

CENE 476 PCI Big Beam

A large, rectangular concrete beam is shown in a laboratory setting. The beam is supported by a metal structure on the left. A prominent vertical crack is visible on the side of the beam, extending from the top to the bottom. The background shows a concrete wall and some wooden panels. The text "CENE 476 PCI Big Beam" is overlaid on the top part of the image.

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Seth Max

Jordan Phelps

Jacob Schaniel

Christian Soutus

PROJECT UNDERSTANDING

PROJECT BACKGROUND

- PCI COMPETITION
- PRESTRESSING TECHNIQUES
- 2017-2018 RESULTS

TECHNICAL CONSIDERATIONS

- STRUCTURAL DESIGN
- CONCRETE MIX
- REINFORCEMENT LAYOUT



Figure 1: PCI Institute [1]



Figure 2: Tpac [2]

SCOPE

TASK 1 COMPETITION UNDERSTANDING

TASK 1.1 ANALYSIS OF NEW LOADING CONDITION

TASK 1.2 COMPETITION SCORING

TASK 1.3 MATERIAL SPECIFICATIONS

TASK 1.4 TESTING SPECIFICATIONS

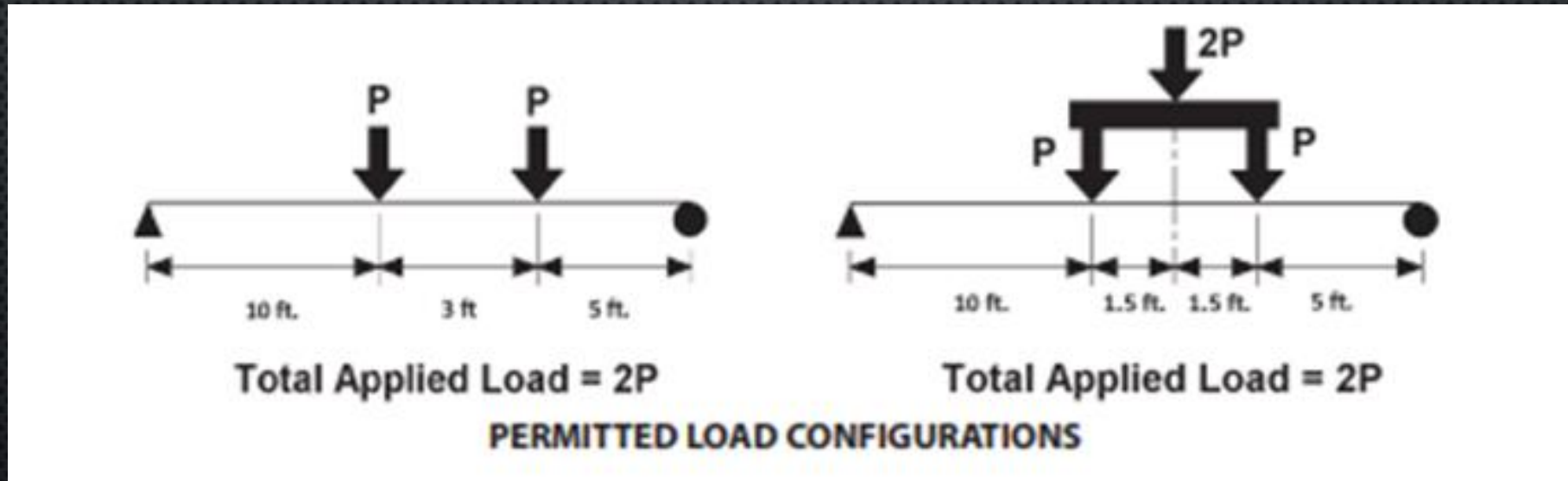


Figure 2: New Loading Condition [3]

SCOPE

TASK 2 BEAM DESIGN

TASK 2.1 MIX DESIGN

TASK 2.2 MATERIAL TESTING



Figure 3: Acquired Material [6]



Figure 4: Compression Test [6]

