

## **Logistics and Funding Plan for the Simpson Strong-Tie Lab Crane**

Arya Ghourchian  
Construction Management B.S.  
California Polytechnic State University  
San Luis Obispo, California 93405

In the recent years, there has been interests regarding an overhead crane to be erected inside of Cal Poly Simpson Strong-Tie Lab (Building 187). This under running single girder crane system will be used for construction classes, and to lift heavy equipment. The installment of this 2-ton indoor crane will be crucial to provide modular pieces, for whom that lost their homes due to the California fires. Additionally, there has been previous senior projects researches; reference attached preconstruction services, and a full structural analysis of SST Laboratory. I am in charge of collecting information regarding: Bid Estimate Comparison, Advertisement Strategy, Permit Compliance. This project seeks funding from Cal Poly trade partners, to help allocate our resources to minimize cost savings/impacts. As well as partially self-allocating proportion of this crane project, while using Facilities Management and Development to manage any proper permitting requirements.

**Keywords:** Overhead Crane, Bid Estimate, Advertisement Strategy, Permit Compliance, Preconstruction, SST Laboratory or Cal Poly CM Department

### **Introduction**

#### *Project Description/Deliverables*

My main goal of this project is to allocate my time and effort into bringing the SST Laboratory overhead crane onto the construction phase. By advancing through preconstruction phase we will be able to procure the crane and install it in place. It will be my utmost responsibility to bring this senior project to the stage where we can utilize the construction phase of SST Overhead Crane project. Although the overall duration of this project will exceed my time at Cal Poly, the crane will arrive soon after the funding milestone is complete. Additionally, it will be a great honor leaving Cal Poly CM Department a legacy, for years to cherish. This is such a phenomenon project for the CM department, while Cal Poly's Master Plan is an undergoing development. This heavy machinery will work as a tool to incorporate new construction practices, and a better use of SST Lab. By using my construction management knowledge to deliver this type of work is a perfect example of a senior student returning the courtesy to the CM Department.

## Process

### *Estimating Process*

By gathering senior project information from Amy Poehlitz and Peter Schoemann, I discovered useful information towards a more accurate crane estimate. My estimate had to be accurate to prevent excess spending, and as a comparison to other supplies, I narrowed down the different parts required for the crane assembly while researching current data on various crane material, labor, equipment, and general overhead cost requirements. Firstly, by reviewing the vendor analysis, I was able to get in contact with Dearborn Crane to confirm their bid elements, while asking about other detailed information for my estimate. Additionally, there were CSI cost codes available that compare a similar 3-ton crane assembly. There were other suppliers providing exclusive parts for the crane, that I used their part costs in my material estimate to further validate crane costs incorporated in this project. Secondly, hard costs, such as labor, were to be confirmed; hence the means and methods of crane construction. Hence that the union and open shop worker rates vary in San Luis Obispo, a crew size of welders, supervisors, electricians, and other skilled workers are needed to fully erect the crane. Thirdly, the equipment costs were determined to not amount to a significant value compared to total costs, since Cal Poly Facilities Department can reallocate necessary resources to further contract out this project.

Material selection can drive this crane purchasing to many different ways, depending on our budget allocation and self-performing measures we deem to take for this project. There were many considerations my SME and I discussed together to determine all cost-efficient material elements. My SME referred me to Alan Hanson with Simpson Strong-Tie company to determine what material best suits our crane application, including our Glu-Lam hangers, SST Part CCO7 (Figure 1). These hangers were incorporated in my estimate, and they meet the allowable load capacity on the SST Glu-Lams, per Amy Poehlitz's structural review. They also can be field bolted onto our Glu-Lams and welded to our wide-flange crane runways, which saves us a good proportion of manufacturer pre-fabrication cost.

