21st Century School Facilities Commission

Martin G. Knott, Jr., Chair

Agenda
August 25, 2016
10:00 a.m.
House Office Building, Room 120
Annapolis, Maryland

I. Call to Order and Chair's Opening Remarks

II. Classrooms of the Future

- Victoria Bergsagel, Architects of Achievement
- Mary Filardo, 21st Century School Fund

III. The Cost of School Construction

- **Comparison of Conventional School Facilities and the Monarch Global Academy; School Facility Cost Containment Study**
  - David Lever, former Executive Director of the IAC
- **Case Study Analysis of Alternative Approaches to School Construction**
  - Gary McGuigan, Maryland Stadium Authority
  - Jay Brinson, City School Partners
  - Will Mangrum, City School Partners

IV. Public Testimony

V. Chair's Closing Remarks and Adjournment

Architects of Achievement

Victoria Bergsagel

The Future of Learning

August 25, 2016

www.archachieve.net
victoria@archachieve.net

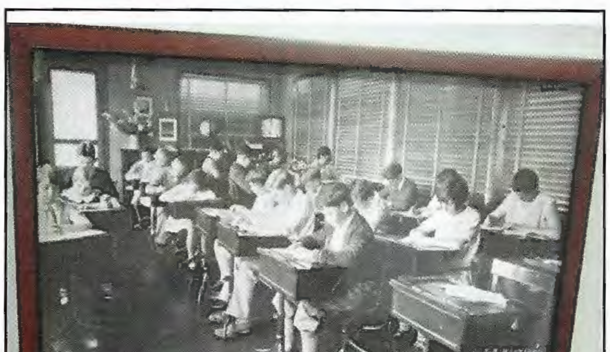
Architects of Achievement

The World is Rapidly Changing

In fact … the World has Changed!

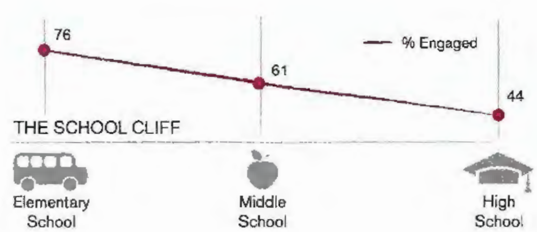
- Social networking
- Global connections
- Info at our fingertips
- A renaissance in manufacturing
- A new generation of makers
- 3-D design and printing
- Mass customization … in everything?
- Personalization and blended learning

So what are the implications for school facility design?



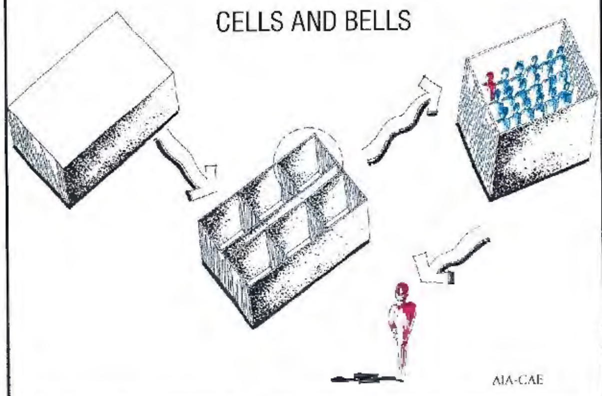
Are we meeting the needs of ALL students in our current learning environments?

HOW ENGAGED ARE STUDENTS?



Source: Gallup Strength Quest Operating System

CELLS AND BELLS



What school experience do students long for?

STUDENTS WANT SCHOOLS THAT ...

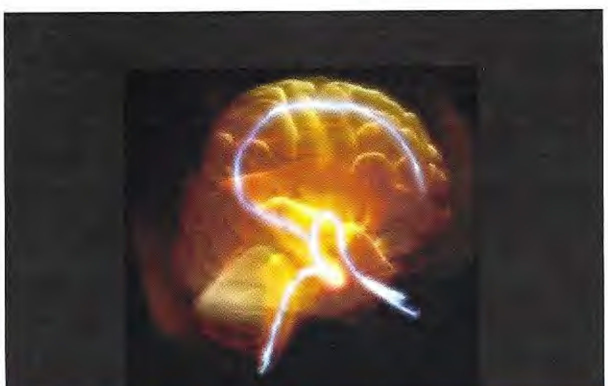
- Create new learning opportunities
  - Community connections and hands-on learning
- Design for variety and flexibility
  - Including aesthetics → beauty
- Provide comfortable, social spaces
  - Food, emotional comfort, safety
- Integrate technology
  - As a tool to produce, not consume
- Connect to the outdoors

Target w/American Architectural Foundation 2009

No one wants to learn in sterile, boring, institutional facilities. Give us beauty, real-life projects, choice, opportunity, and ownership, and we'll show you what we can do.

Mireya Avile, 16, Santa Barbara, CA

Target w/American Architectural Foundation 2009



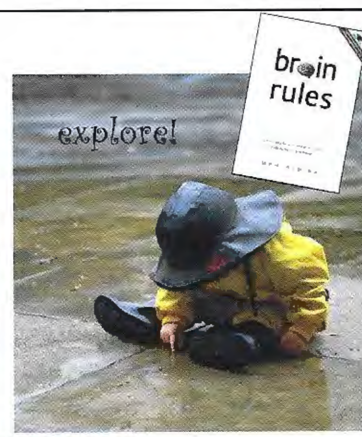
What does brain science tell us?

BRAIN RULES

WE'RE POWERFUL AND NATURAL EXPLORERS
- Inquire and rigor

STIMULATE MORE OF THE SENSES
- Project-based, integrated learning

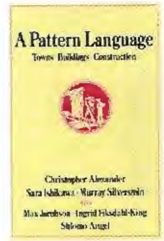
WE DON'T PAY ATTENTION TO BORING THINGS
- Relationships, PATTERNS and emotions

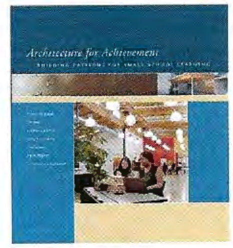


Sources: Talaris Research Institute; AofA (2001); Medina (2008)

Patterns
Exemplary School Design

PATTERNS OF EXEMPLARY SCHOOL DESIGN





"When you build a thing, you cannot merely build that thing in isolation, but must also repair the world around it, and within it."

Christopher Alexander

Resource: Architecture for Achievement, Bergsagel, et. al., 2007

INDOOR-OUTDOOR CONNECTIONS

VMDO Architects, Sam Kettner Photography

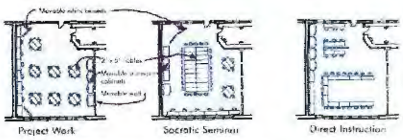
DISPLAY AND STREETSCAPES

MULTI-PURPOSE GATHERING SPACES

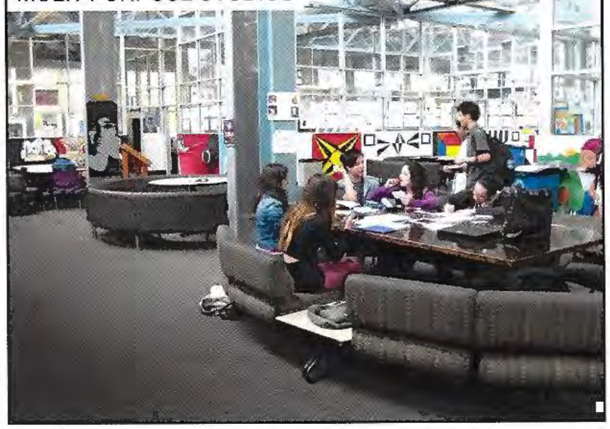
CLUSTERS OF LEARNING

Denver School of Science and Technology, Kipp with David Stephen

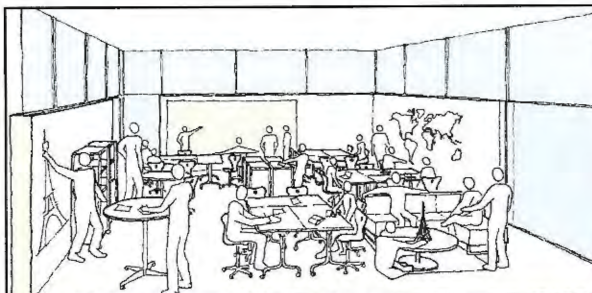
MULTI-PURPOSE STUDIOS



MULTI-PURPOSE STUDIOS

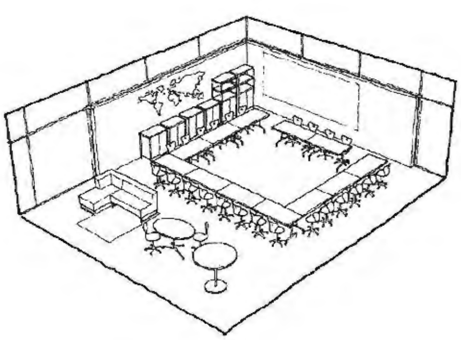


FLEXIBLE FURNISHINGS



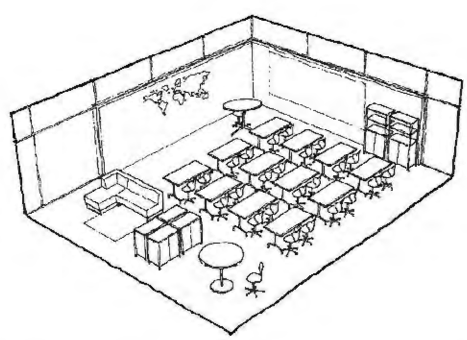
- Dynamic "classrooms" with mobile storage systems
- Places to display student work and surfaces to write on
- Tables for group and project work, to sit or stand, easily rearranged
- Windows to allow natural daylight and views to the outdoors
- Interior windows and increased connections among colleagues
- Comfortable seating areas to collaborate, engage in discussion, read and reflect
- Technology networks provide global connections and expand student interaction

VS Furniture



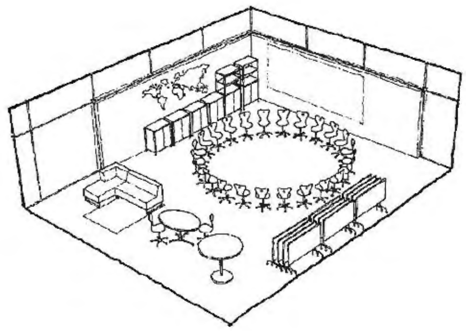
Seminar or panel discussion

VS Furniture



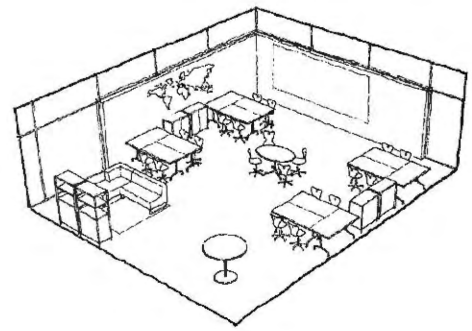
Presentation, whole class videoconferencing

VS Furniture



Large group discussion

VS Furniture



Group work

VS Furniture

21st Century Design

Exemplars

21ST CENTURY DESIGN

1. Incorporates dynamic programs and projects
2. Promotes joyful learning
3. Is flexible and adaptable
4. Leverages community partnerships

21ST CENTURY DESIGN

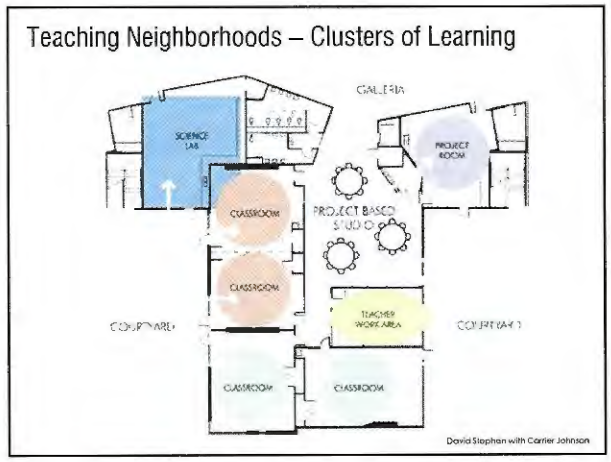
1. Dynamic programs and projects
   - Real-life, interdisciplinary learning
   - Authentic problem-solving
   - Projects related to students' interests
   - Maker spaces

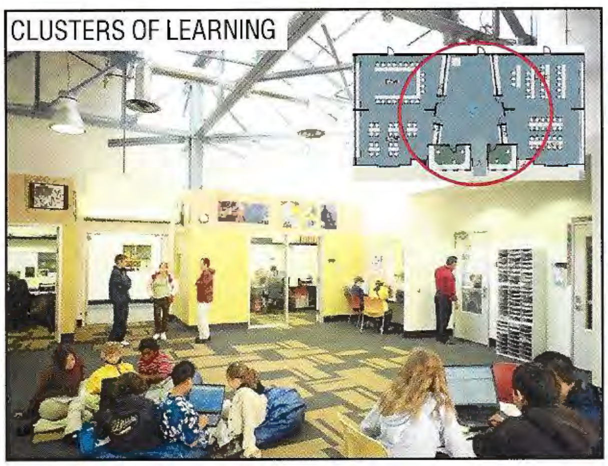
HTH

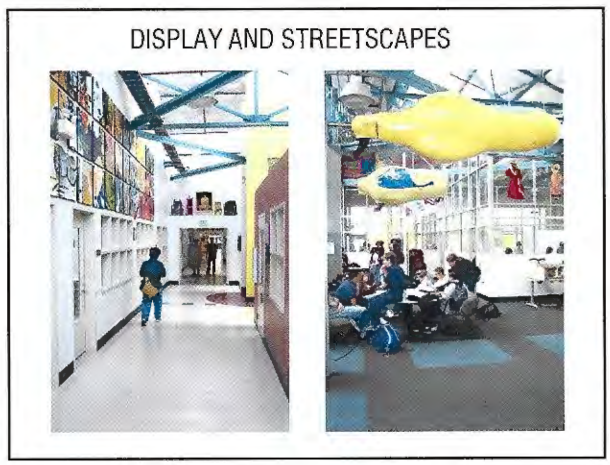
MC STEM HIGH SCHOOL

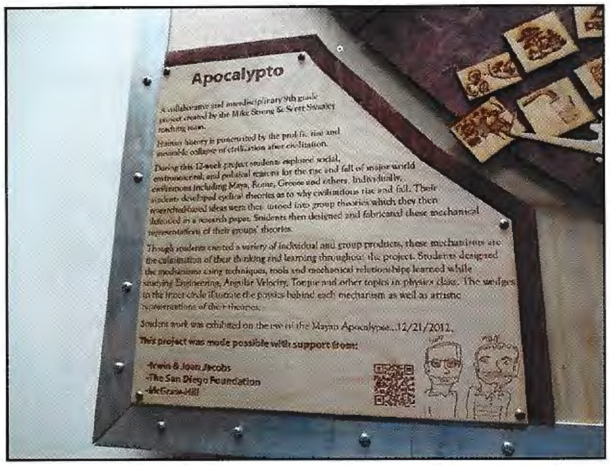
High Tech High

San Diego, CA

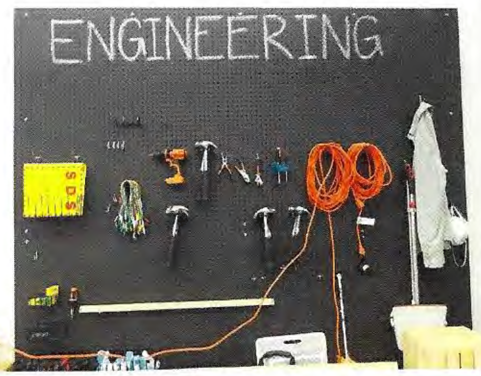

Teaching Neighborhoods – Clusters of Learning
SCIENCE LAB
PROJECT ROOM
CLASSROOM
PROJECT BASED STUDIO
CLASSROOM
TEACHER WORK AREA
CLASSROOM
CLASSROOM
David Stephan with Carrier Johnson


CLUSTERS OF LEARNING


DISPLAY AND STREETSCAPES



MAKER SPACES at an early age



The smartest girl in the class has crazy ideas...

And crazy ideas change the world!

MC² STEM HS
Cleveland, OH

MC² STEM HIGH SCHOOL

Three Campuses, One Nationally-Recognized STEM School that serves ALL Students

MC² STEM HIGH SCHOOL

- Great Lakes Science Center…9th Grade
- GE Smart Lighting…10th Grade
- Cleveland State University…10th and 11th Grades

MC2STEM High School

GE Smart Lighting
Nela Park Campus

Success and Recognition

Mentioned in President Barak Obama's **State of the Union address**, 2014, "Enhanced Live Stream" (27:13)

National Excellence in Urban Education Award Winner, 2012

Students developed an LED sold nationally and own the patent

21ST CENTURY DESIGN

2. Joyful learning
   - Indoor-outdoor connections
   - Daylighting and views
   - Sustainability

VITTRA

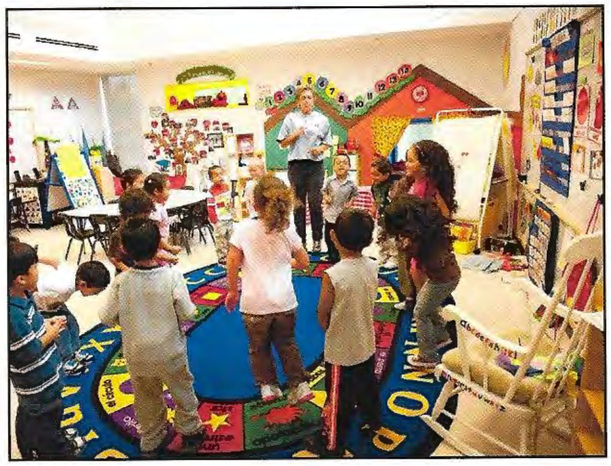
Manassas Park Elementary

Manassas Park, VA

VMDO Architects
Sam Kittner Photographer

CLUSTERS OF LEARNING

The importance of day-lighting and views to the outdoors



Vittra Schools

Sweden

Vittra Schools, Sweden
http://vittra.se/Default.aspx?alias=vittra.se/english

Vittra Schools, Sweden
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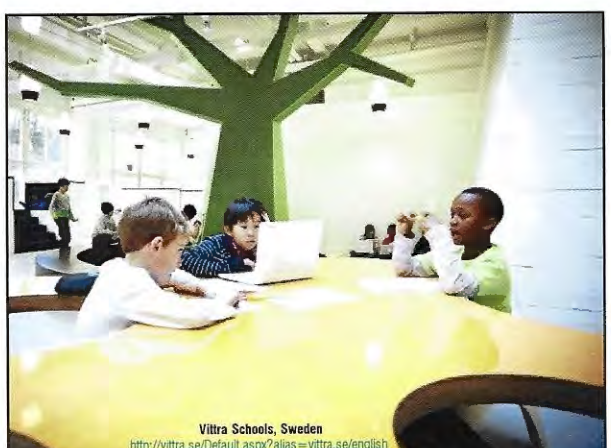


Vittra Schools, Sweden
http://vittra.se/Default.aspx?alias=vittra.se/english

A Resource …

GREEN SCHOOLYARDS

An International Movement

www.greenschoolyards.org

21ST CENTURY DESIGN

3. Flexibility and adaptability
    - Varied spaces
    - Operable walls
    - Small schools and/or comprehensive campus

MARYSVILLE
SCHOOL DISTRICT

Marysville-Getchell

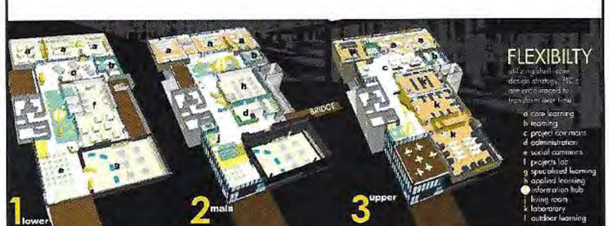
Marysville, WA

MARYSVILLE GETCHEL HIGH SCHOOL CAMPUS

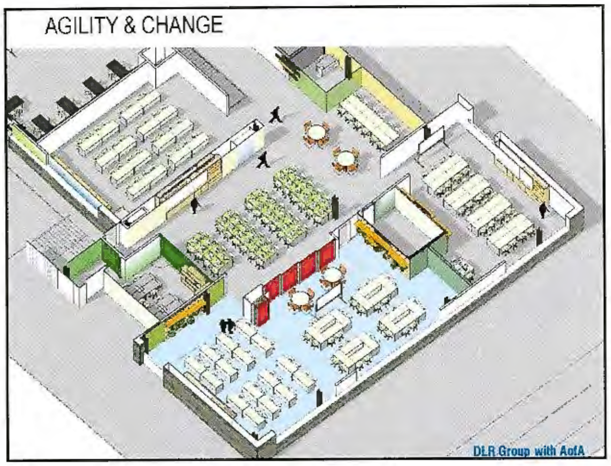
Best School Design in the Country (National School Boards Association, 2011)

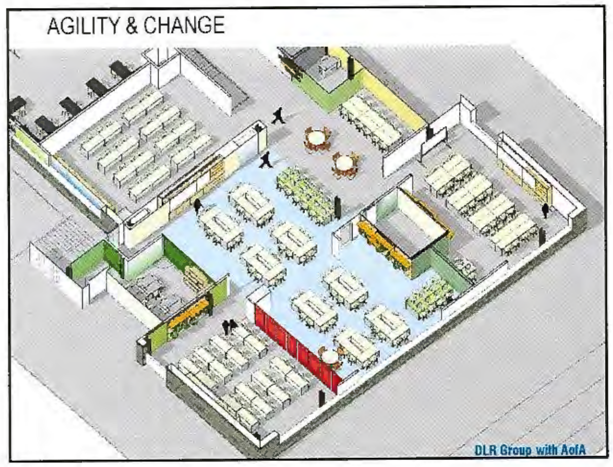
MacConnell Award (Council of Educational Facility Planners International,)

Biomed Academy, Academy of Construction and Engineering, School for the Entrepreneur, International Communications Academy and a Student Union



DLR Group with AofA


AGILITY & CHANGE
DLR Group with AofA


AGILITY & CHANGE
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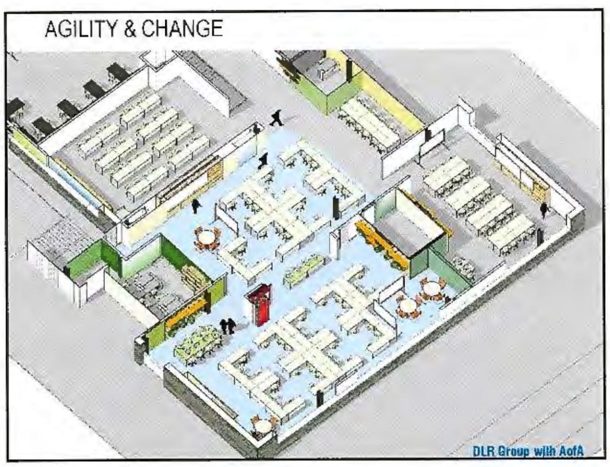

AGILITY & CHANGE
DLR Group with AofA


DLR Group with AofA (Photographer: Chris J. Roberts)


DLR Group with AofA


FLEXIBLE, RECONFIGURABLE, CONNECTED
Construction & Engineering
DLR Group with AofA