SCOPE

TASK 2.3 CROSS SECTIONAL DESIGN

- CENTROID
- CAPACITY
- FAILURE

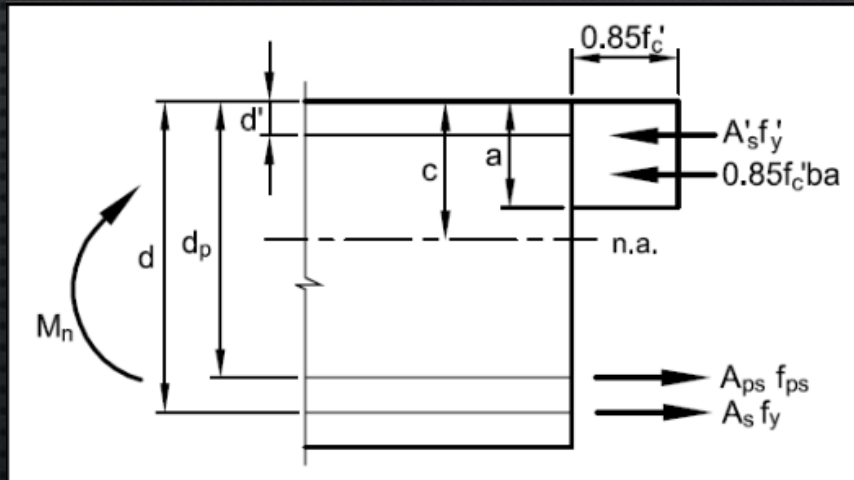
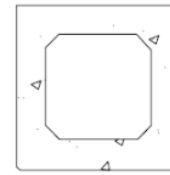


Figure 5: Average Stress Block [6]

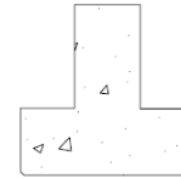
Common Precast Structural Shapes



Box Beam



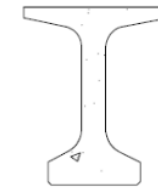
I-Beam



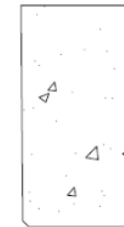
Inverted T-Beam



L-Beam



Bulb Tee Beam



Rectangular Beam

Figure 6: Cross Section Options[6]

SCOPE

TASK 3 TPAC MANUFACTURING

TASK 3.1 FINALIZE BEAM SHOP DRAWINGS

TASK 3.2 FABRICATION

TASK 3.3 PLAN FOR SHIPPING

TASK 4 BEAM TESTING

TASK 4.1 MAKE PREDICTION

TASK 4.2 TEST BEAM

TASK 4.3 MAKE VIDEO



Figure 7: Beam Casting [5]



Figure 8: Beam Loading Device [6]

