Washington-Lee High School

Arlington, Virginia

Matthew Hoerr
The Pennsylvania State University
Construction Management

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Project Overview

Total Cost: $95.2 Million, **LEED Silver Rating**

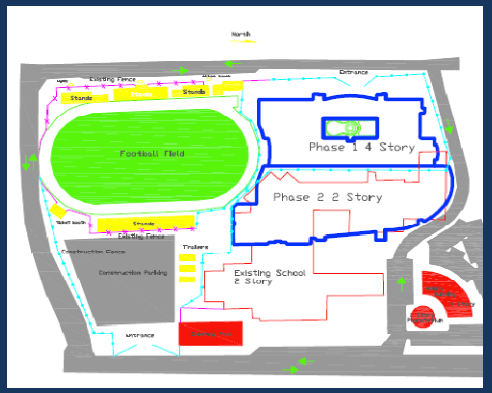
Size: 362,000 sf of new construction, 4 story w/ Mech. penthouse
225,000 sf of demolition

Dates of Construction: Phase 1 - April 2006 to December 2007
Phase 2 - January 2008 to July 2009
Phase 3 – July 2009 to December 2009

Function: Public High School grades 9-12 (1600 students)

Building: Classrooms, Science labs, Business labs, Computer labs, Music rooms, Cafeteria, Courtyard, 800 seat auditorium, Gymnasium, Pools, and Diving area

Project Overview



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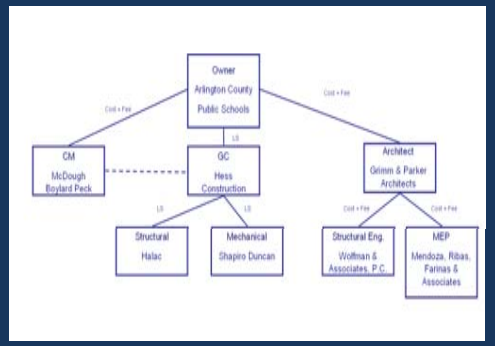
Project Overview

Project Team

Owner: Arlington Public Schools
Architect: Grimm and Parker Architects
CM: McDough Bolyard Peck
GC: Hess Construction Company
Civil Engineer: ADTEK Engineers, Inc.
MEP Engineer: Mendoza, Ribas, Farinas and Associates
Food Service: Nyikos Associates
Aquatics: Councilman, Hunsaker and Associates

Project Delivery Method: Design-Bid-Build

Project Overview



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Project Overview

Structure: Shallow spread footings and strip footings, Structural Steel

Façade: Brick w/ CMU backup, Curtain wall, Storefront windows, and Metal panels

Architecture: Traditional Arlington red brick to match existing school

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Architectural Precast Façade

Problem:

- Site congestion
- Amount of time spent on façade
- Mechanical Loads

Goal:

- Determine if using an architectural precast façade is a viable option
- Reduce mechanical loads

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Architectural Precast Façade

Carboncast System:

- Low cost and Lightweight
- Able to achieve LEED points
- Typically contain two wythes of concrete separated by foam insulation board
- Use C-grid carbon fiber trusses rather than steel wythe connectors
- Reduces hot and cold spots
- Higher quality product
- Less wasted material
- Typical panel designed to be 12’ wide and 1 story high
- Thickness designed to be 10” with thin brick on the exterior and have a high R-value

