

2B + G + M + 7 Mansoura Development Doha, Qatar



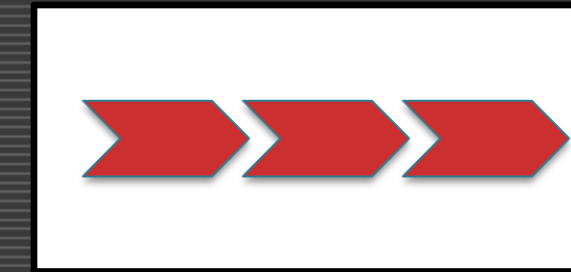
Penn State Architectural Engineering Senior Capstone Project
Ramy Labna | Construction Option | Advisor: Prof Ray Sowers

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion



Photo Courtesy of www.beautifulholidays.com.au



Analysis 1: Precast Vs. Cast in Place



Photo Courtesy of www.mcentirentalproperties.com

Analysis 2: Comparison of Construction Practices between US & Qatar



Photo Courtesy of www.cutcaster.com

Analysis 3: Field Labor Management & Alteration

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Building Name | 2B + G + M + 7 Development at Mansoura
Size | 106,000 Gross Square Feet
No. of Stories | 9 stories above grade & 2 stories below
Dates of Construction | April 15, 2013 – April 15, 2015
Cost of overall Project | \$7M

Project Delivery Method | Design-Bid-Build
Payment Method | Lump Sum Method
Owner | Fakhriya Radhwani
Architect | Petra Design
Contractor | Commitment Construction



OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Opportunity Identification

- Schedule & Construction acceleration scenarios
- Reduction of Schedule with the use of Precast Panels

Existing System

- Cast in Place Concrete – Entire Structure
- Concrete transported in unhardened state as ready-mix
- Used for its long-term durability & structural support
- Current superstructure schedule takes approximately 13 months

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Current Design

- 10" of concrete with no insulation
- Paint Finish

Proposed Design

- 2" of Rigid Insulation
- Sandwiched by two 3" Concrete panels
- Paint Finish

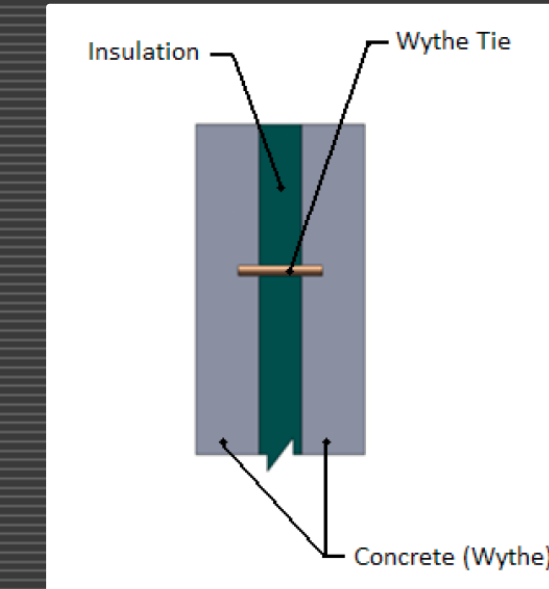


Photo Courtesy of www.enconunited.com

Existing System

- Cast in Place Concrete – Entire Structure
- Concrete transported in unhardened state as ready-mix
- Used for its long-term durability & structural support

Proposed System

- Precast Concrete Exterior Wall Panels
- Floor Beams & Columns and Slabs are cast in place

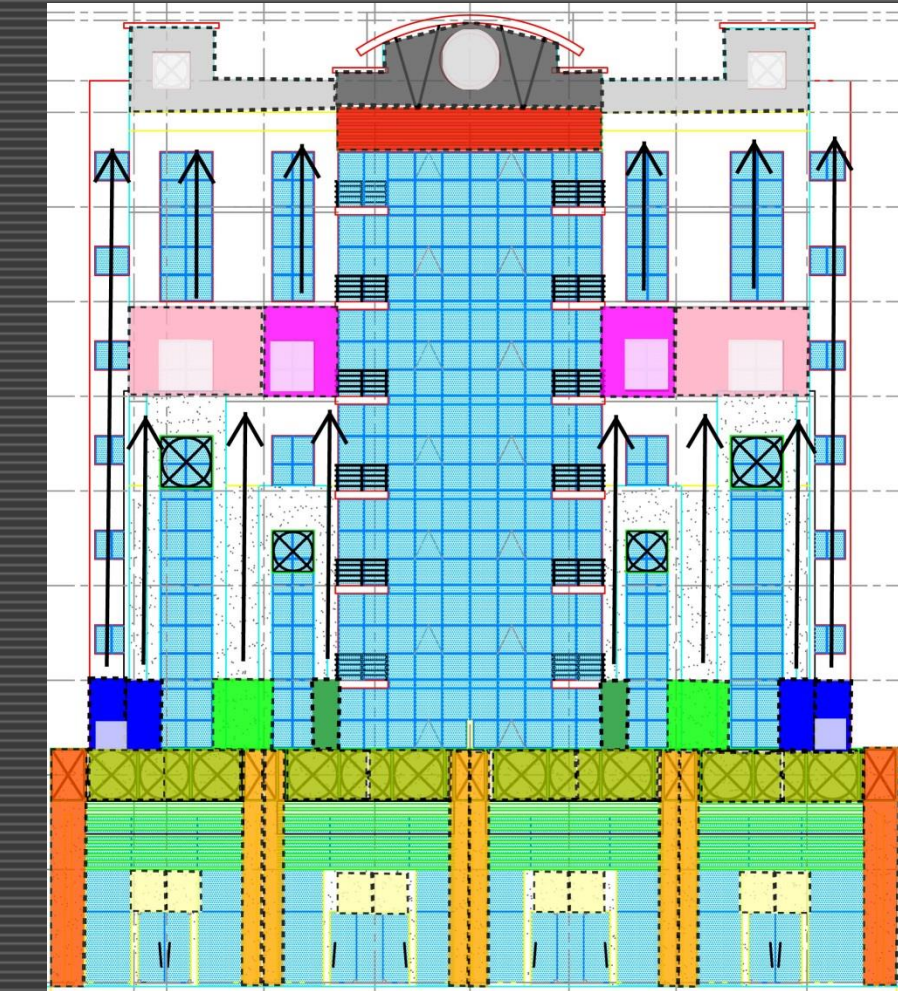
OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Design

