

The Preconstruction of a Foundation for a Greenhouse

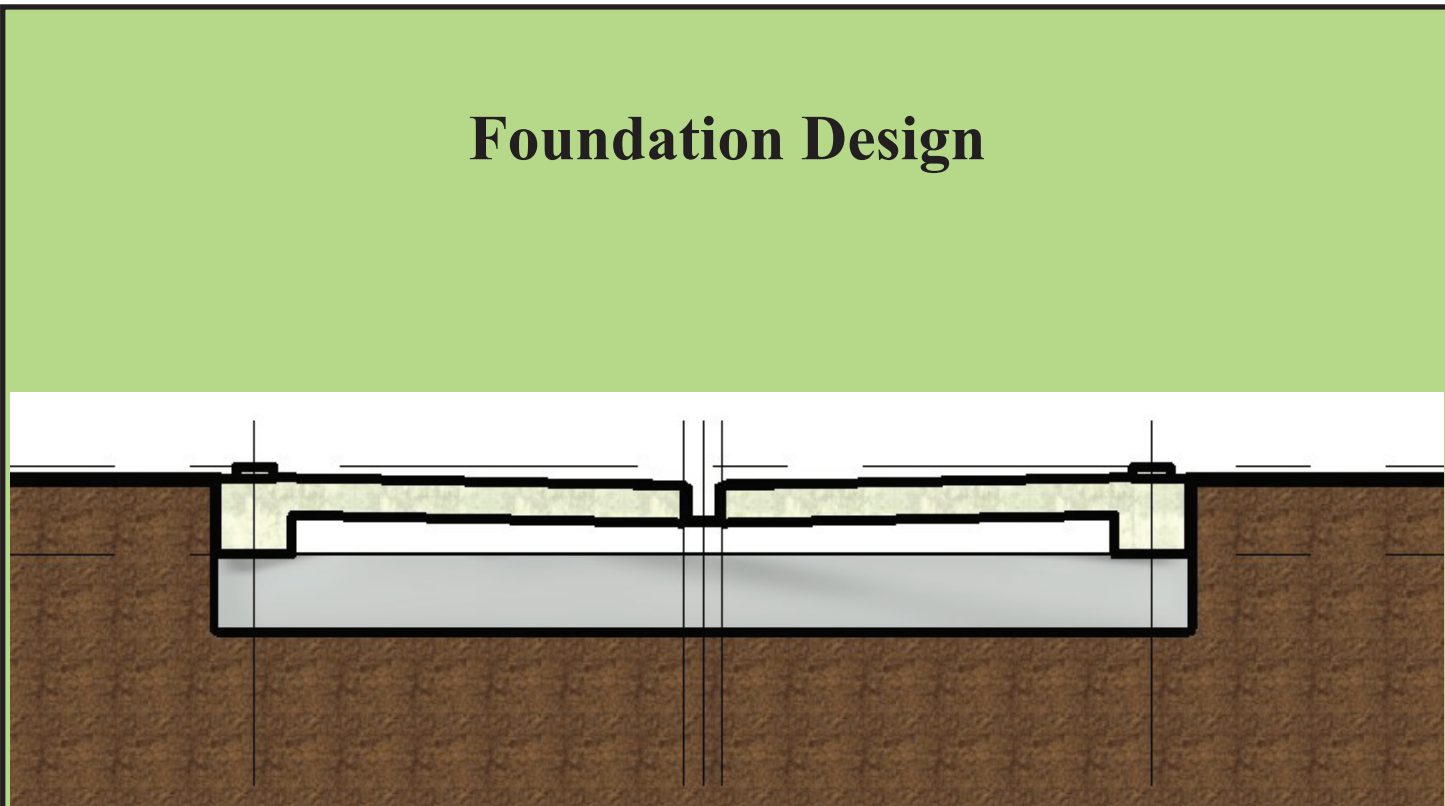


Figure 1

This foundation was designed for proper drainage of the greenhouse as well as being able to support the weight of the prefabricated greenhouse unit and a live load of students and staff. The design started with a concrete footing, twelve inches thick, which will sit below grade, and a stem wall reaching two inches above grade. Then two concrete slabs were added with a 2% slope toward the center of the greenhouse where there is a trench drain to take the excess water out of the unit. Figure 1, above, shows a section cut of the foundation design where you can really see the slope of the slabs. Figure 2, below, shows a 3d view of the slab from a higher angle.

