The Mary J. Drexel Home
Assisted Living Addition

Bala Cynwyd, PA

Analysis #1

Project Schedule Sequencing

Analysis #2

Prefabricated MEP Corridor Racks

Analysis #3

Green Roof Implementation

Structural Breadth

Acoustical Breadth

Analysis #4

Alternate Delivery Method

Penn State AE Senior Capstone Project

Gjon Tomaj – Construction Management Option

Advisor: Dr. Ed Gannon

Gjon Tomaj
Construction Management Option

Project Summary

The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

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- Rack Design
- Cost & Schedule Impacts

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- Structural Breadth
- Cost & Schedule Impacts

Final Recommendations
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Project Location

Bala Cynwd, Pennsylvania

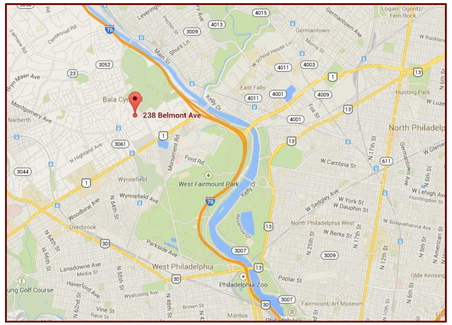

Image Courtesy of Google Maps

Building Information

Size of West Wing: 34,100 GSF
Size of East Wing: 40,600 GSF
 # Stories Above Grade: Two
Structure: Load-Bearing Metal Wall Panels
Size of Existing Mansion: 21,000 GSF

Construction Information

Cost: $14.6 million
Duration: 11/2012 – 12/2013
Delivery: Design-Bid-Build* (*MEP Systems = Design-Build)
Contract Type: GMP

Owner

Liberty Lutheran

Client Expectations

Low Cost
High Quality
Construction Completion by February 2014

Project Purpose

Continue senior care excellence started by MJD 150 years ago
Cultural Change Movement

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Construction Management Option

Project Sequencing

The Mary J. Drexel Home
Assisted Living Addition

Bala Cynwyd, PA

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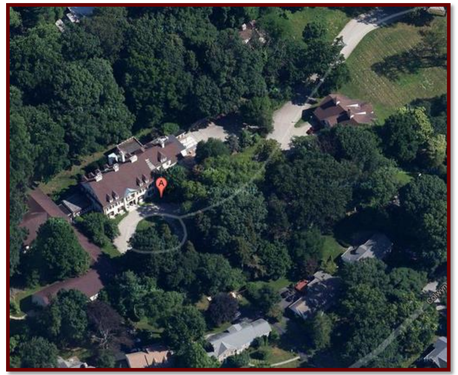

Image Courtesy of Google Maps

Problem Identification

No Urgency Placed on Completing Project Faster
Scheduling Gaps
Limited Activity Overlap (Majority Start-to-Finish Activities)

Background Information

Emphasis on Cost & Quality
Simple Cost Effective Fix

General Conditions Overview

Total Cost: $1,596,477
50% of GC Costs Affected by Schedule Changes: $798,384

Analysis Goals

Two Week Reduction
Savings on General Conditions: $28,514

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Construction Management Option

Project Sequencing

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Bala Cynwyd, PA

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A1280	SOD Poured - 2nd Floor	0	20-Mar-13		
A1290	Infinity Bearing Walls - 2nd Floor	7	29-Mar-13	08-Apr-13	
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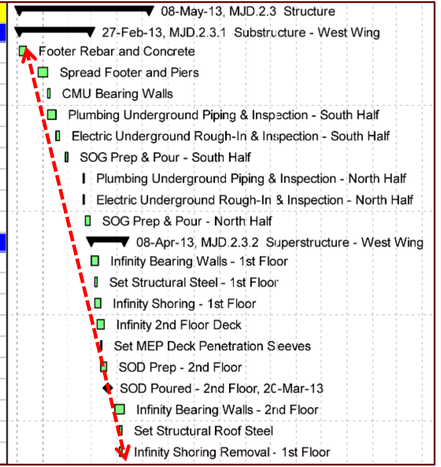

Example: Original Structure Phase Schedule

- Substructure: 60 Days
- Superstructure: 28 Days
- Majority Start-to-Finish Activities

Re-Sequencing Process

1. Remove Schedule Gaps
2. Re-Sequence Activities
3. Overlap Activities

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Construction Management Option

Project Sequencing

The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

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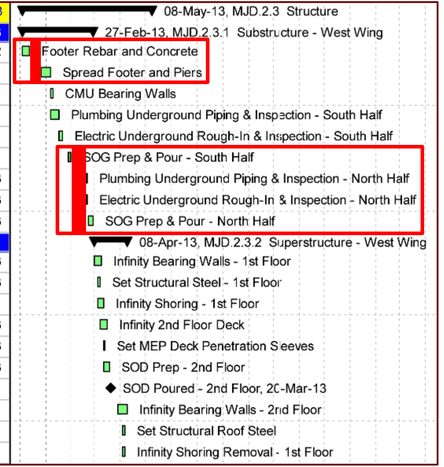

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Majority Start-to-Finish Activities

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Gjon Tomaj
Construction Management Option

Project Sequencing

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Bala Cynwyd, PA

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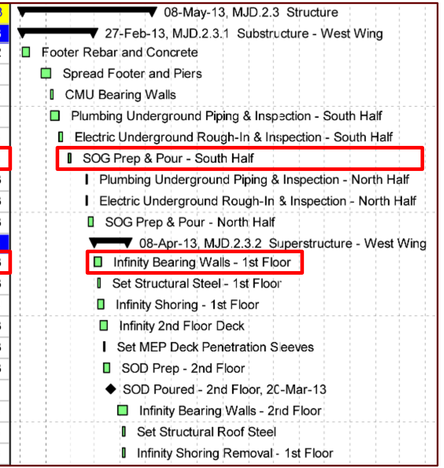