- Aim: To reduce amount of panels used
- Panels designed to fit between each floor beams
- Repetitive floors (1-7)
- Same concrete mold can be used for multiple panels
- Total of 33 Different Panels
- West & East façades are completely identical

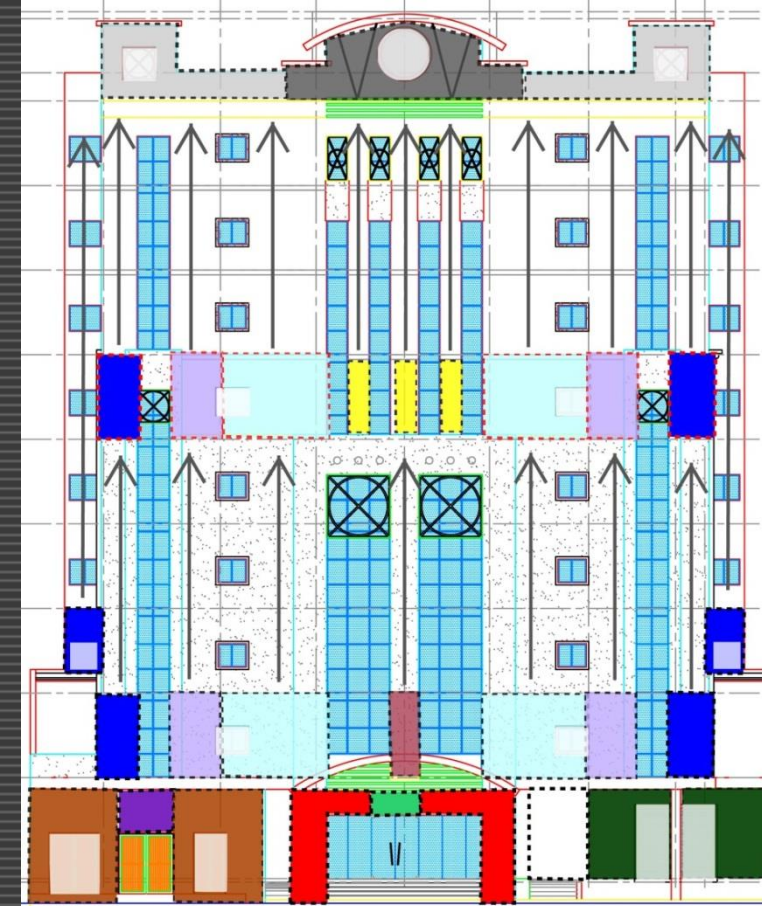
North Elevation



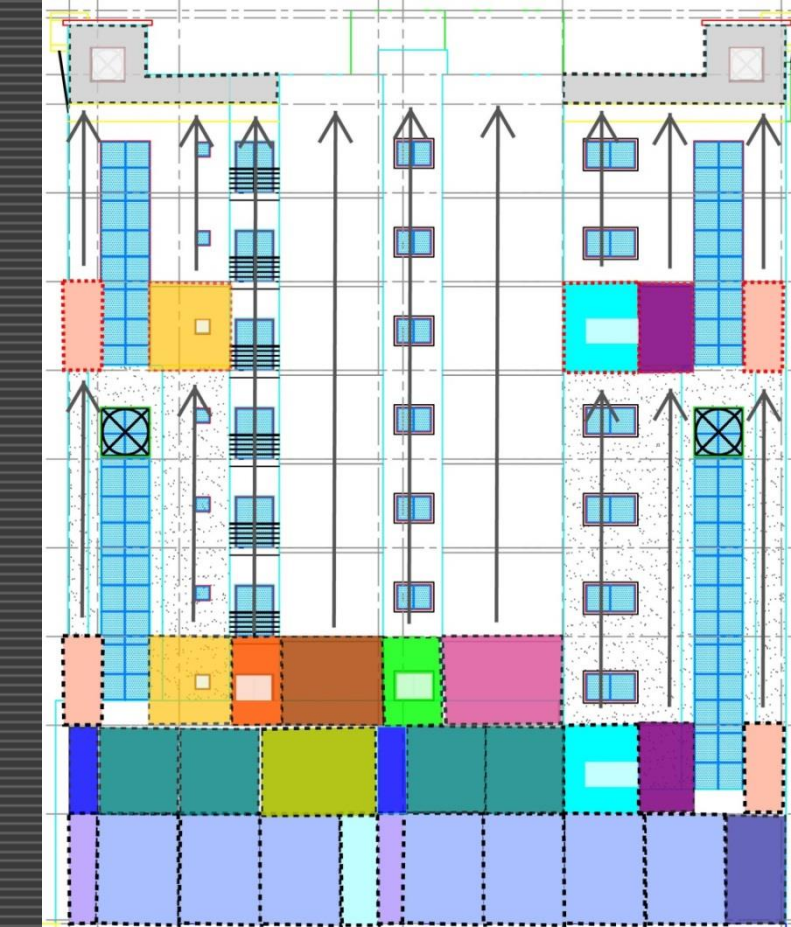
OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