DLR Group with AofA


FLEXIBLE, RECONFIGURABLE, CONNECTED


REPURPOSED HALLWAYS
DLR Group with AofA


LEARNING COMMONS – LIBRARY?
DLR Group with AofA


DLR Group with AofA

21ST CENTURY DESIGN

4. Partnerships
   - Leverage community assets
   - Celebrate genius loci

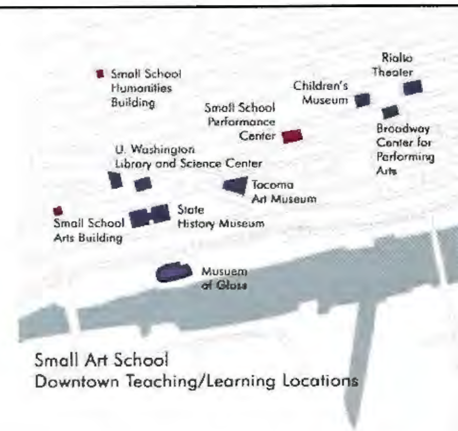
TACOMA SCHOOL of the ARTS

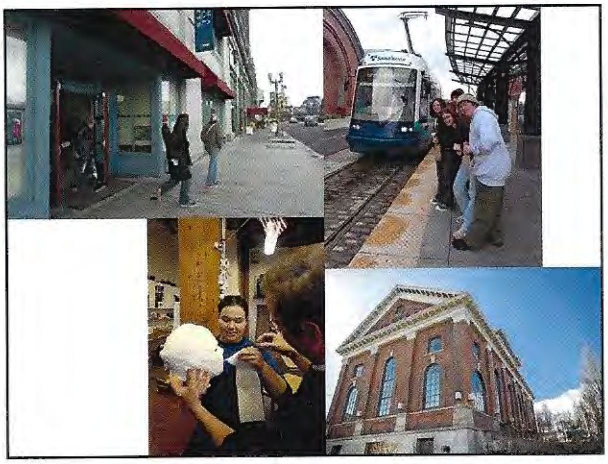
sami science and math institute

RAISBECK AVIATION HIGH SCHOOL

School of the Arts

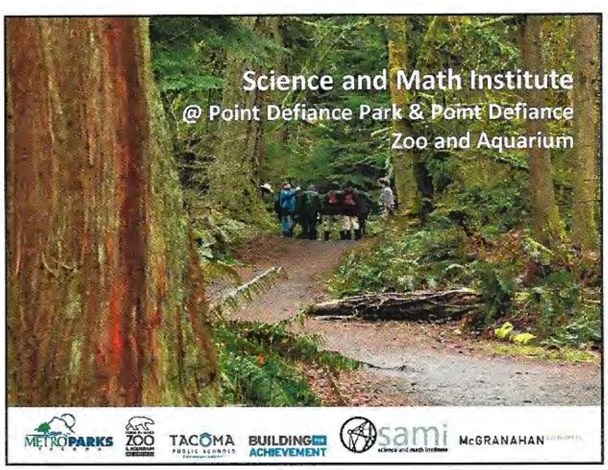
Downtown Tacoma, WA

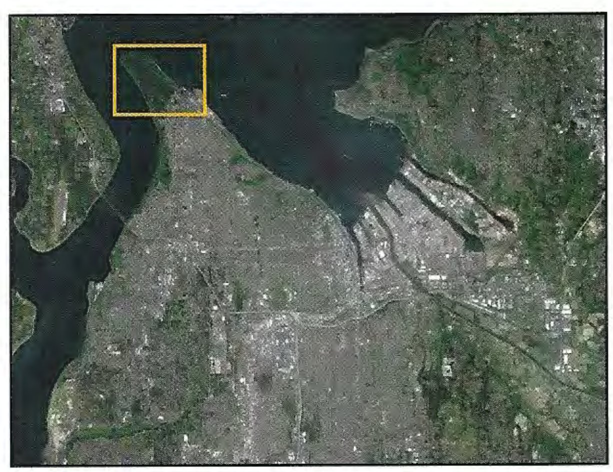


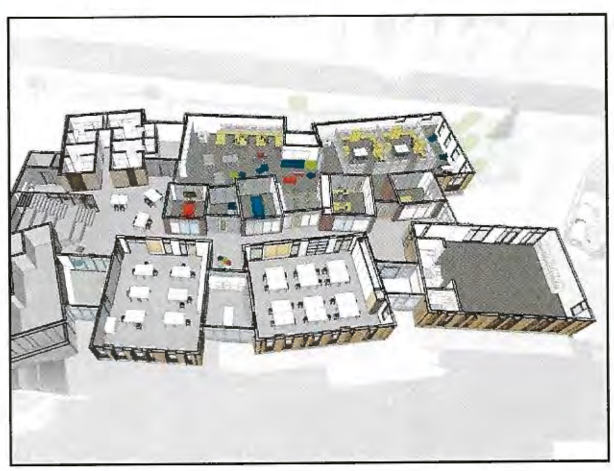


Science and Math Institute

Pt. Defiance Park, Tacoma, WA







Raisbeck Aviation

Seattle, WA

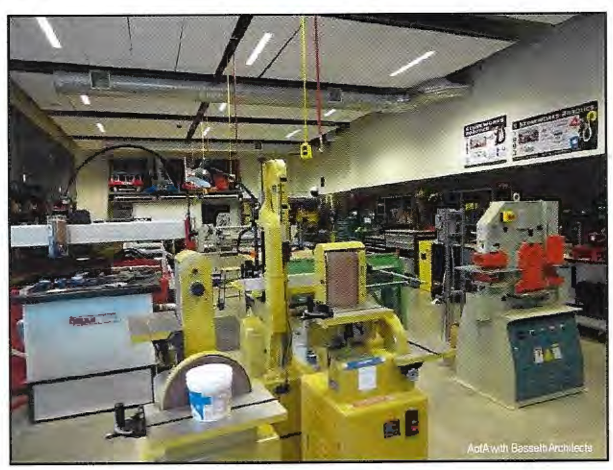

AofA with Bassetti Architects


INDOOR-OUTDOOR CONNECTIONS
AofA with Bassetti Architects


AofA with Bassetti Architects


MULTI-PURPOSE GATHERING SPACES


AofA with Bassetti Architects


AofA with Bassetti Architects

How might instruction drive construction?

http://www.dodea.edu/edSpecs/

Hope lies in dreams, in imagination and in the courage of those who dare to make dreams into reality.

Jonas Salk

Q & A

Architects
of Achievement

Contact Information
www.archachieve.net

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victoria@archachieve.net
(206) 420-1400

Public School Buildings: The Role of the State

In this study, the 21st Century School Fund (21CSF), with support from the National Clearinghouse for Educational Facilities, examined the state capital outlay funding for elementary and secondary public education facility construction and modernization. We examined how much capital outlay has been expended by states from 2005-2008 as reported to the U.S. Census of Governments and surveyed every state on what share of these funds were provided from state sources as compared to local sources. 21CSF collected information about school facility capital outlay and related capital data management, planning, funding and oversight practice from each state's department of education and/or building authority.[1]

Capital funding for elementary and secondary school facilities

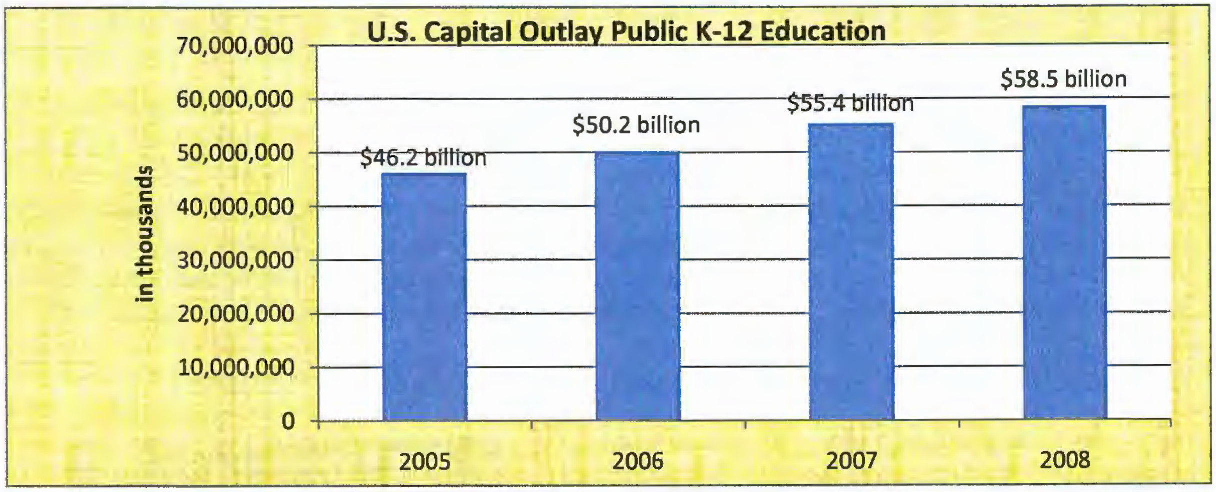
Public elementary and secondary schools use both operating and capital funds to deliver public education programs and services. Operating funds are used for regularly recurring costs of public education—teachers, administrators, books, materials, utilities, cleaning and other everyday costs for schools, administration and operations. Capital funds are used to purchase physical assets with a multi-year life—building additions, building systems and component replacements, new construction, major alterations to buildings, as well as for purchase of equipment, furniture and fixtures. Capital funds can also be used for purchasing existing buildings and land.

Operating funds are raised annually from taxes, fees, or other sources of public revenue and then appropriated and expended each year to pay for operating costs. Capital funds are typically borrowed and repaid over many years, using the annual revenues to repay the debt. Capital spending is called "capital outlay" and is reported annually to the U.S. Census of Governments.[2] Capital outlay reporting is done separately for building construction; acquiring land and existing buildings; educational and other equipment; and interest on long term debt. This report includes analysis of construction and acquisition of land and existing buildings, which was 85% of total capital outlay for the years 2005-2008.

The U.S. Census of Governments reports that during the four years from 2005-2008, a total of $209.7 billion in capital outlay for construction and land/building acquisition was expended by public school districts, an average of $52.6 billion per year. The average annual per student spending on capital facilities (construction and land/building acquisition) for this period was $1,086 per student

[1] Indiana, Pennsylvania and Virginia state officials did not respond, so 21CSF used publicly available data for their profiles.

[2] http://www.census.gov/govs/definitions/ "direct expenditure for contract or force account construction of buildings, grounds, and other improvements, and purchase of equipment, land, and existing structures. [Capital outlay] includes amounts for additions, replacements, and major alterations to fixed works and structures. However, expenditure for repairs to such works and structures is classified as current operation expenditure."



The outstanding long term debt of school districts for ALL capital outlay was $369.4 billion at the end of 2008. Long term debt is any debt that is interest-bearing with a term of more than one year. This includes general obligation bonds, revenue bonds, refunding bonds, and certificates of participation.[3] School districts report to the U.S. Census of Governments that they pay $16 billion per year for interest payments on their long term debt. Since reporting for PK-12 school district capital outlay is from school districts, we would assume that the debt levels and the interest amounts do NOT include state level debt or interest costs, but the reporting is extremely unclear.

Although there have been numerous challenges to the adequacy and equity of how states finance public education with their operating budgets, there has been much less done to address the issues of adequacy and inequity of capital outlay. And in a study done by the 21st Century School Fund with our Building Educational Success Together partners, we found that at the school district and zip code levels, that there was tremendous disparity in the spending by school districts to provide healthy, safe and educational adequate school facilities. Over the period from 1995-2004, the lowest income communities had by far the least spending.[4] Based on the findings of this study It seems clear that this is, in large part, due to the undeveloped roles of the state, as it affects setting standards and support for the quality of public school facilities.

The average state share of spending on capital outlay for construction and land and building acquisition for the years 2005 to 2008 was 30%.[5] Since the U.S. Census of Government Annual Survey of Local Government Finances does not collect information on the source of funds used for capital outlay, the 21st Century School Fund surveyed every state for information on the amount of funds the state department of education or other state facility authority contributed to PK-12 public school construction.

The percent state share is based on the four year total capital outlay for construction and acquisition of land and buildings reported to the U.S. Census of Governments for the years 2005-2008 divided by the total state share as reported in our survey for the same years.

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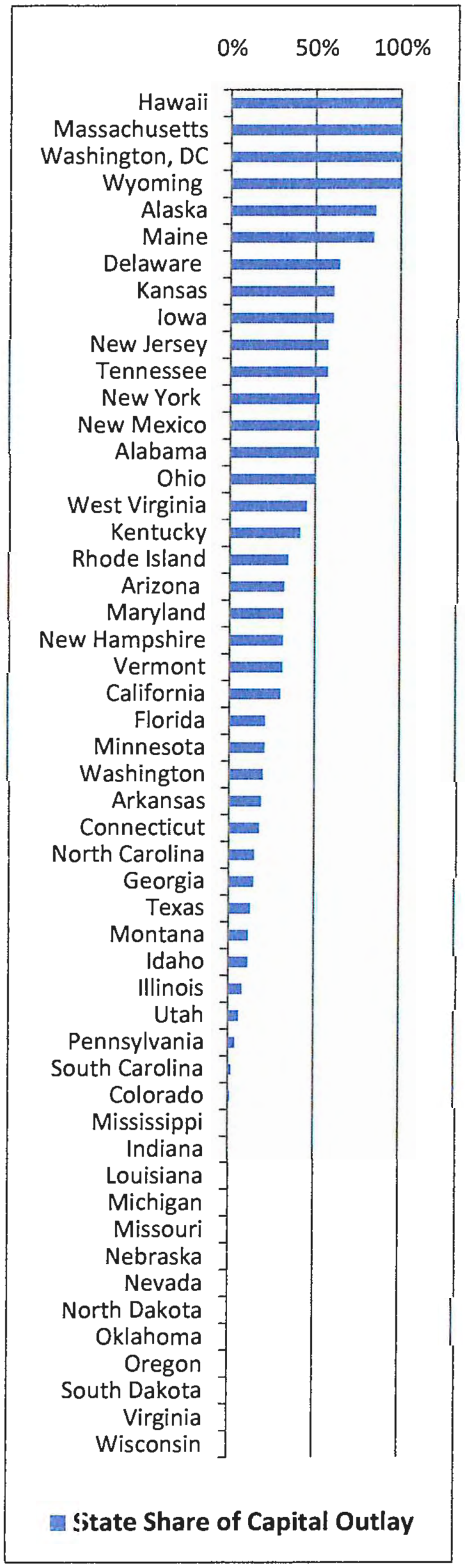
[3] Definition from Annual Survey of Local Government Finances (School Systems); F-33; U.S. Census Bureau.
[4] Growth and Disparity: 10 Years of Public School Construction 1995-2004, October 2006, 21st Century School Fund.
[5] This is the arithmetic mean of the state share for all 50 states plus the District of Columbia.



Eleven states contributed nothing to local districts for capital outlay; 14 provided less than 20%; 12 states paid between 20% and 50%; and 13 states and the District of Columbia paid over 50% of the capital outlay facility costs incurred by local school districts. Direct grants or reimbursements are not the only ways states contribute to local school district facility programs. Some states provide information, standards and technical assistance on school design and construction. Other states offer credit enhancement for local school districts, essentially co-signing the loan, so the local district secures a better interest rate and other improved borrowing terms.

It is clear from this review that only about half of all states have a partnership with local districts to share in the responsibility for providing adequate school facilities. In some cases, even where the state is contributing a significant share of the total capital outlay, the level of capital outlay is so low that children are still attending schools in substandard conditions.

Fiscally independent school districts can levy their own taxes to support schools—including for school building projects. To raise capital funds, fiscally independent school districts identify a particular need for a school building project or projects; estimate their cost; and go to voters in a bond referendum to request an increase in taxes to repay the principal and interest of the bond that will be issued to raise funds to pay for the building projects. Almost 90% of the approximately 14,000 public school districts are fiscally independent.[6]

In the 10% of districts that are fiscally dependent the school district must seek an appropriation of capital funds for school building improvements or construction from the local municipal or governing entity. This municipal entity is responsible for raising the revenue to repay borrowing, which depending on state law may require bond referenda or can be decided on by elected officials without going directly to voters. However, in both fiscally independent and dependent school districts, debt limits are closely regulated by the states.

The following States at a Glance table gives a brief summary of state capital outlay and the state role in school facilities.

[6] Education Commission of the States; StateNotes: Finance, Taxation and Spending Policies, 2004.

Survey Responses 2010
State Facility Planning, Management and Standards

STATE NAME	Number of Schools (1)	% State Funding for School Construction	Facility Staff at State Education Agency	Additional Facility Agency Staffing	State Facility Plan	State Requires LEA Facilities Master Plan	State Technical Assistance to LEAs	Publicly Available State-Level K-12 Facilities Inventory	State PS12 Facility Standards	Green School Construction / Renovation Requirements (2)
Alabama	1,605	52%	4	1	Y	Y	Y	N	None	N
Alaska	501	85%	5	N/A	Y	Y	Y	Y	Limited	N
Arizona	2,135	32%	0	13	N	Y	Y	Y	Comprehensive	Y
Arkansas	1,121	19%	21	N/A	Y	Y	Y	Y	Comprehensive	N
California	9,983	30%	27	116	N	Y	Y	N	Comprehensive	Y
Colorado	1,757	1%	7.5	N/A	N	N	Y	Y	None	Y
Connecticut	1,117	18%	9	N/A	N	N	N	N	Comprehensive	Y
Delaware	235	64%	1.5	N/A	Y	Y	Y	Y	None	N
District of Columbia	244	100%	30	N/A	Y	N	N	N	Comprehensive	Y
Florida	3,935	21%	31	N/A	N	Y	Y	Y	Comprehensive	Y
Georgia	2,452	15%	12	N/A	Y	Y	Y	N	Comprehensive	N
Hawaii (3)	287	100%	363	N/A	Y	N	Y	Y	Comprehensive	Y
Idaho	727	11%	0.1	No info	N	N	N	N	None	N
Illinois	4,399	8%	10	No info	Y	N	Y	Y	Limited	Y
Indiana	1,970	0%	1	N/A	N	N	Y	N	None	N
Iowa	1,511	61%	1	N/A	N	N	Y	Y	None	N
Kansas	1,422	61%	2	N/A	N	N	Y	N	None	N
Kentucky	1,528	41%	8	3	Y	Y	Y	N	Comprehensive	Y
Louisiana	1,470	0%	0	N/A	N	N	N	N	None	N
Maine	670	84%	5	N/A	N	Y	Y	Y	Comprehensive	N
Maryland	1,453	32%	4	22	N	Y	Y	Y	Comprehensive	Y
Massachusetts	1,878	100%	0	45	Y	Y	Y	Y	Comprehensive	Y
Michigan	4,096	0%	5	N/A	N	N	N	N	None	N
Minnesota	2,679	21%	3	N/A	N	N	Y	Y	Comprehensive	N
Mississippi	1,068	0%	4	N/A	N	N	Y	N	Limited	N
Missouri	2,417	0%	0	N/A	N	N	N	N	None	N
Montana	831	12%	0.2	0	N	N	Y	Y	None	N

Survey Responses 2010

State Facility Planning, Management and Standards

STATE NAME	Number of Schools (1)	% State Funding for School Construction	Facility Staff at State Education Agency	Additional Facility Agency Staffing	State Facility Plan	State Requires LEA Facilities Master Plan	State Technical Assistance to LEAs	Publicly Available State-Level K-12 Facilities Inventory	State PS12 Facility Standards	Green School Construction / Renovation Requirements (2)
Nebraska	1,143	0%	2	N/A	N	N	N	N	None	N
Nevada	610	0%	0	N/A	N	N	N	N	None	N
New Hampshire	488	31%	1.5	N/A	N	Y	Y	Y	Limited	N
New Jersey	2,591	57%	20	330	N	Y	Y	Y	Comprehensive	Y
New Mexico	851	52%	0	51	N	Y	Y	N	Comprehensive	N
New York	4,631	52%	20	N/A	N	Y	Y	Y	Limited	N
North Carolina	2,516	15%	8.5	N/A	N	Y	Y	Y	None	N
North Dakota	528	0%	0.5	N/A	N	N	N	N	None	N
Ohio	3,924	50%	0	70	Y	Y	Y	N	Comprehensive	Y
Oklahoma	1,798	0%	2	N/A	N	D/K	Y	N	Comprehensive	N
Oregon	1,295	3%	0	N/A	N	N	N	N	None	N
Pennsylvania	3,246	4%	No info	No info	N	N	Y	N	Limited	Y
Rhode Island	328	34%	3	N/A	Y	Y	Y	N	Comprehensive	Y
South Carolina	1,195	2%	7	N/A	N	N	Y	Y	Comprehensive	Y
South Dakota	730	0%	0	N/A	N	N	N	N	None	N
Tennessee	1,718	57%	1	N/A	N	N	N	N	None	N
Texas	8,758	13%	4	N/A	N	N	Y	N	Limited	N
Utah	1,010	6%	1	N/A	N	N	Y	N	Comprehensive	N
Vermont	329	31%	1	N/A	N	N	Y	N	Comprehensive	N
Virginia	2,027	0%	3	N/A	N	N	Limited	N	None	N
Washington	2,311	20%	12	N/A	N	Y	Y	Y	None	Y
West Virginia	762	45%	4	9	N	Y	Y	Y	Comprehensive	N
Wisconsin	2,268	0%	0	N/A	N	N	N	N	None	N
Wyoming	368	100%	0	18	N	Y	Y	Y	Comprehensive	N

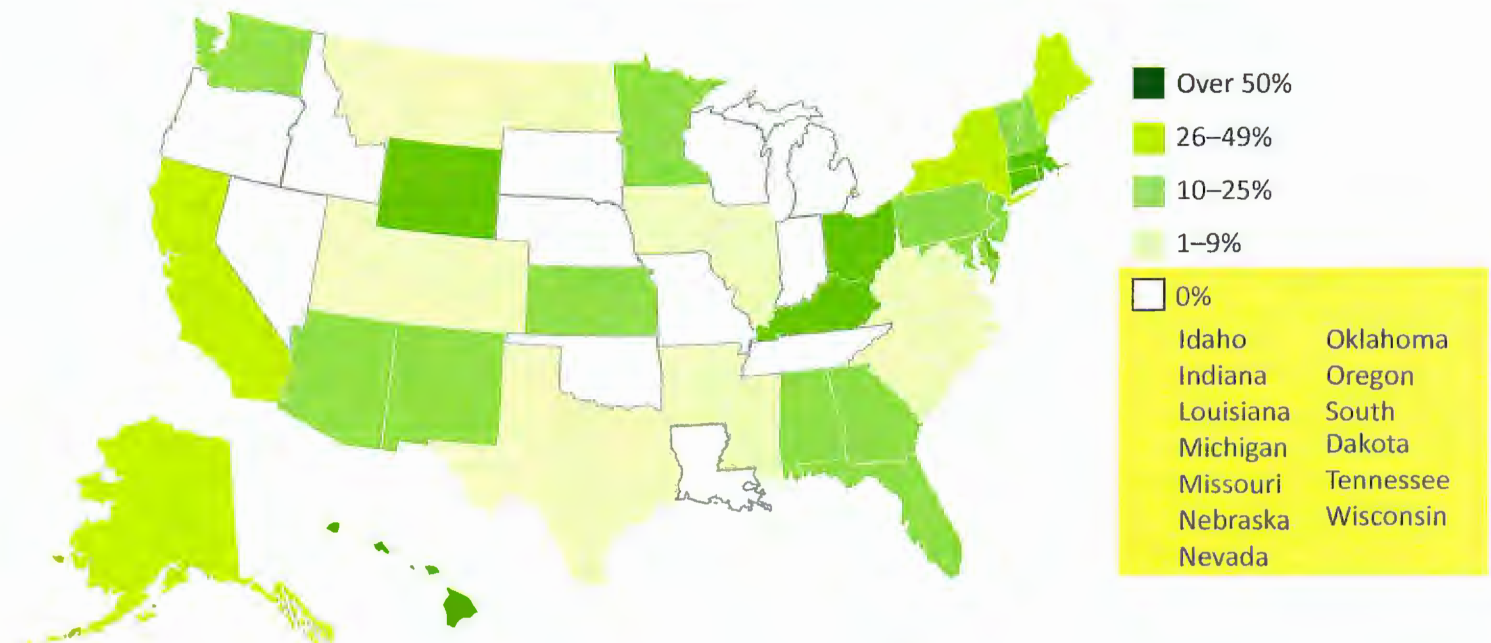
Unless otherwise cited, all data is from survey of state education agencies by 21st Century School Fund in Summer and Fall of 2010.

Additional sources: (1) NCES 2008-2009 school year; (2) US Green Building Council.

(3) Hawaii is a unitary district, so the state manages all school facilities. Staffing includes local and state staff.

