

Walker Jones School

Washington, DC



Maria Piergallini | Construction Management

Final Presentation | April 13, 2009

Presentation Outline



- Project Overview
- The Cost and Benefits of Walker Jones' Pursuit of LEED Certification
- The Incorporation of Daylighting in Walker Jones Classrooms
- Summary and Conclusions
- Acknowledgements
- Questions & Comments





Size: 122,400 ft²
Stories: 3 to 4
Cost: \$36 Million
Dates of Construction:
April 2008 – July 2009

Project Overview

Project Features

Project Team

Project Location

Project Background

Thesis Topics

MAE Requirement

Academic Facility

- K-8 Classrooms
- Science Labs
- Music Rooms
- Gymnasium
- Auditorium
- Public Library
- Multi-Purpose Space
- Multi-Purpose Fields
- Accessible Green Roof



Project Overview

Project Features
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Thesis Topics
MAE Requirement

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Client



District of Columbia

Architect



Hord Coplan Macht

Construction Manager



Forrester Construction & Columbia Enterprises

Structural Engineer



Simpson Gumpertz & Heger

MEP Engineer



Burdette, Koehler, Murphy & Associates

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MAE Requirement

Project Background

- Replacing 2 existing schools
- DCPS has begun a new era of high-quality education
- Start the transition from the bottom
- Revitalizes Northwest One as a vibrant, mixed-use community

LEED Cost and Benefits

Daylighting in Walker Jones Classrooms

Acoustics in Walker Jones Classrooms

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Thesis Topics

MAE Requirement



Research Goals:

- Determine what is valuable in a sustainable school
- Determine how sustainable schools affect students and staff
- Add value to the design without substantially increasing cost or schedule



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MAE Requirement

AE 597D: Sustainable Building Methods

Objectives

Through participation in this course, students will:

-Gain a working vocabulary and familiarity with “green” technologies including water treatment, recycling, day lighting, and energy reducing strategies in buildings.

-Become familiar with the LEED rating system for green buildings, and examine lessons learned on green projects through case studies.

-Be able to participate in a debate on the economic, environmental, and social impacts of green building strategies and technologies.

- Gain a detailed understanding of a chosen “green” material or building technology through independent research.

LEED Cost and Benefits

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LEED Costs and Benefits

Problem:

Many school districts and their constituents are hesitant of the perceived high cost and unknown benefits of a sustainable school

Goals:

- Determine cost premium associated with Walker Jones
- Determine greatest features of sustainable design
- Determine greatest benefits to students and staff

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LEED Cost and Benefits

Cost Analysis

Test Results

Teacher

Survey

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LEED Costs and Benefits

Cost Analysis

-Total Additional Cost: \$907,426

- **Cost per SF:\$7.41**

-Additional Cost without Green Roof: \$308,826

- **Cost per SF: \$2.52**

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LEED Costs and Benefits

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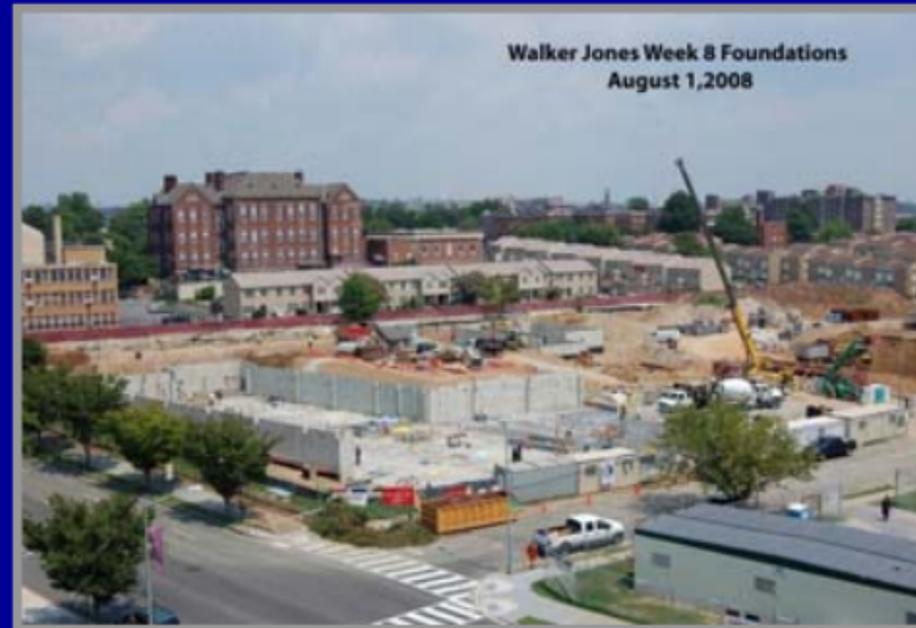
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LEED Point Breakdown