South Elevation



West & East Elevation



OUTLINE

- ❖ Project Background
- ❖ **Analysis 1: Construction Precast Vs. Cast in Place Concrete**
 - Introduction
 - Design
 - **Manufacturing & Quality**
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Manufacturing

- Offsite controlled working environment
- Better efficiency due to repetitive process
- Favorable working conditions
- Less material wasted
- Better safety practices



Photo Courtesy of www.concretetissues.com

Quality

- PCI Certified
- Controlled air entrainment and curing procedures
- Better & more consistent quality of work



Photo Courtesy of www.atmiprecast.com

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Delivery

- 12' x 50' truck bed
- Transported on non-staining, shock absorbing material
- Manage 'just-in-time' deliveries
- Delivery within 20-35 miles



Photo Courtesy of www.truckfax.blogspot.com

Erection

- Duration of erection reduced
- 40 ton lifting crane
- 1 floor erected per day



Photo Courtesy of www.sicklesteelcranes.com

OUTLINE

- ❖ Project Background
- ❖ **Analysis 1: Construction Precast Vs. Cast in Place Concrete**
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - **Cost Impact**
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Cast in Place Concrete

- Price retrieved from RSMeans (Location factor: Philadelphia)
- Cost includes Labor, Material & Erection
- Cost: \$550.50/CY

Precast Concrete Wall Panels

- Price retrieved from Encon United Precast Company
- Cost includes Material, Transportation, Insulation & Erection
- Cost: \$25/SF – without architectural finish
\$30/SF – with architectural finish

Cost Comparison

Cost Implications	
Cast in Place Concrete	\$ 656,416.20
Precast Concrete Panels	\$1,116,145.20
Cost Difference	\$459,729.00

- Further detail can be seen in Appendix I in final report

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - **Schedule Impacts**
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Actual Savings

- Superstructure completed on 17th Sept, 2014 (9 days ahead of schedule)
- Minimum difference due to:
 - Sequencing and coordination of current schedule

Proposed Schedule Savings

Building Enclosure Activity	
Activity	Duration
Cast in Place Concrete Wall	
Formwork/Reinforcement/Concrete Casting	122
Waterproofing & Cement Sandscreed	74
Total	196
Precast Panels	
Erect Panels	11
Seal Joint/Clean Panels	40
Total	51
Days Saved on Enclosure	145

Table 2.1 – Time savings for building enclosure

- Further detail can be seen in Appendix H for revised schedule

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Thermal Properties

- Affects users comfort level
- Notes disparity of energy efficiency

R-Value Analysis

- Performance of system in terms of Heating & Cooling

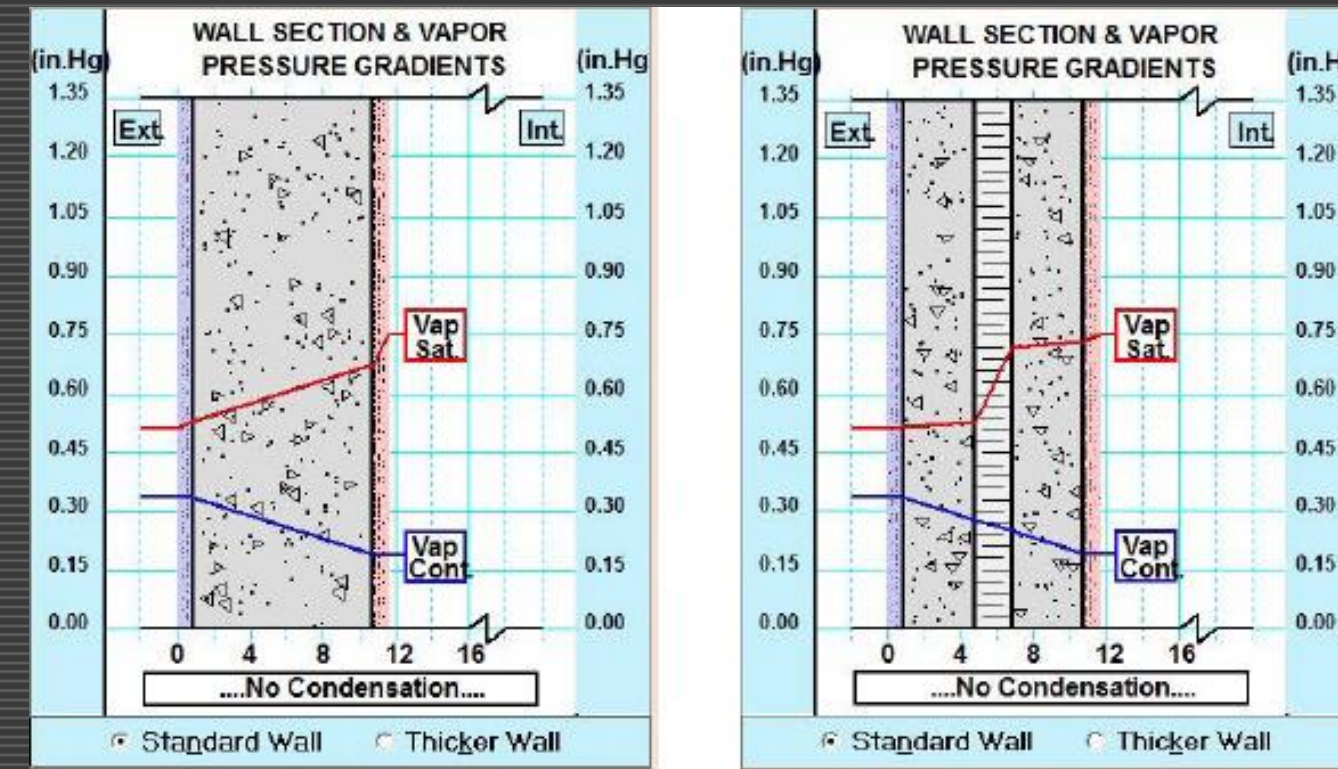
Summer Loads				
System	R-value	Change in Temp	Area (sqft)	Heat Transfer (BTU/hr)
Proposed	9.777913	52	4237.3	22,534.42
Current	1.63333	52	4237.3	134,902.07
Difference				(112,367.65)

