Ursinus College Residence Hall 2

April 17, 2007

Rusty Hoffman

Construction Management

Presentation Outline

- Project Overview
- Temporary Heat Analysis
- Precast Superstructure and Façade Analysis
- Precast Safety Research
- Site Specific Safety Plan
- Conclusions & Recommendations
- Acknowledgements/Questions

Project Overview

- Owner: Ursinus College
- Architect: WRT Planning and Design
- GC/CM: Warfel Construction Company
- Building: R-2 Dormitory
- Area: 52,114 SF
- Cost: $10.6 Million
- Delivery Method: Design-Bid, Lump Sum
- Start Date: May 2006
- Building Turnover: August 2007

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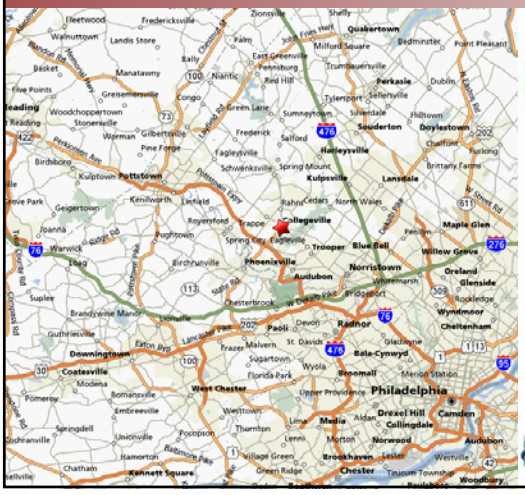
Project Site



Temporary Heat

- Goals:
  - Improve Working Conditions In Building
    - Consistent productivity rates.
    - Provide suitable environment for Interior Trades.
  - Improve Temperature for Masonry Work
    - Concrete/Mortar should be set in ambient temperatures no lower than 40° F without protection.
  - Do Not Add Significant Cost to Project
- Temporary Heat System Chosen
  - Basic Natural Gas (Propane)
    - Use of propane heaters for interior.
    - Baker's scaffold wrapped in polyethylene plastic for masonry work.

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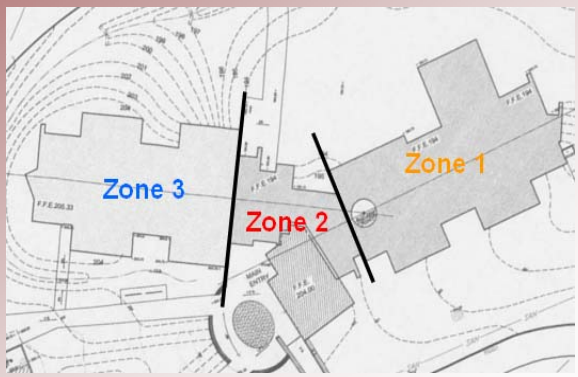
Temporary Heat Analysis

- Basic Temporary Heating System
- Heat Building During 3 Coldest Months
- Average Outdoor Temperature
  - December = 33° F
  - January = 28° F
  - February = 31° F
- Heat 4 Zones of Building At a Time



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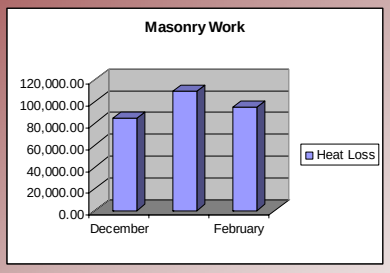
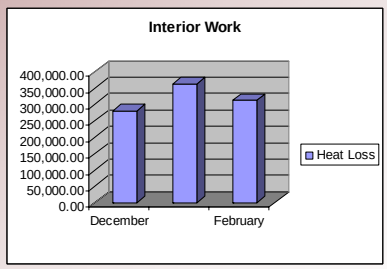
Heat Loss

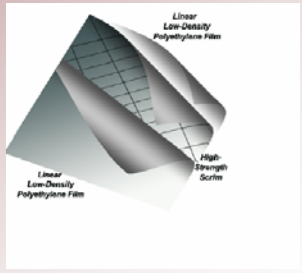
- Masonry Temp Heat
- Maximum Heat Loss
  - BTU/hr
- Building Temp Heat
- Maximum Heat Loss Per Wing
  - BTU/hr





Propane Temp Heat

- Building Breakdown
  - Interior Temporary Heaters
    - Produce 375,000 BTU/hr
  - Exterior Masonry Temporary Heaters
    - Produce 125,000 BTU/hr
  - Wrap Scaffold in Polyethelyne Plastic



