Bond Reimbursement & Grant Review Committee

Report to the Legislature

on

Criteria for Cost-Effective School Construction

December 2017

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Executive Summary

Introduction
This report documents the current work of the Bond Reimbursement & Grant Review Committee in developing criteria for construction of schools in Alaska including standards for energy efficiency and funding eligibility.

Authority & Intent
In 1993, the legislature established the Bond Reimbursement & Grant Review (BR&GR) Committee within the Department of Education & Early Development (DEED).

AS 14.11.014(b) provides that the committee shall

> (3) develop **criteria** for construction of schools in the state; criteria developed under this paragraph must include requirements intended to achieve cost-effective school construction; . . .
>
> (7) recommend to the board necessary changes to the approval **process** for school construction grants and for projects for which bond reimbursement is requested;
>
> (8) set **standards** for energy efficiency for school construction and major maintenance to provide energy efficiency benefits for all school locations in the state and that address energy efficiency in design and energy systems that minimize long-term energy and operating costs.

This enacting legislation provides broad authority for the BR&GR Committee, through DEED, to develop criteria to achieve cost-effective school construction, to recommend processes for funding approval, and to set standards addressing energy efficient design and systems. In this report, the BR&GR Committee is proposing the development of criteria, standards, and processes based on 12 recommendations from three designated subcommittees: the Commissioning Subcommittee, the Design Ratios Subcommittee, and the Model Alaskan School Subcommittee. The recommendations have been through an initial 30-day public comment period. Portions of these proposals anticipate amendment of statute by the legislature. Others would require adoption of regulations by the State Board of Education.

The BR&GR Committee is aware of legislation being considered by the 30th Legislature regarding school construction energy efficiency standards, which would require the development of a series of standards and requirements affecting eligibility for an allocation of fiscal resources to school capital projects funded through AS 14.11, both grant and debt reimbursement. Major elements of the legislation include: 1) establishing a regionally-based maximum cost per square foot amounts for school projects, 2) establishing requirements for commissioning of school projects, 3) establishing standardized systems and components for many building systems, and 4) consideration of establishing a maintenance team to assist districts in maintaining standard systems.

Process
During scheduling of future work products at a BR&GR Committee work session in the spring of 2017, a legislative member of the committee suggested that, due to topics under consideration by the legislature, the committee move up proposed work on cost-effective school construction criteria in order to assist the legislature in its deliberations on that subject. As a base point, the

BR&GR Committee reviewed prior earlier work by the committee, including adoption of the ASHRAE 90.1 energy standard. Identifying areas most likely to provide more immediate and long-term cost savings to the state and districts, the committee formed three subcommittees addressing commissioning, design ratios, and a model Alaskan school. DEED solicited involvement by interested industry partners and school district personnel for each of the subcommittees. The subcommittees met throughout the summer and into autumn collecting data and developing recommended criteria. The BR&GR Committee put the draft subcommittee recommendations out for a month long public comment period and DEED provided announcements to school districts, other state entities, and industry and trade organizations to request feedback; a limited amount of comments were received, but the perspectives represent diverse segments of the state (see Appendix B).

Proposed Criteria, Standards, and Processes

The BR&GR Committee has reviewed and adopted, by majority vote, each subcommittee's recommendations and their associated implementation strategies and is proposing the following criteria, standards, and processes (hereafter referred to as "criteria") in accordance with AS 14.11.013:

Criteria #1 (Commissioning Recommendation #1)
In support of cost-effective school construction, adopt standards for commissioning of building systems in new schools, major additions, and major renovations constructed with state aid. Standards should assist the department in ensuring school projects meet required energy standards.

Criteria #2 (Commissioning Recommendation #2)
Commissioning funded with state aid should be accomplished by a qualified commissioning agent/authority (CxA). The base requirement for a CxA should be an industry-recognized certification but options should be available for alternate qualifications sufficient to help guide the district to the desired level of Cx appropriate for the given project.

Criteria #3 (Commissioning Recommendation #3)
In support of cost-effective school construction, develop and adopt criteria for commissioning in five areas: mechanical, fuel oil, electrical, controls, and building envelope. Criteria should be provided as tools for districts to use in contracting for Cx services or for performing Cx in-house when permitted. *[Note: actionable criteria developed under this item has been completed and is available for review on pages 11 – 16 of this report.]*

Criteria #4 (Design Ratios Recommendation #1)
Adopt the Alaska Climate Zones established by the Alaska Building Energy Efficiency Standard (BEES), and used by the Alaska Housing Finance Corporation, to differentiate allowable ratio ranges, and to support other cost-effective school construction standards as needed. *[Note: a graphic showing the proposed climate zones is available for review on page 27 of this report.]*

Criteria #5 (Design Ratios Recommendation #2)
Implement a school design ratio of Openings Area to Exterior Wall Area (O:EW). Opening Area defined as "the square footage of all windows, doors, and translucent

panels measured to the outside of their frame elements". Exterior Wall Area defined as "the square footage of the exterior vertical enclosure, inclusive of all openings".

Criteria #6 (Design Ratios Recommendation #3)
Implement a school design ratio of Building Footprint Area to Gross Square Footage (FPA:GSF). Building Footprint is defined as "the conditioned square footage measured from the exterior wall face at the lowest floor of the building projected vertically down to a single plane; does not include crawl spaces or areas for building system distribution". Gross Square Footage is defined as "all normally occupied conditioned square footage as measured to the exterior wall face; does not include crawl spaces or areas for building system distribution". This ratio would be applied to facilities in excess of 30,000 GSF.

Criteria #7 (Design Ratios Recommendation #4)
Implement a school design ratio of Building Volume to Net Floor Area (V:NSF). Building Volume is defined as "all conditioned cubic square footage within a building's vapor retarder or elements acting as a vapor retarder at the exterior wall, roof or soffit". Net Floor Area or Net Square Footage is defined as "all normally occupied conditioned square footage as measured to the inside face of walls; does not include crawl spaces or areas for building system distribution".

Criteria #8 (Design Ratios Recommendation #5)
Implement a school design ratio of Building Volume to Exterior Surface Area (V:ES). Building Volume is defined as "all conditioned cubic square footage within a building's vapor retarder or elements acting as a vapor retarder at the exterior wall, roof, or soffit". Exterior Surface Area is defined as "square footage of wall, roof, or underbuilding soffit system at the line of the exterior air barrier or outward most element acting as an air barrier surrounding conditioned space".

Criteria #9 (Model Alaskan School Recommendation #1)
Further develop the Program Demand Cost Model instead of pursuing a state-mandated cost-per-square-foot standard. Actions would include: a) defining/updating geographic cost factors, b) adding detail to the 4.XX Site Work elements, and c) adding detail to the 11.XX Renovation elements.

Criteria #10 (Model Alaskan School Recommendation #2)
Establish a process of reviewing and regularly updating school costs within the Cost Model so that those updates become researched, vetted, and intentional. Vetting could occur as a function of the BR&GR committee or a broader working group, if deemed necessary.

Criteria #11 (Model Alaskan School Recommendation #3)
Develop Model Alaskan School standards by building system (ref. DEED *Cost Format*) to establish the quality and/or quantity of system components needed to ensure cost-effective school construction across the state. Subcommittee resource items 3 and 4 are working drafts.

Criteria #12 (Model Alaskan School Recommendation #4)
As part of describing a Model School that supports an **adequate education**, as contrasted

to a **maximum education**, identify school elements that do not further the core educational mission of the school. These would be elements that are used seasonally or intermittently, benefit a smaller portion of the students, or benefit the community after school hours. The state may choose not to fund these elements, or to fund them at a reduced rate, with the community contributing to the costs.

The BR&GR Committee believes that the preceding criteria, as supported and further developed in this report, establish appropriate, targeted elements that will ensure state aid for school capital projects in Alaska supports adequate school facilities that can be planned, constructed, operated, and maintained in a cost-effective manner. The BR&GR Committee acknowledges there are more comprehensive standards and criteria available in the industry for assessing the full range of school building performance against broad sustainability standards. While it may be appropriate at some future date to adopt such standards—especially as their applicability to Alaskan schools continues to be developed—the BR&GR Committee believes a more targeted, Alaska-specific approach to construction standards, design criteria, and eligibility processes will provide the most direct and intended results.

Implementation

It is envisioned that the proposed criteria, standards, and processes be implemented primarily through regulation. Criteria #12 is envisioned as being established in statute with allowance for possible additional development by DEED in regulation if needed. Since, in some instances, criteria documents will require updating annually (e.g., cost standards, model school systems, etc.) appropriate strategies and language will need to be incorporated to permit this. Furthermore, the standards will be placed in law and administrative code, and not offered as guidance for optional use, so it is essential that they be clear, accurate, and sustainable. To that end, this report identifies a variety of implementation strategies that can be summarized as follows:

BR&GR Subcommittee Efforts

The subcommittees, which were formed to include expertise and leadership from BR&GR Committee members, technical and administrative assistance from DEED staff, and professional knowledge and experience from industry partners, will continue to synthesize research, data, public input, and other factors and will draft recommended regulation language and definitions. Subcommittees will also take responsibility for drafting statements of services for necessary consultant support.

BR&GR Committee Efforts

The BR&GR Committee will continue to provide oversight and will make final proposals to DEED and to the State Board of Education regarding criteria, standards, and processes. The Committee will also approve, as needed, additional subcommittee members as may be proposed by subcommittees. The BR&GR Committee may also make formal requests for input and coordination from other stakeholders as may be needed.

DEED Staff Efforts

DEED staff will draft standards within its areas of expertise and will provide administrative support including solicitation and management of consultant services. Staff will also manage the process of creating or modifying regulations through its normal roles in support of State Board of Education action.

Industry Partners & Stakeholder Efforts
Industry partners and other stakeholders, as may be willing and interested, will participate in identified subcommittee and BR&GR Committee efforts. These could include trade and professional organizations such as the Association for Learning Environments (A4LE), Alaska Energy Efficiency Partnership (AEEP), etc. or individuals.

Consultant Efforts
Seven of the 12 proposed criteria need either special expertise or dedicated time not available within the subcommittee, BR&GR Committee, or department structure. The services identified are primarily cost analysis and energy modeling. A feasibility study of system and component standards also requires some expertise in organizational structure. Consultant services will be managed by DEED on behalf of the BR&GR Committee.

State Board of Education Efforts
All regulations promulgated by DEED must be approved by the State Board of Education. The State Board of Education will consider public comment and DEED recommendations when taking action on proposed regulations. On occasion, when deemed necessary by the State Board of Education, work sessions have been required which could involve any appropriate stakeholders.

Legislative Action
In order to support the implementation of these criteria, standards, and processes, the BR&GR Committee requests that the legislature amend AS 14.11.013(d) and AS 14.11.100(h) to expand the list of school facility features that are not eligible for state aid, or would be eligible at a reduced rate (See Model School Recommendation #4, Subcommittee Resource #9). Statutory language could be detailed, listing specific features, or could identify categories of features and allow or require further definition by DEED, the BR&GR Committee, or by regulation.

Department Action
The BR&GR Committee requests that the DEED Facilities staff solicit, award, and manage the various service contracts recommended to validate and define specific variables as noted.

The BR&GR Committee requests additional work by DEED Facilities staff on legacy documents related to Criteria #11 that the section has been working on over the course of several years.

Estimated Costs
To fully implement the criteria, standards, and processes identified in this report, the BR&GR Committee anticipates a need for approximately $276,200 in one-time expenditures beyond the current costs of the department's staff and supporting costs for committee activity. The additional costs are primarily for professional service contracts for energy modeling, cost estimating, and feasibility study services to refine the proposed criteria identified in the report. These services will ensure that the specific requirements will provide a balance between energy efficient and cost-effective design, durable construction, and district choice of educational program requirements. It is anticipated that there will be $24,000 in annual costs for service contracts to maintain the Cost Model tool and provide updates of geographic cost factors.

Conclusion

The BR&GR Committee is actively and willingly engaged in accomplishing its statutorily assigned duties in the area of cost-effective school construction criteria, energy efficiency standards, and capital funding eligibility processes. Building on efforts initiated a decade ago, the BR&GR Committee has researched and developed 12 proposed criteria that could be used to guide school facility planning, design, construction, and operation to ensure Alaska's resources are used to provide high performing, cost-effective school facilities.

Although led by the BR&GR Committee, this effort requires the input and assistance of individuals and groups with specific knowledge and experience. Many of them are already providing their resources and time to the benefit of students and teachers statewide.