Winter Loads				
System	R-value	Change in Temp	Area	Heat Transfer (BTU/hr)
Proposed	9.777913	11	4237.3	4,766.90
Current	1.63333	11	4237.3	28,536.98
Difference				(23,770.08)

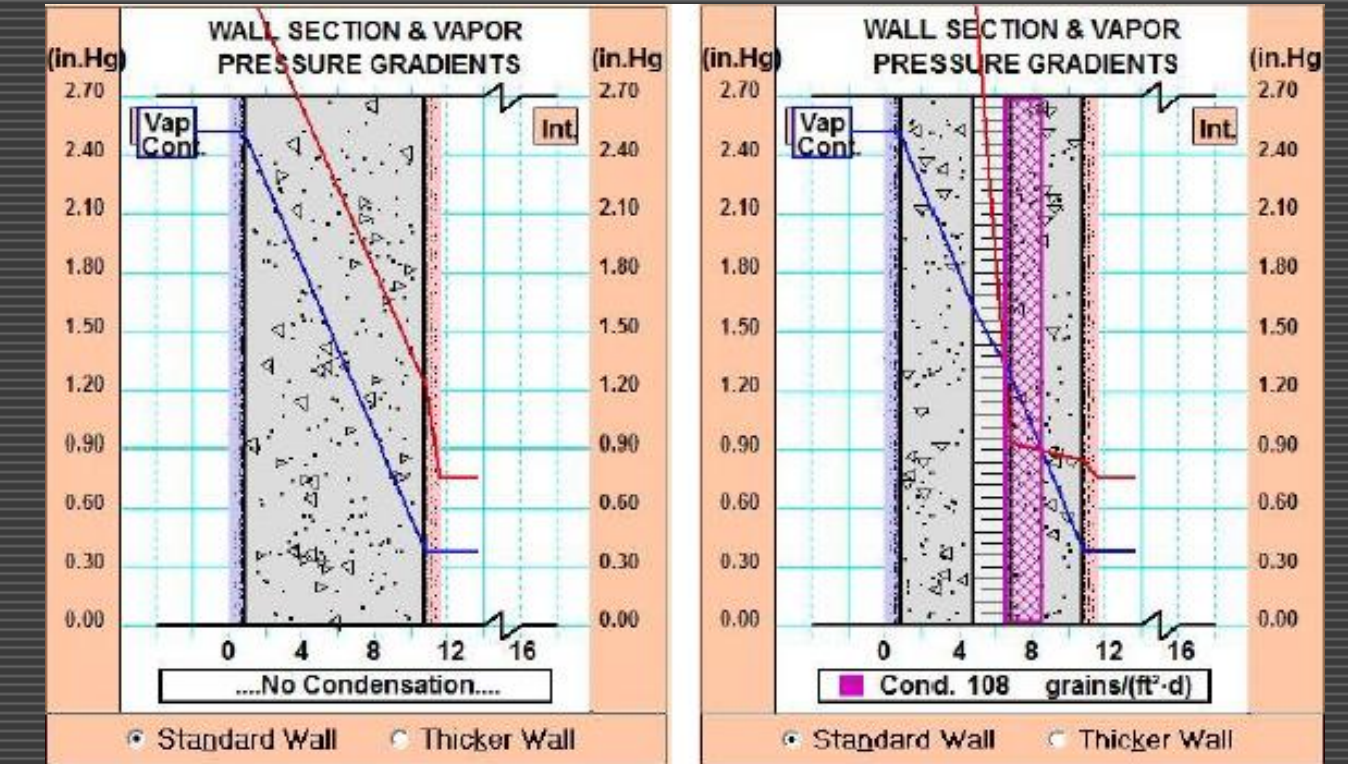
OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - Conclusions & Recommendations
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Winter Condensation Analysis



