

Lancaster General Hospital
5th and 6th Floor Fit-Out & Cardiac Elevator




Devin Learn

Construction Management
AE Senior Thesis

Lancaster General Hospital 5th and 6th Floor Fit-Out & Cardiac Elevator Addition

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Lancaster General Hospital
5th and 6th Floor Fit-Out & Cardiac Elevator




Introduction

- Project Background
- Depth Research: Commissioning Vs. Retro-Commissioning
- Breadth 1: Cast-In-Place Vs. Pre-Cast Floor System
- Breadth 2: Mechanical Connections at ICRA Partitions
- Summary and Conclusions
- Questions

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Lancaster General Hospital
5th and 6th Floor Fit-Out & Cardiac Elevator




Project Background

- 5th and 6th Floor Fit-Out – 44,600 SF
- 5th Floor – 14,700 SF Nero-Trauma ICU
- 6th Floor – 29,900 SF ICU
- Cardiac Elevator Addition – 1,600 SF Serving the 5th and 6th Floor Spaces.

Owned By Lancaster General Hospital a Non-Profit Healthcare Facility.

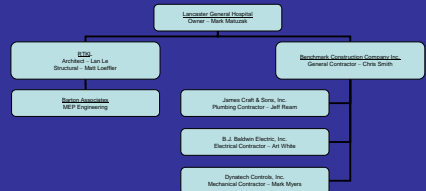
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5th and 6th Floor Fit-Out & Cardiac Elevator




Project Background

Project Intro.
Client Info.
Project Delivery
Staffing Plan
Project Schedule
Cost Summary



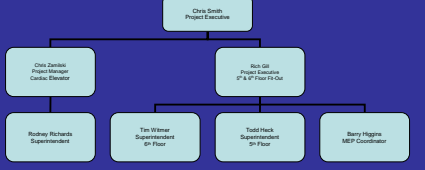
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Key Project Dates

- Start 5th and 6th Floor – August 11, 2006
- Start Cardiac Elevator – September 5, 2006
- Tower Crane Erection – September 20, 2006
- Corridor Connection 5th and 6th Floor – September 5, 2006
- DOH Life Safety Inspection – December 29, 2006
- DOH Licensure Inspection – January 15, 2007

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Project Background

5th and 6th Floor Fit-Out Total Cost - \$9,720,090.00 - Square Foot Cost - \$200.04
Cardiac Elevator Total Cost - \$1,998,973.00 - Square Foot Cost - \$1,249.36

5th and 6th Floor Fit-Out		Cardiac Elevator	
Description	Cost	Description	Cost
General Conditions	\$402,891.00	General Conditions	\$107,119.00
Demolition/Landscaping	\$82,448.00	Demolition/Landscaping	\$154,765.00
Concrete	\$25,249.00	Concrete	\$27,174.00
Steel	\$48,496.00	Masonry	\$17,827.00
Carpentry	\$1,101,131.00	Steel	\$227,297.00
Thermal/Moisture	\$39,252.00	Carpentry	\$8,792.00
Doors & Windows	\$783,344.00	Thermal/Moisture	\$294,954.00
Finishes	\$1,526,672.00	Doors & Windows	\$8,954.00
Specialties	\$123,140.00	Finishes	\$132,653.00
Equipment	\$51,862.00	Specialties	\$11,696.00
Furnishings	\$28,400.00	Furnishings	\$1,141.00
Conveying/Hoisting	\$61,566.00	Conveying/Hoisting	\$433,686.00
MEP	\$5,000,100.00	MEP	\$75,620.00
Contingency and Fee	\$212,250.00	Contingency and Fee	\$35,993.00
Total	\$9,720,090.00	Total	\$1,998,973.00

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Depth Research: Commissioning Vs. Retro-Commissioning

Steps used to complete Industry Research

Overview

Survey

Survey Results

Research

- Process Steps
- Cost/Payback
- Benefits

Summary

- Create Survey for Industry Personnel
- Summarize Survey Results
- Research of Published Industry Information
- Summarize Research and Develop Recommendations for use

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Depth Research: Commissioning Vs. Retro-Commissioning

Overview

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Survey Results

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Summary

- A survey was created in order to obtain feedback from Industry Personnel on the use of Commissioning and Retro-Commissioning.
- In addition to the survey phone interviews were conducted with Industry contacts in order to obtain more detailed feedback.
- Industry Personnel Surveyed include Owners, Contractors, and Commissioning Agents.

