THE COST OF SCHOOL CONSTRUCTION

A Comparison of the Monarch Global Academy and Conventional School Facilities
Report to Governor Larry Hogan and the Board of Public Works

October 28, 2015

The Monarch Global Academy
The Children's Guild
Laurel, Maryland

Rolling Knolls Elementary School
Anne Arundel County Public Schools
Annapolis, Maryland

Interagency Committee on School Construction:

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Secretary Gail Bassette, Department of General Services
Mr. Timothy Maloney, Member of the Public
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Special thanks to the following for their cooperation and extensive contributions to this report:

- Mr. Stephen Baldwin, Executive Vice President and CFO, The Children's Guild
- Mr. Alex Szachnowicz, P.E., Chief Operating Officer, and the facilities staff of Anne Arundel County Public Schools
- Ms. Gloria Mikolajczyk, RA, School Facilities Architect Supervisor, Maryland State Department of Education
- Ms. Jillian Storms, AIA, School Facilities Architect, Maryland State Department of Education
- Mr. Douglas Eder, President, Oak Contracting LLC.

Other individuals who have given generously of their time during the interview process are listed on pages 2 and 3 of this report.

Requests for copies of this report and questions regarding its contents may be directed to the Public School Construction Program at 410-767-0617.

TABLE OF CONTENTS

THE COST OF SCHOOL CONSTRUCTION:
A Comparison of the Monarch Global Academy and Conventional School Facilities
Report to Governor Larry Hogan and the Board of Public Works

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EXECUTIVE SUMMARY

Governor Larry Hogan has asked the Interagency Committee on School Construction (IAC) to compare a privately-financed and owned school in Anne Arundel County, the Monarch Global Academy, to public school facilities that use conventional construction methods and technologies. The Monarch Academy was built to commercial building standards and to a smaller size than a concurrent public school in Anne Arundel County, resulting in a total cost that was approximately $9.67 million less, and a unit cost $67.89/square foot lower, compared to the costs of the public school facility (see chart, page 12). The aim of the study, as understood by the IAC, is to determine if aspects of the Monarch Academy's building technology can be applied to Maryland's large school construction task, in order to extend the reach of limited State and local capital funds through less expensive but still satisfactory building technologies. A study of comparative costs must take into account the differences in the educational program of the two facilities, the business model that each uses, and the life-cycle cost implications that building technologies have for operating budgets.

The primary mission of every school facility is to support the educational program of the school. The IAC finds that the Monarch Global Academy facility has admirably resolved a number of issues in Anne Arundel County: it has relieved overcrowding at three elementary schools pending construction of a permanent, board-owned facility; it has offered educational choice to parents at the three schools; and under the County's Adequate Public Facilities Ordinance (APFO), it allowed developers to construct housing within an area identified for development. However, the IAC also recognizes that the Monarch Global Academy has a number of unique characteristics that align with the commercial building standards of the facility:

- Unlike the majority of public schools, Monarch operates on an annual per-pupil allocation that repays the financing of the building, supports the educational program, and defrays the facility maintenance and operational costs.

- Also unlike other public schools, Monarch has a contractually-fixed enrollment cap, allowing it to avoid the uncertainties associated with overcrowding.

- Monarch has an educational program that is defined for the term of the contract (as much as 25 years).

The financial, enrollment and programmatic stability that these factors bring allows Monarch to operate by a business model that is substantially different from that of typical public schools. The model is analogous to that of a developer who can count on a stable tenancy, and therefore anticipates a stable income stream that will run concurrently with the life of the building. In the Monarch business model, in fact, depreciation of the educational facility is factored into the annual calculation of revenues against expenses. All of these factors combine to permit the efficient and economical operation of a facility built to commercial standards that are generally considered to be less durable than the institutional standards that are typically applied to public schools. For the Monarch facility, capital renewal and maintenance will take place according to the business plan and not in relation to the uncertainties of the school system's capital improvement program and the annual appropriations for maintenance.

Aside from building technology, the principal difference between the Monarch facility and an elementary school of comparable enrollment is found in the educational specification. Monarch has a total size of 63,327 gross square feet; an Anne Arundel County Public Schools elementary facility of similar enrollment would require a building of approximately 94,150 gross square feet. This difference in total area, which results from the differing requirements of the educational specifications and community use space, accounts for a substantial portion of the cost variance between the two facilities. The IAC staff has found that the reduced Monarch educational specification results in a loss of features that would not be acceptable in a

public school facility under current standards; these qualitative differences are described in some detail beginning on page 14.

It can be asked whether Anne Arundel County Public Schools is over-building its facilities unnecessarily. On examination of the educational specifications of elementary schools from a number of Maryland jurisdictions, the IAC staff finds that AACPS builds its schools well within common space parameters. These space requirements are driven by educational methodologies; the characteristics of the student bodies; the need to preserve flexibility in the face of unknown future enrollments, student demographics, educational programs, and regulatory requirements; and good practices related to educational facility design.

The IAC welcomes the opportunity to explore alternative building technologies in greater depth, with two cautions: every alternative must support the educational program of the school, and every alternative must meet requirements for durability, operational efficiency, and maintenance that align with the realistic staffing expectations of the school systems. In an era of increasingly limited resources which challenge our ability to meet our current needs for facility capacity, renovation and maintenance, it is imperative to avoid building technology decisions that could result in premature deterioration of facilities. Many alternative building technologies have been tried in Maryland schools, some with considerable success and others that revealed a host of unanticipated problems. Among the former are a number of high performance technologies, including geothermal ground source heating and cooling systems. Among the latter are the infamous open-space schools of the 1960s and 1970s, which were intended to provide an inexpensive, temporary solution to the wave of baby-boom children that followed World War II; unfortunately, many of those facilities are still in use as schools, including a large number that have never been renovated.

Accordingly, the IAC recommends a number of steps to further explore the potential of alternative building technologies:

1. Engage LEA superintendents, facility planners, maintenance, operational, and instructional staff to visit and assess the Monarch Global Academy in light of their knowledge of educational practice and facility requirements.

2. Conduct a life-cycle cost analysis (LCCA) of the Monarch Global Academy to determine the operational, maintenance, utility, and building system renewal costs over the anticipated useful life of the building, compared to those of conventionally built public school facilities.

3. Conduct separate LCCAs of alternative individual building systems, including pre-engineered structural systems, insulated exterior wall panel enclosure systems, vertical unit ventilators, standing seam metal roofing, impact-resistant drywall in high-traffic areas, PVC piping, and other systems as appropriate.

4. Broaden the study to include school buildings constructed to commercial standards that do not have the unique administrative, educational, and financial characteristics of the Monarch Academy.

5. Consider developing a long-term pilot program to build one public school facility to commercial standards concurrent with the construction of a conventional school of the same size, in order to allow comparison of development time and cost, first construction costs for building and site, life-cycle costs for operations, maintenance, utilities, and renewal, user satisfaction, and other factors.

6. Establish a task force to study in detail the full range of cost reduction measures that may be applicable to public school facilities in Maryland, including State educational requirements, non-educational regulations, prevailing wage rates, alternative building technologies, project delivery methods, and project procurement methods.

The IAC has worked with local school systems on a variety of proposals for innovative and nontraditional designs, construction methodologies, project delivery methods, and alternative financing approaches. The IAC will continue to encourage innovation, and will work with LEAs to develop such proposals.

I. OVERVIEW

Origin and Scope of the Study

Governor Larry Hogan has requested the Interagency Committee on School Construction (IAC) to develop a comparison of the Monarch Global Academy in Anne Arundel County to conventionally designed and built schools. The purpose of the study, as understood by the IAC, is to determine if there are aspects of the Monarch facility that can be incorporated into conventional school buildings in order to significantly reduce construction costs. The assignment is timely: as reported by the Executive Director of the IAC to the Capital Debt Affordability Committee (CDAC) on September 16, 2015, construction costs have risen sharply in the last year due to a number of causes, including changes in market conditions, Maryland's regulatory environment, schedule impacts, and site conditions (a full description is provided in the CDAC report, Attachment 1).

The mission of the school facility is to support the educational program of the school; all decisions regarding facility design, building systems, construction technology, and aesthetics should have this fundamental goal in mind. In a recent report developed for Anne Arundel County, MGT of America writes

> *The educational mission, goals, and objectives combined with the strategic structure of the district, the grade groupings, feeder patterns, school sizes, and educational specifications, define the architecture of the school facilities.*[1]

School facilities are among the most important building tasks of any society. Because of their programmatic complexity and their technical requirements, schools belong to the spectrum of institutional buildings that include libraries, government facilities, museums and hospitals. Like health care facilities, schools house a vulnerable population for whom special facility arrangements are needed to protect their safety, health, and security. Just as in a hospital treatment or operating room, where every piece of equipment, every detail of lighting, power, air supply, and data must be thoroughly thought through to facilitate the indispensable work of the medical staff, just so in an educational building the physical features should be developed in collaboration with teachers, administrators, and educational experts to ensure that the facility will support and engage the best qualities of the students. Like other large civic facilities, schools must house a variety of often conflicting uses involving both large assemblies and small group settings, noisy spaces and spaces that require quiet, and spaces that intermittently experience a high volume of pedestrian traffic along with spaces in which the occupants are sedentary or focused on their studies and projects. And like some other types of institutional buildings, particularly health care facilities, schools must be flexible in order to accommodate future changes in educational program, student enrollments and demographic characteristics, and technology.

The complexity associated with institutional buildings like schools and health care facilities means that the time required for development and design will be longer and their built infrastructure will have a fundamentally different character compared to simpler building types – office buildings, warehouses, shopping centers, even housing: schools must be more durable, without sacrificing flexibility. As publicly-funded facilities dependent on fluctuating public operating budgets, they must require less maintenance than facilities that can depend on more reliable funding sources for maintenance and capital renewal. This points to the conclusion that schools built under a public authority should operate by a different business model than privately funded and operated buildings of all types, including private schools.

To meet the challenge of providing suitable school facilities for Maryland's 866,000 public school students,[2] the IAC has every interest in promoting methods to reduce construction cost, but with two provisos: that every proposal must be evaluated for its effect on the delivery of the educational program, and it must be evaluated for its impact on life-cycle costs, particularly maintenance, energy consumption, and the schedule for renewal of critical building systems.

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1 MGT of America, Inc., *Strategic Facilities Utilization Master Plan*, Final Report, August 31, 2015, page 9.

2 Enrollment as of 2013.

In making decisions on materials and building systems, facility planners and architects experience a continuous tension between reducing the first costs of construction vs. incurring life-cycle costs that will affect operational budgets for decades. It is generally accepted that reductions in first cost that involve use of less durable construction materials, mechanical equipment that has shorter life expectations, or finishes that are less hardy, will almost invariably lead to higher maintenance costs, potential accelerated deterioration, and the need for earlier renovation or replacement. In a recent report, the Council of the Great City Schools referenced a study by the National Research Council that recommends

> *that owners spend between 2 percent and 4 percent of the current replacement value of a building every year on maintenance, with maintenance including routine and preventive maintenance and repairs, as well as capital replacements and renewals of major systems as they reach their expected life. A 2 percent spend rate assumes the facility has a 50-year life expectancy, and a 4 percent spend rate assumes the facility has a 25-year life expectancy.*
>
> *Where school facilities are well maintained, a district allocates operating budget funds of 1.5 percent to 2 percent of the current replacement value of assets for preventive and routine maintenance and minor repairs. In addition to operating budget expenditures for facilities maintenance and repair, a well-managed school district will allocate another 1 percent-2 percent for systems replacements and even entire school replacement if it is determined that replacing a facility may be more cost effective than modernizing it.*[3]

Factors that Influence Construction Costs for New Facilities[4]

The construction cost of new institutional buildings is affected by a range of factors, some of which the owner can control, others that belong to the larger environment within which the project is procured. The principal factors that affect the cost of a kindergarten to grade 12 public school building in Maryland are:

- 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..

  - Clarity and completeness of the procurement documents.

  - 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.

  - 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.

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[3] Council of the Great City Schools, "Reversing the Cycle of Deterioration in the Nation's Public School Buildings," October 2014, page 16. The referenced National Research Council report is "Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings" (National Academy Press, Washington, D.C., 1990).

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

- 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.

In addition, and largely outside of the owner's control, are a number of external factors:

- 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.

- 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.

In developing the comparison between the Monarch School and a typical public school of the same capacity, this report will summarize the differences and the commonalities between the two types of building, their educational programs, and their occupants; will examine those cost factors that are generally under the owner's control, and will develop a qualitative description of the impact each has on construction cost and life-cycle cost; and will provide preliminary recommendations to further the research into the topic of comparative school construction costs.

Study Methodology

The information in this report is based on interviews conducted with key individuals who were and are involved in the development, design, and operation of the Monarch Global Academy. This approach was selected in order to gain as much understanding as possible of the background, the educational program, the physical facility, and the finances of the Monarch Global Academy:

- Officials of Anne Arundel County Public Schools, September 8, 2015:
    - Mr. Alex Szachnowicz, P.E., Chief Operating Officer
    - Ms. Lisa Seaman-Crawford, AIA, Director of Facilities
    - Mr. Larry Alberts, AIA, Supervisor of Planning, Design and Construction
    - Ms. Kathy Lane, Executive Director for Alternative Programs
    - Mr. Patrick Crain, Senior Manager for Alternative Programs
    - Ms. Melissa Comella, Budget Analyst

- The Principal and staff of Monarch Global Academy, September 18 and October 9, 2015:
    - Ms. Donna O'Shea, Principal
    - Ms. Raquelle Moore, Vice Principal
    - Ms. Susan Myer, Principal Secretary

- Officials of The Children's Guild, September 1, September 25, and October 9, 2015:
    - Mr. Stephen Baldwin, Executive Vice President and CFO, The Children's Guild
    - Ms. Amanda Heck, Director of Finance, The Children's Guild

- Principals of Smolen Emr Ilkovitch Architects, September 16, 2015:
    - Mr. James Emr, AIA
    - Mr. Ran Ilkovitch, AIA

- Owners and employees of prefabrication vendors, September 1, 2015:
    - Mr. Gary Cearfoss, Steel Building Specialists, Inc.
    - Mr. Ed Stilling, Steel Building Specialists, Inc.
    - Mr. Alan Kemp, VP Buildings

In addition, the IAC relied on data provided by The Children's Guild, Anne Arundel County Public Schools, Oak Contracting LLC., and Frederick County Public Schools for comparisons of the educational specifications, building sizes, and construction costs of the Monarch facility and two specific public school projects, Rolling Knolls Elementary in Anne Arundel County and North Frederick Elementary in Frederick County.

Finally, the report looked to a body of experience and information collected over a period of many years on the design and construction of public school facilities in Maryland. This consisted of:

- Educational Specifications for schools of comparable capacity and approximately comparable educational program;

- The site observations of the IAC Designees and other IAC staff, October 9, 2015:

    - Maryland State Department of Education (MSDE):
        - Ms. Barbara Bice, RA, Chief, School Facilities Branch
        - Ms. Gloria Mikolajczyk, RA, School Facilities Architect Supervisor
        - Ms. Jillian Storms, AIA, School Facilities Architect

    - Department of General Services (DGS):
        - Mr. Fred Mason III, RA, Program Manager

    - Maryland Department of Planning (MDP):
        - Ms. Patricia Goucher, Director, Infrastructure Planning Division
        - Ms. Arabia Davis, Facility Planner

    - Public School Construction Program (PSCP):
        - Dr. David Lever, RA DA, Executive Director
        - Ms. Joan Schaefer, AIA, Deputy Director
        - Mr. William Levy, Program Manager for Baltimore City Public Schools

Limitations of the Study

Within the timeframe for the current study, four actions could not be carried out that would add significantly to the value of the research:

1. Tour of the Monarch Global Academy by LEA superintendents, facility planners, maintenance and operational staff, and instructional staff, and incorporation of their observations into the report. As the school officials and staff members who are accountable for facility decisions, and who in many cases have direct, daily knowledge of the educational and operational requirements of their schools, they are best positioned to evaluate the programmatic and building technology decisions that were made at the Monarch Academy.

2. A life-cycle cost analysis (LCCA) of the Monarch Academy. No such study was done for the Monarch Academy. 40-year LCCAs for the mechanical systems are a standard requirement for approval of a State-funded school construction project. No comparison between the cost of the Monarch Academy and that of a conventionally built public school will be complete unless it is based on life-cycle analysis, which will take account of operational, maintenance, utility, and building system renewal costs over the anticipated useful life of the building.

