The Performing Arts Center

New Jersey, U.S.A.

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Turner

Analysis 1: CIP Concrete Wall Schedule Acceleration

Analysis 2: Façade Installation Acceleration

Applying the Semi-Automated Mason (SAM)

Analysis 3: FPIU Mechanical System

Effects of introducing to Instrument Rehearsal Space

Mechanical Breadth – FPIU vs. VAV Energy Analysis

Acoustical Breadth – Design of Sound attenuating device

Research:

W – Additive building manufacturing through concrete extrusion

Conclusions

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Cast in Place Concrete Wall Schedule is 30 days delayed

Trio

Maximo

PERI Maximo Formwork is recommended instead of TRIO for both 30 day schedule reduction and cost savings

Number of pours per rental period	8		
Number of rental periods	4		
Total number of uses per project	32		
Average amount of formwork in use for project	4000	sq ft	
Cost of labor per man hour	75	$/mh	
	Competition		**MAXIMO**
List price of equipment ($/sq ft):	80	$/sq ft	100 $/sq ft
Rental rate	3.00%		3.00%
	0	% increase in productivity	16 %
Practical Productivity	15.00	sq ft/mh	17.40 sq ft/mh
*** Practical Productivity=estimated productivity/2 ***			

Cost	**TRIO**	**MAXIMO**
Material cost per square foot (per rental period)	2.40 $/sq ft/rental period	3.00 $/sq ft/rental period
Labor cost per square foot(per rental period)	40.00 $/sq ft/rental period	34.48 $/sq ft/rental period
Total cost per square foot(per rental period)	42.40 $/sq ft/rental period	37.48 $/sq ft/rental period
total rental expenses	**38,400** $	**48,000** $
Total labor cost	**640,000** $	**551,724** $
Total cost for material and labor	**678,400** $	**599,724** $

Savings using Maximo system	88,276 $
Extra rental cost for Maximo System	-9,600 $
Benefit of using Maximo system	**78,676** $

Building	Face	SF of Formwork	Trio Rate	Maximo rate	Total Trio Time (MH)	Trio in days	Total Maximo Time (MH)	Maximo in Days
Arts	North Tower Wall	3153.32	15.00	17.40	210.2213333	26.2776667	181.2252874	22.65316092
	South Tower Wall	3515.67	15.00	17.40	234.378	29.29725	202.05	25.25625
Dance / Theatre	South Wall	3546	15.00	17.40	236.4	29.55	203.7931034	25.47413793
	East Wall	2351.83	15.00	17.40	156.7886667	19.5985833	135.1626437	16.89533046
	West Wall	5073	15.00	17.40	338.2	42.275	291.5517241	36.44396552
	North Wall	3590	15.00	17.40	239.3333333	29.9166667	206.3218391	25.79022989
Music Building	South Wall	3877	15.00	17.40	258.4666667	32.3083333	222.816092	27.85201149
	North Wall	2522	15.00	17.40	168.1333333	21.0166667	144.9425287	18.11781609
DRUM	East Wall	8069	15.00	17.40	537.9333333	67.2416667	463.7356322	57.96695402
	West Wall	5939	15.00	17.40	395.9333333	49.4916667	341.3218391	42.66522989
				Total	2775.788	**346.9735**	2392.92069	**299.1150862**

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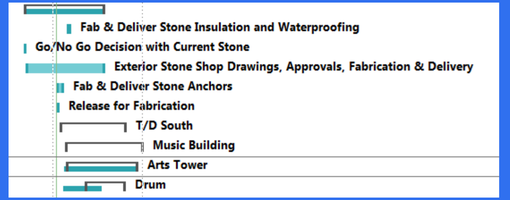
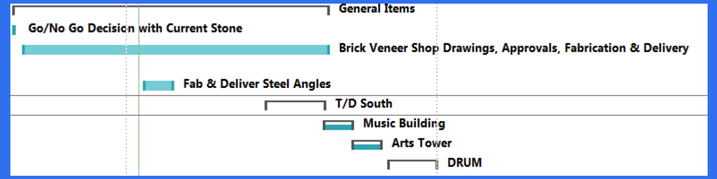
In order to meet the critical path schedule, while maintaining quality finish, the Semi-Automated Mason (SAM) will be used to install a brick façade at 5x speed

Semi-Automated Mason

Using SAM the stone finish schedule is reduced by 60 days



Lecce Limestone Delayed Schedule



SAM – alternative façade schedule

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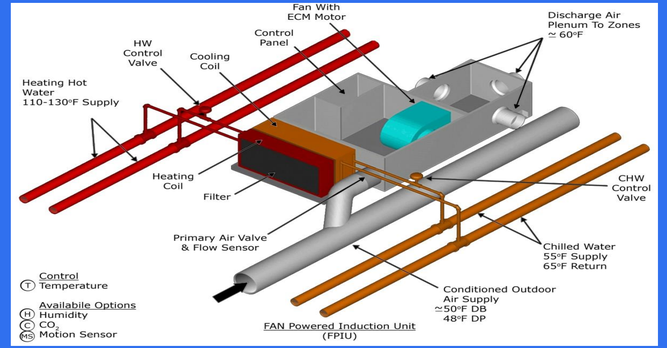
A Fan Powered Induction Unit (FPIU) terminal system provides long term energy savings compared to a Variable Air Volume terminal unit



Fan Powered Induction Unit

Energy Cost Model comparison

% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
0.0 %	0	0
0.0 %	0	0
0.0 %	**0**	**0**
61.7 %	364,719	1,094,265
12.0 %	71,245	213,756
0.0 %	0	0
5.1 %	29,898	89,703
78.8 %	**465,861**	**1,397,723**
1.5 %	8,958	26,876
0.0 %	0	0
0.0 %	0	0
1.5 %	8,958	26,876
19.7 %	116,781	350,379
0.0 %	0	0
0.0 %	0	0
100.0 %	**591,600**	**1,774,978**

Induction Energy Projection

% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy* (kBtu/yr)
0.0 %	0	0
0.0 %	0	0
0.0 %	**0**	**0**
39.3 %	175,417	526,305
7.1 %	31,765	95,305
0.0 %	0	0
2.9 %	12,744	38,236
49.2 %	**219,927**	**659,846**
24.6 %	109,910	329,762
0.0 %	0	0
0.0 %	0	0
24.6 %	109,910	329,762
26.2 %	116,781	350,379
0.0 %	0	0
0.0 %	0	0
100.0 %	**446,618**	**1,339,987**

VAV Energy Projection