- 36 Total Points
- 3 Points Based on Location
- 6 Points Required by Local Codes or Regulations
- 12 Points Included in Design
- 12 Points Add Cost



LEED Points with Highest Impact on Cost

- **SS Credit 7.2: Heat Island Effect, Roof**
- **E&A Prereq. 1: Fundamental Commissioning**
- **IEQ Credit 3.2: Construction IAQ Management Plan**
- **IEQ Credit 1: Outdoor Air Delivery Monitoring**
- **SS Credit 5.2: Site Development, Maximize Open Space**
- **IEQ Credit 6.1: Lighting System Design & Controllability**

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LEED Costs and Benefits

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- Cost Analysis
- Test Results**
- Teacher Survey

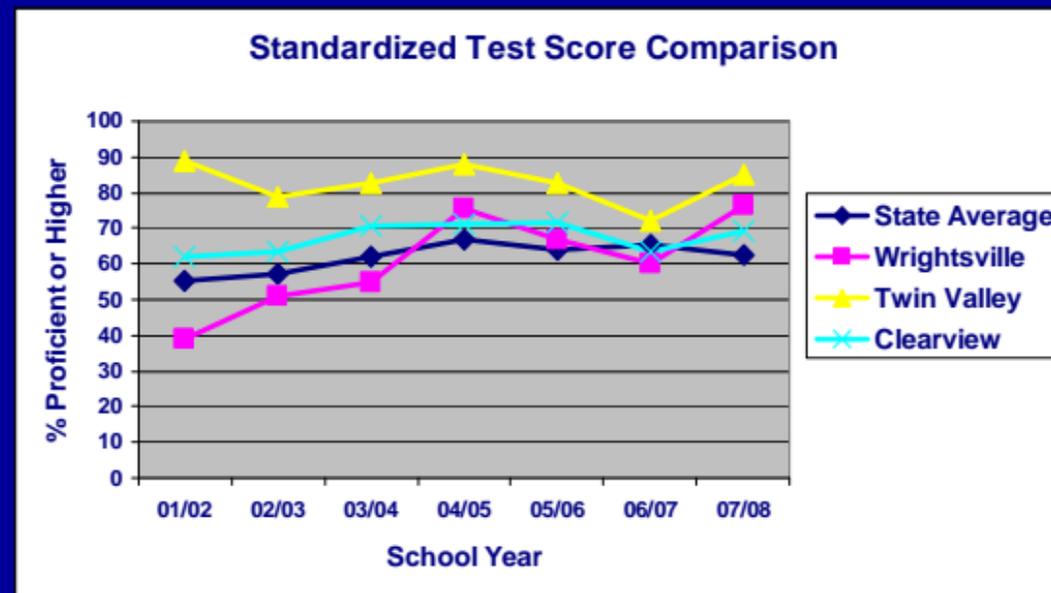
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Percent Increase Comparison	
School	% Increase from 2004 - 2008
Wrightsville	40.11%
Twin Valley	3.21%
Clearview	-2.82%
State Average	0.24%



