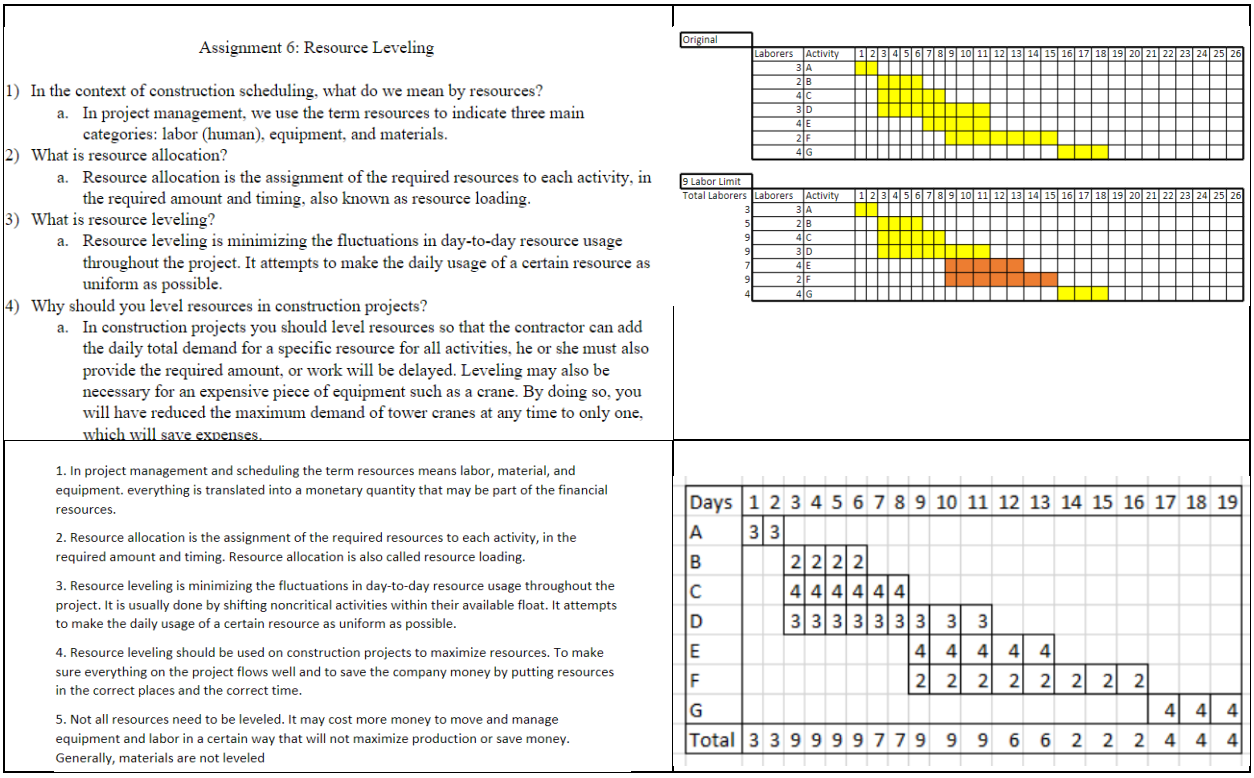
Points 10

Submitting a file upload

Due	For	Available from	Until
Oct 13	Everyone	Oct 6 at 12am	Oct 14 at 11:59pm

- Review Questions 1-8 quiz the student on their understanding of Construction Resources, resource allocation, and resource-leveling.
- Review Question 9 the students level resources on a given network where they use no more than nine laborers per day

Student Submission



Assignment 6: Resource Leveling

1) In the context of construction scheduling, what do we mean by resources?
   a. In project management, we use the term resources to indicate three main categories: labor (human), equipment, and materials.
2) What is resource allocation?
   a. Resource allocation is the assignment of the required resources to each activity, in the required amount and timing, also known as resource loading.
3) What is resource leveling?
   a. Resource leveling is minimizing the fluctuations in day-to-day resource usage throughout the project. It attempts to make the daily usage of a certain resource as uniform as possible.
4) Why should you level resources in construction projects?
   a. In construction projects you should level resources so that the contractor can add the daily total demand for a specific resource for all activities, he or she must also provide the required amount, or work will be delayed. Leveling may also be necessary for an expensive piece of equipment such as a crane. By doing so, you will have reduced the maximum demand of tower cranes at any time to only one, which will save expenses.

Original

Laborers	Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
3	A																										
2	B																										
4	C																										
3	D																										
4	E																										
2	F																										
4	G																										

9 Labor Limit

Total Laborers

Laborers	Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
3	A																										
5	B																										
9	C																										
9	D																										
7	E																										
9	F																										
4	G																										

1. In project management and scheduling the term resources means labor, material, and equipment. everything is translated into a monetary quantity that may be part of the financial resources.

2. Resource allocation is the assignment of the required resources to each activity, in the required amount and timing. Resource allocation is also called resource loading.

3. Resource leveling is minimizing the fluctuations in day-to-day resource usage throughout the project. It is usually done by shifting noncritical activities within their available float. It attempts to make the daily usage of a certain resource as uniform as possible.

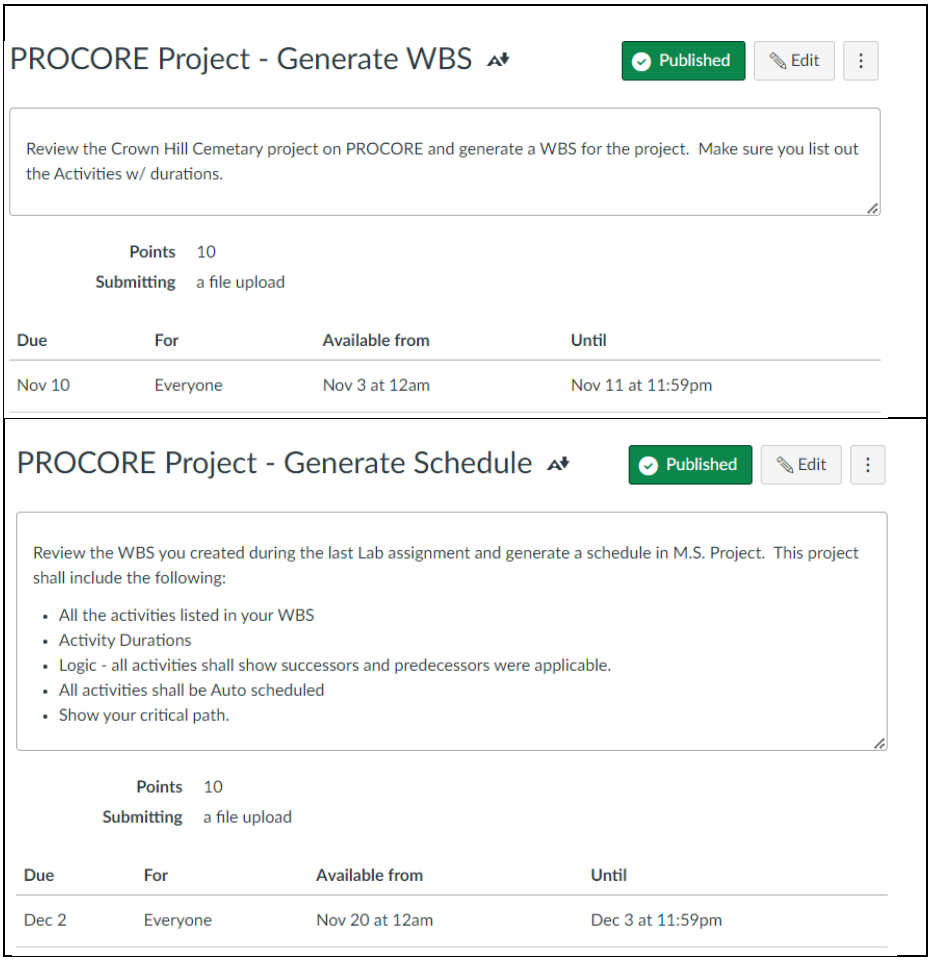
4. Resource leveling should be used on construction projects to maximize resources. To make sure everything on the project flows well and to save the company money by putting resources in the correct places and the correct time.

5. Not all resources need to be leveled. It may cost more money to move and manage equipment and labor in a certain way that will not maximize production or save money. Generally, materials are not leveled

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	3	3																	
B			2	2	2	2													
C			4	4	4	4	4	4											
D			3	3	3	3	3	3	3	3	3								
E									4	4	4	4	4						
F									2	2	2	2	2	2	2	2			
G																	4	4	4
Total	3	3	9	9	9	9	7	7	9	9	9	6	6	2	2	2	4	4	4

PROCORE Project: Crown Hill National Cemetery

The construction project includes the development of land within Crown Hill Cemetery for the four branches of Military Services including the Army, Navy, Marines, and Airforce. Construction will consist of site development, Columbarium's, Support building, and Committal Shelter



PROCORE Project - Generate WBS

Published | Edit

Review the Crown Hill Cemetary project on PROCORE and generate a WBS for the project. Make sure you list out the Activities w/ durations.

Points 10
Submitting a file upload

Due	For	Available from	Until
Nov 10	Everyone	Nov 3 at 12am	Nov 11 at 11:59pm

PROCORE Project - Generate Schedule

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Review the WBS you created during the last Lab assignment and generate a schedule in M.S. Project. This project shall include the following:

- All the activities listed in your WBS
- Activity Durations
- Logic - all activities shall show successors and predecessors were applicable.
- All activities shall be Auto scheduled
- Show your critical path.

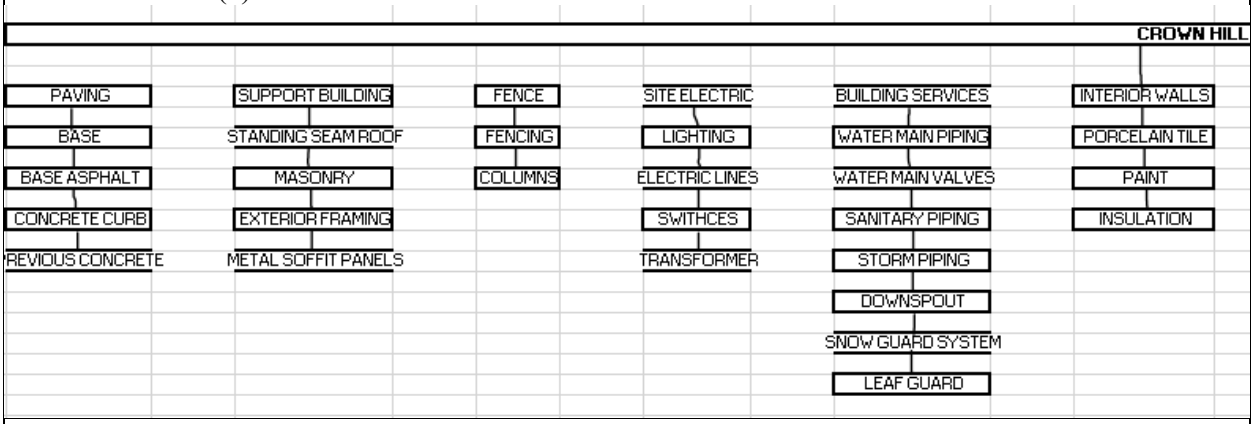
Points 10
Submitting a file upload

Due	For	Available from	Until
Dec 2	Everyone	Nov 20 at 12am	Dec 3 at 11:59pm

Student Submission

Generate WBS

Submission Part (1)



Submission Part (2)