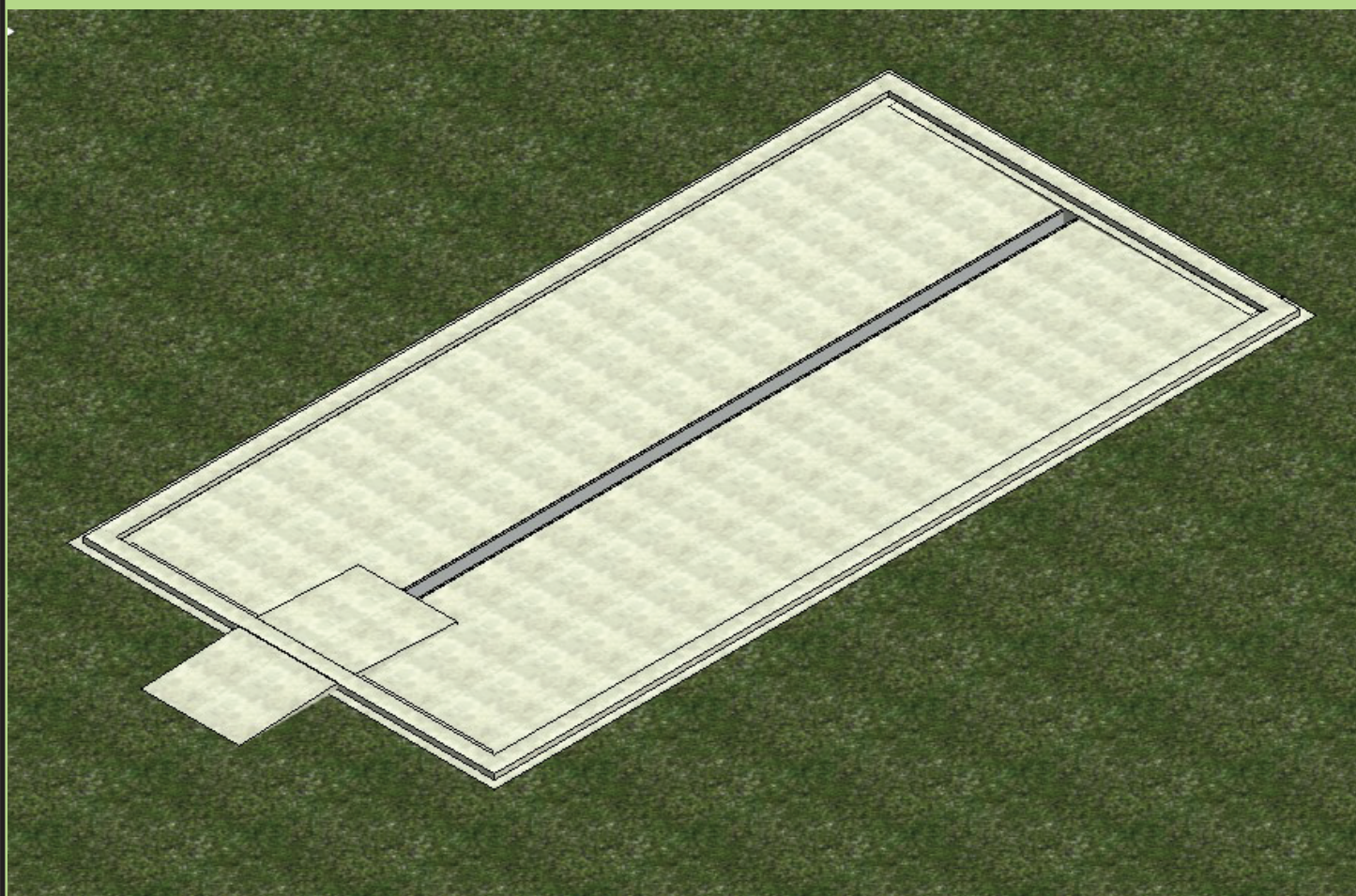


Figure 2

This project outlines the preconstruction process of building a concrete base for a prefabricated greenhouse unit. This project was initiated by the Cal Poly Garden Club so they could plan for the installation of a greenhouse at the Student Experimental Farm on Cal Poly’s campus. The members of the club currently share a greenhouse with another Cal Poly Club which restricts their ability to use the greenhouse freely. The initial goal of the project was to request a permit, however, that will be postponed until specific location is determined. This project still provides the necessary elements for requesting a permit through Cal Poly’s facilities department, including the design of a concrete base with proper drainage for a greenhouse unit to be bolted to. Additionally, a prefabricated greenhouse unit was selected that met all the needs of the Cal Poly Garden Club. A comprehensive cost estimate was created to determine the materials and costs for the project, including: the materials needed for formwork, reinforcement, concrete, and drainage.. A preliminary schedule and construction plan are also included to determine overall project duration. These deliverables can be used by future students to find funding and eventually request a permit for construction.

Keywords: greenhouse, concrete foundation, construction project, construction management, cost estimate



Figure 3

Prefabricated Unit

This prefabricated greenhouse unit was selected for the Cal Poly Garden Club because it fulfilled many of the requirements such as: good air circulation, proper ventilation, temperature control, integrated irrigation, and a size between 200 and 300 square feet. Figure 3, on the left, shows the prefabricated unit. Although it is sitting on grass in the photo, the seller said it is supposed to sit on a concrete base.