3. Separate life cycle cost analyses of the building systems used in the Monarch Academy that are markedly different from standard practice in public school buildings, most notably:

    - Pre-engineering structural system vs. conventional steel frame or load-bearing masonry;
    - Insulated exterior wall panel enclosure systems;
    - Individually controlled, minimally zoned vertical unit ventilators vs. central HVAC system with automatic temperature controls;
    - Standing seam metal roofing vs. single- or multiple-membrane roofing systems (EPDM, TPO, BUR, etc.);
    - Impact-resistant drywall in high-traffic areas, vs. masonry in these areas;
    - Plastic piping (PVC) vs. metal piping;
    - Doors and hardware.

4. Comparison of conventional public school facilities with schools built to commercial standards that do not have the unique circumstances associated with the Monarch Academy, in particular:

    - Schools with educational programs that are similar to those in conventionally built facilities in the same school system;
    - Schools that do not have enrollment caps;
    - Schools that must accept all students within the attendance area, rather than based on a lottery selection;
    - Schools that are funded through the common operating budget of the school system, rather than on a per-pupil allocation specific to the school.

A study is currently being performed for the Maryland Stadium Authority (MSA) through a consultant that will examine several privately-built school facilities in relation to conventionally built public school facilities. It is possible that this study will provide some of the additional information required. This study may be available in the latter part of this year, and will be reviewed for information that will be helpful in addressing the four items above. These four items are among the recommendations found at the end of this report.

II. BACKGROUND: THE MONARCH GLOBAL ACADEMY PROJECT

Origins, Goals and Development of the Monarch Global Academy

The Monarch Global Academy originated from the intersection of two needs. In the mid-2000s, Anne Arundel County Public Schools required a new facility to relieve over-crowding in three elementary schools in the western area of the county. Concurrently, developers in the western area were blocked from building housing by the County's Adequate Public Facilities Ordinance (APFO), which requires that all schools in the service area be at 100% utilization or less in order for final approval of the development plat to be issued by the County Government.[5] In the case of western Anne Arundel County, the housing closure would be lifted only if capacity increased at the elementary school level.

A new elementary school would address both sets of concerns. The communities that sent pupils to the three overcrowded elementary schools – Brock Bridge, Maryland City, and Jessup – were vocal in their support for this option, and the Board of Education owned a parcel of about 70 acres in the area. However, the Board had recently re-drawn the elementary school boundaries in the area and did not intend to do so again, and concurrently other major projects around the county had priority in the capital plan, based on a facility assessment study conducted in the mid-2000s.[6] Because of the commitments made to other communities, it was not envisioned that a new elementary school would be built by the Board of Education within the timeframe needed to relieve overcrowding. Therefore, a relatively near-term solution was needed.

To solve the problem, in 2008 AACPS conceptualized an arrangement under which an educational contractor would provide the educational program, partnering with a developer to construct and own a facility. This arrangement would achieve several goals: it would relieve the over-crowding at the three elementary schools; it would give parents a choice of schools within the area; and it would allow the developers to proceed with construction of housing.

- By working through a contractual rather than a charter school structure, the Board of Education could define the academic program to suit its larger educational purposes. Unlike a charter school in which students must be accepted from throughout the county, a contract school could have a targeted attendance zone in which students would be accepted on a lottery basis; and unlike a charter school, the educational program of a contract school is defined by the Board of Education, not the chartering entity. With respect to the western county elementary school, the intention was to establish an elementary school to serve as a Primary Years Program (PYP) feeder for the International Baccalaureate program at Meade High School.

- A privately-financed facility would avoid displacing any project within the school board's capital improvement program (CIP). However, timing was a critical factor, since under Anne Arundel ordinance, a developer may proceed with housing construction if school capacity is not provided within six years. If the school system was to enjoy the participation of the developers in resolving the overcrowding issue, then an arrangement with a developer needed to be concluded so that capacity could be provided within the six year window.

AACPS contacted the Imagine Schools, a national educational organization based in Arlington, Virginia that manages 74 public charter schools in 12 states, including Maryland.[7] In 2009 and 2010 Imagine Schools partnered with one of the three developers in the area, Mr. Rick Polm, to develop the idea. Mr. Polm had purchased a former Moose Lodge parcel adjacent to a housing development that could serve as a site for the school. Originally, Mr. Polm would have been the developer and owner of the school, with Imagine Schools serving as the contractor to the Board for the educational program. However, the project was delayed as the developer sought to rezone his property, a process that was not viewed favorably by the County government, which prefers to rezone on a 10-year cycle under the General Development Plan. Further delays were incurred due to financial constraints on the part of both the developer and Imagine

[5] Maryland Department of Planning, *Adequate Public Facility Ordinance (APFO) Inventory For Maryland Jurisdictions*, May 10, 2012. The local statutory reference is Anne Arundel County Code, Article 17, Title 5.

[6] MGT of America 2006 *Strategic Facilities Utilization Master Plan.*

[7] Imagine Schools website, September 2015.

Schools, which in the end withdrew from the process. In the meantime, community dissatisfaction increased as a result of the delays.

In early 2012 AACPS turned to The Children's Guild, an educational organization that has been "an innovator in providing services for children and adolescents with emotional, behavioral and mental disorders."[8] Children's Guild operated one public charter school in Anne Arundel County on a lease basis, and had proposed another elsewhere in the county. AACPS asked the Guild to defer the proposed school and to consider instead undertaking a contract school in the western portion of the county. When the developer was not able to obtain financing to build the school, the Guild was asked to step in as both owner and developer, a role that it had never previously held. The Children's Guild thus became both the contractor for the educational program and the owner and operator of the property on Brock Bridge Road, which they acquired from the developer.

Since the estimated cost of the original design for the Monarch facility was beyond The Children's Guild debt capacity, it undertook a number of cost-reduction measures, including the elimination of two kindergarten classrooms, four regular classrooms and one science classroom. The computer lab was reduced from 750 nsf to 330 nsf. The total area dedicated to storage and resource rooms was increased modestly, and other minor adjustments were made. The net effect of these changes was a reduction in the net square footage of 4,826 nsf, which was estimated to be equivalent to a reduction of 4,066 gsf.[9] The changes were said to result in a cost savings of over $1 million. As part of the cost-reduction effort, The Children's Guild modified the classroom wing and other spaces from traditional steel construction to a pre-engineered structural system (the high-bay spaces had always been conceived as pre-engineered); this is reported to be the single most important cost-saving measure that allowed the project to be carried out within the budget.

Construction of the Monarch Academy began in October 2013. The facility and educational program opened in the fall of 2014 with grades K through 5; 6th grade was added in the fall of 2015 with a total enrollment of 701 students. 7th grade will be added in the fall of 2016, and 8th grade in the fall of 2017, bringing the school to its full complement of 805 students. At this writing, Monarch is applying for status as an International Baccalaureate Primary Year Program school; if accepted, Monarch will join 11 other PYP schools in Anne Arundel County. At the time of opening, the building was complete with the exception of the following features:

- Floor finishes in the corridor of the Administration/Gym/Cafeteria wing had not been installed; this work is now complete.

- Wall murals, painted by professional artists, were completed in the summer of 2015.

- The outdoor playing areas were not installed. The playing field and track were in service as of mid-October 2015 and the playground is expected to be completed shortly.

- Ceilings in the majority of 2nd floor classrooms were not covered in ceiling tile or other materials, leaving the insulation exposed between structural elements. This was an architectural decision to achieve an "industrial" quality in these classrooms. Several 2nd floor classrooms do have finished ceilings to reduce the noise caused by nearby mechanical equipment.

Officials at Anne Arundel County Public Schools express considerable satisfaction with the outcome of this project: not only has the overcrowded situation at the three elementary schools been resolved with a high-quality education program that aligns with the International Baccalaureate program at Meade High School, but the Board of Education bears no financial liability for the facility. Through an annual inspection process as well as routine internal and external audits, the Board is able to ascertain whether the educational program is meeting standards and whether the facility is being maintained in a safe, healthy, and orderly manner. During the term of the 25 year contract the Board has no responsibility for the maintenance and

[8] Children's Guild website, October 2015

[9] Since the efficiency factor was also reduced from 75.36% to 72.56%, the reduction in net square footage was less than the estimated reduction in gross square footage.

operation of the facility, and at the end of the term will have no responsibility for its disposition. AACPS has just completed a ten year update of the 2006 MGT of America study that is used to define the scopes and priority of projects in the annual CIP; while the current CIP does not show a new elementary school in the west county area within the next six years, it is envisioned that further updates may substantiate the need for a permanent new elementary to support enrollment growth in this area. In the meantime, in the words of Mr. Alex Szachnowicz, Chief Operating Officer for AACPS, the Monarch Global Academy serves as a "stopgap" that provides genuine benefits both to the communities in the western County and to the school system as a whole.

Unique Features of the Monarch Global Academy

The Children's Guild operates the kindergarten-thru-8th grade (K-8) Monarch Global Academy under a 10-year contract, with three 5-year renewal options for a possible total of 25 years. The Monarch Global Academy is unique within Anne Arundel County in several respects:

- By contract, the total enrollment of Monarch is capped; the school will not receive additional per-pupil allocations if its enrollment exceeds the upper limit of 805 when all grades are present in the fall of 2017. Other public schools in Anne Arundel County (as elsewhere in Maryland) must accept all students in their attendance areas. With this defined enrollment, Monarch is currently able to maintain class sizes for grades 1 through 8 at 25 students.

- Monarch does not accept new students after September 30 of each school year. With the exception of magnet programs, all other schools in Anne Arundel County must accept new students throughout the school year; this condition is true for most schools across the state. Monarch thus has an exceptionally stable and predictable student population. Since the lottery process occurs in the spring of each year, the Monarch staff know with considerable precision not only the number of students they will enroll in the coming autumn, but the actual names of the students. As this information affects staffing, revenues and expenditures, it has important implications not only for the delivery of the educational program and day-to-day school operations, but also for the financial management of the facility.

- The Monarch educational program is defined for the entire period of the contract; it is thus very stable and predictable. In contrast, other schools in Anne Arundel County, as elsewhere in the state, are subject to occasional changes of educational program as a result of local board policy or State mandate or initiative. An example of the latter is the requirement for full-day kindergarten mandated by the Bridge to Excellence in Education Act of 2002, which had significant facility implications.

- Monarch is administered by a principal with a dean of academics and a dean of students (also termed "dean of family life"). AACPS elementary schools are typically administered by a principal with one assistant principal, who between them address all instructional, operational and behavior-related issues. Monarch also has a larger resource team than the typical AACPS elementary school: it has four resource staff members, including three instructional guides and a PYP coordinator. By contrast, an AACPS IB feeder elementary school would have access to a half-time PYP coordinator.

- Monarch is the only K-8 educational program in Anne Arundel County. All other comprehensive AACPS schools are organized as PK-5 or K-5 elementary schools, grades 6 to 8 middle schools, and grades 9 to 12 high schools.[10]

- The Monarch facility and site are not used by the County Department of Recreation and Parks for before- and after-school programs. The majority of Anne Arundel County Public Schools buildings are used intensively for community activities, both during the school year and during weekends, school holidays, and the summer months. Since Anne Arundel County does not have separate

[10] There are exceptions for schools for children with special needs, including alternative and special education centers. The Chesapeake Science Point Charter School in Hanover, MD operates a program for approximately 460 Anne Arundel public school students in grades 6 through 12.

community recreation centers, its public schools serve this function by arrangement with the Department of Recreation and Parks.[11] Monarch does provide limited access for specific user groups in non-school hours, for example Girl Scouts, Boy Scouts, and a church, and a group called The Open Door provides before- and after-school care for students in the Monarch Global program.

- Monarch operates on a per-pupil annual allocation (similar to a charter school). Depreciation of the educational facility is a component of the business plan.

Finances: Capital Expenditures and Operations

The Monarch school administration receives an annual per-pupil allocation from the Board of Education, equal in FY 2016 to $12,219 per pupil, up to a maximum limit of 805 students. The school receives an additional allocation of $1,912 for each special education student. These figures are subject to change each year depending upon the AACPS budget.[12] Out of this revenue stream Monarch pays all expenses, including a rent payment to The Children's Guild that is used to repay the financing costs of the facility, teachers' salaries and other costs associated with the educational program, operating expenses, building maintenance, and an 8% annual fee to the Guild to provide a building operator, a social worker, and a variety of other support services.[13] The principal, teachers, and certain other staff members of the Monarch Academy are employees of Anne Arundel County Public Schools, subject to the same employment conditions as other employees of the school system. Two day-time custodians are also employees of the school system; night-time custodial services are provided through a contractor. Life-cycle renewal of building systems is funded through Monarch Global's payments to The Children's Guild Institute, which annually makes decisions regarding the capital needs of the buildings that house Children's Guild educational programs.

The total annual budget allocation of the Monarch Academy is based on the September 30 enrollments; if this enrollment does not decrease by more than 10% over the course of the school year, then Monarch retains the full September 30 allocation. Since it does not accept new students after September 30, and since the majority of its expenses are known for the coming year (teacher's salaries, contractual custodial services, etc.), it operates at a high level of confidence that the per-pupil allocation will cover all expenses.

While it was originally envisioned that the developer would own the property and build the Monarch facility, in the end The Children's Guild bought the property from the developer and assumed the project at approximately the end of the Schematic Design (SD) phase of architectural design. In order to finance the project, the Maryland Industrial Development Financing Authority (MIDFA) issued tax exempt revenue bonds on behalf of The Children's Guild; the bonds are supported by the per-pupil annual allocation from AACPS. Pending sale of the bonds, The Children's Guild took out a commercial bridge loan, which was repaid with the bond proceeds.

[11] Other jurisdictions in Maryland that do have separate community recreation centers still use their public schools extensively for a variety of recreation, social service, and other community needs.

[12] AACPS, October 8, 2015

[13] These include accounting and bookkeeping, human resources recruitment, facility management and operation, public relations and marketing, IT management and support, purchasing and business operations, staff in-service training, and consultation and management of special education services.

III. COST FACTORS: MONARCH GLOBAL ACADEMY AND MARYLAND PUBLIC SCHOOLS

Overview: Costs of the Monarch Global Academy and an Anne Arundel County Public Schools Facility

This section will examine the cost factors that are generally under the control of the owner. The difference of construction cost is striking between the Monarch Global Academy and Rolling Knolls Elementary School (RKES), an Anne Arundel County Public School facility that began construction at approximately the same time as the Monarch Global Academy: the Monarch Academy bid in October 2013, RKES in March of 2014. Monarch was reported to cost $11.7 million to build, while RKES cost $21.37 million, a difference of $9.67 million. At its opening, the Monarch Academy with a preliminary capacity of 757 had a considerably larger student enrollment than RKES with a target State Rated Capacity of 598.[14] Although housing a larger student body, the Monarch Academy was sized at 63,327 gross square feet (gsf), RKES at 84,588 gsf, a difference of 21,261 gsf. Monarch thus provided 83.7 gsf/student, while RKES provided 141.5 gsf/student. The difference in overall construction cost (exclusive of site acquisition, FF&E, finance, and other non-construction costs) results in a dramatic difference in the cost-per-pupil to construct the two facilities: for the Monarch Academy the figure was $15,456, while for RKES it was $35,738. These differences will be even more apparent when Monarch achieves its full student complement of 805 students: the per-student area will be 78.7 gsf and the per-student cost will be $14,534.

The single most important factor in the overall difference in cost between the two facilities - $9.67 million – is attributable to the difference between their educational specifications; in fact, if RKES had been designed to the educational specification for a school of the same capacity as the Monarch facility, at approximately 94,150 square feet, the difference would have increased to about $12.1 million. Pages 12 through 24 discuss the importance of the educational specification in relation to school size, the qualitative and quantitative differences in the educational specifications of Monarch and RKES, and the relation of the AACPS educational specification to those of other jurisdictions in Maryland.

Equally significant is the difference in the square-foot cost: Monarch cost $184.76 / square foot to construct, RKES cost $252.65, a difference of $67.89. These differences are associated with the factors discussed on pages 24 through 37: site (page 24), design (page 25), project delivery method (page 30), schedule (page 33), and procurement (page 34). To disaggregate the influence that each of these factors had on the cost differential between Monarch and RKES would require a highly detailed study. The IAC is not aware of any study that has been conducted at this level of detail, either in Maryland or nationally. While such a study would be highly worthwhile, it lies well beyond the capacities of the IAC staff.

The chart below updates information provided by Anne Arundel County Public Schools to the IAC and other interested parties at a tour of the Monarch facility on July 17, 2015:

[14] Rolling Knolls ES website, http://www.rollingknolls.com/RKE_Construction_Status_Rpt_July_13.pdf. The FY 2014 Capital Improvement Program (CIP) description of the RKES project indicates a target SRC of 544. It should be noted that SRC is finalized when a school is complete and space assignments are made by the principal and staff of the school.

