CStructureCo.

To: Prof. PE. Lamer and Eng. Ballard

From: Abdullah Aldossary, Mohammad Albalool, Mohammad Albanna, Talal Alnaibari.

Date: April 27th, 2021

Re: Final Proposal

Greetings Prof. PE. Lamer and Eng. Ballard,

This is the requested proposal document that you have recently inquired about in regard to the metal structure building in Cornville, Az. This document will detail the purpose of the project, location, technical consideration, potential challenges as well as the stakeholders involved in the project scope. It will also go over all the tasks and subtasks necessary for the team to complete the project adequately and properly. The document also contains the staffing and cost section of the proposal. Please do not hesitate to reach out to the team members at CStructure Co. with any questions or concerns that may arise.

Thank you,

CStructure Co.

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CStructureCo.

Cornville Shop Footing and Slab Design

CENE 476C - Proposal

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1.0 Project Understanding

1.1 Project Purpose, Engineering Problem and Need

The engineering problem that the CStructure team was faced with is a metal structure building that was designed prior to any foundational designs were made. Thus, project is needed so that the team would be able to design the overall foundations for the proposed metal structure building. Including footings for the columns and the rigid frame present, as well as the connections involved (i.e., the bolts that connect the building to the foundation).

1.2 Status of Project/Site, and Exact Location

As seen from Figure 1-1 and 1-2, the design project is currently in its initial stages. This entails that the materials for the rigid frame and roof supplies were purchased and gathered at the project/building site. However, no work has been performed yet in terms of building or construction. According to our client, PE. Lamer, the construction is proposed to begin within a few months, hoping for completion in a duration of almost a year.

Figure 1: Center Rigid Supports on Site

Figure 2: Center Rigid Supports Infront of Ex. Barn (34'x21')

The project is a proposed shop site plan that will be 75 feet long by 60 feet wide, situated in the city of Cornville, Arizona. At 11450 East Oak Run Lane. Figure 1-3 displays the "zoomed-out" location of the site (red-pin) with respect to nearby cities Sedona and Cottonwood, Arizona. While figure 1-4 displays a more detailed "zoomed-in" location of the site (red-pin) with respect to the surrounding city of Cornville, Az. Figure 1-5 displays the exact metal structure building proposed location on the address property (square). Finally, Figure 1-6 displays a photograph of the site the metal structure building will be constructed on.

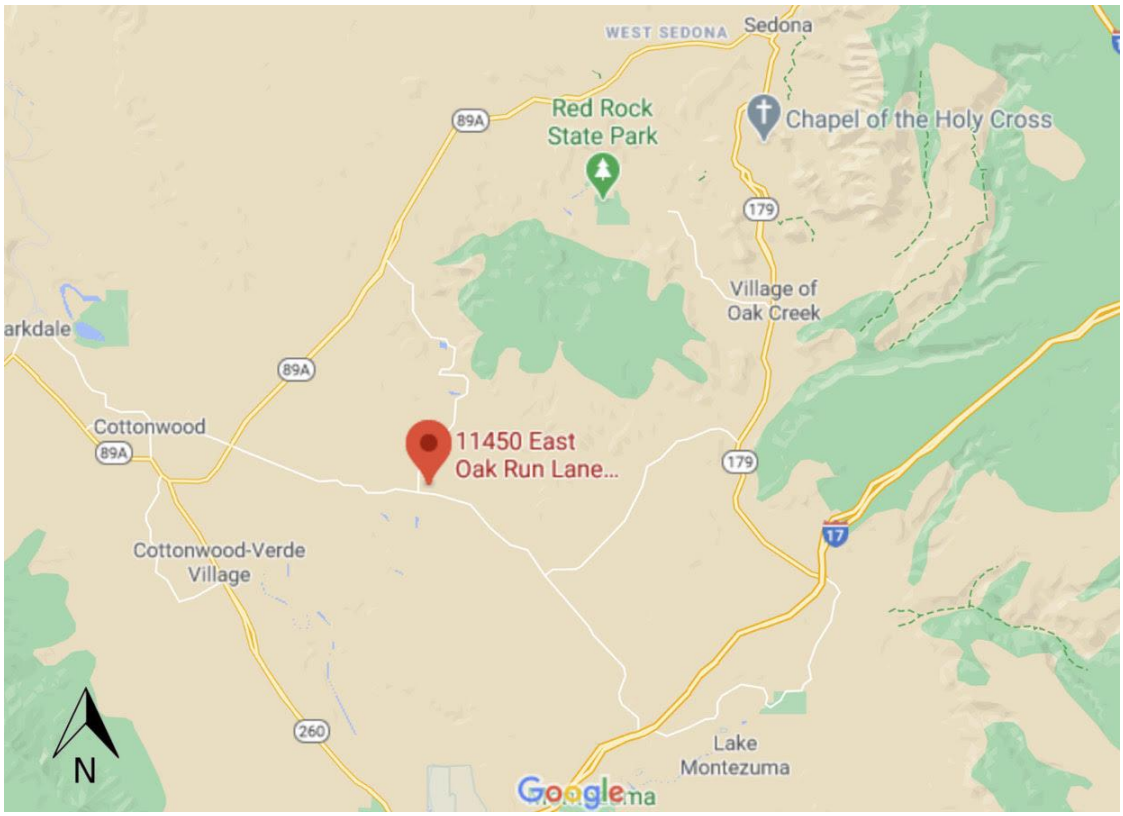

Figure 3: Location of Site Location with Respect to Sedona, Az.