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Gjon Tomaj
Construction Management Option

Project Sequencing

The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

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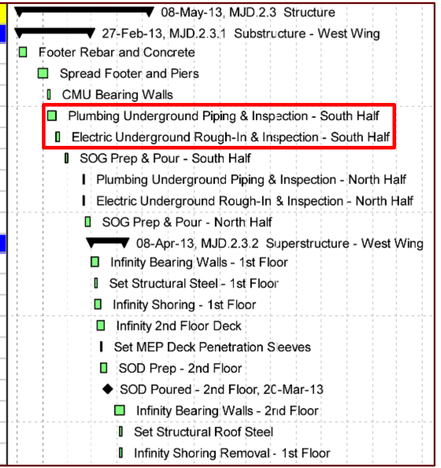

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Construction Management Option

Project Sequencing

The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

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MJD_-1.2.3	Structure	84	04-Dec-12	02-Apr-13	02-Apr-13, MJD_-1.2.3 Structure
MJD_-1.2.3.1	Substructure - West Wing	30	04-Dec-12	16-Jan-13	16-Jan-13, MJD_-1.2.3.1 Substructure - West Wing
A1130	Footer Rebar and Concrete	7	04-Dec-12	12-Dec-12	Footer Rebar and Concrete
A1140	Spread Footer and Piers	7	13-Dec-12	21-Dec-12	Spread Footer and Piers
A1150	CMU Bearing Walls	7	18-Dec-12	27-Dec-12	CMU Bearing Walls
A1160	Plumbing Underground Piping & Inspection - South Ha	8	20-Dec-12	02-Jan-13	Plumbing Underground Piping & Inspection - South Half
A1170	Electric Underground Rough-In & Inspection - South H	3	20-Dec-12	24-Dec-12	Electric Underground Rough-In & Inspection - South Half
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A1210	SOG Prep & Pour - North Half	5	10-Jan-13	16-Jan-13	SOG Prep & Pour - North Half
MJD_-1.2.3.2	Superstructure - West Wing	28	09-Jan-13	15-Feb-13	15-Feb-13, MJD_-1.2.3.2 Superstructure - West Wing
A1220	Infinity Bearing Walls - 1st Floor (South)	4	09-Jan-13	14-Jan-13	Infinity Bearing Walls - 1st Floor (South)
A1225	Infinity Bearing Walls - 1st Floor (North)	4	16-Jan-13	21-Jan-13	Infinity Bearing Walls - 1st Floor (North)
A1230	Set Structural Steel - 1st Floor	3	16-Jan-13	18-Jan-13	Set Structural Steel - 1st Floor
A1240	Infinity Shoring - 1st Floor	5	16-Jan-13	22-Jan-13	Infinity Shoring - 1st Floor
A1250	Infinity 2nd Floor Deck	7	16-Jan-13	24-Jan-13	Infinity 2nd Floor Deck
A1260	Set MEP Deck Penetration Sleeves	3	25-Jan-13	29-Jan-13	Set MEP Deck Penetration Sleeves
A1270	SOD Prep - 2nd Floor	7	29-Jan-13	06-Feb-13	SOD Prep - 2nd Floor
A1280	SOD Poured - 2nd Floor	0	06-Feb-13		SOD Poured - 2nd Floor, 06-Feb-13
A1290	Infinity Bearing Walls - 2nd Floor	7	07-Feb-13	15-Feb-13	Infinity Bearing Walls - 2nd Floor
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Revised Structure Phase Schedule

Substructure: 30 Days

Superstructure: 28 Days

Original Substantial Completion	12/14/13
Revised Substantial Completion	11/25/13
Revised Duration Results	**4 weeks**

Original Activity Durations not changed

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Construction Management Option

Project Sequencing

The Mary J. Drexel Home
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General Conditions 3.6% Savings

General Conditions Savings Breakdown

Original Monthly Items	$798,384
Revised Monthly Items	$741,357
Total Savings	**$57,027**

Analysis Implications

Cost ↓ Schedule ↓

Quality ↑ Safety –

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Construction Management Option

MEP Corridor Racks

The Mary J. Drexel Home
Assisted Living Addition

Bala Cynwyd, PA

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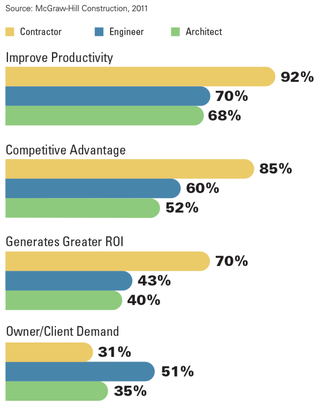
Key Drivers for Prefab



Problem Identification

- Limited Jobsite Access
- Unforeseen Delays
- MEP Trades forced to increase manpower to meet schedule

Background Information

- MEP Systems: Design-Build
- Prefabrication due to identical corridor layouts

Analysis Goals

- Determine Feasibility
- Reduce Schedule
- Reduce Site Congestion
- Potential Cost Savings

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Construction Management Option

MEP Corridor Racks

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Prefabrication Warehouse Location

