

# Creating A Demolition Estimate Lab Assignment

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This senior project aims to create a Demolition Estimate Lab as part of Cal Poly, San Luis Obispo's Demolition Topics Course, with the goal of enhancing construction education through practical experience in estimating demolition costs. The Lab will be equipped with industry-standard tools and software to simulate diverse demolition scenarios, covering site preparation, equipment requirements, waste disposal, labor needs, and environmental considerations. The project methodology entails extensive research and the integration of interactive learning activities. This initiative is expected to yield several benefits for students. Firstly, it will lead to improved learning outcomes by providing hands-on experience in estimating demolition costs, which is a critical aspect of the construction industry. Additionally, it will ensure a more relevant curriculum by aligning educational content with practical industry needs. By gaining proficiency in estimating demolition costs, students will enhance their competitiveness in the job market, as this skill is highly sought after by employers. The successful establishment of the Demolition Estimate Lab will contribute to the development of well-rounded and industry-ready professionals. It will also serve as a catalyst for innovative educational practices in the field of construction, reinforcing Cal Poly's commitment to providing cutting-edge and practical education.

**Key Words:** Demolition Estimate, Lab, Learning Outcomes, Cal Poly, Interactive, Construction

## Introduction

Demolition is a critical phase in construction projects, and accurate estimation of demolition costs is vital for project planning and management. At Cal Poly, SLO, an existing Demolition Topics Course aims to provide students with a comprehensive understanding of demolition principles. However, there is a recognized need to bridge the gap between theoretical knowledge and practical application in estimating demolition expenses. This project focuses on creating a Demolition Estimate Lab specifically designed for the Demolition Topics Course at Cal Poly, SLO. The lab will offer students a hands-on learning experience by simulating real-world demolition scenarios and equipping them with industry-standard software and tools. This introduction outlines the importance of the lab in enhancing the existing course, providing students with valuable practical skills, and preparing them for the challenges of the construction industry.

The remaining sections of this paper cover various aspects of the proposed creation of the Demolition Estimate Lab for the existing Demolition Topics Course at Cal Poly, SLO. These sections include the

background and motivation behind the project, the anticipated deliverables, and the lessons learned throughout the proposal process. These sections provide a comprehensive overview of the journey towards establishing a Demolition Estimate Lab and offer valuable insights for educators and institutions seeking to enhance construction education through practical demolition estimation.

## **Project Origins**

The proposal for the creation of a new Demolition Estimate Lab for the CM-422, Professional Preparation - Demolition class originated from personal experience and a desire to enhance the learning process at Cal Poly. After completing the demolition course during the summer quarter of 2022, it became apparent that while the course provided valuable knowledge on demolition practices, there was limited opportunity to apply that knowledge in a practical setting. Recognizing the university's emphasis on "learning by doing," the inspiration for the lab stemmed from the need to bridge the gap between theoretical learning and hands-on application. By creating the Demolition Estimate Lab, students would have the opportunity to actively apply the knowledge obtained in class, fostering a more comprehensive understanding of demolition principles and practices. The project aims to align with Cal Poly's educational philosophy and enhance the overall learning experience for demolition students.

## **Methodology**

To develop the proposed Demolition Estimate Lab, a comprehensive methodology was followed, incorporating information received from Silverado Contractors, a reputable company with a significant history within the construction industry in the Bay Area. Silverado Contractors, known for their expertise in demolition projects, provided invaluable insights to enhance the realism and industry relevance of the lab.

The methodology involved obtaining detailed information from Silverado Contractors, including project plans, owner descriptions, and project descriptions. This information served as the foundation for creating realistic demolition scenarios that closely mirrored real-world experiences. By incorporating these specific project details, the lab aimed to provide students with a practical learning environment that simulates actual industry conditions. In addition to the project-specific information, Silverado Contractors also shared helpful tips on how to effectively present the material to the students. Their guidance ensured that the lab's content and materials accurately reflected the challenges and considerations encountered in real-world demolition projects. By incorporating these recommendations, the methodology aimed to enhance the authenticity and applicability of the lab experience for the students.

During the development of the proposed Demolition Estimate Lab, I received invaluable guidance and assistance from Thomas Kommer, the current instructor for the Demolition course in which the lab would be incorporated. Kommer's expertise and past field experience provided valuable insights and direction throughout the process. His mentorship helped shape the methodology for the lab, ensuring its alignment with industry standards and best practices. Kommer's input was instrumental in refining the lab's objectives, methodology, and deliverables, enhancing its educational value and practical relevance. His continuous support and collaboration greatly contributed to the successful development of the Demolition Estimate Lab proposal.