12 STATES PAY ZERO CONSTRUCTION COSTS

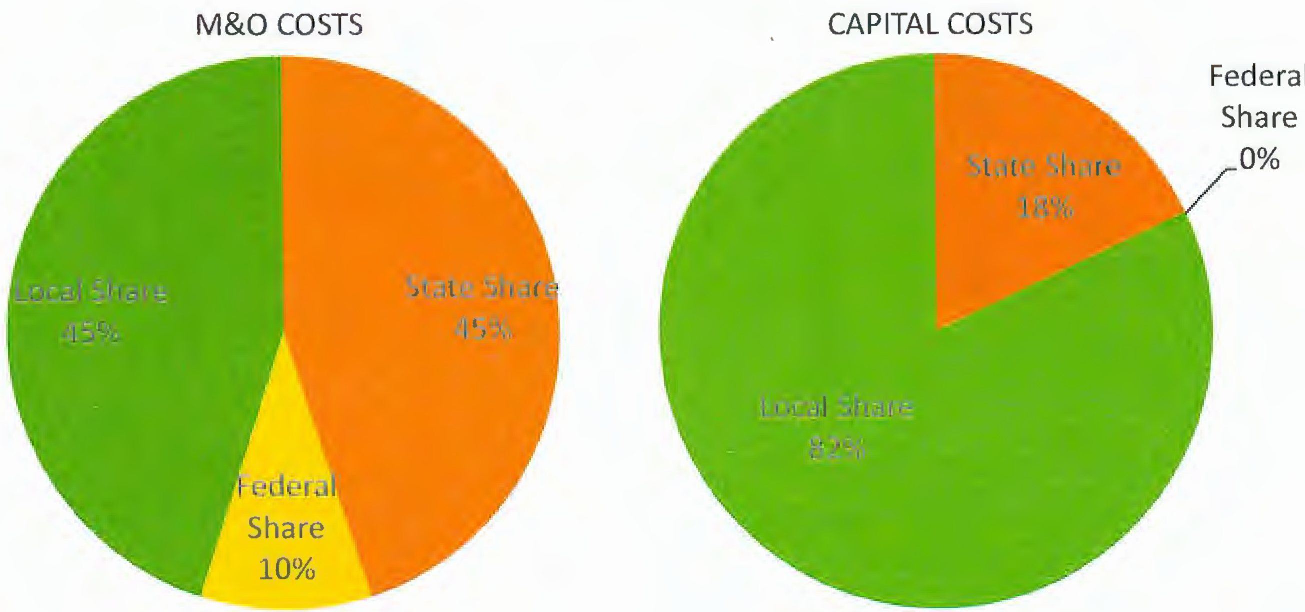
STATE SHARE OF FUNDING FOR CAPITAL OUTLAY, FY 1995–2013



Source: National Center for Education Statistics, analyzed by 21st Century School Fund

AN INEQUITABLE FUNDING SYSTEM

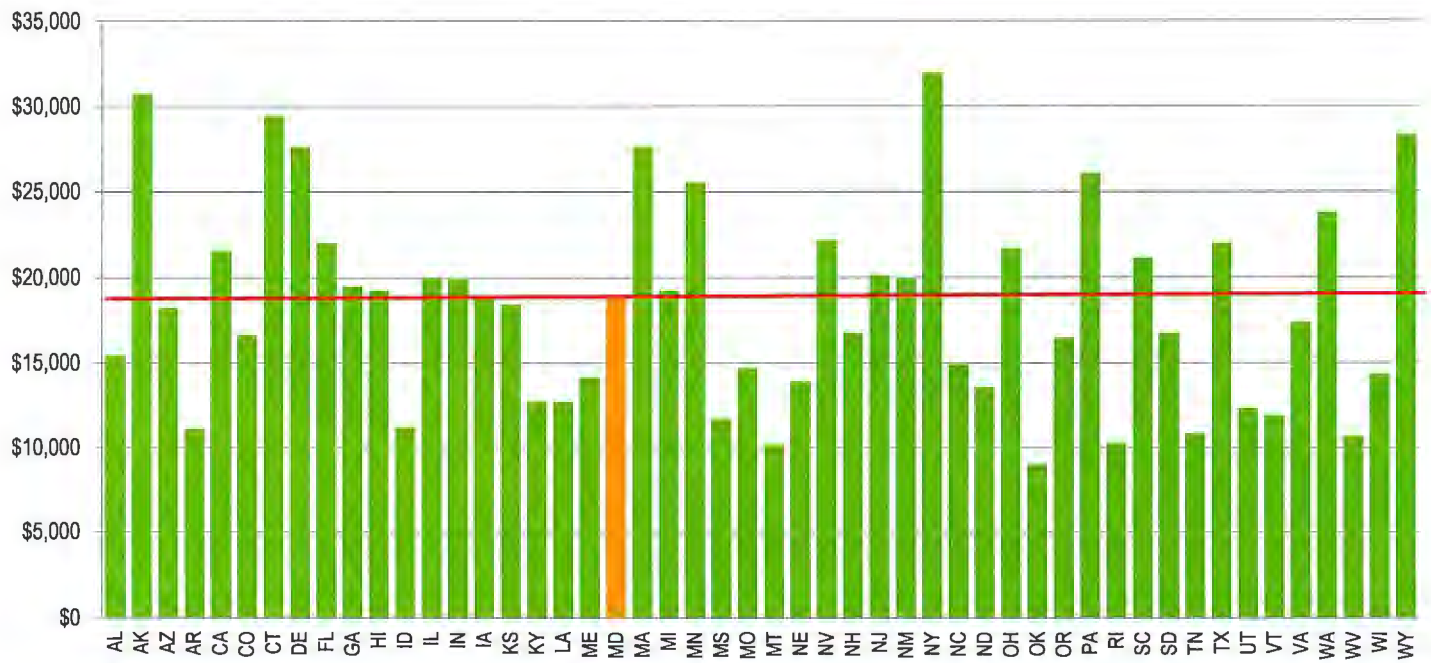
Local communities pay 45% of M&O and 82% of capital construction outlay

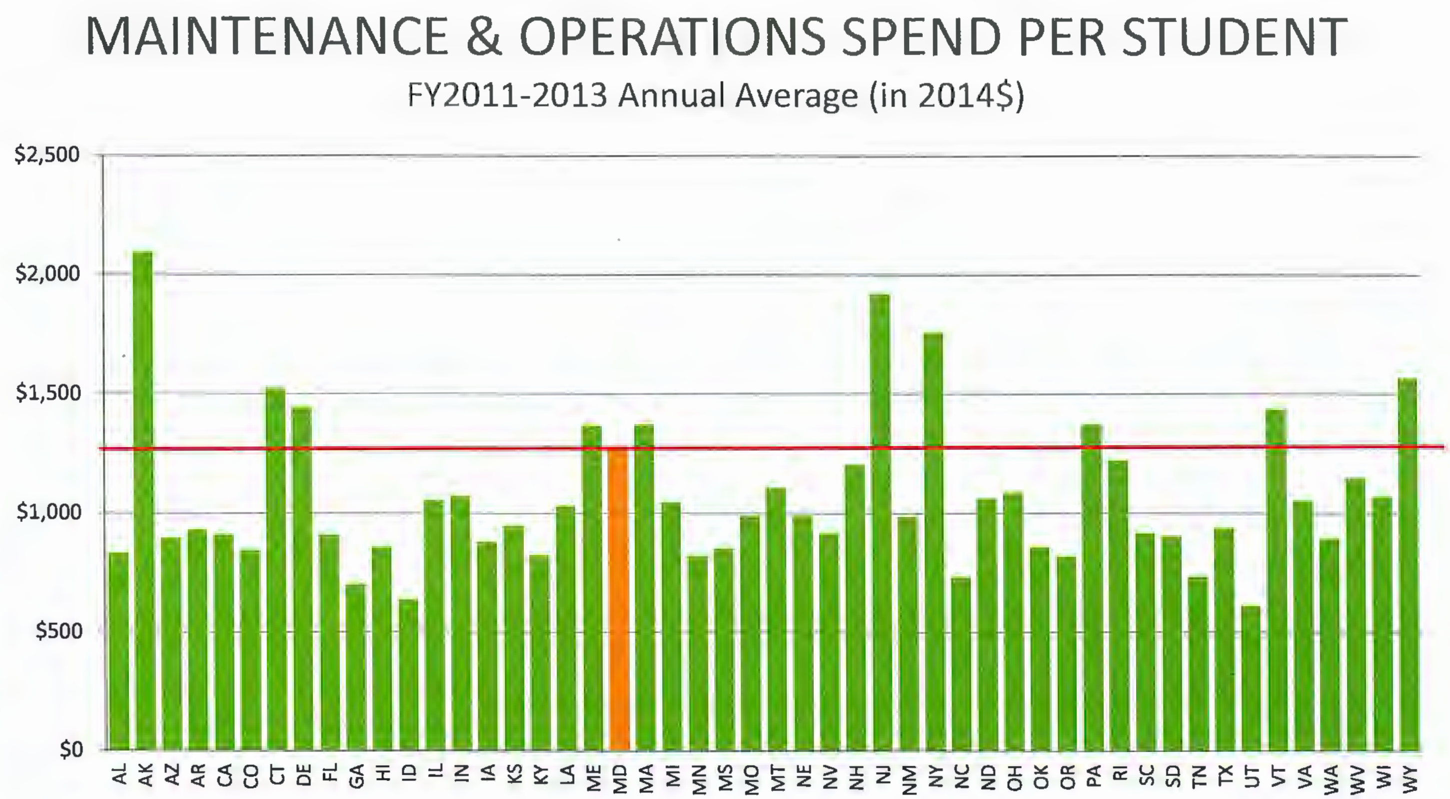


Because local wealth varies greatly, some communities have modern, high-quality schools, while others do not.

CAPITAL CONSTRUCTION SPEND PER STUDENT

Total FY1994-2013 (in 2014$)




MAINTENANCE & OPERATIONS SPEND PER STUDENT
FY2011-2013 Annual Average (in 2014$)
$2,500
$2,000
$1,500
$1,000
$500
$0
AL AK AZ AR CA CO CT DE FL GA HI ID IL IN IA KS KY LA ME MD MA MI MN MS MO MT NE NV NH NJ NM NY NC ND OH OK OR PA RI SC SD TN TX UT VT VA WA WV WI WY

NOW	FUTURE ?	Facility Impact
When is school provided?		
180 days a year September – June 8:00 AM – 3:00 PM Monday – Friday	**Year round education** January – December 7:00 AM – 8:00 PM Monday - Saturday	Potential for space utilization savings Need for air conditioning in all spaces Changes in lighting spaces for more nighttime use M&O management without summer down time
What programs are delivered ***by*** school districts?		
Grade-level education (ALL) Distance learning (SOME) Early childhood education (SOME) Thematic and CTE programs (SOME) After-school programs (SOME) Co-curricular programs (SOME) Summer school (SOME) Breakfast and lunch programs (ALL)	Grade-level education (ALL) **Distance Learning (ALL)** **Early childhood education (ALL)** Thematic and CTE programs (SOME) **After-school programs (ALL)** **School-based social services (ALL)** **Co-curricular programs (ALL)** Breakfast and lunch programs (ALL)	Need for more classroom space if expanding ages served by right Expansion of administrative and specialized program space for social services, camps and more thematic programs Expansion of food service capacity with student feeding programs
How school district programs are delivered?		
In individual age-determined grade level (K-12) groupings Teacher paired with a group of students	**In multi-age groupings, individualized for competencies and readiness** **Team of adults (and even students) paired with groups of students**	Need for more flexible spaces to address various sized groupings Need for collaborative spaces for teams of adults working with students
What programs are delivered ***in*** schools, but not ***by*** school districts?		
School-based social services After-school programs Summer camp programs	**Intersession camps or programs (ALL)** **Daycare** **Feeding programs for elderly (ALL)** **"Let's move" programs for elderly (ALL)** **Job training for adults** School based social services After-school programs for students	Need controlled access, storage, separate utility metering, and administration for facility users not under direct authority of school district Need to account for the full cost of ownership when calculating cost to non-school providers
Who is served in public schools?		
Age appropriate students residing in the district and attendance zone Community members through facilities use agreements	Age appropriate students residing in the district and attendance zone **Age appropriate students from any zone** **Age appropriate students from any district** **Neighborhood infants and toddlers** **Adults** **Neighborhood elderly** Community members through facilities use agreements	Flexibility in growing and shrinking space used for programs delivered by school district since added "choice" puts districts at risk for churn and difficult to predict enrollments.

THE CHANGING SCOPE OF SCHOOLS

Anne Arundel County Public Schools

Hillsmere Elementary School, 1967

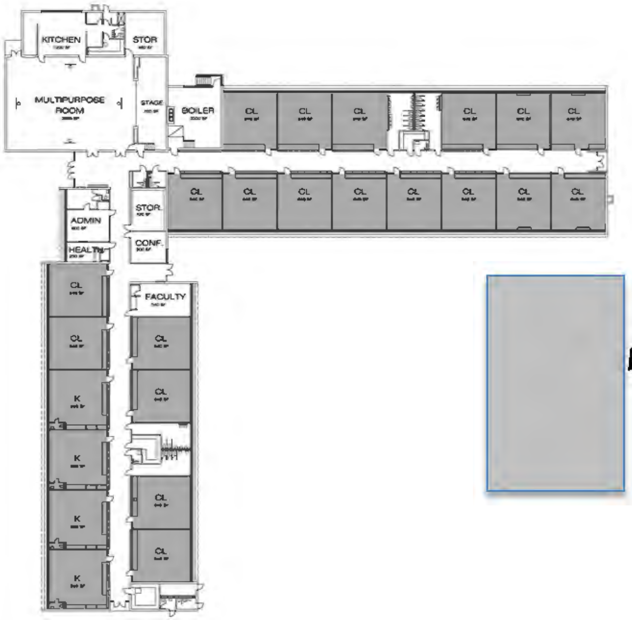
Germantown Elementary School, 2011

21st Century School Facilities Commission

August 25, 2016

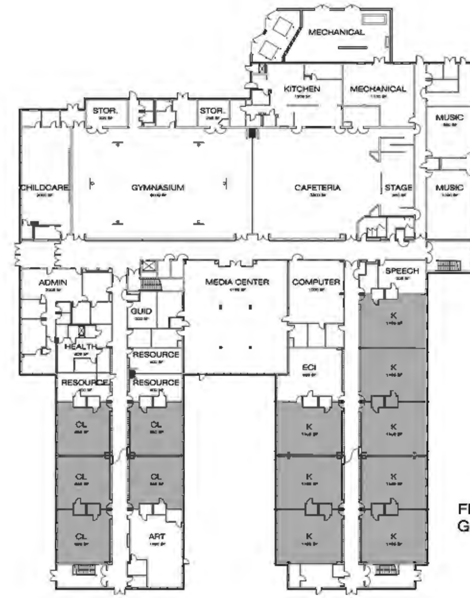
David Lever, Executive Director, Interagency Committee on School Construction

Elementary School Design, 1962 vs. 2011

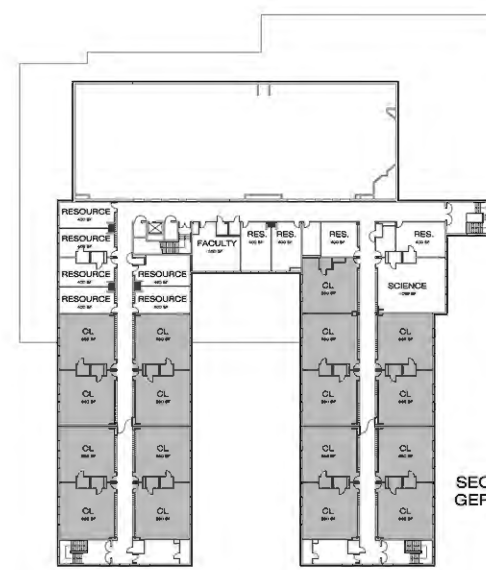


Addition of 6 classrooms needed to meet 685 SRC

Benfield Elementary School
1962
SRC 548
42,234 gsf
77 gsf/student



FIRST FLOOR
GERMANTOWN E.S.



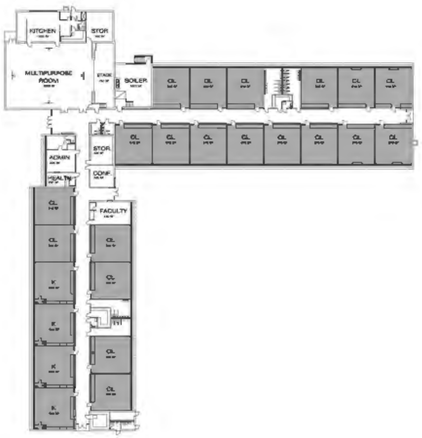
SECOND FLOOR
GERMANTOWN E.S.

Germantown Elementary School
2011
SRC 685
89,998 gsf
131 gsf/student

Anne Arundel County Public Schools

Elementary School Design, 1962 vs. 2011

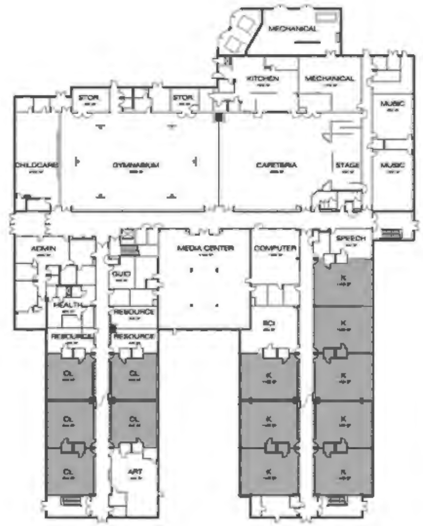
Benfield Elementary School, 1962
1 Story, 548 SRC, 77 gsf/FTE



Similar Spaces:

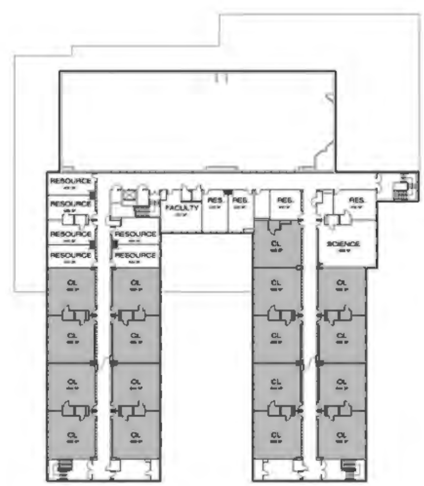
- Classrooms:
  - Kindergarten – 4
  - Regular – 26
- Multipurpose Room w/ stage – 1
- Admin/Conference – 1
- Health – 1
- Faculty - 1
- Kitchen - 1
- Storage – 2
- Mechanical – 1
- Miscellaneous Other – 5

Germantown Elementary School, 2011
2 Stories, 685 SRC, 131 gsf/FTE



Similar Spaces:

- Classrooms:
  - Kindergarten – 8
  - Regular – 21
- **Cafetorium** w/ stage - 1
- **Admin**/Conference – 1
- **Health** – 1
- Faculty - 1
- **Kitchen** - 1
- Storage – 2
- **Mechanical – 2**



New Spaces:

- Gymnasium – 1
- Media Center – 1
- Computer Lab – 1
- ECI* – 1
- Art – 1
- Music – 2
- Science – 1
- Resource - 14
- Childcare - 1

* Early Childhood Intervention

Elementary School Design, 1962 vs. 2011

Benfield Elementary School, 1962
1 Story, 548 SRC, 77 gsf/FTE

Germantown Elementary School, 2011
2 Stories, 685 SRC, 131 gsf/FTE

Elementary School Design, 1962 vs. 2011

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21ST CENTURY SCHOOL FACILITIES COMMISSION
CONTAINING THE COST OF CONSTRUCTION
David Lever
August 25, 2016

I. THE MONARCH GLOBAL ACADEMY AND TRADITIONAL SCHOOL DESIGN

FACTORS THAT INFLUENCE CONSTRUCTION COSTS FOR NEW FACILITIES[1]

Factors within the owner's control:

- Building size: The net square footage that is needed to fulfill the educational mission of the school building, as defined by the educational specification and translated into a gross square footage figure by application of an efficiency factor.
- Site: The programmatic requirements of the site, as well as practical and regulatory requirements for traffic management, pedestrian access, stormwater management, utilities, and landscaping.
- Design:
    - *Complexity of design*: Number and types of interior spaces and exterior improvements such as stormwater management structures; and familiarity of the construction community with the proposed construction technologies, details, finishes, building systems, etc.
    - *Building technologies*: The systems and components that make up the building, especially the structural, mechanical, electrical, plumbing, data, and life safety systems, as well as the building finishes.
    - *Clarity and completeness* of the procurement documents.
    - *Code and regulatory requirements and standards*: Local, state and federal requirements that are a condition for funding, design approval, building permit, and occupancy.
- Project delivery method: The choice of methods available under Maryland regulation.
- Schedule: The time allowed for planning, design, permitting, construction, commissioning, and occupancy of the building.
- Procurement:
    - *Procurement method*: Competitive sealed bid, competitive negotiation, quality based selection (QBS), intergovernmental purchase, other.
    - *Procurement requirements*: Local, State, and federal requirements regarding competitive procurement, minority business enterprise participation, wage scale rates, and other factors.

External factors largely outside of the owner's control:

- General market conditions, including national and international events that affect the demand and price for specific building materials or systems.
- Availability of design and construction capacity to execute the project:
    - *Plant capacity for manufactured items* (windows, HVAC equipment, etc.)
    - *Skilled labor*
- Concurrent work under procurement in similar sectors, e.g. State, General Service Administration, military, major educational institutions, other public owners (including school systems), and the private commercial and housing market.

We know of no study that disaggregates the cost impact of these various factors; however, the two major factors within the owner's control are the size of the building and the construction technologies.

[1] These same cost factors apply to major renovation work, which is complicated in addition by the impact of latent conditions that usually can only be discovered during construction itself.

COST COMPARISON: GLOBAL MONARCH ACADEMY AND ROLLING KNOLLS ELEMENTARY SCHOOL

		Monarch Global	Rolling Knolls ES[2]	Variance
ED SPEC DIFFERENCES:				
1	State Rated Capacity (SRC):	757	598	-159
2	sf:	63,327	84,588	21,261
3	***sf/Student:***	***83.7***	***141.5***	***58***
CONSTRUCTION/PROJECT COST DIFFERENCES:				
4	Property and A/E Fees	$3,000,000	$1,760,728	-$1,239,272
5				
6	Site and Building Construction	$11,200,000		
7	Field and Playground Equipment	$500,000		
8	***Construction Cost***	***$11,700,000***	***$21,371,184***	***$9,671,184***
9				
10	TransZed	$312,500		
11	FF&E	$1,274,500		
12	Fixed Asset Cost	$1,587,000	$1,884,000	$297,000
13				
14	**Project Cost**	**$16,287,000**	**$25,015,912**	**$8,728,912**
15				
16	***Construction Cost/sf***	***$184.76***	***$252.65***	***$67.89***
17	Project Cost/sf	$257.19	$295.74	$38.55
PER STUDENT COST DIFFERENCES:				
18	***Construction Cost/Student***	***$15,456***	***$35,738***	***$20,282***
19	Project Cost/Student	$21,515	$41,833	$20,317

[22] Project opened fall 2015; final figures to be updated after project close-out.

MAJOR COST FACTORS:

A. The Educational Specification

***Rolling Knolls ES**: 2-stories, 85,688 sf, 598 SRC, $21.4 M construction cost, 142 gsf/student, $35.7K/student*

***Monarch Global Academy**: 2-stories, 63,327 sf, 757 SRC, $11.7 M construction cost, 84 gsf/student, $15.5K/student*

Educational Specification Differences:
Note: Monarch Academy is a K-8 facility; Rolling Knolls Elementary holds grades PK-5

The Monarch Academy has three program area types that are not found in the AACPS elementary school educational specification:

Program Space	Net Variance
• I.B. (International Baccalaureate) Coordinator Office	176 nsf
• One additional science classroom (AACPS has one)	494 nsf
• Foreign Language Classrooms and support spaces	1,668 nsf
Monarch Additional *Net* Area:	2,338 nsf
Monarch Additional *Gross* Area (@ 72.54% efficiency):	**3,223 gsf**

The AACPS educational specification has seven program area types that are not found in the Monarch Academy:

Program Space	Net Variance
• Instrumental Music Classroom[3]	850 nsf
• General Instructional Classroom (1 additional)	850 nsf
• General Instructional Area Toilets	1,300 nsf
• Pre-Kindergarten Classroom	1,100 nsf
• Special Education Classroom	1,700 nsf
• Mechanical/Electrical/Telecommunications	2,150 nsf
• Cooperative Community Use	4,800 nsf
AACPS Additional *Net* Area:	12,750 nsf
AACPS Additional *Gross* Area (@ 72.73% efficiency)	**17,531 gsf**
Total *Net* Square Foot Variance:	10,412 nsf
Total *Gross* Square Foot Variance (@ blended efficiency of 72.64%)	**14,333 gsf**

Cost of the Difference Attributable to the Educational Specification:

14,333 gsf X $252.65 = $3.6 million (construction only)

Total Cost Difference = $9.7 million

Balance of Difference = $6.1 million

Balance of Cost Differential is in Building Technologies

[3] AACPS also shows a dedicated Instrumental Classroom of 850 nsf; Monarch shows a Stage/Instrumental Music space of 993 nsf. It is assumed that these are equivalent in function.