Summer Condensation Analysis



- Addition of Vapor Barrier - \$4,024.44

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
 - Introduction
 - Design
 - Manufacturing & Quality
 - Delivery & Erection
 - Cost Impact
 - Schedule Impacts
 - Mechanical Breadth
 - **Conclusions & Recommendations**
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Conclusions

- Accelerated Schedule by 9 days
- Increase in Superstructure cost by \$459,729
- Better thermal properties using Precast

Recommendations

- Resizing of Mechanical Equipment
- Re-sequencing of activities
- Use of Precast Concrete Wall Panels

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - **Introduction**
 - Common Construction Practices in Qatar
 - Case Study: HHD Project (Penn State)
 - Comparison of Labor Wages
 - Comparison of Safety Programs
 - Comparison of Quality Control Programs
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Opportunity Identification

- Improvement of construction practices
- Improve schedule
- Reduce project cost
- Improve overall quality

Potential Comparisons

- Labor Wages
- Safety Programs
- Quality Control Programs

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - **Common Construction Practices in Qatar**
 - Case Study: HHD Project (Penn State)
 - Comparison of Labor Wages
 - Comparison of Safety Programs
 - Comparison of Quality Control Programs
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Cast in Place Construction

- Cheaper
- Material readily available



Photo Courtesy of www.allsortsconcrete.com

Material/Resource Availability

- Shipped from neighboring countries
- No natural resources
- Special material delivery can be timely process



Photo Courtesy of Google Maps

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - Common Construction Practices in Qatar
 - **Case Study: HHD Project (Penn State)**
 - Comparison of Labor Wages
 - Comparison of Safety Programs
 - Comparison of Quality Control Programs
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion



Photo Courtesy of www.opp.psu.edu

Human Health Development (HHD) Project

- Academic/Research building
- 93,000 SF of new construction
- Anticipated completion by Spring 2015
- Multiple Prime Contract

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - Common Construction Practices in Qatar
 - Case Study: HHD Project (Penn State)
 - **Comparison of Labor Wages**
 - Comparison of Safety Programs
 - Comparison of Quality Control Programs
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

HHD Project

- State funded job
- State prevailing wage rate

Job	Effective Date	Hourly Rate	Fringe Benefits	Total
Carpenters	6/1/12	\$25.98	\$11.67	\$37.65
	6/1/13	\$26.09	\$12.51	\$38.60
	6/1/14	\$26.21	\$13.35	\$39.56
Electricians	12/23/11	\$35.76	\$21.10	\$60.81
	12/21/12	\$37.71	\$21.10	\$58.81
	12/21/13	\$39.71	\$21.10	\$60.81
Painters	6/1/11	\$25.72	\$14.09	\$39.81
	6/1/12	\$26.25	\$14.56	\$40.81
	6/1/13	\$26.78	\$15.03	\$41.81
Plumbers	5/1/11	\$31.92	\$20.56	\$52.48
	5/1/12	\$32.67	\$20.81	\$53.48
Masons	1/1/12	\$30.85	\$13.60	\$44.45
	1/1/13	\$31.45	\$14.10	\$45.55
Operators	1/1/11	\$27.68	\$15.74	\$43.42
	1/1/12	\$28.08	\$16.44	\$44.52
	1/1/13	\$28.48	\$17.14	\$45.62
Laborers	1/1/11	\$18.27	\$10.27	\$28.41
	1/1/12	\$18.27	\$10.87	\$28.54

Table 3.1 – HHD Project Wages

Mansoura Development

- No minimum wage rate
- Free medical service
- Unskilled workers – negative impact to project

Job	Effective Date	Hourly Rate	Fringe Benefits	Total
Carpenters	1/1/13	\$2.40	N/A	\$2.40
Electricians	1/1/13	\$3.08	N/A	\$3.08
Painters	1/1/13	\$2.74	N/A	\$2.74
Plumbers	1/1/13	\$2.40	N/A	\$2.40
Masons	1/1/13	\$2.05	N/A	\$2.05
Operators	1/1/13	\$2.43	N/A	\$2.43
Laborers	1/1/13	\$1.37	N/A	\$1.37

Table 3.2 – Mansoura Development Wages

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - Common Construction Practices in Qatar
 - Case Study: HHD Project (Penn State)
 - Comparison of Labor Wages
 - **Comparison of Safety Programs**
 - Comparison of Quality Control Programs
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

HHD Project

- All contractors have OSHA 30 – Safety Course
- Daily Meetings to highlight safety issues
- Safety toolbox topics meeting – Once a week
- Zero Recordable accidents

Mansoura Development

- No safety administration (like OSHA) in Qatar
- Abide by company own Health & Safety Policy
- 4 Step safety program:
 - Make regular job site inspections
 - Enforce use of safety equipment
 - Follow safety procedures
 - Provide on-going safety training
- Suspension of pay if rules not followed
- 8 recordable injuries as of yet

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - Common Construction Practices in Qatar
 - Case Study: HHD Project (Penn State)
 - Comparison of Labor Wages
 - Comparison of Safety Programs
 - **Comparison of Quality Control Programs**
 - Conclusions & Recommendations
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

HHD Project

- Three-Phase Control System:
 - Preparatory Phase
 - Initial Phase
 - Follow-Up Phase
- Lifetime of Building – 100 years

Mansoura Development

- No actual program followed
- Engineer on site check current work
- Lifetime of Building – 50-70 years