Throughout the development process, close collaboration with Silverado Contractors facilitated a valuable exchange of knowledge and expertise. Their input helped shape the lab's design, content, and

overall learning approach. By leveraging the information received from Silverado Contractors and Kommer, the methodology ensured that the Demolition Estimate Lab provided students with practical, real-world insights, preparing them for the challenges they may encounter in their future careers.

### **Applicable Course Learning Outcomes (CLOs):**

Course Learning Outcomes (CLOs) at Cal Poly's Construction Management (CM) department are designed to outline the specific knowledge, skills, and competencies that students are expected to achieve by the end of each course. These CLOs serve as a guide for instructors in structuring their curriculum and assessments to ensure that students gain a comprehensive understanding of the course material. CLOs in the CM department cover a wide range of topics, including project management, construction methods, cost estimation, scheduling, building codes and regulations, sustainability, and communication skills. By aligning the curriculum with these CLOs, Cal Poly's CM department strives to equip students with the necessary abilities to excel in the construction industry and contribute to the successful completion of construction projects.

This Lab would cover to the following CLO's:

3. Understand the application of case studies in demolition.
5. Analyze the safety concerns involved with heavy equipment while demolishing a building.
9. Analyze & understand demolition abatement techniques.
10. Analyze strategies to reduce waste and environmental impact while demolishing.
11. Understand the different types of demolition and analyze how each should be incorporated into a project.
12. Understand how to incorporate green practices into the demolition plan.

### **Applicable Program Learning Objectives (PLOs):**

Cal Poly's construction management program is accredited by the American Council for Construction Education (ACCE), which sets rigorous standards for student learning outcomes (SLOs). To meet these requirements, the program has established 20 Program Learning Outcomes (PLOs) that not only meet but also exceed the ACCE's SLOs. These PLOs are carefully designed to ensure that students acquire the essential knowledge, skills, and competencies needed in the field of construction management. By adhering to these comprehensive PLOs, students are equipped with a well-rounded education that prepares them for successful careers in the construction industry.

This Lab would cover the following PLO's:

3. Create a construction project safety plan.
4. Create construction project cost estimates.
7. Analyze construction documents for planning and management of construction processes.
8. Analyze methods, materials, and equipment used to construct projects.
13. Understand construction risk management
18. Understand Sustainability.

## Lab Description

**General:** The Demolition Estimate Lab is vital for construction education. It offers students practical experience and skills in estimating demolition costs. Through hands-on learning and simulation of real-world scenarios, students gain a comprehensive understanding of demolition complexities. The lab helps them develop crucial estimation skills, including site preparation, equipment needs, waste disposal, labor requirements, and environmental considerations. Accurate estimation equips students for successful project planning and management, enhancing their readiness for the construction industry. The lab bridges the gap between theory and practice, preparing students for future career challenges.

**Due Date:** Project Guidelines will be handed out week 5 and will be due week 10.

**Topic:** Students will be tasked to complete the following

### Part 1: Project Analysis

In this Demolition Estimate Lab, students will step into the role of a Demolition Subcontractor operating under a General Contractor who will be constructing the new CIC Multi-purpose Building. They are tasked with accurately evaluating their company's capacity to safely demolish the existing Construction Innovation Center Building B within the bustling Cal Poly, SLO Campus. Provided with essential information about the building's structure, students must devise the most effective and cost-efficient demolition strategy, considering salvage opportunities as well. Students will tackle the problem presented below. Students must consider the following questions when completing their project analysis:

- Who is the Owner? What are their key values/focus for this project? What is the scope of work they have asked you to complete (aka project type)?
- Does the demolition contractor work directly for the GC or under a separate contract? What effect does this have on the project?
- Can you identify any project risks or potential schedule impacts (owner, contract type, project-related risk)?