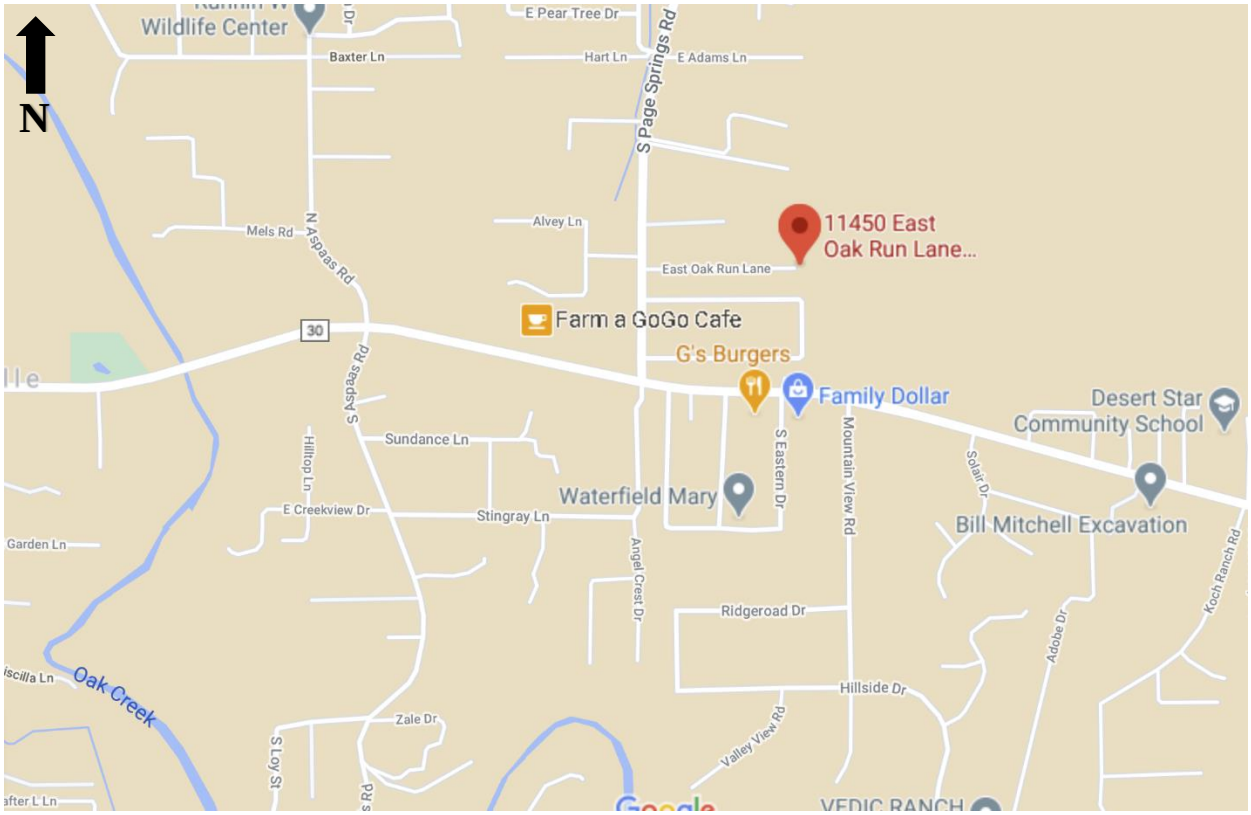

Figure 4: Zoomed in Location of Site within Cornville, Az.

Figure 5: Location of Proposed Building on Property (NOT TO SCALE)

Figure 6: Site Where Metal Structure Building Will Be

1.3 Technical Considerations

In order to properly conduct this project successfully some technical professions/considerations are required. These include and are not limited to:

- Geotechnical analysis of soil samples,
  - This needs to be addressed in order to perform the different experiments needed to obtain the bearing capacity of the soil on the site. Such tests include the plate bearing test as well as the field vane shear test.
- Surveying methodologies and techniques,
  - This is necessary as surveying will need to be done in order to understand the grading present on the project site and the depth of the foundational elements at different sectors of the project site.
- Experience in topographic mapping and interpretation,
  - Topographic mapping knowledge is needed as to be able to present a finalized topographic map of the project site. This is to aid in understanding the surface area and features on site as well as their respective locations.
- Being adept at structural analysis programs (AutoCAD, CIVIL3D, Risa, etc.)
  - This knowledge is important as it is necessary in the conduction of the development of the topographic mapping production as well as the foundation plan production. Programs such as RISA are necessary as they are needed to

calculate different loading elements in order to proceed with load combination analysis.

