

**DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
ROY G. PERRY COLLEGE OF ENGINEERING
PRAIRIE VIEW A&M UNIVERSITY**

ASSESSMENT REPORT

CVEG 4200 SENIOR DESIGN & PROFESSIONALISM I

FALL 2021 SEMESTER

INSTRUCTOR: Dr. Md Jobair Bin Alam

TABLE OF CONTENTS

- 1. Cover Page**
- 2. Detailed Course Syllabus**
- 3. End of Semester Outcomes Assessment Report (New Format)**
- 4. Grade Sheet Showing Student and Class Performance in Outcomes**
- 5. Supporting Outcome Specific Assignments**

Assignments are measuring and assessing the following:

ABET Criterion

- 2) An ability to (1) apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well.**
- 3) An ability to communicate effectively with a range of audiences (verbal and written).**
- 4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts as global, cultural, social, environmental, and economic factor.**
- 5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.**
- 7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies**

Detailed Course Syllabus
(Distributed to Students at the beginning of the Semester)

COURSE DESCRIPTION IN ABET FORMAT

CIVIL ENGINEERING DEPARTMENT CVEG 4200 SENIOR DESIGN AND PROFESSIONALISM I

1.	Course number and name:	CVEG 4200 Senior Design and Professionalism I
2.	Credits and contact hours:	2 credit hours
3.	Instructor's or course coordinator's name:	Dr. Md Jobair Bin Alam
4.	Textbook: Title:	Capstone design Engineering
	Author:	Frederick Bloetscher and Daniel Meeroff
	Publisher, Year & Edition:	J. Ross Publishing
	a. Other Supplemental material	Handouts from US Army Core of Engineers, NAVFAC Manual, Senior Design Manual, other reference technical books, software, agency manuals, scope of work and guidelines.
5.	Specific course information	
	a. Brief description of the content of the course (catalog description)	CVEG 4200. Credit: 2 semester hours. A continuation of CVEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, as well as a final written report. Professionalism education will, and a formal demonstration of prototype, or model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
	b. Prerequisites or Co-requisites	CVEG 3300, 3301, CVEG 3302, CVEG3303, CVEG 3304
	c. *Indicate whether a required, elective, or selected elective (as per definition provided) course in the program	*****Highly Required*****
6.	a. Specific goals for the course specific outcomes of instruction (e.g., The student will be able to explain the significance of current research about a particular topic.) <i>Students will be able to:</i>	b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course. <i>The specific goals for the course specific outcomes listed on the left column will address the following student learning outcomes:</i>
	1. To develop the ability to understand and apply knowledge of civil engineering to design a system, component, or process to meet desired needs of a civil engineering project which includes structural, geotechnical, transportation,	Outcome 2 An ability to (1) apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well. Outcome 3 An ability to communicate effectively with a range of audiences (verbal and written).

	environmental and water resources areas of civil engineering.	Outcome 4 An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts as global, cultural, social, environmental, and economic factor.
	2. To develop the ability to function as a team, adhere to ethical standards and communicate the project design writing reports and presenting effectively to audience.	Outcome 5 An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. Outcome 7 An ability to acquire and apply new knowledge as needed using appropriate learning strategies.
7	Brief list of topics to be covered	1. Introduction Plan for Detailed Design of the Project. Reasons for the Design Option compared to an alternate design choice. Addressing Sustainability to chosen design system and components in structural, geotechnical, transportation, environmental and water resources discipline. 2. Tasks and Responsibility for the current semester & Schedule (For Group Members) 3. Presentation of Project Scope, Tasks, Schedule. 4. Design Integration and Concurrent Engineering. 5. Preparation and Rehearsal for Mid-Term Oral Presentation and Report 6. Industry professional presentation to share their expertise 7. Oral Presentation and Report Writing 8. Fall Semester Project Report (Draft) and Drawings (Draft) 9. Final Report and Drawings Submission including preliminary/final design and recommendation 10. Final Presentation to Faculty

CVEG 4200 - Senior Design and Professionalism I

Fall 2021

General Course Information

Information Item	Information
Instructor:	Dr. Md Jobair Bin Alam, P.E.
Section # and CRN:	P01 and P81 CRN: 17739 and 17740
Office Location:	SR Collins # 312
Office Phone:	936 261 1652
Email Address:	mdalam@pvamu.edu
Office Hours:	W 8:00-10.00 AM
Mode of Instruction:	Face to Face
Course Location:	Wilson 109G and SR Collin 116
Class Days & Times:	W 1:00-1.50 PM and R 2:00-4:50 PM
Catalog Description:	Credit: 2 semester hours. This is a capstone engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice will be integrated into the project experience. The design achievement will be demonstrated by written report, oral presentation, and professional standards and ethics Examinations.
Prerequisites:	CVEG 3300, CVEG 3301, CVEG 3302, CVEG 3303, CVEG 3304
Co-requisites:	None
Required Text(s):	1. Senior Design Manual 2. Other reference technical books, software, agency manuals, Scope of Work and Guidelines
Recommended Text(s):	Capstone design Engineering by Frederick Bloetscher and Daniel Meeroff J.Ross Publishing 2015.

General Course Information Table

Student Learning Outcomes:

Course Goals or Overview:	
	To develop the ability to understand and apply knowledge of civil engineering to design a system, component, or process to meet desired needs of a civil engineering project.
	To develop the ability to function as a team, adhere to ethical standards and communicate the project design writing reports and presenting effectively to audience.

Course Objectives/Accrediting Body ABET Standards Met: SACS and ABET

To provide the student with a clear and thorough understanding of applications of civil engineering knowledge to design a system, component, or process to meet desired needs of a project by working on a project which includes which includes structural, geotechnical, transportation, environmental and water resources areas of civil engineering.

At the end of this course, the student will demonstrate				
		Civil Engineering Program Objectives		ABET Criteria
1	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	1, 2, 3, and 4		2
2	an ability to communicate effectively with a range of audiences	1, 2, 3, and 4		3
3	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	1, 2, 3, and 4		4
4	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	1, 2, 3, and 4		5
5	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	1, 2, 3, and 4		7

Table: Outcome Measures

Course	CVEG Objectives				ABET Criterion 3						
	1	2	3	4	1	2	3	4	5	6	7
CVEG 4472	x	x	x	x		x	x	x	x		x

x are the outcomes measured for this course

Civil Engineering Program Outcomes (Student Learning Outcomes)

ABET EAC Criterion 3 {[1] - [7]} Student Outcomes (SOs)

- 1) an ability to identify, formulate, and solve **complex** engineering problems by applying principles of engineering, science, and mathematics
- 2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- 3) an ability to communicate effectively with a range of audiences
- 4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- 5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- 7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Civil Engineering Program Educational Objectives (PEOs)

Graduates from the Civil Engineering program will:

1. Have careers in civil engineering or related fields that lead to increasing levels of responsibility and leadership
2. Obtain professional licensure/certifications
3. Complete graduate studies in civil engineering or related fields
4. Engage in professional development and service

Mapping of Program Educational Objectives (PEOs) onto Program Outcomes

PEO	Objectives	CVEG Program Outcomes						
	<i>Graduates from the Civil Engineering program will:</i>	[1]	[2]	[3]	[4]	[5]	[6]	[7]
PEO 1	have careers in civil engineering or related fields that lead to increasing levels of responsibility and leadership	X	X	X	X	X	X	X
PEO 2	obtain professional licensure/certifications	X	X					
PEO 3	complete graduate studies in civil engineering or related fields	X	X	X	X		X	X
PEO 4	engage in professional development and service	X	X	X	X		X	X

Mapping of CVEG Courses onto PEOs and Program Outcomes [Beginning Fall 2019] Updated Fall 2021

Previous Course No.	New Course No.	Course Title	CE Student Outcomes/SOs						
			[1]	[2]	[3]	[4]	[5]	[6]	[7]
CVEG 1011	CVEG 1101	Introduction to Engineering							
CVEG 1021	CVEG 1102	Introduction to Civil Engineering Lab							I
CVEG 2043	CVEG 2301	Engineering Mechanics I							I
CVEG 2061	CVEG 2101	Materials & Dynamics Lab						I	
CVEG 2063	CVEG 2332	Mechanics of Materials I		I					
CVEG 2073	CVEG 2304	Global Development Issues {CORE}			I	√	I		R
CVEG 2081	CVEG 2102	Surveying & Geospatial Concepts			R			I	
CVEG 3023	CVEG 3300	Geotechnical Engineering		I					
CVEG 3031	CVEG 3100	Concrete & Steel Lab						√	
CVEG 3043	CVEG 3301	Environmental Engineering			R			√	
CVEG 3051	CVEG 3102	Professional Engineering I				√			
CVEG 3053	CVEG 3302	Transportation Engineering			R		√		
CVEG 3063	CVEG 3303	Hydraulics			√		R	√	
CVEG 3073	CVEG 3304	Structural Analysis I	I						√
CVEG 3083	CVEG 3305	Steel Design	√	√	R				
CVEG 4013	CVEG 4300	Reinforced Concrete	R	√					
CVEG 4021	CVEG 4100	Geotech Engineering Design Lab		R					√
CVEG 4043	CVEG 4301	Environmental Engineering Design	√	√	R				
CVEG 4053	CVEG 4302	Transportation Engineering Design	√				√		
CVEG 4063	CVEG 4303	Water Resources Engineering	√	√					I
CVEG 4093	CVEG 4304	Systems Engineering		√					√
CVEG 4472	CVEG 4200	Sr. Design & Professionalism I		√	√	√	√		√
CVEG 4482	CVEG 4201	Sr. Design & Professionalism II	√	√	√	√			

I – means the described outcome is introduced (not measured) but could be monitored.

√ - means that the skills described in the program outcome are covered and **measured** in the course.

R – means the described outcome is reinforce in the course (not measured) but could be monitored.

Additionally, evidence are to collected to satisfy **CE Program Criteria** covering basic concepts in **Management** (CVEG 3302, 4302, 4200, 4201, 4304), **Business** (CVEG 4304, 4200, 4201), **Public Policy** (CVEG 2304, 4200, 4201), **Professional Ethics** (CVEG 1102, 2304, 3102), Leadership (CVEG 4200, 4201), **Consideration of Sustainability** (CVEG 4301, 4302, 4303), **Importance of Professional Licensure** (CVEG 3102, 4200, 4201).

Note: Courses with a mixture of students from other Programs are intentionally excluded when possible.

The Assessment Process

Student Learning outcomes are measured using both **direct** and **indirect** measurements. Direct measurement is derived from either designated homework, tests, lab reports project reports or other assignments. Indirect measurement is drawn from end-

of-semester Student Opinion Surveys (SOS) and any surveys completed by graduating Seniors. The above listed Student Learning Outcomes (Program Outcomes) are measured and evaluated in specified cycles and an Assessment Report is prepared annually for the purposes of continuously improving the Program's learning outcomes.

Major Course Requirements

TOPICS COVERED

Course goals are:

1. To expose the student to the experience of working in a design team, doing project planning, writing design specifications, procurement of parts and acquiring skills and competencies in designing engineering systems and/or processes. Students will acquire effective communication skills by giving presentations to faculty and invited guests. Guest lecturers will be invited to discuss topics relevant to engineering practice, ethics, design, and real world experiences. The student is required in conjunction with his or her group to submit written reports and give oral presentations throughout the semester.
2. To give the student the Fundamentals of Engineering Design Methodology, and expose them to relevant topics in the field through discussions, lectures and team projects. Each team of students will work closely with faculty advisors knowledgeable in the areas of the design.
3. Students will demonstrate ability to research, identify, formulate, and solve engineering problems.
4. Conduct research on the economical, global impact, ethical, and technical aspects of the engineering design.
5. Students will use acquired knowledge to optimize engineering solutions and designs in accordance with technical and contemporary constraints.
6. Students acquire experience and understanding of diverse engineering systems to produce a final integrated design.
7. Demonstrate team work through regular class presentations and a final design presentation.
8. Students gain appreciation of the functioning of other engineering disciplines.
9. Students gain appreciation of mentoring processes by acquiring Information from industrial and faculty mentors.
10. Students will consider their own values with case studies discussed in class.
11. Students will be able to differentiate between ethical and legal issues.
12. Students will complete a final technical report that includes written description of the project, technical schematics of the components, system or processes.
13. All students will give a formal oral summary presentation on their aspect of the project.
14. Students will understand the importance of engage in learning investigating current technical required to make progress on their project.
15. Students will be able to distinguish the benefit of life-long learning.

***Final Report will be graded only once when it is submitted in a final acceptable form.**

Grades will be given to individual students, not to project or teams. A student's grade will be based on his/her contribution to the project, quality product and performance by demonstrating both oral and written report.

Method of Determining Final Course Grade

Course Grade Requirement	Value
1) Class Attendance	5%
2) Project Proposal	10%
3) Team Participation	10%
4) Professionalism and Ethics	10%
5) Weekly Progress Reports	15%
6) Mid-semester Oral Presentation and Report	10%
7) Faculty/Advisor Meeting	10%
8) Final oral Presentation	10%
9) Final Report *	20%
Total:	100%

Grading Criteria and Conversion:

A = 90-100

B = 80-89

C = 70-79

D = 60-69

F = 0-59

Course Procedures and or Additional Instructor Policies

This course will utilize the following instruments to determine student grades and proficiency of the learning outcomes for the course.

- Class Participation - daily attendance and participation in class discussions; attend guest speaker talks. Outside Class Participation - Field visits, 'Short call' late afternoon or evening sessions, Weeklyteam work, Pre-scheduled weekend team work; Utilization of campus computing resources.
- Initiative - Personal and team initiative to keep track of project needs, develop relationship with teammates and leaders, start and complete project tasks on schedule and meet deadlines.
- Leadership - Execute leadership roles as need be to complete task, maintain regular correspondence with team members and troubleshoot scenarios with Instructor's help. Keep track of Deadlines.
- Professionalism and Ethics - The Sr. Design Course is a mock run of what the graduates will expect in the industry. Professionalism and ethics in getting work done on time through communication and teamwork is vital for ultimate success in CVEG 4200 and to secure a place and good performance in CVEG 4201.
- Teamwork - Develop and maintain solid teamwork mindset; show enthusiasm and be positive to changes and deadlines.
- Communication - Be alert to the needs of the group. Communicate individual needs to the team leader and/or team manager, as appropriate under the protocols discussed in class by the Instructor.
- Quality Control – Practice clear documentation of computer and hand calculations, generate clean, crisp, to-the-point reports, presentation slides, assignments, workstation/AutoCAD drawings, and project model.
- Data Compatibility - All teams will use the same version Microsoft software and workstation/AutoCAD for data compatibility.
- Design - Design work done in accordance to County and TxDOT and applicable standards, codes and guidelines are expected. All design work must be supported by sample hand calculations, Excel spreadsheets with governing equations and assumptions mentioned.
- Faculty/IAC Presentations - Three weeks prior to formal presentations the project team will divide work up to prepare Powerpoint slides; Eventually, the slides must be fluid and look as if one person prepared it; Informal and formal presentation practice session will be scheduled and strictly maintained by each team member. For the formal practice session, the department will work with the team to reserve a suitable auditorium.
- Assignments - Homework assignments supporting ABET Outcome requirements will be announced and requirements and deadlines must be met for full credit and to avoid delay in other more important tasks. Mid Term Exam - Midterm exam will consist of a presentation to the Instructor by each team (and each team member), and a written report which will differ for individuals per the respective area of concentration.
- Final Project Report - Final project report will conform to Sr. Design Manual, Scope of Work and Deliverables Guidelines (part of the Scope).

16 WEEK CALENDAR

Week 1: Topic(s)	Introduction to Capstone Project, Project Assignment Team Formation
Chapter(s):	Project Description, Design manual and Handouts
Assignment(s):	None
Week 2: Topic	Scope of work Preparation
Chapter(s):	Project Description, Design manual and Handouts
Assignment(s):	Assignment # 1
Week 3: Topic(s)	Scope of work Presentation to IAC
Chapter(s):	Design manual and Handouts
Assignment(s):	Presentation# 1
Week 4: Topic(s)	Proposal with revised schedule
Chapter(s):	Design manual and Handouts
Assignment(s):	Assignment # 2
Week 5: Topic(s)	Project Management and organization, Presentation of Project Scope and Task
Chapter(s):	Design manual and Handouts
Assignment(s):	None
Week 6: Topic(s)	Design Integration and Concurrent Engineering, Preparation and Rehearsal for Mid-Term Oral Presentation
Chapter(s):	Design manual and Handouts
Assignment(s):	None
Week 7: Topic(s)	Report and Midterm Presentation
Chapter(s):	Design manual and Handouts
Assignment(s):	Presentation# 2 (Mid Term Report # 1)
Week 8: Topic(s)	Continuing Design, Design Update and Review
Chapter(s):	Design manual and Handouts
Assignment(s):	None
Week 9: Topic(s)	Continuing Design, Design Update and Review
Chapter(s):	Design manual and Handouts
Assignment(s):	Assignment # 3
Week 10: Topic(s)	Continuing Design, Design Update and Review
Chapter(s):	Design manual and Handouts
Assignment(s):	Assignment # 4
Week 11: Topic(s)	Ethics Review and Test,
Chapter(s):	Design manual and Handouts
Assignment(s):	Assignment # 5
Week 12: Topic(s)	Oral Presentation and Report Writing Seminar
Chapter(s):	Design manual and Handouts
Assignment(s):	None
Week 13: Topic(s)	Fall Semester Project Report and Drawings Draft
Chapter(s):	Design manual and Handouts
Assignment(s):	Presentation# 3 (Semester Report # 2)
Week 14: Topic(s)	Report and Drawings Revision and Updating
Chapter(s):	Design manual and Handouts
Assignment(s):	None, Thanksgiving Holiday (November 25-27, 2021)
Week 15: Topic	Oral Presentation to Industry Advisory Council
Chapter(s):	Design manual and Handouts
Assignment(s):	Presentation# 4
Week 16: Topic(s)	Final Report and Drawings Submission, Last Class Day.
Assignment(s):	Comprehensive Final Exam Period – December 2-8, 2021

Taskstream

Taskstream is a tool that Prairie View A&M University uses for assessment purposes. At least one of your assignments is **REQUIRED** to be submitted as an "artifact," an item of coursework that serves as evidence that course objectives are met. More information will be provided during the semester, but for general information, you can visit Taskstream via the link in canvas (ecourse).

Course Procedures and or Additional Instructor Policies

1. Class attendance is a requirement for the course.
2. Student absent or late for four or more classes may receive a failing grade.
3. Homework, projects, or reports must be turned in at the beginning of class on the due date.
4. Quiz may be given on any day without prior announcement.
5. No make-up quiz, test or examination will be given. If you miss a test/examination, you will receive zero credit for that test. If you have an excused absence, notify the instructor ahead of time.
6. Cell phones must not be used during class period, tests and exams.

HOMEWORK:

All assignments must be submitted to complete the course.

The following areas will be graded:

1. Completeness: Did you work all parts of the assignments?
2. Accuracy: Did you get the "correct" answer and indicate the units?
3. Format and Neatness: Is your presentation of the solution easy to follow, legible and in a professional manner?

POLICY TO ERADICATE CHEATING (PROTECT INTEGRITY OF EXAMS)

Cheating is unprofessional, unethical and is antithetical to our core value of "Excellence in Civil Engineering Education," and WILL NOT BE TOLERATED at any level. To combat this serious problem, the Civil & Environmental Engineering (CEE) Department has adopted the following rules to eradicate cheating.

- If a student cheats on a test/assignment, the student shall receive an **automatic zero** for the test/assignment.
- A student who has been determined to have cheated in a course will IMMEDIATELY relinquish his/her leadership position in any of the department's professional organizations.
- If a student cheats multiple times in a course, the student will receive a **grade of "F"** for the course.
- The calculators allowed for use in exams is **restricted** to the **latest** FE-approved calculators. For the latest NCEES FE approved calculators visit ncees.org or <https://ncees.org/exams/calculator/> [This NCEES policy protects the integrity of NCEES exams and has been adopted to do likewise for department's exams.]

EXAM GUIDELINES (Faculty should consider adopting these for all exams)

- 1) All cellphones/smartwatches **MUST** be placed in a book bags during exams and turned off. Book bags **MUST** be placed in front of the classroom and away from students. Students without a book bag must place cellphone/smartwatch (turned off) on Instructor's desk – **no exceptions**
- 2) Any student possessing a cellphone/smartwatch or any other unauthorized device **WILL** receive an **automatic zero for the test/assignment**. This is cheating.
- 3) **Calculator covers** are **DISALLOWED** during tests and must be placed in students' bookbags during exams.
- 4) There shall be **NO SHARING** of resources during the exam
- 5) **Restroom Visit**: if you need to use the restroom, do so before opening the exam. Once the exam begins, you must submit your work to the instructor if you leave the classroom to visit the restroom (your exam terminates).

Student Support and Success

John B. Coleman Library

The John B. Coleman Library's mission is to enhance the scholarly pursuit of knowledge, to foster intellectual curiosity, and to promote life-long learning and research through our innovative services, resources, and cultural programs, which support the Prairie View A&M University's global mission of teaching, service, and research. It maintains library collections and access both on campus, online, and through local agreements to further the educational goals of students and faculty. Website: <https://www.pvamu.edu/library/>; Phone: 936-261-1500

Academic Advising Services

Academic Advising Services offers students a variety of services that contributes to student success and leads towards graduation. We assist students with understanding university policies and procedures that affect academic progress. We support the early alert program to help students get connected to success early in the semester. We help refer students to the appropriate academic support services when they are unsure of the best resource for their needs. Faculty advisors support some students in their respective colleges. Your faculty advisor can be identified in PantherTracks. Advisors with Academic Advising Services are available to all students. We are located across campus. Find your advisor's location by academic major at www.pvamu.edu/advising. Phone: 936-261-5911

The University Tutoring Center

The University Tutoring Center (UTC) offers free tutoring and academic support to all registered PVAMU students. The mission of the UTC is to help provide a solid academic foundation that enables students to become confident, capable, independent learners. Competent and caring staff and peer tutors guide students in identifying, acquiring, and enhancing the knowledge, skills, and attitudes needed to reach their desired goals. Tutoring and academic support are offered face-to-face in the UTC, in virtual face-to-face sessions (<https://www.pvamu.edu/student-success/sass/university-tutoring-center/>), and through online sessions (<https://www.pvamu.edu/pvplace/>). Other support services available for students include Supplemental Instruction, Study Break, Academic Success Workshops, and Algebra Study Jam. Location: J. B. Coleman Library, Rm. 307; Phone: 936-261-1561; Email: pvtutoring@pvamu.edu; Website: <https://www.pvamu.edu/student-success/sass/university-tutoring-center/>

Writing Center

The Writing Center provides well-trained peer tutors to assist students with writing assignments at any stage of the writing process. Tutors help students with various writing tasks from understanding assignments, brainstorming, drafting, revising, editing, researching, and integrating sources. Students have free access to Grammarly online writing assistance. Grammarly is an automated proofreading and plagiarism detection tool. Students must register for Grammarly by using their student email address. In addition, students have access to face-to-face and virtual tutoring services either asynchronously via email or synchronously via Zoom. Location: J. B. Coleman Library, Rm. 209; Phone: 936-261-3724; Website: <https://www.pvamu.edu/student-success/writing-center/>; Grammarly Registration: <https://www.grammarly.com/enterprise/signup>

Academic Early Alert

Academic Early Alert is a proactive system of communication and collaboration between faculty, academic advisors, and PVAMU students that is designed to support student success by promptly identifying issues and allowing for intervention. Academic Early Alerts help students by providing a central location to schedule advising appointments, view advisor contact information, and request assistance. Students who recognize that they have a problem that is negatively affecting their academic performance or ability to continue school may self-refer an Academic Early Alert. To do so, students will log in to PV Place and click on Academic Early Alert on the left sidebar. Phone: 936-261-5902; Website: <https://www.pvamu.edu/student-success/early-alert/>

Student Counseling Services

The Student Counseling Services unit offers a range of services and programs to assist students in maximizing their potential for success: short-term individual, couples, and group counseling, as well as crisis intervention, outreach, consultation, and referral services. The staff is licensed by the State of Texas and assists students who are dealing with academic skills concerns, situational crises, adjustment problems, and emotional difficulties. Information shared with the staff is treated confidentially and in accordance with Texas State Law. Location: Hobart Taylor, 2nd floor; Phone: 936-261-3564; Website: <https://www.pvamu.edu/healthservices/student-counseling-services/>

Office of Testing Services

Testing Services serves to create opportunities by offering a suite of exams that aid in the students' academic and professional success. Currently, we administer entrance (HESI A2), college readiness (TSI assessment), Prior Learning (CLEP, DSST), and proctored exams. Location: Wilhelmina Delco, 3rd Floor, Rm. 305; Phone: 936-261-3627; Email: aetesting@pvamu.edu; Website: www.pvamu.edu/testing

Office of Diagnostic Testing and Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, contact the Office of Disability Services. As a federally-mandated educational support unit, the Office of Disability Services serves as the repository for confidential disability files for faculty, staff, and students. For persons with a disability, the Office develops individualized ADA letters of request for accommodations. Other services include learning style inventories, awareness workshops, accessibility pathways, webinars, computer laboratory with adapted hard and software, adapted furniture, proctoring non-standardized test administrations, ASL interpreters, ALDs, digital recorders, Livescribe, and a comprehensive referral network across campus and the broader community. Location: Hobart Taylor, Rm. 1D128; Phone: 936-261-3583; Website: <https://www.pvamu.edu/disabilityservices/>

Center for Instructional Innovation and Technology Services (CIITS)

Distance Learning, also referred to as Distance Education, is the employment of alternative instructional delivery methods to extend programs and services to persons unable to attend college in the traditional manner. The Center for Instructional Innovation and Technology Services (CIITS) supports student learning through online, hybrid, web-assist, and 2-way video course delivery. For more details and contact information, visit: <https://www.pvamu.edu/dlearning/distance-learning-2-2/students-2/>; Phone: 936-261-3283

Veteran Affairs

Veterans Services works with student veterans, current military and military dependents to support their transition to the college environment and continued persistence to graduation. The Office coordinates and certifies benefits for both the G.I.

Bill and the Texas Hazlewood Act. Location: Evans Hall, Rm. 102; Phone: 936-261-3563; Website: <https://www.pvamu.edu/sa/departments/veteranaffairs/>

Office for Student Engagement

The Office for Student Engagement delivers comprehensive programs and services designed to meet the co-curricular needs of students. The Office implements inclusive and accessible programs and services that enhance student development through exposure to and participation in diverse and relevant social, cultural, intellectual, recreational, community service, leadership development, and campus governance. Location: Memorial Student Center, Rm. 221; Phone: 936-261-1340; Website: <https://www.pvamu.edu/studentengagement/>

Career Services

Career Services supports students through professional development, career readiness, and placement and employment assistance. The Office provides one-on-one career coaching, interview preparation, resume and letter writing, and career exploration workshops and seminars. Services are provided for students at the Northwest Houston Center and College of Nursing in the Medical Center twice a month or on a requested basis. Distance Learning students are encouraged to visit the Career Services website for information regarding services provided. Location: Anderson Hall, 2nd floor; Phone: 936-261-3570; Website: <https://www.pvamu.edu/careerservices/>

University Rules and Procedures

Academic Misconduct

Academic dishonesty is defined as any form of cheating or dishonesty that has the effect or intent of interfering with any academic exercise or fair evaluation of a student's performance. The college faculty can provide additional information, particularly related to a specific course, laboratory, or assignment.

You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with the *University Administrative Guidelines on Academic Integrity*, which can be found on the [Academic Integrity webpage](#). Students who engage in academic misconduct are subject to university disciplinary procedures. As listed in the *University Administrative Guidelines on Academic Integrity*, the University Online Catalog, and the Student Code of Conduct, the following are examples of prohibited conduct. This list is not designed to be all-inclusive or exhaustive. In addition to academic sanctions, any student found to have committed academic misconduct that is also a violation of criminal law may also be subject to disciplinary review and action by the Office of Student Conduct (as outlined in the Student Code of Conduct).

Forms of Academic Dishonesty:

1. **Cheating**: Deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not learned, giving or receiving aid unauthorized by the instructor on assignments or examinations. Examples: unauthorized use of notes for a test; using a "cheat sheet" on a quiz or exam; any alteration made on a graded test or exam which is then resubmitted to the teacher;
2. **Plagiarism**: Careless or deliberate use of the work or the ideas of another; representation of another's work, words, ideas, or data as your own without permission or appropriate acknowledgment. Examples: copying another's paper or answers, failure to identify information or essays from the internet and submitting or representing it as your own; submitting an assignment which has been partially or wholly done by another and claiming it as yours; not properly acknowledging a source which has been summarized or paraphrased in your work; failure to acknowledge the use of another's words with quotation marks;
3. **Collusion**: When more than one student or person contributes to a piece of work that is submitted as the work of an individual;
4. **Conspiracy**: Agreeing with one or more persons to commit an act of academic/scholastic dishonesty; and
5. **Multiple Submission**: Submission of work from one course to satisfy a requirement in another course without explicit permission. Example: using a paper prepared and graded for credit in one course to fulfill a requirement and receive credit in a different course.

Nonacademic Misconduct

The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. The Office of Student Conduct will adjudicate such incidents under nonacademic procedures.

Sexual Misconduct

Sexual harassment of students and employees at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating the university's sexual harassment policy will be subject to disciplinary action. In accordance with the Texas A&M University System guidelines, your instructor is obligated to report to the Office of Title IX Compliance (titleixteam@pvamu.edu) any instance of sexual misconduct involving a student, which includes sexual assault, stalking, dating violence, domestic violence, and sexual harassment, about which the instructor becomes aware during this course through writing, discussion, or personal disclosure. The faculty and staff of PVAMU actively strive to provide a learning, working, and living environment that promotes respect that is free from sexual misconduct, discrimination, and all forms of violence. If students, faculty, or staff would like assistance or have questions, they may contact the Title IX Coordinator at 936-261-2144 or titleixteam@pvamu.edu. More information can be found at www.pvamu.edu/titleix, including confidential resources available on campus.

Pregnancy, Pregnancy-related, and Parenting Accommodations

Title IX of the Education Amendments of 1972 prohibits sex discrimination, which includes discrimination based on pregnancy, marital status, or parental status. Students seeking accommodations related to pregnancy, pregnancy-related conditions, or parenting (reasonably immediate postpartum period) are encouraged to contact Student Disability Services or the Dean of Students' Office for additional information and to request accommodations.

Non-Discrimination Statement

Prairie View A&M University does not discriminate on the basis of race, color, sex, religion, national origin, age, disability, genetic information, veteran status, sexual orientation, or gender identity in its programs and activities. The University is committed to supporting students and complying with The Texas A&M University System non-discrimination policy. It seeks to establish an environment that is free of bias, discrimination, and harassment. If you experience an incident of discrimination or harassment, we encourage you to report it. If you would like to speak with someone who may be able to afford you privacy or confidentiality, there are individuals who can meet with you. The Director of Equal Opportunity & Diversity has been designated to handle inquiries regarding the non-discrimination policies and can be reached at Harrington Science Building, Suite 109 or by phone at 936-261-1744 or 1792.

Class Attendance Policy (See the University Online Catalog for Full Attendance Policy)

Prairie View A&M University requires regular class attendance. Attending all classes supports the full academic development of each learner, whether classes are taught with the instructor physically present or via distance learning technologies such as interactive video and/or the internet. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in the assignment of a grade of "F." Absences are accumulated beginning with the first day of class during regular semesters and summer terms. Each faculty member will include the University's attendance policy in each course syllabus.

Student Academic Appeals Process

Authority and responsibility for assigning grades to students rest with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the University Online Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.

Technical Considerations

Minimum Recommended Hardware and Software:

- Intel PC or Laptop with Windows 10 or later version; Mac with OS High Sierra*
- Smartphone or iPad/Tablet with Wi-Fi*
- High-speed Internet access
- 8 GB Memory

- Hard drive with 320 GB storage space
- 15" monitor, 800x600, color or 16 bit
- Sound card w/speakers
- Microphone and recording software
- Keyboard & mouse
- Most current version of Google Chrome, Safari, or Firefox

Note: Be sure to enable Java & pop-ups in the Web browser preferences

* Smartphones, Google Chrome books, and Android tablets may not be supported. iPads are the only tablets supported.

Participants should have a basic proficiency of the following computer skills:

- Sending and receiving email
- A working knowledge of the Internet
- Microsoft Word (or a program convertible to Word)
- Acrobat PDF Reader
- Windows or Mac OS
- Video conferencing software

Netiquette (online etiquette)

Students are expected to participate in all discussions and virtual classroom chats as directed. Students are to be respectful and courteous to others on discussion boards. Foul or abusive language will not be tolerated. Do not use ALL CAPS for communicating to others AS IT CAN BE INTERPRETED AS YELLING. Avoid slang terms such as "wassup?" and texting abbreviations such as "u" instead of "you." Limit and possibly avoid the use of emoticons. Be cautious when using humor or sarcasm as tone is sometimes lost in an email or discussion post, and the message might be taken seriously or sound offensive.

Video Conferencing Etiquette

When using Zoom, WebEx, or other video conferencing tools, confirm the visible area is tidy, clear of background clutter, inappropriate or offensive posters, and other distractions. Ensure you dress appropriately and avoid using high traffic or noisy areas. Stay muted when you are not speaking and avoid eating/drinking during the session. Before the class session begins, test audio, video, and lighting to alleviate technology issues.

Technical Support

Students should go to <https://mypassword.pvamu.edu/> if they have password issues. The page will provide instructions for resetting passwords and contact information if login issues persist. For other technical questions regarding eCourses, call the Center for Instructional Innovation and Technology Services at 936-261-3283 or email ciits@pvamu.edu.

Communication Expectations and Standards

Emails or discussion postings will receive a response from the instructor, usually in less than 48 hours. Urgent emails should be marked as such. Check regularly for responses.

Discussion Requirement

Online courses often require minimal to no face-to-face meetings. However, conversations about the readings, lectures, materials, and other aspects of the course can occur in a seminar fashion. The use of the discussion board will accomplish this. The instructor will determine the exact use of discussion boards.

It is strongly suggested that students type their discussion postings in a word processing application such as Word and save it to their PC or a removable drive before posting to the discussion board. This is important for two reasons: 1) If for some reason your discussion responses are lost in your online course, you will have another copy; 2) Grammatical errors can be greatly minimized by the use of the spell-and-grammar check functions in word processing applications. Once the post(s) have been typed and corrected in the word processing application, copy and paste to the discussion board.

COVID-19 Campus Safety Measures

To promote public safety and protect students, faculty, and staff during the coronavirus pandemic, PVAMU has adopted policies and practices to limit virus transmission.

- **Self-monitoring** - Students should follow CDC recommendations for self-monitoring. Students who have a fever or exhibit symptoms of COVID-19 should participate in class remotely and should not participate in face-to-face instruction.
- **Face Coverings** - Face coverings (cloth face covering, surgical mask, etc.) are recommended in classrooms, teaching laboratories, common spaces such as lobbies and hallways, public study spaces, libraries, academic resource, and support offices, and outdoor spaces where 6 feet of physical distancing is challenging to maintain reliably.
- **Physical Distancing** - Physical distancing should be maintained between students, instructors, and others in course and course-related activities where possible.
- **Personal Illness and Quarantine** - Students required to quarantine are to participate in courses and course-related activities remotely and must not attend face-to-face course activities. Students should notify their instructors of the quarantine requirement. Students under quarantine are expected to participate in courses and complete graded work unless they have symptoms that are too severe to participate in course activities. Students experiencing personal injury or illness that is too severe for the student to attend class qualify for an excused absence. To receive an excused absence, students must provide appropriate documentation to the Office for Student Conduct, studentconduct@pvamu.edu.

End of Semester Course Assessment Report

This summary contains the following Information

1. Performance Statistics

- Total number of students in class
- The class average performance (**stated as %**) in each course outcome assessed in this class and the **two previous times course was assessed.**
- The acceptable class average for the class in each outcome area as set by your Department. **You cannot use any number of your choice**
- Percentage of students who scored below the expected average in each outcome.

2. Implementation Summary

- Brief summary of plans implemented during the semester based on last assessment report

3. Perceived Problems

- Instructor's critical **evaluation** of perceived problems that affected students' performance. **Realistic problems should be identified throughout the semester and summarized in this section of the report.**

4. New Plans for Addressing Problems

- Instructor's plans for addressing the perceived problems the next time the class is taught. **These should be specific enough for another instructor to implement. Most of these should be things that, you, the instructor can implement to help students to improve. Be creative.**

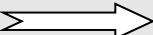
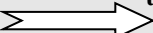
5. Overall Trend over last three assessment periods

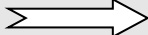
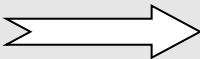
- Instructors summary of overall performance trend for each outcome measured over the last three periods.

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
CVEG 4200 SENIOR DESIGN AND PROFESSIONALISM I
FALL 2021 SEMESTER

Report Prepared by: Dr. Md Jobair Bin Alam

Report Date: December 17, 2021

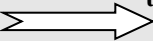
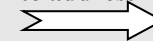
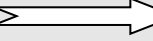
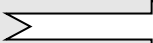
Semester	Analysis Type	Number of Students	Outcome 2 An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factor				Outcome 3 An ability to communicate effectively with a range of audiences (Oral Communication)			
			Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average	Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Fall 2021	Direct	13	70	75%	80	84%	70	75%	90	100%
Fall 2020	Direct	18	70	75%	71	77%	70	75%	80	83%
Fall 2019	Direct	21	70	75%	70	85%	70	75%	100	100%
Implementation Summary	Items implemented from previous report or after meeting previous instructor 		1) Project included design of a Business Center for AMAZON, and IT Hub and Distribution Center in three different counties (Waller, Washington, and Colorado) in Texas. Thirteen (13) in the senior design course were divided into 3 groups with 4/5 members in each group. The site map and geotechnical soil data were distributed to the 3 groups. Project Design objective is to design two office buildings, one convention center, one warehouse (distribution center) including grading, preparation of ground for construction of a detention pond, design roadway design leading to and including the intersection design, storm water drainage for the entire site, structural design of the buildings, geotechnical report. Scope included and provided a good exposure to students on all aspects of civil engineering. Students were also provided with a professional geotechnical report to gain idea and to implement in their project. 2) The students were asked to identify individual responsibilities and tasks in the design. The interaction among the group members and plan to complete the design worked well.				1) Students were able to organize well for the proposal presentation to Industry Advisory Council Members and Civil Engineering Faculties. Also and Final Presentations were organized. 2) Students formed into 3 groups and selected the team manager. Team dynamic procedures were introduced at the beginning of the semester to build connection among team members. 3) Use of presentation techniques including Power point presentation were required. Students used their skills learned from previous courses and projects and did perform excellently.			
Perceived Problems	Perceived problems are directly related to the PC and the sub items under them 		Students had difficulties in the structural design of the buildings and layout plan using AutoCAD. Students used STAAD program, leading to analysis and design. Students had some problems in deciding how to apply techniques learned in classes to practical project design. As they paid attention and work progressed, students understood the project steps and applied concepts well in response to the constraints.				All members did contribute well enough to present their plan of action on working and showing progress every week on the project design. Team members worked consistently. Team leader and associates were very persuasive and interacted well with all members. Mid-semester and final presentations were well rehearsed and oral communication was found to be acceptable.			

Plans for Addressing Problems	Plans for address specific measures to address PC and their sub areas 	Insistence and continuation of assigning exercises and to sample projects to provide practical experience and making aware of how to simplify and carry out tasks of a large size project into sub projects will enhance student performance. Students' ability to design may be enhanced by arranging field visits to construction project sites. Students were asked to observe the ongoing New Engineering Building construction, and be familiarize with civil engineering components in big project.	Continue to teach student how to prepare and present the project. Continue to bring to students' attention how to discuss with colleagues to resolve and how to coordinate individual's performance in their group while working to make an excellent performance as a group.
Overall Trend over Periods	Ascertain if there were improvements over previous semesters 	Overall students' performance was better and met the expectations in all design aspects. Performance of the geotechnical, structural, environmental, transportation and water resources areas were found to be satisfactory.	Student performance was commendable.
Were Expectations Met?		YES	YES

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
CVEG 4200 SENIOR DESIGN AND PROFESSIONALISM I
FALL 2021 SEMESTER

Report Prepared by: Dr. Md Jobair Bin Alam

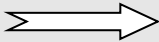
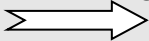
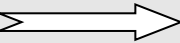
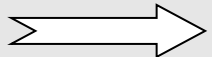
Report Date: December 17, 2021

Semester	Analysis Type	Number of Students	Outcome 4				Outcome 5			
			An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.				An ability to (1) function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, (2) establish goals, plan tasks, and meet objectives.			
			Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average	Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Fall 2021	Direct	13	70	75%	70	85%	70	75%	90	100%
Fall 2020	Direct	18	70	75%	70	80%	70	75%	80	100%
Fall 2019	Direct	21	70	75%	60	70%	70	75%	100	100%
Implementation Summary	Items implemented from previous report or after meeting previous instructor 		Students were given reading materials to learn ethical responsibility. Examples were given to understand the different situations to know how to take correct decisions. Tests were given to make the students to think thru the new situations to meet their ethical responsibility.				Instructor required the students to list their area of interest and the information on the level of performances in earlier courses were reviewed. Instructor and the instructor of professional practice formed the team of 4/5 students each group			
Perceived Problems	Perceived problems are directly related to the PC and the sub items under them 		Some students did well in the ethics assignment, while some students were not able to fully represent their ethical understanding of civil engineering profession. Overall the performance was good.				The students exhibited very well understanding how to work as a team. Produced schedule and Gantt chart for each member of the group.			
Plans for Addressing Problems	Plans for address specific measures to address PC and their sub areas 		More lecturing time on case studies can be considered so that the students could understand and do better on the quiz.				Student performance will be enhanced if continued discussion by the instructor on details relating to project components and how to divide work among group members.			
Overall Trend over Periods	Ascertain if there were improvements over previous semesters 		Students' performance found to be satisfactory and further improvement will be pursued in this area.				Overall students' performance is very good in this area.			
Were Expectations Met?			YES				YES			

END OF SEMESTER COURSE OUTCOME ASSESSMENT REPORT
CVEG 4200 SENIOR DESIGN AND PROFESSIONALISM I
FALL 2021 SEMESTER

Report Prepared by: Dr. Md Jobair Bin Alam

Report Date: December 17, 2021

Semester	Analysis Type	Number of Students	Outcome 7 An ability to acquire and apply new knowledge as needed, using appropriate learning strategies			
			Expected Class Average/	Expected Percent of students at or above average	Class Average	% Students meeting Expected Average
Fall 2021	Direct	13	70	75%	80	84%
Fall 2020	Direct	18	70	75%	71	77%
Fall 2019	Direct	21	70	75%	70	86%
Implementation Summary	Items implemented from previous report or after meeting previous instructor 	Instructor required the students to read additional reference materials relating to the project. Instruction on how to do literature review, and how additional information can be gained to fulfill the project requirements were given to students by the instructor.				
Perceived Problems	Perceived problems are directly related to the PC and the sub items under them 	The students had some difficulty in understanding and obtaining the appropriate information from different sources to be used towards the application to their specific design area.				
Plans for Addressing Problems	Plans for address specific measures to address PC and their sub areas 	Student performance will be enhanced if continued discussion by the instructor on details relating to project components and the information they must look for from references. A list of reference materials relevant to the project may be asked from students before asking students to conduct the literature review.				
Overall Trend over Periods	Ascertain if there were improvements over previous semesters 	Overall students' performance is very good in this area.				
Were Expectations Met?		YES				

**Grade Sheet Showing
Student and Class Performance in Outcomes**

**The computed semester average in each outcome as stated in the
Assessment report are highlighted in boldface.**

Fall 2020 CVEG 4472

Final Grade

ABET Criterion				5	4		3		3	2&7	
	Student	Att.	Prop	Team	Ethics	Progress	Mid Rep.	Mtg	Final Pres	Rept.	Tot
	Maximum Score /10	5	10	10	10	15	10	10	10	20	100
	1	5	7	9.5	9	12	8.8	9	8.5	17.6	86.4
	2	4.5	7	9.5	8	12	9	9	8.5	17.6	85.1
	3	4.5	7	8.5	0	12	9.2	9	7	17.6	74.8
	4	5	7	9.5	9	13	8.8	9	10	17.6	89.1
	5	5	7	9.5	7.5	12	9.2	9	9	13	83.2
	6	5	7	9.5	8	12	9.2	9	9	15	83.7
	7	5	7	9.5	8	12	9.2	9	9	15	83.7
	8	5	7	9.5	7.5	12	9	9	8.5	15	82.5
	9	4.5	7	9.5	8.5	12	8.8	9	9	15	83.3
	10	4.5	7	9.5	9	12	9	9	8.5	16	84.5
	11	5	7	9.5	8	12	8.8	9	9.5	16	84.8
	12	4.25	7	9.5	7	12	9.2	9	8	16	81.95
	13	4.75	7	9.5	8	12	9	9	8.5	16	83.75
	Average	5	7	9	7	12	9	9	8	16	82
	Meeting Req'd. Avg			100%	85%				100%	84%	

**OUTCOME SPECIFIC ASSIGNMENTS
USED TO ASSESS OUTCOMES**

ASSIGNMENTS FOR OUTCOME “2”

An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factor

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 4200 Senior Design and Professionalism I
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET

FALL 2021

Instructor: Dr. Md Jobair Bin Alam

Title of Assignment

Final Project Design Report and Drawings

Outcome Measured Using this Assignment

Outcome 2

An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factor

Check the engineering design characteristics related to this assignment

X	Involves identifying the specific needs to be met by defining/understanding the problem and developing plans for the project to satisfy the need
X	Involves conducting a review of the literature and performing preliminary design by generating alternative ideas/solutions and applying creativity
X	Involves performing detailed engineering design leading to specification and fabrication/selection of components for system being designed.
	Involves consideration of one or more of the following (Please check those involved in this assignment.)
x	Public health
x	Safety and welfare
x	Global factors
x	Cultural factors
x	Social factors
x	Environmental factors
x	Economic factors
	Involves fabrication and testing of model or prototype

Brief justification of the suitability of assignment for the outcome

A project is assigned to develop and design a Business Center for AMAZON, and IT Hub and Distribution Center in three different counties (Waller, Washington, and Colorado) in Texas. Final Report of Fall 2021 Semester covering civil engineering areas such as structural, geotechnical, transportation, environmental and water resources was evaluated.

ASSIGNMENT STATEMENT/QUESTIONS:

A project is assigned to develop and design a Project with residential subdivision on the site located in Waller County. Final Report of Fall 2019 Semester covering civil engineering areas such as structural, geotechnical, transportation, environmental and water resources will be assessed.

GRADING SCHEME FOR ASSIGNMENT:

General outline and Report Content

Front page

Course Name

Group Name and Student Name

Title

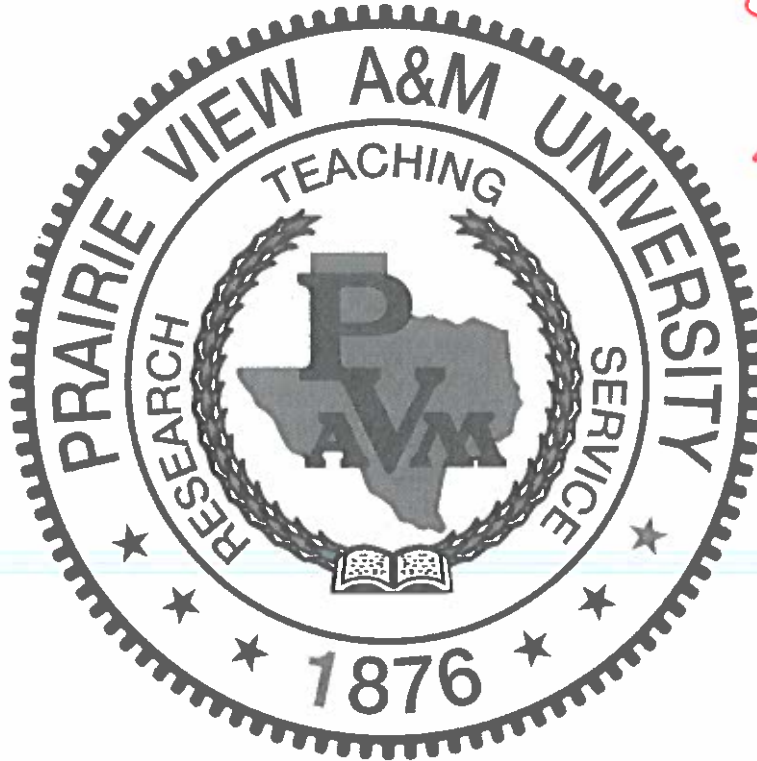
CONTENTS

- 1) Abstract (3 Pts)
- 2) Table of Contents (1 Pt)
- 3) Introduction (5 points)
- 4) Objectives (3 Points)
- 5) Method and approach to design (2 Pts)
- 6) Materials and properties (2 Pts)
- 7) Step by step description of design calculations (25 pts)
- 8) Alternative solutions (5 pts)
- 9) Summary- Conclusion and Recommendations (10 Pts)
- 10) Results and Sketches (10 Pts)
Use of tables, Figures, bar Charts, pictures, photos, etc.
- 11) Reference and Literature Citations (2 Pts)
- 12) Appendices (If Applicable) (2 Pts)
- 13) General Report Layout (3 pts)
- 14) Format consistency, Page numbering (3 Pts)
- 15) Written Communication Skills -Use of English language& Grammar (10 Pts)
- 16) Appropriate Captioning of Tables, Figures and Equations (3 Pts)
- 17) Sequential numbering of Tables, Figures and Equations (3 Pts)
- 18) Practical interpretation of results and findings in relation to Engineering
Material Concept, and Industry Applications (8 Pts)

TOTAL = 100 Pts

Insert here Student sample for Crit. 2

**Prairie View A&M University
Roy G. Perry College of Engineering
Civil & Environmental Engineering Department**



88

CVEG 4200: Senior Design

Section: P01

Course Number: 17739

Title: Final Semester Report

Submitted By: Abram Auguste, Armando Gomez, Alex Martinez, Nathaniel Smith –

G.A.M.S. Engineering

Submitted To: Dr. Alam, Md Jobair Bin Ph.D., P.E.

Due Date: December 01, 2021, 1:00 P.M.

Executive Summary

Prepared by

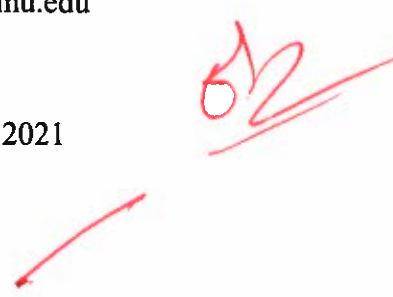
Abram Auguste
AAuguste@pvamu.edu

Alex Martinez
HAlex1011@gmail.com

Nathaniel Smith
Nkis1958@gmail.com

Armando Gomez
agomez28@pvamu.edu

November 17, 2021

A red handwritten signature, possibly reading "AG", is located to the right of the date. A red arrow points from the signature towards the date.

Summary

The proposed project is the development of a 400 acre lot for Amazon. This new development is located near the city of Brenham in Washington County, Texas. G.A.M.S Engineering is to develop and design Amazon distribution center, IT Hub, Office space, convention center, wastewater treatment facility, storm water ditch (to connect to a major lake), parking lots, roads, intersection and a highway extension that will accommodate the new facilities. G.A.M.S Engineering is to provide details on progress and milestones with completion dates for thus scope of work.

Geotechnical Engineering

The following report summarizes G.A.M.S. Engineering, Inc's Geotechnical Evaluation for the proposed Amazon Hub, located in Washington County, Texas. This report includes information regarding the field and laboratory testing analysis, the subsurface conditions encountered, and discussion related to building construction in relationship to the subsurface conditions at the site. The analysis was performed in general accordance with CVEG 3023 and 4100 processes and formulaic assessment.

At this time, the project consists of constructing a two five-story commercial office building, a steel structure warehouse, and a three-story convention center building with a footprint of approximately 30,000 to 50,000 square feet based on historical data. The building is proposed to be constructed at grade (i.e. without subsurface floors) with a finished floor elevation of approximately 340 feet.

On August 26, 2021, two (2) Standard Penetration Test (SPT) borings were performed using CME 75 drill rigs with 8" test hole diameter in the vicinity of the proposed Amazon hub building location to depths at 75 feet below the existing ground surface. Beneath a surface layer, the subsurface conditions observed can be described as lean to fat clay with varying amounts of silt to the extent of the test boring logs. Based on the assessment of the subsurface conditions and information exchanged to and between the G.A.M.S. Engineering team, the following comments and recommendations are made: The proposed building construction could not be supported on a conventional shallow foundation system and slab-on-grade nor a Matt foundation. However, it

was determined that Pile foundations could be designed for a maximum allowable bearing pressure of 560 pounds per square foot (psf). Total foundation settlement is estimated to be on the order of 1.34 inch or less, and a differential settlement on the order of a ½ inch or less; Groundwater was observed in the test borings performed at the site at depths approximately 7.5 feet below the existing ground surface. Based on the groundwater depths observed during soil assessment, it is likely that groundwater will be encountered during foundation construction. Therefore, the best course of action would be a deep pile system suitable to carry the load of the Amazon facility.

Structural Engineering

The scope of work for the structural engineering portion of the project is to provide designs for the Amazon distribution center warehouse, five story IT Hub and office building, and three story civic center. It is to include the location of where the buildings are to be built. The location of the buildings will be coordinated with geotechnical engineers and water resources engineers to provide the best location for the foundation design and on grade slab of the building. As well as the watershed that could cause flooding to the buildings.

The warehouse is to be designed with reinforced concrete step footings that will support the load of the building. Anchors bolts for the columns will be set in the concrete footings. Steel H-beams with base plates will be used for the load bearing column of the buildings. The spacing of the building columns is to utilize and provide the most floor space possible. To roof supports for the building will be that of I beams and joist that will run perpendicular to the beam. The connection joints to be determined depending on shear and moment of the location. The dead, live, and wind loads for the buildings will be calculated using the Load and Resistance Factor Design (LRFD). The live, dead and wind loads that meet the requirements given in the International Building Code. The information will be imputed into STADD pro modeling for all four buildings. To provide output results of the given bending moments, and shear and axial loads. The STADD report is to be utilized for design purposes of the buildings. As the warehouse design, the multistory buildings will also be of steel structure meeting all International Building Code (IBC) guidelines and local ordinances. The building's footing will be dependent on the



geotechnical report and could require pile footing to support the structures. Autocad will be used to provide a detailed design of the building's footing, floor layout, column and beam locations, dimensions of building and building materials that are to be used.

Water Resources

In the water resources portion project the tasks included determining the location of a storm water ditch, the rainfall intensity based on the 100-year rainfall investigation period, calculating the quantity of water and designing the ditch based on the rainfall study. The ditch was assumed to be an unlined trapezoidal channel and was designed by using hydrologic and hydraulic methods. One of The hydrologic methods used was the "Tractive Force based Unlined Channel Design Method " to get the design dimensions for the ditch/channel. One of the first things done was determining the runoff based on the rainfall intensity by using the Rational Method. Next, the Manning's roughness coefficient and the sediment size were determined based on the surrounding land. The slope of the land was then determined. Moving forward the design depth of the was calculated and the value of side slope was assumed. The area and perimeter were then set up as equations where the base was unknown.

After everything that could be determined was calculated, the runoff, Manning's roughness coefficient, area, perimeter, and the slope of the land were all put into an equation to determine the base of the ditch/channel. The design velocity and the Kennedy equation velocity were then calculated. The design velocity would need to be greater than the Kennedy equation velocity in order for the design to be sufficient. If the Kennedy equation velocity was greater, then the design calculations would have to be done again by assuming a different side slope until the design velocity is greater.

Transportation Engineering

The transportation engineering part of this project include the task to design a roadway layout for the entire project site including a connecting road with the nearby highway 290, create an interchange design, design a parking lot for entire facilities, locate signals and related traffic

studies, and provide a plan and profile as well as a pavement design cross section for a typical local road in the development.

Within the roadway layout of the project site there are to be two entrances required into the site. One entrance on the east side and one entrance on the west side of the project site. One entrance must be regulated by a traffic signal in order to direct traffic. The traffic signal setup will be a simple 3 way intersection signal that will help people from the Amazon hub exit the site safely and in a timely manner. Furthermore, within the parking layout there is to be service truck parking for the warehouse that is separate from visiting cars of the office buildings for amazon. The parking for the service trucks are found on the west portion of the project facility near an existing Farm to Market road which will make it efficient for the trucks to come in and out of the facility. In addition, sidewalks will be placed throughout the project site especially around the business offices and convention center. These sidewalks will help connect parking lots to the respective buildings as well as creating an easy path from building to building. Lastly, all roadway designs for this project must meet Texas Department of Traffic (TxDOT) and US DOT requirements and specifications. For all the transportation parts of the project that require design, the software AutoCAD will be used to create and portray these ideas in a professional manner.

Environmental Engineering

In the environmental engineering portion of this project the ~~tasks~~ included calculating the estimated wastewater quantity, determining the location of a wastewater treatment plant, a schematic of the treatment plant, an approach to treat the wastewater, and to choose a reliable dumping location for the disposal of the wastewater. The scope of work for this portion of the project is to be completed in the following semester.

Recommendations

Geotechnical: There are currently no recommendations at this time.

Structural: There are currently no recommendations at this time.

Water Resources: There are currently no recommendations at this time.

Transportation: there are currently no recommendations at this time

Environmental: There are currently no recommendations at this time

Table of Contents

1. **Geotechnical Survey**
2. **Structural Engineering**
3. **Water Resources**
4. **Transportation Engineering**
5. **Environmental Engineering**

X

table of content
must be elaborated

Geotechnical Survey

Introduction

This report is a representation of the subsurface performed for the design and construction of the proposed Amazon Hub in Washington County, Near the city of Brenham, Texas. It is understood that the overall project has been split into four (4) phases, with separate engineers working on each phase, and each phase being constructed within different construction periods. The four phases, and corresponding project periods, are as follows:

Table 1. Project Phasing

Phase	Project Area	Development Period
A	Geotechnical Survey	4 weeks
B	Structural Design	8 weeks
C	Hydrology Design	4 weeks
D	Environmental/Traffic	5 weeks

This investigation was performed for Phase A, which is for the 400-acre segment that is located adjacent to the Interstate-290 and Southwest of the City of Brenham. Information provided by the coursework scope, it is understood that the proposed Amazon Hub will consist of an The specific scope of the project will include Civil Engineering Development and Design services for the entire site which will include two five-story commercial office building, a steel structure warehouse, a three-story convention center, parking lots. The students will also perform new road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility. The facilities will be designed for 20,000 people or based on population projection for 15 years., and road connections to I-290. Phase A project alignment, which will interconnect with the existing drainage systems and interstate roads.

1.1 Existing Site Conditions

The project site encompasses an approximately 400 square foot long area along the southwestern bank of the city of Brenham on the southwest side of the Interstate-290, Texas. Brenham is a city in east-central Texas in Washington County, United States, with a population of 15,716 according to the 2010 U.S. census. It is the county seat of Washington County. The elevation is approximately (341') and the city has an area: 13.03 mi². Brenham is located at 30°9'43"N 96°23'49"W (30.161901, -96.397004). Industrial properties and Blinn Community College facilities are located along the northeast side of the proposed space, and it is presumed that the land is baron and free of residential buildings. Pond Creek sits just southwest of the proposed space in the town of Wesley, Texas.

Design Location (Theory)

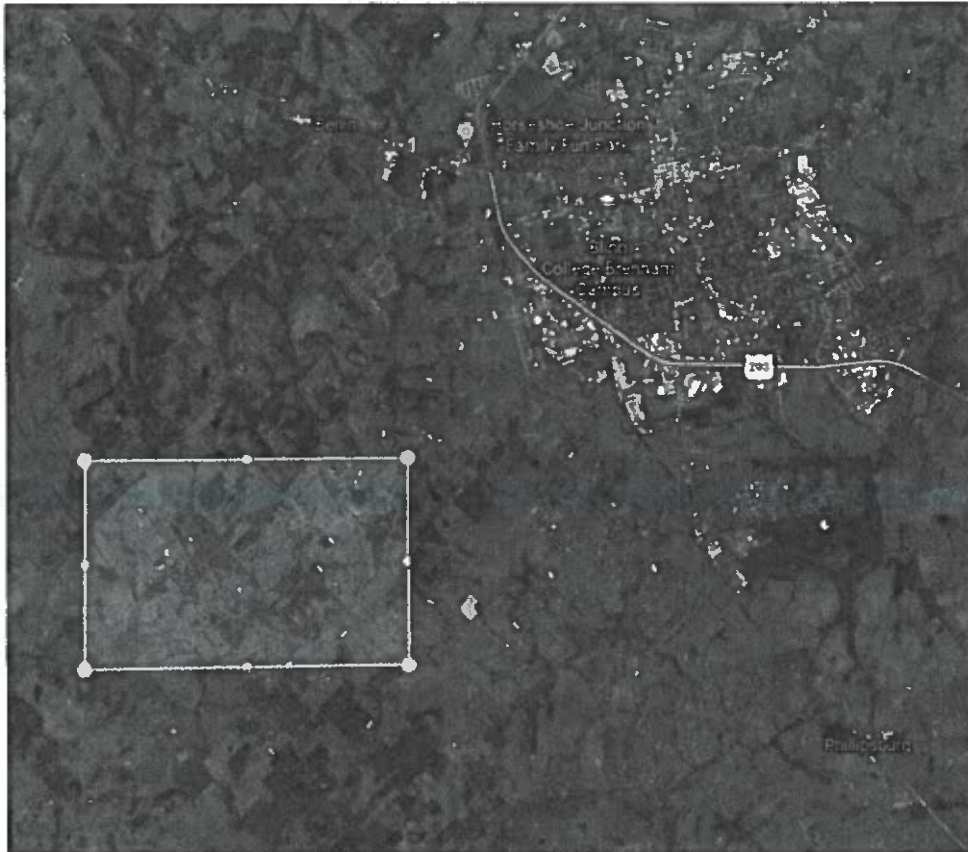


Figure 1: 400 Acre near Brenham (Washington County)

Figure 1: 400 Acre near Brenham (Washington County)

1.2 Site Geology

Washington County is in the Blackland Prairies region of southeast central Texas. The center of the county is at 30°14' north latitude and 96°24' west longitude. Brenham, the seat of government, is near the county's center and seventy-five air miles east of Austin. The county was named for George Washington, the first president of the United States. Washington County encompasses 611 square miles of gently rolling land with elevations ranging between 200 to 500 feet above sea level. Sloping generally southeasterly, the area drains into the Brazos River, which runs along the eastern border. Other prominent streams include New Year's Creek, East Fork Mill Creek, Doe Run Creek, Wolf Creek, and Yegua Creek,

which forms the county's northern border. Soils along the Brazos River are brownish to reddish, cracking and clayey or loamy; in most of the rest of the county, shallow to deep clayey soils cover a bed of chalk. Subterranean water reservoirs include the Catahoula, Oakville, and Lagarto formations. Washington County, located in the post oak belt, is well timbered, and elms, ashes, hackberries, hickories, pecans, cottonwoods, red cedar, mulberry, and other trees grow in its forests. The county's climate is subtropical and humid, with an average annual precipitation of forty inches. Temperatures range from an average low of 39° F in January to an average high of 96° F in July; the growing season lasts 277 days. The principle mineral resources include oil, natural gas, lignite, brick clay, salt and sulphur. The county is linked to the rest of the state by U.S. Highway 290, which crosses east to west, and by the Burlington Northern Santa Fe Railroad, which runs north-south.

The Blackland Prairies region is named for the deep, fertile black soils that characterize the area. Blackland Prairie soils once supported a tallgrass prairie dominated by tall-growing grasses such as big bluestem, little bluestem, indiangrass, and switchgrass. Because of the fertile soils, much of the original prairie has been plowed to produce food and forage crops. The average annual rainfall ranges from 28 to 40 inches. May is the peak rainfall month for the northern end of the region; however, the south-central part has a fairly uniform rainfall distribution throughout the year. Typically, soils are uniformly dark-colored alkaline clays, often referred to as "black gumbo," interspersed with some gray acidic sandy loams. The landscape is gently rolling to nearly level, and elevations range from 300 to 800 feet above sea level. Crop production and cattle ranching are the primary agricultural industries.

2.0 SUBSURFACE INVESTIGATION

On September 1, 2021, a total of two (2) borings, designated as B-1 and B-2, were drilled at the locations illustrated on the boring plan provided in Appendix I and summarized in Table 2 (Appendix III) below. The borings were drilled to a completion depth of 68.0 feet each below the existing ground surface.

The boring locations were determined and field located by G.A.M.S. personnel. During the field reconnaissance, G.A.M.S. personnel documented the existing site conditions. Ground surface elevations at the boring locations were determined using topographic mapping information provided by the United States Soil and Conservation Services (USSCS). The borings were drilled with a drilling machine, utilizing a hollow stem auger to advance the holes. Standard penetration test (SPT) were performed at 6-inch intervals to a depth of 68.0 feet below the ground surface. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). SPT blow counts aid in determining soil properties applicable in foundation system design.

3.0 SUBSURFACE PROFILE

Interpreted engineering logs have been prepared based on the field logs, visual interpretation of samples and chart analysis. Classification follows the current USCS specifications. The following is a summary of what was found in the test borings and what is represented on the boring logs.

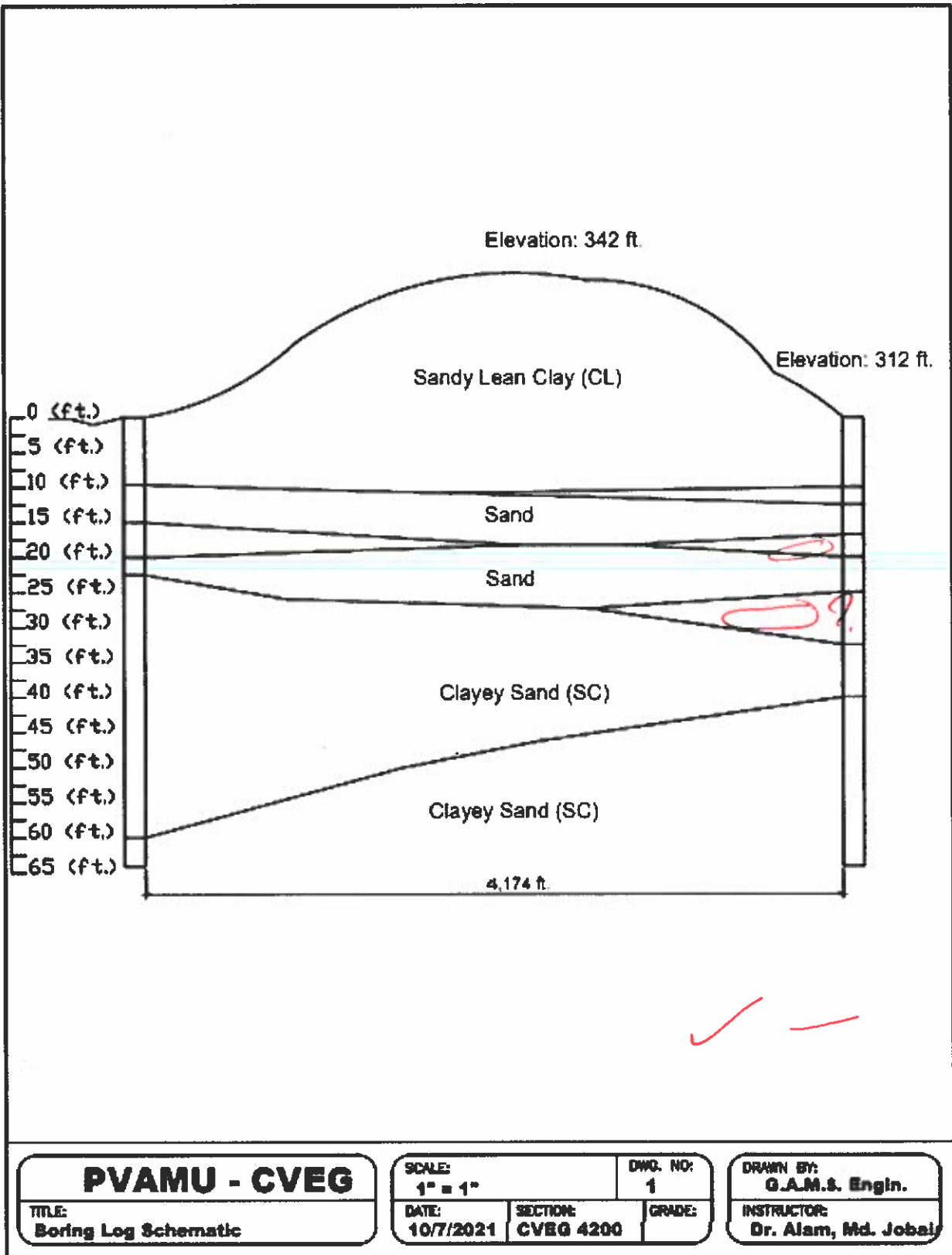
Boring 1										Assume Gravel 0
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
3,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
3,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2										
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

Table 2: Soil Classification Summary

3.1 Subsurface Soils

The below CAD drawing displays the layers of the soil types found in the Boring samples . Bedrock was not encountered for this investigation.



PVAMU - CVEG

TITLE:
Boring Log Schematic

SCALE:
1" = 1"

DATE:
10/7/2021

SECTION:
CVEG 4200

DWG. NO:
1

GRADE:

DRAWN BY:
G.A.M.S. Engin.

INSTRUCTOR:
Dr. Alam, Md. Jobal

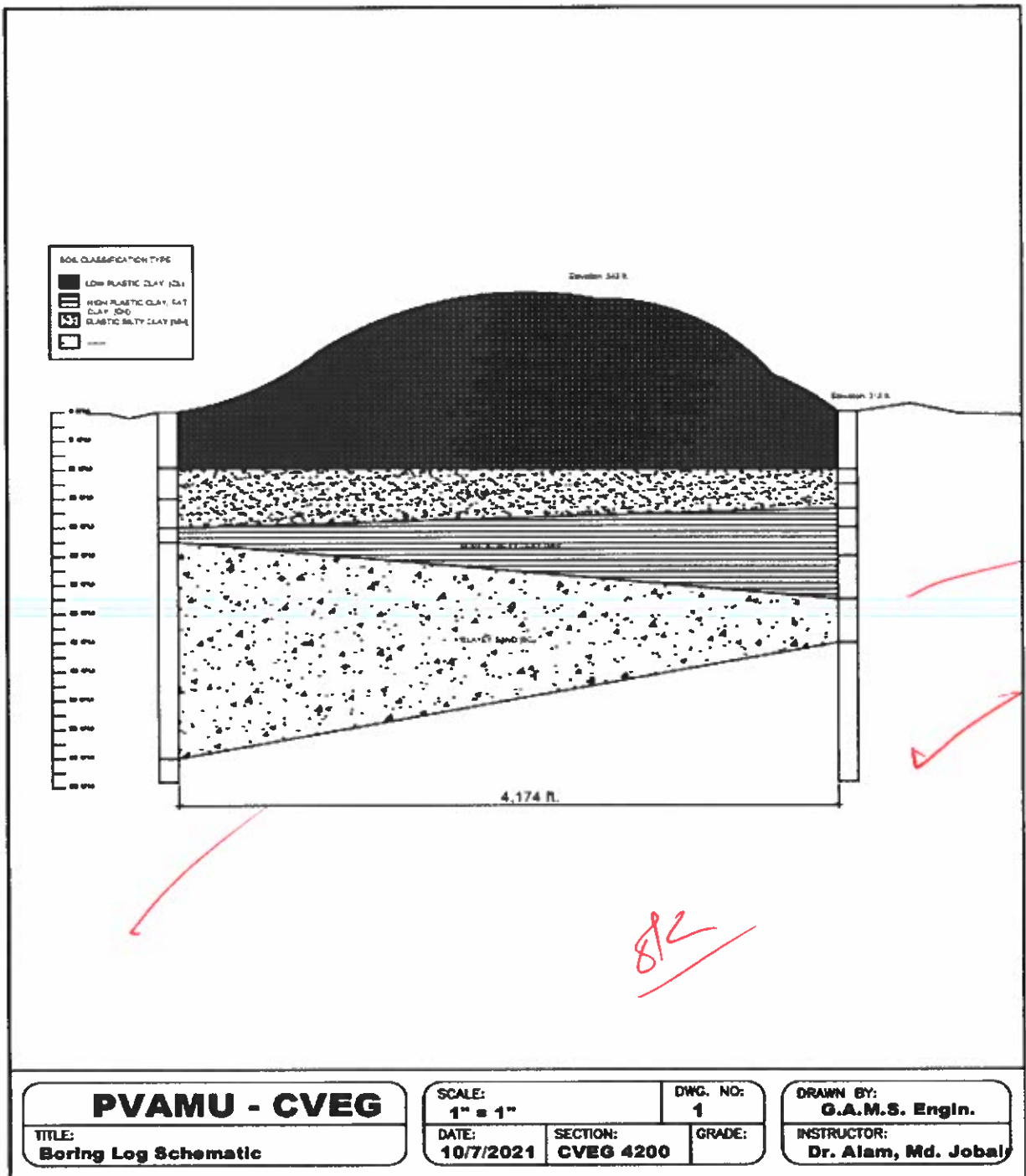


Figure 2. Soil Profile

Note: The Hatch not a clear depiction of the Cad version since not to scale. Some disorientation!

SOIL CLASSIFICATION

TABLE 2.7 AASHTO Soil Classification System

General classification		Granular materials (35% or less of total sample passing No. 200 sieve)					
Group classification	A-1		A-3	A-2			
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (% passing)							
No. 10 sieve	50 max						
No. 40 sieve	30 max	50 max	51 min				
No. 200 sieve	15 max	25 max	10 max	35 max	35 max	35 max	35 max
For fraction passing No. 40 sieve							
Liquid limit (LL)				40 max	41 min	40 max	41 min
Plasticity index (PI)		6 max	Nonplastic	10 max	10 max	11 min	11 min
Usual type of material	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand			
Subgrade rating	Excellent to good						

General classification		Silt-clay materials (More than 35% of total sample passing No. 200 sieve)			
Group classification	A-4		A-5	A-6	A-7
Sieve analysis (% passing)					A-7-5 ^a A-7-6 ^b
No. 10 sieve					
No. 40 sieve					
No. 200 sieve	36 min		36 min	36 min	36 min
For fraction passing No. 40 sieve					
Liquid limit (LL)	40 max		41 min	40 max	41 min
Plasticity index (PI)	10 max		10 max	11 min	11 min
Usual types of material			Mostly silty soil	Mostly clayey soil	
Subgrade rating	Fair to poor				

^aIf $PI \leq LL - 30$, the classification is A-7-5.

^bIf $PI > LL - 30$, the classification is A-7-6.

Table 3: AASHTO Soil Classification

Applying Group index, $GI = (F-35) \times [0.2 + 0.005 \times (LL-40)] + 0.01 \times (F-15) \times (PI-10)$, F IS % OF PASSING #200

3.1 ULTIMATE BEARING CAPACITY SCHEMATIC

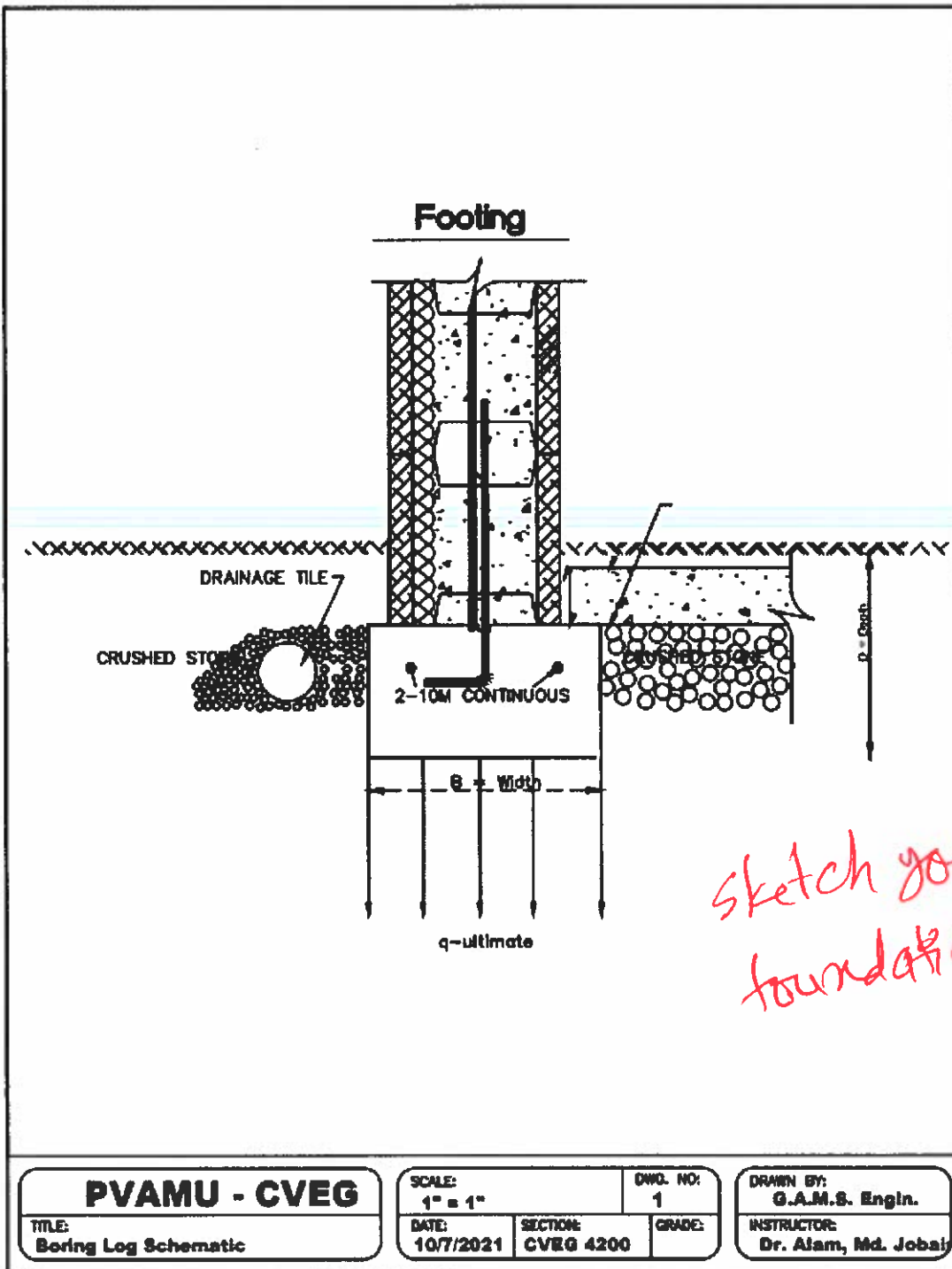
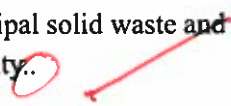


Figure 3. Footing Diagram

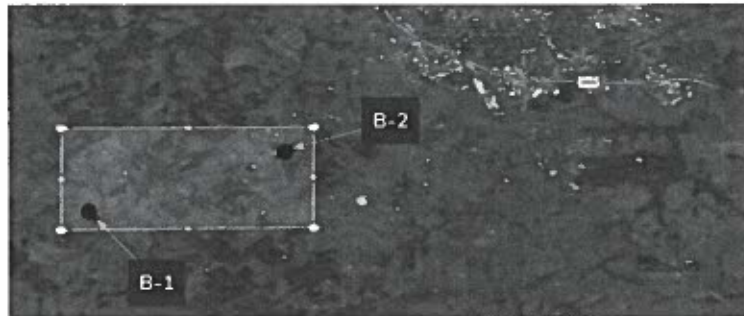
4.0 CONCLUSIONS AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine foundation, structural systems, and pipe support capabilities for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the foundation systems, as well as the construction of the detention basin, the pipe bedding and general earthwork recommendations. Allowable bearing capacity considers the gross loading, which includes weight of foundation concrete for elements placed below the existing ground and the loading from the superstructure. Based on plan information provided by G.A.M.S. Engineering, it is understood that the proposed Amazon hub site will support the two five-story commercial office building, a steel structure warehouse, a three-story convention center, parking lots, road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility..



APPENDIX I

Boring Locations



Topography Map



APPENDIX II

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938
(pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\sum \frac{\text{segments equal to or longer than 4.0 inches}}{\text{Core Run Length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (Nm).

N_{60} = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m * (ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

USCS = Unified Soil Classification System per ASTM D2487

W = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel

SA = % Sand

SI = % Silt

CL = % Clay

Atterberg Limits:

LL = Liquid limit

PL = Plastic limit

PI = Plasticity Index

WC = Water content (%)

$$\tau = c + \sigma_1 \tan(\phi) = 7.5 \text{ kPa} + 25 \text{ kPa} \times \tan(0) = 7.5 \text{ kPa} + 0 = 7.5 \text{ kPa}$$

Thus,

$$\begin{aligned} Q_{ult.} &= \text{Bearing Capacity}(BC) = 1.3 \times c \times N_c + q \times N_q + 0.4 \times \gamma \times B \times N_\gamma \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 + 0.4 \times \gamma \times B \times 0 \text{ (Table 4.2 in Appendix)} \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 \end{aligned}$$

Where, $q = \gamma \times D_f$

The “specific gravity” of soils and soil solids refers to the mass of solids in the soil compared to the mass of water at the same volume. The specific gravity of soil is actually an average of the specific gravity of all included soil particles. In general, the specific gravity tends to fall between 2.65 and 2.80, with coarser soils generally having lower specific gravities than finer soils.

font size is not consistent

A soil’s specific gravity largely depends on the density of the minerals making up the individual soil particles. However, as a general guide, some typical values for specific soil types are as follows:

- The specific gravity of the solid substance of most inorganic soils varies between 2.60 and 2.80.
- Tropical iron-rich laterite, as well as some lateritic soils, usually have a specific gravity of between 2.75 and 3.0 but could be higher.

- Sand particles composed of quartz have a specific gravity ranging from 2.65 to 2.67.
- Inorganic clays generally range from 2.70 to 2.80.
- Soils with large amounts of organic matter or porous particles (such as diatomaceous earth) have specific gravities below 2.60. Some range as low as 2.00.

In solving for the saturated unit clay we apply the below equation taking $w=12\%=0.12$ (at 7.5 feet) where G_s (Specific gravity) = 2.68

Next, we apply the SPT to the dry unit weight relationship to find the Degree of Saturation.

Table 21. Relationship among relative density, penetration resistance, dry unit weight, and angle of internal friction of cohesionless soils (after Duncan and Buchignani, 1976)

Descriptive Relative Density	Relative Density ..	Standard Penetration Resistance N_1 (see Note) *	Static Cone Resistance q_c	Angle of Internal Friction ϕ	Dry Unit Weight
	%	blows/foot	tsf or kgf/cm ²	degrees	KN/m ³
Very Loose	< 15	< 4	< 50	< 30	< 14
Loose	15 - 35	4 - 10	50 - 100	30 - 32	14 - 16
Medium Dense	35 - 65	10 - 30	100 - 150	32 - 35	16 - 18
Dense	65 - 85	30 - 50	150 - 200	35 - 38	18 - 20
Very Dense	85 - 100	> 50	> 200	> 38	> 20

* N_1 = N-value corrected to an effective vertical overburden pressure of 1.0 tsf or 100 kPa

** Freshly deposited, normally consolidated sand

Note: As originally proposed, this correlation used the uncorrected SPT blowcount, N_1 . However, hammers delivering 60% of the theoretical energy have been the most commonly used hammers for SPT tests, and it seems likely that the data on which the correlation was based was obtained primarily from tests with such hammers. It therefore seems logical to use $N_{1,60}$ with this correlation, and it is the recommendation of this report that this be done.

Note: $1 \frac{kN}{ft^3} = 6.366 \frac{lb}{ft^3} \rightarrow 16 \frac{kN}{ft^3} = 101.854 \frac{lb}{ft^3}$

Boring 1						Assume Gravel 0				
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
3,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
3,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2						Assume Gravel 0				
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

$$e \times s = G_s \times w \rightarrow e = \frac{G_s \times w}{s} = \frac{2.68 \times 0.12}{1} = 0.3216$$

Therefore, the saturated unit of clay is given by the below where

$$\gamma_w = 62.4 \frac{lb}{ft^3}$$

$$\gamma_{sat} = \frac{G_s \times +e}{1+e} \times \gamma_w = \frac{2.68+0.3216}{1+0.3216} \times 62.4 \frac{lb}{ft^3} = 141.505 \frac{lb}{ft^3}$$

X too high not possible

Next, we calculate the dry density using the following equation:

$$\gamma_{dry} = \frac{\gamma_{sat}}{w+100} \times 100 \Rightarrow \gamma_{sat} = \frac{\gamma_{dry} \times (w+100)}{100} = \frac{101.854 \frac{lb}{ft^3} \times (13+100)}{100} =$$

$$\gamma_{sat} = 115.095 \frac{lb}{ft^3} \quad \text{and} \quad \gamma_{dry} = 101.854 \frac{lb}{ft^3}$$

where:

γ_{dry} = dry unit weight, in pcf of compacted soil

γ_{sat} = wet unit weight, in pcf of compacted soil

w = percentage of moisture in the specimen

Bearing Capacity Equations (INCOMPLETE)

MEYERHOF EQUATION (Bearing Capacity):

Example: 6.1 Find the allowable, $Q_u = ?$

Approach:

$$\tau = c + \sigma_1 \tan(\phi) = 7.5 \text{ kPa} + 25 \text{ kPa} \times \tan(0) = 7.5 \text{ kPa} + 0 = 7.5 \text{ kPa}$$

Thus,

$$\begin{aligned} Q_{ult.} &= \text{Bearing Capacity}(BC) = 1.3 \times c \times N_c + q \times N_q + 0.4 \times \gamma \times B \times N_\gamma \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 + 0.4 \times \gamma \times B \times 0 \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 \end{aligned}$$

From Table 6.2, for $\phi = 0^\circ$, $N_c = 5.14$, $N_q = 1$, $N_\gamma = 0$

Also, Assuming foundation will be positioned at 7 feet.

$$q(\text{pressure}) = \gamma \times D_f = \gamma_{dry} \times D_f = 115.095 \frac{lb}{ft^3} \times 5 \text{ ft.} = 575.475 \frac{lb}{ft^2} = 27.554 \text{ kPa}$$

By simplification and direct substitution we obtain

$$Q_{ult.} = \text{Bearing Capacity}(BC) = 1.3 \times 7.5 \text{ kPa} \times 5.14 + 27.554 \text{ kPa} \times 1 = 77.669 \text{ kPa} = 1622.151 \frac{lb}{ft^2}$$

Next, $Q_{Allowable}$ is given by the below equation with a given Factor of safety at 3

$$Q_{\text{Allowable}} = \frac{Q_{\text{ult.}}}{F.S.} = \frac{1622.151 \frac{\text{lb}}{\text{ft}^2}}{3} = 540.717 \frac{\text{lb}}{\text{ft}^2} \quad (Q = \text{Load; } q = \text{pressure } B \leq 485 \text{ good. If larger then increase foundation})$$

In order to Solve for B= ??? (Ny=0,)

We know the load applied, Q = (From ARMANDO GOMEZ) = $400 \frac{\text{lb}}{\text{ft}^2}$ (Should be pounds) and Area (Square) = B^2 . The stress developed at the footing base is given by the below where $S = Q_{\text{Allowable}}$

$$S = \frac{Q}{A} = \frac{400 \frac{\text{lb}}{\text{ft}^2}}{B^2} = \frac{400 \frac{\text{lb}}{\text{ft}^2}}{5^2} = 16 \frac{\text{lb}}{\text{ft}^2}$$

(Footing must be greater than Column size- coordinate with structural engineer. Can play with Df value. If the foundation size is greater than required then we are good.)

MATT FOUNDATION DESIGN

Matt Foundations on saturated Clays ($\phi = 0$) and a vertical loading condition ($=0$) the net ultimate bearing capacity

$$\begin{aligned} q_{\text{ult.}} &= c_u \times N_n \times F_m \times F_{cd} \times q \\ &= 5.14 \times C_u \times \left(1 + \frac{0.195 \times B}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q \\ &= 5.14 \times C_u \times \left(1 + \frac{0.195 \times 5}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q \end{aligned}$$

$$q_{\text{allowable net}} = \frac{q}{F.S.} = 1.713 \times C_u \times \left(1 + \frac{0.195 \times B}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q$$

Or, the load-bearing capacity can be obtained based on Standard Penetration Test (SPT) and may be expressed as:

$$q_{\text{allowable net}} \left(\frac{\text{kip}}{\text{ft}^2}\right) = 0.25 \times N_{60} \left[1 + 0.33 \left(\frac{D_f}{B}\right)\right] [S_e(\text{in.})] \leq 0.33 \times N_{60} [S_e(\text{in.})]$$

<http://site.iugaza.edu.ps/ymadhoun/files/2016/09/Chapter-08.pdf>

SOLUTION: Using Meyerhof's Equation (Table 6.4 and Equation 6.19)

$$q_u = C \times N_c \times F_{cs} \times F_{cd} \times F_{ci} + q \times N_q \times F_{qs} \times F_{qd} \times F_{qi} + \frac{1}{2} \times \gamma \times B \times N_\gamma \times F_{\gamma s} \times F_{\gamma d} \times F_{\gamma i}$$

From Table 6.2, for $\phi = 0^\circ$, $N_c = 5.14$, $N_q = 1$, $N_\gamma = 0$

Also, Assuming foundation will be positioned at 7 feet.

$$q = \gamma \times D_f = \gamma_{dry} \times D_f = 144.332 \frac{lb}{ft^3} \times 7 ft. = 1,010.3245 \frac{lb}{ft^2}$$

Next, go to table 6.3 (equation table)

$$F_{cs} = 1 + \frac{B}{L} \times \frac{N_q}{N_c} = 1$$

$$F_{qs} = 1 + \frac{B}{L} \times \tan \phi = 1 + 0 \times \tan \phi = 1$$

$$F_{\gamma s} = 1 - 0.4 \times \frac{B}{L} = 1 - 0.4 \times 0 = 1$$

Table 6.3

$$\frac{D_f}{B} = \frac{1.5}{2} = 0.75 \leq 1$$

$$F_{qd} = 1 + 2 \times \tan \phi' (1 - \sin \phi')^2 \times \frac{D_f}{B} = 1 + 2 \times \tan 26^\circ (1 - \sin 26^\circ)^2 \times 0.75 = 1.23$$

$$F_{cd} = F_{qd} - \frac{1 - F_{qd}}{N_c \times \tan \phi} = 1.23 - \frac{1 - 1.23}{22.5 \times \tan 26^\circ} = 1.25$$

Since $\beta = 0^\circ$, we assumed $F_{ci} = F_{qi} = F_{\gamma i} = 1$

$$q_u = 931.8 \text{ kN/m}^2 \quad \text{and} \quad q_{allowable} = \frac{q_u}{F.S.} = \frac{931.8}{3} = 310.6 \text{ kN/m}^2$$

Next,

$$Q_{Allowable} = q_{allowable} \times \text{Area} = 310.6 \text{ kN/m}^2 \times 2m = 621 \text{ kN/m}$$

$$e = \frac{E_s}{E_c}$$

SETTLEMENT

Given:

$$\gamma_{sat} = 120 \text{ pcf}$$

$$e_o = 1.1173$$

$$\sigma'_c = 1.1 \text{ tcf} \quad \checkmark$$

$$C_c = 0.478 \quad \checkmark$$

$$C_s = 0.041 \quad \checkmark$$

Find:

$$S_c = ?$$

SOLUTION:

$$OCR = \frac{\sigma'_c}{\sigma'_o} \quad \checkmark$$

$$\sigma'_o = 6 \times 118 + 112(120 - 62.4) + 5(120 - 62.4) = 1,687.2 \text{ psf}$$

$$OCR = \frac{1.1 \times 2,000}{1,687.2} = 1.3 > 1 \text{ (Therefore soil is OC)} \quad \checkmark$$

Next, check if a Case 1 or Case 2

$$\sigma'_o + \Delta\sigma$$

$$X = 2, Y = 2$$

$$m = \frac{x}{2} = \frac{2}{17} = 0.118 \quad \checkmark$$

$$n = \frac{y}{2} = \frac{2}{17} = 0.118 \quad \checkmark$$

$$\Delta\sigma = 4 \times l \times q$$

Where

$$q = \frac{Q}{A} = \frac{14}{4 \times 4} = 0.94 \text{ tsf} = 1880 \text{ psf}$$

$$\Delta\sigma = 4 \times l \times q = 4 \times 0.014 \times 1880 = 105.28 \text{ psf}$$

$$\sigma'_o + \Delta\sigma = 1687.2 + 105.28 = 1792.48 \quad \checkmark$$

$$\sigma'_0 = 1.1 \times 2,000 = 2,200 \text{ psf}$$

CASE 2:

$$\sigma'_0 + \Delta\sigma < \sigma'_c$$

CASE 2:

$$S_c = \frac{c_s \times H}{4 \times 4} \times \log \log \left(\frac{\sigma'_0 + \Delta\sigma}{\sigma'_0} \right) = 0.058 \text{ ft} = 0.69 \text{ inches} < 1$$

Since the parameter is met then the soil is good and we are okay!

SHALLOW FOUNDATION DESIGN

DEEP FOUNDATION DESIGN (pg. 463 Ch. 12 Notes 10/20/2021)

$$\text{Total Capacity, } Q_u = Q_p + Q_s$$

Where

$$Q_p = \text{Tip Resistance/End Bearing} = A_p \times N_c \times C_u = 9 \times C_u \times A_p =$$

$$= 9 \times 7.5 \text{ kPa} \times (\text{Base} \times \text{Width})$$

$$= 9 \times 156.6407570477925 \text{ psf} \times (\text{Base} \times \text{Width})$$

$$= 9 \times 156.6407570477925 \text{ psf} \times (\text{Base} \times \text{Width})$$

$$Q_s = f \times P \times \Delta L = \alpha \times (2 \times \text{Base} + 2 \times \text{width}) \times L =$$

$$= f \times P \times \Delta L = \alpha \times C_u \times (2 \times \text{Base} + 2 \times \text{width}) \times L =$$

Note: 1 kilopascal = 20.88543423315 pounds per square foot

$$\gamma_1 - 0.4 \times \frac{B}{L} = 1 - 0.4 \times 0 = 1 \rightarrow \rightarrow$$

CAPACITY CURVES

need revision

Table 1a: Boring 1 Analysis for Circular Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	6361.725204	2544.690082	8906.415286
7.5	9542.587807	12087.27789	21629.86569
9	0	12087.27789	12087.27789
15	14137.16712	35177.98419	49315.15131
20	0	35177.98419	35177.98419
30	24033.18411	96062.05059	120095.2347
40	36756.63451	207148.7682	243905.4027
50	49480.08492	394073.5335	443553.6184
60	56548.66848	650427.4973	706976.1658
68	74220.12738	1031754.018	1105974.146

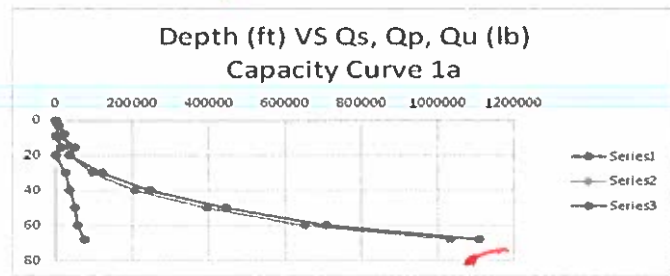
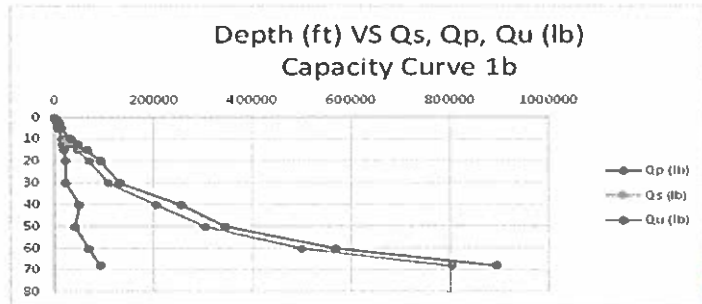


Table 1b: Boring 1 Analysis for Square Section Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	7068.58356	1675	8743.58356
5	9083.129875	5594.25	14677.37988
10	15197.45465	15914.25	31111.70465
12.5	16081.0276	29279.875	45360.9026
15	18873.11811	45700.375	64573.49311
20	22619.46739	70660.375	93279.84239
30	22619.46739	108100.375	130719.8424
40	50186.94328	204660.375	254847.3183
50	40997.78465	303260.375	344258.1597
60	67858.40218	499100.375	566958.7772
68	92598.44464	801972.375	894570.8196



distorted table. put figures in different pages.

Table 2a. Boring 1 Analysis for Circular Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	7,069	1675	8,743.58
5	9,083	5594.25	14,677.38
10	15,197	15,914.25	31,112
12.5	16,081	29,279.88	45,360.90
15	18,873	45,700.38	64,573.49
20	22,619.47	70,660.38	93,279.84
30	22619.46739	108100.375	130719.8424
40	50,187	204660.375	254,847.32
50	40,998	303260.375	344,258.16
60	67,858	499100.375	566,958.78
68	92598.44464	801972.375	894570.8196

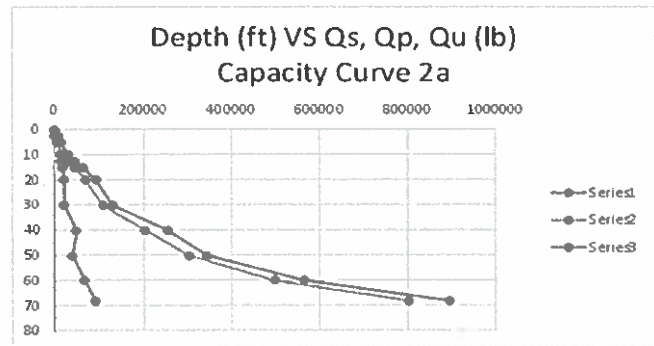
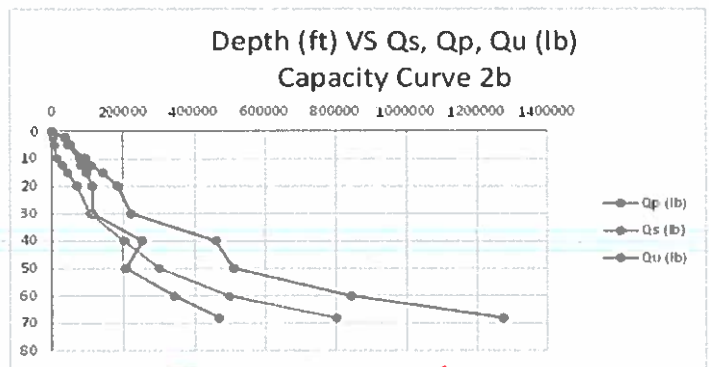


Table 2b. Boring 1 Analysis for Square Section Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	36,000	1675	37,675.00
5	46,260	5594.25	51,854.25
10	77,400	15,914.25	93,314
12.5	81,900	29,279.88	111,179.88
15	96,120	45,700.38	141,820.38
20	115,200.00	70,660.38	185,860.38
30	115200	108100.375	223300.375
40	255,600	204660.375	460,260.38
50	208,800	303260.375	512,060.38
60	345,600	499100.375	844,700.38
68	471,600	801972.375	1,273,572.38



capacity curve
need revision

GEOTECHNICAL APPENDIX

APPENDIX III

BORING LOG DATA



CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG																																																																																																																																																																																																																		
PROJECT ID: CVEG 4200					TEST HOLE # <u>1</u>					SHEET NUMBER <u>1</u> of <u>1</u>																																																																																																																																																																																																																		
PROJECT: Business Center for Amazon					LOCATION: South Texas					DATE STARTED																																																																																																																																																																																																																		
CLIENT: AMAZON					CLIENT: <u>AMZN</u>					DATE FINISHED																																																																																																																																																																																																																		
					CONTACT: Dr. Alan					DRILLER																																																																																																																																																																																																																		
										LOGGER																																																																																																																																																																																																																		
										REVIEWED BY																																																																																																																																																																																																																		
DRILL LOG: <u>CME 75</u>					TEST HOLE DIAMETER (IN) <u>8</u>					GROUND WATER DATA:																																																																																																																																																																																																																		
DRILLING METHOD: <u>Hollow 34</u>					TOTAL DEPTH (ft) <u>70</u>					DATE: <u>8/26/11</u>																																																																																																																																																																																																																		
CASING										TIME: <u>7-5</u>																																																																																																																																																																																																																		
<table border="1"> <thead> <tr> <th rowspan="2">DEPTH (FEET)</th> <th colspan="3">STANDARD PENETRATION</th> <th colspan="3">T-MDOT CONE</th> <th rowspan="2">RECOVERY (IN)</th> <th rowspan="2">NO. IN</th> <th rowspan="2">HAND PEN</th> <th colspan="4">SOIL DESCRIPTION</th> </tr> <tr> <th>0-4</th> <th>4-8</th> <th>8-12</th> <th>Blow</th> <th>PCU</th> <th>Blow</th> <th>PCU</th> <th>Gravel</th> <th>Sand</th> <th>Silt</th> <th>Clay</th> </tr> </thead> <tbody> <tr> <td>2.5'</td> <td>3</td> <td>3</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>12</td> <td>PL</td> <td>-200</td> <td>MC</td> </tr> <tr> <td>5</td> <td>3</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>13</td> <td>16</td> <td>71%</td> <td>14%</td> </tr> <tr> <td>7.5'</td> <td>3</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>47</td> <td>19</td> <td>81%</td> <td>12%</td> </tr> <tr> <td>8.5'</td> <td>3</td> <td>7</td> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>51</td> <td>21</td> <td>69%</td> <td>13%</td> </tr> <tr> <td>10</td> <td>8</td> <td>10</td> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>16%</td> <td>3%</td> </tr> <tr> <td>15</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>62</td> <td>30</td> <td>80%</td> <td>15%</td> </tr> <tr> <td>20</td> <td>9</td> <td>12</td> <td>13</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>62</td> <td>27</td> <td>79</td> <td>13%</td> </tr> <tr> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>69</td> <td>28</td> <td>83</td> <td>17%</td> </tr> <tr> <td>30</td> <td>11</td> <td>18</td> <td>21</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>71</td> <td>33</td> <td>72</td> <td>18%</td> </tr> <tr> <td>35</td> <td>13</td> <td>22</td> <td>24</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>69</td> <td>34</td> <td>70</td> <td>19%</td> </tr> <tr> <td>40</td> <td>14</td> <td>26</td> <td>34</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>45</td> <td>18</td> <td>34</td> <td>42</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>48'</td> <td colspan="3">18 34 42 - 2"</td> <td colspan="10">Bedrock</td> </tr> </tbody> </table>														DEPTH (FEET)	STANDARD PENETRATION			T-MDOT CONE			RECOVERY (IN)	NO. IN	HAND PEN	SOIL DESCRIPTION				0-4	4-8	8-12	Blow	PCU	Blow	PCU	Gravel	Sand	Silt	Clay	2.5'	3	3	4							12	PL	-200	MC	5	3	5	5							13	16	71%	14%	7.5'	3	5	5							47	19	81%	12%	8.5'	3	7	8							51	21	69%	13%	10	8	10	10									16%	3%	15										62	30	80%	15%	20	9	12	13							62	27	79	13%	25										69	28	83	17%	30	11	18	21							71	33	72	18%	35	13	22	24							69	34	70	19%	40	14	26	34											45	18	34	42											48'	18 34 42 - 2"			Bedrock									
DEPTH (FEET)	STANDARD PENETRATION			T-MDOT CONE			RECOVERY (IN)	NO. IN	HAND PEN	SOIL DESCRIPTION																																																																																																																																																																																																																		
	0-4	4-8	8-12	Blow	PCU	Blow				PCU	Gravel	Sand	Silt	Clay																																																																																																																																																																																																														
2.5'	3	3	4							12	PL	-200	MC																																																																																																																																																																																																															
5	3	5	5							13	16	71%	14%																																																																																																																																																																																																															
7.5'	3	5	5							47	19	81%	12%																																																																																																																																																																																																															
8.5'	3	7	8							51	21	69%	13%																																																																																																																																																																																																															
10	8	10	10									16%	3%																																																																																																																																																																																																															
15										62	30	80%	15%																																																																																																																																																																																																															
20	9	12	13							62	27	79	13%																																																																																																																																																																																																															
25										69	28	83	17%																																																																																																																																																																																																															
30	11	18	21							71	33	72	18%																																																																																																																																																																																																															
35	13	22	24							69	34	70	19%																																																																																																																																																																																																															
40	14	26	34																																																																																																																																																																																																																									
45	18	34	42																																																																																																																																																																																																																									
48'	18 34 42 - 2"			Bedrock																																																																																																																																																																																																																								

caption?

CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG					
PROJECT ID: CVEG 4200					TEST HOLE #2					SHEET NUMBER 1 of 1					
PROJECT: Business Center for Amazon					LOCATION: South Texas					DATE STARTED					
CLIENT: AMAZON					CLIENT: AMAZON					DATE FINISHED					
					CONTACT: Dr. Alan					DRILLER					
										LOGGER					
										REVIEWED BY					
DRILL RIG: CME-75					TEST HOLE DIAMETER (in): 8"					GROUND WATER DATA:					
DRILLING METHOD: HSA					TOTAL DEPTH (ft): 70'					DATE: 8/26					
										TIME: 7:5					
										WATER DEPTH (ft):					
										REMARKS:					
DEPTH (FEET)	SAMPLE	STANDARD PENETRATION			T-DOOT CONE				RECOVERY (%)	ROD (ft)	HAND PEN	SOIL DESCRIPTION			
		4"	8"	12"	Tip	Sleeve	Friction	1"				2"	3"	4"	
5	4	4	4	4								48	20	59	13
10	5	6	5	5								61	32	69	14%
15	6	8	5	5											8%
15-18	8	8	9									46	31	74	18%
20	10	10	10												10%
25	12	12	12									32	16	59	13%
30												60	31	81%	21%
35	10	12	12									71	31	82%	20%
40	13	24	28									68	39	62%	4%
45															
50	16	20	22									80	39	69%	18%
55															
60	14	31	36									68	34	84%	20%
65															
68	13	48	50	6-3"											
70															
75															
80															
85															
90															
95															
100															

Boring Log Classification

Boring 1					Assume Gravel 0					
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
8,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
8,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2										
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

Table No?
Title.

TABLE 2.3 Relationships for γ , γ_d , and γ_{sat}

Unit weight relationship	Dry unit weight	Saturated unit weight
$\gamma = \frac{(1+w)G_s\gamma_w}{1+e}$	$\gamma_d = \frac{\gamma}{1+w}$	$\gamma_{sat} = \frac{(G_s+e)\gamma_w}{1+e}$
$\gamma = \frac{(G_s+Se)\gamma_w}{1+e}$	$\gamma_d = \frac{G_s\gamma_w}{1+e}$	$\gamma_{sat} = [(1-n)G_s+n]\gamma_w$
$\gamma = \frac{(1+w)G_s\gamma_w}{1+\frac{wG_s}{S}}$	$\gamma_d = G_s\gamma_w(1-n)$	$\gamma_{sat} = \left(\frac{1+w}{1+wG_s}\right)G_s\gamma_w$
$\gamma = G_s\gamma_w(1-n)(1+w)$	$\gamma_d = \frac{G_s}{1+\frac{wG_s}{S}}\gamma_w$	$\gamma_{sat} = \left(\frac{e}{w}\right)\left(\frac{1+w}{1+e}\right)\gamma_w$
	$\gamma_d = \frac{eS\gamma_w}{(1+e)w}$	$\gamma_{sat} = \gamma_d + n\gamma_w$
	$\gamma_d = \gamma_{sat} - n\gamma_w$	$\gamma_{sat} = \gamma_d + \left(\frac{e}{1+e}\right)\gamma_w$
	$\gamma_d = \gamma_{sat} - \left(\frac{e}{1+e}\right)\gamma_w$	

TABLE 2.4 Specific Gravities of Some Soil

Type of soil	G_s
Quartz sand	2.64–2.66
Silt	2.67–2.73
Clay	2.70–2.90
Chalk	2.60–2.75
Loess	2.65–2.73
Peat	1.30–1.90
Mine tailings	2.80–4.50

these things go to
appendix

Table 4.2 Bearing Capacity Factors

ϕ'	N_c	N_q	N_γ	ϕ'	N_c	N_q	N_γ
0	5.14	1.00	0.00	16	11.63	4.34	3.06
1	5.38	1.09	0.07	17	12.34	4.77	3.53
2	5.63	1.20	0.15	18	13.10	5.26	4.07
3	5.90	1.31	0.24	19	13.93	5.80	4.68
4	6.19	1.43	0.34	20	14.83	6.40	5.39
5	6.49	1.57	0.45	21	15.82	7.07	6.20
6	6.81	1.72	0.57	22	16.88	7.82	7.13
7	7.16	1.88	0.71	23	18.05	8.66	8.20
8	7.53	2.06	0.86	24	19.32	9.60	9.44
9	7.92	2.25	1.03	25	20.72	10.66	10.88
10	8.35	2.47	1.22	26	22.25	11.85	12.54
11	8.80	2.71	1.44	27	23.94	13.20	14.47
12	9.28	2.97	1.69	28	25.80	14.72	16.72
13	9.81	3.26	1.97	29	27.86	16.44	19.34
14	10.37	3.59	2.29	30	30.14	18.40	22.40
15	10.98	3.94	2.65	31	32.67	20.63	25.99

(continued)

Table 4: Bearing Capacity Factors

Structural Engineering

Introduction

The structural design is part of phase B of the project. The Amazon Hub in Washington County encompasses the structural design of two five-story commercial office buildings, a single-story steel Amazon warehouse, and a three-story convention center building. The Amazon distribution center will be a single story warehouse with a total gross area of one million square feet. Its design requirements are that of a single story with a steel frame. One of the five-story commercial buildings will be utilized as office space for Amazon. The second five-story building is to be designed as an IT Hub. The last building will be a convention center and will be three stories steel structure design.

Building Geometry and Utilization

The initial step taken in the structural design process is to have a good understanding of what the structure is to be utilized and its geometric design. The Amazon warehouse is to be the central hub for distribution. Is to be rectangular to be able to accommodate large space for storage that will be utilized as a distribution center. The length of the building is to be 2000ft lby 500ft for a total of 1M square feet facility. The floor layout then would require large open spacing for use storage and for equipment machinery to move around freely. Minimizing then the amount of columns supporting the structure would utilize the floor layout to its fullest potential and storage space. As standard storage racks are 48in in depth. The average height of the racks are 20-28ft. The rack heights need to be taken into account as to have plenty of ceiling space for the rack heights for storing the packages that would later be transported to their final destination.

The Amazon five-story buildings for the IT hub and office space have a different set of requirements that would need to be taken into account in its design. The buildings are to twins of each other as they will both be identail in design of each other. Its rectangular design is to

provide ample work space. The dimensions are to be 300ft by 200ft for a total of 60,000ft² per floor having a total floor space of 300,000ft² per building. Utilizing spacing between the columns for optimal office and IT space.