2nd Submission

Project WBS

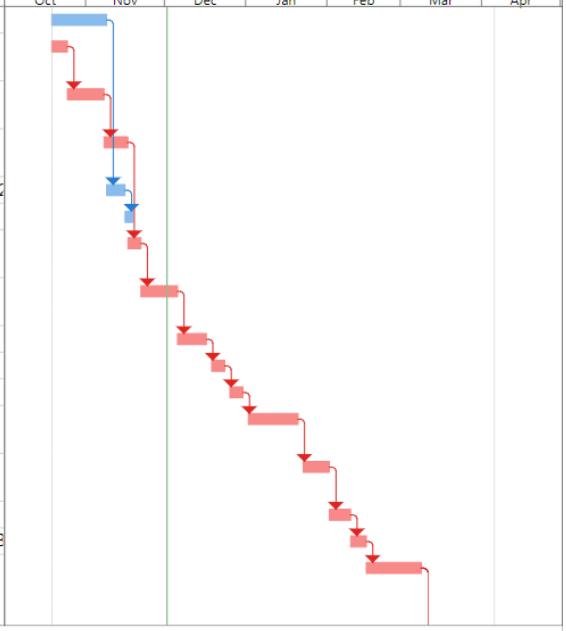
Site Work

1. Paving
    - Base
    - Base asphalt
    - Gutter
2. Pavement
    - Pervious Concrete pavement
    - Concrete Pavement Section
    - Asphalt pavement section
3. Support Building
    - Standing seam roof
    - Masonry
    - Exterior framing
    - Porch
    - Storage
    - Men's restroom
    - Women's restroom
    - Administrative
4. Curbs
    - Flush curb
    - Reverse gutter pan
    - Mountable curb
    - Concrete curb
    - PCC curbs
    - Vertical curb
    - Barrier curb
    - Flush curb
5. Joints
    - PCC joints
    - Expansion joint
    - Contraction joint
    - Grooved joint

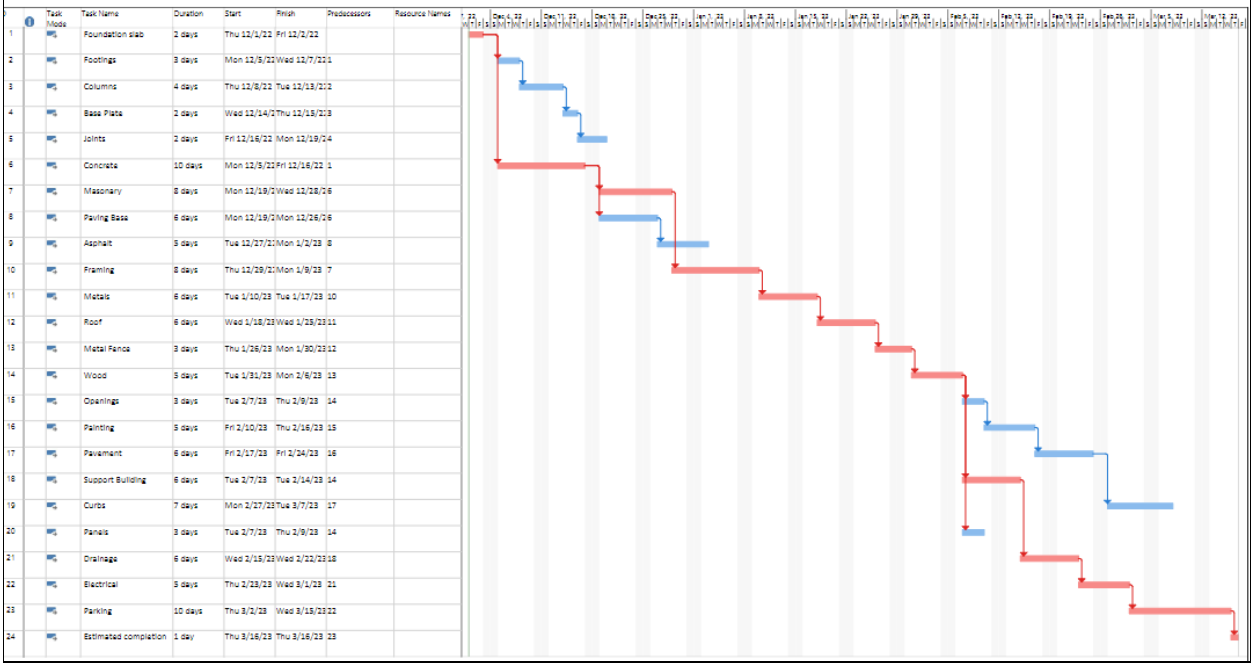
Generate Schedule

1st Sbmission

ID	Task Mode	Task Name	Duration	Start	Finish
1		Civil Site Plan	15 days	Wed 10/19/2	Tue 11/8/22
2		Storm Drain Profile Statining Plan	4 days	Wed 10/19/22	Mon 10/24/22
5		Civil Details Grading and Drainage	10 days	Tue 10/25/22	Mon 11/7/22
6		Civil Details Sanitary Sewer and Misc Utility	7 days	Tue 11/8/22	Wed 11/16/22
3		Civil Details Paving	5 days	Wed 11/9/22	Tue 11/15/22
4		Civil Detail Site	3 days	Wed 11/16/2	Fri 11/18/22
7		Overall Civil Utility Plan	3 days	Thu 11/17/22	Mon 11/21/22
8		Civil Utility Profile Sanitary Sewer	10 days	Tue 11/22/22	Mon 12/5/22
9		Enlarged Site Plan	9 days	Tue 12/6/22	Fri 12/16/22
10		Foundation Plan	5 days	Mon 12/19/2	Fri 12/23/22
11		Framing Plans	5 days	Mon 12/26/2	Fri 12/30/22
12		Floor, Roof, Reflected Ceiling Plans	15 days	Mon 1/2/23	Fri 1/20/23
13		Interior Design Plan & Schedules	8 days	Mon 1/23/23	Wed 2/1/23
14		Elevation	6 days	Thu 2/2/23	Thu 2/9/23
15		Air Barrier Plan	4 days	Fri 2/10/23	Wed 2/15/23
16		Shelter Floor, Ceiling Plan, Roof Plan, & Slab Plans	15 days	Thu 2/16/23	Wed 3/8/23



2nd Submission



Assessment Report for SLO 16

Course: CMGT 32000 - Scheduling and Project Control

Academic Term for Direct Evaluation: Fall 2021, Fall 2022

Instructors: Brad Bastin

Evaluation of Assessment Data:

The Indirect Measure for SLO 16 was assessed using the ACCE Student Learning Outcomes (SLO) Survey (Graduating Senior Exit Survey). A xx% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	16. Understand construction project control processes.	4.0	80%
S 2022		4.44	89%
F 2022		4.7	94%

The Direct Assessment consists of three assignments, as listed below.

Assignment 3-1: Activity on Arrow Diagram
Assignment 6-1: Resource Leveling
Lab 7: Project Scheduling Update

The average grades for the assignments and the exam are shown below.

Term	N	Criteria	Average Percent	Target Percent
Fall 2021	24	Assignment 3-1	75%	75%
		Assignment 6-1	82%	75%
		Lab 7	74%	75%
Fall 2022	15	Assignment 3-1: Basic Networks	81%	75%
		Assignment 6-1: Resource Leveling	81%	75%
		PROCORE Project: Crown Hill National Cemetery	80%	75%

The target for the overall average of the total grades should be at least 75%. The Indirect Measure was 88% and the Direct Measure was 79%. Based on the perception of graduating seniors (Indirect Measure), they felt confident in creating project schedules. The Direct Measure has been improved since the initial accreditation. Direct measures met the target value (75%). The instructor continuously revises the assignments to enhance student learning objectives.

Proposed Actions for Course Improvement:

Related to SLO 16 - Understand Construction Project Control Processes, there are a few actions that I plan to incorporate into the class. The plan is to insert a question or two into the Individual Instructor Report specifically related to Project Control. In addition, questions will be included in the course survey for the other SLOs addressed in this course (SLO 5 - Create a construction project schedules (supporting course) and SLO 10 - Apply electronic-based technology to manage the construction process (supporting course). No major changes are expected for the eight assignments that are used to assess project controls.

An important point to emphasize to the students next semester is the value of completing the course evaluations. I will make an exerted effort to do just that.

Student Learning Outcome 17

Understand the Legal Implications of Contract, Common, and Regulatory Law to Manage a Construction Project

Introduction

SLO 17 - Understand the Legal Implications of Contract, Common, and Regulatory Law to Manage a Construction Project is evaluated and assessed in CMGT 33000 Contract Administration and Specifications.

The importance of construction project documentation of all types and the legal implications of those documents is fundamental to the proper administration of a construction project. This applies not only to traditional legal documents (contracts, change orders, and liens) but also to the legal relevance of day-to-day project documentation (RFIs, daily logs, emails, etc.) that are used on the jobsite. This content is found in the course CMGT 33000 Contract Administration and Specifications.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

1. Selected questions drawn from the midterm.
2. Selected questions drawn from the final exam.

SLO 17 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  - Graded student work of objective questions
- Assessment and Evaluation for SLO 17

Indirect Measure

The Indirect Measure for SLO 17 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are presented below and explained in the Assessment and Evaluation for SLO 17 (found at the end of this SLO report).

Direct Measures

The direct measures for SLO 17 include objective test questions that appear on the midterm and final exams for CMGT 33000 Contract Administration and Specifications. The presented material in this report includes the questions, answer options and the student response rates. The success rates are then combined into an overall success rate and then compared to the target rate.

Graded Student Work

1. – Midterm exam (selected questions) (SP21)

1.

What is the primary purpose of a bond?

To protect the General Contractor if the Owner should fail to compensate the Contractor.	2 respondents	18 %
To protect the Owner if a Contractor fails to perform in accordance to the contract.	9 respondents	82 % ✓
To protect the Owner from costly mistakes made by the Architect.		0 %
To protect the Architect from errors committed by the General Contractor.		0 %

2.

What is the purpose of the general conditions?

To assign the working conditions, hours, staging areas, etc. on the job site.	1 respondent	9 %
To establish the responsibilities assigned to the General Contractor.	2 respondents	18 %
To establish the legal responsibilities, obligations, authority of all parties in the project.	7 respondents	64 % ✓
To identify the legal obligations assigned by the General Contract to the Subcontractors.	1 respondent	9 %

3.

On the left are descriptions of three different bonds. Match the descriptions with the correct bond type from the dropdown menu on the right.

A bond that ensures the low bidder will not withdraw his bid upon being awarded the contract.

A bond that ensures the work will be completed in accordance with contract terms.

A bond that ensure the contractor will pay all bills.

Bid	8 respondents	73 % ✓
Performance		0 %
Bail		0 %
Payment		0 %
Low Bid	2 respondents	18 %
Bill Payment		0 %
Completion	1 respondent	9 %

4.

On the left are descriptions of three different bonds. Match the descriptions with the correct bond type from the dropdown menu on the right.

A bond that ensures the low bidder will not withdraw his bid upon being awarded the contract.
A bond that ensures the work will be completed in accordance with contract terms.
A bond that ensure the contractor will pay all bills.

Bid		0 %
Performance	11 respondents	**100 %** ✓
Bail		0 %
Payment		0 %
Low Bid		0 %
Bill Payment		0 %
Completion		0 %

5.

On the left are descriptions of three different bonds. Match the descriptions with the correct bond type from the dropdown menu on the right.

A bond that ensures the low bidder will not withdraw his bid upon being awarded the contract.
A bond that ensures the work will be completed in accordance with contract terms.
A bond that ensure the contractor will pay all bills.

Bid		0 %
Performance		0 %
Bail		0 %
Payment	11 respondents	**100 %** ✓
Low Bid		0 %
Bill Payment		0 %
Completion		0 %

6.

From the following identify the advantages of the traditional (D-B-B) delivery method. Select ALL that apply.