- Structural analysis methodologies and calculations,
    - These methodologies are important in order to properly conduct load combination analysis and understand the meaning of the results, in terms of what they present and how persistent the loading is.
- Foundation and anchor bolt design,
    - Foundation design knowledge is beneficial in aiding the team come up with a foundation and anchor bolts design as well as concrete slab on grade design.
- Production of finalized plan sets.
    - Technical knowledge in this sector is important as it allows the team to easily produce the finalized plan sets needed to preview the chosen foundation design.

1.4 Potential Challenges and Constraints Influential on Project Completion

When talking about the project in hand, multiple potential challenges appeared. These include the fact that the metal structure building was designed prior to the completion of the foundational requirements. This means that the foundation must be addressed after design according to the 2018 International Building Code (IBC) as well as the Yavapai County building code requirements, which could prove difficult in some scenarios as the foundation is the absorbent of all the loading and forces that occur on the building structure [1].

The second potential challenge that could be present during the design choice, is the assessment of the uplift forces that the metal structure building will face. As metal structure buildings are typically light weighted and are easily countered by wind force or uplift. This should be considered during the foundation choice as a wider base foundation could prove beneficial due to the increase in downward vertical force.

1.5 Stakeholders, and Affected Personnel

The proposed project mainly has one stakeholder involved in the project completion, which is the finalized shop owner. This person is Andrew Lamer. He is the brother of the client observing the completion of the project, PE Mark Lamer. Secondly another possible stakeholder is the CStructure company, as they are interested in completing this project both adequately and professionally to ensure that the customer/client is sufficiently pleased with the outcome of the design.

2.0 Scope of Services

2.1 Task 1: Investigation of Required Regulatory Codes:

Prior to beginning any work, design, or analysis the team will need to research the different building codes and regulations present based on the location of the project site. This is to allow for a full understanding of the project requirements. This will be done by researching the following:

- Task 2.1.1 Task 1.1 Research International Building Code 2018: The team will need to research the IBC 2018. This is to ensure all codes of conduct are following and building

requirements are addresses throughout the completion of the project. Such as Chapter 16 of the IBC which is about structural design (Section 1601).

- Task 2.1.2 Task 1.2 Yavapai County Code/Regulations: Similarly, the team will need to review the Yavapai County Codes and Regulations for building regulations in order to comply with the requirements throughout the project construction. Such as researching permits for draining and flooding, property appraisal, draining and flooding control.

2.2 Task 2: Site Visit

This task involves visiting the proposed construction site and analyzing the different future elements involved. This is to properly plan for future tasks such as the surveying task, soil sample collection task as well as the creation of a topographic map. The team will visit the proposed project site in hand and plan accordingly from there.

2.3 Task 3: Geotechnical Analysis of the Soil Samples

The objective of this task is to allow the team to properly understand the soil characteristics present on the project site. The point of this task is for the team to find the allowable soil bearing pressure in order to understand how much pressure the soil can take before the weight of the metal structure can push down on it.

- 2.3.1 Task 3.1: Plan Laboratory Access Manual and Agreement: The team will need to prepare the necessary documentation required to perform an investigation using NAU laboratories in the engineering building as well as safely visiting the project site.
- 2.3.2 Task 3.2: Collect Soil Samples: The team will need to collect soil samples from the project site. This is followed by the team taking the samples back to the laboratory to perform different Geotech test methods on to classify the soil.
- 2.3.3 Task 3.3 Perform Soil Analysis: The team will need to perform different soil analysis laboratory experiments such as moisture content test, dry density test. Note: This test is to be done on “deeper soil” samples and not “surface level” soil samples as to be more accurate on the results found with the soil that will eventually surround or withhold the foundation structures. Tests to find the bearing capacity of the soil include: Plate bearing test, “pressure meter” test, as well as field vane shear test.

2.4 Task 4: Surveying

The purpose of surveying the site proposed is to gain information on the different spatial characteristics of the design location. These include the area available, nearby structure, elevation information etc. The objective of surveying is to allow the team to build a necessary understanding of both the vertical and horizontal reference points present on the site and how they can/will affect the final project upon completion as well as to prepare a topographic map of the project site and the surrounding area associated.

- 2.4.1 Task 4.1: Lab Access Manual and Agreement: This is to be able to gain permission to lab equipment as well as travel to project site safely.
- 2.4.2 Task 4.2: Surveying Analysis: This subtask is about researching the design site including all topographic features and characteristics such as the different design lengths

present and the available area on the proposed site, by using equipment such as total station, or possibly a laser level.