The convention center design will be required to follow standards for its design. As this building will be a mixed use facility and would need to adhere to them. The building will be that of a three-story building with the dimension of 500ft by 300ft for a total of 150,000ft² per floor and a building total of 450,000ft². This building will also utilize columns optimal spacing to achieve the most spacing for the convention center to utilize for occupancy and accommodate large open spaces for convention center events

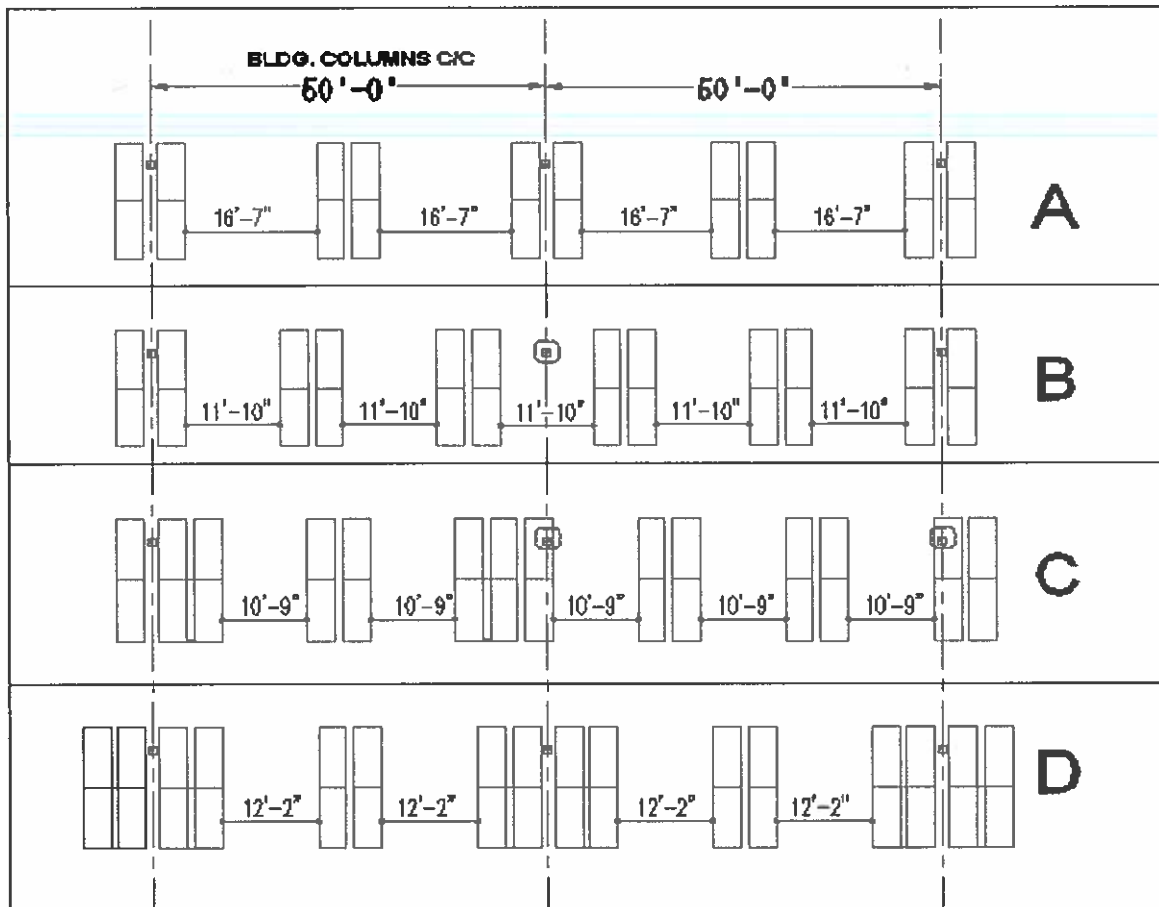


Figure 01: 50ft Column Spacing to maximize storage bays

Loading and standards

It is important when designing the building that all loads are considered so the building can withstand them. The loads that are applied are broken down into dead loads, live loads, and environmental loads (wind loads, snow loads, etc.). This is an important part of the design phase as to be able to anticipate the loads the structures would endure. Depending on the building use different sets of guidelines would be followed in order to accommodate its use as the environmental loads depending on its location. As in some areas are more prone to different weather patterns that need to be taken into consideration during the design stage.

Dead loads

Dead Loads consist of the permanent loads that are affixed to the structure itself. These include the self-weight of the structure, architectural features, fixed service equipment such as heating and air-conditioning systems, sprinkler systems, and utility services. (Williams).

Live loads Live loads are defined in ASCE 7 Sec. 4.1 as loading on a floor produced by the occupancy or use of the building that does not include construction loads, dead loads, or environmental loads. (Williams)

Wind Loads

Wind loads are loads that impact the exterior of the building produced by the wind. The wind exerts forces that can tear roofs from buildings. The building's roof overhang can have air build up a force and cause an uplift. There are three types of wind forces: uplift load, shear load and lateral load.

Load and Resistance Factor design (LRFD)

For the design of the buildings the use of the LRFD will be used to provide the load calculation of the buildings.

Load Types

Loads used in design load equations are given letters by type:

D = dead load

L = live load

L_r = live roof load

W = wind load

S = snow load

E = earthquake load

R = rainwater load or ice water load

T = effect of material & temperature

H = hydraulic loads from soil

F = hydraulic loads from fluids

ASCE-7 (2010) combinations of factored nominal loads:

1. $1.4D$
2. $1.2D + 1.6L + 0.5(L, \text{ or } S \text{ or } R)$
3. $1.2D + 1.6(L, \text{ or } S \text{ or } R) + (L \text{ or } 0.5W)$
4. $1.2D + 1.0W + L + 0.5(L, \text{ or } S \text{ or } R)$
5. $1.2D + 1.0E + L + 0.2S$
6. $0.9D + 1.0W$
7. $0.9D + 1.0E$

When *F* loads are present, they shall be included with the same load factor as dead load *D* in 1 through 5 and 7.

When *H* loads are present, they shall have a load factor of 1.6 when adding to load effect, or 0.9 when resisting the load when permanent.

Figure 01: ASCE-7 Combination of factored nominal loads

Occupancy or Use		Uniform (psf)	Concentrated (lbs)
Access Floor Systems	Office Use	50	2000
	Computer Use	100	2000
Roof	Roof Area not intended for occupancy	20	---
	Roof area used for other occupancy	Same as occupancy served	---
	Primary Roof Members Exposed to a work floor		

Roof	Single panel point of lower chord of roof trusses of any point along primary structural member supporting roofs over manufacturing, storage warehouse, and repair garages	---	2000
	All other Primary Roof Members	---	300
Storage Warehouse (Shall be designed for heavier loads if required for anticipated storage)	Heavy	250	---
	Light	150	---

Figure 03: Table 1607.1 Minimum Uniformly Distributed Live Loads

Building Layout

The building's floor plan was critical in the design process of the building. This is dependent on the use of each individual building. Designation of beam sizes and types is subject to change once it has been run through STAAD Pro its output.

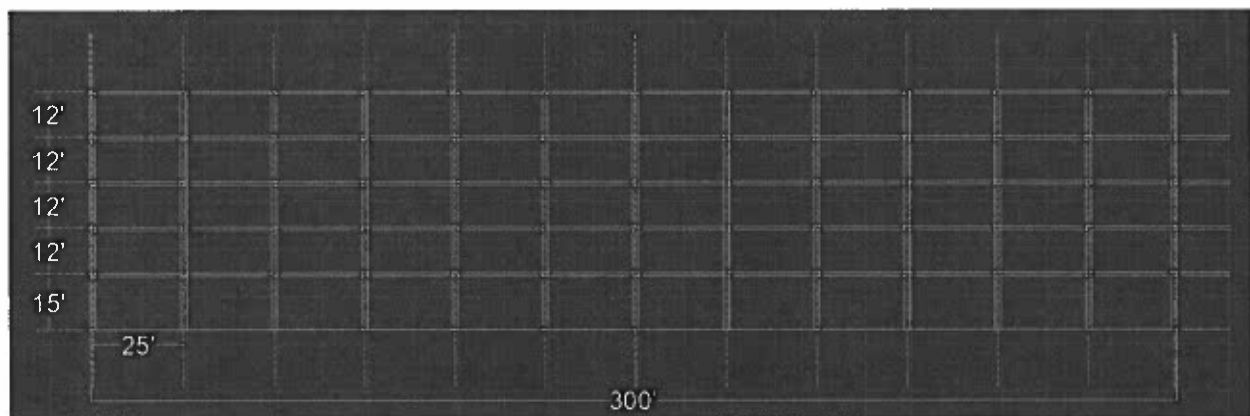


Figure 04: IT Hub and office space building side view

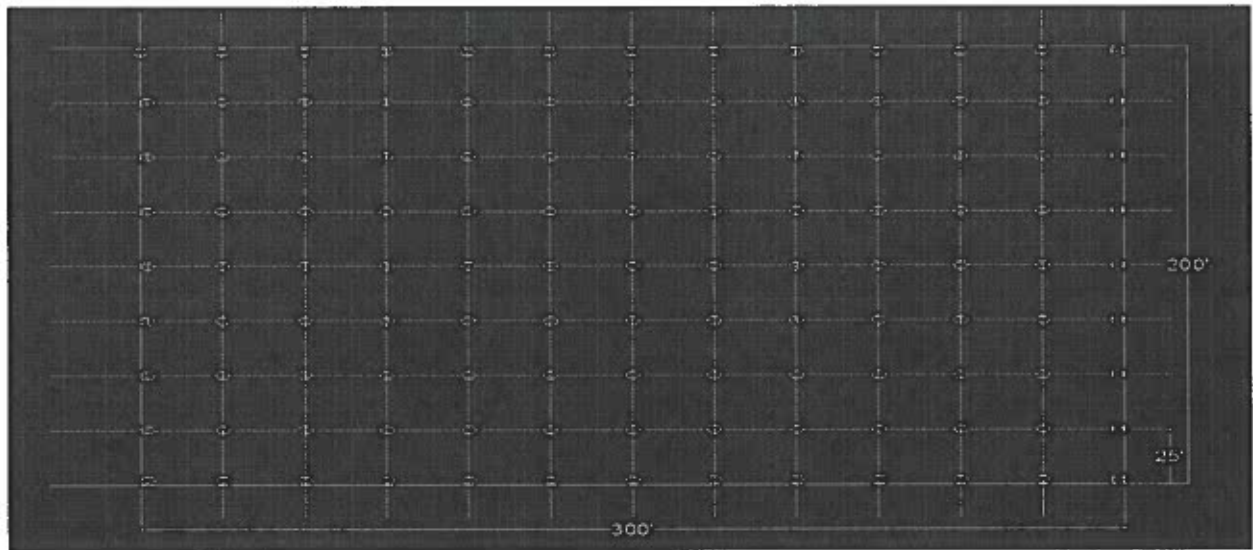


Figure 05: IT Hub and office space building top view of a typical floor

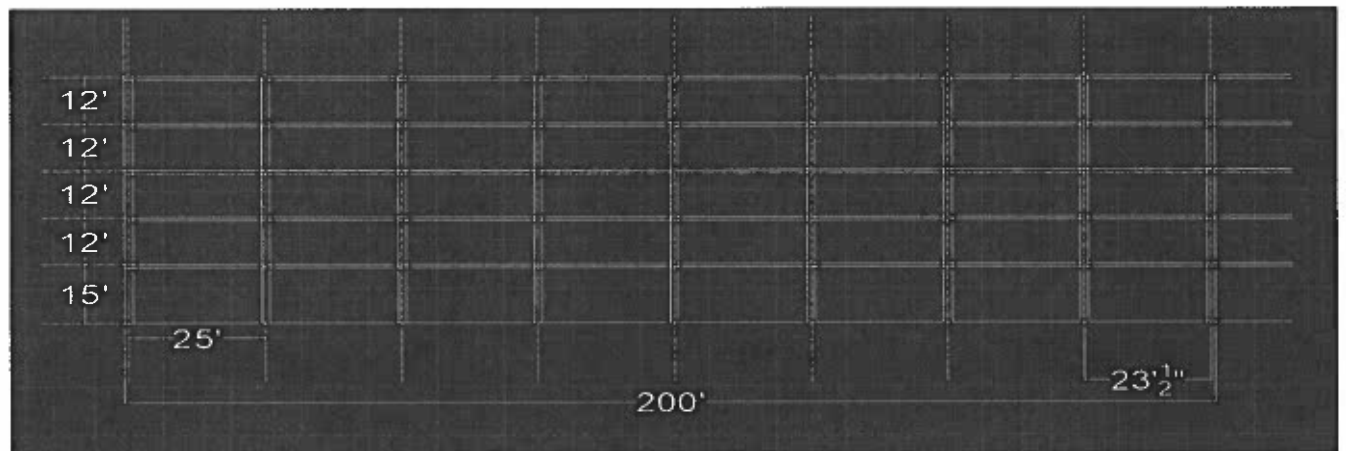


Figure 06: IT Hub and office space building view of front of building

check with structural faculty.

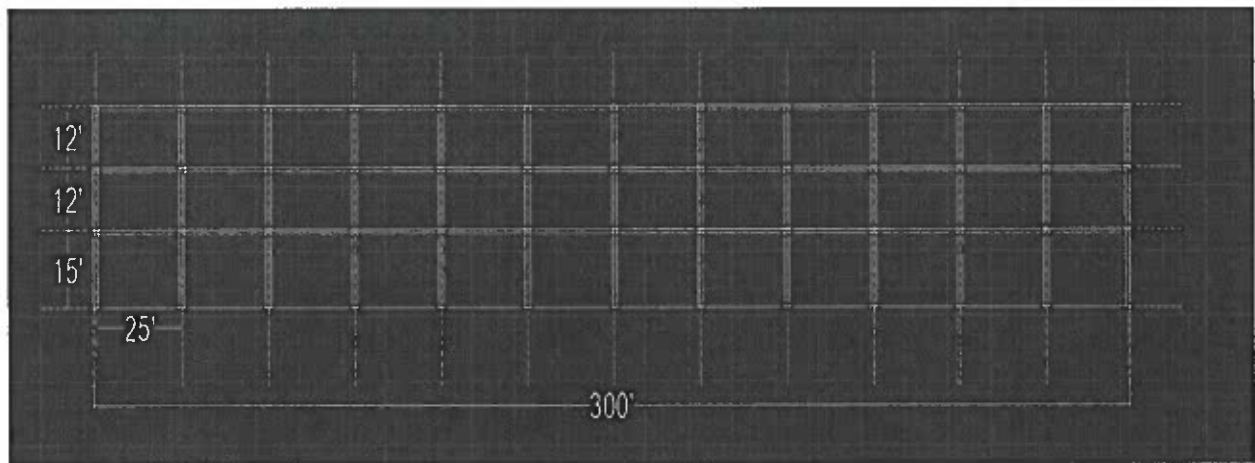


Figure 07: Convention Center front view of the building

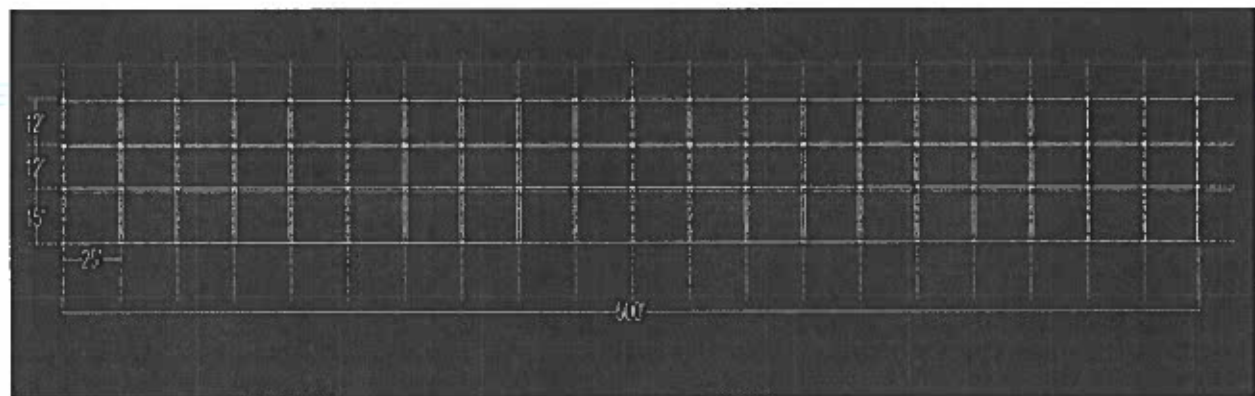


Figure 08: Convention Center side view of building

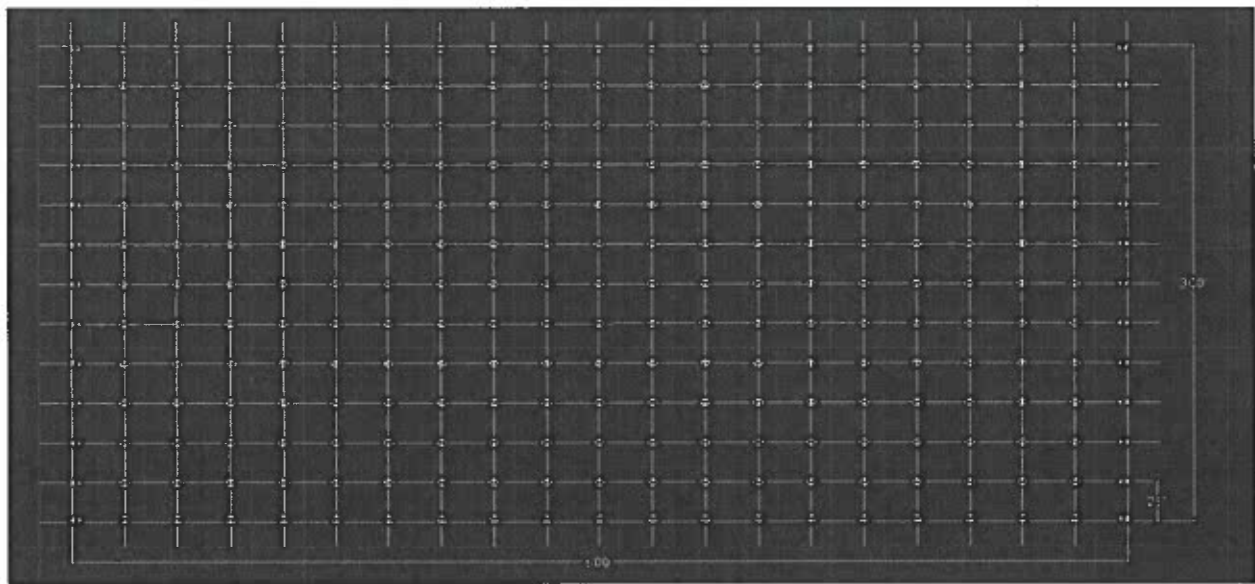


Figure 08: Convention Center top view of a typical floor

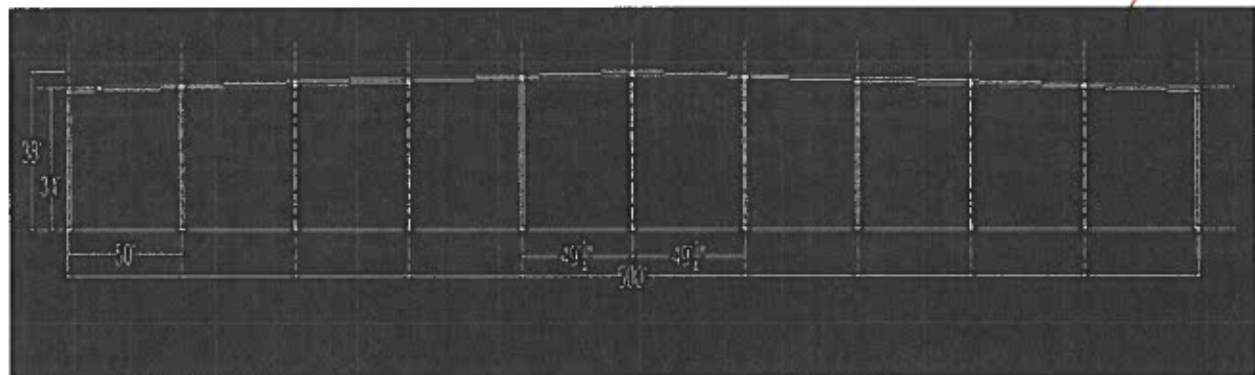


Figure 09: Amazon warehouse front view

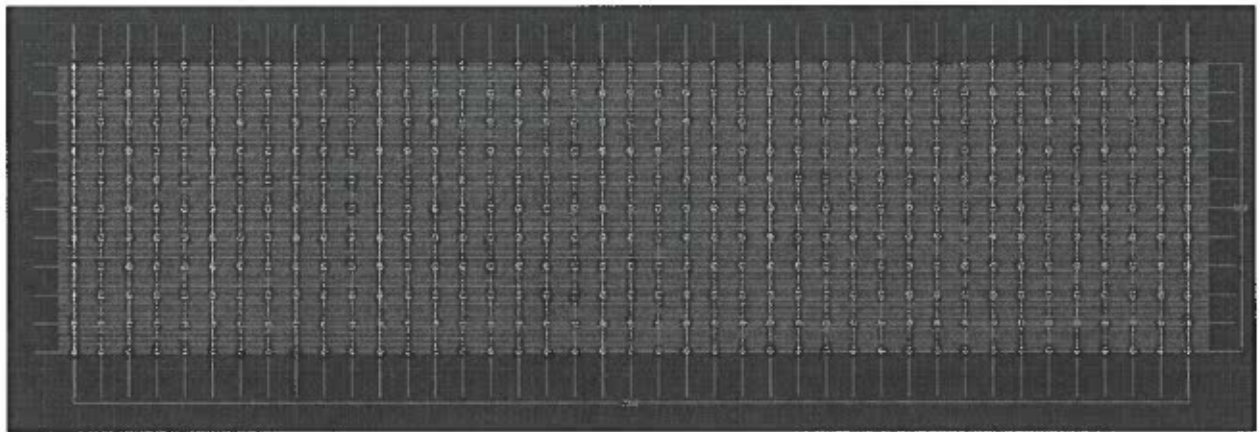


Figure 10: Amazon warehouse top view

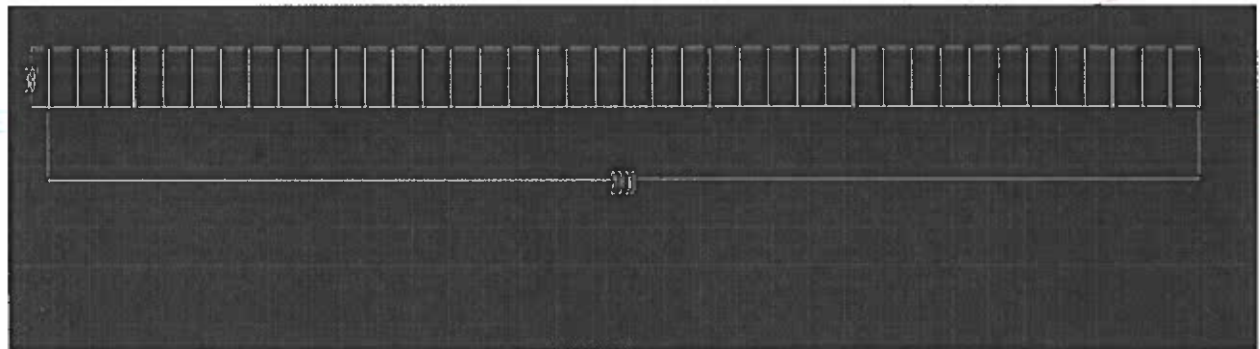


Figure 11: Amazon Warehouse side view of building

Joist Beam

The design of the joist is to provide additional lateral support of the roof load and any additional equipment that will be suspended on the ceiling. The joist will run perpendicular to beams that are spaced 50ft apart. They will run parallel to the long side of the warehouse denoted by Figure 04 joist evenly spaced 5ft from beam to joist center. Using the roof live load given to calculate the beam size to be used. The dead load would be the weight of the beam would be given in lb/ft on Table 1.1 from the Steel Manual on Figure 04 & 05.

When

W = Weight

DL = 15 lb/ft (W8x15)

LL_R = 2000 lbs => (2000 lbs) / (50ft) = 40lbs/ft => (40lbs/ft) / (5ft) = 8psf

$$W = D_L + L_L$$

$$W = 15\text{lbs/ft} + 40\text{ lbs/ft}$$

$$W = 55\text{ lbs/ft}$$

Now we will need to calculate the maximum shear and bending moment to see if the beam chosen would work for this application. Using Table 3-23 from Figure 06 from the steel manual.

When

$$V_{\text{Max}} = WL/2$$

$$V_{\text{Max}} = (55\text{ lbs/ft} * 50\text{ft}) / 2$$

$$V_{\text{Max}} = 1,375\text{ lbs/ft} => 1.38\text{ kip/ft}$$

$$M_{\text{Max}} = WL^2 / 8$$

$$M_{\text{Max}} = (55\text{lb/ft} * 50^2\text{ft}) / 8$$

$$M_{\text{Max}} = 17,187.5\text{ lbs} * \text{ft} => 17.19\text{ kips*ft}$$

Check Answers:

$$V_{\text{Max}} < \phi_V V_{nx}$$

1.38 kips < 59.6 Shear is Okay

$$M_{\text{Max}} < \phi_b M_n$$

17.19 kips*ft < 21.5 kips*ft Bending Moment is Okay

The results of the moment and shear provide that the beam for the joist would work to support the roof structure of the warehouse. All the following calculations will be done through Staad Pro as there is the number of calculations that would be provided through the report.

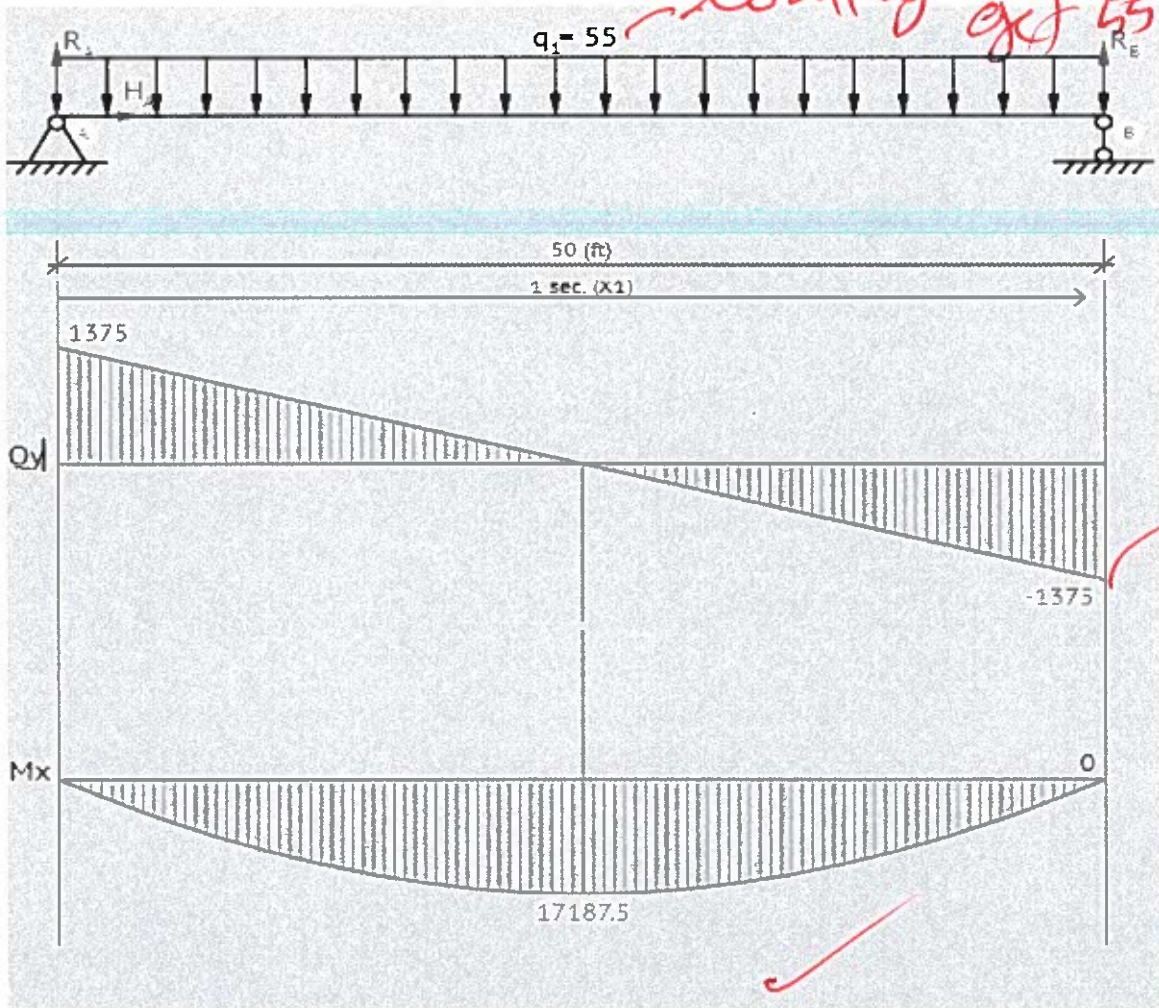


Figure 12: Shear and bending moment of joist

Table 1-1 (continued)
W-Shapes
Dimensions

Shape	Area, A	Depth, d	Web		Flange		Distances					Work- able Gage			
			Thickness, t _w	$\frac{L}{2}$	Width, b _f	Thickness, t _f	k		k ₁	T					
							k _{des}	k _{net}							
	in. ²	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.				
WB-67	19.7	9.00	9	0.570	8 1/4	5/16	8.28	8 1/4	0.935	1 1/8	1.33	1 1/8	15/16	5 3/4	5 1/2
x58	17.1	8.75	8 3/4	0.510	1/2	1/4	8.22	8 1/4	0.810	1 1/8	1.20	1 1/2	7/8	↓	↓
x48	14.1	8.50	8 1/2	0.400	3/8	3/16	8.11	8 1/8	0.685	1 1/8	1.08	1 3/8	13/16	↓	↓
x40	11.7	8.25	8 1/4	0.380	3/8	3/16	8.07	8 1/8	0.580	9/16	0.954	1 1/4	13/16	↓	↓
x35	10.3	8.12	8 1/8	0.310	5/16	3/16	8.02	8	0.495	1/2	0.889	1 1/8	13/16	↓	↓
x31 ¹	9.13	8.00	8	0.285	5/16	3/16	8.00	8	0.435	7/16	0.829	1 1/4	1 1/4	↓	↓
WB-28	8.25	8.08	8	0.285	5/16	3/16	6.54	6 1/2	0.465	7/16	0.859	1 5/16	5/8	6 1/4	4
x24	7.08	7.83	7 7/8	0.245	1/4	1/8	6.50	6 1/2	0.400	3/8	0.794	7/8	9/16	6 1/4	4
WB-21	6.16	8.28	8 1/4	0.250	1/4	1/8	5.27	5 1/4	0.400	3/8	0.700	7/8	9/16	6 1/2	2 3/4
x18	5.26	8.14	8 1/8	0.230	1/4	1/8	5.25	5 1/4	0.330	5/16	0.630	1 3/16	9/16	6 1/2	2 3/4
WB-15	4.44	8.11	8 1/8	0.245	1/4	1/8	4.02	4	0.315	5/16	0.615	1 3/16	9/16	6 1/2	2 1/4
x13	3.84	7.89	8	0.230	1/4	1/8	4.00	4	0.255	1/4	0.555	3/4	9/16	↓	↓
x10 ²	2.99	7.89	7 7/8	0.170	3/16	1/8	3.94	4	0.205	3/16	0.505	1 1/16	1/2	↓	↓
WB-25	7.34	8.38	8 3/8	0.320	5/16	3/16	6.08	6 1/8	0.455	7/16	0.705	1 5/16	9/16	4 1/2	3 1/2
x20	5.87	8.20	8 1/4	0.280	1/4	1/8	6.02	6	0.365	3/8	0.615	7/8	9/16	↓	↓
x15 ¹	4.43	5.99	6	0.230	1/4	1/8	5.99	6	0.280	1/4	0.510	3/4	9/16	↓	↓
WB-18	4.74	8.28	8 1/4	0.280	1/4	1/8	4.03	4	0.405	3/8	0.655	7/8	9/16	4 1/2	2 1/4
x12	3.55	8.03	8	0.230	1/4	1/8	4.00	4	0.280	1/4	0.530	3/4	9/16	↓	↓
x9 ¹	2.68	5.90	5 7/8	0.170	3/16	1/8	3.94	4	0.215	3/16	0.485	1 1/16	1/2	↓	↓
x8.5 ¹	2.52	5.83	5 7/8	0.170	3/16	1/8	3.94	4	0.195	3/16	0.445	1 1/16	1/2	↓	↓
WB-10	5.58	5.15	5 1/8	0.270	1/4	1/8	5.03	5	0.430	7/16	0.730	1 3/16	7/8	3 1/2	2 3/4
x18	4.71	5.01	5	0.240	1/4	1/8	5.00	5	0.360	3/8	0.660	3/4	7/8	3 1/2	2 3/4
WB-13	3.83	4.18	4 1/8	0.280	1/4	1/8	4.08	4	0.345	3/8	0.595	3/4	1/2	2 5/8	2 1/4

¹ Shape is slender for compression with $F_y = 50$ ksi.

² Shape exceeds compact limit for flexure with $F_y = 50$ ksi.

³ The actual size, combination and orientation of fastener components should be compared with the geometry of the cross section to ensure compatibility.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 13: Steel Manual Table 1-1

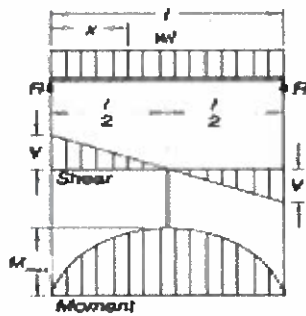
Table 1-1 (continued)															
W-Shapes														W8-W4	
Properties															
Nom- inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_x	r_y	Torsional Properties		
													J	C _w	
	d in.	t in.	I in. ⁴	S in. ³	r in.	Z in. ³	I in. ⁴	S in. ³	r in.	Z in. ³			J in. ⁴	C_w in. ⁶	
67	4.43	11.1	272	60.4	3.72	70.1	88.6	21.4	2.12	32.7	2.43	8.07	5.06	1440	
58	5.07	12.4	228	52.0	3.65	59.8	75.1	18.3	2.10	27.9	2.39	7.84	3.33	1180	
48	5.82	15.9	184	43.2	3.61	49.0	60.9	15.0	2.08	22.9	2.35	7.82	1.98	991	
40	7.21	17.8	148	35.5	3.53	38.8	49.1	12.2	2.04	18.5	2.31	7.69	1.12	729	
35	8.10	20.5	127	31.2	3.51	34.7	42.6	10.6	2.03	16.1	2.28	7.63	0.769	619	
31	9.19	22.3	110	27.5	3.47	30.4	37.1	9.27	2.02	14.1	2.26	7.57	0.536	530	
28	7.03	22.3	98.0	24.3	3.45	27.2	21.7	6.83	1.82	10.1	1.84	7.80	0.537	312	
24	8.12	25.9	82.7	20.9	3.42	23.1	18.3	5.63	1.81	8.57	1.81	7.53	0.346	259	
21	6.59	27.5	75.3	18.2	3.49	20.4	9.77	3.71	1.28	5.89	1.46	7.88	0.282	152	
18	7.95	29.9	61.9	15.2	3.43	17.0	7.97	3.04	1.23	4.86	1.43	7.81	0.172	122	
15	6.37	28.1	48.0	11.8	3.29	13.6	3.41	1.70	0.878	2.87	1.08	7.80	0.137	51.8	
13	7.84	29.9	39.9	9.91	3.21	11.4	2.73	1.37	0.843	2.15	1.03	7.74	0.0871	40.8	
10	9.81	40.5	30.8	7.81	3.22	8.87	2.09	1.08	0.841	1.68	1.01	7.69	0.0426	30.9	
25	6.88	15.5	53.4	16.7	2.70	18.9	17.1	5.81	1.52	8.68	1.74	5.83	0.481	150	
20	8.25	19.1	41.4	13.4	2.69	14.9	13.3	4.41	1.50	6.72	1.70	5.84	0.240	113	
15	11.5	21.8	29.1	9.72	2.59	10.8	9.32	3.11	1.45	4.75	1.66	5.73	0.101	79.5	
16	4.98	19.1	32.1	10.2	2.60	11.7	4.43	2.20	0.987	3.39	1.13	5.88	0.223	38.2	
12	7.14	21.8	22.1	7.31	2.49	8.30	2.99	1.50	0.918	2.32	1.08	5.75	0.0903	24.7	
9	9.16	29.2	18.4	5.58	2.47	6.23	2.20	1.11	0.905	1.72	1.08	5.69	0.0405	17.7	
8.5	10.1	29.1	14.9	5.10	2.43	5.73	1.99	1.01	0.890	1.58	1.05	5.64	0.0333	15.8	
19	5.85	13.7	28.3	10.2	2.17	11.8	9.13	3.83	1.28	5.53	1.45	4.72	0.318	50.9	
16	6.94	15.4	21.4	8.55	2.13	9.63	7.51	3.00	1.28	4.58	1.43	4.85	0.192	40.8	
13	5.88	10.8	11.3	5.48	1.72	6.28	3.88	1.90	1.00	2.92	1.16	3.82	0.151	14.0	

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 14: Steel Manual Table 1-1

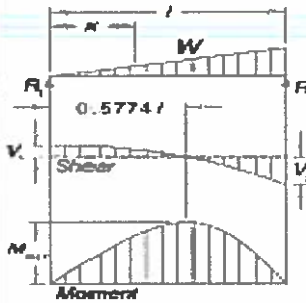
Table 3-23
Shears, Moments and Deflections

1. SIMPLE BEAM — UNIFORMLY DISTRIBUTED LOAD



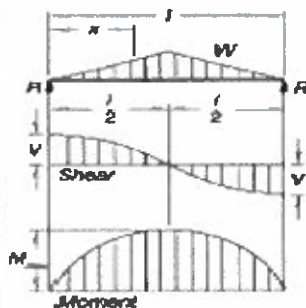
Total Equiv. Uniform Load	$= wl$
$R_1 = V_1$	$= \frac{wl}{2}$
V_2	$= w\left(\frac{l}{2} - x\right)$
M_{max} (at center)	$= \frac{wl^2}{8}$
M_x	$= \frac{wx}{2}(l - x)$
Δ_{max} (at center)	$= \frac{5wl^4}{384EI}$
Δ_x	$= \frac{wx}{24EI}(l^3 - 2lx^2 + x^3)$

2. SIMPLE BEAM — LOAD INCREASING UNIFORMLY TO ONE END



Total Equiv. Uniform Load	$= \frac{16W}{9\sqrt{3}} = 1.03W$
$R_1 = V_1$	$= \frac{W}{3}$
$R_2 = V_2 = V_{max}$	$= -\frac{2W}{3}$
V_x	$= \frac{W}{3} - \frac{Wx^2}{l^2}$
M_{max} (at $x = \frac{l}{\sqrt{3}} = 0.577l$)	$= \frac{2Wl}{9\sqrt{3}} = 0.125Wl$
M_x	$= \frac{Wx}{3l^2}(l^3 - x^3)$
Δ_{max} (at $x = l\sqrt{\frac{8}{15}} = 0.519l$)	$= 0.0130 \frac{Wl^3}{EI}$
Δ_x	$= -\frac{Wx}{180EI^2}(3l^4 - 10l^2x^2 + 7x^4)$

3. SIMPLE BEAM — LOAD INCREASING UNIFORMLY TO CENTER



Total Equiv. Uniform Load	$= \frac{4W}{3}$
$R_1 = V_1$	$= \frac{W}{3}$
V_2 (when $x = \frac{l}{2}$)	$= -\frac{W}{2l^2}(l^2 - 4x^2)$
M_{max} (at center)	$= \frac{Wl}{6}$
M_x (when $x = \frac{l}{2}$)	$= Wx\left(\frac{l}{3} - \frac{2x^2}{3l^2}\right)$
Δ_{max} (at center)	$= \frac{Wl^3}{80EI}$
Δ_x (when $x = \frac{l}{2}$)	$= \frac{Wx}{480EI^2}(5l^2 - 4x^2)^2$

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 15: Table 3-23 Shear, Moment and Deflections

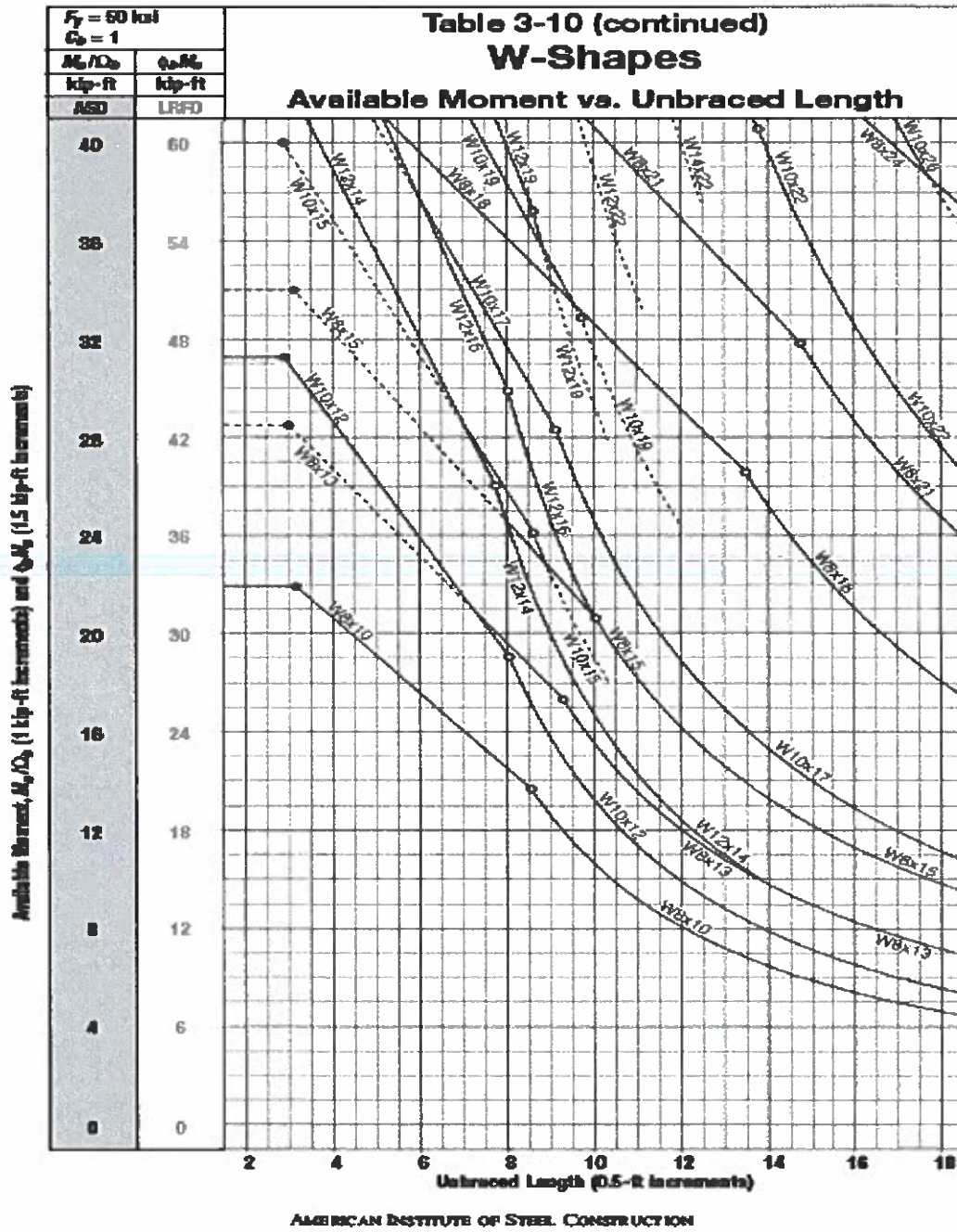


Table 3-2 (continued) W-Shapes Selection by Z_x												
$F_y = 50 \text{ ksi}$												
Shape	Z_x in. ³	M_{px}/Ω_b		M_{py}/Ω_b		M_{px}/ϕ_b		M_{py}/ϕ_b		L_p ft	L_r ft	L_c ft
		ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft			
W12x16	20.1	50.1	75.4	28.9	44.9	3.88	5.73	2.73	8.05	103	52.8	79.2
W10x17	18.7	48.7	70.1	28.3	42.5	2.88	4.47	2.88	9.18	81.9	48.5	72.7
W12x14 ¹	17.4	43.4	65.3	23.0	39.1	3.43	5.17	2.66	7.73	88.8	42.8	64.3
W8x18	17.0	42.4	63.8	29.5	39.9	1.74	2.61	4.34	13.5	81.9	37.4	56.2
W10x15	16.0	39.9	60.0	24.1	36.2	2.75	4.14	2.88	8.81	88.8	48.0	68.9
W8x15	13.6	33.9	51.0	20.8	31.0	1.00	2.85	3.09	10.1	48.0	39.7	59.6
W10x12 ¹	12.6	31.2	46.9	18.0	28.6	2.38	3.53	2.87	8.85	53.8	37.5	56.3
W8x13	11.4	28.4	42.8	17.3	26.0	1.78	2.67	2.98	9.27	39.8	38.8	55.1
W6x10 ¹	8.87	21.8	32.9	13.6	20.5	1.54	2.30	3.14	8.52	30.8	26.3	40.2
ASD	LRFD	¹ Shape exceeds compact limit for flexure with $F_y = 50 \text{ ksi}$ ² Shape does not meet the A/F_y limit for shear in AISC Specification Section G2.1(a) with $F_y = 50 \text{ ksi}$; therefore, $\phi_v = 0.80$ and $\Omega_v = 1.87$.										
$\Omega_b = 1.87$ $\Omega_v = 1.80$	$\phi_b = 0.80$ $\phi_v = 1.00$											

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 17: Table 3-2 W-Shapes Selection by Z_x

Beams design

The beam is to be spread out between columns at 50ft evenly spacing and having joists running perpendicular between the beams. Bracing members must be connected with a minimum of one bolt or its equivalent (Steel Manual).

When

W = Weight

DL = 40 lb/ft (W16x40)

LL = 3,500 lbs/ft

$$W = DL + LL$$

$$W = 40 \text{ lbs/ft} + 10(3,500 \text{ lbs/ft})$$

$$W = 590 \text{ lbs/ft}$$

Now we will need to calculate the maximum shear and bending moment to see if the beam chosen would work for this application. Using Table 3-23 from Figure 06 from the steel manual.

When

$$V_{\text{Max}} = WL/2$$

$$V_{\text{Max}} = (590 \text{ lbs/ft} * 50\text{ft}) / 2$$

$$V_{\text{Max}} = 14.75 \text{ lbs/ft} \Rightarrow 14.8 \text{ kip/ft}$$

$$M_{\text{Max}} = WL^2 / 8$$

$$M_{\text{Max}} = (590 \text{ lb/ft} * 50^2\text{ft}) / 8$$

$$M_{\text{Max}} = 184,375 \text{ lbs} \cdot \text{ft} \Rightarrow 184.4 \text{ kips} \cdot \text{ft}$$

Check Answers:

$$V_{\text{Max}} < \phi_V V_{nx}$$

14.8 kips < 146 kips Shear is Okay

$$M_{\text{Max}} < \phi_b M_n$$

184.4 kips*ft < 200 kips*ft Bending Moment is Okay

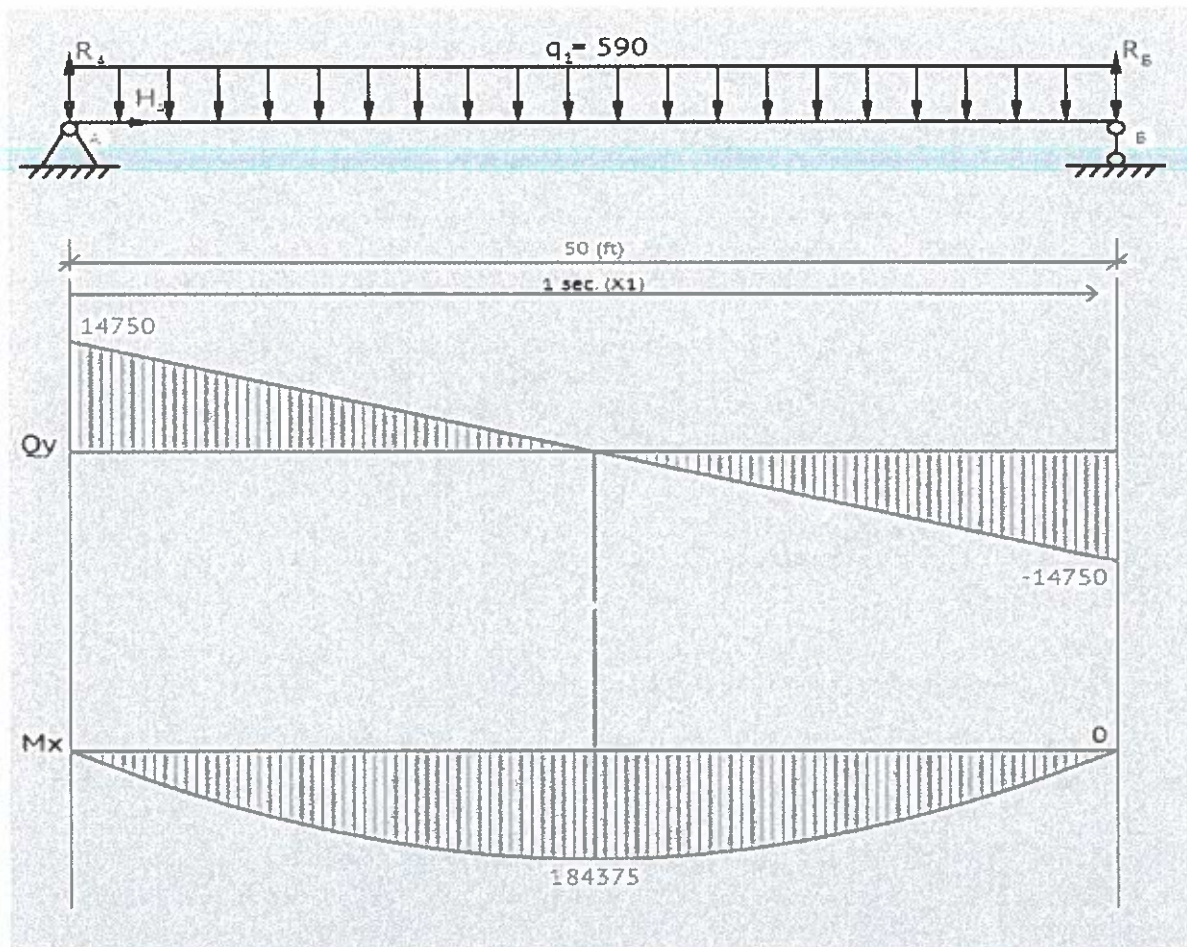


Figure 18: Shear and bending moment of beam

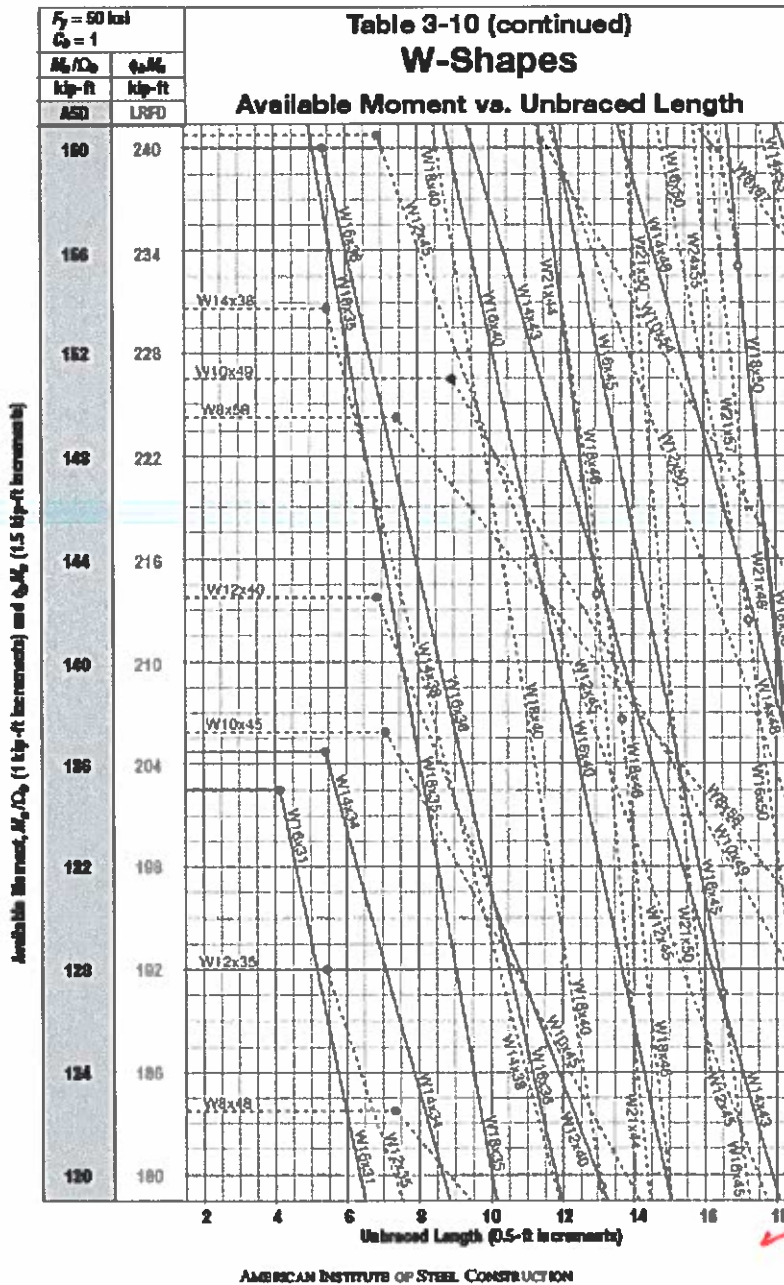


Figure 19: Table 3-10 W-Shapes Available Moment vs Unbraced Length

Table 3-2 (continued)													Z_x							
$F_y = 50$ ksi																				
W-Shapes																				
Selection by Z_x																				
Shape	Z_x in. ³	M_p/Ω_b		ϕM_p		M_r/Ω_b		ϕM_r		B_F/Ω_b		ϕB_F		L_p ft	L_r ft	L_b in. ⁴	M_n/Ω_b		ϕM_n	
		kip-ft		kip-ft		kip-ft		kip-ft		kip-ft		kip-ft					kip-ft		kip-ft	
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD				ASD	LRFD	ASD	LRFD
W21x55	126	314	473	182	288	10.8	16.3	6.11	9.17	11.0	16.3	6.11	9.17	1140	158	234	158	234		
W14x74	128	314	473	182	288	10.8	16.3	6.11	9.17	11.0	16.3	6.11	9.17	1140	158	234	158	234		
W18x60	123	307	461	189	284	9.82	14.4	5.93	8.82	10.8	15.9	5.93	8.82	1084	151	227	151	227		
W12x79	119	297	446	187	281	3.78	5.67	10.8	16.3	10.8	16.3	10.8	16.3	1082	117	175	117	175		
W14x68	115	287	431	180	270	5.19	7.81	8.69	12.9	8.69	12.9	8.69	12.9	1072	116	174	116	174		
W10x68	113	282	424	172	259	2.82	3.94	8.29	12.2	8.29	12.2	8.29	12.2	1034	131	196	131	196		
W18x55	112	279	420	172	258	9.15	13.8	5.90	8.82	10.8	15.9	5.90	8.82	1080	141	212	141	212		
W21x50	110	274	413	165	249	12.1	18.3	4.59	6.82	10.7	15.8	4.59	6.82	1084	158	237	158	237		
W12x72	108	269	405	170	256	3.69	5.56	10.7	15.8	10.7	15.8	10.7	15.8	1097	108	159	108	159		
W21x45	107	265	398	162	244	9.89	14.8	5.86	8.82	10.6	15.7	5.86	8.82	1069	144	216	144	216		
W18x57	105	262	394	161	242	7.98	12.0	5.65	8.55	10.5	15.5	5.65	8.55	1058	141	212	141	212		
W14x61	102	254	383	161	242	4.93	7.48	8.65	12.7	8.65	12.7	8.65	12.7	1040	104	156	104	156		
W18x50	101	252	379	155	233	8.78	13.2	5.83	8.82	10.4	15.4	5.83	8.82	1000	128	192	128	192		
W10x77	97.8	244	368	150	225	2.60	3.90	9.18	13.5	9.18	13.5	9.18	13.5	1055	112	169	112	169		
W12x65	96.8	237	358	154	231	3.58	5.39	10.7	15.8	10.7	15.8	10.7	15.8	1033	94.4	142	94.4	142		
W21x44	95.4	238	358	143	214	11.1	16.8	4.45	6.72	10.5	15.5	4.45	6.72	1043	145	217	145	217		
W18x50	92.0	230	345	141	213	7.69	11.4	5.62	8.55	10.4	15.4	5.62	8.55	1059	124	186	124	186		
W18x46	90.7	226	340	138	207	9.63	14.6	4.58	6.82	10.3	15.3	4.58	6.82	1012	130	195	130	195		
W14x53	87.1	217	327	138	204	5.22	7.93	6.78	12.3	6.78	12.3	6.78	12.3	1041	109	154	109	154		
W12x58	86.4	216	324	138	205	3.82	5.69	8.87	12.8	8.87	12.8	8.87	12.8	1075	87.8	132	87.8	132		
W10x68	85.3	213	320	132	199	2.58	3.85	9.15	13.5	9.15	13.5	9.15	13.5	1004	87.8	147	87.8	147		
W18x45	82.3	205	309	127	191	7.12	10.8	5.55	8.55	10.2	15.2	5.55	8.55	1086	111	167	111	167		
W18x40	78.4	196	294	119	180	3.84	5.72	4.49	6.72	10.1	15.1	4.49	6.72	1012	113	168	113	168		
W14x48	78.4	196	294	123	184	5.09	7.67	6.75	12.1	6.75	12.1	6.75	12.1	1084	98.8	141	98.8	141		
W12x53	77.9	194	292	123	185	3.65	5.50	8.78	12.2	8.78	12.2	8.78	12.2	1025	83.5	125	83.5	125		
W10x60	74.8	188	280	118	175	2.54	3.82	8.08	12.0	8.08	12.0	8.08	12.0	1041	85.7	129	85.7	129		
W18x40	73.0	182	274	118	170	6.87	10.0	5.55	8.55	10.0	15.0	5.55	8.55	1018	87.8	146	87.8	146		
W12x50	71.9	179	270	112	169	3.97	5.98	6.82	12.8	6.82	12.8	6.82	12.8	1001	80.3	135	80.3	135		
W8x67	70.1	175	263	105	159	1.75	2.59	7.49	12.8	7.49	12.8	7.49	12.8	1072	109	154	109	154		
W14x43	69.8	174	261	109	164	4.88	7.28	6.68	12.0	6.68	12.0	6.68	12.0	1028	83.8	125	83.8	125		
W10x54	66.6	168	250	105	158	2.48	3.75	8.04	12.0	8.04	12.0	8.04	12.0	1003	74.7	112	74.7	112		
ASD	LRFD	Shape exceeds compact limit for flexure with $F_y = 50$ ksi																		
$\Omega_b = 1.67$	$\phi_b = 0.90$																			
$\Omega_b = 1.60$	$\phi_b = 1.00$																			

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 20: Table 3-2 W-Shapes Selection by Z_x

Columns Design

The columns are to provide the support of the structures live and dead loads of the building. These compression members are critical that the correct column size is used for its application to provide the ample support of the structure and the cost of not over building the structure if not needed. We can calculate the load on the column by the following.

$$P_u = 1.2P_D + 1.6P_L$$

With the assumptions of the following values the column requirement can be provided:

$$L_{\text{Column}} = 34\text{ft}$$

$$P_D = 165\text{kips}$$

$$P_L = 535\text{kips}$$

$$P_u = 1.2(165\text{kips}) + 1.6(535\text{kips})$$

$$P_u = 1054\text{kips}$$

Getting our total design load for the particular column with a column length of 34 for feet referencing Table 4-1 from Figure 20. The following W- shape beam values will be utilized to meet load requirements.

W12x252

$$\phi_c P_n = 1120 \text{ kips}$$

$$1054 \text{ kips} < 1120 \text{ kips, Okay beam to use}$$

The beam W12x252 will meet the requirements for the total axial load of that particular beam at 34ft in length.

		Table 4-1 (continued) Available Strength in Axial Compression, kips W-Shapes												 W12	
Shape		W12x													
lb/ft		235 ^a		305 ^a		270 ^a		252 ^a		230 ^a		210			
Design	Effective length, KL (ft), with respect to least radius of gyration, r _y	P _n /Ω _c		φ _t P _n		P _n /Ω _c		φ _t P _n		P _n /Ω _c		φ _t P _n		P _n /Ω _c	
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
	0	2360	4450	2680	4030	2450	3680	2220	3330	2030	3050	1850	2780		
	6	2870	4310	2580	3800	2370	3570	2140	3220	1890	2940	1760	2680		
	7	2840	4260	2580	3850	2340	3520	2120	3180	1890	2910	1760	2650		
	8	2800	4210	2530	3800	2310	3470	2090	3140	1810	2860	1740	2610		
	9	2760	4150	2480	3740	2280	3420	2060	3090	1880	2820	1710	2570		
	10	2710	4080	2450	3680	2240	3380	2020	3030	1840	2770	1680	2520		
	11	2680	4000	2400	3610	2190	3300	1980	2970	1800	2710	1640	2470		
	12	2610	3920	2350	3540	2150	3230	1940	2910	1760	2650	1610	2420		
	13	2550	3840	2300	3460	2100	3150	1890	2840	1720	2590	1570	2360		
	14	2490	3750	2250	3380	2050	3080	1840	2770	1680	2520	1530	2300		
	15	2430	3660	2190	3290	1990	3000	1790	2700	1630	2450	1480	2230		
	16	2370	3560	2130	3200	1940	2910	1740	2620	1590	2380	1440	2160		
	17	2300	3460	2070	3100	1880	2820	1680	2540	1540	2310	1390	2100		
	18	2230	3350	2000	3010	1820	2730	1630	2460	1480	2230	1350	2030		
	19	2160	3250	1940	2910	1760	2640	1580	2370	1430	2160	1300	1950		
	20	2090	3140	1870	2810	1700	2550	1520	2290	1380	2070	1250	1880		
	22	1940	2910	1730	2610	1570	2360	1410	2110	1270	1910	1150	1730		
	24	1790	2690	1600	2400	1440	2170	1290	1940	1170	1750	1060	1580		
	25	1640	2480	1480	2190	1320	1980	1170	1760	1080	1590	955	1440		
	26	1490	2240	1320	1990	1190	1790	1080	1590	954	1430	859	1290		
	30	1350	2030	1190	1790	1070	1610	949	1430	854	1280	787	1150		
	32	1210	1820	1070	1600	954	1430	843	1270	758	1140	678	1020		
	34	1090	1620	945	1420	845	1270	748	1120	670	1010	600	902		
	36	959	1440	843	1270	754	1130	688	1000	597	898	535	805		
	38	861	1280	757	1140	678	1020	598	898	538	808	481	722		
	40	777	1170	683	1030	610	917	539	811	484	727	434	652		
Properties															
P _n , kips		1050	1580	897	1340	783	1170	665	998	574	881	492	738		
P _n , kips/in.		59.3	89.0	54.3	81.5	51.0	78.5	48.7	70.0	43.0	64.5	38.3	58.0		
P _n , kips		10000	15100	7600	11600	6380	9590	4870	7320	3810	5730	2980	4400		
P _n , kips		1840	2480	1370	2070	1140	1720	947	1420	802	1210	676	1020		
L _p , ft		12.3		12.1		11.9		11.8		11.7		11.6			
L _r , ft		160		137		128		114		105		95.8			
A _g , in. ²		68.9		88.5		81.9		74.1		67.7		61.8			
b _x , in. ⁴		4060		3550		3110		2720		2420		2140			
I _y , in. ⁴		1190		1050		937		828		742		664			
r _p , in.		5.47		3.42		3.36		3.34		3.31		3.28			
r _{cy} , in.		1.85		1.84		1.82		1.81		1.80		1.80			
P _n (Ω _c) ^{1/2} /10 ⁴ , k-in. ²		118000		102000		89000		77900		69300		61300			
P _n (Ω _c) ^{1/2} /10 ⁴ , k-in. ²		94100		30100		26800		23700		21200		19000			
ASD		LRFD		* Flange thickness is greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.											
Ω _c = 1.87		φ _c = 0.90													

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 20: Table 4-1 Axial Compression kips

Joints and connections

The joints and the connection points for the structure will be provided depending on the results provided by STAAD Pro. As to assume all the joints depend on its final design parameters.

Building Slab

The building slab is to be addressed the following year due to time restraints.

Footings Design

The footing design will be coordinated with Geotechnical Technical engineering to provide the adequate footing support for each of the structures. This is dependent on the load bearing capacity of the soil type at each of the locations. From there knowing the on total load from each of the buildings' live and dead loads.

Water Resources

Introduction:

The Water Resources design is part of phase C of the project. In the water resources portion of this design project, the task was to design a trapezoidal storm water drainage ditch based on a 100-year rainfall investigation period all while avoiding flood risks and property damage from the storm water runoff. The trapezoidal ditch is to be designed by using hydrologic and hydraulic methods. The hydrologic methods used was using the Rational Method to obtain the peak runoff outflow and the "Tractive Force based Unlined Channel Design Method" to get the design dimensions for the channel.

Design Methods and Equations (Theory)

Before the design of the channel/ditch could be done, the Rational Method was used to find the peak runoff outflow, which was then recorded and used to find the design of the channel.

$$Q = CiA \quad (1)$$

Where,

Q = Peak Outflow, cfs

C = Runoff Coefficient based on land

i = Rainfall Intensity, in/hr = 3.93 in/hr (determined by Figure 1 below)

A = Drainage Area, acre = 400 acre

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)

Duration	1	2	5	10	25	50	100	200	500	1000
5-min	0.466 (0.353-0.616)	0.535 (0.410-0.703)	0.651 (0.497-0.857)	0.745 (0.559-0.992)	0.871 (0.632-1.19)	0.964 (0.681-1.36)	1.06 (0.729-1.53)	1.15 (0.776-1.72)	1.29 (0.833-1.98)	1.39 (0.879-2.19)
10-min	0.741 (0.561-0.978)	0.852 (0.653-1.18)	1.04 (0.792-1.37)	1.19 (0.833-1.59)	1.39 (1.01-1.91)	1.55 (1.10-2.18)	1.70 (1.17-2.46)	1.84 (1.24-2.74)	2.03 (1.32-3.12)	2.17 (1.37-3.42)
15-min	0.937 (0.709-1.24)	1.07 (0.820-1.41)	1.30 (0.888-1.71)	1.48 (1.11-1.97)	1.73 (1.26-2.38)	1.92 (1.36-2.71)	2.11 (1.46-3.06)	2.30 (1.55-3.42)	2.55 (1.66-3.92)	2.73 (1.73-4.32)
30-min	1.33 (1.00-1.75)	1.51 (1.16-1.99)	1.82 (1.39-2.43)	2.07 (1.56-2.76)	2.41 (1.75-3.30)	2.66 (1.86-3.75)	2.91 (2.01-4.22)	3.18 (2.14-4.74)	3.56 (2.31-5.48)	3.85 (2.44-6.08)
60-min	1.73 (1.31-2.29)	1.99 (1.53-2.62)	2.42 (1.85-3.19)	2.77 (2.00-3.69)	3.24 (2.34-4.42)	3.58 (2.62-5.03)	3.93 (2.71-5.70)	4.33 (2.92-6.48)	4.91 (3.20-7.58)	5.39 (3.41-8.52)
2-hr	2.10 (1.61-2.75)	2.48 (1.91-3.20)	3.09 (2.28-4.02)	3.61 (2.73-4.76)	4.33 (3.15-5.85)	4.87 (3.46-6.79)	5.46 (3.78-7.85)	6.16 (4.17-9.12)	7.22 (4.71-11.1)	8.12 (5.16-12.8)
3-hr	2.31 (1.77-3.00)	2.78 (2.14-3.54)	3.52 (2.71-4.53)	4.16 (3.16-5.45)	5.07 (3.72-6.84)	5.79 (4.13-8.04)	6.59 (4.59-9.43)	7.55 (5.12-11.1)	9.02 (5.90-13.8)	10.3 (6.50-16.1)
6-hr	2.65 (2.05-3.40)	3.30 (2.53-4.09)	4.26 (3.21-5.41)	5.14 (3.94-6.69)	6.44 (4.77-8.62)	7.51 (5.41-10.4)	8.73 (6.12-12.4)	10.2 (6.94-14.9)	12.4 (8.16-18.9)	14.4 (9.16-22.3)
12-hr	2.97 (2.32-3.77)	3.81 (2.91-4.89)	5.00 (3.90-6.28)	6.15 (4.76-7.89)	7.92 (5.94-10.5)	9.47 (6.90-13.0)	11.3 (7.95-15.9)	13.4 (9.15-19.4)	16.6 (10.9-25.0)	19.3 (12.4-29.9)
24-hr	3.31 (2.61-4.18)	4.37 (3.32-5.12)	5.78 (4.56-7.18)	7.23 (5.65-9.18)	9.50 (7.23-12.6)	11.8 (9.53-15.8)	14.0 (9.93-19.5)	16.7 (11.5-24.0)	20.8 (13.7-31.0)	24.1 (15.5-37.0)
2-day	3.71 (2.95-4.61)	4.99 (3.81-6.73)	6.67 (5.30-8.15)	8.42 (6.64-10.6)	11.2 (8.65-14.8)	13.8 (10.3-18.8)	16.8 (12.0-23.3)	19.9 (13.7-28.2)	24.2 (16.0-35.7)	27.6 (17.8-42.0)
3-day	4.03 (3.22-4.98)	5.41 (4.17-6.20)	7.26 (5.80-8.91)	9.14 (7.24-11.4)	12.1 (9.39-15.9)	14.8 (11.1-20.2)	18.0 (12.9-24.6)	21.2 (14.6-29.9)	25.5 (17.0-37.6)	29.0 (19.0-44.0)
4-day	4.31 (3.47-5.30)	5.79 (4.46-6.59)	7.67 (6.16-9.28)	9.60 (7.63-11.9)	12.6 (9.77-16.4)	15.4 (11.5-20.6)	18.4 (13.2-25.3)	21.6 (15.0-30.4)	26.0 (17.1-38.2)	29.6 (19.2-44.8)
7-day	5.00 (4.05-6.09)	6.44 (5.12-7.45)	8.49 (6.89-10.2)	10.4 (8.37-12.9)	13.4 (10.4-17.3)	16.0 (12.0-21.3)	19.0 (13.7-25.8)	22.1 (15.4-31.0)	26.7 (17.9-39.0)	30.4 (19.8-45.5)
10-day	5.8 (4.56-6.75)	7.04 (5.68-8.18)	9.19 (7.49-11.0)	11.2 (8.99-13.7)	14.1 (11.0-18.0)	16.7 (12.5-22.0)	19.5 (14.1-26.4)	22.6 (16.6-31.6)	27.2 (18.3-39.7)	31.0 (20.2-46.6)
25-day	7.34 (6.03-8.79)	8.93 (7.36-10.4)	11.4 (9.43-13.5)	13.6 (11.0-16.4)	16.7 (13.0-21.0)	19.2 (14.4-24.9)	21.9 (15.9-29.4)	24.8 (17.5-34.5)	29.1 (19.7-42.2)	32.7 (21.4-48.7)
30-day	8.82 (7.28-10.6)	10.5 (8.78-12.3)	13.3 (11.0-15.7)	15.6 (12.7-19.8)	18.8 (14.7-23.5)	21.3 (16.1-27.6)	24.0 (17.5-32.0)	26.8 (19.0-37.0)	30.8 (20.6-44.4)	34.0 (22.3-50.5)
45-day	11.0 (9.11-13.0)	12.8 (10.6-15.0)	15.9 (13.4-18.7)	18.5 (15.2-22.1)	21.9 (17.2-27.1)	24.4 (18.5-31.3)	27.0 (19.8-35.9)	29.7 (21.1-40.8)	33.4 (22.7-48.0)	36.4 (23.9-53.6)
60-day	12.9 (10.8-15.2)	14.9 (12.7-17.5)	18.3 (15.5-21.5)	21.0 (17.3-25.0)	24.6 (19.3-30.3)	27.2 (20.6-34.7)	29.7 (21.8-39.3)	32.3 (23.0-44.3)	35.8 (24.4-51.3)	38.5 (25.4-56.8)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound or less than the lower bound is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Figure 1

Upon completion of the Rational Method, The peak outflow was recorded and continued to be represented by 'Q' when it came to using the "Tractive Force based Unlined Channel Design Method" to find the design dimensions of the channel. Those dimensions were the side slope (z), bottom width (b), design depth from water surface (y_0), and velocity of the channel (V). Each of the dimensions were calculated and determined with the following equations:

$$n = .031d_{75}^{1/6} \quad (2)$$

Where,

n = Manning's roughness coefficient based on land

d_{75} = sediment size, ft

d_{75} will then obtained by manipulating Equation (2)

$$d_{75} = \left(\frac{n}{.031}\right)^6 \quad (3)$$

The value of d_{75} will then be determined.

The slope of the land, S , will be obtained by taking the latitude, longitude, and elevation from the site and comparing it to the latitude, longitude, and elevation of another point in Washington County:

$$S = \frac{\Delta z}{\sqrt{\Delta x + \Delta y}} \quad (4)$$

Where,

S = slope of land

Δx = Change in longitude, ft

Δy = Change in latitude, ft

Δz = Change in elevation, ft

Next, the critical shear stress could either be obtained from Figure 8-11 (from water resources book) or from the following equation:

$$\tau_b = k_b \gamma_w y_0 S_0 \quad (5)$$

Where,

τ_b = critical shear stress, psf

$k_b = 1.0$

γ_w = unit weight of water = 62.4 pcf

y_0 = design depth from water surface, ft

$$S_0 = \text{Slope of land} = .00076$$

The τ_b value will be found from Figure 8-11 (from water resources book) using the determined d_{75} converted from feet to millimeters.

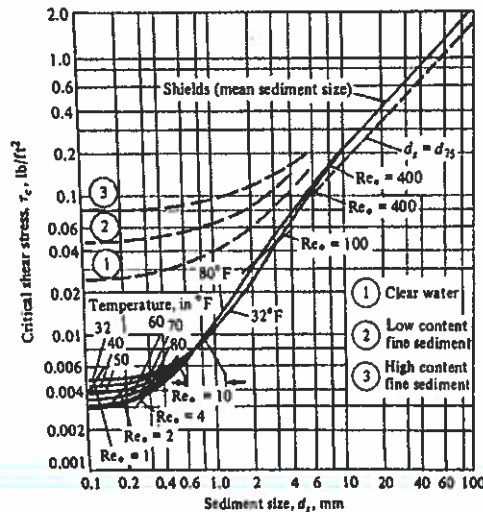


Figure 8-11 Critical shear stress for quartz particles in water (Vanoni, 1975, p. 99)

Scanned with CamScanner

Figure 2

The angle of repose (ϕ) will be determined by using Figure 8-22 (from water resources book) using the obtained d_{75} .



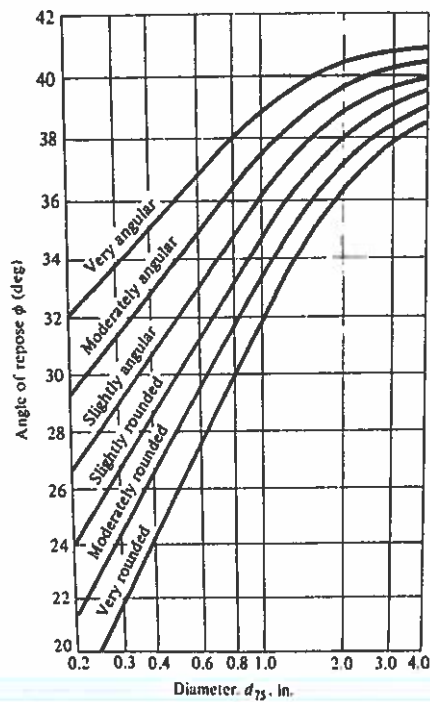


Figure 8-22 Angle of repose (Lane, 1955, p. 1247).

Scanned with CamScanner

Figure 3

The angle from the side slope was determined by:

$$\alpha = z$$

(6)

Where,

z = side slope

For the side slope (z) to be sufficient, it must be greater than $\cot \phi$.

τ_s will be determined with the help from this equation:

$$K = \frac{\tau_s}{\tau_b} = \sqrt{1 - \frac{\alpha}{\phi}}$$

(7)

Where,

τ_b = critical shear stress, psf

τ_s = shear stress, psf

α = angle from side slope

ϕ = angle of repose

τ_s will be determined by manipulating Equation 7:

$$\tau_s = \tau_b \sqrt{1 - \frac{\alpha}{\phi}} \quad (8)$$

τ_s could also be determined by:

$$\tau_s = k_s \gamma_w y_0 S_0 \quad (9)$$

Where,

τ_s = shear stress, psf

$k_s = 0.75$

The design depth (y_0) will be determined by manipulating Equations (5) and (9) and using the equation that produces the smaller value:

$$y_0 = \frac{\tau_b}{k_b \gamma_w S_0} \quad (10)$$

$$y_0 = \frac{\tau_s}{k_s \gamma_w S_0} \quad (11)$$

After conducting proper calculations, the value from the Equation with the lowest value will be used.

Next the bottom width (b) will be determined using the following equation:

$$Q = \frac{1}{n} * \frac{A^{5/3}}{P^{2/3}} * S_0^{1/2} \quad (12)$$

Where,

Q = Outflow

n = Manning's $n = 0.035$

$S_0 = 0.00076$

A = Area of Trapezoidal Channel

P = Perimeter of Trapezoidal Channel

The Area of Trapezoidal Channel was equivalent to:

$$A = by_0 + zy_0^2 \quad (13)$$

The Perimeter of Trapezoidal Channel was equivalent to:

$$P = b + 2y_0\sqrt{1 + z^2} \quad (14)$$

By substituting Equations (13) and (14) into Equation (12):

$$Q = \frac{1}{n} * \frac{(by_0 + zy_0^2)^{5/3}}{(b + 2y_0\sqrt{1 + z^2})^{2/3}} * S_0^{1/2} \quad (15)$$

Equation (15) was then manipulated to solve for b:

$$\frac{Qn}{S_0^{1/2}} = \frac{(by_0 + zy_0^2)^{5/3}}{(b + 2y_0\sqrt{1 + z^2})^{2/3}} \quad (16)$$

b will then be solved by putting Equation (16) into a solver.

The design velocity must be greater than the Kennedy equation velocity. The design velocity will be determined by:

$$V = \frac{Q}{A} \quad (17)$$

Where,

V = design velocity, m/s

The Kennedy equation velocity is given by:

$$V_0 = 0.84y_0^{0.64} \quad (18)$$

Where,

V_0 = Kennedy equation velocity, m/s

After calculations are done for each of the velocities, the design velocity would be sufficient if it is greater than the Kennedy equation velocity.

Results and Discussions

Design Channel Dimensions/Results

Q	235.8 cfs
---	-----------

~~SE~~ check again

Conclusions

Once all the calculations and procedures are finished, the trapezoidal channel/drainage ditch will be successfully designed. There is currently nothing else that has been completed at this time.

Transportation Engineering

Introduction

The task of the transportation portion of this project was to design the roadway layout for the entire project. This included connecting roads from the site to existing roads and highways, interchange design, traffic study, parking lot layout, pavement design cross-section, and the plan and profile of a typical local road in development.

Site Layout

The **Figure 1** below shows the entire layout of the project site and where each of the buildings, drainage ditch, and water treatment plant will be. The Convention Center was placed at the main entrance of the project site near Farm to Market Road 332 which connects to the major Highway 290. The dimensions of the building were made to be 1600 ft by 300 ft. The two Commercial Offices are located in the middle north side of the project site with dimensions of 500 ft by 250 ft. The Warehouse is located on the furthest south west point of the project site out of the way of the office buildings and visitor convention center. The dimensions of the Warehouse is 2000 ft by 500ft. The Warehouse is located by an existing road Baranowski Rd, which allows easy access for trucks to import and export goods from the ports located on the west most portion of the warehouse. The existing road connects to Farm to Market Road 389 which leads to the major Highway 290. Parking lots are placed near and in between each building allowing for easy access for employees and guests to access the buildings. Interconnecting roads were placed within the project site connecting each parking lot. The Detention basin and Water Treatment plant are located in the southeast most part of the project site. This location of the project site is at the lowest elevation of the land which is also located by a forking creek. This will allow the runoff water and drainage water to travel more efficiently to the basin and water treatment plant.

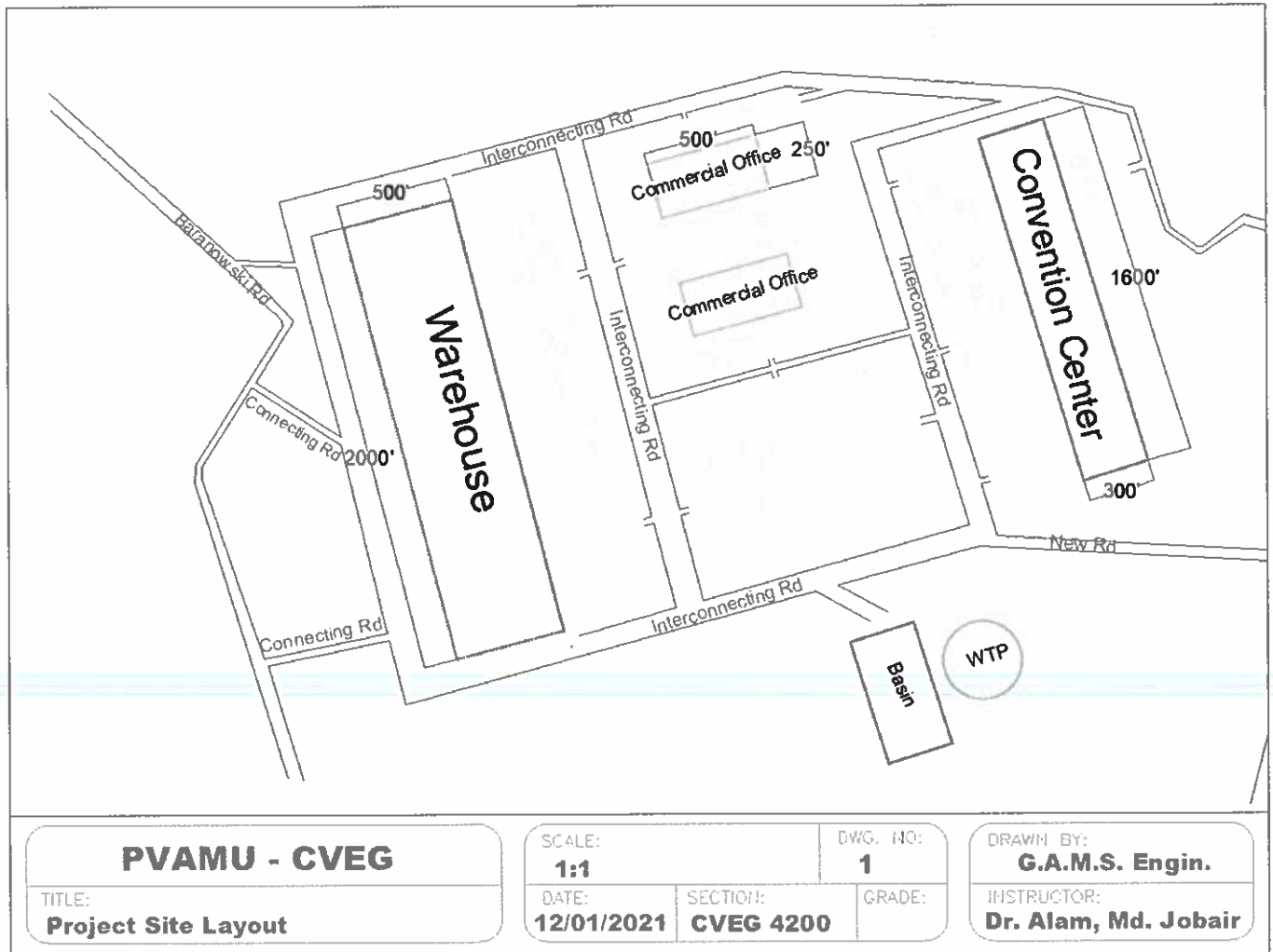


Figure 1: Project layout without geological map

overall layout plan
go at the beginning of the
report.



Figure 2: Project layout without background of site

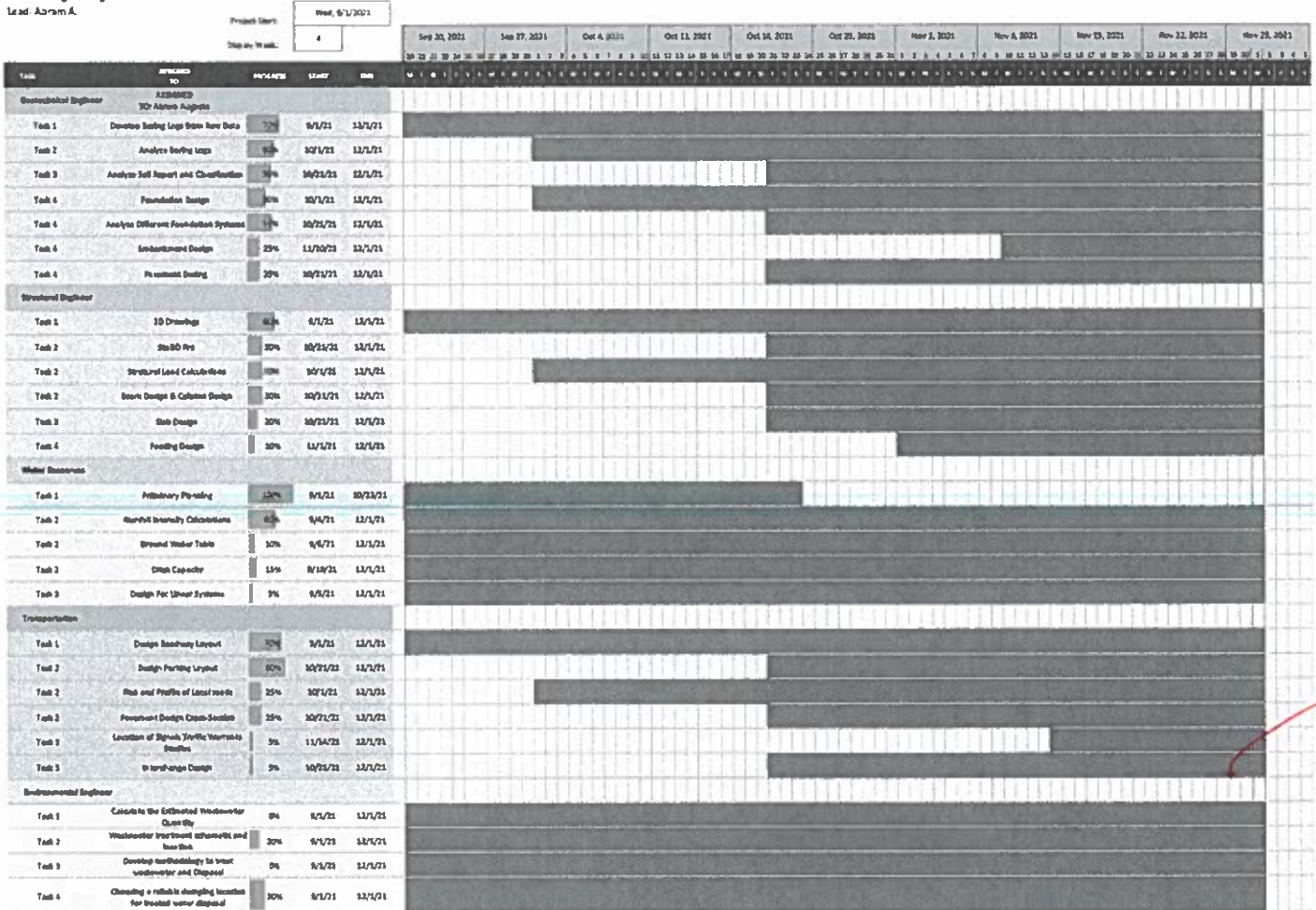
Future Work

In the next phase of the project starting in January, the Transportation Engineering portion of the project will go more in depth showing steps, procedures, and calculations with Interchange Design, Location of signals, Traffic Warrant Studies, Plan and profile as well as pavement design cross-sections for a typical local road in the development.

Gantt Chart

SENIOR DESIGN

G.A.M.S Engineering
Lead: Abram A.



*not visible
make it landscape*

Resources Used

Braja M. Das, Nagaratnam Sivakugan. Principles of Foundation Engineering 9th Edition. Cengage. 2017

<https://www.daytonohio.gov/DocumentCenter/View/3562/W-15-125-Dayton-Parallel-Interceptor---Phase-A---Final-Subsurface-Report?bidId=>

Williams, Alan. Steel Structures Design. McGraw-Hill, 2011.

American Institute of Steel Construction, Manual of Steel Construction, 14th Edition

International Code Council. International Building Code. Falls Church, Va. :International Code Council, 2000.

“ASCE 7.” (2013). Standards, American Society of Civil Engineers,
<<https://ascelibrary.org/doi/book/10.1061/asce7>> (Dec. 1, 2021).

<https://www.tompkinsinc.com/Insight/Tompkins-Blog/the-importance-of-optimal-column-spacing>

g

https://nwis.waterdata.usgs.gov/tx/nwis/peak?site_no=08111500&agency_cd=USGS&format=gif

https://www.usgs.gov/special-topic/water-science-school/science/100-year-flood?qt-science_center_objects=0#qt-science_center_objects

https://nwis.waterdata.usgs.gov/tx/nwis/peak?site_no=08111500&agency_cd=USGS&format=html

https://www.engineeringtoolbox.com/mannings-roughness-d_799.html

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx

<http://abe-research.illinois.edu/courses/tsm352/lectures/runoffcoeffs.html>



Prairie View A&M University
Roy G. Perry College of Engineering



80

Civil & Environmental Department
CVEG 4200: Senior Design Project

SAPS Engineering

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

Prairie View A&M University
Prairie View, Texas 77446

SAPS Engineering Inc.

Dec 1, 2021

Dear Professor Alam,

The attached report contains the detailed plans for a newly constructed business and distribution center, IT Hub, and office development in Colorado County, Texas. This report includes the scope of work, six disciplines of civil engineering to design the development adequately.

SAPS Engineering Inc. is available to answer any questions you may have concerning this report or the project. You can contact our team lead Scott McGary at (phone number: 901-647-5996 or email: smcgary@pvamu.edu)

Sincerely,

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

TABLE OF CONTENTS

List of Figures	3
List of Tables	4
Acknowledgment	4
Gantt Timeline	6
Introduction	8
Chapter 1: Project Scope	9
1.1 Problem Statement	9
1.2 Project Goals	9
Chapter 2: Task Definition and Project Design	10
2.1 Geotechnical Engineering	10
2.1.2 Soil Properties	13
2.2 Water Resources Engineering	17
2.2.1 Water Resources Objective	17
2.2.2 Rainfall Intensity	17
2.2.3 Stormwater Runoff	17
2.2.4 Drainage Ditch	17
2.2.5 Drainage Ditch Design	18
2.2.6 Stormwater Basin	19
2.3 Structural Engineering	21
2.4 Transportation Engineering	21
2.5 Environmental Engineering	22
Chapter 3: References	24
Appendix 1 Images	25
Appendix 2 Calculations	28

List of Figures

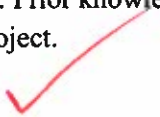
Figure 1.1 Gantt Chart.....	6
Figure 1.2 Gantt Chart.....	7
Figure 2.1 Proposed Site.....	10
Figure 2.2 Preliminary Layout.....	11
Figure 2.3 Office Layout.....	12
Figure 2.4 Boring Logs.....	16
Figure 2.5 Section View of Trapezoid Ditch.....	19
Figure 2.6 Profile View of Trapezoid Ditch.....	19
Figure 2.7 Inflow Hydrograph	21
Figure 2.8 Detention Basin Section View.....	21
Figure 2.9 Detention Basin Profile View.....	22
Figure A.1 Plasticity Chart.....	25
Figure A.2 Terzaghi Bearing Capacity Factors.....	25
Figure A.3: Approximate Value of Cu, SPT and soil consistency.....	26
Figure A.4 Precipitation Point Frequency.....	26
Figure A.5 Roughness Coefficient.....	27

List of Tables

Table 2.1 Soil Classification 1.....	15
Table 2.2 Soil Classification 2.....	15
Table 2.3 Boring 1 Analysis for Square Pile Section.....	16
Table 2.4 Boring 2 Analysis for Square Pile Section.....	16
Table 2.5 Routing Table.....	20

Acknowledgment

The project was prepared by Scott McGary, Autumn Carter, Shadaria Lynch, and Perla Zaldivar collectively. The completion of the project would not have been possible without the hard work and productivity of each team member. Also, a special thanks to Dr. Alam and the Civil & Environmental Engineering Department for providing resources and guidance throughout the semester. Prior knowledge from each design course allowed us to have an advantage in creating a well-planned project.



Gantt chart goes at the end.

Gantt Timeline

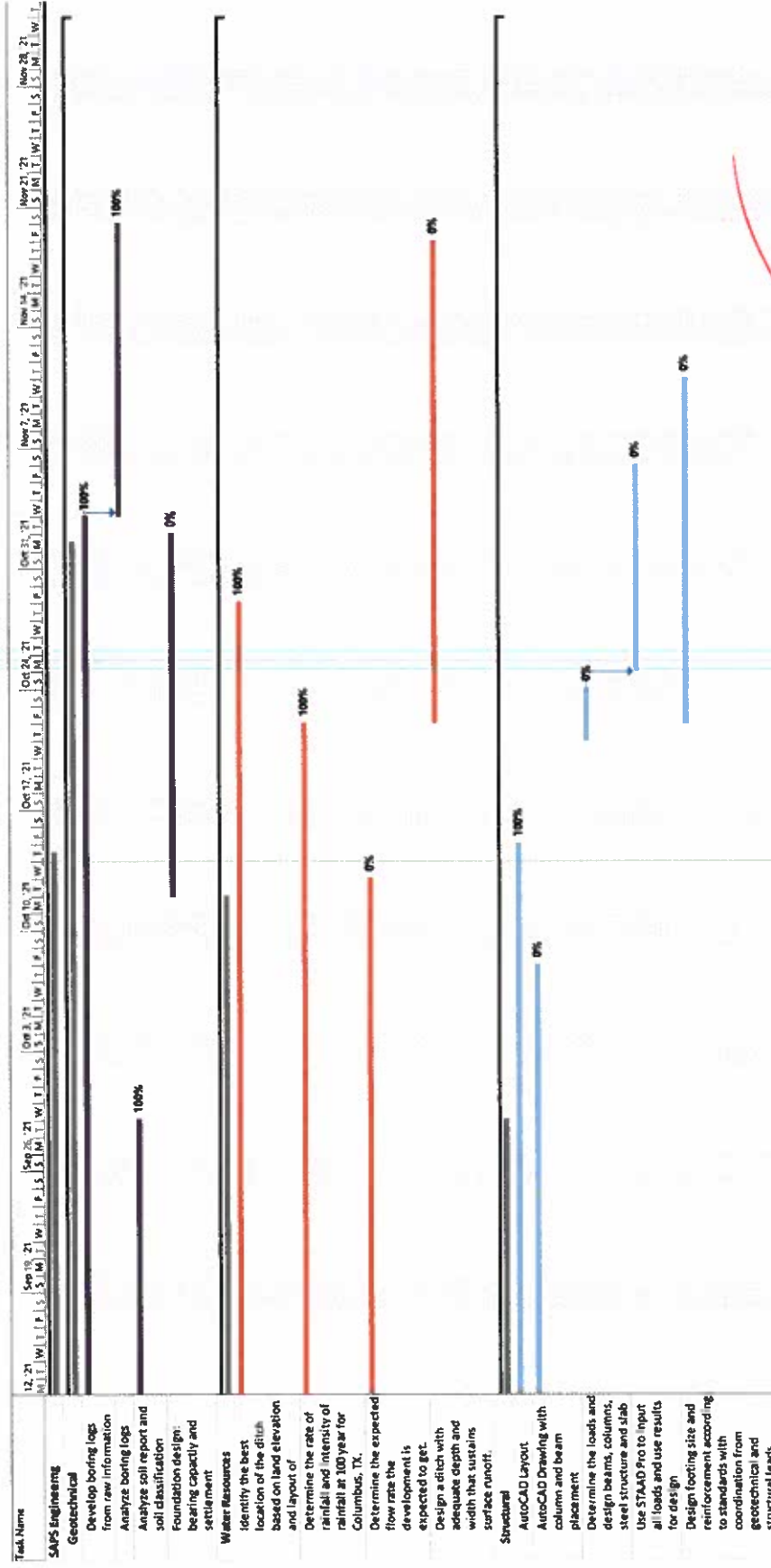


Figure 1. Gantt chart

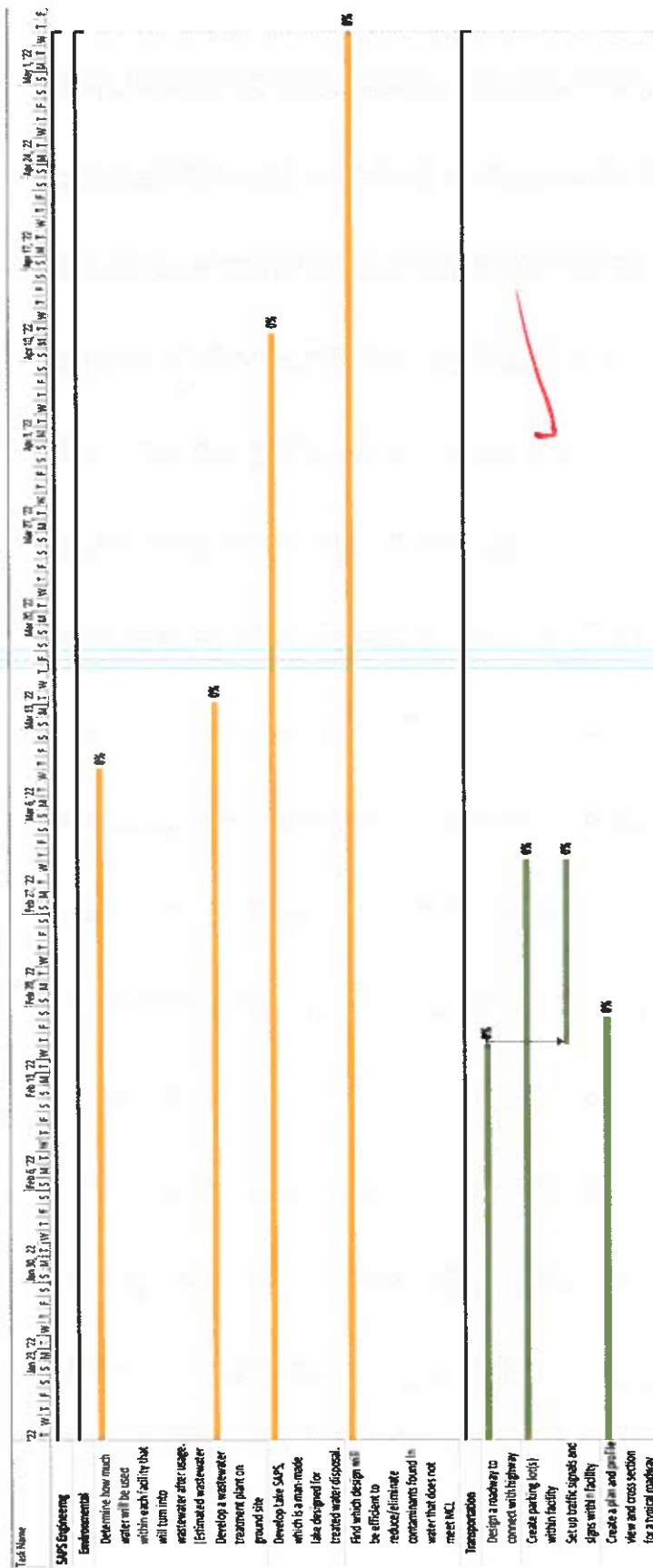
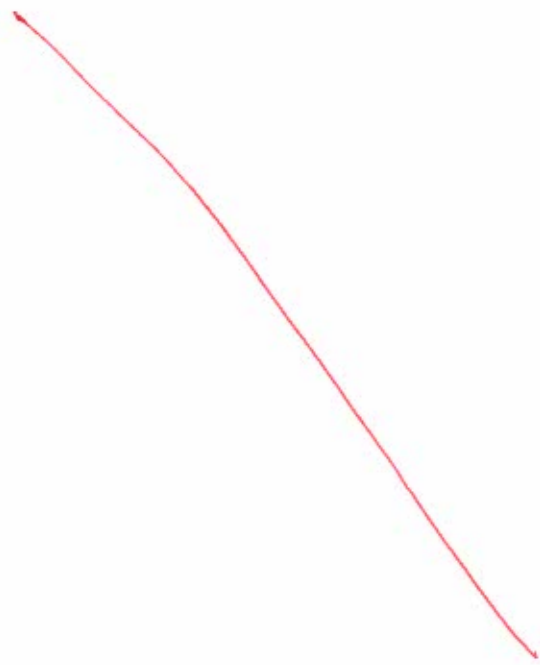


Figure 1.2 Gantt Chart

Introduction

The proposed development is located south of Columbus, TX in Colorado County. The proposed development will be located on 400 acres of land near I-10. The property was designed for 20,000 it will consist of 4 buildings, parking lots that accommodate employees, visitors, and trucks. Within the development, a detention basin and drainage ditch were added to prevent stormwater damage. A wastewater treatment process facility based on the population projection for 15 years. SAPS Engineering designed the roads and parking to effectively and efficiently allow the flow of traffic from I-10 to the Amazon distribution center and other buildings on the property.



Chapter 1: Project Scope

1.1 Problem Statement

Design a two five-story commercial office building, a steel structure warehouse, a three-story convention center, and parking lots for Amazon located in Colorado County, Texas

1.2 Project Goals

The design team was required to perform civil engineering site development and design services and address all aspects outlined in the reporting requirements and deliverable items of this project description. This project aims to provide an AutoCAD geometric design that includes an Amazon distribution headquarters with a roadway layout and a detention pond. Water & Wastewater Treatment plants are needed to serve 20,000 people for the center and surrounding area. In addition, a 2D conceptual layout design of the and office building is needed. Also, in the area, parking facilities will be designed for each building.

Chapter 2: Task Definition and Project Design

2.1 Geotechnical Engineering

To first complete this aspect of the project the task had to be defined first. This task needed to analyze the topography map to develop boring logs from raw information and analyze those boring logs to develop the soil classification. Once this is done the foundation design can begin. To complete this project the foundation design needs to be completed where I will go for both shallow foundation and deep foot foundation and choose which is the most safe at the best cost.

The picture below is a topography map that shows the location of the site. The location of the site is south of I-10, in Colorado County TX. The size of the site is 400 acres. The elevation of the site goes into a downwards slope from 300 to 289 feet above sea level. Therefore the average elevation of the site is 294.5 feet above sea level. The black circles shown on the topography map represent the locations where the borings were taken.

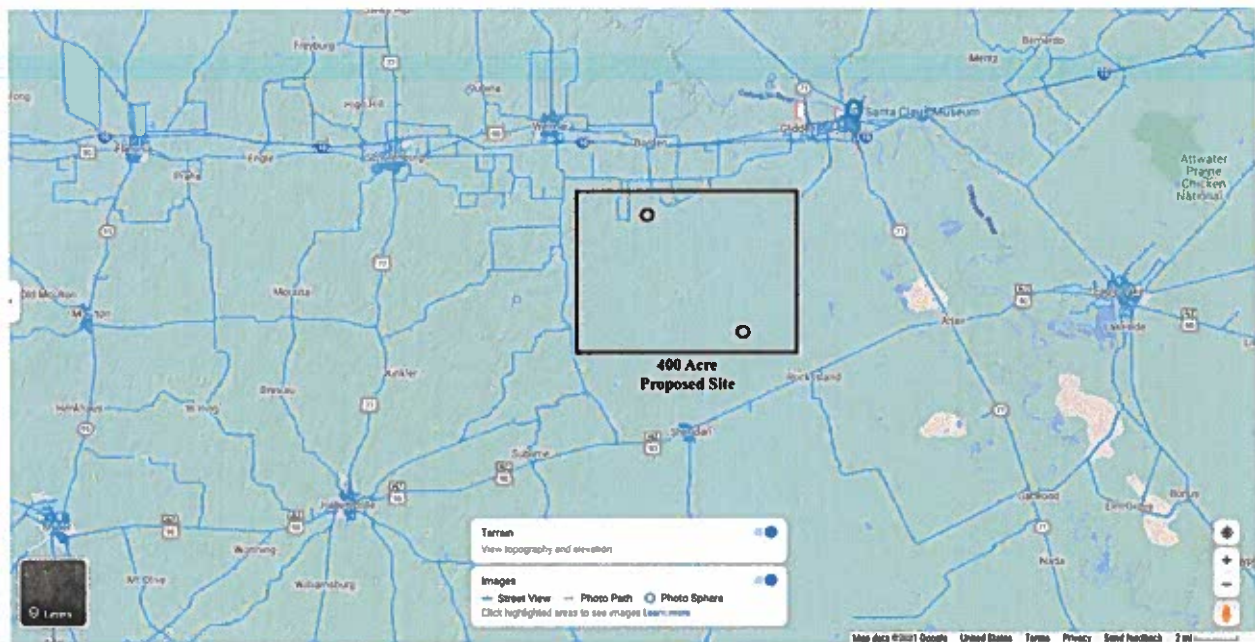


Figure 2.1 Proposed Site

AutoCAD was used in this project to create a preliminary layout of the 400 Acres. In the plan view provided by Google Maps; 2 miles scales to $\frac{1}{2}$ inch. In order to follow the constraints of the project the layout includes two five-story commercial office buildings, a steel structure warehouse, three-story convention center, facility parking lots, new road network development, sidewalks, driveways, and extension of major highways and connecting local road with highway and a storm water ditch connecting a lake. The layout below shows the preliminary layout of the proposed site plan. The layout includes a main entrance for 2-axle cars containing a right-turn lane, traffic signal, and ability to make left turn movements into each entrance. Also in the layout

service truck parking for the warehouse is provided. A wastewater treatment plant with a retention pond provides both stormwater attenuation and water quality treatment by providing additional storage capacity to retain runoff and release at a controlled rate. The design of the pond features includes an emergency spillway for safe overflow when storage capacity is exceeded.

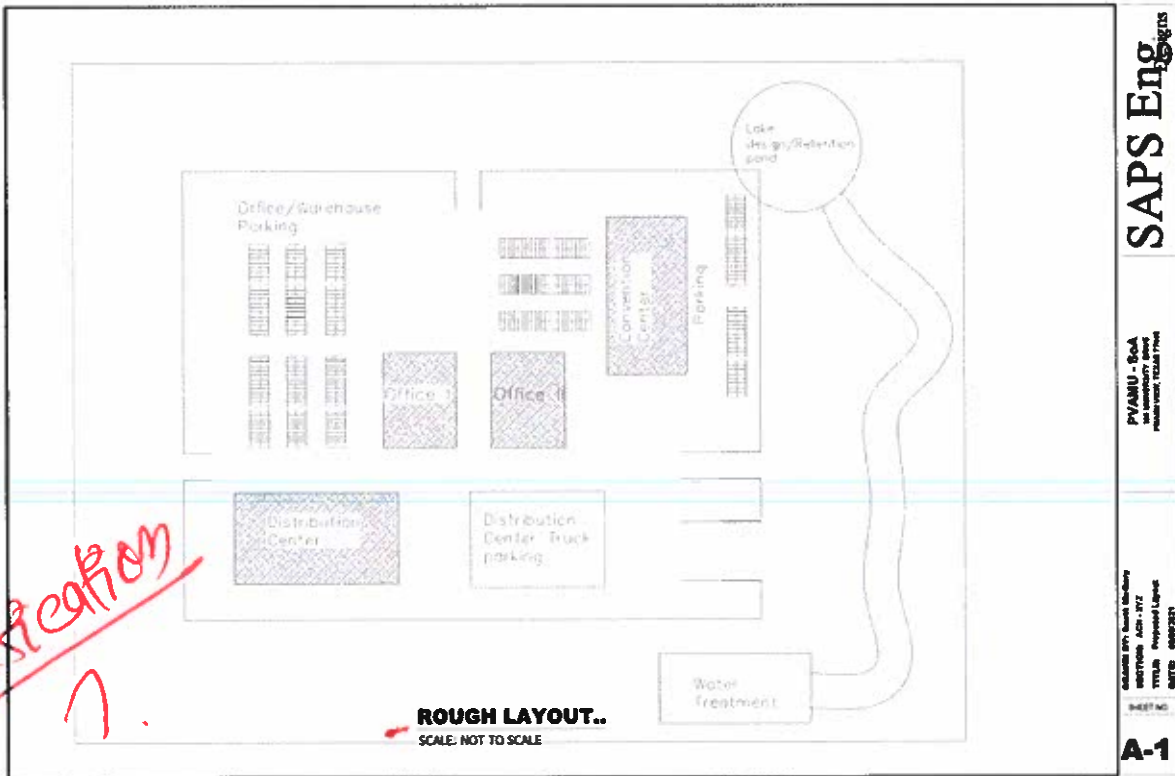


Figure 2.2 Preliminary Layout

Layout plan should be on
separate key in landscape.

structures?