Well known process	11 respondents	**100 %** ✓
Great owner protection	6 respondents	**55 %** ✓
Facilitates bidding	7 respondents	**64 %** ✓
Enhanced contractor / designer interaction	4 respondents	36 %
Maximizes owner-designer-builder collaboration	6 respondents	55 %

18% answered correctly

7.

The Owner's approach to organizing the project team is called the _____.

Contract family		0 %
Compensation method		0 %
Prime contract	2 respondents	25 %
Delivery method	6 respondents	**75 %** ✓

8.

Following are terms that are common to the construction industry and used within Procore. Match the definition on the left with its correct term on the right.

Account numbers which are used to track all expenses associated with a construction project.

A specific financial obligation incurred by the General Contractor.

A specialized contractor that is typically contracted directly to the GC.

The General Contractor's process of converting winning bids and proposals into purchase orders and subcontracts.

The contract between the Owner and the Contractor

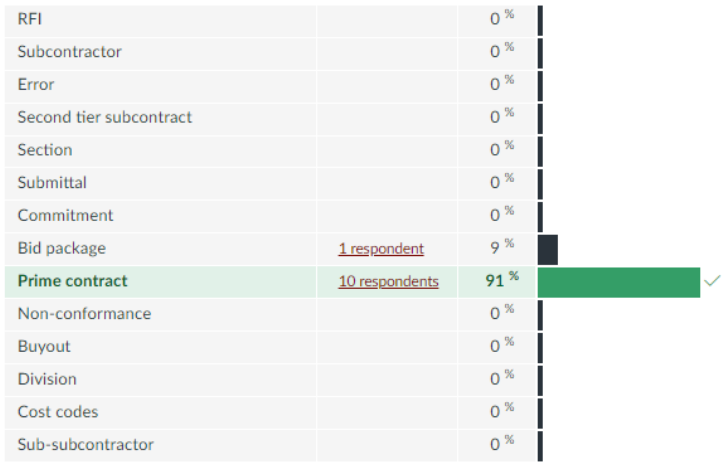
An assembly of materials that are combined together to form the scope of a bid.

A specified document requirement that requires formal approval by the Designer prior to construction.

A "chapter" within the specifications that organizes the document by construction assembly, product or material.

A category which broadly divides all construction materials contained within the specifications.

A situation where the work performed by a subcontractor does not comply with the contract drawings / documents.



2. Final exam (selected questions) (SP21)

1.

From the following, identify ALL of those characteristics of good communication. (3)

Eloquent	2 respondents	18 %
Concise	8 respondents	73 %
Objective	7 respondents	**64 %** ✓
Respectful	5 respondents	45 %
Properly distributed	10 respondents	**91 %** ✓
Comprehensive	9 respondents	**82 %** ✓

18% answered correctly

2.

On the left are scenarios in which changes may occur in a construction project. For each situation determine what documentation would be the best choice to alter the Prime Contract.

Options to consider include 1) if the change would best be handled by a Change Order, 2) a Construction Change Directive, 3) an Architect's Supplemental Instruction or 4) doesn't require change documentation to modify the Prime Contract.

- The Owner wants to change the floor finish in his new office suite AFTER the general contract has been awarded.
- The Architect changes the mounting height of all receptacles by 2" prior to the start of construction.
- The Architect changes the mounting height of all receptacles by 2" after they have been installed.
- The General Contractor discovers a construction error he is responsible for that requires work be torn out and replaced.
- A floor change requested by the Owner requires changing the floor slab which is due to be poured tomorrow.
- Unforeseeable and highly unusual weather has stopped job progress for 3 days.
- Labor conditions are such that it's difficult to properly staff the project, resulting in a schedule delay of 1 week.
- The Owner, Architect and General Contractor cannot agree on the cost of a proposed change however the Owner and Architect want the work done anyway and time is critical.
- The masonry subcontractor's contract with the General Contractor exceeds the amount budgeted by the General Contractor.
- Before any paint has been applied or purchased, the Architect changes the color of 2 walls.

Architect's Supplemental Instruction		0 %
Change Order	2 respondents	18 %
Construction Change Directive	9 respondents	**82 %** ✓
No change documentation.		0 %

3.

In which meeting would you ask, "What is the status of RFI #7"?

Progress meeting	7 respondents	**64 %** ✓
Close-out meeting		0 %
Preconstruction meeting	4 respondents	36 %
Pre-bid meeting		0 %
Pre-installation meeting		0 %

4. Match the following terms with the correct definitions. Answers are used only once.

Extra material for the Owner's use; this is provided as a part of project close-out.

A document which authorizes a change in project cost WITH or WITHOUT the approval of the GC.

The document which officially changes the contract amount and/or completion date; it is executed by the Owner, GC and Architect.

A relatively new process, it adds a new member to the construction team who ensures all building systems are properly functioning, especially HVAC.

The practice of placing a disproportionate amount of the GC's overhead profit on those items in the SOV which occur early in the construction schedule.

A percentage of money withheld every month from the GC's pay application on behalf of the Owner to ensure job completion.

A legal document that ensures the GC cannot place a lien on the Owner's property.

A deliverable at project close-out, it is the binder filled with all warranties, manuals, and construction team contact information.

A list which accompanies every pay application and breaks down the project into recognizable components so that job progress can be accurately determined.

A document issued by the Designer implementing a change with the understanding there is no change in cost or time.

Retainage		0 %
Change order		0 %
Back loading		0 %
Architect's Supplemental Instructions		0 %
Change request		0 %
Request For Information		0 %
Commissioning		0 %
Front loading		0 %
O & M manual		0 %
Schedule of values		0 %
Attic stock		0 %
Construction Change Directive		0 %
Lien waiver	11 respondents	100 % ✓
Deduction		0 %
Payment waiver		0 %

5. The document that assists the Owner & Architect in determining the value of the work in place is called the Certificate for Payment.

True		0 %
False	3 respondents	100 % ✓

6. Regarding the submittal process, fill in the blank found in the following quote from the General Conditions (A201): (The) "_____ has (1) reviewed and approved them, (2) determined and verified materials,... and (3) checked and coordinated..."

General Contractor	1 respondent	11 % ✓
Subcontractor		0 %
Owner	2 respondents	22 %
Architect	6 respondents	67 %

7.	You are a general contractor and you have an industrious intern reviewing the first pay application for a new job. The intern notes there must be something wrong because as shown on the Continuation Sheet, the work completed this period (Column E) = $12,040 however the total completed & stored to date (Column G) = $14,020. Of the following four (4) options which one best explains this situation?

The intern overlooked the $1,980 in stored materials that is also shown on the Continuation Sheet; the intern is offered a permanent position for being alert and asking questions.	9 respondents	**100 %**	
There is an error as the numbers were apparently juxtaposed; the intern gets a raise.		0 %	
The intern forgot to add your company's overhead and profit; the intern's pay is reduced by this amount.		0 %	
Your scam has been discovered; the intern receives $500 to keep quiet.		0 %	

Assessment and Evaluation for SLO 17

Courses: CMGT 33000 - Contract Administration & Specifications

Academic Term for Direct Evaluation: Spring 2021 & Fall 2022

Instructors: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 18 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 84% ranking was achieved for SLO 17.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	17. Understand the Legal Implications of Contract, Common, and Regulatory Law to Manage a Construction Project.	3.875	78%
S 2022		4.32	86%

Direct Measures - Assessments and Evaluations

The Direct Measures consisted of: 8 questions from the midterm exam (Delivery Systems, General Conditions, and Liens) and 7 questions from the final exam (RFI's, Reports, Changes, Pay Applications). Following are the calculations associated with each assessment followed by the summary.

SP21 Midterm Question #	*# of students answering the question*	*% correct*	*Weighted Average*
1	11	82%	
2	11	64%	
3	11	73%	
4	11	100%	
5	11	100%	
6	11	18%	
7	8	75%	
8	11	91%	
Total	88	75%	**72.8%**

SP21 Final Question #	*# of students answering the question*	*% correct*	*Weighted Average*
1	11	18%	
2	11	82%	
3	11	64%	
4	11	100%	
5	3	100%	
6	9	11%	
7	9	100%	
Total	65	68%	**64.6%**

FA22 Midterm Question #	*# of students answering the question*	*% correct*	*Weighted Average*
1	11	91%	
2	11	91%	
3	11	64%	
4	11	64%	
5	11	64%	
6	11	55%	
7	8	80%	
8	11	91%	
Total	82	75%	**74.63%**

FA22 Final Question #	*# of students answering the question*	*% correct*	*Weighted Average*
1	11	0%	
2	11	91%	
3	11	100%	
4	11	100%	
5	3	67%	
6	9	22%	
7	9	78%	
Total		65%	**66.18%**

Direct Measures Calculated Summary	**Weighted Average Grade %**	**Target**
8 Midterm Exam Questions SP21	72.8%	75%
7 Final Exam Questions SP21	64.6%	75%
8 Midterm Exam Questions FA22	74.6%	75%
7 Final Exam Questions FA22	66.2%	75%

The metrics for this course have been recorded for every semester since spring semester 2018. Prior to fall 2021, both indicators were remaining steady at or above 85% or improving significantly. Also, the total correct for the final exam in spring of 2020 was 88%. However, with the pandemic and resultant shift in course delivery to an online format, the results plummeted. The fall 2020 semester saw the final exam score drop to 67%. For spring 2021 semester, the results clearly did not recover.

Additionally, test content was revised significantly as the final exams were given online resulting in some questions not appearing on the exam. This outcome was originally intended to utilize ten (10) questions for both the midterm and final however only 8 and 7 appeared. The scores for fall 2022 have remained consistent indicating no significant decline or improvement.

Proposed Actions for Course Improvement

Because course instruction was profoundly affected during the pandemic, course modification to address the apparent performance deficiencies appears premature. However, now that pandemic related course alterations have been lessened / eliminated, exam content will be restored to include all ten questions for both the midterm and final exams effective spring 2023. The resultant indicators will be reviewed and, should the deficiencies persist, modifications will be made to the course presentation material.

Student Learning Outcome 18

Understand the Basic Principles of Sustainable Construction

Introduction

SLO 18 - Understand the basic principles of sustainable construction is evaluated and assessed in CMGT 11000 - Introduction to Construction Management.

CMGT 11000 incorporates one module (one week) devoted to sustainable construction. The topic is introduced by reviewing the evidence of human-caused global warming and then recognizing the substantial CO^2 contribution generated by the construction industry. The LEED program is presented as one response by the construction industry to lessen its carbon footprint. The module then concludes with a presentation on the fundamentals of LEED and the role the builder can play in successfully implementing LEED building certification.

Assessment Methods (additional information is included in the Direct Assessment section of this report)

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For CMGT 11000, two methods of direct assessment are used for SLO 18.

Direct Assessment #1 – selected questions from Final Exam (additional information included in the "Direct Assessment" section of this report).

Direct Assessment #2 – ten (10) questions that comprise an in-lab assignment within the Top Hat online courseware application (additional information included in the "Direct Assessment" section of this report).

SLO 18 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Measures
  - Exam content: Student responses to objective questions.
  - In-Lab assignment content: Student responses to objective questions.
- Assessment and Evaluation for SLO 18

Indirect Measure

The Indirect Measure for SLO 18 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are explained in the Assessment and Evaluation for SLO 18 found at the end of this SLO report.