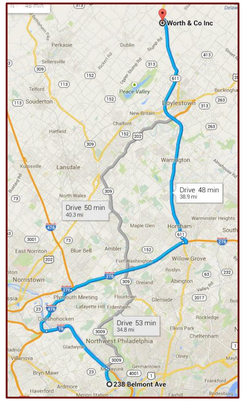
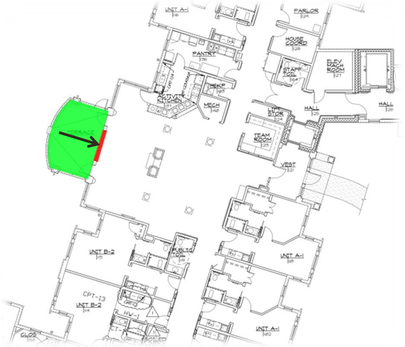


Image Courtesy of Google Maps

Distance:
39 Miles

Area of Implementation

Logistics



West Wing

East Wing

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MEP Corridor Racks

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Design Criteria

Floor to Floor Ht: 11’-6”

Floor to Ceiling Ht: 8’-6”

Corridor Rack:

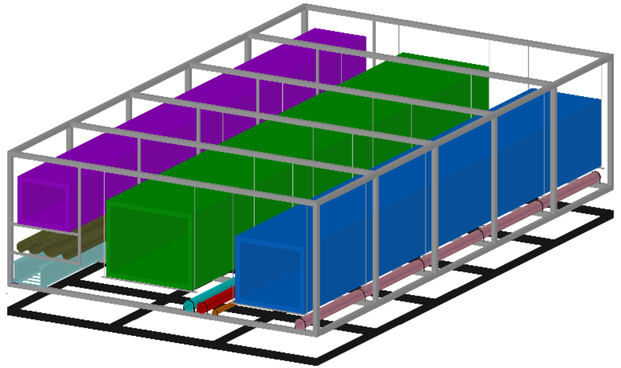
Width: 6’ max

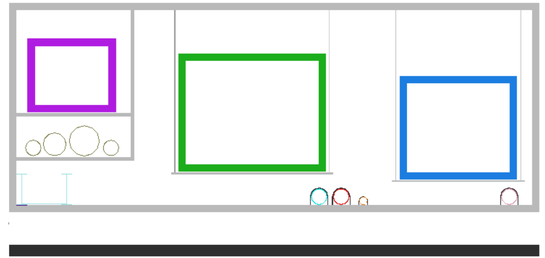
Height: 2’-6” (6” clearance)

Length: 10’*

*Lengths be adjusted to different lengths if necessary (under professional design)

Sample Design





- Supply Air Duct
- Return Air Duct
- Outside Air Duct
- Domestic Cold Water Supply
- Domestic Hot Water Supply
- Domestic Hot Water Recirculate
- Sprinkler Piping
- Electrical Conduit Raceway
- Cable Tray
- Acoustical Ceiling Grid

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Construction Management Option

MEP Corridor Racks

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Cost Savings

GC Cost Savings	**$14,257**
Labor Savings/Day	$3,340*
*Assume 5 laborers per each trade	
Total Potential Labor Savings	**$20,875**

Schedule Savings

Critical Path

Original Corridor Work Duration	25 days
Prefab Corridor Rack Duration	18.75 days
Total Reduction	**6.25 days**

25% reduction in labor duration

1.5 Days for each trade per floor

Total Duration Reduction: 6.25 Days (approx. 1 Week)

Analysis Implications

Cost ↓ Schedule ↓

Quality ↑ Safety ↑

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Construction Management Option

Green Roof Implementation

The Mary J. Drexel Home Assisted Living Addition

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Hydrotech® Garden Tray Module

Image Courtesy of Hydrotech USA

Problem Identification

Very few sustainable VE efforts

Decisions made only to lower initial capital costs

Background Information

Concrete Roof Deck to EPDM Roof

No LEED accreditation

Analysis Goals

Increase quality of project

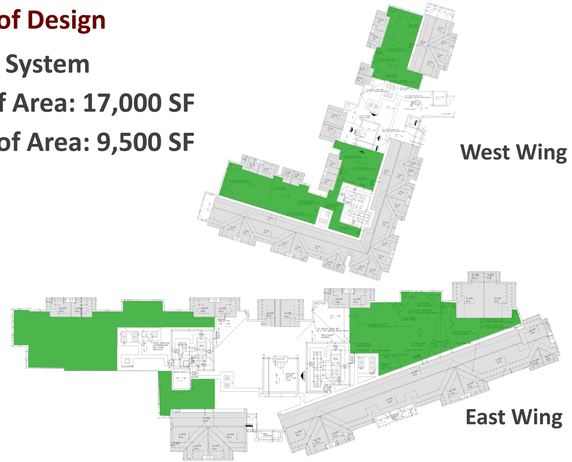
Provide cost savings over life of project

Green Roof Design

Extensive System

Total Roof Area: 17,000 SF

Green Roof Area: 9,500 SF



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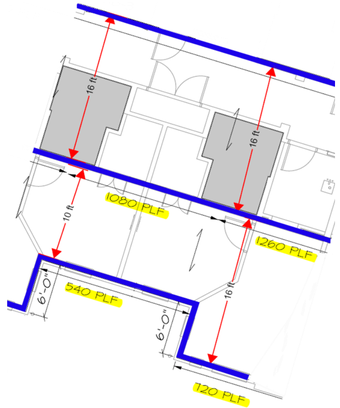
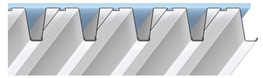
Structural Analysis