Commissioning Subcommittee
Recommendations for Cost-Effective School Construction Criteria
November 30, 2017

Subcommittee Members
BR&GR Committee: Mark Langberg (chair); Bill Murdock
Department Staff: Wayne Marquis
Industry Partners: JaDee Moncur, Support Services of Alaska; Craig Fredeen, Cold Climate Engineering; Brittany Hartmann, Legislative Staff

Purpose of Subcommittee
Under AS 14.11.014(b)(3), propose standards and criteria for commissioning of school projects with state-aid; identify costs for appropriate allocation of resources.

Subcommittee Activity
The subcommittee met throughout the summer to discuss commissioning issues. In addition to acknowledging the preceding purpose-statement, the subcommittee reviewed and adopted the following mission statement (Subcommittee Resource #2):

> *To provide minimum criteria and expectations to test the performance of a school's mechanical, electrical, plumbing, fuel, controls and envelope systems; to promote energy efficiency of the school and save operational costs over the life of the building.*

Building commissioning (Cx) was recognized as adding value to a school district's overall mission of education by maximizing the operational efficiency of its school facilities. Since Cx is building-specific, benefits are also gained at the individual school level. The subcommittee reviewed Cx protocols and practices and determined that Cx criteria should be developed in the following broad categories: mechanical, fuel oil, electrical, controls, and building envelope.

Other focus areas of subcommittee review included:

- Responsibilities that are common to commissioning agents/authorities (CxA) – Cx tasks can cross traditional disciplines (e.g., building controls (mechanical), building envelope (architectural), etc.). Qualifications and certifications are becoming important.
- Standards and certifications for CxA – as Cx transitions from a specialty to a dedicated profession, there are a growing number of professional and trade associations offering certifications in this area.
- The points in a facility's life-cycle where Cx can be effective – Cx has traditionally been tied to the closeout of capital projects; however, the emergence of retro-Cx has brought attention to the value of ongoing Cx throughout the building life-cycle.

Recommendations
The following subcommittee recommendations are proposed for consideration by the BR&GR committee for inclusion in a December report to the Alaska state legislature. In the October 13 version of these recommendations, the subcommittee included specific requests for comments on its recommendations and welcomed all comments on potential implementation of Cx standards

for school construction. The subcommittee reviewed comments received during the public comment period. Comments were considered and as appropriate incorporated in the work of the committee. Responses to the comments are provided in a separate document. Topic-specific comments and subcommittee responses have been included as an attachment to the recommendations.

Recommendation #1
In support of cost-effective school construction, adopt standards for Cx of building systems in new schools, major additions, and major renovations constructed with state aid. Standards should assist the department in ensuring school projects meet required energy standards.

Basis: The value of Cx increases with the complexity of the systems in a facility. Since the complexity of school capital projects with state aid ranges from simple to complex, Cx should generally only be required on new schools, major additions, and major renovations. There may be smaller projects, focused on one or more of these broad categories of systems, which would be appropriate to be commissioned. Since Cx is a growing field and is touching more and more building systems, required Cx standards (in support of cost-effective school construction) should focus on Cx elements related to meeting required energy standards.

Implementation Strategy:
Several strategies were considered, as listed below. Since the Cx subcommittee thinks the work is mostly complete, the suggested course of action is to have the subcommittee complete the editing of the documents that will become the Cx guidelines.

Item 1 – Cx Subcommittee to develop (or identify currently available) definitions of which projects will require Cx (i.e., new schools, major additions, and major renovations). The subcommittee will also consider exceptions or possible broadened categories if warranted based on research and stakeholder input.

Item 2 – Finalize standards via regulation, amendment to existing handbook(s), or new handbook, as needed, to establish when Cx will be required on school capital projects with state aid. Cx Subcommittee to make recommendations to the BR&GR. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:
Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #2
Cx funded with state aid should be accomplished by a qualified CxA. The base requirement for a CxA should be an industry-recognized certification but options should

be available for alternate qualifications sufficient to help guide the district to the desired level of Cx appropriate for the given project.

Basis: Certifications can be helpful in establishing credentials and high standards should be the norm. However, certain conditions may require flexibility and an alternate path to establishing qualifications on a project-basis.

Implementation Strategy:

Item 1 – Develop language establishing required certifications and align with project categories developed under Recommendation #1. Cx Subcommittee to develop initial criteria with assistance that may be available from industry (see comments attached). BR&GR to review and revise.

Item 2 – Finalize standards via regulation, amendment to existing handbook(s), or new handbook, as needed, to establish when Cx will be required on school capital projects with state aid. Cx Subcommittee to make recommendations to the BR&GR. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:

Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #3

In support of cost-effective school construction, develop and adopt criteria for Cx in five areas: mechanical, fuel oil, electrical, controls, and building envelope. Criteria should be provided as tools for districts to use in contracting for Cx services or for performing Cx in-house when permitted.

Basis: Minimum standards for Cx criteria, updated on a regular basis to conform to industry best practices and current building systems, will provide a basis for the state aid. Standards define expectations and result in greater clarity and equity across all projects.

Implementation Strategy:

Item 1 – Complete outline Cx criteria for the five building system areas. Subcommittee to develop outline-level standards with assistance that may be available from industry (see comments attached). BR&GR to review and revise.

Item 2 – Conduct an independent feasibility analysis and cost-benefit analysis on the development of the outline-level standards into a comprehensive set of state-level Cx Criteria standards. Cost evaluation should include impacts on both operating costs and first costs of facilities. Cx Subcommittee to develop statement of services; DEED Facilities to solicit, award, and manage contract; BR&GR to review and make recommendations.

Item 3 – If supported, finalize standards into either an existing or new department handbook. Implement the use of the handbook through regulation.

Cost to Implement:

Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Item 2 – $15,000 (allows for approximately 60 hours of research and documentation plus expenses).

Item 3 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Subcommittee Resources

The resources below were researched or developed during the subcommittee process and informed the recommendations of the committee. The majority of these documents are available in prior BR&GR committee packets for review (https://education.alaska.gov/Facilities/BRGR/). Certain items are attached or provided in the Appendices, as noted, for simplicity in reviewing the recommendations.

1. Meeting Notes/Recordings
2. Mission Statement
3. Commissioning General Overview – 11-29-17 Draft (Attached)
4. Mechanical Systems Commissioning – 11-29-17 Draft (Attached)
5. Fuel Oil Systems Commissioning – 11-29-17 Draft (Attached)
6. Electrical Systems Commissioning – 11-29-17 Draft (Attached)
7. Control Systems Commissioning – 11-29-17 Draft (Attached)
8. Building Envelope Commissioning – 11-29-17 Draft (Attached)
9. Building Envelope Commissioning CSI Spec – 11-29-17 Draft (Attached)
10. Committee Response to Public Comments (Attached)
11. Public Comments (See Appendix B)

COMMISSIONING GENERAL OVERVIEW

Commissioning shall be the responsibility of a single person charged with organizing and leading the commissioning efforts for the project.

Commissioning Agent/Authority (CxA):

- Be certified in commissioning from ASHRAE, Building Commissioning Association (BCxA), or other recognized standards organization.
- Ideally, should be an independent third party, or
- Could be a member of the design team, or
- If appropriate, could be an employee of the school district (consistent with district's commissioning policy)

CxA Responsibilities may include the following (as determined by contract requirements):

- Coordinate commissioning of the mechanical, electrical, fuel oil, controls, and building envelope commissioning sections.
- Coordinate with Contractor's Commissioning Representative (CCR) and commissioning team.
- Create a Commissioning Plan
- Create commissioning checklists
- Create Functional Performance Tests
- Witness the Functional Performance Testing
- Work to resolve issues found during commissioning
- Create Commissioning Report
- Coordinate with owner maintenance personnel for training

MECHANICAL SYSTEMS COMMISSIONING

Mechanical Systems to be commissioned include:

- All life safety interlocks and safeties including but not limited to
    - Boiler safeties, emergency shut-down
    - Combustion air systems
    - Duct smoke detectors and associated code shut-downs
    - Smoke damper activation
    - Fire suppression systems including fire water storage and suppression activation. These may be delegated to Authority Having Jurisdiction review and approval.
- General
    - Occupied modes and unoccupied mode operation for all systems
    - Remote monitoring and alarm generation
- Plumbing System
    - DEC regulated system parameters are maintained
    - Facility domestic water supply (well pump, storage, etc) function
    - Domestic hot water generation, tempering valve operation, high temperature alarm
- Heating System
    - Hydronic system supply temperature control including heat plant operation
    - Distribution system control including circulation pump operation and failure sequences
    - Terminal heating unit operation including room temperature control
- Ventilation System
    - All damper positions to be visually verified during operation
    - Central ventilation unit controls
        - Fan operation
        - Outside air, return, and relief air damper operation
        - Air temperature control including coil operation
        - Demand ventilation control sequences
    - Terminal ventilation unit operation
    - Building pressurization controls
    - Exhaust air operation
    - Combustion air
- Specialty Equipment (specify)

FUEL OIL SYSTEMS COMMISSIONING

Fuel Oil Systems Commissioned Outline:

- Prior to Functional Performance Testing
  - Fill up tanks
  - Verify tank vents operating properly
  - Test Hi / Low level, leak detection and overflow alarms
  - Test circulation pumps operation (supply and return)

- General
  - All sequences will be tested as approved by the designer
  - Alarm generation and remote monitoring (when present) will be demonstrated

- Commissioning Authority (CxA)
  - Should be independent third party
  - Create all Functional Performance Tests
  - Be on site during Functional Performance Testing
  - Create Commissioning (Cx) Report

- Controls
  - Must provide support for Functional Performance Testing
  - Provide Functional Performance Testing results for review

- Fuel Oil Systems to be commissioned
  - All standalone controlled devices
  - All Direct Digital Control (DDC) controlled devices (when present)
  - Large and small day tank controls integration
  - All other systems as noted in the Mechanical, Electrical, Controls, and Building Envelope commissioning sections
  - Specialty Equipment (specify)

ELECTRICAL SYSTEMS COMMISSIONING

Coordinate commissioning of this section with other systems as noted in the mechanical, fuel oil and controls commissioning sections.

Basic Electrical Systems to be commissioned include:

- Uninterruptible Power Supply
- Standby/Emergency Generator System
- Auto Transfer Switch – Standby
- Auto Transfer Switch – Emergency
- Grounding Systems – Power / Telecom
- Motor Starters / Variable Speed Drives (VSD)
- Lighting Control Systems
- Lighting Fixtures
- Secondary Transformers
- Electrical Distribution Equipment

When included as part of the project, electrical Special Systems to be commissioned may include:

- Fire Alarm System
- Security Systems
- Closed Circuit Television
- Audio Video Systems
- Paging System
- Intercom System
- Entry Intercom System
- Telecom Distribution System
- Telecom Optical Fiber Distribution System
- Specialty Equipment (specify)

BUILDING ENVELOPE COMMISSIONING

Mandatory building envelope testing shall apply to the following types of construction:

- New facilities
- Additions over 2,000 SF
    - Testing to be limited to the addition.
    - Testing may be waived by DEED if logistics of isolating the addition for testing are deemed impractical.
- Major renovations to building envelope as deemed by DEED.

Building envelope commissioning shall include:

- The air leakage rate of the building envelope shall not exceed 0.40 cfm/SF at a pressure differential of 0.3 inches water gauge (75 Pa) in accordance with ASTM E 779 or an equivalent method approved by DEED.

Recommended testing includes the following:

- A vapor barrier integrity visual inspection be completed prior to installation of interior finishes.
- Thermal imaging testing of the building envelope.

A guide CSI Specification is available from DEED to provide owners and designers recommendations for how to complete the air leakage and thermal imaging testing.

