2018

OLD TOWN FRAME COMPANY

PROPOSAL

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1.0 Project Understanding

1.1 Purpose of Project

The purpose of this project is to complete a site redesign for Old Town Frame Company in Cottonwood, Arizona. The project will involve survey field work, grading, drainage (hydrology and hydraulics), ADA compliance, geotechnical analysis, probable retaining wall design, and creation of construction plans.

1.2 Background Information/Existing Conditions

The client is the new occupant of the site at 107 S Candy Ln. Furthermore, the owner does not know for certain where the exact site boundaries are in relation to the surrounding properties. This will need to be determined via city records in the due diligence phase of the project. Figure 1 and 2 below show the location of the site. This goal for the Old Town Frame Company is to develop a more efficient site plan that provides better property usage. The site is owned by Trevor Gottschalk, under parcel number 406-33-001C. As observed on Google Earth, the site appears to have little to no paving. There further exists a retaining wall that was believed to have been constructed more than 100 years ago. The client wants a parking lot redesign and the team has been instructed to ignore the actual pavement design aspect for this project.

Figure 1. Cottonwood, AZ

Figure 2. Aerial View of Site (via google maps)

1.3 Technical Aspects of Project

In the project, GPS surveying will be used to collect site data. The equipment will be provided by the school. The team will complete the GPS survey and upload the results to AutoCAD to create a surface. Once the surface is created it will be imported into Civil 3D and a topographic map will be created. This topographic map will be used for the existing grading design. The grading design is necessary to implement the data into the existing grading plan.

The drainage design will aid in reducing the possibility of water flooding on or around the site. Catch basins may be constructed to accommodate the runoff. The design created by the team will accommodate and utilize the existing.

Geotechnical analysis, specifically a consolidated drained soil test, CD test, and Direct Shear Test, will be conducted to determine the strength of soil and whether it fits the desired uses based on American Association of State Highway and Transportation Officials, AASHTO, and Unified Soil Classification System, USCS, soil standards (as well as United States Department of Agriculture, USDA, only if the client desires this classification). This will be done by taking soil samples from the site to gather moisture content information and perform a sieve analysis to perform the tests above.

The retaining wall design for this project will be based on the information gathered from both the preliminary grading plan and the future grading plan. The design will be used for analysis purposes to understand the topography surrounding the retaining wall, and the plan will be used to propose adjustments to the wall. The wall may need to be relocated and redesigned due to the exact location of the wall being unknown.

1.4 Project Constraints

The project constraints will revolve around the schedule, cost and the scope as the limiting factors. This project will focus more on the research, testing, and design for the site development process rather than the actual construction phases. Both the timeline and the construction process dictate that construction will occur after the capstone class has ended. Other constraints will be identified as needed as the project progresses.

ADA compliance requires that public facilities and resources are accessible for people who are physically and mentally challenged [1]. This will be an important constraint specifically when redesigning the parking plan as the team will need to provide wheelchair access, handicap parking spots, etc.

1.5 Project Challenges to be overcome

The retaining wall may not be on the owner's property which will be determined after consulting with City of Cottonwood. Determining the validity of a retaining wall redesign that coincides with new standards and codes since its original reconstruction will be a challenge for the team in the due diligence phase.

1.6 Stakeholders

The sole stakeholder of this project is the client: Old Towne Framing Company, a business in the City of Cottonwood, Yavapai County. The adjacent roadway is owned by Clemenceau Townsite LLC, according to Yavapai County Assessor website, but this should have no effect on the project because it is limited to Old Towne's property. However, if drainage leaves the property to the roadway, the project will become subjected to possible erosion control liabilities per the adjacent company's discretion.

2.0 Scope of Service/Research Plan

2.1 Task 1: Due Diligence

The primary focus of this task is identifying necessary documents and city records that will be necessary to complete the project.

Task 1.1: Existing Mapping

Existing mapping is completed to determine rough property boundaries for the site which will be used for the site survey.

Task 1.2: Site Due Diligence

Site due diligence is completed to determine the current zoning of the site, any easements located on the site, and any other conditions which will impact the site design.

2.2 Task 2: Site Investigation

Data will be gathered for the site. This data will be used for lab testing, grading design, and drainage design.