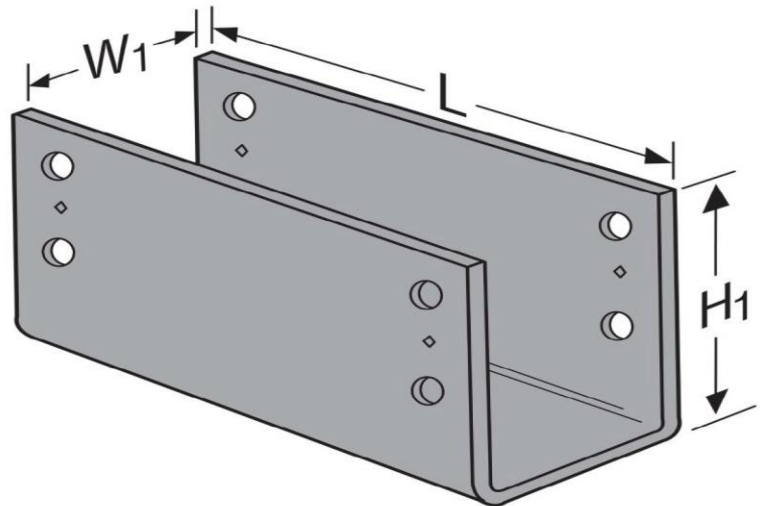


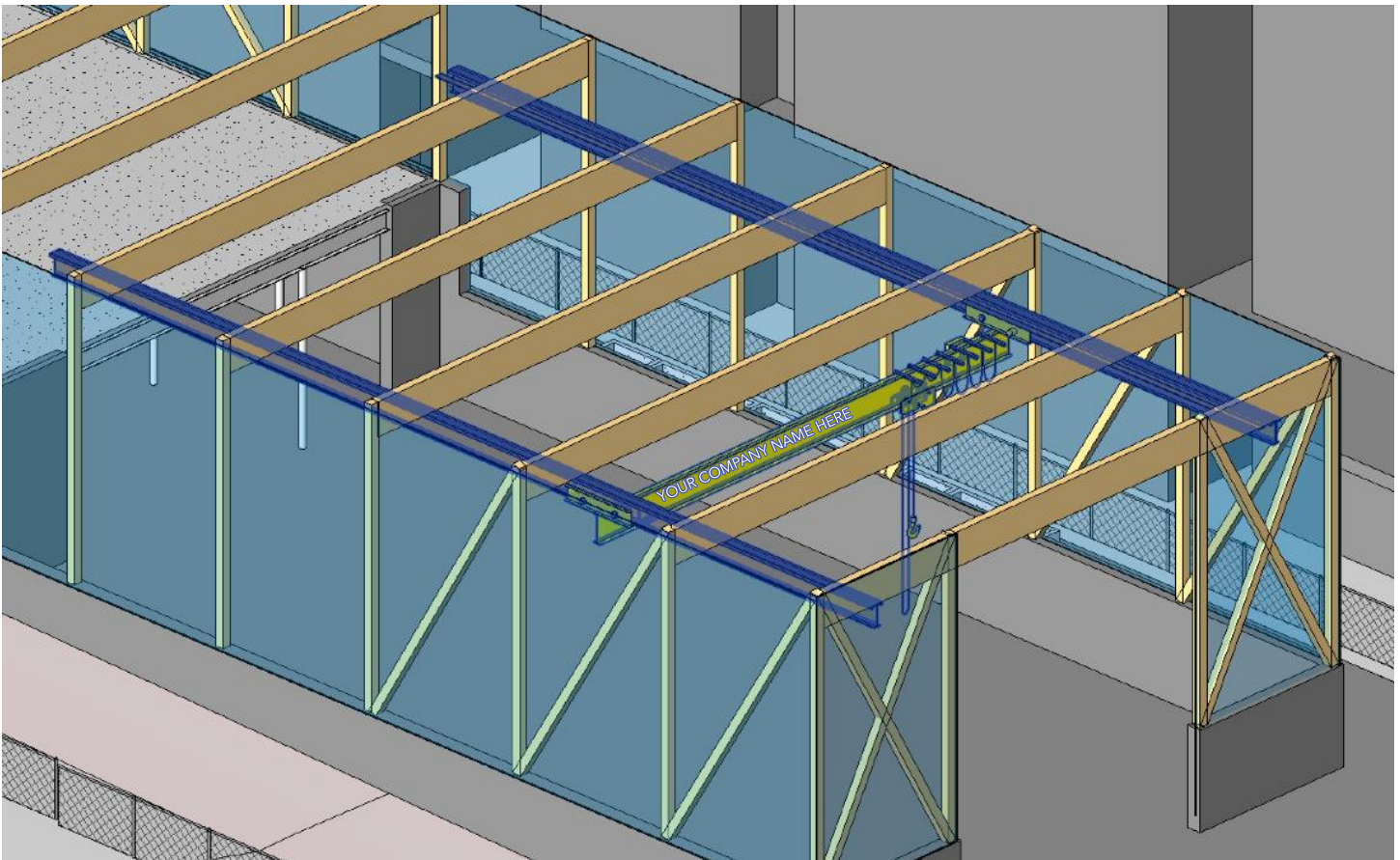
Figure 1:  
Glu-Lam Hanger  
SST Part Number CCO7  
(Meets Allowable Load Requirements)