COST COMPARISON:			
MONARCH GLOBAL ACADEMY AND ROLLING KNOLLS ELEMENTARY SCHOOL			
	Monarch Global	Rolling Knolls ES	Variance
State Rated Capacity (SRC):	**757**	**598**	
Property and A/E Fees	**$3,000,000**	**$1,760,728**	-$1,239,272
Site and Building Construction	$11,200,000		
Field and Playground Equipment	$500,000		
Construction Cost	**$11,700,000**	**$21,371,184**	**$9,671,184**
TransZed	$312,500		
FF&E	$1,274,500		
Fixed Asset Cost	**$1,587,000**	**$1,884,000**	$297,000
Project Cost	**$16,287,000**	**$25,015,912**	**$8,728,912**
sf	63,327	84,588	21,261
Construction Cost/sf	$184.76	$252.65	$67.89
Project Cost/sf	$257.19	$295.74	$38.55

Notes:[15]

- "Construction Cost" figures for both Monarch and RKES include demolition of existing on-site structures.
- The Rolling Knolls ES figure of $1,884,000 for "Fixed Assets" includes FF&E (furniture, furnishings and equipment).
- The total project cost for Rolling Knolls ES of $25,015,912 does not include change orders, technology wiring, or a sewer extension (managed by Anne Arundel County using funds appropriated to AACPS). Since RKES is now under construction, final costs will be assessed at the completion of the project.

The Children's Guild paid $713,000 in finance costs. Since RKES (like most public school construction projects in Maryland) was largely financed using general obligation bond proceeds, it is assumed that Monarch's finance cost is analogous to the transaction and interest costs associated with RKES, and is therefore excluded from the comparison of construction and project costs.

Cost Factor: Building Size; The Relationship Between Educational Specification and Size

The Educational Specification

Rolling Knolls Elementary School was designed to be 21,261 gsf larger than the Monarch Academy, while serving a smaller number of students (598 vs. 757). At the cost-per-square foot attributed to the Monarch facility ($184.76/sf), the overall difference of building area would be equivalent to approximately $3.93 million, or about 41% of the total cost differential between the schools; at the cost of the RKES facility ($252.65/sf), the difference would equate to approximately $5.37 million, or 56% of the differential.

However, if RKES had been designed for 748 students, an enrollment comparable to that of the Monarch Academy, the difference in area would have been approximately 30,845 gross square feet. At the Monarch cost, this additional square footage would have cost approximately $5.7 million; at the AACPS cost, it would have been approximately $7.8 million. On reviewing the educational specifications of the two facilities, we find that approximately 14,300 gsf of the Anne Arundel increase is due to program spaces that are not included in the Monarch educational specification, and the balance of approximately 16,545 gsf is driven by spaces that both schools have in common, but which the educational specification requires to be larger in the

[15] AACPS, October 8, 2015

Anne Arundel facility. Thus the educational specification is a principal driver of the difference in cost between the two facilities.

All public schools in Maryland are designed in accordance with an educational specification approved by the local board of education.[16] The educational specification is the crucial document that translates the educational program into spatial requirements in order to plan the building for construction and use. Approved by the local board of education, the educational specification is a policy document, representing the physical embodiment of the board's educational policies and preferences. The educational specification defines the ranges of student population sizes that the local board deems appropriate to the characteristics and needs of the student population. If the educational specification is faithfully and accurately translated into an architectural design and a finished building, it should support the school's administration, teachers, and students in fulfilling their educational objectives.

The educational specification is used as a guide by the architectural/engineering team to develop a conceptual and finish design. The educational specification includes not only the number and square footages of individual spaces, it also establishes the relationship of these spaces to one another and to common features such as the entrances, vehicular and pedestrian circulation paths, and the playing fields, and it indicates in great detail the specific elements of individual spaces, for example cabinetry, furniture, fixed equipment, and specialized features such as fume hoods or ceramic kilns. Typically, the design team that works out the overall plan is also responsible for the choice of building systems, finishes, fixed equipment, and in some cases art work, movable equipment, and furnishings. Input from building stakeholders, ranging from the principal and teachers to building custodians and plant engineers, is critical both in the formulation of the educational specification and also in the review of the design documents as they evolve.

School systems like Anne Arundel County Public Schools that build a large number of new and replacement schools generally develop a standard educational specification for various building types: elementary, middle, and high schools, as well as career technology centers.[17] Among the other large and mid-size school systems that use a standard educational specification are Montgomery, Baltimore County, Baltimore City, Howard, and Frederick. Typically, a standard educational specification will be modified to some extent when it is applied to a specific building task, due to a number of factors: site constraints, the size and socioeconomic characteristics of the anticipated student enrollment, new educational or building mandates, and evolving informational and other technologies. Rolling Knolls Elementary School provides an example of this process: while the standard AACPS elementary school educational specification used for comparison to the Monarch Global Academy calls for a school of up to 94,172 gross square feet for 748 students, Rolling Knolls ES was built to 84,588 gross square feet for 598 students, a difference of 9,584 gross square feet.[18] [19]

Impact of the Educational Specification on School Size

The number and size of individual spaces clearly has a great impact on the overall size of the school. These spaces are described in terms of net square footage, that is, the actual size of the programmed space inside of the enclosing walls. In the planning and budgeting phase of the project, when the net square footages for all of the programmed spaces are summed, an efficiency factor is then applied that accounts for the un-programmed space in the building: circulation, toilets, mechanical spaces and chases, custodial arrangements, and the dimension of walls, partitions, and structural elements. This calculation results in the gross square footage of a building. If the estimated gross square footage exceeds the approved maximum size of the building or will result in a budget shortfall, it is not unusual for the educational specification to be adjusted to some extent in order to align the project scope with the funding limitations.

For new public schools, an efficiency factor between 70% and 72% is typical. Both the Monarch Academy and the standard AACPS educational specification exceed this figure slightly – Monarch at 72.54% and

[16] COMAR 23.03.02.14.C.

[17] In small school systems, since the execution of major new schools or renovations tends to be episodic, educational specifications are developed for each individual project.

[18] "Students" in this context refers to full-time equivalent (FTE) enrollees.

[19] AACPS indicates that the majority of its elementary schools are designed for a student body smaller than 748.

AACPS at 72.73%. Efficiency factors vary greatly for different types of buildings: a speculative office building, for example, which consists of a central service core, perimeter fire stairs and large amounts of open office space, will generally have a higher efficiency ratio than a school building, which in turn is likely to have a higher efficiency ratio than a hospital in which a great deal of area is devoted to mechanical services, multiple large elevators, toilets, and storage.[20]

To determine why Rolling Knolls Elementary School is so much larger than the Monarch Global Academy, it is necessary to examine the difference in the size and number of individual program spaces called for by the educational specifications. For purposes of this study, comparison will be made between the standard AACPS elementary school educational specification applied to a hypothetical school with the same capacity as the Monarch school, and the educational specification for the Monarch facility.

- How would the qualitative difference in spaces and design seen in the Monarch facility affect the educational program of a public school?

- What are the specific program differences between Monarch and the standard AACPS educational specification?

- Does the AACPS standard elementary school educational specification align with the elementary school facilities of other public school systems in the state of Maryland?

Monarch and AACPS Standard Educational Specification: Qualitative Programmatic Differences

The educational specification for the Monarch Global Academy was originally developed by the Imagine Schools in collaboration with AACPS and the developer. AACPS defined the overall parameters of the program but attempted to give the contractor as much latitude as possible to execute the program. The educational specification for the Monarch facility, as well as the later design documents, was reviewed by AACPS and approved by the Board of Education in the same process used for other projects in Anne Arundel County.

When Imagine Schools withdrew from the project, The Children's Guild inherited the educational specification; architectural design was already well underway. As noted above, The Children's Guild eliminated and reduced a number of spaces in order to align the size of the building with its budget. It also undertook changes in the building systems, particularly the use of a pre-engineered structural system in place of a conventional steel or masonry load-bearing system.

On October 9, 2015 the IAC staff toured the Monarch Academy with the express intent of evaluating it in relationship to public schools seen throughout the State. The IAC staff present included the entire staff of the Facilities Branch of MSDE; the Program Manager for the Public School and Community College section of DGS; the Director of the Infrastructure Planning Division and the Facility Planner for MDP; and the Executive Director, Deputy Director, and Program Manager for Baltimore City of the Public School Construction Program. The visitors from MSDE, DGS, and the PSCP are registered architects who annually review plans for and tour multiple public school facilities, and consequently are very familiar with typical arrangements and their programmatic and staffing rationales.

Qualitative differences noted between the Monarch Academy and conventional schools include:

- The TransZed murals throughout the Monarch Academy are the most memorable aspect of the school facility (Photo 1).[21] The globally-themed murals are bright, professionally executed, and extremely engaging.

[20] One study shows an efficiency ratio of over 86% for an office building (Wayne Foss, *Market Analysis for Office Buildings*). A 2007 guidance document from the University of New Mexico shows efficiency ratios for an administration building in the range of 74% to 82% and ratios for health care facilities in the range of 60% to 68% (https://iss.unm.edu/PCD/SM/doc/Building%20Efficiency%20Ratio%20Guidelines.pdf).

[21] "TransZed" stands for Transformation Education, the educational philosophy and practice that guides The Children's Guild.

- Other memorable aspects include the living green wall and the interactive science sphere at the entry (Photos 2 and 3).

- The clerestory lighting in the 2nd floor corridor is very attractive (however, full advantage of the daylighting for energy conservation purposes is not achieved because the corridor lights do not have automatic dimming controls) (Photo 4).

- The main staircase at the intersection of the two wings would benefit greatly from natural light; as it is, the beautiful murals do not show to full advantage and this main circulation space has a dark, industrial appearance that contrasts noticeably with the bright quality of the rest of the school (Photo 5).

- The corridors, while narrow, are brightened by small way-finding flags that are used to manage the flow of students during class changes and lunch time.

The IAC staff members noted the following instructional, administrative, or support areas that are lacking in the Monarch Academy compared to conventional schools:

- General:
  - Some teachers indicated a desire for another large gathering space, in addition to the cafetorium and gymnasium.
  - Mr. Stephen Baldwin, Executive Vice President and CFO of The Children's Guild, expressed regret about the four classrooms that were removed during the cost-reduction exercise that occurred between schematic design and design development; this decision reduced construction costs by approximately $1 million. These four classrooms would have provided additional flexibility for scheduling. IAC staff has concerns that the scheduling problems will be intensified when 7th grade is added in the fall of 2016 and 8th grade in the fall of 2017, bringing the school to 805 students. The four-classroom addition can be added relatively easily to the east end of the two-story classroom wing, likely with some impact on the adjacent parking area and probably requiring accommodation for the increase in impervious area.

- Collaborative learning areas. In public schools, these typically take the form of expanded circulation areas that are used for intra- or inter-grade project-based learning, small group instruction, or individualized attention to children with special needs. Collaborative learning areas are not present in the Monarch facility.

- Resource rooms. There are few small spaces that can be used for specialized instruction in a small group or individual format for intervention purposes. Students who require intervention services may be tutored in offices or the classrooms.

- Circulation.
  - The corridors in the Monarch facility are extremely narrow, especially on both floors of the instructional wing. This is partly accounted for by the absence of lockers; all student bags, coats, etc. are stored in the classrooms themselves. The width of these corridors would be unacceptably low in a typical public school: congestion is likely to develop at intersections during class changes and conflicts might develop among students. Monarch addresses this through a very well organized movement pattern, but maintaining this arrangement may depend critically on having a known and defined student body with a capped number of students.
  - The corridors are finished in impact resistant gypsum wall board (gwb), even in high traffic and high impact areas. This material is generally recognized to not be as durable as concrete masonry units (CMU) or wainscoting consisting of ceramic tile or other hard materials, the systems typically found in public school high-traffic areas. It was noted that the Monarch administration has installed fiberboard panels to display student work in the

corridors in an effort to prevent deterioration due to staples, tape, etc. used to fix materials to the gwb walls.

- Offices and classrooms for special intervention. There is one dedicated space for students who need to be separated temporarily from the classroom due to behavior problems; however, there are no small-group spaces. Evidently small group instruction occurs in the classroom or on an *ad hoc* basis, using any spaces that are available. This arrangement does work for now, but when 7th and 8th grades are added to bring the school up to its full complement of 805 students, it may be more difficult to make these adjustments.

- Classrooms:
  - The classrooms are slightly undersized: Per the Design Development document, kindergarten classrooms are between 897 and 920 nsf and general classrooms are around 750 nsf (Photo 6).[22] These classrooms are designed to hold about 25 students, the teacher's station, a laptop cart, hooks for student belongings, a unit ventilator about 6 to 8 feet in length, one teaching wall with markerboard & projector, a tackboard on the opposing wall, and some casework. Some of the K classrooms have sinks; three of the five classrooms now used for kindergarten instruction have a toilet in the classroom or shared with another classroom. We understand that the number of K classrooms will be reduced to three once the school attains full capacity.
  - Windows and natural light on the whole are adequate.
  - The acoustic isolation of the classrooms is definitely inadequate. The second floor classrooms were built with no separation between the top of the structural beam and the bottom of the insulation, allowing sound to pass unimpeded between classrooms. A metal panel has been installed in an effort to block the transmission of sound, but by observation in an unoccupied classroom next to an occupied classroom, the acoustic separation remains very poor. Three conduits for the transmission of sound were noted: the metal panel, the metal structural elements that connect directly from classroom to classroom, and gaps in the insulation above the structural members (Photo 7).
  - Only one or two 2nd floor classrooms have acoustical ceilings; ceilings were installed in these classrooms to abate the noise from nearby rooftop mechanical units (Photo 8). Evidently the teachers identify installation of acoustic ceilings as a major improvement they would like to see. It is reported that this installation would cost approximately $40,000.
  - Student storage consists of a rack of coat hooks on a wall. Although these take up far less space than traditional lockers or cubbies, they do not separate items of clothing and so may allow for the easier spread of lice, an issue of concern in schools (Photo 9).

- Library/Media Center. This space is significantly undersized compared to Library/Media Centers in contemporary public schools in Maryland. It lacks stack area for the number of books and periodicals that are typically found in a school library, a distinct reading zone, or a separate area that can be used for instruction. At 330 nsf, the computer lab is significantly smaller than in a conventional public elementary school.

- Cafetorium and Kitchen:
  - The cafetorium is adequate in size for five overlapped lunch periods (Photo 10). It is not, however, set up for instructional purposes: it lacks a permanent stage area or a permanent screen for showing film to large groups. A portable stage is brought into the space for special events.
  - The cafetorium is a highly resonant space and is acoustically difficult: there is an absence of sound absorption materials and there is a direct acoustic link at the top of the demising wall to the gym next door.
  - There is no visual connection between the cafetorium and the outdoors.
  - The kitchen does not prepare food; it receives prepared meals from another source. There are only a few deliveries per week of basic supplies, as well as daily deliveries of the meals.

[22] SEI Architects, Design Development Brochure, May 2, 2012.

Since there is no loading dock, all supplies and meals must be brought into the kitchen through a conventionally sized exterior door with screen.

- Physical Education:
  - The gymnasium is adequate in size and in materials for an elementary school (Photo 11). A SportCourt type flooring has been installed in lieu of the typical hardwood floor found in public schools. There are metal panels at the top of the wall, and a noticeable lack of acoustic treatment. The absence of both fixed basketball equipment and of wall paddings was noted: while not required, basketball equipment is standard throughout Maryland's schools, and the padding is an important safety feature. It was noted that there are a number of sharp corners where structural columns have been enclosed in drywall; this would be unacceptable in a standard public school as a safety item.
  - A classroom has been designated for Kinesthetics, a form of physical education specific to the Monarch program. It allows Kinesthetics to be taught for more than one class during each period. It is not clear how this need will be met once the school achieves its full complement of 7th and 8th grade students.

- Health Suite. Although of a size comparable to that of health suites found in new public schools, the design does not allow for observation throughout the entire suite; full observation would only be possible with two staff members present. There is no separate examination room, and privacy curtains are not provided at the cots. We understand that approximately 30-50 students may pass through the suite in a single day.

- Art and Science. Both Science rooms were originally on the second floor, but one has been appropriated for Art instruction because the original first floor Art room is used for music instruction. If Art is available only on the second floor, this aspect of the curriculum would be unavailable to kindergarten and possibly 1st grade students, who by code must be kept on the first floor (a designated stairwell would be needed for the younger children if they traverse an upper floor for a specific subject). We understand that science instruction occurs in the regular classrooms as well as in the remaining designated Science room.

- Teacher workroom or area. There is no dedicated teacher workroom or area on the second floor.