BUILDING ENVELOPE Cx SPECIFICATION

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Infrared Inspection of Building Envelopes
B. Related Sections:
   1. Exterior doors and jambs
   2. Exterior windows
   3. Vapor retarder
   4. Air Barriers
   5. Sill Sealer
   6. Sealants
   7. Insulated-core Metal Wall Panels
   8. Metal roof panels
   9. Structural insulated panels

1.03 QUALITY ASSURANCE

PART 2-PRODUCTS

2.01 INFRARED CAMERA/GUN

PART 3-EXECUTION

3.01 PREPARATION

A. Ensure building envelope is completed including all related items from 1.02, B.
B. Prior to inspection building shall be brought to temperature for a minimum of 48 hours.
C. Test requires a minimum difference in temperature between ambient air and building interior of 18 degrees Fahrenheit.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
General Comments	
Commissioning definitely has merit, but why isn't it already included in the final inspection activities? Shouldn't the design team already verify that the building functions as intended before signing off? The reality is their fees are not high enough to cover that level of inspection. *(ref. KChristy, 11-15-17)*	Commissioning (Cx) is not just a final inspection activity, but one that occurs throughout the project. Cx has become its own specialty in many ways. This is in response to the increasing complexity of inter-related building systems and the inclusion of an increasing array of building performance sensors and controls. Typical construction phase services have the design team members certify the contract required construction of a building but not its operation. Fees, as noted, are one issue but services (scope) and credentials are also important pieces. The typical design fees are not high enough to include Cx, unless it is specifically included in the negotiations.
Commissioning can provide overall environmental with long-term cost benefits and should be included as a design/construction standard service. *(ref. MCary, 11-15-17)*	Thank you for the support. Continued efforts will be made to assess the cost-benefits of Cx.
Commissioning of existing facilities with funding to correct deficiencies should be considered as the benefits to the ongoing maintenance and operational costs would be significant. *(ref. MCary, 11-15-17)*	Though included as a focus area in subcommittee review, we did not specifically address Cx efforts outside of a capital project. Retro-Cx, as that is often called, could be implemented within district M&O budgets. The guidelines under our recommendations would be a useful resource for that effort.
The recommendation should use more refined definitions of terms and specific goals for those terms, such as in commissioning. *(ref. TFenoseff, 11-15-17)*	We concur; terms used within any standards will need to be very clear.
Recommendation #1 (Adopt Commissioning Standards)	
What are the specific goals for savings as a result of commissioning (i.e. initial cost of construction, target percentage of first cost, target percent of life cycle cost, etc.)? Once defined, this may inform when and if commissioning should be required. *(ref. KPhillips, 11-15-17)*	Cx can save on both initial cost and create long-term savings. It may not be realistic to try to target a percentage without further research to determine relevant benchmarks. Continued efforts will be made to assess the cost-benefits of Cx.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Recommendation #2 (Qualified Commissioning Agent/Authority)	
Criteria should take into consideration the availability of human resources, and specifically, practical level of credentialing. *(ref. TFenoseff, 11-15-17 & KPhillips, 11-15-17)*	Person doing Cx should be accredited and have relevant experience, in order to better serve the needs of the Owner. The committee recognizes the current limited number of accredited Cx agents in the state. Accreditation is recommended but may not be necessary due to the size and complexity of the project. Implementation of these recommendations will further review the level of credentials and on what size of project those credentials will be required.
School districts outside of urban areas may struggle to retain credentialed Cx entities; increased in overall life cycle costs associated with non-local CxA who may perform commissioning in lieu of local entities should be considered. *(ref. KPhillips, 11-15-17)*	The committee recognizes the current limited number of accredited Cx agents in the state. Implementation of these recommendations will further review the level of credentials and on what size of project those credentials will be required.
General Overview: "...be the responsibility of a 'single person'..."? *(ref. KHeusser, 11-15-17)*	Though Cx might be accomplished by a team of people, a single person needs to be coordinating and leading the effort.
Recommendation #3 (Develop and Adopt Criteria for Commissioning)	
Building Envelope - Potential exists for an incomplete building envelope upgrade to occur (i.e. reroof with portion of exterior walls receiving upgrades, but not all; consider how to test and/or measure outcomes on partial building envelope upgrades. *(ref. KPhillips, 11-15-17)*	We concur that the level of Cx / testing should be commensurate with the type of the project. Implementation of these recommendations will further review how to target Cx requirements to the partial upgrade/building addition project type. Currently, per Recommendation #1, only new schools, major additions, and major renovations are slated for required Cx.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Draft Standards (Committee Resource Items 3 – 9)	
Cx General Overview document comments. *(ref. KHeusser, 11-15-17)* 1) Introduces financial stakeholder services 2) Very weak language (in ref. to "could be") 3) Need org chart (in ref. to commissioning team) 4) Flesh out documentation (in ref. to commissioning report)	Thank you for the input. "CxA" bullet items were revised based on comments 1 and 2. Comments 3 and 4 are project specific and do not need to be addressed in detail by this subcommittee.
Mechanical Systems Cx document comments. *(ref. KHeusser, 11-15-17)* 1) AHJ should not be abbreviated 2) Grammar correction at "Occupied modes . . .") 3) Notes on combustion air (in ref. to HVAC systems)	Thank you for the input. The three comments were incorporated into revisions to the document.
Fuel Oil Systems Cx document comments. *(ref. KHeusser, 11-15-17)* 1) Vents properly operating (in ref. to Fill up tanks) 2) Does this specify certain equipment or is the standard now on standalone equipment? (in ref. to Functional Performance Testing)	Thank you for the input. The first comment was incorporated into revisions to the document. Regarding performance testing of equipment, this is envisioned for both standalone and integrated controls.
Electrical Systems Cx document comments. *(ref. KHeusser, 11-15-17)* 1) Intercom (in ref. to Paging System) 2) Specialty Equipment; Shop (in ref. to a possible missing system)	Thank you for the input. The two comments were incorporated into revisions to the document.
Controls Systems Cx document comments. *(ref. KHeusser, 11-15-17)* 1) And written into as-builts (in ref. to a log of changes to sequence of operations) 2) Should be required if type of work in contract (in ref. to Test and Balance Verification)	Thank you for the input. The first comment was incorporated into revisions to the document. We concur, generally, but leave project specific contractual requirements of work to be established by the Owner.
Building Envelope specification document comments. *(ref. KHeusser, 11-15-17)* 1) Certified building commissioning professional? (in ref. to thermographer qualifications) 2) Radiant systems may take a while to reach stasis (in ref. to a 48hr acclimatization requirement) 3) Suggest make round 20 deg. F (in ref. to delta between ambient and building temps) 4) Flesh out documentation (in ref. to commissioning report)	Thanks you for the input. At 1.04 A.1.: The "Level II certification" will be clarified to incorporate the certifying organization. At 3.01 B.: A generic sentence was added to incorporate this comment. A temperature differential should be established on the basis of a workable minimum. Currently we understand that to be 18 degrees F. *Note:* this spec is still a work in progress, so additional updates will be forthcoming.

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Design Ratios Subcommittee
Recommendations for Cost-Effective School Construction Criteria
November 30, 2017

Subcommittee Members
BR&GR Committee: Dale Smythe (chair); Robert Tucker; Rep. Sam Kito III
Department Staff: Tim Mearig; Larry Morris; Lori Weed
Industry Partners: Ryan Butte, LKSD; Ezra Gutschow, Coffman Engineers; Brittany Hartman, Legislative Staff

Purpose of Subcommittee
Under AS 14.11.014(b)(3), evaluate and propose construction design ratio guidelines for use by the department, school districts, and the design community to design new and renovated school facilities to reduce first cost (construction) and long-term cost (operation).

Subcommittee Activity
The subcommittee met throughout the summer to discuss types of design ratios and the magnitude of potential savings in a variety of climatic areas. The subcommittee aimed for design ratio guidelines that would be straightforward for design professionals, district staff, and the department to be able to interpret and review; would achieve measurable savings for first costs and operational costs; would not repeat or contradict existing laws and regulations; and would not unduly limit educational delivery or program formats.

Major influencing factors on the first cost and operational cost of Alaskan schools is the amount, size, and arrangement of the building's roof, spaces, windows, and doors. While the largest influences on total cost are a school's location, the price of energy, and how the building is operated; control of these elements is outside of the consideration of this subcommittee. Any ratio guideline that reduces heating requirements will have a dramatically different cost impact to a facility located in an area with cold temperatures and high price for energy.

Current design technology makes gathering design element data significantly easier, the proposed design guidelines should be able to be implemented without undue burden on stakeholders.

Other focus areas of subcommittee review included:

- Leadership in Energy and Environmental Design (LEED), a widely used green building rating system. LEED provides for a wide variety of trade-offs, not all of which are applicable throughout the state and do not directly affect first costs or operational costs.
- Collaborative for High Performance Schools (CHPS), focuses on high performance features for benefits associated with improved health, productivity and student performance, decreased operating costs, and increased energy savings. CHPS, like LEED, is holistic in nature, requiring measurements across the full spectrum of sustainability practices, some of which may be less applicable to Alaska. It does not provide for targeted or incremental standards—it's an "all-in" approach. It also requires significant investment and involves third-party oversight.
- Existing climatic zone designations for Alaska. Reviews included climatic zone definitions by IECC/ASHRAE, Alaska BEES, and USGS.
- Aspect design ratio (building's length and width); found to be difficult to apply to all school sizes.

- Solar orientation ratio; found to be too controlling, limited savings potential, and difficult to implement.
- Ratios addressing mechanical systems were discussed as a possibility for future committees, but outside of the committee's current scope of review; potentially interconnecting with the commissioning subcommittee.

The subcommittee gathered information from relatively current constructed school designs to create a bracketed range of existing conditions for consideration relative to possible guideline ratios. This information will continue to be updated, refined and examined as an information source.

The subcommittee has also begun the effort of creating energy use models to illustrate differences between the proposed ratios. Currently under development are models for one- and two-story massing types in each of the four BEES climate zones. The goal of this effort is to gather rough order of magnitude operational cost differences. It will consider a 30-year time span based on local fuel prices and typical escalation. The intent is to inform the subcommittee of the potential value of a guideline implementation.

The intent of the recommended ratios is to encourage building compactness and to limit heat loss through the envelope and envelope openings. The subcommittee also believes that these ratios may result in savings in the area of initial capital costs.

Recommendations

The following subcommittee recommendations are proposed for consideration by the BR&GR committee for inclusion in a December report to the Alaska state legislature. In the October 13 version of these recommendations, the subcommittee included specific requests for comments on its recommendations and welcomed all comments on potential implementation of design ratios for school construction. The subcommittee reviewed comments received during the public comment period. Comments received provided the subcommittee with both a general reaction to the concept of developing standards for design ratios and feedback specific to the subcommittee's five recommendations. The comments demonstrated a need to ensure design ratio standards are based on solid research and computations. A positive response to several of the proposed ratios was received from one school district but concern was expressed about the ability to create these standards versus adoption published standards from other entities. Topic-specific comments and subcommittee responses have been included as an attachment to these recommendations.

Recommendation #1

Adopt the Alaska Climate Zones established by the Alaska Building Energy Efficiency Standard (BEES), and used by the Alaska Housing Finance Corporation, to differentiate allowable ratio ranges, and to support other cost-effective school construction standards as needed.

Basis: The subcommittee sought to identify pre-existing and accepted climate designations. Although the Department of Education & Early Development has adopted the ASHRAE 90.1 energy standard, the standard only identifies two climatic regions in Alaska. The four climate zones adopted by BEES offers more flexibility when establishing design ratio ranges and other cost-effective school construction standards.

Implementation Strategy:
Item 1 – Subcommittee to confirm the availability of the BEES standards for use in Design Ratio standards development (i.e., permission from standards author, frequency and process for updates, etc.)

Item 2 – Subcommittee and BR&GR to ensure there is a clear differentiation between when BEES would be used for a school project with state aid, and when ASHRAE 90.1 would be used.

Cost to Implement:
Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #2

Implement a school design ratio of Openings Area to Exterior Wall Area (O:EW). Opening Area defined as "the square footage of all windows, doors, and translucent panels measured to the outside of their frame elements". Exterior Wall Area defined as "the square footage of the exterior vertical enclosure, inclusive of all openings".

Basis: The O:EW ratio is an indicator of envelope efficiency. Operational costs of a school facility are highly influenced by heat loss through penetrations of the envelope. The comparison is not meant to diminish the proven benefits of natural light on student performance. Current ranges from the *Recent School Projects Design Ratios Data Set* are: Low – 3.99% to High – 49.37%.

Implementation Strategy:
Item 1 – Identify and solicit services; issue a contract for energy modeling services to determine appropriate ratio ranges. Design Ratio Subcommittee to develop statement of services with input as needed. DEED Facilities to solicit, award, and manage contract. Compare existing school ratios and annual energy use to define the most effective ratios. Consider developing area specific ratios based on BEES regions.

Item 2 – Develop regulations, as needed, to establish use of the design ratios to establish eligible cost limits for state aid of school capital projects. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:
Item 1 – $20,000 for energy modeling and data collection services (if combined with other recommendations costs; solicit one contract for all four ratio recommendations for cost savings).