## *Modeling Process*

After creating the crane estimate, I collaborated with the Construction Management BIM Club to model this crane assembly using Revit 2018. Initially, I used the as-built drawings of the structural SST model that we made in Jobsite Construction Laboratory as a class. Then, by using a crane assembly from Revit families, I was able to add the crane Revit family to the structural model by inputting it in my initial 3D design. I added some other details to my 3D model to further enhance the model, such as titles and identifiers, dimension, scale, etc. Other clashes such as the horizontal fire sprinkler line or Glu-Lam beam interception with the crane were addressed in this design. Therefore, this crane has predicted future implications in the design by performing a field observation and preliminary measurements. The constructability of this crane assembly and means and methods of its construction were discussed with my SME, to further clarify design clashes; we came up with surveying the building with a Trimble laser measurement tool, in order to hash out field discrepancies in our as-built measurements. We can take field measurements and survey the SST building, to clarify any unknown dimensions and clearances for design purposes.

The illustration below (Figure 2) shows the Revit model of the crane being underhung from the Glu-Lam girders. It was created by using as-built drawings of the SST Laboratory structure, field measuring intercepting elements (Example: Fire Sprinkler), inputting crane dimensions and performing a span check.

Figure 2: 3D Revit Model - SST Building and Crane Assembly



### Permitting Process

Regarding permitting compliance for our crane project, I was able to reach out to Cal Poly Facilities Department and ask about permitting checklist items; including SLO City Building Department, and other checklist items required to initiate the permitting process by Cal Poly Facilities Department. Since this project will be built and funded by Cal Poly trade partners and managed by Cal Poly Facilities Department under a Project Manager, the permitting requirements will be enforced internally through Cal Poly Facilities Department. Items required to initiate the project are outlined below (Figure 3): The scope of construction work, plan/shop drawings, and specification/submittal process are all required, as well as other requirements that need to be requested from the contractor used on this project. After concluding all of the necessary pre-construction checklist items, including the permitting compliance by Cal Poly Facilities Department, we can proceed with the necessary quality assurance and the right safety practices to execute this crane project in a timely manner. Finally, all supporting Construction Documents need to be accompanied in an email to Facilities with a completed Building Permit Application Form (Appendix 2), including a plan-check that can be used to help expedite the permitting process. Material procurement will be an important aspect of this project as it tracks the various components of this crane. A complete list of items can be found in the vendor's list of material supplied and will be signed off by Project Engineer upon delivery. A proper testing agency shall be allocated for quality control purposes, per the specification documents.