Description	EPDM	Green Roof
Dead Load	39 psf	68 psf
Roof Live Load	20 psf	20 psf
Snow Load	23.1 psf	23.1 psf
Load Difference	-	**29 psf**



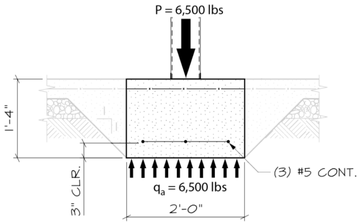
Results

Existing Roof Deck ✓



Metal Wall Panels ✓

Existing Foundation ✓



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Schedule Savings

Original EPDM Roof	15 Days (per wing)

Green Roof 9,500 SF	15 days
EPDM 7,500 SF	7 days
New Duration	**15 Days (per wing)**

Cost Analysis

EPMD Lifespan:
18 Years

Green Roof Lifespan:
39+ years

Tax Credit: 25% of cost for 6 years

Years	EPDM	Green Roof
0	$279,870	$378,272
1	$0	-$20,700
2	$0	-$20,700
3	$0	-$20,700
4	$0	-$20,700
5	$0	-$20,700
6-17	$0	$0
18	$279,870	$123,143
Total	**$559,740**	**$397,915**
Cost Difference	$161,825	
Initial Cost Diff.	$119,102	
TOTAL SAVINGS	**$42,723**	

Analysis Implications

Cost ↑ Schedule —

Quality ↑ Safety —

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Savings Summary

Analysis #1
$57,027

Analysis #2
$14,257

Analysis #3
$42,723 (after 18 years)

TOTAL SAVINGS
$71,284 (not incl. Analysis #3 savings)
$114,007

Analysis #1: Project Sequencing

- Cost Savings: $57,027
- Schedule Savings: 4 weeks
- 3.6% Reduction in General Condition Costs

Analysis #2: MEP Corridor Racks

- Cost Savings: $14,257 + Labor Savings
- Schedule Savings: 6.25 Days
- Reduced Site Congestion & Increased Laborer Safety

Analysis #3: Green Roof Implementation

- Initial Cost Incurred: $119,102
- Cost Savings after first replacement: $42,723
- Increased Quality

- Existing Structural Elements Acceptable
- Better Acoustical Performance for Elderly Residents

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Wohlsen Construction Project Team

Worth and Company

My Family and Friends

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Questions?

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Better Acoustical Performance for Elderly Residents

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Appendix – Project Sequencing

The Mary J. Drexel Home Assisted Living Addition

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General Conditions Estimate
Project Duration - 14 Months - 56 Weeks

Description	Quantity	Unit	Cost	Amount
Project Management Team				**$776,250**
Project Executive (10%)	14	Mo.	$2,050.00	$28,700
Field Operations Manager (10%)	14	Mo.	$1,700.00	$23,800
Project Manager	14	Mo.	$16,000.00	$224,000
Superintendent	14	Mo.	$15,500.00	$217,000
Project Engineer	14	Mo.	$11,200.00	$156,800
Project Assistant (50%)	14	Mo.	$4,000.00	$56,000
Accountant	250	Hr.	$55.00	$13,750
Contract Administrator	100	Hr.	$80.00	$8,000
Safety Manager	165	Hr.	$80.00	$13,200
Laborer (50%)	14	Mo.	$2,500.00	$35,000
Site Conditions				**$95,455**
Temporary Power	1	LS	$7,500.00	$7,500
Temporary Fence	500	LF	$10.00	$5,000
Temporary Phone	14	Mo.	$750.00	$10,500
Temporary Toilets (4)	14	Mo.	$600.00	$8,400
Drinking Water	14	Mo.	$150.00	$2,100
Temporary Stair & Rails	1500	LF	$10.00	$15,000
Dumpsters (2)	14	Mo.	$2,500.00	$35,000
Signage	100	SF	$26.50	$2,650
Small Tools & Equip	14609579	LS	0.05%	$7,305
Job Photos	4	Set	$500.00	$2,000
Insurance				**$200,151**
Builder's Risk	14609579	($)	0.15%	$21,914
General Liability	14609579	($)	0.75%	$109,572
MEP Liability Insurance (based on GMP)	14609579	($)	0.47%	$68,665
Field Operations				**$86,334**
Field Office/Trailer - use existing facilities	0	Mo.	$0.00	$0
Storage Trailers - use existing facilities	0	Mo.	$0.00	$0
Final Cleaning	76,000	SF	$0.50	$38,000
Computer Equipment	1	LS	$3,500.00	$3,500
Job Office Supplies	14	Mo.	$77.40	$1,084
Drawings & Blueprints	65	Ea.	$150.00	$9,750
Safety Equipment	1	LS	$3,000.00	$3,000
Protect New Work	76,000	SF	$0.25	$19,000
Layout (Own Forces)	3	Wk	$4,000.00	$12,000
Contingency	14609579	($)	3.00%	**$438,287**
			TOTAL	**$1,596,477**

General Conditions Estimate - *Monthly Paid Line Items*
Project Duration - 14 Months - 56 Weeks

Description	Quantity	Unit	Cost	Amount
Project Management Team				**$741,300**
Project Executive (10%)	14	Mo.	$2,050.00	$28,700
Field Operations Manager (10%)	14	Mo.	$1,700.00	$23,800
Project Manager	14	Mo.	$16,000.00	$224,000
Superintendent	14	Mo.	$15,500.00	$217,000
Project Engineer	14	Mo.	$11,200.00	$156,800
Project Assistant (50%)	14	Mo.	$4,000.00	$56,000
Laborer (50%)	14	Mo.	$2,500.00	$35,000
Site Conditions				**$56,000**
Temporary Phone	14	Mo.	$750.00	$10,500
Temporary Toilets (4)	14	Mo.	$600.00	$8,400
Drinking Water	14	Mo.	$150.00	$2,100
Dumpsters (2)	14	Mo.	$2,500.00	$35,000
Field Operations				**$1,084**
Field Office/Trailer - use existing facilities	0	Mo.	$0.00	$0
Storage Trailers - use existing facilities	0	Mo.	$0.00	$0
Job Office Supplies	14	Mo.	$77.40	$1,084
			TOTAL	**$798,384**