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #3

Implement a school design ratio of Building Footprint Area to Gross Square Footage (FPA:GSF). Building Footprint is defined as "the conditioned square footage measured from the exterior wall face at the lowest floor of the building projected vertically down to a single plane; does not include crawl spaces or areas for building system distribution". Gross Square Footage is defined as "all normally occupied conditioned square footage as measured to the exterior wall face; does not include crawl spaces or areas for building system distribution". This ratio would be applied to facilities in excess of 30,000 GSF.

Basis: The FPA:GSF ratio is an indicator of enclosure efficiency. This ratio is intended to incur benefits relating to stacking (multi-story) efficiencies in school design. Minimum facility size is partly to reflect practicalities of stacking space as well as the difficulties that may be experienced by a smaller community in obtaining certified personnel to service an elevator, if required. Current ranges from the *Recent School Projects Design Ratios Data Set* are: Low – 61.94% to High – 99.34%.

Implementation Strategy:

Item 1 – Identify and solicit services; issue a contract for energy modeling services to determine appropriate ratio ranges. Design Ratio Subcommittee to develop statement of services with input as needed. DEED Facilities to solicit, award, and manage contract. Compare existing school ratios and annual energy use to define the most effective ratios. Consider developing area specific ratios based on BEES regions.

Item 2 – Develop regulations, as needed, to establish use of the design ratios to establish eligible cost limits for state aid of school capital projects. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:

Item 1 – $20,000 for energy modeling and data collection services (if combined with other recommendations costs; solicit one contract for all four ratio recommendations for cost savings).

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #4

Implement a school design ratio of Building Volume to Net Floor Area (V:NSF). Building Volume is defined as "all conditioned cubic square footage within a building's vapor retarder or elements acting as a vapor retarder at the exterior wall, roof or soffit". Net Floor Area or Net Square Footage is defined as "all normally occupied conditioned square footage as measured to the inside face of walls; does not include crawl spaces or areas for building system distribution".

Basis: The V:NSF ratio is an indicator of space efficiency. The volume of air being heated in a school is a large factor of a facility's operating costs. This ratio is intended to address the amount of double-height volume in a facility. Current ranges from the *Recent School Projects Design Ratios Data Set* are: Low – 1260.28% to High – 2158.93%.

Implementation Strategy:

Item 1 – Identify and solicit services; issue a contract for energy modeling services to determine appropriate ratio ranges. Design Ratio Subcommittee to develop statement of services with input as needed. DEED Facilities to solicit, award, and manage contract. Compare existing school ratios and annual energy use to define the most effective ratios. Consider developing area specific ratios based on BEES regions.

Item 2 – Develop regulations, as needed, to establish use of the design ratios to establish eligible cost limits for state aid of school capital projects. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:

Item 1 – $20,000 for energy modeling and data collection services (if combined with other recommendations costs; solicit one contract for all four ratio recommendations for cost savings).

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #5

Implement a school design ratio of Building Volume to Exterior Surface Area (V:ES). Building Volume is defined as "all conditioned cubic square footage within a building's vapor retarder or elements acting as a vapor retarder at the exterior wall, roof, or soffit". Exterior Surface Area is defined as "square footage of wall, roof, or underbuilding soffit system at the line of the exterior air barrier or outward most element acting as an air barrier surrounding conditioned space".

Basis: The V:ES ratio is an indicator of building compactness. The compactness of a building minimizes the heat loss through the envelope. [Note: Data for this ratio has not been developed in the current version of the *Recent School Projects Design Ratios Data Set*.]

Implementation Strategy:

Item 1 – Identify and solicit services; issue a contract for energy modeling services to determine appropriate ratio ranges. Design Ratio Subcommittee to develop statement of services with input as needed. DEED Facilities to solicit, award, and manage contract. Compare existing school ratios and annual energy use to define the most effective ratios. Consider developing area specific ratios based on BEES regions.

Item 2 – Develop regulations, as needed, to establish use of the design ratios to establish eligible cost limits for state aid of school capital projects. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:

Item 1 – $20,000 for energy modeling and data collection services (if combined with other recommendations costs; solicit one contract for all four ratio recommendations for cost savings).

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Subcommittee Resources

The resources below were researched or developed during the subcommittee process and informed the recommendations of the committee. The majority of these documents are available in prior BR&GR committee packets for review (https://education.alaska.gov/Facilities/BRGR/). Certain items are attached or provided in the Appendices, as noted, for simplicity in reviewing the recommendations.

1. Meeting Notes/Recordings
2. Alaska BEES Climate Zone Map (Attached)
3. The Effect of Building Aspect Ratio on Energy Efficiency: A Case Study for Multi-Unit Residential Buildings in Canada, Philip McKeen and Alan S. Fung.
4. Building Aspect Ratio, Kimberly Hickson, AIA, BNIM Architects.
5. The Function of Form: Building Shape and Energy, John Straube, Ph.D., P.Eng.
6. Energy Efficiency of Public Buildings in Alaska: Schools, Cold Climate Housing Research Center, AHFC.
7. Design Guidance for Minneapolis Schools in Minneapolis, Minnesota
8. Recent School Projects Design Ratios Data Set, DEED. (Appendix A)
9. Energy Model Data: Building Footprint Area to Gross Square Footage (FPA:GSF) (Appendix A)
10. Subcommittee September 6, 2017 Report to BR&GR
11. Committee Response to Public Comments (Attached)
12. Public Comments (Appendix B)