Cost Estimate

This cost estimate shows the materials we would be using to construct the project. Formwork is included for the stem wall and part of the slabs. An assumption was made that Cal Poly’s soil is expansive, so rebar will be reinforcing the footing, slabs, and stem wall. Total cost comes out to slightly over \$34,000.

Greenhouse Materials Estimate							Estimator:	Alla Hashim	
Item Name	Estimated Quantity	Unit	Price per Unit	Labor	Total Per Unit	Total Price	Overall Total		
Concrete Formwork									\$ 93.02
2x3 Formwork	143	LF	\$ 0.36	\$ -	\$ 0.36	\$ 51.48			
2x8 Formwork	46	LF	\$ 0.76	\$ -	\$ 0.76	\$ 34.96			
Nails	1	Box	\$ 6.58	\$ -	\$ 6.58	\$ 6.58			
Concrete									\$ 1,461.55
Concrete	7.51	CY	\$ 120.00	\$ 31.67	\$ 151.67	\$ 1,138.87			
Gravel (crushed stone)	2.39	CY	\$ 51.66	\$ -	\$ 51.66	\$ 123.68			
Vapor Barrier	1	Roll	\$ 199.00	\$ -	\$ 199.00	\$ 199.00			
Greenhouse									\$ 31,509.00
Greenhouse	1	Unit	\$ 30,000.00	\$ 200.00	\$ 30,200.00	\$ 30,200.00			
Channel Drain	1	Unit	\$ 1,309.00	\$ -	\$ 1,309.00	\$ 1,309.00			
Rebar and Hardware									\$ 1,057.26
#4 Rebar	1321.5	LF	\$ 0.44	\$ -	\$ 0.44	\$ 581.46			
rebar ties	244	Tie	\$ 1.95	\$ -	\$ 1.95	\$ 475.80			
TOTAL									\$ 34,120.83
Administrative									\$ 5,800.54
Contingency	10%					\$ 3,412.08			
Overhead	7%					\$ 2,388.46			
OVERALL TOTAL									\$ 38,771.09

Preliminary Schedule

This schedule was created alongside a construction plan to outline the steps needed to be taken for this project to reach completion as well as set a practical duration for the project. This schedule includes the preconstruction phase, construction phase, and closeout. As seen in the grant chart below, it will take about 113 days to complete this project from start to finish. With an assumption that the project started today, Dec 2, the end date would be on May 9.