- 2.4.3 Task 4.3: Creation of Topographic map: This involves extracting the digital survey data acquired and transporting it onto a computer in order to create a topographic map of the project site and surrounding area. This can be done by using AutoCAD or either by using the cross section-stake method or the trace method.

2.5 Task 5: Structural analysis/concrete design

The team needs to perform the different structural analysis involved in the different framing layouts, Design loads for building components, as well as the necessary calculations for the reactions, anchor bolts and base plates. The objective of this task is to allow the team to fully understand the structure in hand and the necessities required both structurally and material wise.

- 2.5.1 Task 5.1: Determination of Internal Forces of each element present and Loading: The team would have to use structural analysis programs such as RISA or STRAIN to analyze the different loadings present that are acting on the structure (RISA preferred). This includes the different loading present such as dead loads, the roof load, as well as the wind load. This is to be referenced with the maximums and requirements present in the IBC 2018 as well as Yavapai County Regulations.
- 2.5.2 Task 5.2: Analysis of Load Combinations: The team will need to perform the different analysis of load combinations. These include the Allowable Strength Design (ASD load combinations) as well as the Load and Resistance Factor Design (LRFD load combination) analysis. The ASD Load combination will mainly deal with the bearing pressure present and the LRFD load combination would deal with the anchor bolt requirements (main component of combination equations that will be used). The team will use the LRFD load combination method to ensure that the final complete structure can endure the 7 ASCE 7-05 equations. This methodology (LRFD) will allow the team to also determine the predictability of the loads present.
- 2.5.3 Task 5.3: Failure Analysis Checks: The team will need to perform the different checks to ensure failure doesn't occur with relation to the loading present. These include the bearing check, the sliding, overturning check as well as uplift check. The sliding check will provide an understanding of the thrust present (resultant from the horizontal load pushing outwards and a high lateral load in metal structures).
- 2.5.4 Task 5.4: Foundation and Anchor Bolt Design: The team will have to decide on a specific foundation choice. This choice is from types such as Tie Rod, Slab Ties, Moment-Resisting, Haunch Slab, Trench Footing, Mat, or Deep Foundation. This also includes the design of the related anchor bolts and the concrete slab on grade. Each has their advantages and disadvantages; however, this is more likely going to be a type of spread footing design as the mass of the concrete involved is greatly beneficial in countering uplift as well as lateral forces that cause sliding/overturning.

2.6 Task 6: Impacts

The objective of this task is to assess all the impacts and their different affecting factors both during and after the completion of the project. This is in relation to the different codes related to the project (IBC2018 and Yavapai County). As well as the effects related to each social, economic as well as environmental impacts and the different strategies present in the reduction of each.

- 2.6.1 Task 6.1: Social Impacts: The team will need to assess the different impacts the metal structure building will have on the neighboring area and the nearby residents. This is to be done by assessing both the benefits of the slab shop will bring and the negatives.
- 2.6.2 Task 6.2: Economic Impacts: The economic impacts will assess the monetary effect the project will have on the personnel involved as well as the final owner/surrounding neighborhood.
- 2.6.3 Task 6.3: Environmental Impacts: The team will need to assess the impacts that the final project will have on the environment. This is to be done by assessing the level of pollution the construction of the project could result in as well as the final operating product.

2.7 Task 7: Project Deliverables

The objective of this task is for the team to fully understand and complete the documents needed as well as all the deliverables required.

- 2.7.1 Task 7.1: 30% Submittal:
  - 2.7.1.1 Task 7.1.1: 30% Report Submittal: The team will need to come up with a primary report for the 30% deliverable. This will then be changed and adjusted based on redline commentary and feedback prior to advancing. By this deliverable certain milestones will be achieved. Such include: Survey analysis results and topographic map completion, Geotechnical and soil analysis completion, and determination of loading.
  - 2.7.1.2 Task 7.1.2: 30% Presentation: The team will have to present their progress up and until the 30% stage of project progress. Detailing all achievements so far.
- 2.7.2 Task 7.2: 60% Submittal:
  - 2.7.2.1 Task 7.2.1: 60% Report Submittal: For this task, the team will have to provide a report submittal detailing all progress up until the 60% mark. This will include all redlines and feedback received solved and finished from the 30% submittal. Similarly, certain milestones should be completed by this stage. Such include: Structural analysis completion, uplift, failure, and foundation design completion.
  - 2.7.2.12Task 7.2.2: 60% Presentation: The team will present their progress up until the 60% point of the project completion.
- 2.7.3 Task 7.3: 90% Submittal:
  - 2.7.3.1 Task 7.3.1: 90% Report Submittal: The team will provide a report that is complete. The 90% report submittal will contain all analysis complete, as well as all the info for the project available and ready to be finalized for a final submission. This deliverable will also contain all previous feedback answered and finalized from both

previous deliverables. All milestones should be completed, and only work onwards would be feedback assessment.
    - 2.7.3.2 Task 7.3.2: 90% Presentation: This presentation will encompass all progress made until the 90% deliverable detailing all new work/progress made from the previous presentation.
    - 2.7.3.3 Task 7.3.3: 90% website: The objective of this task is to allow the team to be able to produce a website that details the project information, provides data about the members, as well as the design solution chosen. It will also encompass any documents produced throughout the lifespan of the project.