Monarch and AACPS Standard Educational Specification: Quantitative Programmatic Differences

The chart below compares programmatic spaces in the Monarch Global Academy to similar spaces in the Anne Arundel County Public Schools educational specification for an elementary school. The total difference in the net building area between the Monarch Academy (757 capacity) and the standard AACPS elementary school educational specification (748 capacity) is 22,545 net square feet; the difference in the total building area is 30,845 gross square feet. This variance is explained by the presence of seven programmatic spaces in the AACPS educational specification that are not present in the Monarch educational specification, and by five program types that are more numerous and/or are larger in the AACPS educational specification than they are in the Monarch educational specification.

AACPS does not have any kindergarten-to-8 or pre-kindergarten-to-8 schools, consequently there is no educational specification that can be compared directly to that of the Monarch school. However, since Monarch has no spaces that are specifically designed for its intended middle school population, the comparison of Monarch to an AACPs elementary school of the same capacity is appropriate. The possible impact of including middle school spaces in a K-8 facility is discussed below.

Per the chart below, 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**

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

Program Space	**Net Variance**
• Instrumental Music Classroom	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**

Note: AACPS 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.

MONARCH GLOBAL ACADEMY AND AACPS STANDARD ELEMENTARY EDUCATIONAL SPECIFICATION:				
PRINCIPAL AREAS OF DIFFERENCE				
Note: All figures are in net square feet (nsf)	Monarch	AACPS Std. Ed. Spec.	Variance	Comments
Programmatic Element				
Administration				
Admin office	1,566	1,933	367	
I. B. Coordinator Office	176	0	-176	
Library Media Center				
Library/Media Center	1,546	3,600	2,054	
Gen'l Use Computer Lab + Support	332	1,000	668	
Dining/Food Service				
Dining Area	2,908	4,250	1,342	
Kitchen Support	1,243	1,850	607	
Stage/Instrumental Music	993		-993	
Stage/Music Storage	77	650	573	
Science/Integrated Arts				
Classroom/Labs	1,694	1,200	-494	Monarch has 2 science classrooms
Music				
Instrumental Classroom	0	850	850	
General Instructional Spaces				
General Classrooms	18,750	22,100	3,350	Monarch: 25 @ 750 nsf; AACPS: 26 @ 850 nsf
Rest Rooms	0	1,300	1,300	
Classrooms - K and PK				
Pre-kindergarten	0	1,100	1,100	
Kindergarten	2,713	5,500	2,787	Monarch: 3 @ variable nsf; AACPS: 5 @ 1,100 nsf
Foreign Language				
Classrooms	1,448	0	-1,448	
Speech & Language Ofc	176	0	-176	
Storage	44	0	-44	
Special Education				
Special Education Resource Room	825	2,400	1,575	
Special Education Classroom	0	1,700	1,700	
Building Support				
Mechanical/Electr/Telecommunications	0	2,150	2,150	
Cooperative Community use				
Expanded Gym and Storage	0	2,400	2,400	
Before/After Care	0	2,400	2,400	
	34,491	**56,383**	**21,892**	

Approximately 14,333 gsf (46%) of the difference in the 30,845 gsf variance between the two buildings is attributable to differences of program elements. Since the efficiency of the two buildings is virtually identical, the balance of the difference, or an estimated 16,512 gsf (54%), must be associated with differences in the number and size of the program elements that are common to both Monarch and the AACPS standard educational specification. The result of this calculation at 72.73% efficiency (17,150 gsf) is slightly higher than the estimated figure (16,512 gsf).[23] The most important of these differences are:

Program Space	Monarch	AACPS	Variance
• Administrative Area	1,566 nsf	1,933 nsf	367 nsf
• Library/Media Center			
– Main Area	1,546 nsf	3,600 nsf	2,054 nsf
– General Use Computer Lab + Support	332 nsf	1,000 nsf	668 nsf
• Dining/Food Service:			
– Dining Area	2,908 nsf	4.250 nsf	1,342 nsf
– Kitchen Support	1,243 nsf	1,850 nsf	607 nsf
– Stage/Music Storage	77 nsf	650 nsf	573 nsf
• General Classrooms:			
– Classroom Spaces (25)	750 nsf ea.	850 nsf ea.	2,500 nsf (100 nsf x 25)[24]
– Kindergarten	2,713 nsf	5,500 nsf	2,787 nsf
• Special Education Resource Room	825 nsf	2,400 nsf	1,575 nsf
Total AACPS Additional *Net* Area:			12,473 nsf
Total AACPS Additional *Gross* Area (@ 72.73% efficiency)			**17,150 gsf**

The analysis shows that the overall difference in area between the Monarch School (757 SRC, 63,327 gsf) and the AACPS standard educational specification (748 SRC, 94,172 gsf) is driven by:

a. The seven program spaces that AACPS includes that are not included in the Monarch design (approximately 14,300 gsf), and

b. The nine program spaces that AACPS builds in a larger number and/or at a larger size than the same spaces at Monarch (approximately 16,500 gsf).

Program Element Sizes: Typical Maryland Public Schools

The analysis above leads to the question, whether the AACPS educational specification aligns with the educational specifications for comparable schools in other Maryland school districts. To answer this question, we compared the educational specifications for nine new elementary schools and PK-8 schools in eight jurisdictions with the educational specifications for two new elementary schools in Anne Arundel County. The schools used in the sample are shown in the following chart:

[23] This is likely because the efficiency of large programmatic spaces such as the Library/Media Center and the Dining Area tend to be higher than for the school as a whole.

[24] The size of the additional AACPS classroom (1 at 850 sf) is already accounted for in the analysis above.

ELEMENTARY / PK-8 COMPARISON								
Jurisdiction	School Name	SRC	Net Sq.Ft	Gross Sq. Ft (@ edSpecs)	GSF/ Student	# of stories	Year Ed Spec appr'd	Year construction completed
Anne Arundel	Rolling Knolls ES	598	61,432	84,588	141	2 Story	2014	In design
Anne Arundel	High Point ES	747	70,108	96,399	129	2 story @ classroom wing	2014	In design
Baltimore City	Prototype PK - 8	714	73,315	102,641	144		2014	In design
Baltimore City	Prototype PK - 8	976	92,090	128,926	132		2014	In design
Baltimore Co.	Lansdowne ES	700	60,710	89941	128		2015	In design
Frederick	Urbana ES	725	66,557	93,180	129		2014	In design
Howard	Ducketts Lane ES	600	64,527	86,000	143	2 Story	2010	2013
Montgomery	Montgomery ES	633	54,912	86,700	137		2014	In design
Prince George's	Edward Felegy ES	794	63,035	88,782	112	2 Story	2009	2014
St. Mary's	Geo.Washington Carver ES	535	45,657	60,600	113		2003	2006
Wicomico	PK-5 w/ 650 core	598	68,100	76,272	128		2014	In planning

In general, we find that AACPS designs its schools well within the space parameters of other comparable schools for 500 or more students. This finding applies to both the overall size of the schools as well as to the majority of the specific programmatic spaces. One major exception was found, as described below.

For 22 programmatic elements for which it is possible to establish clear correlations among all of the educational specifications studied, 20 of the AACPS spaces are within the typical range. For AACPS:

- One minor type of space, the Physical Education Support, is below the typical range.
- One set of spaces, the Dining / Food Service complex (cafetorium, kitchen, storage, can wash, etc.) is considerably larger than the range.
- 8 types of spaces are within the typical range.
- 10 types of spaces are at the upper end of the typical range.
- Two types of spaces are at the lower end of the typical range.
- One type of space (Instructional Support Storage (materials)) is not specifically mentioned by AACPS

	Typical Range, 9 Schools (nsf)	**Range, 2 AACPS Schools** (nsf)	**AACPS Standard Ed Spec** (nsf)	**Evaluation**
SRC	**535 – 976 FTE**	**575 – 747 FTE**	**748 FTE**	
Administrative Office	1,360 – 2,270	1,463 – 1,608	1,783	Within range
Health Suite	710 – 810	810	796	Upper end of range
Guidance	250 - 700	420	300	Within range
Faculty Lounge + Workroom	365 - 850	725 - 850	700	Upper end of range
Library Media Center	3,000 – 4,575	4,060 – 4,280	5,100	Upper end of range
Dining / Food Service	3,000 – 3,575	3,700 – 4,250	4,280	Above range
Kitchen Support	1,200 – 4,000	1,850	1,880	Lower end of range
Science / Integrated Arts	800 – 1,200	1,100 – 1,200	1,200	Upper end of range
Art Classroom / Multi-media Studio	850 – 1,200	1,100 – 1,200	1,200	Upper end of range
Music Classroom	840 – 1,100	1,000	1,000	Within range
Instrumental Classroom	475 - 850	850	850	Upper end of range
Main Gymnasium	2,400 – 6,600	6,000	4,000	Within range
Physical Education Support	120 – 450	80	80	Below range
General Classrooms	750 – 900	850	850	Within range

Pre-kindergarten Classroom	1,010 – 1,150 [25]	1,150 [25]		Upper end of range
Kindergarten Classroom	950 – 1,150 [25]	1,150 [25]	1,150 [25]	Upper end of range
Instructional Resource Area	200 – 600	400 [26]		Within range
Special Education Classroom	525 – 850	850	850	Upper end of range
Special Education Support	250 – 650	400	400	Within range
Instructional Support Storage (books)	300 – 900	600 – 700		Within range
Instructional Support Storage (materials)	800 – 1,375	0		Not provided
Miscellaneous Storage / Support	500 – 2,050 [27]	420 – 875	420	Lower end of range
Cooperative Community Use	200 – 4,800	4,800	4,800	Upper end of range
Total *Net* Square Footage	**45,657 – 92,090**	**63,733 – 70,108**	**68,489**	**Within range**
Total *Gross* Square Footage	**60,600 – 102,641**	**87,633 – 93,399**	**94,172**	**Within range**

The AACPS general classrooms in particular, which constitute the largest overall portion of any school building, are found to be within the range of 750 to 900 square feet that is considered best practice for elementary school classrooms; pre-kindergarten and kindergarten classrooms are at the upper end of the range. Three factors drive the size of these classrooms:

- The classrooms for grades 1 through 5 are usually designed to hold between 23 to 25 students, but often must house as many as 30 or more students because of overcrowding. In the choice between locating students in relocatable classrooms rather than in slightly overcrowded classrooms, most educators and community members will likely choose the latter. The size of the classrooms allows for some flexibility if there is an increase in student enrollments, a highly unpredictable factor that neither the school administration nor the central office can anticipate, but must react to quickly when it develops. The causes of enrollment increases usually lie well outside the control of the school system, and capital projects to address over-enrollment take considerable time to develop and implement.

- Information technologies are now an integral part of the instructional environment. This means that some space must be dedicated to computer terminals, which inherently take up more space than the equivalent number of regular student desks. A Maryland State Department of Education standard that is now being retired required that classrooms be designed with at least five data ports for computers; however, some school systems require more than this minimum figure. New approaches related to technology, for example computers-on-wheels or bring-your-own-device (BYOD) which make use of smaller tablets or laptop computers in a wireless environment, allow larger, stationary desktop computer units to be eliminated from the classroom.

- Federal law stipulates that special education students must be provided with the least restrictive environment (LRE) that is suitable to their educational abilities. In practice, this means that children with Individual Education Plans (IEP) may spend part or all of the school day with their peers in regular classroom settings. Frequently, the children with IEPs require special accommodations, including specialized equipment or the full-time presence of a teaching assistant. Either requirement will require a larger per-student allocation of space and will lead to a larger classroom. This additional space in regular classrooms is separate from the spaces provided for dedicated special education classrooms and resource rooms.

- Modern educational methodology is oriented around project- and experienced-based learning, in which smaller groups of students work together with the teacher or another adult on a focused project or assignment. A class of 25 to 30 students working in small groups will require more space than the same number of students arranged in rows, as in the traditional classroom setting.

From this analysis, it appears that Anne Arundel County designs its schools well within the space parameters of other school systems in Maryland. In all but one case, the Dining/Food Services complex, AACPS

[25] Includes 50 nsf toilet

[26] Four provided, dispersed; may be used for special education and other purposes as needed.

[27] Includes General Storage + Receiving, Exterior Storage, and Building Support (e.g. custodial closets).

designs individual spaces within the range of the other school systems. Moreover, the ranges shown suggest that there is a widespread agreement among the educators and planners of Maryland's schools as to the appropriate size of instructional and support spaces needed in a contemporary public school.

Of particular note is the larger-than-typical allocation of space to Cooperative Community Use. As explained by Mr. Alex Szachnowicz, Chief Operating Officer of Anne Arundel County Public Schools, Anne Arundel County does not have dedicated community recreation centers; rather, public schools throughout the county provide for recreation and other community services, with the result that spaces that might otherwise be provided in a separate recreation center building need to be built into the school. These include a dedicated Before / After Care room, spaces for the storage of equipment, offices for community officers, and a gymnasium with physical dimensions that will allow for safe use by adults (for example, overrun space in a basketball court). The State participates in up to 3,000 gsf of cooperative use space, sharing the cost with the Board of Education; the County Parks and Recreation Department contributes 100% of the cost of the remaining approximately 1,800 gsf.

It can be asked whether the typical sizes seen in this study sample are larger than need be. The IAC has consistently deferred to educators in the setting of educational specifications, based on the idea that local educators best understand the specific educational needs of their own populations, as well as local preferences regarding program offerings and community use spaces. MSDE has developed a number of best-practice facility design guidelines with input from a variety of stakeholders as well as research into national practices.

Middle School Spaces

A K-8 school, in contrast to a typical elementary school of the same capacity, must provide for the educational needs of middle school students. The analysis above does not consider the interior spaces that Anne Arundel County Public Schools, as well as other school systems in Maryland, typically include in a middle school facility. AACPS does not have a K-8 school, therefore it has no educational specification that aligns exactly with that of the Monarch Academy. Moreover, the middle school population of the Monarch Academy, as of any K-8 school, will be smaller than that of a stand-alone middle school. Monarch will have approximately 270 middle school students when it reaches its full complement of grade levels; by contrast, the AACPS standard middle school educational specification shows a State Rated Capacity of 1,050, and the educational specification for the recently completed Severna Park Middle School renovation shows an SRC of 1,433.

However, if AACPS were to build a K-8 school with an enrollment approximately similar to that of the Monarch Academy, it might consider inclusion of some of the following typical spaces that are unique to the middle school educational program (all figures are taken from the AACPS middle school educational specification):

Program Space	**Net Area** (nsf)
Administration / Support:	
Guidance (additional)	1,890
Volunteer Office	400
Security/ SRO	100
In-school Suspension	400
Attendance officer	100
World Languages Classroom	1,000
Language Storage	245
Visual Arts Class/Lab	1,500
Music:	
Keyboard Lab	900
Practice Room Suite	400
Technology Education:	

Tech Ed Classrooms	1800
Audio & finishing rooms	280
Tech Support + Storage	620
Family & Consumer Science:	
Classroom/Labs Clothing	1,600
Classroom/Labs Food Nutrition	1,600
Support	620
Physical Fitness:	
Auxiliary Gym	4,000
Fitness/Aerobics	1,200
Special Education:	
SE Support/Storage	1,900
Resource/ESOL/AVID/Speech (additional)	2,400
Total *Net* Square Footage[28]	**21,455 nsf**
Total *Gross* Square Footage	**30,493 gsf**
(assumes 72% efficiency)	

The relatively small middle school population in a K-8 program would dictate fewer and possibly smaller spaces than in a typical middle school. Nevertheless, the educational specification for an AACPS K-8 school would likely result in a school larger than that of an AACPS elementary school with the same State Rated Capacity, and it would therefore be larger still than the educational specification of the Monarch Global Academy.

Cost Factor: Site

At 8.7 acres, the Monarch Academy site is small for an elementary school and very small for a K-8 school outside of an urbanized area. Moreover, some of the site is reported to include a stream buffer and steep slopes, consequently not all of the site area was available for the building and site infrastructure. These constraints, as well as the fact that the site is not used for community recreation functions in non-school hours, means that it does not have the full range of site facilities that are typically found at an AACPS elementary school, including multi-purpose play area, softball field with backstops and team seating, separate soccer field where possible, basketball court, and separate elementary and intermediate play areas with playground equipment appropriate to each age group. When completed in the fall of 2015, the Monarch Academy by contrast will provide one set of playground equipment for all age groups and a general play field with a running track.