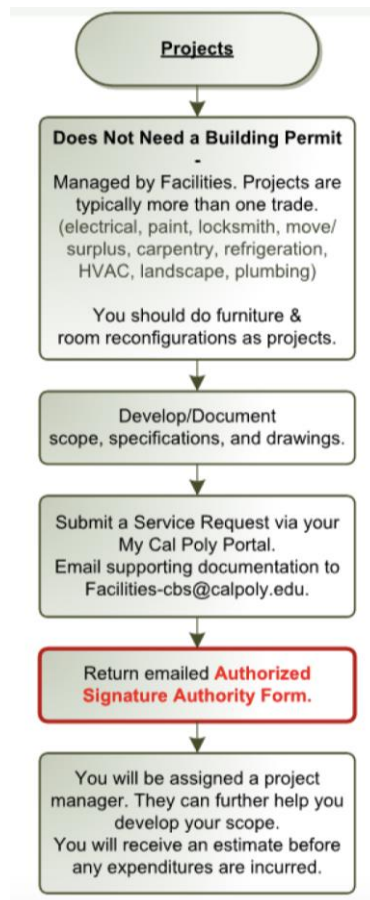


Figure 3:  
Permitting Process for Cal Poly Facilities Department

## New Knowledge

This project will bring new information to the involved parties by researching the necessary aspects to fund, design, and permit the SST crane. We all want to see this crane to be utilized for future classes that are taught at the Cal Poly CM Department. I am honored to be involved in this crane project; therefore, I personally compiled the information below by estimating (Cost control proposes), 3D modeling (For marketing/design purposes), and by compiling the necessary processes for permitting compliance purposes. To review a comprehensive version of my deliverables, refer to my senior project binder. The information below summarizes and compares: Scope of Work Cost Estimate Comparison (Figure 4), Crane Bid Comparison (Figure 5), Construction Means and Methods Comparison (Figure 6), Advertisement Strategy (“Your Company Name Here”), Permitting Compliance (Required Documents and Forms).

### *Crane Project Set Budget & Comparison*

Figure 4: Scope of Work - Cost Estimate Comparison

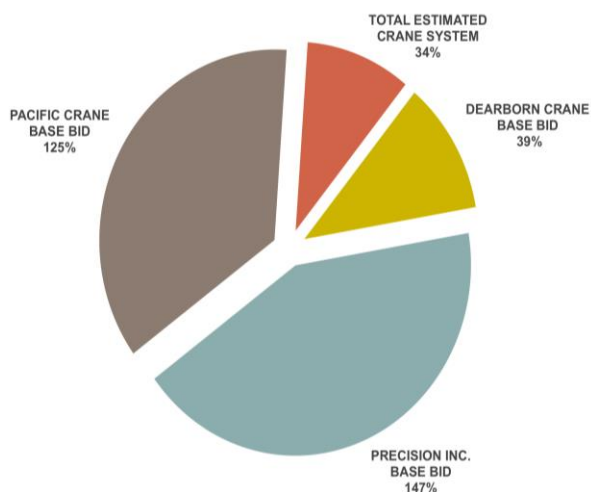
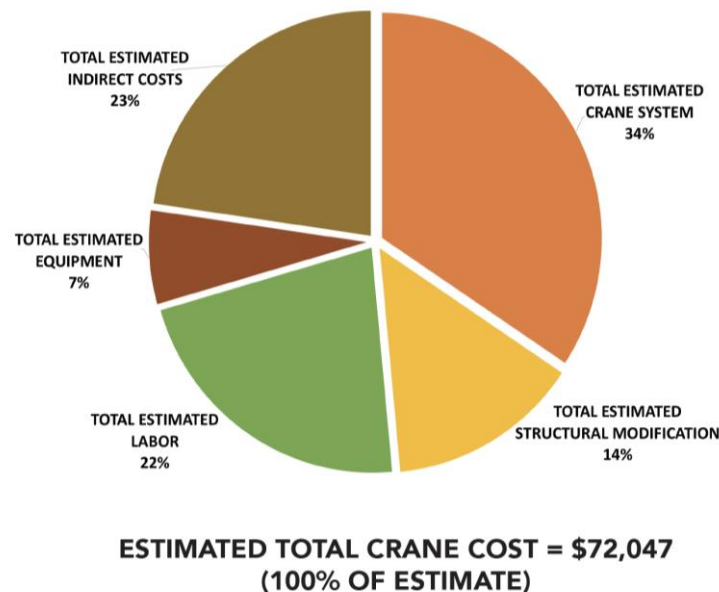


Figure 5: Crane Bid Comparison  
(% of Total Estimate)

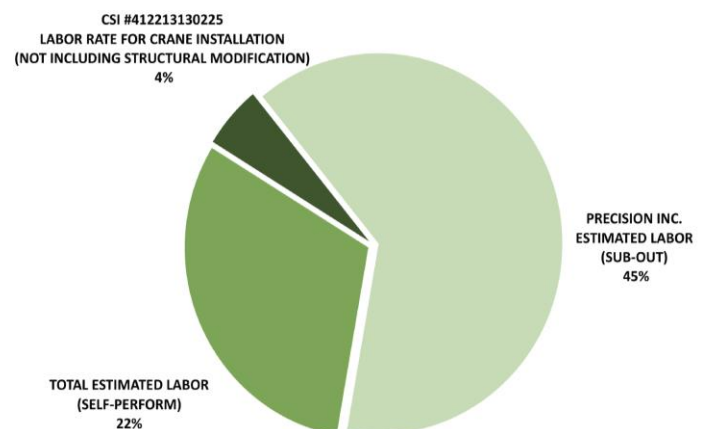


Figure 6: Construction Means and Method Comparison  
(% of Total Estimate)