MAJOR COST FACTORS:

B. Building Technologies

Building Technologies: Monarch Global Academy and AACPS Design Standard

	Monarch Global Academy	**AACPS Standard**
Structural	*Pre-engineered steel building with metal stud*	*Masonry and steel frame*
Exterior	*Exterior metal and insulated panels*	*Masonry*
Interior Finishes	*Gypsum wallboard partitions / the only masonry walls are for stairwells and the elevator shaft*	*Exterior walls and exposed interior walls (ex. Corridor where no lockers protect) are masonry*
	Acoustic separation minimal between classrooms	*Required to meet ANSI S12.60*
	Lower quality doors and hardware	*Doors selected for durability and security*
	Gym floor is Sport Court	*Wood floor for community afterhours and weekend use*
	Ceiling tile not used in some areas	*Ceiling system throughout for sound absorption*
	Casework and storage limited	*Casework provided for storage*
HVAC	*Unit ventilators in all the classrooms; do not control humidity or indoor air quality very well. Unit vents are less expensive than a central system and do not have the cost of ductwork. Rooftop units were used for the administration, gym, and cafeteria.*	*Central boiler/chiller w/ variable air volume dampers at ductwork provide greater control of individual room comfort (fresh air, humidity, temperature, and indoor air quality)*
	No energy management system (EMS) that would allow for remote control and monitoring.	*EMS systems provided allowing for energy efficiency and remote equipment monitoring and adjustments.*
Plumbing	*Plastic pipe utilized*	*Metallic pipe utilized*
	Individual toilets for kindergarten classrooms only, all other grades have hallway located group toilets	*Toilets provided in most classrooms*
	Do not have sinks in all the classrooms	*Sinks provided in most classrooms*
Lighting	*Conventional lighting system*	*LED lighting, providing long-life and lower energy costs*
	No lighting control systems	*Occupancy and daylighting monitoring in individual rooms provides proper lighting levels with minimum energy*
Security	*Limited security features*	*Comprehensive layered security systems*

In general, Monarch chose to use lighter building systems than those in standard Anne Arundel County Public School buildings.

The specifications for the AACPS buildings are similar to those for other LEAs.

Why can Monarch afford to use a lighter building technology?

a. A controlled student enrollment and known student population

b. A controlled educational program

c. A business model based on dedicated and largely known revenue stream for life of the building

d. Building and site are not used extensively by the community

Monarch Global Academy: Unique Factors

The Monarch Global Academy is unique within Anne Arundel County in several respects:

	Monarch Global Academy	AACPS Schools
Enrollment	*Capped by contract*	*Must accept all students in attendance area*
New Students	*Does not accept new students after Sept. 30*	*Must accept new students throughout school year*
Student Needs	*Students are largely known by name in advance; their needs can be anticipated*	*Many students will be new at the beginning of the school year and later, with needs that must be accommodated at that time*
Educational Program	*Defined by contract for a determined period*	*Impacted by State and local policy changes*
Admini-stration	*Principal, 2 deans, 3 instructional guides, 1 full-time Primary International Baccalaureate coordinator*	*Principal + 1 vice principal; itinerant resource staff, ½ time I. B. Coordinator*
Contract	*Operates on a contract, subject to evaluation and audit by AACPS*	*Each school is under direct authority of Board of Education*
Operating Budget	*Operates on a per-pupil annual allocation established in advance*	*Operates out of a budget shared with all other schools in jurisdiction*
Community Use of Building and Site	*Not used regularly by community on a full basis (other than specific user groups, e.g. Girl Scouts and Boy Scouts)*	*Used throughout day and week by community members.*

Conclusion:

Monarch's facility approach is likely to work effectively for its purposes, based on the unique factors of student enrollment, educational program, and budget. Examples:

Educational Specification:

- Absence of resource rooms can be compensated for by scheduling of office and other small spaces
- Narrow corridors do not create congestion problems because of disciplined way-finding approach (however, this could be an issue when 7th and 8th grade are added)

Building Technology:

- Lighter partition construction transmits excessive sound; but the controlled class size allows teachers to keep noise levels within acceptable bounds
- Lighter finishes can be renewed through The Childrens Guild capital expenditure program, or the annual per-student allocation

Monarch's facility approach would <u>not</u> be appropriate for the average public school facility in Maryland. Examples:

Educational Specification:

- Pending considerable further study, media center needs to be larger than in the Monarch facility, and should include a computer lab

- Multiple resource rooms must be incorporated into the design from the beginning, to avoid the use of other spaces (including storage closets) for small group and one-on-one instruction

- Special education requires dedicated space in most schools

- Almost all new schools have community use space

- Corridors must be wider than in the Monarch facility to prevent congestion problems as well as behavioral problems

Building Technology:

- Greater acoustic isolation is essential

- Mechanical system must have central energy management

- Finishes need to be highly durable, low maintenance

- New schools must achieve high performance certification (LEED Silver or MD-IgCC)

- Lighting should be on automatic controls

II. COST CONTAINMENT AND BUILDING ALTERNATIVES

THE SCHOOL FACILITY PLANNERS DILEMMA:

Facility Planner's Axioms:

1: Life-cycle costs are usually in inverse ratio to first costs ("pay now or pay later")

2: There is *never* enough funding both to buy high quality installations and to maintain facilities at industry-recommended levels of care

Maintenance and Operations:

- ***Ideal:*** Annual M&O investment should reflect the Current Replacement Value (CRV) and the anticipated life-cycle of the building:[4]
    - 25 year building: Invest 4% of CRV per year in M&O (adjusted for inflation)
    - 50 year building: Invest 2% of CRV per year in M&O (adjusted for inflation)
- ***Reality:*** Annual M&O budgets remain static or decline, while fixed costs and square footage increase

Facility Planner's Dilemma: Axiom #1 + Axiom #2 - Higher First Cost or Higher Life-Cycle Cost?

- Higher first cost reduces maintenance and defers replacement/renovation/upgrade
- Lower first cost allows more capital projects to be carried out, benefiting more schools and communities

COST CONTAINMENT STUDY 2016:

Joint State/Local/Private Effort:

- Team has worked since March on studying realistic building technology alternatives
- Team includes four LEA Facility Planners, an architectural firm, an engineering firm, and a constructor; inputs have been received from other LEAs

Goal:

- Develop a compendium of information on alternatives to guide choices by LEA Facility Planners, architects, and engineers
- Allow planners and designers to make knowledgeable choices between quality and life-cycle costs, considering other issues (e.g. aesthetics, community preferences)
- Update the compendium with new cost and other information as it becomes available
- Expand the compendium over time to include other building systems

---

[4] Council of the Great City Schools, "Reversing the Cycle of Deterioration in the Nation's Public School Buildings," October 2014, page 16.

Scope: 44 separate building systems under 9 categories:

1. Structural	Steel frame Exterior bearing wall Pre-engineered steel
2. HVAC	Variable refrigerant flow (VRF) Four-pipe variable air volume (VAV) Four-pipe fan coil units, dedicated outdoor air Two-pipe fan coil units, dedicated outdoor air Geothermal heat pump units, dedicated outdoor air
3. Electrical	LED lighting vs. standard fluorescent Light harvesting MC cable vs. flexible MC cable Copper wire mains vs. aluminum Emergency generator and switch gear
4. Plumbing	Cast iron vs. PVC for sanitary and storm Piped secondary roof drain vs. scuppers
5. Building Envelope:	
5a. Exterior Walls	Light gauge metal framing with brick veneer CMU with brick veneer Light gauge metal with insulated aluminum panel Light gauge metal with EIFS[5] Pre-cast concrete panel with brick veneer
5b. Windows and Storefronts	Aluminum frame, low-E insulated glass Vinyl frame, insulated glass Fiberglas frame, insulated glass Vinyl clad wood frame, insulated glass Metal clad frame, insulated glass
5c. Roof	4-ply hot asphalt, CSPE flashing, 2-part insulation Singly ply TPO Single ply mechanically fastened EPDM Cold 2-ply modified bitumen Steel standing seam metal, coated finish Fluid applied (urethane)
6. Interior Finishes:	
6a. Floor	Vinyl composition tile (VCT) Quartz tile Carpet Terrazzo Epoxy or poured resinous
6b. Wall	CMU Conventional gypsum wallboard

[5] Exterior insulation and finish system, e.g. Dryvit (proprietary name)

		High impact gypsum wallboard Tiled wall overlayment
6c.	Ceiling	4'x2' acoustical ceiling tile (ACT) grid system 2'x2' acoustical ceiling tile (ACT) grid system Gypsum drywall Perforated metal pan

Under each category, examine:

- Quantitative Considerations:
  - Construction cost (high and low)
  - Anticipated life of system (years of useful life prior to replacement)
  - Average annual maintenance and operational (M&O) cost
  - Average annual life-cycle cost ($/sf/year)
  - Life cycle cost (total)

- Qualitative Considerations:
  - Pros
  - Cons
  - Other Considerations (e.g., user satisfaction)
  - Comments

Current status of study:

- Filling in several pieces of missing information, will complete this summer and fall

- Will "test drive" alternatives against a single known elementary school design to determine overall cost differences

- Will work with all LEAs to expand and test the findings

APPLICATIONS: HYPOTHETICAL COST DECISIONS

Example 1: Windows and Storefronts[6] (all costs are based on 3' X 5' window size, installed)
Details on all window/storefront systems studied are found in Appendix 1

Case Study: Elementary school requiring replacement of 50 windows

Aluminum frame with thermal break & insulated low-E glass :
@ $975.00 / window X 50 windows = $48,750
45+ years
Total cost over 45 years: $48,750

Fiberglass frame with insulated glass :
@ $600.00 / window X 50 windows = $30,000
10-20 years; avg. 15 years
Replace at 15 years and 30 years: 2 X $30,000 + 1st Cost
Total cost over 45 years: $90,000

[6] Source: Frederick County Public Schools, summer 2016

***Conclusion*: Aluminum frame is the more reasonable option:**

- First Cost Difference: $18,750 greater
- 20 Year Life-Cycle Difference: $41,250 less
- Risk Factor: None; performance of aluminum frame is better, more durable, retains attractive appearance

Example 2: HVAC System[7]

Note: HVAC systems now cost approximately 30% of the entire construction budget for institutional buildings

Details on all HVAC systems studied are found in Appendix 1

Case Study: High school HVAC retrofit, 200,000 sf

Variable refrigerant flow (VRF) with supporting dedicated outdoor air systems

- First Cost: $40 to $44/sf; $42/sf avg. X 200,000 sf ➔ $8.4 M
- Life Expectancy: 16-20 years (entire system; piping will require replacement when equipment is replaced)
- Average Annual M&O: $0.70/sf
- Life Cycle M&O Cost: ~ $140,000/year X 20 = $2.8 M
- Total 20 Year Cost: $8.4 M + $2.8 M = $11.2 M

Four-pipe fan coil units with supporting four-pipe dedicated outdoor air systems.

- First Cost: $45 to $46/sf; $45.5/sf avg. X 200,000 ➔ $9.1 M
- Life Expectancy: 20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.
- Average Annual M&O: $0.85/sf
- Life Cycle M&O Cost: $170,000/year X 20 = $3.4 M
- Total 20 Year Cost: $9.1 M + $3.4 M = $12.5 M

***Conclusion*: VRF is more reasonable option:**

- First Cost Difference: $700,000 less
- 20 Year Life-Cycle Difference: $1.3 M less
- Risk Factor: Replacement of entire VRF system at 20 years +/- will disrupt educational program

COST CONTAINMENT: PRELIMINARY CONCLUSIONS

Underlying factors to consider:

- Schools must:
  - Always meet the educational mission;
  - House a vulnerable population;
  - Meet the daily mission to stay open and operate;
  - Be subject to exceptionally high levels of community concern
- Most schools built today will be in service in 40 to 50 years (based on past record)

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[7] Source: Calvert County Public Schools, summer 2016

- Many will be fully renovated within that timeframe
- All will undergo some level of renovation and system replacement due to aging, changing educational programs, innovation and obsolescence
- The list of capital needs will always exceed funding resources
- LEA maintenance budgets are increasingly constrained, and will remain so
- Underfunded maintenance will lead to poor system performance and premature failure
- Community preferences and expectations play a role

LEA Incentives:
- To stretch limited State and local capital dollars as far as possible
- To apply the dollars to the highest priority projects
- To defer renovation/replacement/upgrade and to reduce future maintenance costs as much as possible

The Facility Planners Dilemma: "Pay now or pay later"

Conclusion:
- Each project must be examined individually:
  - How long will the building be in service?
  - What will be its hours of use?
  - Who will occupy it?
  - What other projects are competing for funds?
- Given a choice between better projects at higher cost, and more projects at lower cost, it is more prudent to choose quality and durability

EXAMPLES OF VALUE ENGINEERING / COST REDUCTION: FOUR HIGH SCHOOLS

Details are provided in Appendix 2

1. Allegany High School Replacement, Allegany County

	9/2/2015 Bid Results	6/29/2016 Bid Results
Base Bid	$46,974,000	$50,275,000
Auditorium/9 Classrooms	6,840,000	Included in Base Bid
Alternates	5,226,000	1,518,000
Project Totals	$59,040,000	$51,793,000

2. Northern High School Replacement, Calvert County

	2/12/2015 Bid Results	6/29/2016 Bid Results
Auditorium Reno	2,300,000	2,300,000
Site	8,000,000	9,000,000
Alternates	2,765,000	2,533,000
Project Totals	$79,065,000	$69,383,000

3. **North Dorchester High School Replacement, Dorchester County**
   Initial bids were $10 million above budget. Through collaborative discussion among the Owner, the Construction Manager At-Risk, and the trade contractors, the project was brought within budget (including a modest supplement from the local government).

4. **Frederick High School Replacement, Frederick County**
   Bids were received in March/April 2015. The bids came in high. FCPS accepted the bids and moved forward with the construction project. They thereafter worked with the approved contractors and the consultants to review the plans and specs to determine any opportunities for cost savings. Reductions in square footage or redesign of the mechanical systems were ruled out since the project was already under contract and was scheduled to open in August 2017. Through this process, FCPS saved over $2 million dollars.

COST CONTAINMENT - FURTHER RESEARCH:

Pre-Engineered Structural Systems:

- Used extensively in the private market for warehouses, shopping centers
- Used by Monarch Global Academy
- Speeds fabrication, erection, and enclosure of building envelope
- Appears to require use of design-build, a project methodology never used for a major public school project in Maryland
- Limitation in number of vendors may pose a bottleneck

Tilt-Up Concrete Construction

- Useful for large buildings with extensive, unbroken wall surfaces
- Speeds erection of exterior walls, building enclosure
- Concrete walls may be less adaptable to modifications over time (new openings, changes in building infrastructure)
- Limitation in number of vendors may pose a bottleneck

Insulated Concrete Form (ICF) Construction

- Insulation and structure are integral
- Said to provide exceptionally high energy performance
- Insulation said to allow for modifications to building systems

Modular Pre-Manufactured Construction

- Used extensively in Alberta, Canada to speed construction, allow for rapid adaptation of schools to enrollment changes
- Used in Pennsylvania for school addition in a very tight site
- Requires intensive early coordination among owner, architect, and constructor

Note: These systems are being studied by Whiting Turner Construction for application to the Somerset County Public Schools Career and Technology Center replacement project; findings will be available within a few months.

APPENDIX 1: BUILDING SYSTEMS USED FOR EXAMPLES

WINDOWS AND STOREFRONT

a. *Aluminum frame with thermal break & insulated low-E glass*

- First Cost: $975.00
- Life Expectancy: 45+ years
- Pro: Frames require little maintenance, do not rust like steel, insulated glass and thermal breaks minimize heat transfer and condensation, frames do not require painting, Low E coating reflects solar ultraviolet (UV) and infrared energy
- Con: Aluminum has a large coefficient of expansion
- Other Comment: This is standard system used in commercial construction

b. *Vinyl frame with insulated glass*

- First Cost: $500.00
- Life Expectancy: 10-15 yrs.
- Pro: Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum
- Con: Vinyl does not hold up well to UV, becomes brittle, significantly shorter lifespan than aluminum
- Other Comment: Typically used in residential construction

c. *Fiberglass frame with insulated glass*

- First Cost: $600.00
- Life Expectancy: 10-20 yrs.
- Pro: Dimensionally stable, frames do not require painting, lower first cost than aluminum
- Con: Fiberglass deteriorates with UV exposure and exhibits "fiberbloom", shorter lifespan than aluminum
- Other Comment: Typically used in residential construction

d. *Vinyl clad wood frame with insulated glass*

- First Cost: $750.00
- Life Expectancy: 15-20 yrs.
- Pro: Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum
- Con: Vinyl doesn't hold up well to UV, becomes brittle, significantly shorter lifespan than aluminum
- Other Comment: Typically used in residential construction

e. *Metal clad frame with insulated glass*

- First Cost: $675.00
- Life Expectancy: 20-30 yrs.
- Pro: Lower first cost than aluminum, frames do not require painting, more dimensionally stable than aluminum
- Con: Paint fades and chalks from UV exposure, longer lifespan than vinyl and fiberglass
- Other Comment: Typically used in residential construction

HVAC

a. *Variable refrigerant flow (VRF) with supporting dedicated outdoor air systems* (DX cooling + gas-fired heating)

- First Cost: $40 to $44/sf
- Life Expectancy: 16-20 years (entire system; piping will require replacement when equipment replaced)

- Average Annual M&O: $0.70/sf
- Comment: Ceiling cassette units lower cost; horizontal ducted units higher cost
- Pro: Excellent for retrofit and additions projects, as well as administration areas; smaller ductwork sizes; flexible during phased construction; quiet operation; low first cost; good energy efficiency; space conditioning systems are separate from ventilation systems; permits independent heating or cooling within each space; energy recovery easily incorporated.
- Con: Controls integration concerns with central energy management systems; manufacturer dependency (equipment not interchangeable between manufacturers); limited system redundancy; difficult to expand or modify an existing system once installed; entire system will require replacement at end of it's operating life; refrigerant leaks can be difficult to locate.
- Other Considerations: Great for stand-alone building projects (no central county energy management system). No guarantee refrigerants will be the same in 20 years. Refrigerant piping line sets will require replacement when system is replaced and/or modified.

b. ***Four-pipe variable air volume (VAV) rooftop units with single duct terminal units*** (need four-pipe arrangement with VAV, unless cooling is DX).
   - First Cost: $48 to $50/sf
   - Life Expectancy: 20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.
   - Average Annual M&O: $0.75/sf
   - Comment: Costs assume non-fan powered VAV Units
   - Pro: Allows for independent heating or cooling within each space; reduced filter maintenance; less mechanical equipment than other system options; central heating system redundancy easily accomplished; minimal floor area required to support system; "free-cooling" (economizer) available.
   - Con: High first cost; larger ductwork sizes; difficult for retrofit projects; space conditioning and ventilation systems are not independent; higher minimum outdoor air quantities; difficult to incorporate energy recovery.
   - Other Considerations: If system is operated as a two-pipe system, the thermal comfort benefit of this system is eliminated; therefore, first cost increase of system (as compared with two-pipe systems) is essentially wasted. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replaced.

c. ***Four-pipe fan coil units with supporting four-pipe dedicated outdoor air systems.***
   - First Cost: $45 to $46/sf
   - Life Expectancy: 20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.
   - Average Annual M&O: $0.85/sf
   - Pro: Good for retrofit projects; smaller ductwork sizes; good energy efficiency; central heating system redundancy easily accomplished; space conditioning systems are separate from ventilation systems; permits independent heating or cooling within each space; energy recovery easily incorporated.
   - Con: High first cost; equipment may need to be located outside of classroom area for compliance with LEED acoustical requirements; some maintenance staff not familiar with system operation.

- Other Considerations: If system is operated as a two-pipe system, the thermal comfort benefit of this system is eliminated; therefore, first cost increase of system (as compared with two-pipe systems) is essentially wasted. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replaced.

d. Two-pipe fan coil units with supporting two-pipe dedicated outdoor air systems.

- First Cost: $42 to $43/sf
- Life Expectancy: 20 years equipment, 20-25 years chiller, 30-35 years boiler, 35-40 years piping and ductwork.
- Average Annual M&O: $0.70/sf
- Pro: Good for retrofit projects; smaller ductwork sizes; low first cost; good energy efficiency; central heating system redundancy easily accomplished; space conditioning systems are separate from ventilation systems; energy recovery easily incorporated; lower first cost than four-pipe systems.
- Con: Occupant temperature complaints typical during the spring and fall seasons; potential for overheating interior spaces during the winter; equipment may need located outside of classroom area for compliance with LEED acoustical requirements.
- Other Considerations: Occupant thermal comfort must be considered before proceeding with this system. Reuse of central equipment (boilers and chillers), ductwork, and piping feasible when other equipment needs replaced.

e. Vertical geothermal heat pump units with supporting dedicated outdoor air systems

- First Cost: $44 to $45/sf
- Life Expectancy: 20 years equipment, 35-40 years piping and ductwork, 40-50 years outdoor geothermal piping.
- Average Annual M&O: $0.70/sf
- Life Cycle Cost: ~ $6.9M (based on 20-yr LCCA)
- Comment: Costs exclude geothermal field; geothermal field ~ $12 to $13 per LF of vertical geothermal well.
- Pro: Smaller ductwork sizes; no central equipment (boilers or chillers); excellent energy efficiency; space conditioning systems are separate from ventilation systems; permits independent heating or cooling within each space; energy recovery easily incorporated.
- Con: High first cost; large "open" site area required; risk of unforeseen conditions during drilling of geothermal borings; equipment typically located outside of classroom area for compliance with LEED acoustical requirements; some maintenance staff not familiar with system operation; energy recovery easily incorporated; remediation can prove costly if system is not properly designed.
- Other Considerations: Operating setpoint of geothermal pumps must be properly established during balancing to provide energy efficiency; reuse of building and site piping feasible when other equipment needs replaced.

APPENDIX 2: HIGH SCHOOL COST REDUCTION EFFORTS

1. ALLEGANY HIGH SCHOOL REPLACEMENT, ALLEGANY COUNTY

	9/2/2015 Bid Results	6/29/2016 Bid Results
Base Bid	$46,974,000	$50,275,000
Auditorium/9 Classrooms	6,840,000	Included in Base Bid
Alternates	5,226,000	1,518,000
Project Totals	$59,040,000	$51,793,000

Examples of Value Engineering:

- County Government agreed to supply all top soil for the project from a stock pile at the industrial park.
- Retaining walls were simplified and a less expensive segmented wall was specified.
- Eliminated polished concrete and replaced with hardened concrete.
- Brick veneer was changed to a larger size (4x4x12)
- Revised rooftop mechanical equipment screen to be steel in lieu of aluminum.
- Revised roofing from 4-ply BUR to single ply EPDM
- Eliminated exterior sunshades
- Allowed Victaulic fittings for mechanical room hydronic piping over 2-1/2" in lieu of welded
- Allowed PVC piping for sanitary lines except exposed locations
- Replaced hardboard duct insulation with foil-backed duct wrap
- Revised and simplified temperature control system and allowed additional HVAC equipment manufacturers
- Revised light fixture schedule
- Revised spec for electrical transformers
- Eliminated conduit for some safety and security cabling and low voltage cables where allowed by code
- Changed TVSS units from integral to external
- Revised the Civil Drawings to allow flexibility in the finished grade elevations allowing the use of all on-site fill material.
- Deleted a large pedestrian ramp and revised the exterior art court from masonry pavers to concrete.
- Simplified the exterior stair design
- Simplified an exterior wall at the music rooms from "saw-toothed" to straight masonry.
- Simplified interior design of the auditorium – curved walls were straightened
- Pre-fab canopies at the bus lane were reduced
- Most of the Add-Alternates were eliminated (athletic field lighting; terrazzo flooring; sub-metering; geothermal system; lighting, rigging, dimming in TV studio and student dining; photovoltaic system, solar domestic hot water)

Construction of the tennis courts and athletic fields with the exception of the running track and football field were removed from the project. The fields and dugouts will be built at a later date by Board of Education and County government staff.