Analogous to the discussion of interior spaces, if AACPS were to develop a K-8 educational specification, it would probably include some of the exterior facilities that are currently provided in its middle schools. Among these are: two softball fields including backstops and seating, two regulation soccer fields superimposed on the softball fields, one fenced basketball area with six backstops, and five fenced tennis courts.[29]

The Monarch School was required to follow the same Maryland Department of the Environment site requirements that apply to other public and private institutional building construction in Anne Arundel County, resulting in a number of stormwater management facilities throughout the site. According to the Schematic Design and Design Development documents, there were no wetlands on the site. An adjacent stream on the south side of the parcel did require establishing a stream buffer, but it does not appear that this generated any difficulties in siting the buildings or the site improvements. Similarly, since the project was defined by Anne Arundel County as a private academic school, a conditional use within the R-5 Residential District, the building was subject to 40 foot setback requirements from the street and adjacent properties; again, it does

[28] Assumes one space of each type is built. In the standard middle school educational specification, more than one space is specified for certain program elements.

[29] Anne Arundel County Public Schools – Educational Specifications

not appear that this requirement caused any undue difficulty or resulted in any additional expenses. Public schools in Anne Arundel County are exempt from these setback requirements.[30]

Cost Factor: Design

Complexity of Design

Monarch. The Monarch Academy consists of two perpendicular bars, a single-story administrative wing that also houses the cafeteria, gymnasium, and music and art classrooms, and a two-story classroom wing that also houses the Media Center on the ground floor. See Attachment 2, Monarch Academy Floor Plans.

According to the architects, the site would have been more efficiently used if the two building bars had been arranged at a modest angle: this would have allowed for more efficient traffic flow and would have better accommodated site constraints such as the stream buffer.[31] However, this arrangement would also have introduced unique plan and section details that might have raised costs, and may not have worked well with the pre-fabrication process that was eventually selected.

Anne Arundel County Public Schools. In 2000 AACPS developed a prototype design that has now been used for 13 new schools. See Attachment 3, AACPS Prototype Elementary School Floor Plans adapted to the Rolling Knolls Elementary School project. The floor plan consists of one bar that contains the administration area and the double-height "noisy" spaces (gymnasium, cafeteria, and music rooms) and perpendicular to it, two double-story classroom wings that flank the library/media center. As with repeat school designs used by other school systems in Maryland, the original prototype served as a testing ground to evaluate both design and construction decisions, allowing later iterations of the plan to be improved in order to reduce change orders and respond to developments in building systems and information technology. Since the pool of contractors who choose to work regularly on Maryland school projects is relatively small, the use of repeat designs allows them to become very familiar with the school system's design standards, reducing their risk and leading to tighter bid costs with less potential for change orders.

***Clarity and Completeness of the Procurement Documents*.**

Monarch. The Monarch academy was delivered using a design-build (D-B) methodology. Because in a D-B project the parties that design the building are also responsible for constructing it, the construction documents typically do not require the same level of design details, schedules, and wall sections as for projects delivered through the more conventional design-bid-build (D-B-B) methodology. D-B is reported to save time and cost, particularly on the design side of the project. The advantages and disadvantages of D-B, and the reasons that it has seen only limited application in Maryland school projects, will be further discussed below. The architects for the Monarch project indicate that the final Monarch drawings were less detailed when compared to the typical set of drawings that are developed for public schools in Maryland.

Anne Arundel County Public Schools. AACPS engages architectural and engineering firms that work throughout Maryland and the Washington-Baltimore metropolitan area and have put many projects out for solicitation. In addition, AACPS has on its facility staff six registered architects and professional engineers, allowing for intensive review of the design documents produced by design consultants. Given the general desire to avoid increases of cost due to change orders, great efforts are made to produce solicitation documents that are clear and complete. The tangible result of the quality control exerted by AACPS is shown in its record of change orders: AACPS averages about 2% on change orders for new construction, a figure that in the world of school construction is noteworthy. It indicates that the majority of change orders develop because of unforeseen conditions (typically in new construction, these consist of soils) or mandated code changes, rather than errors and omissions (E&O) attributed to incomplete or faulty design or procurement documents.

[30] SEI Architects, "Imagine Global Village Academy, Schematic Design Brochure," January 18, 2012, page 55 and "Monarch Academy, Design Development Brochure," May 2, 2012, page 8.

[31] This assertion cannot be independently evaluated because the drawings showing this option are not available.

Building Technologies

For a major new school building, about 85% of the total cost is tied to construction and 15% is related to "soft costs", including FF&E (furniture, furnishings and equipment). Once the general project scope has been determined, any reduction in construction cost will accordingly have a major impact on the overall cost of the project.

Below is a comparison of the Monarch Academy with North Frederick Elementary School (NFES), a public school replacement project in Frederick County. The comparison is apt because both projects bid in 2013 (NFES in May, the Monarch Academy in October), consequently both were subject to the same general cost influences in the Washington-Baltimore construction market. Both projects were well within the boundaries of this market, so that geographical influences can be discounted. Both projects were designed by architectural firms which have worked in multiple jurisdictions across Maryland and are very familiar with LEA and State of Maryland public school requirements, so that differences in cost associated with individual architectural styles are also likely to be negligible. As a result of these similarities, the differences in unit costs ($/sf) for individual building categories will reside almost entirely in the building systems specified.

It is important to note that simple comparisons of this kind can be problematic because the CSI (Construction Specifications Institute) categories used to organize various scopes of work may contain different items. The breakdown for NFES, for example, places toilet and bath accessories, casework, and conveying systems in Division 6, Woods/Plastics/Specialties. Likewise, the Division 7 Thermal and Moisture Protection category for Monarch is exceptionally low compared to NFES; the reason is that the metal roof used in the Monarch facility is likely carried under Division 5 Metals in the Monarch breakdown rather than in Division 7 Thermal and Moisture Protection. Detailed examination of the design specifications for each project would be needed to determine where these costs are carried in the CSI classification system. Nevertheless, the comparisons are useful in identifying four areas of difference: Finishes, Mechanical, Plumbing, and Electrical/IT. These categories are highlighted in the chart below.

BUILDING SYSTEMS: COST COMPARISON

		Monarch Global Academy[32]		**North Frederick Elementary School[33]**	
CSI Div.	**Building System**	**Cost / gsf**	**% of Total $/sf**	**Cost / gsf**	**% of Total $/sf**
1	General Conditions	$4.38	2.4%	$6.06	2.6%
2	Sitework	$31.31	16.9%	$36.61	15.7%
3	Concrete	$7.42	4.0%	$12.45	5.3%
4	Masonry	$3.43	1.9%	$17.52	7.5%
5	Metals	$27.15	14.7%	$16.04	6.9%
6	Woods/Plastics/Specialties	$2.82	1.5%	$21.62	9.3%
7	Thermal & Moisture	$0.79	0.4%	$10.40	4.5%
8	Windows & Storefront	$8.62	4.7%	$11.41	4.9%
9	Finishes	$13.78	7.5%	$21.23	9.1%
10	Specialities	$3.23	0.4%	In Div. 6 (Toilet/Bath Access)	
11	Kitchen Equipment, Built-In	$3.06	1.7%	$2.38	1.0%
14	Conveying Systems	$0.95	0.5%	In Div. 6	
15	Mechanical	$15.79	8.5%	$31.99	13.7%
15	Plumbing	$6.65	3.6%	$22.68	9.7%
16	Electrical/IT	$14.52	7.9%	$22.84	9.8%
	Contractor's Fee	$13.37	7.2%	Included in costs above	
		$157.28 / sf		**$233.23 / sf**	

[32] Courtesy of The Children's Guild.

[33] Courtesy of Oak Contracting LLC., construction manager for the North Frederick Elementary School project.

Finishes: Monarch used a lighter grade of finish throughout:

- This is particularly evident in the hallways, which after one year of use show some wear from staples and tape. Apparently the builder-grade paint that was used is peeling from removal of the staples and tape, and a second coat will be required to be installed. Fiberboard panels have also been installed to allow student work to be hung without disturbing the walls behind.

- The absence of acoustic ceiling tile in the 2nd floor classrooms not only increases the reverberation in the classroom and allows greater transmission from adjacent spaces, it also does not protect the exposed insulation. Several small tears were already evident in the insulation, and it is feared that this will increase with time. The cost to install acoustic ceilings throughout has been reported to be approximately $40,000.

- The roof insulation is placed between the structural members. We do not have a roof detail, but we assume that there is insulation of some kind between the structural members and roof deck and the exterior environment. However, this thermal separation does not benefit from the additional insulation located between the members, creating thermal breaks and likely significantly reducing the energy efficiency of the structure.

Mechanical: Monarch uses a vertical unit ventilator in the classrooms, each with an exterior condensing unit. There is no central temperature control; each classroom is controlled by the occupant. For a number of reasons, this is not considered good practice in public school buildings:

- The absence of an automatic centralized temperature control system reduces the energy efficiency of the building significantly. It does not permit balancing of the building, particularly during the "swing" seasons when a central system allows heat to be moved from the warm side of the building to the cool side, reducing overall demand. An automatic temperature control (ATC) system also allows for pre-set control of time settings so that (depending on the season) the building can be pre-heated or cooled before occupants arrive and temperatures can be automatically adjusted after the building is emptied. An ATC also extends the useful life of the system by operating equipment at maximum efficiency in relation to occupancy, as against the variations that can occur when room occupants over-heat or under-cool a space.

- The quality of the unit ventilators is also of concern: it is uncertain if they will have the 20 to 25 year life-span that is anticipated for institutional quality units. This means that more intensive maintenance will be required to keep them operational. Moreover, since the units are only accessible from within the classroom, maintenance must be performed either while class is in session or outside of class hours, in which case a failed unit will result in room temperatures that are uncomfortably hot or cold until the repair is performed.

- The exterior condensing units appear to be highly vulnerable to damage from vandalism or ground-keeping equipment (Photo 12). These units contain metals that in some circumstances make them ready targets for vandalism and theft, vulnerabilities that can be addressed by installing secure cages around the units. The potential damage from lawnmowers and other grounds-keeping equipment can be prevented by mounting the units on concrete pads larger than the dimensions of the condensing unit.

Plumbing: The Monarch Academy uses PVC (polyvinyl chloride) piping throughout as a cost-saving measure. While a life-cycle analysis (LCA) of PVC vs. traditional metal piping is beyond the scope of this study (and is one of the recommendations made at the end), PVC does have a noticeable impact on noise transmission when it is carrying water. This background noise from flushing toilets and sinks may add to the acoustic distractions that are apparent in the Monarch facility from the lack of isolation provided by the wall structures between classrooms.

Electrical: The difference in square-foot cost between the Monarch Global Academy and the NFES in this category is not immediately explicable, since Monarch appears to have the electrical power and electrical distribution systems that would be found in a conventional school. Overall, the lighting levels in the Monarch Academy are comparable to those in conventional schools, but there are no automatic lighting controls in place. Significant cost differences may arise from the information technology infrastructure used in the two examples: wireless technologies reduce first-costs compared to traditional hard-wired infrastructure. School systems throughout Maryland are moving gradually toward a wireless environment in their new facilities, but we are not aware of any public school built in recent years that is entirely wireless. As the technologies improve and confidence in their reliability and coverage increases, we are likely to see more wireless school facilities.

Anne Arundel County Public Schools has provided the following summary of the differences between building systems in the Monarch Global Academy and in the standard AACPS school building:

	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 VCT	*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*

Each of these differences carries cost implications. A detailed analysis of the first-cost differences between the systems using a standard, industrywide source (e.g. R. S. Means) is beyond the scope of the current study. Of equal importance, an analysis of the life-cycle costs of each system is needed to accurately assess their impacts on operating and maintenance budgets over the life of the building.

Code and Regulatory Requirements

- *Local Code Requirements*. The Monarch Academy was subject to the same local code requirements with respect to fire safety, egress, and accessibility as apply to all new public school buildings in Anne Arundel County. Neither facility experienced a cost difference with respect to code requirements.

- *State Design Requirements*: The IAC has a minimum of design requirements.

  - High Performance Building Requirements. All State-funded new schools and replacement schools in which more than 80% of the final square footage is new are required to achieve a rating of Silver or better under the LEED (Leadership in Energy and Environmental Design) program of the U. S. Green Building Council, or must comply with the requirements of the Maryland International Green Construction Code (IgCC). Based on annual surveys of LEA facility planners, we believe that the high performance requirement increases school construction costs between 2% and 5% over current code requirements. The Monarch Academy was not subject to this requirement.

    A major factor in achieving LEED Silver certification is the mechanical system; centralized temperature control is a minimum requirement. The mechanical system used throughout the Monarch Academy building would likely prevent it from achieving High Performance Certification under Maryland law and policy.

  - Health Suite. MSDE has defined the size and components of the health suite in public school buildings. The sample of 11 schools described on page 19 shows that this results in health suites between 710 and 810 net square feet. The Monarch Academy's health suite is of comparable size at 751 net square feet (however, as noted, the layout of the health suite presents problems of supervision).

  - Roofing Policy. All State-funded roof projects in Maryland, including those on major new, replacement, and renovation projects, are required to follow the Department of General Services roofing policy. For practical reasons, the majority of roofs on Maryland's public schools consist of built up roofing (BUR) systems; other systems, including single membrane and modified bitumen, are also allowable. Pitched roofs are a relative rarity in new schools, but are being installed in some jurisdictions not only for their aesthetic appeal, but also because they provide penthouse space which allows for easy servicing of mechanical equipment. The standing seam roofing system used in the Monarch Academy would be eligible under the DGS roofing policy.

  - Emergency Shelter. All State-funded school projects that involve an upgrade or replacement of the electrical system are required to provide full electrical power in areas that will be used for sheltering, as determined by the Maryland Emergency Management Agency (MEMA). This requirement applies to new and replacement schools.[34] The requirement can be met either through a dedicated emergency generator or through a transfer switch that allows for connection to a portable emergency generator. The first solution involves an additional first cost of approximately $300,000 to $500,000, and long-term maintenance costs; the second solution involves costs ranging from about $5,000 to $25,000, and relatively minor maintenance costs. The Monarch Academy was not subject to this requirement.

  Other State requirements that will apply equally to the Monarch Academy and to a conventional elementary school concern boilers, elevators, and stormwater management.

- *Federal Requirements*. Typically, federal requirements concern the presence on a school site of wetlands or Waters of the U. S., either of which falls under the jurisdiction of the Army Corps of

[34] And to systemic renovation and small renovation projects under certain circumstances.

Engineers. These requirements will apply equally to the Monarch Academy and to sites for conventional public schools in Anne Arundel County. Differences in costs will depend entirely on the conditions of the site.

Cost Factor: Project Delivery Method

Monarch. The Monarch Global Academy was designed and built under a Design-Build methodology. This decision was driven by cost considerations: when The Children's Guild assumed the project, they turned to a pre-engineered structural system as a cost-saving measure. Pre-engineering is said to work best under a Design-Build project delivery methodology. In this case Steel Building Specialists, the pre-engineering manufacturer, used the architect's conceptual design to develop the structural system and then engaged mechanical and electrical contractors to develop the design of these systems. The result was a very significant reduction in the total cost of the project, as well as a reduction of the time required for construction as compared to the original design. Also significantly reduced was the architect's involvement with the later stages of the project: consideration of alternative building systems and finishes from a cost and building performance perspective, construction administration, detailed review of requisitions, certification of substantial completion, etc.

Anne Arundel County and Other Maryland LEAs. Delivery methods allowed under regulation include general contracting (GC), construction management agency (CMA), construction management at-risk (CMR), design-build (D-B), and job order contracting (JOC) (COMAR 23.03.04). A description and evaluation of each of these methods lies beyond the scope of this report; succinct summaries can be found in the literature.[35] All of these methods have been used by the Maryland school systems, the choice depending on factors that include the size and scope of the project, its complexity, the LEA's tolerance for risk, the available capacity of general and trade constructors, schedule requirements, desire for or aversion to innovation, and the LEA's prior record of success with a specific method. LEAs tend to favor the following three project delivery methods:

- *General Contracting* (GC) accounts for the majority of school construction projects in Maryland: it allows for a simple procurement process, it provides a single cost figure on bid day that encompasses the total building construction at a single point in time, and it transfers all risk and responsibility to a single entity.

- *Construction Management Agency* (CMA) has been used successfully by a number of school systems. While the multiple-prime contractor format typically used in CMA involves a more complex procurement process and the owner retains the formal risk for coordinating the trades and may not know all costs at the time that construction begins, it also allows for a fine-tuning of individual scopes of work and schedules to achieve best cost, best value, or other factors that the owner may deem to be important.[36] CMA has the further advantage that the construction manager, as agent to the owner, is brought into the project at an early stage to provide cost estimating, constructability review, value engineering, and other inputs that will affect costs, schedule, and quality.

