The Duval County Unified Courthouse Facility



The Pennsylvania State University AE Capstone Project Darre'll Alston – Construction Management Dr. Robert Leicht – CM Advisor

Jacksonville, Florida

The Duval County Unified Courthouse Facility

Presentation Outline:

- I. Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - I. Financial Status
 - II. Financial Programs
- VII. Conclusion
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Story Levels: 7 Cost: \$224 Million Uses: A-3: Assembly

Project Background

- Building Area: 798,000 SF
- Floor-to-Floor Heights: 18 FT

 - I-3: Institutional
 - B: Business
 - S-1: Storage (Low-Hazard)
 - S-2: Parking
- Project Delivery: Design-Build
- Dates: May 2009-May 2012



Assembly:

Institutional:





Parking: 📩

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- VII. Conclusion
- VIII.Acknowledgments

Problem Statement

City of Jacksonville

- 2005 Operation Re-Instatement /Set-Back
- 2006 Final Award

The owner was eager to have its facility up and running at its original date and price in 2005. Due to economic setbacks and increasing inflation rates, the cost and schedule of the facility were delayed and raised above the expected expenditure.

- Growing Population
- Better Jacksonville Plan
- 2000 Commencement /Shut-Down



*Site of the Duval County Unified Courthouse Facility

*Located at the intersection of W Monroe St and N Clay St

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 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Gain Insight

Proposal Statement

Improve Financial Standing • Financial Methods Precast Concrete Floor Planks • Short Interval Production Schedule (SIPS)

• 2005 Auchter Company Analysis 2005 Turner Construction Company Analysis Current Turner Construction Company Analysis

- Project Background
- II. Problem Statement
- III. Proposal Statement

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- Structural Breadth
- II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Current System:

Precast Concrete Floor Planks

- Cast-In-Place Concrete
- Pan-Joist System

Location	Start Date	Finish Date	Duration
West Slabs	9/25/2009	1/30/2010	132
Center Slabs	9/2/2009	5/4/2010	266
East Slabs	2/16/2010	5/28/2010	117
		Total	325

Smallest Bay: 13' x 25'-7"





Largest Bay: 30'-4" x 35'-8"

- Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Proposed Systems:

Precast Concrete Floor Planks

Double Tee System

- Span Large Lengths
- Common in Parking Garages
- DCUCF Span Not Met

Hollow Core Planks

- Easy Electrical Conduit Layout
- Less Concrete Used
- Meets Span Lengths

Double Tee System:



ALLOW	ABLE SUF	PER	RIMPOSED LIVE LOADS (psf) IBC 2006 & ACI 318-05 (1.2 D + 1.6 L)																						
Section	Ø Mn											S	ban	(Fee	et)										
	(in. Kips)	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82
26 - 4.6PT	5,192	104	87	73	60	49	40	31																	
26 - 6.6PT	7,412			130	112	97	83	71	61	52	43	36													
26 - 8.6PT	9,379						122	107	94	82	71	62	54	46	39										
26 - 10.6PT	11,096								122	108	96	85	74	63	54	45	37								
26 - 12.6PT	12,547									130	114	100	87	76	65	56	47	39							
26 - 14.6DT	16,888													120	107	96	85	76	67	59	51	45	38		
26 - 16.6DT	18,879														123	110	99	89	79	70	62	55	48	41	36
26 - 18.6DT	20,729															123	111	100	90	81	72	64	57	50	44

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- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
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 - Schedule Analysis
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 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Precast Concrete Floor Planks

Typical Bay: 19' x 34'

Hollow Core Plank: 6" – 4'with 2" topping



PHYSICAL PROPERTIES Composite Section				
$\begin{array}{l} A_{c} = 253 \text{ in.}^{2} \\ I_{c} = 1519 \text{ in.}^{4} \\ Y_{bcp} = 4.10 \text{ in.} \\ Y_{tcp} = 1.90 \text{ in.} \\ Y_{tct} = 3.90 \text{ in.} \end{array}$	Precast b _w = 16.13 in. Precast S _{bcp} = 370 in. ³ Topping S _{tct} = 551 in. ³ Precast S _{tcp} = 799 in. ³ Precast Wt. = 195 PLF Precast Wt. = 48.75 PSF			