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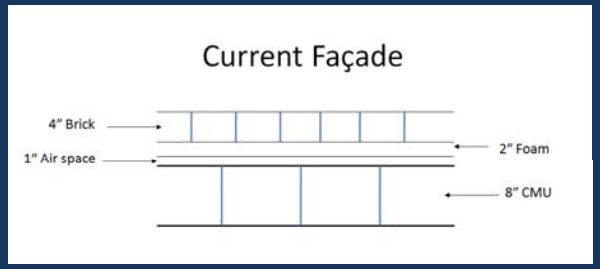
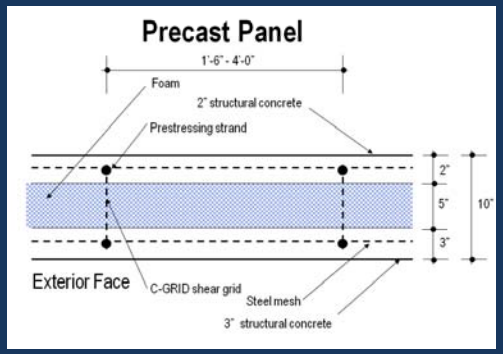
Architectural Precast Façade

Current Design



Architectural Precast Façade

Carboncast Panel Design



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Current Design

Approximately: 75 lbs/sf

Carboncast System

Approximately: 65 lbs/sf

Since weights are about equal there is no need to increase the foundation to support the Carboncast Panels.

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Current Design

Current Design			
Component	R-value	Thickness	Total R-value
Outside Air Film	0.17	∞	0.17
Brick	0.09625	4	0.385
Extruded Polystyrene Ins.	5	2	10
Air gap	1.68	1	1.68
CMU	0.1025	8	0.82
Inside Air Film	0.68	∞	0.68
		Total	13.735
		U-value	0.0728

Carboncast System

Carboncast Panel			
Component	R-value	Thickness	Total R-value
Outside Air Film	0.17	∞	0.17
Concrete	0.08	3	0.24
Extruded Polystyrene Ins.	5	5	25
Concrete	0.08	2	0.16
Inside Air Film	0.68	∞	0.68
		Total	26.25
		U-value	0.0381

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Architectural Precast Façade

Winter

Winter Heat Loss				
System	Area (sf)	U-value	ΔT (F)	Heat Loss (BTU/hr)
Brick w/ CMU backup	120160	0.0728	55	481120.64
Carboncast	120160	0.0381	55	251795.28
			Difference	229325.36
			Boiler Load	4502000
			% Difference	5.10%

Summer

Summer Heat Gain					
System	Area (sf)	U-value	ΔT (F)	Heat Gain (BTU/hr)	Heat Gain (Tons)
Brick w/ CMU backup	120160	0.0728	25	218691.2	18.2
Carboncast	120160	0.0381	25	114452.4	9.5
				Difference	8.7
				Chiller Load	847.6
				% Difference	1.02%

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Type	Quantity	Unit	Production	Days
CMU + Brick	120,160	SF		175
Carboncast System	120,160	SF	1536	79
Panels	626	Panels	8 Panels/day	
			Total Difference	-96

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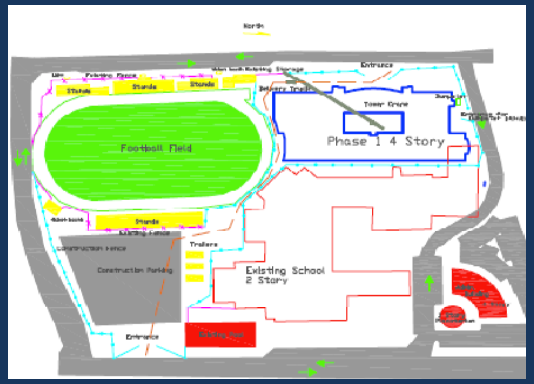
Architectural Precast Façade

- Less site congestion on outside of school
- Need for tower crane placed in courtyard
- Crane can reach all parts of school
- Delivery trucks must now go through site



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Existing Design

Description	Quantity	Unit Price	Cost
4" Standard Brick, Insulation and 8" CMU Backup	120,160	$30.70	$3,688,912
Arlington Location Modifier		0.924	($280,357)
		Total	$3,408,555