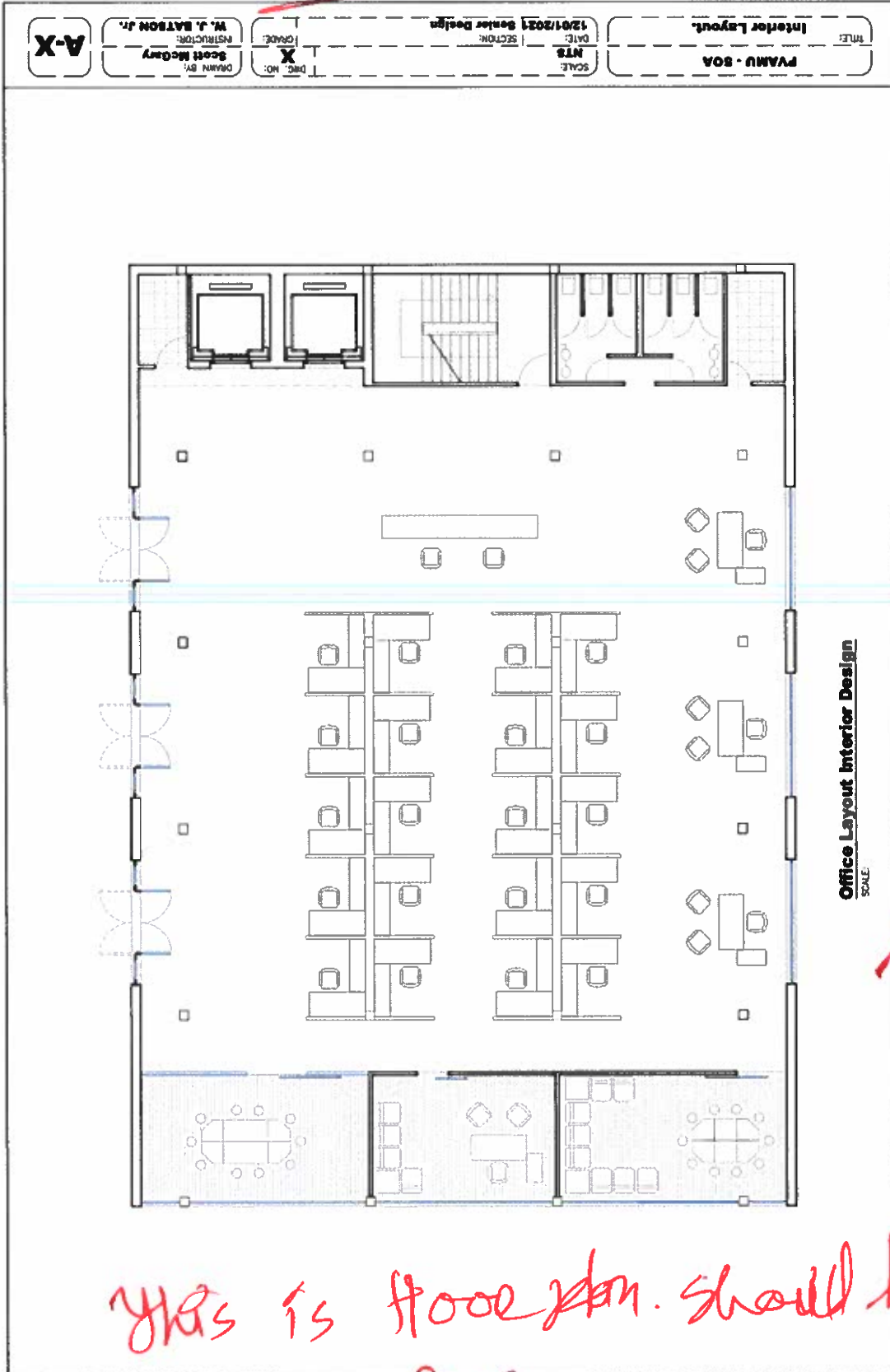


Figure 2.3 Office Layout

Geotechnical - section

2.1.2 Soil Properties

The boring log data for the location of the site is located below. This boring log displays the testing of the soil to classify the type of soil it is, the amount of stress it can take, as well as other properties of the soil that will make a difference when designing a structure on it.

The boring log tells the engineer the results from various tests of the soil within the site location. The log shows the depth of each kind of soil down to 70 feet. Based on the boring log data, the soil is classified as mostly Sandy Elastic Silt from boring 1 and Sandy Fat Clay from boring 2. Excel was utilized in developing a table to analyze this data. This was found by using the Liquid Limit (50), Plastic Limit (30), and Plasticity Index (29) according to the first table and Liquid Limit (60), Plastic Limit (27), and Plasticity Index (32) for the second table. This is shown on the boring log, and the use of the table and chart below to classify the soil of the site.

The bearing capacity of the soil was calculated by using the bearing capacity equation along with the safety factor.

$$q_u = 1.3cN_c' + qN_q' + 0.4\gamma B N_\gamma' \text{ (square foundation)}$$

Where

c = cohesion

B = width of footing

D_f = depth of the footing

The exact calculations of this are provided in the appendix. Using a FS factor of safety, of 3, the allowable bearing capacity, q_{allow} , was found.

$$q_{allow} = \frac{q_u}{FS}$$

Table 2.1 Soil Classification 1

Depth(ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	48	20		28	54%	46%	13% CL	Sandy Lean Clay
5	51	32		19	69%	31%	14% MH	Sandy Elastic Silt
10 ~	~	~	~	~	~	~	8%	Sand
12.5	46	19		27	74%	26%	18% CL	Sandy Lean Clay
17 ~	~	~	~	~	~	~	10%	Sand
20	32	16		16	59%	41%	13% CL	Sandy Lean Clay
25	60	31		29	81%	19%	21% MH	Sandy Elastic Silt
30	72	31		41	82%	18%	20% CH	Sandy Fat Clay
40	68	39		29	62%	38%	4% MH	Sandy Elastic Silt
50	80	39		41	69%	31%	18% MH	Sandy Elastic Silt
60	68	34		34	84%	16%	20% MH	Sandy Elastic Silt

Table 2.2 Soil Classification 2

Depth(ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	43	16		27	71%	29%	19% CL	Sandy Lean Clay
7.5	47	19		28	81%	19%	12% CL	Sandy Lean Clay
8.5 ~	~	~	~	~	20%	80%	6% ~	Sand
15	51	24		27	69%	31%	13% CH	Sandy Fat Clay
20 ~	~	~	~	~	16%	84%	8% ~	Sand
25	62	30		32	80%	20%	15% CH	Sandy Fat Clay
30	62	27		35	79%	21%	13% CH	Sandy Fat Clay
40	69	28		41	83%	17%	17% CH	Sandy Fat Clay
50	71	33		38	72%	28%	18% CH	Sandy Fat Clay
60	69	34		35	79%	21%	19% CH	Sandy Fat Clay

The Plasticity chart which is a graph between plasticity index (PI) and liquid limit (LL) in percentage which is used for the classification of fine-grained soils in accordance with the USCS. From the graph the geotechnical engineer can determine that low plasticity has a (LL) = < 35%, Intermediate plasticity (LL) = 35-50%, High plasticity (LL) = 50-70%, Very High plasticity (LL) 70-90%, and Extremely High plasticity (LL) = > 90%

To develop the boring logs AutoCAD needed to be used. The raw data given was tabulated, and the data produced was essential in creating the boring logs used to show the various fine-grained soils. This boring log also shows the elevations from which the raw information was taken.

Table 2.3 Boring 1 Analysis For Square Pile Section

Depth (ft)	SPT	Cu (psf)	Cu/Pa	α	Qp (lb)	Qs (lb)	Qu (lb)	f	f*AL
0	0	0	0	0	0	0	0	0	0
2.5	7	900	0.43	0.72	32400.00	3240.00	35640.00	648	1620
7.5	10	1200	0.57	0.6	43200.00	14040.00	57240.00	720	5400
9	15	0	0.00	0	0.00	14040.00	14040.00	0	0
15	15	2000	0.96	0.49	72000.00	43440.00	115440.00	980	14700
20	20	0	0.00	0	0.00	43440.00	43440.00	0	0
30	25	3400	1.63	0.38	122400.00	120960.00	243360.00	1292	38760
40	39	5300	2.54	0.34	190800.00	265120.00	455920.00	1802	72080
50	53	7100	3.40	0.34	255600.00	506520.00	762120.00	2414	120700
60	60	8000	3.83	0.34	288000.00	832920.00	1120920.00	2720	163200
68	89	9400	4.50	0.34	338400.00	1267576.00	1605976.00	3196	217328
							Sum		633788

Table 2.4 Boring 2 Analysis for Square Pile Section

Depth (ft)	SPT	Cu (psf)	Cu/Pa	α	Qp (lb)	Qs (lb)	Qu (lb)	f	f*AL
0	0	0	0.00	0.00	0.00	0.00	0.00	0	0
2.5	8	1000	0.48	0.67	36000.00	6700.00	42700.00	670	1675
5	10	1200	0.57	0.61	43200.00	21340.00	64540.00	732	3660
10	16	2100	1.01	0.48	75600.00	61660.00	137260.00	1008	10080
12.5	17	2250	1.08	0.47	81000.00	114535.00	195535.00	1057.5	13218.75
15	20	2500	1.20	0.41	90000.00	176035.00	266035.00	1025	15375
20	24	3300	1.58	0.39	118800.00	278995.00	397795.00	1287	25740
30	24	3300	1.58	0.39	118800.00	433435.00	552235.00	1287	38610
40	54	7200	3.45	0.34	259200.00	825115.00	1084315.00	2448	97920
50	44	5600	2.68	0.34	201600.00	1205915.00	1407515.00	1904	95200
60	72	9400	4.50	0.34	338400.00	1972955.00	2311355.00	3196	191760
68	98	9400	4.50	0.34	338400.00	2842267.00	3180667.00	3196	217328
							Sum		69748.75

capacity curve = ??

?

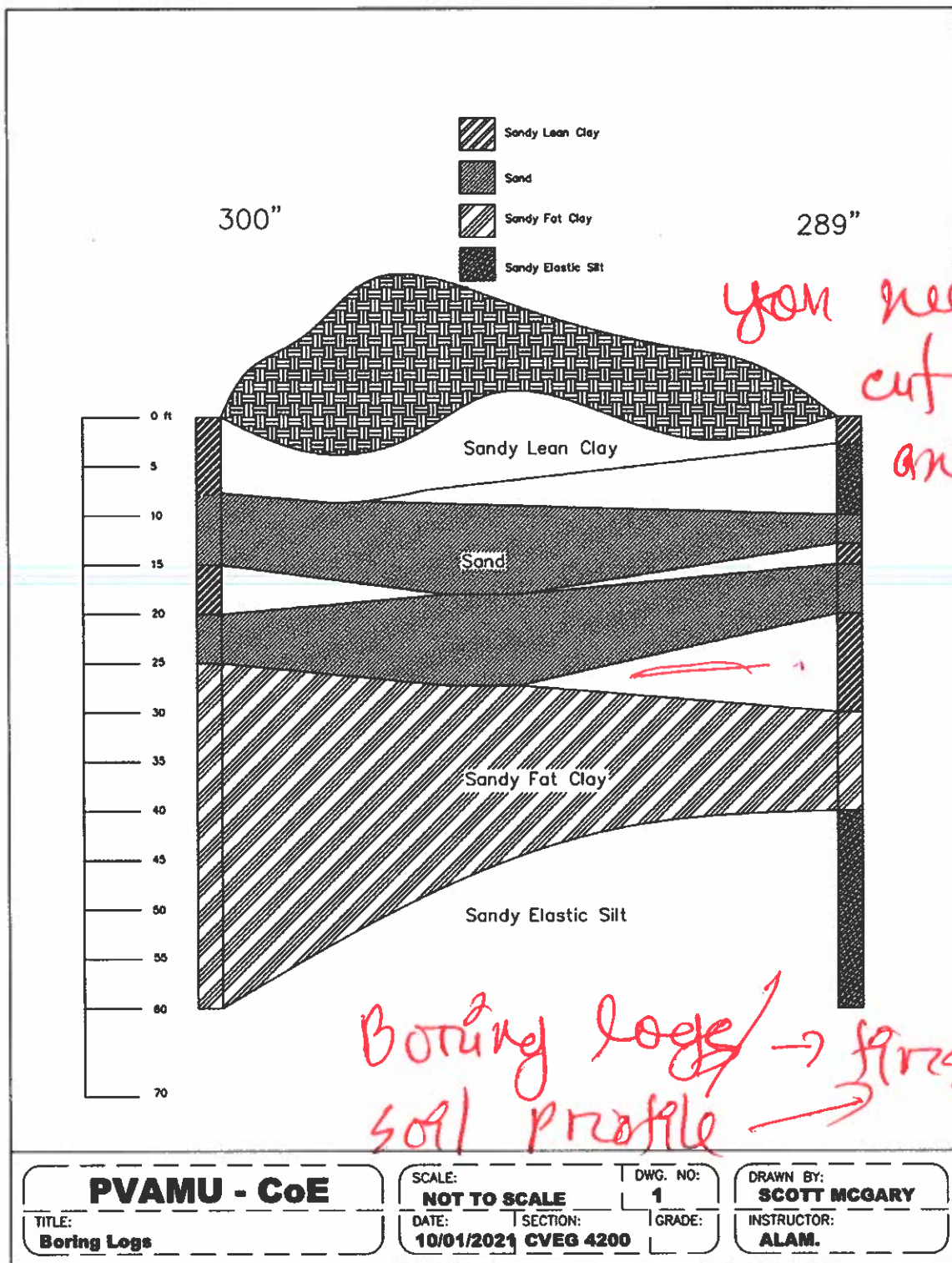


Figure 2.4 Boring Logs

2.2 Water Resources Engineering

2.2.1 Water Resources Objective

The objective of water resources is to design a ditch and a detention basin for the development of 400-acre land. The location of the proposed stormwater ditch was located at the lowest elevation of the proposed site using the local topographic map. The rainfall intensity for 100-year flooding was determined for Colorado County. The quantity of water and stormwater runoff was determined in order to build a ditch that can sustain the flow and detention basin.

2.2.2 Rainfall Intensity

The rainfall intensity was determined by using NOAA's National Weather Service. Using the chart the intensity interval for the 100 year flood period was found to be 0.591 in/hr. Reference Figure A.4 in Appendix that displays the precipitation frequency for Columbus, TX.

2.2.3 Stormwater Runoff

The water runoff depends upon the precipitation that infiltrates the ground. Once the infiltration capacity of the soil exceeds, the water begins to runoff. Development typically increases runoff and decreases absorption of water. Therefore, it is essential to determine the expected stormwater runoff to prevent damage to the property. To manage the stormwater, the pre-development runoff was determined. The runoff can be calculated with the rational equation,

$$Q = ciA$$

Q = peak runoff rate (cfs)

c = runoff coefficient

i = storm intensity (in/hr)

A = area (acres)

The area taken into account for pre-development was 400 acres since the land has no existing buildings. The runoff coefficient was determined to be 0.3 for farmland, the runoff for the pre-development was determined to be 47.28 cfs.

2.2.4 Drainage Ditch

An open channel is an integral part of a stormwater ditch design. In order to design an open trapezoidal channel, the manning equation was utilized.

$$Q = \frac{1.49}{n} AR^{2/3} S_o^{1/2}$$

Q = discharge, ft^3/s

n = roughness coefficient

A = flow area, ft^2

R = hydraulic radius

S_o = channel slope

The hydraulic radius can be expressed as,

$$R = \frac{A}{P}$$

P = perimeter, ft

The area and perimeter can be defined as,

$$A = by_o + zy_o^2$$
$$P = b + 2y_o\sqrt{1 + z^2}$$

z = side slope of the bank

y_o = channel depth, ft

b = bottom width, ft

The manning equation can be written as,

$$Q = \frac{1.49 A^{5/3}}{n P^{2/3}} S_o^{1/2}$$

The continuity equation can be written to find the design velocity,

$$Q = VA$$
$$V_{design} = \frac{Q}{A}$$

V_{design} = velocity, ft/s

2.2.5 Drainage Ditch Design

The Manning's equation and continuity equation were used to find the ditch dimensions.

Manning's roughness coefficient for a grass lined channel is 0.03 with a max permissible channel velocity of 3 to 6 ft/s. The slope of the channel is based on the elevation on the property, which was determined to be 0.7177. The slope of the drainage ditch will be 1:3. Excel was used to determine the channel depth and bottom width. The channel depth came out to be 0.494 ft and width of 3 ft.

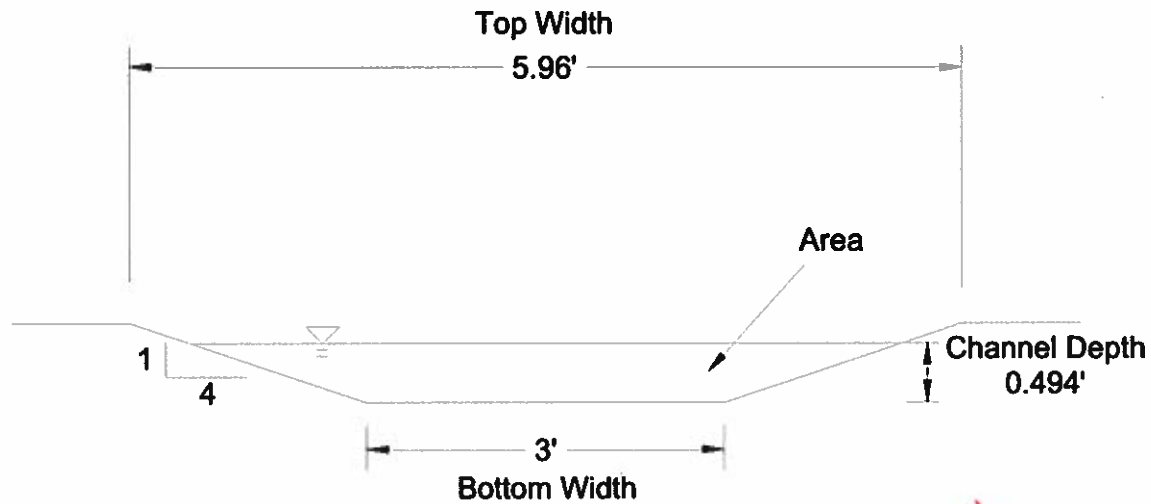


Figure 2.5 Section View of Trapezoid Ditch

The dimensions of the trapezoidal channel will support the discharge for the 100-year flood. Figure 2.6 displays the ditch in and flow of water on for a section of the development.

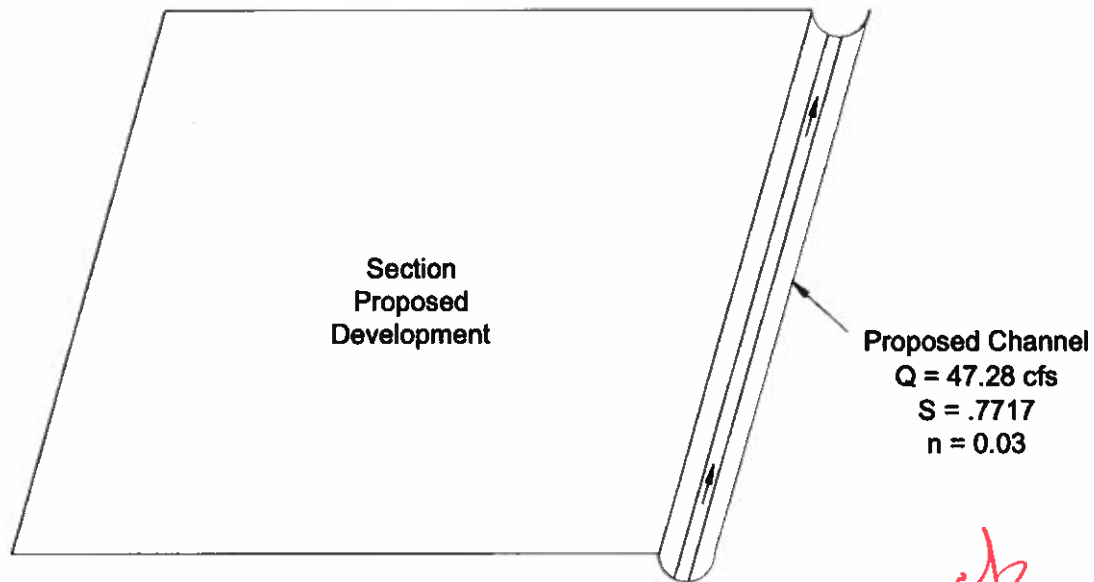


Figure 2.6 Profile View of Trapezoid Ditch

2.2.6 Stormwater Basin

The development requires a stormwater basin that allows the storage of runoff water in order to prevent flooding. With the data found on USGS the inflow of the ditch can be determined. A routing table can be developed to determine peak outflow, as shown in Table 2.2.6.

Table 2.5 Routing Table

Index	Time	Inflow, I	$(2s/\Delta t) - O$	$(2s/\Delta t) + O$	Outflow, O
(i)	(days)	(cfs)	(cfs)	(cfs)	(cfs)
1	0	517	21,600		500
2	1	519	22000	22,636	510
3	2	532	23000	23,051	550
4	3	741	24100	24,273	610
5	4	937	24200	25,778	690
6	5	645	25500	25,782	700
6	6	600	24000	26,745	690
7	7	590	23900	25,190	620
8	8	570	23800	25,060	610
9	9	565	23000	24,935	590

Figure 2.7 illustrates the inflow and outflow of the routing table. The peak discharge taken into account for the detention basin is 700 cfs.

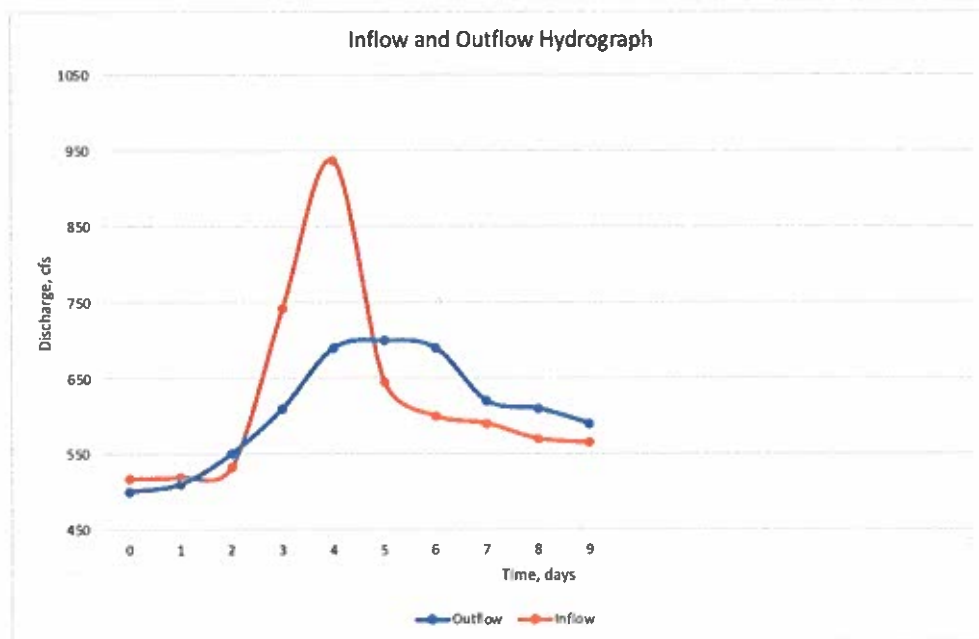


Figure 2.7 Inflow Hydrograph

The basin is suggested to have dimensions of 64ft by 64ft with a depth of 3.2ft. Figure 2.8 and 2.9 shows the section and profile view respectively.

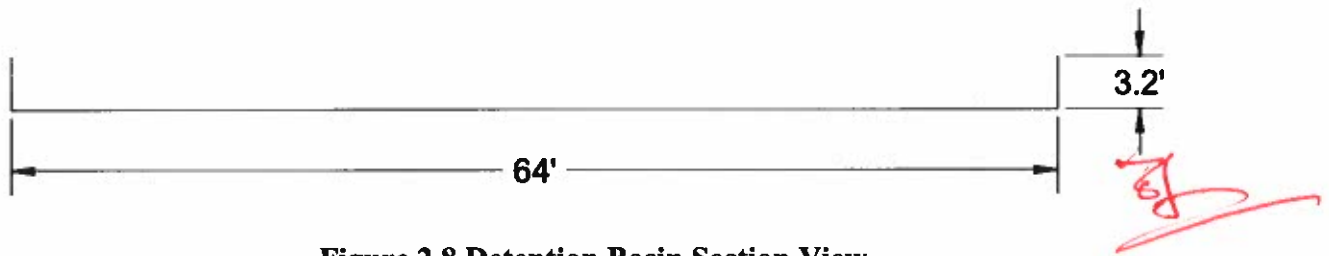
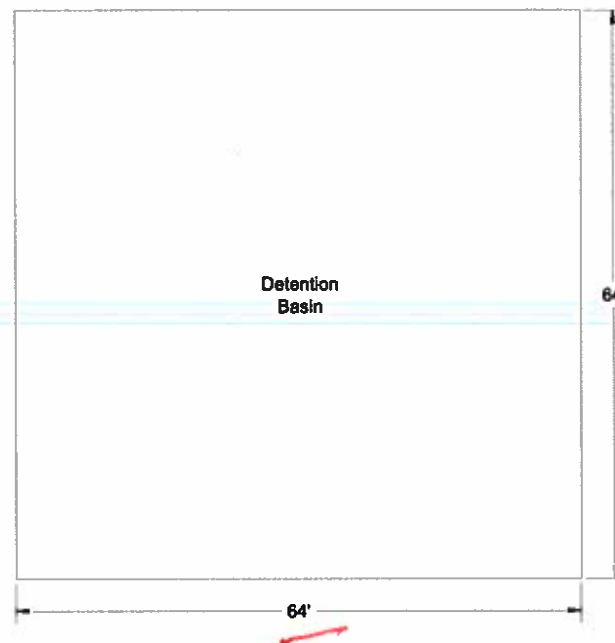


Figure 2.8 Detention Basin Section View



cross section required.

Figure 2.9 Detention Basin Profile View

2.3 Structural Engineering

Structural requires a 2D drawing of the office buildings, warehouse, and convention center. To determine structural load calculations, wind, dead, and live load will be taken for each structure. The load calculations will then be put into STAAD Pro, to provide maximum values of BM, shear, and axial load. Moreover, the structural design will include slab design, beam, and column design, the steel structure design of the warehouse, and reinforcement bars, and reinforced concrete design for foundations, including footing size, reinforcement.

2.4 Transportation Engineering

The goal for transportation is to provide a roadway layout for the project site and to have a connecting road with the highway (I-10). When designing the road interchange designs will be implemented. Plan and profile view and pavement-design cross-section of a typical road will be

included as well. When designing the roads, there will be a minimum of two entrances, left turn movements will be at each entrance, a right-turn lane will be at the main entrance, and at least one entrance will be regulated by traffic signals. Also, there will be parking lots within the project site, service truck parking for the warehouse will be separated from cars to accommodate visitors coming to the office building for Amazon. Additionally, the site will also include sidewalks throughout the business center and subdivision including residential areas, landscaping, and streetlights.

To get started on transportation, the roadway layout will be the first step. The engineer will determine how many roads are needed by taking into consideration existing roads nearby and the type of interchange that will best fit and meet Texas Department of Transportation (TxDOT) and US DOT requirements and specifications. The design for the roadway layout will begin in the next few weeks. Then, next semester the other sections for transportation will be completed.

2.5 Environmental Engineering

The beneficial purpose of environmental designing in the vicinity of Amazon's Distribution Center and IT Hub is to provide an efficient amount of water used for primary purposes that are useful to human life. The importance of water is to control and eliminate diseases, quality of life, carry out waste, and commercial and industrial activities. The municipal water use for this project will be categorized into domestic, and commercial/industrial usage; initializing the quality and quantity of water that will be useful on this site.

As the environmental engineer on this project, we will estimate the inflow water demand for the facility population of twenty thousand with a project projection for 15 years. We will also calculate the water demand for expansion for an additional 10-15 years for possible expansion of the center and surrounding area and communities. With the inflow of water throughout the quarters of the premises we'll have to follow EPA (Environmental Protection Agency) regulations regarding the Maximum Contaminant Level (MCL) that is legally enforced for human consumption and usage; National Primary Drinking Water Regulation. The placement of our wastewater treatment plant (WWTP) is located in the lower southeast region of our 400-acre lot, as of now, we are still working on the methodology for cleaning the wastewater before the disposal of effluent into a source of surface water. The disposal source for the facilities will be Griffin Lake following the Texas Administrative Code (TAC).

The first portion of the design process will start with calculating the population in Columbus, Texas from the past five years, then calculate the population projection with the addition of twenty-thousands employees for future population. We will obtain the current estimated per capita raw water demand to determine our Q values. This process will begin over the span of Christmas Break up until the start of spring semester. The remaining tasks such as developing a wastewater schematic design, developing a disposal site, and articulating the proper disposal of

treated effluent contaminant level causing no harm to the environment and ecosystem will be completed throughout the upcoming semester.

82

Chapter 3: References

AASHTO Soil Classification System

American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011.

EPA, Environmental Protection Agency, <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>.

Hydraulic Design Manual, http://onlinemanuals.txdot.gov/txdotmanuals/hyd/manual_notice.htm.

Storm Water Management Design Manual - Mansfield, Texas.

<https://www.mansfieldtexas.gov/DocumentCenter/View/630/2010-Mansfield-iSWM-Local-Criteria-Section-PDF>.

Texas Department of Transportation, Roadway Design Manual 2020 Edition, July 2020 Engineering Dept Consultants Transportation & Planning Resources.

U.S. Department of Transportation, Federal Highway (FHWA) Hydraulic Design

U.S. Department of Transportation, Federal Highway (FHWA) Manual on Uniform Traffic Control Devices 2009 Edition, January 2010.

US Department of Commerce, NOAA. *PF Map: Contiguous Us*, US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, 7 Nov. 2005, https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx.



Appendix 1 Images

Geotechnical Data Collected

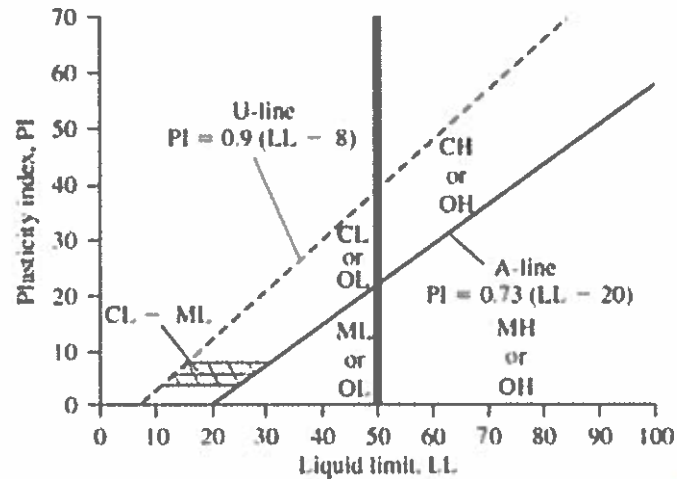


Figure A.1 Plasticity Chart

3.3 Terzaghi's Bearing Capacity Theory 139

Table B.1 Terzaghi's Bearing Capacity Factors—Eqs. (3.4), (3.5), and (3.6) a From Kumbhojkar (1993)

ϕ°	N_c	N_q	N_γ^a	ϕ°	N_c	N_q	N_γ^a
0	5.70	1.00	0.00	26	27.09	14.21	9.84
1	6.00	1.10	0.01	27	29.24	15.90	11.60
2	6.30	1.22	0.04	28	31.61	17.81	13.70
3	6.62	1.35	0.06	29	34.24	19.98	16.18
4	6.97	1.49	0.10	30	37.16	22.46	19.13
5	7.34	1.64	0.14	31	40.41	25.28	22.63
6	7.73	1.81	0.20	32	44.04	28.52	26.87
7	8.15	2.00	0.27	33	48.09	32.23	31.94
8	8.60	2.21	0.35	34	52.64	36.50	38.04
9	9.09	2.44	0.44	35	57.75	41.44	45.41
10	9.61	2.69	0.56	36	63.53	47.16	54.36
11	10.16	2.98	0.69	37	70.01	53.80	65.27
12	10.76	3.29	0.85	38	77.50	61.55	78.61
13	11.41	3.63	1.04	39	85.97	70.61	95.03
14	12.11	4.02	1.26	40	95.66	81.27	115.31
15	12.86	4.45	1.52	41	106.81	93.85	140.51
16	13.68	4.92	1.82	42	119.67	108.75	171.99
17	14.60	5.45	2.18	43	134.58	126.50	211.56
18	15.12	6.04	2.59	44	151.95	147.74	261.60
19	16.56	6.70	3.07	45	172.28	173.28	325.34
20	17.69	7.44	3.64	46	196.22	204.19	407.11
21	18.92	8.26	4.31	47	224.55	241.80	512.84
22	20.27	9.19	5.09	48	258.28	287.85	650.67
23	21.75	10.23	6.00	49	298.71	344.63	831.99
24	23.36	11.40	7.08	50	347.50	415.14	1072.80
25	25.13	12.72	8.34				

^aFrom Kumbhojkar (1993)

Figure A.2: Terzaghi Bearing Capacity Factors

Table 24. Approximate values of undrained shear strength for cohesive soils based on SPT blow count N-values (from Terzaghi and Peck, 1967)

Soil Consistency	SPT N (See Note)	S _u (psf)
Very Soft	< 2	< 250
Soft	2 - 4	250 - 500
Medium	4 - 8	500 - 1000
Stiff	8 - 15	1000 - 2000
Very Stiff	15 - 30	2000 - 4000
Hard	> 30	> 4000

Figure A.3: Approximate Value of Cu, SPT and soil consistency

Water Resources Engineering

Duration	PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹									
	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	5.72 (4.33-7.57)	6.61 (5.08-8.66)	8.08 (6.19-10.6)	9.28 (6.96-12.3)	10.9 (7.92-15.0)	12.1 (8.59-17.1)	13.4 (9.23-19.4)	14.6 (9.84-21.8)	16.3 (10.8-25.2)	17.6 (11.2-27.8)
10-min	4.55 (3.44-6.01)	5.26 (4.02-6.89)	6.43 (4.90-8.46)	7.40 (5.55-9.86)	8.72 (6.35-12.0)	9.73 (6.90-13.7)	10.7 (7.39-15.6)	11.7 (7.84-17.4)	12.9 (8.37-19.8)	13.8 (8.71-21.8)
15-min	3.84 (2.91-5.08)	4.42 (3.38-5.80)	5.38 (4.10-7.08)	6.17 (4.63-8.22)	7.24 (5.28-9.92)	8.04 (5.89-11.3)	8.84 (6.10-12.8)	9.66 (6.50-14.4)	10.8 (6.90-16.6)	11.6 (7.34-18.3)
30-min	2.74 (2.07-3.61)	3.13 (2.40-4.11)	3.79 (2.89-4.99)	4.33 (3.25-5.77)	5.06 (3.67-6.82)	5.59 (3.95-7.88)	6.14 (4.23-8.90)	6.73 (4.53-10.0)	7.54 (4.90-11.6)	8.19 (5.18-12.9)
60-min	1.78 (1.35-2.38)	2.06 (1.58-2.70)	2.51 (1.92-3.31)	2.88 (2.17-3.85)	3.40 (2.46-4.84)	3.77 (2.66-5.31)	4.17 (2.87-6.04)	4.60 (3.10-6.88)	5.23 (3.40-8.07)	5.74 (3.63-8.77)
2-hr	1.07 (0.816-1.41)	1.28 (0.973-1.64)	1.60 (1.22-2.08)	1.87 (1.41-2.48)	2.26 (1.65-3.08)	2.57 (1.82-3.60)	2.90 (2.01-4.18)	3.26 (2.23-4.85)	3.84 (2.50-5.89)	4.31 (2.74-6.76)
3-hr	0.779 (0.584-1.02)	0.947 (0.720-1.21)	1.20 (0.921-1.56)	1.43 (1.08-1.89)	1.77 (1.28-2.40)	2.03 (1.45-2.84)	2.33 (1.62-3.34)	2.68 (1.81-3.94)	3.19 (2.08-4.86)	3.61 (2.30-5.65)
6-hr	0.447 (0.342-0.579)	0.541 (0.424-0.700)	0.729 (0.559-0.934)	0.894 (0.671-1.18)	1.12 (0.826-1.51)	1.31 (0.943-1.83)	1.54 (1.07-2.19)	1.79 (1.22-2.62)	2.17 (1.42-3.29)	2.49 (1.59-3.88)
12-hr	0.259 (0.183-0.323)	0.323 (0.243-0.385)	0.425 (0.327-0.538)	0.534 (0.399-0.800)	0.675 (0.502-0.910)	0.809 (0.584-1.12)	0.982 (0.673-1.36)	1.13 (0.771-1.64)	1.39 (0.912-2.09)	1.60 (1.03-2.47)
24-hr	0.141 (0.109-0.181)	0.186 (0.136-0.224)	0.248 (0.181-0.312)	0.309 (0.237-0.399)	0.405 (0.303-0.544)	0.491 (0.358-0.679)	0.581 (0.445-0.809)	0.690 (0.478-1.00)	0.854 (0.583-1.27)	0.961 (0.632-1.50)
2-day	0.090 (0.062-0.101)	0.107 (0.080-0.127)	0.144 (0.112-0.180)	0.182 (0.140-0.233)	0.241 (0.183-0.324)	0.297 (0.218-0.409)	0.358 (0.253-0.499)	0.419 (0.287-0.597)	0.509 (0.330-0.738)	0.582 (0.383-0.854)
3-day	0.068 (0.045-0.073)	0.078 (0.059-0.092)	0.105 (0.082-0.130)	0.132 (0.102-0.169)	0.174 (0.133-0.234)	0.214 (0.159-0.294)	0.257 (0.182-0.387)	0.299 (0.205-0.424)	0.354 (0.236-0.521)	0.396 (0.266-0.590)
4-day	0.047 (0.036-0.059)	0.062 (0.047-0.073)	0.083 (0.065-0.103)	0.104 (0.080-0.132)	0.136 (0.104-0.181)	0.168 (0.122-0.226)	0.198 (0.140-0.274)	0.230 (0.158-0.325)	0.272 (0.181-0.389)	0.306 (0.197-0.459)
7-day	0.031 (0.024-0.039)	0.040 (0.031-0.048)	0.053 (0.041-0.065)	0.065 (0.050-0.082)	0.083 (0.063-0.108)	0.099 (0.073-0.134)	0.117 (0.083-0.161)	0.135 (0.093-0.191)	0.161 (0.107-0.234)	0.181 (0.117-0.271)
10-day	0.024 (0.019-0.030)	0.030 (0.024-0.037)	0.040 (0.031-0.049)	0.048 (0.038-0.061)	0.061 (0.046-0.080)	0.072 (0.053-0.097)	0.084 (0.060-0.116)	0.097 (0.067-0.138)	0.115 (0.077-0.165)	0.130 (0.085-0.194)
20-day	0.016 (0.012-0.019)	0.019 (0.015-0.023)	0.025 (0.019-0.030)	0.032 (0.023-0.037)	0.038 (0.027-0.048)	0.041 (0.030-0.055)	0.047 (0.034-0.064)	0.053 (0.037-0.074)	0.062 (0.042-0.090)	0.069 (0.045-0.103)
30-day	0.012 (0.010-0.015)	0.015 (0.012-0.018)	0.019 (0.015-0.023)	0.022 (0.017-0.028)	0.027 (0.020-0.035)	0.031 (0.022-0.040)	0.034 (0.025-0.046)	0.038 (0.027-0.053)	0.044 (0.030-0.063)	0.048 (0.032-0.072)
45-day	0.010 (0.008-0.013)	0.012 (0.010-0.015)	0.015 (0.012-0.019)	0.018 (0.014-0.022)	0.021 (0.016-0.027)	0.023 (0.017-0.031)	0.026 (0.019-0.036)	0.029 (0.020-0.040)	0.032 (0.022-0.046)	0.035 (0.022-0.051)
60-day	0.009 (0.007-0.011)	0.011 (0.009-0.013)	0.013 (0.010-0.016)	0.015 (0.012-0.019)	0.018 (0.013-0.023)	0.020 (0.015-0.026)	0.022 (0.016-0.029)	0.024 (0.017-0.033)	0.026 (0.018-0.037)	0.028 (0.018-0.041)

Figure A.4 Precipitation Point Frequency

Channel Description	Manning's n	Maximum Permissible Channel Velocity (ft/s)
MINOR NATURAL STREAMS		
Fairly regular section		
1. Some grass and weeds; little or no brush	0.030	3 to 6
2. Dense growth of weeds, depth of flow materially greater than weed height	0.035	3 to 6
3. Some weeds, light brush on banks	0.035	3 to 6
4. Some weeds, heavy brush on banks	0.050	3 to 6
5. Some weeds, dense willows on banks	0.060	3 to 6
For trees within channels with branches submerged at high stage, increase above values by	0.010	
Irregular section with pools, slight channel meander, increase above values by	0.010	
Floodplain – Pasture		
1. Short grass	0.030	3 to 6
2. Tall grass	0.035	3 to 6
Floodplain – Cultivated Areas		
1. No crop	0.030	3 to 6
2. Mature row crops	0.035	3 to 6
3. Mature field crops	0.040	3 to 6
Floodplain – Uncleared		
1. Heavy weeds scattered brush	0.050	3 to 6
2. Wooded	0.120	3 to 6
MAJOR NATURAL STREAMS		
Roughness coefficient is usually less than for minor streams of similar description on account of less effective resistance offered by irregular banks or	Range from 0.028 to 0.060	3 to 6

Figure A.5 Roughness Coefficient

Appendix 2 Calculations

Water Resources

Stormwater Runoff

$$Q = ciA$$

$$Q = (0.3)(0.91 \text{ in/hr})(400 \text{ acres})$$

$$Q = 47.28 \text{ cfs}$$

Drainage Ditch

$$Q = 47.28 \text{ cfs}$$

$$Z = 3 \quad (1:3)$$

$$S_0 = 0.7177 \text{ ft/ft}$$

$$\text{assume } b = 3$$

• Flow area

$$A = by + zy^2$$

$$A = (3 \text{ ft})(0.494 \text{ ft}) + (3)(0.494 \text{ ft})^2$$

$$A = 2.214 \text{ ft}^2$$

• Top width

$$T = b + 2zy$$

$$T = (3 \text{ ft}) + 2(3)(0.494 \text{ ft})$$

$$T = 5.904 \text{ ft}$$

• Wetted Perimeter

$$P = b + 2\sqrt{y^2 + Z^2y^2}$$

$$P = 3 \text{ ft} + 2\sqrt{(0.494 \text{ ft})^2 + (3)^2(0.494 \text{ ft})^2}$$

$$P = 6.124 \text{ ft}$$

• Hydraulic Radius

$$R = A/P$$

$$R = (2.214 \text{ ft}^2) / 6.124 \text{ ft}$$

$$R = 0.3615 \text{ ft}$$

hand calculation - ?

• Hydraulic Depth

$$D = A / T$$

$$D = (2.214 \text{ ft}^2) / 5.964$$

$$D = 0.3712 \text{ ft}$$

• Flowrate

$$Q = \frac{1.49}{n} A R^{2/3} S_0^{1/2}$$

$$Q = \frac{1.49}{0.03} (2.214 \text{ ft}^2) (0.3015 \text{ ft})^{2/3} (0.7177)^{1/2}$$

$$Q = 47.28 \text{ cfs}$$

• Channel Velocity

$$V = Q / A$$

$$V = \frac{47.28 \text{ cfs}}{2.214 \text{ ft}^2}$$

$$V = 21.35 \text{ ft/s}$$

75

Prairie View A&M University
Roy G Perry College of Engineering
Civil & Environmental Engineering Department



CVEG 4200-P01 – Senior Design

Fall 2021

**Project Report 1- Development of Business and
Distribution Center, and IT Hub for Amazon**

Submitted to:

Dr. Jobair Bin Alam

Submitted by: JJMPS Consulting

Sydney Jones, Paige Hines, Jerral Walker, Michael Leblanc,

Johnathon Chevalier

Date Due: December 1st, 2021

Table of Contents

Introduction	3
Project Scope:	3
Progression Timeline	4-5
Water Resources	6-7
Structural	8-15
Geotechnical	16-19
Transportation	19-22
Environmental (Wastewater Treatment Plant)	23-25
Executive Summary	26-32
References	33-34

Introduction

PVAMU Civil Engineering Students are to develop and design the business and distribution center, IT Hub, and office development on a 400-acre site located in Waller, Washington and Colorado Counties located south of major Highways (US 290 and I-10) for Amazon. The specific scope of the project will include Civil Engineering Development and Design services for the entire site which will include two five-story commercial office buildings, a steel structure warehouse, a three-story convention center, and parking lots. The students will also perform new road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility. The facilities will be designed for 20,000 people or based on population projection for 15 years. A map showing site locations is included at the end of this document.

Project Scope

The project team is required to perform Civil Engineering Site Development and Design services and address all aspects outlined in the project description:

Employee Count – 20,000 employees

- o 40% of employees in the warehouse
- o 35% of employees in the warehouse

- o 15% of employees in the IT Hub
- o 10% of employees in the warehouse

Location – Waller County



Figure 1.1: Waller County Project Location

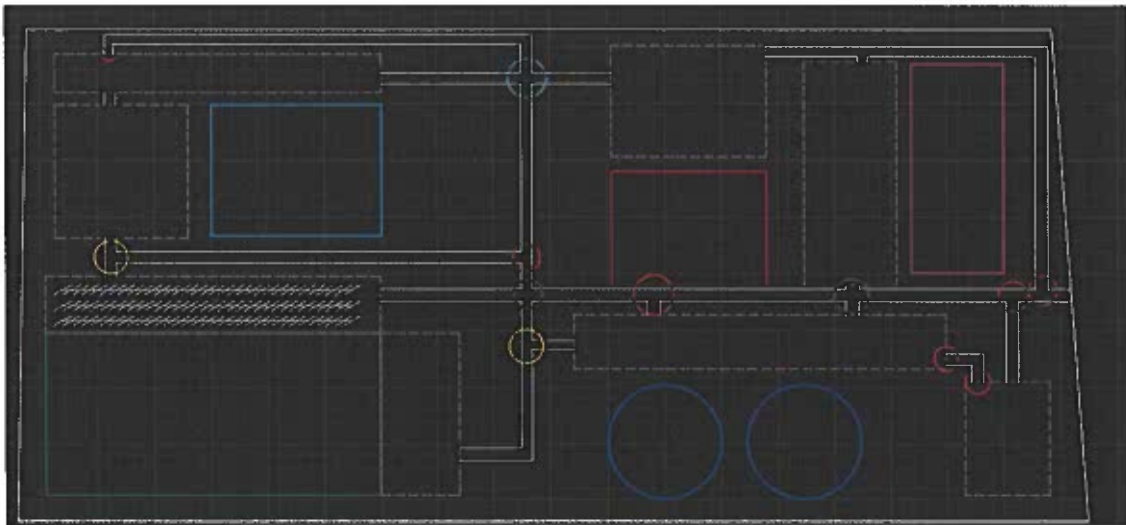


Figure 1.2: Project Plan View

Layout plan on any CAD drawing in white background is recommended.

Progression Timeline

Structural Engineering:

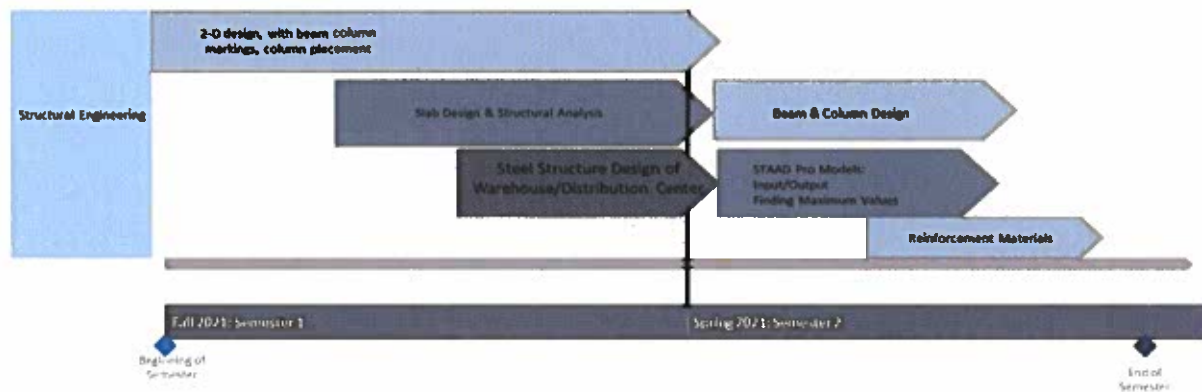


Figure 2.1: Structural Engineering Progression Timeline

Geotechnical Engineering:

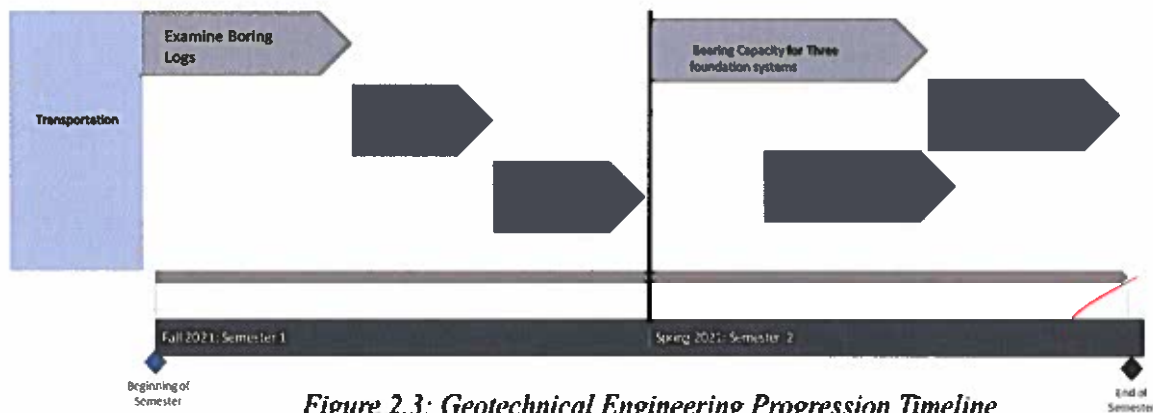


Figure 2.3: Geotechnical Engineering Progression Timeline

Water Resources Engineering:

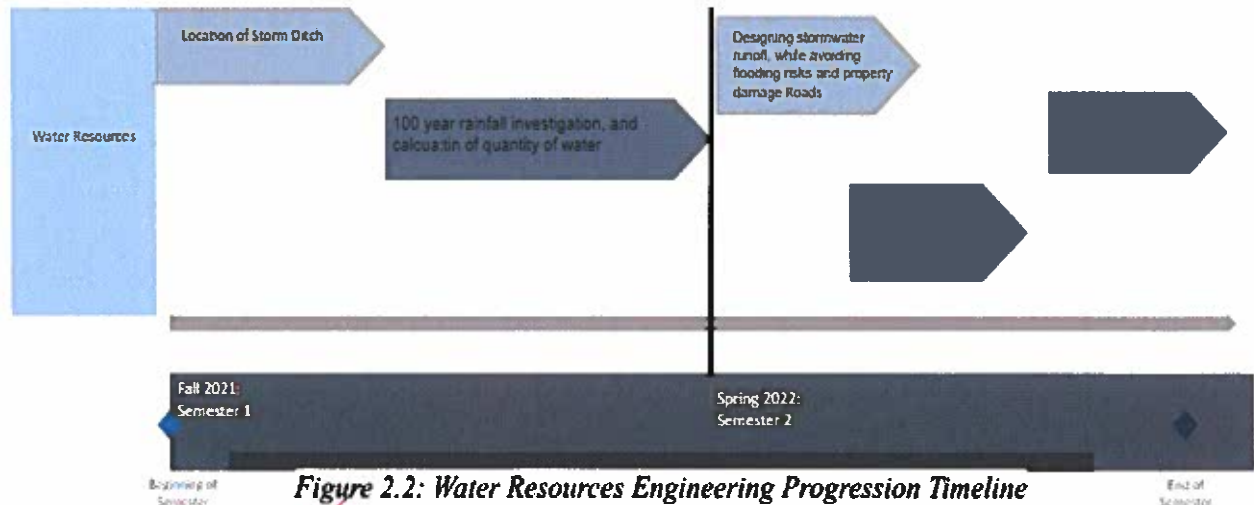


Figure 2.2: Water Resources Engineering Progression Timeline

Transportation Engineering:

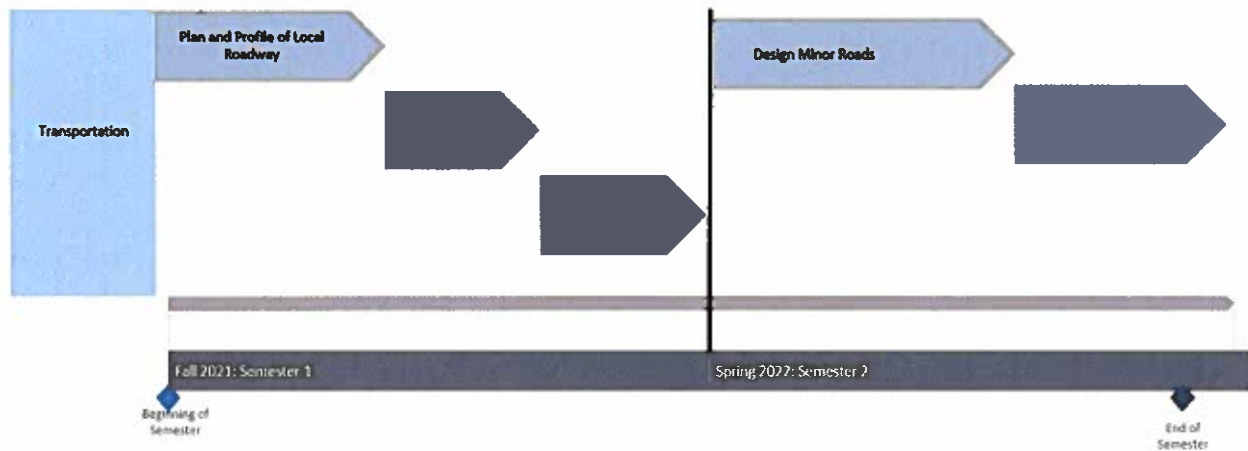


Figure 2.4: Transportation Engineering Progression Timeline

Environmental Engineering:

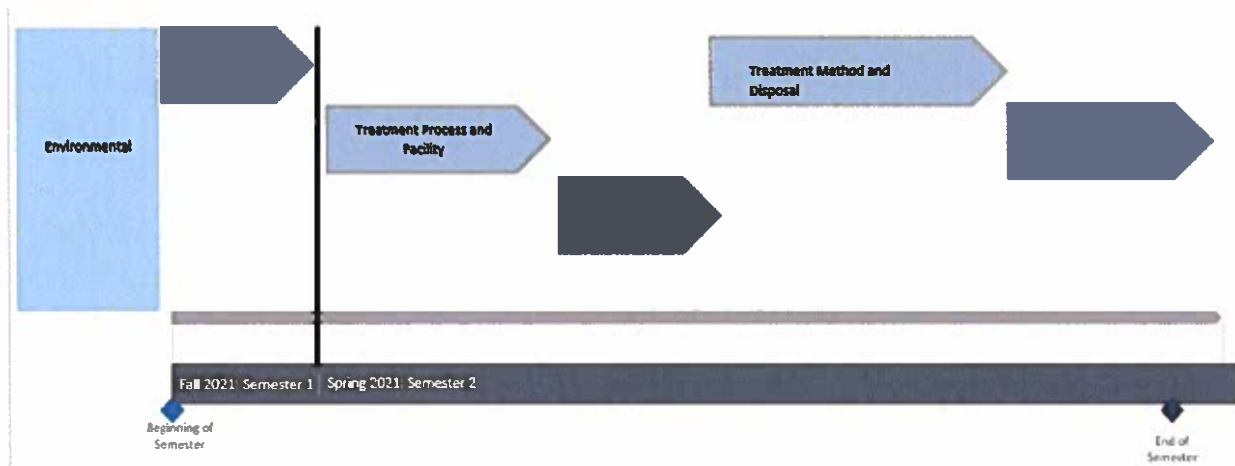


Figure 2.4: Environmental Engineering Progression Timeline

OK

OK! now
more detail breakdown
of the tasks is required.

Water Resources

For the water resources part, the location of the storm water ditch was discussed and placed with the help of the environmental and geotechnical authorities so that all aspects balance out. Engineers studied the site using google maps to understand the elevation of the construction site. Obtaining that information, the storm drainage ditches could be designed by the use of gravity to create flow from the highest elevation. Below is a demonstration of where the storm ditch will be placed as well as the detention basin:



The quantity of water was calculated by using the rational method. This equation represents the relationship between rainfall intensity and catchment area as independent variables and the investigation of the 100 year peak flood discharge as a dependent variable. This will help with determining Q, the storm water runoff to avoid risk of flooding and property damage.

Rational Method:

$$Q = C * I * A$$

Where

Q = Runoff Flow

C = Runoff Coefficient

I = Rainfall Intensity

A = Acres

$$127.05cfs = .3 \times 1.05 \frac{in}{hr} \times 400acres \times \frac{43560 ft}{1in} \times \frac{1ft}{12in} \times \frac{1hr}{3600s}$$

All water will be carried from the pre/post construction area at its highest elevation, in a designed trapezoid channel based on the peak rainfall in Waller county. The elevation information has been obtained from my geotechnical engineer. To complete the design a profile and crosssection will be provided.

~ why trapezoidal? you may decide your channel geometry after design?

Structural Engineering

Requirements and Designs

- i. 2D Drawing- For the purpose of understanding, the IT Hub will be fully disclosed with figures and an explanation as a guide to how the other buildings were designed and accurately accounted for. Refer to appendix for *Excel file 1* to account for the other buildings.

1. It Hub

a. AREA:

- i. 100,000 square feet
- ii. 400'x 250'

b. 4 – story building

- c. This building is to be able to employ 10% of the projected 20,000 employees that are to be hired by Amazon.

2. Office Buildings

a. AREA:

- i. 540,225 square feet (Combined)
- ii. 12.5 acres roughly

b. 5 – story building each

- c. These buildings are to be able to employ of 30% of the projected 20,000 employees that is to be hired by Amazon.

3. Convention Center

a. AREA:

- i. 2.5 million square feet
- ii. 57 acres (largest structure)

b. 3 – story building

- c. This building is to be able to employ at least 15% of the projected 20,000 employees that is to be hired by Amazon.

4. Warehouse

a. AREA:

- i. 350,000 square feet
- ii. 1000'x 350'

b. 1 – story building

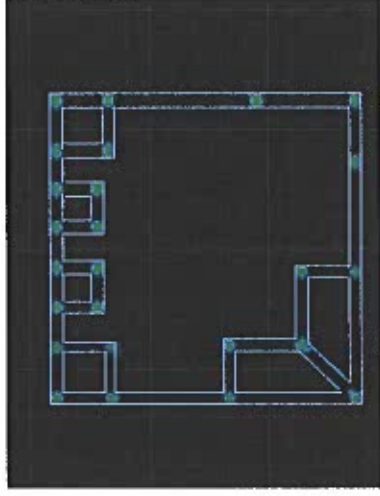
- c. This building is to be able to employ at least 45% of the projected 20,000 employees that are to be hired by Amazon.

2. Structural load calculation/ Slab Design

- i. As an update, the determination of load for each structure is being calculated and appraised with regards to references from multiple manuals and from similar buildings of the same structure in the nearby area.
- 3. Beam Column Design
- 4. Completion of Steel Structure
- 5. STAAD Pro
- 6. Reinforcement Materials

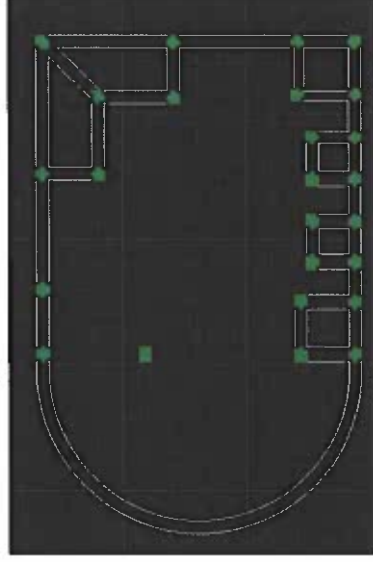
~~title~~
 figure No. always
 below the figure
 label?

Figure 3.1: First Floor of IT Hub



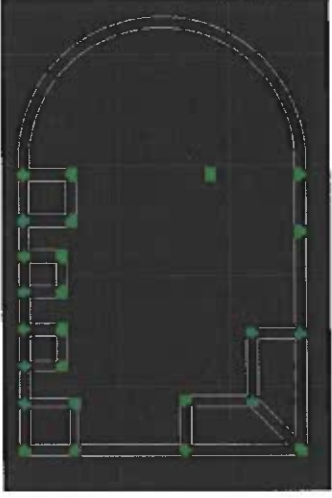
This figure includes an autocad version of the 2-D drawing of the first floor of the IT Hub designs with beam & column placement.

Figure 3.2: Second Floor of IT Hub



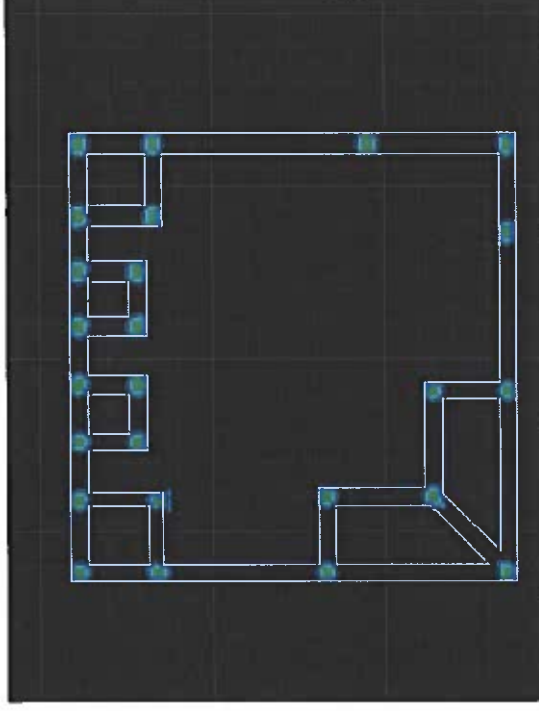
This figure includes an autocad version of the 2-D drawing of the second floor of the IT Hub designs with beam & column placement.

Figure 3.3: Third Floor of IT Hub



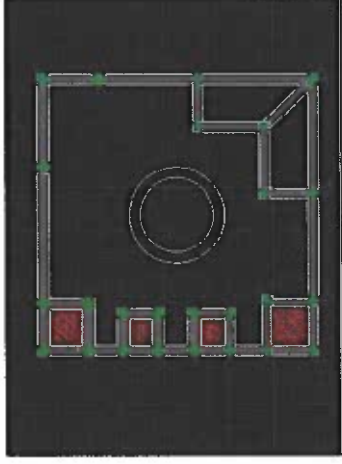
This figure includes an autocad version of the 2-D drawing of the third floor of the IT Hub designs with beam & column placement.

Figure 3.4: Fourth Floor of IT Hub



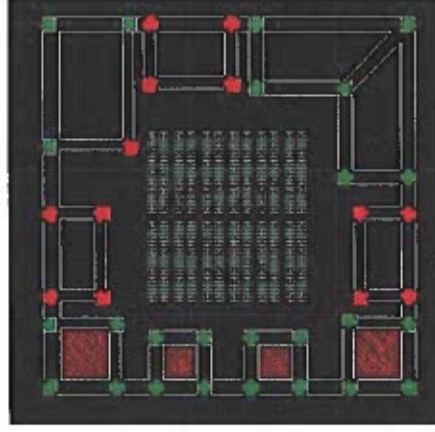
This figure includes an autocad version of the 2-D drawing of the fourth floor of the IT Hub designs with beam & column placement.

Figure 3.5: First Floor of Office Buildings



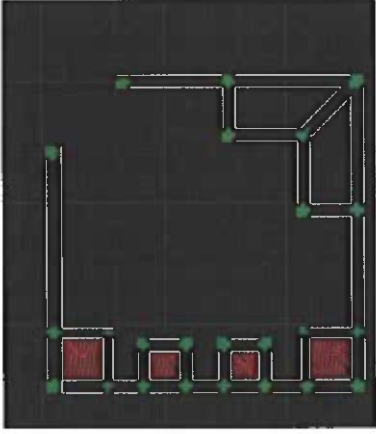
This figure includes an autocad version of the 2-D drawing of the first floor of the office building designs with beam & column placement.

Figure 3.6: Second Floor of Office Buildings



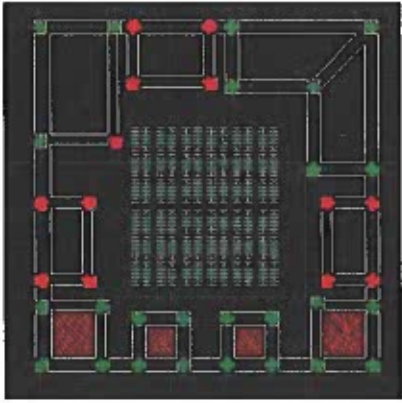
This figure includes an autocad version of the 2-D drawing of the first floor of the office building designs with beam & column placement.

Figure 3.7: Third Floor of Office Buildings



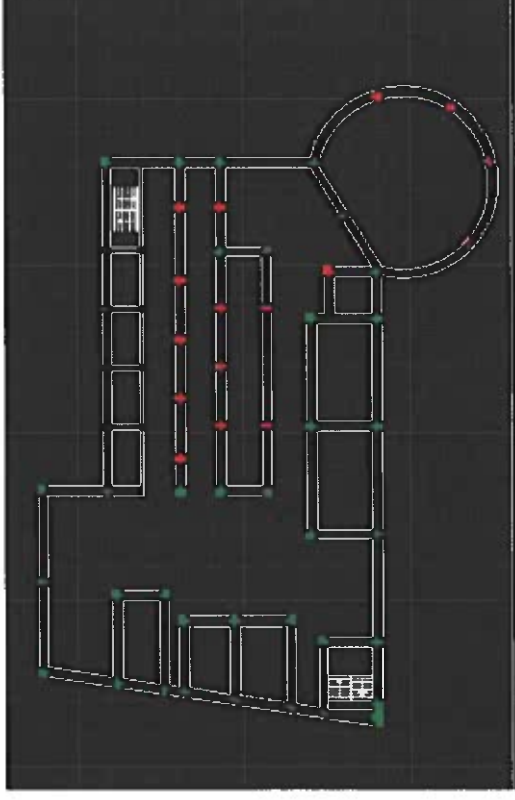
This figure includes an autocad version of the 2-D drawing of the third floor of the office building designs with beam & column placement.

Figure 3.8: Fourth/Fifth Floor of Office Buildings



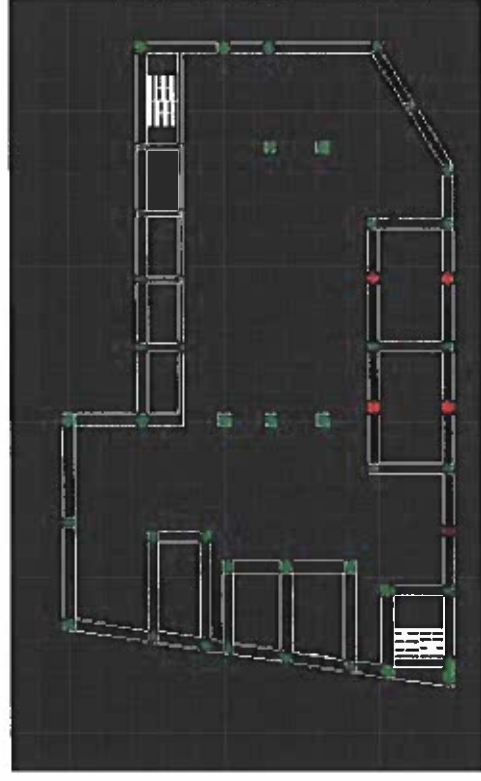
This figure includes an autocad version of the 2-D drawing of the fourth and fifth floor of the office building designs with beam & column placement.

Figure 3.9: First Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the first floor of the convention center designs with beam & column placement

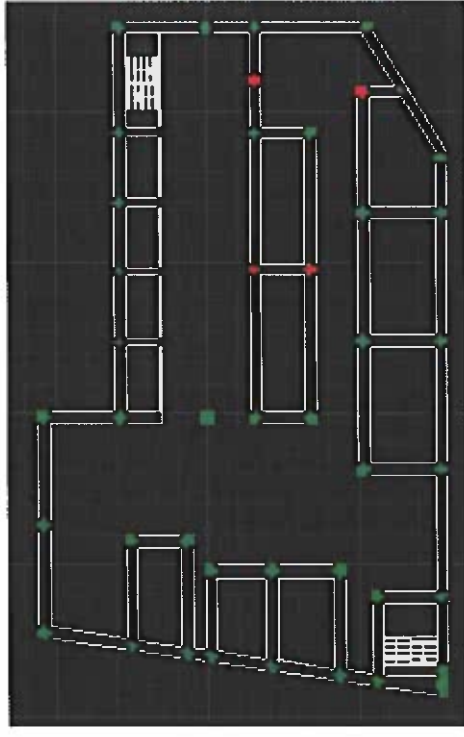
Figure 3.10: Second Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the second floor of the convention center designs with beam & column placement

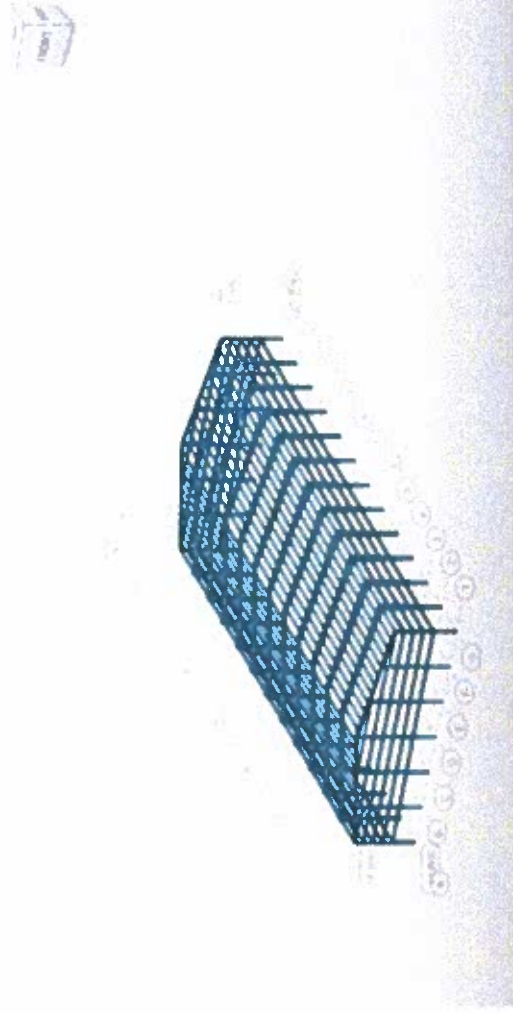
you need to
provide proper
labelling!

Figure 3.11: Third Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the third floor of the convention center designs with beam & column placement

Figure 3.12: Ground Floor of Steel Distribution Center ?



This figure includes an autocad version of the 3-D drawing of the Ground floor of the Steel Structure
Distribution center designs with beam & column placement

Geotechnical

Introduction:

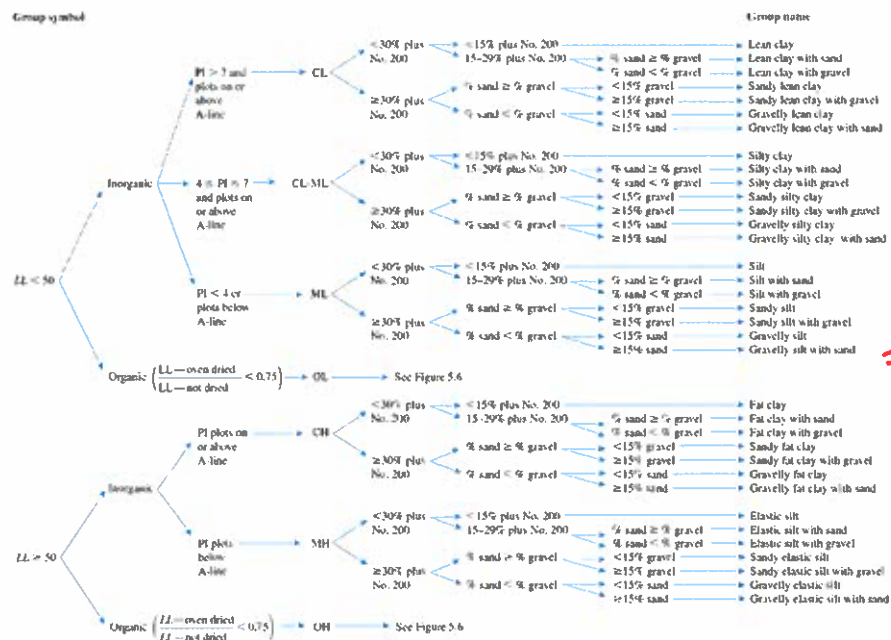
This section of the report is the progress for the geotechnical engineering portion of the Amazon Business building and Distribution center. Our Company was contacted by Dr. Alam to perform the appropriate task to make this project successful. The starting point for this project was the SPT test. The Standard Penetration Test (SPT) is a method of determining the geotechnical parameters of subsurface soil. This test is inexpensive and can accurately estimate the density and shear strength of soil. To conduct this test, a standard, thick-walled sample tube is driven into the earth at the bottom of a borehole. Strikes from a slide hammer mechanism with a set weight and fall distance accomplish this.

Scope Of work:

The investigation's goal was to undertake subsurface exploration and establish subsurface conditions at the project site so that geotechnical recommendations for the Amazon parking lots, distribution facility, and company buildings could be developed. Testing and classifying subsurface soils for strength, allowed bearing capacities, and foundation options, as well as foundation soil expansive properties for construction of the above-mentioned institutions based on laboratory tests and best engineering practices, are also included. The soil research began with the drilling of two holes to a depth of 70 feet in the project site's center and the northwest corner of the 400-acre property.

Drilling, Sampling, and Soil Classification:

The CME 75 Drilling Rig was used for the drilling. The subgrade soils were investigated with a continuous flight auger that was used to advance the hole's dryness. Soil samples were collected using thin-walled tubes in accordance with ASTM D 1587 during the drilling operation, and split spoon sampler testing (STP) was performed in accordance with ASTM D 1586. Because bedrock was encountered, continuous push tube samples were taken for the ground surface to a depth of 70 feet, and the borings were spaced 80 feet apart. The changes in soil strata noticed during drilling operations were meticulously calculated and recorded on the boring logs. The procedures outlined in ASTM D 2487, based on the Unified Soil Classification System, were used to classify all soil samples (shown in Figure 1). Furthermore, using the methods provided in the Plasticity Chart, the soils are documented in the boring logs (Shown in figure two). The Boring logs' soil Classification were placed in Table 1 and Table 2 shown below.



⇒ This is appendix

Figure 4.1: Unified Soil Classification System

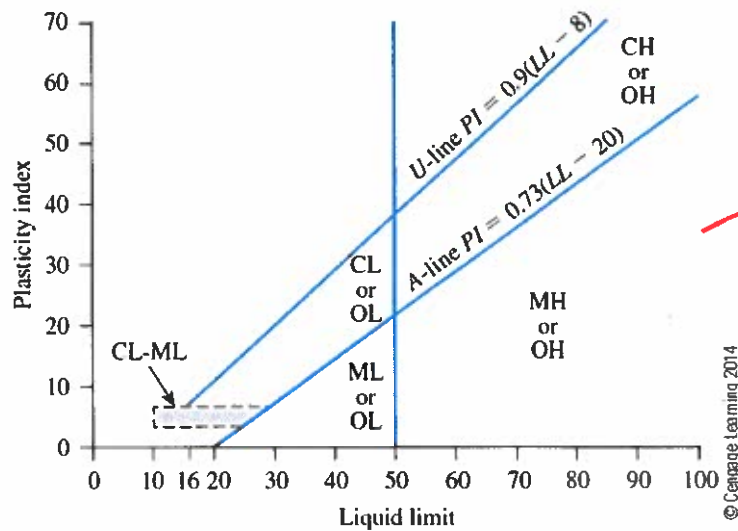


Figure 4.2: Plasticity Chart

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	43	16	27	71%	29%	19%	CL	Sandy lean Clay
7.5	47	19	28	81%	19%	12%	CL	Sandy lean Clay
8.7	-	-	0	20%	80%	6%	-	Sand
15	51	24	27	69%	31%	13%	CH	Sandy Fat Clay
20	-	-	0	16%	84%	8%	-	Sand
25	62	30	32	80%	20%	15%	CH	Sandy Fat Clay
30	62	27	35	79%	21%	13%	CH	Sandy Fat Clay
40	69	28	41	83%	17%	17%	CH	Sandy Fat Clay
50	71	33	38	72%	28%	18%	CH	Sandy Fat Clay
60	69	34	35	79%	21%	19%	CH	Sandy Fat Clay

Table 4.1: Soil Classification for Test hole #1

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	48	20	28	54%	46%	13%	CL	Sandy lean Clay
5	51	32	19	69%	31%	14%	MH	Sandy Elastic Silt
10	-	-	-	-	-	8%	-	Sand
12.5	46	19	27	74%	26%	18%	CL	Sandy lean Clay
17	-	-	-	-	-	10%	-	Sand
20	32	16	16	54%	46%	13%	CL	Sandy lean Clay
25	60	31	29	81%	19%	21%	MH	Sandy Elastic Silt
30	72	31	41	82%	18%	20%	CH	Sandy Fat Clay
40	68	39	29	62%	38%	4%	MH	Sandy Elastic Silt
50	80	39	41	69%	31%	18%	MH	Sandy Elastic Silt
60	68	34	34	84%	16%	20%	MH	Sandy Elastic Silt

Table 4.2: Soil Classification for Test hole #2

The next step is to gather the unit weight of each soil layer and after recently receiving the Unconsolidated Undrained test we can now calculate the settlement conditions, allowable

bearing capacity, and develop a foundation recommendation. The foundation will not only be safe for loading but will also be very cost efficient.

Transportation

For the Transportation aspect of this project, the parking lot design, plan and profile of the local road, and the roadway intersections have been completed. For the parking lot design, the amount of employees in each building was calculated based on the percentage of employees working in each building. For the warehouse, 40% of employees work in the building so the parking lot's capacity was 8000 parking spots. For the office development, 35% of employees worked in the buildings so 7000 parking spots were designed. The convention center holds 15% of the total number of employees so the parking lot will consist of 3000 parking spots and finally the IT Hub will hold 10% of the total employees and will require 2000 parking spots. The parking lot angle selected to ensure enough parking spots will fit in the provided area will be 30 degrees. This allows the space between one aisle to another to be the smallest at 14 feet. The MUTCD was utilized to ensure the number of spots and the dimensions of the parking spots and rows met the code.

For the plan and profile of the local road, the elevation for Warren Road, the road we plan on connecting to, was determined and a 2% grade was calculated and drawn in autocad to create an accurate profile curve. Below in figure 5.2 and 5.3 the plan and profile drawing completed in autocad can be found. We designed each road within the property that will connect one building to the next and allow simple access to each designated parking lot. Between each lot where there is an intersection, the type was selected based on the maximum flow during peak hours. There is a minimum of two entrances/exits for each parking lot to prevent congestion and allow a smooth

flow of traffic on the property. The roadway intersections were designed based on the maximum number of employees that will be expected to travel through that area and estimate the peak hours of traffic and the minimum for accurate timing on the signals. Next it was determined what risks were found at each intersection and designed necessary barriers and and other protective structures to protect all commuters that met the MUTCD code. Finally, utilizing autocad, a plan drawing of each intersection was created so the layout and proximity to each parking lot is clear. Below are the autocad drawings of each type of intersection as well as a sample parking lot plan view to show the dimensions of each bay as well as the distance each row is from the next.

Figure 5.1 : 4-way intersection with stop sign

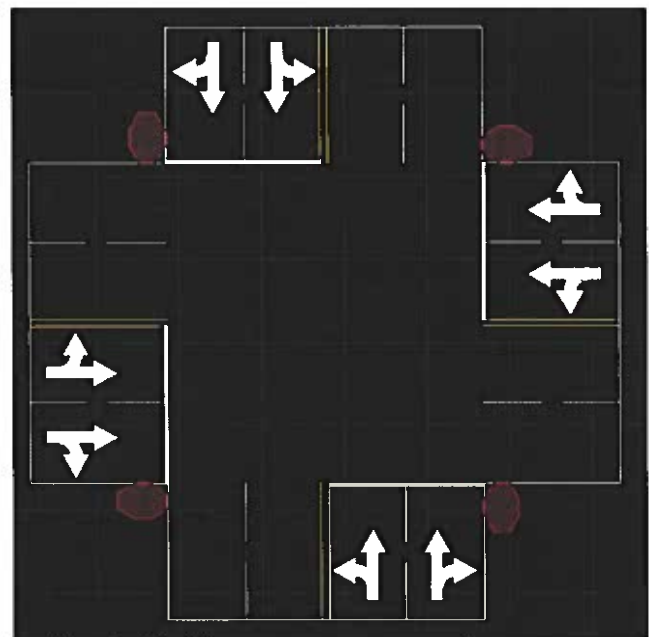


Figure 5.2: Profile View of Local Roadway

white background of the CAD drawing is recommended.

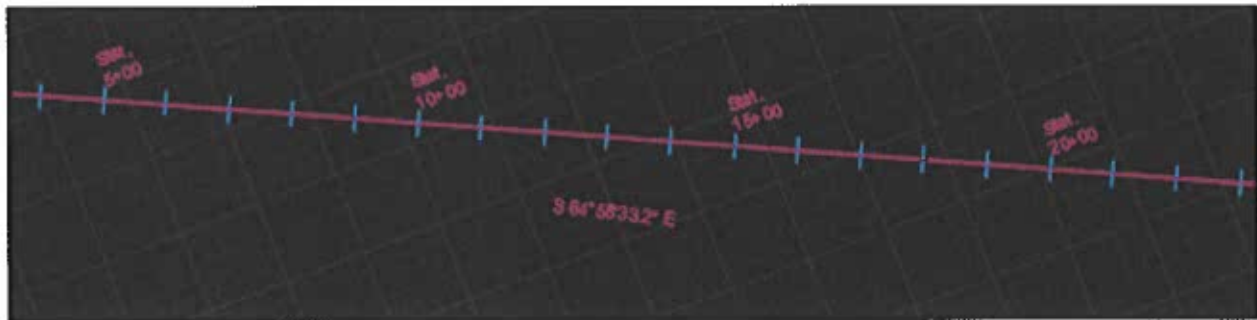


Figure 5.3: Plan View of Local Roadway

- Cyan:** 4-Way intersection with stop signs
- Green:** 4-Way intersection with stop light
- Yellow:** 3-Way intersection with stop signs
- Red:** Continuous traffic with singular stop sign

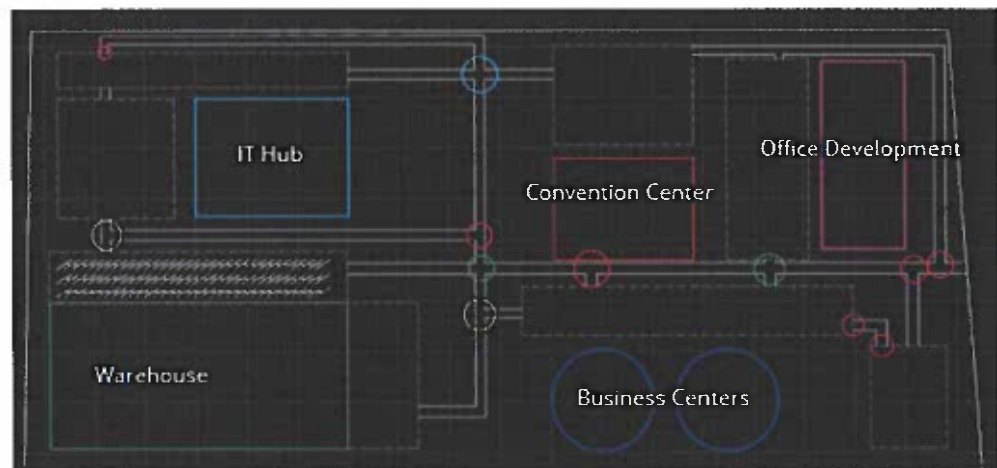


Figure 5.4: Intersection plan view of Project

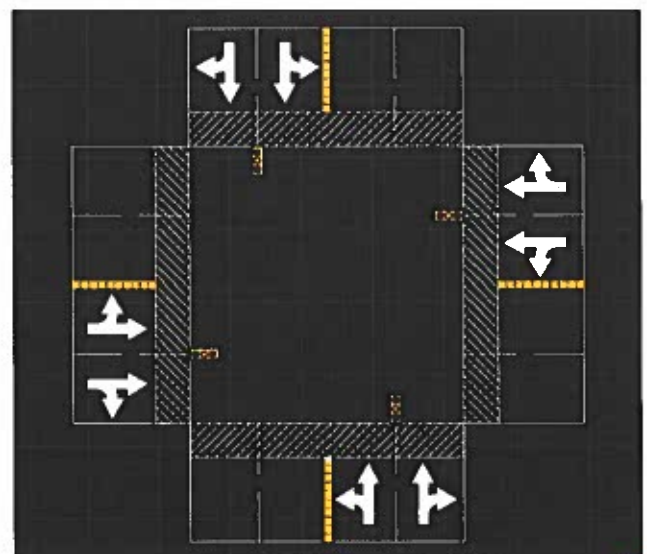


Figure 5.5: 4-way intersection with stop light

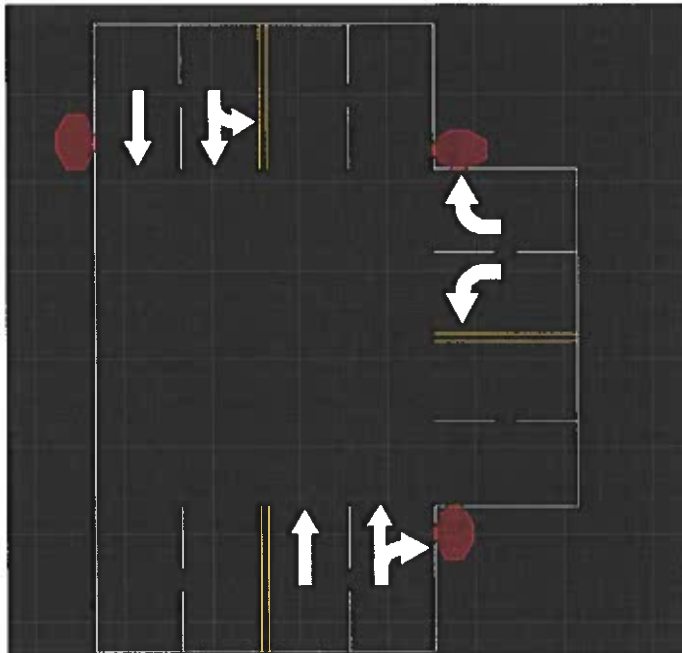


Figure 5.6: 3-way intersection with stop signs

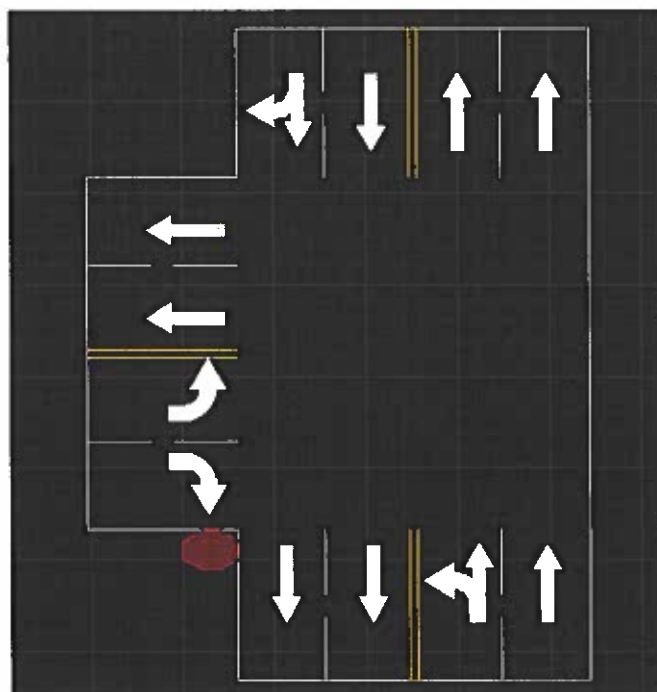


Figure 5.7: Continuous Traffic Intersection

Environmental

Wastewater treatment is the process of removing impurities from wastewater (water that is no longer needed or appropriate for use) and converting it into effluent that can be returned to the environment. The Texas Commission on Environmental Quality (TCEQ) and the Texas Administrative Code (TAC) Chapter 30 will be used to design the Wastewater Treatment Plant.

Table : Wastewater Characteristics

→ Table number - ??

Constituent	Concentration, mg/l
-------------	---------------------

	Strong	Medium	Weak
Total solids	1200	700	350
Dissolved solids (TDS) ¹	850	500	250
Suspended solids	350	200	100
Nitrogen (as N)	85	40	20
Phosphorus (as P)	20	10	6
Chloride ¹	100	50	30
Alkalinity (as CaCO ₃)	200	100	50
Grease	150	100	50
BOD ₅ ²	300	200	100

In accordance with the Texas Commission of Environmental Quality (TCEQ) Design Organic Loadings and Flows for a New Wastewater Treatment Facility, for an office building or factory, designed for the largest shift, will produce a daily wastewater flow of 20 gallons/person.

Table : Design Organic Loadings and Flows for a New Wastewater Treatment Facility

Source	Remarks	Daily Wastewater Flow (gallons/person)	Wastewater Strength (mg/l BOD ₅)	Wastewater Strength (mg/l NH ₃ -N)
Municipality	Residential	75-100	250-400	15-75
Subdivision	Residential	75-100	250-400	15-75
Trailer Park (Transient)	2½ Individuals per Trailer	50-60	250-350	15-75
Mobile Home Park	3 Individuals per Trailer	50-75	300	15-75
School	Cafeteria & Showers	20	300	15-75
	Cafeteria/No Showers	15	300	15-75
Recreational Parks	Overnight User	30	200	15-75
	Day User	5	100	15-75
Office Building or Factory	A facility must be designed for the largest shift	20	300	15-75
Hotel/Motel	Per Bed	50-75	300	15-75
Restaurant	Per Meal	7-10	1000*	15-75
Restaurant with bar or cocktail lounge	Per Meal	9-12	1000*	15-75
Hospital	Per Bed	200	300	15-75
Nursing Home	Per Bed	75-100	300	15-75
Alternative Collection Systems (Subchapter D of this chapter)	Per Capita	75	N/A	N/A
*Based on a restaurant with a grease trap				

With this data, the expected wastewater flow may be calculated by multiplying the flow per person by the population, and then converting the units to meters cubed per day using the conversion factor.

calculation:

$$AADF = \text{Population} \times \text{Average Daily Flow per Capita}$$

$$AADF = 20000 \text{ ppl} \times 20 \frac{\text{gal}}{\text{capita} - \text{day}} = 400000 \frac{\text{gal}}{\text{day}}$$

$$Q = 400000 \frac{\text{gal}}{\text{day}} \times 0.003785 \frac{\text{m}^3}{\text{gal}} = 1514 \frac{\text{m}^3}{\text{day}}$$

caption?

what quantity
is that?

Executive Summary

Structural Problem Statement for Structural

In a recent request, Amazon has proposed a problem of expansion of distribution centers for the Texas region. Only been provided with 400 acres of land and being asked to construct five different structures along with wastewater management systems and a flood prevention technique, there seems to be issues with proper location access within certain sub-disciplines. To best accomplish, from a structural standpoint, or what Amazon is asking to do we must take in a considerable design and make them simplistic yet intricate to the point where they will function but in an Amazon style without disturbing existing surroundings.

Proposed Solutions for Structural

JPMS Consulting creates solutions to fit what is being asked for. The structural design components have been set in place by the firm. With these designs, we will be able to actively maximize the size of the buildings while still reducing cost of buildings by doing the following:

1. Allowing column beams to share the same footings would reduce cost.
2. By building identical office buildings it will help us determine cost and when it comes to planning exactly how the building should be built.
3. Due to the small staff and the number of employees in the IT department, we can reduce the size of the IT department and add office space to the office buildings.
4. And to incorporate an Amazon style building, with all of these are cost-efficient solutions and we can add a skywalk between the identical office buildings.

JPMS Consulting creates solutions to fit what is being asked for. The structural design components have been set in place by the firm. With these designs, we will be able to actively maximize the size of the buildings while still reducing cost of buildings by doing such in the following: Note that our solutions are only apply to four of the five buildings being asked to be built this is only because for our steel structure warehouse it has a more open floor design which is automatically going to cost less the materials may cost more by finding the proper material is the only effective problem at hand.

Value for Structural

With the inclusions of this land and the construction of these buildings, add personal belief that the highest value of Amazon's net worth will increase. The location may not have a high demand population but is in high demand with high traffic volume. The structural design components will not only as be mentioned before reducing costs play be an area where there is easier access to any building maintenance that needs to occur. So, the value that is being 6 portrayed is more song a long-term value in the sense of being one of the first to build on a new area, and he when he comes to needing to get heavy equipment for maintenance equipment there's not as much in-tune section of regular traffic.

Final Thoughts and Next Steps for Structural

My recommendation for the enhancements of things is by increasing the dimensions of the workplace buildings by permitting another story within the building to accommodate the remaining worker overflow from the IT Hub or produce a second building of a smaller nature to accommodate the remaining share of staff. As for the opposite buildings, the steel structure of the warehouse was designed from innovation except for easier calculations, the warehouse can mimic that of the FedEx warehouse off ninety-nine grand drive south. As for the workplace buildings, mimicking the thought of the dual towers, however, not knowing the precise load can produce these difficulties, so finding the foremost stable foundation within the profile for a minimum of one, 600 sq. footage. The convention center was originally placed and is unambiguously designed however the sole recommendation that's being thought of is to relocate the building to accommodate alternative subdisciplines of the project

Proposed Solution for Water Resources

The first solution to the problem is to find where the location of the drainage ditch will be placed. We will use gravity to create the flow of the water to the nearest existing lake water source which is East of our construction site. The drainage ditch will start at its highest elevation of 456.9 coming from the topography map. Next the calculation of the rainfall intensity and collection for 100 years should be computed. This is to keep the area from flooding. I will do so by using the typical rainfall intensity -duration -recurrence interval curves. This graph shows the rainfall inserted in in/h proportional with time min and hours.

1. A design and location of a storm water ditch that avoids flooding hazards and damage to valuable property.
2. Rainfall intensity and rainfall collection for 100-year flooding

Note that the project is still in progress and on route to be completed in 2022.

Value for Water Resources

The storm water drainage ditch has been stamped to its location with the help of my geotechnical and environmental engineer. This was decided by locating the start of the ditch at its highest elevation to help with gravitating the water to its correct location.

Final Thoughts and Steps for Water Resources

Final steps for this project pertaining to water resources would be to calculate the quantity of water, design the storm water ditch based on a rainfall study, and show a profile and cross section of the drainage ditch.

Problem Statement for Transportation

For the JJMPS consulting firm, the transportation engineer will be in charge of the entire roadway layout of the project, interchange design, a parking lot proposal, and a plan and profile of each local road.

Proposed Solution for Transportation

The dimensions for each major roadway will be determined and the speed for the minor and major roads will be chosen based on the overall layout and utilizing the MUTCD (Manual on

Uniform Traffic Control Devices). The size of each parking lot will be selected to accommodate each employee in the vicinity as well as overflow and guests and the dimensions of each parking spot and the angle of each spot will be chosen utilizing the MUTCD. Interchanges will be 4 designed based on the flow of traffic in the area at peak times. The type of interchange will be selected based on the peak flow and location of the area. The roadway layout of the entire project will be designed to meet the peak amount of traffic and to ensure that no congestion will occur at peak hours of traffic flow. The dimensions of the lanes will be chosen to match the local roads surrounding the project. This will allow a simple transition between one local road and a minor road on the project site. A plan and profile will be drafted using the local existing road's elevation and using that to continue a seamless transition from one roadway to another.

Value for Transportation

The value of this project is to provide necessary insight and experience for each member of the JJMPS Consulting company. The design portion of this project allows the transportation group to utilize skills learned in previous courses and allows the application of those skills towards real world issues and will force the transportation group to learn to adapt and apply them as necessary.

Problem Statement for Geotechnical

The scope of work is to execute a geotechnical analysis for Amazon's proposed 400-acre commercial and distribution center, IT hub, and office development in Waller County, which is located south of major highways (US 290 and I-10). The report includes the findings of the site inspection as well as project recommendations.

Solution for Geotechnical

For the drilling, a CME 75 Drilling Rig was employed. A continuous flight auger was employed to progress the holes dry as the subgrade soils were explored. During the drilling operation, soil samples were obtained using thin-walled tubes according to ASTM D 1587, and split spoon sampler testing (STP) was done according to ASTM D 1586. Due to the presence of bedrock, continuous push tube samples were taken from the ground surface to a depth of 70 feet, with the borings spaced 80 feet apart. Soil samples were sent to a lab to be examined for soil characteristics. The findings were incorporated into the final report. During soil testing, a 7m depth of water was detected. In addition, the study discusses the many types of retaining structures and how to choose them based on the data provided. To help grasp the design and focus on the details, a visual layout has been provided. In addition, calculations for footings and settlements were performed to see whether they met the necessary requirement, and if appropriate, helpful recommendations were made.

Geotechnical Value & Recommendations

The report includes a broad description of the soils found, their qualities, expected behavior during construction, and measured groundwater levels. The final report includes geotechnical advice for shallow foundations, pavement design, pile foundations, and embankment design. The foundation design parameters were calculated using calculations from Braja M. Das Nagaratnam Sivakugan's "Principles of Foundation Engineering, 9th Edition, SI Edition" and an engineering textbook.

Problem Statement for Environmental

For our project, the environmental engineer will be calculating the estimated wastewater quantity for the project area. The location of the wastewater treatment facility should be near the lowest elevation. After analyzing the wastewater quality, a method to treat said water can be determined, as well as picking a suitable dumping location.

The Solution for Environmental

The environmental engineer will be utilizing the instruction given in the environmental design course to determine the wastewater quantity. It is known that the wastewater treatment facility should be placed at the lowest elevation to allow gravity to maneuver the wastewater to its proper location. The wastewater will be disposed of in a local stream or, if treated properly, could be used as irrigation for the project area.

Value for Environmental

The purpose of this project is to give students a chance to apply the knowledge that they have been acquiring over their last 4-5 years at university. The project is expected to be completed by May 2022.

References

1. A Policy on Geometric Design of Highways and Streets, American Association for State and Highway Transportation Officials, 7th Edition, 2018.
2. Manual on Uniform Traffic Control Devices, US Department of Transportation, Federal Highway Administration, 3rd Edition, 2009.
3. American Institute of Steel Construction Steel Construction Manual, 15th Edition, 2016.
4. Texas State Building Code – Volume I (General Construction), Current Code.
5. Phase I Environmental Site Assessment.
6. Principles of Environmental Engineering and Sciences, Mackenzie Davis and Susan Masten, McGraw-Hill, 2013.
7. Report of Phase II Assessment.
8. Report of Subsurface Exploration and Geotechnical Engineering Analysis, 2014.
9. Soil and Foundation, Cheng Liu and Jack Evett, Prentice Hall, 8th Edition 2014.
10. US Army Corps of Engineers Reference Manuals
11. NAVFAC Manual, Foundations & Earth Structures, 2021
(https://web.mst.edu/~rogersda/umrcourses/ge441/DM7_02.pdf)
12. Standard Handbook for Civil Engineers, Frederick S. Merritt et al., McGraw-Hill, 5th Edition, 2004.
13. Storm water and Pollution Prevention – US EPA, 2021. 4
14. Erosion and Sediment Control Planning and Design Manual, 2013
15. Structural Engineering Handbook, McGraw-Hill, 5th Edition, 2020.
16. The Dimensions of Parking, Urban Land Institute and the National Parking Association, 5th Edition, 2014.
17. Traffic Engineering Handbook, Institute of Transportation Engineers, 7th Edition, 2016.
18. Statewide Traffic Analysis, TxDOT, 2021
(<https://www.txdot.gov/inside-txdot/division/transportation-planning/stars.html>).
19. Water Resources Handbook, Larry Mays, McGraw-Hill, 1996.
20. Structural Steel Designer's Handbook, Roger Brockenbrough and Frederick Merritt, McGraw-Hill, 6th edition, 2019.
21. <https://www.tdhca.state.tx.us/single-family/training/docs/14-TMCS.pdf>
22. [https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate,\(106.88%2D121.92%20cm\).](https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate,(106.88%2D121.92%20cm).)
23. American Disability Act – 60 inches minimum hallway requirement
24. Cubicle Size- 36 ft squared
25. <https://www.osha.gov/laws-regs/standardinterpretations/1972-05-15>
 - a. OSHA Requires at least an aisle be at least 3 feet wider than the largest equipment or a minimum of 4 ft
26. <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=19717&context=rtd>
27. OSHA
28. <https://www.youtube.com/watch?v=ebM4bzjmiKQ>
29. <https://6river.com/warehouse-automation-statistics/>
30. <https://www.tdhca.state.tx.us/single-family/training/docs/14-TMCS.pdf>

31. [https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate.\(106.88%2D121.92%20cm\).](https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate.(106.88%2D121.92%20cm).)
32. <https://www.osha.gov/laws-regs/standardinterpretations/1972-05-15>
33. <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=19717&context=rtd>
34. <https://ncma.org/resource/empirical-design-of-concrete-masonry-walls/>
35. <https://www.osha.gov/sites/default/files/publications/emergency-exit-routes-factsheet.pdf>
36. <https://closetandbeyond.com/walk-in-closet-layout/#:~:text=A%20standard%20full%2Dsize%20walk,as%20low%20as%2025%20sq.>
37. <https://www.partitionsandstalls.com/ada-bathroom-layout.html>
38. <https://pubs.usgs.gov/wri/wri98-4044/pdf/98-4044.pdf>
39. file:///C:/Users/Trsy/Downloads/Subdivision%20-%20Development%20Regulations%20REVISED_FINAL-2021%20(2).pdf

ASSIGNMENTS FOR OUTCOME “3”

An ability to communicate effectively with a range of audiences

**DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 4200 SENIOR DESIGN AND PROFESSIONALISM I**

**OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET
FALL 2021**

INSTRUCTOR: DR. Md Jobair Bin Alam

Title of Assignment

Midterm and semester-end presentation of the design results to faculty and student audiences

Outcome Measured Using this Assignment

Outcome 3

An ability to communicate effectively with a range of audiences (Oral Communication)

Check the communication characteristics related to this assignment

X	Involves ability to organize, plan, design/prepare and use appropriate visual aids for communication/presentation to a range of audiences (executives, technical and non-technical).
X	Involves ability to demonstrate technical knowledge and understanding of the subject, prepare and display prototypes or models when they are necessary, respond clearly to questions in a professional manner
X	Requires use of correct grammatical English and technical terms appropriate to technical area and audience type; ability to speak with clarity and confidence, maintain good posture and eye contact with the audience
X	Geared to diverse groups of stakeholders (students and industrial representatives, etc.)

Brief justification of the suitability of assignment for the outcome

Students will complete a technical report with description of the project, technical schematics of the components, system or processes. All students will give a formal oral summary presentation on their aspect of the project at Mid-Semester and at the end of Fall 2021 semester to Faculty.

**CVEG 4200 Senior Design and Professionalism I
FALL 2021**

**ASSIGNMENT STATEMENT/QUESTIONS
GRADING SCHEME FOR ASSIGNMENT**

PVAMU Civil & Environmental Engineering Department

PROJECT RESENTATION

EVALUATION

Name of Evaluator: Md Jobair Bin Alam

Date: 12/01/2021

Team Evaluation: CVEG 4200-Senior Design & Professionalism I
Presentation on 12/01/2021 Group 1
Evaluation

Team Score			Comments
Organization (15)			
Introduction of presentation	5	4	
Preparedness for presentation	5	4	
Ability to stay within time limit	5	4	
Total out of 15		12	
Technical Content (40)			
Technical content	10	7	
Demonstration of understanding of Project Scope	10	8	
Creativity/originality of design concepts	10	8	
Proper understanding of codes and standards	10	7	
Total out of 40		30	
Delivery (20)			
Use of vocabulary appropriate to technical subject and audience, clarity/confidence	10	10	
Business attire, posture and eye contact	10	10	
Total out of 20		20	
Visual Aids (10)			
Quality and adequacy of slides	5	4	
Readability and relevance of information	5	4	
Total out of 10		8	
Professionalism (15)			
<u>Management skills:</u> Project management scheme, scheduling, and meeting milestones	5	4	
<u>Business skills:</u> Mention of providing a service to a client	5	4	
<u>Leadership skills:</u> Mention of leadership roles and challenges as a leader	5	5	
Total out of 15		12	
Grand Total out of 100		83	Team presentation as group was a concern, but the leadership was commendable from the team lead.

PVAMU Civil & Environmental Engineering Department

PROJECT RESENTATION

EVALUATION

Name of Evaluator: Md Jobair Bin Alam

Date: 12/01/2021

**Team Evaluation: CVEG 4200-Senior Design & Professionalism I
Presentation on 12/01/2021 Group 2
Evaluation**

Team Score			Comments
Organization (15)			
Introduction of presentation	5	5	
Preparedness for presentation	5	5	
Ability to stay within time limit	5	5	
Total out of 15		15	
Technical Content (40)			
Technical content	10	8	N. Smith presented very good in the technical content of the project.
Demonstration of understanding of Project Scope	10	8	
Creativity/originality of design concepts	10	8	
Proper understanding of codes and standards	10	8	
Total out of 40		32	
Delivery (20)			
Use of vocabulary appropriate to technical subject and audience, clarity/confidence	10	10	
Business attire, posture and eye contact	10	10	
Total out of 20		20	
Visual Aids (10)			
Quality and adequacy of slides	5	5	
Readability and relevance of information	5	4	
Total out of 10		9	
Professionalism (15)			
<u>Management skills:</u> Project management scheme, scheduling, and meeting milestones	5	5	
<u>Business skills:</u> Mention of providing a service to a client	5	4	
<u>Leadership skills:</u> Mention of leadership roles and challenges as a leader	5	5	
Total out of 15		13	
Grand Total out of 100		90	

PVAMU Civil & Environmental Engineering Department

PROJECT RESENTATION

EVALUATION

Name of Evaluator: Md Jobair Bin Alam

Date: 12/01/2021

**Team Evaluation: CVEG 4200-Senior Design & Professionalism I
Presentation on 12/01/2021 Group 3
Evaluation**

Team Score			Comments
Organization (15)			
Introduction of presentation	5	4	
Preparedness for presentation	5	5	
Ability to stay within time limit	5	5	
Total out of 15		14	
Technical Content (40)			
Technical content	10	8	
Demonstration of understanding of Project Scope	10	8	
Creativity/originality of design concepts	10	8	
Proper understanding of codes and standards	10	8	
Total out of 40		32	
Delivery (20)			
Use of vocabulary appropriate to technical subject and audience, clarity/confidence	10	9	
Business attire, posture and eye contact	10	9	
Total out of 20		18	
Visual Aids (10)			
Quality and adequacy of slides	5	4	
Readability and relevance of information	5	4	
Total out of 10		8	
Professionalism (15)			
<u>Management skills:</u> Project management scheme, scheduling, and meeting milestones	5	5	
<u>Business skills:</u> Mention of providing a service to a client	5	4	
<u>Leadership skills:</u> Mention of leadership roles and challenges as a leader	5	4	
Total out of 15		13	
Grand Total out of 100		85	Overall, the presentation was commendable, but need more improvement.

Development of Business and Distribution Center, and IT Hub for Amazon

Designed and Constructed by:
JJMPS Consulting

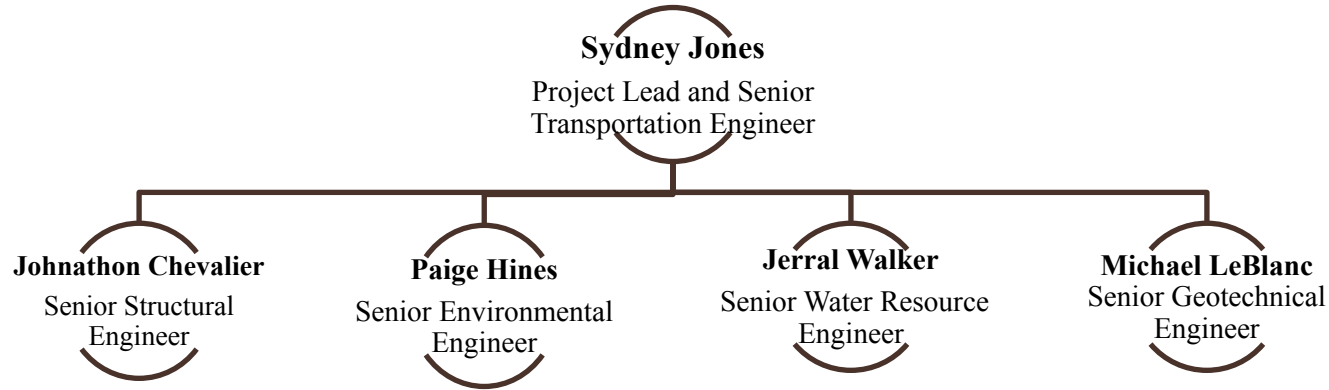


Table of Contents

- Introduction
- Table of Contents
- Members Flowchart
- About the Project
- Scope of Work
- Project Requirements
- Structural
- Geotechnical
- Transportation
- Water Resources
- Environmental
- Questions
-



Members flowchart



About the project

JJMPs Consulting is to develop and design the business and distribution center, IT Hub, and office development in Waller county on approximately 400-acre plot of land (shown below) for Amazon.



Scope of Work

JJMPS Consulting has been requested to perform Civil Engineering Site Development and Design services and address all aspects outlined in the project description.

