

PCI Big Beam

CENE 476: Capstone Prep Presentation
December 9, 2016

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Project Understanding

- Purpose
 - Design a prestressed concrete beam according to the PCI Big Beam competition rules
- Background
 - PCI Big Beam contest started in 2005
 - Fabrication Location: TPAC Kiewit Western in Phoenix, Arizona
 - Testing Location: NAU Engineering Building

Technical Considerations/Challenges

- Mixture Design
 - Testing and analysis
- Beam Design
 - MathCAD
- Beam Fabrication
 - Fabricated by TPAC Kiewit Western



Photo by Rick Wilson

Stakeholders

- NAU Department of Civil Engineering, Construction Management and Environmental Engineering (CECMEE)
- Precast/Prestressed Concrete Institute (PCI)
- TPAC Kiewit Western
- Dr. Robin Tuchscherer



Scope of Services

1. Mix Design
2. Beam Cross-Section Design
3. Final Beam Design
4. Beam Fabrication
5. Beam Testing
6. Beam Analysis
7. Project Management



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Task 1.0: Mix Design

1.1 Design Mix Experimental

1.2 Mix Design

1.3 Cylinder Creation

1.4 Cylinder Testing

1.4.1 Compression Test – ASTM C39

1.4.2 Tensile Test – ASTM C496

1.4.3 Stress-Strain Test – ASTM C469

Task 2.0: Beam Cross-Section Design

2.1 Creating a MathCAD Model

2.2 Cross-Section Designs



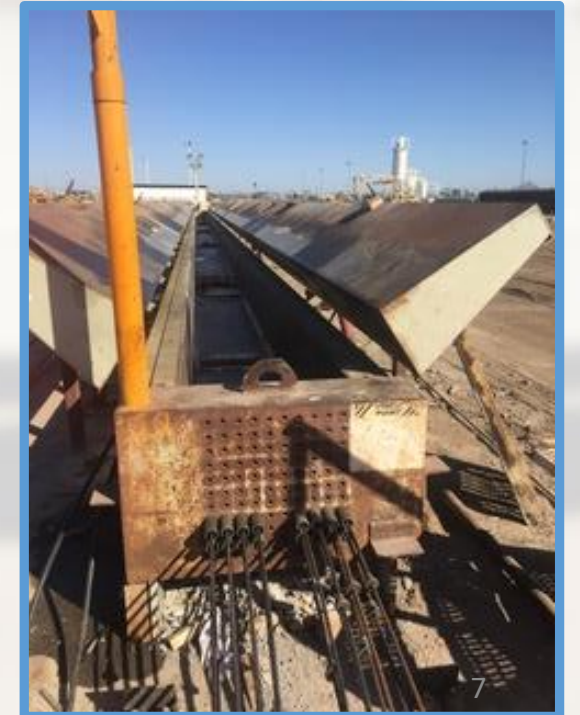
Photo by Rick Wilson⁶

Task 3.0: Final Beam Design

- Judging Criteria for beam
 1. Design Accuracy
 2. Lowest Cost
 3. Lowest Weight
 4. Largest Deflection