- Cost Difference of over $2 Million
- 2.5% increase in total cost

Architectural Precast Façade

Carboncast System

Description	Quantity	Unit Price	Cost
Carboncast Panel and Delivery	120,160	$50.00	$6,008,000.00
Tower Crane	8	$60,000	$480,000
Mobile Crane	103	$2,600	($267,800)
General Conditions	19 WK	$13,140	($249,660)
Arlington Location Modifier		0.924	($453,761)
		Total	$5,516,779

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Architectural Precast Façade

- **Conclusion:**
  - Thickness of façade decreased by 5 inches
  - Weight of panels approximately the same as current design
  - Reduced mechanical loads
  - Decreased schedule by 96 work days
  - Reduced site congestion but now need for tower crane
  - Increased cost by over $2 Million

The Carboncast panel system is a feasible alternative

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Redesign of Gymnasium Lighting

Problem:

- Current design uses a lot of energy
- Not much control over when lights are on

Goal:

- Reduce energy costs by using fluorescent lighting
- Give owner more control on lighting levels in the gymnasium

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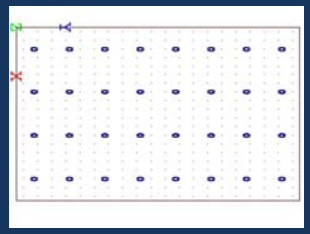
Redesign of Gymnasium Lighting

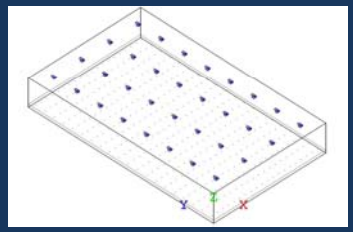
Introduction Existing Conditions Redesign Conditions Cost Savings Conclusion

- 32 Pendant Style Fixtures
- 1000 Watt Metal Halide bulbs
- Shows off the structure of the Gymnasium
- High Electricity costs
- No control over lighting levels

Existing Fixture

Redesign of Gymnasium Lighting





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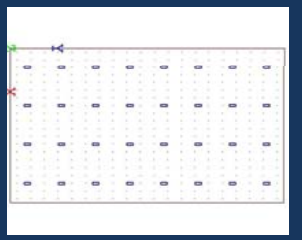
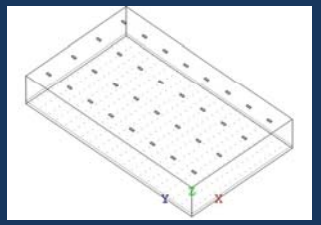
Redesign of Gymnasium Lighting

- 32 High bay fixtures containing 6 bulbs each
- 54 Watt T5HO Linear Fluorescent bulb
- Concentrates all light on floor
- Very energy efficient
- Can turn off lights regularly

Redesign Fixture

Redesign of Gymnasium Lighting





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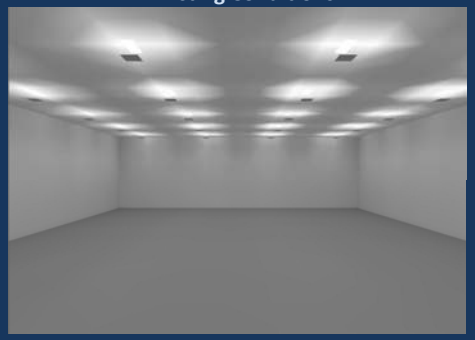
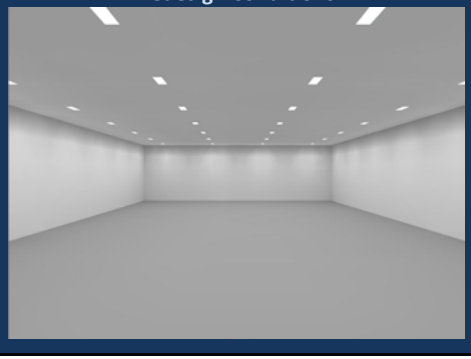
Redesign of Gymnasium Lighting