- Structural
- Geotechnical
- Transportation
- Water Resources
- Environmental (Wastewater Treatment Plant)

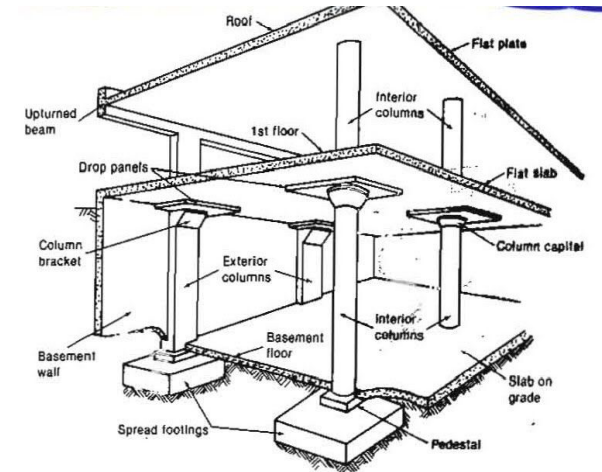


Structural

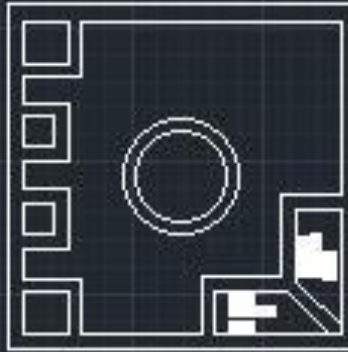


- 2D Drawing
 - Office Building, Steel Structure Design, Convention Center
 - beam placement
 - mark columns
 - Label dimensions
- Structural load calculation
- Slab Design

- STADD Pro models
 - Analyze your output results
- Beam and Column Design
- Steel Structure design of warehouse
- Maximum Values
 - Bending Moment,
 - Shear Force
 - Axial load
 - Location Component
- Reinforced Bars
 - Footing size, reinforcement
- Reinforced Concrete Design

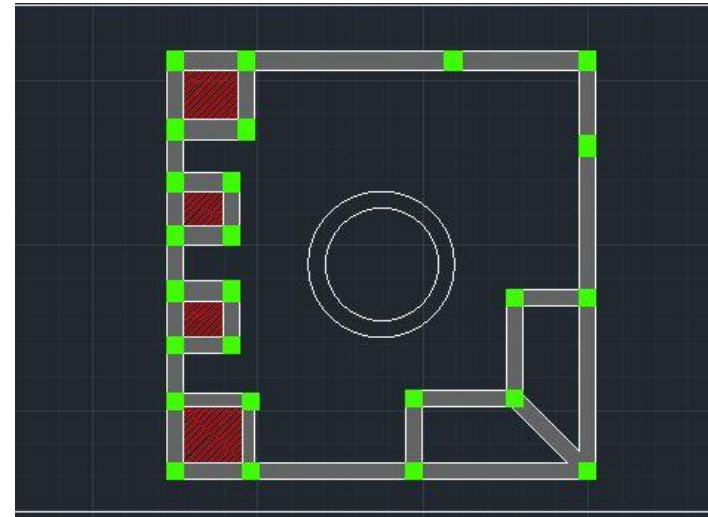
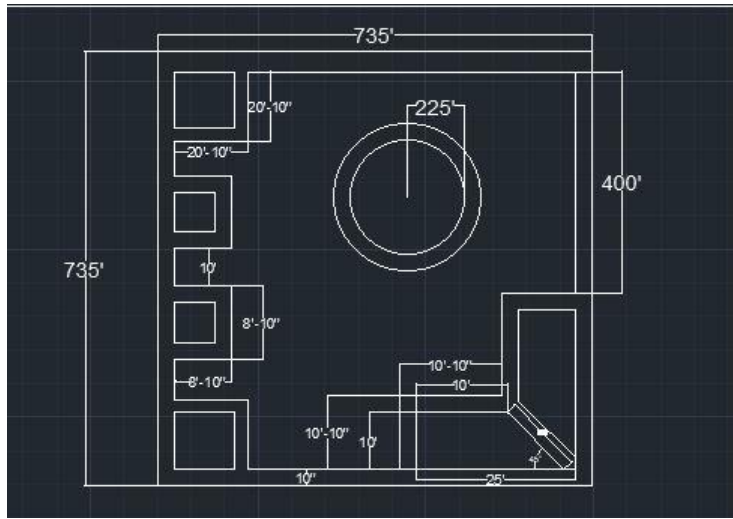


Ground Level Floor Plan



OFFICE BUILDING ½ - Ground Level INFORMATION

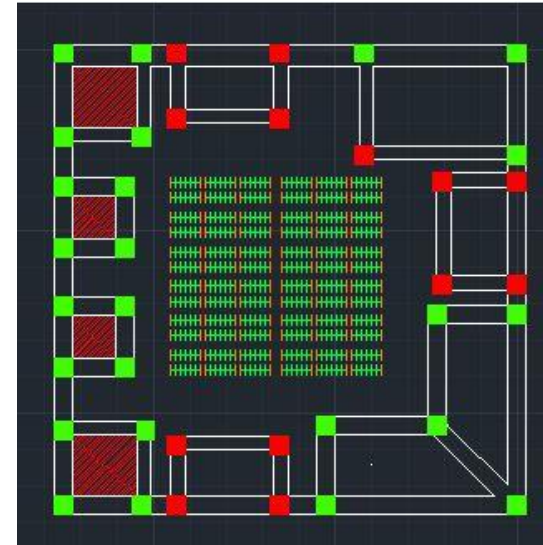
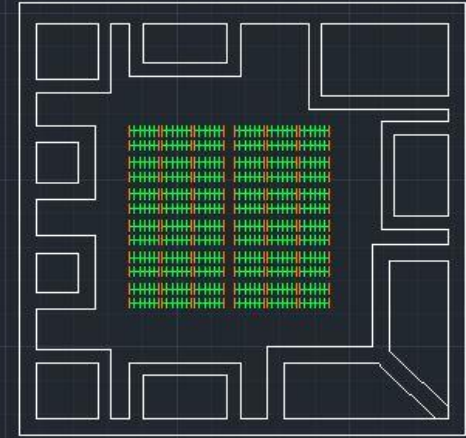
- AREA:
 - 540,225 square feet
 - 735'x 735'
 - 12.4 acres
- Population:
 - 30 % of 20,000 employees
 - 6,000 employees total
- 5 – story building each

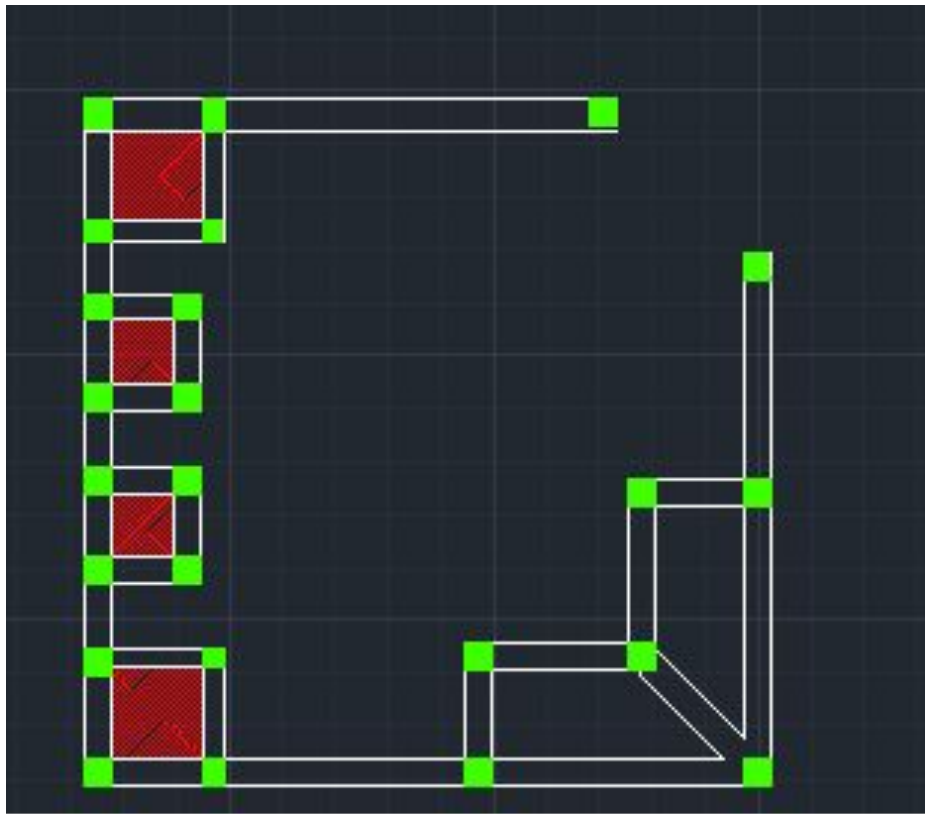


OFFICE BUILDING 1/2- Second Floor INFORMATION

- AREA:
 - 540,225 square feet
 - 735'x 735'
 - 12.4 acres
- Population:
 - 30 % of 20,000 employees
 - 6,000 employees total
- 5 – story building each

Second Level Floor Plan

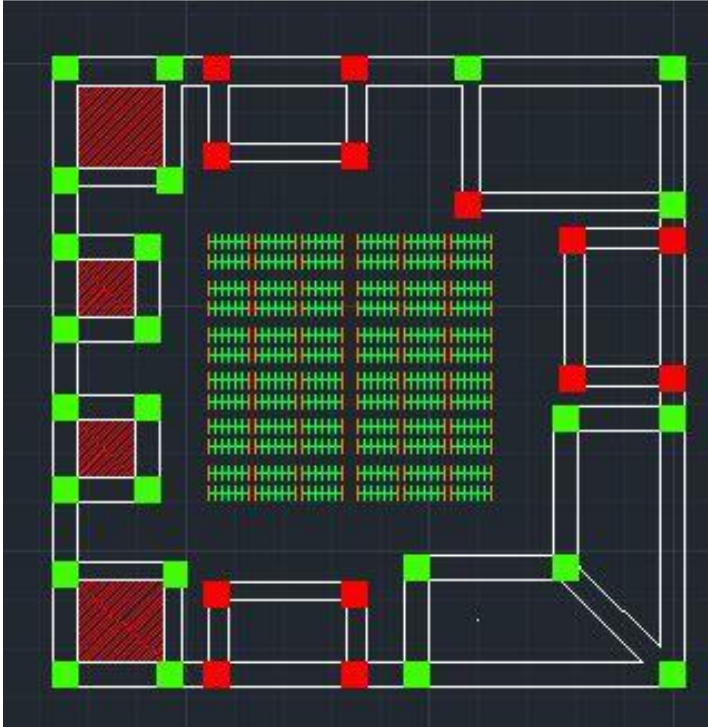




OFFICE BUILDING 1/2 – Third Floor INFORMATION

- AREA:
 - 540,225 square feet
 - 735'x 735'
 - 12.4 acres
- Population:
 - 30 % of 20,000 employees
 - 6,000 employees
- 5 – story building
- Sky walk is to be added during structural analysis





OFFICE BUILDING 1/2- Fourth/Fifth Floor INFORMATION

- AREA:
 - 540,225 square feet
 - 735'x 735'
 - 12.4 acres
- Population:
 - 30 % of 20,000 employees
 - 6,000 employees
- 5 – story building



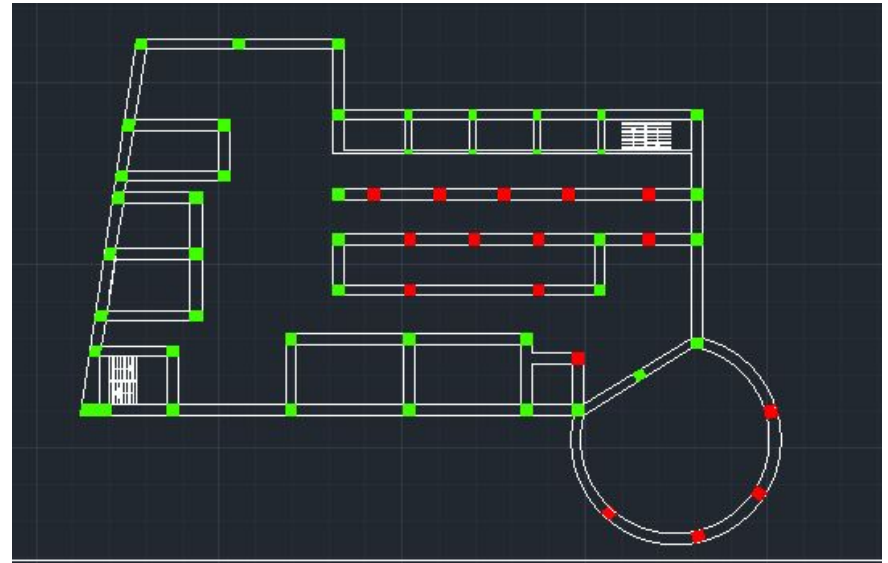
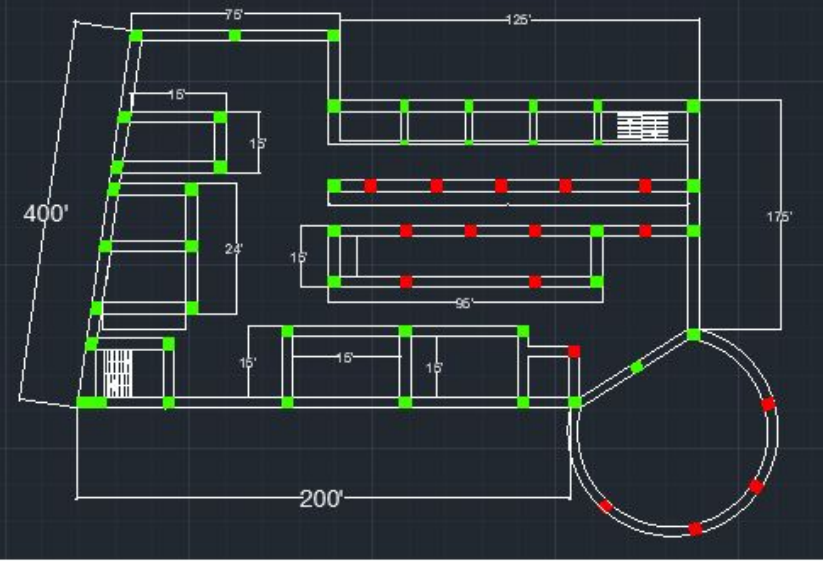
CONVENTION CENTER- First Floor INFORMATION

□ AREA:

- 2,500,000 square feet
- 57 acres

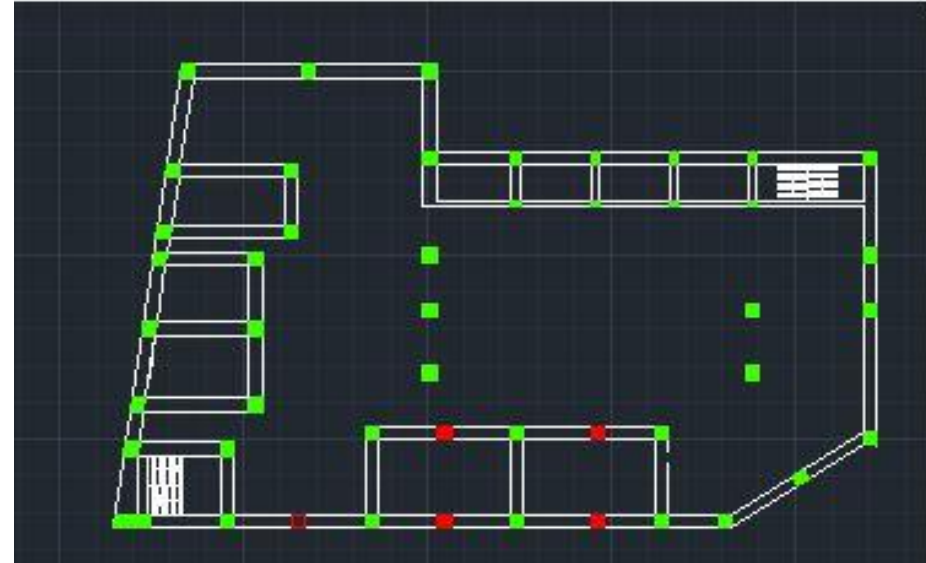
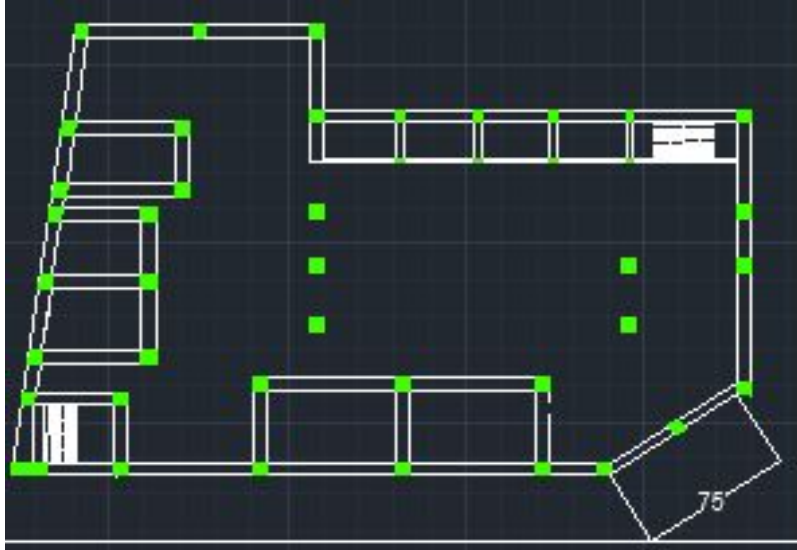
□ Population:

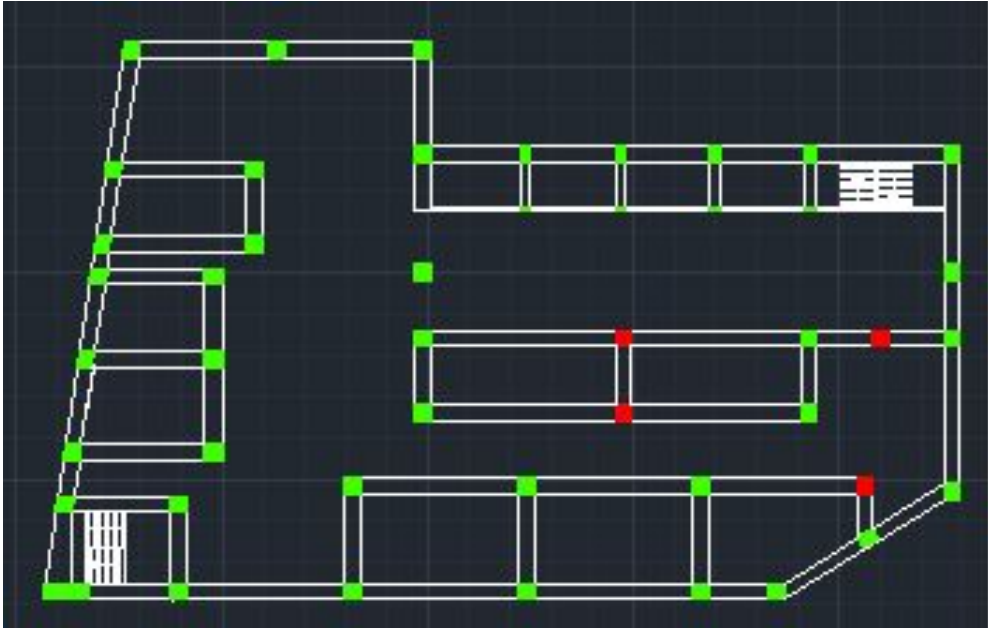
- 15 % of 20,000 employees
 - 3,000 employees
- 3 – story building



CONVENTION CENTER- Second Floor INFORMATION

- AREA:
 - 2,500,000 square feet
 - 57 acres
- Population:
 - 15 % of 20,000 employees
 - 3,000 employees
- 3 – story building

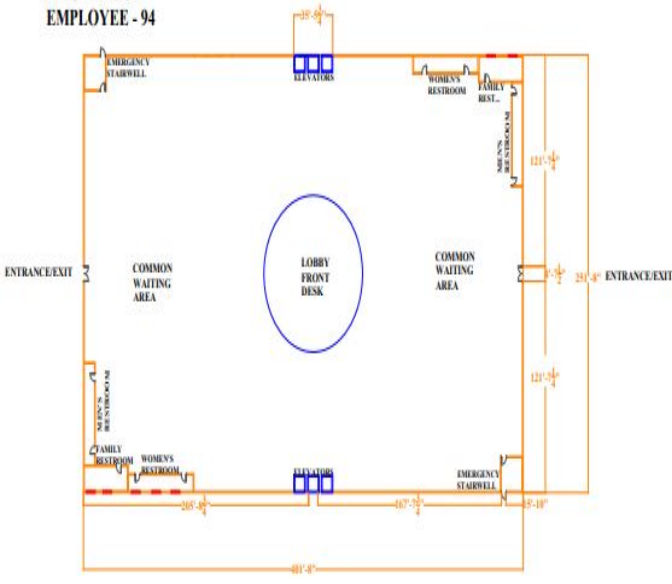




CONVENTION CENTER- Third Floor **INFORMATION**

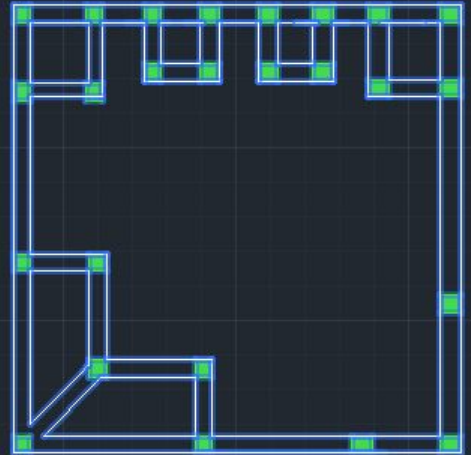
- AREA:
 - 2,500,000 square feet
 - 57 acres
- Population:
 - 15 % of 20,000 employees
 - 3,000 employees
- 3 – story building



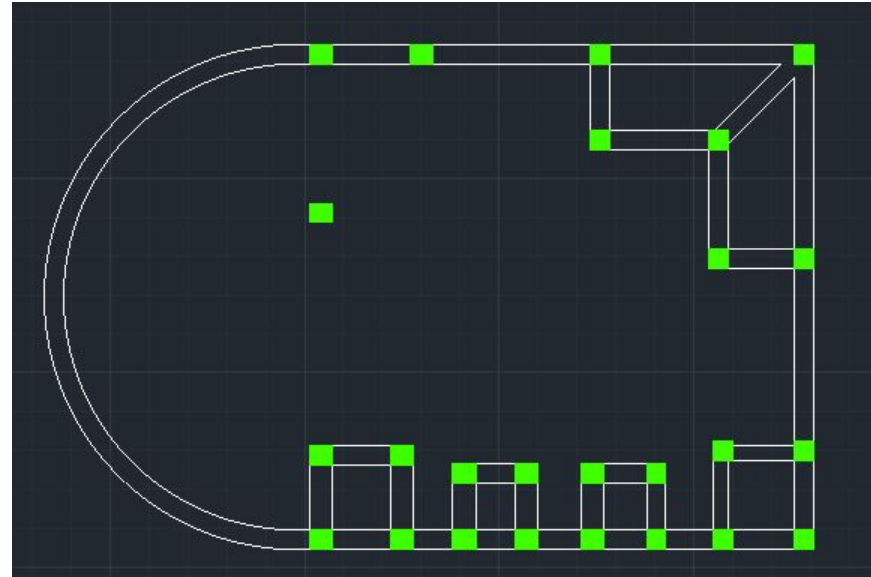
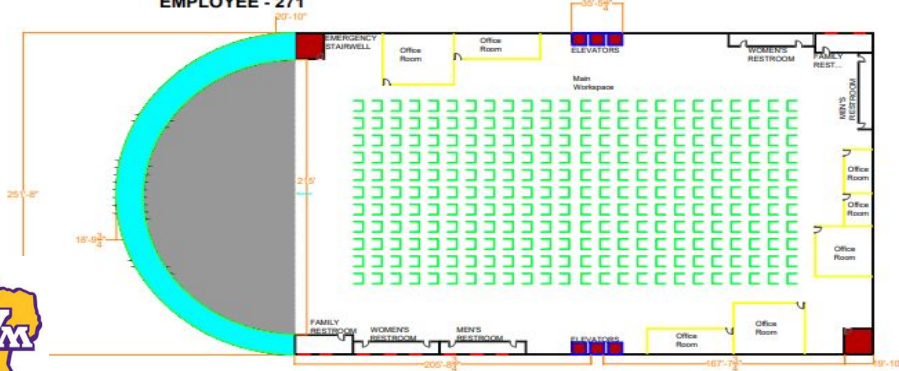


INFORMATION TECHNOLOGY HUB GROUND LEVEL

- AREA:
 - 100,000 square feet
 - 400'x 250'
- Population:
 - 10 % of 20,000 employees
 - 2,000 employees
- 4 – story building



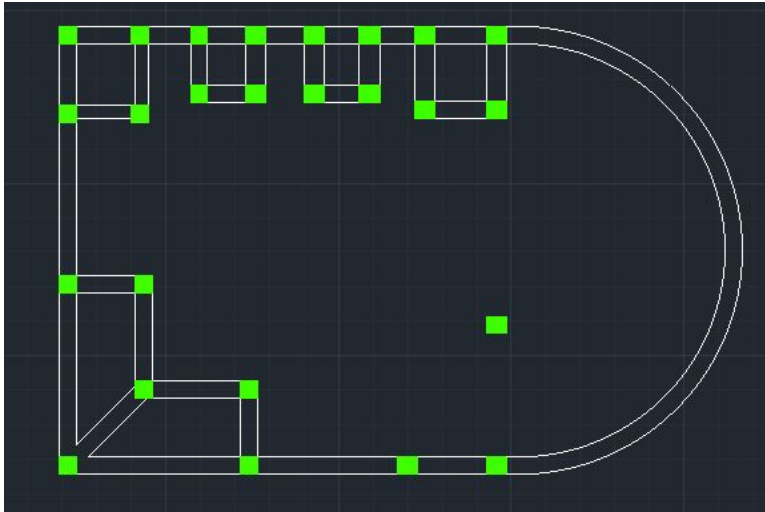
- SECOND FLOOR
EMPLOYEE - 271**



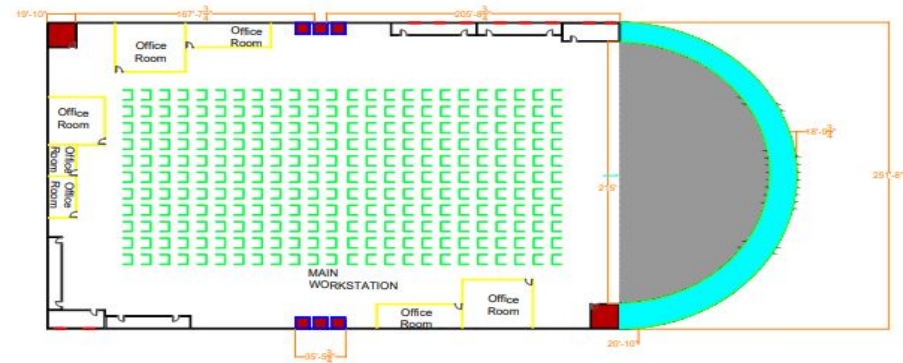
INFORMATION TECHNOLOGY HUB

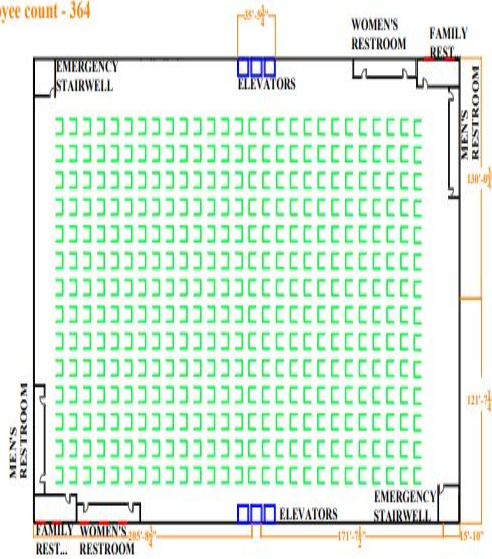
GROUND LEVEL

- AREA:
 - 100,000 square feet
 - 400'x 250'
- Population:
 - 10 % of 20,000 employees
 - 2,000 employees
- 4 – story building



**THIRD FLOOR
EMPLOYEE - 271**

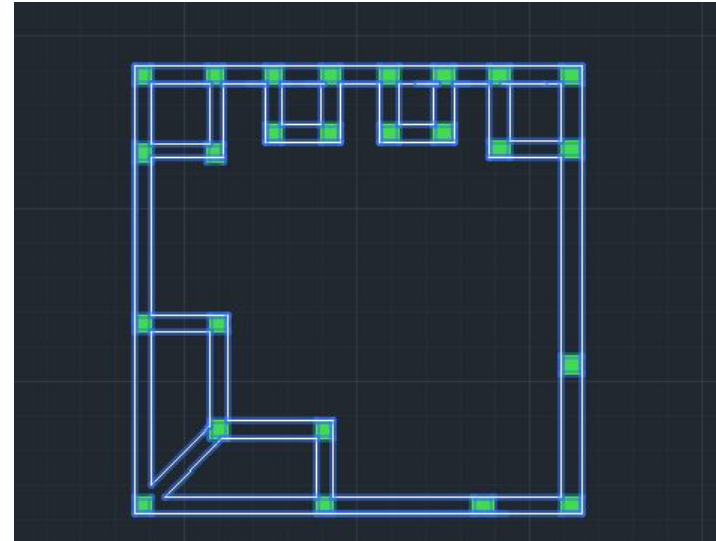




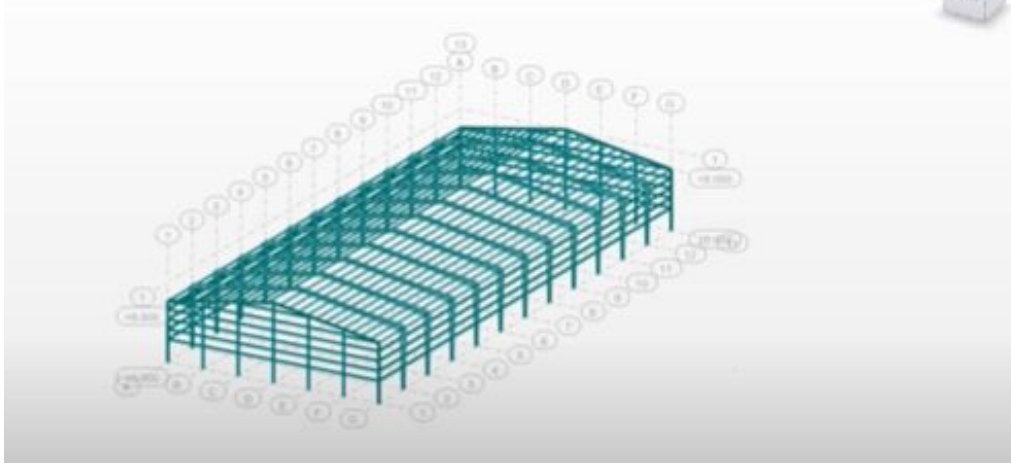
INFORMATION TECHNOLOGY HUB

GROUND LEVEL

- AREA:
 - 100,000 square feet
 - 400'x 250'
- Population:
 - 10 % of 20,000 employees
 - 2,000 employees
- 4 – story building



WAREHOUSE INFORMATION



- AREA:
 - 350,000 square feet
 - 1000'x 350'
- Population:
 - 45 % of 20,000 employees
 - 9,000 employees
- 1 – story building
- Used Autodesk Robot Structural to design



Original Progress Timeline for Structural

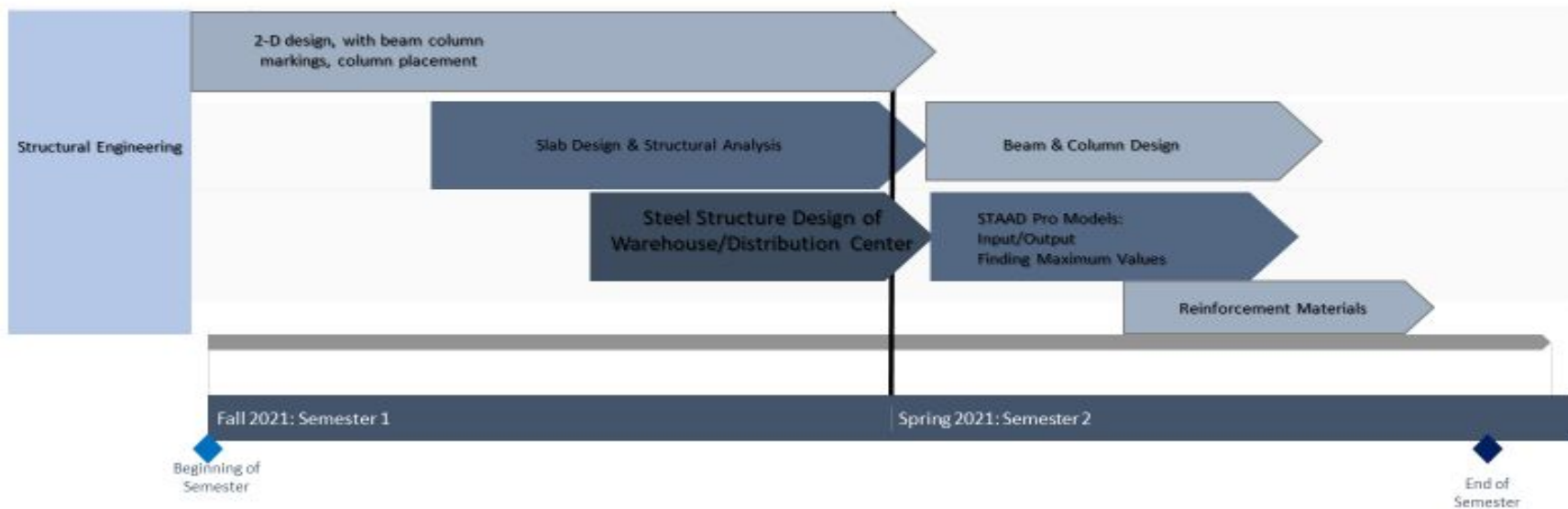
Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Structual Engineering									
2D Drawing- Office Building, Warehouse, Convention Center, (Label dimensions, mark columns and beam placement)	Johnathon Chevalier								
Structural load calculation	Johnathon Chevalier								
Slab Design	Johnathon Chevalier								
Input and output after analyzing STADD Pro model for Office Buildings, Warehouse, Convention Center, (dead, live, and wind loads)	Johnathon Chevalier								
Beam and Column Design, steel structure design of warehouse	Johnathon Chevalier								
Analyze your output results obtained from STADD Pro.	Johnathon Chevalier								
Reinforcement bars and Reinforced Concrete Design for foundations including footing size, reinforcement.	Johnathon Chevalier								



Updated Progress Timeline For Structural

Crisis Management Timeline

Key activities and planning for risk mitigation



Geotechnical



- Create Boring logs based on raw data.
- Examine Boring logs
- Prepare soil report and classification.
- Bearing capacity and settling are two factors to consider while designing a foundation.
- Analyze various foundation systems and make recommendations for a safe and low-cost foundation (Type, size and depth and material for foundation, and related specifications)
- Design of the embankment (slope of major highway)
- Material specification and pavement design (geotechnical design)



Location of Borings



Boring logs

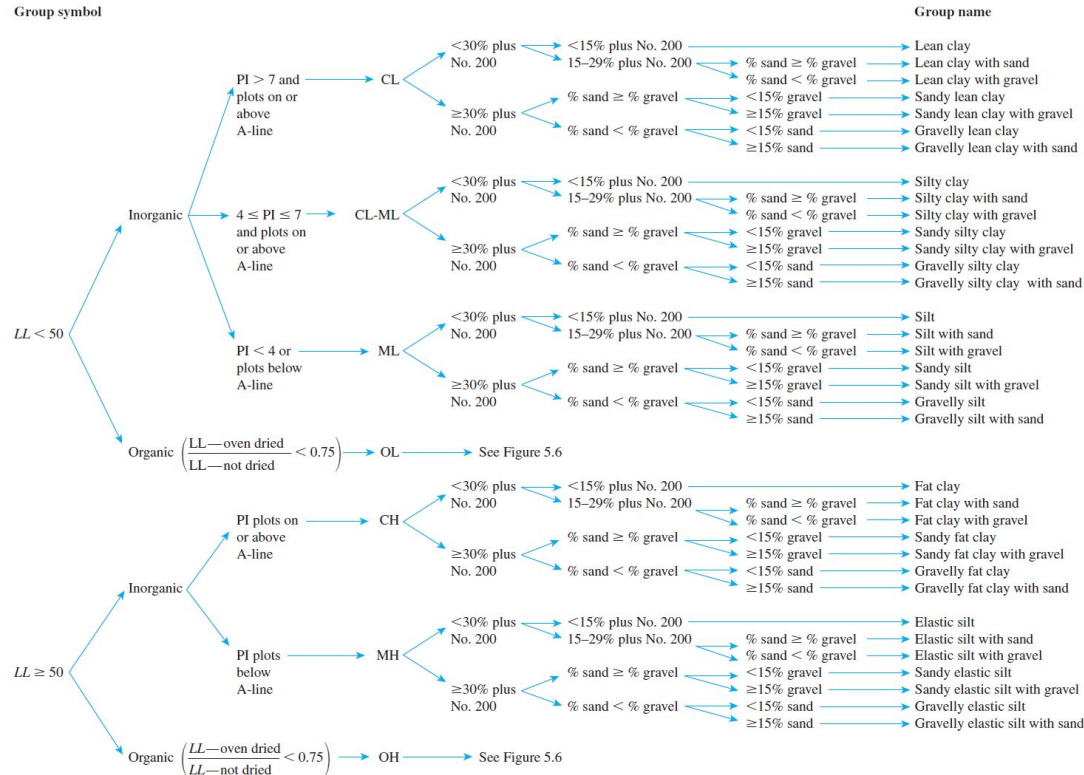
CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG																																																																																																																																																																																																																																																				
PROJECT ID: CVEG 4200					TEST HOLE # <u>1</u>					SHEET NUMBER 1 of 1																																																																																																																																																																																																																																																				
PROJECT: Business Center for Amazon					LOCATION: South Texas					DATE STARTED: _____																																																																																																																																																																																																																																																				
CLIENT: AMAZON					CLIENT: AMAZON					DATE FINISHED: _____																																																																																																																																																																																																																																																				
					CONTACT: Dr. Alam					DRILLER: _____																																																																																																																																																																																																																																																				
										LOGGER: _____																																																																																																																																																																																																																																																				
										REVIEWED BY: _____																																																																																																																																																																																																																																																				
DRILL RIG: <u>CME 75</u>					TEST HOLE DIAMETER (in): <u>8"</u>					DATE: <u>8/26/21</u>																																																																																																																																																																																																																																																				
DRILLING METHOD: <u>Hollow Stem</u>					TOTAL DEPTH (ft): <u>70'</u>					TIME: <u>7:5</u>																																																																																																																																																																																																																																																				
CASING: _____					GROUND WATER DATA: _____					REMARKS: _____																																																																																																																																																																																																																																																				
<table border="1"> <thead> <tr> <th>DEPTH (FEET)</th> <th colspan="3">STANDARD PENETRATION</th> <th colspan="3">TxDOT CONE</th> <th colspan="2">RECOVERY (in)</th> <th colspan="2">HAND PEN</th> </tr> <tr> <th>SAMPLE</th> <th>0-6"</th> <th>6-12"</th> <th>12-18"</th> <th>Blooms</th> <th>Inches</th> <th>Blooms</th> <th>Inches</th> <th>ROD (in)</th> <th>HAND PEN</th> </tr> </thead> <tbody> <tr><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td>3</td><td>3</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td>3</td><td>5</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>15</td><td>3</td><td>7</td><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>20</td><td>3</td><td>7</td><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>25</td><td>3</td><td>10</td><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>30</td><td>9</td><td>12</td><td>13</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>35</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>40</td><td>11</td><td>13</td><td>21</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>45</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>50</td><td>13</td><td>22</td><td>31</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>60</td><td>17</td><td>26</td><td>34</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>65</td><td>18</td><td>39</td><td>52</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>										DEPTH (FEET)	STANDARD PENETRATION			TxDOT CONE			RECOVERY (in)		HAND PEN		SAMPLE	0-6"	6-12"	12-18"	Blooms	Inches	Blooms	Inches	ROD (in)	HAND PEN	0										5	3	3	4							10	3	5	5							15	3	7	8							20	3	7	8							25	3	10	10							30	9	12	13							35										40	11	13	21							45										50	13	22	31							55										60	17	26	34							65	18	39	52							70										<table border="1"> <thead> <tr> <th colspan="4">SOIL DESCRIPTION</th> </tr> </thead> <tbody> <tr><td>0</td><td>PL</td><td>-200</td><td>M/C</td></tr> <tr><td>5</td><td>16</td><td>71%</td><td>14%</td></tr> <tr><td>10</td><td>19</td><td>81%</td><td>12%</td></tr> <tr><td>15</td><td>21</td><td>69%</td><td>13%</td></tr> <tr><td>20</td><td>-</td><td>16%</td><td>8%</td></tr> <tr><td>25</td><td>30</td><td>80%</td><td>15%</td></tr> <tr><td>30</td><td>27</td><td>79</td><td>13%</td></tr> <tr><td>35</td><td>28</td><td>83</td><td>17%</td></tr> <tr><td>40</td><td></td><td></td><td></td></tr> <tr><td>45</td><td>33</td><td>72</td><td>18%</td></tr> <tr><td>50</td><td>34</td><td>70</td><td>19%</td></tr> <tr><td>55</td><td></td><td></td><td></td></tr> <tr><td>60</td><td></td><td></td><td></td></tr> <tr><td>65</td><td></td><td></td><td></td></tr> <tr><td>70</td><td></td><td></td><td></td></tr> </tbody> </table>					SOIL DESCRIPTION				0	PL	-200	M/C	5	16	71%	14%	10	19	81%	12%	15	21	69%	13%	20	-	16%	8%	25	30	80%	15%	30	27	79	13%	35	28	83	17%	40				45	33	72	18%	50	34	70	19%	55				60				65				70				215' 7.5' 8.5' 68' Bedrock				
DEPTH (FEET)	STANDARD PENETRATION			TxDOT CONE			RECOVERY (in)		HAND PEN																																																																																																																																																																																																																																																					
SAMPLE	0-6"	6-12"	12-18"	Blooms	Inches	Blooms	Inches	ROD (in)	HAND PEN																																																																																																																																																																																																																																																					
0																																																																																																																																																																																																																																																														
5	3	3	4																																																																																																																																																																																																																																																											
10	3	5	5																																																																																																																																																																																																																																																											
15	3	7	8																																																																																																																																																																																																																																																											
20	3	7	8																																																																																																																																																																																																																																																											
25	3	10	10																																																																																																																																																																																																																																																											
30	9	12	13																																																																																																																																																																																																																																																											
35																																																																																																																																																																																																																																																														
40	11	13	21																																																																																																																																																																																																																																																											
45																																																																																																																																																																																																																																																														
50	13	22	31																																																																																																																																																																																																																																																											
55																																																																																																																																																																																																																																																														
60	17	26	34																																																																																																																																																																																																																																																											
65	18	39	52																																																																																																																																																																																																																																																											
70																																																																																																																																																																																																																																																														
SOIL DESCRIPTION																																																																																																																																																																																																																																																														
0	PL	-200	M/C																																																																																																																																																																																																																																																											
5	16	71%	14%																																																																																																																																																																																																																																																											
10	19	81%	12%																																																																																																																																																																																																																																																											
15	21	69%	13%																																																																																																																																																																																																																																																											
20	-	16%	8%																																																																																																																																																																																																																																																											
25	30	80%	15%																																																																																																																																																																																																																																																											
30	27	79	13%																																																																																																																																																																																																																																																											
35	28	83	17%																																																																																																																																																																																																																																																											
40																																																																																																																																																																																																																																																														
45	33	72	18%																																																																																																																																																																																																																																																											
50	34	70	19%																																																																																																																																																																																																																																																											
55																																																																																																																																																																																																																																																														
60																																																																																																																																																																																																																																																														
65																																																																																																																																																																																																																																																														
70																																																																																																																																																																																																																																																														

Field Log / Professional Boring Log

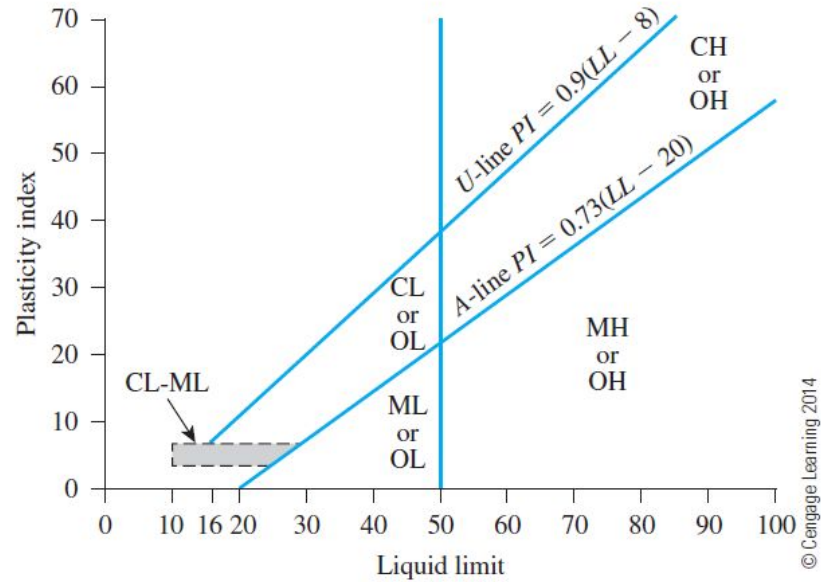
CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG																																																																																																																																																																																																																																																				
PROJECT ID: CVEG 4200					TEST HOLE # <u>2</u>					SHEET NUMBER 1 of 1																																																																																																																																																																																																																																																				
PROJECT: Business Center for Amazon					LOCATION: South Texas					DATE STARTED: _____																																																																																																																																																																																																																																																				
CLIENT: AMAZON					CLIENT: AMAZON					DATE FINISHED: _____																																																																																																																																																																																																																																																				
					CONTACT: Dr. Alam					DRILLER: _____																																																																																																																																																																																																																																																				
										LOGGER: _____																																																																																																																																																																																																																																																				
										REVIEWED BY: _____																																																																																																																																																																																																																																																				
DRILL RIG: <u>CME 75</u>					TEST HOLE DIAMETER (in): <u>8"</u>					DATE: <u>8/26</u>																																																																																																																																																																																																																																																				
DRILLING METHOD: <u>HSA</u>					TOTAL DEPTH (ft): <u>70'</u>					TIME: <u>7:5</u>																																																																																																																																																																																																																																																				
CASING: _____					GROUND WATER DATA: _____					REMARKS: _____																																																																																																																																																																																																																																																				
<table border="1"> <thead> <tr> <th>DEPTH (FEET)</th> <th colspan="3">STANDARD PENETRATION</th> <th colspan="3">TxDOT CONE</th> <th colspan="2">RECOVERY (in)</th> <th colspan="2">HAND PEN</th> </tr> <tr> <th>SAMPLE</th> <th>0-6"</th> <th>6-12"</th> <th>12-18"</th> <th>Blooms</th> <th>Inches</th> <th>Blooms</th> <th>Inches</th> <th>ROD (in)</th> <th>HAND PEN</th> </tr> </thead> <tbody> <tr><td>0</td><td>4</td><td>4</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td>5</td><td>5</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td>6</td><td>8</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>15</td><td>8</td><td>8</td><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>20</td><td>8</td><td>10</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>25</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>30</td><td>10</td><td>12</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>35</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>40</td><td>13</td><td>22</td><td>28</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>45</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>50</td><td>16</td><td>20</td><td>22</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>55</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>60</td><td>14</td><td>31</td><td>35</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>65</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>70</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>										DEPTH (FEET)	STANDARD PENETRATION			TxDOT CONE			RECOVERY (in)		HAND PEN		SAMPLE	0-6"	6-12"	12-18"	Blooms	Inches	Blooms	Inches	ROD (in)	HAND PEN	0	4	4	4							5	5	5	5							10	6	8	5							15	8	8	9							20	8	10	12							25										30	10	12	12							35										40	13	22	28							45										50	16	20	22							55										60	14	31	35							65										70										<table border="1"> <thead> <tr> <th colspan="4">SOIL DESCRIPTION</th> </tr> </thead> <tbody> <tr><td>0</td><td>PL</td><td>-200</td><td>M/C</td></tr> <tr><td>5</td><td>20</td><td>59</td><td>13%</td></tr> <tr><td>10</td><td>32</td><td>69</td><td>14%</td></tr> <tr><td>15</td><td>19</td><td>74</td><td>13%</td></tr> <tr><td>20</td><td></td><td></td><td>10%</td></tr> <tr><td>25</td><td>16</td><td>59</td><td>13%</td></tr> <tr><td>30</td><td>31</td><td>81%</td><td>21%</td></tr> <tr><td>35</td><td>31</td><td>82%</td><td>20%</td></tr> <tr><td>40</td><td>39</td><td>62%</td><td>4%</td></tr> <tr><td>45</td><td></td><td></td><td></td></tr> <tr><td>50</td><td>39</td><td>69%</td><td>18%</td></tr> <tr><td>55</td><td></td><td></td><td></td></tr> <tr><td>60</td><td>34</td><td>84%</td><td>20%</td></tr> <tr><td>65</td><td></td><td></td><td></td></tr> <tr><td>70</td><td></td><td></td><td></td></tr> </tbody> </table>					SOIL DESCRIPTION				0	PL	-200	M/C	5	20	59	13%	10	32	69	14%	15	19	74	13%	20			10%	25	16	59	13%	30	31	81%	21%	35	31	82%	20%	40	39	62%	4%	45				50	39	69%	18%	55				60	34	84%	20%	65				70				215' 7.5' 8.5' 68' Bedrock				
DEPTH (FEET)	STANDARD PENETRATION			TxDOT CONE			RECOVERY (in)		HAND PEN																																																																																																																																																																																																																																																					
SAMPLE	0-6"	6-12"	12-18"	Blooms	Inches	Blooms	Inches	ROD (in)	HAND PEN																																																																																																																																																																																																																																																					
0	4	4	4																																																																																																																																																																																																																																																											
5	5	5	5																																																																																																																																																																																																																																																											
10	6	8	5																																																																																																																																																																																																																																																											
15	8	8	9																																																																																																																																																																																																																																																											
20	8	10	12																																																																																																																																																																																																																																																											
25																																																																																																																																																																																																																																																														
30	10	12	12																																																																																																																																																																																																																																																											
35																																																																																																																																																																																																																																																														
40	13	22	28																																																																																																																																																																																																																																																											
45																																																																																																																																																																																																																																																														
50	16	20	22																																																																																																																																																																																																																																																											
55																																																																																																																																																																																																																																																														
60	14	31	35																																																																																																																																																																																																																																																											
65																																																																																																																																																																																																																																																														
70																																																																																																																																																																																																																																																														
SOIL DESCRIPTION																																																																																																																																																																																																																																																														
0	PL	-200	M/C																																																																																																																																																																																																																																																											
5	20	59	13%																																																																																																																																																																																																																																																											
10	32	69	14%																																																																																																																																																																																																																																																											
15	19	74	13%																																																																																																																																																																																																																																																											
20			10%																																																																																																																																																																																																																																																											
25	16	59	13%																																																																																																																																																																																																																																																											
30	31	81%	21%																																																																																																																																																																																																																																																											
35	31	82%	20%																																																																																																																																																																																																																																																											
40	39	62%	4%																																																																																																																																																																																																																																																											
45																																																																																																																																																																																																																																																														
50	39	69%	18%																																																																																																																																																																																																																																																											
55																																																																																																																																																																																																																																																														
60	34	84%	20%																																																																																																																																																																																																																																																											
65																																																																																																																																																																																																																																																														
70																																																																																																																																																																																																																																																														



Soil Classification



Soil Classification



Soil Classification Test hole #1

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name		Classification	SPT
0 - 2.50	43	16	27	71%	29%	19%			Sandy lean Clay	7
2.50 - 7.50	47	19	28	81%	19%	12%	CL		Sandy lean Clay	10
7.50 - 8.50	-	-	0	20%	80%	6%	-		Sand	15
8.50 - 15.00	51	24	27	69%	31%	13%	CH		Sandy Fat Clay	15
20.00 - 25.00	-	-	0	16%	84%	8%	-		Sand	20
25.00 - 30.00	62	30	32	80%	20%	15%	CH		Sandy Fat Clay	25
30.00 - 40.00	62	27	35	79%	21%	13%	CH		Sandy Fat Clay	39
40.00 - 50.00	69	28	41	83%	17%	17%	CH		Sandy Fat Clay	53
50.00 - 60.00	71	33	38	72%	28%	18%	CH		Sandy Fat Clay	65
60.00 - 70.00	69	34	35	79%	21%	19%	CH		Sandy Fat Clay	89



Soil Classification Test hole #2

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification	SPT
2.5 - 5.0	48	20	28	54%	46%	13%	CL	Sandy lean Clay	8
5.0 - 10.00	51	32	19	69%	31%	14%	MH	Sandy Elastic Silt	10
10.00 - 12.50	-	-	-	-	-	8%		Sand	13
12.5 - 17.00	46	19	27	74%	26%	18%	CL	Sandy lean Clay	17
17.00 - 20.00	-	-	-	-	-	10%		Sand	20
20.00 - 25.00	32	16	16	54%	46%	13%	CL	Sandy lean Clay	24
25.00 - 30.00	60	31	29	81%	19%	21%	MH	Sandy Elastic Silt	24
30.00 - 40.00	72	31	41	82%	18%	20%	CH	Sandy Fat Clay	54
40.00 - 50.00	68	39	29	62%	38%	4%	MH	Sandy Elastic Silt	42
50.00 - 60.00	80	39	41	69%	31%	18%	MH	Sandy Elastic Silt	72
60.00 - 70.00	68	34	34	84%	16%	20%	MH	Sandy Elastic Silt	98



Foundation Systems

1. Shallow Foundation
2. Mat Foundation
3. Pile Foundation



Shallow Foundation

A shallow foundation, unlike a deep foundation, transfers structural load to the earth extremely close to the surface, rather than a subterranean layer or a variety of depths.



Mat Foundation

When the subsoil is weak and the column loads are so high that the standard spread footings cover more than half of the building area, a mat foundation is employed. Mat foundations or deep foundations are commonly used to transfer column loads to the underlying soil while also providing a floor slab for the basement.



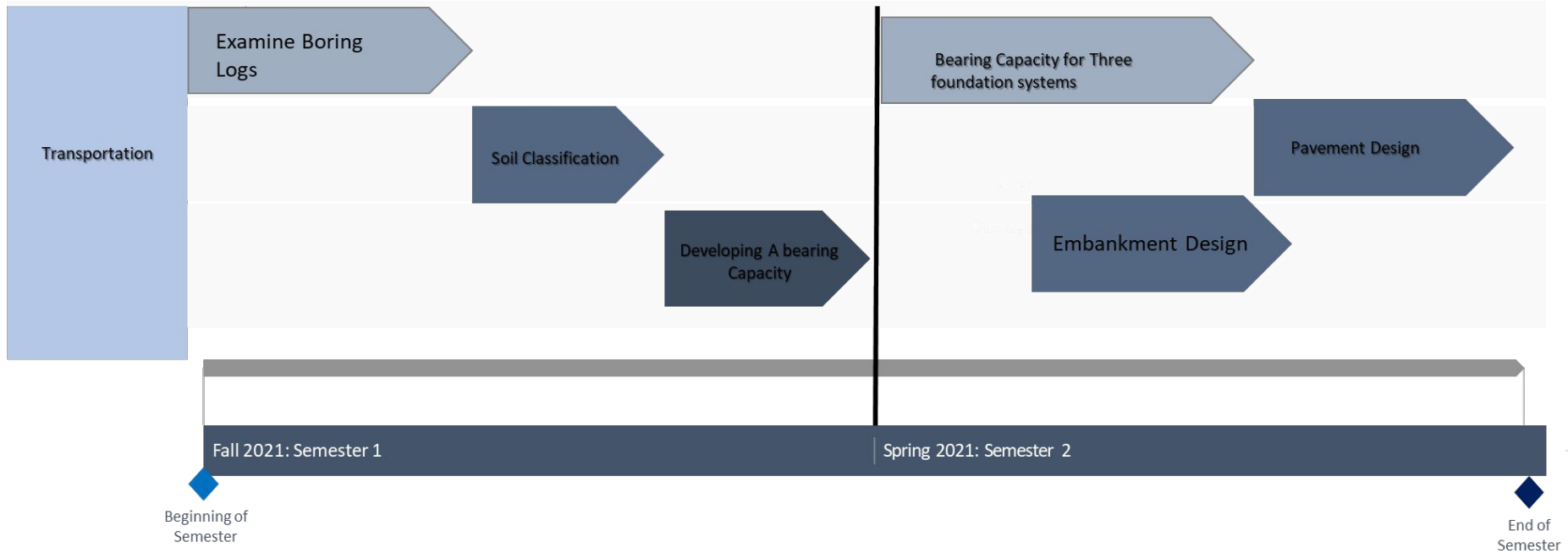
Pile Foundation

A pile foundation is a set of columns built or placed into the ground to transport loads to a lower subsoil level. A pile is a long, cylinder-shaped structure built of a strong material like concrete. Piles are driven into the earth to provide a stable foundation for structures that are built on top of them.

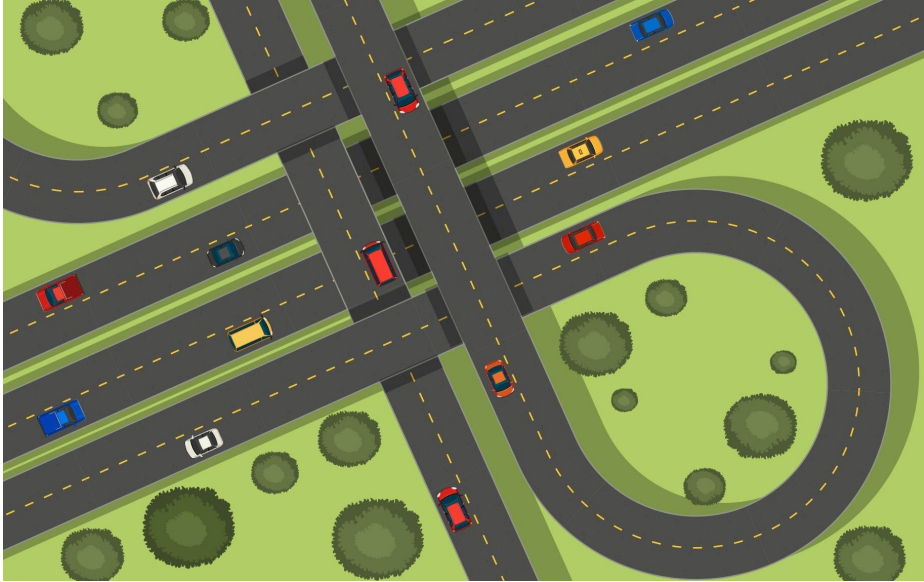


Geotechnical Management Timeline

Key activities and planning for risk mitigation



Transportation

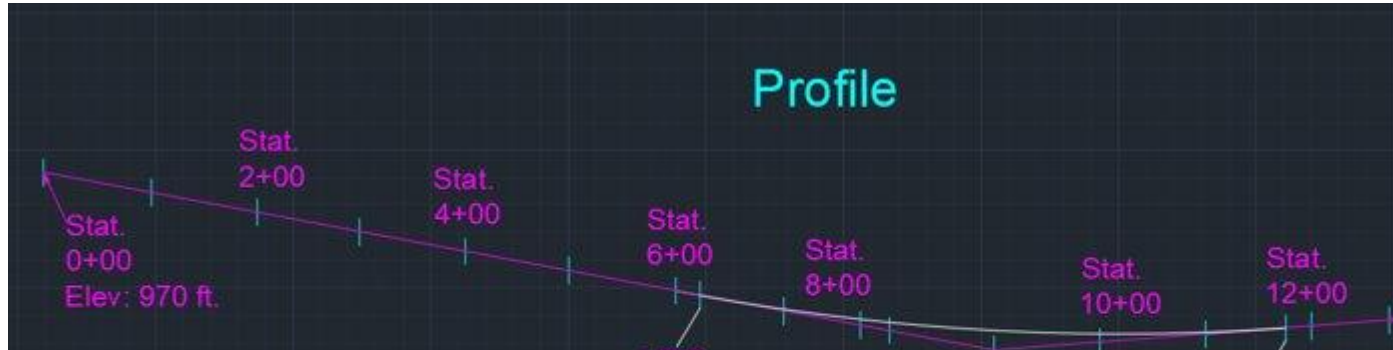


This semester the following tasks were completed:

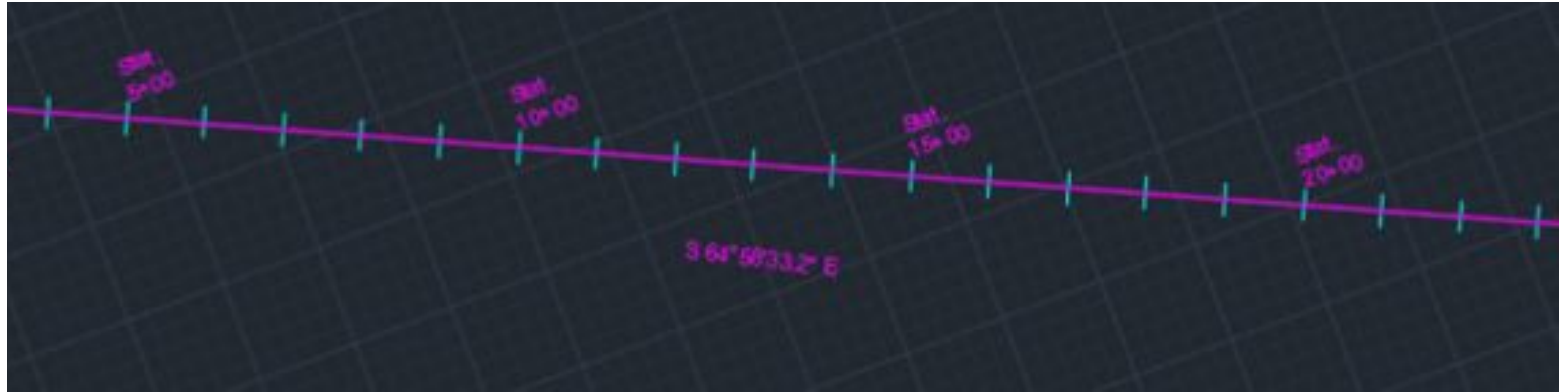
- Plan and Profile of a local road
- Intersection Design
- Parking Lot Design



Profile of Local Roadway

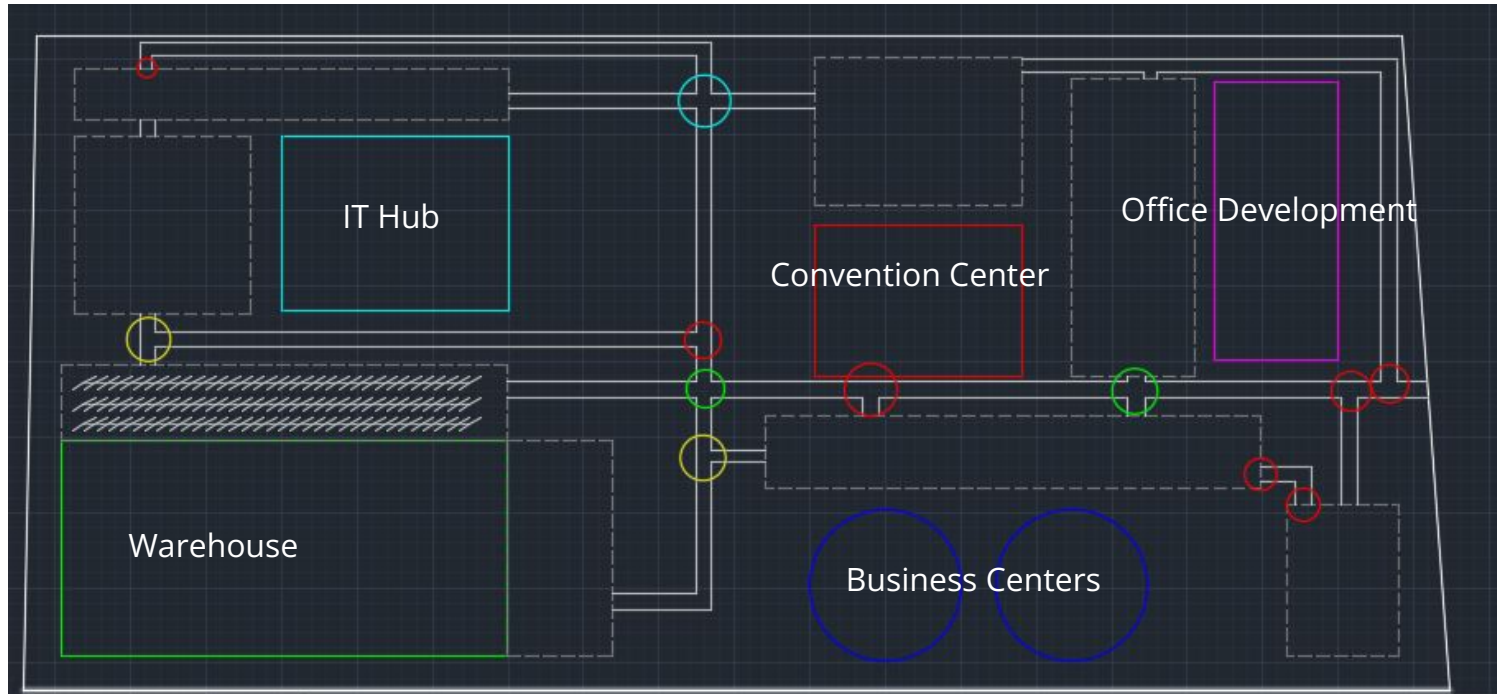


Plan of Local Roadway

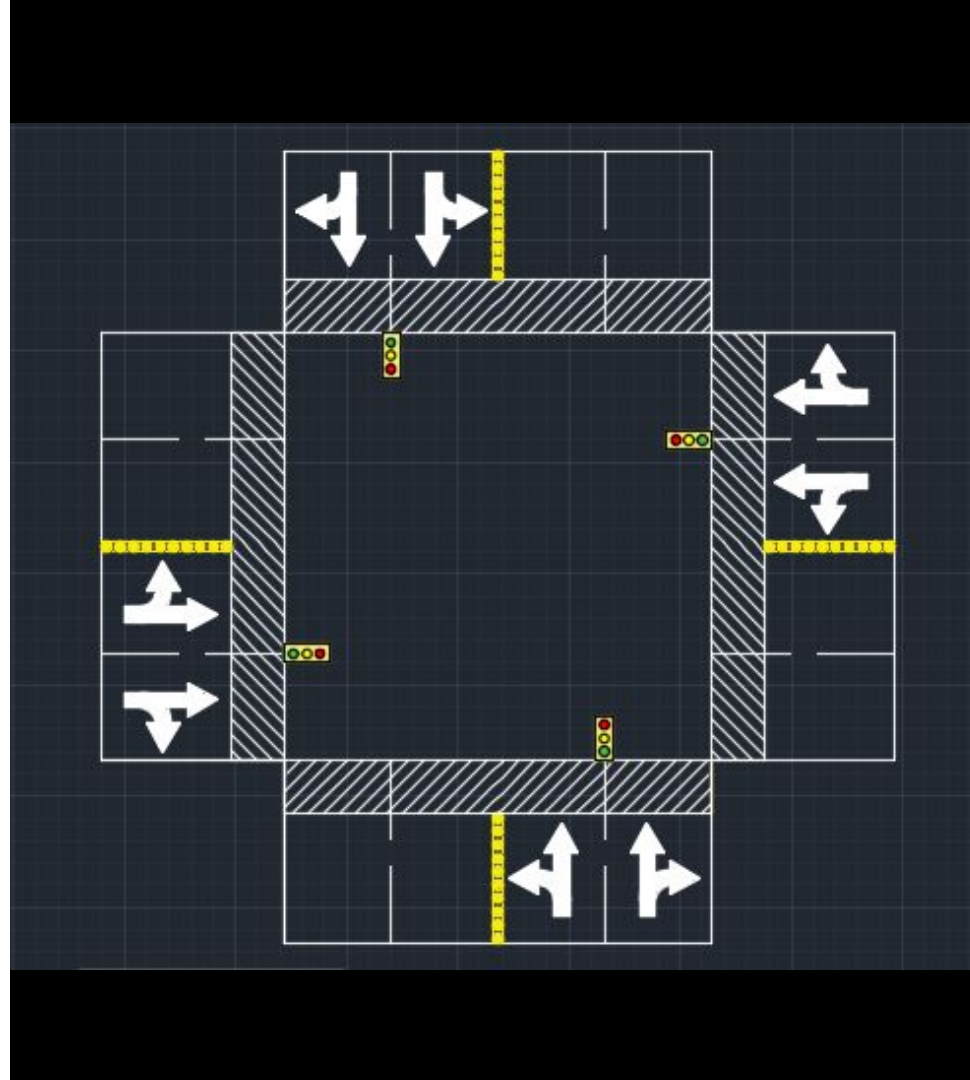


Plan View of Project with Intersections

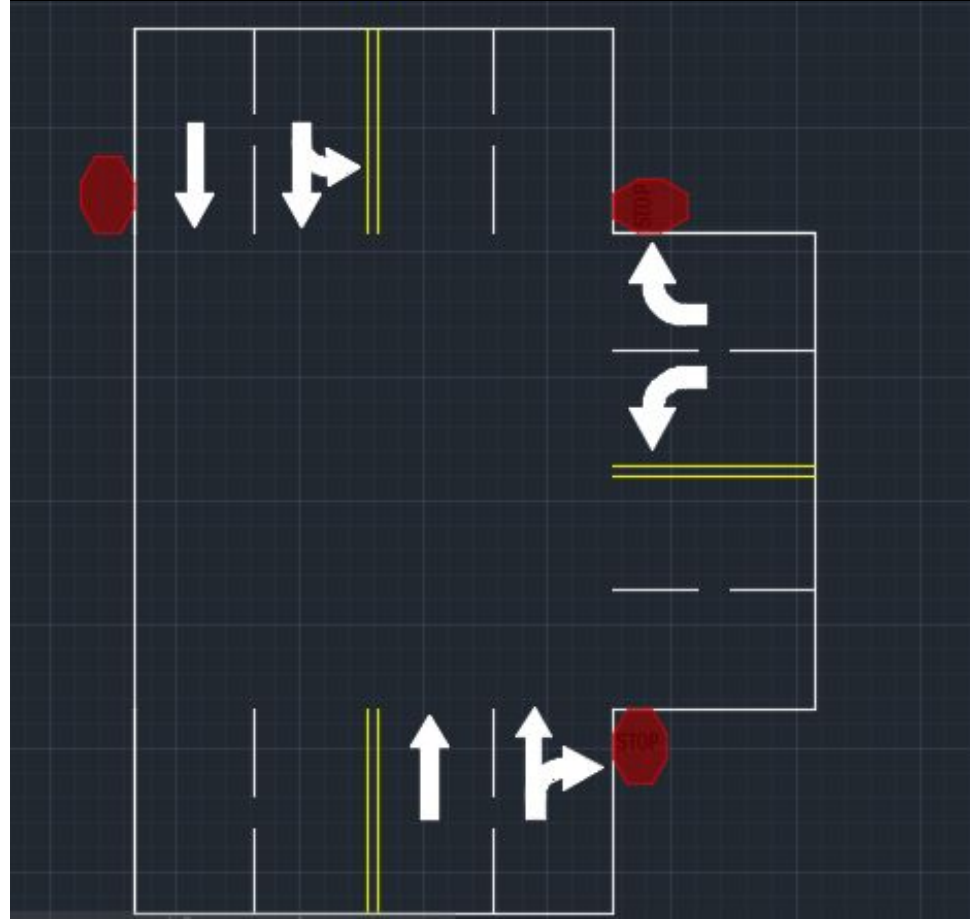
- Cyan:** 4-Way intersection with stop signs
- Green:** 4-Way intersection with stop light
- Yellow:** 3-Way intersection with stop signs
- Red:** Continuous traffic with singular stop sign



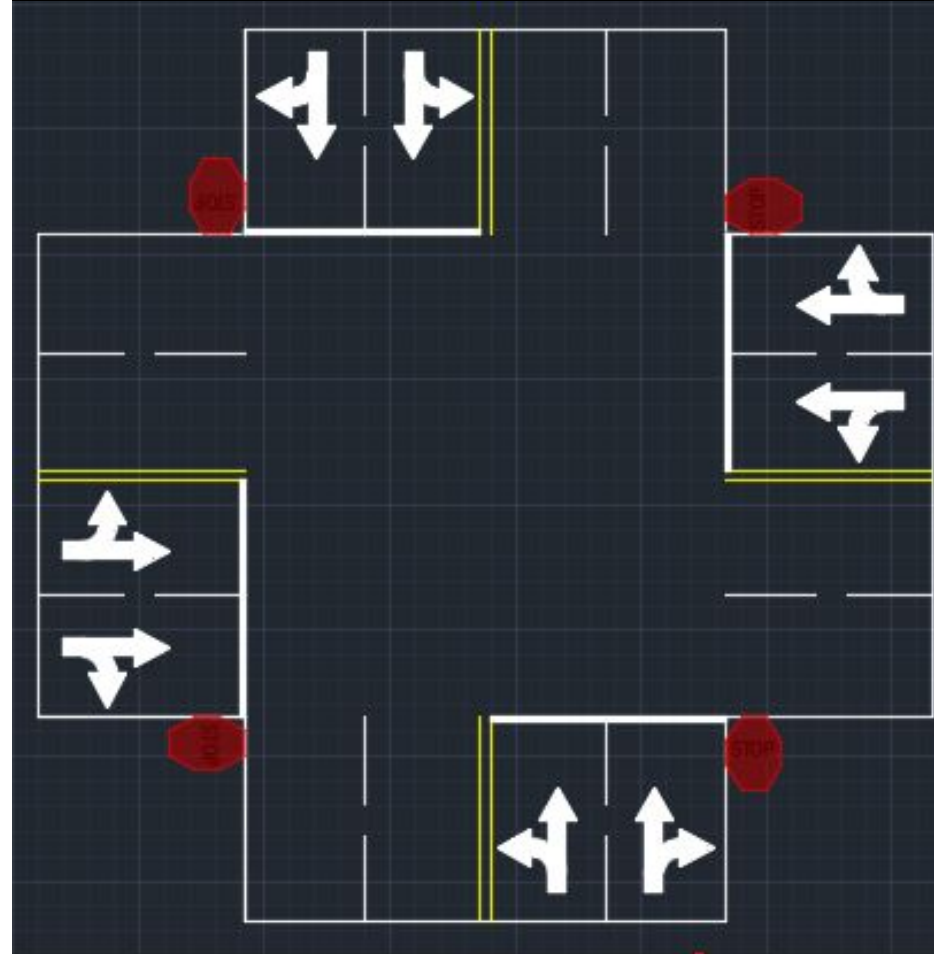
4-Way Intersection with Stop Lights



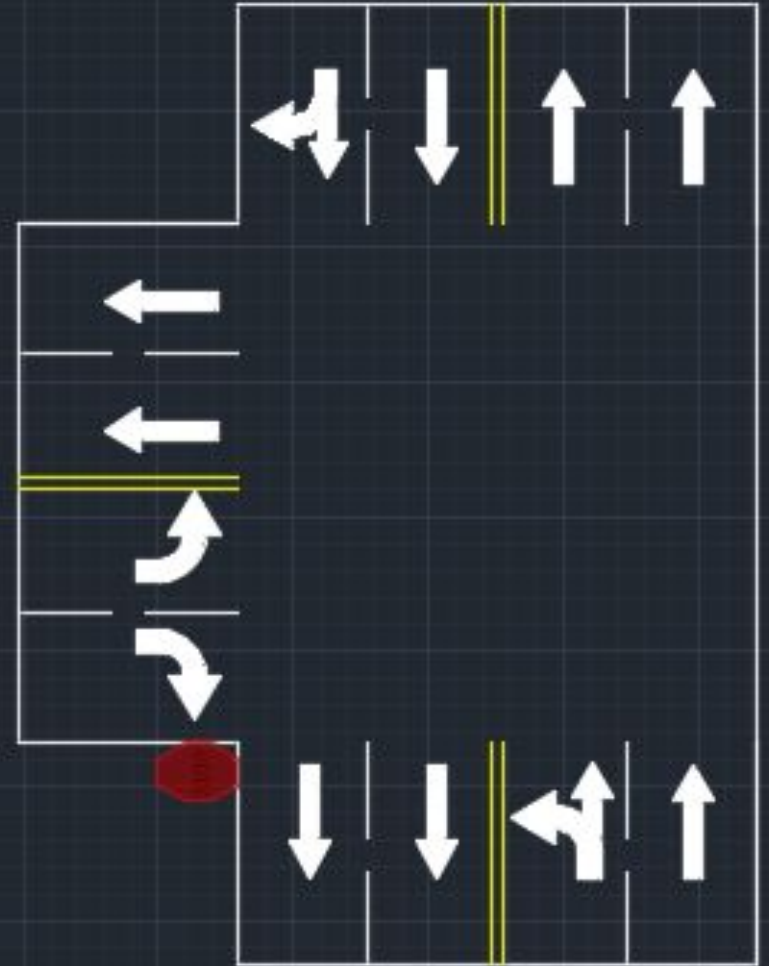
3-Way Intersection with Stop Sign



4-Way Intersection with Stop Sign



Continuous Traffic Intersection



Sample of Parking Lot Design

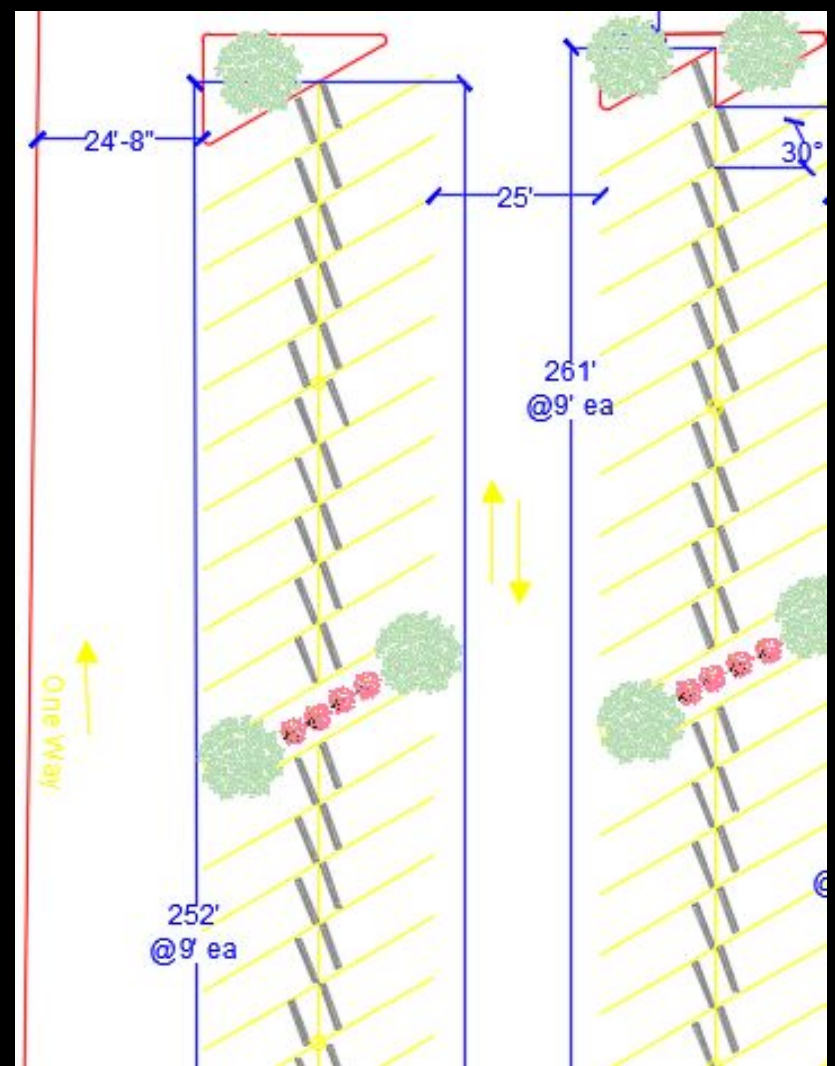
Number of parking spots per building:

Warehouse (40% of employees): 8000

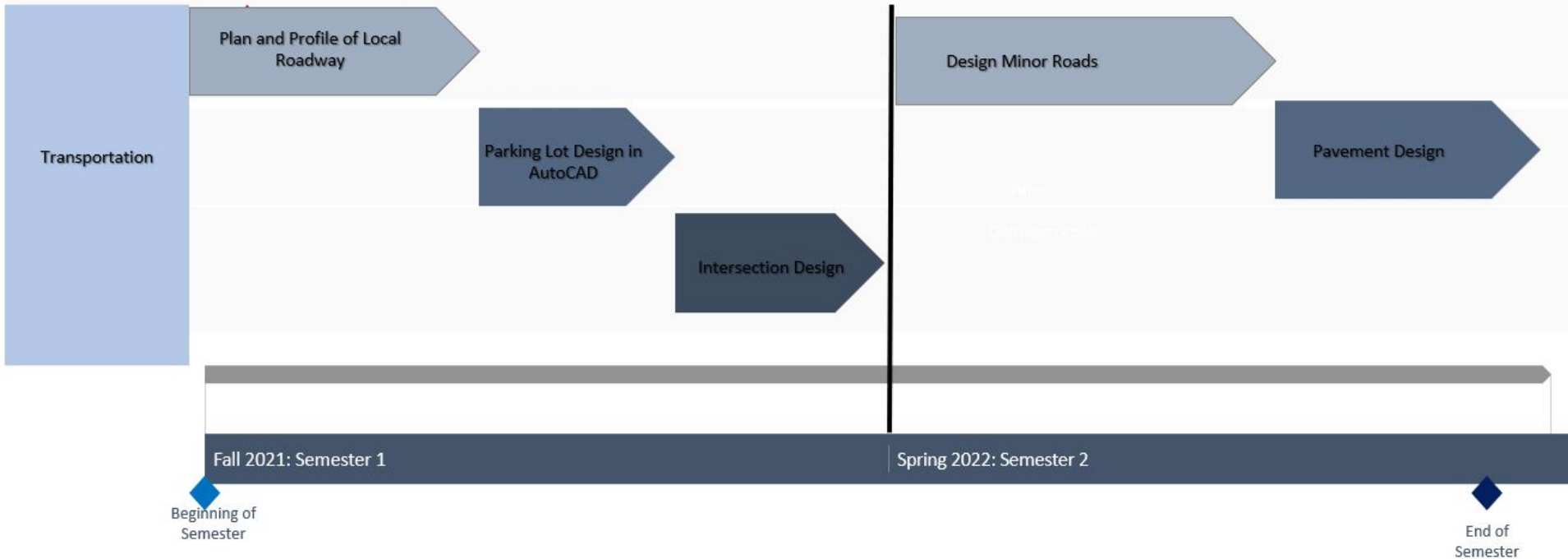
Office Development (35% of employees): 7000

Convention Center (15% of employees): 3000

IT HUB (10% of employees): 2000



Progress Timeline for Transportation



Water Resources

- Location of Storm Ditch
- Rainfall intensity/100-year rainfall investigation
- Calculation of the quantity of water
- Designing stormwater runoff, while avoiding flooding risks and property damage
- Design capacity of the ditch based on rainfall study
- Drainage ditch with profile and cross section



Location of Stormwater Ditch



Rainfall Intensity/100-year

$$Q=C*I*A$$

Where

Q =Runoff Flow

C = Runoff Coefficient

I = Rainfall Intensity

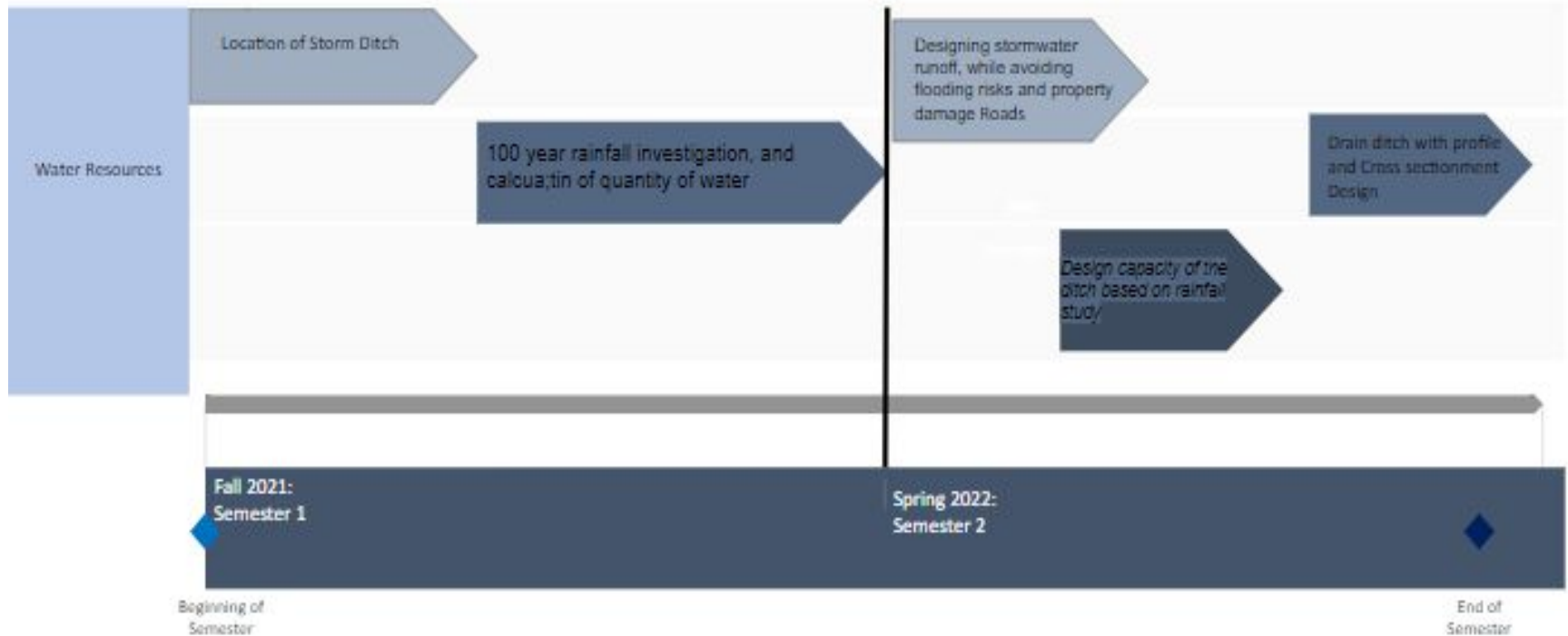
A = Acres



$$127.05 cfs = .3 \times 1.05 \frac{in}{hr} \times 400 acres \times \frac{43560 ft}{1 in} \times \frac{1 ft}{12 in} \times \frac{1 hr}{3600 s}$$



Progress Timeline for Water Resources

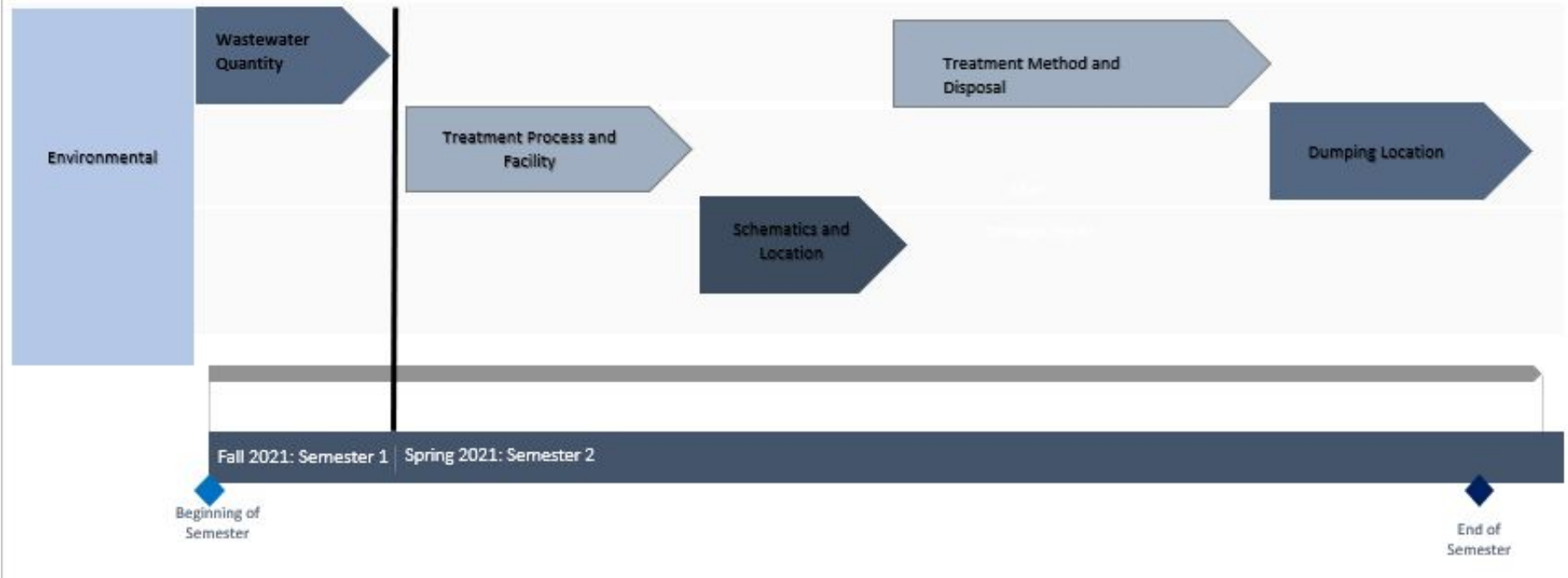


Environmental (Wastewater Treatment Plant)

- Calculate and estimate wastewater quantity.
- Wastewater treatment process and facility.
- Wastewater Treatment Schematics and Location.
- Develop methodology to treat wastewater and disposal.
- Choosing a reliable dumping location for treated water disposal



Progress Timeline for Environmental



Environmental (Wastewater Treatment Plant)

Source	Remarks	Daily Wastewater Flow (gallons/person)	Wastewater Strength (mg/l BOD ₅)	Wastewater Strength (mg/l NH ₃ -N)
Municipality	Residential	75-100	250-400	15-75
Subdivision	Residential	75-100	250-400	15-75
Trailer Park (Transient)	2½ Individuals per Trailer	50-60	250-350	15-75
Mobile Home Park	3 Individuals per Trailer	50-75	300	15-75
School	Cafeteria & Showers	20	300	15-75
	Cafeteria/No Showers	15	300	15-75
Recreational Parks	Overnight User	30	200	15-75
	Day User	5	100	15-75
Office Building or Factory	A facility must be designed for the largest shift	20	300	15-75
Hotel/Motel	Per Bed	50-75	300	15-75
Restaurant	Per Meal	7-10	1000*	15-75
Restaurant with bar or cocktail lounge	Per Meal	9-12	1000*	15-75
Hospital	Per Bed	200	300	15-75
Nursing Home	Per Bed	75-100	300	15-75
Alternative Collection Systems (Subchapter D of this chapter)	Per Capita	75	N/A	N/A
*Based on a restaurant with a grease trap				



Environmental (Wastewater Treatment Plant)

- $AADF = Population \times Average\ Daily\ Flow\ per\ Capita$

$$AADF = 20000\ ppl \times 20\ \frac{gal}{capita - day} = 400000\ \frac{gal}{day}$$

$$Q = 400000\ \frac{gal}{day} \times 0.003785\ \frac{m^3}{gal} = 1514\ \frac{m^3}{day}$$

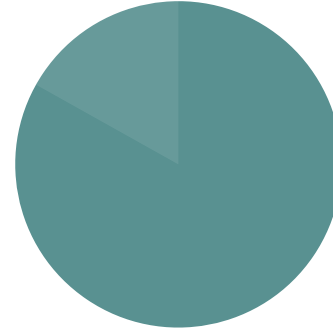


Closing

Thank you for your time! Are there any questions?



Development of Business and Distribution Center, and IT Hub for Amazon



G.A.M.S. Engineering

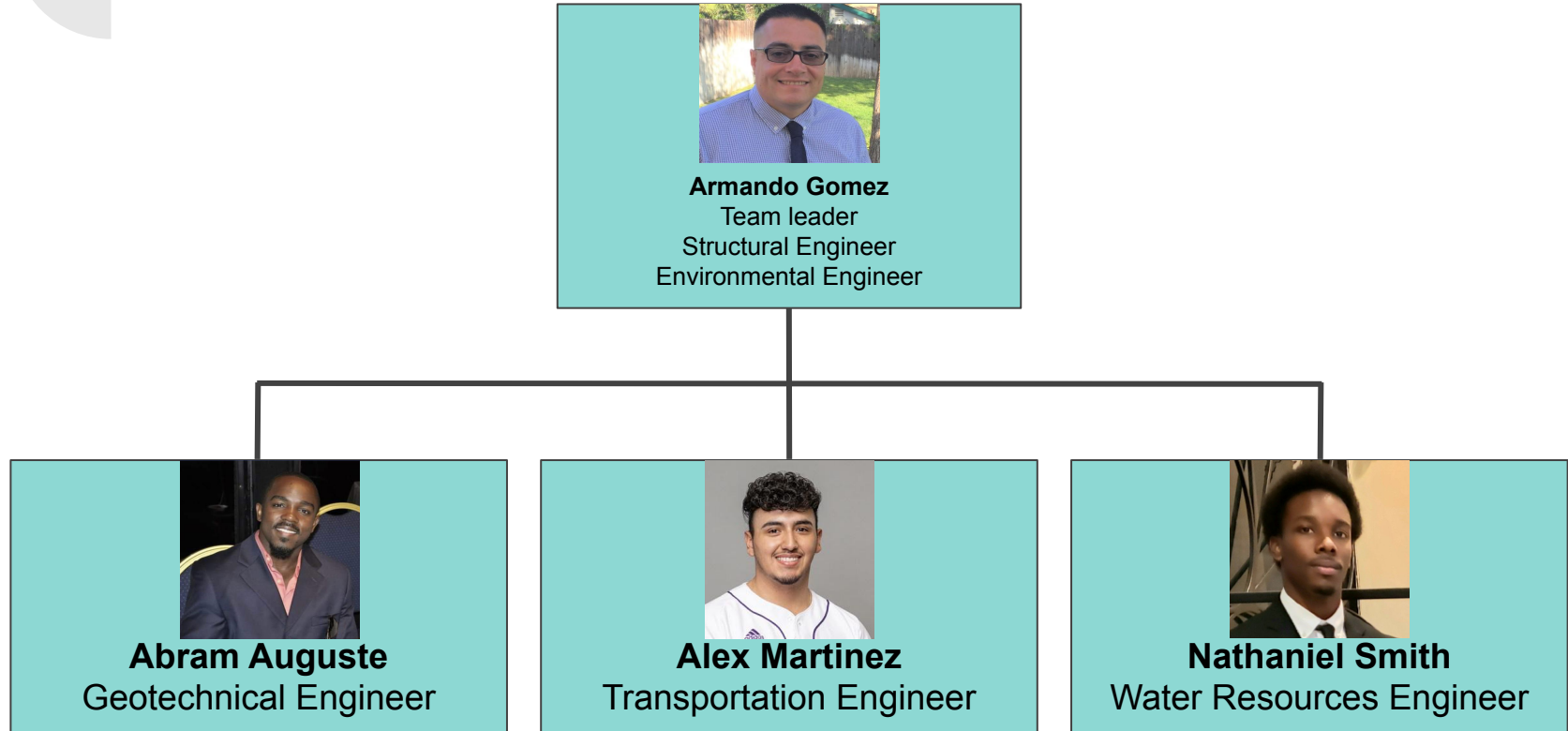
Armando Gomez, Abram Auguste, Alex Martinez, Nathaniel Smith



Presentation Outline

- ❖ Project Flow Chart Of Member
 - Armando Gomez - Structural Engineer
 - Abram Auguste - Geotechnical Engineer
 - Alex Martinez - Transportation Engineer
 - Nathaniel Smith - Water Resource Engineer
- ❖ Project Description
 - Project Summary
 - Proposed Site Location
- ❖ Tasks
 - Structural
 - Geotechnical
 - Transportation
 - Water Resources
 - Environmental

Organizational Chart





G.A.M.S. Engineering



Name: Armando Gomez

Title: Structural Engineer

Description: Armando Gomez is a structural engineer and a partner at G.A.M.S Engineering. He was born and raised in Watsonville, California to immigrant parents from Michoacan, Mexico. He graduated from Prairie View A&M with a Bachelors of Science in civil engineering. In 2018 attended the Pacific South Western Conference (PSWC) and was a participant in the steel bridge design competition. He's done volunteer work as a proctor for regional Mathcounts competitions held at California Baptist University for middle school students. He is also a current member of American Society of Civil Engineers (ASCE). He has worked in the construction industry for over 10 years. He has worked for a consulting company providing estimating or project management for sub and general contractors. He has estimated and project managed multimillion dollar projects in California for electrical contractors.

G.A.M.S. Engineering



Name: Abram Auguste

Title: Geotechnical Engineer

Description: Abram Auguste is a Co-founder of G.A.M.S. Engineering. He was born and raised in Boston, Massachusetts and is a first generation Haitian-American. He is a graduate from the Prairie View A&M University with a Bachelor's of Science Degree in Civil Engineering. He is a current member of American Society of Civil Engineers (ASCE). He enjoys using his skills to bridge the complex concepts of technology and engineering with day-to-day civil obstacles. His pastime includes real estate development and design, physical athletic training, and venturing different restaurants.



G.A.M.S. Engineering



Name: Alex Martinez

Title: Transportation Engineer

Description: Alex Martinez is a Transportation engineer and a partner at G.A.M.S Engineering. He was born and raised in Houston, Texas. He is a graduate from Prairie View A&M University with a Bachelors of Science in Civil Engineering. He previously worked with a Surveying and Field Services company in Houston, where he mapped out and created CAD Sheets to Portray various Proposed Pipelines.

G.A.M.S. Engineering



Name: Nathaniel Smith

Title: Water Resources Engineer

Description: Nathaniel Smith is a water resources engineer and a partner at G.A.M.S Engineering. He was raised in Mililani, Hawaii and moved to Houston, Texas in 2015. He is a graduate from Prairie View A&M with a Bachelors of Science in Civil Engineering. He is a current member of American Society of Civil Engineers (ASCE). He also works as a math tutor.



Project Summary

Client: Amazon

Location: Washington County, Texas.

- Develop approximately 400-acre site providing civil engineering development and design services.
 - two five-story commercial buildings,
 - a steel structure warehouse,
 - a three-story convention center
 - parking lots for entire facilities.
 - New road network development including intersection, sidewalks, driveways, and extensions of highways/service road that would connect local roads to highways.
 - Provide storm water ditch/basin or detention pond that that will connect to a local lake.
 - To provide waste disposal facility and wastewater treatment process and facility.
 - The site facilities are to be designed for a 20,000 population over a 15 year period.

Proposed Site Landscaping

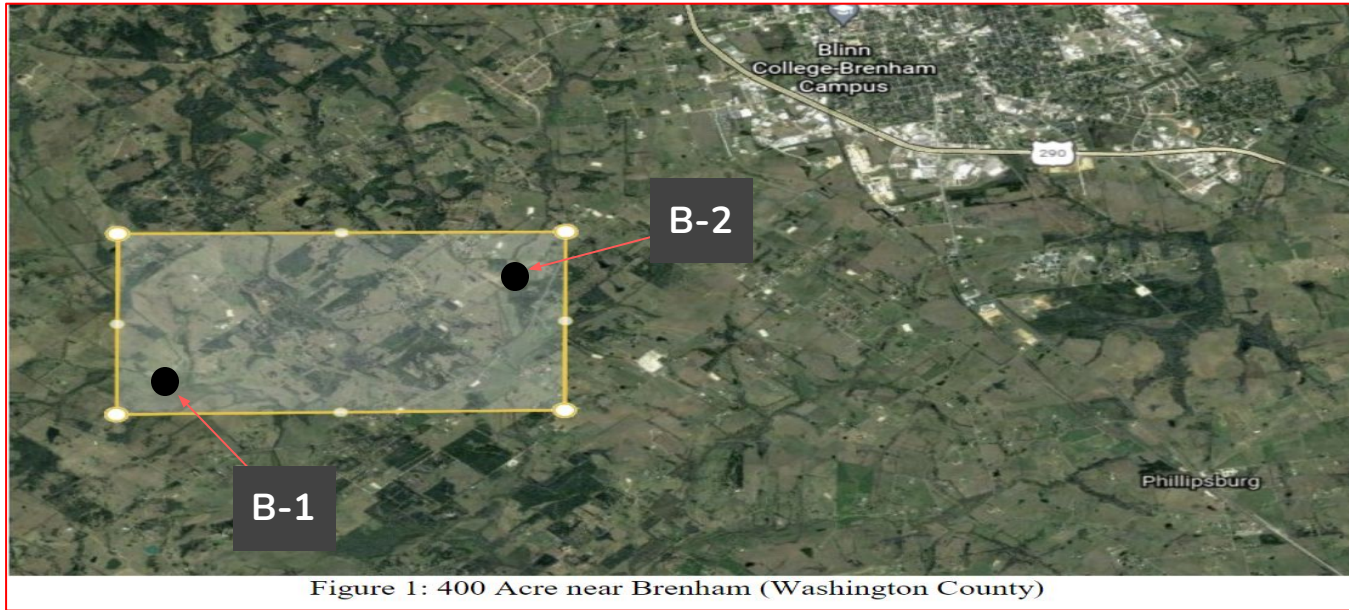


Figure 1: 400 Acre near Brenham (Washington County)

Amazon approximate 400-acre site facilities are to be located in Washington County, Texas. Boring Logs 1 and 2.

Geotechnical

- Develop boring logs using raw information
- Analyze the boring logs
- Analyze both the soil report and soil classification
- Foundation design: bearing capacity and settlement
- Analyze different foundation system and recommend safe and low-cost foundation system (Type, size and depth and material for foundation, and related specifications)
- Embankment design (slope of major highway)
- Pavement design (geotechnical design) and material specification





Existing Site Conditions

The project site encompasses an approximately 400 square foot long area along the southwestern bank of the city of Brenham on the southwest side of the Interstate-290, Texas.

The elevation is approximately (341') and the city has an area: 13.03 mi². Brenham is located at 30°9'43"N 96°23'49"W (30.161901, -96.397004).

Industrial properties and Blinn Community College facilities are located along the northeast side of the proposed space, and it is presumed that the land is barren and free of residential buildings. Pond Creek sits just southwest of the proposed space in the town of Wesley, Texas.



SUBSURFACE INVESTIGATION

On September 1, 2021, a total of two (2) borings, designated as B-1 and B-2, were drilled at the locations illustrated on the boring plan provided in Appendix I and summarized in Table 2 (Appendix III)

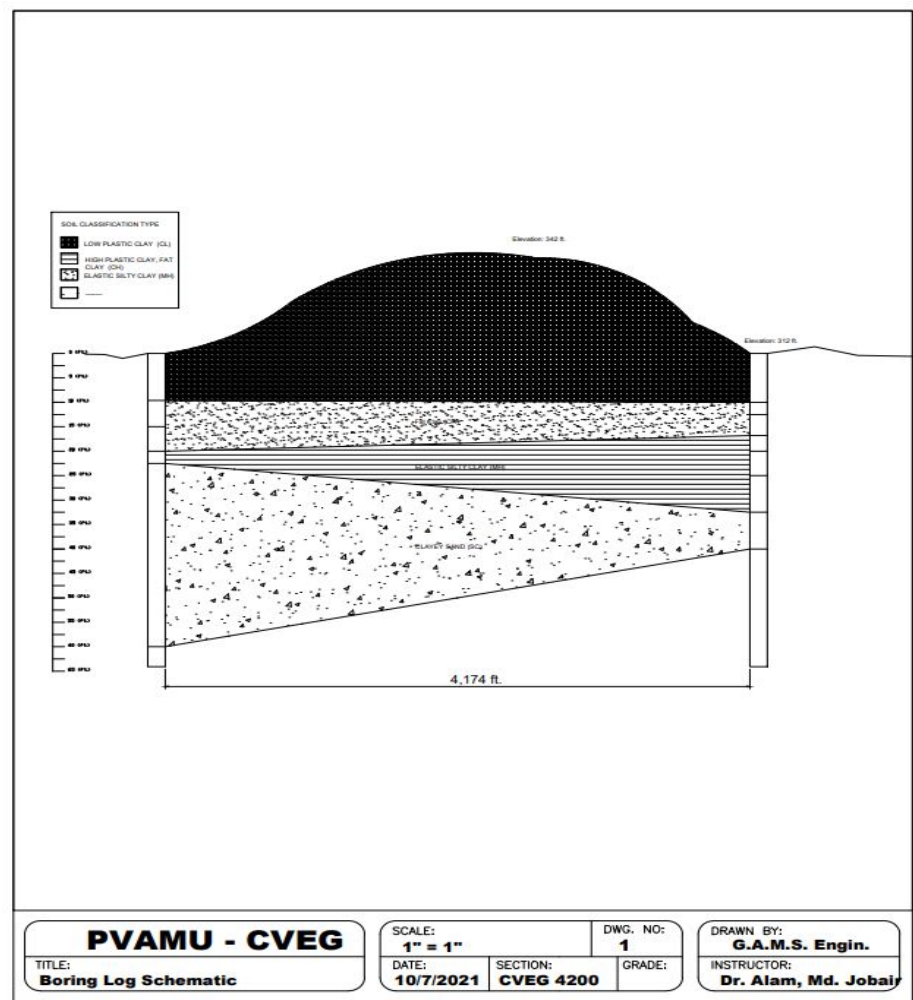
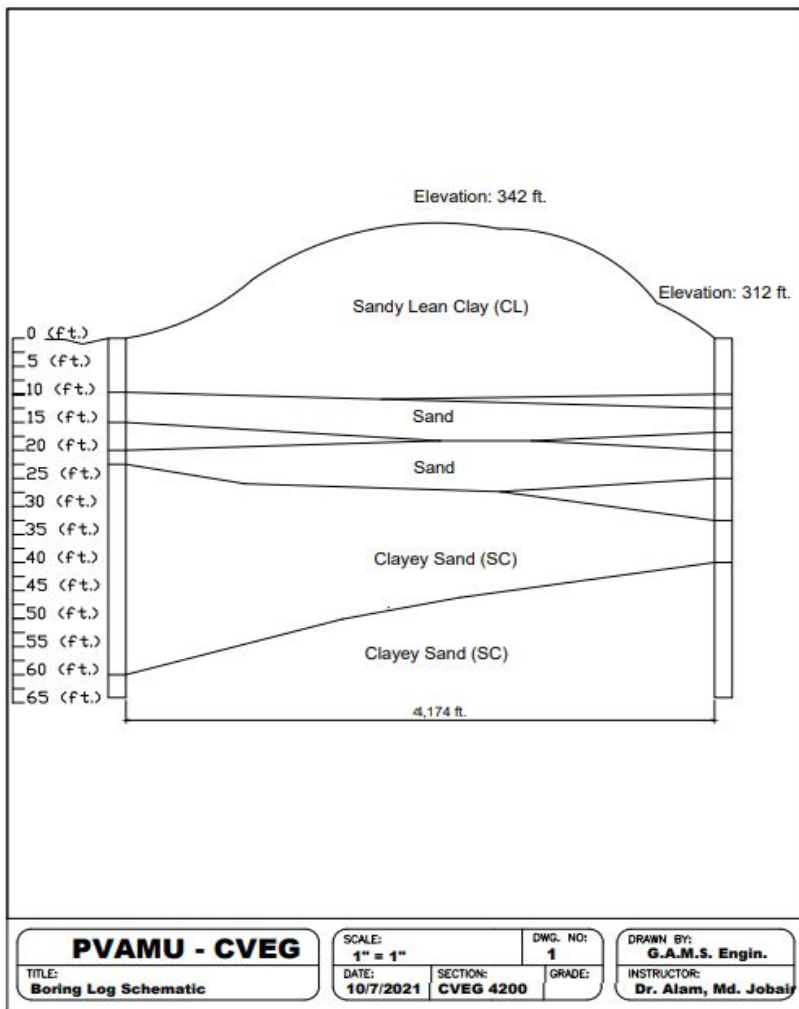
The borings were drilled to a completion depth of 68.0 feet each below the existing ground surface.

The boring locations were determined and field located by G.A.M.S. personnel. During the field reconnaissance, G.A.M.S. personnel documented the existing site conditions. Ground surface elevations at the boring locations were determined using topographic mapping information provided by the United States Soil and Conservation Services (USSCS). The borings were drilled with a drilling machine, utilizing a hollow stem auger to advance the holes. Standard penetration test (SPT) were performed at 6-inch intervals to a depth of 68.0 feet below the ground surface. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). SPT blow counts aid in determining soil properties applicable in foundation system design.

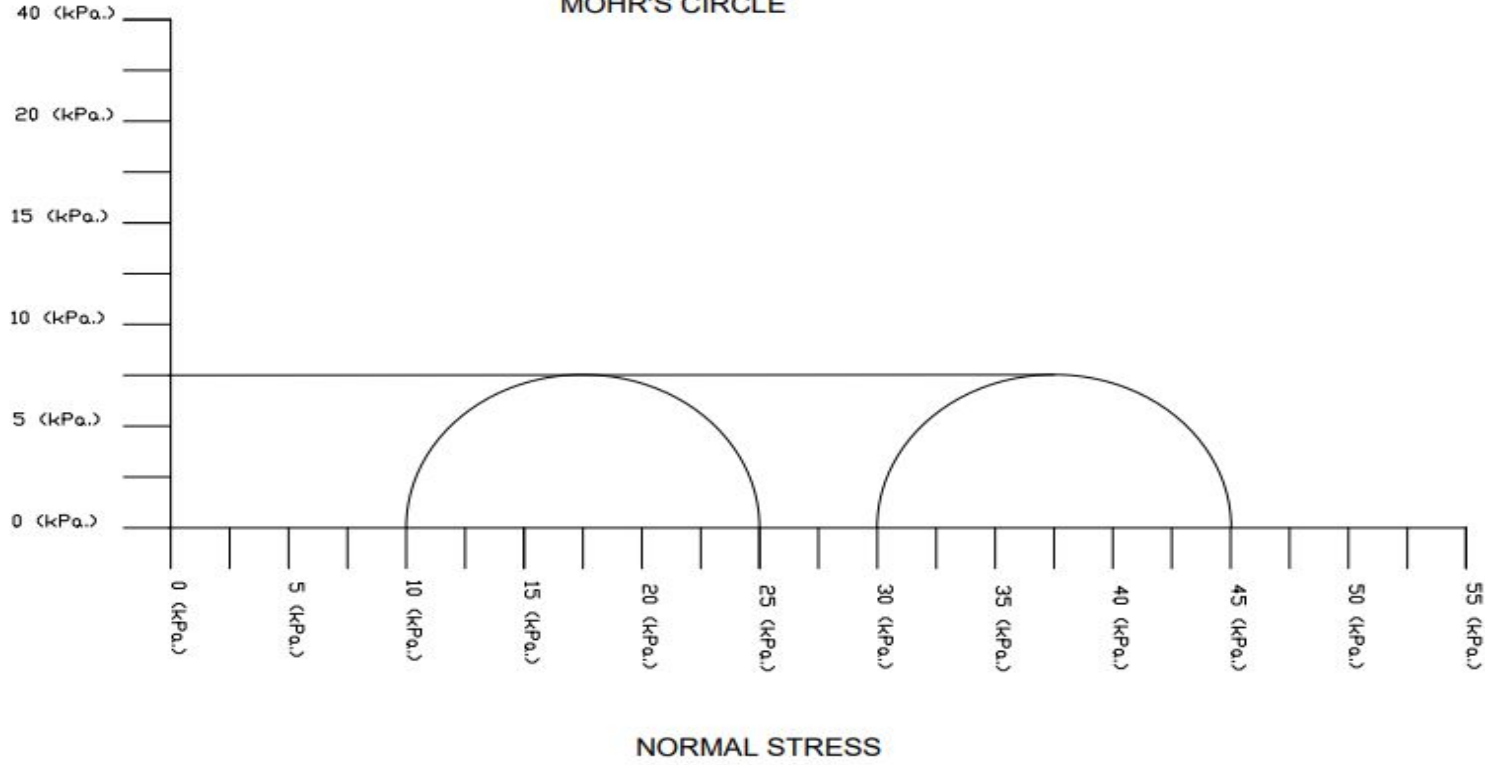
Assume Gravel 0

SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
3,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
3,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

[illegible]



SHEAR STRESS



Boring Soil Schematic DWG.
SCALE: 1"=1"

PVAMU - Roy G. Perry Bldg

Mohr's Circle Analysis

SCALE:
1" = 1"

DATE: 12/1/2021

SECTION: CVEG 4200 - Senior Design

DWG. NO: 1

GRADE

DRAWN BY: G.A.M.S. Group

INSTRUCTOR: Dr. Alam, Md. Jobai

A-1

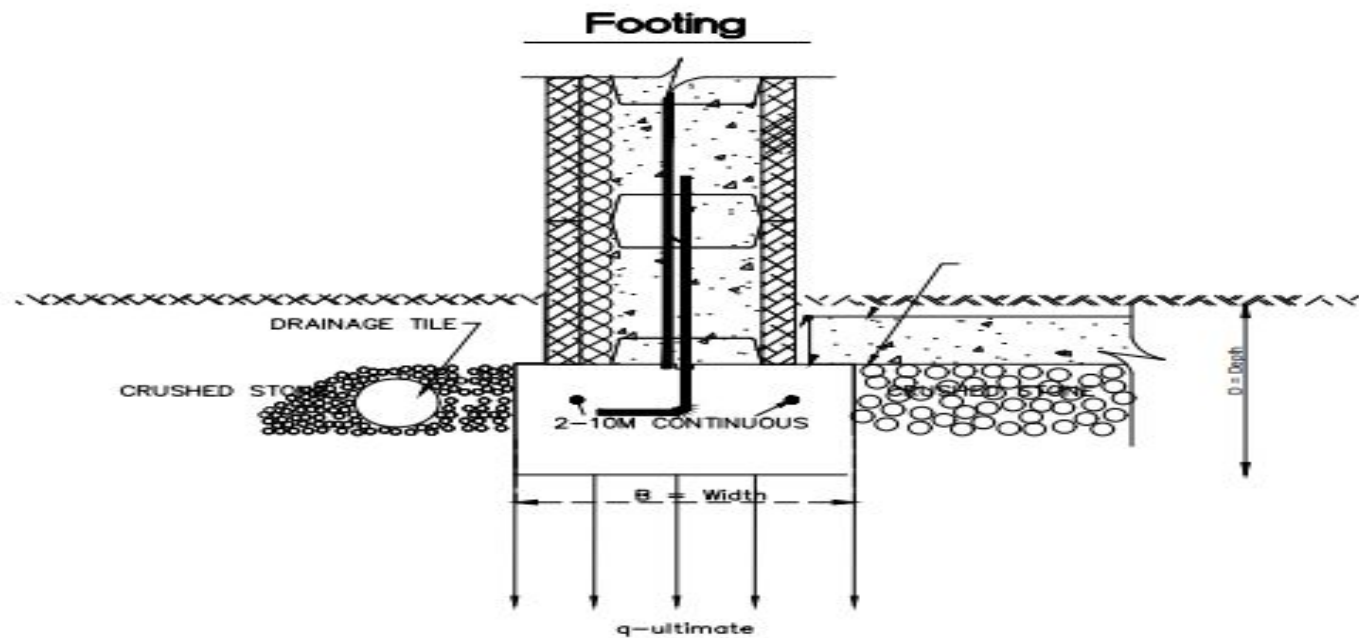


Obtained Values

$$\gamma_{sat} = 115.095 \frac{lb}{ft^3} \quad \text{and} \quad \gamma_{dry} = 101.854 \frac{lb}{ft^3}$$

$$Q_{ult.} = \text{Bearing Capacity}(BC) = 1.3 \times 7.5 \text{ kPa} \times 5.14 + 27.554 \text{ kPa} \times 1 = 77.669 \text{ kPa} = 1622.151 \frac{lb}{ft^2}$$

$$Q_{Allowable} = \frac{Q_{ult.}}{F.S.} = \frac{1622.151 \frac{lb}{ft^2}}{3} = 540.717 \frac{lb}{ft^2} \quad (Q = \text{Load}; q = \text{pressure } B \leq 485 \text{ good. If larger then increase foundation})$$



PVAMU - CVEG

TITLE:
Boring Log Schematic

SCALE:
1" = 1"

DATE:
10/7/2021

SECTION:
CVEG 4200

DWG. NO:
1

GRADE:

DRAWN BY:
G.A.M.S. Engin.