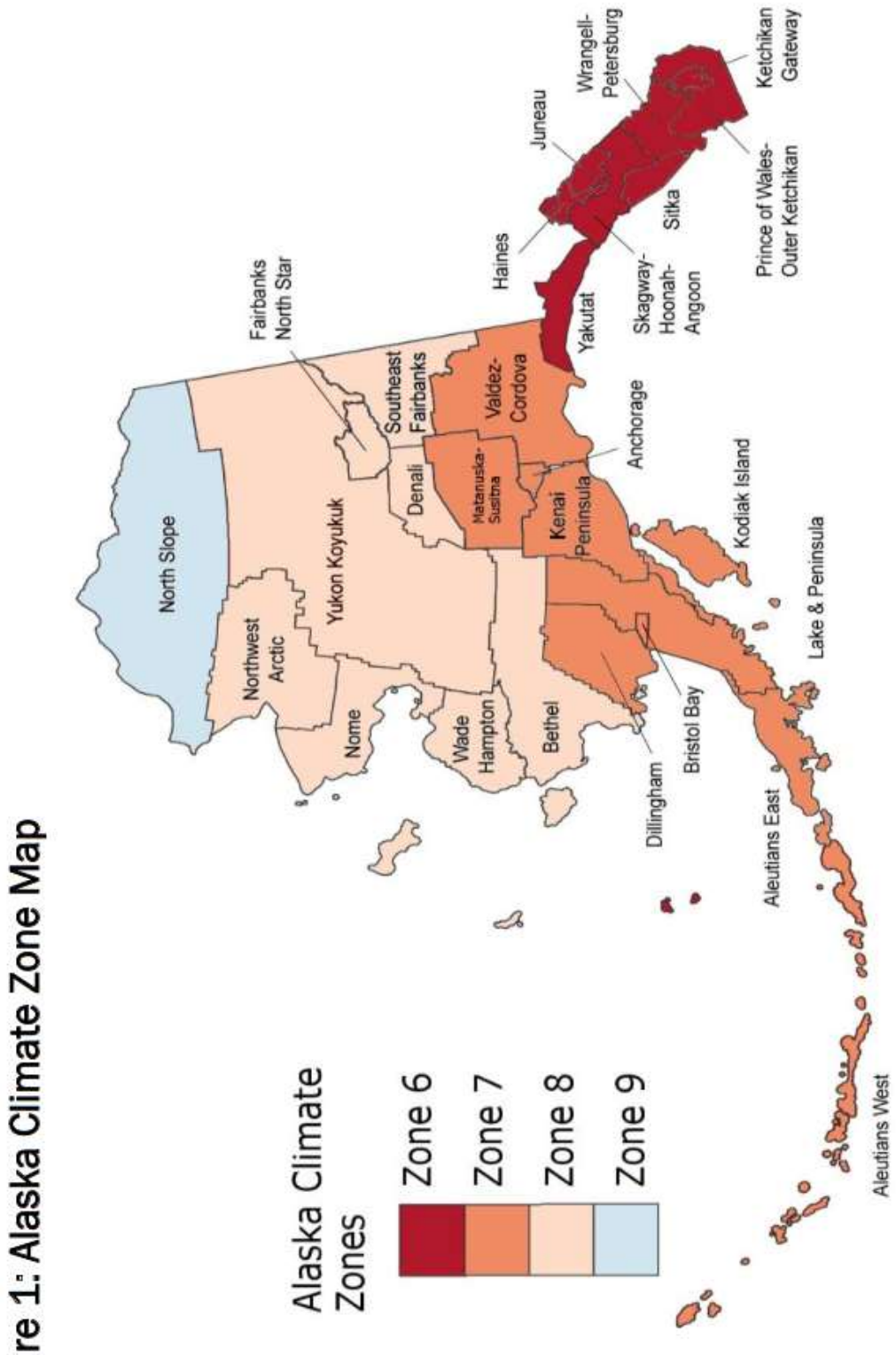

Figure 1: Alaska Climate Zone Map

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PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
General Comments	
What other northern design regions "best practices" (Canada, Scandinavia) were researched related to Design Ratios? The research and decision-making data should reach beyond Alaska, as there are many northern design regions around the world employing high-performance northern school design. *(ref. KPhillips, 11-15-17)*	Research included studies—national and international—related to building form and energy use. Where possible, focus was given to northern climates and schools; however, some reviewed studies included other latitudes and building types. There was a surprisingly limited amount of northern latitude school studies available. Studies reviewed and referenced in meetings are available on DEED's BR&GR web page.
An examination of 'Design Ratios' is very much an examination of 'best practices' in basic design methods applied to our variety of northern design regions. To gain licensure in the state of Alaska, architects must pass a licensing board-approved supplemental course focusing on northern region design. Consider how this course and potential DEED requirements for Design Ratios overlap and are synergistic, and/or conflict in any manner. *(ref. KPhillips, 11-15-17)*	Thank you. We will take care to consider this possible overlap to the extent northern design coursework is available for review. While the concepts covered may align, it is unlikely that the registration coursework identifies or implements design ratio targets or standards. Design Ratios are being considered because currently there are no guidelines, regulation or code requirements that influence building compactness in Alaska. Window-to-wall ratios are considered in certain municipalities and as a part of certain certification but not required on state funded schools.
Criteria for cost-effective school construction should take into consideration availability of human resources: qualified educational, maintenance, and operations staff/recruiting. *(ref. KPhillips, 11-15-17)*	Agreed, most of these variables will be addressed in the companion Model Alaskan School initiative.
One of the most effective and simple to implement means of encouraging more cost-effective building envelopes *is* to change the square footage matrix and *to* go back to calculating school size using interior rather than exterior dimension. *(ref. KChristy, 11-15-17)*	We concur that better performing building envelopes are typically thicker, which puts pressure on the state's school space allocation. That issue is still to be considered and will be outside of this effort.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Washington State might provide a good role model in looking at the process they used to develop the Washington Sustainable Schools Protocol Criteria for High-Performance Schools. It would not be appropriate to adopt the document itself but the result is viewed as a positive tool for that state. *(ref. KChristy, 11-15-17)*	The subcommittee will review the Washington State School Criteria for relatable concepts.
Much of what is discussed is simply daunting to think about implementing and complying. *(ref. KChristy, 11-15-17)*	No more so than building owners and designers complying with other high-performance building criteria such as mentioned in the previous comment. Fortunately, there are tools available to assist in these analyses that easily produce the information requested for straightforward review.
I believe it would have been beneficial for each of the committees to have had representation from both rural and urban educators. It is all too easy to lose perspective that the main purpose of these facilities is to support effective student learning, and we need to look at sustainable future trends and not necessarily continue to support and maintain the current resource-consuming facilities. This involves a big picture statewide conversation as to future educational delivery options based on Alaska's fiscal reality. *(ref. MCary, 11-15-17)*	Subcommittee makeup was open to interested parties outside the BR&GR committee and the department. Research of existing facilities included urban and rural facilities.
I'd encourage a more performance-based approach to design in lieu of an overly prescriptive approach (design ratios) to meet energy goals. *(ref. MCary, 11-15-17)*	Agreed; there is a place for performance-based design. Performance-based standards were reviewed such as those from USGBC, LEED, and CHPS. To date, the subcommittee believes a limited set of Alaska-specific criteria developed on a prescriptive basis would work best.
The recommendation should use more refined definitions of terms and specific goals for those terms, such as in commissioning. *(ref. TFenoseff, 11-15-17)*	We concur; terms used within any standards will need to be very clear.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Recommendation #1 (Adopt Alaska Building Energy Efficiency Standard Climate Zones)	
Clarify if adoption of four BEES climate zones would be substituted for the two climatic regions noted in ASHRAE 90.1 or would ASHRAE 90.1 be replaced as the standard with BEES exclusively. *(ref. KPhillips, 11-15-17)*	The intent of adopting the BEES climate zones is to more specifically represent the different climate zones as they influence facility design priorities when comparing ratios only. The current requirement to meet ASHRAE 90.1 would not change.
Recommendation #2 (Implement Design Ratio Openings Area to Exterior Wall Area)	
I would be in favor of a **lower O:EW ratio** for the following:	
a. Natural light is extremely important but it doesn't take an entire exterior wall of windows to give adequate light. I feel less but strategically placed windows would offer a quality interior natural light effect.	Thank you for the support. Natural light and views to the exterior will remain important factors for owners and designers to consider within the energy-driven limitations of the O:EW ratio.
b. In windy climates like [Bering Strait School District] windows are one of our larger maintenance expenses. We are continually fixing mechanisms and experience full failures as early as 15 years. The glass vendors love us! Our most troubled areas are classrooms with the entire exterior wall length being window. The lack of framing structure between each window creates a weak point, that moves in the wind, which loosens casings and loosens window edges allowing argon to escape. We see this in quite a few of our schools. With a lower O:EW ratio designers may look at getting away from continuous long banks of windows.	Thank you for the input. However, limiting glazing with the O:EW design ratio would not necessarily make up for missing framing. Best practice related to that issue should be incorporated in the proposed Model Alaskan School criteria or in the district's design standards.
c. With LED lighting being used the cost of offsetting natural lighting with electric lighting isn't as big of a deal. Also LED replicates the spectrums of natural lighting much better.	Thank you for the input.
d. And of course the difference between r-5 and r-30 but as time factors in windows are not their original r-value and leak.	Thank you for the input.
e. Less windows, less problems. *(GEckenweiler 11/9/2017)*	Thank you for the input.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
What 'best practices' in educational design were researched during the development of the recommendation? In order to define "good" versus "bad" of an effective range of O:EW ratio, let's be certain we understand as many intimacies/impacts associated with example projects as noted in "Recent School Project Design Ratios Data Set". *(ref. KPhillips, 11-15-17)*	We concur that in establishing allowable ranges within each of these energy-centric design ratios, impacts and trade-offs in other areas will need to be considered. Using recent school project data as a benchmark should go a long way toward balancing best practices in education design. All of the sample schools were unfettered by energy-design ratios as they met education design best practice yet some clearly perform better from an energy standpoint than others.
The concept of implementing a range of school design ratio or O:EW needs to be weighed against impact to student learning. Much health research tells us that humans must have the opportunity to connect visually and physically with the outside. Even though there are many months of darkness in Alaska, students and staff should be afforded the opportunity to visually connect with the natural environment, regardless if its daylight or dark, i.e. windows. The human connection between the built environment and the natural environment is necessary for learning and wellbeing. *(ref. KPhillips, 11-15-17)*	Agreed; natural light and views to the exterior will remain important factors for owners and designers to consider within the energy-driven limitations of the O:EW ratio.
Does this apply to new construction only, or additions as well? *(ref. KPhillips, 11-15-17)*	The implementation of design ratios in additions or renovations has not been discussed in detail but the subcommittee has recognized the potential difficulty.

Recommendation #3 (Implement Design Ratio Footprint Area to Gross Square Footage)

Criteria for cost-effective school construction should take into account the differences between rural and urban cost of construction. *(ref. TFenoseff and KPhillips, 11-15-17)*	Agreed; window and building compactness can affect construction cost; however, the intent of this effort was to consider both construction and operation.
Consider differing levels of criteria for urban versus rural conditions. *(ref. KPhillips, 11-15-17)*	While energy saving is greater considering the price of energy, the goal of this is to reduce energy use in any location.
The practice of design of an efficient building footprint is a basic component of 'good northern design'. *(ref. KPhillips, 11-15-17)*	Agreed; the intent of design ratio standards is to ensure 'good northern design' for all schools with state aid.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Was 30,000 GSF as the trigger for FPA:GSF ratio based on historical or contemporary typical school footprints? Based on trigger of energy loss to a footprint larger than this and therefore an operational cost trigger? In Anchorage School District, our current Ed Specs call for nearly 70,000 GSF of space for an elementary school, which represents our smallest school facility in size; therefore, this FPA:GSF ratio requirement would apply to all new schools within ASD and (assuming) any additions to schools if designed over 30,000GSF. *(ref. KPhillips, 11-15-17)*	The 30,000 GSF trigger was based on the school size above which there would typically be 12 classrooms or more. This was the point at which a stacked classroom wing might be feasible.

Recommendation #4 (Implement Design Ratio Building Volume to Net Floor Area)

The practice of design of efficient spatial building volume is a basic component of 'good northern design'. *(ref. KPhillips, 11-15-17)*	Agreed; the intent of design ratio standards is to ensure 'good northern design' for all schools with state aid.
Assuming building volume of concern is all normally occupied conditioned space, not unconditioned space - clarify. *(ref. KPhillips, 11-15-17)*	Yes, the recommendation defines the volume boundary as "all conditioned cubic square footage . . .".

Recommendation #5 (Implement Design Ratio Building Volume to Exterior Surface Area)

Maybe (V:ES) best defines the goals of these three recommendations [(FPA:GSF), (V:NSF), (V:ES)]. *(GEckenweiler 11/9/2017)*	Thank you for the input.
I would be in favor of a tighter ratio, which would push simplistic building shapes in our climate region.	Thank you for the input
a. When you live in windy NW AK practicalities take over, especially in construction, to a point where unpractical stands out like a sore thumb.	Thank you for the input.
b. Rectangular, fewer wings, lower roof pitch and fewer rooflines are all things folks deem as practical. The local critics will quickly criticize unpractical buildings and praise simplicity.	Thank you for the input.
c. Keeping construction funds in the interiors of the facility has a much greater positive impact on educational environments.	Interesting perspective; thank you for the input.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
d. We have all seen some incredibly beautiful designs utilizing simple shapes. *(GEckenweiler 11/9/2017)*	Thank you for the input.
This criteria seems very similar to Recommendation #4. Data not provided; needs more clarity. *(ref. KPhillips, 11-15-17)*	The difference is between floor area and building surface area as it relates to volume.
Assuming building volume of concern is all normally occupied conditioned space, not unconditioned space - clarify. *(ref. KPhillips, 11-15-17)*	Yes, the recommendation defines the volume boundary as "all conditioned cubic square footage . . .". The recommendation also responds to buildings up on piles and the influence of additional surface area.

Model School Subcommittee
Recommendations for Cost-Effective School Construction Criteria
November 30, 2017

Subcommittee Members
BR&GR Committee: Doug Crevensten (chair); Don Hiley; Representative Sam Kito
Department Staff: Tim Mearig
Industry Partner(s): Dana Menendez, ASD; Brittany Hartmann, Legislative Staff

Purpose of subcommittee
Under AS 14.11.014(b)(3), propose elements and features of a Model Alaskan School that will support an adequate education and for which state resources would be allocated.

Subcommittee Activity
The subcommittee met throughout the summer to discuss Model Alaskan School issues. Our subcommittee could not define one particular Model Alaskan School due to the variances in school construction demanded by Alaska's vast geography and climate. However, it may well be possible to define Model School *standards* that do define adequate Alaskan schools depending on a particular region or set of circumstances, provide for more accurate project cost estimates, and reduce project and operational costs.

Three questions seemed to reoccur in each meeting's discussion:

- Can/should resource allocation using a Model School standard be accomplished by establishing a cost-based framework?
- Can/should resource allocation using a Model School standard be accomplished by establishing the quality and quantity of systems and components?
- Can/should resource allocation using a Model School standard be accomplished by establishing program space allowances and/or space standards, and identifying school elements not eligible for State funding?

This idea of developing a cost-based framework remained an active discussion throughout. The state's Program Demand Cost Model for Alaskan Schools (Cost Model) was identified early on as a promising tool on which to base model school standards and resource allocation because it identifies many elements in a school, and provides methods for establishing fairly accurate estimates for new construction and renovation projects. (However, actual costs for schools can only be determined through the design and construction process.)

Other focus areas of subcommittee review included:

- Shortcomings of the Cost Model and where it might be improved to better reflect Model School standards and more accurately forecast costs.
- Defining the type, quality, and performance factors of Model Alaskan School systems—these standards are currently not defined. This results in an ad hoc, wide variety of systems and components of varying quality and cost.
- Usefulness of establishing Model School standards that define both the minimum acceptable State-funded solution and the maximum acceptable State-funded solution.
- Elements of a school that are currently funded by the State that may be beyond the definition of an "adequate education".

- Alternatives to the Cost Model, such as the cost per square foot approach, and prototypical schools.

Recommendations

The following subcommittee recommendations are proposed for consideration by the BR&GR committee for inclusion in a December report to the Alaska state legislature. In the October 13 version of these recommendations, the subcommittee included specific requests for comments on its recommendations and welcomed all comments on potential implementation of model Alaskan school standards. The subcommittee reviewed comments received during the public comment period. Comments received provided the subcommittee with both a general reaction to the concept of developing standards for a model school and feedback specific to the subcommittee's four recommendations. The comments demonstrated a need to further differentiate between the proposed model school standards and a prescribed prototype school, and to further develop committee and stakeholder understanding about how model school standards might impact choices in education delivery models. Topic-specific comments and subcommittee responses have been included as an attachment to these recommendations.

Recommendation #1

Further develop the Program Demand Cost Model instead of pursuing a state-mandated cost-per-square-foot standard. Actions would include: a) defining/updating geographic cost factors, b) adding detail to the 4.XX Site Work elements, and c) adding detail to the 11.XX Renovation elements.

Basis: *Cost per square foot (CPSF)* limits are difficult to apply to rehabilitation and major maintenance projects. Of the 122 projects on the DEED FY2018 priority lists, only 2 are new construction, making a CPSF approach of limited practical use. Also, many districts do not have the funds to accomplish design and construction documents in support of their projects. A more detailed Cost Model, especially from the foundation down, can serve as a useful (although imperfect) substitute.

The existing *Cost Model* has flexibility to accommodate a wide variety of project types and educational programs. It identifies most necessary elements in any school and provides methods for establishing fairly accurate estimates for new construction and renovation projects, including those elements tied to geography and climate.

Implementation Strategy:

Item 1 – Identify and solicit services; issue a contract for the updates identified in a) through c) of the recommendation. Model School Subcommittee to develop statement of services with input as needed. DEED Facilities to solicit, award, and manage contract.

Item 2 – Develop regulations, as needed, to establish use of the enhanced Cost Model to establish eligible cost limits for state aid of school capital projects. Model School Subcommittee to review pros and cons and make recommendations to the BR&GR. BR&GR to make recommendations to the State Board. DEED Facilities to manage the administrative process of regulation development.

Cost to Implement:
Item 1 – Defining/updating geographic costs - ~$45,000 ($1000/factor at 45 locations). Adding detail to Site and Renovation sections - ~$60,000 ($30,000/section where $15,000 has been the approximate cost of annual updates of the complete tool).

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee and board activity.

Recommendation #2

Establish a process of reviewing and regularly updating school costs within the Cost Model so that those updates become researched, vetted, and intentional. Vetting could occur as a function of the BR&GR committee or a broader working group, if deemed necessary.

Basis: Construction materials and methods advance over time, as do processes and tools for educational delivery. A systematic, on-going review of construction costs, new technologies, and emerging education methods results in a more accurate and useful *Cost Model*.

For example, new technology needs to be reviewed before inclusion in the cost model. Are high performance air barriers and roofing underlayments proven best-practices for building longevity? Are Smart Boards still needed in every classroom? How does adoption of ASHRAE 90.1 as an energy standard impact school building systems? Are educational programming shifts, such as maker-spaces in schools that emphasize project-based learning, accommodated in the Cost Model's space-costs element?