In Figure 5, we can see three bids in percentage proportions of my total estimate that are compared to the information compiled in my crane estimate using RS Means Cost Data estimating method (2017 Version). Dearborn Crane Base Bid turned out to be similar to my gathered estimate, while the other two vendors (Pacific and Precision) have an overhung railway system in their bids, which came out to be about 3-4 times of Dearborn's bid proposal. These two high cost bids will not be worthy of qualification, considering their cost impacts of this project, let alone their systems not meeting our project requirements (Overhung versus Underhung Railways). For the sake of this project, Optimal situation will be to gather new bid findings; new bids that the PM on this project can gather, in the purpose of having enough information comparison for the awarding purposes.

In figure 6, we can see different methods of means and methods compared together in a form of proportions that reflect based on my total estimate (\$72,047). Precision Inc. was the only company in the bid sets that included erection costs that was utilized as a good base comparison to the different contracting methods; to subcontract-out this scope of work, to self-perform using internal contracts, or to use a typical labor rate comparison for specialty crane installation (Cheapest Method). Since this project requires extra scope of work besides the crane installation, we would need to eliminate the typical labor rate for specialty contracting option, or only use it as hard bid method of contracting. Using internal resources to contract out various project scope requirements is the optimal option to go forward with and consider for proper contracting methods.

### *Advertisement Strategy*

My presented Revit model can be used as a preliminary rough-draft design to create awareness to the possibility of having this crane in our SST Lab. The finished 3D model will illustrate many aspects of this crane project for the proposed prospects to help fund and build this project. Additionally, we can further detail this designed model by using a Trimble surveying tool, and by sharing the existing design with our crane vendor for proper fabrication purposes. This model will be working as an advertisement strategy to be utilized for our future donors, and for marketing outreach purposes. An accessible Revit file is available in my deliverable submission.

### *Permitting Compliance*

Cal Poly has developed its construction master plan to develop new building structures around the campus. Since this project is considered a small project by the Cal Poly Facilities Management and Development it will not require a permit through the City of San Luis Obispo Building and Planning Department; the permitting will be conveyed internally within Cal Poly Facilities. This is a system assembly that is being added to the existing structure and not a new construction, therefore this project will be managed by the Cal Poly Facilities' department. In basic terms, the permitting requirements of this project will be up to Facilities department and in the discretion of their Project Manager in charge of this project to gather the project requirements. To be able to comply with the requirements of this project, there is a "Building Permit Application Form requirement" (Appendix B) as well as an "Authorized Signature Authority Form" to be submitted to the Facilities Department for review. Once this form is approved, this will be considered a Facilities project, and a Project Manager is assigned to the project properly manage

the installation of this crane. Additionally, the assigned Project Manager will require construction documents (Figure 6), that include but are not limited to: scope alignments, specifications, and drawings. Once they have analyzed these documents, they will open an internal coordination channel that will develop other project requirements including an estimate.

### **Future Research**

There might be funding complications regarding donations that we receive for this project. Therefore, it will be essential to seek assistance from the CM department's program specialist, by reaching out to all applicable construction company prospects to reach the best funding results. Considering that the CM Department is the owner of this crane, we shall seek funding through our industry partners, to reach our set budget goals. To be able to procure these scopes of work properly, including electrification, structural modification, crane, etcetera, we require multiple other bid shopping to reach better results. I suggest Facilities Department to consider another bid shopping from other new vendors.



## References

Plotner, Stephen C, and Christopher Babbitt. *RSMeans Building Specialty Construction Cost Data*. Vol. 76th, R S Means Co; 2018 Ed. Edition, 2017.

Unifomat, Construction Specifications Institute, <http://www.csinet.org/unifomat>

Cal Poly. “Building Permits.” *Facilities Management & Development Department*, [afd.calpoly.edu/facilities/services\\_buildingpermits.asp](http://afd.calpoly.edu/facilities/services_buildingpermits.asp).

Conversation with Stacy Kolegraff regarding outreach with Facilities Management & Development.