Direct Assessment: SLO 18 - Understand the Basic Principles of Sustainable Construction

Course Assessed and Evaluated:
CMGT 11000 - Introduction to Construction Management

CMGT 11000 Material

CMGT 11000 – Final Exam (selected questions) FA21

1. What is a "brown field"?

An undesirable construction site which would benefit from improvement.	5 respondents	17 %	✓
A construction site stripped of all vegetation.	17 respondents	57 %	
A site where building construction is prohibited.	3 respondents	10 %	
A construction site best suited for industrial construction.	5 respondents	17 %	

2. What does a commissioning agent do?

The agent validates the LEED submission and awards the LEED certification.	16 respondents	53 %	
The agent submits the paperwork for LEED certification.	2 respondents	7 %	
The agent works with the General Contractor and LEED to help ensure the building will be certified.	10 respondents	33 %	
The agent tests the building systems to ensure they're working as designed.	1 respondent	3 %	✓
No Answer	1 respondent	3 %	

CMGT 11000 – Final Exam (selected questions) FA21

3. Refer to the following figure. What does it depict?

LEED Categories	17 respondents	**57 %**	✓
LEED Credits	9 respondents	30 %	
LEED priorities	2 respondents	7 %	
LEED goals	2 respondents	7 %	

4. Which of the following best describes the purpose of LEED?

It is a national program intended to promote good building design.	1 respondent	3 %	
It is a program intended to award designers that promote energy efficiency.	10 respondents	33 %	
It is a government program intended to reduce carbon dioxide pollution.	2 respondents	7 %	
It is a program which promotes sustainable construction & design practices.	17 respondents	**57 %**	✓

5. "Green Associate", "Accredited Professional" and "Fellow" are all examples of what?

LEED building certifications	2 respondents	7 %	
LEED professional accreditations	26 respondents	**87 %**	✓
LEED point categories		0 %	
LEED degrees	2 respondents	7 %	

CMGT 11000 – Final Exam (selected questions) FA21

6. What is the role of the general contractor on a construction project that is seeking LEED certification?

To avoid interfering with the LEED administration process.	2 respondents	7 %
To evaluate building systems to ensure they work as designed.	8 respondents	27 %
To assist the LEED construction team in points acquisition and administration.	12 respondents	40 % ✓
To assist the Owner in making design decisions	8 respondents	27 %

Figure 1. CMGT 11000 Final Exam sustainability related questions (FA21).

CMGT 11000 – Lab Assignment FA22

1. On-site smoking — Hide Correct Answer

True / False - Smoking on the construction site of a LEED project is permitted.

A	True	0
B	False	18

2. How many LEED points can the Contractor be responsible for (not including prerequisites)?

A	< =2	0
B	2 - 8	0
C	8 - 12	18
D	12 +	0

CMGT 11000 – Lab Assignment FA22

3. An important approach on a LEED project that involves the General Contractor is the "Integrative Process". Which of the following best describes this process?

A	The Design Team works separately from the General Contractor to develop separate design ideas and project strategies.	0
B	The Owner works with the General Contractor to develop a project approach. The approach is then presented to the Design Team.	2
C	**The General Contractor is an integral member of the Design Team, with everyone working together.**	**16**
D	The General Contractor integrates his/her entire team of Subcontractors after the design is completed.	0

4. Which of the following is NOT a typical contribution of the General Contractor on a LEED project?

A	GC's can identify opportunities to save time & money.	0
B	GC's can reduce was during the construction process.	1
C	**GC's can design more efficient M/E/P systems to save energy.**	**17**
D	GC's can maximize material quality during construction.	0

5. Who is responsible for educating the subcontractors about their role in supporting the LEED aspects of a project?

A	Owner	0
B	**General Contractor**	**18**
C	Architect	0
D	Engineer	0

6. What is the concern about how subcontractors manage their construction waste?

A	If subcontractors produce too much waste, a LEED credit will be lost.	0
B	If subcontractors recycle too much, the recycling facility will be overloaded and stop servicing the site.	4
C	If subcontractors produce too little waste, the LEED reviewers will suspect the waste is not being accurately reported.	0
D	**If subcontractors mix their waste and recyclables, the value of the recycled material will be reduced due to contamination.**	**14**

CMGT 11000 – Lab Assignment FA22

7. What is the importance of LEED "prerequisites"?

A	The project cannot achieve LEED Platinum if prerequisites are not satisfied.	1
B	**Prerequisites are mandatory; if they're not met they will impact credits and certification.**	**16**
C	Prerequisites ensure the General Contractor will be compensated.	1
D	None of the above.	0

8. Which of the following IS NOT a General Best Practice?

A	Begin LEED actions when construction starts.	0
B	**Share LEED requirements with the subcontractors after they have been selected.**	**17**
C	Have quality control processes in place.	0
D	Be organized.	0

9. When a LEED requirement exceeds a local energy code requirement, how should the LEED team proceed?

A	**Consider applying for a variance to allow the LEED requirement to remain.**	**13**
B	Change the building design to comply with the building code.	1
C	Begin the process of changing the local energy code.	1
D	Because LEED overrides local building codes, continue building with the LEED requirement.	3

10. When doing a "split" LEED submission, there are two (2) credit designations. What are they?

A	Architect & General Contractor	0
B	Design & pre-design	0
C	Construction & pre-construction	0
D	**Design & construction**	**18**

Figure 2. CMGT 11000 In-Lab Assignment: *Contractor +LEED* (FA22).

Assessment and Evaluation for SLO 18

Course: CMGT 11000 - Introduction to Construction Management

Academic Term for Direct Evaluation: Fall 2019 and Fall 2021; Spring 2022 and Fall 2022.

Instructor: Bill White

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 18 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 86% ranking was achieved for SLO 18.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	18. Understand the basic principles of sustainable construction.	4.125	83%
S 2022		4.48	90%

Direct Measures - Assessments and Evaluations

The Direct Measures consisted of: 1) 6 questions from the Final Exam and 2) 10 questions from an in-lab assignment. Below are the calculations associated with each assessment followed by the summary.

SLO 18 – Final Exam			
FA19 Final Exam	# of students answering the question	% correct	Weighted Average
1	31	48%	
2	27	4%	
3	29	69%	
4	31	39%	
5	34	79%	
6	28	61%	
Total	180	51%	51%

SLO 18 – Final Exam			
FA21 Final Exam	# of students answering the question	% correct	Weighted Average
1	30	17%	
2	30	3%	
3	30	57%	
4	30	57%	
5	30	87%	
6	30	40%	
Total	180	44%	44%

SLO 18 – Lab Assignment			
SP22 Lab Assignment	# of students answering the question	% correct	Weighted Average
1	10	90%	
2	10	100%	
3	10	90%	
4	10	50%	
5	10	100%	
6	10	90%	
7	10	80%	
8	10	80%	
9	10	90%	
10	10	70%	
Total	100	84%	84%

SLO 18 – Lab Assignment			
FA22 Lab Assignment	# of students answering the question	% correct	Weighted Average
1	18	100%	
2	18	100%	
3	18	89%	
4	18	94%	
5	18	100%	
6	18	78%	
7	18	89%	
8	18	94%	
9	18	72%	
10	18	100%	
Total	180	92%	92%

Direct Measures Calculated Summary	**Weighted Average Grade %**	**Target %**
Final Exam (6 Questions) FA19	51%	75%
Final Exam (6 Questions) FA21	44%	
Lab Assignment (10 Questions) SP22	84%	
Lab Assignment (10 Questions) FA22	92%	
Overall average	67.75%	

The overall weighted average of 67.75% is below the target of 75%. In reviewing the previous assessment (spring 2018) of this SLO, four (4) possible remedies were proposed to improve this outcome. Unfortunately, the Covid pandemic disrupted course content and instructional delivery such that one alternative – adding a homework assignment – was not added until fall 2021. The results of this homework assignment (added as an in-lab assignment) have been incorporated within the calculation. The homework assignment requires the student to read an article pertaining to the contractor's role in implementing LEED and then answer questions within Top Hat. While we still haven't met the target, it must be noted that the weighted average indicates an improved outcome beginning with SP 22, a semester that utilized the added in-lab assignment.

Following is documentation of this outcome every semester since fall 2017 (Figure 3.)

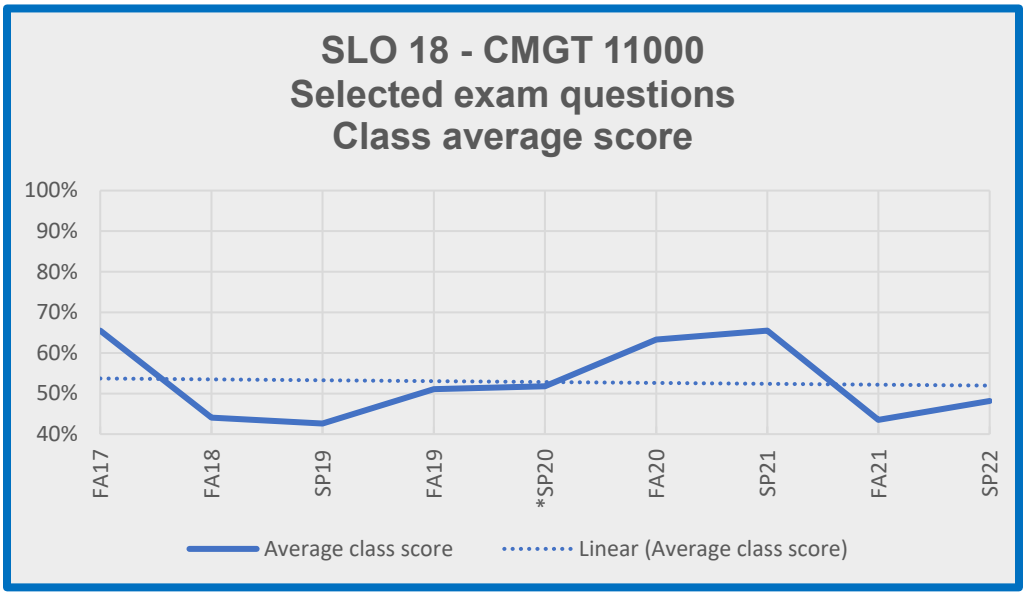


Figure 3. SLO 18 results in CMGT 11000 every semester since fall 2017 (final exam questions only).

Actions for Course Improvement

As can be seen in Figure 3, the performance on this SLO was steadily improving until the fall semester 2021 when it took a 22% drop following spring 2021. Corrective actions have been implemented including:

1. Adding a homework assignment requiring the student to read an article about the role the general contractor plays in implementing LEED. The assignment requires the student to answer questions within the Top Hat application.
2. Make all in-class Top Hat presentations available to students for study. This material includes both the Powerpoint presentation slides and the embedded questions within the Top Hat environment. The in-class embedded questions closely correlate to the questions presented in the exam.
3. Refine the exam study guide to ensure students are aware that this material will be covered on the exam.

Student Learning Outcome 19

Understand the Basic Principles of Structural Behavior

Introduction

SLO 19 – Understand the Basic Principles of Structural Behavior is assessed in CMGT 26000 – Statics.

CMGT 26000 course studies forces acting on bodies at rest, including coplanar, concurrent, and non-concurrent systems; equivalent force systems and distributed forces. Use of free body diagrams and equations of equilibrium in solving problems for an array of determinate structural systems: trusses, pin frames, arches, cables, retaining walls, and beams. Load tracing to examine the overall structural conditions with regard to lateral and gravity loads.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 19, there are two examples of student work.

1. Class quiz
2. Homework
3. Exam

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 19 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
    - Graded Student Work
        - Quiz (graded example shown)
        - Homework (examples of homework shown)
        - Exam (graded midterm exam shown)
- Assessment Report for SLO 19

Indirect Measure

The Indirect Measure for SLO 19 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are explained in the Assessment and Evaluation for SLO 19 found at the end of this SLO report.