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ **Analysis 2: Comparison of Construction Practices between US & Qatar**
 - Introduction
 - Common Construction Practices in Qatar
 - Case Study: HHD Project (Penn State)
 - Comparison of Labor Wages
 - Comparison of Safety Programs
 - Comparison of Quality Control Programs
 - **Conclusions & Recommendations**
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ Conclusion

Conclusions

- Potential to cut down on project costs
- Potential delivery of project on or before time
- Huge potential to improve safety of construction site

Recommendations

- Acquire/Train more experienced workers
- OSHA trained personnel on site
- Regular unscheduled site safety inspections
- Implement Quality Control program similar to HHD Project

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - **Introduction**
 - Evaluate Current Schedule
 - Labor Increase
 - SIPS Analysis
 - Man Power Loaded Schedule
 - Conclusions & Recommendations
- ❖ Conclusion

Problem Identification

- Immense heat of summer months (Over 122 degrees)
- Government halts construction during the day
- Delays in schedule

Potential Solutions

- Re-evaluate/Re-sequence activities in schedule
- Increasing labor force pre-summer months
- SIPS implementation of superstructure
- Man Power Loaded schedule

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - **Evaluate Current Schedule**
 - Labor Increase
 - SIPS Analysis
 - Man Power Loaded Schedule
 - Conclusions & Recommendations
- ❖ Conclusion

Current Schedule

- Superstructure construction goes through summer
- Floor by floor phasing

*See Appendix E for current project schedule

Possible Solutions

- Completion of Superstructure before July, 2014
- Phasing construction by trade
- Increase man power for superstructure completion

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - Evaluate Current Schedule
 - **Labor Increase**
 - SIPS Analysis
 - Man Power Loaded Schedule
 - Conclusions & Recommendations
- ❖ Conclusion

Cost Analysis

- \$1.37 – Labor Cost
- 13 extra laborers added
- Overall reduction: \$22,906.40

Cost Analysis of Labor Increase					
	# of Laborers	Hourly Rate	Monthly Cost	Months to complete superstructure	Total Cost
Original Crew	53	\$1.37	\$12,779.36	13	\$166,131.68
Proposed Crew	66	\$1.37	\$15,913.92	9	\$143,225.28

Table 4.1 – Analysis of labor Increase

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - Evaluate Current Schedule
 - Labor Increase
 - **SIPS Analysis**
 - Man Power Loaded Schedule
 - Conclusions & Recommendations
- ❖ Conclusion

SIPS

- Implementation on superstructure (Concrete Casting)
- 5 activities per floor
- Construction start: 26th August, 2013
- Ground & Mezzanine floors – 9900 GSF
- Floors 1-7 – 7900 GSF

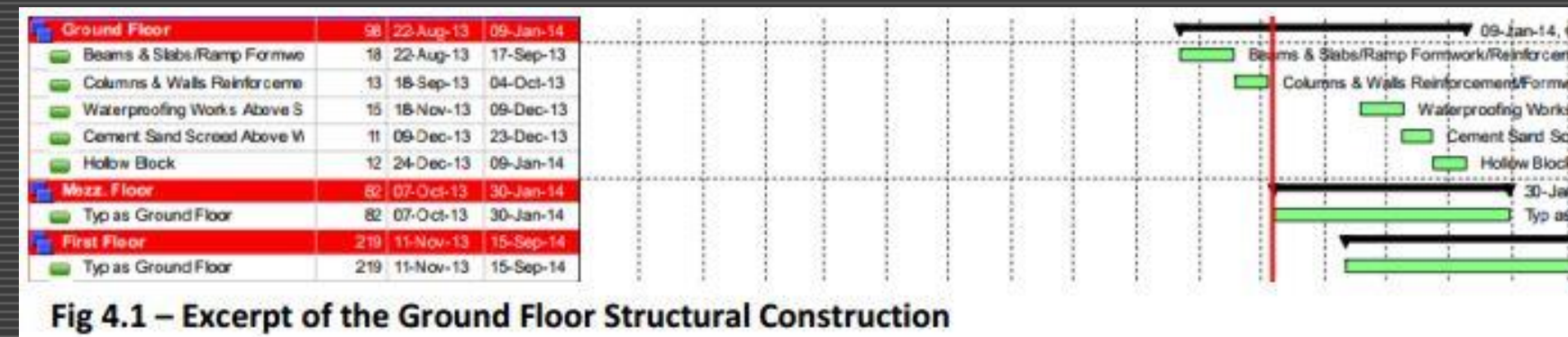


Fig 4.1 – Excerpt of the Ground Floor Structural Construction

Original Superstructure Constr. (G&M)		
Activity	Crew (Laborers)	Duration (Days)
Beams & Slabs/Ramp - Formwork/Reinforcement/Concrete Casting	20	18
Columns & Walls Reinforcement/Formwork/Concrete Casting	20	13
Waterproofing works above Slab & Ramp	4	15
Cement sand screed above water proofing	4	11
Hollow Block	5	12

Table 4.2 – Original Crews and Duration Designation (G&M)

Proposed Superstructure Constr. (G&M)		
Activity	Crew (Laborers)	Duration (Days)
Beams & Slabs/Ramp - Formwork/Reinforcement/Concrete Casting	20	18
Columns & Walls Reinforcement/Formwork/Concrete Casting	20	13
Waterproofing works above Slab & Ramp	8	8
Cement sand screed above water proofing	8	6
Hollow Block	10	6

Table 4.3 – Proposed Crews and Duration Designation (G&M)