Task 2.1: Lot Sketch

The lot sketch is important to determine the general geometry of the site to create a plan of action for the land survey of the site.

Task 2.2: Field Investigation

The field investigation is used to identify any challenges that may be encountered during the land survey and soil sampling of the site.

Task 2.3: Land Survey

The land survey will be completed to generate the site layout in AutoCAD including: property boundaries, building corners, landscaping, and utilities.

Task 2.4: Soil Sampling

The soil sampling will be done to be able to complete the geotechnical analysis of the site.

2.3 Task 3: Geotechnical Analysis

The primary purpose of this task is to understand the properties of the soil on site. The soil can be classified via AASHTO and USCS standards and the suggested uses can be determined from this. Results of suggested uses can be presented to the client and if the soil is determined not suitable for desired uses then the client can decide if importing soil is an option.

Task 3.1: Moisture Content

Moisture content is used to determine the plastic limit and the water content in the soil, which will aid in determining further soil properties.

3.1.1 Plastic Limit (ASTM D4318)

Plastic limit is rolling out a piece of the soil sample until it is at 1/8 inches and is used to aid in finding the soil strength. It is necessary to do this test to determine the strength of the soil.

3.1.2 Water Content (ASTM D2216)

The water content is used to find the percent of soil which is saturated in order to find the unit weight of the soil. This must be done to determine if clay will play a role in whether the soil can handle the design load.

Task 3.2: Perform Sieve Analysis

The sieve analysis is done to determine the particle sizes of the soil.

3.2.1 AASHTO/ USCS Soil Classification

The soil classification is used to determine the suggested and allowed uses by AASHTO and USCS. The classifications are necessary to ensure the soil is not used for a structure that it cannot support.

Task 3.3: Perform Hydrometer Test – (tentative)

A hydrometer test is necessary if the sieve analysis comes back with results of more than 90% of the soil passing through the #200 sieve. If this is not the case it will not be necessary. It is necessary to perform this test if 90% pass through the #200 sieve because standard classifications are not sufficient in analyzing soil that fine.

Task 3.4: Perform Consolidated Undrained Test

This test is used to determine the angles of internal friction and cohesion strength parameters of soils by triaxial compression [2]. This is necessary because it is a fast way to determine the strength of the soil in compression [2].

Task 3.5: Perform Direct Shear Test

The direct shear test is used to determine the failures envelopes for soils. This test is necessary to determine how much shear the soil can take before it fails.

Task 3.6: Perform Triaxial Compression Test [3].

This test provides data for determining strength properties and stress-strain relations for soils [4]. This test provides a shear-strain graph and is necessary for determining the range of elasticity as well as the point of ultimate bearing capacity.

Task 3.7: Lab Testing Report

The lab testing report is used to compile the results from the soil testing into a single master report which outlines: the moisture content, the sieve analysis, the hydrometer test results, the consolidated undrained test results, the direct shear test results, and the triaxial compression test results. This is necessary to provide to the client via email and let them know the team's results and recommendations for soil uses.

2.4 Task 4: Site Topo Map

The topographic map is used to determine site elevations and to assist in grading design. Will be used to determine if a cut/fill is necessary.

Task 4.1: Data Processing

The data processing consists of adding all the survey data into AutoCAD and creating a surface. The survey data is necessary to create a topographic map.

Task 4.2: Topographic Map

The topographic map is used to create an existing drainage plan. It will be referenced in the future to create a new drainage plan and provide cost estimate for any desired or necessary cut/fill. A topographic map is necessary in determining the elevations of the site and where to place the parking layout to minimize cut/fill needs.

Task 4.3: Aerial Map

An aerial map using google images and the topographic map will be created to better visualize the site. The creation of the aerial map will allow the team and client to visually see the elevations of the site in relation to the existing site features.

2.5 Task 5: Parking Lot Design

This task will use the developed topographic map as well as the initial site visit data to determine a new parking lot design. Current drainage conditions will be analyzed so they can be utilized with the new design as well to avoid having to install a completely new drainage runoff design.

Task 5.1: Existing Drainage

Using the topographic map from task 4 and the data gathered from the site visit, existing drainage patterns will be noted and labeled in AutoCAD. An existing drainage is necessary because the existing site basins and channels will be utilized in the new proposed drainage plan to minimize construction.