- *Construction Manager At-Risk* (CMR) has been used successfully by a small number of LEAs on a limited number of major projects since 2007. The method combines the qualities of GC and CMA: all risks reside in a single entity, but the same entity is involved in the pre-construction evaluation of building systems, materials, and finishes prior to offering a Guaranteed Maximum Price (GMP). Procurement is more complex than under GC or CMA and requires considerable involvement by the owner; however, by report of the LEAs that have used CMR, the results in quality, schedule, and cooperation between the constructor, the A/E, and the owner appear to warrant the investment of time.

[35] See, for example, Construction Management Association of America (CMMA), "An Owner's Guide to Project Delivery Methods," 2012.

[36] For example, improved Minority Business Enterprise participation, or splitting of package scopes to accommodate the bonding capacities or the availability of local contractors.

To date, Design Build (D-B) and Job Order Contracting (JOC) have been used by Maryland school systems only on small projects that involve either a very clear performance specification (e.g. replacement of an HVAC system), or else involve a defined and limited educational and architectural program (e.g. renovation of a science classroom). Neither JOC, D-B, nor a combination of the two have been used for any major new, replacement, or renovation project in the state.

The State of Maryland has allowed the use of Design-Build for school construction since legislation was enacted in 2004 (Education Article 4-126; COMAR 23.03.04.07). It is of some significance that during this time no LEA has used D-B for a major project. Based on discussion with LEAs, the principal reason given for not using this method is the loss of control of design decisions at crucial stages of design development (DD) and construction documents (CD), and of field decisions during construction administration (CA):

- LEAs find great value in obtaining the services of experienced school architects and engineers throughout the entire design process, including the mid-point "quarter scale reviews" when the A/E team works closely with teachers, administrators, and facility managers on specific furniture and equipment layouts, as well as in the final stages of design when critical decisions about finishes are made and the procurement package or packages are assembled.

- LEAs also find value in the design team's participation in the construction phase (Construction Administration, CA). On-site visits, responses to contractor requests for information (RFIs), evaluation of proposed change orders and claims, the approval of requisitions in relation to installed and purchased work, and final sign-off for substantial completion, are among the duties performed by the A/E team. These actions by an independent, third-party agent who is not financially related to the constructor help to ensure that the final product will meet the design and performance requirements of the owner.

- It is understood that in order for Design-Build to work successfully on a major K-12 construction project, the performance specification would need to be extensive, detailed, and contractually unassailable. The expense and effort involved in developing such a specification is a major inhibition against using the method, since it appears to offset the principal purported advantage of Design-Build, the acceleration of the project schedule.

Cost Implications of Delivery Method. No particular delivery method offers clear-cut cost savings over others; the factors that lead to success in cost are too complex to reduce to a simple choice of this kind. The following discussion is based on general observations from the field as well as on the literature on the subject.

- *General Contracting*: In a competitive market, the widespread publication of the bidders' list leads to noticeable cost reductions on bid day. However, during the recent recession some contractors bid at- or even below-cost to secure work, with the expectation that the losses would be made up for through change orders. In this situation, the owner runs a high risk of receiving an inferior product or of being engaged in extensive disputes about scope, quality, or schedule. In the current recovering market, in which bidders have ample opportunities outside of school construction, the pool of contractors for school projects is markedly smaller and the reduced competition has led to noticeable cost increases, exasperated by reduced plant and labor force capacity and contractors' need to recover margins foregone during the previous recovery.[37]

- *Construction Management Agency* (CMA): As agent to the owner on a fee basis, the construction manager (CM) is not at risk for the project. Moreover, the CM can be procured using a non-competitive professional services approach, based on qualifications, past performance, and personnel. Professionalism, the desire for repeat work with the same client, and the incentive of

[37] Ed Zarenski, Gilbane, Inc., "Construction Economics: Market Conditions in Construction," Winter 2014/Spring 2015; see also KCI Technologies, Inc., "Cost Impacts on School Construction and Cost Savings Through Design and Construction," powerpoint, May 2015.

obtaining good references for work with other public clients, drives CMs to perform at or better than general contractors with respect to quality control, schedule adherence, safety, and cost control. In CMA, the owner does not pay the overhead and profit (O&M) charges that are associated with general contracting; instead, the CM fee as well as the owner's increased staff costs roughly substitute for these expenses. The qualifications of the CM are the most important criterion to ensure that the entity will provide accurate constructability review and cost input during the design stage, review the multiple contract packages to avoid omissions or overlapping scopes, and coordinate all trades in the field.

- *Construction Management At-Risk* (CMR): Under Maryland regulation the CM in this arrangement must be procured competitively, typically using the competitive negotiation method at an early stage of project design (COMAR 23.03.03.10). As with CMA, with an experienced CM significant cost avoidance is achieved during design through constructability review, value engineering, and accurate estimating. Also like CMA, under Maryland regulation the trade packages are almost invariably procured using competitive sealed bid, resulting in open competition for each trade. Unlike either GC or CMA, post-bid negotiation is possible among the owner, the CMR, and the trade contractors before the CMR establishes the final GMP. Since the CMR who owns the GMP was also involved in design, change orders that result from errors and omissions in the bid documents are reduced to a minimum, representing a substantial saving to the owner.[38]

- *Design-Build* (D-B): Since Maryland does not have an example of a major project carried out under D-B, there is no basis for a cost comparison with the other methods discussed in this section. However, industry advocates in general do not claim that cost saving is a primary advantage of D-B; rather, the advantage lies in the enhancement of the schedule by allowing for fast-tracking of the project, because fabrication or even installation work of early systems can be underway even while the scopes of later work are being developed. For the simpler building types such as offices, shopping centers, and warehouses, and especially those that are keyed to specific occupancy dates (e.g. opening a shopping center in time for the holiday shopping season), D-B offers a very valid opportunity. In these circumstances, the speed of D-B may not translate into direct construction savings, but may indirectly produce savings or increased profits that can only be realized when the facility is complete. In a rapidly escalating construction market such as Maryland is now experiencing, the expedited delivery of projects through the D-B methodology may produce savings in the avoidance of increased construction costs.

Cost Factor: Schedule

Monarch. The total time required between initial conception of the Monarch Academy project and the opening of the facility was just under six years, as follows:

October 2008:	AACPS approaches developer to investigate contract school concept
January 2009- October 2010:	Negotiations among AACPS, developer, and first educational contractor, and development of first architectural design
May 2011:	Board of Education approves Imagine Schools educational specifications
January 2012:	Imagine School schematic design (SD) approved.
January 2012:	AACPS selects The Children's Guild to develop the facility and provide the educational program

[38] The total saving potential may be enhanced if the savings are split between the owner and the CMR per contract.

March 2012:	Children's Guild selects SBS to produce the design and to construct, based on modification of the original concept design
June 2012:	Children's Guild revises plans, design development (DD) approved
June 29, 2012:	Submitted for building permits.
October 2013:	Construction begins
August 2014:	Occupancy
October 2015:	Anticipated completion of playing fields and playground.

While the construction period was shorter than that of a typical elementary school by about four to six months, the total time for development of the project from initial concept to final completion reflects the possible uncertainties involved in working with private sector interests. Some of this delay was attributable to the change from the initial educational contractor to The Children's Guild, and to the initial negotiations with the developer and Anne Arundel County. These times, of course, will vary markedly depending on the players, their financial capabilities, their experience with both finance and construction, and the incentives involved.

Anne Arundel County. The typical timeframe to develop a hypothetical public elementary school of comparable size to the Monarch facility is approximately three years, as follows. This timeframe assumes the use of a repeat school design, allowing for expedited architectural design and possibly permitting.

Summer/Autumn 2011:	BOE approves project to begin design in the budget year of the CIP, and the local government indicates its support
January-May 2012:	State approves project for FY 2013 CIP planning
Summer 2012 to Spring 2013:	Architectural design: SDs by September 1, DDs by November 1, CDs by Spring 2013
Summer/Autumn 2012:	BOE approves project to begin construction in the budget year of the CIP, and the local government indicates its support
January-May 2013:	State approves project for FY 2014 CIP funding
Late Winter/Spring 2013:	Submitted for building permits
Late Winter/Spring 2013:	Project bids
Spring/Summer 2013:	Construction begins
Summer 2014:	Occupancy

The timeframes shown here will be longer for larger and more complex facilities, e.g. the design of a new middle school requires approximately 18 months and its construction approximately 18 – 24 months; design of a new high school requires approximately two years, its construction approximately 24 - 36 months. Depending on the urgency of implementing the educational program, some LEAs may also choose to extend the design period for an elementary school to two years: while the LEA runs the risk of increased cost due to escalation, the extended timeframe also allows for enhanced involvement by all stakeholders, leading to a project of superior quality and one that meets educational and community expectations. The extended timeframe is usually used for a one-time major project among smaller LEAs.

Cost Factor: Procurement

***Procurement Method*:** Competitive sealed bid, multi-step competitive sealed bid, competitive negotiation, quality based selection (QBS), intergovernmental purchase, and sole source are the procurement methods outlined in Maryland regulation for school construction (COMAR 23.03.03). As with the variety of project delivery methods available to school systems in Maryland, there is no evidence that any particular method consistently produces costs that are better than others. Each method is appropriate in different circumstances and for different types of services. There are, however, general alignments between procurement methods and the different project delivery arrangements:

- *Competitive Sealed Bid*: Used for the vast majority of general contracting projects and for the trade packages under CMA and CMR.

- *Multi-Step Competitive Sealed Bid*: Selectively used by some LEAs for larger general contracting projects and occasionally for the trade packages under CMA or CMR.

- *Competitive Negotiation*: Used for procurement of CMR services for pre-GMP services. The CMR's fees and costs are combined with the cost of the trade packages procured through competitive sealed bid to make up the Guaranteed Maximum Price (GMP) in a CMR project. Competitive negotiation is also used for procurement of CMA services when an LEA wishes the IAC to participate in the construction-side services that the CM will provide (bidding, construction management, close-out, etc.).

- *Quality Based Selection* (QBS): Not used to date for hard project scopes in school construction projects; possibly used by some LEAs for procurement of some soft services.[39]

- *Intergovernmental Purchase*: Used extensively by a small number of LEAs for projects that involve standard specifications (e.g. roof replacement projects) or limited scopes (renovation of open space pods or science classrooms); therefore sometimes used in conjunction with JOC project delivery for these smaller projects.

- *Sole Source*: Rarely used except when there are severe restrictions on the scope of the work (e.g. a building control system that must tie into existing central-office management systems) or under emergency procurement conditions; invariably the use is for small projects involving a single vendor or a small general contractor.

***Procurement Requirements*:**

Monarch: As a privately-owned and privately financed facility that houses an educational program under contract to the Anne Arundel County Board of Education, the Monarch Academy was not subject to State procurement requirements for school construction. The Children's Guild, as developer of the facility, was able to act in the same manner as the private developer of an office building or shopping center, selecting a constructor based on past experience, reputation, reference from other owners, or other non-cost criteria. The Children's Guild could unilaterally select and sole-source the procurement of various components of the building, as well as the vendors installing these components, without the requirements to advertise or compete the procurement that apply to public school construction projects. The procurement of the Monarch facility was also not subject to State requirements regarding Minority Business Enterprise participation or prevailing wage rates.

Anne Arundel: Like all Maryland school systems, Anne Arundel is subject to the requirements of the Education Article with respect to State procurement requirements:

[39] Since the State does not participate in funding these services, the PSCP keeps no records of how they were procured.

- *Competitive Procurement*: All projects over $25,000 in construction value must be competitively procured, both those that are locally funded and those that have State funding participation.

  Cost Implication: Presumably competition improves the cost and/or value of the project to the public. Competitive procurement does increase administrative costs, particularly those associated with the time required for staff members to develop the procurement documents, obtain State approvals, administer the procurement, deliberate on the results (including protests or even injunctions), and submit the results for approval by the local board of education and (for State-funded projects) the IAC or its designees.

- *Minority Business Enterprise*: All projects with State funding participation are required to meet the MBE requirements of local board policy, which must align with those approved by the IAC (available on the PSCP website at www.pscp.state.md).

  Cost Implication: No evidence indicates that MBE requirements directly increase the cost of construction; they do, however, entail very substantial amounts of staff and administrative time, from development of the MBE goal and subgoals for the specific project, to review of bid documentation for compliance, to review of requests for waiver, to annual reporting to the PSCP and the Governor's Office of Minority Affairs (GOMA). Larger school systems that have many State-funded projects will often have an assigned MBE officer for construction alone to manage the flow of documents, correspondence, and reports.

  There may be indirect costs associated with the State's MBE requirements. It is reported anecdotally that some small contractors have declined to bid on State-funded projects because the administrative burden associated with MBE requirements exceeds their office and personnel capacity.

- *Prevailing Wage Rates*: Prevailing wage rates are required on all State-funded school construction projects that are awarded after July 1, 2014 that have a total construction value greater than $500,000 and in which State-funding participation is 25% or more of the total construction cost. If a project meets these requirements and the LEA chooses to not apply prevailing wage rates, they must accept a reduction of the State participation to 24.9%. For projects that are close to the cost and/or percentage thresholds based on estimates, LEAs may solicit projects both with and without prevailing wage rates so that they can determine which pay schedule is most advantageous.

  Cost Implication: The Rolling Knolls Elementary School that is used in this study for cost comparisons with the Monarch Global Academy bid before July 1, 2014 and was therefore not subject to prevailing wage rates. None of the cost differential between the two projects is attributable to prevailing wage rates. However, current and future AACPS projects will generally be subject to the prevailing wage requirement.

  There is incontrovertible evidence that prevailing wage rates increase construction costs. The PSCP has examined 262 trade package and small project bids that were solicited both with and without prevailing wage rates, and find that prevailing wage rates increase bid costs by an average of 11.65%. These side-by-side bids are taken at the same time, for the same scope of work, and are submitted by the same contractors; all factors are therefore the same except for the labor rates. The spring 2013 bids for the replacement project for North Frederick Elementary School in Frederick City showed that prevailing wage rates added 13.98% to the cost of this major school construction project.

Cost Factors: Summary

The following chart shows how the cost factors outlined above affected the Monarch Global Academy and a conventionally built school in Anne Arundel County.

Cost Factor	Applicable to Monarch?	Applicable to AACPS?	Comment
State and local site development requirements	Yes	Yes	
Technical requirements:			
Materials	Yes	Yes	Considerable variety possible, depending on educational program and student characteristics.
Performance requirements	Yes	Yes	
Finishes	Yes	Yes	
State technical requirements:			
Emergency shelter	No	Yes	Adds up to $20,000 or more to new construction
High Performance	No	Yes	Adds 3% to 5% to project cost
Health Suite	No	Yes	No square foot impact on the Monarch Academy
State roofing policy	No	Yes	Monarch's roof is acceptable under the State roofing policy
Requirements for permit:			
Fire	Yes	Yes	
Stormwater management	Yes	Yes	
Other: soils, wetland and forest mitigation	Yes	Yes	
Procurement requirements			
Competitive procurement	No	Yes	Adds to time required for procurement (w/ impacts in escalating construction market)
Prevailing wage	No	Yes	Adds average of 11.65% to trade contract bids. Prevailing wage requirements changed after July 1, 2014; RKES was not subject to prevailing wage rates.
Minority Business Enterprise	No	Yes	Cost impact depends on project scope and location; adds administrative costs
Schedule	Yes	Yes	Procurement requirements add to schedule for publicly bid work
Soft costs			
Planning	Yes	Yes	
Design:			
A/E Fees	No	Yes	Monarch used Design-Build, A/E fees were built into project delivery cost; see note below.
Special consultants	Yes	Yes	
Site investigation	Yes	Yes	
Permits	Yes	Yes	
FF&E	Yes	Yes	Considerable variety possible, depending on educational program and student characteristics.

Of the factors above, the two that will have the greatest impact on the total project cost are the technical requirements of the project and the procurement requirements. As noted, disaggregating the specific impact that each factor has on the total cost of the project will require a very detailed study that is beyond the capacities of the IAC at this time.

IV. RECOMMENDATIONS

The Interagency Committee on School Construction recommends that the following actions be taken to continue the evaluation of school construction costs, using the technologies and construction method of the Monarch Global Academy as one example of an alternative approach. The IAC believes that the building methodology used by the Monarch Global Academy has application under particular circumstances, for example when capacity is needed on an accelerated basis as in the Monarch situation, when a private developer is contractually obligated to assume all responsibilities for the maintenance of the facility, or possibly under the Design-Build-Finance-Maintain-Operate (DBFMO) strategy used successfully in the United Kingdom and Canada to build school facilities rapidly in response to enrollment needs.