Original Superstructure Constr. (1-7)		
Activity	Crew (Laborers)	Duration (Days)
Beams & Slabs/Ramp - Formwork/Reinforcement/Concrete Casting	20	13
Columns & Walls Reinforcement/Formwork/Concrete Casting	20	10
Waterproofing works above Slab & Ramp	4	12
Cement sand screed above water proofing	4	9
Hollow Block	5	15

Table 4.4 – Original Crews and Duration Designation (1-7)

Proposed Superstructure Constr. (1-7)		
Activity	Crew (Laborers)	Duration (Days)
Beams & Slabs/Ramp - Formwork/Reinforcement/Concrete Casting	20	13
Columns & Walls Reinforcement/Formwork/Concrete Casting	20	10
Waterproofing works above Slab & Ramp	8	6
Cement sand screed above water proofing	8	5
Hollow Block	10	8

Table 4.5 – Proposed Crews and Duration Designation (1-7)

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - Evaluate Current Schedule
 - Labor Increase
 - **SIPS Analysis**
 - Man Power Loaded Schedule
 - Conclusions & Recommendations
- ❖ Conclusion

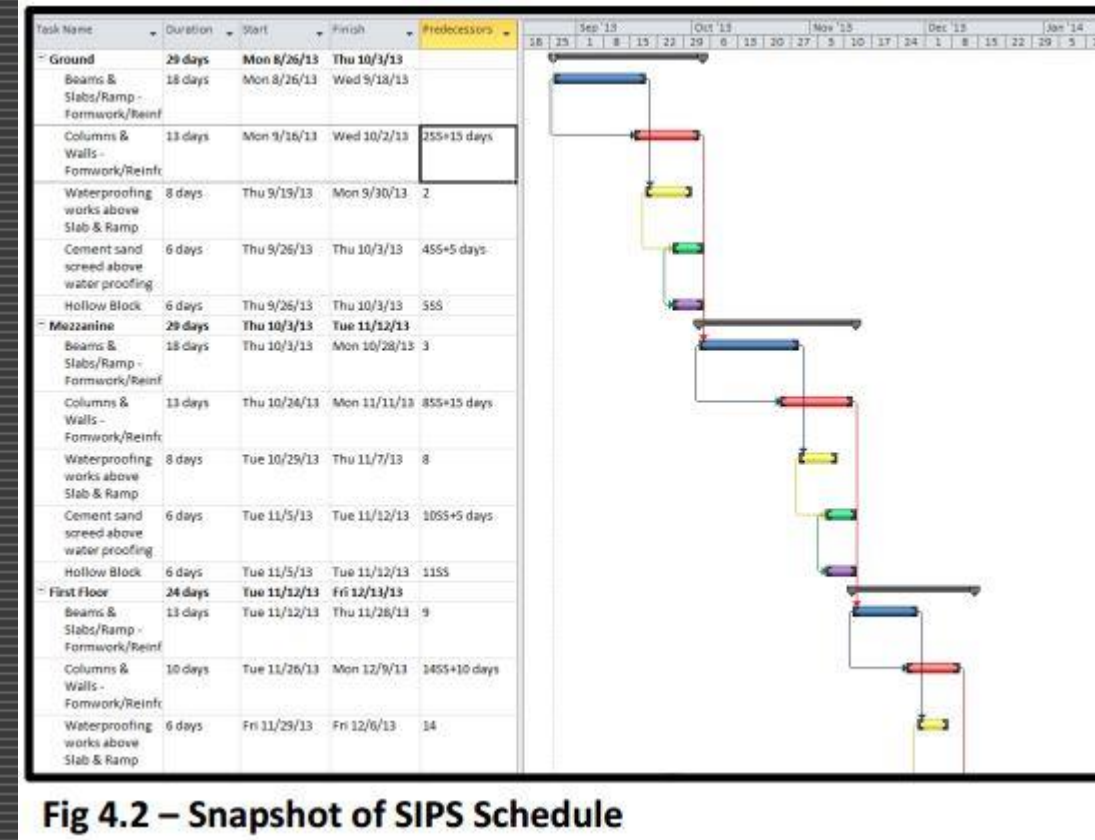


Fig 4.2 – Snapshot of SIPS Schedule

Schedule Reduction

- New finish date: 30th May, 2014
- 120 Days ahead of schedule
 - 27th Sept, 2014

*See Appendix L for Full version of SIPS Schedule

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - Evaluate Current Schedule
 - Labor Increase
 - SIPS Analysis
 - **Man Power Loaded Schedule**
 - Conclusions & Recommendations
- ❖ Conclusion

Man Power Loaded Schedule

- Based on SIPS Schedule
- Ensures SIPS feasibility
- Over-allocation of Laborers

Man Power Loading	
Activity	Crew (Laborers)
Beams & Slabs/Ramp - Formwork/Reinforcement/Concrete Casting	20
Columns & Walls Reinforcement/Formwork/Concrete Casting	20
Waterproofing works above Slab & Ramp	8
Cement sand screed above water proofing	8
Hollow Block	10