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Depth Research: Commissioning Vs. Retro-Commissioning

What was the result of the Survey?

Overview

Survey

Survey Results

Research

- Process Steps
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Summary

Owners – Major benefits include reduced operations and maintenance costs.

Contractors – Reduced call backs for warranty and comfort issues.

Commissioning Agents – Stress early introduction of commissioning process for project success.

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Depth Research: Commissioning Vs. Retro-Commissioning

Overview

Survey

Survey Results

Research

- Process Steps
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Summary

Issues that were investigated in this section include:

- Differences in process steps
- Cost and Payback Period
- Benefits
- Summary of Research

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Depth Research: Commissioning Vs. Retro-Commissioning

Overview

Survey

Survey Results

Research

- Process Steps
- Cost/Payback
- Benefits

Summary

New construction commissioning	Retro-commissioning building equipment
1. Commissioning or pre-design phase 01 Develop commissioning objectives 02 Develop design phase commissioning requirements 03 Develop the design team 2. Design phase 04 Develop commissioning plan 05 Develop commissioning specifications for bid documents 06 Assign job to contractor 3. Construction phase 07 Conduct and review documentation 08 Conduct commissioning testing meeting and buildout plan 09 Develop pre-bid checklist 10 Conduct pre-bid or pre-construction checks to ensure readiness for successful testing during acceptance 4. Acceptance phase 11 Execute functional tests and diagnostics 12 Fix deficiencies 13 Review and monitor as needed 14 Verify system energy 15 Develop commissioning plan/schedule 16 Obtain approval from owner	1. Planning phase 01 Develop commissioning objectives 02 Develop commissioning plan 03 Review available documentation and obtain historical utility data 04 Develop retro-commissioning plan 2. Design phase activities 3. Investigation phase 05 Perform site assessment 06 Review and develop testing documentation 07 Develop and review diagnostic checklist and test plan 08 Analyze results 09 Develop and review functional test plan 10 Develop Master List of deficiencies and improvements 11 Develop test load/efficiency requirements for implementation 4. Implementation phase 12 Implement repairs and improvements 13 Review and monitor for results 14 Verify system energy savings 15 Develop retro-commissioning plan/schedule 16 Obtain approval from owner

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Depth Research: Commissioning Vs. Retro-Commissioning

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Summary

Key factors that can have a direct impact on commissioning costs:

- When the commissioning process starts (during design, construction, or post construction)
- The number and complexity of systems
- The level of detail required during the commissioning process (does it include documenting and witnessing all equipment start-up, verification tests, spot checking the balancing report, etc.)
- Deliverables (design intent document, number of design reviews, commissioning plan, O&M manual review, final report, etc.)
- Allocation of costs (will the budget allow for increased design fee, increased contractor bid, training time for O&M personnel, the commissioning consultant's fee, etc.)
- Type of project (design-build, plan and spec, retrofit, etc.)

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Depth Research: Commissioning Vs. Retro-Commissioning

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Summary

Commissioning of new buildings costs
Average cost - \$1 per SF
Average Payback period - 4.8 years

Retro-Commissioning of existing building equipment costs
Average cost - \$.05 - \$.43 per SF
Average Payback period - 2 - 4 years

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Depth Research: Commissioning Vs. Retro-Commissioning

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Summary

Benefits of Commissioning Buildings that factor into payback periods and return on investment include:

- Savings in energy cost and improved building performance
- Improved indoor air quality, comfort and increased productivity by building users
- Early detection of potential problems (the sooner problems are resolved, the less expensive they are to fix)
- Fewer change orders to the owner during construction
- Precise tune-up and operation of systems and applicable controls
- Better building documentation
- Trained building operators and maintenance staff
- Shortened occupancy-transition period
- Reduced maintenance, operation, and equipment replacement cost

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Depth Research: Commissioning Vs. Retro-Commissioning