INSTRUCTOR:
Dr. Alam, Md. Jobair

Table 1a: Boring 1 Analysis for Circular Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	6361.725204	2544.690082	8906.415286
7.5	9542.587807	12087.27789	21629.86569
9	0	12087.27789	12087.27789
15	14137.16712	35177.98419	49315.15131
20	0	35177.98419	35177.98419
30	24033.18411	96062.05059	120095.2347
40	36756.63451	207148.7682	243905.4027
50	49480.08492	394073.5335	443553.6184
60	56548.66848	650427.4973	706976.1658
68	74220.12738	1031754.018	1105974.146

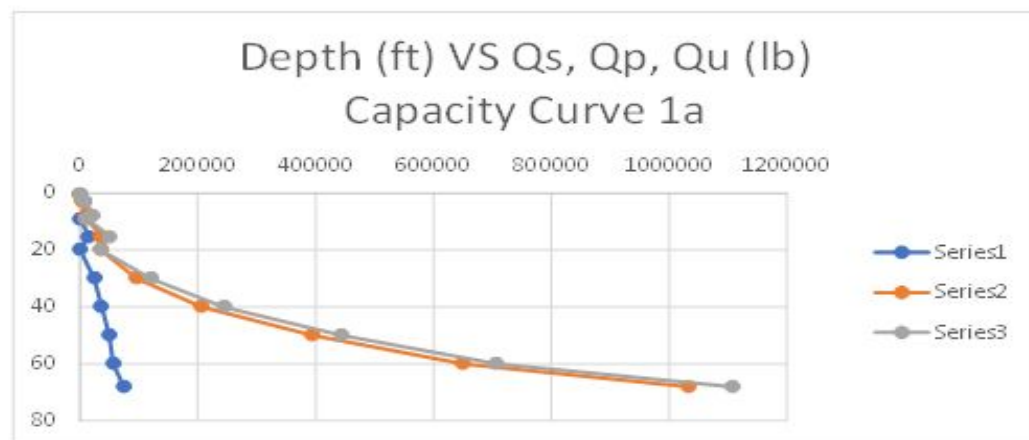
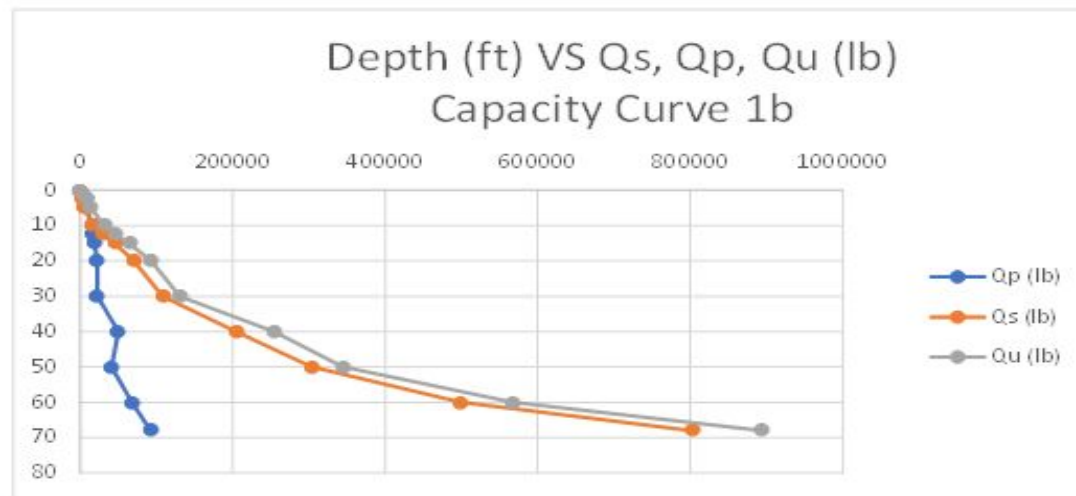


Table 1b: Boring 1 Analysis for Square Section Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	7068.58356	1675	8743.58356
5	9083.129875	5594.25	14677.37988
10	15197.45465	15914.25	31111.70465
12.5	16081.0276	29279.875	45360.9026
15	18873.11811	45700.375	64573.49311
20	22619.46739	70660.375	93279.84239
30	22619.46739	108100.375	130719.8424
40	50186.94328	204660.375	254847.3183
50	40997.78465	303260.375	344258.1597
60	67858.40218	499100.375	566958.7772
68	92598.44464	801972.375	894570.8196



Structural



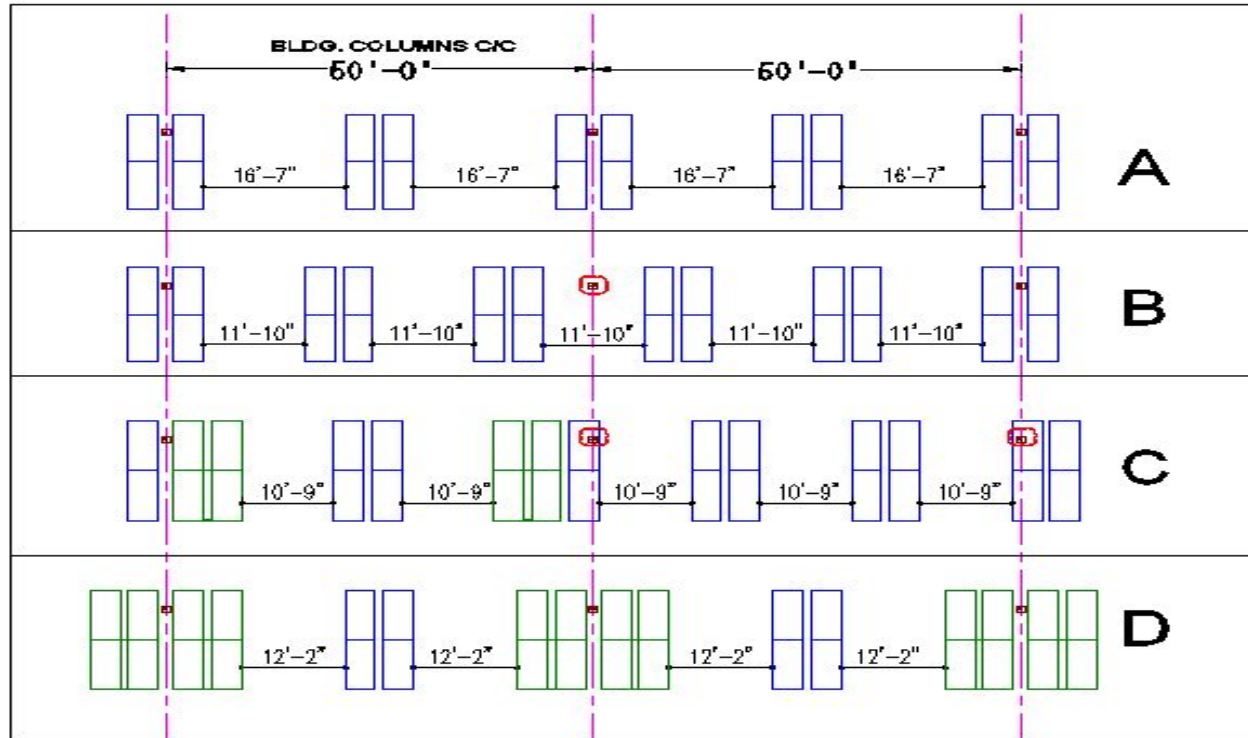
- Analyze Geotechnical report
- Design Structures per specification
- 2D Drawing- Office Building, Warehouse, Convention Center
- Slab Design
- Input and output analysis using STADD Pro model for Office Buildings, Warehouse, Convention Center.
- Beam and Column Design, steel structure design of warehouse
- Give Maximum values of Bending Moment, Shear, and Axial load, identifying member or component location etc.
- Reinforcement bars and Reinforced Concrete Design.
- Follow Construction standards, safety guidelines and Authority Having Jurisdiction (AHJ)



Beams & Columns

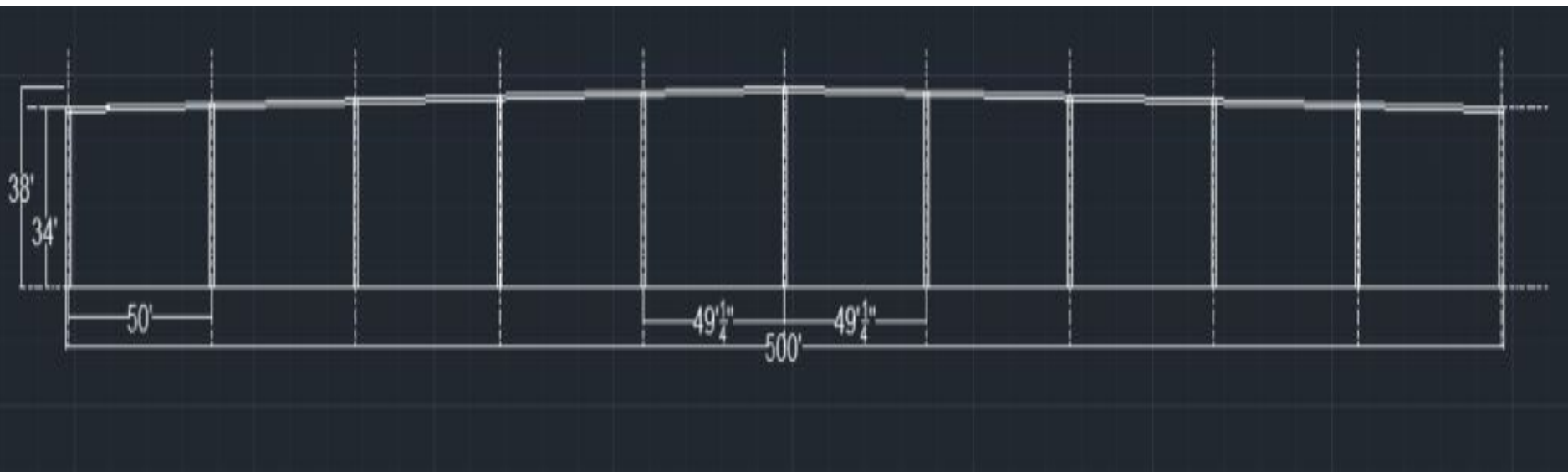
- Steel Manual 14th Edition
- International building code 2021
- Calculation of dead & live loads
 - $W = D_L + L_L$
- Uniformly Distributed Load Simply Supported Beam
 - $V_{Max} = WL/2$
 - $M_{Max} = WL^2 / 8$
 - Check Answers
 - $V_{Max} < \phi_V V_{nx}$
 - $M_{Max} < \phi_b M_n$

Warehouse Column Spacing



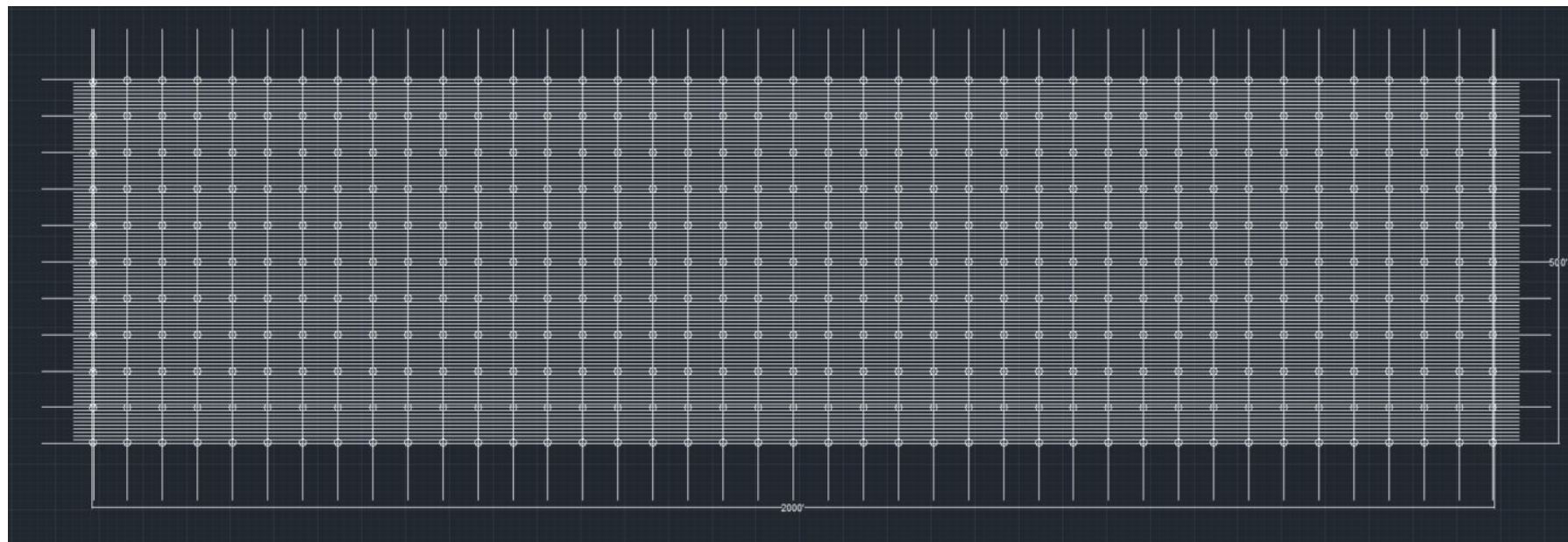


Amazon Warehouse



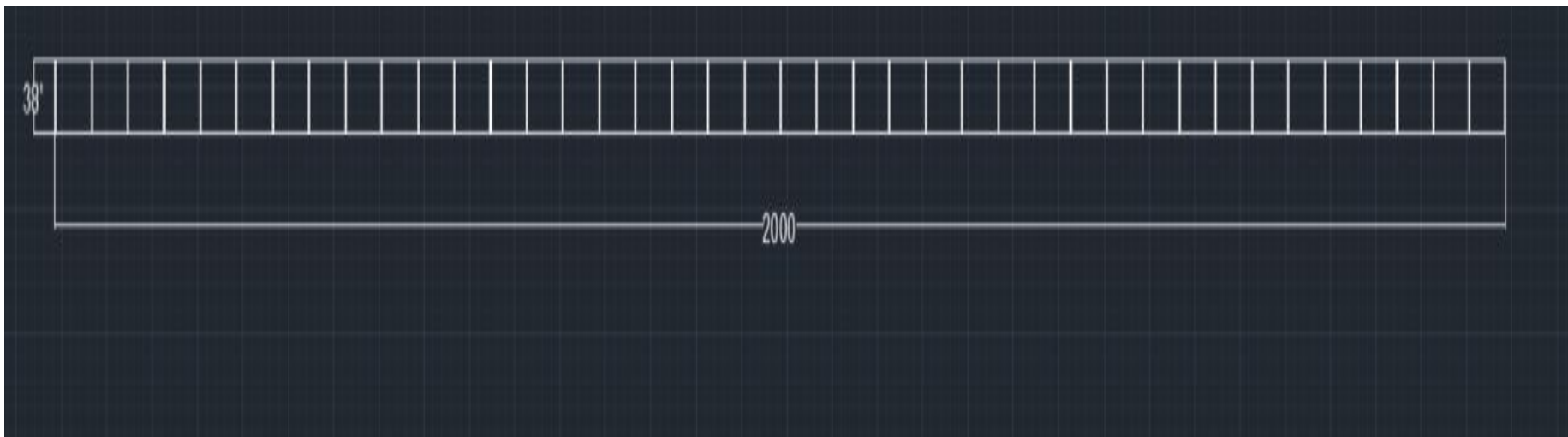


Amazon Warehouse



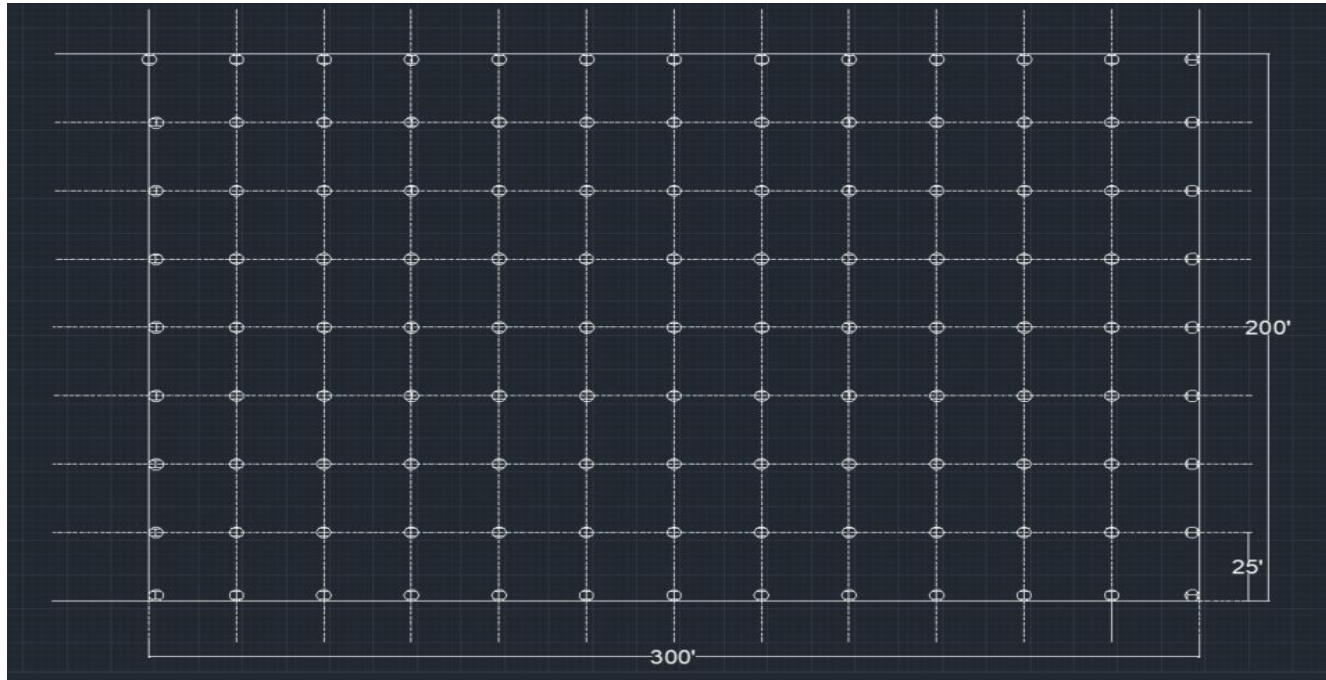


Amazon Warehouse



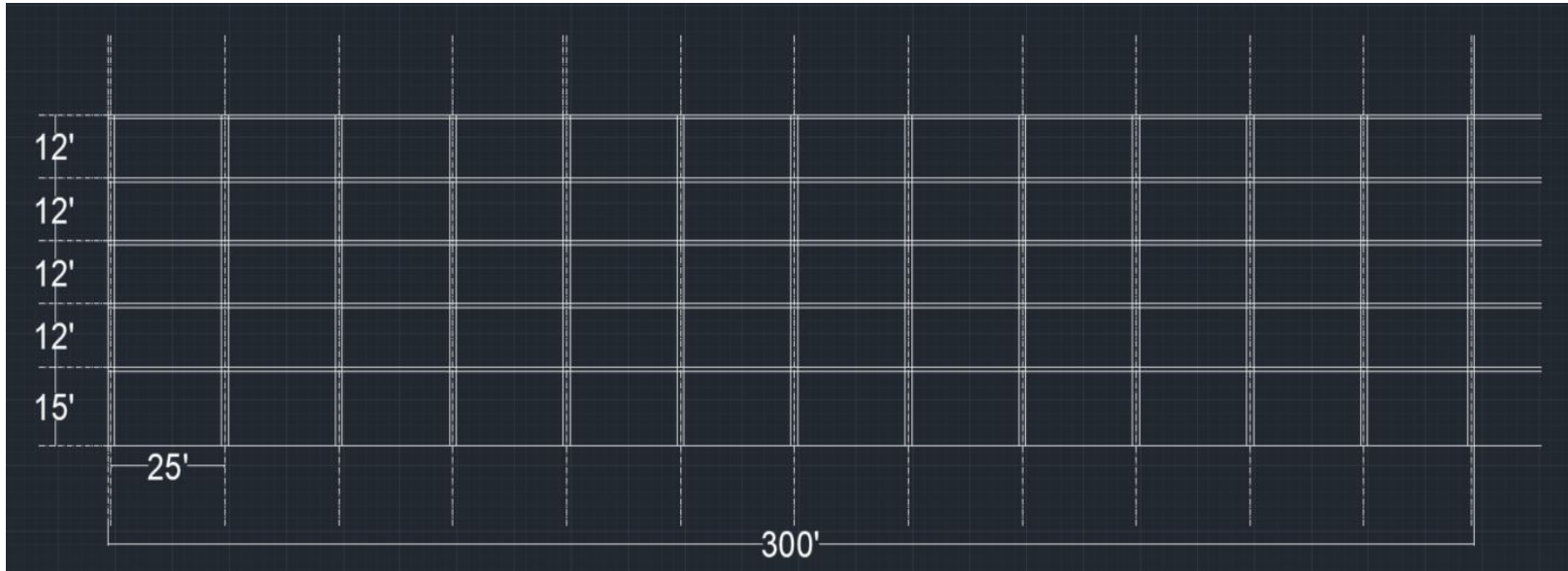


5 Story IT Hub and Office Space

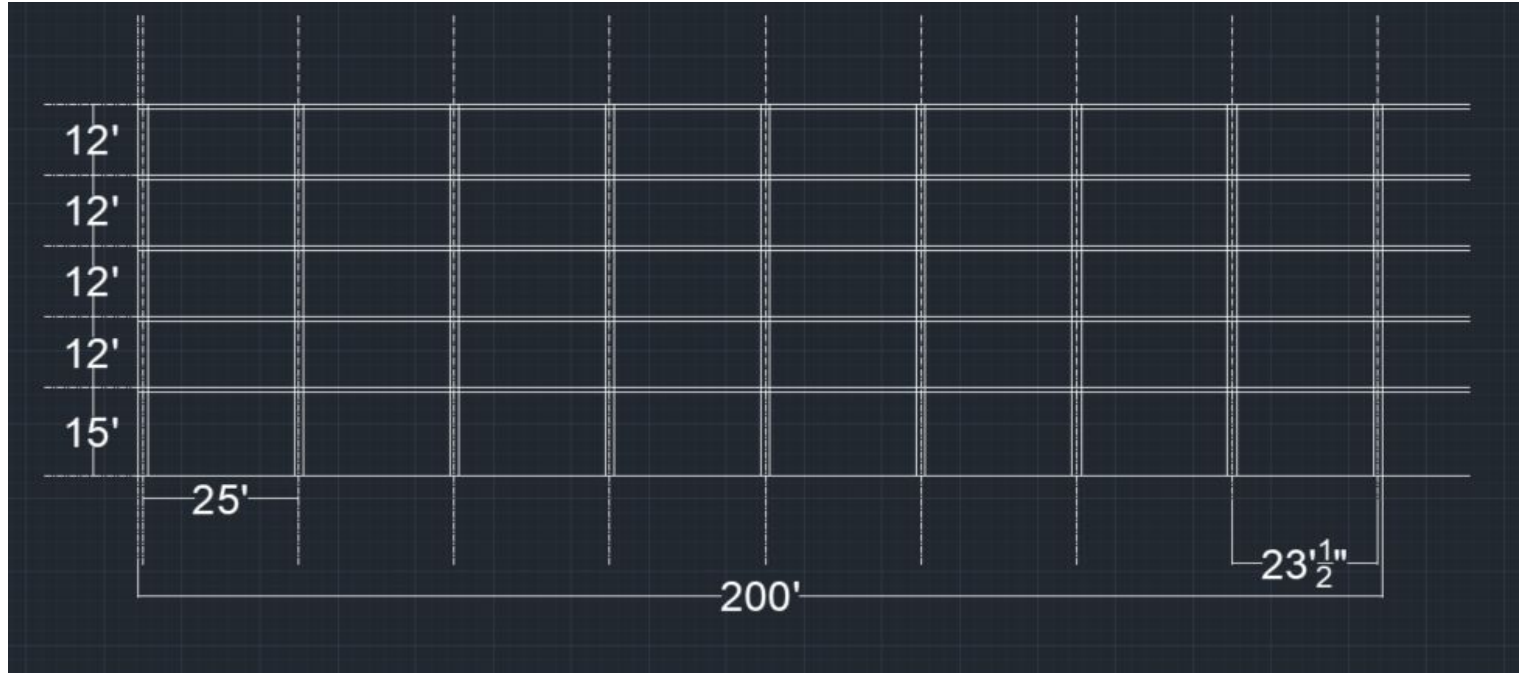




5 Story IT Hub and Office Space

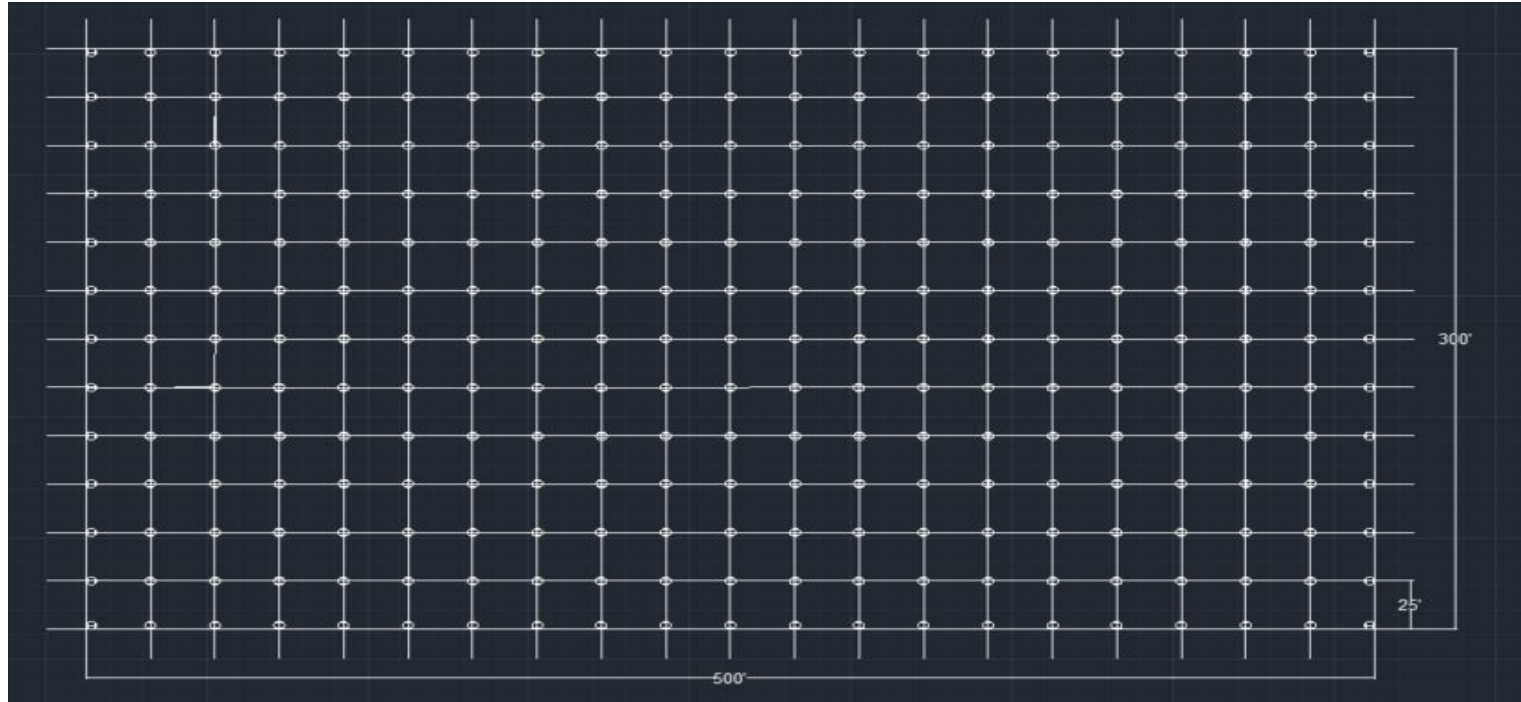


5 Story IT Hub and Office Space



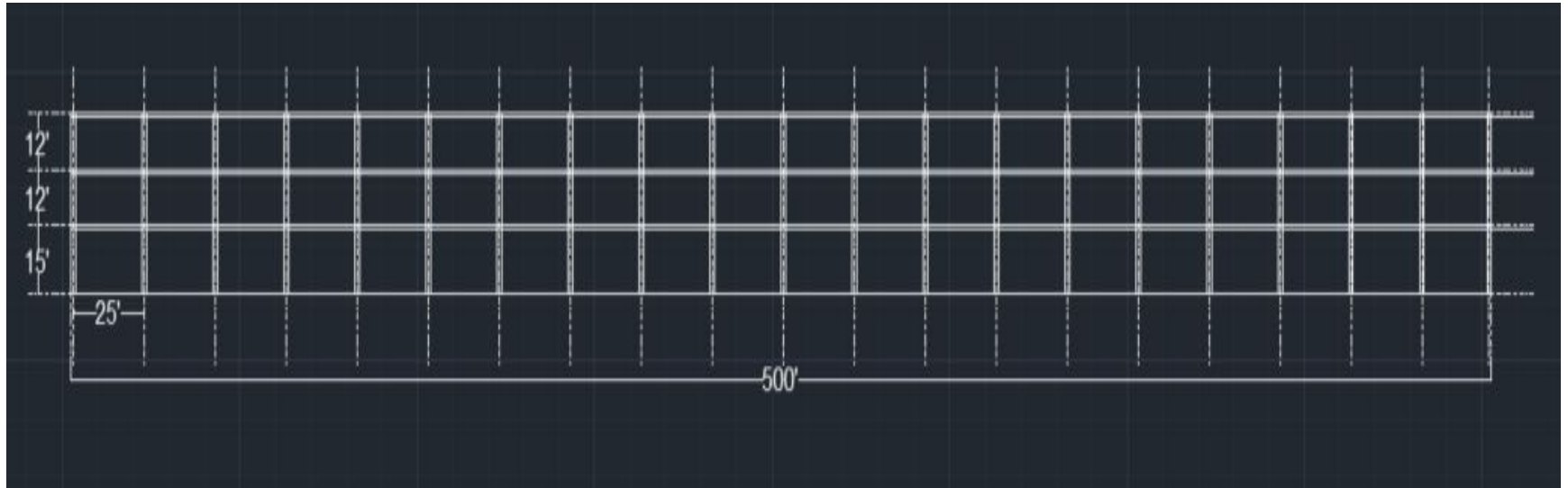


3 Story Convention Center



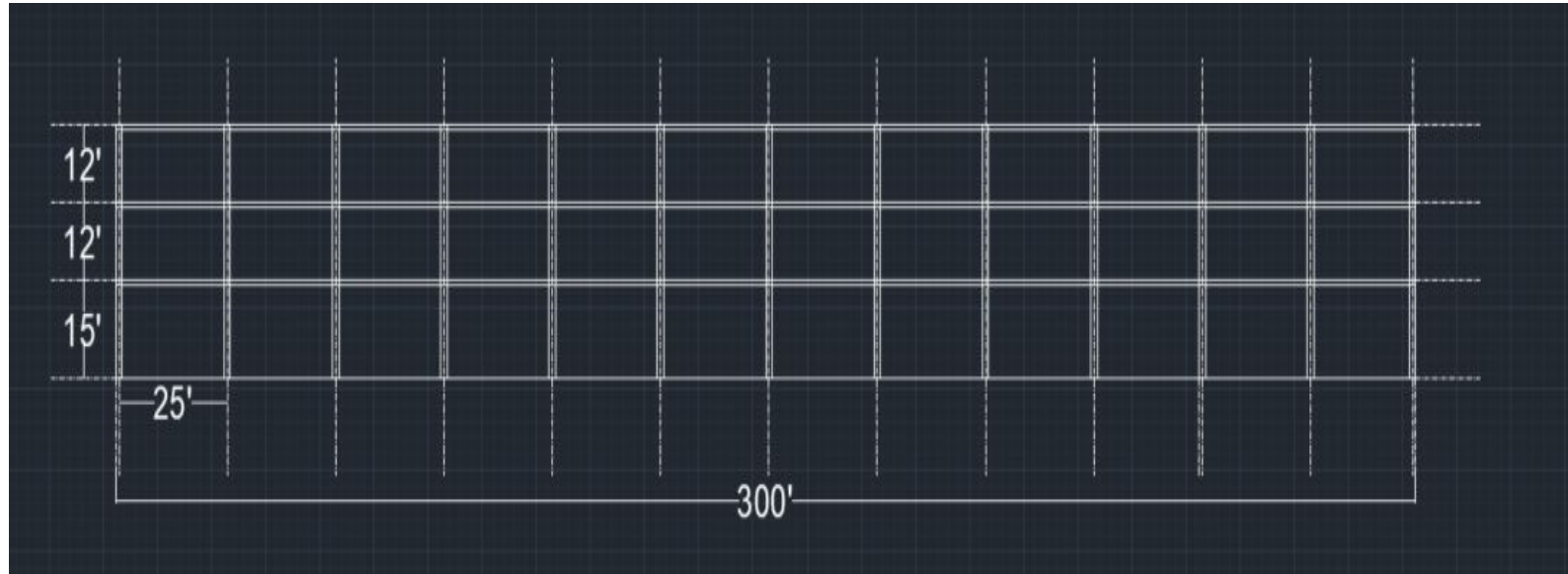


3 Story Convention Center





3 Story Convention Center





Transportation



- Roadway Layout for entire project, connecting road with highway
- Interchange design
- Parking lot layout plan for the entire project facility
- Location of signals and related traffic study
- Plan and Profile of a typical local road in the development
- Pavement Design cross-section for the typical local road in the development

Figure 1:
Project Layout
W/O Geological
Map

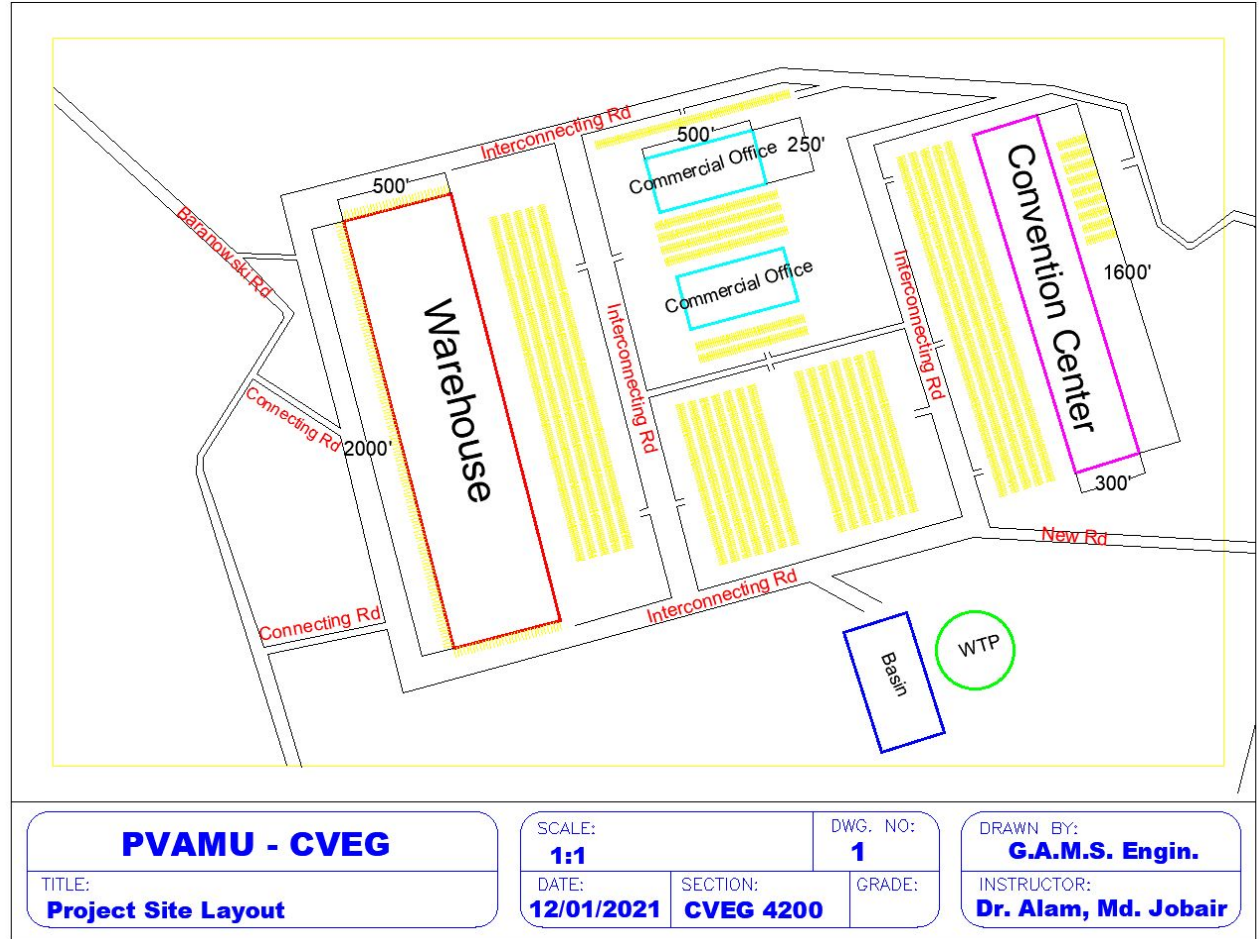
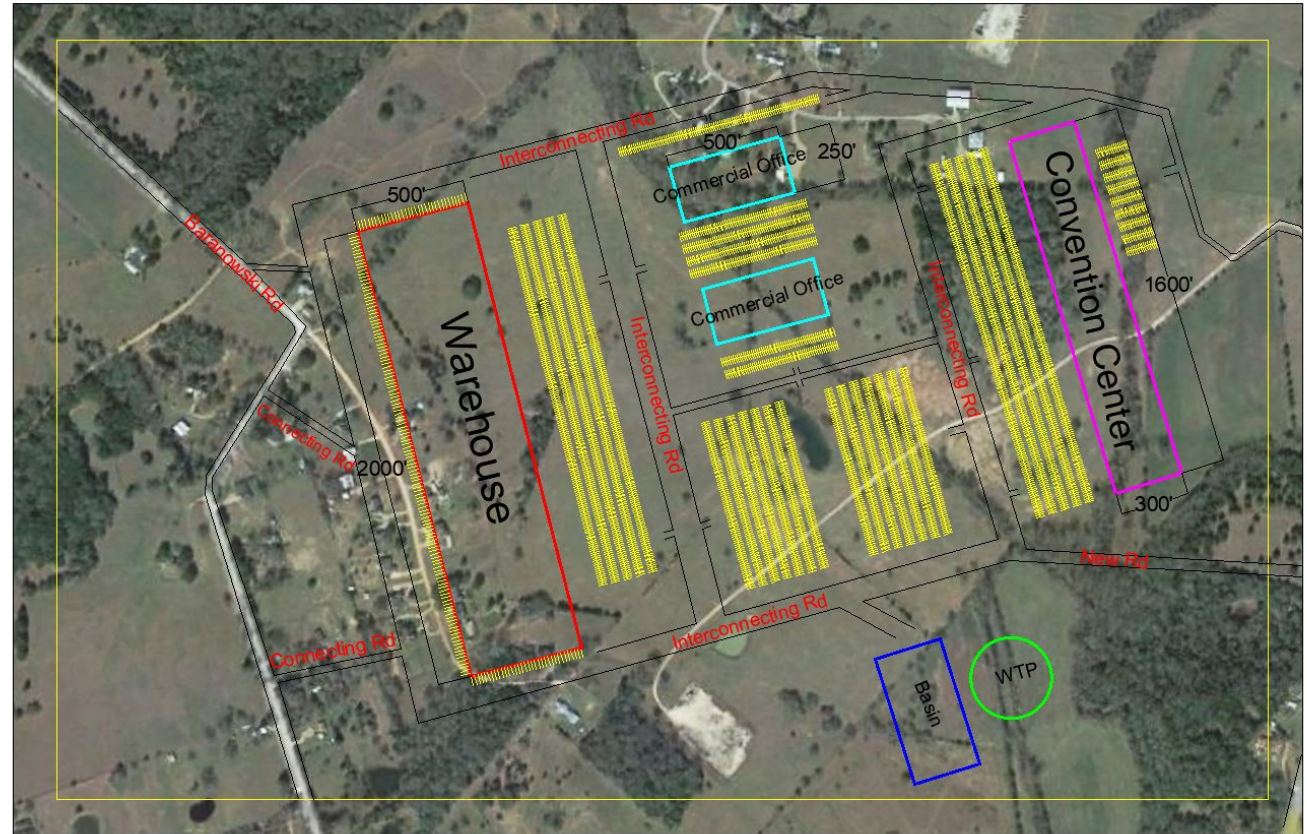


Figure 2:
Project Layout
With Geological
Map



PVAMU - CVEG

TITLE:
Project Site Layout

SCALE:
1:1

DATE:
12/01/2021

SECTION:
CVEG 4200

DWG. NO:
1

GRADE:

DRAWN BY:
G.A.M.S. Engin.

INSTRUCTOR:
Dr. Alam, Md. Jobair



Water Resources



- Location of storm water ditch
- Rainfall intensity, 100-year rainfall investigation period
- Calculation of the quantity of water
- Designing stormwater runoff, while avoiding flooding risks and property damage
- Design capacity of the ditch based on rainfall study
- Drainage ditch with profile and cross section

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Water Resources



- Storm Water Runoff
 - Found using rational method ($Q=CiA$)
 - Q = runoff
 - C = runoff coefficient= 0.15
 - i = rainfall intensity= 3.93 in/hr
 - A = area in acre= 400 acre
 - $Q=0.15*(3.93 \text{ in/hr})*(400 \text{ acre})=235.8 \text{ cfs}$



Environmental

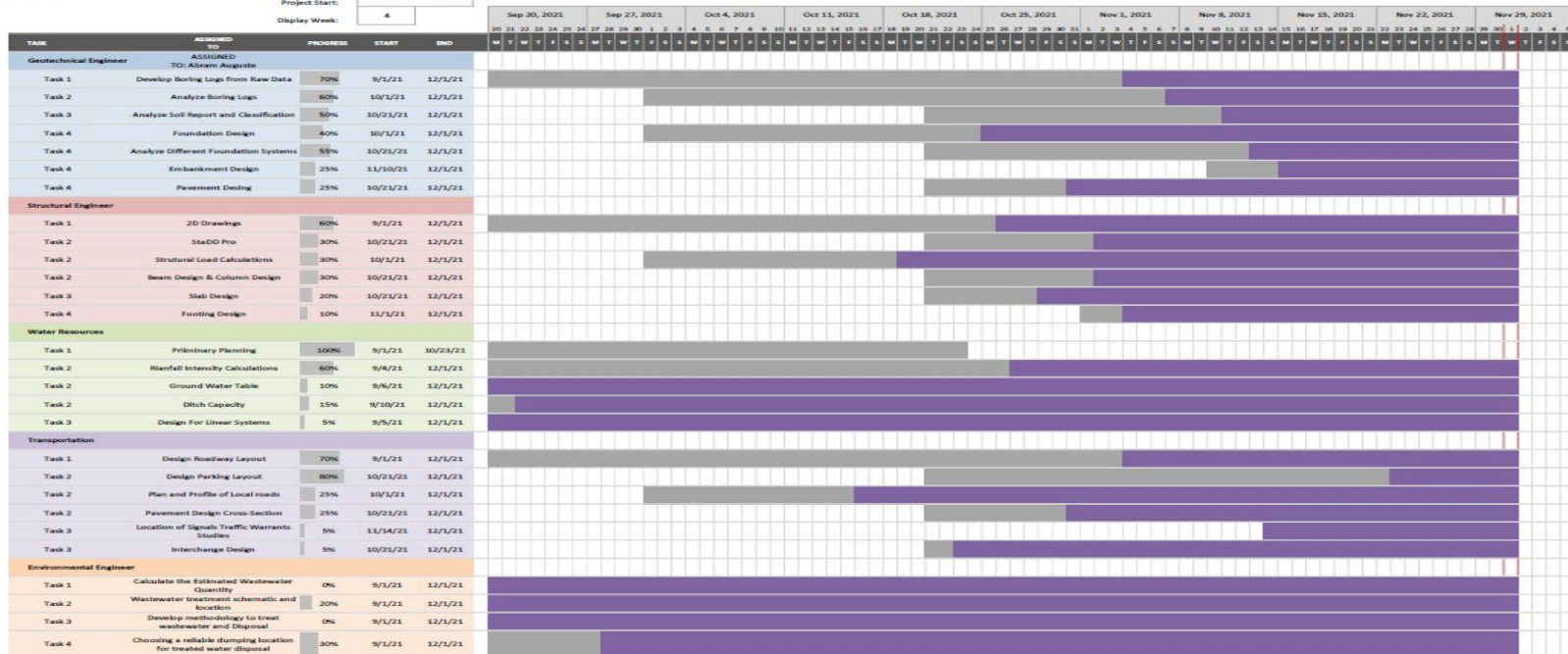
- Calculate the estimated wastewater quantity
- Schematic, and location wastewater treatment plant.
- Develop an approach to treat the wastewater and disposal
- Choosing a reliable dumping location for treated water disposal



G.A.M.S. Engineering
Lead: Abram A.

Wed. 9/1/2021

4





Thank You! Any Questions?



SAPS ENGINEERING

YOUR VISION BECOMES OUR
MISSION.

Est. 2017

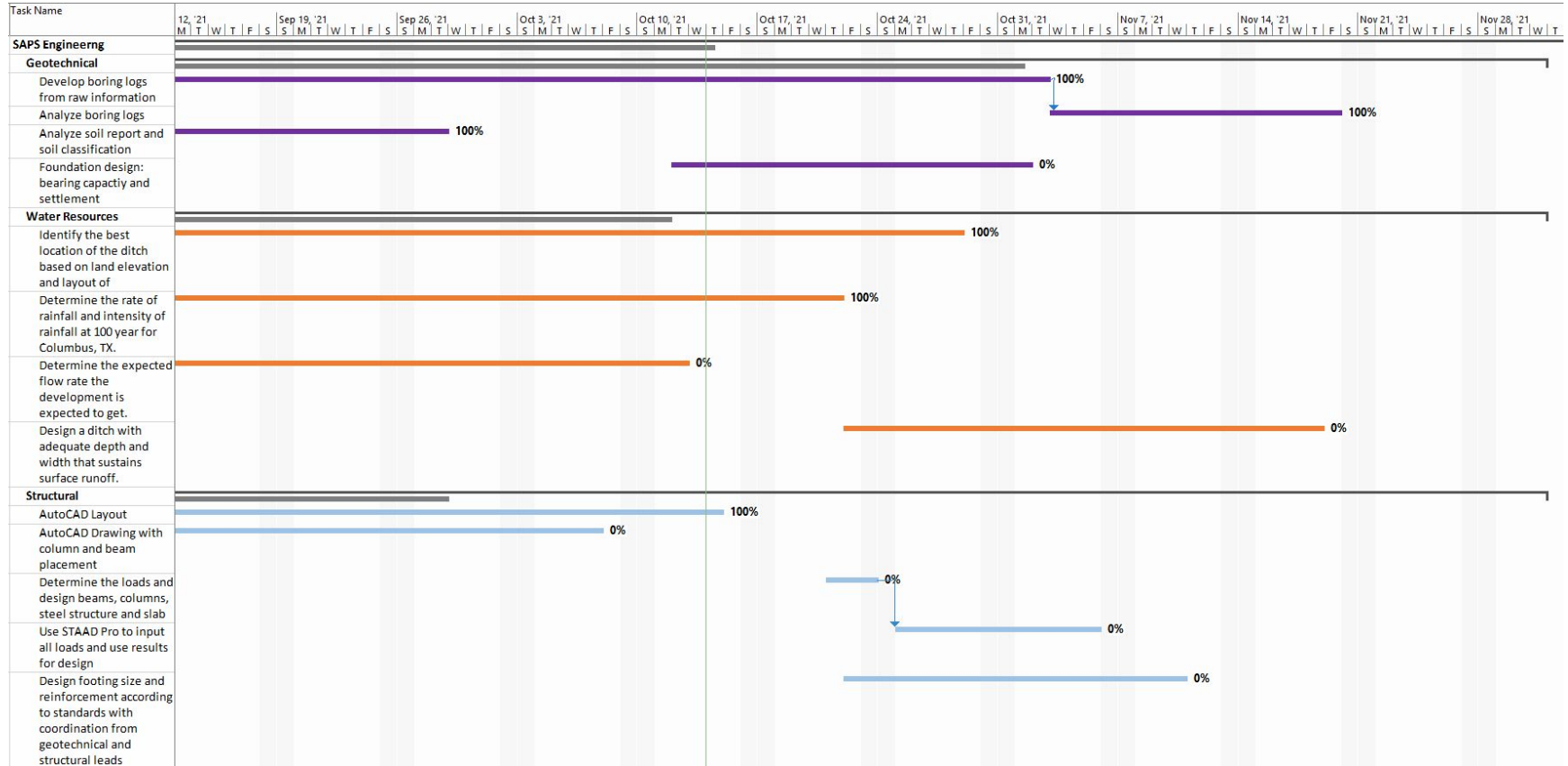
Development of Business and Distribution Center, and IT Hub for Amazon

Scott McGary, Autumn Carter,
Perla Zaldivar, Shadaria Lynch

Presentation outline

- Gantt Chart
- Organizational Chart
- Meet the team
- Who is SAPS and our mission
- Project site and description (or Project overview)
- Breakdown of the six disciplines
- Standards

Gantt Chart



Perla Zaldivar

Scott McGary

SAPS Engineering Organizational Chart





Meet the Professionals

Scott McGary Team Lead

- Scott is a senior Civil Engineering student at Prairie View A&M University from Memphis, TN. I had the opportunity to intern with Tennessee DOT as a maintenance and construction engineer this gave me experience to work on the Hernando de Soto bridge.
- Main interest is in Environmental Engineering, so I am determined to take the Environmental PE exam. After graduation, I plan to attend graduate school to obtain a master's in Environmental Engineering.



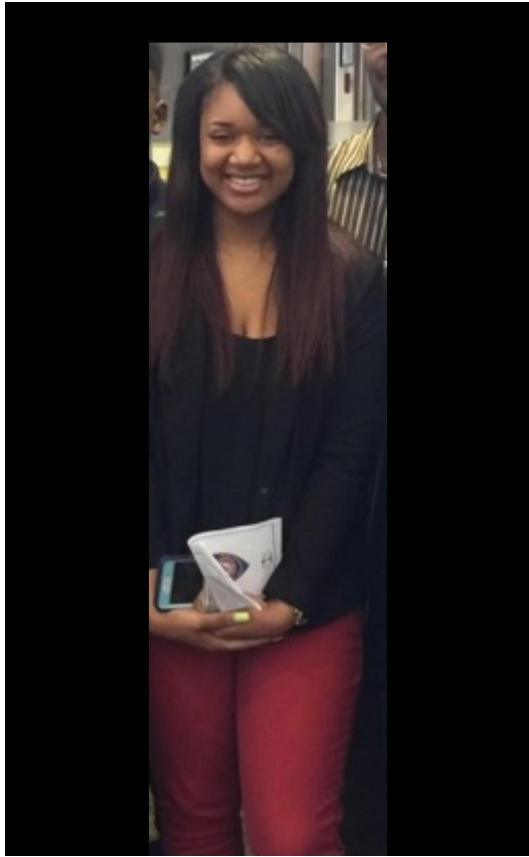
Autumn Carter

- From Houston, Texas.
- With obtaining my Bachelor's of Science in Civil and Environmental Engineering, I will be receiving a Minor in Agriculture. After graduation I plan to focus on the professional side of Environmental Engineering. I also plans to become an entrepreneur and start her own landscaping business.



Perla Zaldivar

- She has been working with Harris County Engineering Department in the Traffic Design and Operations for two years. After graduation she plans on working for transportation engineering or geotechnical engineering firm.



Shadaria Lynch

- From Dallas, Texas experience in transportation engineering while working with HNTB. After graduation plans on doing field work in the transportation subdiscipline.

Your vision becomes our mission.

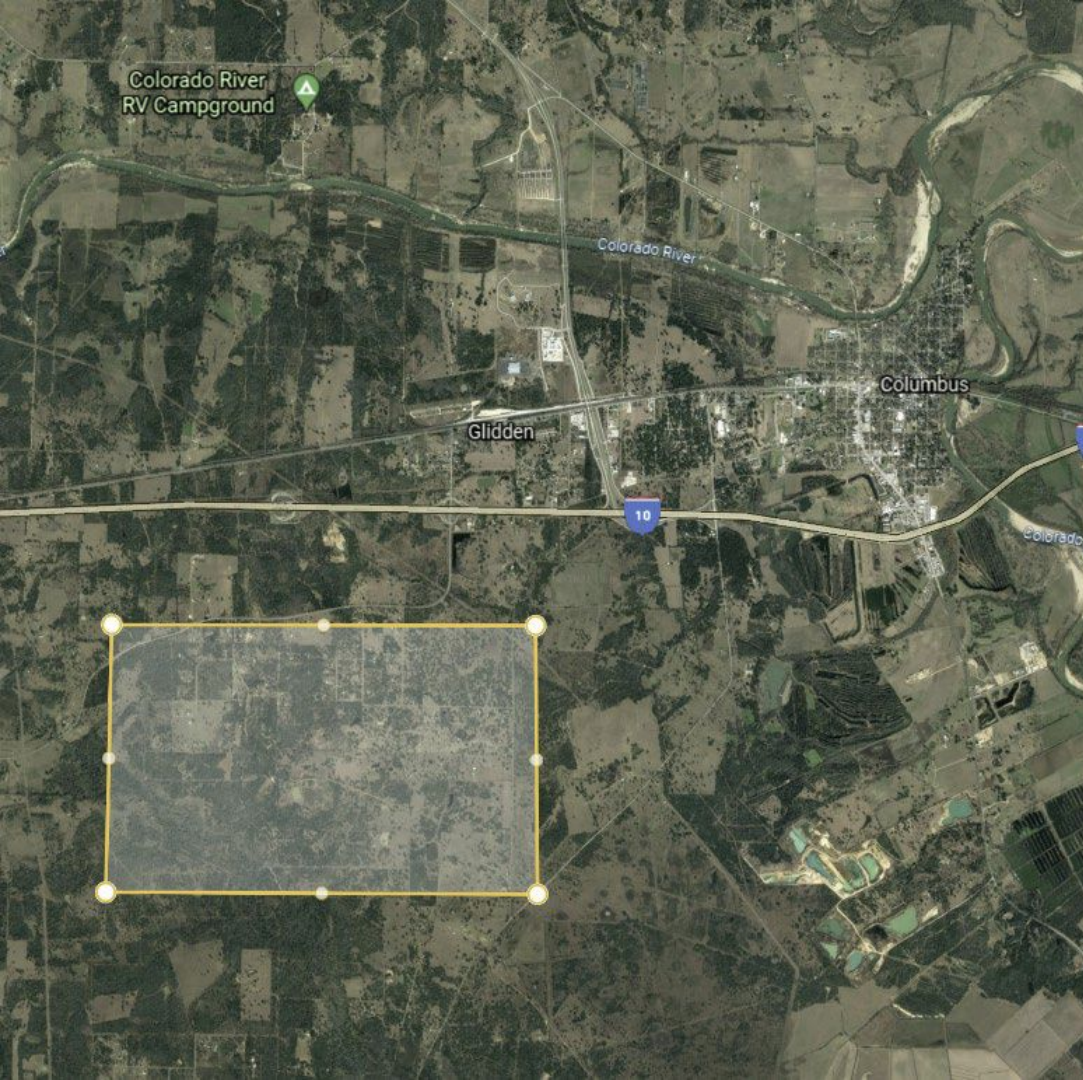
- Since our establishment in 2017, we are committed to providing unparalleled service to our clients.
- Our team of skilled engineers and designers are committed to moving your vision forward.



Your vision becomes our mission.

- Transportation
- Structural
- Geotechnical
- Water Resources
- Environmental
- Geotechnical-Environmental





Project Site

- Site Location
 - South of I-10
 - Colorado Co.
 - South of Columbus, TX
- AutoCAD drawing in layout
- Site Size
 - Approximately 600 Acre site
 - Given 400 acres based on our engineering judgement expanded project site.

Project at hand

- Develop and design the business and distribution center, IT Hub, and office development
- Approximately 600-acre site located in Colorado County.
- Two five-story commercial office building
- Steel structure warehouse
- Three-story convention center
- Facility parking lots.
- New road network development, sidewalks, driveways, and extension of major highways and connecting local road with highway
- Storm water ditch connecting a major lake

Geotechnical

Site Assessment

Use software to convert raw information into boring log

gINT Software

Foundation Design

Geo-environmental aspect

Development of solid waste recycle facility 15-year period



Geotechnical Scope

Site Assessment

Boring Logs

Soil Bearing Capacity

Capacity Curves

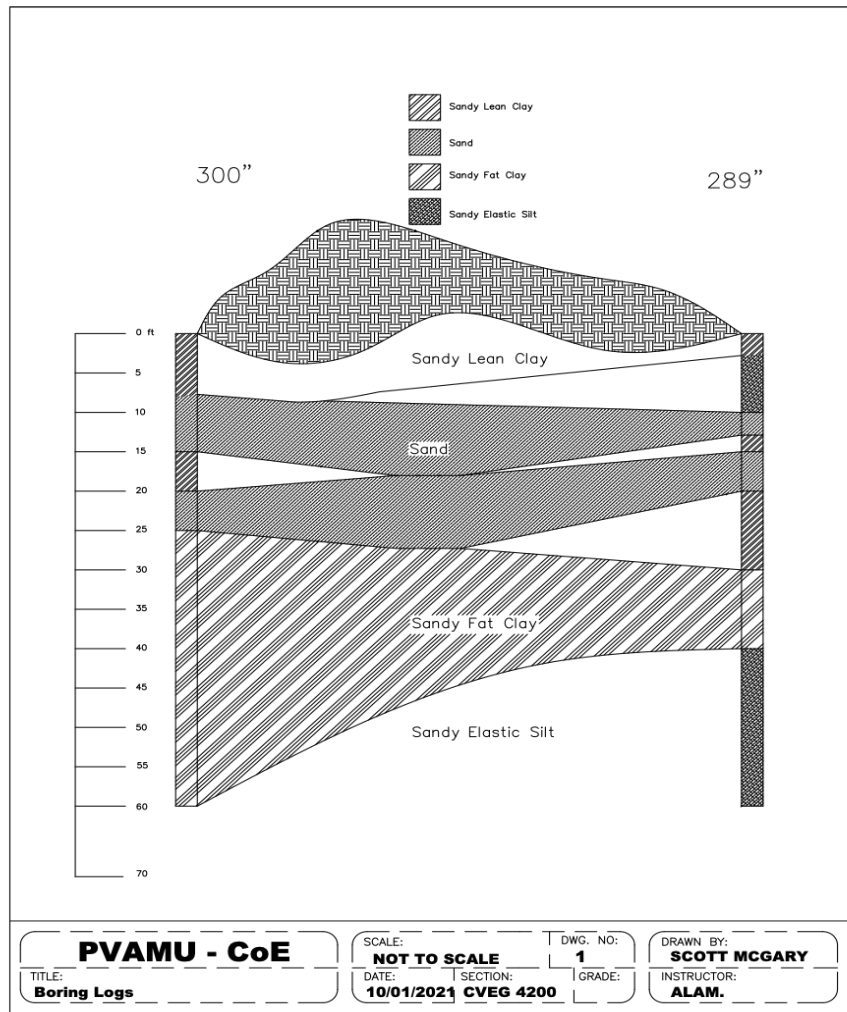
Still need to be completed
Foundation Design

Foundation Design Requirements



Geotechnical Boring Logs

- Boring Data from Colorado County
- Surface elevation of 300' and 289'
- Soil Density and Consistency
- Soil Classification
- Layer boundaries and thickness
- Blow counts (SPT)
- Depth of Groundwater
- Plasticity Index



Soil Bearing and Mohr's Circle

The bearing capacity of the soil was calculated by using the bearing capacity equation along with the safety factor.

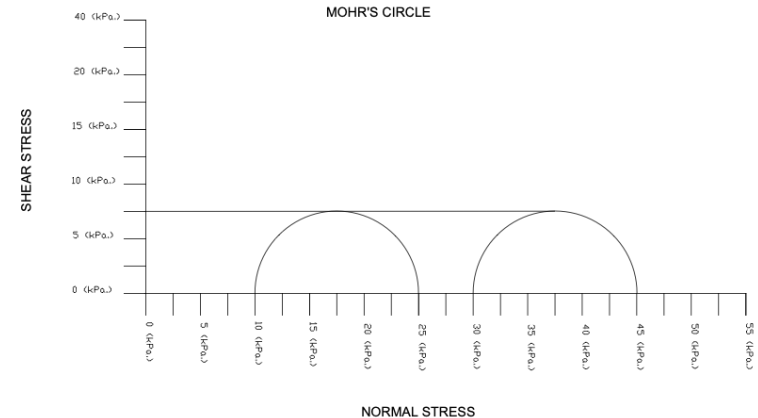
$$q_u = 1.3cN_c' + qN_q' + 0.4\gamma BN\gamma' \text{ (square foundation)}$$

Where

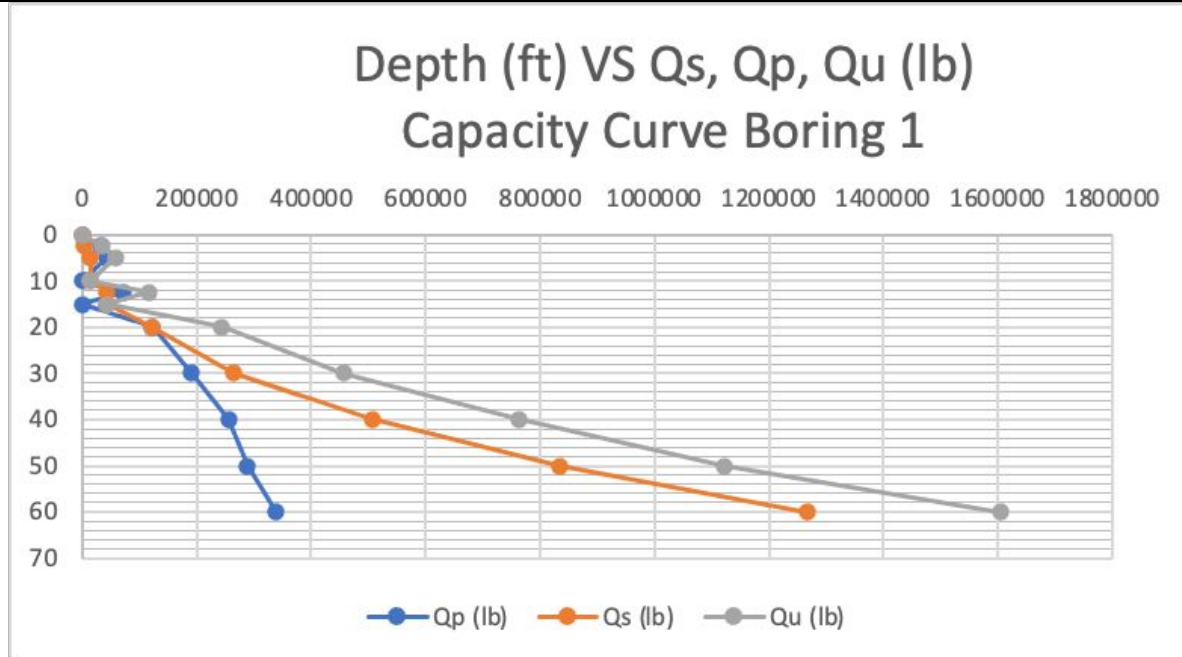
c = cohesion

B = width of footing

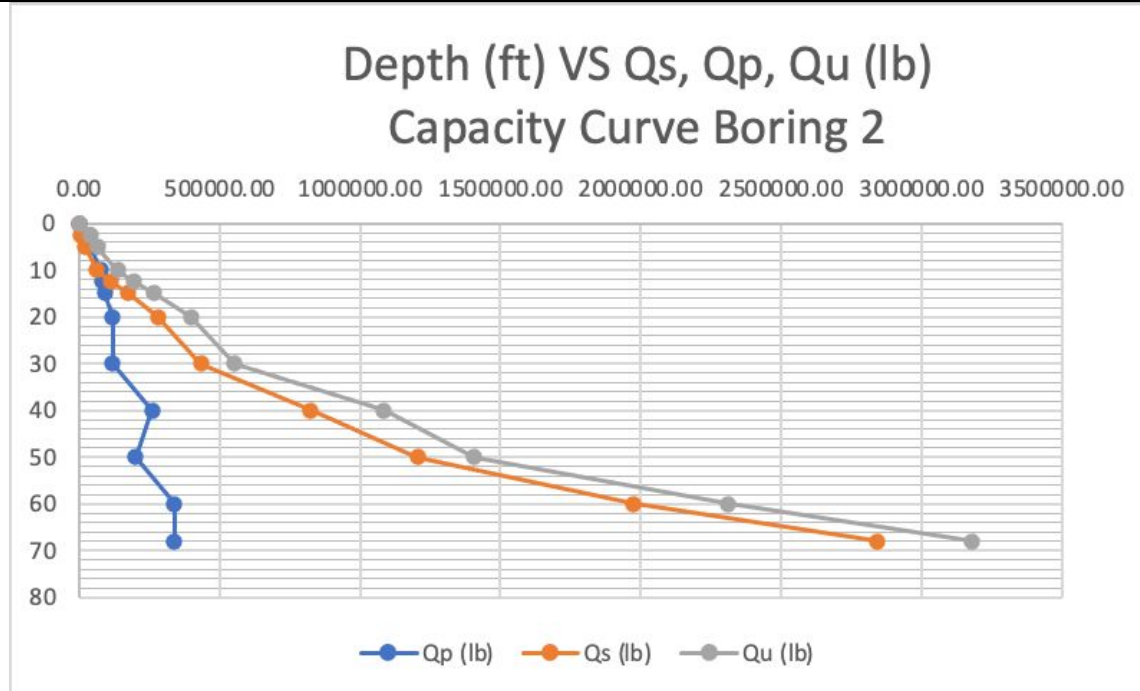
D_f = depth of the footing



Square Pile Capacity Curves



Square Pile Capacity Curves



Water Resources Scope

- Determine Location of stormwater ditch
- Calculate rainfall intensity for 100 year flooding
- Determine quantity of stormwater
- Design of drainage ditch
- Design of detention basin

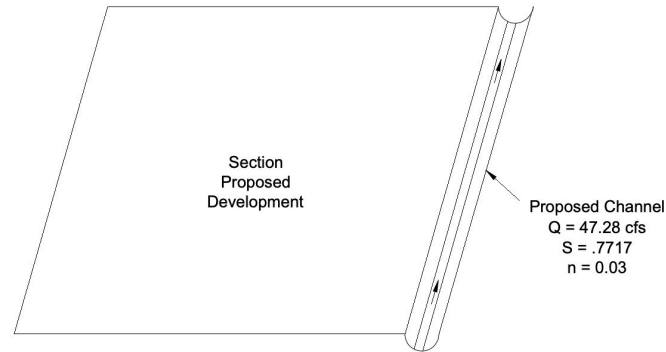
Rainfall Intensity

- NOAA's National Weather Service for 100 year period
- Rainfall intensity was found to be 0.591 in/hr

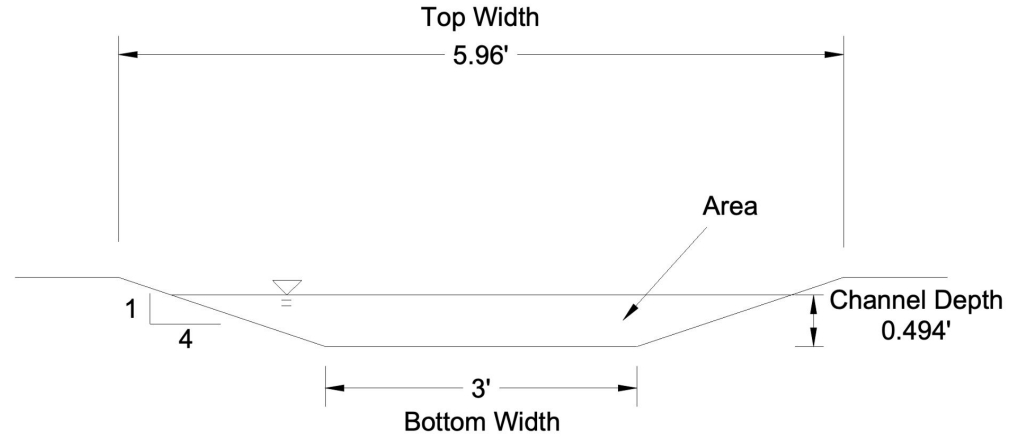
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	5.72 (4.33-7.37)	6.61 (5.06-8.66)	8.08 (6.16-10.6)	9.28 (6.96-12.3)	10.9 (7.92-15.0)	12.1 (8.58-17.1)	13.4 (9.23-19.4)	14.6 (9.84-21.8)	16.3 (10.6-25.2)	17.6 (11.2-27.9)
10-min	4.55 (3.44-6.01)	5.26 (4.02-6.89)	6.43 (4.90-8.46)	7.40 (5.56-9.86)	8.72 (6.35-12.0)	9.73 (6.90-13.7)	10.7 (7.39-15.5)	11.7 (8.14-17.4)	12.9 (8.37-19.8)	13.8 (8.71-21.8)
15-min	3.84 (2.91-5.08)	4.42 (3.39-5.80)	5.38 (4.10-7.09)	6.17 (4.62-8.22)	7.24 (5.29-9.82)	8.04 (5.89-11.3)	8.84 (6.50-12.8)	9.66 (6.80-14.4)	10.8 (6.99-16.6)	11.6 (7.34-18.3)
30-min	2.74 (2.07-3.81)	3.13 (2.40-4.11)	3.79 (2.89-4.99)	4.33 (3.25-5.77)	5.06 (3.67-6.82)	5.59 (3.95-7.88)	6.14 (4.23-8.90)	6.73 (4.53-10.0)	7.54 (4.90-11.6)	8.19 (5.18-12.9)
60-min	1.78 (1.39-2.36)	2.06 (1.58-2.70)	2.51 (1.92-3.31)	2.89 (2.17-3.85)	3.40 (2.46-4.94)	3.77 (2.66-5.31)	4.17 (2.87-6.04)	4.60 (3.10-6.88)	5.23 (3.63-8.07)	5.74 (3.83-8.77)
2-hr	1.07 (0.816-1.41)	1.28 (0.975-1.64)	1.60 (1.22-2.08)	1.87 (1.41-2.48)	2.26 (1.65-3.08)	2.57 (1.82-3.60)	2.90 (2.01-4.18)	3.28 (2.22-4.85)	3.84 (2.50-5.89)	4.31 (2.74-6.76)
3-hr	0.779 (0.594-1.02)	0.947 (0.720-1.21)	1.20 (0.921-1.56)	1.43 (1.08-1.89)	1.77 (1.29-2.40)	2.03 (1.45-2.84)	2.33 (1.62-3.34)	2.68 (1.81-3.94)	3.19 (2.08-4.86)	3.61 (2.30-5.65)
6-hr	0.447 (0.340-0.579)	0.561 (0.424-0.700)	0.728 (0.559-0.934)	0.884 (0.671-1.18)	1.12 (0.824-1.51)	1.31 (0.942-1.83)	1.54 (1.07-2.19)	1.79 (1.22-2.62)	2.17 (1.42-3.29)	2.49 (1.59-3.86)
12-hr	0.250 (0.193-0.323)	0.323 (0.243-0.396)	0.425 (0.327-0.539)	0.524 (0.396-0.680)	0.676 (0.502-0.910)	0.809 (0.584-1.12)	0.962 (0.673-1.36)	1.13 (0.771-1.64)	1.39 (0.912-2.09)	1.60 (1.03-2.47)
24-hr	0.141 (0.100-0.181)	0.186 (0.139-0.254)	0.248 (0.191-0.312)	0.309 (0.217-0.399)	0.405 (0.300-0.544)	0.491 (0.358-0.678)	0.591 (0.415-0.829)	0.698 (0.476-1.00)	0.854 (0.563-1.27)	0.981 (0.628-1.50)
2-day	0.080 (0.062-0.101)	0.107 (0.080-0.127)	0.144 (0.112-0.180)	0.182 (0.140-0.233)	0.241 (0.183-0.324)	0.297 (0.219-0.409)	0.358 (0.253-0.499)	0.419 (0.287-0.597)	0.500 (0.330-0.738)	0.562 (0.363-0.854)
3-day	0.058 (0.046-0.073)	0.078 (0.060-0.092)	0.105 (0.082-0.130)	0.132 (0.102-0.168)	0.174 (0.130-0.234)	0.214 (0.158-0.284)	0.257 (0.192-0.357)	0.299 (0.202-0.424)	0.354 (0.235-0.521)	0.398 (0.264-0.599)
4-day	0.047 (0.036-0.059)	0.062 (0.047-0.079)	0.083 (0.060-0.103)	0.104 (0.080-0.132)	0.136 (0.104-0.181)	0.166 (0.122-0.226)	0.198 (0.140-0.274)	0.230 (0.158-0.325)	0.272 (0.181-0.399)	0.305 (0.197-0.459)
7-day	0.021 (0.014-0.031)	0.040 (0.031-0.048)	0.053 (0.041-0.065)	0.065 (0.050-0.082)	0.083 (0.063-0.109)	0.099 (0.073-0.134)	0.117 (0.083-0.161)	0.135 (0.093-0.191)	0.161 (0.107-0.234)	0.181 (0.117-0.271)
10-day	0.024 (0.019-0.030)	0.030 (0.024-0.037)	0.040 (0.031-0.049)	0.048 (0.038-0.061)	0.061 (0.046-0.080)	0.072 (0.053-0.097)	0.084 (0.060-0.110)	0.097 (0.067-0.136)	0.115 (0.077-0.158)	0.130 (0.085-0.194)
20-day	0.012 (0.010-0.019)	0.015 (0.015-0.023)	0.019 (0.019-0.030)	0.022 (0.022-0.037)	0.027 (0.027-0.046)	0.031 (0.030-0.055)	0.034 (0.034-0.064)	0.038 (0.037-0.074)	0.044 (0.042-0.090)	0.048 (0.046-0.103)
30-day	0.012 (0.010-0.015)	0.015 (0.015-0.018)	0.019 (0.019-0.023)	0.022 (0.017-0.028)	0.027 (0.026-0.035)	0.031 (0.022-0.045)	0.034 (0.025-0.048)	0.038 (0.027-0.053)	0.044 (0.030-0.063)	0.048 (0.032-0.072)
45-day	0.010 (0.008-0.013)	0.012 (0.010-0.015)	0.015 (0.012-0.019)	0.018 (0.014-0.022)	0.021 (0.016-0.027)	0.023 (0.017-0.031)	0.026 (0.019-0.035)	0.029 (0.020-0.040)	0.032 (0.022-0.046)	0.035 (0.023-0.051)
60-day	0.008 (0.007-0.011)	0.011 (0.009-0.013)	0.013 (0.010-0.018)	0.015 (0.012-0.019)	0.018 (0.013-0.023)	0.019 (0.015-0.026)	0.020 (0.016-0.029)	0.024 (0.017-0.033)	0.028 (0.018-0.037)	0.030 (0.018-0.041)

Drainage Ditch

- Using the manning equation the stormwater runoff was found to be 47.28 cfs
- Ditch is a grass lined channel, $n = 0.03$
- A side slope of 1:3 was used
- Slope of channel is 0.7177

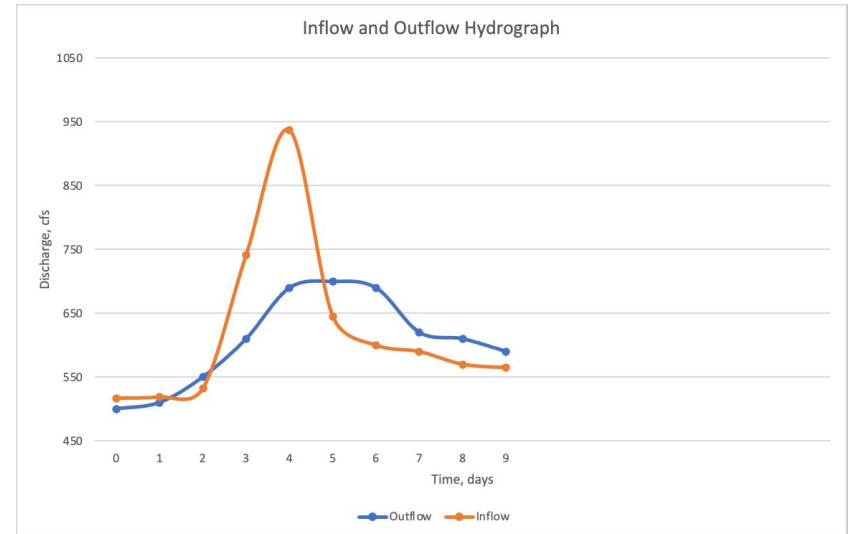


Section View of Ditch



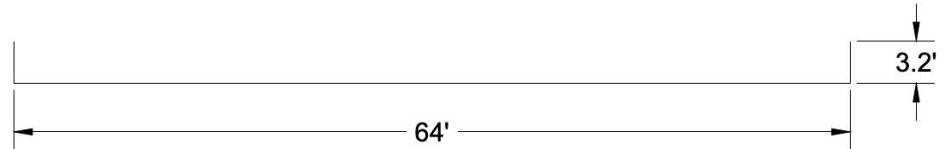
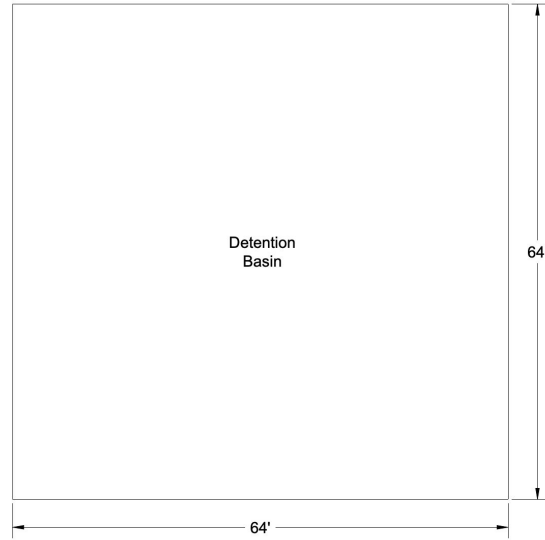
Detention Basin

- USGS provides flow data for Colorado county
- By developing a routing table, an inflow and outflow hydrograph was developed
- The peak flow was found to be 700 cfs



Detention Basin

- The basin is 64 ft by 64 ft and 3.2 ft high



Environmental

Determine how much water will be used within each facility that will turn into wastewater after usage. (Estimated wastewater quantity)

Develop a wastewater treatment plant on ground site

Develop Lake SAPS, which is detention pond

Built on low ground

WW schematic is designed based the types of contaminants found in the water. Find which design will be efficient to reduce and or eliminate contaminants found in water that does not meet MCL(maximum contaminant level).

Transportation

Designing a roadway to connect with highway

Create parking lot(s) within facility

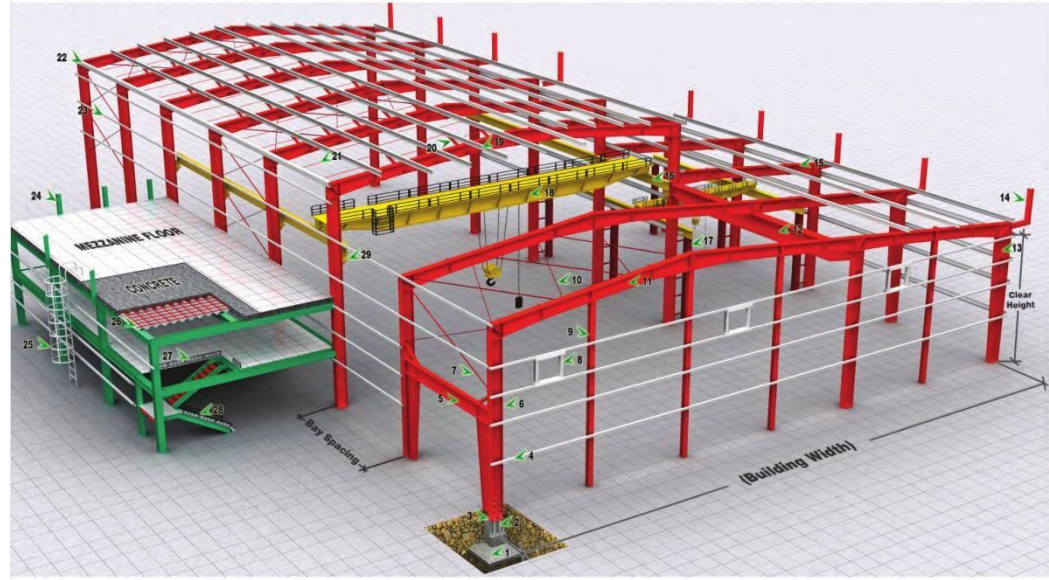
Create a plan and profile view and cross section for a typical roadway.

Create AutoCAD layout include sidewalks, streetlights, and landscaping

Set up traffic signals and signs within facility

Structural Analysis

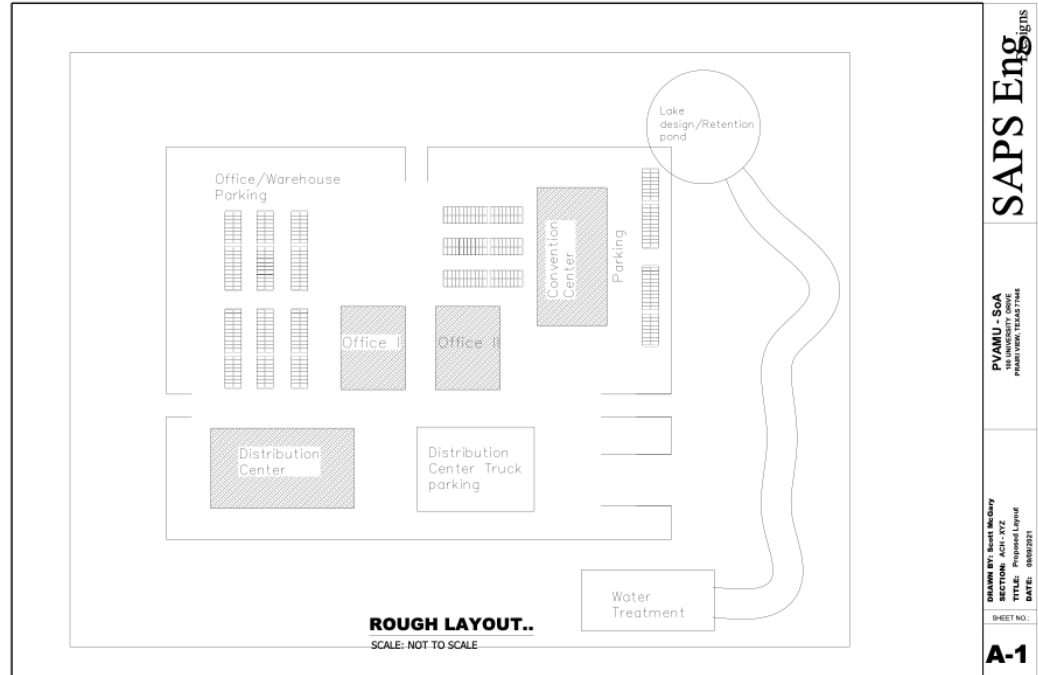
- AutoCAD Drawing- with column and beam placement
- Use STAAD Pro to input all loads and use results for design
- Determine the loads and design beams, columns, steel structure and slab design.
- Design footing size and reinforcement according to standards with coordination from geotechnical and structural leads



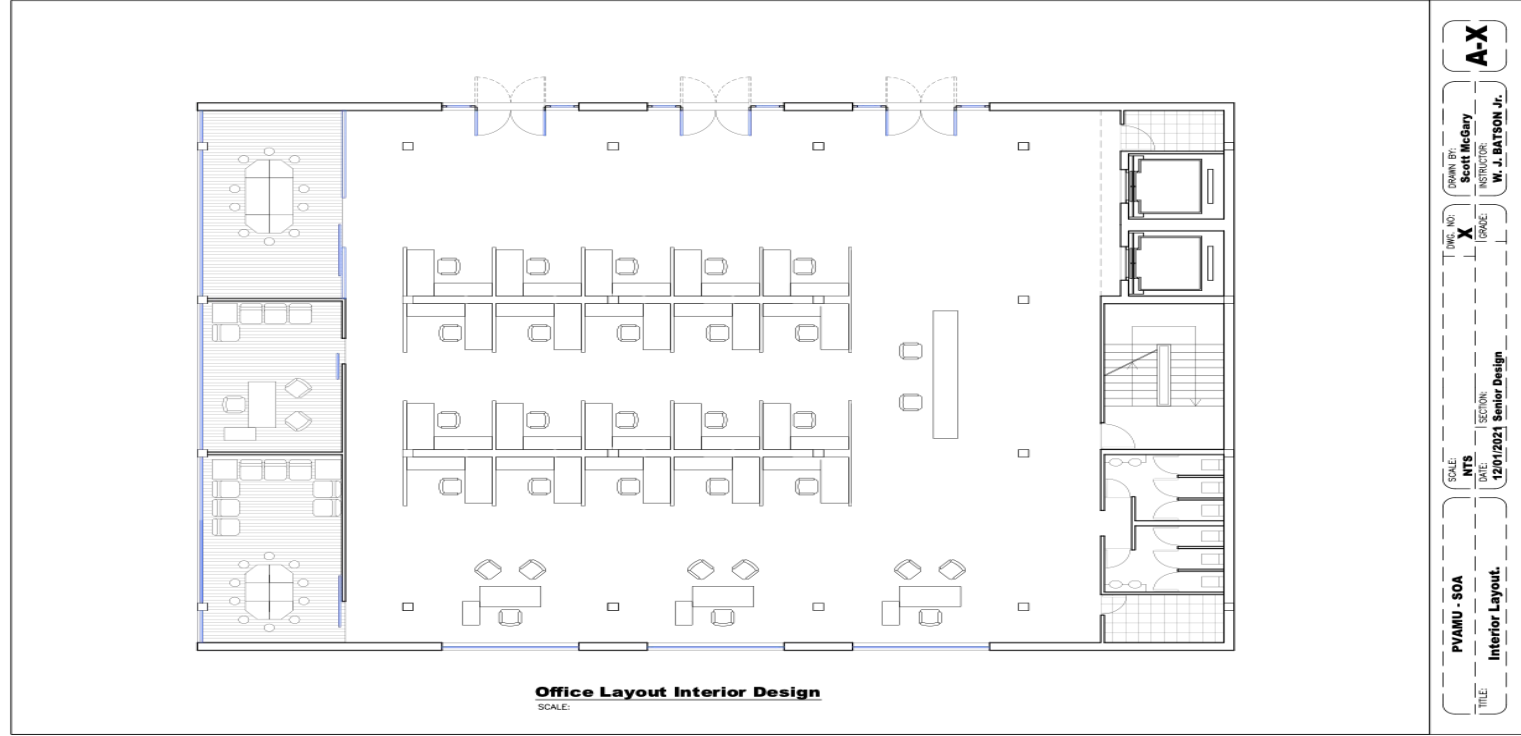
AutoCAD

Preliminary layout

- Dimensionless can change as project progresses.



Layout and Design of Office Space



Outcomes for Next Semester

- Geotechnical
 - Complete Foundation Design after meeting with Structural engineers
 - Analyze settlement
 - Calculate low-cost foundation
- Water Resources
 - Revise and analysed the detention basin
- Correct formatting and Organization of powerpoint and report
- Structural Analysis
 - Complete slab design, beam and column design.
 - Finish footing size and reinforcements
 - Check results using STADD Pro.
- Transportation
 - Complete Roadway Design
 - Interchange Design
 - Parking Layout
 - Plan & Profile
- Environmental
 - Estimate wastewater quantity
 - Develop a schematic wastewater treatment plant
 - Develop Lake SAPS

Standards

- AASHTO Soil Classification System
- U.S. Department of Transportation, Federal Highway (FHWA) Manual on Uniform Traffic
- Control Devices 2009 Edition, January 2010.
- American Association of State Highway and Transportation Officials (AASHTO), A Policy on
- Geometric Design of Highways and Streets, 6th Edition, 2011.
- Texas Department of Transportation, Roadway Design Manual 2020 Edition, July 2020



Questions

Thank you

Project Executive Summary

Senior Design and Professionalism I (CVEG 4200)

Homework #3

Fall 2021



92

Submitted by:

Sydney Jones, Jerral Walker, Johnathon Chevalier, Paige Hines, and Michael LeBlanc

Submitted to: Dr. Alam

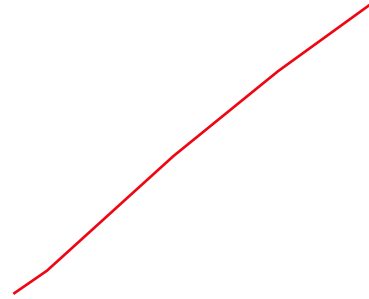
Department of Civil and Environmental Engineering

Prairie View A&M University

Due: November 17, 2021

Table of Contents

Environmental Engineering.....	2
Geotechnical Engineering.....	3
Transportation Engineering.....	4
Structural Engineering.....	5
Water Resources.....	7



JJMPS Consultants

Overview

JJMPS Consulting will plan and build Amazon's commercial and distribution center, IT hub, and office development on a 400-acre property in Waller County, south of major highways (US 290). Civil Engineering Development and Design services will be provided for the entire site, which will include two five-story commercial office buildings, a steel structure warehouse, a three-story convention center, and parking lots. New road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service roads and connecting local road with highway, a storm water ditch connecting a major lake, and wastewater treatment process and facility are also among the tasks that the students will complete. The facilities will be built to accommodate 20,000 people.

Environmental

Problem Statement for Environmental

For our project, the environmental engineer will be calculating the estimated wastewater quantity for the project area. The location of the wastewater treatment facility should be near the lowest elevation. After analyzing the wastewater quality, a method to treat said water can be determined, as well as picking a suitable dumping location.

The Solution for Environmental

The environmental engineer will be utilizing the instruction given in the environmental design course to determine the wastewater quantity. It is known that the wastewater treatment facility should be placed at the lowest elevation to allow gravity to maneuver the wastewater to

its proper location. The wastewater will be disposed of in a local stream or, if treated properly, could be used as irrigation for the project area.

Value for Environmental

The purpose of this project is to give students a chance to apply the knowledge that they have been acquiring over their last 4-5 years at university. The project is expected to be completed by May 2022.

Geotechnical

Problem Statement for Geotechnical

The scope of work is to execute a geotechnical analysis for Amazon's proposed 400-acre commercial and distribution center, IT hub, and office development in Waller County, which is located south of major highways (US 290 and I-10). The report includes the findings of the site inspection as well as project recommendations.

Solution for Geotechnical

For the drilling, a CME 75 Drilling Rig was employed. A continuous flight auger was employed to progress the holes dry as the subgrade soils were explored. During the drilling operation, soil samples were obtained using thin-walled tubes according to ASTM D 1587, and split spoon sampler testing (STP) was done according to ASTM D 1586. Due to the presence of bedrock, continuous push tube samples were taken from the ground surface to a depth of 70 feet, with the borings spaced 80 feet apart. Soil samples were sent to a lab to be examined for soil characteristics. The findings were incorporated into the final report. During soil testing, a 7m depth of water was detected. In addition, the study discusses the many types of retaining

structures and how to choose them based on the data provided. To help grasp the design and focus on the details, a visual layout has been provided. In addition, calculations for footings and settlements were performed to see whether they met the necessary requirement, and if appropriate, helpful recommendations were made.

Geotechnical Value & Recommendations:

The report includes a broad description of the soils found, their qualities, expected behavior during construction, and measured groundwater levels. The final report includes geotechnical advice for shallow foundations, pavement design, pile foundations, and embankment design. The foundation design parameters were calculated using calculations from Braja M. Das Nagaratnam Sivakugan's "Principles of Foundation Engineering, 9th Edition, SI Edition" and an engineering textbook.

Transportation

Problem Statement for Transportation

For the JJMPS consulting firm, the transportation engineer will be in charge of the entire roadway layout of the project, interchange design, a parking lot proposal, and a plan and profile of each local road.

Proposed Solution for Transportation

The dimensions for each major roadway will be determined and the speed for the minor and major roads will be chosen based on the overall layout and utilizing the MUTCD (Manual on Uniform Traffic Control Devices). The size of each parking lot will be selected to accommodate each employee in the vicinity as well as overflow and guests and the dimensions of each parking spot and the angle of each spot will be chosen utilizing the MUTCD. Interchanges will be

designed based on the flow of traffic in the area at peak times. The type of interchange will be selected based on the peak flow and location of the area. The roadway layout of the entire project will be designed to meet the peak amount of traffic and to ensure that no congestion will occur at peak hours of traffic flow. The dimensions of the lanes will be chosen to match the local roads surrounding the project. This will allow a simple transition between one local road and a minor road on the project site. A plan and profile will be drafted using the local existing road's elevation and using that to continue a seamless transition from one roadway to another.

Value for Transportation

The value of this project is to provide necessary insight and experience for each member of the JJMPS Consulting company. The design portion of this project allows the transportation group to utilize skills learned in previous courses and allows the application of those skills towards real world issues and will force the transportation group to learn to adapt and apply them as necessary.

Structural

Problem Statement for Structural

In recent request Amazon has proposed a problem of expansion of distribution centers for the Texas region. Only been provided with 400 acres of land and being asked to do construct five different structures along with wastewater management systems and a flood prevention technique, there seems to be issues with proper location access within certain sub-disciplines. To best accomplish, from a structural standpoint, or what Amazon is asking to do we must take in a considerable design and make them simplistic yet intricate to the point where they will

function but in an Amazon style without disturbing existing surroundings.

Proposed Solutions for Structural

JJPMS consulting creates solutions to fit what is being asked for. The structural design components have been set in place by the firm. With these designs or, we will be able to eat actively maximize the size of the buildings while still reducing cost of buildings by doing such in the following:

1. Allowing column beams to share the same footings would reduce cost.
2. By building identical office buildings it will help us determine cost and when it comes to plan exactly how the building should be built.
3. Due to the small staff the number of employees in the IT department, we can reduce the size of the IT department and add office space to the office buildings.
4. And to incorporate an Amazon style building, with all of these are cost-efficient are solutions and we can add a skywalk between the identical office buildings.

Note that our solutions are only apply to four of the five buildings being asked to be built this is only because for our steel structure warehouse it has a more open floor design which is automatically going to cost less the materials may cost more by finding the proper material is the only effective problem at hand.

Value for Structural

With the inclusions of this land and the construction of these buildings, add personal believes that the highest value of Amazon's net worth will increase. The location may not be as a high demand population but is in high demand with traffic volume. The structural design components will not only as be mentioned before reducing costs play be an area where are there is easier access to any building maintenance that needs to occur. So, the value that is being

portrayed is more song a long-term value in the sense of being one of the first to build on a new area, and he when he comes to needing to get heavy equipment for maintenance equipment there's not as much in-tune section of regular traffic.

Final Thoughts and Next Steps for Structural

My recommendation for the enhancements of things Is by increasing the dimensions of the workplace buildings by permitting another story within the building to accommodate the remaining worker overflow from the IT Hub or produce a second building of a smaller nature to accommodate the remaining share of staff. As for the opposite buildings, the steel structure of the warehouse was designed from innovation except for easier calculations, the warehouse can mimic that of the FedEx warehouse off ninety-nine grand drive south sure. As for the workplace buildings, mimicking the thought of the dual towers however not knowing the precise load can produce these difficulties so finding the foremost stable foundation within the profile for a minimum of one, 600 sq. footage. The convention center was originally placed and is unambiguously designed however the sole recommendation that's being thought of is to relocate the building to accommodate alternative subdisciplines of the project.

Water Resources

Problem Statement for Water Resources

For Amazon, JJMPS consultant firm have taken on a project to develop and design a business and distribution center, IT hub, and office development on a 400-acre site located in Waller, County. As a water resource engineer my goal is to find, calculate and design a way to move water from the 400 acres bought, by the employer, to a nearby retention basin. They use these sources to discharge water from a certain place in a time efficient and safe way to keep the area of purpose from flooding.

Proposed Solution for Water Resources

The first solution to the problem is to find where the location of the drainage ditch will be placed. We will use gravity to create the flow of the water to the nearest existing lake water source which is East of our construction site. The drainage ditch will start at its highest elevation of 456.9 coming from the topography map. Next the calculation of the rainfall intensity and collection for 100 years should be computed. This is to keep the area from flooding. I will do so by using the typical rainfall intensity -duration -recurrence interval curves. This graph shows the rainfall inserted in in/h proportional with time min and hours.

1. A design and location of a storm water ditch that avoids flooding hazards and damage to valuable property.
2. Rainfall intensity and rainfall collection for 100-year flooding

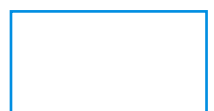
Note that the project is still in progress and on route to be completed in 2022.

Value for Water Resources

The storm water drainage ditch has been stamped to its location with the help of my geotechnical and environmental engineer. This was decided by locating the start of the ditch at its highest elevation to help with gravitating the water to its correct location.

Final Thoughts and Steps for Water Resources

Final steps for this project pertaining to water resources would be to calculate the quantity of water, design the storm water ditch based on a rainfall study, and show a profile and cross section of the drainage ditch.



Prairie View A&M University
Roy G. Perry College of Engineering



90

Civil & Environmental Department
CVEG 4200: Senior Design Assignment 3

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

Date Given: 11/10/2021

Date Due: 11/17/2021

Prairie View A&M University
Prairie View, Texas 77446

SAPS Engineering

EXECUTIVE SUMMARY

Overview

SAPS Engineering was asked to develop and design a distribution center, IT Hub, office buildings, and wastewater treatment facility for Amazon for 20,000 people. SAPS Engineering has a team of skilled individuals that specialize in Geotechnical Engineering, Environmental Engineering, Transportation Engineering, Water Resource Engineering, and Structural Engineering. The engineering firm works closely together to design and evaluate the client's proposal.

The Problem

Using a 400-acre lot in Colorado county located south of I-10, develop and design a distribution center, IT Hub, convention center, and administration buildings for Amazon with a total of 20,000 employees. This site should also include a wastewater treatment plant and dumping site for treated water, stormwater ditch, faculty, and convention parking lots. Lastly include landscaping ornamental on the project site.

The Solution

By developing this project site to meet the requirements of Amazon we will construct two five-story office buildings that are identical to one another. Build a steel structure warehouse, develop three parking lots one to accommodate convention center vehicles only, another for office/warehouse vehicles, and office/convention center parking. We will also create a lot ~~for~~ trucks located next to the distribution center, giving truck drivers easy access. The wastewater treatment plant will be located

on the southeast end of the project site where the treated water will be dumped into Lake SAPS. A retention pond will be located at the northeast wing of the facility that will be used as the stormwater ditch. The site will also ensure the flow of traffic between employees and trucks is as efficient as possible.

Geotechnical

Task needed to analyze the topography map to develop boring logs from raw information and analyze those boring logs to develop the soil classification. Once this is done the foundation design can begin. To complete this project the foundation design needs to be completed where I will go for both shallow foundation and deep foot foundation and choose which is the safest at the best cost.

Water Resources

A Water Resource engineer studies the management of water for human use and moving water to avoid any damage. The management and planning of water is an important aspect in water resources. The water resource lead will design a drainage ditch and basin to accommodate all the stormwater anticipated in the property. The design will ensure no flooding occurs in the property avoiding any flood damage in the property. The engineer will closely follow the County's Flood Control District Manual, as well as the drainage criteria and regulations for Colorado County. The location of the ditch will be analyzed and selected based on the elevation of the property. All options will be evaluated and select the cost efficient and effective option, preferably using the gravity and slope of land to our advantage. Once the location of the ditch is determined, the engineer will review the rainfall history in Colorado County using USGS. The study will help determine the expected outflow the development will expect in accordance with the 100-year flooding. The design will be innovative and effective in ensuring that the stormwater flows into the drainage ditch. The property will contain a basin that will

store the stormwater. The basin will be designed to hold enough water based on the 100-year flooding and doesn't pass the spillway in order to prevent any flooding on the property. The Water Resource engineer will work closely with the Transportation lead in order to integrate landscaping in the parking lot. This is a natural process that allows the water to infiltrate in the soil to help aid on the amount of stormwater runoff. Once all the information is determined the engineer will provide a cross sectional view of the ditch and basin that followed Colorado County regulations.

Structural

A structural engineer analyzes, designs, plans and creates drawings of structures that a client requests. Structural requires a 2D drawing of the office buildings, warehouse, and convention center. To determine structural load calculations, wind, dead, and live load will be determined for each respective structure. The load calculations will then be put into STAAD Pro, to provide maximum values of BM, shear, and axial load and determine if the design can sustain the loads. Moreover, the structural design will include slab design, beam, column design, and the steel structure design of the warehouse. The engineer will also determine the reinforcement bars, reinforced concrete design for foundations, footing size for each structure. AutoCAD will be used to show the layout of the building with appropriate dimensions. The plan and profile view for the footing, column and beam will be designed according to STAAD Pro information. The Structural engineer will follow the ACI Code closely in order to safely design the structures, always keeping safety in mind.

Transportation

The transportation lead will provide a roadway layout for the project site and have a connecting road with the highway (I-10). When designing the road, interchange designs will be implemented. Plan and profile view and pavement-design cross-section of a typical road will be included as well. When

designing the roads, there will be a minimum of two entrances, left turn movements will be at each entrance, a right-turn lane will be at the main entrance, and at least one entry will be regulated by traffic signals. Also, there will be parking lots within the project site, service truck parking for the warehouse will be separated from cars to accommodate visitors coming to the office building for Amazon. Additionally, the site will also include sidewalks throughout the business center and subdivision including residential areas, landscaping, and streetlights. To approach this, the constraints and requirements, and specifications from TxDOT and US DOT will first be taken into consideration. Reference materials such as Roadway Design Manual (RDM), Traffic and Highway Engineering, 5th Ed, and more will be used to help complete this portion. The design of the roads, parking lot, and landscaping will be done using AutoCAD.

Environmental

The environmental lead will also determine the usage of water that will be used in each facility with a total of twenty-thousand employees. Also estimating the population growth with the expansion of the company and population in Columbus, Texas over a span of 15 years. As the environmental engineer on this project, we will estimate the inflow water demand for the facility population of twenty thousand with a project projection for 15 years. We will also calculate the water demand for expansion for an additional 10-15 years for possible expansion of the center and surrounding area and communities. With the inflow of water throughout the quarters of the premises we'll have to follow EPA (Environmental Protection Agency) regulations regarding the Maximum Contaminant Level (MCL) that is legally enforced for human consumption and usage; National Primary Drinking Water Regulation. We will calculate the usage of water in all five ~~buildings~~ on the project site determining the quantity of wastewater. Wastewater will inflow to the wastewater treatment plant (WWTP) which is located on the lower southeast region of the 400-acre lot, where we will develop a wastewater schematic system that will accept untreated/contaminated water and treat it using multiple cleaning sources and

disinfection processes to remove bacterial factors and suspended solids. Once these requirements are met and water is properly treated it will be distributed into Griffin Lake following the Texas Administrative Code (TAC).

Project Benefits

Speed is key in the customers' minds. Amazon has conditioned shoppers to expect fast and free shipping one-day delivery is an incentive to buy online more. Building the Amazon Hub near I-10 will provide this for customers.

1. Faster delivery times
2. More job opportunities in Colorado County.
3. Centrally located to major highways,
 - a. grants easy access to transportation channels so vital for a business to move inventory in the shortest amount of time.
4. Close distance to Houston's major airports, seaports, and railways streamlines storage operations

Keys to Success

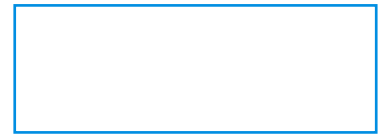
- Create a document that can be updated weekly to keep the schedule
- AutoCAD, StaadPro, and Excel software to run checks and calculate numbers
- Gantt Chart with an updated timeline
- Meet a deadline of April 15
- Weekly team meetings in order to keep track of progress
- Each engineer lead will use their respective design manuals, codes, and regulations to complete their section.

- Attend clientele meetings.

Immediate Plan of Action

Since the project has already been funded SAPS Engineering is required to push forward with the program, we may immediately begin work on the following:

1. Start Excavation need for cut & fill to even topography
2. Start construction of the building
3. Start construction on the ditch and detention pond



**Prairie View A&M University
Roy G. Perry College of Engineering
Civil & Environmental Engineering Department**



Handwritten signature in red ink.

CVEG 4200: Senior Design

Section: P01

Course Number: 17739

Title: Assignment #03

Submitted By: Abram Auguste, Armando Gomez, Alex Martinez, Nathaniel Smith –

G.A.M.S. Engineering

Submitted To: Dr. Alam, Md Jobair Bin Ph.D., P.E.

Due Date: November 18, 2021 - 11:59PM

Executive Summary

Prepared by

Abram Auguste
AAuguste@pvamu.edu

Alex Martinez
HAlex1011@gmail.com

Nathaniel Smith
Nkis1958@gmail.com

Armando Gomez
agomez28@pvamu.edu

November 17, 2021

Summary

The proposed project is the development of a 400 acre lot for Amazon. This new development is located near the city of Brenham in Washington County, Texas. G.A.M.S Engineering is to develop and design Amazon distribution center, IT Hub, Office space, convention center, wastewater treatment facility, storm water ditch (to connect to a major lake), parking lots, roads, intersection and a highway extension that will accommodate the new facilities. G.A.M.S Engineering is to provide details on progress and milestones with completion dates for this scope of work.

Geotechnical Engineering

The following report summarizes G.A.M.S. Engineering, Inc's Geotechnical Evaluation for the proposed Amazon Hub, located in Washington County, Texas. This report includes information regarding the field and laboratory testing analysis, the subsurface conditions encountered, and discussion related to building construction in relationship to the subsurface conditions at the site. The analysis was performed in general accordance with CVEG 3023 and 4100 processes and formulaic assessment.

At this time, the project consists of constructing a two five-story commercial office building, a steel structure warehouse, and a three-story convention center building with a footprint of approximately 30,000 to 50,000 square feet based on historical data. The building is proposed to be constructed at grade (i.e. without subsurface floors) with a finished floor elevation of approximately 340 feet.

On August 26, 2021, two (2) Standard Penetration Test (SPT) borings were performed using CME 75 drill rigs with 8" test hole diameter in the vicinity of the proposed Amazon hub building location to depths at 75 feet below the existing ground surface. Beneath a surface layer, the subsurface conditions observed can be described as lean to fat clay with varying amounts of silt to the extent of the test boring logs. Based on the assessment of the subsurface conditions and information exchanged to and between the G.A.M.S. Engineering team, the following comments and recommendations are made: The proposed building construction could not be supported on a conventional shallow foundation system and slab-on-grade nor a Matt foundation. However, it

was determined that Pile foundations could be designed for a maximum allowable bearing pressure of 560 pounds per square foot (psf). Total foundation settlement is estimated to be on the order of 1.34 inch or less, and a differential settlement on the order of a ½ inch or less; Groundwater was observed in the test borings performed at the site at depths approximately 7.5 feet below the existing ground surface. Based on the groundwater depths observed during soil assessment, it is likely that groundwater will be encountered during foundation construction. Therefore, the best course of action would be a deep pile system suitable to carry the load of the Amazon facility.



Structural Engineering

The scope of work for the structural engineering portion of the project is to provide designs for the Amazon distribution center warehouse, five story IT Hub and office building, and three story civic center. It is to include the location of where the buildings are to be built. The location of the buildings will be coordinated with geotechnical engineers and water resources engineers to provide the best location for the foundation design and on grade slab of the building. As well as the watershed that could cause flooding to the buildings.