	Task Name	Duration	Start	Finish	Predecessors
GANTT CHART	1 Greenhouse and Foundation Project	113 days	Thu 12/2/21	Mon 5/9/22	
	2 Preconstruction	86 days	Thu 12/2/21	Thu 3/31/22	
	3 Planning	1 day	Thu 12/2/21	Thu 12/2/21	
	4 Meeting with the Garden Club	1 day	Thu 12/2/21	Thu 12/2/21	
	5 Determining Location	1 day	Thu 12/2/21	Thu 12/2/21	
	6 Site Planning	8 days	Fri 12/3/21	Tue 12/14/21	3
	7 Surveying	3 days	Fri 12/3/21	Tue 12/7/21	3
	8 Survey the site	1 day	Fri 12/3/21	Fri 12/3/21	5
	9 Designing a New	1 day	Mon 12/6/21	Mon 12/6/21	8
	10 Excavation Plan	1 day	Tue 12/7/21	Tue 12/7/21	8
	11 Site Plan	5 days	Wed 12/8/21	Tue 12/14/21	10
	12 Determining Location of Water and Electrical Lines on a plan	5 days	Wed 12/8/21	Tue 12/14/21	10
GANTT CHART	13 Design	28 days	Wed 12/15/21	Fri 1/21/22	6
	14 Concrete Foundation	21 days	Wed 12/15/21	Wed 1/12/22	12
	15 Design of a Concrete Base	4 days	Wed 12/15/21	Mon 12/20/21	12
	16 Greenhouse	7 days	Tue 12/21/21	Wed 12/29/21	15
	17 Pick a Prefabricated Greenhouse	7 days	Tue 12/21/21	Wed 12/29/21	15
	18 Permitting	66 days	Thu 12/30/21	Thu 3/31/22	17
	19 Cost	32 days	Thu 12/30/21	Fri 2/11/22	17
	20 Create and Estimate	2 days	Thu 12/30/21	Fri 12/31/21	17
	21 Find Funding	30 days	Mon 1/3/22	Fri 2/11/22	20
	22 Scheduling	1 day	Thu 12/30/21	Thu 12/30/21	
	23 Creating a Prelim	1 day	Thu 12/30/21	Thu 12/30/21	17
	24 Proposal and Permit Request	35 days	Fri 2/11/22	Thu 3/31/22	21
GANTT CHART	25 Submit a Proposal	1 day	Mon 2/14/22	Mon 2/14/22	21
	26 Request a Permit	30 days	Tue 2/15/22	Mon 3/28/22	25
	27 Construction	29 days	Tue 3/29/22	Fri 5/6/22	
	28 Site Prep	14 days	Tue 3/29/22	Fri 4/15/22	
	29 Excavation	7 days	Tue 3/29/22	Wed 4/6/22	26
	30 Grading	7 days	Thu 4/7/22	Fri 4/15/22	29
	31 Footing	3 days	Mon 4/18/22	Wed 4/20/22	
	32 Laying Rebar	1 day	Mon 4/18/22	Mon 4/18/22	30
	33 Pouring Concrete	2 days	Tue 4/19/22	Wed 4/20/22	32
	34 Stem Wall	3 days	Thu 4/21/22	Mon 4/25/22	
	35 Formwork	1 day	Thu 4/21/22	Thu 4/21/22	33
	36 Laying Rebar	1 day	Thu 4/21/22	Thu 4/21/22	33
GANTT CHART	37 Pouring Concrete	2 days	Fri 4/22/22	Mon 4/25/22	36
	38 Slabs	6 days	Thu 4/21/22	Thu 4/28/22	
	39 Placing gravel	1 day	Thu 4/21/22	Thu 4/21/22	33
	40 Placing Vapor Retarder	1 day	Fri 4/22/22	Fri 4/22/22	39
	41 Placing Formwork	1 day	Mon 4/25/22	Mon 4/25/22	40
	42 Laying Rebar	1 day	Mon 4/25/22	Mon 4/25/22	40
	43 Pouring concrete	3 days	Tue 4/26/22	Thu 4/28/22	42
	44 Greenhouse	6 days	Fri 4/29/22	Fri 5/6/22	
	45 Placing Trench Drain	1 day	Fri 4/29/22	Fri 4/29/22	43
	46 Assembling Greenhouse	5 days	Mon 5/2/22	Fri 5/6/22	45
	47 Closeout	1 day	Mon 5/9/22	Mon 5/9/22	
	48 Inspection	1 day	Mon 5/9/22	Mon 5/9/22	46