Conversation with Alan Hanson regarding outreach with Simpson Strong-Tie catalog pricing.



## Appendix A

Detailed Estimate - Overhead Crane in SST Laboratory					
MATERIAL	ESTIMATED QUANTITY	ESTIMATED COST PER UNIT	ESTIMATED SUBTOTAL	% OF TOTAL ESTIMATE	NOTES
2 Ton Under Running, Single Girder Crane	1	\$ 8,676	\$ 8,676	12%	Ductile Iron Single-Flange Prefabricated
Runway Electrification System	1	\$ 900	\$ 900	1%	460v / 3 Ø / 60 HZ
End Stops/Trucks	4	\$ 98	\$ 392	1%	2 Speed Hoist Motor
Trolley	1	\$ 1,587	\$ 1,587	2%	Galvanized Steel Cable W/ Cable Supports
Trolley Brake/Clamp	1	\$ 869	\$ 869	1%	Heavy-Duty DC Disc Stop
Trolley Bumpers	2	\$ 67	\$ 134	0.2%	Model: EKDR
Electric Chain Hoist	1	\$ 8,809	\$ 8,809	12%	2 Ton Wire Rope
Rigging Parts	4	\$ 219	\$ 876	1%	Optional
Pendant Controller	1	\$ 1,100	\$ 1,100	2%	ASME H4
Weight Watcher Load Cell	1	-	-	<1%	Included
Warning Horn	1	-	-	<1%	Included
OPTIONAL MATERIAL					
Remote Radio Control system	1	\$ 1,000	\$ 1,000	1.4%	"RaCon" Radio
Anti-collision Feature	1	-	-	<1%	
Warning Devices	1	-	-	<1%	
Crane Lights	2	-	-	<1%	
Adjustable Frequency Drives	1	-	-	<1%	
Outdoor Application	1	-	-	<1%	
Dolly	2	\$ 112	\$ 224	0.3%	
TOTAL ESTIMATED CRANE SYSTEM			\$ 24,343	34%	Based On 2018 Supplier Quote Rates
*DEARBORN BASE BID - CRANE ASSEMBLY			\$ 28,300	39%	CMAA Class C (Moderate Use)
*PRECISION BASE BID - CRANE ASSEMBLY			\$ 105,869	147%	
*PACIFIC BASE BID - CRANE ASSEMBLY			\$ 90,100	125%	
STRUCTURAL ASSEMBLY					
Wide Flange Steel Beam	2	\$ 1,164	\$ 2,328	3%	W 18 x 65, 70 Feet Span (Special Trucking)
Compressible Neoprene Pad	16	\$ 7	\$ 112	0.2%	Sheet Rolls
Lag Screws	32	\$ 5	\$ 160	0.2%	1" diameter, 11" Long
Fastener Bolts/Nuts	144	\$ 5	\$ 720	1%	1" diameter, 8" Long
"U" Metal Clip (Glulam Attachment)	16	\$ 66	\$ 1,056	1%	SST Part # CCO7 (A36 Steel Plate: 1/4" x 23" x 18")
Electrification Breaker Panel	1	\$ 5,500	\$ 5,500	8%	460v, 3 phase, 60HZ, 4.33 HP
Paint	1	\$ 80	\$ 80	0.1%	Yellow
Signage	6	\$ 10	\$ 60	0.1%	Safety Hazard Signs
TOTAL ESTIMATED STRUCTURAL MODIFICATION			\$ 10,016	14%	
TOTAL ESTIMATED MATERIAL			\$ 17,704	25%	
LABOR ACTIVITY					
Trimble Field Measurements	1	-	-	<1%	Use As-Built Drawing
Laser Layout	2	-	-	<1%	
Pre-Drill	2	\$ 320	\$ 640	1%	
Fastener/Bolts	2	\$ 320	\$ 640	1%	
Ironwork/Metal U Plate	6	\$ 800	\$ 4,800	7%	
Electrification/Breaker Panel	5	\$ 1,200	\$ 6,000	8%	Elevator Shaft By SST has 480v Electricity
Crane Assembly	2	\$ 1,600	\$ 3,200	4%	Supervisor/Manufacturer Directions
Paint/Signage	1	\$ 320	\$ 320	0.4%	
Inspections/Load Test	1	-	-	<1%	Free (Per Dearborn Crane Bid Package)
TOTAL ESTIMATED LABOR			\$ 15,600	22%	45 Total Work Days Per Schedule
*TYPICAL LABOR RATE FOR CRANE INSTALLATION (NOT INCLUDING STRUCTURAL MODIFICATIONS) CSI CODE #412213130225			\$ 2,680	4%	Under Running, Single Girder Crane, 30' Span, 3 Ton (Similar to Dearborn's Quote)
*PRECISION INC ESTIMATED LABOR			\$ 32,071	45%	Installation, Engineering, Documentation, Etc.
EQUIPMENT					
Arial Lifts	4	\$ 1,200	\$ 4,800	7%	Rental Cost / Self-Perform Cost
Lasers	2	-	-	<1%	Facilities Management & Development
Machine Drill	1	-	-	<1%	CM Department Tool Box
Basic Construction Tools	1	-	-	<1%	CM Department Tool Box
TOTAL ESTIMATED EQUIPMENT			\$ 4,800	7%	Rental Cost / Self-Perform Cost
PRECISION INC. ESTIMATED EQUIPMENT			\$ 6,000	8%	
ESTIMATED DIRECT COST			\$ 55,959	78%	
INDIRECT COSTS					
Permitting/Stamping Costs			\$ 1,679	3%	Facilities' Project Manager Suggestion
Shipping/Trucking			\$ 5,596	10%	Based on Distance/Size/Weight
Sales Tax			\$ 4,337	7.75%	California Sales Tax
Overhead Markup			\$ 2,798	5%	Cal Poly Facilities Overhead
Purchasing Markup			\$ 1,679	3%	Cal Poly Facilities Overhead
Inspections			-	-	Included
Warranty			-	-	Included
Crane Load Test			-	-	ANSI B30.11 / OSHA 1910.179 Paragraph K2
Operator Training/Orientation			-	-	Provided By Supervisor
TOTAL ESTIMATED INDIRECT COSTS			\$ 16,088	22%	
ESTIMATED TOTAL COST			\$ 72,047	100%	