The warehouse is to be designed with reinforced concrete step footings that will support the load of the building. Anchors bolts for the columns will be set in the concrete footings. Steel H-beams with base plates will be used for the load bearing column of the buildings. The spacing of the building columns is to utilize and provide the most floor space possible. To roof supports for the building will be that of I beams and joist that will run perpendicular to the beam. The connection joints to be determined depending on shear and moment of the location. The dead, live, and wind loads for the buildings will be calculated using the Load and Resistance Factor Design (LRFD). The live, dead and wind loads that meet the requirements given in the International Building Code. The information will be imputed into STADD pro modeling for all four buildings. To provide output results of the given bending moments, and shear and axial loads. The STADD report is to be utilized for design purposes of the buildings. As the warehouse design, the multistory buildings will also be of steel structure meeting all International Building Code (IBC) guidelines and local ordinances. The building's footing will be dependent on the

geotechnical report and could require pile footing to support the structures. Autocad will be used to provide a detailed design of the building's footing, floor layout, column and beam locations, dimensions of building and building materials that are to be used.

Water Resources

In the water resources portion project the tasks included determining the location of a storm water ditch, the rainfall intensity based on the 100-year rainfall investigation period, calculating the quantity of water and designing the ditch based on the rainfall study. The ditch was assumed to be an unlined trapezoidal channel and was designed by using hydrologic and hydraulic methods. One of The hydrologic methods used was the "Tractive Force based Unlined Channel Design Method " to get the design dimensions for the ditch/channel. One of the first things done was determining the runoff based on the rainfall intensity by using the Rational Method. Next, the Manning's roughness coefficient and the sediment size were determined based on the surrounding land. The slope of the land was then determined. Moving forward the design depth of the was calculated and the value of side slope was assumed. The area and perimeter were then set up as equations where the base was unknown.

After everything that could be determined was calculated, the runoff, Manning's roughness coefficient, area, perimeter, and the slope of the land were all put into an equation to determine the base of the ditch/channel. The design velocity and the Kennedy equation velocity were then calculated. The design velocity would need to be greater than the Kennedy equation velocity in order for the design to be sufficient. If the Kennedy equation velocity was greater, then the design calculations would have to be done again by assuming a different side slope until the design velocity is greater.

Transportation Engineering

The transportation engineering part of this project include the task to design a roadway layout for the entire project site including a connecting road with the nearby highway 290, create an interchange design, design a parking lot for entire facilities, locate signals and related traffic

studies, and provide a plan and profile as well as a pavement design cross section for a typical local road in the development.

Within the roadway layout of the project site there are to be two entrances required into the site. One entrance on the east side and one entrance on the west side of the project site. One entrance must be regulated by a traffic signal in order to direct traffic. The traffic signal setup will be a simple 3 way intersection signal that will help people from the Amazon hub exit the site safely and in a timely manner. Furthermore, within the parking layout there is to be service truck parking for the warehouse that is separate from visiting cars of the office buildings for amazon. The parking for the service trucks are found on the west portion of the project facility near an existing Farm to Market road which will make it efficient for the trucks to come in and out of the facility. In addition, sidewalks will be placed throughout the project site especially around the business offices and convention center. These sidewalks will help connect parking lots to the respective buildings as well as creating an easy path from building to building. Lastly, all roadway designs for this project must meet Texas Department of Traffic (TxDOT) and US DOT requirements and specifications. For all the transportation parts of the project that require design, the software AutoCAD will be used to create and portray these ideas in a professional manner.

Environmental Engineering

In the environmental engineering portion of this project the tasks included calculating the estimated wastewater quantity, determining the location of a wastewater treatment plant, a schematic of the treatment plant, an approach to treat the wastewater, and to choose a reliable dumping location for the disposal of the wastewater. The scope of work for this portion of the project is to be completed in the following semester.

Recommendations

Geotechnical: There are currently no recommendations at this time.

Structural: There are currently no recommendations at this time.

Water Resources: There are currently no recommendations at this time.

Transportation: there are currently no recommendations at this time

Environmental: There are currently no recommendations at this time



ASSIGNMENTS FOR OUTCOME “4”

An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

**DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 4200 Senior Design and Professionalism I
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET**

FALL 2021

Instructor: Dr. Md Jobair Bin Alam

Title of Assignment

Assignment and test to understand professional and ethical responsibility

Outcome Measured Using this Assignment

Outcome 4

An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Check the ethical dimensions related to this assignment

Requires students to		
X		Recognize ethical and professional responsibilities in engineering situations involving global, and societal contexts
X		Make informed judgements on ethical and professional responsibilities in engineering while considering the impact of engineering solutions in
	x	global context
	x	economic context
	x	and societal context.

Brief justification of the suitability of assignment for the outcome

Reading and homework assignments are given to students to learn professional and ethical responsibility. Examples and class discussions will give students exposure to different situations and think through the new situations to take correct decisions

**CVEG 4200 Senior Design and Professionalism I
FALL 2021**

**ASSIGNMENT STATEMENT/QUESTIONS
GRADING SCHEME FOR ASSIGNMENT**

Assignment	100 points
Total:	100 points

Insert here Student Sample Crit. 4

Prairie View A&M University
Roy G. Perry College of Engineering
Civil & Environmental Engineering Department

90



CVEG 4200: Senior Design and Professionalism I

Section: P01

Course Number: 17739

Title: Assignment # 2: Ethics

Submitted By: Abram Auguste (Roster # 1)

Submitted To: Dr. Alam, Md. Jobair

Issue Date: October 21, 2021

Due Date: October 31, 2021 NLT 5:00 p.m.

Problem 1

Review the Code of Ethics from ASCE (attached in CANVAS, also with this attachment). Based on your review,

- (1) demonstrate your understanding of professional code for your senior design project. Also,
- (2) describe your ethical responsibility, in general, to be successful in professional career.

Not more than 2 pages

Problem 2

Review the two case studies (link below) on professional ethics. Based on your review,

- (1) provide justification on what should be the approach to be ethical and professionally competent.
- (2) With respect to your senior design project, describe (a) global, (b) economic, (c) environmental, and (d) societal contexts

Global Impact: investigate a given engineering problem, and explain how proposed engineering solutions to similar problems may be adopted in different parts of the world

Societal Impact: investigate a given engineering problem, and develop engineering solutions that take into account societal factors.

Economic Impact: investigate a given engineering problem, and develop solutions that take into account economic factors.

Environmental Impact: investigate a given engineering problem, and develop solutions that take into account environmental impact.

Not more than 2 pages

- (1) <https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases/giving-in-or-giving-up/>
- (2) <https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases/a-marshlands-fleeting-flourishing/>

Part A

The underlying principles discussed in the code ethics helps guide an engineers moral compass in the field of engineering. The key points under the code helps to promote a safe, fair, and educational environment for all engineers and with the general public. Promoting a safe and conducive environment helps to promote the fields and morals of the engineering profession. The code of ethics is applicable to the senior design project in that it sets a frame of working as a collective in a group environment while promoting engineering principles amongst our team members. As professional students the code states that we should uphold the honor, integrity, and dignity of the profession; represent their professional qualifications and experience truthfully; also to educate the public on the role of civil engineering in society. As our group pursues the concepts surrounding the senior design project we are working diligently and with integrity to understand information surrounding the senior design, investigation, and problem solving. In addition, efforts are being made to present the final product of the design to the ISC board members and our cohorts who attend the presentation. The code of ethics concepts apply to the senior design classroom since knowledge is being shared both between the instructors and the students. The information that we are learning in the classroom and as we navigate the design project will directly influence the general public since the students are the future engineers that will build structures that will impact the general public. The designs implemented will improve society and promote engineering as a whole. If the designs are faulty then harm can be made to the public which can ultimately lead to death. That is why the code of ethics state that we MUST communicate in a timely manner to clients and employers any risks and limitations related to their work; and present clearly and promptly the consequences to clients and present to employers if their engineering judgement is overruled where health, safety, and welfare of the public may be endangered. The safety we exercise as engineers will ultimately be correlated with the foundations learned in the classroom and through job experience. That is why it is important that we approach the project with the truth and sincerity of our knowledge base and progressively learn the material as we move forward both in the classroom and with the design project.

My ethical responsibility consists of doing right by the general public, consistent professional growth, and to constantly advance my knowledge of engineering to assure the safety of the general public. rest on my knowledge base and commitment to both the general public and nature collectively.

Under the fact pattern Ashton was assigned to build their construction headquarters in a specific region in East Africa. In order to obtain building permits in the region, Ashton had to negotiate with the local government. As she begins negotiations, she realizes that bribery is both a common and expected practice. If she does not bribe the local officials, she will not be able to build PDRC's headquarters in that region and consequently will lose the contracts. Also, it is illegal for a U.S. citizen to bribe a foreign official in order to obtain business. Under the set of circumstances it would have been ethical for Ashton to turn down the contract or refuse the process of bribery in order to proceed with business as usual. the fundamental principle under the code of ethics state that an engineer must treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity; uphold the honor, integrity, and dignity of the profession. The principles outlined by the code of ethics are concepts that follow engineers both domestically and

internationally. The simple fact that Ashton is doing work in East Africa does not negate the fact that she has to uphold the Code of Ethics and standards outside of the United States of America. The fact that Ashton is a representation of all engineers under the licensing board. The best business and professional practice would be for Ashton to refuse to compromise her ethical standards

Part B

Solomon's main role is to advise clients on what type of action to take when they are faced with risks and liabilities while conducting certain projects. Solomon's client prioritized a cost-effective plan, the environment would be subject to a certain percentage of contamination that would, within five to ten years, stifle the marshlands flourishing. Under the set of circumstances Solomon should push for a more fiscally demanding, yet sustainable strategy--at the risk of his client backing out of the partnership altogether. The Code of ethics reads under the first guideline set for societal standards that first and foremost, protect the health, safety, and welfare of the public. Getting rid of an environmental importance would terminate all wildlife that depends on the marshland. The financial strategy on the client is not more important than nature itself. Solomon should advise the client of contingent plans that can benefit both the marshland and the client together.

Impacts

Global: The senior design project sets the engineering framework for students as they pursue their engineering careers. The foundations of engineering are established through the classroom and influence their work throughout their careers which influences both local engineering and engineering on a global scale. America has led the way for structural influences across the world. The American infrastructure has been seen as a leading competitor and sets America as a first world country. When the Surfside condominium collapse occurred on June 24, 2021 in Miami Florida, the news outlets both locally and internationally were stunned because such collapses don't occur here in the U.S. A media frenzy was set for organizations to get to the bottom of the situation and to better understand why the collapse occurred. I recall one outlet stating that "This just doesn't happen here in the U.S." referring to the collapse. The result of the collapse led to countries around the world taking notes on best procedures with setting zone laws to prevent collapses in the future. The analysis of such collapse cause engineers to reflect on their work and best practices when executing a structural design. Therefore, it is imperative that as we progress throughout the senior design that we take notes on best practices since our work can avoid similar situations like that of the surfside building collapse.

Societal: Our work as Engineers begin in the classroom and with the assessments of preliminary exposure like that of our senior design project. Civil engineers, especially, influence societal convenience when it pertains to civil matter like living and transportation. The slightest mishap with a calculation can lead to infrastructure collapse or even death. That is why it is important to take copious notes in the classroom and to perform well with the senior design project. It is important that our analysis on designs

are sound since we will have the lives of the general public at our hands. Not only should our design be sound but there should exist quality assurance measures in every step of our work. As it relates to senior design the Internal Advisory council will serve as the quality assurance of our work assuring that our understanding is sound. Such exposure will lead to good work that the general public will use in our society.

Economic: The economical analysis is why we are hired as engineers. Companies hire us to save them money and materials. Also, our sound analysis can help avoid repeating a project. The senior design project helps to focus our understanding of budgeting to prevent excess spending. As we progressed with our senior design project we followed a rubric and guideline to help structure our approach with the design. Without such guidance we would have wasted valuable time and energy with our execution. In the professional world such wasted time can lead to additional expenses as working professionals that the corporations would be responsible for. Also, the poor performance could lead to employees getting fired.

Environmental: Lastly, the environmental impact of our design can impact the natural habitat if our design is not properly executed. As we excavate and alter nature for human benefit we also impact how animals and nature interact. Our work will include tearing down trees, excavating land, altering water movements, and removing natural animal cycles. We need to be mindful of how animals live and have plans in place to avoid disturbing their life cycles. Interfering with an animal cycle can lead to animal extinction as has occurred in the past. That is why it is important to not only execute our design but we must take into consideration how we can better the living conditions of animals near the project site. Factoring water sources, vegetation in our design, and following zoning codes catered to animals and vegetation in the area. An example would include Park Rangers planting fish in an artificial pond put in place by engineers. The fish draws birds and wildlife to the water source which in turn causes them to live without fear of extinction.

Civil & Environmental Engineering Department
Prairie View A&M University



80

CVEG 4200 P01 Senior Design and Professionalism 1

Roster Number 2

Fall 2021

Homework Assignment #2

Submitted by:

Autumn Carter

Due: October 31, 2021

To

Dr. J. Alam

As professional engineers we have this mindset of building infrastructure to appeal to the eyes of people in the world, or to provide improved roadways and services. That questions do we think of everyone's safety and how long the sustainability of life will be inputted into these buildings or roadways while constructing projects. After viewing multiple catastrophic disasters in America just alone from the Florida International University pedestrian bridge to the Florida condominium casualty causing a severe number of deaths; these individuals' safety was not taken into consideration. After thoroughly reviewing the code of ethics it brought attention to a specific section which is the mission statement stating; *"Members of The American Society of Civil Engineers conduct themselves with integrity and professionalism, and above all else protect and advance the health, safety, and welfare of the public through the practice of civil engineering."* From interpretation I received that holding yourself to have strong morals as a professional. Either to be honest to yourself and project, so that you can excel while providing protection of health, safety, and welfare to the public.

As to conducting my senior design project I will take on the responsibility as an inspiring civil engineer to conduct myself in a manner that resembles a professional in training. That includes following the fundamental principles of creating safe resilient and sustainable infrastructure, treating all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regards to personal identity. Consider the current and anticipated needs of society, and utilize knowledge and skills to enhance life for humanity. Working alongside my colleagues will give us a brighter understanding of how work is done in the field. Assuring all structures and planning is up to par for the development of the amazon IT hub and distribution center.

To be a successful professional engineer it comes with hard work and dedication. Speaking from personal experience it all starts with undergraduate. During this time you are learning the fundamentals of engineering and what is there to expect during design projects. Everything starts with attending class; I've always believed that missing a day of class equaled up to missing three weeks. Attending is beneficial to gain the proper knowledge. Following the code of ethics action as a professional is to uphold the honor, integrity, and dignity of the profession, practice engineering in compliance with all legal requirements in the jurisdiction of the practice. Represent their professional qualifications and experience truthfully and always reject practices of unfair competition. Never do anything to jeopardize your license from being suspended or even if terminated from further practices. Remember to educate the public on the role of civil

engineering in society and continue professional development to enhance their technical and non-technical competencies.

Case 1

In this case we have Ashton who's trying to start a contract in East Africa for international development. This scenario ends with her communicating with the local government to earn her contract to construct the headquarter facility. She's left with the option to fraudulently commit bribery which is illegal. The next approach she should take from an ethical and professional aspect is to; reject practices if things aren't negotiated in a legal matter., because in civil engineering bribery is not ethical; having a zero tolerance for bribery, fraud, and corruption in all forms, and reporting violations to the proper authorities. If things aren't handled in an ethical manner, resign from moving forward with this client. There are always bigger and better opportunities; when one door closes, multiple open.

Case 2

In this case I believe Solomon should push for a more sustainable strategy that will not jeopardize the environment. Each and every source of water has to meet federal regulations whether it's being used or not because it can become harmful to both humans and aquatic life and even the environment. One thing the ASCE pushes for is health, safety, and welfare of the public. This is the number one priority as a civil engineer. Although the client came with options that are cost effective which we like to hear always finding the lowest cost, it isn't easy to decide life over budget. Knowing that as an engineer you are here to swerve the people. I believe Solomon should continue to push his client to reach required regulations even if it costs a bit more.

Global Impact- Pollution from landfills not following Federal and governmental regulations.

Social Impact-Failed infrastructure

Economical Impact- A change in funding for a firm that can either jeopardize them for the worst or earn a must investment that isn't good.

Environmental Impact- Trying to conserve funds to be more cost efficient; where the environmental impact would be high contamination of surface water to eliminate cerion processes in cleaning water.

Jerral T. Walker,

CVEG 4200 Pol, Senior Design and
Professionalism 1

Homework # 2
Given:

Oct 21, 2021

Due:

October 31, 2021

70

Problem #1

1) Demonstrate your understanding of professional Code for your Senior Design Project.

Considering the Senior design project apposed to the the professional code given, each engineer should forefill thier duties accordingly. I am the water resource engineer for our senior design project where we are to design a business an distribution center, IT Hub, and office development ~~on~~ a 400-acre site in Walter County.

Based upon Society corresponding to my role in the design project I must work design to protect the health of the public. I must do so by still trying to improve the quality of my design. For an example, by improving how much water I can get from one place to another in a safe and efficient way. Based upon the Natural and built environment, I must follow the rules and regulations given by the state and County. When Considering clients and employer

I must work to please my Customer in the most professional way. This is done by being honest, about conflict such as time, and money.

Further ^{continue} more by doing what the Customer asks to meet their wants and wishes. Communication is the most important part when working for your customer to make sure both parties have a great understanding of what's being done and when. Under the peers, I must give credit where it's due. I also have to complete a design that ensures the safety of them as well as something that even possible to build. I must have a respectable supervision and managing skills.

102

A professional code of ethic offers a set of guideline teams that can be used to make good decisions to make my work environment better. My responsibilities are to be honest, trustworthy, loyal, respectful to others, respect laws/standards, safety, and taking accountability. By following these principles I will be a successful engineer.

Problem #2

Case 1) (1.1)

Based on the first case study the approach to be ethical would be to be honest with PDRC and let them know why she isn't willing to proceed with the project. It is not ethical to be dishonest and untrustworthy. In that case she needs to resign and apply to a company that abides by the code of ethics.

Case 2

In this case Solomon should push for a more fiscally demanding and sustainable strategy. It is unethical to not use resource wisely to meet the regulations and standards. Therefore Solomon should stop constructing until a more ethical plan or design has been completed.

(1.2)

Global.

- 1) In respects to global impacts of my Senior design climate change plays a huge role in my design. To solve this problem that it may cause would be to educate and have self awareness. Also look into new conservation tech, recycle waste water and improve irrigation and water use.

ASSIGNMENTS FOR OUTCOME “5”

An ability to (1) function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, (2) establish goals, plan tasks, and meet objectives.

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 4200 Senior Design and Professionalism I
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET

FALL 2021

Instructor: Dr. Md Jobair Bin Alam

Title of Assignment

**Project Management, Identification of Tasks, Setting Milestones
and Gantt chart for the assigned Project**

Outcome Measured Using this Assignment

Outcome 5

An ability to (1) function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, (2) establish goals, plan tasks, and meet objectives.

Check the teaming problem characteristics related to this assignment

Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment.	
Requires students working in groups to:	
X	Organize and assign team roles; plan and keep good record of team meetings including documentation of individual contributions
X	Share ideas, complete assigned task on time, help others, and be professional to each other (through peer evaluation of team members on these characteristics).
	Resolve conflicts professionally within the group with the view of creating an inclusive and collaborative environment
Establish goals, plan tasks, and meet objectives.	
Requires students working in groups to:	
X	Set goals and objectives
X	Identify and break down work into tasks and subtasks and identify the personnel and deliverables for each.
X	Develop a Gantt chart and critical path analysis for managing the project.
X	Establish major milestones for tracking progress and define performance metrics to measure success.
X	Track progress of team members to ensure project is on schedule and meets objectives (through submission of progress reports).

Brief justification of the suitability of assignment for the outcome

Team dynamic activities will be given to ensure connection among team and group members. All members will be monitored to contribute to the identification of the project progress

FALL 2021

ASSIGNMENT STATEMENT/QUESTIONS GRADING SCHEME FOR ASSIGNMENT

Project Management	25 pts
Identification of Tasks	25 pts
Setting Milestones and Gantt chart	25 pts
Weekly Progress of the assigned Project	25 pts
Total:	100 pts

Insert here Student Sample Crit. 5

**Prairie View A&M University
Roy G. Perry College of Engineering
Civil & Environmental Engineering Department**



90

CVEG 4200: Senior Design

Section: P01

Course Number: 17739

Title: Assignment #04

Submitted By: Abram Auguste, Armando Gomez, Alex Martinez, Nathaniel Smith –

G.A.M.S. Engineering

Submitted To: Dr. Alam, Md Jobair Bin Ph.D., P.E.

Due Date: November 11, 2021 - 11:59PM

Management Report

Prepared by

Abram Auguste
AAuguste@pvamu.edu

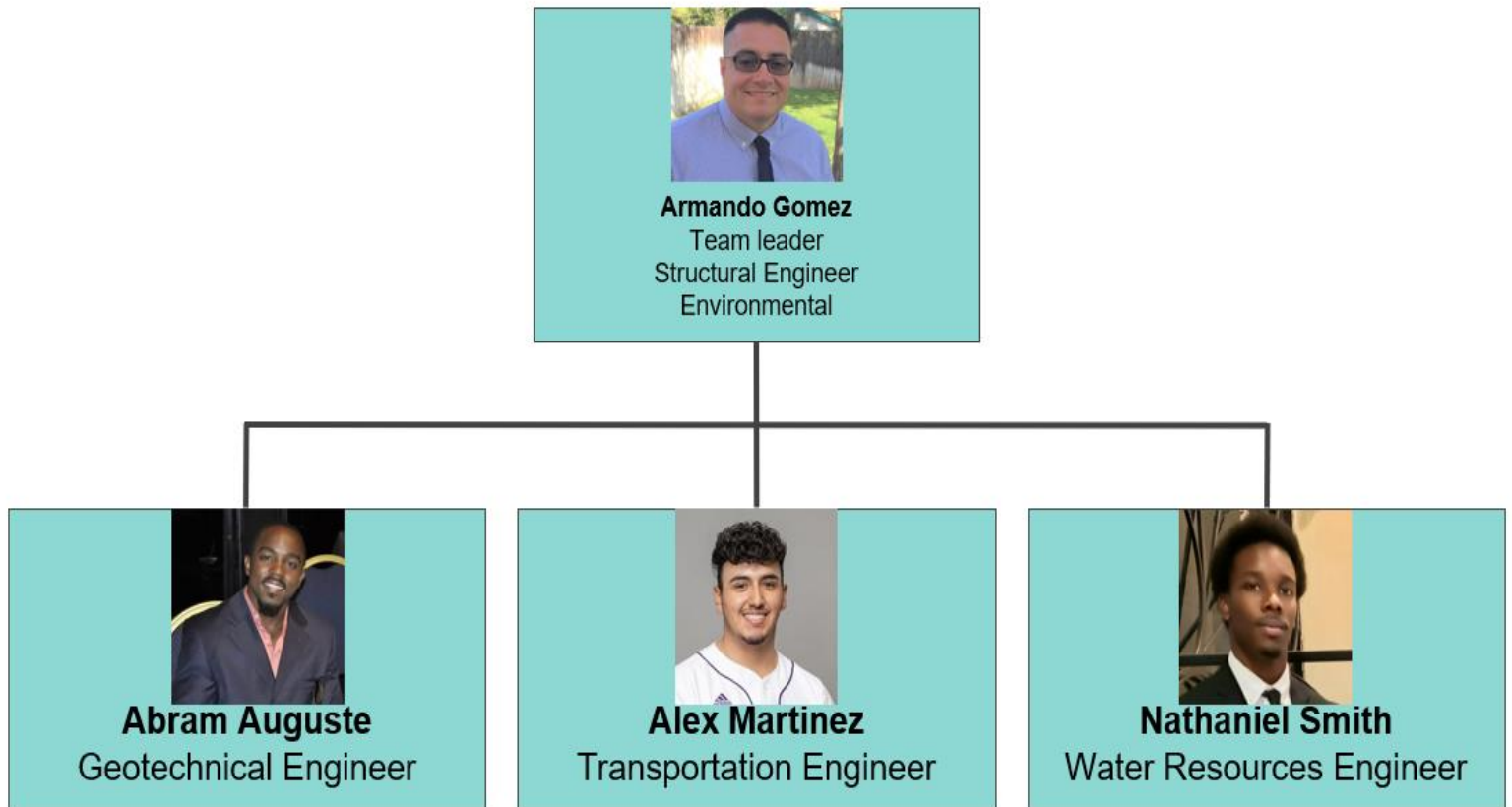
Alex Martinez
HAlex1011@gmail.com

Nathaniel Smith
Nkis1958@gmail.com

Armando Gomez
agomez28@pvamu.edu

November 11, 2021

Organizational Chart



Executive Summary

With a design objective issued by Dr. Alam, Jobair, G.A.M.S. Engineering implemented and commenced the senior design project on August 21, 2021. The project's main purpose is to establish the parameters for the execution of an Amazon Hub center in Brenham County, Texas. The report aims to detail the progress, milestones, and current gaps of the said project to complete it before its deadline.

Objectives

The objectives of this progress management report are:

1. To communicate the progress and milestone of the project
2. To report Individual efforts

Strategy

In developing the project, the project management team communicated with both the Internal Advisory Council (IAC) and Prairie View A&M University professors to help guide the project advancement. The necessary formulas and analysis was then conducted to see if the analyzed environmental parameters and project instructions can support the building's structure. Lastly, the team frequently communicated amongst each other to balance and assure each other's work.

Geotechnical Engineer (Abram Auguste)

Geotechnical engineers analyze soil integrity for building of infrastructure.

Responsibilities

- Model and apply ethical values and our guiding engineering principles throughout all our interactions and studies.
- Provide expert engineering advice and recommendations for the Amazon Hub projects
- Perform geotechnical studies, field tests, analysis, and design from Boring Logs provided
- Prepare and present findings and recommendations to Internal Advisory Council and Prairie View A&M University Faculty and staff
- Organize and direct geotechnical site assessment from maps provided and raw data
- Determine and obtain necessary compliance measures for the execution of the Amazon Hub
- Iteratively create and maintain high quality formulaic analysis, tests, and documentation that aligns with team goals.

- Document and share group progress in relevant lab meetings at least twice a week

Geotechnical Task

Geotechnical - The team was provided with raw boring and soil data of the site. The Geotechnical Engineer developed professional boring logs using the AutoCAD software.

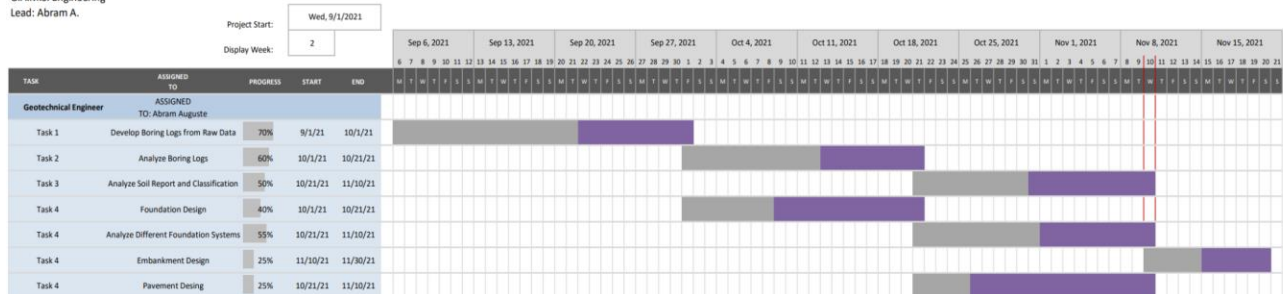
Geotechnical design meets the USACE, NAVFAC and TxDOT or local County standards.

- Analyzed boring logs to determine the soil quality and for the erection of the Amazon HUB
- Analyze soil report and soil classification to determine was modifications (ie. Cut and fill) of the soil classified.
- Foundation design: bearing capacity and settlement was determined applying formulas learned in both CVEG 3023 and 4100 courses.
- Analyze different foundation systems and recommend safe and low-cost foundation systems in tandem with the Structural Engineer (Armando Gomez). The Foundation type, size and depth and material specifications were determined and explained in the final report.

Geotechnical Gantt Chart

SENIOR DESIGN

G.A.M.S. Engineering
Lead: Abram A.



Structural Engineering Task (Armando Gomez)

The progress of the structural portion of the project is partially completed. There is still much work to be done but progress is being made each week. The Autocad drawings have had the most

progress and any changes to the design can be easily changed. STADD Pro has been the largest challenge and getting familiarized with the software. As there is a large array of things that can be done with this software. Progress is being made to be able to provide printouts of input and outputs of the structures. Have reached out to academic professors for meeting times for recommendations. The largest set back this year has been due to Covid as it had put me behind by two weeks but have continued to catch up on a daily basis.

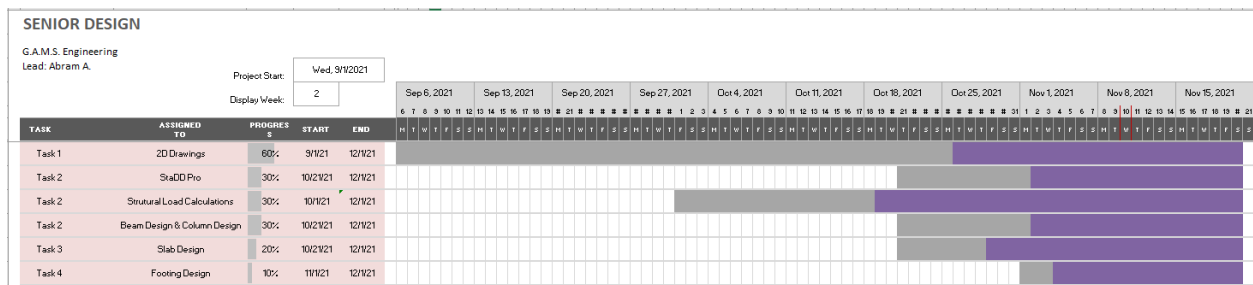
Responsibilities

- Model and apply ethical values and our guiding engineering principles throughout all our interactions and studies.
- Provide expert engineering advice and recommendations for the Amazon Hub projects
- Perform structural engineering studies, analysis, and design from research
- Prepare and present findings and recommendations to Internal Advisory Council and Prairie View A&M University Faculty and staff
- Determine and obtain necessary design requirements from structural steel design handbook
- Communications between the group on each others progress by meeting twice a week.

Structural Task

- Provide 2D drawing of all buildings including labeling dimensions, mark columns and beam placements.
- Determined the structural load calculation
- Provide a slab design slab design
- Provide a STADD Pro analysis of all buildings (dead, live and wind loads)
- Determine the beam and column design for all structure
- Provide STADD Pro maximum values of bending moments, shear, and axial load. Then to identify all members or components.
- Reinforcement concrete footing

Structural Engineering Gantt Chart



Water Resources Engineering (Nathaniel Smith)

The status of the water resources part of the project is partially completed. Almost all of the preliminary measurements and studies have been recorded. The last things that are left to do include finding the Manning's roughness coefficient, "n", and the appropriate sediment diameter for the land. After these two values are determined, the design of the trapezoidal water basin/ditch can be completed.

Responsibilities

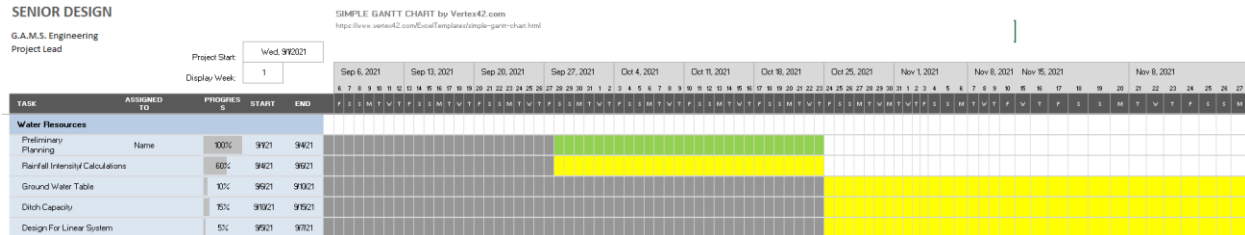
- Model and apply ethical values and our guiding engineering principles throughout all our interactions and studies.
- Provide expert engineering advice and recommendations for the Amazon Hub projects
- Perform water resource studies, analysis, and design from research
- Prepare and present findings and recommendations to Internal Advisory Council and Prairie View A&M University Faculty and staff
- Determine and obtain necessary design requirements from county flood control manual
- Iteratively create and maintain high quality formulaic analysis, tests, and documentation that aligns with team goals.

Water Resources Task

- Determine location of storm water ditch
- Determine the rainfall intensity from a 100-year rainfall investigation period
- Calculate the quantity of water
- Design stormwater runoff, while avoiding flooding risks and property damage

- Design capacity of the ditch based on rainfall study
- Design drainage ditch with profile and cross section

Water Resources Gantt Chart



Transportation Engineering (Alex Martinez)

Transportation Engineers design and analyze various modes for transportation and stationing.

Responsibilities

- Model and apply ethical values and our guiding engineering principles throughout all our interactions and studies.
- Provide expert engineering advice and recommendations for the Amazon Hub projects
- Perform Transportation studies, analysis, and design from existing land and roads within our project site
- Prepare and present findings and recommendations to Internal Advisory Council and Prairie View A&M University Faculty and staff
- Determine and obtain necessary compliance measures for connecting roads and parking lots
- Carry out studies, necessary formulaic analysis, and documentation that aligns with team goals

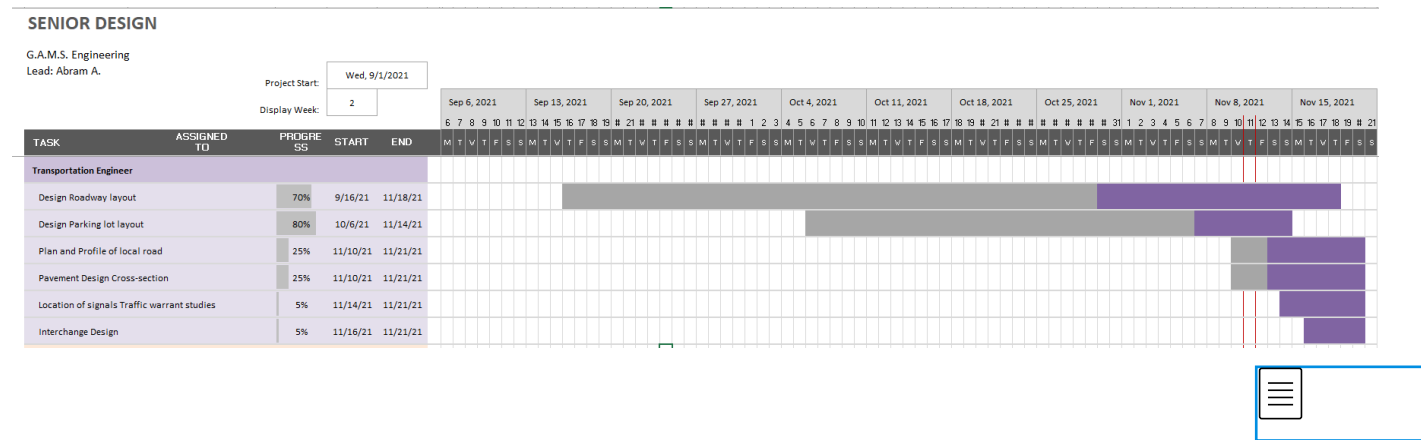
Transportation Task

The team was provided with parameters for where the Amazon Hub site would be located. The Transportation Engineer developed a professional layout of the project site using the AutoCAD software. Transportation design meets the TxDOT and US DOT requirements and specifications.

- Design Roadway Layout, using AutoCAD, for the entire project site. This will include a connecting road with highway 290.
- Determine Interchange design and analysis.

- Design Parking lot layout plan, using AutoCAD, for the entire project facility which includes separate lots for each building as well as a visitors parking lot, based on the number of employees.
- Analyze and Determine Location of signals within the roadway layout and related traffic warrant study.
- Provide a Plan and Profile of a typical local road in the development.
- Provide a Pavement Design cross-section for a typical local road in the development

Transportation Gantt Chart



Environmental Engineering (All)

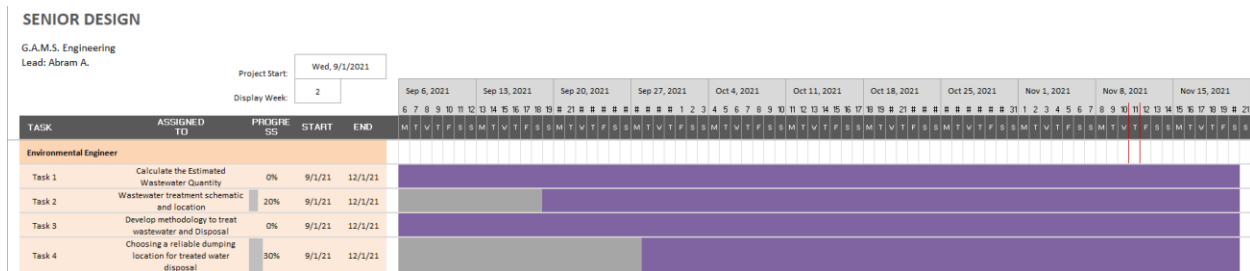
Responsibilities

- Model and apply ethical values and our guiding engineering principles throughout all our interactions and studies.
- Provide expert engineering advice and recommendations for the Amazon Hub projects
- Perform Transportation studies, analysis, and design from existing land and roads within our project site
- Prepare and present findings and recommendations to Internal Advisory Council and Prairie View A&M University Faculty and staff
- Determine and obtain necessary compliance measures for connecting roads and parking lots
- Carry out studies, necessary formulaic analysis, and documentation that aligns with team goals

Environmental Task

- Calculate the estimated wastewater quantity
- Schematic, and location wastewater treatment plant
- Develop an approach to treat the wastewater and disposal
- Choosing a reliable dumping location for treated water disposal

Environmental Gantt Chart



Findings

Geotechnical

1. The project execution met all the deliverables as it pertains to the outlined schedule provided in the initial Gantt Chart
2. The project's complete soil analysis should conclude by December 1, 2021 meeting all parameters outlined in the project instructions issued at the beginning of the semester.

Structural

1. Project status is outlined in the Gantt Chart as it pertains to the scheduled completion of the project for the semester.

Conclusion

Based on the report's findings and preliminary assessment, it is concluded that the project is a complete success, with the deliverables meeting all assigned dates and scope of work.

Recommendations

In a recommendation to ensure more successful projects in the future, Prairie View A&M University should

1. Continue monitoring students' individual progress on the projects from beginning to end, ensuring each goal/deliverable is completed on time.
2. Ensure that students have guaranteed access to the professor's according to their assigned job description.

CVEG 4200 P01 Senior Design Professionalism 1



85

Homework #4

Date Given :November 3, 2021

Date Due : November 11, 2021

Jerral Walker ,12

Sydney Jones, 6

Paige Hines, 5

Michael LeBlanc Jr., 7

Johnathon Chevalier, 3

Prairie View A&M University
Roy G. Perry College of Engineering



75

Civil & Environmental Department
CVEG 4200: Senior Design Project

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

Date Given: 11/4/2021

Date Due: 11/11/2021

Prairie View A&M University
Prairie View, Texas 77446

Project Management Report

Organization and Team Roles

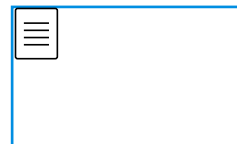
SAPS Engineering consists of four engineers that specialize in different areas of civil engineering. Scott McGary is the project manager for SAPS Engineering and Geotechnical Lead. Autumn Carter is the Environmental Lead as well as the Structural Co-Lead. Shadaria Lynch is the Transportation Lead as well as the Structural Co-Lead. Perla Zaldivar is the Water Resources Lead as well as the Structural Co-Lead.

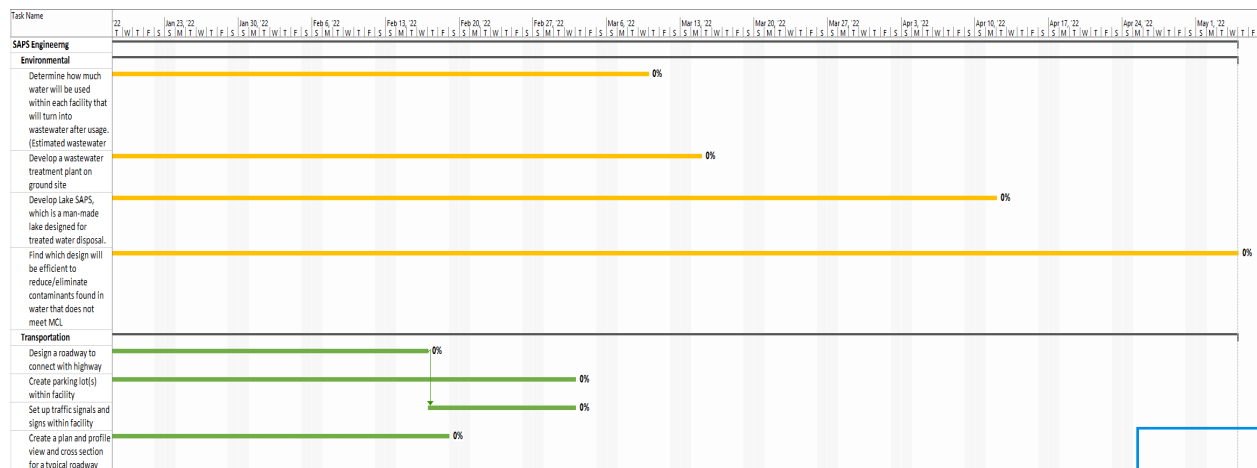
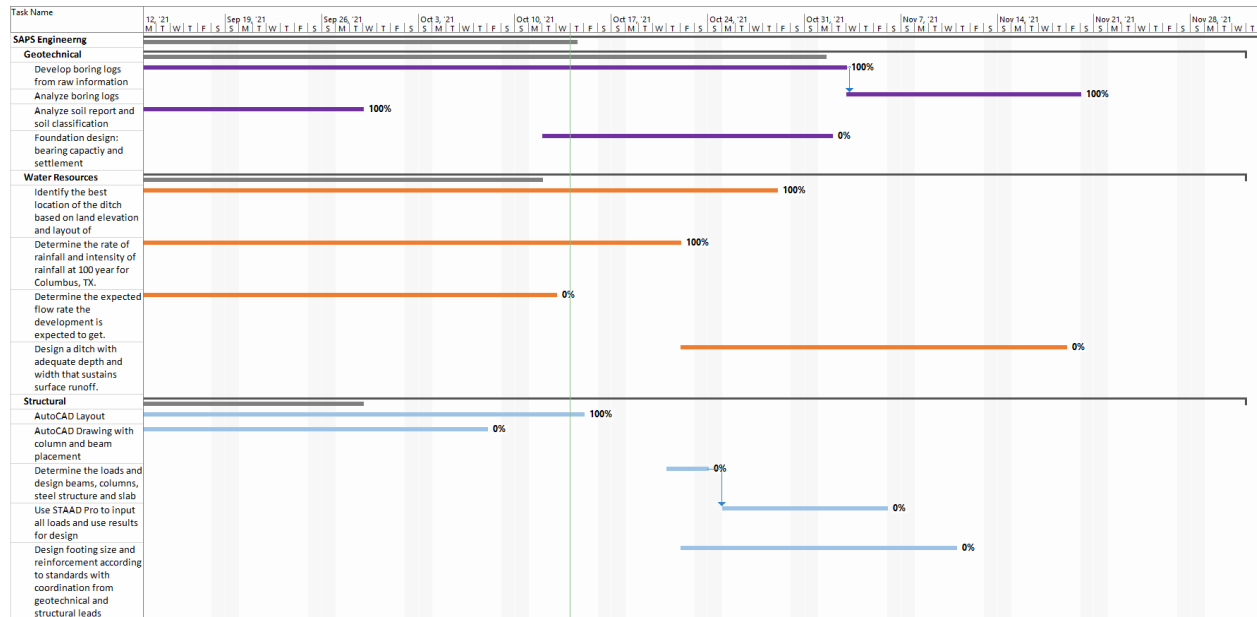
Goals and Objectives

The goal of the project is to effectively develop and design a distribution center, IT Hub and office buildings for the client. The project team is expected to provide Civil Engineering Site Development and Design services, as well as handle all of the project's requirements. Additionally, the team will perform new road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service roads and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and temporary recyclables disposal facility, and wastewater treatment process and facility. The students' objectives are to improve their ability to comprehend and use civil engineering information to design a system, component, or process that meets the needs of a civil engineering project. Develop the capacity to work as part of a team, follow ethical guidelines, and explain project design through reports and presentations to an audience.

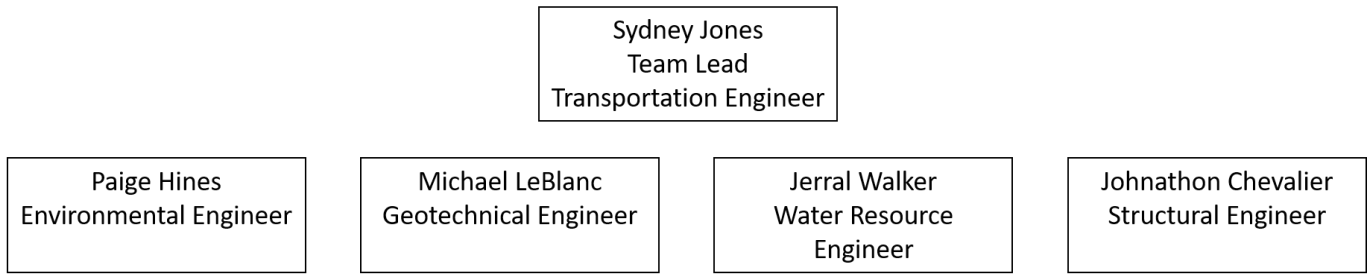
Gantt Chart

The gantt chart below shows the progress and anticipated progress for each discipline for the development of Amazon. The project is on schedule to be completed on time for the month of December.





Company Organizational Structure



Goals & Objectives

The overall goal of our project is to effectively and efficiently produce a distribution Center for Amazon in order for their business to continue to thrive at such a euphoric level. The mission is to use creativity and innovation along with technical knowledge to create multiple structures such as office buildings, water plants, and roads while ensuring the soil foundation is sufficient enough for longevity.

Structural Goals:

- Design structures within standards
- Be unique but careful with structure placement
- Less then 3 errors in Staad Pro output analysis
- Completely done by February 2022, besides adjustments
- To be as cost saving as possible

Transportation Goals:

- Effectively design a flow of traffic that mitigates vehicle collision the best
- Provide enough parking for all employees despite of shift working
- Implementation of traffic devices to ensure the flow of traffic is rarely disturbed

Environmental Goals:

- Reduce the amount of wear and tear on the surrounding environment
- Replacing any disturbed pre-existing environmental components.
- Propose a working method for treating wastewater with intentions on recycling water for usage.

Geotechnical Goals:

- Securing information on the soil in order to provide the okay for the buildings to begin the construction site plans.
- Identify and determine the best foundation system for the layout of the distribution center
- Create a design of the embankment from the highway

Water Resources Goal:

- Locate or Create a stormwater ditch system to help with the prevention of flood
- Educated hypothesis on the flood damage possibilities with regard to the location and the amount of rainfall
- Drainage, design a stable and efficient drainage system

Gantt Chart

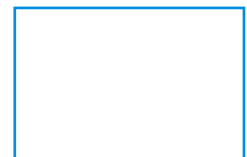
Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Structual Engineering									
2D Drawing- Office Building, Warehouse, Convention Center, (Label dimensions, mark columns and beam placement)	Johnathon Chevalier								
Structural load calculation	Johnathon Chevalier								
Slab Design	Johnathon Chevalier								
Input and output after analyzing STADD Pro model for Office Buildings, Warehouse, Convention Center, (dead, live, and wind loads)	Johnathon Chevalier								
Beam and Column Design, steel structure design of warehouse	Johnathon Chevalier								
Analyze your output results obtained from STADD Pro.	Johnathon Chevalier								
Reinforcement bars and Reinforced Concrete Design for foundations including footing size, reinforcement.	Johnathon Chevalier								

Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Geo-Technical Engineering									
Create Boring logs based on raw data, Examine the soil report and classification.	Michael LeBlanc								
Bearing capacity and settling are two factors to consider while designing a foundation.	Michael LeBlanc								
Analyze various foundation systems and make recommendations for a safe and low-cost foundation (Type, size and depth and material for foundation, and related specifications)	Michael LeBlanc								
Design of the embankment (slope of major highway)	Michael LeBlanc, Sydney Jones								
Material specification and pavement design (geotechnical design)	Michael LeBlanc, Sydney Jones								

Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Transportation Engineering									
Design minor roads for project and connecting road with highway, Design interchanges for roads	Sydney Jones								
Plan parking lot in AutoCad for the entire project, Calculate total parking (regular and handicap)	Sydney Jones								
Pavement Design cross-section for a typical local road in the development	Sydney Jones								
Design roadway intersections with correct traffic signals, Display location of signals and related traffic warrant study	Sydney Jones								
Plan and Profile of a typical local road in the development	Sydney Jones								

Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Water Resources Engineering									
Location of stormwater ditch	Jerral Walker								
Rainfall intensity/Rainfall collection for 100-year flooding	Jerral Walker								
Calculation of the quantity of water	Jerral Walker								
Designing stormwater runoff, while avoiding flooding risks and property damage	Jerral Walker								
Design capacity of the ditch based on rainfall study	Jerral Walker								
Drainage ditch with profile and cross section	Jerral Walker								

Task	Assigned Task	Semester 1				Semester 2			
		4 weeks	8 weeks	12 weeks	16 weeks	4 weeks	8 weeks	12 weeks	16 weeks
Enviornmental Engineering									
Calculate and estimate wastewater quantity.	Paige Hines								
Wastewater treatment process and facility.	Paige Hines								
Wastewater Treatment Schematics and Location.	Paige Hines								
Develop methodology to treat wastewater and disposal.	Paige Hines								
Choosing a reliable dumping location for treated water disposal	Paige Hines								



ASSIGNMENTS FOR OUTCOME “7”

An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 4200 Senior Design and Professionalism I
OUTCOMES SPECIFIC ASSIGNMENT COVER SHEET

FALL 2021

Instructor: Dr. Md Jobair Bin Alam

Title of Assignment

**Information research for the project, determining needs,
understanding contemporary issues and to use the information
to implement in the project design**

Outcome Measured Using this Assignment

Outcome 7

**An ability to acquire and apply new knowledge as needed, using appropriate learning
strategies**

Check the outcome appropriate characteristics related to this assignment

Ability to Acquire new knowledge using the appropriate learning strategies Requires students to:	
X	Be knowledgeable of and use different learning strategies (<i>Instructor may provide information on different learning strategies</i>)
X	Identify and take advantage of learning opportunities available in the library, online resources, seminars, webinars, conferences, workshops and tutorials.
X	Be aware of the need for and are able to independently acquire additional knowledge and data needed for solving problem using appropriate learning strategies and tools.
Ability to apply new knowledge to solve problems Requires students to:	
X	Demonstrate appropriate use of the new knowledge to solve problems.

Brief justification of the suitability of assignment for the outcome

**All students will be required to read reference materials and use library and
web resources needed to perform the project. Literature review and reference
documentation related to the project subtasks will have to be prepared and
submitted**

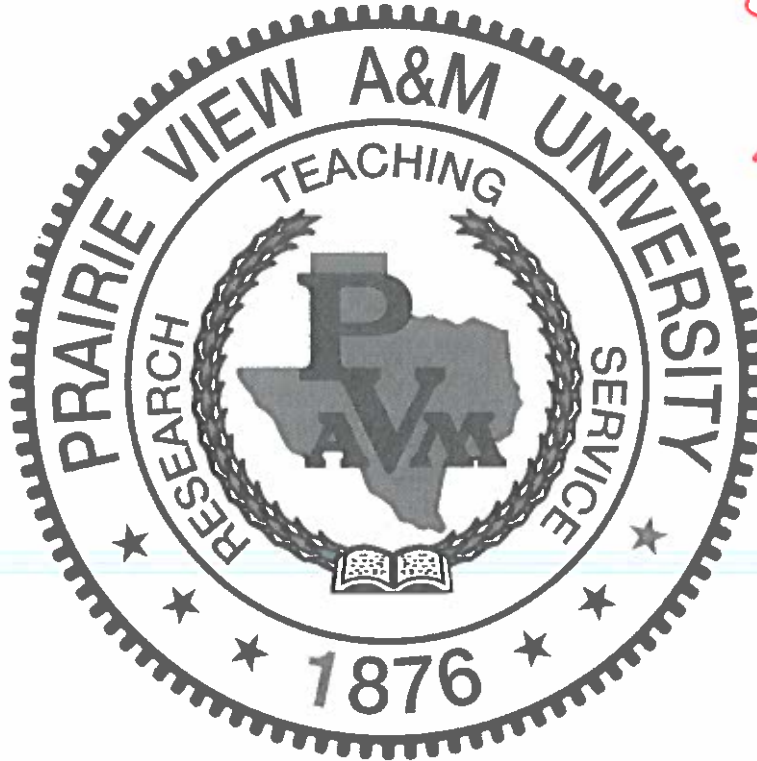
**CVEG 4200 Senior Design and Professionalism I
FALL 2021**

**ASSIGNMENT STATEMENT/QUESTIONS
GRADING SCHEME FOR ASSIGNMENT**

Literature search documentation	25 pts
Document use of new knowledge	25 pts
References listing and relevance statements	50 pts
Total:	100 pts

Insert here Student Sample for Crit. 7

**Prairie View A&M University
Roy G. Perry College of Engineering
Civil & Environmental Engineering Department**



88

CVEG 4200: Senior Design

Section: P01

Course Number: 17739

Title: Final Semester Report

Submitted By: Abram Auguste, Armando Gomez, Alex Martinez, Nathaniel Smith –

G.A.M.S. Engineering

Submitted To: Dr. Alam, Md Jobair Bin Ph.D., P.E.

Due Date: December 01, 2021, 1:00 P.M.

Executive Summary

Prepared by

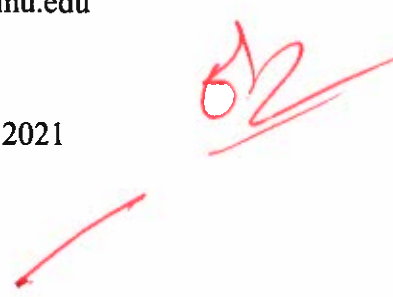
Abram Auguste
AAuguste@pvamu.edu

Alex Martinez
HAlex1011@gmail.com

Nathaniel Smith
Nkis1958@gmail.com

Armando Gomez
agomez28@pvamu.edu

November 17, 2021

A red handwritten signature, possibly reading "AG", is located to the right of the date. A red arrow points from the signature towards the date.

Summary

The proposed project is the development of a 400 acre lot for Amazon. This new development is located near the city of Brenham in Washington County, Texas. G.A.M.S Engineering is to develop and design Amazon distribution center, IT Hub, Office space, convention center, wastewater treatment facility, storm water ditch (to connect to a major lake), parking lots, roads, intersection and a highway extension that will accommodate the new facilities. G.A.M.S Engineering is to provide details on progress and milestones with completion dates for thus scope of work.

Geotechnical Engineering

The following report summarizes G.A.M.S. Engineering, Inc's Geotechnical Evaluation for the proposed Amazon Hub, located in Washington County, Texas. This report includes information regarding the field and laboratory testing analysis, the subsurface conditions encountered, and discussion related to building construction in relationship to the subsurface conditions at the site. The analysis was performed in general accordance with CVEG 3023 and 4100 processes and formulaic assessment.

At this time, the project consists of constructing a two five-story commercial office building, a steel structure warehouse, and a three-story convention center building with a footprint of approximately 30,000 to 50,000 square feet based on historical data. The building is proposed to be constructed at grade (i.e. without subsurface floors) with a finished floor elevation of approximately 340 feet.

On August 26, 2021, two (2) Standard Penetration Test (SPT) borings were performed using CME 75 drill rigs with 8" test hole diameter in the vicinity of the proposed Amazon hub building location to depths at 75 feet below the existing ground surface. Beneath a surface layer, the subsurface conditions observed can be described as lean to fat clay with varying amounts of silt to the extent of the test boring logs. Based on the assessment of the subsurface conditions and information exchanged to and between the G.A.M.S. Engineering team, the following comments and recommendations are made: The proposed building construction could not be supported on a conventional shallow foundation system and slab-on-grade nor a Matt foundation. However, it

was determined that Pile foundations could be designed for a maximum allowable bearing pressure of 560 pounds per square foot (psf). Total foundation settlement is estimated to be on the order of 1.34 inch or less, and a differential settlement on the order of a ½ inch or less; Groundwater was observed in the test borings performed at the site at depths approximately 7.5 feet below the existing ground surface. Based on the groundwater depths observed during soil assessment, it is likely that groundwater will be encountered during foundation construction. Therefore, the best course of action would be a deep pile system suitable to carry the load of the Amazon facility.

Structural Engineering

The scope of work for the structural engineering portion of the project is to provide designs for the Amazon distribution center warehouse, five story IT Hub and office building, and three story civic center. It is to include the location of where the buildings are to be built. The location of the buildings will be coordinated with geotechnical engineers and water resources engineers to provide the best location for the foundation design and on grade slab of the building. As well as the watershed that could cause flooding to the buildings.

The warehouse is to be designed with reinforced concrete step footings that will support the load of the building. Anchors bolts for the columns will be set in the concrete footings. Steel H-beams with base plates will be used for the load bearing column of the buildings. The spacing of the building columns is to utilize and provide the most floor space possible. To roof supports for the building will be that of I beams and joist that will run perpendicular to the beam. The connection joints to be determined depending on shear and moment of the location. The dead, live, and wind loads for the buildings will be calculated using the Load and Resistance Factor Design (LRFD). The live, dead and wind loads that meet the requirements given in the International Building Code. The information will be imputed into STADD pro modeling for all four buildings. To provide output results of the given bending moments, and shear and axial loads. The STADD report is to be utilized for design purposes of the buildings. As the warehouse design, the multistory buildings will also be of steel structure meeting all International Building Code (IBC) guidelines and local ordinances. The building's footing will be dependent on the



geotechnical report and could require pile footing to support the structures. Autocad will be used to provide a detailed design of the building's footing, floor layout, column and beam locations, dimensions of building and building materials that are to be used.

Water Resources

In the water resources portion project the tasks included determining the location of a storm water ditch, the rainfall intensity based on the 100-year rainfall investigation period, calculating the quantity of water and designing the ditch based on the rainfall study. The ditch was assumed to be an unlined trapezoidal channel and was designed by using hydrologic and hydraulic methods. One of The hydrologic methods used was the "Tractive Force based Unlined Channel Design Method " to get the design dimensions for the ditch/channel. One of the first things done was determining the runoff based on the rainfall intensity by using the Rational Method. Next, the Manning's roughness coefficient and the sediment size were determined based on the surrounding land. The slope of the land was then determined. Moving forward the design depth of the was calculated and the value of side slope was assumed. The area and perimeter were then set up as equations where the base was unknown.

After everything that could be determined was calculated, the runoff, Manning's roughness coefficient, area, perimeter, and the slope of the land were all put into an equation to determine the base of the ditch/channel. The design velocity and the Kennedy equation velocity were then calculated. The design velocity would need to be greater than the Kennedy equation velocity in order for the design to be sufficient. If the Kennedy equation velocity was greater, then the design calculations would have to be done again by assuming a different side slope until the design velocity is greater.

Transportation Engineering

The transportation engineering part of this project include the task to design a roadway layout for the entire project site including a connecting road with the nearby highway 290, create an interchange design, design a parking lot for entire facilities, locate signals and related traffic

studies, and provide a plan and profile as well as a pavement design cross section for a typical local road in the development.

Within the roadway layout of the project site there are to be two entrances required into the site. One entrance on the east side and one entrance on the west side of the project site. One entrance must be regulated by a traffic signal in order to direct traffic. The traffic signal setup will be a simple 3 way intersection signal that will help people from the Amazon hub exit the site safely and in a timely manner. Furthermore, within the parking layout there is to be service truck parking for the warehouse that is separate from visiting cars of the office buildings for amazon. The parking for the service trucks are found on the west portion of the project facility near an existing Farm to Market road which will make it efficient for the trucks to come in and out of the facility. In addition, sidewalks will be placed throughout the project site especially around the business offices and convention center. These sidewalks will help connect parking lots to the respective buildings as well as creating an easy path from building to building. Lastly, all roadway designs for this project must meet Texas Department of Traffic (TxDOT) and US DOT requirements and specifications. For all the transportation parts of the project that require design, the software AutoCAD will be used to create and portray these ideas in a professional manner.

Environmental Engineering

In the environmental engineering portion of this project the ~~tasks~~ included calculating the estimated wastewater quantity, determining the location of a wastewater treatment plant, a schematic of the treatment plant, an approach to treat the wastewater, and to choose a reliable dumping location for the disposal of the wastewater. The scope of work for this portion of the project is to be completed in the following semester.

Recommendations

Geotechnical: There are currently no recommendations at this time.

Structural: There are currently no recommendations at this time.

Water Resources: There are currently no recommendations at this time.

Transportation: there are currently no recommendations at this time

Environmental: There are currently no recommendations at this time

Table of Contents

1. **Geotechnical Survey**
2. **Structural Engineering**
3. **Water Resources**
4. **Transportation Engineering**
5. **Environmental Engineering**

X

table of content
must be elaborated

Geotechnical Survey

Introduction

This report is a representation of the subsurface performed for the design and construction of the proposed Amazon Hub in Washington County, Near the city of Brenham, Texas. It is understood that the overall project has been split into four (4) phases, with separate engineers working on each phase, and each phase being constructed within different construction periods. The four phases, and corresponding project periods, are as follows:

Table 1. Project Phasing

Phase	Project Area	Development Period
A	Geotechnical Survey	4 weeks
B	Structural Design	8 weeks
C	Hydrology Design	4 weeks
D	Environmental/Traffic	5 weeks

This investigation was performed for Phase A, which is for the 400-acre segment that is located adjacent to the Interstate-290 and Southwest of the City of Brenham. Information provided by the coursework scope, it is understood that the proposed Amazon Hub will consist of an The specific scope of the project will include Civil Engineering Development and Design services for the entire site which will include two five-story commercial office building, a steel structure warehouse, a three-story convention center, parking lots. The students will also perform new road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility. The facilities will be designed for 20,000 people or based on population projection for 15 years., and road connections to I-290. Phase A project alignment, which will interconnect with the existing drainage systems and interstate roads.

1.1 Existing Site Conditions

The project site encompasses an approximately 400 square foot long area along the southwestern bank of the city of Brenham on the southwest side of the Interstate-290, Texas. Brenham is a city in east-central Texas in Washington County, United States, with a population of 15,716 according to the 2010 U.S. census. It is the county seat of Washington County. The elevation is approximately (341') and the city has an area: 13.03 mi². Brenham is located at 30°9'43"N 96°23'49"W (30.161901, -96.397004). Industrial properties and Blinn Community College facilities are located along the northeast side of the proposed space, and it is presumed that the land is baron and free of residential buildings. Pond Creek sits just southwest of the proposed space in the town of Wesley, Texas.

Design Location (Theory)

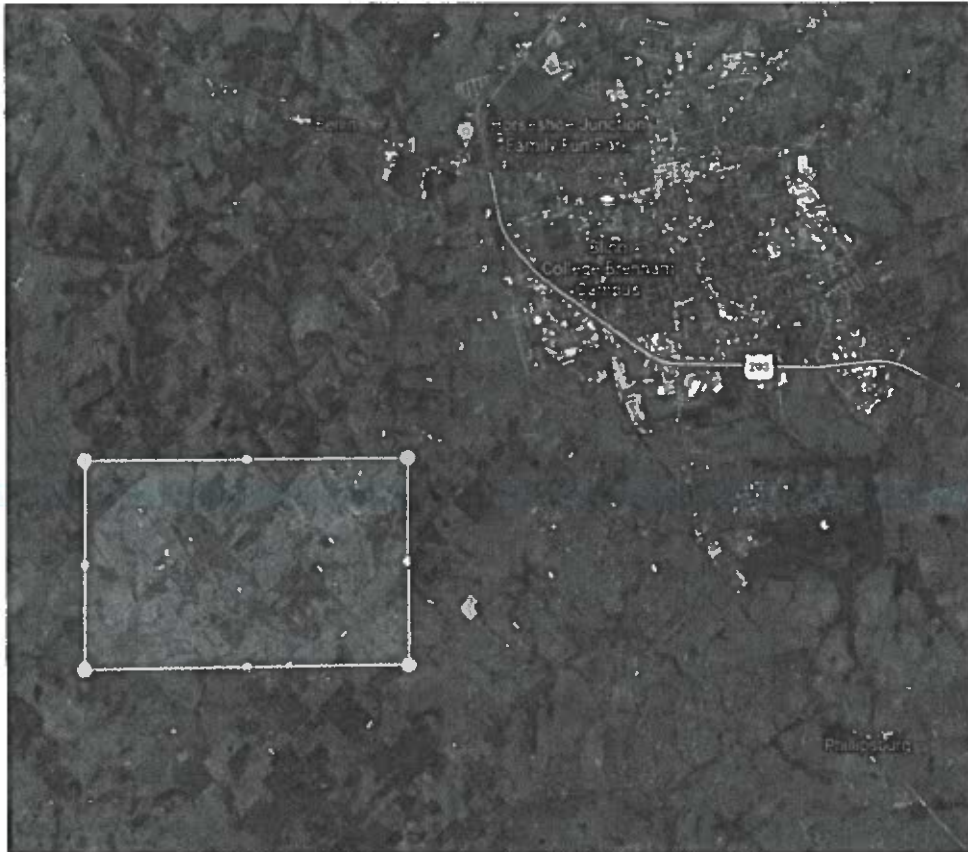


Figure 1: 400 Acre near Brenham (Washington County)

Figure 1: 400 Acre near Brenham (Washington County)

1.2 Site Geology

Washington County is in the Blackland Prairies region of southeast central Texas. The center of the county is at 30°14' north latitude and 96°24' west longitude. Brenham, the seat of government, is near the county's center and seventy-five air miles east of Austin. The county was named for George Washington, the first president of the United States. Washington County encompasses 611 square miles of gently rolling land with elevations ranging between 200 to 500 feet above sea level. Sloping generally southeasterly, the area drains into the Brazos River, which runs along the eastern border. Other prominent streams include New Year's Creek, East Fork Mill Creek, Doe Run Creek, Wolf Creek, and Yegua Creek,

which forms the county's northern border. Soils along the Brazos River are brownish to reddish, cracking and clayey or loamy; in most of the rest of the county, shallow to deep clayey soils cover a bed of chalk. Subterranean water reservoirs include the Catahoula, Oakville, and Lagarto formations. Washington County, located in the post oak belt, is well timbered, and elms, ashes, hackberries, hickories, pecans, cottonwoods, red cedar, mulberry, and other trees grow in its forests. The county's climate is subtropical and humid, with an average annual precipitation of forty inches. Temperatures range from an average low of 39° F in January to an average high of 96° F in July; the growing season lasts 277 days. The principle mineral resources include oil, natural gas, lignite, brick clay, salt and sulphur. The county is linked to the rest of the state by U.S. Highway 290, which crosses east to west, and by the Burlington Northern Santa Fe Railroad, which runs north-south.

The Blackland Prairies region is named for the deep, fertile black soils that characterize the area. Blackland Prairie soils once supported a tallgrass prairie dominated by tall-growing grasses such as big bluestem, little bluestem, indiangrass, and switchgrass. Because of the fertile soils, much of the original prairie has been plowed to produce food and forage crops. The average annual rainfall ranges from 28 to 40 inches. May is the peak rainfall month for the northern end of the region; however, the south-central part has a fairly uniform rainfall distribution throughout the year. Typically, soils are uniformly dark-colored alkaline clays, often referred to as "black gumbo," interspersed with some gray acidic sandy loams. The landscape is gently rolling to nearly level, and elevations range from 300 to 800 feet above sea level. Crop production and cattle ranching are the primary agricultural industries.

2.0 SUBSURFACE INVESTIGATION

On September 1, 2021, a total of two (2) borings, designated as B-1 and B-2, were drilled at the locations illustrated on the boring plan provided in Appendix I and summarized in Table 2 (Appendix III) below. The borings were drilled to a completion depth of 68.0 feet each below the existing ground surface.

The boring locations were determined and field located by G.A.M.S. personnel. During the field reconnaissance, G.A.M.S. personnel documented the existing site conditions. Ground surface elevations at the boring locations were determined using topographic mapping information provided by the United States Soil and Conservation Services (USSCS). The borings were drilled with a drilling machine, utilizing a hollow stem auger to advance the holes. Standard penetration test (SPT) were performed at 6-inch intervals to a depth of 68.0 feet below the ground surface. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). SPT blow counts aid in determining soil properties applicable in foundation system design.

3.0 SUBSURFACE PROFILE

Interpreted engineering logs have been prepared based on the field logs, visual interpretation of samples and chart analysis. Classification follows the current USCS specifications. The following is a summary of what was found in the test borings and what is represented on the boring logs.

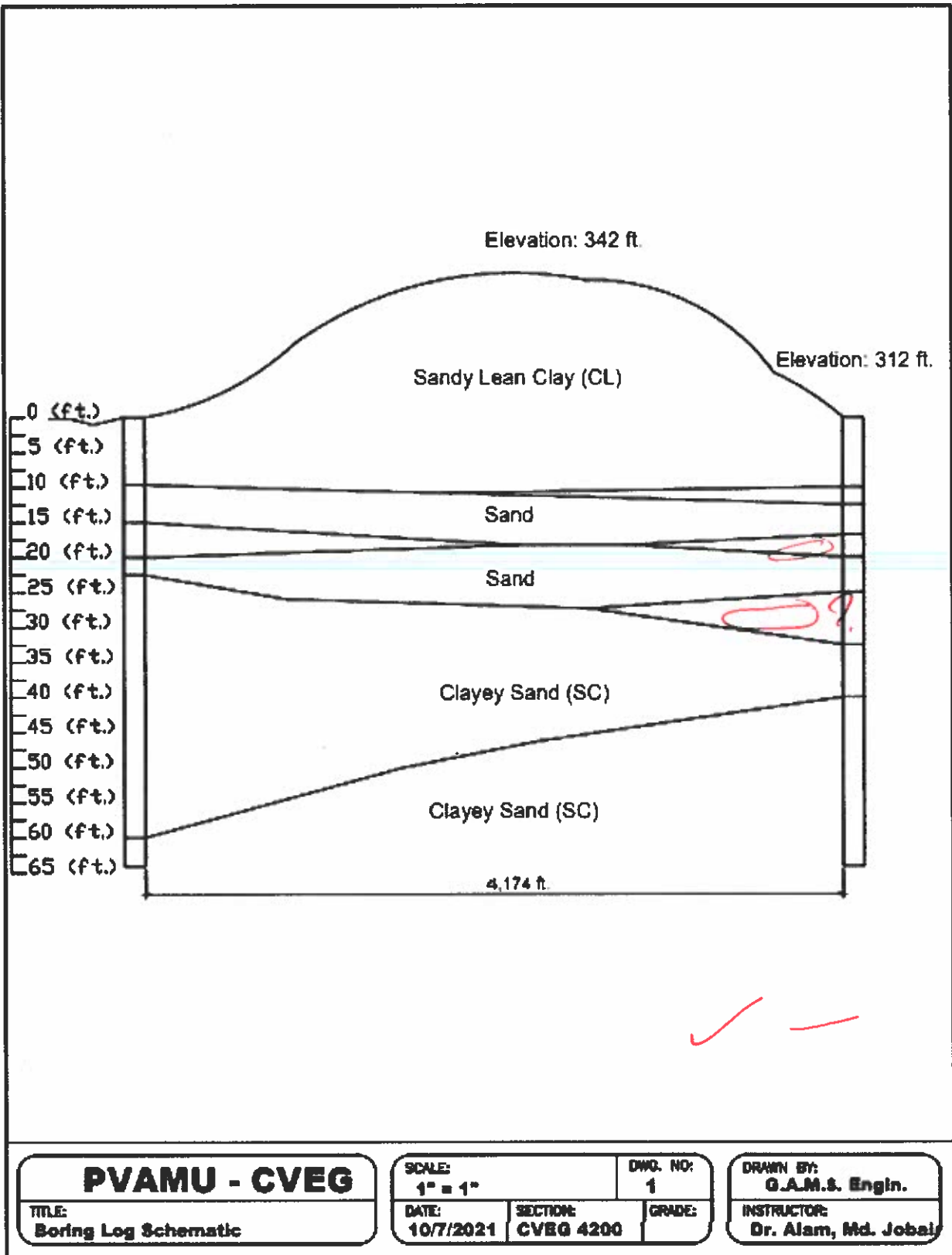
Boring 1										Assume Gravel 0
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
3,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
3,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2										
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

Table 2: Soil Classification Summary

3.1 Subsurface Soils

The below CAD drawing displays the layers of the soil types found in the Boring samples. Bedrock was not encountered for this investigation.



PVAMU - CVEG

TITLE:
Boring Log Schematic

SCALE:
1" = 1"

DATE:
10/7/2021

SECTION:
CVEG 4200

DWG. NO:
1

GRADE:

DRAWN BY:
G.A.M.S. Engin.

INSTRUCTOR:
Dr. Alam, Md. Jobal

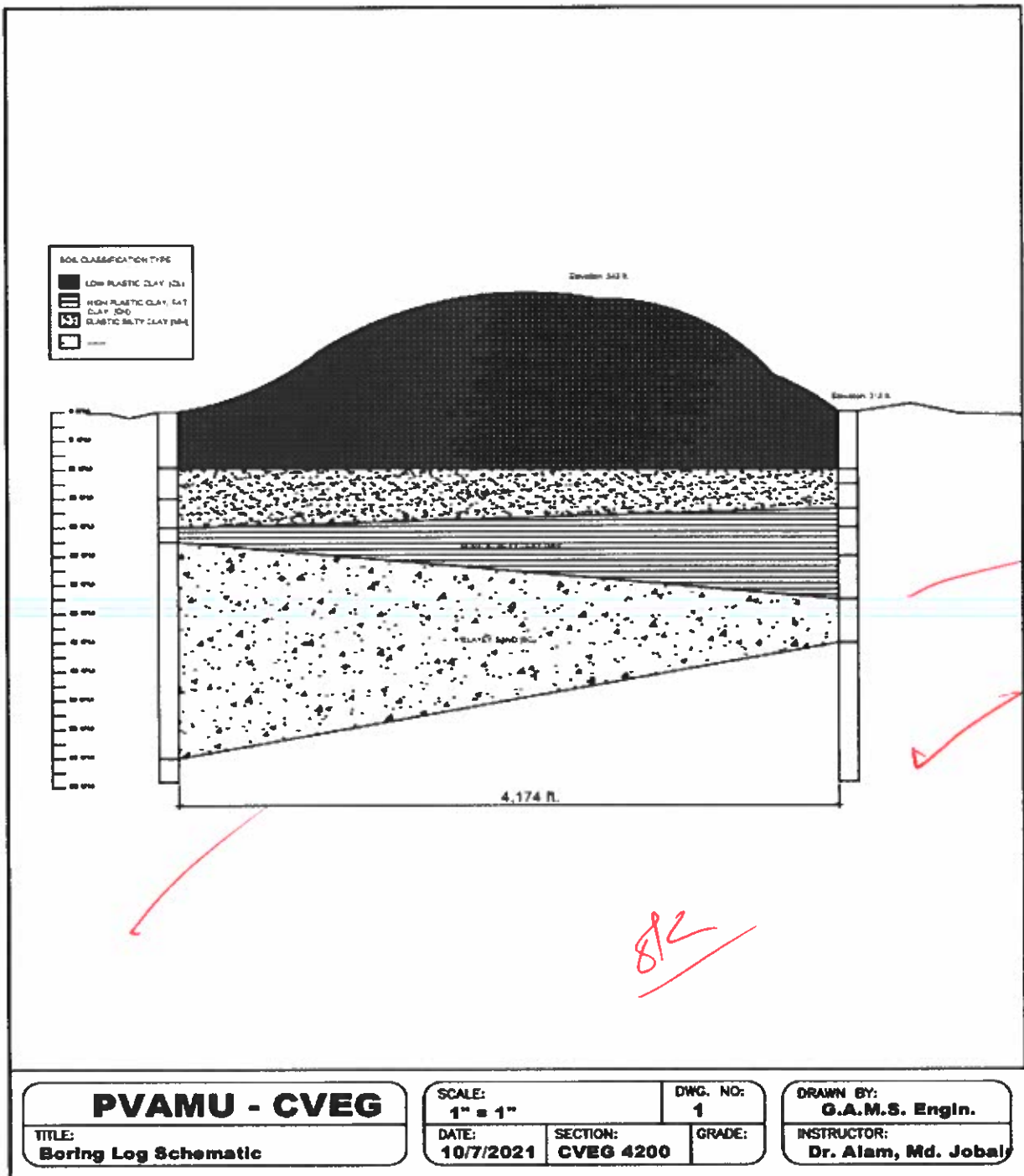


Figure 2. Soil Profile

Note: The Hatch not a clear depiction of the Cad version since not to scale. Some disorientation!

SOIL CLASSIFICATION

TABLE 2.7 AASHTO Soil Classification System

General classification		Granular materials (35% or less of total sample passing No. 200 sieve)					
Group classification	A-1		A-3	A-2			
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7
Sieve analysis (% passing)							
No. 10 sieve	50 max						
No. 40 sieve	30 max	50 max	51 min				
No. 200 sieve	15 max	25 max	10 max	35 max	35 max	35 max	35 max
For fraction passing							
No. 40 sieve							
Liquid limit (LL)				40 max	41 min	40 max	41 min
Plasticity index (PI)	6 max		Nonplastic	10 max	10 max	11 min	11 min
Usual type of material	Stone fragments, gravel, and sand		Fine sand	Silty or clayey gravel and sand			
Subgrade rating			Excellent to good				

General classification		Silt-clay materials (More than 35% of total sample passing No. 200 sieve)			
Group classification	A-4		A-5	A-6	A-7
					A-7-5 ^a A-7-6 ^b
Sieve analysis (% passing)					
No. 10 sieve					
No. 40 sieve					
No. 200 sieve	36 min		36 min	36 min	36 min
For fraction passing					
No. 40 sieve					
Liquid limit (LL)	40 max		41 min	40 max	41 min
Plasticity index (PI)	10 max		10 max	11 min	11 min
Usual types of material			Mostly silty soil	Mostly clayey soil	
Subgrade rating			Fair to poor		

^aIf $PI \leq LL - 30$, the classification is A-7-5.

^bIf $PI > LL - 30$, the classification is A-7-6.

Table 3: AASHTO Soil Classification

Applying Group index, $GI = (F-35) \times [0.2 + 0.005 \times (LL-40)] + 0.01 \times (F-15) \times (PI-10)$, F IS % OF PASSING #200

3.1 ULTIMATE BEARING CAPACITY SCHEMATIC

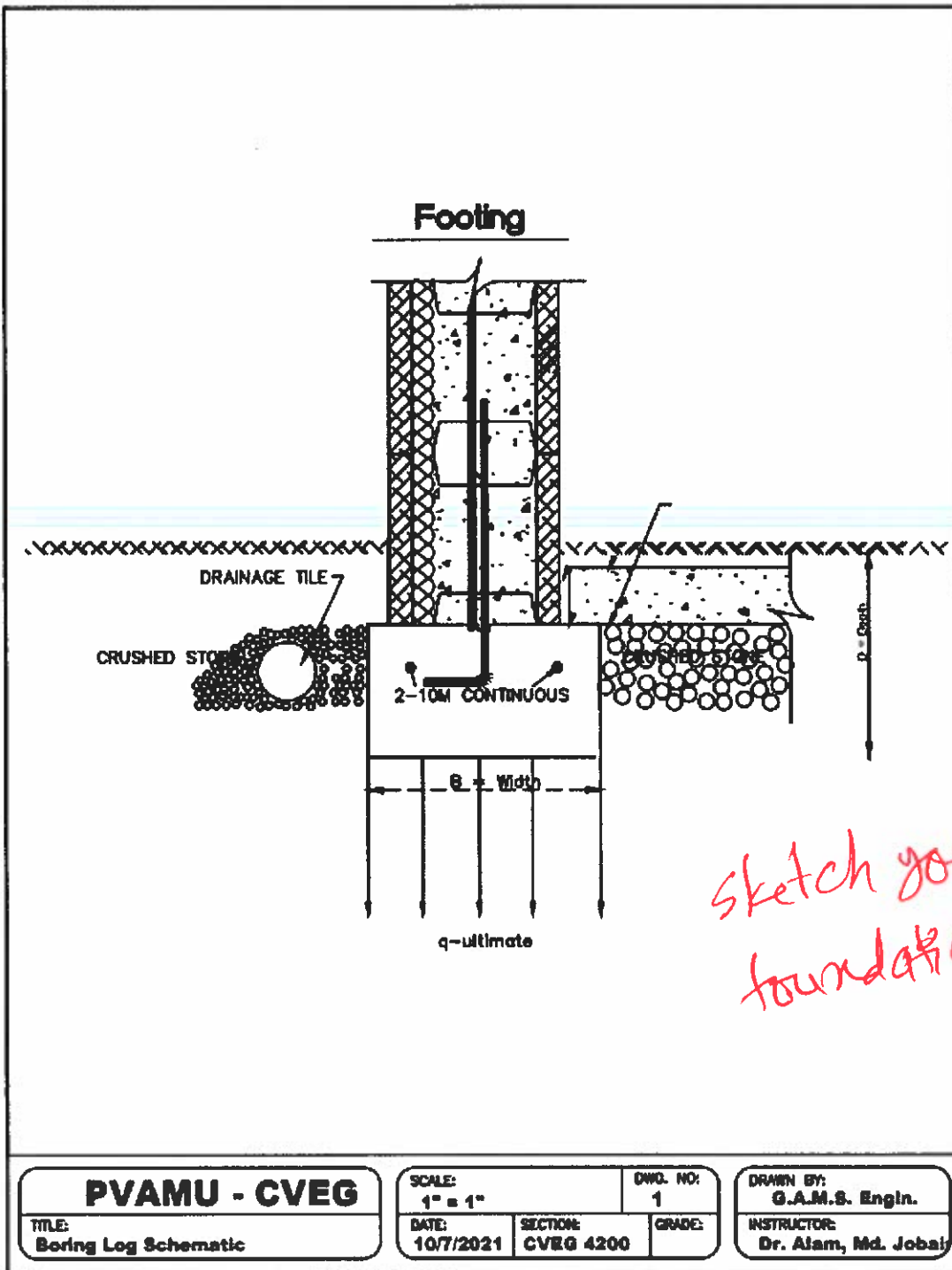
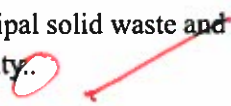


Figure 3. Footing Diagram

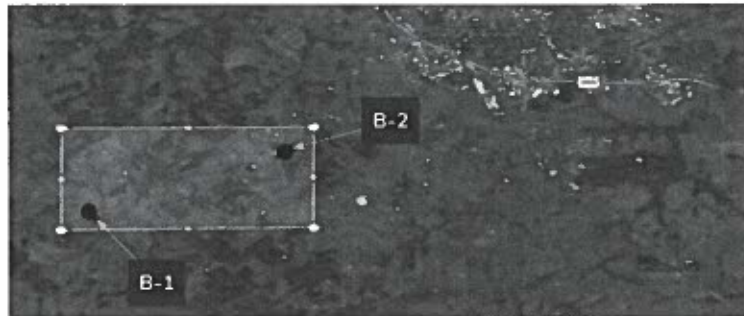
4.0 CONCLUSIONS AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine foundation, structural systems, and pipe support capabilities for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the foundation systems, as well as the construction of the detention basin, the pipe bedding and general earthwork recommendations. Allowable bearing capacity considers the gross loading, which includes weight of foundation concrete for elements placed below the existing ground and the loading from the superstructure. Based on plan information provided by G.A.M.S. Engineering, it is understood that the proposed Amazon hub site will support the two five-story commercial office building, a steel structure warehouse, a three-story convention center, parking lots, road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility..



APPENDIX I

Boring Locations



Topography Map



APPENDIX II

BORING LOGS

Definitions of Abbreviations

AS = Auger sample

HP = Unconfined compressive strength as determined by a hand penetrometer (tons per square foot)

LOI = Percent organic content (by weight) as determined by ASTM D2974 (loss on ignition test)

PID = Photo-ionization detector reading (parts per million)

QR = Unconfined compressive strength of intact rock core sample as determined by ASTM D2938
(pounds per square inch)

QU = Unconfined compressive strength of soil sample as determined by ASTM D2166 (pounds per square foot)

RC = Rock core sample

REC = Ratio of total length of recovered soil or rock to the total sample length, expressed as a percentage

RQD = Rock quality designation – estimate of the degree of jointing or fracture in a rock mass, expressed as a percentage:

$$\sum \frac{\text{segments equal to or longer than 4.0 inches}}{\text{Core Run Length}} \times 100$$

S = Sulfate content (parts per million)

SPT = Standard penetration test blow counts, per ASTM D1586. Driving resistance recorded in terms of blows per 6-inch interval while letting a 140-pound hammer free fall 30 inches to drive a 2-inch outer diameter (O.D.) split spoon sampler a total of 18 inches. The second and third intervals are added to obtain the number of blows per foot (Nm).

N_{60} = Measured blow counts corrected to an equivalent (60 percent) energy ratio (ER) by the following equation: $N_{60} = N_m * (ER/60)$

SS = Split spoon sample

2S = For instances of no recovery from standard SS interval, a 2.5 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 2S sampling are not correlated with N_{60} values.

3S = Same as 2S, but using a 3.0 inch O.D. split spoon sampler.

TR = Top of rock

USCS = Unified Soil Classification System per ASTM D2487

W = Initial water level measured during drilling

▼ = Water level measured at completion of drilling

Classification Test Data

Gradation (as defined on Description of Soil Terms):

GR = % Gravel

SA = % Sand

SI = % Silt

CL = % Clay

Atterberg Limits:

LL = Liquid limit

PL = Plastic limit

PI = Plasticity Index

WC = Water content (%)

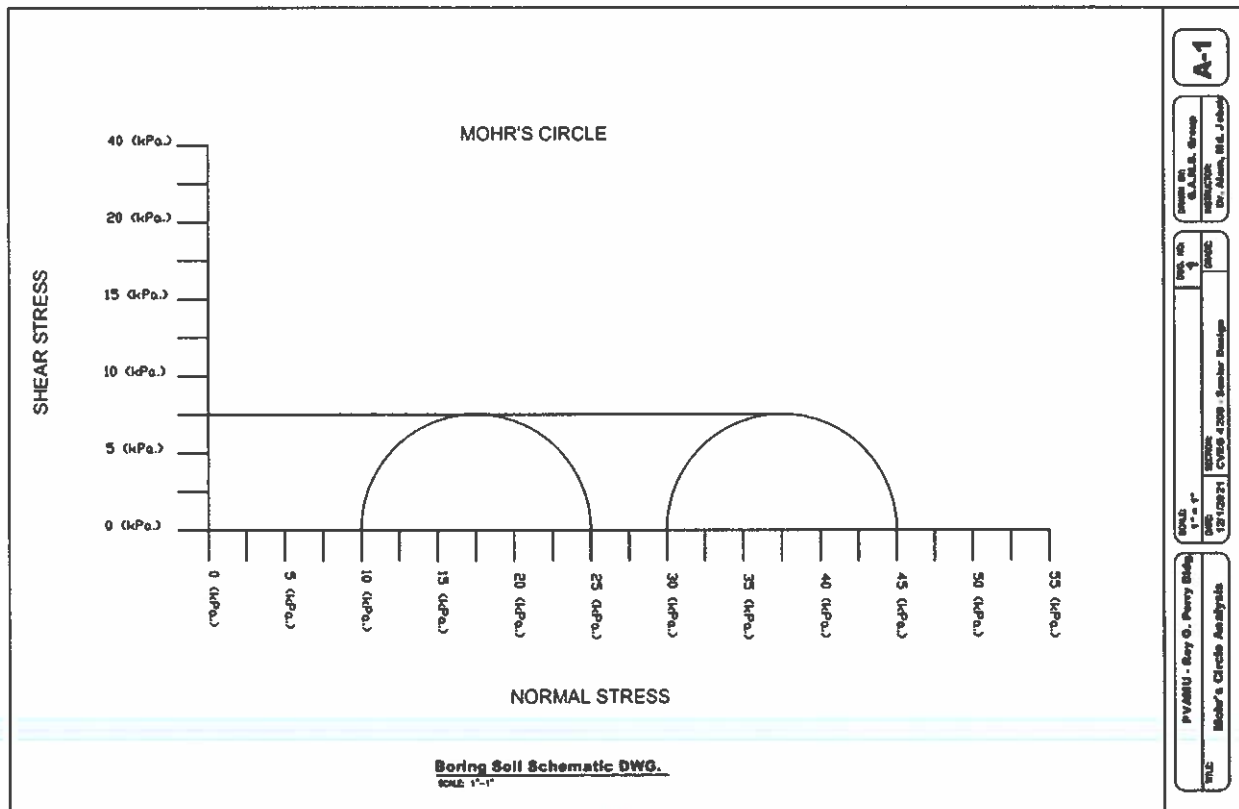


Figure 5. Mohr's Circle - of UU test → cor) from what depth

Determining Bearing Capacity Factors

Step 1:

Test 1: $\sigma_1 = \sigma_3 + \Delta\sigma_d \leftrightarrow \Delta\sigma_d = \sigma_1 - \sigma_3 = 25 \text{ kPa} - 10 \text{ kPa} = 15 \text{ kPa}$

Test 2: $\sigma_1 = \sigma_3 + \Delta\sigma_d \leftrightarrow \Delta\sigma_d = \sigma_1 - \sigma_3 = 45 \text{ kPa} - 30 \text{ kPa} = 15 \text{ kPa}$

Step 2:

$$\tau = c + \sigma_1 \tan(\phi) = 7.5 \text{ kPa} + 25 \text{ kPa} \times \tan(0) = 7.5 \text{ kPa} + 0 = 7.5 \text{ kPa}$$

Thus,

$$\begin{aligned} Q_{ult.} &= \text{Bearing Capacity}(BC) = 1.3 \times c \times N_c + q \times N_q + 0.4 \times \gamma \times B \times N_\gamma \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 + 0.4 \times \gamma \times B \times 0 \text{ (Table 4.2 in Appendix)} \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 \end{aligned}$$

Where, $q = \gamma \times D_f$

The “specific gravity” of soils and soil solids refers to the mass of solids in the soil compared to the mass of water at the same volume. The specific gravity of soil is actually an average of the specific gravity of all included soil particles. In general, the specific gravity tends to fall between 2.65 and 2.80, with coarser soils generally having lower specific gravities than finer soils.

font size is not consistent

A soil’s specific gravity largely depends on the density of the minerals making up the individual soil particles. However, as a general guide, some typical values for specific soil types are as follows:

- The specific gravity of the solid substance of most inorganic soils varies between 2.60 and 2.80.
- Tropical iron-rich laterite, as well as some lateritic soils, usually have a specific gravity of between 2.75 and 3.0 but could be higher.

- Sand particles composed of quartz have a specific gravity ranging from 2.65 to 2.67.
- Inorganic clays generally range from 2.70 to 2.80.
- Soils with large amounts of organic matter or porous particles (such as diatomaceous earth) have specific gravities below 2.60. Some range as low as 2.00.

In solving for the saturated unit clay we apply the below equation taking $w=12\%=0.12$ (at 7.5 feet) where G_s (Specific gravity) = 2.68

Next, we apply the SPT to the dry unit weight relationship to find the Degree of Saturation.

Table 21. Relationship among relative density, penetration resistance, dry unit weight, and angle of internal friction of cohesionless soils (after Duncan and Buchignani, 1976)

Descriptive Relative Density	Relative Density ..	Standard Penetration Resistance N_1 (see Note) *	Static Cone Resistance q_c	Angle of Internal Friction ϕ	Dry Unit Weight
	%	blows/foot	tsf or kgf/cm ²	degrees	KN/m ³
Very Loose	< 15	< 4	< 50	< 30	< 14
Loose	15 - 35	4 - 10	50 - 100	30 - 32	14 - 16
Medium Dense	35 - 65	10 - 30	100 - 150	32 - 35	16 - 18
Dense	65 - 85	30 - 50	150 - 200	35 - 38	18 - 20
Very Dense	85 - 100	> 50	> 200	> 38	> 20

* N_1 = N-value corrected to an effective vertical overburden pressure of 1.0 tsf or 100 kPa

** Freshly deposited, normally consolidated sand

Note: As originally proposed, this correlation used the uncorrected SPT blowcount, N_1 . However, hammers delivering 60% of the theoretical energy have been the most commonly used hammers for SPT tests, and it seems likely that the data on which the correlation was based was obtained primarily from tests with such hammers. It therefore seems logical to use $N_{1,60}$ with this correlation, and it is the recommendation of this report that this be done.

Note: $1 \frac{kN}{ft^3} = 6.366 \frac{lb}{ft^3} \rightarrow 16 \frac{kN}{ft^3} = 101.854 \frac{lb}{ft^3}$

Boring 1						Assume Gravel 0				
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
3,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
3,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2						Assume Gravel 0				
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

$$e \times s = G_s \times w \rightarrow e = \frac{G_s \times w}{s} = \frac{2.68 \times 0.12}{1} = 0.3216$$

Therefore, the saturated unit of clay is given by the below where

$$\gamma_w = 62.4 \frac{lb}{ft^3}$$

$$\gamma_{sat} = \frac{G_s \times (1+e)}{1+e} \times \gamma_w = \frac{2.68 + 0.3216}{1 + 0.3216} \times 62.4 \frac{lb}{ft^3} = 141.505 \frac{lb}{ft^3}$$

X too high not possible

Next, we calculate the dry density using the following equation:

$$\gamma_{dry} = \frac{\gamma_{sat}}{w+100} \times 100 \rightarrow \gamma_{sat} = \frac{\gamma_{dry} \times (w+100)}{100} = \frac{101.854 \frac{lb}{ft^3} \times (13+100)}{100} =$$

$$\gamma_{sat} = 115.095 \frac{lb}{ft^3} \quad \text{and} \quad \gamma_{dry} = 101.854 \frac{lb}{ft^3}$$

where:

γ_{dry} = dry unit weight, in pcf of compacted soil

γ_{sat} = wet unit weight, in pcf of compacted soil

w = percentage of moisture in the specimen

Bearing Capacity Equations (INCOMPLETE)

MEYERHOF EQUATION (Bearing Capacity):

Example: 6.1 Find the allowable, $Q_u = ?$

Approach:

$$\tau = c + \sigma_1 \tan(\phi) = 7.5 \text{ kPa} + 25 \text{ kPa} \times \tan(0) = 7.5 \text{ kPa} + 0 = 7.5 \text{ kPa}$$

Thus,

$$\begin{aligned} Q_{ult.} &= \text{Bearing Capacity}(BC) = 1.3 \times c \times N_c + q \times N_q + 0.4 \times \gamma \times B \times N_\gamma \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 + 0.4 \times \gamma \times B \times 0 \\ &= 1.3 \times 7.5 \text{ kPa} \times 5.14 + q \times 1 \end{aligned}$$

From Table 6.2, for $\phi = 0^\circ$, $N_c = 5.14$, $N_q = 1$, $N_\gamma = 0$

Also, Assuming foundation will be positioned at 7 feet.

$$q(\text{pressure}) = \gamma \times D_f = \gamma_{dry} \times D_f = 115.095 \frac{lb}{ft^3} \times 5 \text{ ft.} = 575.475 \frac{lb}{ft^2} = 27.554 \text{ kPa}$$

By simplification and direct substitution we obtain

$$Q_{ult.} = \text{Bearing Capacity}(BC) = 1.3 \times 7.5 \text{ kPa} \times 5.14 + 27.554 \text{ kPa} \times 1 = 77.669 \text{ kPa} = 1622.151 \frac{lb}{ft^2}$$

Next, $Q_{Allowable}$ is given by the below equation with a given Factor of safety at 3

$$Q_{\text{Allowable}} = \frac{Q_{\text{ult}}}{F.S.} = \frac{1622.151 \frac{\text{lb}}{\text{ft}^2}}{3} = 540.717 \frac{\text{lb}}{\text{ft}^2} \quad (Q = \text{Load; } q = \text{pressure } B \leq 485 \text{ good. If larger then increase foundation})$$

In order to Solve for B= ??? (Ny=0,)

We know the load applied, Q = (From ARMANDO GOMEZ) = $400 \frac{\text{lb}}{\text{ft}^2}$ (Should be pounds) and Area (Square) = B^2 . The stress developed at the footing base is given by the below where $S = Q_{\text{Allowable}}$

$$S = \frac{Q}{A} = \frac{400 \frac{\text{lb}}{\text{ft}^2}}{B^2} = \frac{400 \frac{\text{lb}}{\text{ft}^2}}{5^2} = 16 \frac{\text{lb}}{\text{ft}^2}$$

(Footing must be greater than Column size- coordinate with structural engineer. Can play with Df value. If the foundation size is greater than required then we are good.)

MATT FOUNDATION DESIGN

Matt Foundations on saturated Clays ($\phi = 0$) and a vertical loading condition ($=0$) the net ultimate bearing capacity

$$\begin{aligned} q_{\text{ult.}} &= c_u \times N_n \times F_m \times F_{cd} \times q \\ &= 5.14 \times C_u \times \left(1 + \frac{0.195 \times B}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q \\ &= 5.14 \times C_u \times \left(1 + \frac{0.195 \times 5}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q \end{aligned}$$

$$q_{\text{allowable net}} = \frac{q}{F.S.} = 1.713 \times C_u \times \left(1 + \frac{0.195 \times B}{L}\right) \times \left(1 + 0.4 \times \frac{D_f}{B}\right) + q$$

Or, the load-bearing capacity can be obtained based on Standard Penetration Test (SPT) and may be expressed as:

$$q_{\text{allowable net}} \left(\frac{\text{kip}}{\text{ft}^2}\right) = 0.25 \times N_{60} \left[1 + 0.33 \left(\frac{D_f}{B}\right)\right] [S_e(\text{in.})] \leq 0.33 \times N_{60} [S_e(\text{in.})]$$

<http://site.iugaza.edu.ps/ymadhoun/files/2016/09/Chapter-08.pdf>

SOLUTION: Using Meyerhof's Equation (Table 6.4 and Equation 6.19)

$$q_u = C \times N_c \times F_{cs} \times F_{cd} \times F_{ci} + q \times N_q \times F_{qs} \times F_{qd} \times F_{qi} + \frac{1}{2} \times \gamma \times B \times N_\gamma \times F_{\gamma s} \times F_{\gamma d} \times F_{\gamma i}$$

From Table 6.2, for $\phi = 0^\circ$, $N_c = 5.14$, $N_q = 1$, $N_\gamma = 0$

Also, Assuming foundation will be positioned at 7 feet.

$$q = \gamma \times D_f = \gamma_{dry} \times D_f = 144.332 \frac{lb}{ft^3} \times 7 ft. = 1,010.3245 \frac{lb}{ft^2}$$

Next, go to table 6.3 (equation table)

$$F_{cs} = 1 + \frac{B}{L} \times \frac{N_q}{N_c} = 1$$

$$F_{qs} = 1 + \frac{B}{L} \times \tan \phi = 1 + 0 \times \tan \phi = 1$$

$$F_{\gamma s} = 1 - 0.4 \times \frac{B}{L} = 1 - 0.4 \times 0 = 1$$

Table 6.3

$$\frac{D_f}{B} = \frac{1.5}{2} = 0.75 \leq 1$$

$$F_{qd} = 1 + 2 \times \tan \phi' (1 - \sin \phi')^2 \times \frac{D_f}{B} = 1 + 2 \times \tan 26^\circ (1 - \sin 26^\circ)^2 \times 0.75 = 1.23$$

$$F_{cd} = F_{qd} - \frac{1 - F_{qd}}{N_c \times \tan \phi} = 1.23 - \frac{1 - 1.23}{22.5 \times \tan 26^\circ} = 1.25$$

Since $\beta = 0^\circ$, we assumed $F_{ci} = F_{qi} = F_{\gamma i} = 1$

$$q_u = 931.8 \text{ kN/m}^2 \quad \text{and} \quad q_{allowable} = \frac{q_u}{F.S.} = \frac{931.8}{3} = 310.6 \text{ kN/m}^2$$

Next,

$$Q_{Allowable} = q_{allowable} \times \text{Area} = 310.6 \text{ kN/m}^2 \times 2m = 621 \text{ kN/m}$$

$$e = \frac{E_s}{E_c}$$

SETTLEMENT

Given:

$$\gamma_{sat} = 120 \text{ pcf}$$

$$e_o = 1.1173$$

$$\sigma'_c = 1.1 \text{ tcf} \quad \checkmark$$

$$C_c = 0.478 \quad \checkmark$$

$$C_s = 0.041 \quad \checkmark$$

Find:

$$S_c = ?$$

SOLUTION:

$$OCR = \frac{\sigma'_c}{\sigma'_o} \quad \checkmark$$

$$\sigma'_o = 6 \times 118 + 112(120 - 62.4) + 5(120 - 62.4) = 1,687.2 \text{ psf}$$

$$OCR = \frac{1.1 \times 2,000}{1,687.2} = 1.3 > 1 \text{ (Therefore soil is OC)} \quad \checkmark$$

Next, check if a Case 1 or Case 2

$$\sigma'_o + \Delta\sigma$$

$$X = 2, Y = 2$$

$$m = \frac{x}{2} = \frac{2}{17} = 0.118 \quad \checkmark$$

$$n = \frac{y}{2} = \frac{2}{17} = 0.118 \quad \checkmark$$

$$\Delta\sigma = 4 \times l \times q$$

Where

$$q = \frac{Q}{A} = \frac{14}{4 \times 4} = 0.94 \text{ tsf} = 1880 \text{ psf}$$

$$\Delta\sigma = 4 \times l \times q = 4 \times 0.014 \times 1880 = 105.28 \text{ psf}$$

$$\sigma'_o + \Delta\sigma = 1687.2 + 105.28 = 1792.48 \quad \checkmark$$

$$\sigma'_0 = 1.1 \times 2,000 = 2,200 \text{ psf}$$

CASE 2:

$$\sigma'_0 + \Delta\sigma < \sigma'_c$$

CASE 2:

$$S_c = \frac{c_s \times H}{4 \times 4} \times \log \log \left(\frac{\sigma'_0 + \Delta\sigma}{\sigma'_0} \right) = 0.058 \text{ ft} = 0.69 \text{ inches} < 1$$

Since the parameter is met then the soil is good and we are okay!

SHALLOW FOUNDATION DESIGN

DEEP FOUNDATION DESIGN (pg. 463 Ch. 12 Notes 10/20/2021)

$$\text{Total Capacity, } Q_u = Q_p + Q_s$$

Where

$$Q_p = \text{Tip Resistance/End Bearing} = A_p \times N_c \times C_u = 9 \times C_u \times A_p =$$

$$= 9 \times 7.5 \text{ kPa} \times (\text{Base} \times \text{Width})$$

$$= 9 \times 156.6407570477925 \text{ psf} \times (\text{Base} \times \text{Width})$$

$$= 9 \times 156.6407570477925 \text{ psf} \times (\text{Base} \times \text{Width})$$

$$Q_s = f \times P \times \Delta L = \alpha \times (2 \times \text{Base} + 2 \times \text{width}) \times L =$$

$$= f \times P \times \Delta L = \alpha \times C_u \times (2 \times \text{Base} + 2 \times \text{width}) \times L =$$

Note: 1 kilopascal = 20.88543423315 pounds per square foot

$$\gamma_1 - 0.4 \times \frac{B}{L} = 1 - 0.4 \times 0 = 1 \rightarrow \rightarrow$$

CAPACITY CURVES

need revision

Table 1a: Boring 1 Analysis for Circular Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	6361.725204	2544.690082	8906.415286
7.5	9542.587807	12087.27789	21629.86569
9	0	12087.27789	12087.27789
15	14137.16712	35177.98419	49315.15131
20	0	35177.98419	35177.98419
30	24033.18411	96062.05059	120095.2347
40	36756.63451	207148.7682	243905.4027
50	49480.08492	394073.5335	443553.6184
60	56548.66848	650427.4973	706976.1658
68	74220.12738	1031754.018	1105974.146

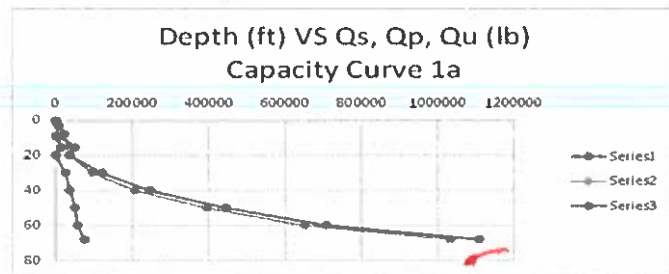
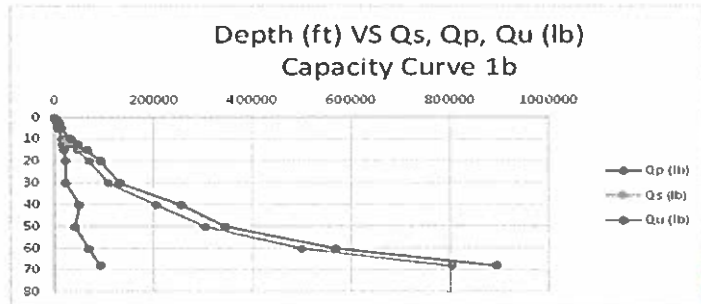


Table 1b: Boring 1 Analysis for Square Section Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	7068.58356	1675	8743.58356
5	9083.129875	5594.25	14677.37988
10	15197.45465	15914.25	31111.70465
12.5	16081.0276	29279.875	45360.9026
15	18873.11811	45700.375	64573.49311
20	22619.46739	70660.375	93279.84239
30	22619.46739	108100.375	130719.8424
40	50186.94328	204660.375	254847.3183
50	40997.78465	303260.375	344258.1597
60	67858.40218	499100.375	566958.7772
68	92598.44464	801972.375	894570.8196



distorted table. put figures in different pages.

Table 2a. Boring 1 Analysis for Circular Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	7,069	1675	8,743.58
5	9,083	5594.25	14,677.38
10	15,197	15,914.25	31,112
12.5	16,081	29,279.88	45,360.90
15	18,873	45,700.38	64,573.49
20	22,619.47	70,660.38	93,279.84
30	22619.46739	108100.375	130719.8424
40	50,187	204660.375	254,847.32
50	40,998	303260.375	344,258.16
60	67,858	499100.375	566,958.78
68	92598.44464	801972.375	894570.8196

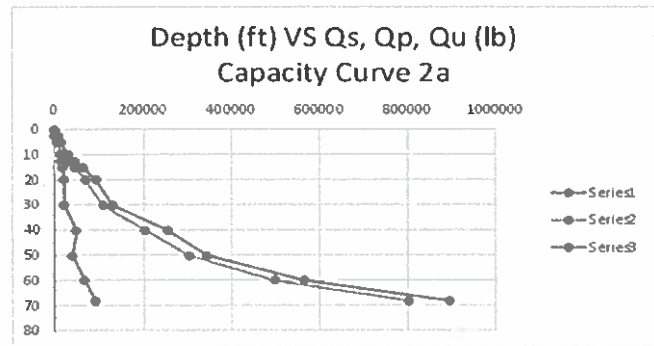
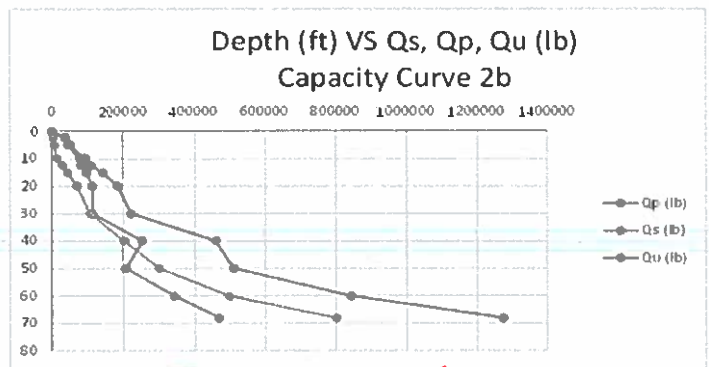


Table 2b. Boring 1 Analysis for Square Section Pile

Depth (ft)	Qp (lb)	Qs (lb)	Qu (lb)
0	0	0	0
2.5	36,000	1675	37,675.00
5	46,260	5594.25	51,854.25
10	77,400	15,914.25	93,314
12.5	81,900	29,279.88	111,179.88
15	96,120	45,700.38	141,820.38
20	115,200.00	70,660.38	185,860.38
30	115200	108100.375	223300.375
40	255,600	204660.375	460,260.38
50	208,800	303260.375	512,060.38
60	345,600	499100.375	844,700.38
68	471,600	801972.375	1,273,572.38



capacity curve
need revision

GEOTECHNICAL APPENDIX

APPENDIX III

BORING LOG DATA



CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG																																																																																																																																																																																																																																																														
PROJECT ID: CVEG 4200					TEST HOLE # <u>1</u>					SHEET NUMBER <u>1</u> of <u>1</u>																																																																																																																																																																																																																																																														
PROJECT: Business Center for Amazon					LOCATION: <u>South Texas</u>					DATE STARTED: _____																																																																																																																																																																																																																																																														
CLIENT: <u>AMAZON</u>					CLIENT: <u>AMAZON</u>					DATE FINISHED: _____																																																																																																																																																																																																																																																														
					CONTACT: <u>Dr. Alan</u>					DRILLER: _____																																																																																																																																																																																																																																																														
										LOGGER: _____																																																																																																																																																																																																																																																														
										REVIEWED BY: _____																																																																																																																																																																																																																																																														
DRILL LOG: <u>CME 75</u>					TEST HOLE DIAMETER (in): <u>8</u>					GROUND WATER DATA:																																																																																																																																																																																																																																																														
DRILLING METHOD: <u>Hollow 34</u>					TOTAL DEPTH (ft): <u>70</u>					DATE: <u>8/26/11</u>																																																																																																																																																																																																																																																														
CASING										TIME: <u>7-5</u>																																																																																																																																																																																																																																																														
<table border="1"> <thead> <tr> <th rowspan="2">DEPTH (FEET)</th> <th colspan="3">STANDARD PENETRATION</th> <th colspan="3">T-MDOT CONE</th> <th colspan="3">RECOVERY (in)</th> <th colspan="3">LEGEND</th> <th colspan="2" rowspan="2">SOIL DESCRIPTION</th> </tr> <tr> <th>0-4</th> <th>4-8</th> <th>8-12</th> <th>Blows</th> <th>qc (ksi)</th> <th>qc (MPa)</th> <th>Recovery</th> <th>NO RECOVERY</th> <th>NO RECOVERY</th> <th>NO RECOVERY</th> <th>NO RECOVERY</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>3</td> <td>3</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>12 PL -200 MC</td> </tr> <tr> <td>5</td> <td>3</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>43 16 71% 14%</td> </tr> <tr> <td>10</td> <td>3</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>47 19 81% 12%</td> </tr> <tr> <td>15</td> <td>3</td> <td>7</td> <td>8</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>51 21 69% 13%</td> </tr> <tr> <td>20</td> <td>8</td> <td>10</td> <td>10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>62 30 80% 15%</td> </tr> <tr> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>62 27 79 13%</td> </tr> <tr> <td>30</td> <td>9</td> <td>12</td> <td>13</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>69 28 83 17%</td> </tr> <tr> <td>35</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>40</td> <td>11</td> <td>18</td> <td>21</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>71 33 72 18%</td> </tr> <tr> <td>45</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>50</td> <td>13</td> <td>22</td> <td>24</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>69 34 79 19%</td> </tr> <tr> <td>55</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>60</td> <td>14</td> <td>26</td> <td>34</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>65</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>68</td> <td>18</td> <td>34</td> <td>50</td> <td>2"</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Bedrock</td> </tr> </tbody> </table>														DEPTH (FEET)	STANDARD PENETRATION			T-MDOT CONE			RECOVERY (in)			LEGEND			SOIL DESCRIPTION		0-4	4-8	8-12	Blows	qc (ksi)	qc (MPa)	Recovery	NO RECOVERY	NO RECOVERY	NO RECOVERY	NO RECOVERY	0	3	3	4											12 PL -200 MC	5	3	5	5											43 16 71% 14%	10	3	5	5											47 19 81% 12%	15	3	7	8											51 21 69% 13%	20	8	10	10											62 30 80% 15%	25														62 27 79 13%	30	9	12	13											69 28 83 17%	35															40	11	18	21											71 33 72 18%	45															50	13	22	24											69 34 79 19%	55															60	14	26	34												65															68	18	34	50	2"										Bedrock
DEPTH (FEET)	STANDARD PENETRATION			T-MDOT CONE			RECOVERY (in)			LEGEND			SOIL DESCRIPTION																																																																																																																																																																																																																																																											
	0-4	4-8	8-12	Blows	qc (ksi)	qc (MPa)	Recovery	NO RECOVERY	NO RECOVERY	NO RECOVERY	NO RECOVERY																																																																																																																																																																																																																																																													
0	3	3	4											12 PL -200 MC																																																																																																																																																																																																																																																										
5	3	5	5											43 16 71% 14%																																																																																																																																																																																																																																																										
10	3	5	5											47 19 81% 12%																																																																																																																																																																																																																																																										
15	3	7	8											51 21 69% 13%																																																																																																																																																																																																																																																										
20	8	10	10											62 30 80% 15%																																																																																																																																																																																																																																																										
25														62 27 79 13%																																																																																																																																																																																																																																																										
30	9	12	13											69 28 83 17%																																																																																																																																																																																																																																																										
35																																																																																																																																																																																																																																																																								
40	11	18	21											71 33 72 18%																																																																																																																																																																																																																																																										
45																																																																																																																																																																																																																																																																								
50	13	22	24											69 34 79 19%																																																																																																																																																																																																																																																										
55																																																																																																																																																																																																																																																																								
60	14	26	34																																																																																																																																																																																																																																																																					
65																																																																																																																																																																																																																																																																								
68	18	34	50	2"										Bedrock																																																																																																																																																																																																																																																										

caption?