General Conditions – *Potential Cost Savings*

Description	Quantity	Unit	Cost/Unit	Amount
Project Management Team				**$52,950**
Project Executive (10%)	1	Mo.	$2,050.00	$2,050
Field Operations Manager (10%)	1	Mo.	$1,700.00	$1,700
Project Manager	1	Mo.	$16,000.00	$16,000
Superintendent	1	Mo.	$15,500.00	$15,500
Project Engineer	1	Mo.	$11,200.00	$11,200
Project Assistant (50%)	1	Mo.	$4,000.00	$4,000
Laborer (50%)	1	Mo.	$2,500.00	$2,500
Site Conditions				**$4,000**
Temporary Phone	1	Mo.	$750.00	$750
Temporary Toilets (4)	1	Mo.	$600.00	$600
Drinking Water	1	Mo.	$150.00	$150
Dumpsters (2)	1	Mo.	$2,500.00	$2,500
Field Operations				**$77**
Field Office/Trailer - use existing facilities	0	Mo.	$0.00	$0
Storage Trailers - use existing facilities	0	Mo.	$0.00	$0
Job Office Supplies	1	Mo.	$77.40	$77
			TOTAL	**$57,027**

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Appendix – MEP Corridor Racks

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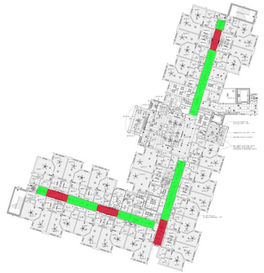
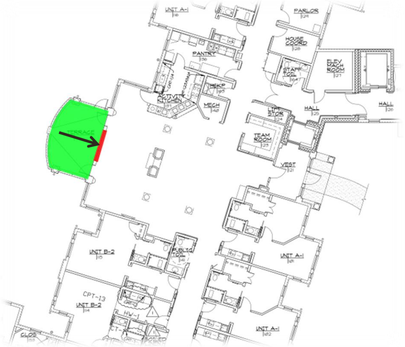


Labor Rates On-Site vs Off-Site (Prefabrication)					
Trade	Hourly Wages		# of Laborers	Daily Costs	
	On-Site ($/hr)	Off-Site ($/hr)		On-Site ($/hr)	Off-Site ($/hr)
Mechanical	$83.55	$62.66	5	$3,342.00	$2,506.50
Electrical	$79.85	$59.89	5	$3,194.00	$2,395.50
Plumbing	$86.90	$65.18	5	$3,476.00	$2,607.00
Fire Protection	$83.70	$62.78	5	$3,348.00	$2,511.00
			Total Daily Labor Costs	$13,360.00	$10,020.00
				Total Labor Savings / Day	**$3,340.00**
				Total Labor Savings (6.25 days)	**$20,875.00**

Activity	Original Total Work (d)	Original Corridor Work Duration (d)	Prefab Corridor Rack Duration (d)	Total Corridor Reduction (d)
Mechanical	20	6	4.5	1.5
Electrical	20	6	4.5	1.5
Plumbing	25	8	6	2
Fire Protection	15	5	3.75	1.25
TOTAL		25	18.75	**6.25**



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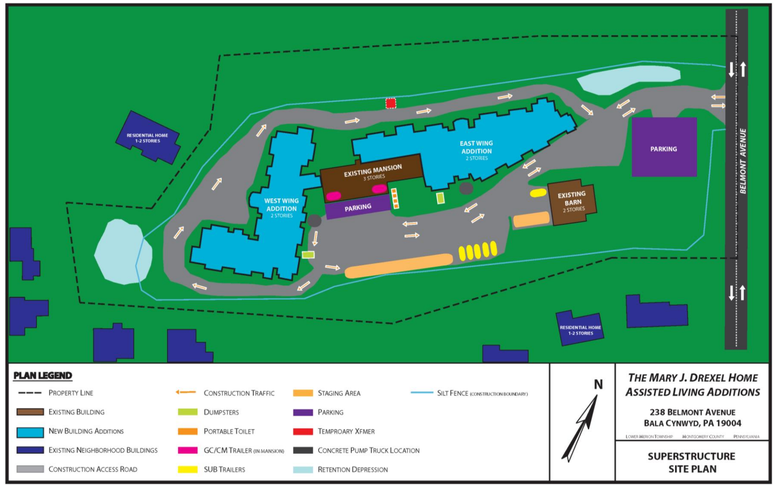

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Years	EPDM	Green Roof
0	$279,870	$378,272
1	$0	-$20,700
2	$0	-$20,700
3	$0	-$20,700
4	$0	-$20,700
5	$0	-$20,700
6-17	$0	$0
18	$279,870	$123,143
Total	**$559,740**	**$397,915**
Cost Difference	$161,825	
Initial Cost Diff.	$119,102	
TOTAL SAVINGS	**$42,723**	

Initial Roof System Cost			
	EPDM	Green Roof	Total New System
	17,000 SF	9,500 SF	(Green Roof=9500 SF) + (EPDM=7500 SF)
Total	$279,870	$275,500	$398,972
$ / SF	$16.46	$29.00	$23.47
Cost Difference			$119,102