Task 4.0: Beam Fabrication

- 4.1 Submit Shop Drawings
- 4.2 Beam Fabrications



Photos by Rick Wilson

Task 5.0: Beam Testing

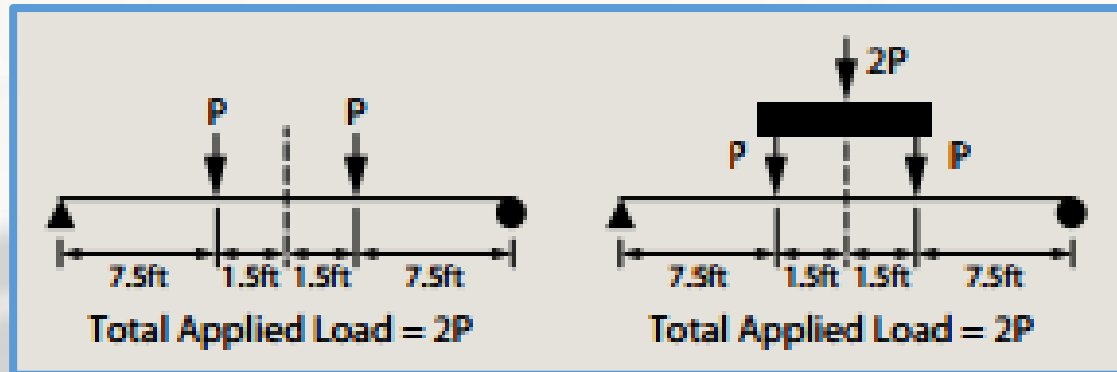
5.1 Test Setup

5.2 Final Predictions

5.3 Beam Test

Task 6.0: Beam Analysis

6.1 Compare MathCAD vs Actual Result



Task 7.0: Project Management

7.1 Communications

7.1.1 Team Meetings

7.1.2 Client Meetings

7.2 Deliverables

7.2.1 50% Design Report

7.2.2 Final Draft of Report

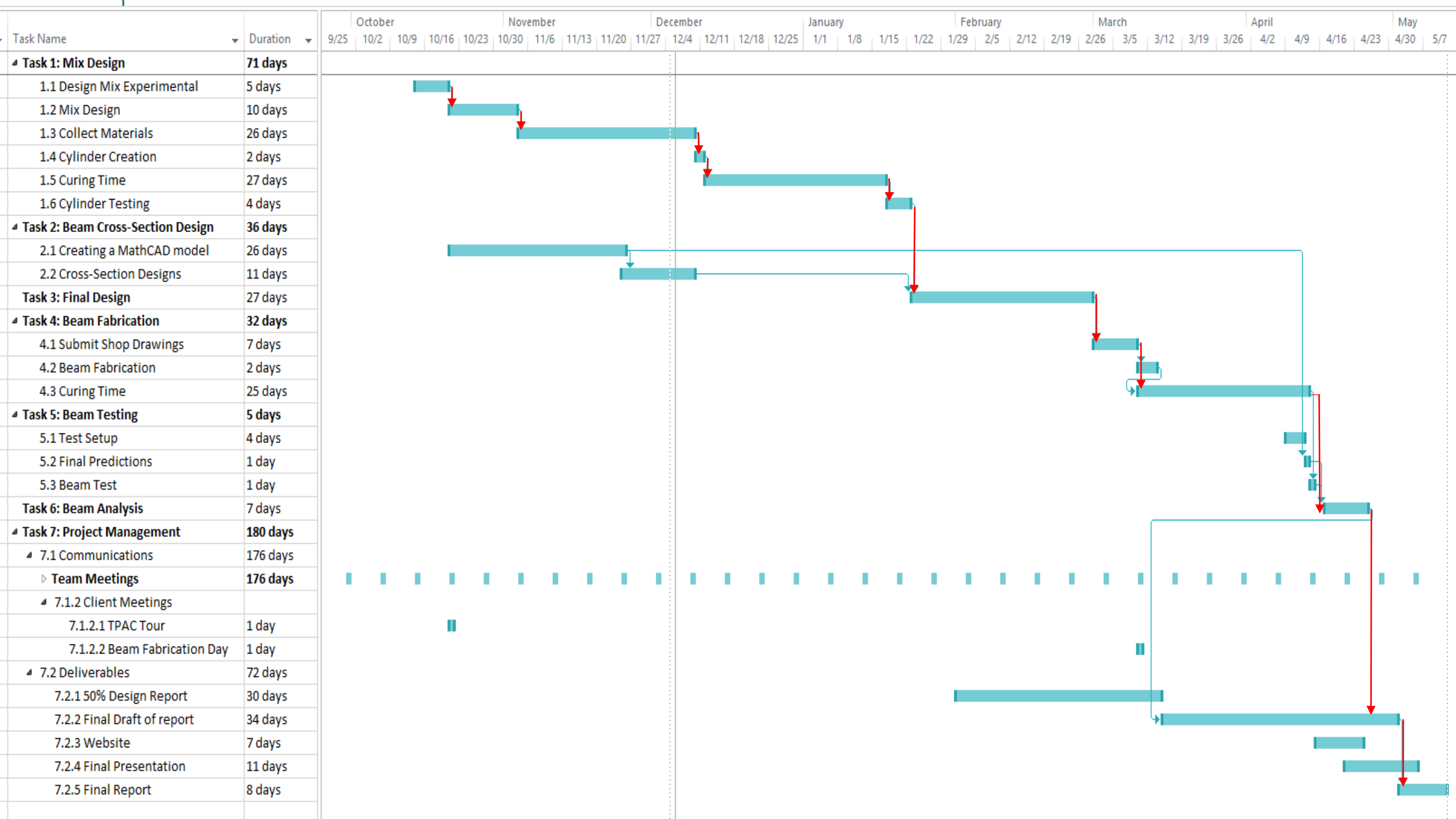
7.2.3 Website

7.2.4 Final Presentation

7.2.5 Final Report



Photo by Rick Wilson



Cost of Engineering Services Breakdown

Task	SENG (hrs)	ENG (hrs)	LAB (hrs)	AA (hrs)
Task 1.0: Mix Design	15	61	101	17
Task 2.0: Beam Cross-Section Design	16	46	31	6
Task 3.0: Final Design	13	26	36	16
Task 4.0: Beam Fabrication	17	33	51	7
Task 5.0: Beam Testing	19	31	85	4
Task 6.0: Beam Analysis	12	46	16	8
Task 7.0: Project Management	46	36		21
Total Hours per Person	138	279	320	79
Total Project Hours	816			

Cost of Services

	Classification	Hours	Rate\$/Hour	Cost
1.0 Personnel	SN	138	140	\$19,320
	ENG	279	88	\$24,552
	LAB	320	61	\$19,520
	AA	79	28	\$2,212
	Total Personnel			\$45,039
2.0 Travel	3 meetings @ 290 miles/meeting	\$0.44/mi		\$383
3.0 Lab	Lab cost for equipment and facilities	30	100	\$3000
4.0 Subcontract	Beam Fabrication			\$5,000
5.0 Total				\$233,426

Questions?