However, keeping in mind the unique administrative, educational, and financial circumstances that surround the Monarch Academy, the IAC expresses caution about applying the Monarch building approach broadly to Maryland's school construction tasks until a more thorough study of the life-cycle implications has been undertaken. To that end, the IAC recommends:

1. The Monarch Global Academy should be visited and assessed by LEA superintendents, facility planners, maintenance and operational staff, and instructional staff. The observations and findings of these officials should become an integral part of any evaluation of alternative facility approaches.

2. A life-cycle cost analysis (LCCA) of the Monarch Global Academy should be conducted to determine the operational, maintenance, utility, and building system renewal costs over the anticipated useful life of the building, and to compare these costs to those of conventionally built public school facilities of comparable size.

3. Separate LCCAs of the building systems used in the Monarch Global Academy should be conducted, most notably:

    - Pre-engineering structural system vs. conventional steel frame or load-bearing masonry;
    - Insulated exterior wall panel enclosure systems;
    - Individually controlled, minimally zoned vertical unit ventilators vs. central HVAC system with automatic temperature controls;
    - Standing seam metal roofing vs. single- or multiple-membrane roofing systems (EPDM, TPO, BUR, etc.);
    - Impact-resistant drywall in high-traffic areas, vs. masonry in these areas;
    - Plastic piping (PVC) vs. metal piping;
    - Doors and hardware.

4. The study should be broadened to include public school buildings constructed to commercial standards that do not have the unique administrative, educational, and financial circumstances associated with the Monarch Academy, in particular:

    - Schools with educational programs that are similar to those in conventionally built facilities in the same school system;
    - Schools that do not have enrollment caps;
    - Schools that must accept all students within the attendance area, rather than based on a lottery selection;

- Schools that are funded through the common operating budget of the school system, rather than on a per-pupil allocation specific to the school.

5. The State should consider developing a long-term pilot program to build one public school facility to commercial standards concurrent with the construction of a conventional school of the same size. A side-by-side pilot would allow for a true comparison of:

    - Development time and cost;
    - First-costs for building and site;
    - Life-cycle costs for operations, maintenance, utilities, and building system renewal;
    - User satisfaction;
    - Other factors to be determined

    The best candidate school system for such a pilot is one that is in the early process of developing a prototype design with the intention of using it multiple times. Once the educational specifications are developed, additional design funding should be provided to allow the design to be developed by the selected architect using conventional school facility standards in one case, commercial building standards in the other. Funding should also be provided to allow the two facilities to be tracked for up to 25 years to determine their life-cycle cost characteristics. While this long timeframe is necessary in order to understand the full costs implications of the decisions, findings on maintenance, operations and utility costs within the first three to five years could be helpful for policymakers and facility officals.

    Alternatively, the State should provide design funds to allow a school system that has a workable prototype design to convert it from conventional building technologies to commercial building standards.

    The State should also provide an assurance to the candidate school system that life-cycle costs for the commercial structure that exceed those of the conventionally constructed school will be borne by the State (assuming occupancies and hours of use, environmental loading, and other factors are similar).

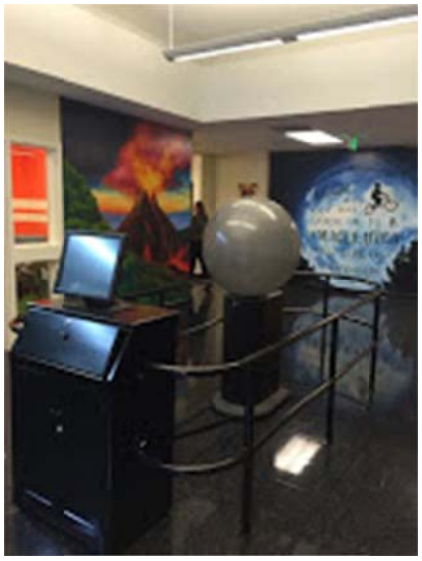
    The State should continue to encourage LEAs to investigate innovative and nontraditional designs, construction methodologies, project delivery methods, and alternative financing. The IAC is receptive to working with LEAs to develop and consider such proposals.

6. The State should establish a task force to study in detail the full range of cost reduction measures that may be applicable to public school facilities in Maryland, including:

    - State educational requirements that may be driving the size of school facilities;
    - Non-educational regulations that increase costs, particularly stormwater management requirements;
    - The full impact of prevailing wage rates, both direct (increased wages) and indirect (e.g., contractors' willingness to participate in school construction solicitations; productivity).
    - Alternative building technologies, project delivery methods, and project procurement methods.

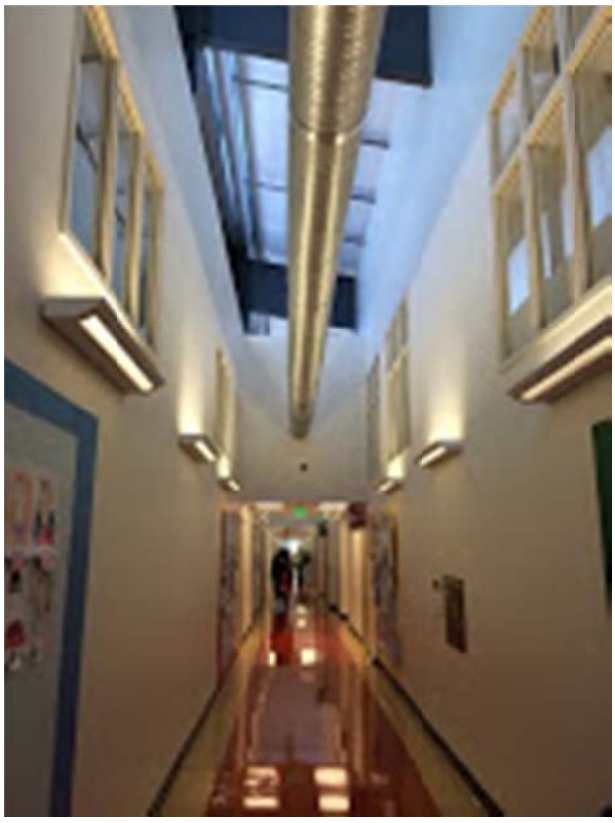
PHOTOGRAPHS: MONARCH GLOBAL ACADEMY

1. First floor hallway, Administrative Wing

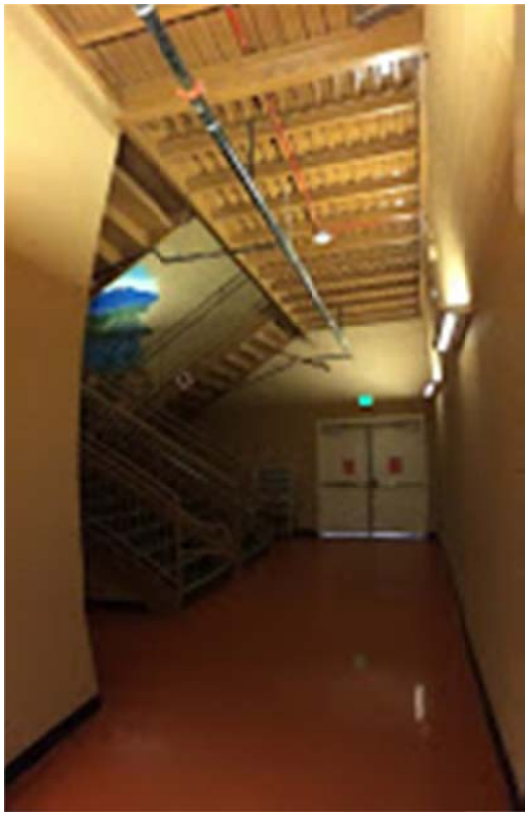


2. Entry lobby: Science Sphere

3. Entry Lobby: Living Wall and Science Sphere



4. Second Floor Corridor



5. Principal Staircase

6. Second Floor Classroom

7. Second Floor Classroom Ceiling

8. Rooftop Mechanical Equipment

9. Student Storage in Classroom

10. Cafetorium

11. Gymnasium

12. Condensing Unit

STATE OF MARYLAND
PUBLIC SCHOOL CONSTRUCTION PROGRAM
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INTERAGENCY COMMITTEE ON SCHOOL CONSTRUCTION

LILLIAN M. LOWERY, Ed.D
CHAIRPERSON

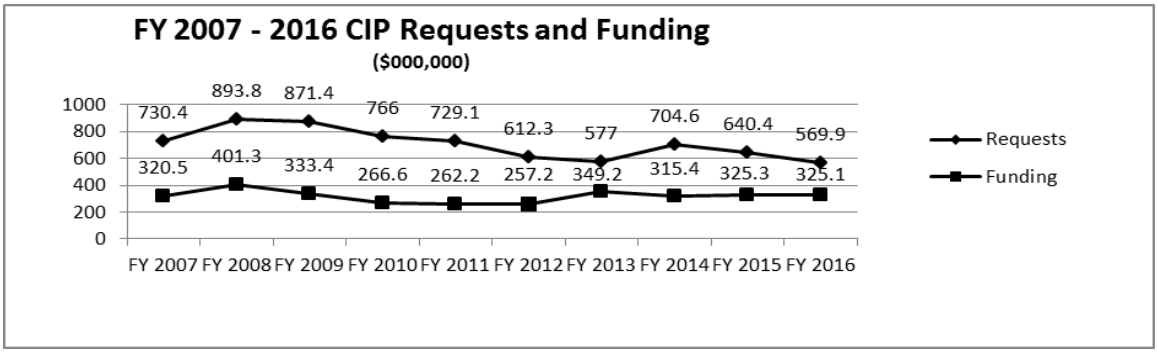
ATTACHMENT 1

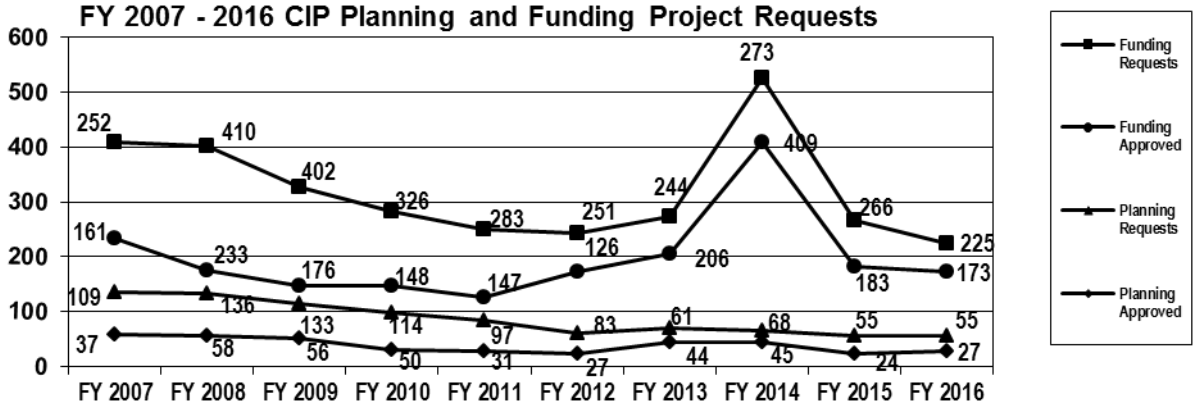
PUBLIC SCHOOL CONSTRUCTION PROGRAM
REPORT TO THE CAPITAL DEBT AFFORDABILITY COMMITTEE
David Lever, Executive Director
September 16, 2015

Capital Funding and the Capital Need

Since FY 2006, the State of Maryland has allocated over $313 million each fiscal year to public school construction. Despite this high level of commitment, the need for funding continues; the first of the following charts shows that in the annual Capital Improvement Program (CIP), State funding has exceeded 50% of the local requests for funding in only three years (FY 2013, 2015 and 2016).

Recognizing that the CIP requests represent only a partial picture of the capital needs of the school systems, and that in the current market the value of the State and local construction dollar has lost a considerable amount of its value, it is clear that a continuing commitment to school construction is needed.





Note for Charts: Figures for FY 2014 include a) 259 requests and 227 approved projects under the FY 2013 Energy Efficiency Initiative (EEI) and b) 20 requests and 19 approved projects under the FY 2014 Air Conditioning Initiative (ACI). The figures do not include the numerous small requests and approvals for the FY 2014 Security Initiative (SI). Figures for FY 2016 include $6.9 million (pending IAC/BPW approval) for the Enrollment Growth and Relocatable Classroom (EGRC) Initiative. The remaining $13.1 million is held in reserve for allocation with the FY 17 CIP.

Construction Cost Escalation
Significant changes have occurred in the cost of construction in the last year, accelerating the modest escalation trend experienced since 2011:

- In July 2003, the approved State construction cost was calculated at $138.75/sf for new construction; for July 2015 it was $233.00/sf, a 68% increase. However, this figure was found to be significantly below the actual cost of construction in mid-2015:

  Vertical Construction Cost:
  - For three fiscal years, FY 2012 to FY 2014, the estimated 4% annual increase of construction cost used by the IAC and DGS tracked well with actual bid-day costs.
  - In developing the cost for the FY 2016 CIP in July 2014, the IAC applied the same 4% increase: the FY 2015 cost of $224.00/sf was increased to $233.00/sf.
  - However, in the last eight months, four school construction bids showed that the 4% increase was about 16% too low; the figure should have been approximately $271/sf. This figure corresponds to costs reported from construction sources in Maryland.

  Sitework Cost
  - The IAC has used a sitework cost of 12% for many years; in recent years, LEAs have asserted that this figure was too low, largely because of the new stormwater management requirements that became effective in 2011.
  - The four bids indicated that the revised FY 2016 figure of $271/sf should have been increased by 19% (to $322.42/sf). This figure is on the low end of percentages experienced by a constructor who has built a large number of Maryland public schools.
  - The combined building-plus-site number of $322.42 for FY 2016 represents a full 23.6% increase over the figure used by the IAC for the FY 2015 CIP (it is 107% higher than the corresponding figure for 2003).

- For the FY 2017 CIP, the IAC will:
  - Escalate the building-only figure by 4% above the figure that should have applied in FY 2016 ($271.00/sf) to $282.00/sf, and
  - Will use 19% for the sitework cost for new construction, for a total of $335.58/sf.
  - However, these assumptions are on the low side of industry indicators. Given the volatility of the construction market and our recent experience, we will continue to monitor these figures throughout the upcoming FY 2017 CIP process.

Causes of the Cost Escalation
In early May 2015, a discussion about construction cost was held among LEA Facility Planners, architects, and constructors at a meeting in Hagerstown, MD. Based on the discussion, the rapid escalation in construction cost can be attributed to the following factors:

- Market conditions: Competition for bidders from the private sector and other governmental entities; reduced number of contractors and plant capacity as a result of the recession; shortage of labor, particularly skilled; increase of contractor margins as they recover from years of at- or below-cost bidding.

- Regulations/Codes/Standards: Increased direct costs due to stormwater management, high performance building standards, ventilation, accessibility, and energy code requirements, as well as prevailing wage rates and associated labor requirements, and emergency electrical power regulations; and increased indirect costs as contractors show a preference to bid in less highly regulated environments, reducing competition.

  Based on a sample of 240 side-by-side bids (i.e., both with and without prevailing wage rates) between January 2012 and March 2015, the average cost increase attributable to prevailing wage rates was 11.27%. The sample included 65 separate trade packages at 22 school construction projects in four LEAs. For mechanical systems, the average increase attributable to prevailing wage rates was 12.47% (28 bids on seven separate packages). For roofing, the average increase was 8.28% (66 bids on 13 separate packages).

- Schedule: Longer times required to obtain permits, reducing the time available to complete the projects and resulting in higher costs associated with acceleration or phasing of construction activities.

- Sites: High development costs for sites that are less than ideal, requiring soil mitigation or extensive import/export of soils, combined with the increased cost of stormwater management to meet Maryland's regulatory requirements in effect since 2011.

A more detailed report on the causes of the cost increases is provided as an attachment. The document also mentions some of the strategies used by LEAs and recommended by practitioners to reduce the cost of construction.

Projections of Total School Construction Need

As a result of this new situation, we have revised our projections of the total need for school construction funding as follows:

- **Task Force to Study Public School Facilities: $7.8 Billion.** If a study similar to the 2003 survey were undertaken today and the same or equivalent deficiencies were found, the total cost to correct the deficiencies beginning in the summer of 2016 would increase from $3.85 billion to in excess of $7.8 billion. The $2 billion that was defined as an eight-year goal for State funding in the Public School Facilities Act of 2004 would need to be increased to approximately $4.1 billion, or about $508 million per year over eight years.

  Given the general agreement among LEA facility planners that the deferred maintenance backlog is increasing, it is likely that if the Task Force survey were conducted today, it would find that the list of deficiencies had grown. Without the considerable investment of the State and the local governments over eleven fiscal years, the list would of course be longer.