Quiz Chapter 3.2 (student example)

CMGT 26000 – Statics

Nam [redacted]

Total Points: 18/20

Quiz #03

(Chapter 3.2)

(1) Distributed loads act on a relatively large area (2pts).
- True
- ② False

(2) (a: Central) loads have a specific point of application, whereas (b: Distributed) loads are scattered over large surface (2pts per each, 4pts in total).

(3) Provide two examples of distributed loads (2pts per each, 4pts in total).
a: COUCH
b: Fridge

(4) To compute beam reactions, a distributed load is replaced by an equivalent concentrated load (2pts).
- True
- ② False

(5) Most common load conditions on building structures begin as distributed loads (2pts).
- True
- False

(6) The location of the equivalent concentrated load is based on the centroid of the load area (2pts).
- True
- ② False

(7) In case that the distributed load area is rectangular, the centroid is located at half of the distance of the distribution (2pts).
- ① True
- False

(8) Trapezoidal distributed load can be though of as two triangular distributed loads or as a rectangular distributed load with a triangular distributed load (2pts).
- True
- ② False

CMGT 26000 – Statics

Nam [redacted]

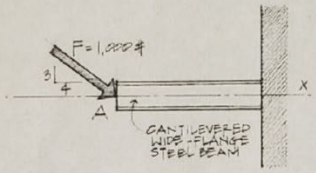
Total Points: 18/20

Homework #02

(Chapter 2.3)

Problem 01 (2pts)

2.6 Determine the x and y components of the force, F, shown.



direction = $\tan^{-1}\left(\frac{3}{4}\right) = 36°52'$

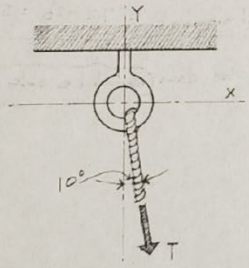
$F_x = F\cos\theta = 1000\cos(36°52') = 800.03$

$F_y = F\sin\theta = 1000\sin(36°52') = 599.95$

⟨800.03, 599.95⟩ No unit....

Problem 02 (3pts)

2.7 If a hook can sustain a maximum withdrawal force of 250 N in the vertical direction, determine the maximum tension T that can be exerted.

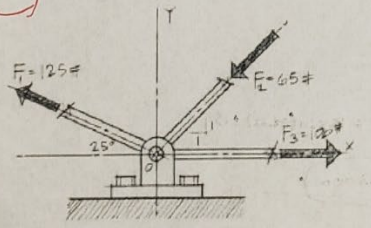


$F_y = 250\ N$

$F_y = T\cos(10°)$

$T = \frac{F_y}{\cos(10°)} = \frac{250}{\cos(10)} = 253.85N$

Problem 03 (3pts)



2.10 An anchoring device is subjected to the three forces as shown. Determine analytically the resultant force the anchor must resist.

$-F_{1x} = F_1\cos(25) = 125\cos(25) = -113\#$

$+F_{1y} = F_1\sin(25) = 125\sin(25) = 53\#$

$-F_{2x} = F_2\left(\frac{1}{\sqrt{2}}\right) = 65\left(\frac{1}{\sqrt{2}}\right) = -46\#$

$-F_{2y} = F_2\left(\frac{1}{\sqrt{2}}\right) = 65\left(\frac{1}{\sqrt{2}}\right) = -46\#$

$F_{3x} = F_3 = 100\#$

$F_{Rx} = -125\cos(25) - 65\cos(45) + 100 = -59.25\#$

$F_{Ry} = 125\sin 25 - 65\sin 45 = 6.865$

$R = \sqrt{(59.25)^2 + (6.865)^2} = 59.6464\#$

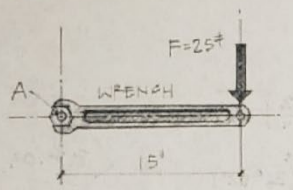
$\theta = \tan\theta = \frac{F_y}{F_x} = \frac{6.865}{59.25} = 0.61°$

Name: _____

Total Points: _____

Problem 04 (2pts)

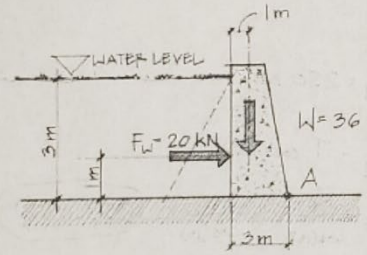
2.12 What is the moment of the force F about point A?



Moment = 15 × 25 = 375 F clockwise

Problem 05 (3pts)

2.14 The equivalent forces due to water pressure and the self-weight of the dam are shown. Determine the resultant moment at the toe of the dam (point A). Is the dam able to resist the applied water pressure? The weight of the dam is 36 kN.



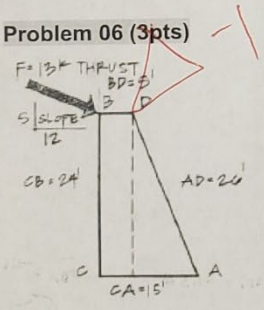
Moment = 20 × 1 = 20 kNm clockwise

Resisting moment = 36(3-1) = 72

Final moment = 72 − 20 = 52 ccNm

So, the dam should be able to resist the water.

Problem 06 (3pts)



2.15 Determine the moment M_A at the base of the buttress due to the applied thrust force F. Use Varignon's theorem.

Force F is at a 5:12 slope.

$\theta = \tan^{-1}\left(\frac{5}{12}\right) = 22.62°$

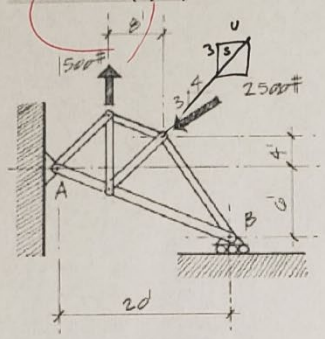
$M_A = -13 \cdot \cos(22.62) + 13 \sin(22.62) \cdot 15$

$= 213000$ unit.

Name: _____

Total Points: _____

Problem 07 (2pts)



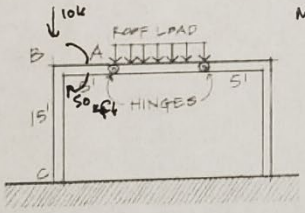
2.19 An inclined truss is subjected to two forces as shown. Determine the moments at A and B due to the two forces.

$M_A = 1500 \cdot 12 \cdot (2500 \cdot 4/5) \cdot 4' - (2500 \cdot \frac{3}{5}) = (-4000\ \text{ft})$

$M_B = 2500\ (\frac{3}{5}) \cdot 10 + (2500 \cdot \frac{4}{5}) \cdot 6 = 1500 \cdot 8 = (30000\ \text{FT})$

Problem 08 (2pts)

2.20 A bent concrete column is subjected to a downward force of 10 k. To design the column, it is necessary to have the compressive force applied through the axis of the column. Show the equivalent force system when the force is moved from A to B. Apply an equal and opposite pair of forces at B.



$M = -10 \cdot 5 = (-50k)$

Midterm Exam (Student Example)

Mid-Term Exam Results for Ereny Hanna (she/her/hers) View Log

Score for this quiz: **300** out of 320
Submitted Oct 12 at 8:22pm
This attempt took 141 minutes.

Question 1

5 / 5 pts

1. The free body diagram of a particle is a drawing that shows all external forces and reactions acting on the particle.

Correct!

- (•) True
- ( ) False

Additional Comments:

Question 2

5 / 5 pts

2. Dynamic loads are typically gravity-type forces.

- ( ) True

Correct!

- (•) False

Additional Comments:

Question 3

5 / 5 pts

3. The graphical method of vector addition requires that all vectors be non-coplanar.

- ( ) True

Correct!

- (•) False

Additional Comments:

Question 4

5 / 5 pts

4. Wind and earthquake loads are two types of dynamic loads.

Correct!

- (•) True
- ( ) False

Additional Comments:

Question 5

5 / 5 pts

5. In solving for an unknown support reaction on a rigid body, the direction of the reaction must be known before solving for the value.

- ( ) True

Correct!

- (•) False

Additional Comments:

Question 6

8 / 8 pts

6. Newton's third law states that for every force of action, there is a reaction that is

- ( ) less in magnitude, opposite in direction and has the same line of action
- ( ) equal in magnitude and direction and has the same line of action.

Correct!

- (•) equal in magnitude, opposite in direction and has the same line of action.
- ( ) greater in magnitude, opposite in direction and has the same line of action.

Additional Comments:

Question 7

0 / 8 pts

7. A building must never _____ under the action of assumed loads, and must experience _____ deformations.

- Move, imperceptible
- Stress, large
- Correct Answer — Collapse, tolerable
- You Answered — Strain, small

Additional Comments:

Question 8

8 / 8 pts

8. Name the three characteristics of a force.

- Magnitude, concurrent, and rotation
- Correct! — Magnitude, direction, and point of application
- Orientation, magnitude, and non-concurrent
- Concurrent, coplanar, parallel

Additional Comments:

Question 9

8 / 8 pts

9. When forces act at a single point, they are called _____, and these forces cannot create a _____ around that point.

- three-dimensional, moment
- Correct! — concurrent, moment
- concurrent, force
- none of the above

Additional Comments:

Question 10

8 / 8 pts

10. The sum of two or more vectors is called the _____.

Correct!

- (•) Resultant
- ( ) Equilibrant
- ( ) Concurrent vector
- ( ) Complement

Additional Comments:

Question 11

8 / 8 pts

11. The moment of a force is equal to the magnitude of the force times which distance from the point of rotation?

- ( ) The parallel distance to the line of action of the force
- ( ) The distance that the force travels rotationally

Correct!

- (•) The perpendicular distance to the line of action of the force
- ( ) The longest distance of the rigid body to which the force is applied

Additional Comments:

Question 12

8 / 8 pts

12. Varignon's Theorem states that the moment of an inclined force about a point is equal to the _____ the moments of its orthogonal force components about the same point.

- ( ) square root of the sum of the squares of
- ( ) difference between
- ( ) product of

Correct!

- (•) algebraic sum of

Additional Comments:

Question 13

8 / 8 pts

13. Which of the following are parts of a good structural design procedure?

- Proportioning the structural components
- Correct! All of the above
- Developing a foundation scheme
- Determining the structural material to be used

Additional Comments:

Question 14

0 / 8 pts

14. The principle of transmissibility is valid only in terms of

- You Answered: both internal and external effects.
- no internal or external effects
- Correct Answer: the external effects.
- the internal effects.

Additional Comments:

Question 15

8 / 8 pts

25. External forces which act on a rigid body

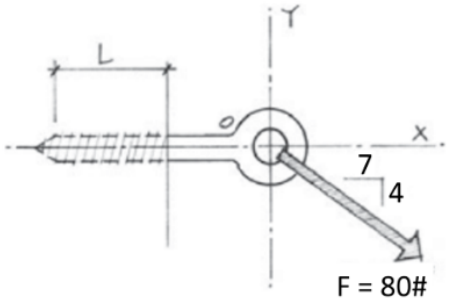
- Correct! represent the action of forces exerted on the rigid body
- represent the resistance generated by the rigid body internally.
- are responsible from keeping the body from pulling apart.
- deform the rigid body resisted by internal forces.

Additional Comments:

Question 16

40 / 40 pts

26. A clothesline with a maximum tension of 80# is anchored to a wall by means of an eye screw. If the eye screw is capable of carrying a horizontal pulling force (with draw force) of 15# per inch of penetration, how many inches L should the threads be embedded into the wall? Please upload your paper showing your calculations.