Temporary Heat Cost

- Total of 3 months on the project
- Improved Working Conditions

Equipment	Unit Cost	Units	Total Cost
Propane	$1.06/gal	7,665	$8,125.18
Poly Sheathing	$26/Roll	15	$390
Baker Scaffold	$182/100SF	25	$4,550
Heater (125,000 BTU/hr)	$259/EA.	2	$1,554
Heater (375,000 BTU/hr)	$599/Ea.	4	$2,396
Total Cost			**$17,015.18**

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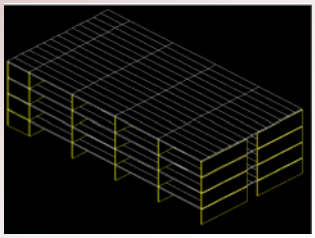
Precast Superstructure/Facade

- Goals:
  - Accelerate Schedule
  - Control Cost
- Results:
  - Proposed Precast Structure with Precast Façade
    - Proposed Schedule: May 30, 2006 – December 13, 2006
    - Proposed Cost: $2,410,719.18
  - 10 Week Schedule Savings
  - $151,719.18 Additional Cost

Precast Superstructure/Facade

- Existing Facility
  - Block and Plank Structure
  - Masonry Face Brick
  - 8” Load Bearing CMU Walls
  - 8” Precast Hollow Core Plank

- Proposed Structure
  - “Stack Wall” Structure
  - Architectural Precast
  - 8” Load Bearing Precast Walls
  - 8” Precast Hollow Core Plank



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Design Analysis

- Precast LB wall panels to remain at 8” thickness
- Factored Loading:
  - 156 psf Dead Load
  - 272 psf Live Load
  - 428 psf Total
- Minimum Reinforcement
  - Asmin = 0.1512 in²
  - #4 @ 12” O.C. gives As = 0.2 in²
- Moment Capacity
  - Max M = 3.47' kips
  - ØMn = 6.85' kips
- Architectural Precast
  - LB panels = 9” thickness
  - Non LB panels = 7” thickness
- Precast hollow core plank to remain at 8” thickness
- All panels require minimum thickness of l/20 = 5.4”

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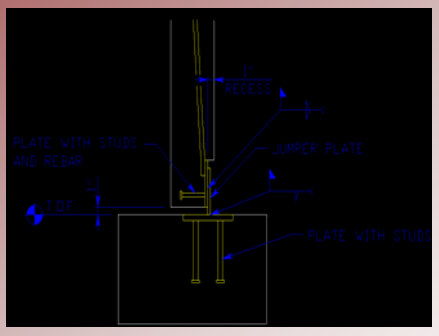
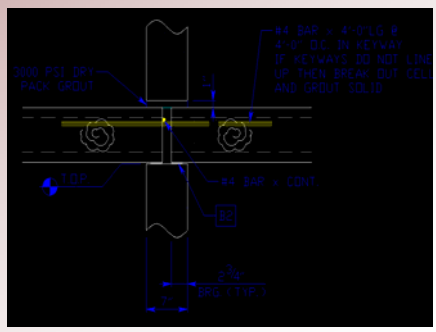
Typical Connection Details

CIP Footing to Precast Wall



Precast Plank to Precast Plank



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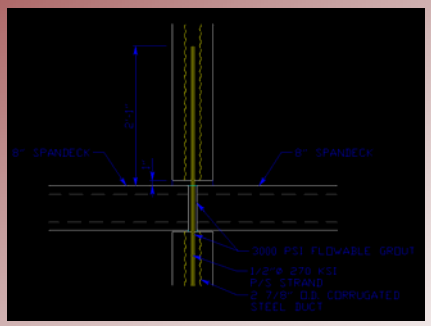
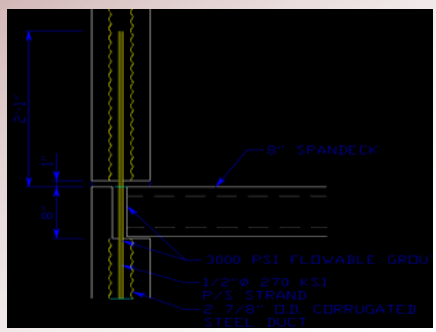
Typical Connection Details