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Wrightsville Elementary School Eastern York School District (Completed in 2003)

% Proficient or Higher

Wrightsville / State	01/02	02/03	03/04	04/05	05/06	06/07	07/08	% Increase 2004-2008
Wrightsville	39.05	50.95	54.6	75.5	67	60	76.5	40.11%
State Average	55.05	57.15	62.25	66.6	63.75	65.5	62.4	0.24%

Twin Valley Elementary School Eastern York School District (Completed in 2003)

% Proficient or Higher

Twin Valley / State	01/02	02/03	03/04	04/05	05/06	06/07	07/08	% Increase 2004-2008
Twin Valley	88.75	78.85	82.65	88.2	82.85	72.15	85.3	3.21%
State Average	55.05	57.15	62.25	66.6	63.75	65.5	62.4	0.24%

Clearview Elementary School Hanover Public School District (Completed in 2003)

% Proficient or Higher

Clearview / State	01/02	02/03	03/04	04/05	05/06	06/07	07/08	% Increase 2004-2008
Clearview	-	63.4	70.5	71	71.5	63.55	69	-2.82%
State Average	-	69.6	73	74.5	76	75.5	79.5	0.24%

“What if I answer yes to #6, but it is my current school that is not sustainable?”
-Anonymous Teacher

What's a sustainable school?
-Anonymous Teacher

Are you more likely to stay at your current school because it is sustainable?

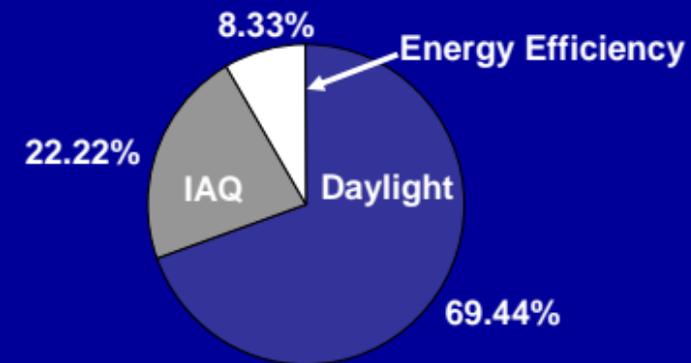
“No, there is more to a school than its appearance.”
-Anonymous Teacher

“WOW! I didn't know! I knew I loved this building, but it was the people and the air conditioning before. Now I have some new reasons. Thanks for the info.”
-Anonymous Teacher

LEED Costs and Benefits

Survey Results		
Question	Yes	No
Have you taught at a traditional (not sustainable) school?	88.89%	11.11%
Have you noticed an improvement in:		
Student performance?	6.25%	93.75%
Student Test Scores?	3.13%	96.88%
Student Productivity?	62.50%	37.50%
Student Attendance?	31.25%	68.75%
Learning Environment?	93.75%	6.25%
Your productivity?	90.63%	9.38%
Does a sustainable School improve the school's image in the community?	69.44%	30.56%
Are you happier working at a sustainable school than one that is not?	72.22%	27.78%
Are you more likely to stay at your current school because it is sustainable?	30.56%	69.44%
Do you incorporate sustainability into your lesson plans?	19.44%	80.56%

Greatest Perceived Design Benefit



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Benefits

- Productivity
- Learning Environment
- Image
- Happiness

Value

- Daylighting



LEED Costs and Benefits

Conclusions and Recommendations

Benefits

Value

LEED System

Schools

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LEED System

- LEED ID Credit 3: The School as a Teaching Tool



Schools

- Teacher Orientations
- Change in Curriculum
- National Energy Education Development (NEED) Project
- Alliance to Save Energy's Green Schools Program
- Energy Information Agency

Daylighting in Walker Jones Classrooms

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Daylighting in Walker Jones Classrooms

Problem:

The current design does not incorporate daylighting into the Walker Jones Classrooms

Goals:

- **Improve the layout of a typical Walker Jones classroom to allow for daylighting**
- **Maximize student performance**
- **Reduce energy costs**

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Current Design

New Design

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Daylighting in Walker Jones Classrooms

Current Design

- **One 8' x 8' window**
- **12 Luminaires with (2) T8 Lamps each**
- **Visible Transmittance of 0.80**
- **Occupancy Sensors**

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Current Design

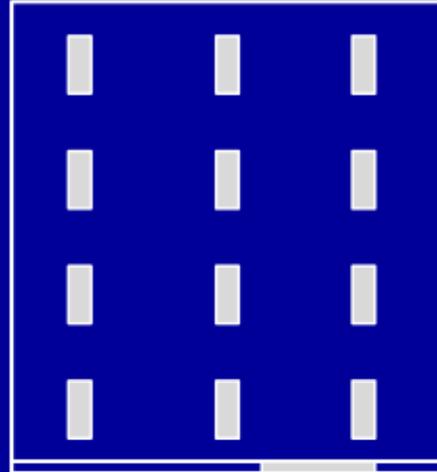
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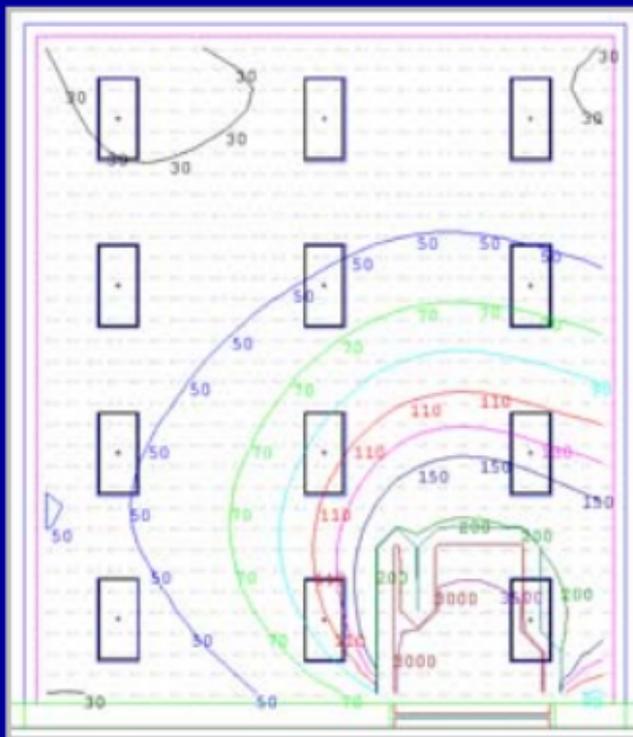


Daylighting in Walker Jones Classrooms

Current Design Calculations

- **Workplane is 2'-6"**
- **Light Loss Factor is 0.75**
- **Target Illuminance is 50 Footcandles +/- 10%**

Current Layout Calculation				
Condition	Average Illuminance (FC)	Maximum Illuminance (FC)	Minimum Illuminance	Suitable for Daylighting
Clear Skies	242	5880	29.8	No
Overcast	55.23	253	8.5	No



Daylighting in Walker Jones Classrooms

New Design

- **T5 Lamps**
- **(2) 6' x 8' Windows**
- **Visible Transmittance of 0.40**
- **Daylight Sensors**