CVEG 4200 Sr. Design and Professionalism										FIELD BORING LOG																																																																																																																																																																																																																																																																																																																																																																
PROJECT ID: CVEG 4200				TEST HOLE #2				SHEET NUMBER 1 of 1																																																																																																																																																																																																																																																																																																																																																																		
PROJECT: Business Center for Amazon				LOCATION: South Texas				DATE STARTED																																																																																																																																																																																																																																																																																																																																																																		
CLIENT: AMAZON				CLIENT: AMAZON				DATE FINISHED																																																																																																																																																																																																																																																																																																																																																																		
				CONTACT: Dr. Alan				DRILLER																																																																																																																																																																																																																																																																																																																																																																		
								LOGGER																																																																																																																																																																																																																																																																																																																																																																		
								REVIEWED BY																																																																																																																																																																																																																																																																																																																																																																		
DRILL RIG: CME-75		DRILLING METHOD: HSA		TEST HOLE DIAMETER (in): 8"		TOTAL DEPTH (ft): 70'		DATE: 8/26		TIME: 7:5																																																																																																																																																																																																																																																																																																																																																																
GROUND WATER DATA:		DATE:		TIME:		WATER DEPTH (ft):		REMARKS:																																																																																																																																																																																																																																																																																																																																																																		
<table border="1"> <thead> <tr> <th rowspan="2">DEPTH (FEET)</th> <th rowspan="2">SAMPLE</th> <th colspan="3">STANDARD PENETRATION</th> <th colspan="4">T-DOOT CONE</th> <th rowspan="2">RECOVERY (%)</th> <th rowspan="2">ROD (ft)</th> <th rowspan="2">HAND PEN</th> <th rowspan="2">LEGEND</th> <th rowspan="2">SOIL DESCRIPTION</th> </tr> <tr> <th>4"</th> <th>8"</th> <th>12"</th> <th>Tip</th> <th>Sleeve</th> <th>Friction</th> <th>Penetration</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>5</td> <td>6</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>6</td> <td>8</td> <td>5</td> <td>5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>15</td> <td>8</td> <td>8</td> <td>9</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>20</td> <td>10</td> <td>12</td> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>25</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>30</td> <td>10</td> <td>12</td> <td>12</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>35</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>40</td> <td>13</td> <td>24</td> <td>28</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>45</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>50</td> <td>16</td> <td>20</td> <td>22</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>55</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>60</td> <td>14</td> <td>31</td> <td>36</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>65</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>68</td> <td>13</td> <td>48</td> <td>50</td> <td>6-3"</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>70</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>75</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>80</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>85</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>90</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>95</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>100</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>												DEPTH (FEET)	SAMPLE	STANDARD PENETRATION			T-DOOT CONE				RECOVERY (%)	ROD (ft)	HAND PEN	LEGEND	SOIL DESCRIPTION	4"	8"	12"	Tip	Sleeve	Friction	Penetration	1	4	4	4	4											5	5	6	5	5											10	6	8	5	5											15	8	8	9												20	10	12	12												25															30	10	12	12												35															40	13	24	28												45															50	16	20	22												55															60	14	31	36												65															68	13	48	50	6-3"											70															75															80															85															90															95															100														
DEPTH (FEET)	SAMPLE	STANDARD PENETRATION			T-DOOT CONE				RECOVERY (%)	ROD (ft)	HAND PEN			LEGEND	SOIL DESCRIPTION																																																																																																																																																																																																																																																																																																																																																											
		4"	8"	12"	Tip	Sleeve	Friction	Penetration																																																																																																																																																																																																																																																																																																																																																																		
1	4	4	4	4																																																																																																																																																																																																																																																																																																																																																																						
5	5	6	5	5																																																																																																																																																																																																																																																																																																																																																																						
10	6	8	5	5																																																																																																																																																																																																																																																																																																																																																																						
15	8	8	9																																																																																																																																																																																																																																																																																																																																																																							
20	10	12	12																																																																																																																																																																																																																																																																																																																																																																							
25																																																																																																																																																																																																																																																																																																																																																																										
30	10	12	12																																																																																																																																																																																																																																																																																																																																																																							
35																																																																																																																																																																																																																																																																																																																																																																										
40	13	24	28																																																																																																																																																																																																																																																																																																																																																																							
45																																																																																																																																																																																																																																																																																																																																																																										
50	16	20	22																																																																																																																																																																																																																																																																																																																																																																							
55																																																																																																																																																																																																																																																																																																																																																																										
60	14	31	36																																																																																																																																																																																																																																																																																																																																																																							
65																																																																																																																																																																																																																																																																																																																																																																										
68	13	48	50	6-3"																																																																																																																																																																																																																																																																																																																																																																						
70																																																																																																																																																																																																																																																																																																																																																																										
75																																																																																																																																																																																																																																																																																																																																																																										
80																																																																																																																																																																																																																																																																																																																																																																										
85																																																																																																																																																																																																																																																																																																																																																																										
90																																																																																																																																																																																																																																																																																																																																																																										
95																																																																																																																																																																																																																																																																																																																																																																										
100																																																																																																																																																																																																																																																																																																																																																																										

Boring Log Classification

Boring 1					Assume Gravel 0					
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
8,3,4	2.5	43	16	27	71	14	CL	29%	Sandy Lean Clay	7
8,5,5	7.5	47	19	28	81	12	CL	19%	Sandy Lean Clay	10
4,8,7	9	-	-	-	20	6	-	80%	Sand	15
3,7,8	15	51	24	27	69	13	CH	31%	Sandy Fat Clay	15
8,10,10	20	-	-	-	16	8	-	84%	Sand	20
9,12,13	30	62	30	32	80	15	CH	20%	Sandy Fat Clay	25
11,18,21	40	62	27	35	79	13	CH	21%	Sandy Fat Clay	31
13,22,31	50	69	28	41	83	17	CH	17%	Sandy Fat Clay	53
17,26,34	60	71	33	38	72	18	CH	28%	Sandy Fat Clay	60
18,39,50	68	69	34	35	79	19	MH	21%	Sandy Elastic Silt	89

Boring 2										
SPT-Values	Depth (Feet)	LL	PL	Plastic Index, PI	Sieve No. 200	Water Content, %	Plasticity Chart	Coarse Fraction, %	Classification	N
4,4,4	2.5	48	20	28	54	13	CL	46	Sandy Lean Clay	8
5,5,5	5	51	32	19	69	14	MH	31	Sandy Elastic Silt	10
6,8,8	10	-	-	-	-	8	-	-	Sand	16
8,8,9	12.5	46	19	27	74	18	CL	26	Sandy Lean Clay	17
8,10,10	17	-	-	-	-	10	-	-	Sand	20
10,12,12	20	32	16	16	54	13	CL	46	Sandy Lean Clay	24
-	25	60	31	29	81	21	MH	19	Sandy Elastic Silt	-
10,12,12	30	72	31	41	82	20	CH	18	Sandy Fat Clay	24
13,26,28	40	68	34	34	62	4	MH	38	Sandy Elastic Silt	54
16,20,22	50	80	39	41	69	18	MH	31	Sandy Elastic Silt	44
14,34,38	60	68	34	34	84	20	MH	16	Sandy Elastic Silt	72
13,48,50	68	-	-	-	-	-	-	-	-	98

Table No?
Title.

TABLE 2.3 Relationships for γ , γ_d , and γ_{sat}

Unit weight relationship	Dry unit weight	Saturated unit weight
$\gamma = \frac{(1+w)G_s\gamma_w}{1+e}$	$\gamma_d = \frac{\gamma}{1+w}$	$\gamma_{sat} = \frac{(G_s+e)\gamma_w}{1+e}$
$\gamma = \frac{(G_s+Se)\gamma_w}{1+e}$	$\gamma_d = \frac{G_s\gamma_w}{1+e}$	$\gamma_{sat} = [(1-n)G_s+n]\gamma_w$
$\gamma = \frac{(1+w)G_s\gamma_w}{1+\frac{wG_s}{S}}$	$\gamma_d = G_s\gamma_w(1-n)$	$\gamma_{sat} = \left(\frac{1+w}{1+wG_s}\right)G_s\gamma_w$
$\gamma = G_s\gamma_w(1-n)(1+w)$	$\gamma_d = \frac{G_s}{1+\frac{wG_s}{S}}\gamma_w$	$\gamma_{sat} = \left(\frac{e}{w}\right)\left(\frac{1+w}{1+e}\right)\gamma_w$
	$\gamma_d = \frac{eS\gamma_w}{(1+e)w}$	$\gamma_{sat} = \gamma_d + n\gamma_w$
	$\gamma_d = \gamma_{sat} - n\gamma_w$	$\gamma_{sat} = \gamma_d + \left(\frac{e}{1+e}\right)\gamma_w$
	$\gamma_d = \gamma_{sat} - \left(\frac{e}{1+e}\right)\gamma_w$	

TABLE 2.4 Specific Gravities of Some Soil

Type of soil	G_s
Quartz sand	2.64–2.66
Silt	2.67–2.73
Clay	2.70–2.90
Chalk	2.60–2.75
Loess	2.65–2.73
Peat	1.30–1.90
Mine tailings	2.80–4.50

these things go to
appendix

Table 4.2 Bearing Capacity Factors

ϕ'	N_c	N_q	N_γ	ϕ'	N_c	N_q	N_γ
0	5.14	1.00	0.00	16	11.63	4.34	3.06
1	5.38	1.09	0.07	17	12.34	4.77	3.53
2	5.63	1.20	0.15	18	13.10	5.26	4.07
3	5.90	1.31	0.24	19	13.93	5.80	4.68
4	6.19	1.43	0.34	20	14.83	6.40	5.39
5	6.49	1.57	0.45	21	15.82	7.07	6.20
6	6.81	1.72	0.57	22	16.88	7.82	7.13
7	7.16	1.88	0.71	23	18.05	8.66	8.20
8	7.53	2.06	0.86	24	19.32	9.60	9.44
9	7.92	2.25	1.03	25	20.72	10.66	10.88
10	8.35	2.47	1.22	26	22.25	11.85	12.54
11	8.80	2.71	1.44	27	23.94	13.20	14.47
12	9.28	2.97	1.69	28	25.80	14.72	16.72
13	9.81	3.26	1.97	29	27.86	16.44	19.34
14	10.37	3.59	2.29	30	30.14	18.40	22.40
15	10.98	3.94	2.65	31	32.67	20.63	25.99

(continued)

Table 4: Bearing Capacity Factors

Structural Engineering

Introduction

The structural design is part of phase B of the project. The Amazon Hub in Washington County encompasses the structural design of two five-story commercial office buildings, a single-story steel Amazon warehouse, and a three-story convention center building. The Amazon distribution center will be a single story warehouse with a total gross area of one million square feet. Its design requirements are that of a single story with a steel frame. One of the five-story commercial buildings will be utilized as office space for Amazon. The second five-story building is to be designed as an IT Hub. The last building will be a convention center and will be three stories steel structure design.

Building Geometry and Utilization

The initial step taken in the structural design process is to have a good understanding of what the structure is to be utilized and its geometric design. The Amazon warehouse is to be the central hub for distribution. Is to be rectangular to be able to accommodate large space for storage that will be utilized as a distribution center. The length of the building is to be 2000ft lby 500ft for a total of 1M square feet facility. The floor layout then would require large open spacing for use storage and for equipment machinery to move around freely. Minimizing then the amount of columns supporting the structure would utilize the floor layout to its fullest potential and storage space. As standard storage racks are 48in in depth. The average height of the racks are 20-28ft. The rack heights need to be taken into account as to have plenty of ceiling space for the rack heights for storing the packages that would later be transported to their final destination.

The Amazon five-story buildings for the IT hub and office space have a different set of requirements that would need to be taken into account in its design. The buildings are to twins of each other as they will both be identail in design of each other. Its rectangular design is to

provide ample work space. The dimensions are to be 300ft by 200ft for a total of 60,000ft² per floor having a total floor space of 300,000ft² per building. Utilizing spacing between the columns for optimal office and IT space.

The convention center design will be required to follow standards for its design. As this building will be a mixed use facility and would need to adhere to them. The building will be that of a three-story building with the dimension of 500ft by 300ft for a total of 150,000ft² per floor and a building total of 450,000ft². This building will also utilize columns optimal spacing to achieve the most spacing for the convention center to utilize for occupancy and accommodate large open spaces for convention center events

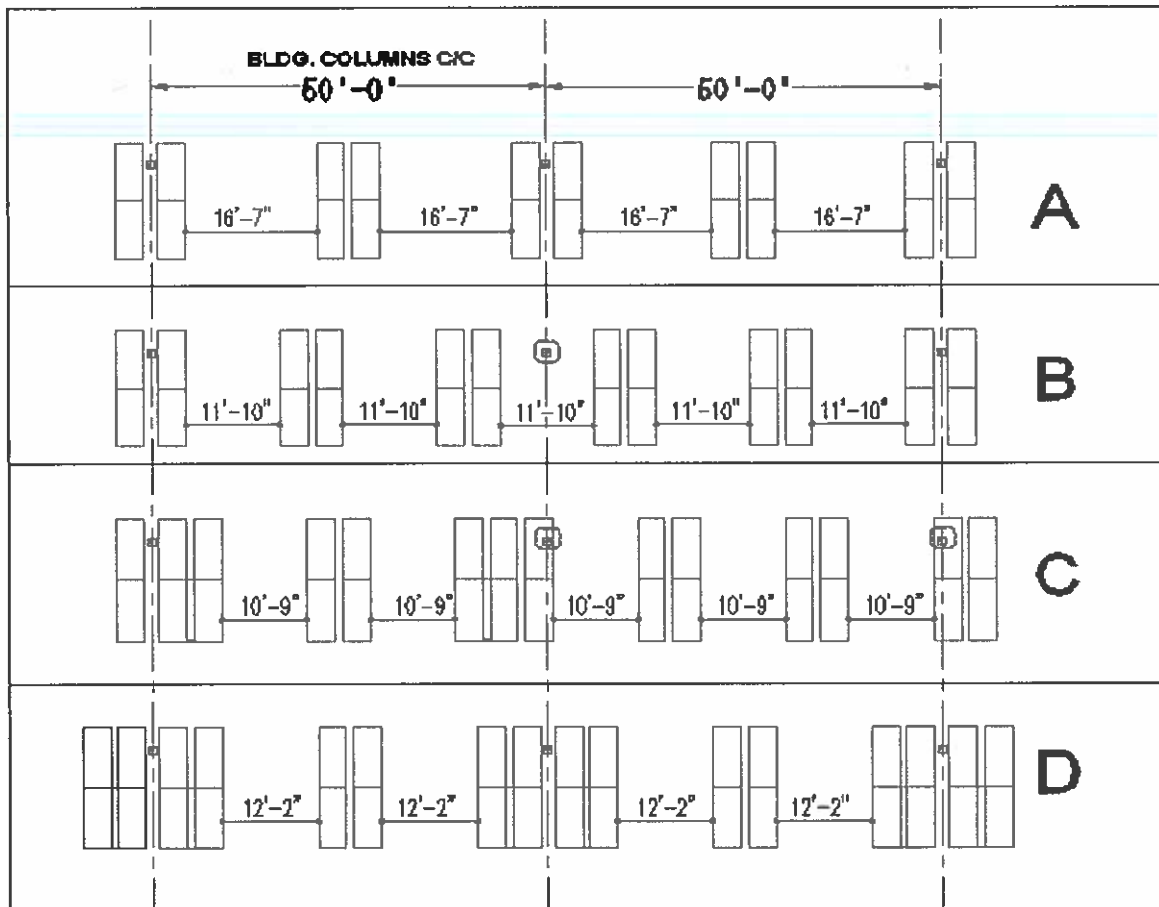


Figure 01: 50ft Column Spacing to maximize storage bays

Loading and standards

It is important when designing the building that all loads are considered so the building can withstand them. The loads that are applied are broken down into dead loads, live loads, and environmental loads (wind loads, snow loads, etc.). This is an important part of the design phase as to be able to anticipate the loads the structures would endure. Depending on the building use different sets of guidelines would be followed in order to accommodate its use as the environmental loads depending on its location. As in some areas are more prone to different weather patterns that need to be taken into consideration during the design stage.

Dead loads

Dead Loads consist of the permanent loads that are affixed to the structure itself. These include the self-weight of the structure, architectural features, fixed service equipment such as heating and air-conditioning systems, sprinkler systems, and utility services. (Williams).

Live loads Live loads are defined in ASCE 7 Sec. 4.1 as loading on a floor produced by the occupancy or use of the building that does not include construction loads, dead loads, or environmental loads. (Williams)

Wind Loads

Wind loads are loads that impact the exterior of the building produced by the wind. The wind exerts forces that can tear roofs from buildings. The building's roof overhang can have air build up a force and cause an uplift. There are three types of wind forces: uplift load, shear load and lateral load.

Load and Resistance Factor design (LRFD)

For the design of the buildings the use of the LRFD will be used to provide the load calculation of the buildings.

Load Types

Loads used in design load equations are given letters by type:

D = dead load

L = live load

L_r = live roof load

W = wind load

S = snow load

E = earthquake load

R = rainwater load or ice water load

T = effect of material & temperature

H = hydraulic loads from soil

F = hydraulic loads from fluids

ASCE-7 (2010) combinations of factored nominal loads:

1. $1.4D$
2. $1.2D + 1.6L + 0.5(L, \text{ or } S \text{ or } R)$
3. $1.2D + 1.6(L, \text{ or } S \text{ or } R) + (L \text{ or } 0.5W)$
4. $1.2D + 1.0W + L + 0.5(L, \text{ or } S \text{ or } R)$
5. $1.2D + 1.0E + L + 0.2S$
6. $0.9D + 1.0W$
7. $0.9D + 1.0E$

When *F* loads are present, they shall be included with the same load factor as dead load *D* in 1 through 5 and 7.

When *H* loads are present, they shall have a load factor of 1.6 when adding to load effect, or 0.9 when resisting the load when permanent.

Figure 01: ASCE-7 Combination of factored nominal loads

Occupancy or Use		Uniform (psf)	Concentrated (lbs)
Access Floor Systems	Office Use	50	2000
	Computer Use	100	2000
Roof	Roof Area not intended for occupancy	20	---
	Roof area used for other occupancy	Same as occupancy served	---
	Primary Roof Members Exposed to a work floor		

Roof	Single panel point of lower chord of roof trusses of any point along primary structural member supporting roofs over manufacturing, storage warehouse, and repair garages	---	2000
	All other Primary Roof Members	---	300
Storage Warehouse (Shall be designed for heavier loads if required for anticipated storage)	Heavy	250	---
	Light	150	---

Figure 03: Table 1607.1 Minimum Uniformly Distributed Live Loads

Building Layout

The building's floor plan was critical in the design process of the building. This is dependent on the use of each individual building. Designation of beam sizes and types is subject to change once it has been run through STAAD Pro its output.

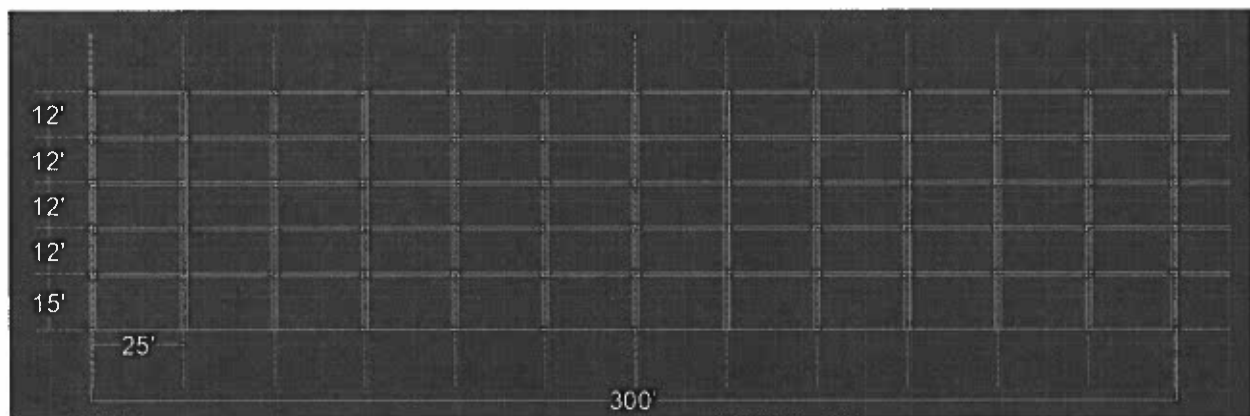


Figure 04: IT Hub and office space building side view

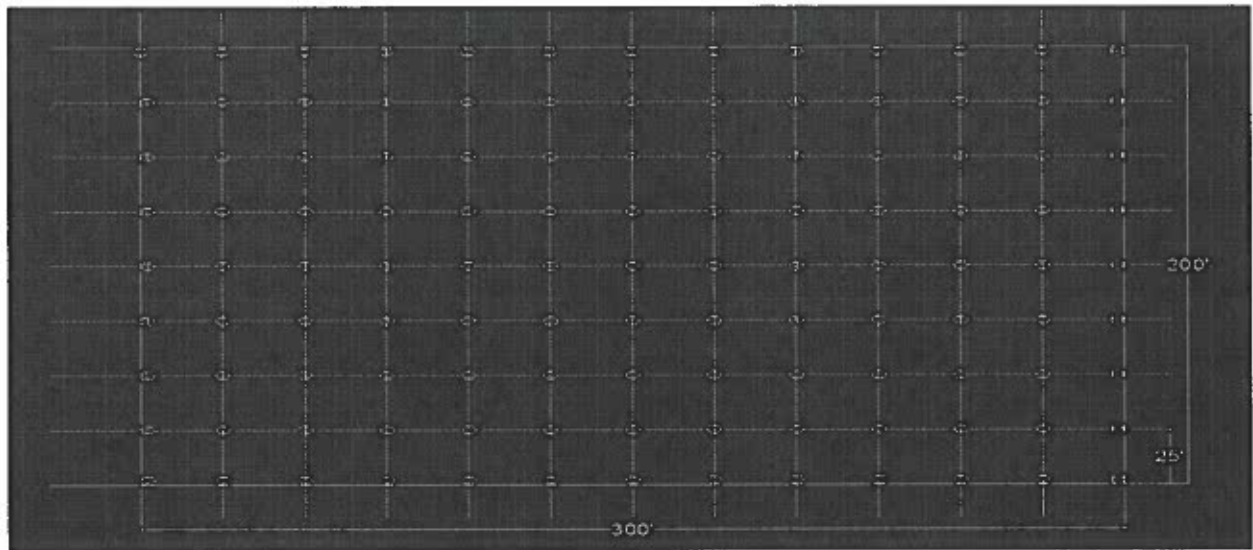


Figure 05: IT Hub and office space building top view of a typical floor

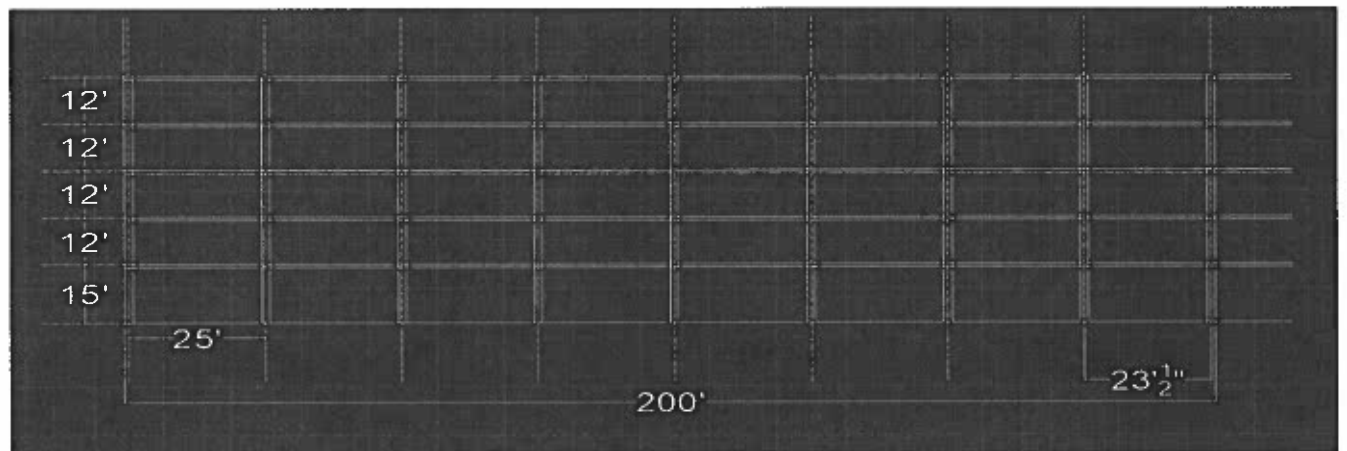


Figure 06: IT Hub and office space building view of front of building

check with structural faculty.

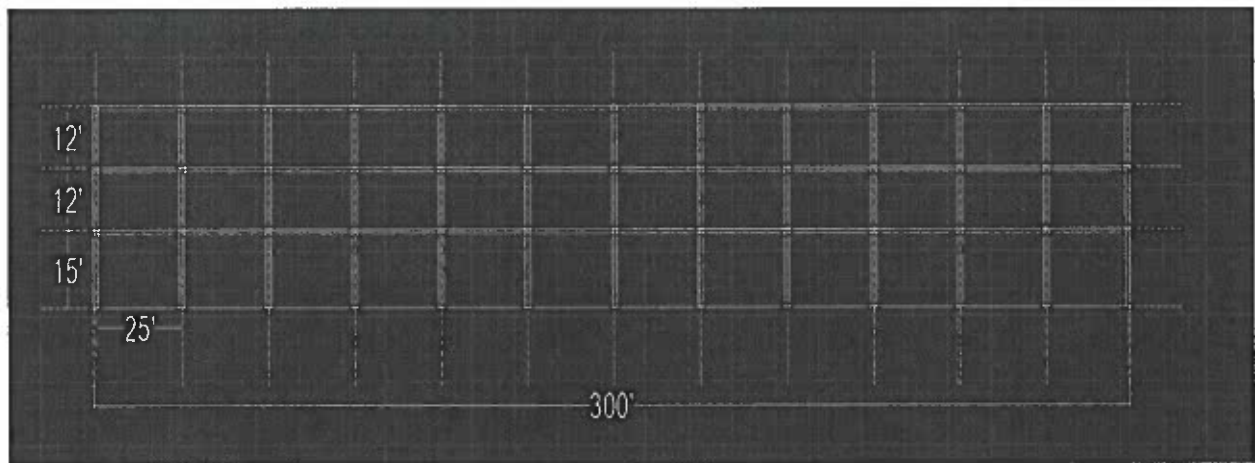


Figure 07: Convention Center front view of the building

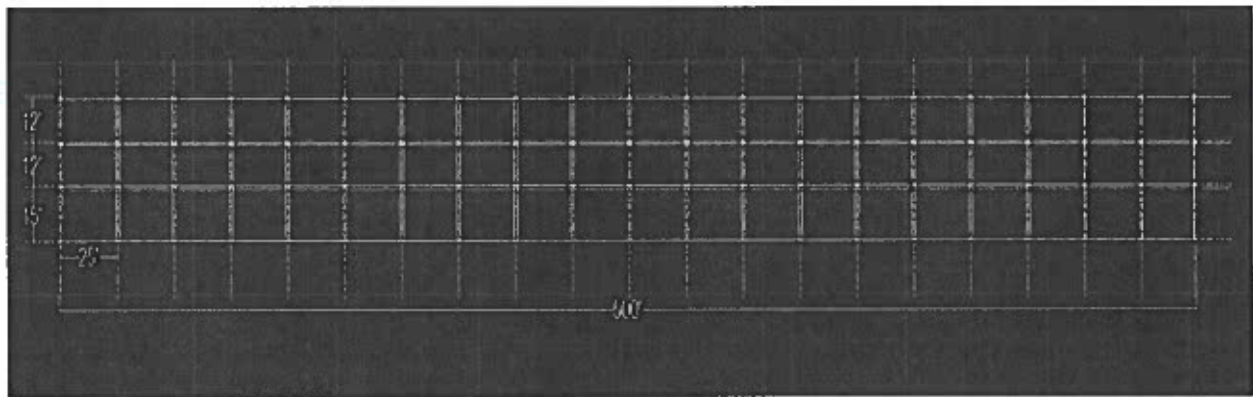


Figure 08: Convention Center side view of building

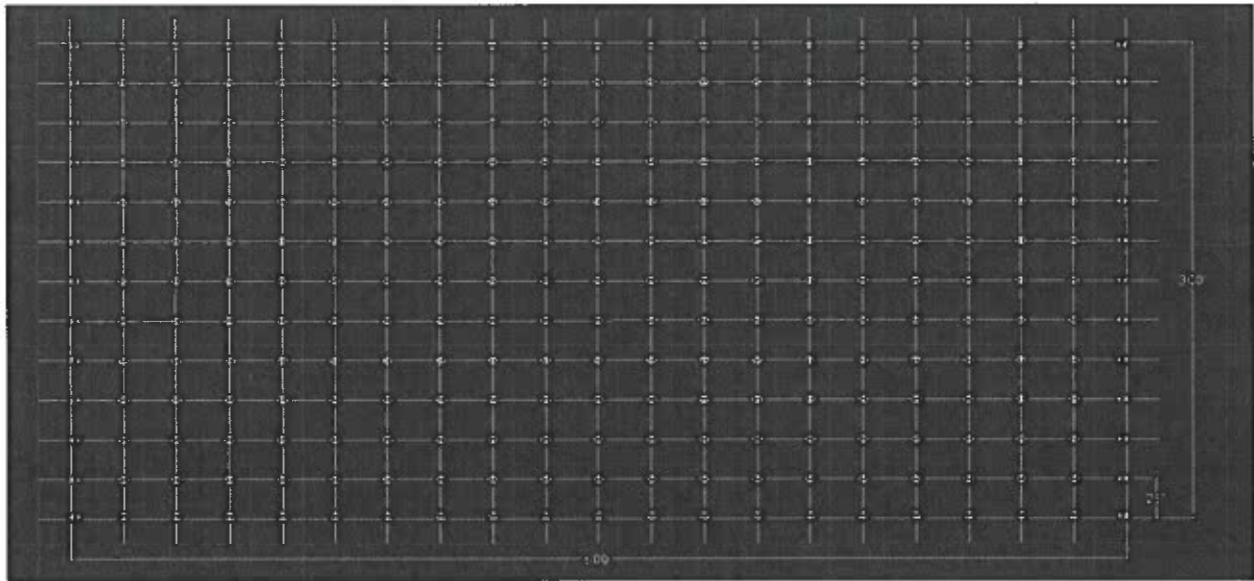


Figure 08: Convention Center top view of a typical floor

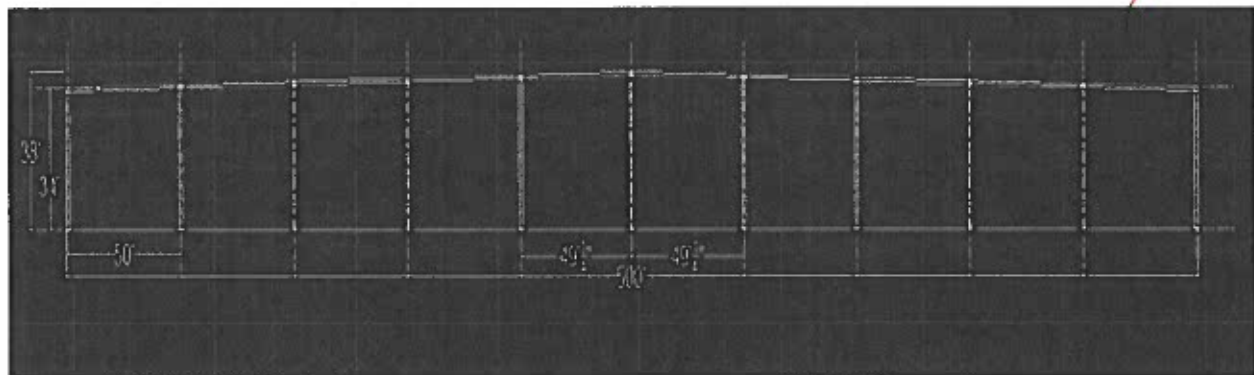


Figure 09: Amazon warehouse front view

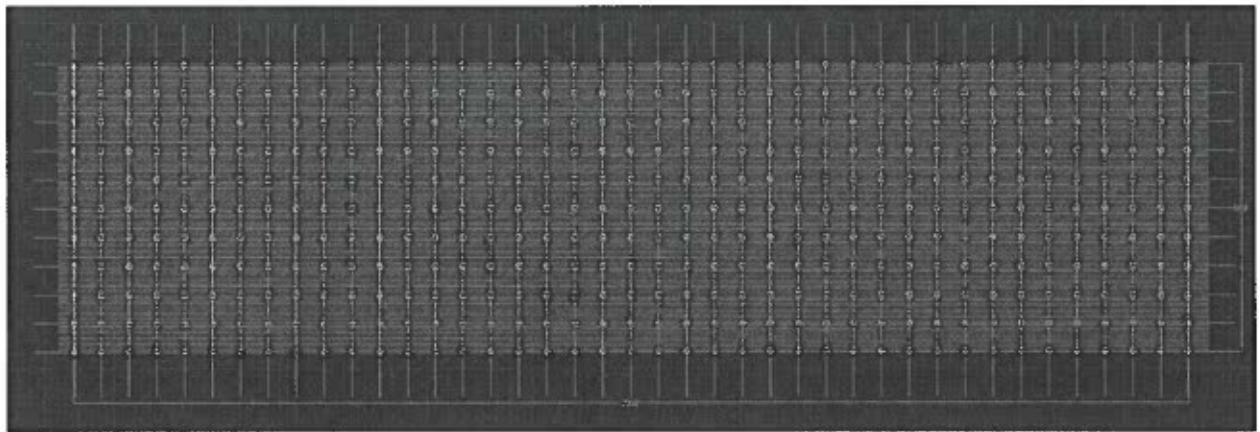


Figure 10: Amazon warehouse top view

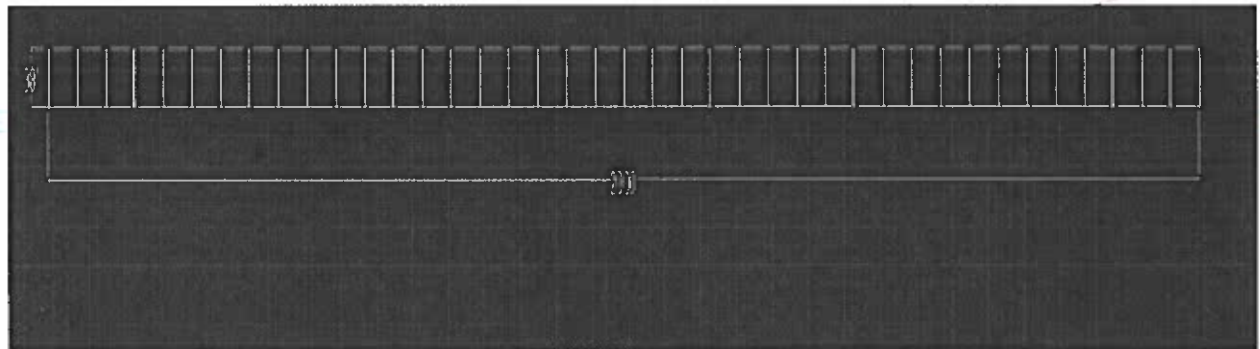


Figure 11: Amazon Warehouse side view of building

Joist Beam

The design of the joist is to provide additional lateral support of the roof load and any additional equipment that will be suspended on the ceiling. The joist will run perpendicular to beams that are spaced 50ft apart. They will run parallel to the long side of the warehouse denoted by Figure 04 joist evenly spaced 5ft from beam to joist center. Using the roof live load given to calculate the beam size to be used. The dead load would be the weight of the beam would be given in lb/ft on Table 1.1 from the Steel Manual on Figure 04 & 05.

When

W = Weight

DL = 15 lb/ft (W8x15)

LL_R = 2000 lbs => (2000 lbs) / (50ft) = 40lbs/ft => (40lbs/ft) / (5ft) = 8psf

$$W = D_L + L_L$$

$$W = 15\text{lbs/ft} + 40\text{ lbs/ft}$$

$$W = 55\text{ lbs/ft}$$

Now we will need to calculate the maximum shear and bending moment to see if the beam chosen would work for this application. Using Table 3-23 from Figure 06 from the steel manual.

When

$$V_{\text{Max}} = WL/2$$

$$V_{\text{Max}} = (55\text{ lbs/ft} * 50\text{ft}) / 2$$

$$V_{\text{Max}} = 1,375\text{ lbs/ft} \Rightarrow 1.38\text{ kip/ft}$$

$$M_{\text{Max}} = WL^2 / 8$$

$$M_{\text{Max}} = (55\text{lb/ft} * 50^2\text{ft}) / 8$$

$$M_{\text{Max}} = 17,187.5\text{ lbs} * \text{ft} \Rightarrow 17.19\text{ kips*ft}$$

Check Answers:

$$V_{\text{Max}} < \phi_V V_{nx}$$

1.38 kips < 59.6 Shear is Okay

$$M_{\text{Max}} < \phi_b M_n$$

17.19 kips*ft < 21.5 kips*ft Bending Moment is Okay

The results of the moment and shear provide that the beam for the joist would work to support the roof structure of the warehouse. All the following calculations will be done through Staad Pro as there is the number of calculations that would be provided through the report.

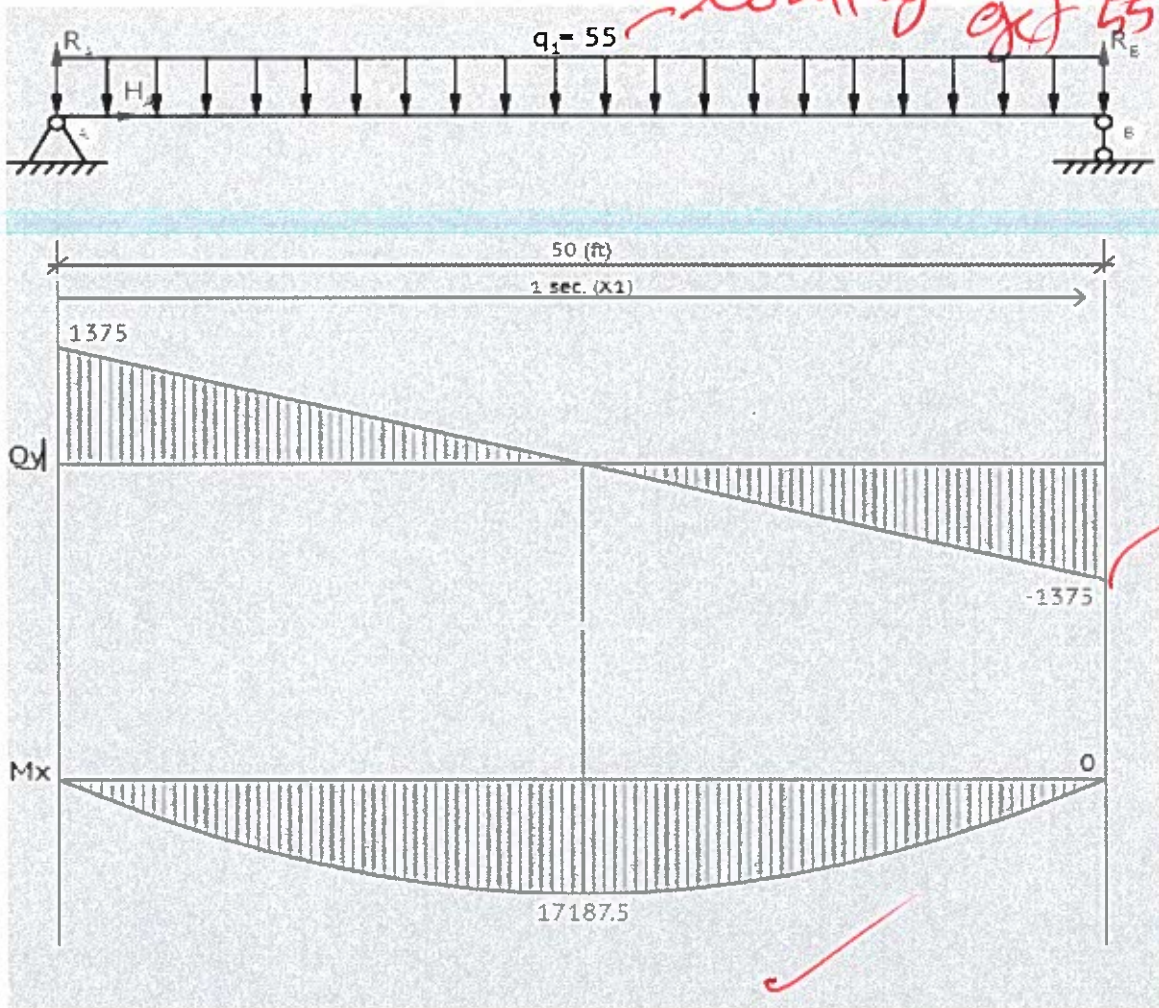


Figure 12: Shear and bending moment of joist

Table 1-1 (continued)
W-Shapes
Dimensions

Shape	Area, A	Depth, d	Web		Flange		Distances					Work- able Gage			
			Thickness, t _w	$\frac{L}{2}$	Width, b _f	Thickness, t _f	k		k ₁	T					
							k _{des}	k _{net}							
	in. ²	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.				
WB-67	19.7	9.00	9	0.570	8 1/4	5/16	8.28	8 1/4	0.935	1 1/8	1.33	1 1/8	15/16	5 3/4	5 1/2
x58	17.1	8.75	8 3/4	0.510	1/2	1/4	8.22	8 1/4	0.810	1 1/8	1.20	1 1/2	7/8	↓	↓
x48	14.1	8.50	8 1/2	0.400	3/8	3/16	8.11	8 1/8	0.685	1 1/8	1.08	1 1/8	13/16	↓	↓
x40	11.7	8.25	8 1/4	0.360	3/8	3/16	8.07	8 1/8	0.590	9/16	0.954	1 1/4	13/16	↓	↓
x35	10.3	8.12	8 1/8	0.310	5/16	3/16	8.02	8	0.495	1/2	0.889	1 1/8	13/16	↓	↓
x31 ¹	9.13	8.00	8	0.285	5/16	3/16	8.00	8	0.435	7/16	0.829	1 1/4	1 1/4	↓	↓
WB-28	8.25	8.08	8	0.285	5/16	3/16	6.54	6 1/2	0.465	7/16	0.859	1 5/16	5/8	6 1/4	4
x24	7.08	7.83	7 7/8	0.245	1/4	1/8	6.50	6 1/2	0.400	3/8	0.794	7/8	9/16	6 1/4	4
WB-21	6.16	8.28	8 1/4	0.250	1/4	1/8	5.27	5 1/4	0.400	3/8	0.700	7/8	9/16	6 1/2	2 1/4
x18	5.26	8.14	8 1/8	0.230	1/4	1/8	5.25	5 1/4	0.330	5/16	0.630	1 3/16	9/16	6 1/2	2 1/4
WB-15	4.44	8.11	8 1/8	0.245	1/4	1/8	4.02	4	0.315	5/16	0.615	1 3/16	9/16	6 1/2	2 1/4
x13	3.84	7.89	8	0.230	1/4	1/8	4.00	4	0.255	1/4	0.555	3/4	9/16	↓	↓
x10 ²	2.99	7.89	7 7/8	0.170	3/16	1/8	3.94	4	0.205	3/16	0.505	1 1/16	1/2	↓	↓
WB-25	7.34	8.38	8 3/8	0.320	5/16	3/16	6.08	6 1/8	0.455	7/16	0.705	1 5/16	9/16	4 1/2	3 1/2
x20	5.87	8.20	8 1/4	0.280	1/4	1/8	6.02	6	0.365	3/8	0.615	7/8	9/16	↓	↓
x15 ¹	4.43	5.99	6	0.230	1/4	1/8	5.99	6	0.290	1/4	0.510	3/4	9/16	↓	↓
WB-18	4.74	8.28	8 1/4	0.260	1/4	1/8	4.03	4	0.405	3/8	0.655	7/8	9/16	4 1/2	2 1/4
x12	3.55	8.03	8	0.230	1/4	1/8	4.00	4	0.290	1/4	0.530	3/4	9/16	↓	↓
x9 ¹	2.68	5.90	5 7/8	0.170	3/16	1/8	3.94	4	0.215	3/16	0.485	1 1/16	1/2	↓	↓
x8.5 ¹	2.52	5.83	5 7/8	0.170	3/16	1/8	3.94	4	0.195	3/16	0.445	1 1/16	1/2	↓	↓
WB-10	5.58	5.15	5 1/8	0.270	1/4	1/8	5.03	5	0.430	7/16	0.730	1 3/16	7/8	3 1/2	2 1/4
x18	4.71	5.01	5	0.240	1/4	1/8	5.00	5	0.360	3/8	0.660	3/4	7/8	3 1/2	2 1/4
WB-13	3.83	4.18	4 1/8	0.280	1/4	1/8	4.08	4	0.345	3/8	0.595	3/4	1/2	2 1/4	2 1/4

¹ Shape is slender for compression with $F_y = 50$ ksi.

² Shape exceeds compact limit for flexure with $F_y = 50$ ksi.

³ The actual size, combination and orientation of fastener components should be compared with the geometry of the cross section to ensure compatibility.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 13: Steel Manual Table 1-1

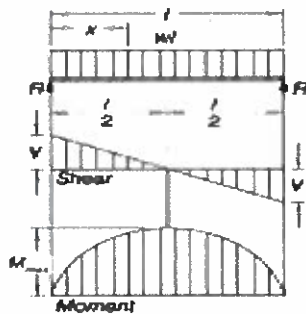
Table 1-1 (continued)														
W-Shapes														
Properties														
														
Nom- inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				rx	ry	Torsional Properties	
	d in.	t in.	I in. ⁴	S in. ³	r in.	Z in. ³	I in. ⁴	S in. ³	r in.	Z in. ³			J in. ⁴	Cu in. ³
67	4.43	11.1	272	80.4	3.72	70.1	88.9	21.4	2.12	32.7	2.43	8.07	5.06	1440
58	5.07	12.4	228	52.0	3.65	59.8	75.1	18.3	2.10	27.9	2.39	7.84	3.33	1180
48	5.92	15.9	184	43.2	3.61	49.0	60.9	15.0	2.08	22.9	2.35	7.82	1.98	991
40	7.21	17.8	148	35.5	3.53	38.8	49.1	12.2	2.04	18.5	2.31	7.69	1.12	729
35	8.10	20.5	127	31.2	3.51	34.7	42.6	10.6	2.03	16.1	2.28	7.63	0.769	619
31	9.19	22.3	110	27.5	3.47	30.4	37.1	9.27	2.02	14.1	2.26	7.57	0.536	530
28	7.03	22.3	98.0	24.3	3.45	27.2	21.7	6.83	1.82	10.1	1.84	7.80	0.537	312
24	8.12	25.9	82.7	20.9	3.42	23.1	18.3	5.63	1.81	8.57	1.81	7.53	0.346	259
21	6.59	27.5	75.3	18.2	3.49	20.4	9.77	3.71	1.28	5.89	1.46	7.88	0.282	152
18	7.95	29.9	61.9	15.2	3.43	17.0	7.97	3.04	1.23	4.86	1.43	7.81	0.172	122
15	6.37	28.1	48.0	11.8	3.29	13.6	3.41	1.70	0.878	2.87	1.08	7.80	0.137	51.8
13	7.84	29.9	39.9	9.91	3.21	11.4	2.73	1.37	0.843	2.15	1.03	7.74	0.0871	40.8
10	9.81	40.5	30.8	7.81	3.22	8.87	2.09	1.08	0.841	1.88	1.01	7.69	0.0428	30.9
25	6.88	15.5	53.4	16.7	2.70	18.9	17.1	5.81	1.52	8.68	1.74	5.83	0.481	150
20	8.25	19.1	41.4	13.4	2.69	14.9	13.3	4.41	1.50	6.72	1.70	5.84	0.240	113
15	11.5	21.8	29.1	9.72	2.58	10.8	9.32	3.11	1.45	4.75	1.66	5.73	0.101	79.5
16	4.98	19.1	32.1	10.2	2.60	11.7	4.43	2.20	0.987	3.39	1.13	5.88	0.223	38.2
12	7.14	21.8	22.1	7.31	2.49	8.30	2.99	1.50	0.918	2.32	1.08	5.75	0.0903	24.7
9	9.16	29.2	18.4	5.58	2.47	6.23	2.20	1.11	0.905	1.72	1.08	5.69	0.0405	17.7
8.5	10.1	29.1	14.9	5.10	2.43	5.73	1.98	1.01	0.890	1.58	1.05	5.64	0.0333	15.8
19	5.85	13.7	28.3	10.2	2.17	11.8	9.13	3.83	1.28	5.53	1.45	4.72	0.318	50.9
16	6.94	15.4	21.4	8.55	2.13	9.63	7.51	3.00	1.28	4.58	1.43	4.85	0.192	40.8
13	5.88	10.8	11.3	5.48	1.72	6.28	3.88	1.90	1.00	2.92	1.16	3.82	0.151	14.0

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 14: Steel Manual Table 1-1

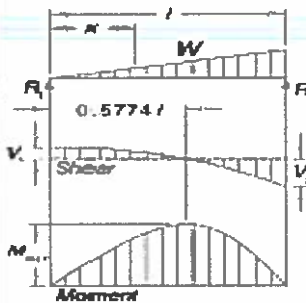
Table 3-23
Shears, Moments and Deflections

1. SIMPLE BEAM — UNIFORMLY DISTRIBUTED LOAD



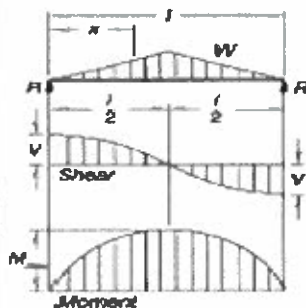
Total Equiv. Uniform Load	$= wl$
$R_1 = V_1$	$= \frac{wl}{2}$
V_2	$= w\left(\frac{l}{2} - x\right)$
M_{max} (at center)	$= \frac{wl^2}{8}$
M_x	$= \frac{wx}{2}(l - x)$
Δ_{max} (at center)	$= \frac{5wl^4}{384EI}$
Δ_x	$= \frac{wx}{24EI}(l^3 - 2lx^2 + x^3)$

2. SIMPLE BEAM — LOAD INCREASING UNIFORMLY TO ONE END



Total Equiv. Uniform Load	$= \frac{16W}{9\sqrt{3}} = 1.03W$
$R_1 = V_1$	$= \frac{W}{3}$
$R_2 = V_2 = V_{max}$	$= \frac{2W}{3}$
V_x	$= \frac{W}{3} - \frac{Wx^2}{l^2}$
M_{max} (at $x = \frac{l}{\sqrt{3}} = 0.577l$)	$= \frac{2Wl}{9\sqrt{3}} = 0.125Wl$
M_x	$= \frac{Wx}{3l^2}(l^3 - x^3)$
Δ_{max} (at $x = l\sqrt{\frac{8}{15}} = 0.519l$)	$= \frac{0.0130}{EI} Wl^3$
Δ_x	$= \frac{Wx}{180EI^2}(3l^4 - 10l^2x^2 + 7x^4)$

3. SIMPLE BEAM — LOAD INCREASING UNIFORMLY TO CENTER



Total Equiv. Uniform Load	$= \frac{4W}{3}$
$R_1 = V_1$	$= \frac{W}{3}$
V_2 (when $x = \frac{l}{2}$)	$= \frac{W}{2l^2}(l^2 - 4x^2)$
M_{max} (at center)	$= \frac{Wl^3}{80}$
M_x (when $x = \frac{l}{2}$)	$= Wx\left(\frac{l}{3} - \frac{2x^2}{3l^2}\right)$
Δ_{max} (at center)	$= \frac{Wl^3}{80EI}$
Δ_x (when $x = \frac{l}{2}$)	$= \frac{Wx}{480EI^2}(5l^2 - 4x^2)^2$

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 15: Table 3-23 Shear, Moment and Deflections

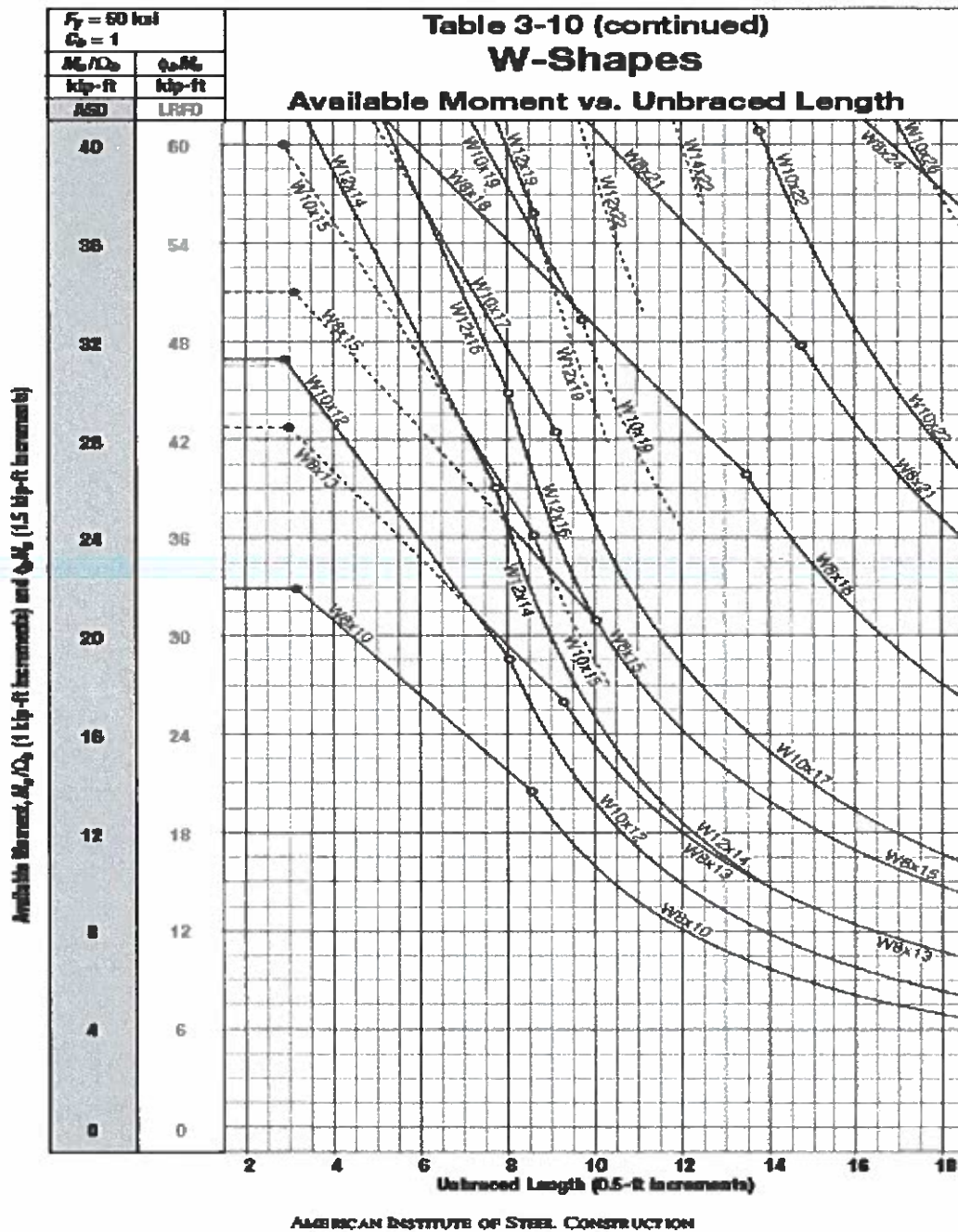


Figure 16: Table 3-10 W-Shapes Available Moment vs Unbraced Length

Table 3-2 (continued) W-Shapes Selection by Z_x												
$F_y = 50 \text{ ksi}$												
Shape	Z_x in. ³	M_{px}/Ω_b		M_{py}/Ω_b		M_{px}/ϕ_b		M_{py}/ϕ_b		L_p ft	L_r ft	L_c ft
		ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft	ASD kip-ft	LRFD kip-ft			
W12x16	20.1	50.1	75.4	28.9	44.9	3.88	5.73	2.73	8.05	103	52.8	79.2
W10x17	18.7	48.7	70.1	28.3	42.5	2.88	4.47	2.88	9.18	81.9	48.5	72.7
W12x14 ¹	17.4	43.4	65.3	23.0	39.1	3.43	5.17	2.66	7.73	88.8	42.8	64.3
W8x18	17.0	42.4	63.8	29.5	39.9	1.74	2.61	4.34	13.5	81.9	37.4	56.2
W10x15	16.0	39.9	60.0	24.1	36.2	2.75	4.14	2.88	8.81	88.8	48.0	68.9
W8x15	13.6	33.9	51.0	20.8	31.0	1.00	2.85	3.09	10.1	48.0	39.7	59.6
W10x12 ¹	12.6	31.2	46.9	18.0	28.6	2.38	3.53	2.87	8.85	53.8	37.5	56.3
W8x13	11.4	28.4	42.8	17.3	26.0	1.78	2.67	2.98	9.27	39.8	38.8	55.1
W6x10 ¹	8.87	21.8	32.9	13.6	20.5	1.54	2.30	3.14	8.52	30.8	26.3	40.2
ASD	LRFD	¹ Shape exceeds compact limit for flexure with $F_y = 50 \text{ ksi}$ ² Shape does not meet the A/ϕ_b limit for shear in AISC Specification Section G2.1(a) with $F_y = 50 \text{ ksi}$; therefore, $\phi_v = 0.80$ and $\Omega_v = 1.87$.										
$\Omega_b = 1.87$ $\Omega_v = 1.80$	$\phi_b = 0.80$ $\phi_v = 1.00$											

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 17: Table 3-2 W-Shapes Selection by Z_x

Beams design

The beam is to be spread out between columns at 50ft evenly spacing and having joists running perpendicular between the beams. Bracing members must be connected with a minimum of one bolt or its equivalent (Steel Manual).

When

W = Weight

DL = 40 lb/ft (W16x40)

LL = 3,500 lbs/ft

$$W = DL + LL$$

$$W = 40 \text{ lbs/ft} + 10(3,500 \text{ lbs/ft})$$

$$W = 590 \text{ lbs/ft}$$

Now we will need to calculate the maximum shear and bending moment to see if the beam chosen would work for this application. Using Table 3-23 from Figure 06 from the steel manual.

When

$$V_{\text{Max}} = WL/2$$

$$V_{\text{Max}} = (590 \text{ lbs/ft} * 50\text{ft}) / 2$$

$$V_{\text{Max}} = 14.75 \text{ lbs/ft} \Rightarrow 14.8 \text{ kip/ft}$$

$$M_{\text{Max}} = WL^2 / 8$$

$$M_{\text{Max}} = (590 \text{ lb/ft} * 50^2\text{ft}) / 8$$

$$M_{\text{Max}} = 184,375 \text{ lbs} \cdot \text{ft} \Rightarrow 184.4 \text{ kips} \cdot \text{ft}$$

Check Answers:

$$V_{\text{Max}} < \phi_V V_{nx}$$

14.8 kips < 146 kips Shear is Okay

$$M_{\text{Max}} < \phi_b M_n$$

184.4 kips*ft < 200 kips*ft Bending Moment is Okay

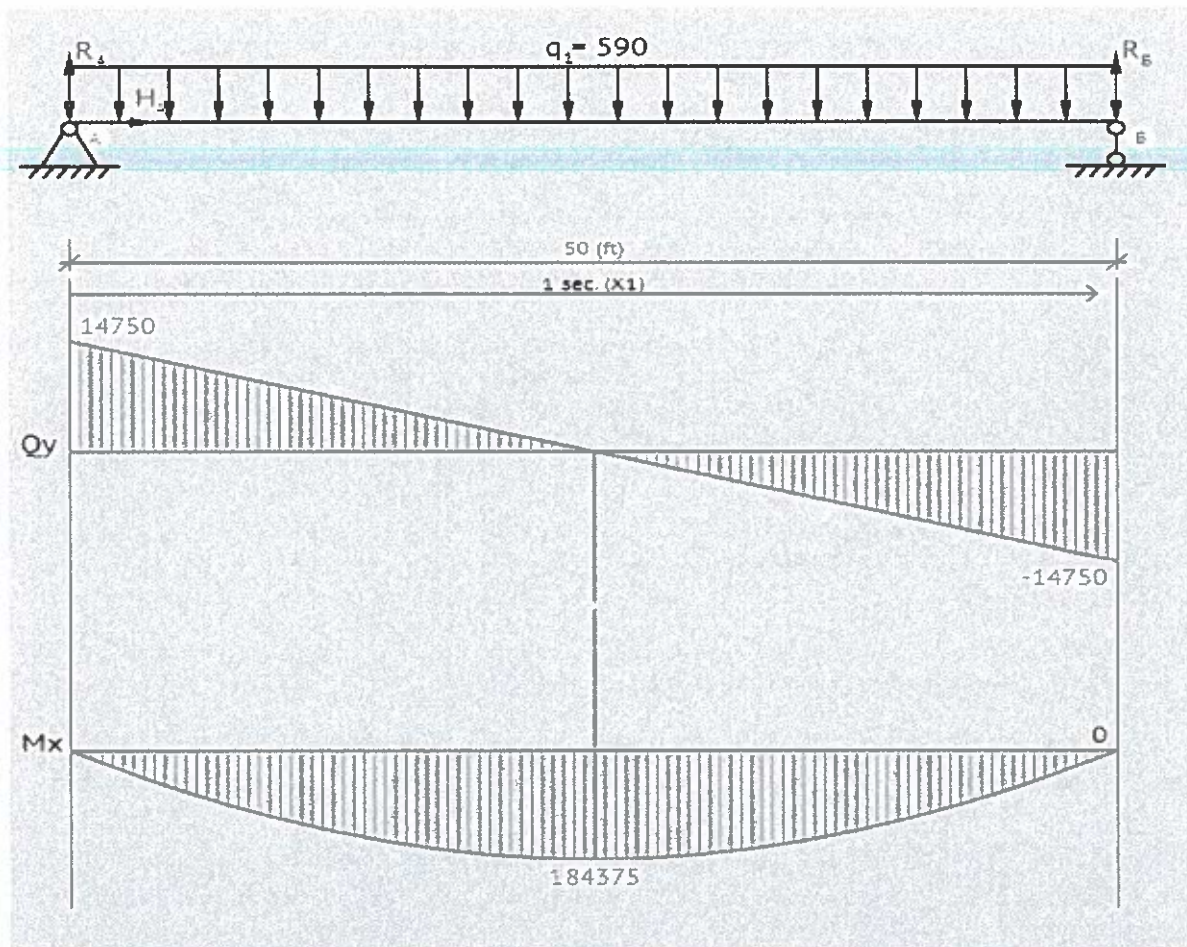


Figure 18: Shear and bending moment of beam

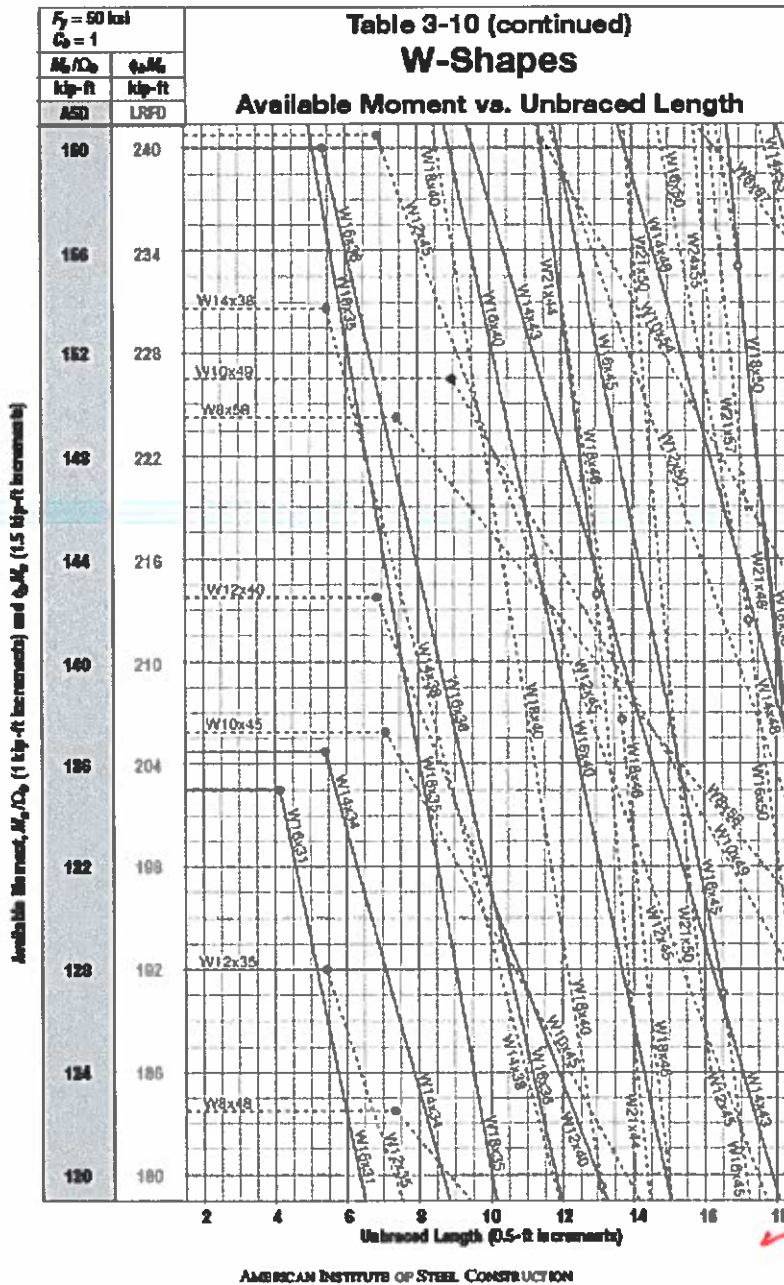


Figure 19: Table 3-10 W-Shapes Available Moment vs Unbraced Length

Table 3-2 (continued)													Z_x					
$F_y = 50$ ksi																		
W-Shapes																		
Selection by Z_x																		
Shape	Z_x in. ³	M_p/Ω_b		ϕM_p		M_r/Ω_b		ϕM_r		$B F/\Omega_b$		$\phi B F$	L_p ft	L_r ft	L_c in. ⁴	M_n/Ω_b		ϕM_n
		kip-ft		kip-ft		kip-ft		kip-ft		kip-ft						kip-ft		
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD					ASD	LRFD	
W21x55	126	314	473	182	288	10.8	16.3	6.11	17.4	1140	158	234						
W14x74	128	314	473	186	294	5.31	8.05	8.78	31.0	795	128	192						
W18x60	123	307	461	189	284	9.82	14.4	5.89	18.2	984	151	227						
W12x79	119	297	448	187	281	3.78	5.67	10.8	38.9	682	117	175						
W14x68	115	287	431	180	270	5.19	7.81	8.69	29.3	722	116	174						
W10x88	113	282	424	172	259	2.82	3.94	8.29	51.2	534	131	198						
W18x55	112	279	420	172	258	9.15	13.8	5.90	17.6	890	141	212						
W21x50	110	274	413	165	249	12.1	18.3	4.59	13.6	984	158	237						
W12x72	108	269	405	170	258	3.69	5.56	10.7	37.5	697	108	159						
W21x45	107	265	398	162	244	9.89	14.8	5.86	16.5	959	144	216						
W18x57	105	262	394	161	242	7.98	12.0	5.65	18.3	758	141	212						
W14x61	102	254	383	161	242	4.93	7.48	8.65	27.5	640	104	158						
W18x50	101	252	379	155	233	8.78	13.2	5.83	16.9	800	128	192						
W10x77	97.8	244	368	150	225	2.80	3.90	9.18	45.3	455	112	169						
W12x65	96.8	237	358	154	231	3.58	5.39	10.7	35.1	533	94.4	142						
W21x44	95.4	238	358	143	214	11.1	16.8	4.45	13.0	843	145	217						
W18x50	92.0	230	345	141	213	7.69	11.4	5.62	17.2	859	124	186						
W18x46	90.7	226	340	138	207	9.63	14.6	4.58	13.7	712	130	195						
W14x53	87.1	217	327	138	204	5.22	7.93	6.78	22.3	541	109	154						
W12x58	86.4	216	324	138	205	3.82	5.69	8.87	29.8	475	87.8	132						
W10x68	85.3	213	320	132	199	2.58	3.85	9.15	40.8	394	87.8	147						
W18x45	82.3	205	309	127	191	7.12	10.8	5.55	16.5	586	111	167						
W18x40	78.4	196	294	119	180	3.84	5.72	4.49	13.1	812	113	168						
W14x48	78.4	196	294	123	184	5.09	7.67	6.75	21.1	484	98.8	141						
W12x53	77.9	194	292	123	185	3.65	5.50	8.78	26.2	425	83.5	125						
W10x60	74.8	188	280	118	175	2.54	3.82	8.08	38.8	341	85.7	129						
W18x40	73.0	182	274	118	170	6.87	10.0	5.55	15.9	518	87.8	146						
W12x50	71.9	179	270	112	169	3.97	5.98	6.82	23.8	391	80.3	135						
W8x67	70.1	175	263	105	159	1.75	2.59	7.49	47.8	272	108	154						
W14x43	69.8	174	261	109	164	4.88	7.28	6.68	20.0	428	83.8	125						
W10x54	66.6	168	250	105	158	2.48	3.75	9.04	33.6	303	74.7	112						
ASD	LRFD	Shape exceeds compact limit for flexure with $F_y = 50$ ksi																
$\Omega_b = 1.67$	$\phi_b = 0.90$																	
$\Omega_b = 1.60$	$\phi_b = 1.00$																	

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 20: Table 3-2 W-Shapes Selection by Z_x

Columns Design

The columns are to provide the support of the structures live and dead loads of the building. These compression members are critical that the correct column size is used for its application to provide the ample support of the structure and the cost of not over building the structure if not needed. We can calculate the load on the column by the following.

$$P_u = 1.2P_D + 1.6P_L$$

With the assumptions of the following values the column requirement can be provided:

$$L_{\text{Column}} = 34\text{ft}$$

$$P_D = 165\text{kips}$$

$$P_L = 535\text{kips}$$

$$P_u = 1.2(165\text{kips}) + 1.6(535\text{kips})$$

$$P_u = 1054\text{kips}$$

Getting our total design load for the particular column with a column length of 34 for feet referencing Table 4-1 from Figure 20. The following W- shape beam values will be utilized to meet load requirements.

W12x252

$$\phi_c P_n = 1120 \text{ kips}$$

$$1054 \text{ kips} < 1120 \text{ kips, Okay beam to use}$$

The beam W12x252 will meet the requirements for the total axial load of that particular beam at 34ft in length.

Table 4-1 (continued)															
Available Strength in Axial Compression, kips														W-Shapes	
W-Shapes														W12	
Shape		W12x													
lb/ft		235 ^a		305 ^a		270 ^a		252 ^a		230 ^a		210			
Design		P_u/ϕ_c		P_u/ϕ_c		P_u/ϕ_c		P_u/ϕ_c		P_u/ϕ_c		P_u/ϕ_c			
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD		
Effective length, KL (ft), with respect to least radius of gyration, r_y	0	2960	4450	2680	4030	2450	3690	2220	3330	2030	3050	1850	2780		
	6	2870	4310	2580	3800	2370	3570	2140	3220	1890	2940	1760	2680		
	7	2840	4260	2580	3850	2340	3520	2120	3180	1890	2910	1760	2650		
	8	2800	4210	2530	3800	2310	3470	2090	3140	1810	2860	1740	2610		
	9	2760	4150	2480	3740	2280	3420	2060	3090	1880	2820	1710	2570		
	10	2710	4080	2450	3680	2240	3380	2020	3030	1840	2770	1680	2520		
	11	2660	4000	2400	3610	2190	3300	1980	2970	1800	2710	1640	2470		
	12	2610	3920	2350	3540	2150	3230	1940	2910	1760	2650	1610	2420		
	13	2550	3840	2300	3460	2100	3150	1890	2840	1720	2590	1570	2360		
	14	2490	3750	2250	3380	2050	3080	1840	2770	1680	2520	1530	2300		
	15	2430	3660	2190	3290	1990	3000	1790	2700	1630	2450	1480	2230		
	16	2370	3560	2130	3200	1940	2910	1740	2620	1590	2380	1440	2160		
	17	2300	3460	2070	3100	1880	2820	1690	2540	1540	2310	1390	2100		
	18	2230	3350	2000	3010	1820	2730	1630	2460	1480	2230	1350	2030		
	19	2160	3250	1940	2910	1760	2640	1580	2370	1430	2160	1300	1950		
	20	2090	3140	1870	2810	1700	2550	1520	2290	1380	2070	1250	1880		
	22	1940	2910	1730	2610	1570	2360	1410	2110	1270	1910	1150	1730		
	24	1790	2690	1600	2400	1440	2170	1290	1940	1170	1750	1060	1580		
	25	1840	2460	1480	2190	1320	1980	1170	1760	1080	1590	955	1440		
	28	1490	2240	1320	1990	1160	1790	1080	1590	954	1430	859	1290		
	30	1350	2030	1190	1790	1070	1610	949	1430	854	1280	787	1150		
	32	1210	1820	1070	1600	954	1430	843	1270	758	1140	678	1020		
	34	1090	1620	945	1420	845	1270	748	1120	670	1010	600	902		
	36	959	1440	843	1270	754	1130	688	1000	597	898	535	805		
	38	861	1280	757	1140	678	1020	598	898	538	808	481	722		
	40	777	1170	683	1030	610	917	539	811	484	727	434	652		
Properties															
P_n , kips		1050	1580	897	1340	783	1170	665	998	574	881	492	738		
P_n , kips/in.		59.3	89.0	54.3	81.5	51.0	78.5	48.7	70.0	43.0	64.5	38.3	58.0		
P_n , kips		10000	15100	7600	11600	6380	9590	4870	7320	3810	5730	2980	4400		
P_n , kips		1840	2480	1370	2070	1140	1720	947	1420	802	1210	676	1020		
L_p , ft		12.3		12.1		11.9		11.8		11.7		11.6			
L_r , ft		160		137		128		114		105		95.8			
A_g , in. ²		68.9		68.5		61.9		74.1		67.7		61.8			
b_x , in. ⁴		4060		3550		3110		2720		2420		2140			
I_y , in. ⁴		1190		1050		937		828		742		664			
r_y , in.		5.47		5.42		5.36		5.34		5.31		5.28			
$r_{x/y}$		1.85		1.84		1.82		1.81		1.80		1.80			
$P_n/(KL)^2/10^4$, k-in. ²		118000		102000		89000		77900		69300		61300			
$P_n/(KL)^2/10^4$, k-in. ²		94100		80100		69800		60700		52100		45100			
ASD		LRFD													
$\phi_c = 1.87$		$\phi_c = 0.90$													
^a Flange thickness is greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.															

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

Figure 20: Table 4-1 Axial Compression kips

Joints and connections

The joints and the connection points for the structure will be provided depending on the results provided by STAAD Pro. As to assume all the joints depend on its final design parameters.

Building Slab

The building slab is to be addressed the following year due to time restraints.

Footings Design

The footing design will be coordinated with Geotechnical Technical engineering to provide the adequate footing support for each of the structures. This is dependent on the load bearing capacity of the soil type at each of the locations. From there knowing the on total load from each of the buildings' live and dead loads.

Water Resources

Introduction:

The Water Resources design is part of phase C of the project. In the water resources portion of this design project, the task was to design a trapezoidal storm water drainage ditch based on a 100-year rainfall investigation period all while avoiding flood risks and property damage from the storm water runoff. The trapezoidal ditch is to be designed by using hydrologic and hydraulic methods. The hydrologic methods used was using the Rational Method to obtain the peak runoff outflow and the "Tractive Force based Unlined Channel Design Method" to get the design dimensions for the channel.

Design Methods and Equations (Theory)

Before the design of the channel/ditch could be done, the Rational Method was used to find the peak runoff outflow, which was then recorded and used to find the design of the channel.

$$Q = CiA \quad (1)$$

Where,

Q = Peak Outflow, cfs

C = Runoff Coefficient based on land

i = Rainfall Intensity, in/hr = 3.93 in/hr (determined by Figure 1 below)

A = Drainage Area, acre = 400 acre

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)

Duration	1	2	5	10	25	50	100	200	500	1000
5-min	0.466 (0.353-0.616)	0.535 (0.410-0.703)	0.651 (0.497-0.857)	0.745 (0.559-0.992)	0.871 (0.632-1.19)	0.964 (0.681-1.36)	1.06 (0.729-1.53)	1.15 (0.776-1.72)	1.29 (0.833-1.98)	1.39 (0.879-2.19)
10-min	0.741 (0.561-0.978)	0.852 (0.653-1.18)	1.04 (0.792-1.37)	1.19 (0.833-1.59)	1.39 (1.01-1.91)	1.55 (1.10-2.18)	1.70 (1.17-2.46)	1.84 (1.24-2.74)	2.03 (1.32-3.12)	2.17 (1.37-3.42)
15-min	0.937 (0.709-1.24)	1.07 (0.820-1.41)	1.30 (0.888-1.71)	1.48 (1.11-1.97)	1.73 (1.26-2.38)	1.92 (1.36-2.71)	2.11 (1.46-3.06)	2.30 (1.55-3.42)	2.55 (1.66-3.92)	2.73 (1.73-4.32)
30-min	1.33 (1.00-1.75)	1.51 (1.16-1.99)	1.82 (1.39-2.43)	2.07 (1.56-2.76)	2.41 (1.75-3.30)	2.66 (1.86-3.75)	2.91 (2.01-4.22)	3.18 (2.14-4.74)	3.56 (2.31-5.48)	3.85 (2.44-6.08)
60-min	1.73 (1.31-2.29)	1.99 (1.53-2.62)	2.42 (1.85-3.19)	2.77 (2.00-3.69)	3.24 (2.34-4.42)	3.58 (2.62-5.03)	3.93 (2.71-5.70)	4.33 (2.92-6.48)	4.91 (3.20-7.58)	5.39 (3.41-8.52)
2-hr	2.10 (1.61-2.75)	2.48 (1.91-3.20)	3.09 (2.28-4.02)	3.61 (2.73-4.76)	4.33 (3.15-5.85)	4.87 (3.46-6.79)	5.46 (3.78-7.85)	6.16 (4.17-9.12)	7.22 (4.71-11.1)	8.12 (5.16-12.8)
3-hr	2.31 (1.77-3.00)	2.78 (2.14-3.54)	3.52 (2.71-4.53)	4.16 (3.16-5.45)	5.07 (3.72-6.84)	5.79 (4.13-8.04)	6.59 (4.59-9.43)	7.55 (5.12-11.1)	9.02 (5.90-13.8)	10.3 (6.50-16.1)
6-hr	2.65 (2.05-3.40)	3.30 (2.53-4.09)	4.26 (3.21-5.41)	5.14 (3.94-6.69)	6.44 (4.77-8.62)	7.51 (5.41-10.4)	8.73 (6.12-12.4)	10.2 (6.94-14.9)	12.4 (8.16-18.9)	14.4 (9.16-22.3)
12-hr	2.97 (2.32-3.77)	3.81 (2.91-4.89)	5.00 (3.90-6.28)	6.15 (4.76-7.89)	7.92 (5.94-10.5)	9.47 (6.90-13.0)	11.3 (7.95-15.9)	13.4 (9.15-19.4)	16.6 (10.9-25.0)	19.3 (12.4-29.9)
24-hr	3.31 (2.61-4.18)	4.37 (3.32-5.12)	5.78 (4.56-7.18)	7.23 (5.65-9.18)	9.50 (7.23-12.6)	11.8 (9.53-15.8)	14.0 (9.93-19.5)	16.7 (11.5-24.0)	20.8 (13.7-31.0)	24.1 (15.5-37.0)
2-day	3.71 (2.95-4.61)	4.99 (3.81-6.73)	6.67 (5.30-8.15)	8.42 (6.64-10.6)	11.2 (8.65-14.8)	13.8 (10.3-18.8)	16.8 (12.0-23.3)	20.2 (13.7-28.2)	24.2 (16.0-35.7)	27.6 (17.8-42.0)
3-day	4.03 (3.22-4.98)	5.41 (4.17-6.20)	7.26 (5.80-8.91)	9.14 (7.24-11.4)	12.1 (9.39-15.9)	14.8 (11.1-20.2)	18.0 (12.9-24.6)	21.2 (14.6-29.9)	25.5 (17.0-37.6)	29.0 (18.9-44.0)
4-day	4.31 (3.47-5.30)	5.79 (4.46-6.59)	7.67 (6.16-9.28)	9.60 (7.63-11.9)	12.6 (9.77-16.4)	15.4 (11.5-20.6)	18.4 (13.2-25.3)	21.6 (15.0-30.4)	26.0 (17.1-38.2)	29.6 (19.2-44.8)
7-day	5.00 (4.05-6.09)	6.44 (5.12-7.45)	8.49 (6.89-10.2)	10.4 (8.37-12.9)	13.4 (10.4-17.3)	16.0 (12.0-21.3)	19.0 (13.7-25.8)	22.1 (15.4-31.0)	26.7 (17.9-39.0)	30.4 (19.8-45.5)
10-day	5.68 (4.56-6.75)	7.04 (5.68-8.18)	9.19 (7.49-11.0)	11.2 (8.99-13.7)	14.1 (11.0-18.0)	16.7 (12.5-22.0)	19.5 (14.1-26.4)	22.6 (16.3-31.6)	27.2 (18.3-39.7)	31.0 (20.2-46.6)
25-day	7.34 (6.03-8.79)	8.93 (7.36-10.4)	11.4 (9.43-13.5)	13.6 (11.0-16.4)	16.7 (13.0-21.0)	19.2 (14.4-24.9)	21.9 (15.9-29.4)	24.8 (17.5-34.5)	29.1 (19.7-42.2)	32.7 (21.4-48.7)
30-day	8.82 (7.28-10.6)	10.5 (8.78-12.3)	13.3 (11.0-15.7)	15.6 (12.7-19.8)	18.8 (14.7-23.5)	21.3 (16.1-27.6)	24.0 (17.5-32.0)	26.8 (19.0-37.0)	30.8 (20.6-44.4)	34.0 (22.3-50.5)
45-day	11.0 (9.11-13.0)	12.8 (10.6-15.0)	15.9 (13.4-18.7)	18.5 (15.2-22.1)	21.9 (17.2-27.1)	24.4 (18.5-31.3)	27.0 (19.8-35.9)	29.7 (21.1-40.8)	33.4 (22.7-48.0)	36.4 (23.9-53.6)
60-day	12.9 (10.8-15.2)	14.9 (12.7-17.5)	18.3 (15.5-21.5)	21.0 (17.3-25.0)	24.6 (19.3-30.3)	27.2 (20.6-34.7)	29.7 (21.8-39.3)	32.3 (23.0-44.3)	35.8 (24.4-51.3)	38.5 (25.4-56.8)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound or less than the lower bound is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Figure 1

Upon completion of the Rational Method, The peak outflow was recorded and continued to be represented by 'Q' when it came to using the "Tractive Force based Unlined Channel Design Method" to find the design dimensions of the channel. Those dimensions were the side slope (z), bottom width (b), design depth from water surface (y_0), and velocity of the channel (V). Each of the dimensions were calculated and determined with the following equations:

$$n = .031d_{75}^{1/6} \quad (2)$$

Where,

n = Manning's roughness coefficient based on land

d_{75} = sediment size, ft

d_{75} will then obtained by manipulating Equation (2)

$$d_{75} = \left(\frac{n}{.031}\right)^6 \quad (3)$$

The value of d_{75} will then be determined.

The slope of the land, S , will be obtained by taking the latitude, longitude, and elevation from the site and comparing it to the latitude, longitude, and elevation of another point in Washington County:

$$S = \frac{\Delta z}{\sqrt{\Delta x + \Delta y}} \quad (4)$$

Where,

S = slope of land

Δx = Change in longitude, ft

Δy = Change in latitude, ft

Δz = Change in elevation, ft

Next, the critical shear stress could either be obtained from Figure 8-11 (from water resources book) or from the following equation:

$$\tau_b = k_b \gamma_w y_0 S_0 \quad (5)$$

Where,

τ_b = critical shear stress, psf

$k_b = 1.0$

γ_w = unit weight of water = 62.4 pcf

y_0 = design depth from water surface, ft

$$S_0 = \text{Slope of land} = .00076$$

The τ_b value will be found from Figure 8-11 (from water resources book) using the determined d_{75} converted from feet to millimeters.

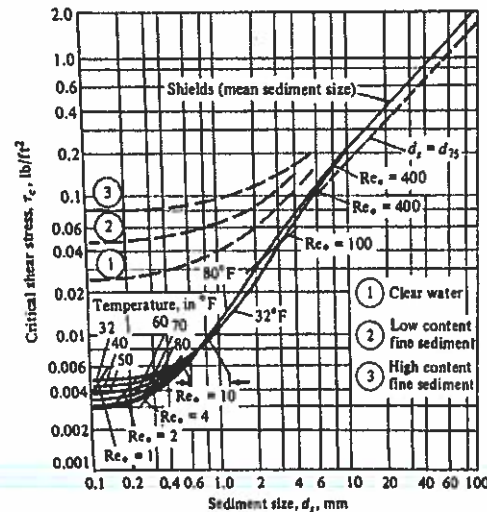


Figure 8-11 Critical shear stress for quartz particles in water (Vanoni, 1975, p. 99)

Figure 2

The angle of repose (ϕ) will be determined by using Figure 8-22 (from water resources book) using the obtained d_{75} .



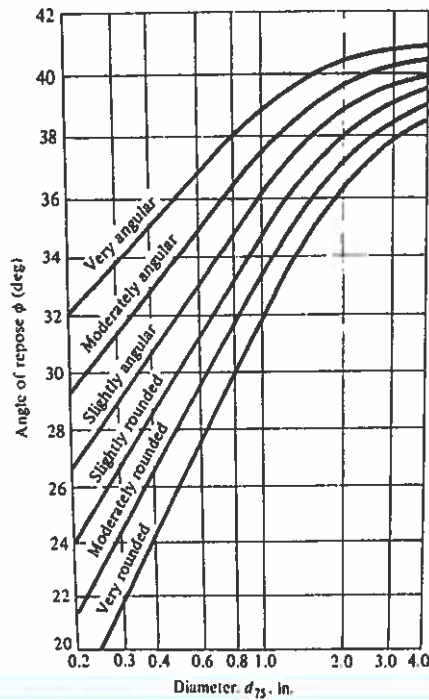


Figure 8-22 Angle of repose (Lane, 1955, p. 1247).

Scanned with CamScanner

Figure 3

The angle from the side slope was determined by:

$$\alpha = z$$

(6)

Where,

z = side slope

For the side slope (z) to be sufficient, it must be greater than $\cot \phi$.

τ_s will be determined with the help from this equation:

$$K = \frac{\tau_s}{\tau_b} = \sqrt{1 - \frac{\alpha}{\phi}}$$

(7)

Where,

τ_b = critical shear stress, psf

τ_s = shear stress, psf

α = angle from side slope

ϕ = angle of repose

τ_s will be determined by manipulating Equation 7:

$$\tau_s = \tau_b \sqrt{1 - \frac{\alpha}{\phi}} \quad (8)$$

τ_s could also be determined by:

$$\tau_s = k_s \gamma_w y_0 S_0 \quad (9)$$

Where,

τ_s = shear stress, psf

$k_s = 0.75$

The design depth (y_0) will be determined by manipulating Equations (5) and (9) and using the equation that produces the smaller value:

$$y_0 = \frac{\tau_b}{k_s \gamma_w S_0} \quad (10)$$

$$y_0 = \frac{\tau_s}{k_s \gamma_w S_0} \quad (11)$$

After conducting proper calculations, the value from the Equation with the lowest value will be used.

Next the bottom width (b) will be determined using the following equation:

$$Q = \frac{1}{n} * \frac{A^{5/3}}{P^{2/3}} * S_0^{1/2} \quad (12)$$

Where,

Q = Outflow

n = Manning's $n = 0.035$

$S_0 = 0.00076$

A = Area of Trapezoidal Channel

P = Perimeter of Trapezoidal Channel

The Area of Trapezoidal Channel was equivalent to:

$$A = by_0 + zy_0^2 \quad (13)$$

The Perimeter of Trapezoidal Channel was equivalent to:

$$P = b + 2y_0\sqrt{1 + z^2} \quad (14)$$

By substituting Equations (13) and (14) into Equation (12):

$$Q = \frac{1}{n} * \frac{(by_0 + zy_0^2)^{5/3}}{(b + 2y_0\sqrt{1 + z^2})^{2/3}} * S_0^{1/2} \quad (15)$$

Equation (15) was then manipulated to solve for b:

$$\frac{Qn}{S_0^{1/2}} = \frac{(by_0 + zy_0^2)^{5/3}}{(b + 2y_0\sqrt{1 + z^2})^{2/3}} \quad (16)$$

b will then be solved by putting Equation (16) into a solver.

The design velocity must be greater than the Kennedy equation velocity. The design velocity will be determined by:

$$V = \frac{Q}{A} \quad (17)$$

Where,

V = design velocity, m/s

The Kennedy equation velocity is given by:

$$V_0 = 0.84y_0^{0.64} \quad (18)$$

Where,

V_0 = Kennedy equation velocity, m/s

After calculations are done for each of the velocities, the design velocity would be sufficient if it is greater than the Kennedy equation velocity.

Results and Discussions

Design Channel Dimensions/Results

Q	235.8 cfs
---	-----------

~~OK~~ check again

Conclusions

Once all the calculations and procedures are finished, the trapezoidal channel/drainage ditch will be successfully designed. There is currently nothing else that has been completed at this time.

Transportation Engineering

Introduction

The task of the transportation portion of this project was to design the roadway layout for the entire project. This included connecting roads from the site to existing roads and highways, interchange design, traffic study, parking lot layout, pavement design cross-section, and the plan and profile of a typical local road in development.

Site Layout

The **Figure 1** below shows the entire layout of the project site and where each of the buildings, drainage ditch, and water treatment plant will be. The Convention Center was placed at the main entrance of the project site near Farm to Market Road 332 which connects to the major Highway 290. The dimensions of the building were made to be 1600 ft by 300 ft. The two Commercial Offices are located in the middle north side of the project site with dimensions of 500 ft by 250 ft. The Warehouse is located on the furthest south west point of the project site out of the way of the office buildings and visitor convention center. The dimensions of the Warehouse is 2000 ft by 500ft. The Warehouse is located by an existing road Baranowski Rd, which allows easy access for trucks to import and export goods from the ports located on the west most portion of the warehouse. The existing road connects to Farm to Market Road 389 which leads to the major Highway 290. Parking lots are placed near and in between each building allowing for easy access for employees and guests to access the buildings. Interconnecting roads were placed within the project site connecting each parking lot. The Detention basin and Water Treatment plant are located in the southeast most part of the project site. This location of the project site is at the lowest elevation of the land which is also located by a forking creek. This will allow the runoff water and drainage water to travel more efficiently to the basin and water treatment plant.

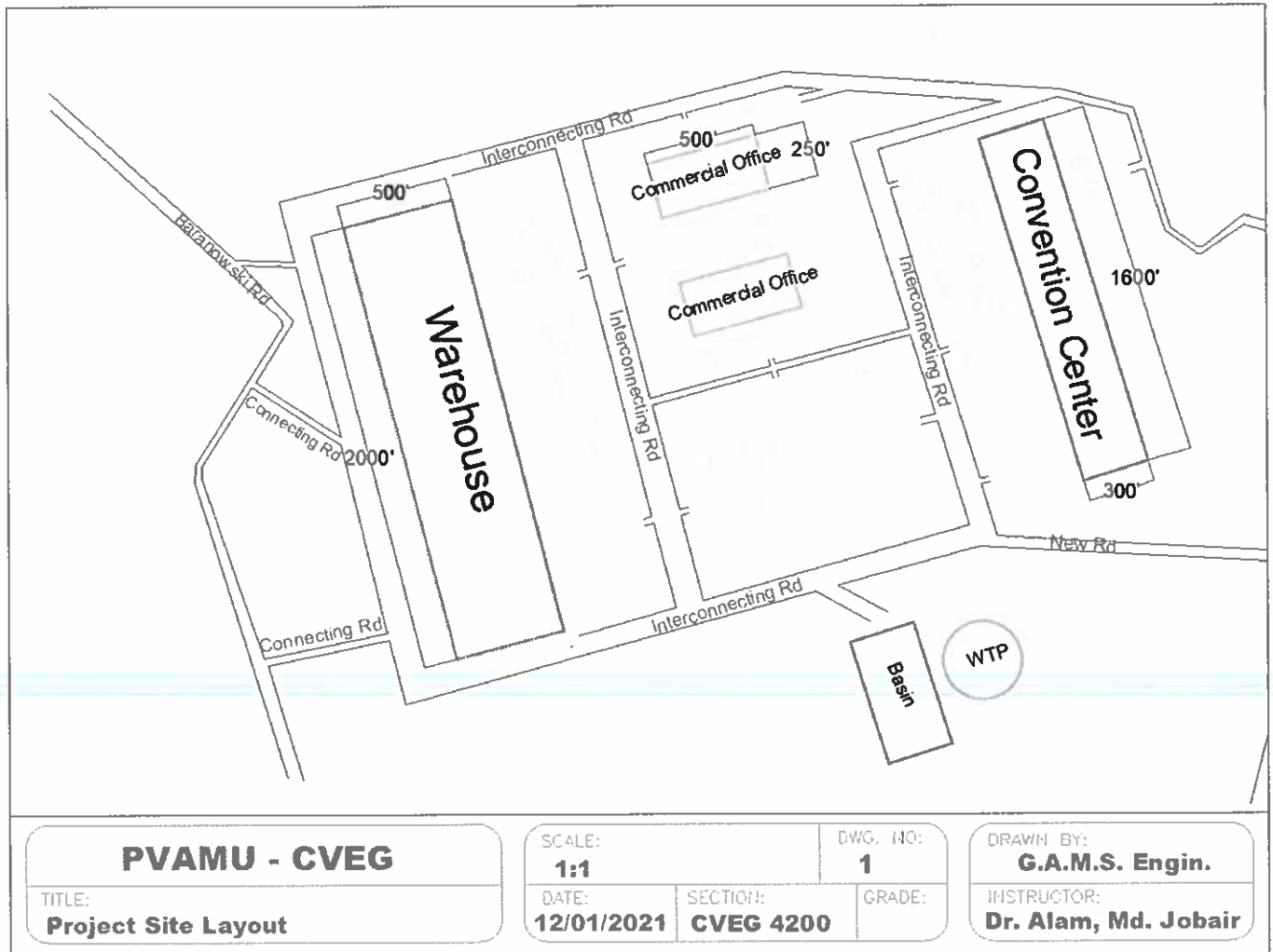


Figure 1: Project layout without geological map

overall layout plan
go at the beginning of the
report.



Figure 2: Project layout without background of site

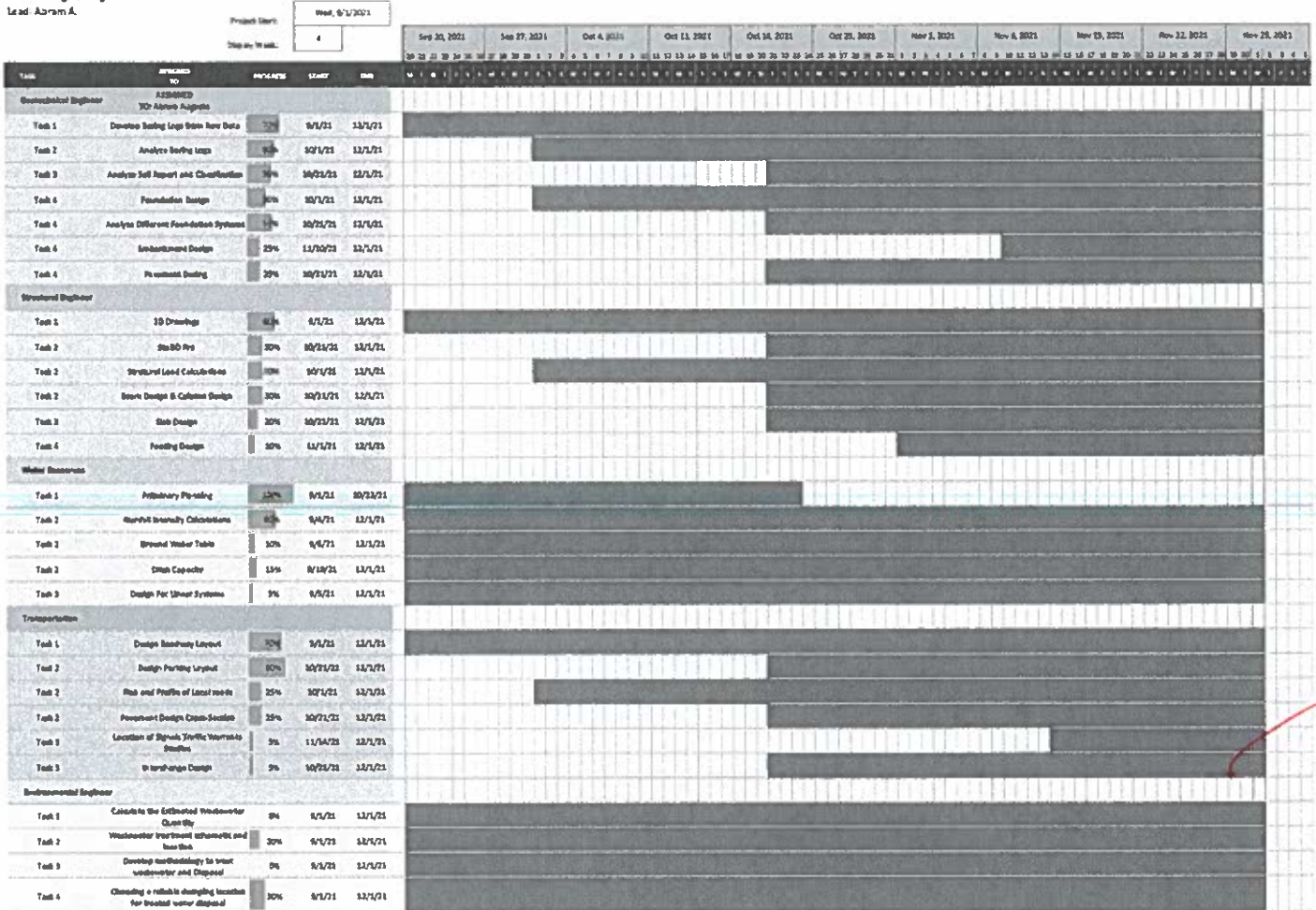
Future Work

In the next phase of the project starting in January, the Transportation Engineering portion of the project will go more in depth showing steps, procedures, and calculations with Interchange Design, Location of signals, Traffic Warrant Studies, Plan and profile as well as pavement design cross-sections for a typical local road in the development.

Gantt Chart

SENIOR DESIGN

G.A.M.S Engineering
Lead: Abram A.



*not visible
make it landscape*

Resources Used

Braja M. Das, Nagaratnam Sivakugan. Principles of Foundation Engineering 9th Edition. Cengage. 2017

<https://www.daytonohio.gov/DocumentCenter/View/3562/W-15-125-Dayton-Parallel-Interceptor---Phase-A---Final-Subsurface-Report?bidId=>

Williams, Alan. Steel Structures Design. McGraw-Hill, 2011.

American Institute of Steel Construction, Manual of Steel Construction, 14th Edition

International Code Council. International Building Code. Falls Church, Va. :International Code Council, 2000.

“ASCE 7.” (2013). Standards, American Society of Civil Engineers,
<<https://ascelibrary.org/doi/book/10.1061/asce7>> (Dec. 1, 2021).

<https://www.tompkinsinc.com/Insight/Tompkins-Blog/the-importance-of-optimal-column-spacing>

https://nwis.waterdata.usgs.gov/tx/nwis/peak?site_no=08111500&agency_cd=USGS&format=gif

https://www.usgs.gov/special-topic/water-science-school/science/100-year-flood?qt-science_center_objects=0#qt-science_center_objects

https://nwis.waterdata.usgs.gov/tx/nwis/peak?site_no=08111500&agency_cd=USGS&format=html

https://www.engineeringtoolbox.com/mannings-roughness-d_799.html

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx

<http://abe-research.illinois.edu/courses/tsm352/lectures/runoffcoeffs.html>



Prairie View A&M University
Roy G. Perry College of Engineering



80

Civil & Environmental Department
CVEG 4200: Senior Design Project

SAPS Engineering

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

Prairie View A&M University
Prairie View, Texas 77446

SAPS Engineering Inc.

Dec 1, 2021

Dear Professor Alam,

The attached report contains the detailed plans for a newly constructed business and distribution center, IT Hub, and office development in Colorado County, Texas. This report includes the scope of work, six disciplines of civil engineering to design the development adequately.

SAPS Engineering Inc. is available to answer any questions you may have concerning this report or the project. You can contact our team lead Scott McGary at (phone number: 901-647-5996 or email: smcgary@pvamu.edu)

Sincerely,

Autumn Carter

Shadaria Lynch

Scott McGary

Perla Zaldivar

TABLE OF CONTENTS

List of Figures	3
List of Tables	4
Acknowledgment	4
Gantt Timeline	6
Introduction	8
Chapter 1: Project Scope	9
1.1 Problem Statement	9
1.2 Project Goals	9
Chapter 2: Task Definition and Project Design	10
2.1 Geotechnical Engineering	10
2.1.2 Soil Properties	13
2.2 Water Resources Engineering	17
2.2.1 Water Resources Objective	17
2.2.2 Rainfall Intensity	17
2.2.3 Stormwater Runoff	17
2.2.4 Drainage Ditch	17
2.2.5 Drainage Ditch Design	18
2.2.6 Stormwater Basin	19
2.3 Structural Engineering	21
2.4 Transportation Engineering	21
2.5 Environmental Engineering	22
Chapter 3: References	24
Appendix 1 Images	25
Appendix 2 Calculations	28

List of Figures

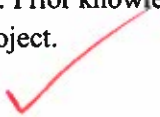
Figure 1.1 Gantt Chart.....	6
Figure 1.2 Gantt Chart.....	7
Figure 2.1 Proposed Site.....	10
Figure 2.2 Preliminary Layout.....	11
Figure 2.3 Office Layout.....	12
Figure 2.4 Boring Logs.....	16
Figure 2.5 Section View of Trapezoid Ditch.....	19
Figure 2.6 Profile View of Trapezoid Ditch.....	19
Figure 2.7 Inflow Hydrograph	21
Figure 2.8 Detention Basin Section View.....	21
Figure 2.9 Detention Basin Profile View.....	22
Figure A.1 Plasticity Chart.....	25
Figure A.2 Terzaghi Bearing Capacity Factors.....	25
Figure A.3: Approximate Value of Cu, SPT and soil consistency.....	26
Figure A.4 Precipitation Point Frequency.....	26
Figure A.5 Roughness Coefficient.....	27

List of Tables

Table 2.1 Soil Classification 1.....	15
Table 2.2 Soil Classification 2.....	15
Table 2.3 Boring 1 Analysis for Square Pile Section.....	16
Table 2.4 Boring 2 Analysis for Square Pile Section.....	16
Table 2.5 Routing Table.....	20

Acknowledgment

The project was prepared by Scott McGary, Autumn Carter, Shadaria Lynch, and Perla Zaldivar collectively. The completion of the project would not have been possible without the hard work and productivity of each team member. Also, a special thanks to Dr. Alam and the Civil & Environmental Engineering Department for providing resources and guidance throughout the semester. Prior knowledge from each design course allowed us to have an advantage in creating a well-planned project.



Gantt chart goes at the end.

Gantt Timeline

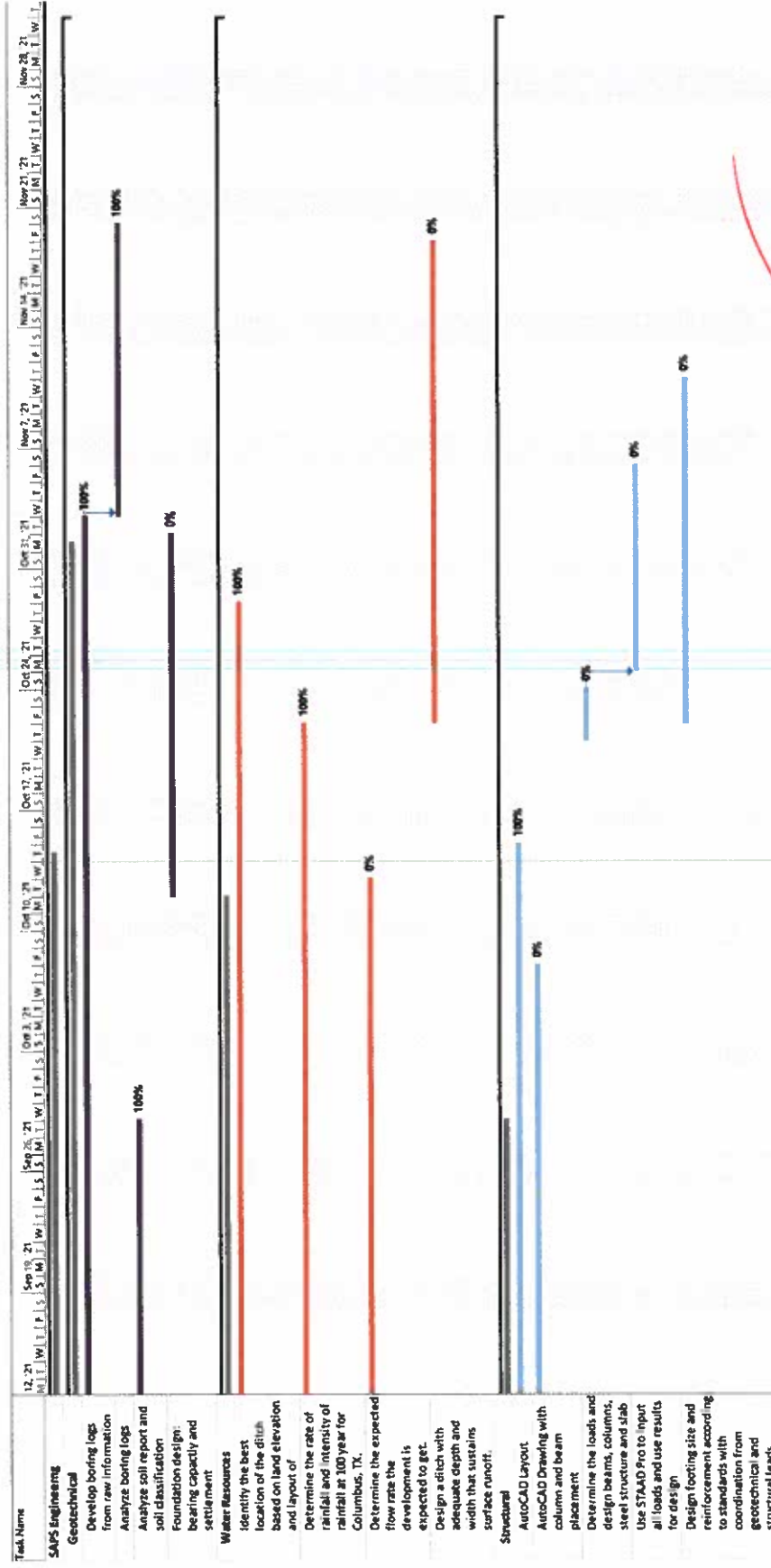
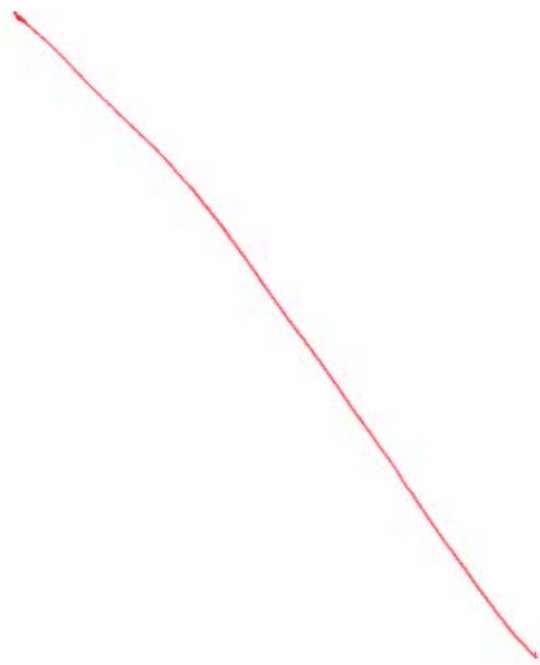


Figure 1. Gantt chart

Introduction

The proposed development is located south of Columbus, TX in Colorado County. The proposed development will be located on 400 acres of land near I-10. The property was designed for 20,000 it will consist of 4 buildings, parking lots that accommodate employees, visitors, and trucks. Within the development, a detention basin and drainage ditch were added to prevent stormwater damage. A wastewater treatment process facility based on the population projection for 15 years. SAPS Engineering designed the roads and parking to effectively and efficiently allow the flow of traffic from I-10 to the Amazon distribution center and other buildings on the property.