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The decision to implement the commissioning or retro-commissioning processes involves several variables:

- Intended use of building
- Complexity of systems used in the building
 - Owner's goals
- Availability of commissioning personnel

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Depth Research: Commissioning Vs. Retro-Commissioning

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Lancaster General Hospital 5th and 6th Floor Fit-Out Project:

- Complex systems
- Congested ceiling space
- Non-profit owner
- On-site operations and maintenance personnel



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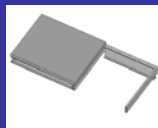
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Breadth 1: Cast-In-Place Vs. Pre-Cast Floor System

Overview
Calculations
Supplier
Cost Analysis
Schedule Reduction
Constructability Review

Lancaster General Hospital Cardiac Elevator Addition

- 1,600 SF Elevator shaft and lobbies on floors 1-9
- Cast-in-place concrete on composite metal decking
- Structural steel frame
- Analysis of floor system for floors 5-8
 - Calculations to determine pre-cast plank size
 - Supplier availability
 - Cost analysis
 - Schedule Reduction
- Constructability Review



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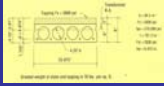
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Pre-Cast Concrete Plank Floor Decking:

- T6-E23 Pre-Cast Concrete Plank
- 6" x 24" Plank w/ 2" topping slab
- 14' Span
- Live Load required – 150 lbs. sq. ft.
- Load Allowable – 294 lbs. sq. ft.



Sample Designation	1 Day Compressive Strength, % of 28 Day	28 Day Compressive Strength, % of 28 Day	Concrete Slab Thickness, in.	Concrete Slab Density, lb/cu ft	SAMPLE SPAN IN FEET														4 Day Modulus of Elasticity, % of 28 Day			
					12	13	14	15	16	17	18	19	20	21	22	23	24	25		26	27	28
T6-E23	3,714	445	87.7		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	12,443
T6-E24	3,712	388	87.7		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	11,488
T6-E25	3,714	250	88.6	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	294	11,540
T6-E27	3,336	175	82.2	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	289	11,138

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Lancaster General Hospital Cardiac Elevator Addition

Strescon Industries, Inc.
Langhorne, PA
Flexicore pre-cast planks
Located outside of Philadelphia; about 2 hours from Lancaster



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Construction Costs of Original Design Cast-In-Place Concrete Slab

3 1/2" 4000psi Lightweight Concrete on 2" 20Ga. Composite Metal Decking

- Reinforcing Wire Mesh – 1080 SF \$428.00
- Slab on Deck Accessories – 36 Drilled Dowels \$796.00
- Cast-In-Place Concrete – 15 cuyd \$1,812.00
- Place/Finish Concrete – 1080 SF \$3,526.00
- Composite Metal Decking – 1080 SF \$2,528.00
- Structural Steel Beam – W12X16 64 LF \$1,440.00
- Total Cost - \$10,530.00**

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Breadth 1: Cast-In-Place Vs. Pre-Cast Floor System

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Construction Costs of Proposed Design Pre-Cast Concrete Planks

6" X 24" Pre-Cast Concrete Planks w/ 2" 4000psi Lightweight Topping Slab

- Pre-Cast Planks – 1080 SF \$7816.00
- Cast-In-Place Concrete – 7 cuyd \$800.00
- Place/Finish Topping Slab – 1080 SF \$3,526.00
- Total Cost - \$12,142.00**

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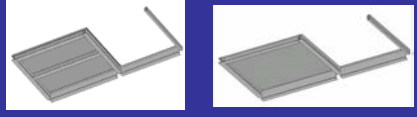
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Breadth 1: Cast-In-Place Vs. Pre-Cast Floor System

Overview
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Construction Cost Comparison

- Cast-In-Place Floor System – \$10,530.00
- Pre-Cast Floor System – \$12,142.00
- Total Savings – (\$1,612.00)**




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Breadth 1: Cast-In-Place Vs. Pre-Cast Floor System

Overview
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Original Schedule 5 Days