Table 4.6 – Man Power Loaded Crews

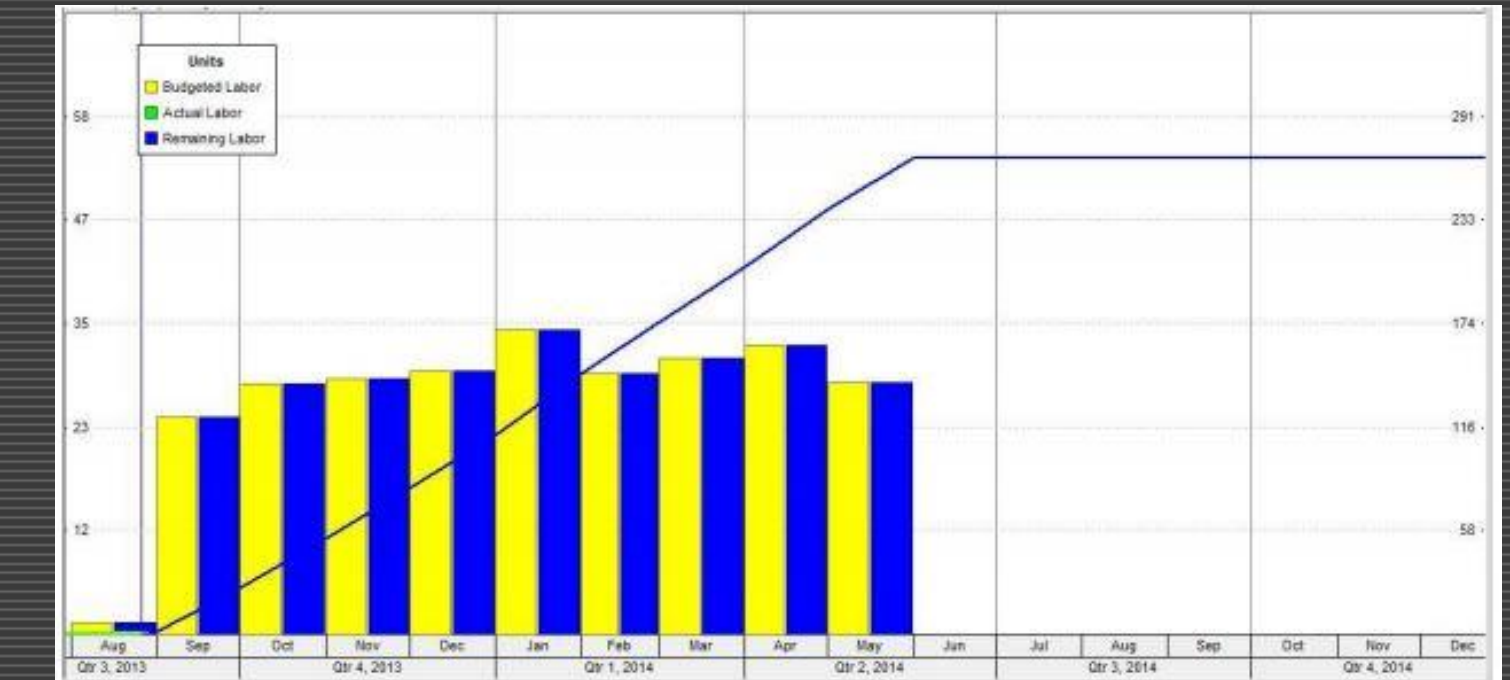


Fig. 4.3 – Man Power Loaded Schedule

OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ **Analysis 3: Field Labor Management & Alteration**
 - Introduction
 - Evaluate Current Schedule
 - Labor Increase
 - SIPS Analysis
 - Man Power Loaded Schedule
 - **Conclusions & Recommendations**
- ❖ Conclusion

Conclusions

- Superstructure schedule reduced by 120 days
- By-pass halt in construction
- Promotion of safer site

Recommendations

- Implement SIPS over original schedule
- Further consideration to apply SIPS on all trades

OUTLINE

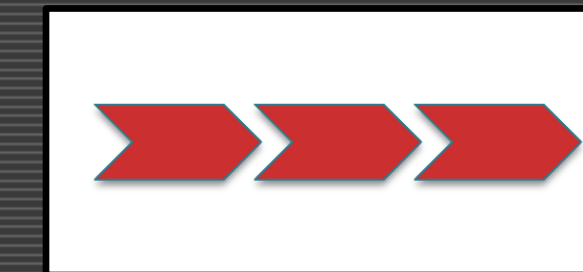
- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ **Conclusion**

Conclusion

- Schedule acceleration primary concern for owner
- Potential in resizing of Mechanical equipment
- Potential schedule accelerations through re-sequencing of activities for Precast

Analysis 1 | Precast Vs. Cast in Place

- Accelerates schedule by 9 days
- Increases cost by \$459,729



Analysis 2 | Comparison of Construction Practices between US & Qatar

- Increase in skilled workers
- Introduction to OSHA personnel
- Implementation of Quality Control Program

Analysis 3 | Field Labor Management & Alteration

- Decreases labor cost by \$22,906.40
- Accelerates superstructure schedule by 120 days



OUTLINE

- ❖ Project Background
- ❖ Analysis 1: Construction Precast Vs. Cast in Place Concrete
- ❖ Analysis 2: Comparison of Construction Practices between US & Qatar
- ❖ Analysis 3: Field Labor Management & Alteration
- ❖ **Conclusion**

THANKS!

Special Thanks

Petra Design – Mahmoud El-Salti
Commitment Construction Project Team
John Bechtel
My Family & Friends

Academic Acknowledgements

Prof. Ray Sowers – CM Faculty Advisor
Dr. Craig Dubler
Dr. Robert Leicht
Dr. John Messner
Penn State AE Faculty

Industry Acknowledgements