Data Name	Results
Live Load	100 psf
Dead Load	20 psf
Tributary Width	4 feet

Equations:

 W_{\parallel} = tributary width x W_{\parallel}

 $E = 57^* \, sq(f'c)$

 $\Delta_{\rm II} = 5 W_{\rm II} I_{\rm n}^{-4} / (384 \text{EI}) \rightarrow \text{I}/360$

∆_d = 5W_dI_n⁴/(384EI) →I/240

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- II. Problem Statement
- III. Proposal Statement
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 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Connectivity:

- Rebar casted into pockets for extension to pan joist
- Cost effective than welding two different systems

Precast Concrete Floor Planks

Pockets provided on side of plank



REBAR @ 4'-0" GROUTED INTO POCKETS CAST IN PLANK, REBAR SUPPLIED NOT BY NCP, AND GROUTED SOLID IN POCKETS

- Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Cost Comparison:

- Total Plank Savings = \$14,516,090

Precast Concrete Floor Planks

- Cast-In-Place = \$18,711,274
- <u>Precast Planks = \$4,195,184</u>

Cast-In-Place Concrete Cost:

Location	Deck	Material	Rebar	Form	Total
2nd Floor	\$2,191,020.00	\$1,492,550.00	\$688,654.00	\$476,079.00	\$4,848,303.00
3rd Floor	\$1,091,610.00	\$772,069.00	\$343,101.00	\$476,079.00	\$2,682,859.00
4th Floor	\$1,091,610.00	\$756,330.00	\$343,101.00	\$476,079.00	\$2,667,120.00
5th Floor	\$1,091,610.00	\$756,330.00	\$343,101.00	\$476,079.00	\$2,667,120.00
6th Floor	\$1,224,776.00	\$814,038.00	\$384,956.00	\$476,079.00	\$2,899,849.00
7th Floor	\$1,237,288.00	\$843,767.00	\$388,889.00	\$476,079.00	\$2,946,023.00
Total	¢7 077 014 00	¢E 42E 094 00	¢2 401 902 00	C2 0E6 171 00	¢10 711 271 00

Precast Hollow Core Plank Cost:

Location	Area (SF)	Material Unit Cost	Labor Unit Cost	Material Cost	Labor Cost	Total
2nd Floor Slabs	\$170,700.00	\$6.65	\$1.19	\$1,135,155.00	\$203,133.00	\$1,338,288.00
3rd Floor Slabs	\$88,300.00	\$6.65	\$1.19	\$587,195.00	\$105,077.00	\$692,272.00
4th Floor Slabs	\$86,500.00	\$6.65	\$1.19	\$575,225.00	\$102,935.00	\$678,160.00
5th Floor Slabs	\$86,500.00	\$6.65	\$1.19	\$575,225.00	\$102,935.00	\$678,160.00
6th Floor Slabs	\$93,100.00	\$6.65	\$1.19	\$619,115.00	\$110,789.00	\$729,904.00
7th Floor Slabs	\$96,500.00	\$6.65	\$1.19	\$641,725.00	\$114,835.00	\$756,560.00
					Total	\$4,195,184.00

|\$7,927,914.00| \$5,435,084.00 | \$2,491,802.00 |\$2,856,474.00|\$18,711,274.0

*Disregarding Shipping Costs



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- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Schedule Comparison:

Precast Concrete Floor Planks

• Cast-In-Place: 325 Days • Two crews accessible

• Precast Planks: 50 Days • Total Members: 3356 • Two crews accessible

• Total Plank Savings: 275 Days

Cast-In-Place Concrete Duration:

Location	Start Date	Finish Date	Duration
West Slabs	9/25/2009	1/30/2010	132
Center Slabs	9/2/2009	5/4/2010	266
East Slabs	2/16/2010	5/28/2010	117
		Total	325

Precast Hollow Core Plank Duration:

Location	Members	Duration	Start Date	Finish Date
		Center		
2nd Floor	394	5	9/2/2009	9/7/2009
3rd Floor	388	5	9/7/2009	9/12/2009
4th Floor	136	2	9/12/2009	9/14/2009
5th Floor	136	2	9/14/2009	9/16/2009
6th Floor	136	2	9/16/2009	9/18/2009
7th Floor	138	2	9/18/2009	9/20/2009
		West		
2nd Floor	311	4	9/20/2009	9/24/2009
3rd Floor	306	4	9/24/2009	9/28/2009
4th Floor	87	2	9/28/2009	9/30/2009
5th Floor	87	2	9/30/2009	10/2/2009
6th Floor	111	2	10/2/2009	10/4/2009
7th Floor	112	2	10/4/2009	10/6/2009
		East		
2nd Floor	311	4	10/6/2009	10/10/2009
3rd Floor	306	4	10/10/2009	10/14/2009
4th Floor	87	2	10/14/2009	10/16/2009
5th Floor	87	2	10/16/2009	10/18/2009
6th Floor	111	2	10/18/2009	10/20/2009
7th Floor	112	2	10/20/2009	10/22/2009

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- Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Definition:

- Problem:

SIPS Schedule

Project scheduling method used in conjunction with tasks that can be completed through repetition for maximization of schedule and cost efficiency.

On the DCUCF, the courtroom finishes have increased in schedule due to complexity detail.

Schedule Duration: 267 Days

Original Durations: Key Players: . Hang Gypsum/Tape & Finish 2. Prime Paint, Caulk & Paint First Coat 3. Millwork & Trim 4. Acoustical Wall Panels 5. Audience Courtroom Seating and Furnishings 6. Final Paint 7. Acoustical Ceiling Tile 8. Flooring Base 9. Flooring Carpet 10. Doors & Hardware

(2 Days) (2 Days) (5 Days) (2 Days) (2 Days) (3 Days) (2 Days) (2 Days) (2 Days) (2 Days)

- Project Background
- Problem Statement Ш.
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Zone Breakdown:



SIPS Schedule

Schedule Duration: 163 Days Schedule Savings: 104 Days General Conditions Savings: \$21,250

Matrix Durations: Key Players: 1. Hang Gypsum/Tape & Finish 2. Prime Paint, Caulk & Paint First Coat 3. Millwork & Trim 4. Acoustical Wall Panels 5. Audience Courtroom Seating and Furnishings 6. Final Paint 7. Acoustical Ceiling Tile 8. Flooring Base 9. Flooring Carpet 10. Doors & Hardware

(1 Day)(1 Day)(2 Days) (1 Day)(1 Day)(2 Days) (1 Day)(1 Day)(1 Day)(1 Day)

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- Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Problem Statement:

- problem.

Proposed New System:

SIPS Schedule

The current millwork of Mahogany Veneer increased the time reverberation causing echoes within the assigned space. To aid in this obstacle, acoustical wall panels were added. The addition slightly helped, but didn't completely solve the

Since 75% of the wall systems inside the courtrooms consist of the Mahogany Veneer, a carpet wall panel is to be suggested at the 4 feet height.

Current System:





New System:







- Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Time Reverberation Summary:

SIPS Schedule

• New system yields 10% better sound dissipation



Area Parameters:

Proposed System	Areas (ft)Proposed	Actual System	Area (ft) Actual
GWP w/ Studs	505	GWP w/ Studs	505
Mahogany	1179	Mahogany	1852
Carpet Panel	673	Carpet Flooring	1705
Carpet Flooring	1705	Acoustical Tile	1705
Acoustical Tile	1705	Acoustical Wall	1007
Acoustical Wall	1007		

Time Reverberations:

Frequency Level (Hz)	Proposed Room System (secs)	Actual Room System (secs)
125	2.53	2.61
250	2.18	2.31
500	1.59	1.8
1000	1.23	1.39
2000	1.2	1.25

- Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Cost Calculations:

SIPS Schedule

Millwork Veneer: 1208 yds x \$52.08/yd = \$62,914

Carpet Panel: 1208 yds x \$18.95/yd = \$22,893

Carpet Panel Savings = \$40,021

Schedule Calculations:

- Millwork Veneer: 51 days
- Carpet Panel: 25 days
- Carpet Panel Savings = 26 days

*Installation = fabric inserted with steel blade (show above) at intersections and corners



- Project Background 1.
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Financial Awareness

- Financial Ratio Coverage
- Financial Strategy Coverage

Auchter Construction Company (2005)

• \$263.5 Million

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- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - **Financial Status**
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Financial Awareness

Finance Ratios:



Bid Expectancy:

p is the probability of getting the bid (0 = lowest & 1 = highest). h is the amount of the bid. t is the cost of work.

Ratio	Measures	Rating	Actual
Quick Ratio	Cash Readily Available	> or = to 1	Fell Short
Current Ratio	Short Term Financing	> 1	Fell Short
nt Project Income to Net Worth	Capital Invested in Comany	Average	Too large
t Project Income to Total Assests	Profit Available to Assets	Average	Too large

Expected profit = p(h-t)

Other Financial Ratio Considerations:

Ratio	Formula
Quick Ratio	Quick Asset/Current Liabilites
Current Ratio	Current Assets/Current Liabilites
Total Liability to Net Worth	Total Liabilites/Net Worth
Project income to Net Working	Project Income/Net Working
Project Income to Net Worth	Project Income/Net Worth
Fixed Assests to Net Worth	Fixed Asset/Net Worth
%Project Income to Project Income	Net Project Income*100/Project Income
% Net Project Income to Net Worth	Net Project Income*100/Net Worth
% Net Project Income to Total Assets	Net Project Income*100/Total Assets

- Project Background
- Problem Statement Ш.
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Financial Awareness

Financial Programs:

- Joint Venture
 - Responsibilities distributed
 - Risk Factor = Medium

- Limited Partnership
 - Utilizing a non-contracting firm to sponsor cash and property values while assuming profit and losses.
 - No management say
 - Risk Factor = Medium-High
 - Utilizing another contracting firm to pool resources and spread construction risks.

Financial Broker Risk Factor:

- Spread of Risk

• Determination of company self-recovery

- I. Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - I. Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Current Perspective:

Starting Bid Precast Syst SIPS Sched <u>Millwork Cha</u> New Bid:

Conclusion

(GMP):	\$350 Million
tem:	\$14,516,090
lule:	\$21,250
ange:	\$40,021
	\$335,422,639



- Project Background .
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Starting Bid Precast Syst SIPS Sched Millwork Cha New Bid:

Conclusion

Turner Perspective (2005)

\$350 Million
\$12,774,159
\$18,700
<u>\$35,218</u>
\$337,171,923

*ENR minimum inflation for all materials involved = 3%



- I. Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - I. Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Auchter Perspective (2005)

Starting Bid Precast Syst SIPS Schedu <u>Millwork Cha</u> New Bid:

*ENR minimum inflation for all materials involved = 3%

Conclusion

(GMP):	\$263.5 Million
tem:	\$12,774,159
lule:	\$18,700
ange:	<u>\$35,218</u>
	\$250,671,923



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- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

Current Perspective New Bid: 2nd Option

New Bid: 3rd Option

Auchter Perspective (2005) New Bid: 1st Option

Conclusion

\$335,422,639

Turner Perspective (2005)

\$337,171,923

\$250,671,923

Owner savings to be built by original standards:

- Lower government funding
- Early use of facility

Government focus on local ticketed objectives

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- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments

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 - Dr. David Lenze
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- Family and Friends







- I. Project Background
- II. Problem Statement
- III. Proposal Statement
- IV. Analysis 1: Precast Concrete Floor Planks
 - I. Structural Breadth
 - II. Cost & Schedule Comparison
- V. Analysis 2: SIPS Schedule
 - I. Schedule Analysis
 - II. Acoustical Breadth
- VI. Analysis 3: Financial Awareness
 - I. Financial Status
 - II. Financial Programs
- VII. Conclusion
- VIII.Acknowledgments



QUESTIONS?