Implementation Strategy:
Item 1 – In conjunction with the department's vendor, HMS Inc., develop a best-practice strategy and timeline for annual updates to the Model Alaskan School that would account for changes in materials and labor, codes/standards, and educational delivery.

Item 2 – Implement the strategy with DEED and BR&GR resources for the initial year. Review and analyze effectiveness of these parties in accomplishing this task.

Item 3 – Seek outside assistance if warranted.

Cost to Implement:
Items 1-2 – ~$1200 for consultant involvement.

Item 2 – $15,000 annually (currently budgeted) for consultant contract. No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Item 3 – $15,000 annually (in addition to Item 2) for industry specialists ($3000/specialist at 5 disciplines).

Recommendation #3

Develop Model Alaskan School standards by building system (ref. DEED *Cost Format*) to establish the quality and/or quantity of system components needed to ensure cost-

effective school construction across the state. Subcommittee resource items 3 and 4 are working drafts.

Basis: Building system and component types, quantities, and quality vary widely across school projects with state aid. Powers granted to the department provide broad authority for the State to revise a project's scope and budget if the costs are excessive and to reject projects not in the state's best interests. The basis for making these determinations could be more transparent if there were written standards.

Many states have documents that lay out standards for the various elements of schools. Others have adopted national standards that reflect 21st Century school design. These documents have the purpose of setting adequate quality standards (minimum acceptable for State funding) and placing limits on costs (maximum acceptable for State funding). Parts of the other states' standards documents can be considered; however, it seems unlikely that incorporation of another state's standards would result in an Alaska-specific document that responds effectively to Alaska's diverse needs.

Model Alaskan School standards would first address systems with a high return on effort expended, such as Mechanical and Interiors, and avoid the impulse to 'regulate everything'. A Model Alaskan School standard should fill a niche between adopted building codes and any detailed school design criteria adopted by districts. This standards document should be meshed with the Cost Model.

Implementation Strategy:

Item 1 – Complete outline of Model School Standards for the remaining DEED CostFormat sections. DEED Facilities to develop outline-level standards with assistance that may be available from industry (see comments attached). BR&GR to review/revise.

Item 2 – Conduct an independent feasibility analysis and cost-benefit analysis on the development of the outline-level standards into a comprehensive set of state-level Model School standards. Cost evaluation should include impacts on both operating costs and first costs of facilities. Additionally, the study should evaluate development of the standards in-house and by contract, and include an evaluation of processes and cost by other states in implementing a customized industry standard (i.e., LEED, CHPS). Model School Subcommittee to develop statement of services; DEED Facilities to solicit, award, and manage contract; BR&GR to review and make recommendations.

Item 3 – If supported, finalize standards into a department handbook. Implement the use of the handbook through regulation.

Cost to Implement:

Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Item 2 – $25,000 (allows for approximately 100 hours of research and documentation plus expenses).

Item 3 – $0 - $50,000 (depending on in-house or contract).

Recommendation #4

As part of describing a Model School that supports an **adequate education**, as contrasted to a **maximum education**, identify school elements that do not further the core educational mission of the school. These would be elements that are used seasonally or intermittently, benefit a smaller portion of the students, or benefit the community after school hours. The state may choose not to fund these elements, or to fund them at a reduced rate, with the community contributing to the costs.

Basis: The extent of non core-education school facility features varies widely across the State. Identifying elements of schools that are not primarily core educational in use, and defining when they would or would not be eligible for state funding, could result in better funding equity and more cost-effective schools. Most examples of these are in site development around the school buildings such as landscaping, running tracks, stadium seating, hockey rinks, turf sports fields, and cross-country trails. Examples of non-core amenities within schools might include bathrooms beyond primary grades, sinks in every classroom, and weight rooms. While a case for the educational benefits of such elements can be made, the question remains, "At what point are we funding on the fringes of educational benefit?"

Implementation Strategy:

Item 1 – Review and finalize current topic paper Non-core Educational Restrictions as a BR&GR recommendation. Include with report to legislature for consideration in development of statutory language under AS 14.11.013(d) and AS 14.11.100(h).

Item 2 – DEED develops regulations to define non-core amenities and criteria for allowable state aid.

Cost to Implement:

Item 1 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Item 2 – No additional costs anticipated outside the current costs of the department's staff and supporting costs for committee.

Subcommittee Comment

Space Allocations

Periodically, the subcommittee's work moved us into discussions about school space. We acknowledged the state's current use of space eligibility as a resource allocation tool, noting its resilience over time. Though the subcommittee did not develop any Model Alaskan School recommendations in the area of space allocations, this isn't meant to indicate that the space component of our current resource allocation model is perfect. The subcommittee accepts that valid concerns may arise in addressing space adequacy and space calculations.

Based on public comment received *(ref. MCary 11-15-17)*, additional work on the allocation of space should take into account the future of education delivery options. Since these comments question the need for continued support and maintenance of the current resource-consuming facilities, presumably this is the opportunity for distance delivery which may impact the overall

amount of space needed statewide. The subcommittee has not developed a position on non-facility education alternatives.

Prototype Schools

Prototypical schools seem attractive as a Model School option because they appear to address the three resource allocation variables of cost, quality, and space in one solution. However, varied construction requirements due to the climatic differences of our vast State make establishing prototypical schools problematic. And, prototypical schools appear to have difficulty incorporating local educational program desires into their designs. (As support for this last statement, Massachusetts identified 16 prototypical school models (flat ground, hillsides, limited space, modular, etc.) and gave districts extra funds if they used those designs. The program was discontinued three years after implementation because local districts wanted the freedom to design schools around their own vision of education, and because cost savings were not significant. https://www.bostonglobe.com/metro/regionals/south/2014/09/13/state-rethinking-model-school-designs-after-touting-them-cost-saving-approach/8OYcz758CWd8dFKxFensuJ/story.html)

Public comment received *(ref. KPhillips 11-15-17)* suggested, if understood correctly, that a fourth area of standards, Planning & Programming, be considered that would establish criteria regarding the functional and programmatic design of schools including a definition of allowed spaces. The subcommittee remains unconvinced that this level of criteria (akin to prescriptive requirements of prototype schools, see above) is in the state's best interest. Additional public comment *(ref. KChristy 11-15-17, and MCary 11-15-17)* supports that criteria regarding educational programs and spaces remain at the district level with the state establishing continued aggregate allocations for proposed student populations.

Subcommittee Resources

The resources below were researched or developed during the subcommittee process and informed the recommendations of the committee. The majority of these documents are available in prior BR&GR committee packets for review (https://education.alaska.gov/Facilities/BRGR/). Certain items are provided in Appendices, as noted, for simplicity in reviewing the recommendations in this document.

1. Meeting Notes/Recordings
2. DEED Cost Model 15th Ed. – Model School Elements (Appendix A)
3. 02 Substructure Construction Standard – Draft (Appendix A)
4. 08 Mechanical Construction Standard – Draft (Appendix A)
5. Prototypical School Articles – Massachusetts & New Jersey
6. District Facility Design Criteria Manuals – LKSD & MSBSD
7. Subcommittee Topic Paper – Mechanical Project Costing Challenges (Appendix A)
8. Subcommittee Topic Paper – Non-core Education Restrictions (Attachment)
9. Subcommittee September 6, 2017 Report to BR&GR
10. The *Cost Model* is available at https://education.alaska.gov/Facilities/FacilitiesCIP.html#CostModel.
11. Committee Response to Public Comments (Attachment)
12. Public Comments (See Appendix B)

BR&GR MODEL ALASKA SCHOOL SUBCOMMITTEE

By: Tim Mearig
Facilities Manager
Phone: 465-6906

Date: Aug 17, 2017

File: g:\br&gr\subcommittees

For: BR&GR Model School Subcommittee **Subject:** Model School Restrictions – Low-hanging Fruit

Committee Topic Paper

Issue

What are some of the most easily identifiable areas where a Model Alaskan School initiative might result in conserving available resources?

Discussion

The lists below are intended to spark an initial discussion in response to the above question.

Exterior and Site Elements

- Parking lots – establish a basis of need that works for various communities and vehicle types.
- Playground/play decks – typically used by the community, establish local responsibility vs. state.
- Fuel storage – establish both quantity and type standards. What establishes adequate? Where does local choice begin? Also, there are a variety of solutions being implemented with widely varying costs.
- Boardwalk/sidewalk – establish a basis of need that works for various communities and accessibility.
- Landscaping – establish a maximum level for state participation.
- Site lighting – coordinate standards with parking and pedestrian needs.
- Headbolt heaters – establish climate standards and quantities for which schools receive them.
- Hockey rinks – similar to playgrounds/playdecks.
- Sports fields – same issues as playgrounds/playdecks; turf fields for every school?
- Ski trails – same issues as playgrounds/playdecks; ski trails for every school?
- Running trails – same issues as above; running trails for every school?
- Event seating/bleachers/storage facilities/scoreboards – same issues as above

Building Systems & Components

- DDC points – establish a maximum number of points/sensors per SF?
- R-value of roofs/walls – does R-80/R-60 have a meaningful payback? The folks at National Renewable Energy Lab that wrote BEOpt suggested the following general answer to this question. We all know that increasing insulation, say in the attic, costs the same for each inch, but it saves less and less energy for each added inch. At some point, your long-term cost will be greater than the amount of money saved in utility bills.
- U-value of windows/doors – same issues as above.

School Programs & Space

- Weight rooms – is this curricular or extra-curricular?
- Running tracks – same issues as above
- Dedicated toilet rooms in classrooms – should there be an age/grade-based standard?

Conclusions

Where significant resource allocations in support of the above categories differ between projects, it would be reasonable to develop a standard.

Public Comment Received	BR&GR Response
General Comments	
Frankly, I just don't see more regulations and criteria improving the process and the end result. *These* may well result in increased costs to Districts for additional services and *will* certainly make the grant process more difficult for the District that need the most assistance. *(ref. KChristy 11-15-17)*	If done well, we expect that these criteria will increase consistency in both cost-effectiveness, and facility parity among school capital projects with state aid. These standards are intended to assist the state in making resource allocations.
As diverse as Alaskan communities are in size, local conditions, and climate how can there be a "Model" school? The differences within a given District are significant. For example, K-12 schools work well in smaller communities but function as schools of choice in larger communities. *(ref. KChristy 11-15-17)*	We recognize that differences in climate and geography are so wide in this state that one physical model for a school building will never work, and none is proposed. The current recommendations are focused on model building systems and features and would continue to allow for development of a wide variety of education delivery models.
State statutes require educational specifications that identify how students are going to be taught and how the building should support that program. This discussion seems to lose sight of the instructional element and the changing role of the teacher and the increased use of Distance Delivery. *(ref. KChristy 11-15-17)*	We recognize that alternative methods of delivering educational programs are on the rise, some of which may not require equally resource-intensive school facilities. This is a huge discussion beyond the scope of this BR&GR subcommittee. That said, the school building-based model of education is practiced most widely in this state and is likely to be around for some time. It is appropriate to examine ways to construct these facilities in more cost-effective ways. (Also see previous response.)
The current square footage formula allows the District to decide what spaces can be shared, where toilet facilities are placed, and what size and type of instructional spaces are needed. *(ref. KChristy 11-15-17)*	The space allocation formula is the state's primary—and to some degree, only—codified resource allocation tool for school facilities. The subcommittee report supports this tool. (Also see previous responses.)

Public Comment Received	BR&GR Response
I believe it would have been beneficial for each of the committees to have had representation from both rural and urban educators. It is all too easy to lose perspective that the main purpose of these facilities is to support effective student learning, and we need to look at sustainable future trends and not necessarily continue to support and maintain the current resource-consuming facilities. This involves a big picture statewide conversation as to future educational delivery options based on Alaska's fiscal reality. *(ref. MCary, 11-15-17)*	Subcommittee makeup was open to interested parties outside the BR&GR committee and the department. (See previous responses addressing changing education delivery scenarios.)
The recommendation should use more refined definitions of terms and specific goals for those terms, such as in commissioning. *(ref. TFenoseff, 11-15-17)*	We concur; terms used within any standards will need to be very clear.

Recommendation #1 (Further Develop Program Demand Cost Model)

Agree with further development of the Program Demand Cost Model in lieu of another method of cost estimating. Considerations include how to gain most relevant information (from whom in industry and how to seek/receive input). *(ref. KPhillips 11-15-17)*	Thank you for the support. Implementation strategies are being considered by the BR&GR and will address comments related to 'who' and 'how'.