Interior Wall to Wall



Exterior Wall to Wall



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Wall R-Value Comparison

CMU Masonry Wall		Precast Panel Wall	
Wall Component	**R-Value**	**Wall Component**	**R-Value**
Outside Air Film	0.17	Outside Air Film	0.17
4" Face Brick	0.385	9" Precast Panel	0.72
2" Air Space	0.61	3 1/2" Fiberglass Batt Ins.	11
8" CMU Block	1.71	5/8" GWB	0.56
3 1/2" Fiberglass Batt Ins.	11	Inside Air Film	0.68
5/8" GWB	0.56		
Inside Air Film	0.68		
Total	**15.115**		**13.13**

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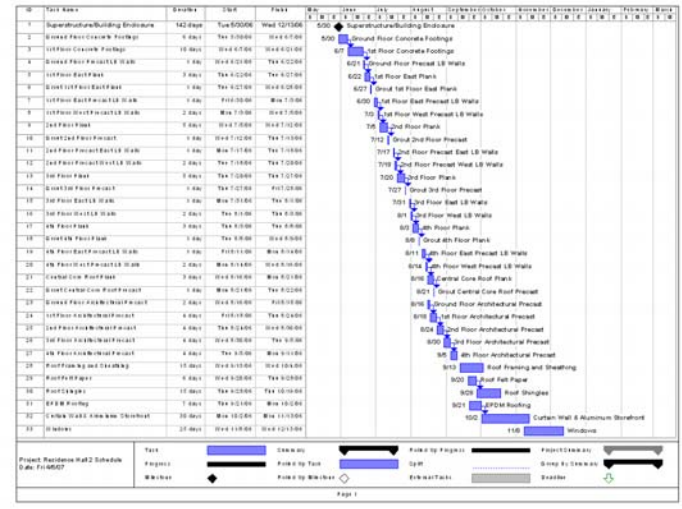
Schedule Overview

- Start Date: May 30, 2006
- Substantial Building Enclosure: December 13, 2006
  - 10 Week Acceleration From Original Schedule



Cost Overview

- Cost of Precast Units
  - Plank = $8.50/SF
  - LB Wall Panel = $32/SF
  - LB Wall Panel W/Brick = $42/SF
  - Architectural Panels = $42/SF
- Total Cost of Proposed System
  - $2,410,719.18
  - Cost Increase of $151,720
  - 7% Increase In Cost From Original System

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Precast Safety Research/Analysis

- Goals:
  - Determine aspects of safety that are a “grey” area.
  - Determine hazardous areas of precast erection work.
  - Find a model Company
- Development of a Site Specific Safety Plan
  - Plan will reflect hazardous areas

Precast Concrete Safety Issues

- The following issues have been identified
  - Fall Protection
  - Erectors Working at Leading Edge
  - Pick and Placement of Precast Members
  - Plank Swinging Near Other Activities
- Issues that are a "grey" area in the OSHA Handbook:
  - Fall Protection

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OSHA Statements

- Job Site Safety: General Duty Clause
  - Each Employer Shall:
    - "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees."
    - "comply with occupational safety and health standards promulgated under this act."
- OSHA on Fall Protection
  - "Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems."
  - "Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer shall develop and implement a fall protection plan which meets the requirements of paragraph (k) of 1926.502."

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Precast Concrete Safety Survey

- Purpose
  - Identify what industry feels is greatest risk of Precast Erection
  - Find industries view on fall protection
  - Determine who has final say in safety guidelines on specific sites
- Sample Questions/Common Responses
  - What aspect of precast concrete erection do you feel is most dangerous and why?
  - OSHA states fall protection is not necessary where it would be hazardous to operate while being tied off. Do you agree with this? If not, why?
  - Do you, as the construction manager, have the right to force a subcontractor to abide by your safety guidelines if they go above and beyond that which is required by OSHA?

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A Model Company

- Davis Construction Company
  - Precast Garage Collapse
  - After Which Developed a Precast Concrete Erection Checklist & Release
- Highlights of the Checklist and Release:
  - Are there any unique precast erection situations on this project that we should take notice of?
  - Does the Precast Erector have adequate fall protection equipment on site? Is the Precast Erector aware that all workers must be tied off, or have alternate fall protection above 6'-0"? (Unless Davis and erector agree that circumstances prohibit safe and feasible tie off) The use of a Safety Monitoring system is not permitted without written permission from the Davis Safety Department. Describe the system to be used.
  - Describe fall protection controls used by subcontractor while guard rails or perimeter barricades are taken down in order to set the panels.
  - Has Precast Erector performed a survey of the installation area?
  - Verify that all Safety Plan elements are presented to and agreed upon by all parties involved including all lower tier subcontractors.
- Checklist eliminates majority of safety problems once erection begins.
- Very Important Key to Safety
  - COMMUNICATION