Estimates of the most significant savings:

- Supplying topsoil $272,000
- Eliminate polished concrete $75,000
- Revise grades/reduce retaining walls $200,000
- Revise Brick size $270,000
- Use single-ply roofing $339,000
- Eliminate sunshades $133,000
- Use PVC pipe $200,000
- Use foil backed duct insulation $150,000
- Add HVAC equipment manufacturers $300,000
- Simplify temp control system $150,000

2. NORTHERN HIGH SCHOOL REPLACEMENT, CALVERT COUNTY

	2/12/2015 Bid Results	**6/29/2016 Bid Results**
Auditorium Reno	2,300,000	2,300,000
Site	8,000,000	9,000,000
Alternates	2,765,000	2,533,000
Project Totals	$79,065,000	$69,383,000

- Retained the old gym and reduced the auditorium scope.
- Eliminated the Northern Middle School parking lot improvements (to be done during the future NMS project).
- Reduced the building area by eliminating a large amount of common space set aside for student interaction (BOE request for a collegiate theme), reduced the classroom count to better reflect the current enrollment (area for an addition is provided) and eliminated the large penthouses for the mechanical system.
- Reduced the building excavations by raising the gym and cafeteria to "grade".
- Reduced the dependence on the masonry trade by eliminating CMU classroom partitions and exterior CMU back-up in lieu of structural stud and gyp partitions. Kept masonry veneer and CMU corridor walls, stair wells and elevator shaft.
- Lighter structural steel package as a result of the masonry switch and deleted HVAC penthouses.
- Building will build quicker, thus a reduction in general conditions and down time due to weather by reducing the mason's involvement.
- The HVAC system was revisited. The original plant involved essentially two systems, geothermal and back-up/assist boiler and chiller. The back-up/assist was deleted.
- The ATC package was simplified which reduced some cost but more importantly the maintenance crew would appreciate the reduce headache.
- Eliminated the penthouses and specified RTUs instead of AHUs.

Estimates of the most significant savings:

- Building (penthouses included): $5.5m Reduction
- Site (NMS deleted, environmental added): $0.9m Add
- HVAC: $4.5m Reduction

3. NORTH DORCHESTER HIGH SCHOOL REPLACEMENT, DORCHESTER COUNTY

Initial bids were $10 million above budget. Through collaborative discussion among the Owner, the Construction Manager At-Risk, and the trade contractors, the project was brought within budget (including a modest supplement from the local government).

- Masonry — Simplify masonry detailing, change CMU and brick selections
- Steel — Replace trusses with regular joists at several locations
  Revise Decorative Panels/railings system
- Carpentry — Revisions to hardware
- Roofing — Provide 4" total thick nailboard insulation (R-25) in lieu of 6" thick insulation assembly (R-30)
  Provide single row of snowguard in lieu of double rows
- Windows — Reduce number of vents on window systems
  Eliminate testing of curtain walls and storefronts per specifications
  Use of solabane 60 throughout project.
  Revisions of overhead door (delete operator system; will be chain hoist operation)
- Ceiling — Delete Metalworks and hard ceiling in Dining Commons Room
  Redesign joist framing
  Light gage framing from 16ga to standard 20ga for trusses
  Wall Panels: Reduce, remove or use alternate manufacturer and size
  Delete ACT or replace with other ceiling in several areas
- Flooring — Replace SVT with VCT or polished concrete in several areas
  Other flooring substitutions
- Wall — Delete glass tile at walls
  Casework — Delete maple benches in learning commons; replace solid surface tops with laminate
- Shades — Delete motarized shades
- Fire — White semi-recessed pendent sprinkler heads in lieu of the specified white concealed pendent sprinkler heads; do not install sprinkler heads in the center of the ceiling tile; delete requirement for sleeves for fire protection in Drywall
- Mechanical — PVC pipe and fittings on condensate drains in lieu of copper
  Fusion pipe in lieu of Welding for geothermal piping (isco)
  CPVC in lieu of Copper for Domestic Water
  PVC for all above ground Sanitary, Storm
  Provide a TEL Packaged Kitchen Hood Ventilation System
  Delete redundant well (keep all pump house equipment/electrical)
- Electrical — CM to buy lighting/gear direct
  Reduction of security lighting to 2 site poles
  Remove power locations at (2) field - keep conduit and handholes
  Delete under cabinet lighting
  Revise RR fixtures in learning commons

Revise micro ring fixtures in Learning Commons
Controllers to power packs
Gear revisions
Reduce the number of light fixtures in the gymnasium/classrooms (labor/material)
Wireless Lighting Control System (labor/material)
Delete overtime requirement
Alternate manufacturer for security

- Sitework — Create a berm on site in lieu of haul off
  Reduce asphalt thickness at standard parking lots - deduct 1" of base paving and add 1" of stone base on LD paving only
  Delete stone base at pedestrian only sidewalk
  Site contractor to trench for electrical
  remove sod

4. FREDERICK HIGH SCHOOL REPLACEMENT, FREDERICK COUNTY

Bids were received in March/April 2015. The bids came in high. Instead of rejecting the bids, FCPS accepted the bids and moved forward with the construction project. They thereafter worked with the approved contractors and the consultants to review the plans and specs to determine any opportunities for cost savings. Reductions in square footage or redesign of the mechanical systems were ruled out since the project was already under contract and was scheduled to open in August 2017. Through this process, FCPS saved over $2 million dollars.

- Furnishings — Remove sliding marker boards
- Windows — Provide Hunter Douglas window shades in lieu of the specified mechosystems Shades
- Cabinetry — Revise detail in all labs
  Revise the wall cabinets in the classrooms to be solid wood fronts
  Revise the wall cabinets in the prep rooms to be glass fronts.
  Delete from every lab 2 added base cabinets w/deep bowl epoxy sink, acid resistant piping, fixtures, etc.
  Delete the instructor casework w/epoxy top in woodworking.
  Delete requirement for stainless steel locker bottoms
- Walls — Reduction in layers of GWB in Partition Types and Fire Track
  Stud Change
- Ceiling — Replacement of "Techzone" specialty ceiling with 2x4 ceiling panel in Academic Corridors
  Delete Absorptive/Diffusive Acoustic Panel.
- Lighting — Changes in light fixtures due to ceiling changes
- Plumbing — Delete the gas main to the Ag Science/Horticulture labs.
  Revise all gas cocks to be 2 port rather than 4 port.
- HVAC — Delete canvas & PVC jackets fr. exposed pipe & duct for pipe & duct more than 8 feet a.f.f.
  Delete requirement for vaporwick insulation and replace with standard fiberglass w/asj
  Delete acoustic duct lagging from certain ducts.
  Delete the siesmic requirement

Delete sound lined, double wall 18G for duct in shafts
Supply air ductwork first 10 feet off water to air heat pumps; five (5) feet of double wall lined ductwork after every manual balancing damper serving an air device on all supply and return air duct systems.
Delete requirement for exterior paint on the indoor HVAC units
Flexiduct should be equal to Flexmaster '6B' or '6M'
Delete acoustic lining in air device plenum boxes and delete plenum boxes.

- Fire — Allow Schedule 10 black steel pipe in lieu of Schedule 40 black steel pipe
  Delete the shower head feature in woodworking, ceramics, drawing & both foundations labs.
- Electrical — Make PA/clock package non-proprietary
  Numerous changes to outlets, data ports
  Miscellaneous other electrical changes
  Delete the under-cabinet strip lighting
  Delete the motorized shades/power in the café skylights. Leave the rgh-ins.
  Reduce the computer-on-wheels charging stations to be a single 20 amp circuit
  Reduce the quantity of charging stations in room B227 to 12 total; delete 8 stations
  Delete the EPO/contactors/utility cabinet, etc. in drawing studio, & both foundations labs (unless required by code).
  Delete the motorized projection screens in foundations labs. Install manual pull down or an alternate TV location.

CASE STUDY ANALYSIS OF ALTERNATIVE APPROACHES TO SCHOOL CONSTRUCTION

SUMMARY OF COST DRIVERS AND IMPACTS | MAY 2016

Prepared By:

Jay Brinson, City School Partners

CONTENTS

Section 1: Introduction and Overview

Background and Purpose

The Maryland Stadium Authority (MSA) has requested that City Schools Partners (CSP) provide a formal report evaluating differences in construction project implementation processes and costs between traditional public schools and schools delivered via alternative means. The request for this analysis is motivated by the desire to seek best practices with the use of public funds in the financing of school construction projects within the current Baltimore City Public Schools (City Schools) modernization program. As such, the objective for this analysis is to provide an assessment of the factors contributing to reduced construction costs at some charter schools and identify any potential applications for MSA and City Schools.

Approach

The primary data utilized in conducting this evaluation is derived from a side-by-side comparison of four schools; two operated by Baltimore City Public Schools and two by the Children's Guild. The four schools were selected based upon the similarities in grade configuration and construction type. The evaluation focuses on the program of spaces, materials, and systems included in each of the buildings and analyzes the impacts on construction costs, building operations, and ability of the facilities to support the objectives of the schools they serve.

The two schools being evaluated from Baltimore are Fort Worthington K – 8 and Frederick Elementary PreK-5. These two schools are being compared to two Children's Guild schools, the Monarch Global Academy in Laurel and Monarch Academy Baltimore on Kirk Avenue. Both of the Children's Guild schools are K – 8. Because Monarch Global in Laurel is a newly constructed building, it is compared against building plans that have been developed for Fort Worthington[1]. Monarch's Baltimore campus is located in a renovated bottling plant and it is being compared against construction plans for Frederick Elementary which will include a complete renovation of the existing building plus an addition.

Summary of Context

New educational facilities are a reflection of organizational values, priorities, and the difficult choices that must be made during project planning, design, and implementation. This assessment will place factors that drive cost savings within the context of specific associated tradeoffs, such as the impact on learning environments and long term operations, providing MSA and City Schools with a more comprehensive understanding of the viability of applying these methodologies when modernizing Baltimore City Public Schools.

[1] Fort Worthington and Frederick schools have just recently moved into the construction phase, therefore, the comparisons made herein are based upon the planned facilities, not the existing facilities.

Traditional Schools vs. Charter Schools General

District-operated, or traditional, public schools and charter schools share a common goal: to provide the best possible education to the children and families they serve. Charter schools are public schools and the education they provide is free to families living in the district where the charter is operated. Access to education at a public charter school is restricted by the school's enrollment capacity, which is restricted by available space and/or local policy. If more students apply for seats in a school than are available, a lottery is used to determine acceptance into the schools.

Charter schools operate in a different manner than traditional schools. Most charter organizations are autonomous, often only operating one school, and are typically led by a head of school or principal and a volunteer board of directors. There are several charter operators, like Monarch, who operate a few school facilities and there are a handful of Charter Management Organizations (CMO's), such as KIPP, which operate dozens of schools in multiple jurisdictions. Districts, of course, operate all of the schools required to serve the educational needs of the children living within their district boundaries and are, therefore, accountable to a much larger constituency. Organizationally, district schools require multiple departments of specialists to manage a bevy of educational and operational concerns ranging from transportation and facilities management to special education and food services.

These organizational differences have significant implications during the planning and implementation phases of a new school construction project. For starters, districts must carefully plan for new construction projects by prudently evaluating the impacts on the utilization of surrounding schools, changing demographics, and academic priorities such as early childhood education as well as objectively considering a myriad of other important priorities. Additionally, the planning process for traditional schools typically involve a public engagement process which often raises equity concerns that force district school leadership to be very methodical in establishing quality standards for new buildings as well as spatial accommodations in support of the communities they serve. As an example, attached as Exhibit A, is a 'subway map' of the community engagement process developed by Baltimore City Public Schools for the planning of new school projects in the 21st Century School Buildings Program. Finally, traditional school designs must ensure that taxpayer investment is well spent and that school facility designs appropriately balance upfront costs with ongoing maintenance and operating costs to the taxpayer.

The public engagement process and a balancing of short and long-term costs to the taxpayer is an acknowledgement of the accountability to multiple constituencies by Baltimore City Public Schools and the amount of effort that is deemed necessary to successfully develop a thoughtful public building. Charter schools, on the other hand, do not have the same accountabilities and typically only have to focus on ensuring their buildings[2] are constructed to meet their programmatic needs. The amount of time and effort associated with planning a district project leads to extended design timelines and increased design costs compared to charter schools.

[2] Not discussed here, but significant, is the amount of time, effort, and money most charter schools must devote to finding and securing the utilization rights to a facility that meets their needs.

Another significant contextual element is financing and availability of capital. Traditional school construction projects across Maryland are typically funded through a blend of local and State tax dollar allocations. Certain jurisdictions, including Baltimore City, rely more heavily on State-allocated construction funding and must compete with other jurisdictions to obtain necessary financing. The disparity between the amount of available State funding and requests from local school districts is significant, leaving many important school construction projects unfunded. This disparity in available State funding particularly impacts low-wealth jurisdictions that do not have the local tax base to support robust capital plans. Additionally, districts are required to provide matching funds to access State dollars which may limit some jurisdictions ability to complete projects.

In order to achieve eligibility for State funding, districts in Maryland must complete a feasibility study[3] during the planning phase to establish the justification for the proposed project plan. The State has established school utilization guidelines and conducts a review of specified materials and building systems to ensure that the taxpayer dollars are protected in a long term investment. Should the State deem a certain portion of the square footage unjustified, local contributions can fully fund that space. However, once all requirements are met, including the provision of local funding, project financing is in place.

Charter schools in Maryland, by contrast, are only eligible for State or local school construction program funding if they are located within a District-owned building and this funding is typically not available at the inception of a Charter school, but is rather provided within the context of the LEA's normal CIP prioritization process. Instead, Charter schools may utilize their annual allocation of operating dollars based upon student enrollment to fund projects in privately owned buildings or renovation projects to district buildings that are not funded through the CIP process. Charter schools must operate as any private business and secure independent financing based upon these annual operating cash flows and their balance sheet. This is typically a daunting process for most charter schools, particularly startups, even though there are multiple private non-profit organizations established to help the schools secure bridge loans, credit, grants, and other sources of financing, such as New Market Tax Credits, to build a multilayered stack of funding sources to design and build their new schools.

The organizational, accountability, and project funding differences between charter and traditional schools form the backbone of the resulting differences in construction project scoping and costs. Districts must carefully plan their projects to meet a variety of demands and eligibility requirements within the constraints of their local jurisdictions capital program capacity and likely eligibility for State funding while the principal concern of charter schools their capacity to support the debt from construction loans with their annual operating allocation. In other words, in traditional school projects the building program requirements typically drive the budgets while in charter schools the available budget is a high priority factor in most key program decisions[4].

[3] The State requirement to complete a feasibility study only applies when a local school district proposes to replace at least 50% of an existing building as is the case with both Baltimore schools evaluated in this report.
[4] Importantly, the local board of education must approve the educational program proposed within any charter school residing in its boundaries.

This difference in approach can have a dramatic impact on construction project outcomes. According to John Burke[5] of Studio 27 Architecture, charter schools in the District of Columbia typically make numerous programmatic concessions compared to district schools, including:

- Capital construction is typically limited to 100 SF/Student across all school types. District schools, by contrast range anywhere from 140 to 200 SF/Student depending upon the grade configuration.
- Classrooms tend to be about 200 SF smaller on average, compared to District schools.
- Minimal or no staff amenities and staff are typically provided only with open work rooms
- Media centers are significantly reduced or are not included
- A single multi-purpose space is utilized for lunch and physical education
- Only non-cooking kitchens are installed and contracted food service operators are utilized
- 21st century school elements such as collaborative learning areas and extensive shared spaces are typically eliminated
- Science rooms and science labs are typically included but the specialized equipment, casework, and furniture is significantly reduced.
- Interior finishes are more basic and exterior glazing is typically minimized

These differences have a significant impact on project costs and often require alternative approaches to the delivery of educational programs and it is critical to understand that this is the context within which this analysis will consider the differences between the two Children's Guild facilities and the two Baltimore City Public schools evaluated herein.

Summary of Scope and Cost Differences

As mentioned above, this assessment will compare City Schools' Frederick Elementary School (PK-5) with Monarch Academy's K-8 Baltimore Campus and City Schools Fort Worthington K-8 school with Monarch Global Academy K-8. Following is a summary of the project descriptions and cost differences.

City Schools Ft. Worthington vs. Monarch Global

City Schools Ft. Worthington K-8

The project consists of the demolition of an existing 75,000SF three (3) story school building and construction of a new 103,000SF replacement K-8 school. The new building will be designed and constructed to accommodate a capacity of 700 students and projects to be nearly 90% utilized by the 2022-2023 school year. The new building will be three (3) stories and the main body of the structure will consist of a conventional structural steel frame with CMU and metal stud back up and brick veneer.

Monarch Global Academy K-8

Monarch's Anne Arundel County campus is a K-8 school that received its first class of students in August 2014. The school is located in a new 63,327 square foot building that was constructed utilizing a pre-

[5] John and his team have designed over two dozen charter schools and nearly one dozen district schools in the District of Columbia.

engineered metal building, which is not typically utilized for schools in Maryland. The school currently has children enrolled in grades K-6 and expects to reach its full capacity of 805 students as grades 7 and 8 are incorporated over the next two years. For purposes of this analysis, the school is being evaluated based upon its anticipated maximum enrollment.

The construction cost differences between City Schools Fort Worthington and Monarch Global are summarized below in Table 1. The table indicates that Monarch Global was able to accommodate 805 students in a new facility for approximately one third of the total cost that BCPS Fort Worthington is expected to accommodate 700 students. Despite this, it is important to point out that total hard costs for Fort Worthington fall well below the $336/SF identified by the State IAC in its December 2015 update to the State BPW as the expected average cost of school construction in 2016.

Summary of Construction Costs					
	Fort Worthington		Monarch Global		
	Cost	$/SF	Cost	$/SF	Cost Differential
Building Costs	$29,416,141	$284.62	$ 10,055,909	$ 158.79	$125.83
Site Improvement	$3,664,504	$35.46	$ 1,604,721	$ 25.34	$10.12
Total Hard Costs	$33,080,645	$320.08	$11,660,631	$184.13	$135.95

1. All costs converted to 2016 dollars. Monarch Global costs w ere escalated 2.5% annually from 2013.
2. Monarch Global costs based upon 2013 schedule of values provided by Steel Building Specialists.
3. Fort Worthington costs based upon final GMP contract value established w ith Gilbane in March 2016.

Table 1

City Schools Frederick vs. Monarch Baltimore

City Schools Frederick Elementary School:

This project includes the renovation of an existing 46,079 GSF two story, plus basement, building incorporating 42,711 GSF into the new design, and the construction of a new 41,400 GSF three story addition. The updated facility will be designed and constructed to accommodate a capacity of 605 students in grades PK-5 and projects to be approximately 90% utilized by the 2022-2023 school year

Monarch Academy Baltimore City

Monarch Academy's Baltimore City campus is a K-8 school that received its first class of students in August 2013. Per its charter agreement, the school has a capped enrollment of 990 students and is located within a former bottling plant which was renovated between January and August 2013. The scope evaluated for this assessment encompasses just over 92,000 square feet on three floors and includes all major building systems.

The construction cost differences between BCPS Frederick and Monarch Baltimore are summarized below in Table 2. The graphic indicates that Monarch Academy was able to accommodate 990 students in a renovated facility for approximately one third of the total cost[6,7] that City Schools Frederick is expected to accommodate 605 students. It is important to keep in mind that nearly half of the total square footage associated with the Frederick project includes the construction of a new building wing, which limits the value of comparing the two facilities. As noted earlier, the total hard costs for Frederick fall well below the $336/SF identified by the State IAC in its December 2015 update to the State BPW as the expected average cost of school construction in 2016.

Summary of Construction Costs					
	Frederick		Monarch Baltimore		
	Cost	$/SF	Cost	$/SF	Cost Differential
Building Costs	$22,538,733	$266.20	$ 7,567,920	$ 81.52	$184.68
Site Improvement	$2,596,589	$30.67	$ 229,590	$ 2.47	$28.19
Total Hard Costs	$25,135,322	$296.86	$7,797,510	$83.99	$212.87

1. Project costs for Monarch are based upon actual costs incurred to complete construction, w hile BCS Frederick costs are based upon final GMP contract value established w ith Gilbane in March 2016.
2. Approximately 50% of Frederick's square footage is for new construction, w hile Monarch Baltimore is 100% renovation
3. Site improvement costs include Divisions 31-33 plus a portion of builder mark-ups and contingencies, all other hard costs are included in building costs.

Table 2

The following sections provide a detailed analysis of the differences between the buildings with a focus on understanding the tradeoffs associated with the lower construction costs realized by Monarch Academy in each of its two facilities. The first section will focus on project specifications, or materials and systems, and the second section will focus on the key programmatic differences.

6 All costs have been converted to 2015 dollars. Additional detail provided in the subsequent section.
7 Importantly, site acquisition costs of nearly $4 million paid by Monarch are not included on this table because site acquisition is not included in the Baltimore costs. However, Monarch must support the site acquisition costs as part of its debt services, which limited their capital expenditure capabilities.

Section 2: Summary Review of Project Specifications

Methodology

An in-depth analysis of differences in the hard[8] construction costs between the Monarch and BCPS facilities was conducted by comparing the actual costs reported by Monarch with the December 2015 detailed cost estimates for each of the City Schools. An earnest attempt was made to convert the construction costs reported by Monarch into the standard 33 Division construction cost format; however, several assumptions were made about the division of specific systems. The resulting side-by-side comparisons along with the associated assumptions are provided in Exhibits B and C.

This analysis focuses on the relative value, or percentage of total hard costs, being spent on particular systems and understanding the key scope differences between the facilities. Costs were all converted into 2015 dollars and then evaluated on a cost per square foot basis and based upon the percentage of total hard costs. Finally, the cost per square foot for each of the individual systems was evaluated based upon its relative contribution to the overall difference in hard costs per square foot between the two buildings. This is reported as the $/SF Gap and % Total Gap in the Cost Differential column of Exhibits B & C.

For example, the total hard cost per square foot gap between Fort Worthington and Monarch Global is $135 which means that the total hard costs for Fort Worthington are projected to be $135 per square foot higher than what it cost to construct Monarch Global (all in 2015 dollars). The projected hard costs for Division 22, plumbing, at Fort Worthington are expected to be $11.21 per square foot while plumbing costs at Monarch Global were $6.42 per square foot. The $/SF Gap, then, is $4.79 which constitutes 3.7 percent of the total $128 per square foot gap in costs between the two facilities.

Conducting the evaluation on this basis allows for a high level comparison of the systems having the most significant contribution to the overall cost per square foot differences between the buildings. The analysis focuses solely on the systems having the largest impact on up-front costs, understanding the types of materials being selected, and evaluating their pros and cons.

Observations

Monarch Global vs. Ft. Worthington

The evaluation of systems having the most significant contribution to the cost per square foot difference between Monarch Global and BCPS Ft. Worthington reveals a concentration within four major groupings: building structure and envelope, openings (i.e. doors, windows, etc.), interior finishes, and mechanical/electrical systems[9].

[8] Hard construction costs refer to all costs for building materials or labor directly attributed to the construction of the building. Soft costs are for services needed to enable the construction such as design and engineering fees.

[9] Earthwork and site improvements also constitute a significant portion of the cost differential; however, it is not included in this analysis as variations in site configurations and existing conditions limit the usefulness of an analysis.

Divisions 04, 05, and 07 – Masonry, Metals, and Thermal/Moisture protection have been grouped together for this analysis primarily because the majority of costs associated with these three divisions are captured within Division 04, metals, for the Monarch Global project due to the use of a pre-engineered steel building system. Pre-engineered steel buildings incorporate all of the building structural, roofing, exterior walls, and exterior insulation all within a single trade[10]. By using the pre-engineered building system rather than a conventional steel frame, Monarch was able to deliver this set of systems for approximately $31 per square foot less than the comparable systems specified for Fort Worthington making this grouping the largest contributor to the overall cost per square foot difference at just under 25%.