- 2.7.4 Task 7.4: Final Submittal:
    - 2.7.4.1 Task 7.4.1: Final Report Submittal: The team will produce a finalized report with all aspects of the project complete and ready to present. This final report will detail all the requirements as well as the final design decision made.
    - 2.7.4.2 Task 7.4.2: Final Presentation: This presentation will encompass all progress made until the final deliverable detailing all new work/progress made from the previous presentations/deliverables. It will detail the decision made on the final foundation.
    - 2.7.4.3 Task 7.4.3: Final Website: The objective of this task is to produce a final website summarizing the entire project. This website will display the final design, as well as the data accompanied throughout the lifespan of the project.

2.8 Task 8: Project Management

The objective of this task is to adequately manage the different project elements including and not limited to client meetings, technical advisor meetings, schedule management, and finally resource management.

- 2.8.1 Task 8.1: Client Meetings: The objective of this task is to periodically arrange client meetings as needed to ensure satisfaction of design and up-to date information.
- 2.8.2 Task 8.2: Technical Advisor Meetings: TA meetings to ensure the right paths are taken to completion of the project as well as to refer in case any assistance is needed.
- 2.8.3 Task 8.3: Schedule Management: This sub-task allows the team to provide a complete schedule that can be followed in order to stay ahead through the tasks and not fall behind.
- 2.8.4 Task 8.4: Resource Management: The objective of this sub-task is to be able to manage the finite resources and ensure the project will complete without exceeding any set limits.

2.9 Exclusions

The team's main objective is to design the foundation elements for the proposed metal building structure. The following tasks are not required for completion by the team members mainly due to the fact that those tasks are either done previously or the tasks are not involved in the assignment presented to the team within the project.

- 2.9.1 Excavation on the site: The objective of this task is to allow for the necessary grading and landscaping to occur according to the grading plan provided. The team does not need to perform any excavation operations in order to satisfy any grading or landscaping requirements (per the grading plan presented), as it is not involved in the overall goal of this project.
- 2.9.2 Concrete Mixture Check: The objective of this task is to verify the integrity/quality of the recommended concrete mixture after analysis. There are a variety of concrete mixture quality check tests available such as the Vee-Bee consistometer test, compaction factor test, and slump test, but the team is also not required to perform any quality checks on the concrete mixture that was created in order to fulfill the calculations given by the client.
- 2.9.3 Grading and Drainage Design: A grading and drainage plan will not be developed by the team. The objective of a grading plan is to propose a design alternative that is viable at directing any surface runoff water/precipitation away from the proposed structure.

3.0 Project Schedule

3.1 Duration, Main Deliverables and Tasks

The duration of the project according to the developed schedule is expected to take around 114 total days. The project will begin on August 18th,2021 and will be ending on December 10th, 2021 when the final report deliverable would be due. The major deliverables and tasks that are associated with the project include: Soil bearing capacity results, survey topography map design, the analysis of load combination, the failure analysis check, the uplift check, the foundation design solution, the different report submittal checkpoints (30%, 60%, 90% and final deliverable), as well as Project Management. A Gantt Chart (Figure 7 shown below) displays the schedule of the tasks required for project completion.

3.2 Critical Path

The team concluded on the tasks listed below as part of the critical path. This is the path the team needs to take in order to finish the project as promptly as possible, without including tasks that aren't necessary for the design and analysis of the foundation choice needed. The tasks below must be finished on time, or delays in the overall schedule will occur resulting in a longer completion period.

- Task 4.1 Lab Access Manual and Lab Agreement
- Task 2.2 Site Visit
- Task 3.2 Collect and Test Soil Samples from Project Site
- Task 4.2 Perform Surveying Analysis on the Proposed Project Site
- Task 4.3 Creation of Topographic Map
- Task 5.1 Determination of Internal Forces of Each Element Present and Loading
- Task 5.2 Analysis of Load Combinations
- Task 5.3 Failure Analysis Checks
- Task 5.4 Foundation and Anchor Bolt Design

- Task 7.4 Final Submittal

These tasks all play an important role in the assessment of the final foundation design to be used. The access manual is important in order to safely use and return the laboratory equipment needed. The site visit will allow the team to both collect soil samples for identification and bearing soil capacity testing. It will also allow the team to perform the necessary surveying of the site. The topographic map will allow a better understanding of the grading present and the foundation depth needed. The analysis of the elements and loading present allows the team to perform the LRFD and ASD load combination evaluations. The team will then be able to perform the bearing, sliding, thrust and overturning checks. Finally, the team will assess the high amount of uplift the Metal Structure faces and decide on a spread foundation and anchor bolt design. In order to ensure the team does not face delays with these tasks, they were given a 50% increase in time needed on the schedule and to allow for more leniency in time availability must these delays occur. The schedule will be checked constantly and adjusted by the team to ensure no delays occur and time management is up to date.