Description	EPDM Roof	Hydrotech® GT15™ Module
4-½" 18 GA Metal Deck	5 psf	5 psf
Avg. 10" Rigid Insulation	5 psf	5 psf
MEP + Fire Protection	15 psf	15 psf
Ceiling	4 psf	4 psf
Miscellaneous	10 psf	10 psf
4" Garden Tray GT15™	-	29 psf
Total Dead Load	**39 psf**	**68 psf**
Total Roof Live Load	**20 psf**	**20 psf**
Total Snow Load	**23.1 psf**	**23.1 psf**

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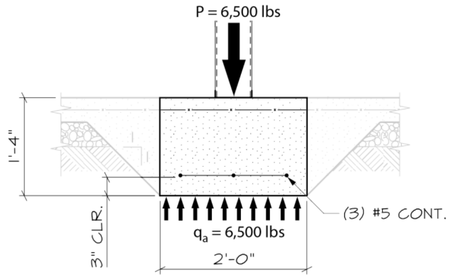

2000 Series (2nd Floor Panels)						
Wall Type	TL (plf)	New TL (plf)	Stud Spacing (in)	Interior / Exterior	Typ Stud Load (lbs)	Capacity (lbs)
W1	1050	1514	16	Interior	2019	3145
W2	1290	1522	16	Interior	2029	3145
W3	720	952	16	Exterior	1269	1885
W4	540	772	16	Exterior	1029	1885
W5	1350	1814	16	Interior	2419	3145
W6	720	952	16	Exterior	1269	1885
W7	440	904	16	Interior	1205	3145

1000 Series (1st Floor Panels)						
Wall Type	TL (plf)	New TL (plf)	Stud Spacing (in)	Interior / Exterior	Typ Stud Load (lbs)	Capacity (lbs)
W1	3050	3514	16	Interior	4685	5355
W2	3590	3967	16	Interior	5289	5355
W3	2010	2242	16	Exterior	2989	4105
W4	1440	1672	16	Exterior	2229	2730
W5	4300	4764	16	Interior	6352	6800
W6	2350	2582	16	Exterior	3443	4105
W7	1380	1844	16	Interior	2459	3145

Deck Conditions: Double Span @ 16'-0" | 18 Gage | Weight = 4.20 psf

Strength and Deflection are the two conditions must be met in order for the current deck to be substantial enough for the additional load by the green roof system.

- Strength (Max superimposed factored LRFD dead + live load):
  - Allowable total (psf) ≥ $W_{TOTAL\ (factored)}$ (psf)
    - Allowable total = 138 psf
    - W_{TOTAL} = **125 psf** (calculated earlier in total load)
    - 138 psf ≥ 125 psf. ✓

Therefore, the addition of the green roof meets the strength limitation of the current roof deck.

- Deflection (Max. superimposed unfactored LRFD dead + live load):
  - Load causing deflection (psf) ≥ $W_{TOTAL\ (unfactored)}$
    - Load causing deflection = 138 psf
    - W_{TOTAL} = 68 psf + 20 psf + 23.1 psf = **111.1 psf**
    - 138 psf ≥ 111.1 psf. ✓

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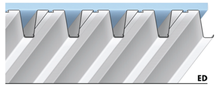


ED600	16	4.63	2.16	1.19	1.18	1512	2803	
	14	5.80	2.30	1.51	1.51	2343	4145	
ED750	20	3.14	2.84	0.98	0.99	572	1139	
	18	4.20	3.00	1.33	1.45	963	1883	
	16	5.29	5.21	1.96	1.81	1486	2866	
	14	6.57	6.50	2.48	2.49	2218	4243	
	18	4.70	7.46	2.17	2.07	925	1889	
	16	5.87	9.85	2.92	2.76	1437	2952	
	14	7.36	12.29	3.58	3.59	2158	4266	
	18	5.20	12.36	2.88	2.64	899	1999	
	16	6.50	16.28	3.77	3.67	1391	2882	
	14	8.11	20.34	4.80	4.80	2099	4269	

*Minimum end and interior support bearing lengths (see Note 5 below):
End = 4"
Interior = 6"

Wideck ED & EDA EpiGrip® Hanger Safe Load Hanging Capacities

1. EpiGrip Hangers carry 100 pounds safe load hanging capacities.
2. Deck shall be designed to carry these additional hanging loads.
3. Do not place hangers closer together than 5' on center along the same deck rib.
4. Contact EPIC for installation instructions.

WARNING: Failure to adhere to the above notes may cause hangers to pull from deck rib.

AE 404 used LRFD Design (refer to similar roof deck for LRFD loads) [Deep-Dek 4.5]