Recommendation #2 (Establish Process To Update Program Demand Cost Model)

Agree with establishment of an ongoing process of reviewing and establishing components and systems and current costs of a model school. Considerations include how to gain most relevant information (from whom in industry and how to seek/receive input). *(ref. KPhillips 11-15-17)*	Thank you for the support. Implementation strategies are being considered by the BR&GR and will address comments related to 'who' and 'how'.

Public Comment Received	BR&GR Response
Recommendation #3 (Develop Model School Standards By Building System)	
What is the expected life cycle for a school/school addition to be designed and constructed under these proposed criteria? *(ref KPhillips 11-15-17)*	We believe that life cycle expectations are important and that they vary for the different building systems. We will work to define and establish building system life expectancies within the criteria.
Consider differing levels of cost-effectiveness criteria for urban versus rural conditions since, between these: a) The cost of construction varies, and b) The availability of qualified facilities personnel varies. *(ref. KPhillips 11-15-17)*	If done well, the criteria established will allow for the most cost-effective construction considering all the variables of any specific project. We agree that construction cost and ease of O&M are among the important variables.
Reference made in commentary to national standards and/or other states' design standards. What standards were reviewed outside of Alaska? Quality and longevity should be the driving force of a statewide standard for building systems. Example "sub-structure" standard states buildings over 40,000 GSF should be considered as two story solutions, not one story. How does this relate to "Design Ratio Criteria" as noted in their Recommendation #3 - 30,000 GSF as size threshold? *(ref. KPhillips 11-15-17)*	Sample documents from states with construction standards were reviewed as were national standards from USGBC, LEED, and CHPS. To date, the subcommittee believes a limited set of Alaska-specific criteria would work best. Documents reviewed by the subcommittee are available on the DEED website for the BR&GR. We will work to ensure consistency in any criteria that is developed.
There are some items missing from the Model School Elements for mechanical systems. Also, the Mechanical Construction Standard is a bit out of date. That's the way we designed rural schools 15 years ago. Definitely different preferred strategies for facilities where natural gas is available. Is this document up for review and if so, can I get a Word version of the document? Same with the Model School Elements section. I can make recommendations using Track Changes and send it back to you for consideration. *(ref. CFredeen 10-7-17)*	Thank you for the input. Our implementation recommendations call for vetting building system standards with input from the AEC industry. We welcome your involvement.

Public Comment Received	BR&GR Response
Recommendation #4 (Identify Non Core-Education School Elements For Reduced Funding)	
The definition of "core" education may differ significantly between urban and rural settings. *(ref. TFenoseff 11-15-17)*	Subcommittee work to date suggests that the "core educational mission" does not vary as much as one may think across the state—though the facility needs to support those core elements can vary widely. The subcommittee brought forward this recommendation because our charge was to examine ways to achieve more cost-effective school construction.
This recommendation is challenging by nature of applying one definition to "core education". Every geographic location in Alaska that delivers education has specific needs regarding elements of a school and its site. Elements in one community that may be defined as "core" may not be defined as "core" in another. How to balance the need for cost-effective funding strategies and the need for education to provide core purposes based on community culture? *(ref. KPhillips 11-15-17)*	As defined, non-core includes 'elements that are used seasonally or intermittently, benefit a smaller portion of the students, or benefit the community after school hours.' Criteria developed under this recommendation are unlikely to impact education delivery models or school space.
Consider how this recommendation can be marketed as a partnership opportunity. It's currently written with an undertone that does not recognize the benefit school property provides to communities which ultimately result in betterment of quality of life and economy for all Alaskans. *(ref. KPhillips 11-15-17)*	It is not the intent of the subcommittee to indicate that non-core elements have no value. Often, within the features we have currently identified, there is great value to community life and in formation of character via extra-curricular activities, etc.
This may be a recommendation that needs to be analyzed based on urban and/or non-urban settings, as there are significant differences between core education in an urban setting versus a non-urban setting. *(ref. KPhillips 11-15-17)*	(See previous comments.)
What is the definition of 'adequate education', 'maximum education', and 'non-core amenities'? *(ref. KPhillips 11-15-17)*	The current recommendation, along with its basis, provides the early indicators of these categories. Further development of any criteria will offer specific, clear definitions.

Bond Reimbursement & Grant Review Committee

Public Comment Response

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PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
General Comments	
What analysis has been done to consider the three proposed sets of criteria together? *(ref. KPhillips, 11-15-17)*	In May 2017, the Committee considered options for criteria in a half-dozen categories and selected the three currently identified as the most appropriate. Together, they are the Committee's recommended criteria for cost-effective school construction when considering both first costs and operating costs. Care will be taken to integrate those criteria that are closely aligned—most of those alignments have been expressly acknowledged in the documents prepared to date.
As it relates to these three sets of criteria: What is the definition of 'cost-effective'? What is the definition of 'adequate education'? *(ref. KPhillips, 11-15-17)*	Currently, the Committee does not intend to provide any unique or specific definition of these two terms. The first, though evaluated in many ways, is defined sufficiently for our purposes in its general sense. The second should remain open for continued discussion and development.
Should there be a fourth criteria to measure/assess functional and programmatic designs of schools? Efficiency and savings comes first through flexible, appropriately planning: the building program (list of spaces, adjacencies, and sizes) must define all spaces required, prior to these proposed three criteria being utilized. It makes sense to ensure this component meets the goals of efficiency prior to review of the proposed three criteria. *(ref. KPhillips, 11-15-17)*	The Model Alaskan School subcommittee addresses this in their report under Subcommittee Comments. This Committee likewise remains unconvinced that this level of criteria is in the state's best interest and that criteria regarding educational programs and spaces remain at the district level with the state establishing continued aggregate allocations for proposed student populations.
Assumed order of these criteria in terms of sequence of use in review for efficiency and educational adequacy: Planning/Programming - unidentified as part of this review and comment Design Ratio Model School Commissioning *(ref. KPhillips, 11-15-17)*	Please see the previous comment with respect to Planning/Programming. Otherwise, there is no intent for a precedent of application for the proposed criteria. Some Design Ratio criteria aggregates to the whole-building level but will be based on defined Model Alaskan School elements. Commissioning has the sense of occurring later chronologically but would be integrated with the other criteria during planning and design phases.

PUBLIC COMMENT RECEIVED	BR&GR RESPONSE
Frankly, I just don't see more regulations and criteria improving the process and the end result, and may well result in increased costs to Districts for additional services and certainly make the grant process more difficult for the Districts that need the most assistance. *(ref. KChristy, 11-15-17)*	[From Model School: If done well, we expect that these criteria will increase consistency in both cost-effectiveness, and facility parity among school capital projects with state aid. These standards are intended to assist the state in making resource allocations.]
Is the state willing to accept [commissioning] as an additional project cost? It may well pay for itself but it will still be an increased cost that someone must cover. *(ref. KChristy, 11-15-17)*	The Committee anticipates that the cost of complying with commissioning criteria will be an allowed cost under projects with state-aid.
What about incentivizing cost savings? One effective means of encouraging savings is to allow District to reallocate all or a percentage of what is saved to another priority project. If the District has a true six-year CIP the school that is next on the list can be an effective voice against "scope creep." In my experience Districts tend to manage bond funded projects, where savings can be reallocated, differently than grant projects where unspent funds return to the general fund. *(ref. KChristy, 11-15-17)*	We understand the Committee's statutory charge to develop criteria for the construction of schools as establishing clear guidance for project definition, project prioritization, and establishing the eligible and necessary costs of school capital projects. This current initiative of cost-effective school construction criteria is a subset of the last element. The concept of incentivizing cost savings is not being considered by the Committee under its charge as it runs counter to allocating resources on a statewide priority basis.
Just brainstorming - what about rewarding Districts that reduce energy costs with increased allocation in funding formula (to be applied to maintenance budget)? *(ref. KChristy, 11-15-17)*	Thank you for this input. The Committee does not have purview over adjustments to the foundation funding provisions in statute.
Commissioning can provide overall environmental with long-term cost benefits and should be included as a design/construction standard service. *(ref. MCary, 11-15-17)*	BR&GR will consider including commissioning in the definitions of "construction" and "design services" for the purposes of making it a specific allowable budget cost.

Appendix A

Subcommittee Resources

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Design Ratio

Resources

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Recent School Project Design Ratios Data Set

Compiled for BR&GR Design Ratio Subcommittee
October 10, 2017

BEES Zone	District	DEED Project Description	Grades Served	Gross Square Footage	Net Square Footage	Building Footprint Area	Exterior Wall Area	Exterior Glazing	Exterior Door	Exterior Transp. Panel	Heated Vol. (ft^3)	FPA:GSF	O:EW	V:NSF	Source
7	Mat-Su Borough	New Mat-Su Day School	K-12	21,982	21,105	21,838	26,786	2,857	273	522	390,893	99.34%	13.63%	1852.13%	architect
7	Southwest Region	New Stuyahok K-12 School Replacement	K-12	47,147	45,022	34,098	23,017	2,138	651	326		72.32%	13.53%	0.00%	architect
7	Southwest Region	Koliganek K-12 School Replacement	K-12	18,818	15,988	17,273	14,339	394	405	568		91.79%	9.53%	0.00%	cost est
8	Lower Kuskokwim	Kipnuk K-12 School Renovation/Addition	K-12	51,352	49,684	50,202	19,037	2,866	410			97.76%	17.21%	0.00%	cost est
8	Lower Kuskokwim	Napaskiak K-12 School Replacement	K-12	42,476	41,476	41,469	28,679	2,056	448	640	840,898	97.63%	10.96%	2027.43%	architect
8	Lower Kuskokwim	Kwethluk K-12 Replacement School - Kasayulie #2 - 2015	K-12	46,959	45,434	32,930	32,610	1,269	616	717		70.13%	7.98%	0.00%	cost est
8	Lower Kuskokwim	Nightmute School Renovation/Addition - Kasayulie #1 - 2014	K-12	28,026	26,956	27,200	22,644	807	287	380	555,600	97.05%	6.51%	2061.14%	drawings
8	Lower Yukon	Marshall K-12 School Replacement	K-12	41,510		30,885	22,422	1,629	269			74.40%	8.47%	0.00%	cost est
8	Lower Yukon	Alakanuk K-12 School Replacement	K-12	55,438	53,241	39,763	27,349	2,084	206	376		71.73%	9.75%	0.00%	cost est
8	Lower Yukon	Emmonak K-12 School Addition/Renovation (Data: Addition Only)	K-12	25,627	25,126	24,754	12,072	728	336	707	542,453	96.59%	14.67%	2158.93%	drawings
8	Northwest Arctic	Kobuk K-12 Renovation/Addtion	K-12	16,325	15,522	14,948	14,869	637	143	637	259,356	91.57%	9.53%	1670.89%	architect
8	Yukon-Koyukuk	Andrew K Demoski K-12 School Reno, Nulato	K-12	24,780	21,685	21,810	20,468	485	332			88.01%	3.99%	0.00%	cost est
8	Yukon-Koyukuk	Jimmy Huntington K-12 Renovation/Addition, Huslia	K-12	25,269	24,052	24,312	13,776	601	231	150	303,123	96.21%	7.13%	1260.28%	architect
7	Mat-Su Borough	New Knik Area Elementary School	K-5	44,739	42,444	27,713	24,668	5,630	424			61.94%	24.54%	0.00%	cost est
7	Mat-Su Borough	Iditarod Elementary School Replacement	K-5	51,652	50,387	32,391	25,050	11,887	481		972,890	62.71%	49.37%	1930.84%	drawings
7	Mat-Su Borough	Susitna Valley HS Replacement	6-12	51,286	50,578	47,522	24,680	2,262	525	-	797,119	92.66%	11.37%	1576.02%	drawings
7	Mat-Su Borough	New Knik Area Middle/High School (Joe Redington Jr/Sr High School)	6-12	96,094	92,800	70,550	55,217	5,706	993	-	1,973,025	73.42%	12.13%	2126.10%	architect
8	Kuspuk	Kalskag High School Replacement	7-12	17,929	16,601	17,077	17,939	665	196	282	315,890	95.25%	6.37%	1880.19%	architect
7	Kodiak Island	Kodiak High School Renovation/Addition	9-12	179,104	164,951		42,039	14,921			2,416,420	0.00%	35.49%	1464.93%	architect

FPA:GSF - "Footprint Area to Gross Square Footage"
O:EW - "Openings to Exterior Wall Area"
V:NSF - "Volume to Net Square Footage"