Task 5.2: Parking Layout

A proposed parking lot layout will be constructed using AutoCAD. A new parking layout was requested by the client and the new design will optimize accessibility in favor of capacity.

Task 5.3: Proposed Drainage Plan

A new drainage plan, one that accommodates the current drainage plan, will be designed to account for the runoff of the new parking lot design. A new drainage design is necessary because the new parking lot design will change the site runoff. The new drainage plan will accommodate the new parking lot and utilize existing channels and basins where possible.

2.6 Task 6: Construction Plans

Construction plans are used in the field during construction as guidance. Specific recommendations and requirements are referenced to provide as much clear and concise information as possible on the site itself.

Task 6.1: Create Border

A professional border detailing the company name and logo, page numbers, scale and all other requirements will be created to accommodate the construction plans. This is necessary to provide information to the reader on every page.

Task 6.2: Cover

A professional cover sheet will be created to present the construction documents. All of the necessary information needed before reading the plans will be on this page.

Task 6.3: Notes/Details

Notes and detail sheets will need to be created to outline the standards that are being followed along with any other important requirements. Details will be included to display the standard design drawings that will be implemented in the design. Notes and details will be used in accordance with City of Cottonwood engineering standards.

Task 6.4: Site Layout

The site layout will show the layout of the site including building locations, retaining wall location, and proposed drainage.

Task 6.5: Plan and Profile (tentative based on retaining wall)

A plan and profile view of the current and proposed retaining wall will be added. The proposed wall will be a typical retaining wall design that would work with the site.

Task 6.6: Cross Sections

A typical cross section used for pavement design will be include in the construction documents.

2.7 Task 7: Project Management

Project management is essential to stay on schedule, on budget, and up to date with deliverables.

Task 7.1: Meetings

7.1.1 Technical Advisor

No less than once every 3 weeks. The meetings are necessary to ensure the team is on time and doing things correctly.

7.1.2 Client

After task 4 and after task 5. Or as requested by the client. Client meetings will be minimized due to the distance. Emails with updates will be sent after Task 2 and 3.

7.1.3 Grading Instructor

After each submittal. These meetings will be used to speak with the grader on whether the team met the submittal requirements.

7.1.4 Lab Coordination

Speak with Adam no less than 2 weeks before we wish to use the lab.

Task 7.2: Deliverables

7.2.1 30% Submittal

The first preliminary deliverable which will tentatively cover the first two task.

7.2.2 60% Submittal

An amendment to the deliverable above which will now also includes the first four tasks.

7.2.3 Final Report

The third preliminary submittal which serve as the final draft of the design report.

7.2.4 Website

An internet-based resource which will serve as a reference to the client about the project. A home page, project info page, and documents page will be included.

Task 7.3: Travel Reports

Weekly log of all miles driven to a from project site location. These are important to stay on budget.

Task 7.4: Engineers Opinion of Probable Cost

Proposal of the cost and suggested budget of the project. This is necessary so the client can make decisions on how much of the work they want done.

2.8 Project Limitations

2.8.1 Challenges

The timeline will be a challenge as land development, even a small project like this, will usually take at least a year to complete and the team will have 6 months with not all time dedicated to the project. The lack of pre-existing data on the site is a challenge. The team has little information to go on and will have to work with the little information offered. The distance from the school to the site will be a challenge. Each trip to the site will need to be utilized efficiently as the number of trips will be limited.

2.8.2 Exclusions

The exclusions will include: pavement design, property mapping, survey staking, and floodplain work. The team will provide a typical pavement design cross-section, but will not provide a full pavement plan for the proposed parking lot. The team cannot complete any property mapping or survey staking work since no one in the team is a registered land surveyor (RLS). The team cannot complete any floodplain work since no one in the team is a professional engineer (PE).