4.0 Staffing

4.1 Personnel

The completion of this project will depend upon the contribution of the following personnel (listed in table 4-1 below). Each of the listed roles will be conducted by each member on the team throughout the completion of this project.

Table4- 1: Personnel and Respective Abbreviation

Personnel	Abbreviation
Senior Engineer	*Sr. Eng.*
Project Engineer	*Proj. Eng.*
Engineer in Training	*E.I.T*
Lab Assistant	*LAB*
Administrative Assistant	*A.A*

4.2 Qualifications

The Cornville Structure team consists of three senior civil engineering students and one environmental engineering student. Each team member has special qualifications that allows them to conduct the project adequately and as needed. Listed below is each team member and their respective qualifications:

4.2.1 Mohammad Albalool

Mohammad Albalool is a senior Civil Engineering student with the following qualifications:

- AutoCAD and Civil3D experience
- Water Resources I and II coursework experience
- Geotechnical Engineering and Lab experience
- Land Surveying and Lab Coursework

- ArcGIS/Map construction coursework
- Leadership/Time Management skills
- RISA 2D and 3D, STRIAN Coursework experience
- Structural Analysis Coursework Experience
- Engineering Design Experience

4.2.2 Mohammad Albanna

Mohammad Albanna is a senior Civil Engineering student with the following qualifications:

- Civil Engineering Diploma (College of Technological Studies, State of Kuwait)
- 6 Year experience in the Ministry of Electricity and Water (Power Station Surveying)
- AutoCAD and Civil3D experience
- Land Surveying and Lab Coursework
- Structural Analysis Coursework Experience
- Geotechnical Engineering and Lab experience
- Water Resources I and II coursework experience
- Engineering Design Experience
- ArcGIS/Map construction coursework
- Leadership/Time Management skills
- RISA 2D and 3D, STRIAN Coursework experience

4.2.3 Abdullah Aldossary

Abdullah Aldossary is a senior Environmental Engineering student with the following qualifications:

- ArcGIS/Map construction coursework
- AutoCAD, Civil3D and REVIT Experience
- Land Surveying and Lab Coursework
- Leadership/Time Management skills
- Structural Analysis Coursework Experience
- Geotechnical Engineering and Lab experience
- Air Quality Engineering Coursework

4.2.4 Talal Alnaibari

Talal Alnaibari is a senior Civil Engineering student with the following qualifications:

- AutoCAD, Civil3D and REVIT Experience
- Geotechnical Analysis experience in Soil Classification
- Land Surveying and Construction Layout Experience
- Structural Analysis Experience
- RISA 2D and 3D, STRIAN Coursework experience
- Time Management and Writing Skills
- ArcGIS/Map construction coursework
- Water Resources I and II coursework experience

4.3 Task Staffing Matrix

Table 4-2 in Appendix B below displays each task and its relative subtasks, with the hourly requirements for each personnel role displayed to the right of said tasks. The total hours required for the completion of the project is also displayed which adds up to an estimated 939 hours.

Table 4-3 below display each personnel role with its respective total hours required for completion of the project.

Table 4-3: Personnel Roles and their Respective Hours

Personnel	Hours
Senior Engineer	97
Engineer	132.5
Engineer in Training	266
Lab Technician	85
Administrative Assistant	118
Total	**698.5**

5.0 Cost of Engineering Services

The total cost for the required engineering services were summarized in Table 5-1 and are present in Appendix B below. Table 5-1 displays the different cost parameters and their relative amount of units which were then evaluated at the costs detailed below to obtain a total engineering cost for the Cornville Structure Project.

5.1 Hourly Cost of Personnel

This section will outline the reasoning behind the total cost evaluation for each segment/role required in the completion of this project. Table 5-2 below displays the hourly billing rates used to calculate the total costs for each personnel's work done.

Table 5-2: Personnel Billing Compensation

Personnel	Billing Rate ($/Hr)
Senior Engineer	*$150*
Engineer	*$115*
Engineer in Training	*$85*
Lab Technician	*$60*
Administrative Assistant	*$45*

5.1.1 Senior Engineer

The senior Engineer will be compensated an estimated $150 per hour of work on the project. This work is to be done by assisting the project Eng. And E.I.T throughout the different milestones set and by assuring that the work done is complete according to standards and up to the expected quality. The senior engineer was compensated the highest billing rate as the experience provided to the project is important and beneficial to the team. The senior engineer will be compensated for a total of approximately 97 hours of work, totaling a cost of $14,550.