Divisions 23, 26, 27, and 28 – HVAC, Electrical and Communications have been grouped together because of the typical interconnectedness of the systems and the lack of available detail from Monarch needed to ensure alignment of trade responsibilities between the two projects. Together these four divisions account for about 23% of the total cost per square foot differential at just over $24 per square foot. The most significant differences appear to be in the provisions of low voltage/security systems and the selected HVAC systems.

City schools specify robust security systems which include intrusion detection and video monitoring along with extensive communications, IT, and A/V requirements which are all supported by a robust back-end network. Detailed specifications were not available for Monarch's low-voltage systems but, the security system at Monarch Global was designed by a professional security vendor and reviewed by the head of security for the Anne Arundel County Public School System. The system is completely compliant with AACPS standards. However, based upon observations, the Global campus did not appear to have the same level of video monitoring, A/V, and intercom requirements as is being specified for Fort Worthington, which may be due to more extensive system requirements in Baltimore City versus Anne Arundel County. These systems could account for up to $11 per square foot of the total hard cost differential.

HVAC costs, Division 23, account for about $7 per square foot, or just under 6% of the cost per square foot differential between the two schools. A comprehensive evaluation of the HVAC systems installed at the four case study schools is included as Exhibit D[11]. The system evaluation indicates that the system selected by Monarch has the lowest first cost but that it comes at the expense of energy efficiency, system longevity, controllability, and air quality. The analysis indicates that the expected equipment useful life for the system selected by Monarch is approximately 15 years in comparison to 25 years for the system selected by BCPS.

Division 09 – Interior Finishes is the next largest contributor to the cost per square foot differential at just under $15 per square foot or 11% of the total gap between the schools. The majority of costs in this trade are associated with interior partitions, ceilings, and insulation. The typical interior partition detail for Monarch Global calls for 5/8" impact resistant GWB, which is similar to the specification for most interior walls at Ft. Worthington. Details regarding interior insulation and ceilings were not available, but Monarch did indicate that all interior walls were insulated. During site walks, acoustic separation issues and the lack

[10] In an effort to better align costs, the interior insulation costs tracked within Division 07 for Ft. Worthington were moved to Division 09, finishes which is where they are also tracked for Monarch Global.
[11] The evaluation was provided by Global Engineering solutions based upon the system description included in the 100% DD Life Cycle Cost analysis for Ft. Worthington and a system description provided by Monarch.

of ceilings in second floor classrooms was noted and it is likely that the insulation specifications are different[12]. It is likely that these items are the primary drivers of this cost differential. LEED Silver standards, to which all City School buildings must be designed per State standards, require significant attention to acoustic isolation between classrooms and to minimizing reverberation within classrooms.

The final grouping evaluated is Division 08, Openings, which accounts for $9 per square foot, or 7% of the total gap in costs between the schools. This division includes interior and exterior doors and windows and, upon close examination of the project scopes, it appears that nearly the entire cost differential is related exclusively to the extensive use of storefront and curtainwall glazing systems at Fort Worthington as opposed to the use of more standard, aluminum, window systems installed at Monarch Global.

Monarch Baltimore vs. Frederick

The evaluation of systems having the most significant contribution to the cost per square foot difference between Monarch Global and BCPS Frederick reveals a concentration within three major groupings: HVAC/Electrical, Finishes, and Openings[13].

Divisions 23 through 28 – HVAC, Electrical and Communications have been grouped together because of the typical interconnectedness of the systems and the lack of available detail from Monarch needed to ensure alignment of trade responsibilities between the two projects. Together these four divisions account for nearly 24% of the total cost per square foot differential at just over $50 per square foot. The most significant difference appears to be in the selected HVAC system which accounts for nearly $31 per square foot.

A comprehensive evaluation of the HVAC systems installed at the four case study schools is included as Exhibit D[14]. The system evaluation indicates that the system selected by Monarch has the lowest first cost but that it comes at the expense of energy efficiency, system longevity, controllability, and air quality. The analysis indicates that the expected equipment useful life for the system selected by Monarch is approximately 15 years in comparison to 25 years for the system selected by BCPS.

City schools specify robust security systems which include intrusion detection and video monitoring along with extensive communications and A/V requirements which are all supported by a robust back-end network. Detailed specifications were not available for Monarch's low-voltage systems. However, Monarch utilized a professional security firm to design their system and had the system reviewed by two independent parties, including the former head of the Sherriff's Department. The cost differential of $10 per square foot associated with these systems is most likely due to differences in audio visual and/or back end networking standards but further comparisons are needed to understand any differences.

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[12] During a separate set of site walks, representatives from the State school construction program found at least three other acoustical conduits between the classrooms.

[13] Masonry and Metals account for over 11% of the total cost per square foot gap between schools but the difference is primarily due to new construction scope at Frederick that is not comparable to Monarch Baltimore.

[14] The evaluation was provided by Global Engineering solutions based upon the system description included in the 100% DD Life Cycle Cost analysis for Ft. Worthington and a system description provided by Monarch.

Division 09 – Interior Finishes account for nearly 8% of the total cost per square foot gap at just over $18 per square foot. 40% of the cost per square foot delta in this division is concentrated within flooring and drywall. The flooring delta appears to be a mixture of scope or quantity and quality or product specifications. Monarch used VCT throughout classrooms and corridors, however there were extensive sections of the building within which new flooring was not added or in which flooring subsurface was not required. The Frederick project also relies on VCT as the predominant flooring type but it also incorporates epoxy, resin, wood, and polished concrete in select locations.

The remainder of the cost per square foot difference in interior finishes appears to be driven by acoustic ceilings, tile, and acoustic wall panels. Monarch Baltimore clearly had installed new ACT ceilings but the cost is unclear from the information provided. Frederick includes new tile flooring and walls in bathrooms, which is a best practice, and acoustic wall panels are typically provided in large gathering spaces to enhance user experience. Monarch Baltimore does not incorporate these items. Specifications for Monarch Baltimore interior drywall were not provided so a comparison of impact resistance ratings and other performance criteria cannot be made at this time.

Division 08 – Openings account for just under 6% of the total cost per square foot gap at just over $13 per square foot. The aluminum window specification utilized by Monarch is similar to what is being specified at Frederick and, because the total cost for windows at Frederick exceeds that at Monarch it is highly likely that the cost per square foot delta is primarily driven by interior window and door specifications and exterior window systems with greater architectural appeal such as store front and curtainwall. These systems are not present at Monarch Baltimore and come with a projected price tag of just over $1M in the new Frederick building. Vestibule entries, interior glazing (windows), and architectural glazing features are the primary components driving these costs.

Assessment of Impacts and Cost Drivers

The significant hard cost per square foot differences between the Monarch and City School facilities is driven by two primary factors: Monarch's budget limitations and the standards driven process utilized by City Schools to ensure compliance with state and local standards. As noted in Section 01, decisions related to building systems and product for Monarch are predominantly driven by sensitivity to up-front costs due to the direct impact on the school's operating budget and capacity to support debt service. Baltimore City Public Schools, on the other hand must go through a deliberate process that entails significant reviews by multiple parties, internal and external, of systems and product selections based upon factors such as life cycle cost analysis and architectural quality with the goal of maximizing taxpayer investment by balancing upfront costs with longevity, maintenance and utility costs, and community use beyond normal school operations.

Importantly, the cost differentials highlighted above are concentrated within the building systems that typically account for the greatest percentage of total construction costs in most projects: structural, building envelope, mechanical, electrical, plumbing, openings, and interior finishes. Further, these are the systems that have the most significant impact on long-term facility operations, maintenance, and capital reserve budgets. Therefore, decisions related to these systems require careful consideration prior to implementing major changes, particularly on a system-wide basis.

The decision by Monarch to utilize a pre-engineered steel structural system (PEB) at it Global campus in Laurel has been subject of significant debate. Unfortunately, there is not substantial independent research available on the pros and cons of this system in relation to a conventional steel building. A brief internet search revealed that over 2,000 schools have been built utilizing PEB systems in the U.S. in the past five years and that design standards for their use exist in multiple jurisdictions. A 2008 white paper to the North Carolina State Board of Education, attached hereto as Exhibit E, generally recommends against the use of PEB systems for schools due to concerns related to building longevity, energy efficiency, water proofing, and lifetime maintenance costs[15] and additional research is warranted to further substantiate the widespread use of PEB for schools in Maryland.

It is unlikely that a PEB system could have been introduced at Fort Worthington for anything other than the large clear span spaces in the gymnasium and dining room wing of the building because of the tight site and configuration of the classroom wing. Furthermore, the use of PEB systems, for any part of the building, would likely limit architectural options at Fort Worthington and face tremendous scrutiny from the community and the city of Baltimore's UDARP process.

Concerns related to energy efficiency of the PEB system are compounded by Monarch's selection of a low first-cost HVAC system and the lack of available detail on the exterior wall insulation. An evaluation of Monarch's annual energy costs from 2015 when compared to the projected annual energy costs for Fort Worthington, as shown in Table 3 below, reveals that the process put in place by City Schools (and most other State-funded school districts) is more likely to result in significant annual utility savings. The process, which requires development of comprehensive energy modeling and building life cycle cost analyses combined with the stringent energy performance requirements associated with a LEED Silver certification all but ensures that City School facilities will maximize operating efficiency.

	Fort Worthington	Monarch - Global
Building SF	103,351	63,327
Projected[1]/Actual Annual Energy costs	$ 76,630	$ 112,000
Energy Cost / SF / Year	$ 0.74	$ 1.77

1. Energy costs for Ft. Worthington are projected based upon an energy model developed by James Posey Associates in April 2015. Costs for Monarch Global are actual for 2015.

Table 3

It is important to point out that above table only accounts for utility costs and that the impact on long term maintenance and capital reserve costs must also be carefully considered. Steve Baldwin, Executive Vice President of The Children's Guild, acknowledges the importance of conducting a detailed life cycle cost

[15] It is acknowledged that significant improvements in PEB systems have likely occurred since the drafting of the 2008 white paper.

analysis particularly due to his organization's sensitivity to the operations and maintenance costs of his facilities which directly impact their ability to cover debt service. For instance, utility costs at the Fort Worthington facility would cost approximately $100,000 more per year if the building had the same energy efficiency as the Monarch Global academy. However, the process that City Schools and other LEAs utilize to evaluate the life cycle and energy use costs of certain systems effectively assesses the impact on up-front costs but is currently unable to accurately account for comprehensive affordability due to the disconnect between system (or funding level) debt service and local school operational costs. In other words, even though the analysis conducted by City Schools (and other LEAs) will lead to the best decision from a return on investment perspective, it is not effective for determining if the upfront investment is actually affordable based upon the individual school's proportional share of debt service.

As discussed, the cost savings that Monarch appears to be achieving in the low voltage and telecommunications components of their buildings appear to be the result of a less extensive scope of work than what is being specified in the new City Schools building projects. As previously mentioned, further evaluation of this is required due to the lack of detail presently available on the systems utilized by Monarch.

The differences in interior finishes between the schools is more prominent when comparing Monarch Global with Ft. Worthington and, as noted, the cost differential appears to be driven by the lack of ceiling systems and potential differences in interior wall insulation specifications. The LEED standards and best practices for school design place a heavy emphasis on the mitigation of noise from both exterior sources and internal to the classroom. The specifications implemented by City Schools are designed to mitigate those issues and ensure classroom activities are not disturbed by noise from adjacent areas. Making the types of reductions that appear to have been taken at Monarch Global would negatively impact the ability of the building to mitigate those concerns.

The final component that had a major impact on the cost differential between buildings was related to window and glazing specifications. The most striking difference between both of the City Schools and Monarch schools was the specification of large quantities of storefront and curtainwall glazing systems in the BCPS schools. These glazing systems typically come with a heavy price tag and are most frequently incorporated to address LEED interior daylighting standards or provide an architectural enhancement. It is unclear the extent to which these systems directly impact energy efficiency, but the costs associated with purely architectural advantages should be closely examined.

Because the City Schools Frederick project incorporates a significant amount of new construction, it is best to evaluate the overall impacts of system and product choices by focusing on the differences between Monarch Global and City Schools Fort Worthington. Applying the same cost per square foot from Monarch Global to BCPS Ft. Worthington would result in cost savings of nearly $15 million. However, about 75% of those costs (just under $12 million) are tied to the systems evaluated above and, as noted, implementing many of the changes will likely have negative impacts to energy usage, long term maintenance costs, the architectural appearance of the building, and compliance with existing State requirements and standards.

Section 3: Evaluation of Program Differences

Methodology

Evaluation of the differences in the programs at each of the four case study facilities was conducted using information provided by Monarch and Baltimore City Public Schools. For the two City Schools facilities, the March 2015 final, site-specific, educational specifications were used and details provided directly by Monarch were utilized for their two buildings. In order to compare the programs side by side, each of the spaces were organized into one of the following six categories;

Building Services: This category includes spaces such as restrooms, locker rooms, mechanical equipment spaces, utility closets, data closets, custodial closets, and other difficult to categorize spaces such as the kiln room.

Administrative: This category includes office spaces, workrooms, conference rooms, waiting areas, teacher planning and lounge areas in addition to the health suite spaces.

Food Service: All rooms needed to support food service operations, including the cafeteria, food storage spaces, freezers, refrigerators, and serving lines are included in this category.

Storage: All storage areas, except for food storage, are included in this category.

Teaching Capacity: All spaces over 500 square feet that are dedicated to support student instruction with scheduled class time are placed into this category. All classrooms, gyms, labs, special education, music, art, and flex spaces are included.

Teaching Shared: All spaces that are designed for student instruction but are flexibly scheduled throughout the day, or are under 500 square feet are included in this category. Examples include resource spaces, media centers, stages, and the collaborative learning areas.

Community Spaces: This category includes all space (regardless of above categorizations) dedicated for use by a third party or partner organization other than the school operator.

Only programmed spaces, that is rooms or areas within the building with a defined use were placed into the above categories. The square footages associated with these programmed spaces, discussed below, are all reported in terms of net square footage – which is the actual space that can be physically occupied or utilized for the intended purpose. Other non-programmed spaces, which include areas such as corridors, stairwells, and vestibules in addition to the thickness of the exterior and interior walls, make up the difference between each building's net square footage and gross square footage. For the purpose of this evaluation, only two factors are used for drawing comparisons between the schools:

1. The net square footages for the programmed spaces is evaluated to understand differences in how the buildings are utilized

2. The ratio of non-programmed to programmed spaces is evaluated to understand how efficiently the buildings are designed.

Observations

Tables 4 and 5 below, provide a summary of programmatic space allocation differences between the four case study schools. Generally, the distribution of spaces among the six room types is similar among all four schools with teaching spaces accounting for the vast majority of net square feet, as would be expected in a school facility. Additionally, the four schools have very similar efficiency factors with Monarch Global having the highest ratio of programmed space to gross square footage.

	Monarch - Global			BCS - Fort Worthington		
Room Type	Net SF	% by Type	Net SF Per Student	Net SF	% By Type	Net SF Per Student
Building Services	1,938	4%	2	2,970	4%	4
Administrative	3,668	8%	5	5,670	8%	8
Food Services	4,035	9%	5	5,400	7%	8
Storage	2,928	6%	4	4,115	6%	6
Teaching Capacity	30,634	65%	38	41,350	57%	59
Teaching Shared	3,832	8%	5	10,600	14%	15
Community Spaces	0	0%	0	3,000	4%	4
Total Building NSF	**47,035**			**73,105**		
NSF Total Teaching Space/Student	**43**			**74**		
Total NSF/Student	**58**			**104**		
Building Gross SF	**63,327**			**103,351**		
Gross SF/Student	**79**			**148**		
Non-Programmed Space	**16,292**			**30,246**		
Building Efficiency Factor	**74%**			**71%**		

Table 4

	Monarch - Baltimore			BCS - Frederick		
Room Type	Net SF	% by Type	Net SF Per Student	Net SF	% By Type	Net SF Per Student
Building Services	5,661	9%	6	2,260	4%	4
Administrative	6,305	10%	6	5,440	9%	9
Food Services	5,829	9%	6	4,755	8%	8
Storage	2,225	3%	2	2,895	5%	5
Teaching Capacity	42,220	65%	42	34,550	58%	57
Teaching Shared	2,572	4%	3	6,350	11%	10
Community Spaces	0	0%		3,000	5%	5
Total Building NSF	**64,812**			**59,250**		
NSF Total Teaching Space/Student	**45**			**68**		
Total NSF/Student	**65**			**98**		
Building Gross SF	**92,838**			**84,670**		
Gross SF/Student	**93**			**140**		
Non-Programmed Space	**28,026**			**25,420**		
Building Efficiency Factor	**70%**			**70%**		

Table 5

There are, however, four critical differences between the Monarch and the City Schools facilities:

1. The percentage of space allocated to shared teaching spaces, such as media centers, computer labs, resource rooms, and collaborative learning areas is significantly lower in the Monarch schools than it is in the City schools.
2. The City schools allocate a significantly higher amount of programmed square footage per student than do the two Monarch facilities. City Schools Fort Worthington School provides 79% more space per student than the Monarch Global facility and the BCPS Frederick building allocates 51% more space per student than Monarch's Baltimore campus.
3. The differences in net square foot per student allocated to teaching spaces is stark. The City Schools Fort Worthington School is being designed to provide an additional 31 square feet per student of teaching and learning spaces when compared to Monarch's Global Academy and the difference between City Schools Frederick and Monarch Baltimore is 23 square feet per student. The primary drivers for these differences are reduced classroom sizes and the lack of collaborative learning areas in the Monarch facilities.
    a. Utilizing the total project costs from the previous section, increasing the net square feet per student at Monarch Global to align with City Schools Fort Worthington would have increased construction costs by approximately $6.5 million.
    b. Reducing the net square feet per student at Fort Worthington to align with Monarch could reduce Fort Worthington's construction costs by nearly $10.5 million.
4. Neither of the Monarch facilities are required to provide community spaces, which account for about five percent of the total square footage in each of the two City Schools.

Notably, the differences between the facilities are less pronounced in the renovated schools (Frederick and Monarch Baltimore) than they are in the buildings that are entirely new construction. This is due to the fact that Monarch was able to stretch its dollars further in the existing warehouse building and that site limitations at Frederick limited the amount of shared teaching spaces implemented. Furthermore, the percentage of space allocated to building services is significantly higher in the Monarch Baltimore facility than the other buildings because of the preponderance of existing bathrooms and mechanical spaces which are not easily repurposed.

A brief evaluation of full time equivalent (FTE) staffing was conducted to further underscore the differences in teaching space allocations between the Monarch and BCPS facilities. The analysis is based upon staffing data provided directly from Monarch and the proposed FTEs shown in the March 2015 educational specifications for each of the City Schools facilities. To facilitate analysis, the staff positions were categorized into the four categories shown in Table 6, below. The ratio of students to total FTEs is very similar among these four schools as is the ratio of students to teaching FTE's.

	Monarch Global	BCS - Fort Worthington	Monarch Baltimore	BCS - Frederick
Teaching FTE	55	42	59	40
Student Support FTE	8	12	7	10
General Admin/Operations	11	11	17	5
Food Service	3	3	4	1
Total FTE	77	68	87	56
Students / FTE	**10**	**10**	**11**	**11**
Students / Teaching FTE	**15**	**17**	**17**	**15**
Teaching NSF/Teaching FTE	**624**	**1237**	**759**	**1020**
Admin & Support NSF / Admin & Support FTE	**195**	**247**	**263**	**356**

Table 6

The most pronounced difference among the four schools is in the ratio of net square feet of teaching spaces per teaching FTE, which is shown on the second to last line of Table 6. Utilizing the total net square feet for all spaces designed to accommodate teaching and learning and dividing that figure by the total number of full time teaching staff reveals that Fort Worthington offers nearly double the space per FTE compared to Monarch Global and that Frederick has approximately 34 percent more teaching space per FTE than does Monarch Baltimore. The data also shows that the two City Schools facilities do provide more administrative and support space per associated FTE; however, the relative impact to overall building size is small compared to the differences in teaching spaces provided.

Importantly, the FTE and program analyses both reveal that the differences between the Monarch and City Schools facilities is more pronounced in the buildings that are entirely new construction (Fort Worthington and Monarch Global). This is driven primarily by the fact that in a new construction facility a greater percentage of costs must be spent on building systems such as structure, exterior walls, and site improvements which force Monarch to divert its restricted capital funding away from programmatic features and site elements toward facility elements it believes provide the greatest benefit per dollar spent.

Assessment of Impacts and Cost Drivers

The significant programmatic differences between the Monarch and BCPS facilities is a direct result of the differing approaches to project development. As noted previously, the programs in the Monarch facilities are strongly influenced by budget limitations while the budgets in the City Schools facilities are driven by the programmatic requirements. Baltimore City Public Schools is programming its schools based upon the latest best practices in educational facility design which emphasize the importance of supporting individualized instruction and collaborative learning.

The desire to better support individualized instruction is one of the primary drivers for larger classroom sizes as more space is needed when multiple instructors are present in the same classroom concurrently. This is particularly relevant at the elementary grades when students will frequently work in small groups at different stations supported by a teaching assistant. For many students, individualized instruction requires that teaching occur outside of the traditional classroom in a small group setting. To accommodate this need many school systems provide smaller resource rooms that can be used by specialists who serve students across multiple grade levels throughout the day. The lack of separate resource rooms in the Monarch facilities does not appear to impact their successful approach to the delivery of individualized instruction; however, it is anticipated that the provision of such spaces might further enhance their results.

Facilities that support collaborative or cross functional learning is one of the hallmarks of 21st Century educational design. The intention is to create learning spaces outside of the traditional classroom where teachers can combine students from multiple classrooms, and even across multiple grades, to collaborate on cross-disciplinary activities such as project based learning. Neither of Monarch's facilities provide formal collaborative learning areas, while they are a significant (over 5,000 SF) component within the City Schools designs.

Monarch's educational program does place an emphasis on experiential, project-based learning so it is possible to deliver these types of programs within a facility that does not provide distinct, specialized collaborative learning areas. What is not known is whether the Monarch programs would be significantly enhanced by the provision of distinct collaboration areas[16] or if City Schools would achieve its desired educational outcomes if these spaces were eliminated or reduced.

Larger classrooms, resource rooms, and collaborative learning areas account for the vast majority of the difference in net square feet per student provided by City Schools compared to the Monarch facilities. Given its budget restrictions, Monarch has chosen not to provide these additional spaces. In order for Monarch to provide a similar allocation of teaching space per student would have added about $6.5 million to the cost of constructing the Global Academy campus. Conversely, City Schools has developed a building program closely linked to its vision for the delivery of a 21st century education and it is unlikely that a wholesale reduction in the net square feet of teaching spaces to align with what Monarch offers would be worth the $10.5 million in savings it could potentially yield at Fort Worthington.

[16] There is significant information available on the efficacy and importance of collaborative learning areas as they are a core component of 21st Century educational design trends. A thorough review and summary of this material was outside the scope of this document.

Section 4: Conclusions and Recommendations

As detailed in Sections 2 and 3, above, the differing approaches to school design and construction taken by Monarch Academy and Baltimore City Public Schools result in substantive variances in the functionality of the facilities and in the costs needed to construct them. The comparisons of Monarch's Global Academy in Laurel and Baltimore's Fort Worthington School provide the best indicators of those differences because the schools both offer similar K-8 programs and both are (or are planned to be) newly-constructed facilities. The analyses indicate that the cost differential associated with selected building materials and systems to be about $15 million and for building program to be about $10 million[17]. If Ft. Worthington had been built to the same program requirements as Monarch Global (about 79 gross SF per student) the cost differential associated with building materials and systems would have only been about $7 million.

The reasons for the differences in cost are clear. Monarch Academy, faced with construction costs limited by its ability to support debt service via its allocated operating budget is required to make choices with regard to building systems and program space allocations that would generally not be made given the process and standards applied to the planning and design of schools by Baltimore City Public Schools. Importantly, most charter schools, including Monarch, do not have the time or resources needed to engage in the full planning and design process employed by City Schools. This is because from the moment a charter school secures a facility and receives approval from the Local Education Agency (LEA) to open, the new school must engage a designer, secure financing, and construct the facility all while recruiting students to attend their school. All of these activities typically take place in 18-24 months.

For Monarch Global, the tradeoffs include less available space dedicated to student learning in a less energy efficient building that is likely to have higher long-term maintenance and capital replacement costs due to the systems installed. Conversely, the deliberative planning and design process employed by City Schools results in more energy efficient buildings constructed to last 40-50 years and accommodate the latest best practices in educational facility planning.