3.0 Project Schedule

3.1 Discussion

The total duration, as seen in the attached schedule, will be approximately 81 days, the major tasks are as follows: 10 days

- Task 1 Due Diligence, specifically identifying site boundaries: 10 days
- Task 2 Site Investigation, specifically the survey and soil sampling: 20 days
- Task 3 Geotechnical Analysis, specifically the sieve analysis and direct shear test: 20 days
- Task 4 Site Topo Map, specifically the map to create the grading and drainage plans: 15 days
- Task 5 Parking Lot Design, specifically a site redesign: 11 days
- Task 6 Construction Plans, specifically a complete set of the design plans for the project: 11 days
- Task 7 Project Management, a part of the entire project, managing deliverables, meetings, and engineers opinion of probable cost: 81 days (complete duration of project)

The deliverables, as noted in the scope above, are the 30%, 60%, and final design report, a final presentation, and a website.

3.2 Critical Path

The critical path is highlighted in the attached schedule and has a total duration of 68 days. The critical path is the shortest duration that the project can be finished, which would be once the construction plans have been created. The team will follow the schedule for the duration of the project, making any adjustments as the project progresses. The team is prepared to adapt to any changes that may be encountered.

LEAVE BLANK FOR SCHEDULE

4.0 Staffing Plan

4.1 Staffing Positions

Table 1 displays the positions required for this project along with the typical abbreviations to be used.

Table 1. Staff Positions

Classification	Code
Senior Engineer	SENG
Engineer	ENG
Lab Tech	LTECH
Intern/Drafter	INT/DRF

4.2 Staffing Qualifications

4.2.1 Senior Engineer
The requirement for senior engineer is to have a past experience in the engineering field for a minimum 10 years. The senior engineer will be billed as $145.00/hour based on table 3 below.

4.2.2 Engineer
The requirement for the engineer is to have a past experience in the engineering field for a minimum of 4 years. The engineer should be an E.I.T. Based on table 4 the engineer will be billed as $90.00hour.

4.2.3 Lab Tech
The lab tech should have a minimum of 5 years of experience working in a soils lab and preparing soils reports. Based on table 4 the lab tech will be billed as $80.00/hour.

4.2.4 Intern
The intern should be a current engineering student, or a recent college graduate. Based on table 4 the intern/drafter will be billed as $45.00/hour.

4.3 Staff Estimation Hours

Table 2 displays the projected number of hours each position will spend on each task.

Table 2. Staff Estimation Hours

Tasks	SENG	ENG	LTECH	INT	Total Hours
Task 1: Due Diligence					44
task 1.1: Existing Mapping	6	6	0	11	23
task 1.2: Site Due Diligence	5	5	0	11	21
Task 2: Site Investigation					116
Task 2.1: Lot Sketch	3	3	3	3	12
Task 2.2: Field Investigation	3	3	3	3	12
Task 2.3: Land Survey	20	20	20	20	80
Task 2.4: Soil Sampling	3	3	3	3	12
Task 3: Geotechnical Analysis					142
Task 3.1: Moisture Content	2	2	5	4	13
3.1.1 Plastic Limit (ASTM D4318)	2	2	5	4	13
3.1.2 Water Content (ASTM D2216)	2	2	5	4	13
Task 3.2: Perform Sieve Analysis	2	2	5	4	13
3.2.1 AASHTO/ USCS Soil Classification	2	2	5	4	13
Task 3.3: Perform Hydrometer Test - (tentative)	2	2	5	4	13
Task 3.4: Perform Consolidated Undrained Test	2	2	5	4	13
Task 3.5: Perform Direct Shear Test	2	2	5	4	13
Task 3.6: Perform Triaxial Compression Test	2	2	5	4	13
Task 3.7: Lab Testing Report	2	6	12	5	25
Task 4: Site Topo Map					32
Task 4.1: Data Processing	2	5	0	4	11
Task 4.2: Topographic Map	2	5	0	4	11
Task 4.3: Aerial Map	2	2	2	4	10
2.5 Task 5: Parking Lot Design					59
Task 5.1: Existing Drainage	5	8	2	6	21
Task 5.2: Parking Layout	5	8	0	6	19
Task 5.3: Proposed Drainage Plan	5	8	0	6	19
Task 6: Construction Plans					92
Task 6.1: Create Border	2	2	2	5	9
Task 6.2: Cover	2	2	0	5	9
Task 6.3: Notes/Details	3	5	0	5	13
Task 6.4: Site Layout	8	8	0	8	24
Task 6.5: Plan and profile (tentative based onretaining wall)	8	8	0	8	24
Task 6.6: Cross Sections	3	5	0	5	13
Task 7: Project Management					88
7.1: Meetings					
7.1.1 Technical Advisor	5	5	5	5	20
7.1.2 Client	5	5	5	5	20
7.1.3 Grading Instructor	10	10	10	10	40
7.1.4 Lab Coordination	2	2	2	2	8
Task 7.2: Deliverables					179
7.2.1 30% Submittal	10	10	10	10	40
7.2.2 60% Submittal	8	8	8	8	32
7.2.3 Final Report	8	8	8	8	32
7.2.4 Website	8	8	8	8	32
Task 7.3: Travel Reports	4	4	2	5	15
Task 7.4: Engineers Opinion of Probable Cost	7	9	7	5	28
Total Hours	174	199	157	224	752