New Schedule 3 Days

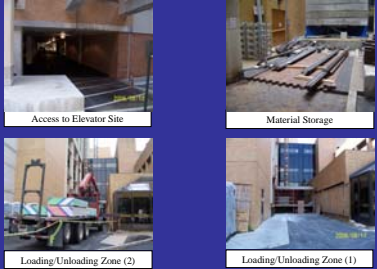


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Breadth 2: Mechanical Connections at ICRA Partitions

Overview
Requirements
Standard Connection Types
Cost and Schedule Impact

Reducing rework at ICRA Partitions by Selection of Mechanical Connection

- Identify requirements for ICRA partitions
- Identify standard connection types
- Evaluate impact on project cost and schedule

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Breadth 2: Mechanical Connections at ICRA Partitions

Overview
Requirements
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Cost and Schedule Impact

Based on Infection Control Risk Assessment Guidelines the Lancaster General Hospital 5th and 6th Floor Project is a Class V which requires:


- Isolate HVAC system within work areas to prevent contamination of duct system.
- Block off and seal HVAC registers, grills and any openings in ductwork to remain
- Maintain negative pressure within work site utilizing HEPA equipped air filtration units.

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Lancaster General Hospital
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Breadth 2: Mechanical Connections at ICRA Partitions

Overview
Requirements
Standard Connection Types
Cost and Schedule Impact

Adds un-planned cost to the project

Additional Cost of Rework		
Description	Hours	Total
Laborer	4	\$500
Laborer	4	\$500
Contractor	4	\$700
Total Labor	12	\$1700
Misc. Material		\$500
Total		\$1,150

Impacts on schedule could cause problems
Both of which are AVOIDABLE!

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Summary and Conclusions



Depth Research: Commissioning Vs. Retro-Commissioning

- Differences in Steps between Commissioning and Retro-Commissioning

Breadth 1: Cast-In-Place Vs. Pre-Cast

Breadth 2: Mechanical Connections at ICRA Partitions

- Recommendations for Use

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Summary and Conclusions

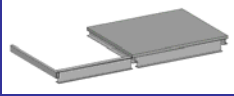

Depth Research: Commissioning Vs. Retro-Commissioning

Proposed Pre-Cast Concrete Floor Plank System

- Increased Cost
- Decreased Schedule
- Not enough to offset costs

Breadth 1: Cast-In-Place Vs. Pre-Cast

Breadth 2: Mechanical Connections at ICRA Partitions

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Lancaster General Hospital
5th and 6th Floor Fit-Out & Cardiac Elevator

Summary and Conclusions


Depth Research: Commissioning Vs. Retro-Commissioning

Proper Planning and Installation of Mechanical Connections

- Eliminate Rework
- Reduce Cost and Schedule Impacts

Breadth 1: Cast-In-Place Vs. Pre-Cast

Breadth 2: Mechanical Connections at ICRA Partitions



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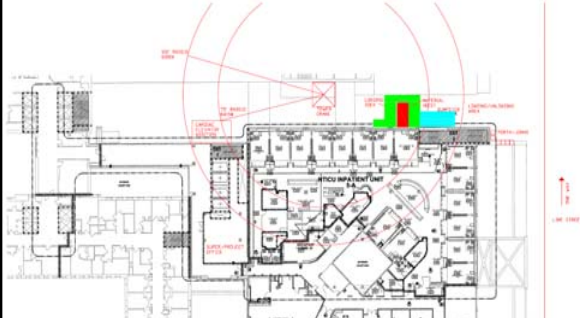
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Questions & Comments




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Tower Crane

CRANE OPERATION LOAD CHART		
Distance (ft)	Troch (ft)	Radius (ft)
85.0		1225 ft.
83.2		1193 ft.
81.4		1161 ft.
79.6		1129 ft.
77.8		1097 ft.
76.0		1065 ft.
74.2		1033 ft.
72.4		1001 ft.
70.6		969 ft.
68.8		937 ft.
67.0		905 ft.
65.2		873 ft.
63.4		841 ft.
61.6		809 ft.
59.8		777 ft.
58.0		745 ft.
56.2		713 ft.
54.4		681 ft.
52.6		649 ft.
50.8		617 ft.
49.0		585 ft.
47.2		553 ft.
45.4		521 ft.
43.6		489 ft.
41.8		457 ft.
40.0		425 ft.

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