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Current Design

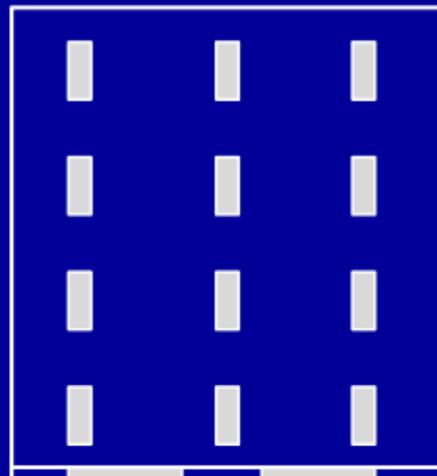
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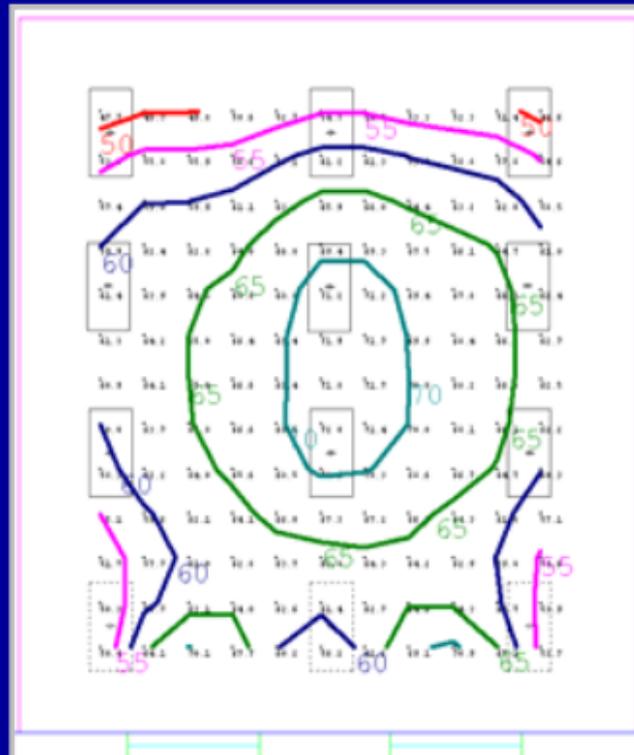
Questions & Comments



Daylighting in Walker Jones Classrooms

New Design Calculation

- **T5 Lamps**
- **(2) 6' x 8' Windows**
- **Visible Transmittance of 0.40**
- **Daylight Sensors**



New Layout Calculation - Overcast Skies				
Time	Average Illuminance (FC)	Maximum Illuminance (FC)	Minimum Illuminance	Suitable for Daylighting
8:00 AM	45.76	62.4	16.5	No
10:00 AM	52.56	64.4	34.2	No
12:00 PM	57.18	81.1	43.1	Yes
2:00 PM	58.31	86.9	44.7	Yes
4:00 PM	55.67	73.73	40.3	Yes
Total Hours Suitable for Daylighting				6 Hours
New Layout Calculation - Clear Skies				
Time	Average Illuminance (FC)	Maximum Illuminance (FC)	Minimum Illuminance	Suitable for Daylighting
8:00 AM	52.43	66.3	27.1	No
10:00 AM	66.53	77.1	48.8	Yes
12:00 PM	62.72	72	47.7	Yes
2:00 PM	61.4	91.5	46.8	Yes
4:00 PM	190.58	2144	49.8	No
Total Hours Suitable for Daylighting				6 Hours

Total Hours Suitable for Daylighting per Year		
Overcast Conditions		
Hours per Day	Days per Year	Total Hours per Year
6	268	1608
Clear Sky Conditions		
Hours per Day	Days per Year	Total Hours per Year
6	97	582