- **LEA Projections, FY 2016 – 2021: $8 Billion.** The total need for State funding projected by school systems in the FY 2016 – FY 2021 CIP was $4.02 billion, or an

average of $670 million per year.[1] This equates to a total construction value of over $8 billion. However, since local fiscal constraints imposed by reduced property and income tax revenues limit the ability of local governments to provide the required local funding match, it is clear that the actual need is substantially greater than shown in the CIP requests.

- **LEA Facility Assessment Studies: Over $20 Billion.** In September 2014 we reported that facility assessment studies conducted by the six largest jurisdictions in Maryland showed a total of $13.5 billion in deficiencies.[2] Extrapolating for those jurisdictions that had not conducted facility assessment studies, we believed the total need was in excess of $15 billion.

  Since that time, Prince George's County Public Schools has conducted a new study that indicates a total deficiency of about $8.5 billion, substantially higher than the $2 to $3 billion figure shown before. If this increase (which represents the impacts of the current market, the continuing aging of building systems, capacity needs, and the new educational and regulatory requirements) is typical for other large jurisdictions, and if the results are extrapolated across all of Maryland's schools, then it is safe to say that the total of all deficiencies is now in the $20 billion range.

- **Cost to Renovate all Pre-1980 Square Footage: $18.6 Billion.** An analysis of the cost to renovate all pre-1980 square footage in Maryland, based on the IAC figures for July 2016 ($282.00 building-only, $335.58 building-plus-site), shows a total figure of roughly $16 billion, for construction only. If project soft costs are included, the figure increases to $18.6 billion. These figures are for renovations only, and do not account for schools that may warrant replacement, or for additions to existing schools that may be carried out simultaneously with renovations for programming or capacity purposes.

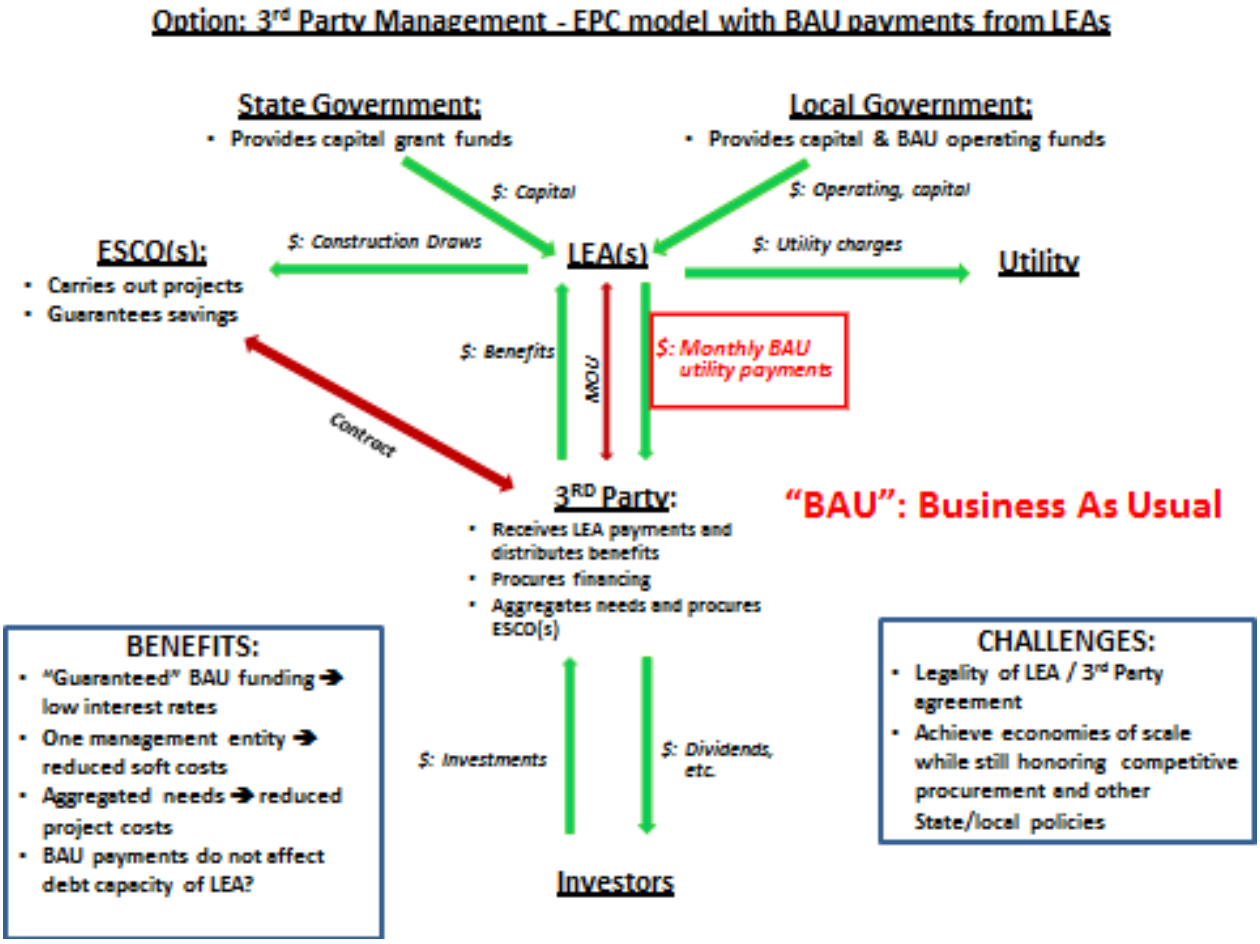
Funding-Financing Study

The IAC is engaged in a funding-financing study in collaboration with the Maryland Energy Administration and the Maryland Clean Energy Center, based on research and analysis conducted in the summer of 2014 with the Governor's Office, the Department of Budget and Management, the State Treasurer's Office, and the Department of Legislative Services. In general terms, the concept would leverage the energy savings achieved through a large-scale performance contract or contracts to carry out more energy projects, or in the most optimistic scenario, to carry out other types of projects as well. We envision a third-party entity that would aggregate need, seek out investors, and negotiate favorable contracts with energy service companies (ESCOs).

The chart below indicates one possible organizational model, in which LEAs would pay the third-party entity their business-as-usual (BAU) payments and would receive in return energy projects at reduced cost due to the effects of a volume program.

[1] This figure includes a construction cost escalation factor of 4% per year.

[2] These studies do not necessarily assess the same items, particularly when they are weighted to account for some element of educational deficiency.



We have met with members of the financial community, with energy service companies, and with LEA facility planners to discuss the parameters of the program. From these conversations we have learned:

- That the financial community does view this as a viable and attractive investment opportunity.
- That the ESCOs believe that a program of this kind, at a regional or statewide scale, will deliver projects at a reduced cost compared to the jurisdictional-level programs that now exist.
- That LEAs would find the program attractive if it does deliver projects at lower cost. However, LEAs indicate that it is important to retain local control of project delivery methods and schedules, and that certain building systems should be specified at the local level while others may be standardized to enhance the savings.

MEA has submitted an application to the U. S. Department of Energy for a grant to conduct an energy assessment of a sample of approximately 140 school facilities, and a cost analysis of a subset of the sample. The results from the sample will be extrapolated to the entire fleet of Maryland schools to determine the total likely energy savings if a large-scale performance contract were carried out.

Concurrently, we will initiate a parallel study of the actual energy-related projects that LEAs intend to carry out in the next six fiscal years. The upcoming FY 2017 – 2022 CIP will provide a partial indication; the total list of projects will also include smaller projects in the ASP and QZAB programs, the locally-funded capital programs, and the LEAs' Comprehensive Maintenance Plans (CMPs). The result of this study will permit more detailed discussion with financiers and ESCOs to refine the estimate of financial benefits and to develop concepts regarding the organizational structure, the financial instruments, and the geographic implications of the proposed program.

If this alternative path proves to be viable, it will not substitute for the State's capital funding programs but will rather stand as a parallel program that will both supplement the conventional capital programs and allow scarce capital program funds to be used more efficiently for non-energy related projects.

FY 2017 Capital Request

The IAC requests the following allocations in the FY 2017 Capital Budget:

Target FY 2017 CIP Allocation:	***$250,000,000***
Target FY 2017 ASP Allocation:	***$6,109,000***
Target FY 2017 QZAB Allocation:	***$4,680,000***
Total Target FY 2017 Capital Allocation:	***$ 260,789,000***

LEA FACILITY PLANNERS MEETING, May 6, 2015
FACTORS INCREASING SCHOOL CONSTRUCTION COSTS

Market Conditions

1. Fewer bidders due to competition from other strong markets – residential, commercial, federal, military, airport, neighboring states
2. Fewer contractors/subcontractors in business after 2008 recession
3. Shortage of skilled and unskilled labor
4. Increased HVAC systems costs
5. Increased site development costs for SWM, geothermal systems,
6. Increased masonry costs
7. Increased contractor's profits compared to recession times

Regulations/Codes/Standards – in general - additional paperwork, stricter requirements; results in both direct costs and indirect cost increases as contractors choose not to participate in school construction, reducing competition.

1. SWM
2. Prevailing wage
3. MEMA (emergency electrical power)
4. MBE
5. LEED – costs of AE/LEED consultant, USGBC registration fee, materials, control systems, commissioning fees
6. ASHRAE 90.1 – results in increased HVAC costs
7. Codes: NEC, IBC
8. ADA access to all program and public spaces – additional space

Time

1. Longer time to get permits
2. Less time allowed for construction
3. Lack of holding schools requires phased construction

Site

1. High site acquisition costs
2. Less than ideal sites requiring soil mitigation and additional structural/civil engineering
3. SWM costs
4. High costs associated with phased construction due to occupied site

Union/DLLR requirements

Additional requirements that go along with prevailing wage rates: labor hiring requirements, overtime pay.

Educational/Community programs - Additional requirements or options

1. Wired and wireless technology in all spaces
2. Additional computer labs for State testing (only some LEAs)
3. security cameras
4. security cameras connected to emergency generators
5. more square footage for specials, students with special needs, community use.
6. single user toilet rooms in classrooms (optional)
7. sinks in every classroom (optional)

Building/Systems Technology

1. Shorter life cycle of computerized controls requires early replacement in less than 16 years
2. More sophisticated and costly control systems

STRATEGIES TO REDUCE OR MITIGATE INCREASES IN CONSTRUCTION COSTS

Design

1. Studying new prototype designs
2. Use steel rather than masonry structure
3. Shared storage spaces between classrooms
4. Eliminate built-in cabinetry, shift cost to FFE budget
5. Increase standardization of classroom design

Specifications

1. Specify open platforms on control systems
2. Eliminate proprietary specifications
3. Improve quality of documents
4. Specify less costly materials, such as PVC over copper piping, and accept greater maintenance/replacement costs in future

Bidding

1. Increased use of add alternates
2. Require contractors to hold bids as many days as possible
3. Bundling bid packages
4. Lock in prices
5. Avoid phasing as much as possible
6. Provide sufficient time for construction (implies early start to design)

Funding

1. Based on side-by-side bidding, accept 24.99% IAC funding to avoid requirement to use prevailing wage rates when appropriate.
2. Separate IT and FFE budgets

Advocacy

1. Support apprenticeship programs by construction trades to increase labor pool
2. Support directing students into construction and building maintenance career technology programs

MONARCH GLOBAL ACADEMY – FIRST FLOOR PLAN
Design Development Brochure, May 2, 2012

ARCHITECTURAL DESIGN

Proposed First Floor Plan

Plan Legend

- CIRCULATION
- CORE EDUCATIONAL PROGRAMS
- SPECIALIZED INSTRUCTIONAL PROGRAMS
- STUDENT SUPPORT PROGRAMS
- ADMINISTRATIVE PROGRAMS
- HEALTH
- BUILDING OPERATIONS

( ) EDUCATIONAL SPECIFICATIONS SQUARE FOOTAGE

0' 10' 30' 60' N

SEI

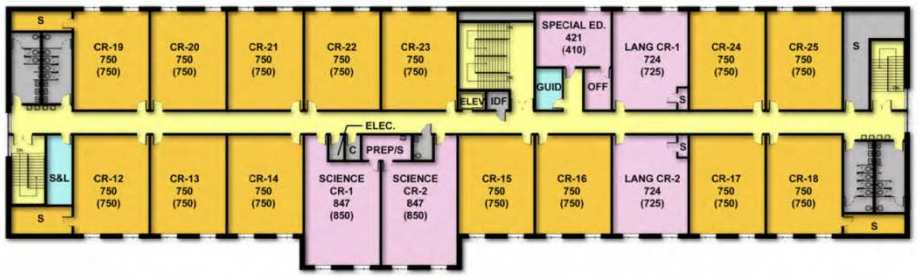
Monarch Academy 21

ATTACHMENT 2

MONARCH GLOBAL ACADEMY – SECOND FLOOR PLAN
Design Development Brochure, May 2, 2012

ARCHITECTURAL DESIGN

Proposed Second Floor Plan



Plan Legend

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( ) EDUCATIONAL SPECIFICATIONS SQUARE FOOTAGE

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SEI

Monarch Academy 22

ATTACHMENT 2

Rolling Knolls Elementary School
Annapolis, Maryland

First Floor Plan

56,558 s.f.

N 0 12' 24' 48'

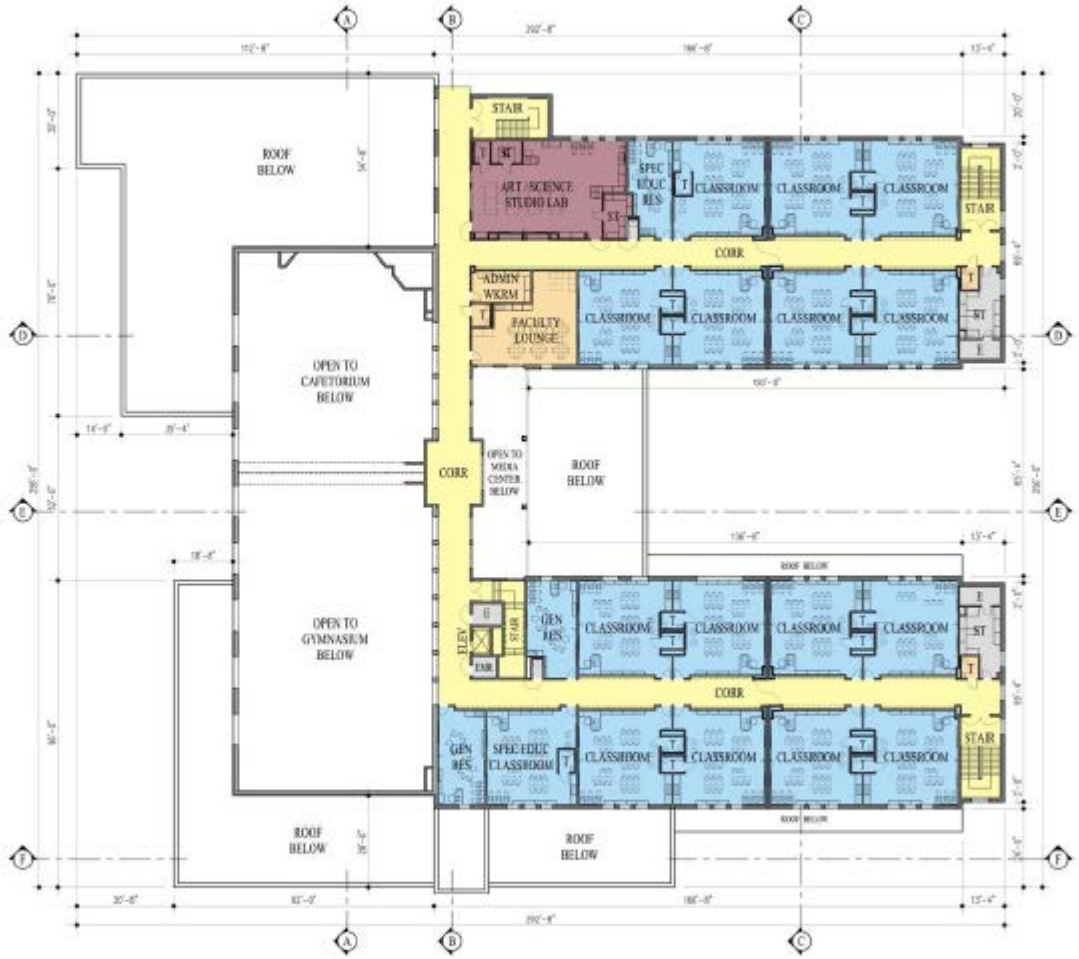
ATTACHMENT 3

Rolling Knolls Elementary School
Annapolis, Maryland

Second Floor Plan

28,782 s.f.

N 0 12' 24' 48'



ATTACHMENT 3