5.1.2 Project Engineer

The project engineer will be compensated an estimated $115 per hour of work dedicated to this project. The project engineer contributions are important to the success of this project as they can provide a lot of experience in completing the structural analysis objective of the project , as well as provide the E.I.T with feedback and improvement guidance. The project engineer was compensated the usual salary of a project engineer for an estimated 132.5 hours of work, totaling a cost of $15,238.

5.1.3 Engineer in Training

The engineer in training is a beneficial addition to the project as they will be assisting in the completion of the structural analysis and final foundation design choice. They will also be guiding the lab technician in the completion of some laboratory experiments. The E.I.T will be compensated for a total of 266 hours at a billing rate of $85/hr. Therefore, totaling a cost of $22,610.

5.1.4 Lab Technician

The lab technician will be in charge of the completion of almost all laboratory testing needed. This includes the surveying and geotechnical soil analysis and classification. The soil tests the lab technician will be performing includes the soil moisture content test, dry moisture test, Atterberg Limit test etc. They will be compensated for a total of 85 hours at a billing rate of $60/hr. Totaling a cost of $5,100.

5.1.5 Administrative Assistant

The administrative assistant will be in charge of the completion of all laboratory summarization reports, project presentations, and milestone reports. They will be compensated for a total of 118 working hours at a rate of $45/hr. Totaling a cost of $5,310.

5.2 Total Cost

5.2.1 Total Personnel Cost

The total hours required for the work of the personnel involved in the Cornville Structure project added up to an estimated 698.5 hours. This resulted in a total hourly compensation cost of $62,808.

5.2.2 Laboratory

The laboratory costs consisted of the laboratory equipment rental (surveying equipment) at an average of $150/day for two days. These costs also included the rental of the laboratory room at a rate of $150/day for 7 days. Therefore, the total cost for the laboratory class will be an estimated $1,350.

5.2.3 Travel

The travel cost requirement was estimated based on the need to complete 2 trips to the project site in total. This was estimated at a distance of 50 miles one way, totaling 100 miles per trip. The referenced price per mile was said to be around $0.56/mile. The total cost of travel was then estimated to be around $112 for the 2 trips, totaling 200 miles.

5.2.4 Total Project Cost

The estimated total project cost based on all the categorial classes listed above was calculated to be around $64,270. This total costs consists of the personnel cost, the laboratory cost, and finally the travel costs involved.

6.0 References:

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Appendix A Schedule Gantt Chart