ED Load Table — Uniform Total Load (Dead and Live) in Pounds Per Square Foot

No. Spans	Deck Type	Gage	Span Length Center to Center of Supports (ft.) 10	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	30	32
1	ED324	20	96/77	67/45	49/28	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		18	147/160	102/93	75/59	65/52	58/47	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		16	190/142	133/82	97/52	85/46	76/41	69/29	—	—	—	—	—	—	—	—	—	—	—	—	—
		14	243/177	169/103	123/65	107/57	96/51	86/43	84/36	75/30	67/26	—	—	—	—	—	—	—	—	—	—
2	ED324	20	89/107	61/108	46/68	41/55	36/45	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		18	141/259	98/150	72/94	63/77	55/63	49/53	43/44	39/38	35/32	32/27	—	—	—	—	—	—	—	—	—
		16	180/341	131/198	96/124	84/101	74/83	65/69	58/58	52/50	47/43	43/35	39/29	—	—	—	—	—	—	—	—
		14	243/427	168/247	123/156	107/126	94/104	84/87	75/73	67/62	60/53	55/44	50/36	46/31	43/26	—	—	—	—	—	—
1	ED450	20	114/188	108/95	80/60	70/55	61/48	54/38	48/32	43/27	—	—	—	—	—	—	—	—	—	—	—
		18	193/255	181/163	123/95	107/77	94/63	84/53	75/44	67/38	60/32	55/27	—	—	—	—	—	—	—	—	—
		16	267/363	218/198	180/131	139/101	123/84	109/70	97/59	87/50	78/43	71/35	65/29	—	—	—	—	—	—	—	—
		14	363/427	276/247	227/156	176/126	155/104	137/87	122/73	110/62	99/53	90/44	82/36	75/31	69/26	—	—	—	—	—	—
2	ED452	20	93/449	70/280	57/184	51/153	51/130	54/91	49/77	44/65	40/56	36/48	33/39	30/32	—	—	—	—	—	—	—
		18	151/500	125/281	98/228	100/185	91/152	80/127	72/107	66/91	58/78	53/64	48/53	44/45	40/38	37/32	34/27	—	—	—	—
		16	229/500	191/413	156/300	136/244	119/201	106/169	94/143	85/120	76/103	69/85	63/70	58/59	53/50	49/42	45/36	42/31	39/27	—	—
		14	299/500	277/500	202/374	177/304	156/251	138/209	123/179	110/153	100/130	91/108	83/88	75/73	69/62	64/53	59/45	55/39	51/33	44/25	—
1	ED600	18	185/490	154/351	131/176	123/145	116/120	103/100	93/84	86/71	81/61	76/50	72/42	68/35	65/30	56/25	—	—	—	—	—
		16	283/500	247/374	205/228	192/192	179/158	156/132	139/111	125/94	113/81	102/67	93/55	85/46	78/39	72/33	67/28	—	—	—	—
		14	432/500	382/482	292/294	255/239	224/197	199/166	177/138	159/118	143/101	130/83	118/69	108/58	99/49	92/41	85/35	79/30	73/26	—	—
2	ED750	18	179/500	154/433	127/296	115/240	111/198	101/165	93/139	86/118	80/101	75/84	71/70	67/59	64/49	61/42	58/36	55/31	52/27	46/20	—
		16	272/500	237/500	196/390	185/317	174/261	164/218	155/183	146/156	139/134	132/110	125/91	118/76	105/64	97/55	89/47	83/40	77/35	67/26	—
		14	412/500	365/500	300/487	280/396	262/328	247/273	233/229	213/195	192/167	174/137	159/114	145/95	133/81	123/68	114/58	105/50	98/43	85/33	75/25

If higher loads or longer spans are required, contact EPIC Metals Corporation.

NOTES: 1. Loads are based on ASD Design.
2. Uniform load values listed on the left side of the box, 300/75 , are governed by stress and the values listed on the right side, 300/75 , are governed by deflection.

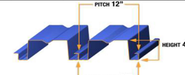
Metal Dek Group® a unit of CSi

DEEP-DEK® 4.5 ROOF (LRFD)
4-1/2" high x 12" pitch x 12" wide

SECTION PROPERTIES fy = 40 ksi

GAGE	Wd	Ip (per flute)	Sp	Sn	Rbe 4"	Rbe 5"	Rbe 6"	Rbi 5"	Rbi 6"	Va
20	3.14	2.962	1.099	1.181	900	977	1046	1622	1722	2347
18	4.15	3.954	1.560	1.611	1515	1639	1752	2700	2864	6429
16	5.23	4.902	2.005	2.039	2322	2586	2873	4100	4339	10233
14	6.53	6.215	2.531	2.531	3487	3753	3994	6118	6458	14726

similar data to ED450



LRFD Loads used to perform analysis of existing ED450 deck

Span	LRFD DESIGN Load Combinations	MAXIMUM SUPERIMPOSED UNIFORM LRFD LOADS, psf SINGLE SPAN GAGE 20	18	16	14	DOUBLE SPAN GAGE 20	18	16	14	TRIPLE SPAN GAGE 20	18	16	14
11'-0"	1.D+L (Strength)	160*	279*	400	400	122*	203*	309*	400*	139*	232*	352*	400*
	D+L (Deflection)	140	190	241	300	122	203	309	400	139	232	352	400
	L (Deflection)	96	130	164	204	122	203	309	400	139	232	309	385
12'-0"	1.D+L (Strength)	147*	247*	343	400	112*	186*	283*	400*	127*	212*	322*	400*
	D+L (Deflection)	107	146	184	230	112	186	283	400	127	212	322	400
	L (Deflection)	74	100	126	157	112	186	283	379	127	109	230	297
13'-0"	1.D+L (Strength)	135*	223*	294	372	103*	171*	261*	364*	117*	195*	297*	400*
	D+L (Deflection)	84	114	144	179	103	171	261	364	117	195	275	343
	L (Deflection)	58	79	99	124	103	171	259	280	111	143	187	233
14'-0"	1.D+L (Strength)	125*	197	253	319	95*	159*	242*	313*	109*	181*	276*	390*
	D+L (Deflection)	67	90	114	142	95	159	242	313	109	174	219	274
	L (Deflection)	46	63	79	99	95	152	191	239	89	119	150	187
15'-0"	1.D+L (Strength)	116*	171	220	277	89*	148*	217*	273*	101*	169*	257*	340*
	D+L (Deflection)	54	73	92	114	89	148	217	273	101	141	177	221
	L (Deflection)	38	51	65	81	89	123	156	194	72	97	122	152
16'-0"	1.D+L (Strength)	105	149	192	243	83*	139*	191*	239*	95*	155*	233*	299*
	D+L (Deflection)	44	59	75	93	83	139	187	233	86	115	145	181
	L (Deflection)	31	42	53	66	76	102	128	160	60	80	100	125
17'-0"	1.D+L (Strength)	95	132	170	214	73*	130*	169*	211*				
	D+L (Deflection)	36	49	61	77	78	123	155	193				
	L (Deflection)	26	35	44	55	64	85	107	133				