Existing Conditions



Redesign of Gymnasium Lighting

Redesign Conditions



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Redesign of Gymnasium Lighting

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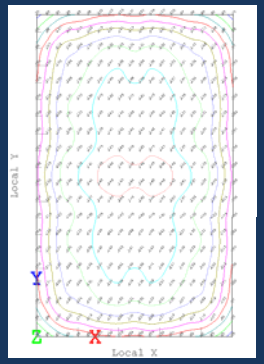
Existing Conditions

Avg. Illuminance: 124 fc

Max Illuminance: 149 fc

Power Density: 2.79 W/sf

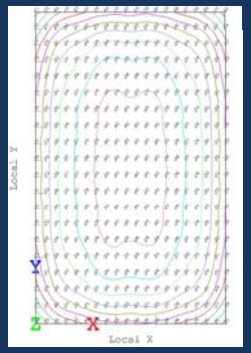


Redesign Conditions

Avg. Illuminance: 34.4 fc

Max Illuminance: 40.2 fc

Power Density: 0.7 W/sf



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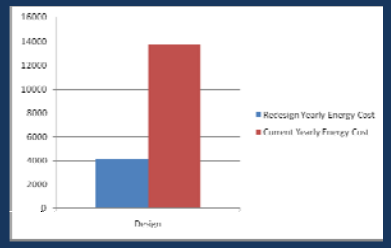

Cost Savings of over $9500 per year

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Redesign of Gymnasium Lighting

- **Conclusion**
  - Less maintenance because Fluorescent bulbs last longer
  - No increase in the number of fixtures used
  - Doesn't show off gymnasium structure like current design
  - More control over lighting levels
  - No increase in the number of circuits needed
  - Savings of over $9500 annually on energy costs

Overall the Redesign Conditions are recommended over the current design.

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Green School Research

Problem:

- Public schools not going for LEED rating
- Environmental and Health impacts to students

Goal:

- Determine why schools are not going LEED
- Suggest a solution to the answers from surveys

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Green School Research

Research:

- Costs on average 2% more or approximately $3 more to go for a LEED rating
- Green Schools save 30% on energy, 30-50% less water, and reduce carbon dioxide emissions by 40%
- Green Schools contain better lighting, more temperature control, and better ventilation systems
- Test scores have been known to go up in green schools
- Absenteeism has decreased and faculty retention has increased in green schools

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Green School Research

Dallastown Area School District School Board Members

- My graduating High School
- Located in one of the most growing areas in the entire country
- New High School completed in 2001-2002 already overpopulated
- None of the current schools are LEED rated
- Currently in the process of designing a new Intermediate High School

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Green School Research

Results:

- Dallastown's Utility and Maintenance Costs are very high
- Knew a lot about LEED schools even though none of there schools are LEED rated
- Tax payers in the area are already upset over the cost of the new school
- Cost and pleasing the public are the reasons for not going green
- Suggested that public needs to become more educated on green school advantages

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Green School Research

Ways for Dallastown to Educate the Public

- Put articles and statistics about green schools in the Community couriers and flyers that are sent out to the public weekly and monthly
- Educate parents on the health and learning advantages of having a green school
- Give students information on LEED rated schools that will cause them to talk to their parents about the issue

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Green School Research

Conclusions:

- Green Schools provide a healthier and a better learning environment for students
- On average, LEED schools cost approximately 2% more
- Cost is the main reason preventing Dallastown from going green
- Best way for Dallastown to educate the public is to put articles and statistics in the publications that they send out to the them

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Summary and Conclusions

Architectural Precast Façade

- Carboncast panels are feasible alternative to current design

Redesign of Gymnasium Lighting

- Redesign is recommended over the current design because it saves energy costs and gives owner more control over lighting level

Green School Research

- Cost is the main reason why public schools are not going green
- Public needs to be educated more on the advantages of having their children going to a green school

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Acknowledgements

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All my Friends and Family

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Questions

Questions ?

Comments

Comments ??