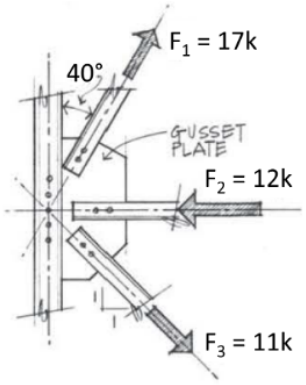
IMG_7999.HEIC

Additional Comments:

Question 17

40 / 40 pts

27. Three members of a truss frame into a steel gusset plate as shown. All forces are concurrent at point O. Determine the resultant of the three forces that must be carried by the gusset plate. Please upload your paper showing your calculations.



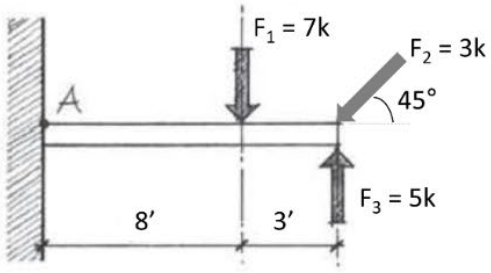
IMG_8005.HEIC

Additional Comments:

Question 18

45 / 45 pts

28. A cantilevered beam is subjected to three forces. Determine the resultant moment M_A at the beam support. Please upload your paper showing your calculations.



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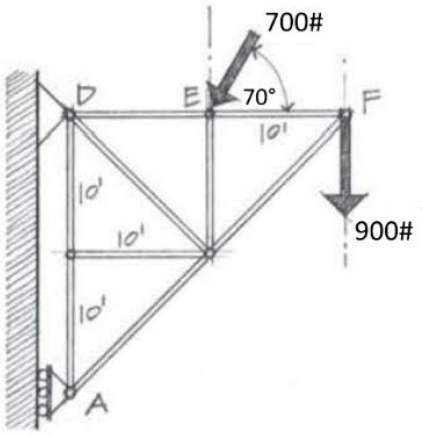
Additional Comments:

Question 19

50 / 50 pts

29. Determine the support reactions for the truss at joints A and D. Please upload your paper showing your calculations.



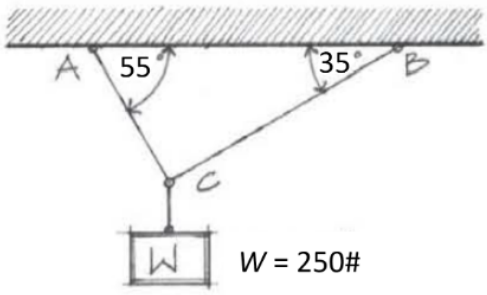
IMG_8007.HEIC

Additional Comments:

Question 20

36 / 40 pts

30. Two cables are used to support a weight W = 250# suspended at C. Determine the tension developed in cables CA and CB. Please upload your paper showing your calculations.



IMG_8004.HEIC

Additional Comments:

No unit of CB and CA

Fudge Points: --

You can manually adjust the score by adding positive or negative points to this box.

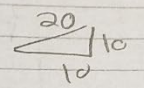
Final Score: 300 out of 320

Update Scores

Question 19

$F_{EX} = 700 \cos 70 = 239.41$

$F_{EY} = 700 \sin 70 = 657.78$



$F_{DY} = 900 + 657.78 = 1557.78$

$\Sigma M =$

$F_{AX} \times 20 = 657.78(10) + 900(20)$

$F_{AX} = \frac{24577.8}{20} = \boxed{1228.89\ \#}$

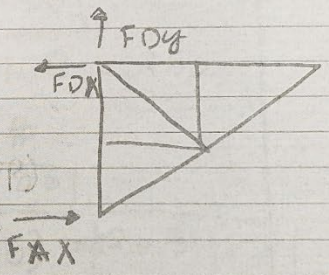
$F_{DX} = 239.41 - 1228.89$

$= \boxed{-989.48\ \#}$

$F_{AX} = 1228.89\ \#\ \rightarrow$

$F_{DX} = 989.48\ \#\ \leftarrow$

$F_{DY} = 1557.78\ \#\ \uparrow$



Assessment Report for SLO 19

Course: CMGT 26000 – Statics

Academic Term for Direct Evaluation: Fall 2022 and Spring 2023

Instructors: Kwonsik Song

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 19 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 87.5% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	19. Understand the Basic Principles of Structural Behavior	3.875	78%
S 2022		4.69	94%
F 2022		4.56	91%

Direct Measures

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2022	15	Quiz	82.50	75
		Homework	75.07	75
		Midterm Exam	83.00	75
Spring 2023	12	Quiz	86.11	75
		Homework	77.86	75
		Midterm Exam	71.86	75

After the initial ACCE accreditation for the CMGT program, it was decided that the overall average of the total grades should be at least 75%. The Indirect Measure was 87.5% and the Direct Measure for the midterm exam in Spring 2023 was only below the target. I decided not to average those values. Based on the perception of graduating seniors (Indirect Measure), they felt confident in creating project schedules. The Direct Measure showed that the target value (75%) was not met for the Direct Measure of Midterm Exam in Spring 2023. This is mainly because students have an insufficient understanding of basic trigonometry and the Pythagorean theorem which is the starting point for determining results forces and support reactions.

Proposed Actions for Course Improvement:

Based on the indirect/direct measurements and IUPUI course evaluation it is evaluated that the course has provided the proposed student learning outcomes. Students were able to understand load types and basic mechanisms of structural systems in response to external forces. However, some students had difficulties in performing basic calculations related to resultant forces. The root cause was a lack of understanding of basic trigonometry and Pythagorean theorem which are the starting point of determining results forces. As a consequence of the shortage, they found wrong answers or stopped solving relevant problems. Another area that some students failed in was support reaction calculations. This failure happened because they were confused about distinguishing which support reactions take place depending on the type of support. Therefore, in order for students to perform basic calculations regarding resultant forces and support reactions, the course improvement is to allocate time for students to practice trigonometry problems as well as the Pythagorean theorem at the beginning of the coursework. This will help increase students' abilities to identify the magnitude and direction of resultant forces and, in turn, understand how structures behave depending on multiple external forces. In addition, students will be provided with more in-class exercises to improve their understanding of which types of supports are used in structural systems and how they resist external forces.

Student Learning Outcome 20

Understand the Basic Principles of Mechanical, Electrical, and Piping Systems

Introduction

SLO 20 - Understand the Basic Principles of Mechanical, Electrical, and Piping Systems is assessed in CMGT 25000 - Mechanical and Electrical Systems. This course presents the methods for design, construction, and inspection of mechanical and electrical systems for buildings. Emphasis on plumbing systems, heating and cooling (HVAC) systems, and electrical systems.

Piping systems deal with plumbing, potable water, waste removal, and building services including fire protection. HVAC includes expectations for human comfort, building loads, equipment selection, duct and pipe sizing. Electrical systems deal with system basics of electrical loads, distribution, and equipment. The course introduces the basics of, codes, installation, inspection, commissioning, safety, and estimating.

Assessment Methods

Indirect Measure

ACCE Student Learning Outcome Survey (i.e., graduation senior exit survey)

Direct Measures

For SLO 20, there are two examples of student work.

1. Class quiz
2. Homework
3. Exam

Additional information concerning the above assignments is provided in the Direct Assessment section of this report.

SLO 20 Report Content

Subsequent sections of this SLO Report document the following:

- Indirect Measure (ACCE Student Learning Outcome Survey)
- Direct Assessments
    - Graded Student Work
        - Quiz (graded example shown)
        - Homework (examples of homework shown)
        - Exam (graded midterm exam shown)
    - Assessment Report for SLO 20

Indirect Measure

The Indirect Measure for SLO 20 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). The results are explained in the Assessment and Evaluation for SLO 20 found at the end of this SLO report.

Quiz Chapter 2 (student example)

CMGT 25000 – M&E Systems

Name: [redacted]

Total Points: 5/10

Quiz #02

(Ch. 2. Mechanical and Electrical Systems)

(1) (Building Drain) conveys wastewater and waterborne waste from plumbing fixtures and appliances to sanitary sewer (1pt).

(2) (Stack) provides circulation of air to or from a sanitary drainage system and provides air circulation within the sanitary drainage piping to protect trap seals (1pt).

Sanitary Drainage Piping

(3) (Sewer drain) conveys rainwater or other precipitation to storm sewer or other places of disposal (1pt).

Vent Piping

(4) The sizing of building drain is based on code for accumulated upstream fixtures using drainage fixture unit (DFU) (1pt).

① True

② False

(5) Stack is a piping arrangement that retains water in the pipe to prevent gas flow (1pt).

① True

② False

(6) Cleanout is a fitting with a removable cap or plug to allow access to piping for removing stoppages and cleaning the interior of pipes (1pt).

① True

② False

(7) The objective of water system design is to prevent excessive velocity at minimum flow (1pt).

① True

② False

(8) Stack Offset is a non-vertical section of a drainage pipe between two vertical sections (1pt).

① True

② False

(9) (Horizontal) branch drains are drainage pipe extending horizontally from a soil or waste stack or building drain, with or without vertical sections or branches (1pt).

(10) Sanitary waste and stormwater must be collected and removed individually (1pt).

① True

② False

Homework Chapter 2.3 (Student Example)

CMGT 25000 – M&E Systems

Name: [redacted]

Total Points: 18/20

Homework #03

1) A cooling coil cools 12,500 cfm (cu-ft/min) of air. The air enters the coil at a dry bulb temperature of 74 °F and a wet bulb temperature of 63.2 °F. The air leaves the coil at a dry bulb temperature of 55 °F and a wet bulb temperature of 52.5 °F. Find the total cooling as the air passes through the cooling coil (10pts). Please show your calculations.

2) A basketball gym is 140'x100'x40'. The AC has been off and, conditions in the room are 100 °F (db) and 70% (rh). The principal wants 72 °F (db) and 60% (rh) by game time. If you have 5 hours notice to cool the gym down, what would be the required capacity of the system (10pts)? Please show your calculations.

1. Difference in dry bulb temp. 74°-55°= 19°F

63.2° - 52.5° = 10.7°F - wet bulb difference.

29.5 BTU/LB - 21.5 = 8 BTU/LB

12,500/13.7 = 912.409 · 8 BTU · 60 = 437,701.4 BTU ? ? BTU/hr.