City Schools implementing cost saving measures similar to those taken by Monarch would be challenging because of equity concerns and the unproven nature of the comprehensive impacts to school operations. It is unclear to what extent the resulting reductions in program space allocations or modifications to system standards would have a detrimental effect on the delivery of a high-quality education or the long-term costs of maintenance and operations. And, it is unclear to what extent those impacts would be worth the reduced capital costs, and the ability of City Schools to potentially deliver more new facilities more quickly given the likely long-term increase in operating costs. Finally, it is also unclear to what extent PEB construction would even be possible in the majority of projects due to the reality that existing structures are being reused in many cases.

[17] These two differentials cannot be taken cumulatively because reductions in building material cost per square foot would result in a lower differential when program reductions are counted, which is why the total cost difference is about $21 million.

The time and scope limitations placed upon this case study analysis made inevitable the result being more questions. The following recommendations focus entirely on next steps and processes that can be put in place to help answer the two critical questions posed above and are organized into items that MSA and City Schools can immediately incorporate into the 21st Century Buildings program and items that the State should consider more broadly.

Examine and Validate Project Specification and Programming Options. As part of the delivery of the 21st Century Buildings Program MSA and City Schools have already implemented several significant cost savings measures and utilize an extensive value engineering process prior to arriving at final construction costs for projects. This process has resulted in changes to several interior finish and interior wall insulation specifications in schools implanted in the latter stages of Plan Year 1 and MSA and City Schools intend to carry over these changes into the Plan Year 2 projects. MSA and City Schools should also consider closely evaluating the potential for modifications to low voltage, A/V, security, and telecommunication standards, interior finish specifications and acoustic upgrades so long as are confirmed to not impact critical programmatic and operational values.

As noted, City School projects include several shared and collaborative learning areas which account for a significant portion of the additional space provided. These types of spaces are being implemented by school districts across the country to better support the latest trends in student-centered learning; however, the programmatic benefits received should continue to be weighed against the additional costs associated with the increased square footage. To offset the additional square footage for collaborative teaching spaces, many school districts implement floating teacher policies[18] in secondary schools. It is recommended that City Schools continue to explore similar policies to maximize school utilization.

Evaluate Usage of Alternative Buildings and Funding Sources. The single biggest driver of cost differentials in this study was Monarch Academy's use of a pre-engineered building (PEB) system in Laurel and their re-use of a former manufacturing facility in Baltimore. City Schools should carefully consider the need to construct buildings with a 40-50 year life span by evaluating historical shifts in neighborhood populations and aligning facility types in response to localized population volatility to mitigate long-term uncertainties in school utilization. Analysis of this nature may lead City Schools to consider the implementation of shorter lifespan buildings or the use of long-term leases from private entities.

City Schools should evaluate the possibility of supplementing project funding sources with alternative funding sources such as New Market Tax Credits and low interest loans for energy efficiency upgrades. Taking advantage of programs like this may require local and State policy changes but are viable sources of revenue that warrant closer investigation, particularly for the City of Baltimore, which is laden with qualifying zones.

[18] Floating teachers refers to decreasing the percentage of teachers who utilize dedicated classrooms during planning periods. City Schools has evaluated but not yet implemented policies or building designs needed to support this concept.

Evaluate Opportunities to Link State Construction Funding to School Level Operating Costs. As noted earlier, system affordability analysis requirements, particularly life cycle cost analyses, are currently unable to accurately account for comprehensive affordability due to the disconnect between system (or funding level) debt service and local school operational costs. This separation leads to an incomplete return on investment assessment and it is recommended that the State of Maryland engage an analysis to establish operating cost benchmarks by school type. The purpose of the exercise should be to create a standardized format for the evaluation of an LEA's capacity to support financing that is independent of State construction capital allocations and better justify the distribution of limited State construction dollars. Additional benefits of this exercise include:

a. Enhanced ability of school systems to evaluate operating efficacy of individual schools.
b. Opportunity to establish legal structures that enable private financing that is linked to the operating performance of an individual school. Similar structures, such as special purpose entities and foundations, have been used for decades by public institutions to blend private and public capital.
c. Ability to more readily pursue non-traditional sources of capital such as New Market Tax Credits and CDA loans for qualifying schools.
d. More careful consideration of system enhancements and capital upgrades if private financing is required to fund implementation.

Exhibit A - Subway Map

21st CENTURY SCHOOLS
BALTIMORE

21st Century School Buildings Engagement Process

The essential role of school stakeholders in the 21st Century School Buildings process.

Each school is unique. Creating modern, high-quality learning environments that meet the needs of individual school communities and support their vision for student success is a collaborative effort. The process for the design of each school building takes 18-24 months. The process for the construction of a school takes an additional 18-24 months marked by multiple opportunities for school communities to provide input and feedback.

PLANNING 8 months	PRE-DESIGN 2-4 months	DESIGN 12-18 months	CONSTRUCTION - OCCUPANCY 18-24 months

MONTHS 1 2 3 4 5 6 7 **8** 9 10 11 **12** 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 **30** 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 **54**

PLANNING

- C Orientation
- C I Essential Elements
- C Feasibility Study
- C I 50% Feasibility Study
- C I 95% Feasibility Study Review

COMMUNITY SCHOOLS PROCESS

1. Complete school needs assessment and gap analysis
2. Host community forum
3. Develop school community action plan

FAMILY LEAGUE OF BALTIMORE Coordinated by The Family League of Baltimore, Inc.

PRE-DESIGN

- P MOU partners' boards vote
- P Request for proposal for design architect/engineer
- Architect/engineer are interviewed
- Architect/engineer is selected

INSPIRE
Baltimore City Department of Planning **INSPIRE** process kicks off

COMMUNITY SCHOOLS PROCESS

Community use of space-potential partner identified

FAMILY LEAGUE Coordinated by The Family League of Baltimore, Inc.

DESIGN

- T I Concept Design Working Session
- C I Concept Design Review
- P Urban Design & Architecture Review Panel (UDARP) review #1
- T I Schematic Design Working Session
- C I Schematic Design Review
- P Urban Design & Architecture Review Panel (UDARP) review #2
- T I Design Development, FF&E (furniture, fixtures, and equipment), Finishes Session
- C Final Drawings

CONSTRUCTION

- C What to expect during construction
- C Respond/update
- C Planning for School Relocation (transportation)

OCCUPANCY

Students occupy the renovated/replaced school building!

Key

- C = open to the entire community
- I = input is collected from meeting participants
- T = intended for School Core Team participants
- P = open session; no public comment

Revised 3/15/2016 Summerville

Exhibit B - Cost Comparison Frederick and Monarch Baltimore City

DIV	Description	Frederick ES Cost	Frederick ES $/SF	Frederick ES $/Student	Frederick ES % Hard Costs	Monarch Baltimore Cost	Monarch Baltimore $/SF	Monarch Baltimore $/Student	Monarch Baltimore % Hard Costs	Cost Differential $/SF	Cost Differential $/Student	Cost Differential % Total Gap
Hard Costs												
1	General Requirements	$990,403	11.68	$1,637	3.9%	$ -	$ -	$ -	0%	$ 11.68	$ 1,637	5.0%
2	Existing Conditions	$321,364	3.79	$531	1.3%	$ 285,770	$ 3.08	$ 286	4%	$ 0.71	$ 245	0.3%
3	Concrete	$879,809	10.38	$1,454	3.5%	$ 254,252	$ 2.74	$ 254	3%	$ 7.64	$ 1,200	3.3%
4	Masonry	$1,111,612	13.11	$1,837	4.4%	$ 137,684	$ 1.48	$ 138	2%	$ 11.63	$ 1,700	5.0%
5	Metals	$1,395,735	16.47	$2,307	5.5%	$ 162,217	$ 1.75	$ 162	2%	$ 14.72	$ 2,145	6.3%
6	Wood, Plastics & Composites	$53,915	0.64	$89	0.2%	$ 11,032	$ 0.12	$ 11	0%	$ 0.52	$ 78	0.2%
7	Thermal & Moisture Protection	$933,674	11.02	$1,543	3.7%	$ 562,513	$ 6.06	$ 563	7%	$ 4.96	$ 981	2.1%
8	Openings	$1,508,859	17.8	$2,494	6.0%	$ 391,378	$ 4.22	$ 391	5%	$ 13.58	$ 2,103	5.8%
9	Finishes	$2,419,799	28.55	$4,000	9.6%	$ 973,212	$ 10.48	$ 973	12%	$ 18.07	$ 3,026	7.7%
10	Specialties	$345,049	4.07	$570	1.4%	$ 63,277	$ 0.68	$ 63	1%	$ 3.39	$ 507	1.4%
11	Equipment	$624,780	7.37	$1,033	2.5%	$ 94,902	$ 1.02	$ 95	1%	$ 6.35	$ 938	2.7%
12	Furnishings	$902,952	10.65	$1,492	3.6%	$ 151,784	$ 1.63	$ 152	2%	$ 9.02	$ 1,341	3.8%
13	Special Construction	0	0	$0	0.0%			$ -	0%	$ -	$ -	0.0%
14	Conveying Equipment	$132,500	1.56	$219	0.5%	$ 261,774	$ 2.82	$ 262	3%	$ (1.26)	$ (43)	-0.5%
21	Fire Suppression	$373,230	4.4	$617	1.5%	$ 187,782	$ 2.02	$ 188	2%	$ 2.38	$ 429	1.0%
22	Plumbing	$1,033,655	12.2	$1,709	4.1%	$ 782,295	$ 8.43	$ 782	10%	$ 3.77	$ 926	1.6%
23	HVAC	$3,520,605	41.54	$5,819	14.0%	$ 986,978	$ 10.63	$ 987	13%	$ 30.91	$ 4,832	13.2%
26	Electrical	$1,739,709	20.53	$2,876	6.9%	$ 857,043	$ 9.23	$ 857	11%	$ 11.30	$ 2,019	4.8%
27	Communications	$514,860	6.07	$851	2.0%			$ -	0%	$ 6.07	$ 851	2.6%
28	Electronic Safety & Security	$359,889	4.25	$595	1.4%			$ -	0%	$ 4.25	$ 595	1.8%
31	Earthwork	$1,138,220	13.43	$1,881	4.5%			$ -	0%	$ 13.43	$ 1,881	5.7%
32	Site Improvements	$713,739	8.42	$1,180	2.8%	$ 50,414	$ 0.54	$ 50	1%	$ 7.88	$ 1,129	3.4%
33	Utilities	$241,557	2.85	$399	1.0%	$ 136,581	$ 1.47	$ 137	2%	$ 1.38	$ 263	0.6%
	Subtotal Direct Costs	$21,255,915	$251.04	$35,134	84.6%	$ 6,350,888	$ 68.41	$ 6,351	81%	$ 182.64	$ 28,783	77.8%
	Contingencies	$1,813,251	$21.42	$2,997	7.2%	$ 703,919	$ 7.58	$ 704	9%	$ 13.83	$ 2,293	5.9%
	CM Fee	$355,000	$4.19	$587	1.4%	$ 350,477	$ 3.78	$ 350	4%	$ 0.42	$ 236	0.2%
	CM General Conditions	$1,249,622	$14.76	$2,065	5.0%	$ 312,376	$ 3.36	$ 312	4%	$ 11.39	$ 1,753	4.9%
	CM Bonds and Insurances	$461,534	$5.45	$763	1.8%	$ 79,850	$ 0.86	$ 80	1%	$ 4.59	$ 683	2.0%
Total Hard Cost		*$25,135,322*	*$296.86*	*$41,546*	*100.0%*	*$ 7,797,510*	*$ 83.99*	*$ 7,798*	*100%*	*$ 212.87*	*$ 33,748*	*90.7%*
Soft Costs												
	A/E Fees	$1,278,759	$15.10	$2,114		$ 556,831	$ 6.00	$ 557		$ 9.10	$ 1,557	*3.9%*
	AV/IT Systems	$274,020	$3.24	$453		$ 189,242	$ 2.04	$ 189		$ 1.20	$ 264	*0.5%*
	Commissioning/LEED	$182,680	$2.16	$302		$ 42,025	$ 0.45	$ 42		$ 1.70	$ 260	*0.7%*
	FF&E	$365,360	$4.32	$604		$ 217,554	$ 2.34	$ 218		$ 1.97	$ 386	*0.8%*
	Swing/Phasing Allowance	$548,040	$6.47	$906		$ 73,544	$ 0.79	$ 74		$ 5.68	$ 832	*2.4%*
	Testing & Inspections	$91,340	$1.08	$151		$ -	$ -	$ -		$ 1.08	$ 151	*0.5%*
	3rd Party Plans Review	$91,340	$1.08	$151		$ -	$ -	$ -		$ 1.08	$ 151	*0.5%*
Total Soft Costs		*$2,831,538*	*$33.44*	*$4,680*		*$ 1,079,196*	*$ 11.62*	*$ 1,079*		$ 21.82	*$ 3,601*	*9.3%*
Total Project Costs		**$27,966,860**	**$330.30**	**$46,226**		**$ 8,876,705**	**$ 95.62**	**$ 8,877**		**$ 234.69**	**$ 37,350**	***100.0%***

1. All costs converted to 2015 dollars. Monarch Global costs were escalated by 2.5% annually from 2013.

2. Total hard costs for Frederick are reflective of the final GMP contract negotiated with Gilbane in March 2016; however, Divisional details are based upon the November 2015 50% CD cost estimate because the GMP was being negotiated at the time this analysis was prepared. There was not an impact on the distribution of costs however an approximate $540K difference was added to the contingency line.

3. Monarch Baltimore costs based upon 2013 budget report provided by Steve Baldwin

Exhibit C - Cost Comparison[1] Fort Worthington and Monarch Global Academy

		BCS - Fort Worthington[2]				Monarch Global Academy[3]				Cost Differential		
Hard Costs												
DIV	**Description**	**Costs**	**$/SF**	**$/Student**	**% Hard Cost**	**Costs**	**$/SF**	**$/Student**	**% Hard Cost**	**$/SF**	**$/Student**	**% Total Gap**
1	General Requirements	$ 777,070	$ 7.52	$ 1,110	2.3%	$ 158,991	$ 2.51	$ 198	1.4%	$ 5.01	$ 913	3.7%
2	Existing Conditions	$ 697,562	$ 6.75	$ 997	2.1%	$ 110,316	$ 1.74	$ 137	0.9%	$ 5.01	$ 859	3.7%
3	Concrete	$ 1,025,731	$ 9.92	$ 1,465	3.1%	$ 618,006	$ 9.76	$ 768	5.3%	$ 0.17	$ 698	0.1%
4	Masonry	$ 2,433,104	$ 23.54	$ 3,476	7.4%	$ 265,241	$ 4.19	$ 329	2.3%	$ 19.35	$ 3,146	14.2%
5	Metals	$ 2,690,643	$ 26.03	$ 3,844	8.1%	$ 1,821,644	$ 28.77	$ 2,263	15.6%	$ (2.73)	$ 1,581	-2.0%
6	Wood, Plastics & Composites	$ 105,933	$ 1.02	$ 151	0.3%			$ -	0.0%	$ 1.02	$ 151	0.8%
7	Thermal & Moisture Protection[4]	$ 1,486,911	$ 14.39	$ 2,124	4.5%	$ 25,215	$ 0.40	$ 31	0.2%	$ 13.99	$ 2,093	10.3%
8	Openings	$ 1,922,387	$ 18.60	$ 2,746	5.8%	$ 596,478	$ 9.42	$ 741	5.1%	$ 9.18	$ 2,005	6.8%
9	Finishes[5]	$ 3,104,090	$ 30.03	$ 4,434	9.4%	$ 971,271	$ 15.34	$ 1,207	8.3%	$ 14.70	$ 3,228	10.8%
10	Specialties	$ 453,173	$ 4.38	$ 647	1.4%	$ 21,086	$ 0.33	$ 26	0.2%	$ 4.05	$ 621	3.0%
11	Equipment	$ 771,684	$ 7.47	$ 1,102	2.3%	$ 750,746	$ 11.86	$ 933	6.4%	$ (4.39)	$ 170	-3.2%
12	Furnishings	$ 990,249	$ 9.58	$ 1,415	3.0%	$ -	$ -	$ -	0.0%	$ 9.58	$ 1,415	7.0%
13	Special Construction	$ -	$ -	$ -	0.0%	$ -	$ -	$ -	0.0%	$ -	$ -	0.0%
14	Conveying Equipment	$ 125,000	$ 1.21	$ 179	0.4%	$ 65,559	$ 1.04	$ 81	0.6%	$ 0.17	$ 97	0.1%
21	Fire Suppression	$ 387,566	$ 3.75	$ 554	1.2%	$ 183,615	$ 2.90	$ 228	1.6%	$ 0.85	$ 326	0.6%
22	Plumbing[6]	$ 1,159,054	$ 11.21	$ 1,656	3.5%	$ 406,789	$ 6.42	$ 505	3.5%	$ 4.79	$ 1,150	3.5%
23	HVAC	$ 3,615,457	$ 34.98	$ 5,165	10.9%	$ 1,745,036	$ 27.56	$ 2,168	15.0%	$ 7.43	$ 2,997	5.5%
26	Electrical	$ 2,234,970	$ 21.63	$ 3,193	6.8%	$ 1,005,085	$ 15.87	$ 1,249	8.6%	$ 5.75	$ 1,944	4.2%
27	Communications	$ 1,041,152	$ 10.07	$ 1,487	3.1%	$ -	$ -	$ -	0.0%	$ 10.07	$ 1,487	7.4%
28	Electronic Safety & Security	$ 479,450	$ 4.64	$ 685	1.4%	$ 229,479	$ 3.62	$ 285	2.0%	$ 1.02	$ 400	0.7%
31	Earthwork	$ 1,152,022	$ 11.15	$ 1,646	3.5%	$ 134,480	$ 2.12	$ 167	1.2%	$ 9.02	$ 1,479	6.6%
32	Site Improvements	$ 1,447,301	$ 14.00	$ 2,068	4.4%	$ 1,000,195	$ 15.79	$ 1,242	8.6%	$ (1.79)	$ 825	-1.3%
33	Utilities	$ 480,674	$ 4.65	$ 687	1.5%	$ 272,112	$ 6.60	$ 338	2.3%	$ (1.95)	$ 349	-1.4%
	Subtotal Direct Costs	$ 28,581,183	$ 276.54	$ 40,830	86.4%	$ 10,381,342	$ 163.93	$ 12,896	89.0%	$ 112.61	$ 27,934	82.8%
	Contingencies	$ 2,577,722	$ 24.94	$ 3,682	7.8%	$ 367,719	$ 5.81	$ 457	3.2%	$ 19.13	$ 3,226	14.1%
	CM Fee	$ 445,000	$ 4.31	$ 636	1.3%	$ 521,289	$ 8.23	$ 648	4.5%	$ (3.93)	$ (12)	-2.9%
	CM General Conditions	$ 1,209,240	$ 11.70	$ 1,727	3.7%	$ 390,281	$ 6.16	$ 485	3.3%	$ 5.54	$ 1,243	4.1%
	CM Bonds and Insurances	$ 267,500	$ 2.59	$ 382	0.8%	$ -	$ -	$ -	0.0%	$ 2.59	$ 382	1.9%
Total Hard Costs		**$ 33,080,645**	**$ 320.08**	**$ 47,258**	**100.0%**	**$ 11,660,631**	**$ 184.13**	**$ 14,485**	**100.0%**	**$ 135.95**	**$ 32,773**	
											$ -	
Soft Costs[7]												
	A/E Fees	$ 1,605,643	$ 15.54	$ 2,294		$ 68,442	$ 1.08	$ 85		$ 14.46	$ 2,209	
	AV/IT Systems	$ 344,066	$ 3.33	$ 492		$ -		$ -		$ 3.33	$ 492	
	Commissioning/LEED	$ 229,378	$ 2.22	$ 328		$ -		$ -		$ 2.22	$ 328	
	FF&E	$ 458,755	$ 4.44	$ 655		$ -		$ -		$ 4.44	$ 655	
	Swing/Phasing Allowance	$ 688,133	$ 6.66	$ 983		$ -		$ -		$ 6.66	$ 983	
	Testing & Inspections	$ 114,689	$ 1.11	$ 164		$ 37,928	$ 0.60	$ 47		$ 0.51	$ 117	
	3rd Party Plans Review	$ 114,689	$ 1.11	$ 164		$ 525,313	$ 8.30	$ 653		$ (7.19)	$ (489)	
Total Soft Costs [7]		*$ 3,555,351*	*$ 34.40*	*$ 5,079*		*$ 631,682*	*$ 9.97*	$ 785		*$ 24.43*	*$ 4,294*	
										$ -		
Total Project Costs		**$ 36,635,996**	**$ 354.48**	**$ 52,337**		**$ 12,292,313**	**$ 194.11**	**$ 15,270**		**$ 160.37**	**$ 37,067**	

1. All costs converted to 2015 dollars. Monarch Global costs were escalated by 2.5% annually from 2013.

2. Total hard costs for Ft. Worthington are reflective of the final GMP contract negotiated with Gilbane in March 2016; however, Divisional details are based upon the November 2015 50% CD cost estimate because the GMP was being negotiated at the time this analysis was prepared. There was not an impact on the distribution of costs however an approximate $800k difference was added to the contingency line.

3. Monarch Global costs based upon 2013 schedule of values provided by Steel Building Specialists

4. Interior insulation costs from Ft Worthington were moved to finishes to align with the Monarch Global distribution of costs

5. Finishes inclusive of GWB, ceilings, & insulation

6. Monarch reported plumbing in HVAC division. For purpose of this analysis it was assumed that plumbing costs were approximately 25% of HVAC costs

7. Soft costs were assumed for Monarch Global because it was a Design-Build Project. Separate A/E Fees were not reported by Monarch. Analysis is restricted to hard costs due to lack of available detail on soft costs.