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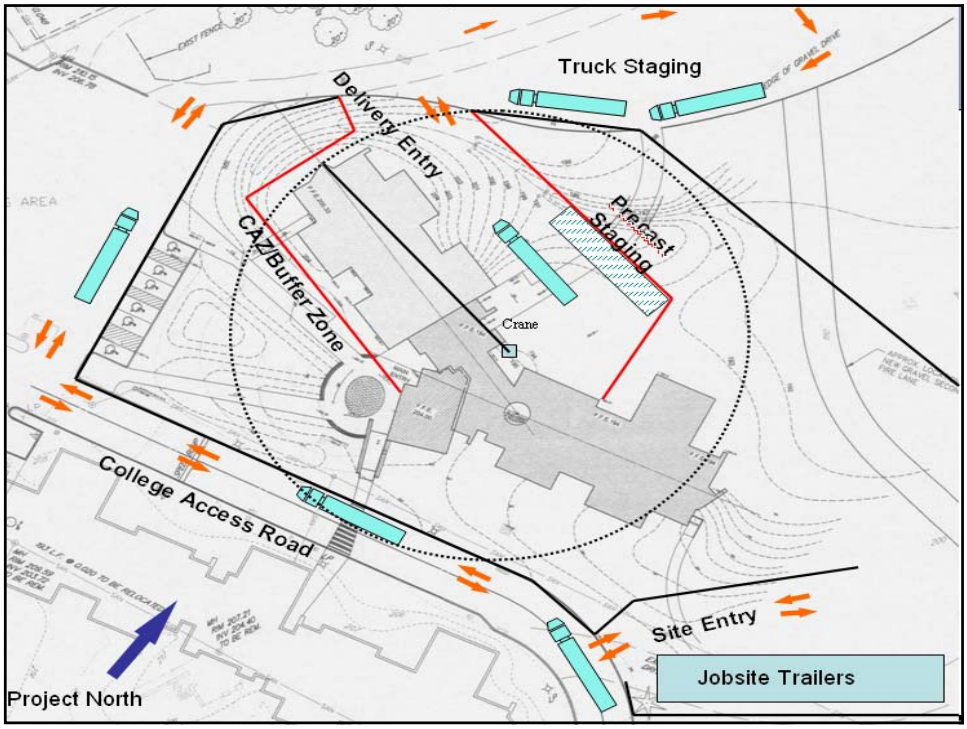

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Conclusion & Recommendations

- Temporary Heat – Propane System
  - Use System
  - Additional Cost of $17,015.18
  - Improve Working Conditions
- Precast Superstructure & Façade
  - Use Precast System
  - 10 Week Schedule Acceleration
  - Additional Cost of $151,720
- Precast Safety
  - Communicate
  - Safety Is Most Important
- New Project Summary
  - Cost
    - $10,768,735
  - Project Start
    - May 2006
  - Project Finish
    - June 2007
- College Recieves Building 10 Weeks Prior Than Expected

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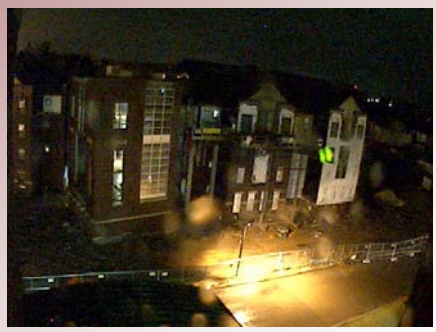
Acknowledgements & Questions

- Warfel Construction Company
  - Brett Calabretta, Project Manager
- Ursinus College
  - Andy Feick, Owner's Representative
- Wallace Roberts & Todd, LLC
  - Architect
- MEP/FP Engineers
  - Gillespie Electric, Inc.
  - Rogers Mechanical Company
  - SDR Mechanical
  - Precision Fire Protection



Questions?

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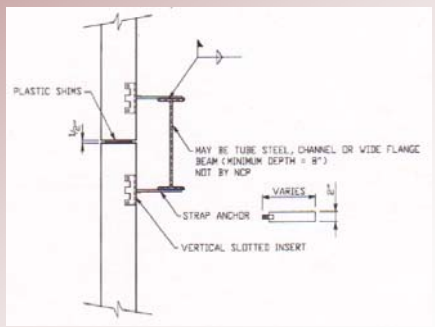
Typical Connection Details

- Non LB Precast Panels
  - Primarily on North and South Faces of building.
  - Do not connect to precast directly.
- New wide flange beams will be needed.
- Calculation of size not done for this analysis but noted that this additional member will be needed for architectural system.



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