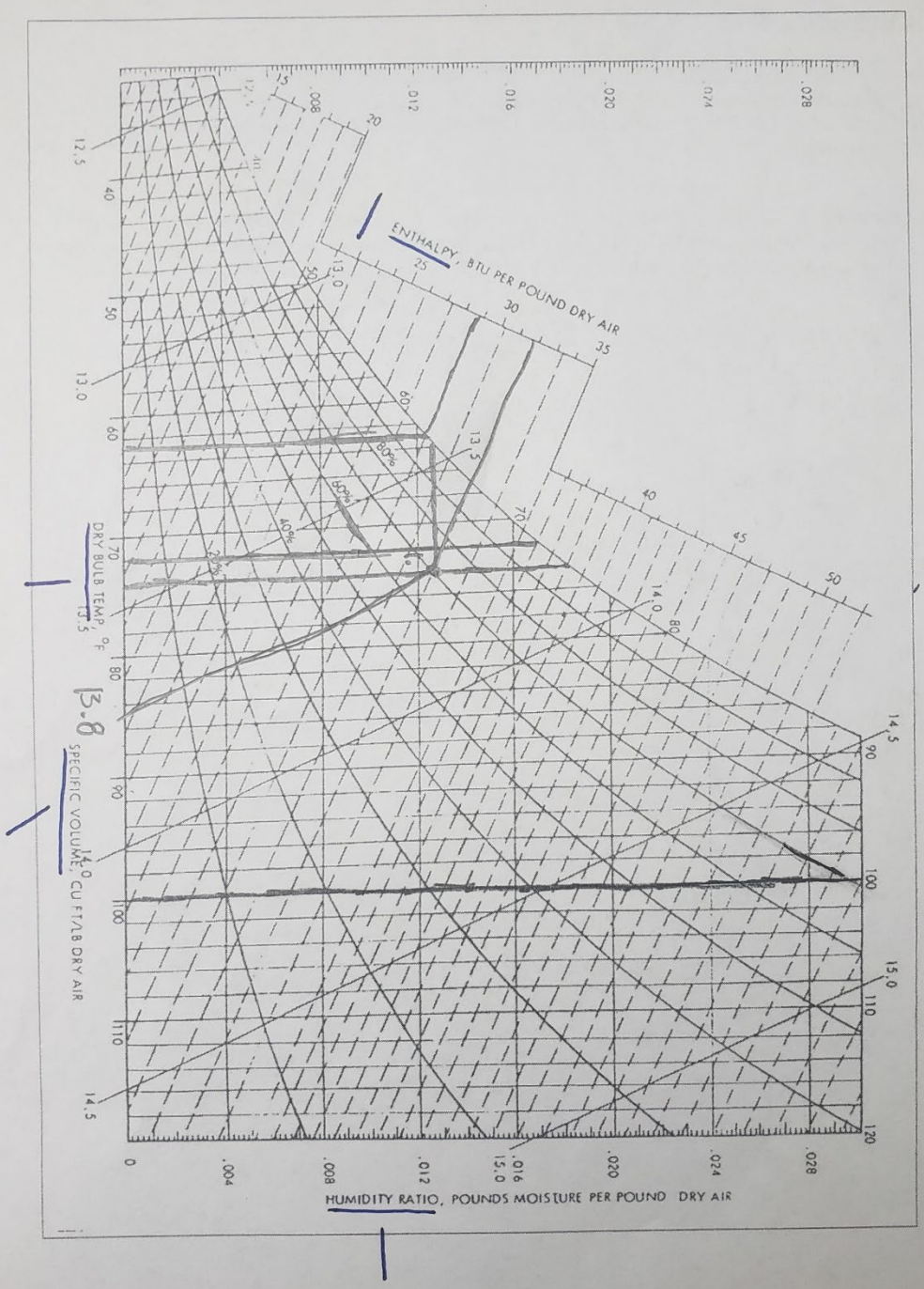
2. 560,000 cu-ft. 140 · 100 · 40 = 560,000.

- 560,000 cu-ft / 13.7 cu-ft/LB = 40,876 LB
- 40,876 LB · (54 - 29) BTU/LB =
- 40,876 · (25) = 1,021,900
- 1,021,900 / 5 = 204,380 BTU/H
- 204,380 BTU/H ÷ 12,000 BTU/H = 17.03 Ton capacity.

CMGT 25000 – M&E Systems

Name: [redacted]

Total Points: _____



Midterm Exam (Student Example)

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: ~~36~~ 261/300

Mid-Term Exam

(Date: 10/10/2022)

- **Total points: 300pts**
- **Open book and open note**
  - Do not use previous homework and quizzes
  - Do not search the internet
  - Do not communicate
- **11 Pages (33 questions)**
  - Put your name on all the pages
- **Time limit of 150 minutes (2.5 hours)**
  - Allowed to leave once you complete
  - In-class submission

1/10

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____

Section 1. True/False (20 questions, 5 pts per each, 100 pts in total) -5

(1) Building commissioning is the process of balancing and adjusting mechanical & electrical systems for maximum efficiency.

① True
② False

(2) Sustainable construction refers only to building design that efficiently use materials, energy, water, and other natural resources.

① True
② False

(3) Energy efficiency significantly affects utility bill, maintenance cost, building-related sicknesses, resale value, and pollution and environment.

① True
② False

(4) The sizing of building drain is based on code for accumulated upstream fixtures using drainage fixture unit (DFU).

① True
② False

(5) The objective of water system design is to prevent excessive velocity at minimum flow.

① True
② False

(6) Sanitary waste and stormwater must be collected and removed individually.

① True
② False

(7) Plastic pipe and fittings are resistant to most household chemicals, acids, and other corrosive liquids.

① True
② False

(8) Steel pipe and fitting are relatively inexpensive given their lifecycle.

① True
② False

(9) The type of piping materials that may be used for each plumbing system is specified by local plumbing codes.

① True
② False

(10) Comfort is a condition that occurs when a person cannot sense a difference between themselves and the surrounding air.

① True
② False

Name: [redacted]

Total Points: _____

(11) Relative humidity is the amount of moisture in air compared to the amount of moisture the air would hold at the same temperature if it were saturated.

① True
② False

(12) Dry-bulb temperature is the measurement of sensible and latent heat.

① True
② False

(13) While cooling load is the amount of heat lost by a building, heating load is the amount of heat gained by a building.

① True
② False

(14) The coldest outdoor temperature is considered while calculating heating loads.

① True
② False

(15) As the number of occupants in a certain room increases while controlling other factors, cooling load decreases.

① True
② False

(16) Heating and Cooling requirements for a building are independent of sunlight impact.

① True
② False

(17) A trap is used in building plumbing systems that drain water & waste water away from appliances to keep sewer gases from entering the building.

① True
② False

(18) Arranging for human comfort in a building is achieved by adjusting energy and moisture levels primarily through building mechanical and electrical systems.

① True
② False

(19) General energy audit requires more data collection and is more thorough than investment-grade energy audit.

① True
② False

(20) Vent piping conveys rainwater or other precipitation to storm sewer or other places of disposal.

① True
② False

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____

Section 2. Multiple Choice and Answers (10 questions, 10pts per each, 100pts in total) -12

(21) Please select all the correct statements about the water supply system.

- ① Water pressure in a water supply system is increased due to the height to which the water must flow.
- ② In buildings, the water supply system must be designed on the basis of the minimum pressure available.
- ③ Pressure loss due to friction occurs in all water supply piping due to the resistance resulting from water contacting the interior pipe surface and resistance between water molecules.
- ④ Smaller pipe sizes are used to reduce the amount of friction withing the pipe and fittings.

(22) What are appliances for plumbing? Please select all that apply.

- ① Bathtubs
- ② Water closets
- ③ Water softeners
- ④ Lavatories
- ⑤ Water heaters

(23) Please select all the correct statements about plumbing materials.

- ① Plastic pipe and fittings have good flexibility, which allows long pipe runs with a maximum number of joints.
- ② Plastic piping materials vary depending on their applications
- ③ Steel pipe and fitting is relatively inexpensive but causes a high installation cost.
- ④ Bell-and-spigot cast iron soil pipe and fittings are joined using a mechanical coupling consisting of a neoprene sleeve and a stainless steel band equipped with screw clamps.

(24) Why are mechanical and electrical systems needed in buildings?

- ① To achieve comfort by HVAC systems
- ② To pursue modern living by plumbing systems
- ③ To improve public health by electrical system

(25) Please select all the correct statements related to comfort.

- ① A change in any property of the air does not affect other properties.
- ② If web bulb temperature increases, enthalpy will increase.
- ③ Web bulb temperature, humidity ratio, and relative humidity are all directly related to the amount of moisture in the air.
- ④ If the dry bulb temperature decreases, the specific volume will always increase.

(26) _____ intentionally bring outdoor air into buildings.

- ① Infiltration
- ② Cooling
- ③ Heating
- ④ Ventilation

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____

(27) Please select the correct statement related to comfort.

1. Heating degree days are a measure of how hot the temperature was on a given day or during a period of days.
2. Cooling degree days are a measure of how cold the temperature was on a given day or during a period of days.
3. Indoor design temperature for comfort is same across all climate regions.
4. Outdoor design temperature is used to size heating/cooling equipment.

(28) What would be the ways to evaluate and improve energy efficiency of buildings? Please select all that apply.

1. Energy audit
2. Energy-related codes, standard, and guidelines
3. Building commissioning
4. Energy-related programs and rating systems

(29) Please select all the correct statements about the plumbing systems.

1. Stormwater drainage piping conveys wastewater and waterborne waste from plumbing fixtures and appliances to sanitary sewers.
2. Vent piping provides circulation of air to or from a sanitary drainage system and provides air circulation within the sanitary drainage piping to protect trap seals.
3. Fitting is used to regulate fluid flow within a system.
4. Clean out is a fitting with a removable cap or plug to allow access to piping for removing stoppages and cleaning the interior of pipes.

(30) Please select all the correct statements about the heating and cooling load.

1. As the number of occupants in spaces increases, this will increase cooling load.
2. As occupants are more active in spaces, the heating load will decrease.
3. The heating load will increase with a lower window-to-wall ratio.
4. As the number of lights increases, the cooling load will decrease.

5/10

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____

Section 3. Calculation-Based Questions (3 questions, 100pts in total) -22

(31) The figure below shows a typical two-story residence. Please answer the questions below using the tables attached after this page in conjunction with the following factors.

a. Determine the total dfu value (6pts).

22

b. Determine the individual dfu value (2pts per each, 8pts in total).

A1	6	A2	2	A3	6	A4	1

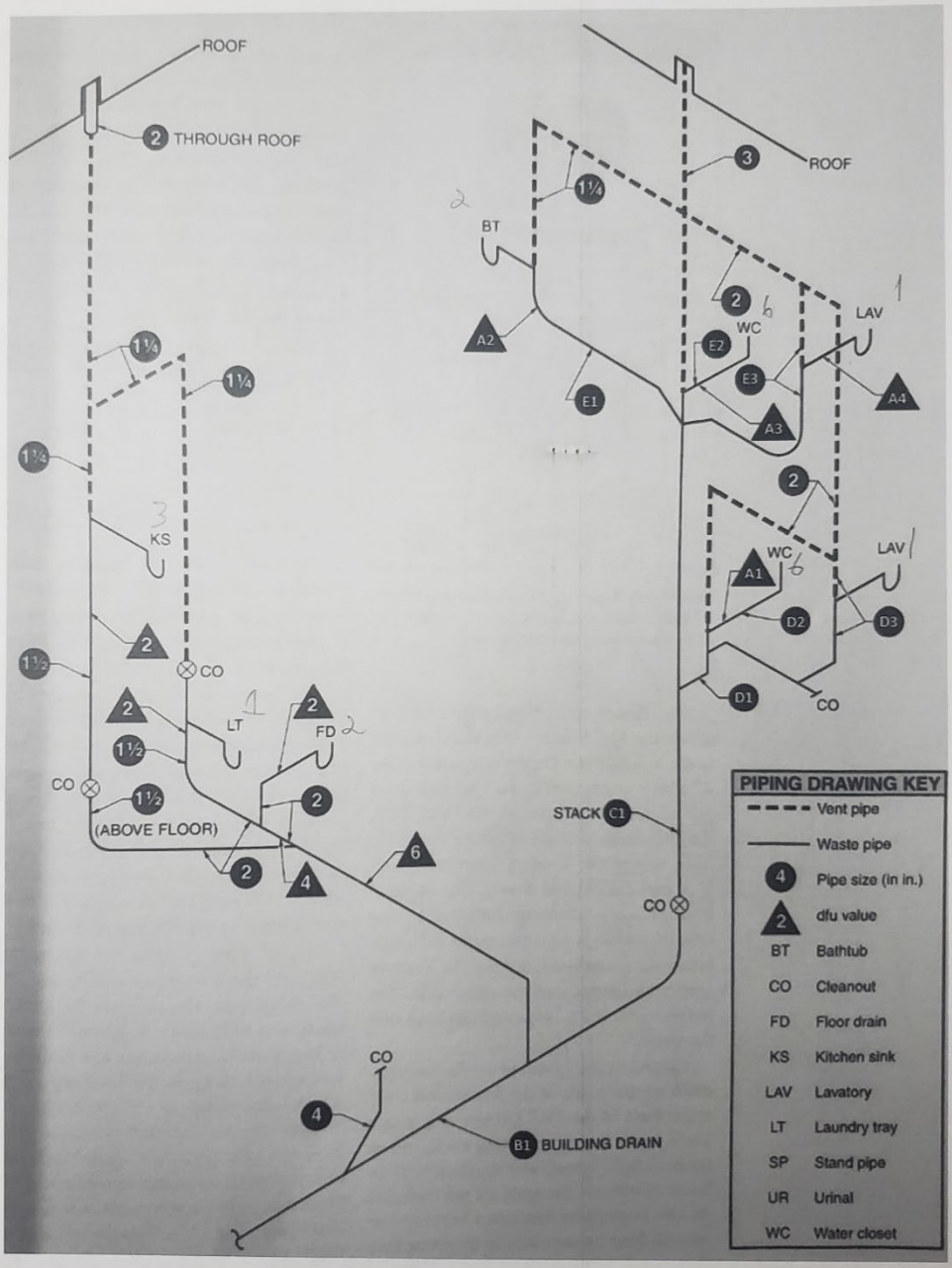
c. Determine the individual pipe size (2pts per each, 16pts in total).