### Part 2: Project Estimate

Students will be tasked with completing a full takeoff using the estimate template provided. Necessary equipment, material, and labor must be included along with other items as students see fit (aka Salvage Materials - Limiting Waste). Students will create an abatement takeoff for the proposed "Hot areas" noted by the contracting company. Students are expected to include all, but are not limited to the following within their cost proposal:

- Labor Costs
- Equipment Costs
- Material Costs
- Expected Salvage & Reuse Value
- Jobsite Overhead
- Organizational Overhead
- Profit

## **Project Description – Construction Innovation Center (CIC) Building B**

The Demolition project involves the complete removal of the three-story educational CIC Building B on the Cal Poly San Luis Obispo campus. **The original Building was built in 2001.** For the assignment, it is understood that the building has already undergone the soft demolition phase and has been gutted, setting the stage for the upcoming demolition activities. During the soft-demo phase, the General Contractor had noted certain “Hot Areas” within the buildings first floor amounting to 30 LF of ACM Pipe.

One of the primary objectives of this project is to safely remove the remaining heating, ventilation, and air conditioning (HVAC) systems located on the roof, along with all mechanical, electrical, and plumbing (MEP) systems. This includes cutting and capping utilities to ensure a seamless transition during the demolition process.

The project is scheduled to commence on June 19th, 2023, and must be completed by September 19th, before the start of classes. The contract type for this project is Design-Bid-Build, and the team is subcontracted under a General Contractor, who will be responsible for constructing the new state-of-the-art labs and multipurpose centers for CAED (College of Architecture and Environmental Design) students. Throughout the project, the team will prioritize safety, adhering to all relevant regulations and industry best practices; because of this, a Project-Specific Safety Plan will be required listing off strategies to maintain safe practices throughout the course of demolition.

## **Owner Description – Cal Poly, SLO**

Cal Poly, a prestigious educational institution located in San Luis Obispo, California, is embarking on a construction project to enhance its campus infrastructure. They understand the importance of modern and efficient facilities in fostering creativity, collaboration, and hands-on learning experiences. The owner values effective project management, clear communication, and transparency throughout the process. Cal Poly is committed to promoting sustainability and environmental stewardship. They encourage the use of green building practices, energy-efficient systems, and environmentally friendly dumping techniques to minimize the environmental impact. The safety and well-being of everyone involved in the construction project are of utmost importance to the owner. They will strictly adhere to safety standards and regulations to ensure a secure working environment.

**Deliverables:** Students must submit the following items to Canvas by the due date

### **1. Project Analysis (7-12 pages, pdf)**

- Cover Page (Use Template)
- Condensed Project Health & Safety Plan (HASP)
- Risk Breakdown Structure (RBS)
- Risk register with at least 15 items
- Project Takeoff
- Safe Disposal Practices
- Material Dump Location(s)
- Haul Route

### **2. Project Estimate (xlsx. Document)**

## LAB Templates & Plan-sets

**Construction Innovation Center Building B Plan-set:** Providing the CIC Building B plan-set empowers students to engage in a practical estimation process based on actual project documentation. It enhances their ability to interpret construction drawings, make accurate assessments, and develop comprehensive demolition cost estimates. By utilizing the plan-set, students gain valuable hands-on experience in working with project documents, fostering their understanding of real-world demolition projects and strengthening their estimating skills.

**Estimate Template:** The Estimate Template is a valuable tool in the Demolition Estimate Lab, providing a structured framework for students to develop accurate and comprehensive demolition cost estimates. The template serves as a standardized format to capture essential information, such as labor costs, equipment needs, material quantities, waste disposal, permits, and other relevant factors. By utilizing the Estimate Template, students can systematically organize and analyze the various cost elements involved in a demolition project.

The Estimate Template for the demolition lab includes several tabs, each serving a specific purpose to ensure a comprehensive and accurate estimation process. The "Building Demolition" tab is included to capture all the costs associated with the actual demolition of the building, including labor, equipment, and any specialized techniques required. This tab focuses on the direct costs related to the physical demolition process.

The "Wheel/Process Debris" tab addresses the costs associated with waste management and debris removal. It includes expenses related to waste disposal, recycling, and any necessary permits or regulations.

The "Truck & Dump" tab covers the costs of transportation and disposal of demolished materials. It includes expenses such as trucking fees, fuel costs, and landfill or recycling fees.

The "Project Overhead & Supervision" tab accounts for indirect costs and project management expenses. This includes costs for project supervision, site management, insurance, and general overhead expenses.

The "Project Assumptions" tab provides a space to document any assumptions made during the estimation process. This could include assumptions about project duration, labor productivity, material prices, or any other relevant factors that may impact the overall estimate.