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Construction Management Option

Appendix – Green Roof

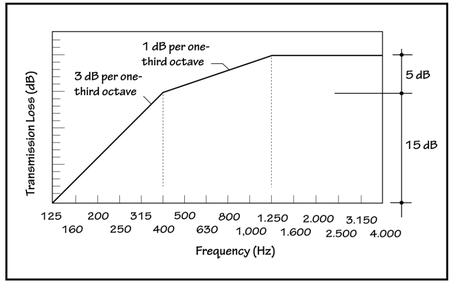
The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

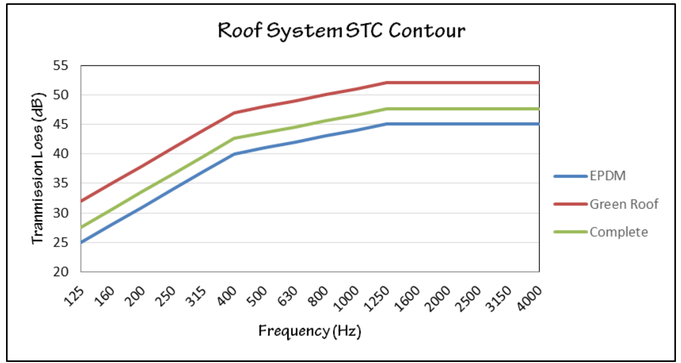
Project Summary
Analysis #1: Project Sequencing
- Sequencing Process
- Schedule Results
- Cost Results

Analysis #2: MEP Corridor Racks
- Feasibility
- Rack Design
- Cost & Schedule Impacts

Analysis #3: Implementation of Green Roof
- Structural Breadth
- Cost & Schedule Impacts

Final Recommendations
Acknowledgements





EPDM STC: 41 **Green Roof STC: 48**

Complete System STC: 44

Changes in STC Rating	Changes in Apparent Loudness
+/- 1 dB	Almost imperceptible
+/- 3 dB	Just Imperceptible
+/- 5 dB	Clearly noticeable
+/- 10 dB	Twice (or half) as loud

Gjon Tomaj
Construction Management Option

Appendix –Alternate Delivery

The Mary J. Drexel Home
Assisted Living Addition
Bala Cynwyd, PA

Project Summary
Analysis #1: Project Sequencing
- Sequencing Process
- Schedule Results
- Cost Results

Analysis #2: MEP Corridor Racks
- Feasibility
- Rack Design
- Cost & Schedule Impacts

Analysis #3: Implementation of Green Roof
- Structural Breadth
- Cost & Schedule Impacts

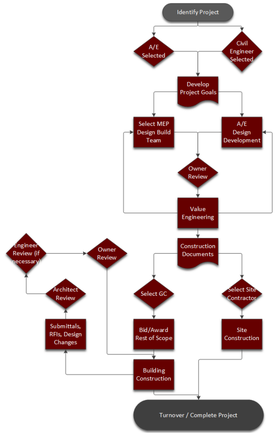
Final Recommendations
Acknowledgements

Advantages

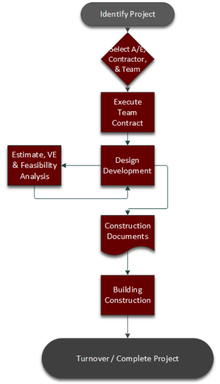
- Chance of project success is very high due to entire team's interests aligned with the project goals.
- Owner gains the same advantages as Design-Build
- Owner gains advantages of Construction Management at Risk delivery method as well:
  - Owner has input from the contractor's perspective and input in planning and design decisions.
  - The ability to "fast-track" early components of construction prior to the full completion of design.

Disadvantages

- Actual agreement on the criteria and final contract may be difficult and take increased time and effort.
- Chance of failure is most dependent on the behavior of individuals within the team and damaging behavior is very hard to control which could breakdown the collaborative process.
- IPD contracts have not yet been tested in law, so the result of a failure within the team is unpredictable.



Hybrid Project Delivery (DBB + DB) Process Map



IPD Project Delivery Process Map

TRADITIONAL PROJECT DELIVERY		INTEGRATED PROJECT DELIVERY
Fragmented, ad-hoc, hierarchical, controlled	**Project participants**	Team of project constituencies, open, collaborative
Linear, segregated, silo-oriented, limited information exchange	**Process**	Concurrent, project life-cycle oriented, shared information, collaborative
Individually managed	**Risk**	Collectively shared and managed
Cost-based, individually focused	**Compensation**	Performance and value based
Paper-based and/or digital 2D representations, spreadsheets, domain-centric software silos, email, FTP sites	**Technology**	Object oriented, centralized data repository linked with complementary knowledge-based systems, 2D, 3D, and 4D BIM, IPD/JOC software, shared model

Traditional Delivery vs. IPD – Image from Building Information Management