Table 3 is a summary of the total hours each staffing position is estimated to work for the duration of the project. The total hours projected to be spent on this project are 555. The lab tech has the least amount of hours since most of this work will be done during the geotechnical analysis portion of the project. The drafter and intern share similar tasks with similar hours which is to be expected for the level of experience. The engineer has the most hours on the project, since the engineer will take part in every task. The project manager takes part in most tasks as an advisor and to make sure the project is running smoothly.

Table 3. Total Hours for Each Staffing Position

	SENG	ENG	LTECH	INT	Total Hours
Total Hours	174	199	157	224	752

5.0 Cost of Engineering Services

5.1 Bill Rate for Each Staffing Position

Table 4 displays the calculation of the bill rate for each of the staffing positions. This takes in to consideration the benefit percentages and the profit percentages for each percentages from the base pay amounts.

Table 4. Bill Rate for Each Staffing Position

Cost of Personal	Base Pay	Benefit	Act Pay	Profit	Bill Rate
SENG	$90.00	19.00%	$107.10	35.33%	$ 145.00
ENG	$50.00	30.00%	$65.00	35.33%	$ 90.00
LTECH	$40.00	44.00%	$57.60	35.33%	$ 80.00
INT	$22.00	50.00%	$33.00	35.33%	$ 45.00

5.2 Cost of Staffing

Table 5 displays the total cost that each position will be billed for the duration of the project.

Table 5. Total Cost for Each Staffing Position

Cost of Personal	Total Hours	Rate per Hour	Cost
SENG	174.00	$145.00	$25,230.00
ENG	199.00	$90.00	$17,910.00
LTECH	157.00	$80.00	$12,560.00
INT	224.00	$45.00	$10,080.00
		Total	$65,780.00

5.3 Total Cost of Project

Table 6 displays the total cost of the project. The total project costs are a summation of the costs for each staffing position, travel miles, and overhead costs. It can be seen in the table that there is no supplies or subcontracting required for this project. The engineering team has all the necessary surveying and lab equipment to complete the project.

Table 6. Cost of Engineering Services

Personnel	Classification	Hours	Rate $/hr	Cost
	SENG	174	$145.00	$25,230.00
	ENG	199	$90.00	$17,910.00
	LAB	157	$80.00	$12,560.00
	INT	224	$45.00	$10,080.00
	Total			$65,780.00
2.0 Travel	Distance (miles)	Meetings	Rate $/mile	Cost
	120	5	$0.54	$324.00
3.0 Supplies		Hours	Rate $/hr	Cost
Survey equipment		20	$50.00	$1,000.00
4.0 TOTAL				**$67,104.00**

6.0 References

[1] J. Demkin, *The Architect's Handbook of Professional Practice,* New York: American Institute of Architects, 2001.

[2] T. D. o. Transportation, *Consolidated Undrained Triaxial Compression Test for Undisturbed Soils*, TDOT, 1999.

[3] R. E. Olson, *Direct Shear Testing,* Chaoyang: Department of Construction Engineering Chaoyang University of Technology, 2004.

[4] T. D. o. Transportation, *Triaxial Compression Test for Undisturbed Soils,* TDOT, 1999.

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[7] C. Hendrickson and T. Au, *Project management for construction: fundamental concepts for owners, engineers, architects, and builders,* Pittsburgh: Carnegie Mellon University, 2018.

[8] J. Kent, *A Visual Synthese of the ADA.*