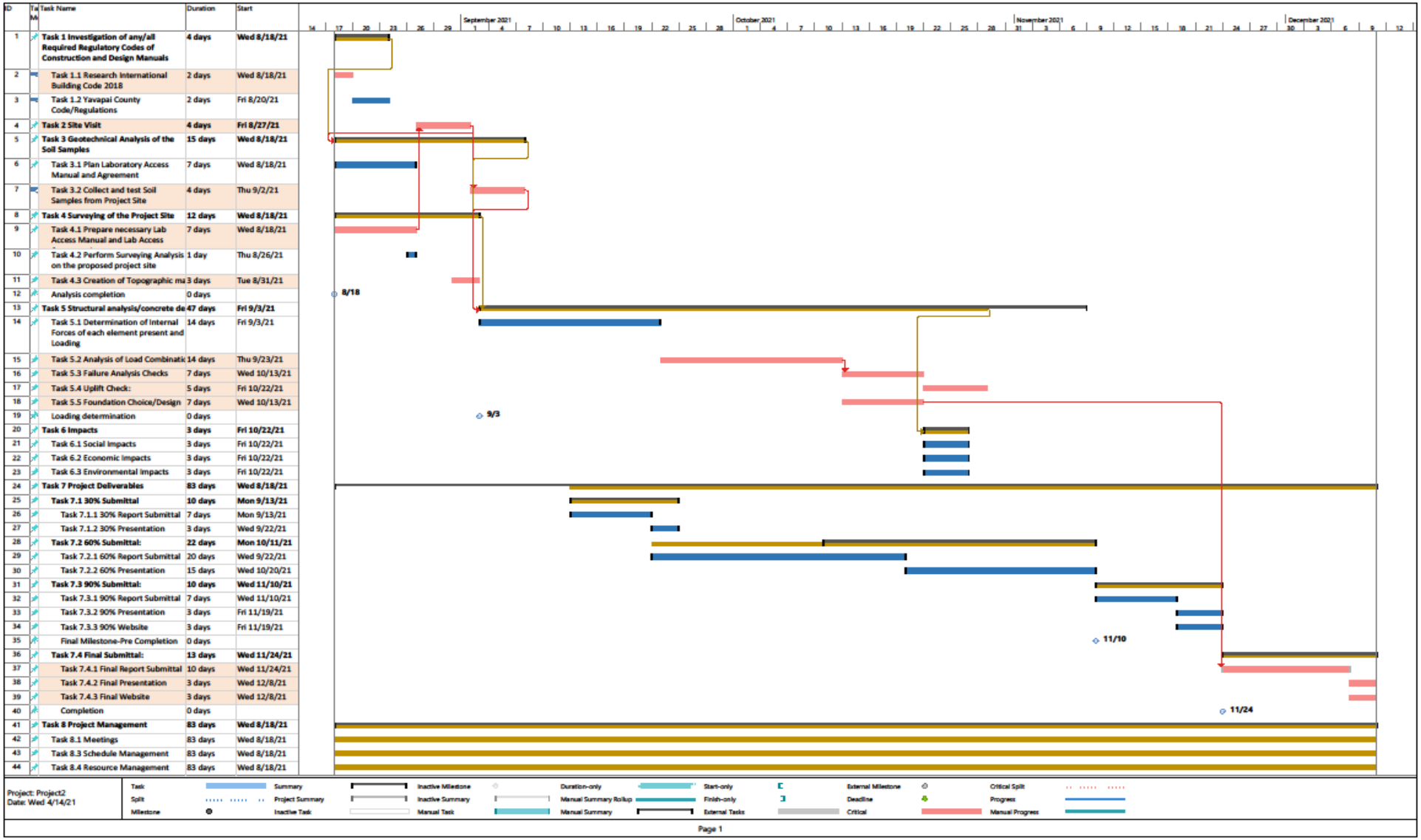

Figure 7: Schedule Gantt Chart

Appendix B - Tables

Table 4-2: Task Staffing Matrix

Task	Hours Per Position					
	Sr. Eng.	Eng.	E.I.T	LAB	A.A	Total
1.0 Investigation of Required Regulatory Codes						
1.1 Research International Building Code 2018	1	2	6	3	1.5	13.5
1.2 Yavapai County Code/Regulations	1	2	5	3	1.5	12.5
2.0 Site Visit	4	12	16	16	6	54
3.0 Geotechnical Analysis of Soil Samples						
3.1 Plan Laboratory Access Manual and Agreement	1	1	2	7	1	12
3.2 Collect Soil Samples				4		4
3.3 Perform Soil Analysis				4	1.5	5.5
4.0 Surveying						
4.1 Prepare necessary Lab Access Manual and Lab Access Agreement	1	1	2	14	1	19
4.2 Perform Surveying Analysis on the proposed project site	1	2	5	14	1.5	23.5
4.3 Creation of Topographic map	1	1	3	12	1.5	18.5
5.0 Structural analysis/concrete design						
5.1 Determination of Internal Forces and Loading	10	14	20		12	56
5.2 Analysis of Load Combinations	14	18	22		10	64
5.3 Failure Analysis Checks	16	22	34		12	84
5.4 Foundation and Anchor Bolt Design	10	12	14		10	46
6.0 Impacts						
6.1 Social Impacts	1	2	8		1.5	12.5
6.2 Economic Impacts	1	2	8		1.5	12.5
6.3 Environmental Impacts	1	2	8		1.5	12.5
7.0 Project Deliverables						
7.1 30% Submittal						
7.1.1: 30% Report Submittal	1	1.5	8	1	4	15.5
7.1.2: 30% Presentation:	1	1.5	7	1	3	13.5
7.2: 60% Submittal						
7.2.1: 60% Report Submittal	1	1	8	1	4	15
7.2.2: 60% Presentation	1	1	7	1	3	13
7.3: 90% Submittal						
7.3.1: 90% Report Submittal	1.5	1.5	8	1	4	16
7.3.2: 90% Presentation	1.5	1.5	7	1	3	14
7.3.3: 90% website	2.5	3.5	9		4	19
7.4: Final Submittal						
7.4.1: Final Report Submittal	2.5	3	8	1	4	18.5
7.4.2: Final Presentation	2.5	3	7	1	3	16.5
7.4.3: Final Website	1.5	2	4		4	11.5
8.0 Project Management						
8.1 Client Meetings	6	7	14		6	33
8.2 Technical Advisor Meetings	6	7	14		6	33
8.3 Schedule Management	3	3	6		3	15
8.4 Resource Management	3	3	6		3	15
Total	97	132.5	266	85	118	698.5

Table 5-1: Cost of Engineering Services

Cost Classification	Rate	# of Units	Units	Total Calculated Cost
Sr. Eng.	$150	97	Hr.	$14,550
Eng.	$115	132.5	Hr.	$15,238
E.I.T	$85	266	Hr.	$22,610
LAB	$60	85	Hr.	$5,100
A.A	$45	118	Hr.	$5,310
Total Personnel		698.5	Hr.	**$62,808**
Laboratory	Surveying Equipment Rental at ($150/day)	2	Days	$300
	Laboratory Room Rental ($150/day)	7	Days	$1,050
Travel	2 Trips to Project Site ($0.56/mi.)(50mi. One way)	200	Miles	$112
Total Cost				**$64,270**