Daylighting in Walker Jones Classrooms

New Design

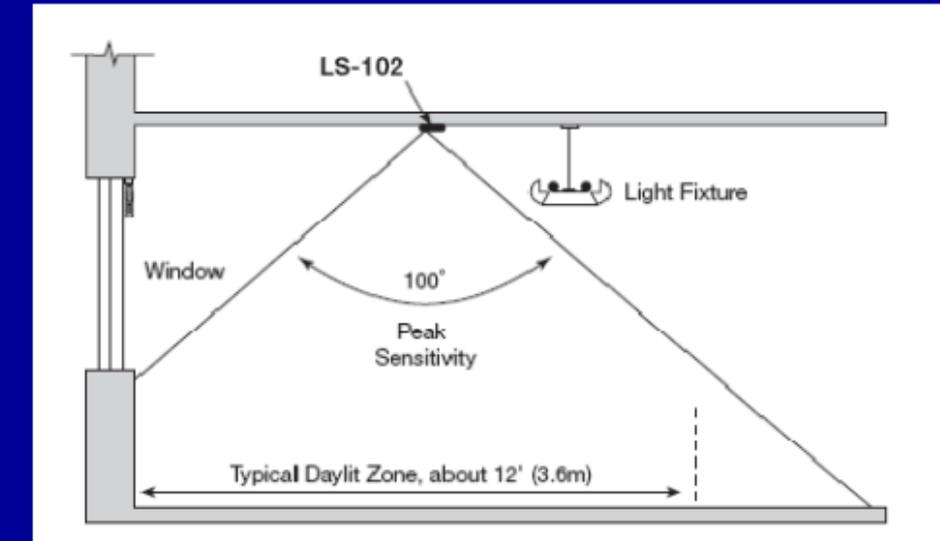
- **Allows for more natural light**
- **Allows for energy savings**
- **Provides the opportunity to teach students a valuable lesson**

New Layout Calculation - Overcast Skies				
Time	Average Illuminance (FC)	Maximum Illuminance (FC)	Minimum Illuminance	Suitable for Daylighting
8:00 AM	45.76	62.4	16.5	No
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2:00 PM	61.4	91.5	46.8	Yes
4:00 PM	190.58	2144	49.8	No
Total Hours Suitable for Daylighting				6 Hours

Daylighting in Walker Jones Classrooms

Sensor Selection

- **Occupancy Sensors are not most efficient**
- **Daylight sensors can teach valuable lessons while saving money on energy costs**



Sensor Location

Watt Stopper



Light Saver LS102

Daylighting in Walker Jones Classrooms

Conclusions and Recommendations

- T5s
- Windows
- Sensors

All worth the investment!

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Payback Period Calculation

Switching to T5 Lamps

Number of Luminaires	Total Added Cost
492	\$8,856.00

Additional Windows

SF of Added Windows	Total Added Cost
1312	\$17,056.00

T5 Energy Savings

kW per Year	Total Savings
14,366	(\$1,867.63)

Sensor Cost Savings

Number of Sensors	Total Savings
41	(\$1,205.40)

Daylight Cost Savings

kW per Year	Total Savings
15,085	(\$1,961.00)

Total Initial Difference	\$24,706.60
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Total Yearly Savings	(\$3,828.63)
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Payback Period	6.45 Years
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Schools

- **Greatest benefits are productivity, learning environment, image and happiness**
- **Most valuable design aspect is daylighting**
- **LEED for Schools ID Credit 3**
- **Certified schools need to make internal changes**

Summary and Conclusions

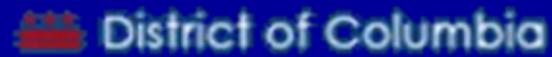
Daylighting

- **Add windows**
- **Change lamps to T5's**
- **Switch to daylight sensors**
- **Payback period of 6.5 years**

Acoustics

- **Acoustical Society of America 's Guidelines for Classroom Design**
- **Reverberation time, reflections, mechanical equipment and interior and exterior noise sources**
- **Reverberation time is above 0.6 seconds & can interfere with speech intelligibility**
- **Change ceiling tile to Armstrong Ultima for NRC of 0.70 versus 0.55 - added cost is \$35,000 or \$0.29 per SF**

Acknowledgements



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**Wrightsville
Elementary**



Clearview Elementary



**St. Stephen's
Episcopal K-8**



Twin Valley Elementary



**...And my Family
and Friends**

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Lessons Learned

- **Penn State's network is great**
- **Time management**
- **Roll with the punches**

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