Finally, the "Summary" tab consolidates all the costs from the other tabs to provide a comprehensive overview of the total estimated project cost. This tab allows for a quick reference of the overall estimate and facilitates decision-making and budgeting processes.

By including these elements in the estimate template, a comprehensive assessment of the costs involved in a demolition project can be achieved, ensuring that all necessary expenses are accounted for and providing an accurate estimation of the overall project cost.

COMPANY NAME		DEMOLITION ESTIMATE - SUMMARY			
COMPANY ADDRESS					
ESTIMATE NUMBER	DATE	COST DESCRIPTION	TOTAL	Notes	
JOB NUMBER		Building Demolition	\$ 32,291.53	Refer to "Building Demolition" tab	
JOB NAME		Wheel/Process Debris	\$ 10,762.92	Refer to "Wheel/Process Debris" tab	
JOB LOCATION		Truck & Dump	\$ 167,406.06	Refer to "Truck & Dump" tab	
PERIOD	(Month,year)	Project Overhead & Supervision	\$ 85,361.50	Refer to "Overhead & Supervision" tab	
CUSTOMER NAME		<b>TOTAL Construction Costs</b>	\$ 295,822.01		
ADDRESS		<b>OH &amp; P</b>	%	<b>TOTAL</b>	
CONTACT PERSON		Company Overhead & Profit	15%	\$ 44,373.30	
EMAIL	PHONE	<b>TOTAL CC's + OH&amp;P</b>	\$ 340,195.32		
JOB DESCRIPTION		<b>Bonding</b>	%	<b>TOTAL</b>	
NOTES		Bond	-1.05%	\$ 3,572.05	
VALID TROUGH		<b>TOTAL CC's + Bonding</b>	\$ 343,767.37		
PREPARED BY	DATE	<b>KEY:</b>	<b>Meaning</b>	<b>Additional Notes</b>	
REVIEWED & APPROVED BY	DATE	OTR	Operator	69.95 for wages and burden + 10.00 for truck + 3.00 for small tools	\$ 82.95
		LT	Laborer	49.91 for wages and burden + 3.00 for torch + 3.00 for small tools	\$ 57.91
		L	Lead	49.91 for wages and burden + 3.00 for small tools	\$ 52.91
		S	Supervisor	76.58 for wages and burden + 10.00 small tools/truck	\$ 86.58
		"t"	Debris		CY 1500
		"c"	Concrete		CY 1164
		"d"	Brick		CY 400
		"s"	Steel		CY 200
			<b>Labor Rate</b>		
		SOG 12" Thick	Slab On Grade 12 inches Thick	20 CY/Hr	
			<b>Bldg Demo</b>	<b>W &amp; P</b>	<b>T &amp; D</b>
		Durations	16.88	8.48	
		Total Labor Cost	\$ 28,122.37	\$ 10,762.92	\$ 54,840.00
		Total Equipment Cost	\$ 67,540.00		\$ 67,540.00
		Total Material Cost		\$ 99,866.06	\$ 99,866.06
					\$ 261,131.35
		<b>Project Notes:</b>			
		Project Start: June 19th, 2023 / Project Completion: September 19th, 2023			
		Assume Project contains 50 CY of Steel to remove and roughly 48 CY is Salvagable			
		Assume Project contains 400 CY of Brick to remove and roughly 0 CY is Salvagable			
		Assume Project contains 1500 CY of Debris to remove and roughly 0 CY is Salvagable			
		Find CY of Concrete through Plan Takeoff			
		Assume 30 LF of ACM is present in the building			
		SALVAGE MATERIAL	\$	1,324.07	
		<b>OVERALL PROJECT COST</b>	\$	343,767.37	