SCOPE

TASK 5 CAPSTONE DELIVERABLES

TASK 5.1 FINAL REPORT

TASK 5.1.1. 30% SUBMITTAL

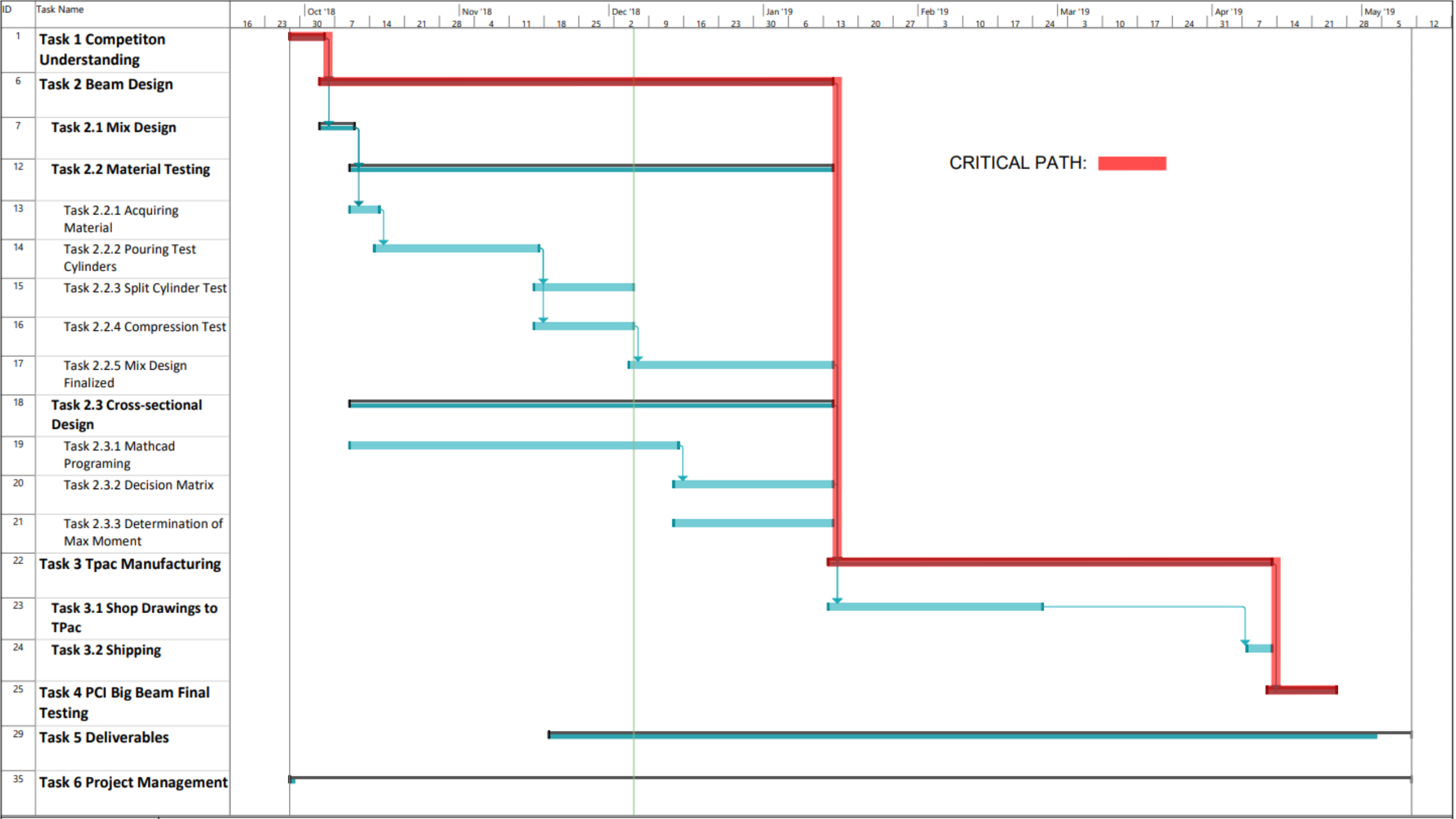
TASK 5.1.2. 60% SUBMITTAL

TASK 5.2 WEBSITE DESIGN

TASK 5.3 FINAL PRESENTATION

TASK 6 PROJECT MANAGEMENT





STAFF POSITION

Table 1: Staff Position and Task Hours

Task vs Staff position (estimated hours)					
Task	Senior Engineer	Structural Engineer	Lab Technician	EIT	Total Hours
Task 1 - Competiton Understanding	7	6	8	6	27
Task 2 - Beam Design	51	68	137	72	328
Task 3 - Tpac Manufacturing	8	6	0	28	42
Task 4 - PCI Big Beam Final Testing	20	25	12	29	86
Task 5 - Delilverables	32	15	14	74	135
Task 6 - Project Management	40	40	30	25	135
Total	158	160	201	234	753

COST ESTIMATION

Table 2: Cost of Engineering Services

Engineering Services			
Personnel	Hours	Rate (\$/hr)	Cost \$
Senior Eng.	158	126	19831
Struct. Eng.	160	101	16166
Lab Tech.	201	57	11519
EIT	234	52	12175
Total \$			59690

Table 3: Travel Cost

Travel (Cost of team driving to these sites)			
Location	\$/mile	Round Trip	Total Travel Cost
Cemex	\$0.55	20	\$44
Tpac	\$0.55	300	\$165
Total \$			209

Table 4: Supply Cost

Supplies			
	Initial Cost		Total Cost Through Project
5 Gallon Buckets	\$4	per bucket	\$24
Safety Glasses	\$5		\$20
Casting Molds	\$1.5	per mold	\$75
Paper Supplies	\$50		\$300
Printer	\$300		\$300
Computer & Monitor	\$600		\$600
Total \$			1319

Table 5: Testing Cost

Subcontract			
Test	\$/Test	# of Test	Total Cost
Compression Test	\$104	21	\$2,184
Split Cylinder Test	\$104	21	\$2,184
Modulus Test	\$94	21	\$1,974
Total \$			\$6,342

Total Cost = \$67,560

REFERENCES

- [1] "DESIGN RESOURCES/ GUIDES AND MANUALS," 09 2018. [ONLINE]. AVAILABLE: [WWW.PCI.ORG](http://www.pci.org).
- [2] TPAC ARCHITECTURAL AND PRESTRESSED CONCRETE. [ONLINE].
- [3] "STUDENT COMPETITIONS," PCI PRECAST/PRESTRESSED CONCRETE INSTITUTE , 2018. [ONLINE].
- [4] "PRESTRESSING WORKS - OVERVIEW," UNITED CONSTRUCTION DEVELOPEMENT, 2015. [ONLINE].
- [5] R.CROUCH, *TPAC CASTING PICTURES*, PHOENIX, 2018.
- [6] S. MAX, FIELD WORK PHOTOGRAPHS, FLAGSTAFF, 2018.
- [7] PCI DESIGN HANDBOOK, CHICAGO : PRECAST/PRESTRESSED CONCRETE INSTITUTE, 2004.