## Appendix B

<div style="text-align: center;">  <p><b>CAL POLY</b> SAN LUIS OBISPO</p> <p><b>Facilities Customer and Business Services</b></p> </div>	<div style="text-align: center;"> <p><b>BUILDING PERMIT APPLICATION FORM</b></p> <p>Send completed permit application to:  Email: <a href="mailto:facilities-CBS@calpoly.edu">facilities-CBS@calpoly.edu</a>  Fax: 756-6114 Attn: Facilities Help Center</p> </div>
<b>Applicant's Name:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div> <small>(Applicant will be the primary contact for this project)</small>	<b>Today's Date:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Phone Number:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>	<b>Department:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Alternate Phone Number:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>	<b>Email Address:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Optional: Names and Phone numbers of other involved parties</b> <small>(Supervisor, Dean, Advisor etc.)</small>	
<b>Project Name:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>	<b>Bldg. Name:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
	<b>Bldg. #:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Who is doing the work?</b> <small>(Check all that apply)</small>	<b>Room #:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<input type="checkbox"/> Contractor	<input type="checkbox"/> Student Project
<input type="checkbox"/> Department Labor	<input type="checkbox"/> Other <small>(Explain)</small> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Source of Funding:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>	<b>Estimated Cost/Budget:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<b>Description of Project:</b> <div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>	
<p><b>**Email supporting documents</b> such as scope, plans, specifications, location, etc. to:  <a href="mailto:facilities-CBS@calpoly.edu">facilities-CBS@calpoly.edu</a> <b>and</b> Mike Hogan at <a href="mailto:mhogan@calpoly.edu">mhogan@calpoly.edu</a></p>	
<b>Status of Project:</b>	<input type="checkbox"/> Proposal <small>(We can only review the concept, not issue a permit)</small>
	<input type="checkbox"/> Plans Ready to Review
	<input type="checkbox"/> Under Construction <small>(oops!)</small>
<b>Approval Signature:</b>	<div style="background-color: #cccccc; width: 100px; height: 15px; margin-top: 5px;"></div>
<small>Academic Departments Require Dean's Signature (Non-Academic Departments Require Division or Department Head Signature)</small>	<small>(Please Print Name)</small>
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