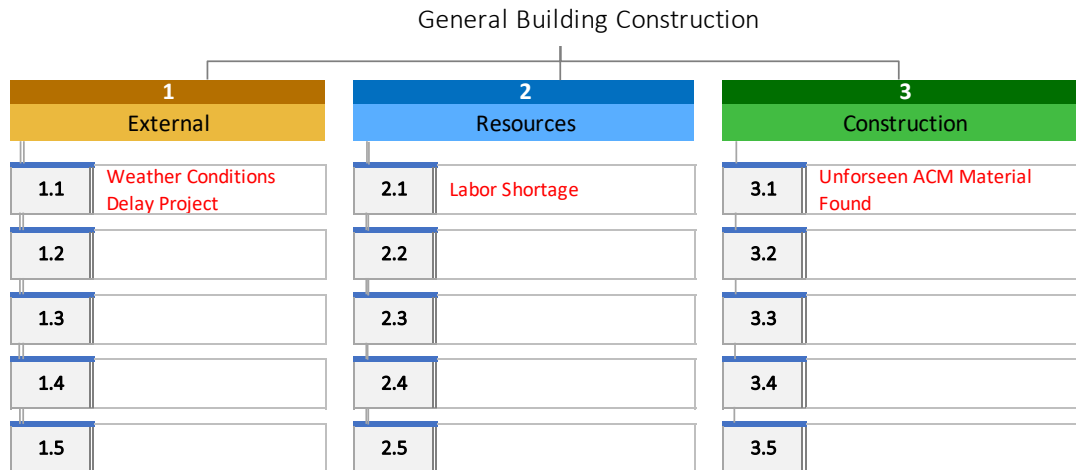
**Risk Breakdown Structure (RBS):** The Risk Breakdown Structure involves breaking down potential risks into categories and subcategories, providing a structured framework to identify, analyze, and address risks specific to the demolition project. By systematically organizing risks, the RBS allows students to comprehensively assess the various aspects of the project that may pose potential threats or challenges. It helps in identifying risks related to the site, project execution, safety, environmental concerns, contractual issues, and other relevant factors.

The three categories of External, Resources, and Construction were chosen for the Risk Breakdown Structure (RBS) in a demolition project to comprehensively capture and analyze potential risks from different perspectives. The External category encompasses risks that arise from external factors beyond the direct control of the project team. These can include environmental factors, regulatory changes, community impacts, and legal considerations. By including this category, the RBS ensures that risks originating from the project's external environment are identified and effectively managed. The Resources category focuses on risks related to the availability and utilization of project resources. This includes risks associated with labor, equipment, materials, and subcontractors. By including this category, the RBS helps identify potential risks that may impact the timely completion of the project, cost overruns, or resource shortages. The Construction category addresses risks specific to the demolition process itself. These risks may include structural instability, hazardous materials, unforeseen site conditions, and the coordination of demolition activities. By including this category, the RBS highlights risks that are inherent to the demolition process, ensuring that they are adequately assessed and mitigated.

By organizing risks into these three categories, the RBS provides a structured framework for identifying, categorizing, and addressing risks in a systematic manner. This approach allows project

teams to have a comprehensive view of potential risks across different aspects of the demolition project, enabling them to develop effective risk mitigation strategies and improve project outcomes.

### Risk Breakdown Structure (RBS)



**Risk Register:** The Risk Register serves as a central repository to document and track identified risks throughout the demolition project. It includes details such as the risk description, potential impact, likelihood, mitigation measures, assigned responsibilities, and status updates. The Risk Register enables students to effectively manage and monitor risks, facilitating proactive planning and decision-making. It ensures that risks are properly documented, regularly reviewed, and appropriate actions are taken to mitigate or address them.

### Risk Register

ID	Date raised	Risk description	Likelihood	Impact	Severity	Owner	Mitigating action	Contingent action	Progress on actions	Status
1	[12/12/2023]	[There is a risk that.... If this happens.....]	[High/Medium/Low]	[High/Medium/Low]	[High/Medium/Low. See Severity Table]	[Person managing the risk]	[Actions that can be taken to reduce the likelihood of the risk occurring. May also be acceptance of the risk or transference of the risk e.g. insurance]	[What will be done if this risk does occur. Usually actions to reduce the impact on the project]	[Action taken and date. E.g. Update 12/03/2015 mitigation actions implemented]	[Open, Waiting, Closed]
2	[12/12/2023]	[There is a risk that.... If this happens.....]	[High/Medium/Low]	[High/Medium/Low]	[High/Medium/Low. See Severity Table]	[Person managing the risk]	[Actions that can be taken to reduce the likelihood of the risk occurring. May also be acceptance of the risk or transference of the risk e.g. insurance]	[What will be done if this risk does occur. Usually actions to reduce the impact on the project]	[Action taken and date. E.g. Update 12/03/2015 mitigation actions implemented]	[Open, Waiting, Closed]
3	[12/12/2023]	[There is a risk that.... If this happens.....]	[High/Medium/Low]	[High/Medium/Low]	[High/Medium/Low. See Severity Table]	[Person managing the risk]	[Actions that can be taken to reduce the likelihood of the risk occurring. May also be acceptance of the risk or transference of the risk e.g. insurance]	[What will be done if this risk does occur. Usually actions to reduce the impact on the project]	[Action taken and date. E.g. Update 12/03/2015 mitigation actions implemented]	[Open, Waiting, Closed]
4	[12/12/2023]	[There is a risk that.... If this happens.....]	[High/Medium/Low]	[High/Medium/Low]	[High/Medium/Low. See Severity Table]	[Person managing the risk]	[Actions that can be taken to reduce the likelihood of the risk occurring. May also be acceptance of the risk or transference of the risk e.g. insurance]	[What will be done if this risk does occur. Usually actions to reduce the impact on the project]	[Action taken and date. E.g. Update 12/03/2015 mitigation actions implemented]	[Open, Waiting, Closed]
5	[12/12/2023]	[There is a risk that.... If this happens.....]	[High/Medium/Low]	[High/Medium/Low]	[High/Medium/Low. See Severity Table]	[Person managing the risk]	[Actions that can be taken to reduce the likelihood of the risk occurring. May also be acceptance of the risk or transference of the risk e.g. insurance]	[What will be done if this risk does occur. Usually actions to reduce the impact on the project]	[Action taken and date. E.g. Update 12/03/2015 mitigation actions implemented]	[Open, Waiting, Closed]