Global Engineering Solutions®

Exhibit D - MEP System Evaluation

Monarch Charter Schools and Baltimore City Schools
January 12, 2016

School	SYSTEMS		SYSTEM COMPARISON	
	Primary Description	Other Systems	System Advantages	System Disadvantages
Monarch Charter School - Baltimore Location	**Variable Volume Temperature (VVT) Heating and Cooling System:** Utilizes indoor VVT terminal units and with constant volume air-cooled, gas heat rooftop units providing both supply and fresh air.	**Other Systems:** N/A	● Low first cost systems comparatively. ● Provides individual comfort with temperature controlled by the VVT systems. ● Quiet system at the classroom level as there are no fans or compressors in the classrooms ● Gas heat is less expensive than electric heat ● System component longevity is approximately 15 years. ● System could be outfitted with centralized BAS system if not already provided ● Majority of maintenance located outside of the classrooms ● Full and partial economizer operation available - lowers energy usage.	● Energy consuming - in essence, the system is a constant volume system with the VVT dampers allowing unrequired air to bypass the occupied space and return to the rooftop units creating additional energy usage and no fan savings ● Moderate maintenance costs to maintain rooftops, change filters, etc. ● Rooftop unit failure will take down all classrooms/areas served by this unit ● Lower air quality with lower ratings on air filters - this may be able to be improved if rooftop units can accept higher filter mediums and fans can overcome slightly increased static pressure
Monarch Charter School - Laurel Location	**Unit Ventilators:** Utilizes split system HVAC units with electric heat pumps and electric heat to provide conditioned air and ventilation to each individual space with no centralized tepmerature control.	**Other Systems:** *Gym and Cafeteria:* Constant Colume HVAC Units - see pros/cons for VVT system Office Area: Gas-Fired VAV System with electric reheat - see pros/cons for VAV system	● Low first cost systems comparatively. ● Mechanical failure impacts only the affected classroom ● Flexibility for scheduling after school activities without impacting the other areas ● Adjustable ventilation per classroom ● Provides individual comfort at each space. ● System component longevity is approximately 15 years.	● Electric heat (electric heat pumps) is expensive ● Lowest energy efficiency of listed systems ● All maintenance inside the classroom ● Only one manufacturer ● Fresh air intake and exhaust air discharge in close proximity, code verification required ● Limited economizer capability ● Units are noisy due to the presence of the compressor within the unit and therefore not the ideal solution for a classroom environment. ● Localized control only ● Lower air quality due to lower air filtration medium at ventilators
Baltimore City School - Frederick Elementary School	**Variable Air Volume (VAV) Heating and Cooling System:** Utilizes indoor VAV terminal units and central station air handlers providing both supply and fresh air with central plant chillers and gas-fired boilers to provide chilled water and hot water to the air handler units and hot water reheat to the VAV terminal units. MERV 13 filters are provided for air filtration.	**Other Systems:** *Community Space:* Dedicated outside air handling unit with single zone variable air volume operation. Pros/cons for Variable Air Volume system apply in kind to the single zone VAV system.	● Higher first cost comparatively. ● System performance tailored to individual comfort control ● Quiet system at the classroom level as there are no fans or compressors in the classrooms ● Centralized control systems capble ● System performance tailored to individual comfort control ● Longevity of system components and equipment is approximately 25 years. ● Full and partial economizer operation available - lowers energy usage. ● Energy savings realized through centralized plant, fan speed control, centralized control systems, energy recovery in rooftop units, economizer operation, and gas-fired boilers providing hot water for heating. ● Air quality is higher with high filtration of air in rooftop units (MERV 13 filters).	● High level of technical service required to maintain the overall HVAC system boilers/chillers/cooling tower/pumps/energy recovery wheel /piping /controls). ● A high level of commissioning is required and is essential to its performance. ● Base building systems (chillers, boilers, pumps) required to run even during low occupied time to supply chilled and hot water for heating and cooling resulting in high uses of energy during lightly occupied periods ● Breakdown/maintenance of major equipment may cause complete shutdown of system and interruption of building operation
Baltimore City School - Fort Washington	**Vertical Four-Pipe Heating and Cooling System:** Utilizes indoor four pipe fan coils and outdoor air handlers with central plant chillers and boilers for fresh air. Four-pipe distribution system is served by gas-fired boilers and an air cooled chiller.	**Other Systems:** *Administrative Areas:* Variable Refrigerant System with dedicated outdoor air unit. The VRF System provides the following PROS: ● High level of air filtration with MERV 13 filters in dedicated outdoor air unit ● Built-in ability to recover heat throughout the building during normal operation. ● Extremely high energy efficiency ● System performance tailored to individual comfort control ● Low noise operational levels ● Low system operational and maintenance service required. ● Modularity of system and high level of zoning availability - creating reliability The VRF system provides the following CONS: ● Presence of refrigerant piping within occupied spaces. *Gymnasium, Dining, Stage, Media, and Community* : Dedicated outside air handling unit with single zone variable air volume operation - direct expansion (DX) cooling and gas-fired heating. Pros/cons for Variable Air Volume system apply in kind to the single zone VAV system.	● Higher first cost comparatively. ● System performance tailored to individual comfort control ● Centralized control systems capble ● Longevity of system components and equipment is approximately 25 years. ● Full and partial economizer operation available - lowers energy usage. ● Energy savings realized through centralized plant, centralized control systems, energy recovery in rooftop units, economizer operation, and gas-fired boilers providing hot water for heating. ● Air quality is higher with high filtration of air in rooftop units (MERV 13 filters).	● High level of technical service required to maintain the overall HVAC system (boilers/chillers/cooling tower/pumps/energy recovery wheel /piping /controls). ● Fan coil units tend to be noisy and therefore not the ideal solution for a classroom environment. ● Energy consuming system (high utility bills) and of relatively low energy efficiency providing no LEED points ● A high level of commissioning is required and is essential to its performance. ● Base building systems (chillers, boilers, pumps, cooling towers) required to run even during low occupied time to supply chilled and hot water for heating and cooling resulting in high uses of energy during lightly occupied periods ● Breakdown/maintenance of major equipment may cause complete shutdown of system and interruption of building operation. ● Maintenance is not centrally located - maintenance required at central plant, at rooftop units, and at EACH individual fan coil unit

Exhibit E

Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Financial and Business Services
Division of School Support
School Planning Section

PRE-ENGINEERED BUILDINGS

Relating to the Construction and Maintenance of Public Schools in North Carolina

March - 2008

CONTENTS

DEFINITION

Typically, a pre-engineered building is a metal building that consists of light gauge metal standing seam roof panels on steel purlins spanning between rigid frames with light gauge metal wall cladding. It is a relatively flexible structure vs. a conventional steel framed building. In other words, it has a much greater vertical and horizontal deflection. The intent for this publication is to recognize the nature and limitations of pre-engineered buildings for school projects.

GENERAL

A pre-engineered building may be purchased by local school boards as part of regular new school project, addition or renovation project, or stand-alone building project. It must be designed by a North Carolina licensed architect and/or engineer and submitted to School Planning for review per General Statute 115C-521.

The superstructure shall be designed by a certified engineer and fabricated by a pre-engineered manufacturer as a complete system. The foundation system shall be designed by an independent structural engineer who will be the engineer of record for the project. The engineer of record shall review and approve the pre-engineered manufacturer's shop drawings.

Project reviews are completed and certificates of review issued upon certification to School Planning that the pre-engineered structural systems have been reviewed and approved by a North Carolina registered structural engineer for the projects. General Statute 133-1 requires that project architects and engineers be in the employ of owners and prohibits project designers being employed by or having financial interest in manufacturers or suppliers of pre-engineered structures.

ADVANTAGES

1. Fast erection
2. Low cost if choosing manufacturer's standard package/inventory and no add-on
3. Open clear span
4. Can be easily expanded to grow with needs

DISADVANTAGES

1. Marginal design, material and construction
2. Not energy efficient
3. Higher lifetime maintenance
4. Not durable for long term use, generally last 10 to 15 years
5. May not include all construction/fit-up needed for the building to serve the intended purpose.
6. No secondary roof membrane
7. Usually no internal finished walls

Note: Because of the above disadvantages, pre-engineered buildings are generally **not** recommended for school buildings except for non-instructional purposes such as storage, maintenance facility and etc.

RECOMMENDATIONS

1. All manufacturer drawings and design calculation shall bear the professional seal and signature of licensed professional engineer registered in the state of North Carolina.
2. Roof system is very light (approx. 3 psf). Check the wind net uplift requirements for attachments of roof deck, roof structural members, anchorage of steel columns and column piers/footings in accordance with latest North Carolina State Building Code. Pay special attention to net uplift force at the columns that are part of vertical cross-bracing frames.
3. Roof deck has little diaphragm capacity. Horizontal cross-bracing shall be provided on the roof plane in both directions.
4. If using standing seam metal roof deck with clip anchors, place the continuous row of screw anchors at the ridge, under the ridge flashing.
5. Pay special care to the flashing at valley and intersections of roof.
6. Check roof structural members for surcharge load due to snow drifting.
7. Provide portal frames and/or cross-bracing at side walls to properly stabilize the building.
8. Use pre-engineered frame at end walls and add wind columns as necessary in between the columns of pre-engineered frame. It should easily accommodate future expansion.
9. Provide horizontal ties such as tie rods or hairpins to resist outward thrust at the base of rigid frame's column.
10. Foundation system including column piers/footings, tie rods/hairpins and anchor bolts must be checked against the forces calculated by pre-engineered manufacturer.
11. Provide and show the location of all collateral loads such as sprinklers, basketball goal, exhaust fan, underhung equipment, mechanical & electrical systems and ceilings.
12. Any field modifications of structural members shall be approved by pre-engineered building manufacturer and carried out under the supervision of engineer of record or a registered structural engineer.
13. Specify limitation of horizontal deflection/lateral drift of the pre-engineered frames if brick veneer and/or masonry wall are part of building enclosures and are supported laterally by girts.
14. To insure the quality of structural steel work, we recommend that pre-engineer manufacturer be AISC (American Institute of Steel Construction) certified steel fabricator.

MINIMUM DRAWINGS FOR DPI, SCHOOL PLANNING, REVIEW

- Site plan showing relationship to playfields, drives, walks, parking areas, utilities, other buildings and site improvements and property lines.
- Foundation plans showing slab on grade, slab control joints, tie rods/hairpins, wind columns, footings, locations of lateral bracing & portal frames and etc.
- Structural design of framing system including but not limited to anchor bolts, roof diaphragm, lintels, girts, wall openings and stability of the building must be reviewed and approved by the engineer of record, other than a registered engineer in the employment of the manufacturer.
- Pre-engineered shop drawings produced by the successful bidder shall be submitted to DPI, School Planning for review as a final step in securing a "Certificate of Review" and completion of the review process.
- Electrical system layout including electrical service equipment, lighting and power.
- Heating and/or cooling systems and ventilation.
- Plumbing Systems.
- Other architectural drawings as required to show subdivision of space, ceilings, finishes, doors, windows and etc.
- Building Code summary sheet and life safety plan.

ADDITIONAL RESOURCES

"Guide Specifications"
"Metal Building System Manual"
Metal Building Manufacturer Association
http://www.mbma.com/

"Technical FAQ"
"Fire rating/Insurance"
Metal Building Manufacturer Association
http://www.mbma.com/

"Metal Building system design Guidelines"
NC Department of Administration, Office of State Construction
http://www.nc-sco.com/

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Long Chang, P.E., Principal Author, Consulting Engineer, School Planning Section, NC Department of Public Instruction, Raleigh, NC.

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21st Century School Facilities Commission

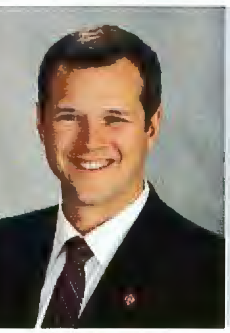
CASE STUDY: ANALYSIS OF ALTERNATIVE APPROACHES TO SCHOOL CONSTRUCTION

August 25, 2016

City School Partners - Joint Venture

McKissack & McKissack and Brailsford & Dunlavey

Introductions



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FRIT

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Senior Vice President
Brailsford & Dunlavey

James Posey Associates
Engineering Your Vision

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Introductions

City School Partners K-12 Combined Program Management Experience

- Over 70 Projects Completed
- $3.5 billion Completed
- Representative Large Public K-12 Programs:
  - Chicago Public Schools, LA Unified School District, Detroit Public Schools, DC Public Schools, City of Alexandria Public Schools, Prince George's Public Schools, Baltimore City Schools - 21st Century School Building Program, etc.
- Representative Charter Schools Projects:
  - Kipp DC, Cesar Chavez, DC Prep, E.L. Haynes, Building Hope, DC Bilingual, Bridges, Achievement Prep, DC Scholars, etc.

Background and Purpose

1. **The Maryland Stadium Authority (MSA) contracted with CSP in the Fall of 2015 to** evaluate differences in construction project implementation processes and costs between traditional public schools and schools delivered via alternative means;
2. Seek best practices to assist with the implementation of the Baltimore City Public Schools (City Schools) modernization program;
3. Assess factors contributing to reduced construction costs at some charter schools and identify any potential applications for MSA and City Schools.

Approach

Side-by-Side Comparison of 4 Schools;

Baltimore City Public Schools

- Fort Worthington K-8 / New Construction
- Frederick Elementary PreK-5 / Renovation + Addition

Monarch Academy Public Charter Schools.

- Monarch Global Academy (Laurel, MD) - PreK-8 / New Construction
- Monarch Academy (Baltimore, MD) – PreK-8 / Renovation

❖ Selected based upon the similarities in grade configuration and construction type.

Context

1. New educational facilities are a reflection of organizational values, priorities, and the difficult choices that must be made during project planning, design, and implementation.

2. Factors that drive cost savings must placed within the context of specific associated tradeoffs, such as the impact on learning environments and long term operations.

District Schools and Charter Schools: General Operating Models

Charter Schools - Most charter organizations are autonomous, often only operating one school, and are typically led by a head of school or principal and a volunteer board of directors. Budget is a high priority factor in most key program decisions.

District Schools - Require multiple departments of specialists to manage a bevy of educational and operational concerns ranging from transportation and facilities management to special education and food services. The building's program of requirements drives the projects budget.

Organizational differences have significant implications during the planning, funding, and implementation phases of a new school construction project.

Operating Model Impacts

District Schools – Equity Considerations

1. District Schools must carefully evaluate the impacts on the utilization of surrounding schools, changing demographics, and academic priorities;

2. Planning process for district schools typically involves State participation and an extensive public engagement process.

Operating Model Impacts

Charter Schools

1. Only eligible for State or local school construction program funding if located within a District-owned building
2. May utilize annual allocation of operating dollars (based upon student enrollment) to independently fund projects
3. Must operate as a private business and secure independent financing based upon annual operating cash flows and their balance sheet.

The organizational, accountability, and project funding differences between charter and traditional schools form the backbone of the resulting differences in construction project scoping and costs.

Scope & Cost Differences

City Schools Fort Worthington and Monarch Global Summary of Construction Cost

	Ft. Worthington		Monarch Global		Cost Differential
	Costs	$/SF	Costs	$/SF	$/SF
Total Hard Costs	$33M	$320	$11.6M	$184	$136

Scope & Cost Differences

Summary Review of Project Specifications
City Schools Fort Worthington and Monarch Global

Differences

1. Pre-engineered steel building (Monarch) vs conventional construction
   a. Monarch delivered $31 per SF <u>**less**</u> for the structure and building envelope than Fort Worthington, 25% of cost differential

2. HVAC, Electrical and Communications
   a. Monarch - Lowest 1st cost, lack of energy efficiency, system longevity, and controllability. Expected useful life for the system selected is approximately 15 years in comparison to 25 years for the system selected by BCPS.
   b. Monarch delivered $24 per SF, 23% of cost differential

Scope & Cost Differences

Summary Review of Project Specifications
City Schools Fort Worthington and Monarch Global, Cont.

Differences

3. Interior Finishes - Differential of 11% of the total gap between the schools. Difference in acoustic separation issues, and lack of ceilings in second floor classrooms
   a. Monarch delivered $15 per SF, 11% of cost differential

4. Window Systems - Cost differential is related exclusively to the extensive use of storefront and curtainwall glazing systems at Fort Worthington as opposed to the use of more standard, aluminum, window systems installed at Monarch Global.
   a. Monarch delivered $9 per SF, 7% of cost differential

Scope & Cost Differences

City Schools Frederick and Monarch -Baltimore Summary of Construction Cost

	Frederick		Monarch		Cost Differential
	$/SF	Cost	Cost	$/SF	$/SF
Total Hard Cost	$25M	$297	$7.8M	$84	$213

Scope & Cost Differences

City Schools Frederick and Monarch –Baltimore

1. HVAC, Electrical and Communications
   a. Monarch - Lowest 1st cost, lack of energy efficiency, system longevity, and controllability. Expected useful life for the system selected is approximately 15 years in comparison to 25 years for the system selected by BCPS.
   b. Monarch delivered $50 per SF, 24% of cost differential

2. Interior Finishes – Quantity and quality or product specifications. Monarch used VCT throughout classrooms and corridors, however there were extensive sections of the building within which new flooring was not added or in which flooring subsurface was not required.
   a. Monarch delivered $18 per SF, 8% of cost differential

Scope & Cost Differences

City Schools Frederick and Monarch –Baltimore

3. Window Systems - Cost differential is related exclusively to the extensive use of storefront and curtainwall glazing systems at Fort Worthington as opposed to the use of more standard, aluminum, window systems installed at Monarch Baltimore.
   a. Monarch delivered $13 per SF, 6% of cost differential

Energy Consumption Analysis

City Schools Fort Worthington and Monarch Global

Monarch's annual energy costs from 2015 when compared to the projected annual energy costs for Fort Worthington;

Building SF	103,351	63,327
Projected / Actual Annual Energy Costs	$76,630	$112,000
Energy cost / SF / Year	$0.74	$1.77

1. Energy costs for Ft. Worthington are projected based upon an energy model developed by James Posey Associates in April 2015. Costs for Monarch Global are actual for 2015.

Evaluation of Program Differences

City Schools Fort Worthington and Monarch Global Summary – Programmatic Space Allocation

Total Building NSF	47,035	73,105
NSF Total Teaching Space / Student	43	74
Total NSF / Student	58	104
Building Gross SF	63,327	103,351
Gross SF / Student	79	148
Non-Programmed Space	16,292	30,246
Building Efficiency Factor	74%	71%

Evaluation of Program Differences

ity Schools Frederick and Monarch – Baltimore
ummary – Programmatic Space Allocation

Total Building NSF	64,812	59,250
NSF Total Teaching Space / Student	45	68
Total NSF / Student	65	98
Building Gross SF	92,838	84,670
Gross SF / Student	93	140
Non-Programmed Space	28,026	25,420
Building Efficiency Factor	70%	70%

Evaluation of Program Differences

City Schools and Monarch
Summary – Assignable Square Footage / FTE

	Monarch Global	Fort Worthington	Monarch-Baltimore	Frederick
Students / Teaching FTE	15	17	17	15
Teaching NSF / Teaching FTE	624	1,237	759	1,020
Admin & Support NSF / Admin & Support FTE	195	247	263	356

Conclusions & Recommendations

1. **Examine and Validate Project Specification and Programming Options.** MSA and City Schools should also consider closely evaluating the potential for modifications to low voltage, A/V, security, and telecommunication standards, interior finish specifications and acoustic upgrades so long as are confirmed to not impact critical programmatic and operational values.

Conclusions & Recommendations

2. **Evaluate Usage of Alternative Buildings and Funding Sources;**
   a. Carefully consider the need to construct buildings with a 40-50 year life span by evaluating historical shifts in neighborhood populations and aligning facility types in response to localized population volatility to mitigate long-term uncertainties in school utilization.
   b. Evaluate the possibility of supplementing project funding sources with alternative funding sources such as New Market Tax Credits and low interest loans for energy efficiency upgrades.

Conclusions & Recommendations

3. **Evaluate Opportunities to Link State Construction Funding to School Level Operating Costs.** Engage an analysis to establish operating cost benchmarks by school type.

   a. Enhanced ability of school systems to evaluate operating efficacy of individual schools.
   b. Opportunity to establish legal structures that enable private financing that is linked to the operating performance of an individual school.
   c. Ability to more readily pursue non-traditional sources of capital such as New Market Tax Credits and CDA loans for qualifying schools.
   d. More careful consideration of system enhancements and capital upgrades if private financing is required to fund implementation.

Q&A

August 17, 2016

The Honorable Bridget Newton
and Members of the City Council
City of Rockville
111 Maryland Avenue
Rockville, Maryland 20850

Dear Mayor Newton and Councilmembers:

I am writing this letter regarding the testimony that was presented on behalf of the Mayor and Council on July 21, 2016, at the 21st Century School Facilities Commission meeting in Annapolis, Maryland. We appreciate that the City of Rockville participated in this forum to share their thoughts regarding school construction in the state of Maryland. Montgomery County Public Schools (MCPS) believes that this Commission is a great opportunity to share some of the experiences, including successes and challenges, that we have faced and will continue to face as we plan, design, and construct 21st century school buildings for the students of Montgomery County.

Over the years, MCPS has worked closely with the Mayor and Council as well as City of Rockville staff to ensure that you have been informed about our construction program, especially projects that are within the city limits of Rockville. As you know, MCPS will soon begin the construction of Richard Montgomery Elementary School #5 to address the overutilization at several schools in Rockville. We value the input from you and your staff during the design development process and appreciate your support of the final building design for the new school. MCPS will follow all of our construction best practices to ensure that this new elementary school will have all of the program spaces needed for our students to be successful learners and will have the infrastructure needed so that this facility will serve Rockville students for generations to come.

Your testimony stated that "Montgomery County Public Schools has some of the highest per student construction costs with an average of \$48,498 to \$59,513 per student." This data, to my understanding, was provided by the Children's Guild, which also claimed that "the per student construction cost of their projects range from \$13,018 to \$15,456 per student." In order to benchmark construction costs, MCPS uses the industry standard of a cost/square foot comparison. This industry standard is the measure that should be used to compare school construction costs. Since Fiscal Year (FY) 2008, MCPS' construction costs have averaged between a low of \$212 per square foot to a high of \$297 per square foot in FY 2015. The state of Maryland also uses the cost/square foot figure and, historically, the MCPS cost/square foot for construction projects has been lower than the state. As indicated on the enclosure provided by staff in the Department of Facilities Management, MCPS once again has lower average construction costs than the statewide average, based on the most recent or anticipated bids for the 2016 calendar year.

MCPS takes great pride in our construction program, both in terms of quality and the fact that we are strong stewards of the public funds entrusted to us. We complete our projects on time and on budget, and our commitment to environmental sustainability is evident in all of our new facilities. Design of high performance green buildings promises a better and healthier environment for our students and staff, and that is what drives our construction program to choose sustainable construction and Leadership in Energy and Environmental Design (LEED) certified buildings. For your reference, some facts regarding our school construction program are listed in the enclosure.

We think it is important to highlight all of these strategies because we know the importance of our fiduciary responsibility with state construction dollars, and we know we must do everything we can to make the most of limited funding. I can assure you we will utilize state construction funding well.

All of these best practices have been refined over the past 30 years and have resulted in a 100 percent on time completion rate, with an average change order rate of only 2 percent. Our schools serve as a learning center for our students and as a community center after school and on weekends. We continue to receive positive feedback with respect to our many construction projects throughout the county from all users and will continue to strive to deliver high-quality construction projects to benefit every user in Montgomery County.

I would welcome the opportunity to have a conversation with you and the Councilmembers to discuss our school construction program to ensure that you have accurate information about school construction in Montgomery County in comparison to the other school districts in the state, as well as in the Washington metropolitan area. In the past, you and the Councilmembers have testified at our public hearings as well as in front of the Montgomery County Council in support of the MCPS Capital Improvements Program (CIP), and we want to ensure that we have your continued support as we move forward into the next CIP cycle, as well as at the 21st Century School Facilities Commission meetings in Annapolis, Maryland. We certainly recognize that our construction program would not be possible without the tremendous contribution from our local government. Therefore, I believe that it is imperative that we are united as a county and that the various cities and municipalities within the county join together to support our capital needs and continue to advocate for additional construction funding at the state level.

We look forward to working with you to ensure that the students of our county continue to learn in well-designed buildings that accommodate enrollment and provide the educational programs of which we are so proud.

If you have any questions, please contact Mr. James Song, director, Department of Facilities Management, at 240-314-1064. I look forward to the possibility of meeting after school opens.

Sincerely,

Andrew M. Zuckerman, Ed.D.
Chief Operating Officer

AMZ:JS:ak

Enclosure

Copy to:
Senator Nancy J. King
Delegate Aruna Miller
Montgomery County Executive Isiah Leggett
Members of the Montgomery County Council
Members of the Board of Education
Dr. Smith
Dr. Navarro
Dr. Statham
Mr. Song
Mr. Ikheloa
Ms. Swanson

Enclosure

Montgomery County Public Schools Construction Program
Additional Information

1. MCPS vs. State Construction Costs

Most Recent or Anticipated Bids for 2016	Median	Average	Average Above/Below State
State Data			
Without Site	$ 261.83	$ 267.69	
With Site	$ 305.22	$ 314.22	
MCPS Data			
Without Site	$ 242.53	$ 238.40	-15.5%
With Site	$ 285.98	$ 277.63	-17.3%

*Data provided by the Maryland Public School Construction Program.

2. Facts regarding the MCPS school construction program:
   - Our square-foot cost trend is consistent with other school districts in Maryland and northern Virginia.
   - Our construction program has set many standards and shared best practices and benchmarked with numerous school districts in Maryland and the Washington metropolitan area, including Alexandria, Arlington, and Fairfax counties.
   - We take pride in an excellent quality-control process resulting in 100 percent on-time completion and within budget for more than 15 years with an average of 2 percent in change order rates.
   - Our construction program was the first in the state to obtain Leadership in Energy and Environmental Design (LEED) Gold Level certification through the United States Green Building Council in 2006 before Maryland adopted the LEED standards in 2008.
   - Our construction program continues to lead the state in environmental sustainability efforts, accomplishing 21 LEED certified projects and earning many other environmental stewardship accolades.
   - In 2010, MCPS was the recipient of the Malcolm Baldrige National Quality Award, which included extensive review of our construction program to achieve this recognition.
   - Our reroofing program is one of the lowest costs in the state and is recognized at the state level as well as the Washington metropolitan area. This is achieved through refining roofing standards and designs and inspections managed by in-house expert staff.
   - The U.S. Department of Education has recognized five MCPS schools with the National Green Ribbon School Award since the inaugural year of the award in 2012.
   - In 2013, MCPS was recognized with the District Sustainability Award by the U.S. Department of Education. Associated Builders and Contractors, Inc. recognized two MCPS capital projects with the 2015 Excellence in Construction Award.