B1	4"	C1	3"	D1	3"	E1	1½"
				D2	3"	E2	3"
				D3	1¼"	E3	1¼"

6/10

Name: [redacted]

Total Points: _____



7/10

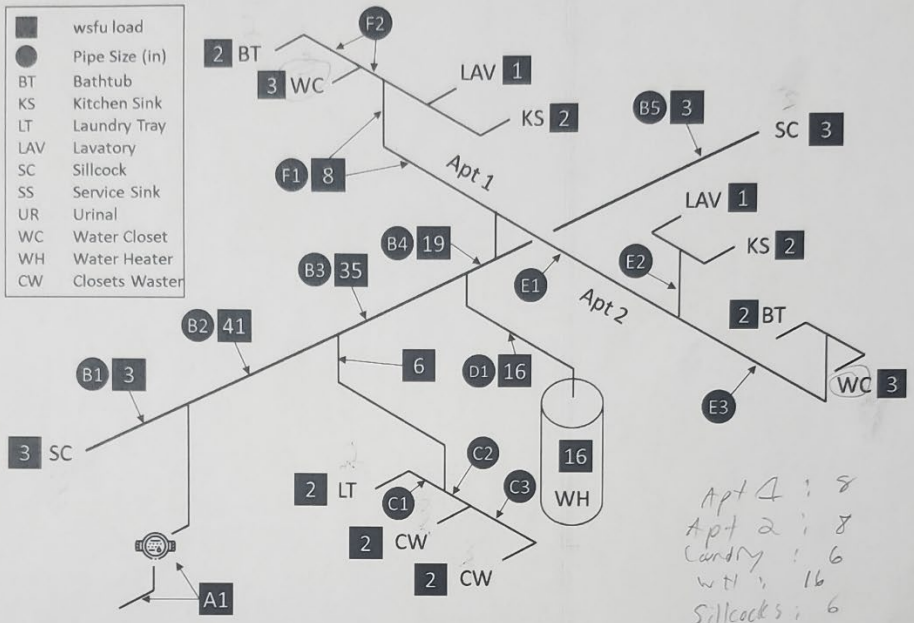
CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____ -20

(32) The figure below shows a two-unit apartment building. In the building, the conditions assumed are:

- Length of the cold-water piping from the water meter to the most remote cold-water outlet = 60'
- Available water pressure = 50 psi
- Head difference between water meter and highest water supply outlet = 12'



Apt 1 : 8
Apt 2 : 8
Laundry : 6
WH : 16
Sillcocks : 6

Using the information above,

-5 a. Determine the wsfu demand for the entire building (5pts). 44 25

-5 b. Determine working water pressure (5pts). 55.2 psi 44 psi

-2 c. Determine the wsfu of A1 (2pts). 41

-8 d. Determine the individual pipe size (2pts per each, 28pts in total).

B1	3/4"	C1	1/2"	D1	3/4"	E1	3/4"	F1	3/4"
B2	~~3~~ 1"	C2	1/2"			E2	1/2"	~~F2~~	3/4" 1/2"
B3	~~3~~ 1"	C3	1/2"			E3	1/2"		
B4	~~2 1/2~~ 1"								
B5	3/4"								

8/10

CMGT 25000 – Mechanical and Electrical Systems

Name: [redacted]

Total Points: _____

(33) A cooling coil cools 12,000 cfm (cu-ft/min) of air. The air enters the coil at a dry bulb temperature of 92 °F and a wet bulb temperature of 80 °F. The air leaves the coil at a dry bulb temperature of 68 °F and a wet bulb temperature of 54 °F.

a. Determine relative humidity in the two conditions (5pts).
the RH of the air is about 60% as it enters and 42.0% as it leaves

b. Determine humidity ratio in the two conditions (5pts).
the HR of the air is about .019 as it enters, and .006 as it leaves

c. Determine specific volume in the two conditions (5pts).
the SV is about 14.3 a the air enters and 13.4 as it leaves

d. Determine enthalpy in the two conditions (5pts).
the enthalpy is about 44 as air enters and 23 when it leaves

e. Find the total cooling as the air passes through the cooling coil (10pts). Please show your calculations.

SV enters @ 14.3

Dif in enthalpy = 21

$\frac{12000}{14.3} = 839.6\#/min$

$BTU = 21 \times 839 \times 60 = 1,057,140$ BTU

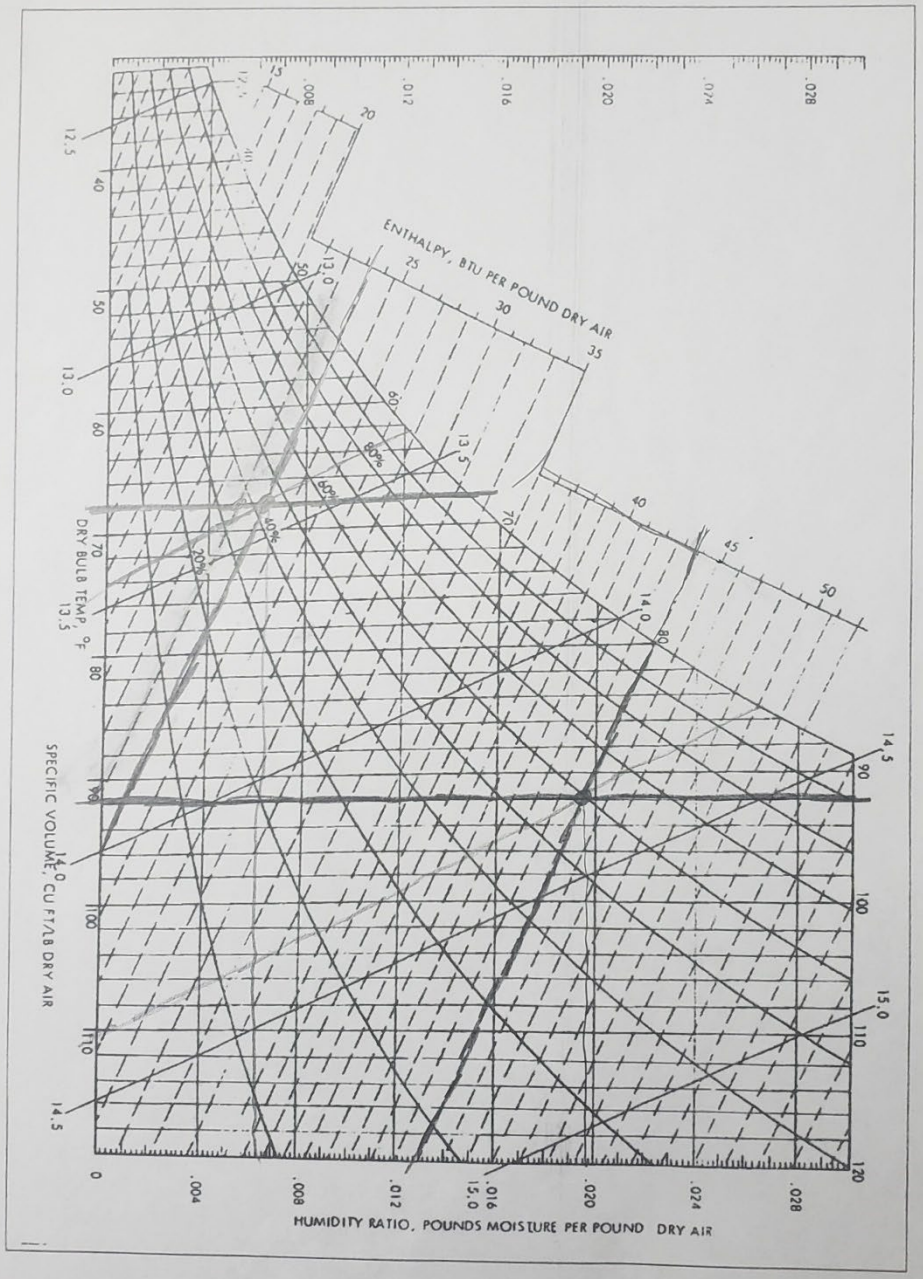
dif in enthalpy × flow

BTU/hr.

9/10

Name: [redacted]

Total Points: _____



10/10

Assessment Report for SLO 20

Course: CMGT 25000 – Mechanical and Electrical Systems

Academic Term for Direct Evaluation: Fall 2022 and Spring 2023

Instructors: Kwonsik Song

Evaluation of Assessment Data:

Indirect Measure

The Indirect Measure for SLO 20 was assessed using the ACCE Student Learning Outcomes Survey (Graduating Senior Exit Survey). An 84% ranking was achieved for this SLO.

Term	ACCE SLO	Raw Score (1-5)	Percent
F 2021	20. Understand the Basic Principles of Mechanical, Electrical, and Piping Systems	3.75	75%
S 2022		4.16	83%
F 2022		4.63	93%

Direct Measures

The Direct Measures consists of three assignments. The table below shows the average grades and percentages for the direct assessments.

Term	N	Criteria	Average Percent	Target Percent
Fall 2022	23	Quiz	84.10	75
		Homework	92.75	75
		Midterm Exam	80.17	75
Spring 2023	7	Quiz	71.42	75
		Homework	88.09	75
		Midterm Exam	71.47	75

After the initial ACCE accreditation for the CMGT program, it was decided that the overall average of the total grades should be at least 75%. The Indirect Measure was 84% and some of the Direct Measure was below the target. I decided not to average those values. The Direct Measure showed that the target value (75%) was not met for the Direct Measure of Quiz and Midterm Exam in Spring 2023. This is mainly because students have a lack of understanding of how sanitary systems operate in buildings.

Proposed Actions for Course Improvement:

Based on the indirect/direct measurements and IUPUI course evaluation, it is evaluated that the course has provided the proposed student learning outcomes. Through the quiz, homework, and exam, students showed their understanding of key components of mechanical and electrical systems in buildings. However, basic calculations related to piping systems were the area where course improvement needs to be suggested. This work is important because it helps improve the ability to read the sanitary drainage plan and understand key components of sanitary drainage systems in buildings. Also, students are able to understand how wastewater and waterborne waste flow in the sanitary drainage system. For these reasons, the instructor allocated time for students to practice several sanitary system design problems in the classroom. Also, relevant homework was given to students. Nevertheless, some students incorrectly determined the size of sanitary pipes as well as the demand for drainage and water supply. The main cause was a lack of understanding basic principles of sanitary system design. Therefore, the course improvement is to create a team exercise that helps team members share their ideas about sanitary system design and find correct sanitary system design options. Also, by providing students with more in-class exercises, they will be able to increase their understanding of how sanitary systems need to be designed.