**Project Health and Safety Plan (HASP) Guidelines:** Including a Project HASP (Health and Safety Plan) Guideline document for students in the Demo Lab provides a framework and reference for



structuring their own HASPs effectively, ensuring consistency and adherence to industry best practices. Drawing from OSHA standards and guidelines, the document incorporates relevant information and recommendations to guide students in developing comprehensive safety plans that align with recognized regulatory requirements. It serves as an educational resource, promotes a safety culture, and helps students navigate the process, fostering proactive hazard identification, risk assessment, and the inclusion of essential safety measures in their plans.

## **Lessons Learned**

During the process of creating the Demolition Lab, several important lessons were learned. One key lesson was the need to carefully manage the project's complexity. It was essential to strike a balance between exposing students to the crucial aspects of demolition estimating and avoiding overwhelming them with excessive details. The lab aimed to provide a comprehensive overview of the fundamental concepts without losing sight of the intended learning outcomes.

Another significant lesson was the recognition that acting as a subcontractor in the lab presented a distinct experience compared to that of a general contractor. Students are able to understand the unique responsibilities, perspectives, and challenges faced by subcontractors in demolition projects. By highlighting the differences between subcontractor and general contractor roles, students gained a deeper understanding of the collaborative nature of project execution and the importance of effective communication and coordination within the construction industry.

Furthermore, the process of creating the Demolition Lab highlighted the importance of project adaptability. It became evident that the project items and parameters might need to be periodically reviewed and updated to stay in line with the evolving industry practices, regulations, and emerging technologies. By keeping the lab materials up to date, students are exposed to realistic scenarios and relevant skills, ensuring their preparedness for the dynamic field of demolition estimating.

## **Conclusion**

In conclusion, the process of composing the Demolition Estimate Lab proposal has highlighted the potential to enhance the current Demolition Topics course at Cal Poly by providing students with a practical application of the knowledge and skills they acquire in the class. The course, initiated by Eli Lipton and taught by Thomas Kommer, already offers a solid foundation for understanding demolition practices. However, the addition of the lab assignment creates a unique opportunity for students to apply everything they learn in the course to a real-world project scenario.

By engaging in the lab assignment, students can actively utilize their knowledge of demolition techniques, safety protocols, and cost estimation principles to assess their companies' ability to safely demolish the existing CIC Building B. They will have the chance to analyze project plans, owner descriptions, and project specifications, and then develop comprehensive demolition strategies that consider factors such as salvage opportunities and the owner's key values and priorities.

This practical application of classroom concepts allows students to bridge the gap between theory and practice, honing their critical thinking, problem-solving, and communication skills in a real-world context. The lab assignment serves as a valuable platform for students to demonstrate their understanding of demolition principles, collaborate effectively in teams, and make informed decisions based on project requirements and constraints.

Overall, the Demolition Estimate Lab provides an invaluable opportunity for students to integrate and apply their classroom learning to a tangible project. It prepares them for the challenges and expectations of the construction industry, fostering their professional growth and readiness for successful careers in the field of demolition management.

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