Chapter 1: Project Scope

1.1 Problem Statement

Design a two five-story commercial office building, a steel structure warehouse, a three-story convention center, and parking lots for Amazon located in Colorado County, Texas

1.2 Project Goals

The design team was required to perform civil engineering site development and design services and address all aspects outlined in the reporting requirements and deliverable items of this project description. This project aims to provide an AutoCAD geometric design that includes an Amazon distribution headquarters with a roadway layout and a detention pond. Water & Wastewater Treatment plants are needed to serve 20,000 people for the center and surrounding area. In addition, a 2D conceptual layout design of the and office building is needed. Also, in the area, parking facilities will be designed for each building.

Chapter 2: Task Definition and Project Design

2.1 Geotechnical Engineering

To first complete this aspect of the project the task had to be defined first. This task needed to analyze the topography map to develop boring logs from raw information and analyze those boring logs to develop the soil classification. Once this is done the foundation design can begin. To complete this project the foundation design needs to be completed where I will go for both shallow foundation and deep foot foundation and choose which is the most safe at the best cost.

The picture below is a topography map that shows the location of the site. The location of the site is south of I-10, in Colorado County TX. The size of the site is 400 acres. The elevation of the site goes into a downwards slope from 300 to 289 feet above sea level. Therefore the average elevation of the site is 294.5 feet above sea level. The black circles shown on the topography map represent the locations where the borings were taken.

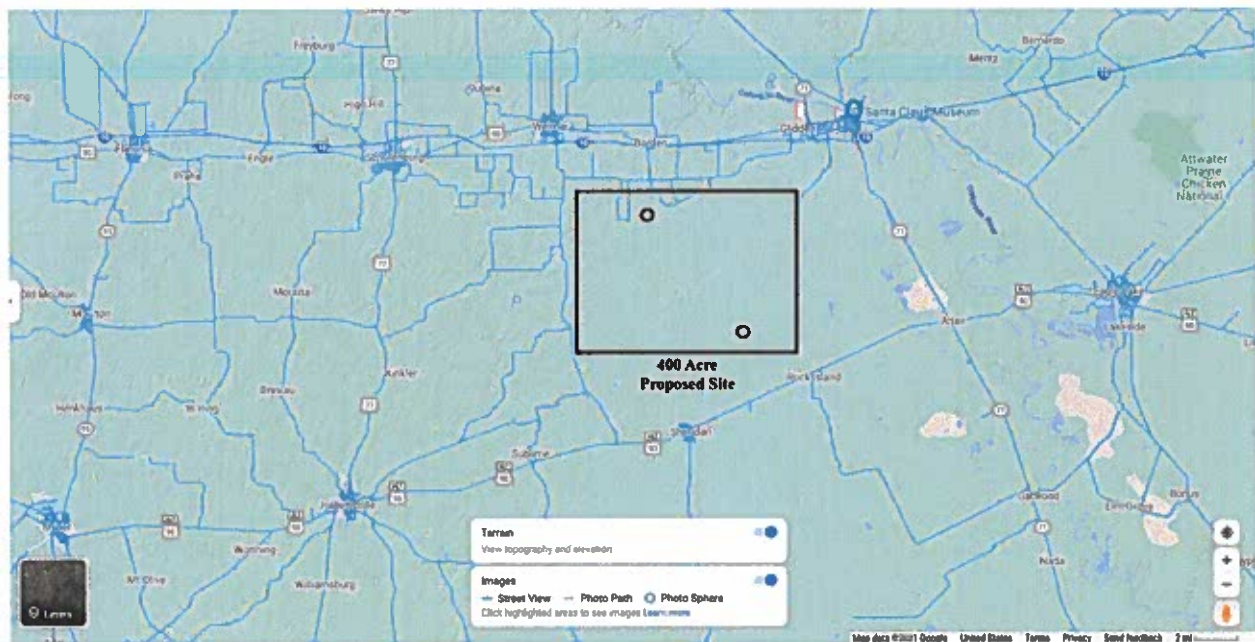


Figure 2.1 Proposed Site

AutoCAD was used in this project to create a preliminary layout of the 400 Acres. In the plan view provided by Google Maps; 2 miles scales to $\frac{1}{2}$ inch. In order to follow the constraints of the project the layout includes two five-story commercial office buildings, a steel structure warehouse, three-story convention center, facility parking lots, new road network development, sidewalks, driveways, and extension of major highways and connecting local road with highway and a storm water ditch connecting a lake. The layout below shows the preliminary layout of the proposed site plan. The layout includes a main entrance for 2-axle cars containing a right-turn lane, traffic signal, and ability to make left turn movements into each entrance. Also in the layout

service truck parking for the warehouse is provided. A wastewater treatment plant with a retention pond provides both stormwater attenuation and water quality treatment by providing additional storage capacity to retain runoff and release at a controlled rate. The design of the pond features includes an emergency spillway for safe overflow when storage capacity is exceeded.

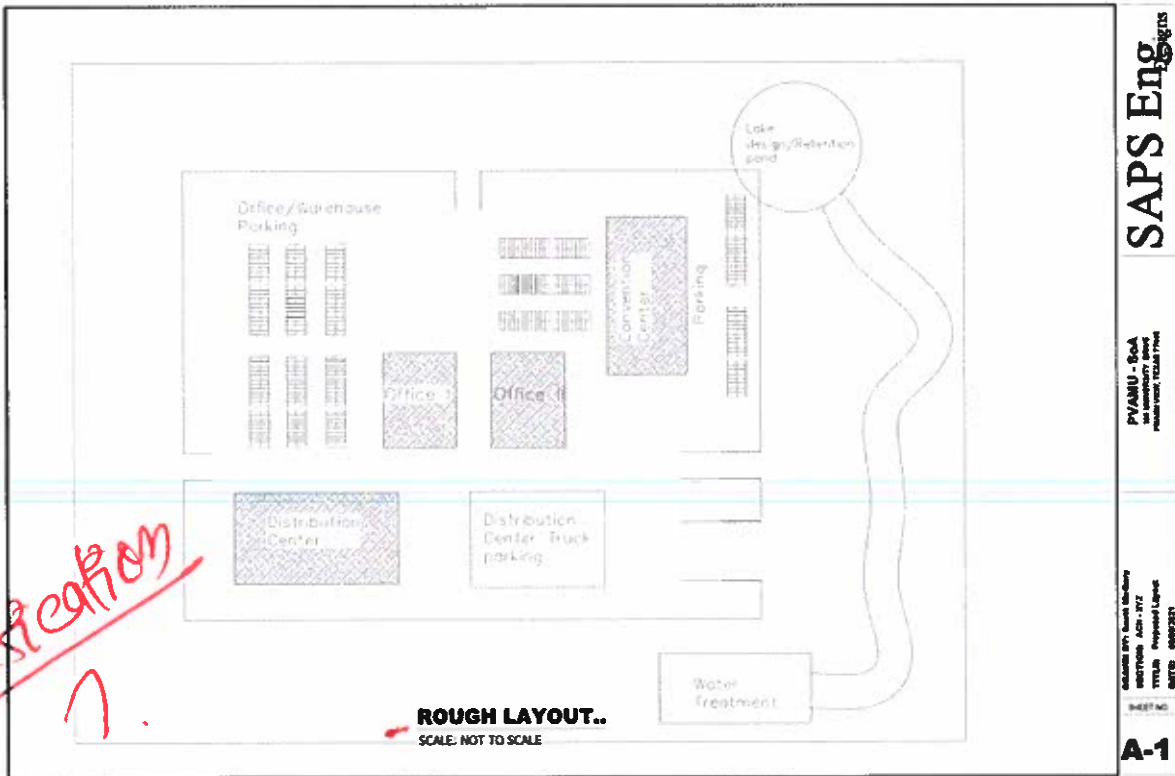
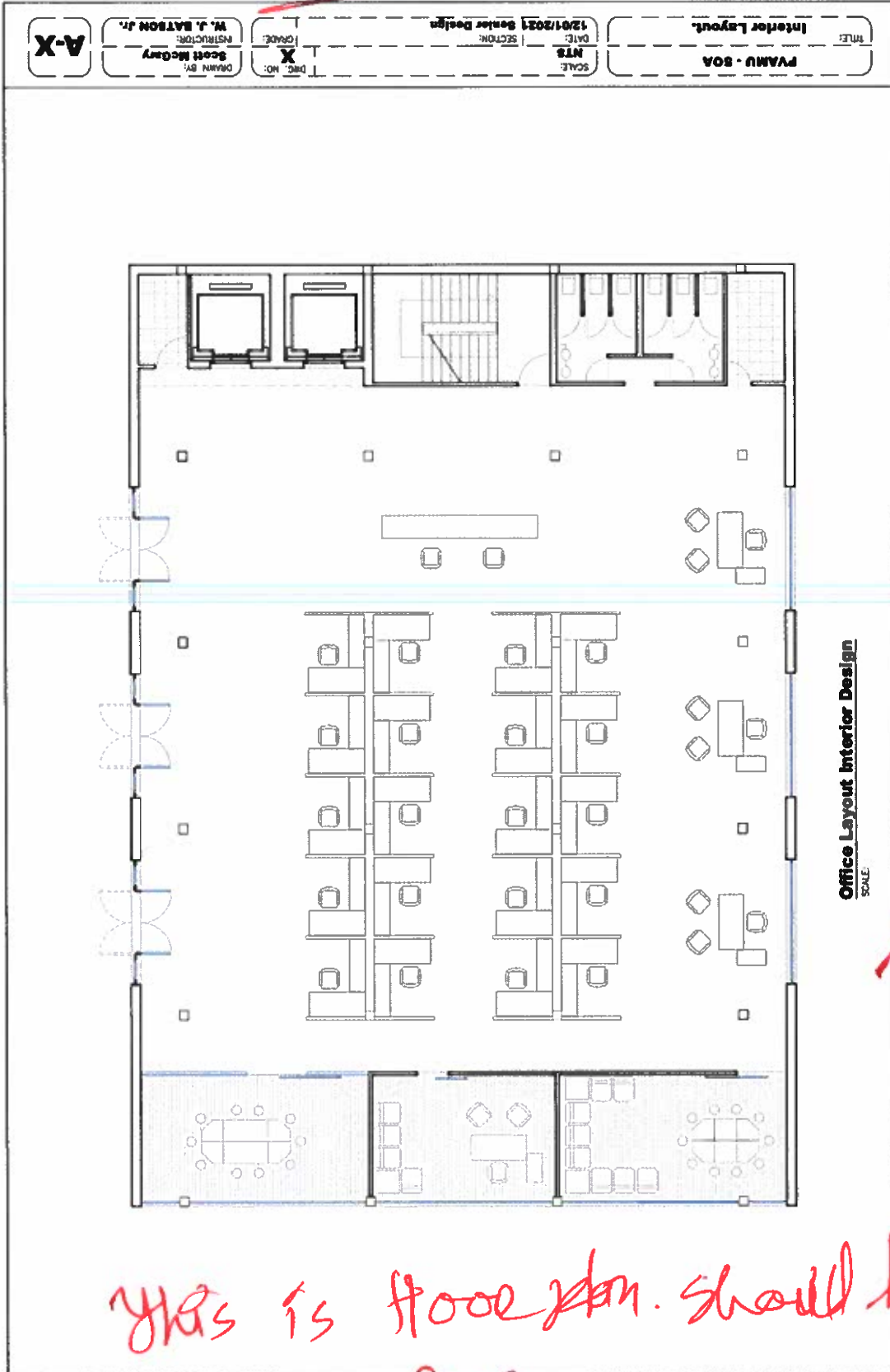


Figure 2.2 Preliminary Layout

Layout plan should be on
separate key in landscape.

structures?



Geotechnical - section

2.1.2 Soil Properties

The boring log data for the location of the site is located below. This boring log displays the testing of the soil to classify the type of soil it is, the amount of stress it can take, as well as other properties of the soil that will make a difference when designing a structure on it.

The boring log tells the engineer the results from various tests of the soil within the site location. The log shows the depth of each kind of soil down to 70 feet. Based on the boring log data, the soil is classified as mostly Sandy Elastic Silt from boring 1 and Sandy Fat Clay from boring 2. Excel was utilized in developing a table to analyze this data. This was found by using the Liquid Limit (50), Plastic Limit (30), and Plasticity Index (29) according to the first table and Liquid Limit (60), Plastic Limit (27), and Plasticity Index (32) for the second table. This is shown on the boring log, and the use of the table and chart below to classify the soil of the site.

The bearing capacity of the soil was calculated by using the bearing capacity equation along with the safety factor.

$$q_u = 1.3cN_c' + qN_q' + 0.4\gamma B N_\gamma' \text{ (square foundation)}$$

Where

c = cohesion

B = width of footing

D_f = depth of the footing

The exact calculations of this are provided in the appendix. Using a FS factor of safety, of 3, the allowable bearing capacity, q_{allow} , was found.

$$q_{allow} = \frac{q_u}{FS}$$

Table 2.1 Soil Classification 1

Depth(ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	48	20		28	54%	46%	13% CL	Sandy Lean Clay
5	51	32		19	69%	31%	14% MH	Sandy Elastic Silt
10 ~	~	~	~	~	~	~	8%	Sand
12.5	46	19		27	74%	26%	18% CL	Sandy Lean Clay
17 ~	~	~	~	~	~	~	10%	Sand
20	32	16		16	59%	41%	13% CL	Sandy Lean Clay
25	60	31		29	81%	19%	21% MH	Sandy Elastic Silt
30	72	31		41	82%	18%	20% CH	Sandy Fat Clay
40	68	39		29	62%	38%	4% MH	Sandy Elastic Silt
50	80	39		41	69%	31%	18% MH	Sandy Elastic Silt
60	68	34		34	84%	16%	20% MH	Sandy Elastic Silt

Table 2.2 Soil Classification 2

Depth(ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	43	16		27	71%	29%	19% CL	Sandy Lean Clay
7.5	47	19		28	81%	19%	12% CL	Sandy Lean Clay
8.5 ~	~	~	~	~	20%	80%	6% ~	Sand
15	51	24		27	69%	31%	13% CH	Sandy Fat Clay
20 ~	~	~	~	~	16%	84%	8% ~	Sand
25	62	30		32	80%	20%	15% CH	Sandy Fat Clay
30	62	27		35	79%	21%	13% CH	Sandy Fat Clay
40	69	28		41	83%	17%	17% CH	Sandy Fat Clay
50	71	33		38	72%	28%	18% CH	Sandy Fat Clay
60	69	34		35	79%	21%	19% CH	Sandy Fat Clay

The Plasticity chart which is a graph between plasticity index (PI) and liquid limit (LL) in percentage which is used for the classification of fine-grained soils in accordance with the USCS. From the graph the geotechnical engineer can determine that low plasticity has a (LL) = < 35%, Intermediate plasticity (LL) = 35-50%, High plasticity (LL) = 50-70%, Very High plasticity (LL) 70-90%, and Extremely High plasticity (LL) = > 90%

To develop the boring logs AutoCAD needed to be used. The raw data given was tabulated, and the data produced was essential in creating the boring logs used to show the various fine-grained soils. This boring log also shows the elevations from which the raw information was taken.

Table 2.3 Boring 1 Analysis For Square Pile Section

Depth (ft)	SPT	Cu (psf)	Cu/Pa	α	Qp (lb)	Qs (lb)	Qu (lb)	f	f*AL
0	0	0	0	0	0	0	0	0	0
2.5	7	900	0.43	0.72	32400.00	3240.00	35640.00	648	1620
7.5	10	1200	0.57	0.6	43200.00	14040.00	57240.00	720	5400
9	15	0	0.00	0	0.00	14040.00	14040.00	0	0
15	15	2000	0.96	0.49	72000.00	43440.00	115440.00	980	14700
20	20	0	0.00	0	0.00	43440.00	43440.00	0	0
30	25	3400	1.63	0.38	122400.00	120960.00	243360.00	1292	38760
40	39	5300	2.54	0.34	190800.00	265120.00	455920.00	1802	72080
50	53	7100	3.40	0.34	255600.00	506520.00	762120.00	2414	120700
60	60	8000	3.83	0.34	288000.00	832920.00	1120920.00	2720	163200
68	89	9400	4.50	0.34	338400.00	1267576.00	1605976.00	3196	217328
							Sum		633788

Table 2.4 Boring 2 Analysis for Square Pile Section

Depth (ft)	SPT	Cu (psf)	Cu/Pa	α	Qp (lb)	Qs (lb)	Qu (lb)	f	f*AL
0	0	0	0.00	0.00	0.00	0.00	0.00	0	0
2.5	8	1000	0.48	0.67	36000.00	6700.00	42700.00	670	1675
5	10	1200	0.57	0.61	43200.00	21340.00	64540.00	732	3660
10	16	2100	1.01	0.48	75600.00	61660.00	137260.00	1008	10080
12.5	17	2250	1.08	0.47	81000.00	114535.00	195535.00	1057.5	13218.75
15	20	2500	1.20	0.41	90000.00	176035.00	266035.00	1025	15375
20	24	3300	1.58	0.39	118800.00	278995.00	397795.00	1287	25740
30	24	3300	1.58	0.39	118800.00	433435.00	552235.00	1287	38610
40	54	7200	3.45	0.34	259200.00	825115.00	1084315.00	2448	97920
50	44	5600	2.68	0.34	201600.00	1205915.00	1407515.00	1904	95200
60	72	9400	4.50	0.34	338400.00	1972955.00	2311355.00	3196	191760
68	98	9400	4.50	0.34	338400.00	2842267.00	3180667.00	3196	217328
							Sum		69748.75

capacity curve = ??

?

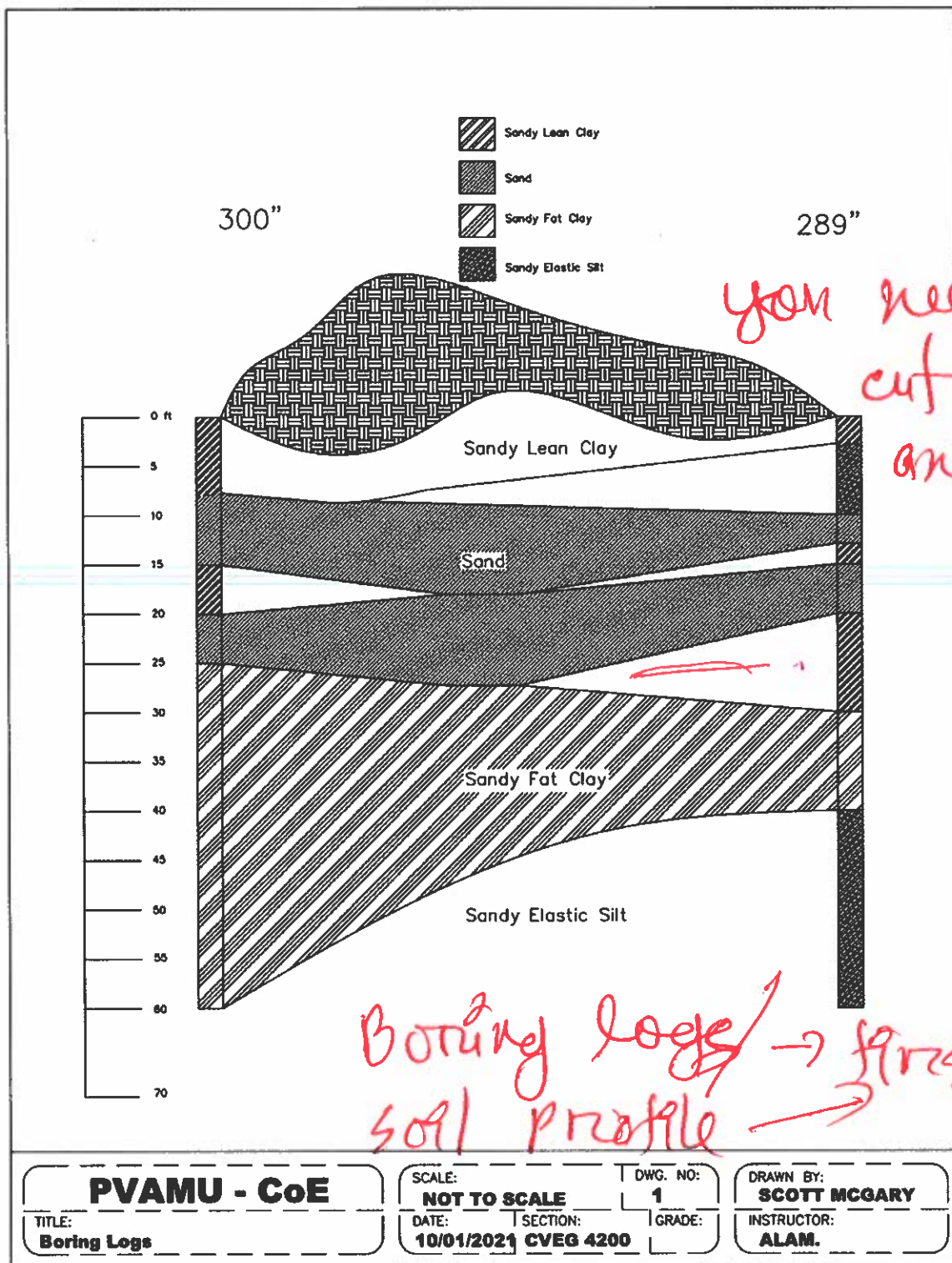


Figure 2.4 Boring Logs

2.2 Water Resources Engineering

2.2.1 Water Resources Objective

The objective of water resources is to design a ditch and a detention basin for the development of 400-acre land. The location of the proposed stormwater ditch was located at the lowest elevation of the proposed site using the local topographic map. The rainfall intensity for 100-year flooding was determined for Colorado County. The quantity of water and stormwater runoff was determined in order to build a ditch that can sustain the flow and detention basin.

2.2.2 Rainfall Intensity

The rainfall intensity was determined by using NOAA's National Weather Service. Using the chart the intensity interval for the 100 year flood period was found to be 0.591 in/hr. Reference Figure A.4 in Appendix that displays the precipitation frequency for Columbus, TX.

2.2.3 Stormwater Runoff

The water runoff depends upon the precipitation that infiltrates the ground. Once the infiltration capacity of the soil exceeds, the water begins to runoff. Development typically increases runoff and decreases absorption of water. Therefore, it is essential to determine the expected stormwater runoff to prevent damage to the property. To manage the stormwater, the pre-development runoff was determined. The runoff can be calculated with the rational equation,

$$Q = ciA$$

Q = peak runoff rate (cfs)

c = runoff coefficient

i = storm intensity (in/hr)

A = area (acres)

The area taken into account for pre-development was 400 acres since the land has no existing buildings. The runoff coefficient was determined to be 0.3 for farmland, the runoff for the pre-development was determined to be 47.28 cfs.

2.2.4 Drainage Ditch

An open channel is an integral part of a stormwater ditch design. In order to design an open trapezoidal channel, the manning equation was utilized.

$$Q = \frac{1.49}{n} AR^{2/3} S_o^{1/2}$$

Q = discharge, ft^3/s

n = roughness coefficient

A = flow area, ft^2

R = hydraulic radius

S_o = channel slope

The hydraulic radius can be expressed as,

$$R = \frac{A}{P}$$

P = perimeter, ft

The area and perimeter can be defined as,

$$A = by_o + zy_o^2$$
$$P = b + 2y_o\sqrt{1 + z^2}$$

z = side slope of the bank

y_o = channel depth, ft

b = bottom width, ft

The manning equation can be written as,

$$Q = \frac{1.49 A^{5/3}}{n P^{2/3}} S_o^{1/2}$$

The continuity equation can be written to find the design velocity,

$$Q = VA$$
$$V_{design} = \frac{Q}{A}$$

V_{design} = velocity, ft/s

2.2.5 Drainage Ditch Design

The Manning's equation and continuity equation were used to find the ditch dimensions.

Manning's roughness coefficient for a grass lined channel is 0.03 with a max permissible channel velocity of 3 to 6 ft/s. The slope of the channel is based on the elevation on the property, which was determined to be 0.7177. The slope of the drainage ditch will be 1:3. Excel was used to determine the channel depth and bottom width. The channel depth came out to be 0.494 ft and width of 3 ft.

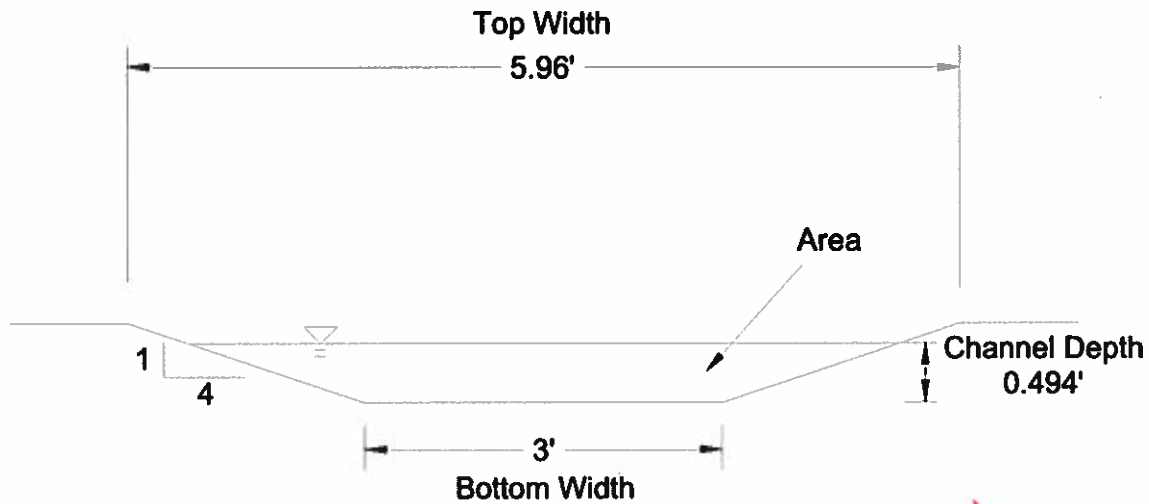


Figure 2.5 Section View of Trapezoid Ditch

The dimensions of the trapezoidal channel will support the discharge for the 100-year flood. Figure 2.6 displays the ditch in and flow of water on for a section of the development.

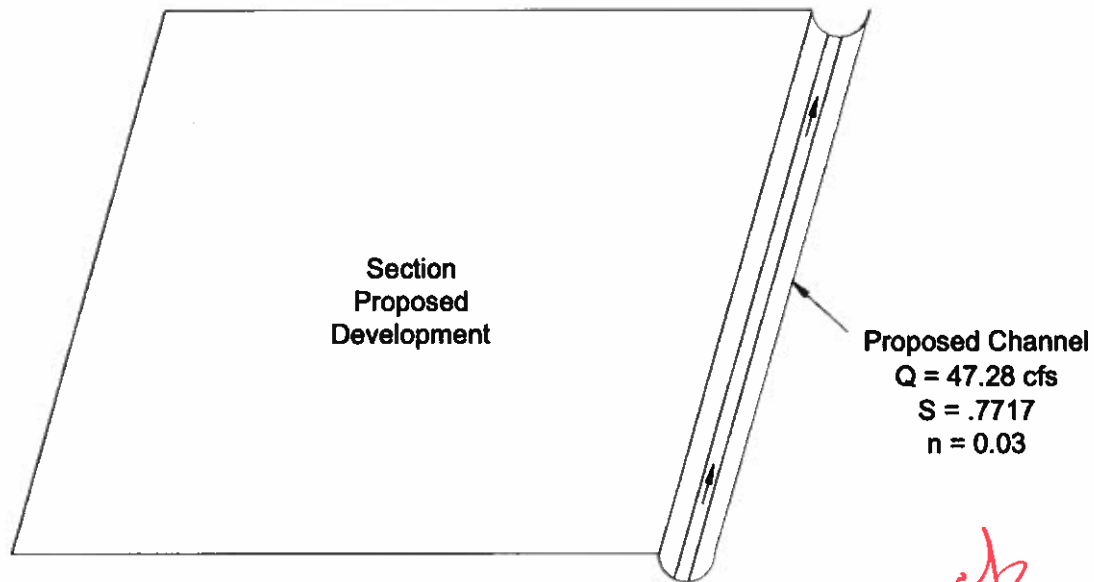


Figure 2.6 Profile View of Trapezoid Ditch

2.2.6 Stormwater Basin

The development requires a stormwater basin that allows the storage of runoff water in order to prevent flooding. With the data found on USGS the inflow of the ditch can be determined. A routing table can be developed to determine peak outflow, as shown in Table 2.2.6.

Table 2.5 Routing Table

Index	Time	Inflow, I	$(2s/\Delta t) - O$	$(2s/\Delta t) + O$	Outflow, O
(i)	(days)	(cfs)	(cfs)	(cfs)	(cfs)
1	0	517	21,600		500
2	1	519	22000	22,636	510
3	2	532	23000	23,051	550
4	3	741	24100	24,273	610
5	4	937	24200	25,778	690
6	5	645	25500	25,782	700
6	6	600	24000	26,745	690
7	7	590	23900	25,190	620
8	8	570	23800	25,060	610
9	9	565	23000	24,935	590

Figure 2.7 illustrates the inflow and outflow of the routing table. The peak discharge taken into account for the detention basin is 700 cfs.

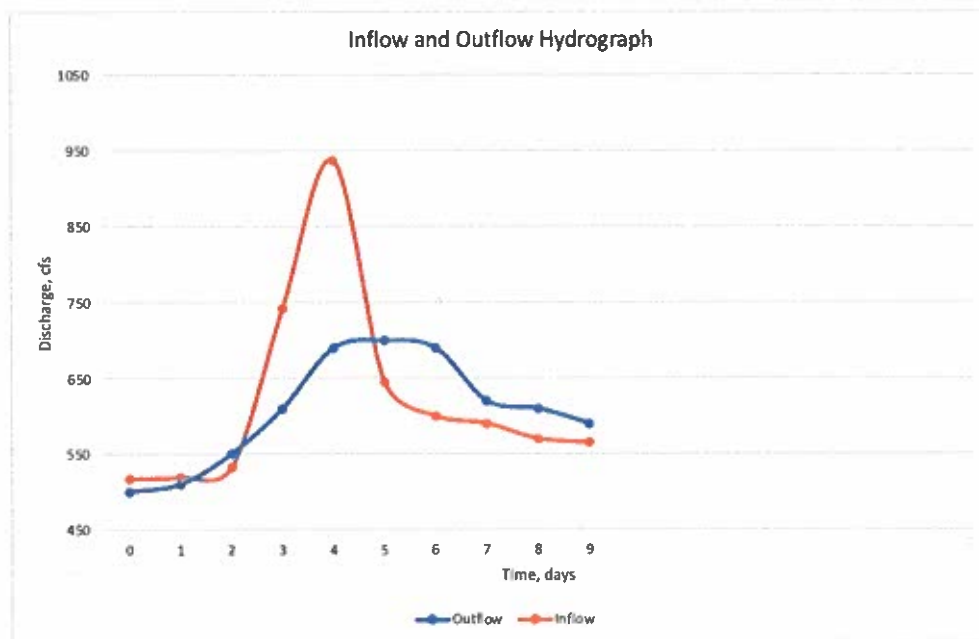


Figure 2.7 Inflow Hydrograph

The basin is suggested to have dimensions of 64ft by 64ft with a depth of 3.2ft. Figure 2.8 and 2.9 shows the section and profile view respectively.

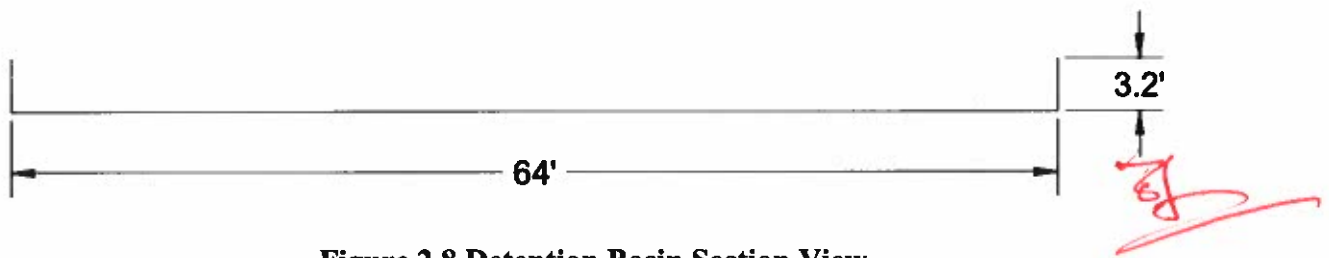


Figure 2.8 Detention Basin Section View

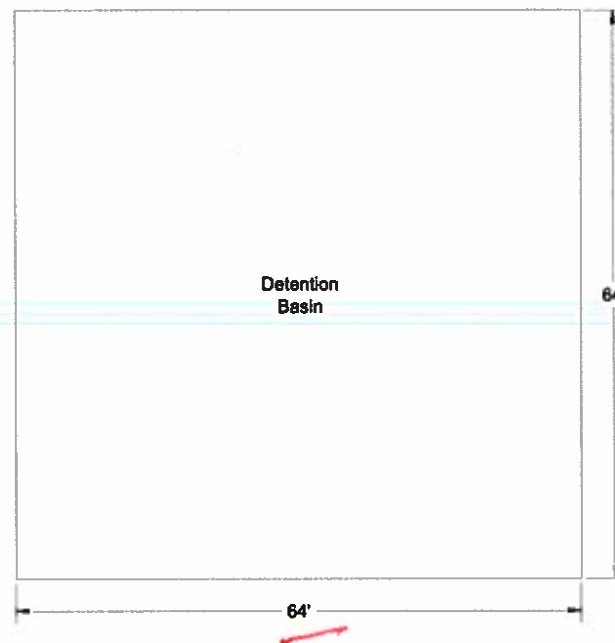


Figure 2.9 Detention Basin Profile View

*cross section
required.*

2.3 Structural Engineering

Structural requires a 2D drawing of the office buildings, warehouse, and convention center. To determine structural load calculations, wind, dead, and live load will be taken for each structure. The load calculations will then be put into STAAD Pro, to provide maximum values of BM, shear, and axial load. Moreover, the structural design will include slab design, beam, and column design, the steel structure design of the warehouse, and reinforcement bars, and reinforced concrete design for foundations, including footing size, reinforcement.

2.4 Transportation Engineering

The goal for transportation is to provide a roadway layout for the project site and to have a connecting road with the highway (I-10). When designing the road interchange designs will be implemented. Plan and profile view and pavement-design cross-section of a typical road will be

included as well. When designing the roads, there will be a minimum of two entrances, left turn movements will be at each entrance, a right-turn lane will be at the main entrance, and at least one entrance will be regulated by traffic signals. Also, there will be parking lots within the project site, service truck parking for the warehouse will be separated from cars to accommodate visitors coming to the office building for Amazon. Additionally, the site will also include sidewalks throughout the business center and subdivision including residential areas, landscaping, and streetlights.

To get started on transportation, the roadway layout will be the first step. The engineer will determine how many roads are needed by taking into consideration existing roads nearby and the type of interchange that will best fit and meet Texas Department of Transportation (TxDOT) and US DOT requirements and specifications. The design for the roadway layout will begin in the next few weeks. Then, next semester the other sections for transportation will be completed.

2.5 Environmental Engineering

The beneficial purpose of environmental designing in the vicinity of Amazon's Distribution Center and IT Hub is to provide an efficient amount of water used for primary purposes that are useful to human life. The importance of water is to control and eliminate diseases, quality of life, carry out waste, and commercial and industrial activities. The municipal water use for this project will be categorized into domestic, and commercial/industrial usage; initializing the quality and quantity of water that will be useful on this site.

As the environmental engineer on this project, we will estimate the inflow water demand for the facility population of twenty thousand with a project projection for 15 years. We will also calculate the water demand for expansion for an additional 10-15 years for possible expansion of the center and surrounding area and communities. With the inflow of water throughout the quarters of the premises we'll have to follow EPA (Environmental Protection Agency) regulations regarding the Maximum Contaminant Level (MCL) that is legally enforced for human consumption and usage; National Primary Drinking Water Regulation. The placement of our wastewater treatment plant (WWTP) is located in the lower southeast region of our 400-acre lot, as of now, we are still working on the methodology for cleaning the wastewater before the disposal of effluent into a source of surface water. The disposal source for the facilities will be Griffin Lake following the Texas Administrative Code (TAC).

The first portion of the design process will start with calculating the population in Columbus, Texas from the past five years, then calculate the population projection with the addition of twenty-thousands employees for future population. We will obtain the current estimated per capita raw water demand to determine our Q values. This process will begin over the span of Christmas Break up until the start of spring semester. The remaining tasks such as developing a wastewater schematic design, developing a disposal site, and articulating the proper disposal of

treated effluent contaminant level causing no harm to the environment and ecosystem will be completed throughout the upcoming semester.

82

Chapter 3: References

AASHTO Soil Classification System

American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011.

EPA, Environmental Protection Agency, <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>.

Hydraulic Design Manual, http://onlinemanuals.txdot.gov/txdotmanuals/hyd/manual_notice.htm.

Storm Water Management Design Manual - Mansfield, Texas.

<https://www.mansfieldtexas.gov/DocumentCenter/View/630/2010-Mansfield-iSWM-Local-Criteria-Section-PDF>.

Texas Department of Transportation, Roadway Design Manual 2020 Edition, July 2020 Engineering Dept Consultants Transportation & Planning Resources.

U.S. Department of Transportation, Federal Highway (FHWA) Hydraulic Design

U.S. Department of Transportation, Federal Highway (FHWA) Manual on Uniform Traffic Control Devices 2009 Edition, January 2010.

US Department of Commerce, NOAA. *PF Map: Contiguous Us*, US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, 7 Nov. 2005, https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=tx.

Appendix 1 Images

Geotechnical Data Collected

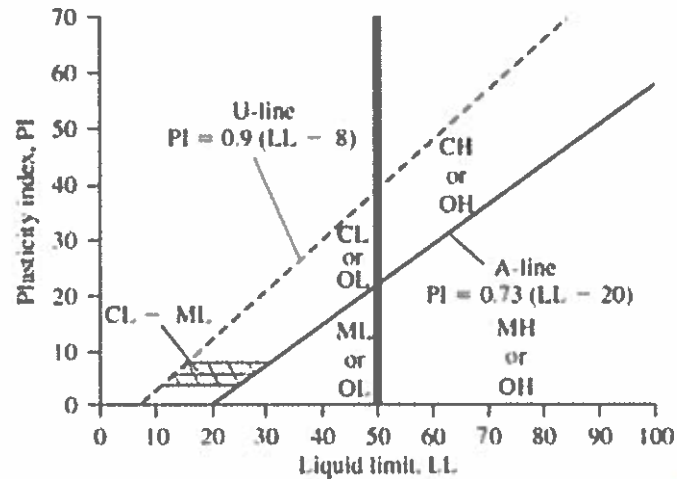


Figure A.1 Plasticity Chart

3.3 Terzaghi's Bearing Capacity Theory 139

Table B.1 Terzaghi's Bearing Capacity Factors—Eqs. (3.4), (3.5), and (3.6) a From Kumbhojkar (1993)

ϕ°	N_c	N_q	N_γ^a	ϕ°	N_c	N_q	N_γ^a
0	5.70	1.00	0.00	26	27.09	14.21	9.84
1	6.00	1.10	0.01	27	29.24	15.90	11.60
2	6.30	1.22	0.04	28	31.61	17.81	13.70
3	6.62	1.35	0.06	29	34.24	19.98	16.18
4	6.97	1.49	0.10	30	37.16	22.46	19.13
5	7.34	1.64	0.14	31	40.41	25.28	22.63
6	7.73	1.81	0.20	32	44.04	28.52	26.87
7	8.15	2.00	0.27	33	48.09	32.23	31.94
8	8.60	2.21	0.35	34	52.64	36.50	38.04
9	9.09	2.44	0.44	35	57.75	41.44	45.41
10	9.61	2.69	0.56	36	63.53	47.16	54.36
11	10.16	2.98	0.69	37	70.01	53.80	65.27
12	10.76	3.29	0.85	38	77.50	61.55	78.61
13	11.41	3.63	1.04	39	85.97	70.61	95.03
14	12.11	4.02	1.26	40	95.66	81.27	115.31
15	12.86	4.45	1.52	41	106.81	93.85	140.51
16	13.68	4.92	1.82	42	119.67	108.75	171.99
17	14.60	5.45	2.18	43	134.58	126.50	211.56
18	15.12	6.04	2.59	44	151.95	147.74	261.60
19	16.56	6.70	3.07	45	172.28	173.28	325.34
20	17.69	7.44	3.64	46	196.22	204.19	407.11
21	18.92	8.26	4.31	47	224.55	241.80	512.84
22	20.27	9.19	5.09	48	258.28	287.85	650.67
23	21.75	10.23	6.00	49	298.71	344.63	831.99
24	23.36	11.40	7.08	50	347.50	415.14	1072.80
25	25.13	12.72	8.34				

^aFrom Kumbhojkar (1993)

Figure A.2: Terzaghi Bearing Capacity Factors

Table 24. Approximate values of undrained shear strength for cohesive soils based on SPT blow count N-values (from Terzaghi and Peck, 1967)

Soil Consistency	SPT N (See Note)	S _u (psf)
Very Soft	< 2	< 250
Soft	2 - 4	250 - 500
Medium	4 - 8	500 - 1000
Stiff	8 - 15	1000 - 2000
Very Stiff	15 - 30	2000 - 4000
Hard	> 30	> 4000

Figure A.3: Approximate Value of Cu, SPT and soil consistency

Water Resources Engineering

Duration	PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹									
	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	5.72 (4.33-7.57)	6.61 (5.08-8.66)	8.08 (6.19-10.6)	9.28 (6.96-12.3)	10.9 (7.92-15.0)	12.1 (8.59-17.1)	13.4 (9.23-19.4)	14.6 (9.84-21.8)	16.3 (10.8-25.2)	17.6 (11.2-27.8)
10-min	4.55 (3.44-6.01)	5.26 (4.02-6.89)	6.43 (4.90-8.46)	7.40 (5.55-9.86)	8.72 (6.35-12.0)	9.73 (6.90-13.7)	10.7 (7.39-15.6)	11.7 (7.84-17.4)	12.9 (8.37-19.8)	13.8 (8.71-21.8)
15-min	3.84 (2.91-5.08)	4.42 (3.38-5.80)	5.38 (4.10-7.08)	6.17 (4.63-8.22)	7.24 (5.28-9.92)	8.04 (5.89-11.3)	8.84 (6.10-12.8)	9.66 (6.50-14.4)	10.8 (6.90-16.6)	11.6 (7.34-18.3)
30-min	2.74 (2.07-3.61)	3.13 (2.40-4.11)	3.79 (2.89-4.99)	4.33 (3.25-5.77)	5.06 (3.67-6.82)	5.59 (3.95-7.88)	6.14 (4.23-8.90)	6.73 (4.53-10.0)	7.54 (4.90-11.6)	8.19 (5.18-12.9)
60-min	1.78 (1.35-2.38)	2.06 (1.58-2.70)	2.51 (1.92-3.31)	2.88 (2.17-3.85)	3.40 (2.46-4.84)	3.77 (2.66-5.31)	4.17 (2.87-6.04)	4.60 (3.10-6.88)	5.23 (3.40-8.07)	5.74 (3.63-8.77)
2-hr	1.07 (0.816-1.41)	1.28 (0.973-1.64)	1.60 (1.22-2.08)	1.87 (1.41-2.48)	2.26 (1.65-3.08)	2.57 (1.82-3.60)	2.90 (2.01-4.18)	3.26 (2.23-4.85)	3.84 (2.50-5.89)	4.31 (2.74-6.76)
3-hr	0.779 (0.584-1.02)	0.947 (0.720-1.21)	1.20 (0.921-1.56)	1.43 (1.08-1.89)	1.77 (1.28-2.40)	2.03 (1.45-2.84)	2.33 (1.62-3.34)	2.68 (1.81-3.94)	3.18 (2.08-4.86)	3.51 (2.30-5.65)
6-hr	0.447 (0.342-0.579)	0.541 (0.424-0.700)	0.728 (0.559-0.934)	0.894 (0.671-1.18)	1.12 (0.826-1.51)	1.31 (0.943-1.83)	1.54 (1.07-2.19)	1.79 (1.22-2.62)	2.17 (1.42-3.29)	2.48 (1.59-3.88)
12-hr	0.259 (0.183-0.323)	0.323 (0.243-0.385)	0.428 (0.327-0.538)	0.534 (0.399-0.800)	0.675 (0.502-0.910)	0.809 (0.584-1.12)	0.982 (0.673-1.36)	1.13 (0.771-1.64)	1.38 (0.912-2.09)	1.58 (1.03-2.47)
24-hr	0.141 (0.109-0.181)	0.186 (0.136-0.224)	0.248 (0.181-0.312)	0.309 (0.237-0.399)	0.405 (0.303-0.544)	0.491 (0.358-0.679)	0.581 (0.445-0.809)	0.690 (0.478-1.00)	0.854 (0.583-1.27)	0.961 (0.632-1.50)
2-day	0.090 (0.062-0.101)	0.107 (0.080-0.127)	0.144 (0.112-0.180)	0.182 (0.140-0.233)	0.241 (0.183-0.324)	0.297 (0.218-0.409)	0.358 (0.253-0.499)	0.419 (0.287-0.597)	0.509 (0.330-0.738)	0.582 (0.383-0.854)
3-day	0.068 (0.045-0.073)	0.078 (0.059-0.092)	0.105 (0.082-0.130)	0.132 (0.102-0.168)	0.174 (0.133-0.234)	0.214 (0.159-0.294)	0.257 (0.182-0.387)	0.299 (0.205-0.424)	0.354 (0.236-0.521)	0.396 (0.266-0.590)
4-day	0.047 (0.036-0.059)	0.062 (0.047-0.073)	0.083 (0.065-0.103)	0.104 (0.080-0.132)	0.136 (0.104-0.181)	0.168 (0.122-0.226)	0.198 (0.140-0.274)	0.230 (0.158-0.325)	0.272 (0.181-0.389)	0.306 (0.197-0.459)
7-day	0.031 (0.024-0.039)	0.040 (0.031-0.048)	0.053 (0.041-0.065)	0.065 (0.050-0.082)	0.083 (0.063-0.108)	0.099 (0.073-0.134)	0.117 (0.083-0.161)	0.135 (0.093-0.191)	0.161 (0.107-0.234)	0.181 (0.117-0.271)
10-day	0.024 (0.019-0.030)	0.030 (0.024-0.037)	0.040 (0.031-0.049)	0.048 (0.038-0.061)	0.061 (0.046-0.080)	0.072 (0.053-0.097)	0.084 (0.060-0.116)	0.097 (0.067-0.138)	0.115 (0.077-0.165)	0.130 (0.085-0.194)
20-day	0.016 (0.012-0.019)	0.019 (0.015-0.023)	0.025 (0.019-0.030)	0.032 (0.023-0.037)	0.038 (0.027-0.048)	0.041 (0.030-0.055)	0.047 (0.034-0.064)	0.053 (0.037-0.074)	0.062 (0.042-0.090)	0.069 (0.045-0.103)
30-day	0.012 (0.010-0.015)	0.015 (0.012-0.018)	0.019 (0.015-0.023)	0.022 (0.017-0.028)	0.027 (0.020-0.035)	0.031 (0.022-0.040)	0.034 (0.025-0.046)	0.038 (0.027-0.053)	0.044 (0.030-0.063)	0.048 (0.032-0.072)
45-day	0.010 (0.008-0.013)	0.012 (0.010-0.015)	0.015 (0.012-0.019)	0.018 (0.014-0.022)	0.021 (0.016-0.027)	0.023 (0.017-0.031)	0.026 (0.019-0.036)	0.029 (0.020-0.040)	0.032 (0.022-0.046)	0.035 (0.022-0.051)
60-day	0.009 (0.007-0.011)	0.011 (0.009-0.013)	0.013 (0.010-0.016)	0.015 (0.012-0.019)	0.018 (0.013-0.023)	0.020 (0.015-0.026)	0.022 (0.016-0.029)	0.024 (0.017-0.033)	0.026 (0.018-0.037)	0.028 (0.018-0.041)

Figure A.4 Precipitation Point Frequency

Table 4.4-2 Roughness Coefficients (Manning's n) and Allowable Velocities for Natural Channels		
Channel Description	Manning's n	Maximum Permissible Channel Velocity (ft/s)
MINOR NATURAL STREAMS		
Fairly regular section		
1. Some grass and weeds; little or no brush	0.030	3 to 6
2. Dense growth of weeds, depth of flow materially greater than weed height	0.035	3 to 6
3. Some weeds, light brush on banks	0.035	3 to 6
4. Some weeds, heavy brush on banks	0.050	3 to 6
5. Some weeds, dense willows on banks	0.060	3 to 6
For trees within channels with branches submerged at high stage, increase above values by	0.010	
Irregular section with pools, slight channel meander, increase above values by	0.010	
Floodplain – Pasture		
1. Short grass	0.030	3 to 6
2. Tall grass	0.035	3 to 6
Floodplain – Cultivated Areas		
1. No crop	0.030	3 to 6
2. Mature row crops	0.035	3 to 6
3. Mature field crops	0.040	3 to 6
Floodplain – Uncleared		
1. Heavy weeds scattered brush	0.050	3 to 6
2. Wooded	0.120	3 to 6
MAJOR NATURAL STREAMS		
Roughness coefficient is usually less than for minor streams of similar description on account of less effective resistance offered by irregular banks or	Range from 0.028 to 0.060	3 to 6

Figure A.5 Roughness Coefficient

Appendix 2 Calculations

Water Resources

Stormwater Runoff

$$Q = ciA$$

$$Q = (0.3)(0.91 \text{ in/hr})(400 \text{ acres})$$

$$Q = 47.28 \text{ cfs}$$

Drainage Ditch

$$Q = 47.28 \text{ cfs}$$

$$Z = 3 \quad (1:3)$$

$$S_0 = 0.7177 \text{ ft/ft}$$

$$\text{assume } b = 3$$

• Flow area

$$A = by + zy^2$$

$$A = (3 \text{ ft})(0.494 \text{ ft}) + (3)(0.494 \text{ ft})^2$$

$$A = 2.214 \text{ ft}^2$$

• Top width

$$T = b + 2zy$$

$$T = (3 \text{ ft}) + 2(3)(0.494 \text{ ft})$$

$$T = 5.904 \text{ ft}$$

• Wetted Perimeter

$$P = b + 2\sqrt{y^2 + Z^2y^2}$$

$$P = 3 \text{ ft} + 2\sqrt{(0.494 \text{ ft})^2 + (3)^2(0.494 \text{ ft})^2}$$

$$P = 6.124 \text{ ft}$$

• Hydraulic Radius

$$R = A/P$$

$$R = (2.214 \text{ ft}^2) / 6.124 \text{ ft}$$

$$R = 0.3615 \text{ ft}$$

hand calculation - ?

- Hydraulic Depth

$$D = A / T$$

$$D = (2.214 \text{ ft}^2) / 5.964$$

$$\boxed{D = 0.3712 \text{ ft}}$$

- Flowrate

$$Q = \frac{1.49}{n} A R^{2/3} S_0^{1/2}$$

$$Q = \frac{1.49}{0.03} (2.214 \text{ ft}^2) (0.3015 \text{ ft})^{2/3} (0.7177)^{1/2}$$

$$\boxed{Q = 47.28 \text{ cfs}}$$

- Channel Velocity

$$V = Q / A$$

$$V = \frac{47.28 \text{ cfs}}{2.214 \text{ ft}^2}$$

$$\boxed{V = 21.35 \text{ ft/s}}$$

75

Prairie View A&M University
Roy G Perry College of Engineering
Civil & Environmental Engineering Department



CVEG 4200-P01 – Senior Design

Fall 2021

**Project Report 1- Development of Business and
Distribution Center, and IT Hub for Amazon**

Submitted to:

Dr. Jobair Bin Alam

Submitted by: JJMPS Consulting

Sydney Jones, Paige Hines, Jerral Walker, Michael Leblanc,

Johnathon Chevalier

Date Due: December 1st, 2021

Table of Contents

Introduction	3
Project Scope:	3
Progression Timeline	4-5
Water Resources	6-7
Structural	8-15
Geotechnical	16-19
Transportation	19-22
Environmental (Wastewater Treatment Plant)	23-25
Executive Summary	26-32
References	33-34

Introduction

PVAMU Civil Engineering Students are to develop and design the business and distribution center, IT Hub, and office development on a 400-acre site located in Waller, Washington and Colorado Counties located south of major Highways (US 290 and I-10) for Amazon. The specific scope of the project will include Civil Engineering Development and Design services for the entire site which will include two five-story commercial office buildings, a steel structure warehouse, a three-story convention center, and parking lots. The students will also perform new road network development, engineering design of pavement and pavement subgrade, intersections, sidewalks, driveways, and extension of major highways/service road and connecting local road with highway, a storm water ditch connecting a major lake, a municipal solid waste and a temporary recyclables disposal facility, and wastewater treatment process and facility. The facilities will be designed for 20,000 people or based on population projection for 15 years. A map showing site locations is included at the end of this document.

Project Scope

The project team is required to perform Civil Engineering Site Development and Design services and address all aspects outlined in the project description:

Employee Count – 20,000 employees

- o 40% of employees in the warehouse
- o 35% of employees in the warehouse

- o 15% of employees in the IT Hub
- o 10% of employees in the warehouse

Location – Waller County



Figure 1.1: Waller County Project Location

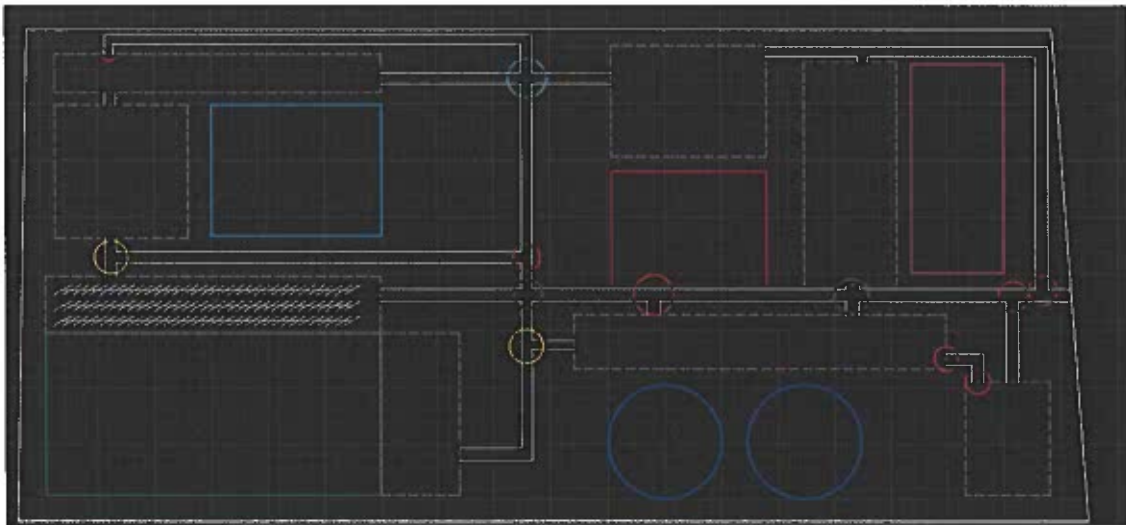


Figure 1.2: Project Plan View

Labels?
Layout plan on any CAD drawing in white background is recommended.

Progression Timeline

Structural Engineering:

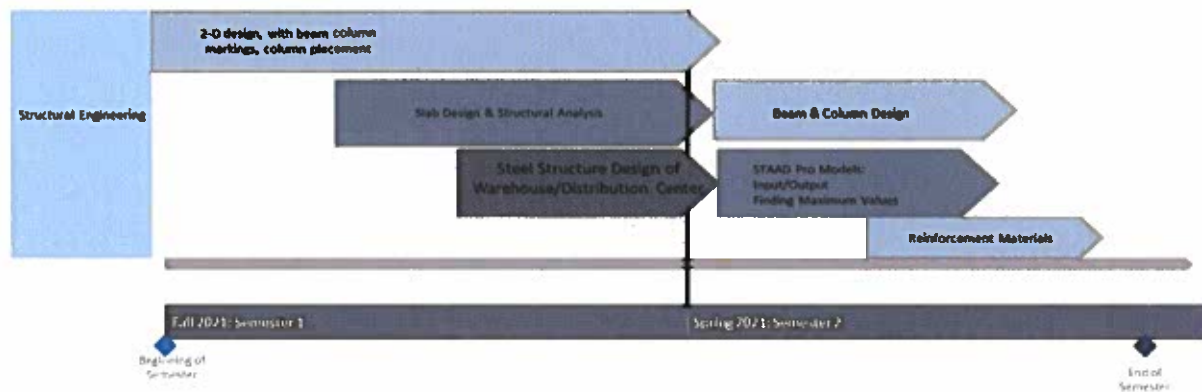


Figure 2.1: Structural Engineering Progression Timeline

Geotechnical Engineering:

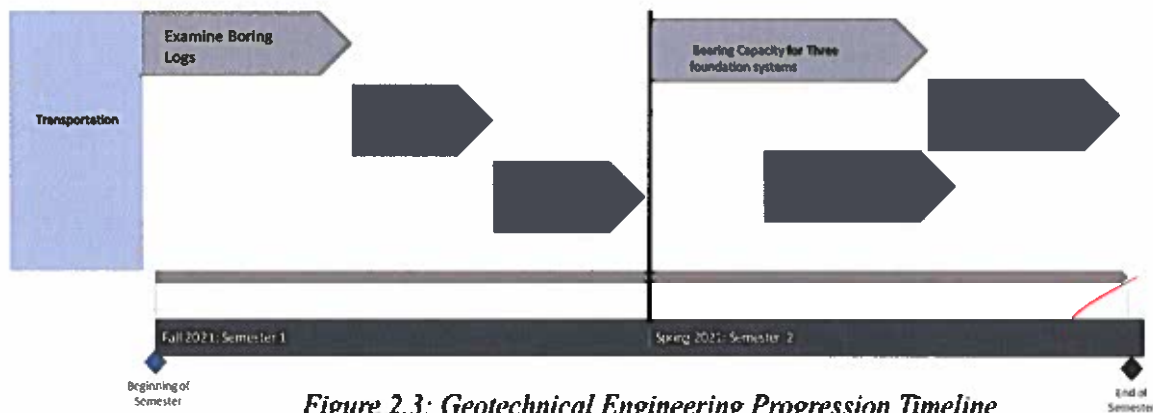


Figure 2.3: Geotechnical Engineering Progression Timeline

Water Resources Engineering:

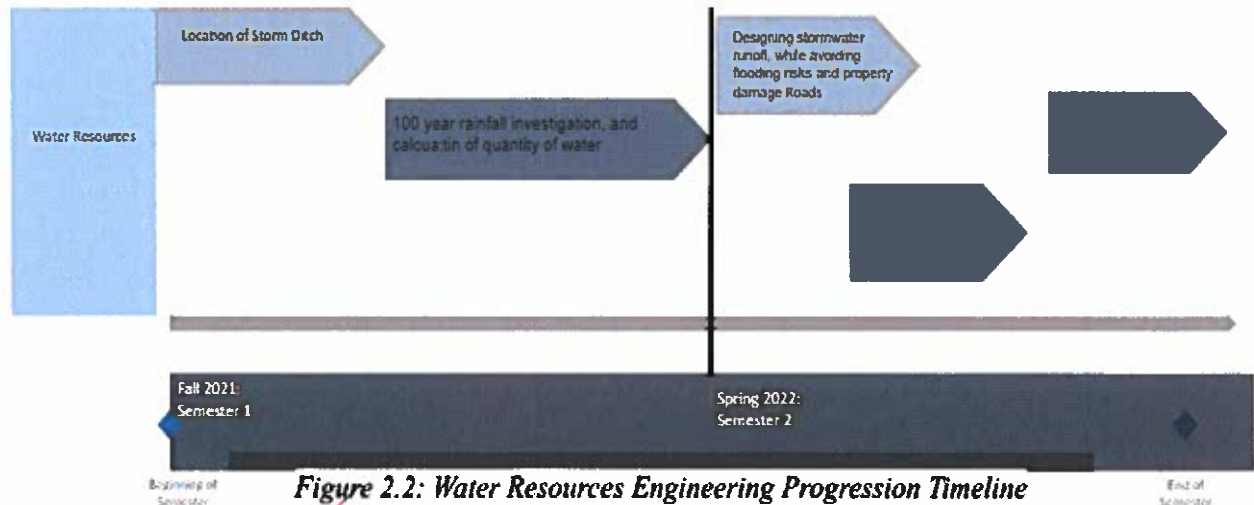


Figure 2.2: Water Resources Engineering Progression Timeline

Transportation Engineering:

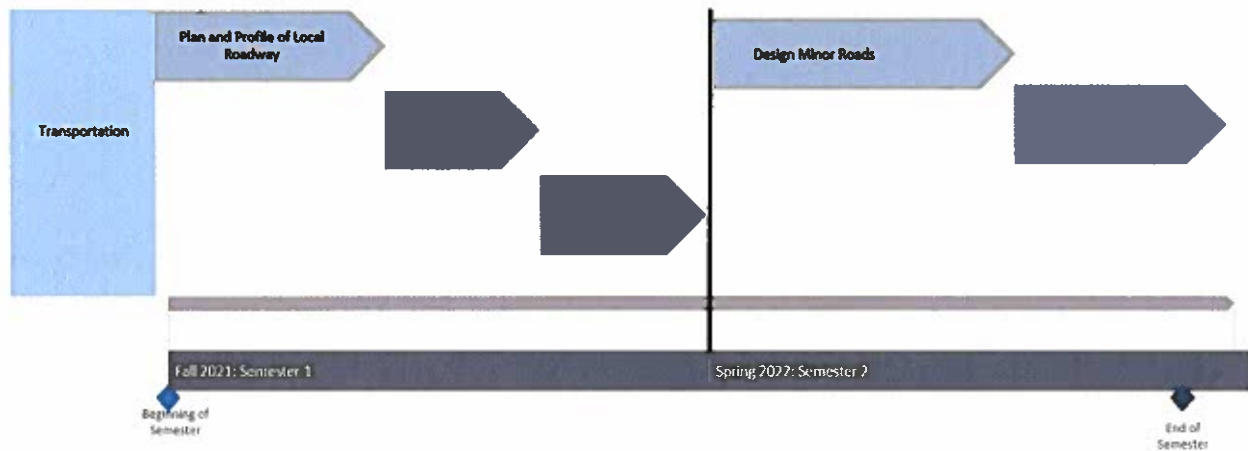


Figure 2.4: Transportation Engineering Progression Timeline

Environmental Engineering:

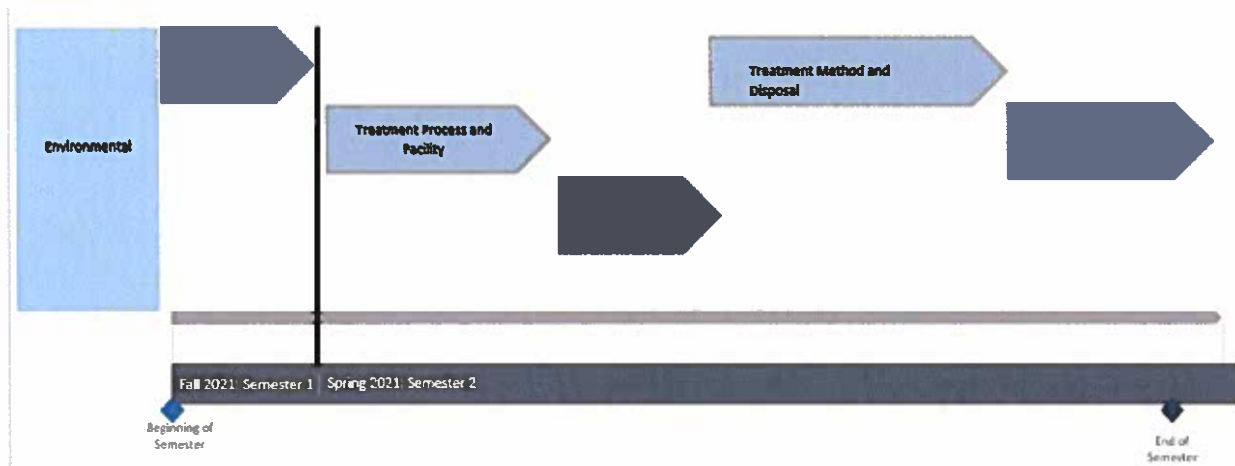


Figure 2.4: Environmental Engineering Progression Timeline

OK

OK! now
more detail breakdown
of the tasks is required.

Water Resources

For the water resources part, the location of the storm water ditch was discussed and placed with the help of the environmental and geotechnical authorities so that all aspects balance out. Engineers studied the site using google maps to understand the elevation of the construction site. Obtaining that information, the storm drainage ditches could be designed by the use of gravity to create flow from the highest elevation. Below is a demonstration of where the storm ditch will be placed as well as the detention basin:



The quantity of water was calculated by using the rational method. This equation represents the relationship between rainfall intensity and catchment area as independent variables and the investigation of the 100 year peak flood discharge as a dependent variable. This will help with determining Q, the storm water runoff to avoid risk of flooding and property damage.

Rational Method:

$$Q = C * I * A$$

Where

Q = Runoff Flow

C = Runoff Coefficient

I = Rainfall Intensity

A = Acres

$$127.05cfs = .3 \times 1.05 \frac{in}{hr} \times 400acres \times \frac{43560 ft}{1in} \times \frac{1ft}{12in} \times \frac{1hr}{3600s}$$

All water will be carried from the pre/post construction area at its highest elevation, in a designed trapezoid channel based on the peak rainfall in Waller county. The elevation information has been obtained from my geotechnical engineer. To complete the design a profile and crosssection will be provided.

~ why trapezoidal? you may decide your channel geometry after design?

Structural Engineering

Requirements and Designs

- i. 2D Drawing- For the purpose of understanding, the IT Hub will be fully disclosed with figures and an explanation as a guide to how the other buildings were designed and accurately accounted for. Refer to appendix for *Excel file 1* to account for the other buildings.

1. It Hub

a. AREA:

- i. 100,000 square feet
- ii. 400'x 250'

b. 4 – story building

- c. This building is to be able to employ 10% of the projected 20,000 employees that are to be hired by Amazon.

2. Office Buildings

a. AREA:

- i. 540,225 square feet (Combined)
- ii. 12.5 acres roughly

b. 5 – story building each

- c. These buildings are to be able to employ of 30% of the projected 20,000 employees that is to be hired by Amazon.

3. Convention Center

a. AREA:

- i. 2.5 million square feet
- ii. 57 acres (largest structure)

b. 3 – story building

- c. This building is to be able to employ at least 15% of the projected 20,000 employees that is to be hired by Amazon.

4. Warehouse

a. AREA:

- i. 350,000 square feet
- ii. 1000'x 350'

b. 1 – story building

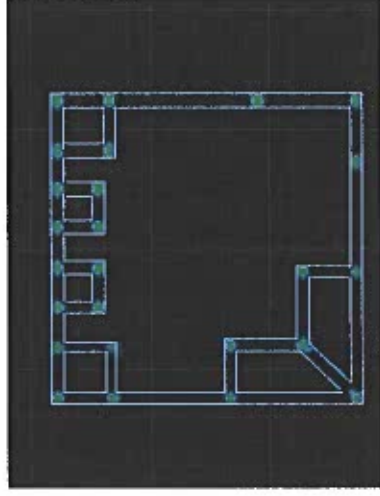
- c. This building is to be able to employ at least 45% of the projected 20,000 employees that are to be hired by Amazon.

2. Structural load calculation/ Slab Design

- i. As an update, the determination of load for each structure is being calculated and appraised with regards to references from multiple manuals and from similar buildings of the same structure in the nearby area.
- 3. Beam Column Design
- 4. Completion of Steel Structure
- 5. STAAD Pro
- 6. Reinforcement Materials

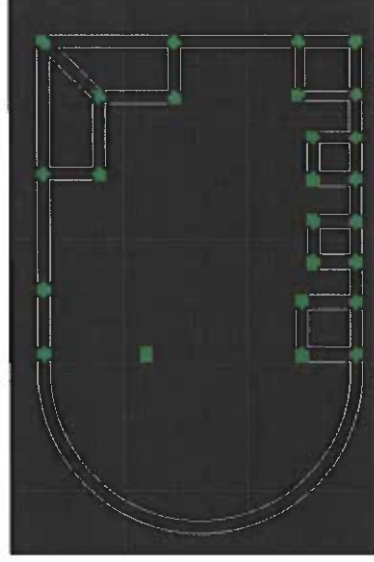
~~title~~
 figure No. always
 below the figure
 label?

Figure 3.1: First Floor of IT Hub



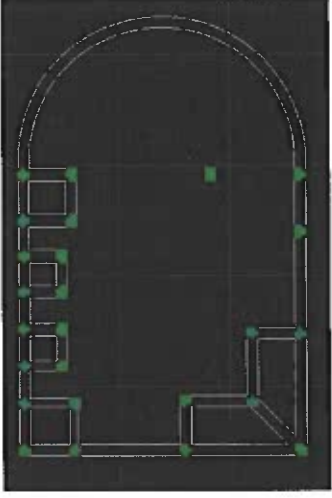
This figure includes an autocad version of the 2-D drawing of the first floor of the IT Hub designs with beam & column placement.

Figure 3.2: Second Floor of IT Hub



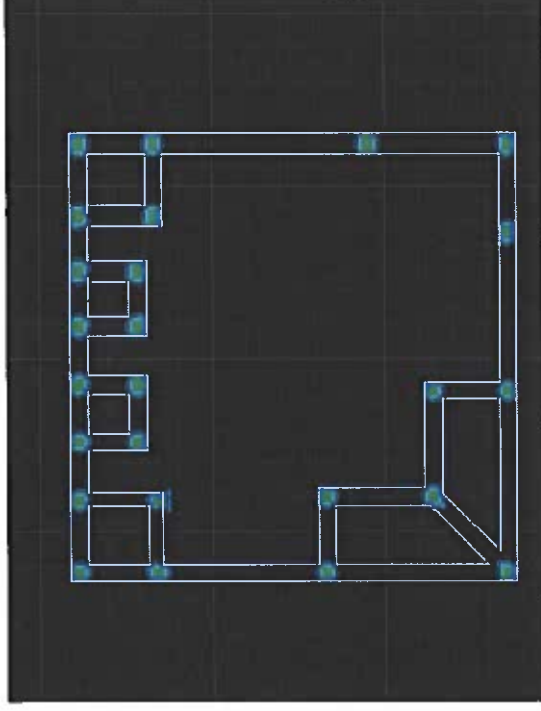
This figure includes an autocad version of the 2-D drawing of the second floor of the IT Hub designs with beam & column placement.

Figure 3.3: Third Floor of IT Hub



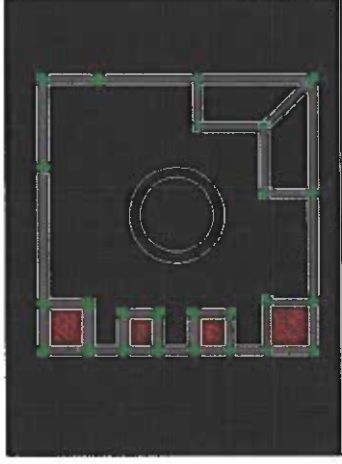
This figure includes an autocad version of the 2-D drawing of the third floor of the IT Hub designs with beam & column placement.

Figure 3.4: Fourth Floor of IT Hub



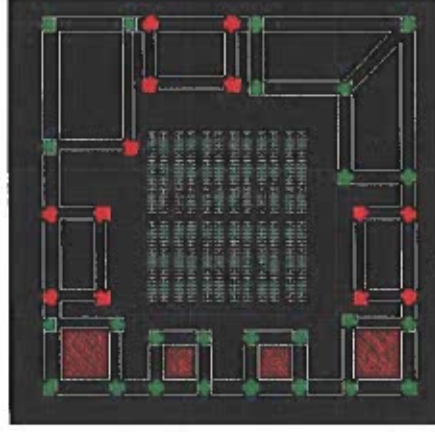
This figure includes an autocad version of the 2-D drawing of the fourth floor of the IT Hub designs with beam & column placement.

Figure 3.5: First Floor of Office Buildings



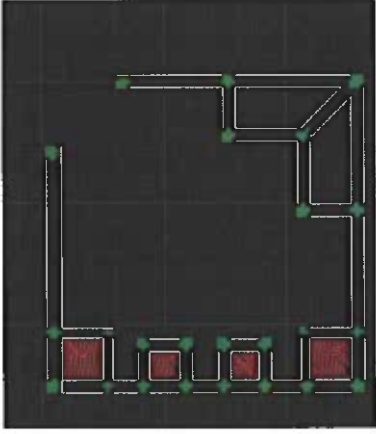
This figure includes an autocad version of the 2-D drawing of the first floor of the office building designs with beam & column placement.

Figure 3.6: Second Floor of Office Buildings



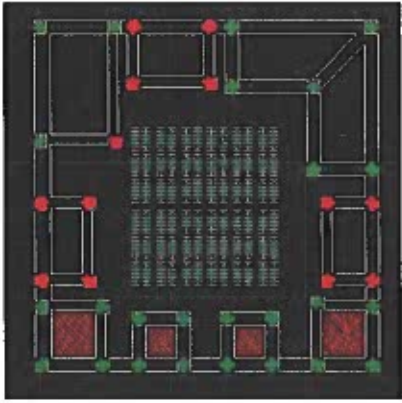
This figure includes an autocad version of the 2-D drawing of the first floor of the office building designs with beam & column placement.

Figure 3.7: Third Floor of Office Buildings



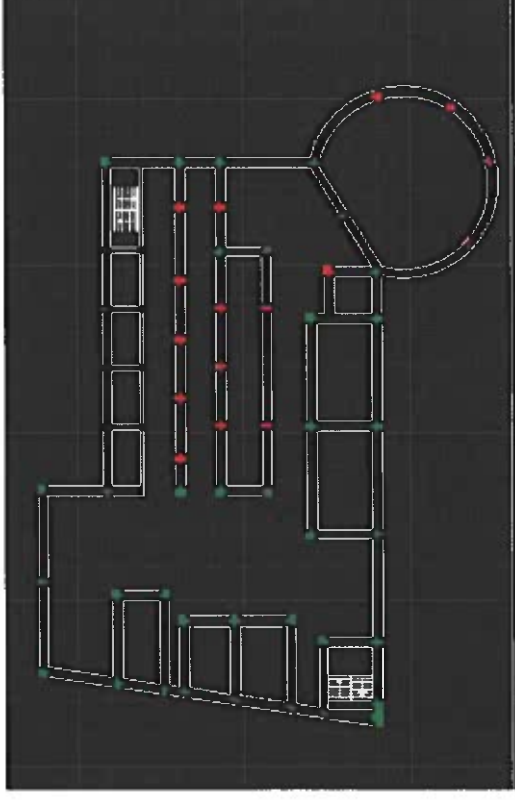
This figure includes an autocad version of the 2-D drawing of the third floor of the office building designs with beam & column placement.

Figure 3.8: Fourth/Fifth Floor of Office Buildings



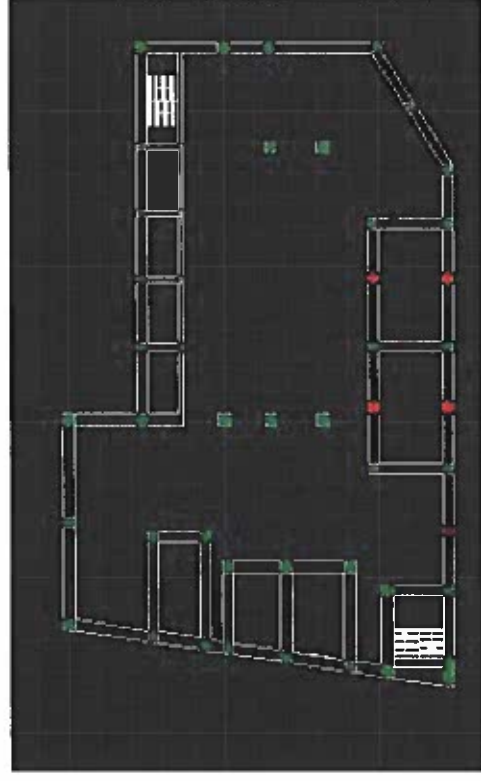
This figure includes an autocad version of the 2-D drawing of the fourth and fifth floor of the office building designs with beam & column placement.

Figure 3.9: First Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the first floor of the convention center designs with beam & column placement

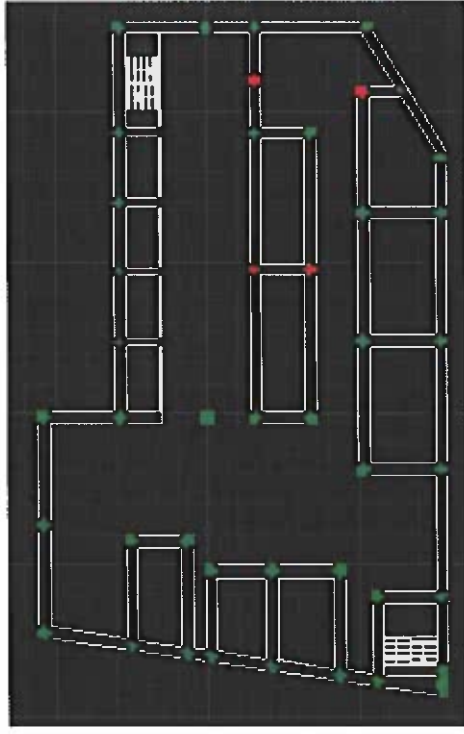
Figure 3.10: Second Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the second floor of the convention center designs with beam & column placement

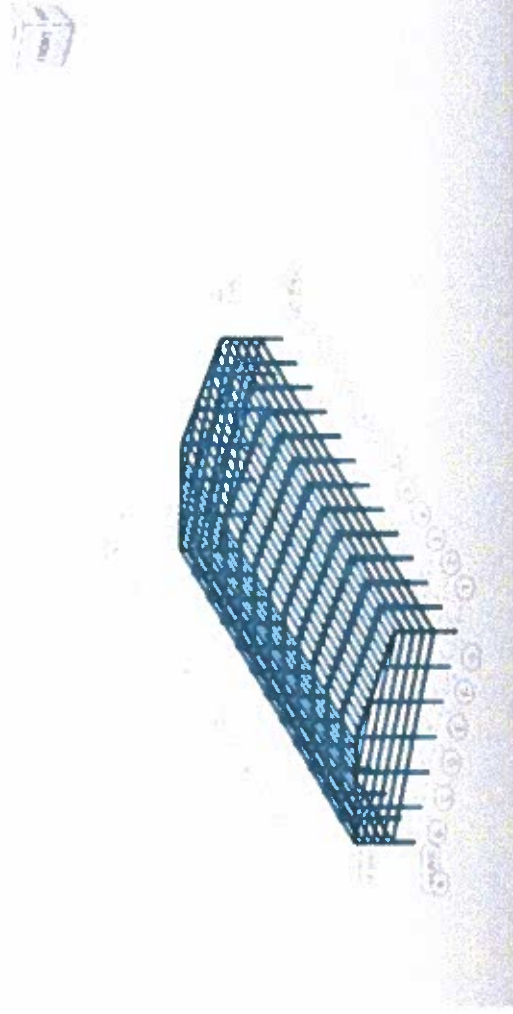
you need to
provide proper
labelling!

Figure 3.11: Third Floor of Convention Center



This figure includes an autocad version of the 2-D drawing of the third floor of the convention center designs with beam & column placement

Figure 3.12: Ground Floor of Steel Distribution Center ?



This figure includes an autocad version of the 3-D drawing of the Ground floor of the Steel Structure
Distribution center designs with beam & column placement

Geotechnical

Introduction:

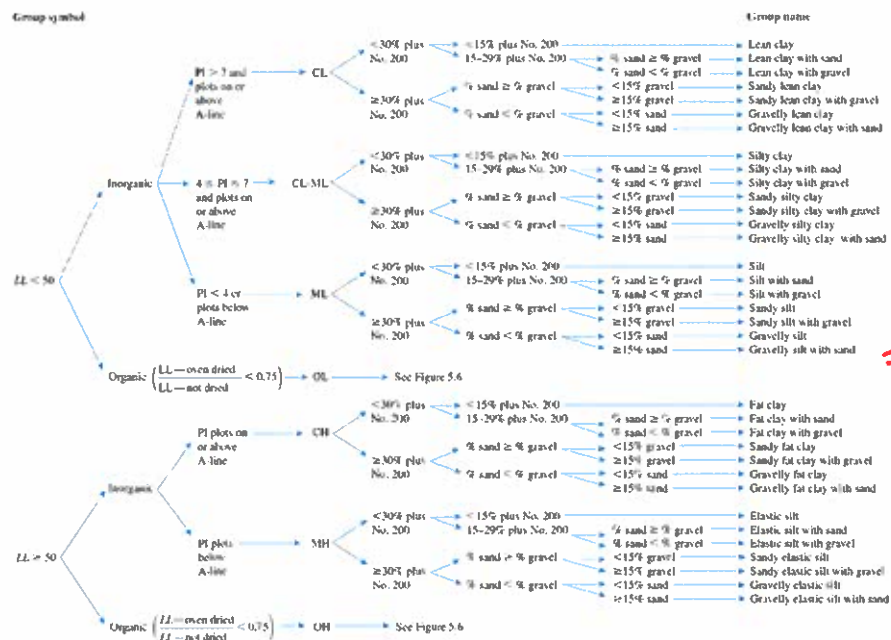
This section of the report is the progress for the geotechnical engineering portion of the Amazon Business building and Distribution center. Our Company was contacted by Dr. Alam to perform the appropriate task to make this project successful. The starting point for this project was the SPT test. The Standard Penetration Test (SPT) is a method of determining the geotechnical parameters of subsurface soil. This test is inexpensive and can accurately estimate the density and shear strength of soil. To conduct this test, a standard, thick-walled sample tube is driven into the earth at the bottom of a borehole. Strikes from a slide hammer mechanism with a set weight and fall distance accomplish this.

Scope Of work:

The investigation's goal was to undertake subsurface exploration and establish subsurface conditions at the project site so that geotechnical recommendations for the Amazon parking lots, distribution facility, and company buildings could be developed. Testing and classifying subsurface soils for strength, allowed bearing capacities, and foundation options, as well as foundation soil expansive properties for construction of the above-mentioned institutions based on laboratory tests and best engineering practices, are also included. The soil research began with the drilling of two holes to a depth of 70 feet in the project site's center and the northwest corner of the 400-acre property.

Drilling, Sampling, and Soil Classification:

The CME 75 Drilling Rig was used for the drilling. The subgrade soils were investigated with a continuous flight auger that was used to advance the hole's dryness. Soil samples were collected using thin-walled tubes in accordance with ASTM D 1587 during the drilling operation, and split spoon sampler testing (STP) was performed in accordance with ASTM D 1586. Because bedrock was encountered, continuous push tube samples were taken for the ground surface to a depth of 70 feet, and the borings were spaced 80 feet apart. The changes in soil strata noticed during drilling operations were meticulously calculated and recorded on the boring logs. The procedures outlined in ASTM D 2487, based on the Unified Soil Classification System, were used to classify all soil samples (shown in Figure 1). Furthermore, using the methods provided in the Plasticity Chart, the soils are documented in the boring logs (Shown in figure two). The Boring logs' soil Classification were placed in Table 1 and Table 2 shown below.



⇒ This is appendix

Figure 4.1: Unified Soil Classification System

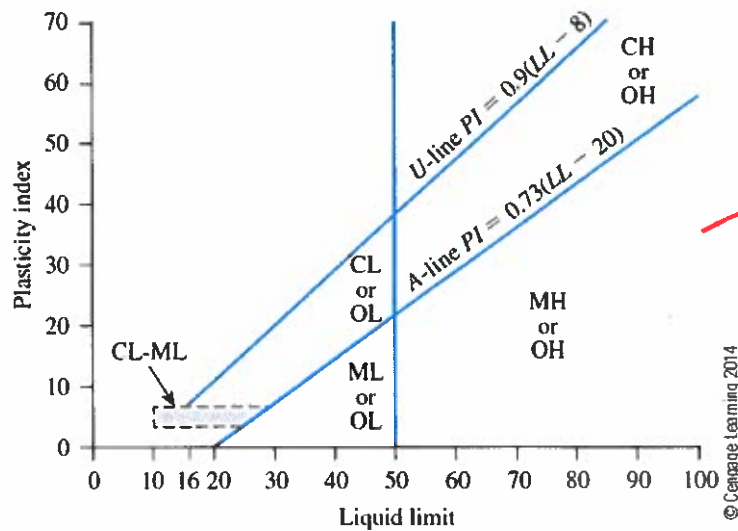


Figure 4.2: Plasticity Chart

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	43	16	27	71%	29%	19%	CL	Sandy lean Clay
7.5	47	19	28	81%	19%	12%	CL	Sandy lean Clay
8.7	-	-	0	20%	80%	6%	-	Sand
15	51	24	27	69%	31%	13%	CH	Sandy Fat Clay
20	-	-	0	16%	84%	8%	-	Sand
25	62	30	32	80%	20%	15%	CH	Sandy Fat Clay
30	62	27	35	79%	21%	13%	CH	Sandy Fat Clay
40	69	28	41	83%	17%	17%	CH	Sandy Fat Clay
50	71	33	38	72%	28%	18%	CH	Sandy Fat Clay
60	69	34	35	79%	21%	19%	CH	Sandy Fat Clay

Table 4.1: Soil Classification for Test hole #1

Depth (ft)	Liquid Limit	Plastic Limit	Plastic Index	Sieve Analysis (#200)	Coarse Fraction	Water Content	Group Name	Classification
2.5	48	20	28	54%	46%	13%	CL	Sandy lean Clay
5	51	32	19	69%	31%	14%	MH	Sandy Elastic Silt
10	-	-	-	-	-	8%	-	Sand
12.5	46	19	27	74%	26%	18%	CL	Sandy lean Clay
17	-	-	-	-	-	10%	-	Sand
20	32	16	16	54%	46%	13%	CL	Sandy lean Clay
25	60	31	29	81%	19%	21%	MH	Sandy Elastic Silt
30	72	31	41	82%	18%	20%	CH	Sandy Fat Clay
40	68	39	29	62%	38%	4%	MH	Sandy Elastic Silt
50	80	39	41	69%	31%	18%	MH	Sandy Elastic Silt
60	68	34	34	84%	16%	20%	MH	Sandy Elastic Silt

Table 4.2: Soil Classification for Test hole #2

The next step is to gather the unit weight of each soil layer and after recently receiving the Unconsolidated Undrained test we can now calculate the settlement conditions, allowable

bearing capacity, and develop a foundation recommendation. The foundation will not only be safe for loading but will also be very cost efficient.

Transportation

For the Transportation aspect of this project, the parking lot design, plan and profile of the local road, and the roadway intersections have been completed. For the parking lot design, the amount of employees in each building was calculated based on the percentage of employees working in each building. For the warehouse, 40% of employees work in the building so the parking lot's capacity was 8000 parking spots. For the office development, 35% of employees worked in the buildings so 7000 parking spots were designed. The convention center holds 15% of the total number of employees so the parking lot will consist of 3000 parking spots and finally the IT Hub will hold 10% of the total employees and will require 2000 parking spots. The parking lot angle selected to ensure enough parking spots will fit in the provided area will be 30 degrees. This allows the space between one aisle to another to be the smallest at 14 feet. The MUTCD was utilized to ensure the number of spots and the dimensions of the parking spots and rows met the code.

For the plan and profile of the local road, the elevation for Warren Road, the road we plan on connecting to, was determined and a 2% grade was calculated and drawn in autocad to create an accurate profile curve. Below in figure 5.2 and 5.3 the plan and profile drawing completed in autocad can be found. We designed each road within the property that will connect one building to the next and allow simple access to each designated parking lot. Between each lot where there is an intersection, the type was selected based on the maximum flow during peak hours. There is a minimum of two entrances/exits for each parking lot to prevent congestion and allow a smooth

flow of traffic on the property. The roadway intersections were designed based on the maximum number of employees that will be expected to travel through that area and estimate the peak hours of traffic and the minimum for accurate timing on the signals. Next it was determined what risks were found at each intersection and designed necessary barriers and other protective structures to protect all commuters that met the MUTCD code. Finally, utilizing autocad, a plan drawing of each intersection was created so the layout and proximity to each parking lot is clear. Below are the autocad drawings of each type of intersection as well as a sample parking lot plan view to show the dimensions of each bay as well as the distance each row is from the next.

Figure 5.1 : 4-way intersection with stop sign

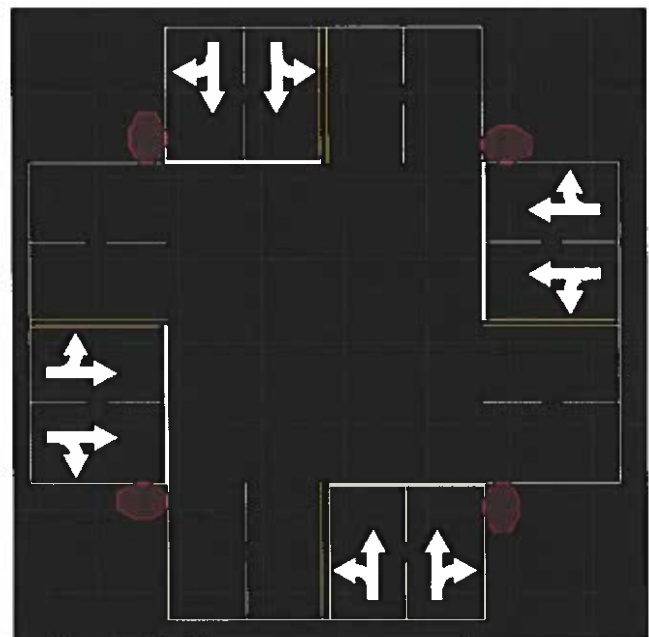


Figure 5.2: Profile View of Local Roadway

white background of the CAD drawing is recommended.

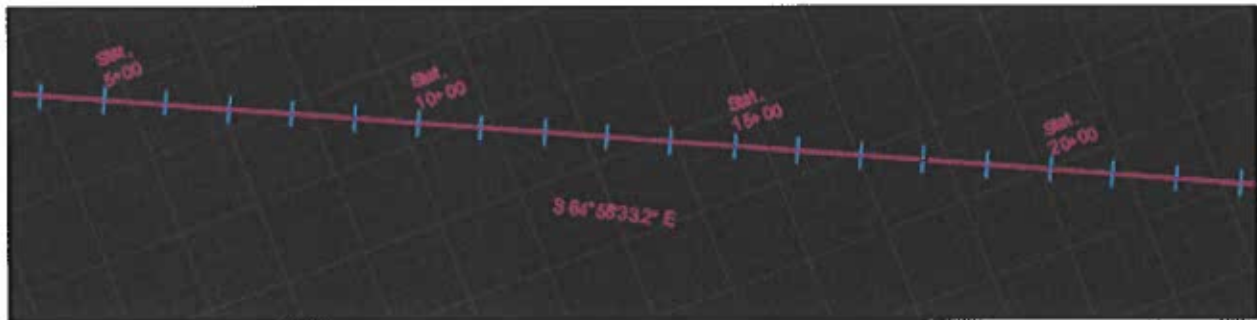


Figure 5.3: Plan View of Local Roadway

- Cyan:** 4-Way intersection with stop signs
- Green:** 4-Way intersection with stop light
- Yellow:** 3-Way intersection with stop signs
- Red:** Continuous traffic with singular stop sign

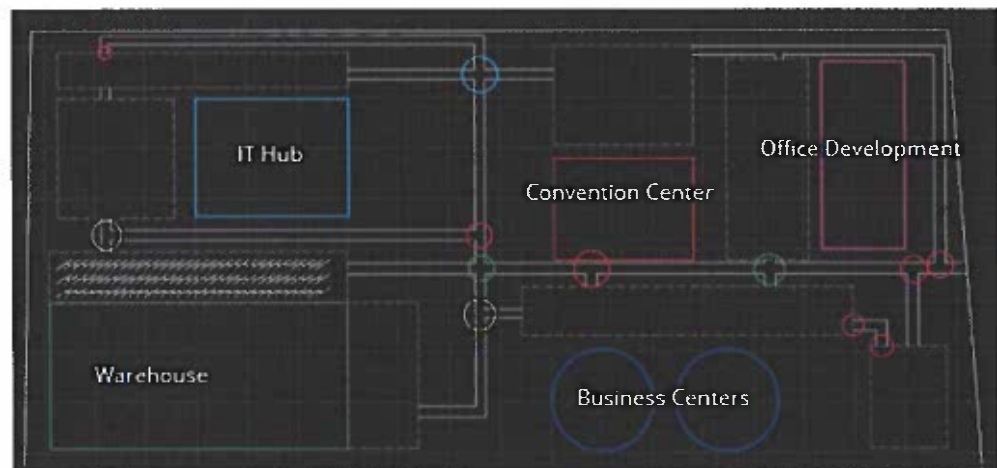


Figure 5.4: Intersection plan view of Project

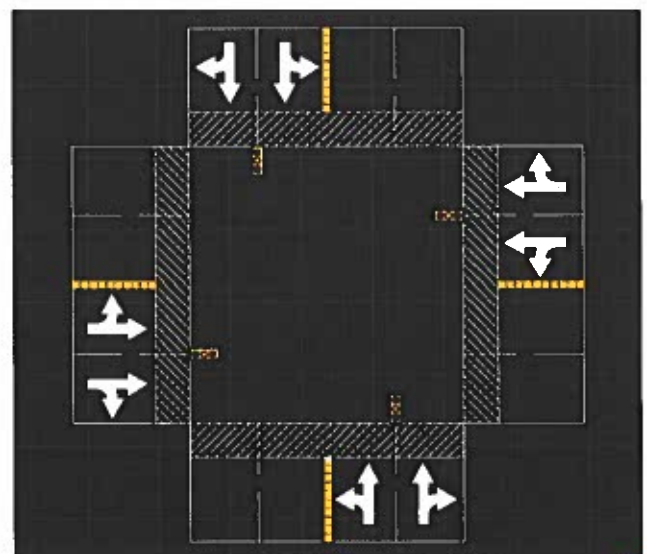


Figure 5.5: 4-way intersection with stop light

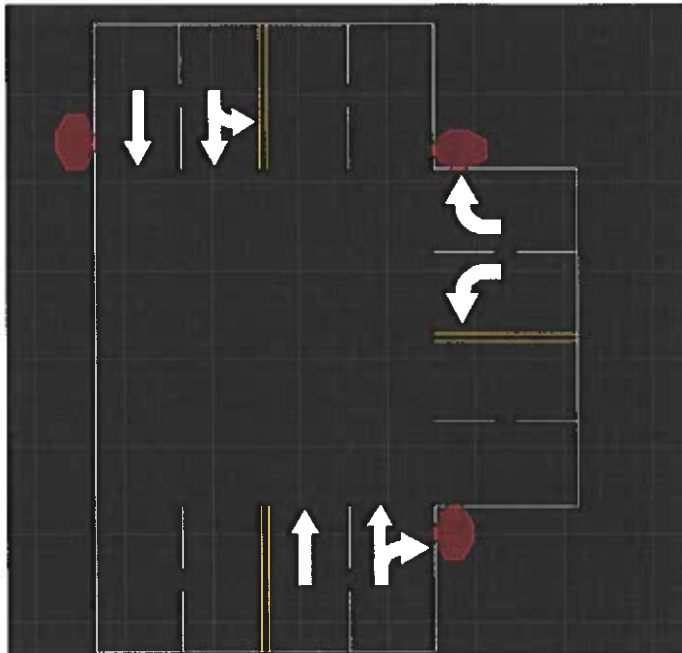


Figure 5.6: 3-way intersection with stop signs

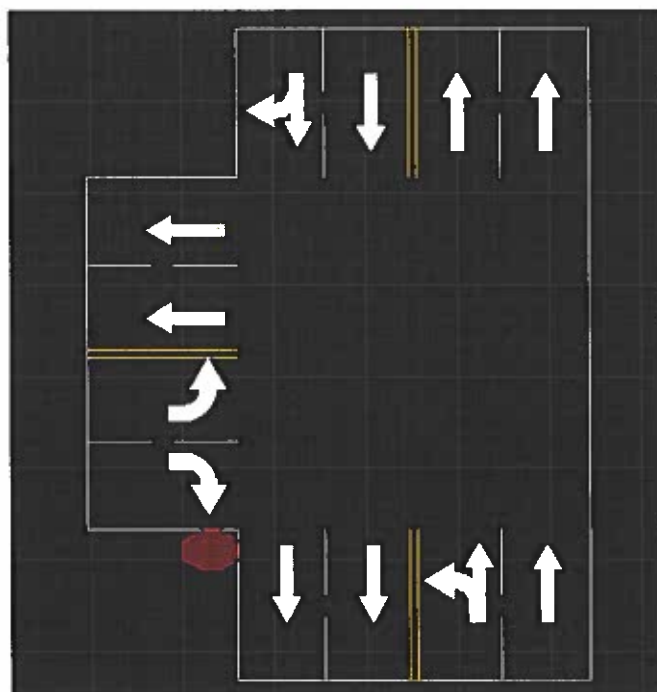


Figure 5.7: Continuous Traffic Intersection

Environmental

Wastewater treatment is the process of removing impurities from wastewater (water that is no longer needed or appropriate for use) and converting it into effluent that can be returned to the environment. The Texas Commission on Environmental Quality (TCEQ) and the Texas Administrative Code (TAC) Chapter 30 will be used to design the Wastewater Treatment Plant.

Table : Wastewater Characteristics

→ Table number - ??

Constituent	Concentration, mg/l
-------------	---------------------

	Strong	Medium	Weak
Total solids	1200	700	350
Dissolved solids (TDS) ¹	850	500	250
Suspended solids	350	200	100
Nitrogen (as N)	85	40	20
Phosphorus (as P)	20	10	6
Chloride ¹	100	50	30
Alkalinity (as CaCO ₃)	200	100	50
Grease	150	100	50
BOD ₅ ²	300	200	100

In accordance with the Texas Commission of Environmental Quality (TCEQ) Design Organic Loadings and Flows for a New Wastewater Treatment Facility, for an office building or factory, designed for the largest shift, will produce a daily wastewater flow of 20 gallons/person.

Table : Design Organic Loadings and Flows for a New Wastewater Treatment Facility

Source	Remarks	Daily Wastewater Flow (gallons/person)	Wastewater Strength (mg/l BOD ₅)	Wastewater Strength (mg/l NH ₃ -N)
Municipality	Residential	75-100	250-400	15-75
Subdivision	Residential	75-100	250-400	15-75
Trailer Park (Transient)	2½ Individuals per Trailer	50-60	250-350	15-75
Mobile Home Park	3 Individuals per Trailer	50-75	300	15-75
School	Cafeteria & Showers	20	300	15-75
	Cafeteria/No Showers	15	300	15-75
Recreational Parks	Overnight User	30	200	15-75
	Day User	5	100	15-75
Office Building or Factory	A facility must be designed for the largest shift	20	300	15-75
Hotel/Motel	Per Bed	50-75	300	15-75
Restaurant	Per Meal	7-10	1000*	15-75
Restaurant with bar or cocktail lounge	Per Meal	9-12	1000*	15-75
Hospital	Per Bed	200	300	15-75
Nursing Home	Per Bed	75-100	300	15-75
Alternative Collection Systems (Subchapter D of this chapter)	Per Capita	75	N/A	N/A
*Based on a restaurant with a grease trap				

With this data, the expected wastewater flow may be calculated by multiplying the flow per person by the population, and then converting the units to meters cubed per day using the conversion factor.

calculation:

$$AADF = \text{Population} \times \text{Average Daily Flow per Capita}$$

$$AADF = 20000 \text{ ppl} \times 20 \frac{\text{gal}}{\text{capita} - \text{day}} = 400000 \frac{\text{gal}}{\text{day}}$$

$$Q = 400000 \frac{\text{gal}}{\text{day}} \times 0.003785 \frac{\text{m}^3}{\text{gal}} = 1514 \frac{\text{m}^3}{\text{day}}$$

caption?

what quantity
is that?

Executive Summary

Structural Problem Statement for Structural

In a recent request, Amazon has proposed a problem of expansion of distribution centers for the Texas region. Only been provided with 400 acres of land and being asked to construct five different structures along with wastewater management systems and a flood prevention technique, there seems to be issues with proper location access within certain sub-disciplines. To best accomplish, from a structural standpoint, or what Amazon is asking to do we must take in a considerable design and make them simplistic yet intricate to the point where they will function but in an Amazon style without disturbing existing surroundings.

Proposed Solutions for Structural

JPMS Consulting creates solutions to fit what is being asked for. The structural design components have been set in place by the firm. With these designs, we will be able to actively maximize the size of the buildings while still reducing cost of buildings by doing the following:

1. Allowing column beams to share the same footings would reduce cost.
2. By building identical office buildings it will help us determine cost and when it comes to planning exactly how the building should be built.
3. Due to the small staff and the number of employees in the IT department, we can reduce the size of the IT department and add office space to the office buildings.
4. And to incorporate an Amazon style building, with all of these are cost-efficient solutions and we can add a skywalk between the identical office buildings.

JPMS Consulting creates solutions to fit what is being asked for. The structural design components have been set in place by the firm. With these designs, we will be able to actively maximize the size of the buildings while still reducing cost of buildings by doing such in the following: Note that our solutions are only apply to four of the five buildings being asked to be built this is only because for our steel structure warehouse it has a more open floor design which is automatically going to cost less the materials may cost more by finding the proper material is the only effective problem at hand.

Value for Structural

With the inclusions of this land and the construction of these buildings, add personal belief that the highest value of Amazon's net worth will increase. The location may not have a high demand population but is in high demand with high traffic volume. The structural design components will not only as be mentioned before reducing costs play be an area where there is easier access to any building maintenance that needs to occur. So, the value that is being 6 portrayed is more song a long-term value in the sense of being one of the first to build on a new area, and he when he comes to needing to get heavy equipment for maintenance equipment there's not as much in-tune section of regular traffic.

Final Thoughts and Next Steps for Structural

My recommendation for the enhancements of things is by increasing the dimensions of the workplace buildings by permitting another story within the building to accommodate the remaining worker overflow from the IT Hub or produce a second building of a smaller nature to accommodate the remaining share of staff. As for the opposite buildings, the steel structure of the warehouse was designed from innovation except for easier calculations, the warehouse can mimic that of the FedEx warehouse off ninety-nine grand drive south. As for the workplace buildings, mimicking the thought of the dual towers, however, not knowing the precise load can produce these difficulties, so finding the foremost stable foundation within the profile for a minimum of one, 600 sq. footage. The convention center was originally placed and is unambiguously designed however the sole recommendation that's being thought of is to relocate the building to accommodate alternative subdisciplines of the project

Proposed Solution for Water Resources

The first solution to the problem is to find where the location of the drainage ditch will be placed. We will use gravity to create the flow of the water to the nearest existing lake water source which is East of our construction site. The drainage ditch will start at its highest elevation of 456.9 coming from the topography map. Next the calculation of the rainfall intensity and collection for 100 years should be computed. This is to keep the area from flooding. I will do so by using the typical rainfall intensity -duration -recurrence interval curves. This graph shows the rainfall inserted in in/h proportional with time min and hours.

1. A design and location of a storm water ditch that avoids flooding hazards and damage to valuable property.
2. Rainfall intensity and rainfall collection for 100-year flooding

Note that the project is still in progress and on route to be completed in 2022.

Value for Water Resources

The storm water drainage ditch has been stamped to its location with the help of my geotechnical and environmental engineer. This was decided by locating the start of the ditch at its highest elevation to help with gravitating the water to its correct location.

Final Thoughts and Steps for Water Resources

Final steps for this project pertaining to water resources would be to calculate the quantity of water, design the storm water ditch based on a rainfall study, and show a profile and cross section of the drainage ditch.

Problem Statement for Transportation

For the JJMPS consulting firm, the transportation engineer will be in charge of the entire roadway layout of the project, interchange design, a parking lot proposal, and a plan and profile of each local road.

Proposed Solution for Transportation

The dimensions for each major roadway will be determined and the speed for the minor and major roads will be chosen based on the overall layout and utilizing the MUTCD (Manual on

Uniform Traffic Control Devices). The size of each parking lot will be selected to accommodate each employee in the vicinity as well as overflow and guests and the dimensions of each parking spot and the angle of each spot will be chosen utilizing the MUTCD. Interchanges will be 4 designed based on the flow of traffic in the area at peak times. The type of interchange will be selected based on the peak flow and location of the area. The roadway layout of the entire project will be designed to meet the peak amount of traffic and to ensure that no congestion will occur at peak hours of traffic flow. The dimensions of the lanes will be chosen to match the local roads surrounding the project. This will allow a simple transition between one local road and a minor road on the project site. A plan and profile will be drafted using the local existing road's elevation and using that to continue a seamless transition from one roadway to another.

Value for Transportation

The value of this project is to provide necessary insight and experience for each member of the JJMPS Consulting company. The design portion of this project allows the transportation group to utilize skills learned in previous courses and allows the application of those skills towards real world issues and will force the transportation group to learn to adapt and apply them as necessary.

Problem Statement for Geotechnical

The scope of work is to execute a geotechnical analysis for Amazon's proposed 400-acre commercial and distribution center, IT hub, and office development in Waller County, which is located south of major highways (US 290 and I-10). The report includes the findings of the site inspection as well as project recommendations.

Solution for Geotechnical

For the drilling, a CME 75 Drilling Rig was employed. A continuous flight auger was employed to progress the holes dry as the subgrade soils were explored. During the drilling operation, soil samples were obtained using thin-walled tubes according to ASTM D 1587, and split spoon sampler testing (STP) was done according to ASTM D 1586. Due to the presence of bedrock, continuous push tube samples were taken from the ground surface to a depth of 70 feet, with the borings spaced 80 feet apart. Soil samples were sent to a lab to be examined for soil characteristics. The findings were incorporated into the final report. During soil testing, a 7m depth of water was detected. In addition, the study discusses the many types of retaining structures and how to choose them based on the data provided. To help grasp the design and focus on the details, a visual layout has been provided. In addition, calculations for footings and settlements were performed to see whether they met the necessary requirement, and if appropriate, helpful recommendations were made.

Geotechnical Value & Recommendations

The report includes a broad description of the soils found, their qualities, expected behavior during construction, and measured groundwater levels. The final report includes geotechnical advice for shallow foundations, pavement design, pile foundations, and embankment design. The foundation design parameters were calculated using calculations from Braja M. Das Nagaratnam Sivakugan's "Principles of Foundation Engineering, 9th Edition, SI Edition" and an engineering textbook.

Problem Statement for Environmental

For our project, the environmental engineer will be calculating the estimated wastewater quantity for the project area. The location of the wastewater treatment facility should be near the lowest elevation. After analyzing the wastewater quality, a method to treat said water can be determined, as well as picking a suitable dumping location.

The Solution for Environmental

The environmental engineer will be utilizing the instruction given in the environmental design course to determine the wastewater quantity. It is known that the wastewater treatment facility should be placed at the lowest elevation to allow gravity to maneuver the wastewater to its proper location. The wastewater will be disposed of in a local stream or, if treated properly, could be used as irrigation for the project area.

Value for Environmental

The purpose of this project is to give students a chance to apply the knowledge that they have been acquiring over their last 4-5 years at university. The project is expected to be completed by May 2022.

References

1. A Policy on Geometric Design of Highways and Streets, American Association for State and Highway Transportation Officials, 7th Edition, 2018.
2. Manual on Uniform Traffic Control Devices, US Department of Transportation, Federal Highway Administration, 3rd Edition, 2009.
3. American Institute of Steel Construction Steel Construction Manual, 15th Edition, 2016.
4. Texas State Building Code – Volume I (General Construction), Current Code.
5. Phase I Environmental Site Assessment.
6. Principles of Environmental Engineering and Sciences, Mackenzie Davis and Susan Masten, McGraw-Hill, 2013.
7. Report of Phase II Assessment.
8. Report of Subsurface Exploration and Geotechnical Engineering Analysis, 2014.
9. Soil and Foundation, Cheng Liu and Jack Evett, Prentice Hall, 8th Edition 2014.
10. US Army Corps of Engineers Reference Manuals
11. NAVFAC Manual, Foundations & Earth Structures, 2021
(https://web.mst.edu/~rogersda/umrcourses/ge441/DM7_02.pdf)
12. Standard Handbook for Civil Engineers, Frederick S. Merritt et al., McGraw-Hill, 5th Edition, 2004.
13. Storm water and Pollution Prevention – US EPA, 2021. 4
14. Erosion and Sediment Control Planning and Design Manual, 2013
15. Structural Engineering Handbook, McGraw-Hill, 5th Edition, 2020.
16. The Dimensions of Parking, Urban Land Institute and the National Parking Association, 5th Edition, 2014.
17. Traffic Engineering Handbook, Institute of Transportation Engineers, 7th Edition, 2016.
18. Statewide Traffic Analysis, TxDOT, 2021
(<https://www.txdot.gov/inside-txdot/division/transportation-planning/stars.html>).
19. Water Resources Handbook, Larry Mays, McGraw-Hill, 1996.
20. Structural Steel Designer's Handbook, Roger Brockenbrough and Frederick Merritt, McGraw-Hill, 6th edition, 2019.
21. <https://www.tdhca.state.tx.us/single-family/training/docs/14-TMCS.pdf>
22. [https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate,\(106.88%2D121.92%20cm\).](https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate,(106.88%2D121.92%20cm).)
23. American Disability Act – 60 inches minimum hallway requirement
24. Cubicle Size- 36 ft squared
25. <https://www.osha.gov/laws-regs/standardinterpretations/1972-05-15>
 - a. OSHA Requires at least an aisle be at least 3 feet wider than the largest equipment or a minimum of 4 ft
26. <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=19717&context=rtd>
27. OSHA
28. <https://www.youtube.com/watch?v=ebM4bzjmiKQ>
29. <https://6river.com/warehouse-automation-statistics/>
30. <https://www.tdhca.state.tx.us/single-family/training/docs/14-TMCS.pdf>

31. [https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate.\(106.88%2D121.92%20cm\).](https://www.dimensions.com/collection/hallway-corridor-layouts#:~:text=The%20minimum%20width%20of%20a,to%20comply%20with%20ADA%20requirements.&text=The%20average%20width%20considered%20adequate.(106.88%2D121.92%20cm).)
32. <https://www.osha.gov/laws-regs/standardinterpretations/1972-05-15>
33. <https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=19717&context=rtd>
34. <https://ncma.org/resource/empirical-design-of-concrete-masonry-walls/>
35. <https://www.osha.gov/sites/default/files/publications/emergency-exit-routes-factsheet.pdf>
36. <https://closetandbeyond.com/walk-in-closet-layout/#:~:text=A%20standard%20full%2Dsize%20walk,as%20low%20as%2025%20sq.>
37. <https://www.partitionsandstalls.com/ada-bathroom-layout.html>
38. <https://pubs.usgs.gov/wri/wri98-4044/pdf/98-4044.pdf>
39. file:///C:/Users/Trsy/Downloads/Subdivision%20-%20Development%20Regulations%20REVISED_FINAL-2021%20(2).pdf

This is Last Page of This Document