Minimum	61.94%	3.99%	1260.28%
Maximum	99.34%	49.37%	2158.93%
Average	85.03%	14.33%	1818.99%
Median	91.68%	10.96%	1880.19%

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Energy Model Data: Building Footprint Area to Gross Square Footage (FPA:GSF)

Modeling Enclosure Efficiency

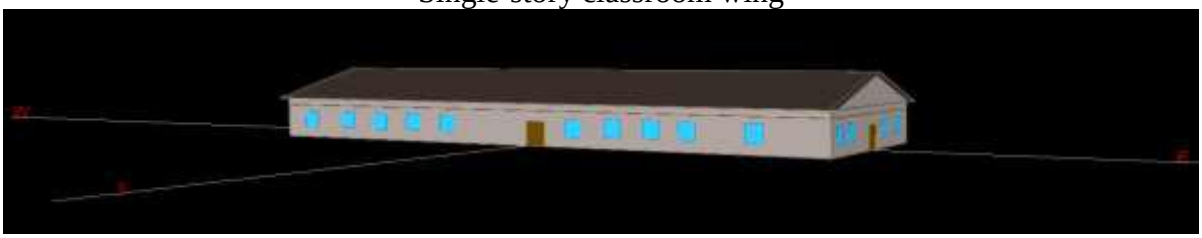
Ezra Gutschow, Coffman Engineers, utilized public domain energy modeling software (eQuest) to compare the estimated lifecycle cost differences between a one and two story building. The model was based on a 12-classroom wing typical of schools in the 30,000gsf range. For simplicity, the interior spaces were comprised only of classrooms and corridors. The total enclosure square footage for the one-story version was 27,303sf while the same enclosure square footage for the two-story version was 21,2787sf—a 22% reduction. Energy modeling was used to compare heat loss at the exterior envelope between the two versions. The thermal properties of the envelope are identical between the two versions and all other functions and details of operation are the same. The primary model variables include the number of occupants and the use of heat recovery ventilation. An occupancy load with 24 persons in each classroom was the baseline. An occupant load with 12 persons per classroom was also developed as being more typical of rural schools. The "1/2 People" version was also run with and without Energy Recovery Ventilation (ERV) units.

Finally, the model compared the variations in each of the four BEES climate regions and used Juneau, Palmer, Fairbanks and Wainwright using climate and energy cost data. Because the model was intended to be used to compare locations where piles and an exposed building soffit would be required, that configuration is reflected in all locations.

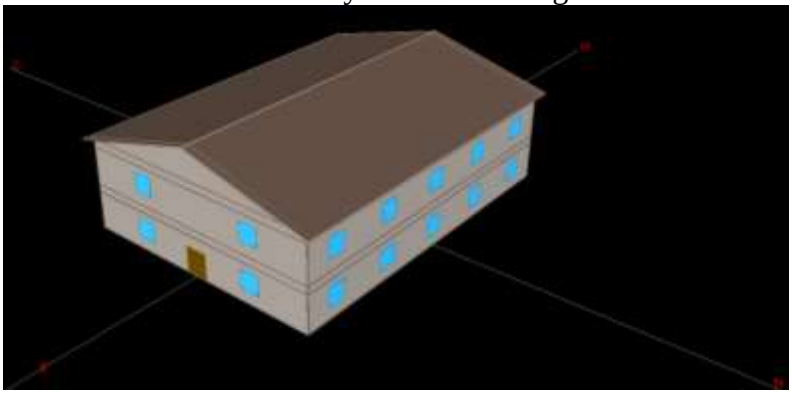
Following are the initial results of the modeling effort, which shows an estimated savings, as expected with a more compact envelope, for area of high heating load and high fuel expense. It also clearly shows the occupant-driven impact of ventilation volume on costs and how the volume of air being moved and heated can quickly reduce any building form or envelope energy savings.

Models

Single-story classroom wing



Two-story classroom wing



Details & Assumptions

	1-Story	2-Story
Geometry		
Total Wall SF	5,777	7,359
Total Exterior Roof SF	13,303	6,796
Total Exterior Window SF	760	760
Total Exterior Door SF	63	63
Total Exterior Floor SF	12,600	6,300
Envelope		
Roof	R-Value = 46.51 h*ft^2*F/BTU	
Wall	R-Value = 19.23 h*ft^2*F/BTU	
Window	R-Value = 1.81 h*ft^2*F/BTU	
Door	R-Value = 1.22 h*ft^2*F/BTU	
Floor (Elevated)	R-Value = 16.13 h*ft^2*F/BTU	
Infiltration	0.0152 cfm/ft^2	
Occupancy		
Population	300 (12 Classrooms, 1 Teacher, 24 Students)	
Hours	0800-1500	
Seasons	Sept 9-Dec 15, Jan 7-March 22, April 8-June 14 (No Summer usage)	
Miscellaneous Loads		
Lighting	0.72 W/SF	
Receptacles	0.09 W/SF	
Mech Equipment		
Type	VAV, no cooling	
Outside Air	4,500 CFM per ASHRAE 62.1	
CFM	Varies per Climate zone and building ratio	
Boiler Efficiency	80%	
Boiler Type	Cast iron sectional, non-condensing, oil fired	
Pump Type	Variable Speed	
Program Used	eQUEST 3.65, using DOE 2.2 engine	

Energy Modeling Output for Ratio Building Footprint Area to Gross Square Footage (FPA:GSF)

City	Story	Climate Zone	Annual Electricity (kWh)	Annual Fuel (Therms)	Electric Cost ($/kWh)	Fuel Cost ($/Gal)	First Year Electric	First Year Fuel	30 Year Electric (Total)	30 Year Fuel (Total)	Total 30 Year (Total)	% (1 Story/2 story)	Notes
Juneau	1-Story	6	28960	6502	$ 0.13	$ 2.88	$3,764.80	$ 13,187.15	$170,239.93	$ 596,307.98	$ 766,547.91	100%	
	2-Story		29190	6489	$ 0.13	$ 2.88	$3,794.70	$ 13,160.79	$171,591.97	$ 595,115.73	$ 766,707.71		
Juneau	1-Story	6	29010	6580	$ 0.13	$ 2.88	$3,771.30	$ 13,345.35	$170,533.85	$ 603,461.48	$ 773,995.33	108%	1/2 people
	2-Story		28910	5932	$ 0.13	$ 2.88	$3,758.30	$ 12,031.10	$169,946.00	$ 544,032.44	$ 713,978.45		
Juneau	1-Story	6	30620	5327	$ 0.13	$ 2.88	$3,980.60	$ 10,804.06	$179,998.16	$ 488,547.01	$ 668,545.16	111%	1/2 People (ERV)
	2-Story		31200	4595	$ 0.13	$ 2.88	$4,056.00	$ 9,319.44	$183,407.66	$ 421,414.21	$ 604,821.86		
Palmer	1-Story	7	29330	7431	$ 0.15	$ 2.47	$4,399.50	$ 15,071.32	$198,940.33	$ 681,507.94	$ 880,448.27	112%	
	2-Story		29290	7481	$ 0.15	$ 2.47	$4,393.50	$ 13,012.73	$198,669.02	$ 588,420.48	$ 787,089.50		
Palmer	1-Story	7	29420	7446	$ 0.15	$ 2.47	$4,413.00	$ 15,101.75	$199,550.79	$ 682,883.61	$ 882,434.40	120%	1/2 People
	2-Story		28980	6835	$ 0.15	$ 2.47	$4,347.00	$ 11,889.05	$196,566.34	$ 537,609.14	$ 734,175.48		
Fairbanks	1-Story	8	30190	10450	$ 0.23	$ 2.50	$6,943.70	$ 18,177.11	$313,986.13	$ 821,948.14	$1,135,934.27	97%	
	2-Story		29600	10857	$ 0.23	$ 2.50	$6,808.00	$ 19,114.44	$307,849.93	$ 864,332.85	$1,172,182.78		
Fairbanks	1-Story	8	30270	10330	$ 0.23	$ 2.50	$6,962.10	$ 17,968.38	$314,818.16	$ 812,509.50	$1,127,327.65	106%	1/2 People
	2-Story		29290	9513	$ 0.23	$ 2.50	$6,736.70	$ 16,748.24	$304,625.83	$ 757,336.13	$1,061,961.96		
Wainwright	1-Story	9	31960	15966	$ 0.14	$ 2.83	$4,554.30	$ 28,109.15	$205,940.21	$1,271,063.67	$1,477,003.88	94%	
	2-Story		29800	15364	$ 0.14	$ 2.83	$4,246.50	$ 30,619.80	$192,021.85	$1,384,592.28	$1,576,614.12		
Wainwright	1-Story	9	32060	15764	$ 0.14	$ 2.83	$4,568.55	$ 31,416.99	$206,584.58	$1,420,639.98	$1,627,224.56	108%	1/2 People
	2-Story		29590	14562	$ 0.14	$ 2.83	$4,216.58	$ 29,021.45	$190,668.67	$1,312,316.63	$1,502,985.31		
Wainwright	1-Story	9	34070	13147	$ 0.14	$ 2.83	$4,854.98	$ 26,201.42	$219,536.39	$1,184,797.88	$1,404,334.27	113%	1/2 People (ERV)
	2-Story		32160	11520	$ 0.14	$ 2.83	$4,582.80	$ 22,958.87	$207,228.95	$1,038,173.85	$1,245,402.80		

Intentionally Blank

Model School

Resources

Intentionally Blank

Model School Elements – DEED Cost Model 15th Ed.

02 - SUBSTRUCTURE

Excavate for footings and backfilling

4,000 psi concrete footings & walls (incl. forms and rebar)

2" insulation to wall

Dampproof

6" fill, Type II, 2" minus

4,000 psi concrete slab

10 mil vapor retarder

6"x6" - W1.4xW1.4 welded wire mesh

Slab cure, finish, and joints

03 - SUPERSTRUCTURE

(MEZZANINE FLOOR FAN ROOM)

W-beams

T.S. columns

Plates, anchors and grout

Bar Joists

Angles

1 1/2" metal deck, 20 gauge

Concrete topping

6"x6" - W1.4xW1.4 mesh

Slab cure, finish, and joints

Pump concrete

Steel access ladder (8'0")

(ROOF STRUCTURE)

Plates, anchors and grout

Tube steel columns

Steel joists

W-beams

T.S. bracing

Angles, connectors, etc.

3" metal deck, 20 gauge

(MISCELLANEOUS)

Testing/inspection

Crane rental

04 - EXTERIOR CLOSURE

EXTERIOR WALL

2"x10" studs, 16" o/c

2"x6" studs, 16" o/c

1/2" plywood CDX AWW sheathing

3/4" beveled cedar 10" siding, tite knot

1"x4" cedar trim

Sealant

Air barrier

R-30 batt insulation

R-19 batt insulation

10 mil vapor retarder

Model School Elements – DEED Cost Model 15th Ed.

5/8" Type X gypboard

Tape and finish

3/4" CDX AWW plywood soffit

2"x6" framing and nailers to soffit

Rigid eave vent screen

Fascia 1/2" CDX plywood (both sides)

3/4" beveled cedar 10" siding to fascia, tite knot

2"x4" framing for fascia

Flashing

1"x6" interior trim

DOORS

Hollow metal insulated frames for 3'0"x7'0" doors

Hollow metal insulated frames for 6'0"x7'0" double doors

3'0"x7'0" hollow metal insulated single doors

3'0"x7'0" hollow metal insulated doors with vision panel (for double doors, each leaf counted separately)

Hardware for single exterior doors

Hardware for double exterior doors

Hardware for double exterior doors with panic hardware

Motorized operable accessible door

WINDOWS

Metal clad insulated windows with screens

Sills

CAULKING

Sealant and backer rod

PAINTING

Stain siding and fascia

Stain trim

Stain soffit

05 - ROOF SYSTEMS- General Contractor

GENERAL CONTRACTOR

PITCHED ROOF

5/8" fire treated CDX plywood

R-50 rigid insulation (8" plus)

5/8" gypboard sheathing

Vapor barrier

SUBCONTRACTOR

Klip Rib metal roofing including fasteners, etc.

Ice and water shield at eaves

Ridge flashing

Flashings

Fascia board and flashing

06 - INTERIORS

GENERAL CONTRACTOR

PARTITIONS

3 5/8" metal, 20 gauge studs at 16" o/c and track

Model School Elements – DEED Cost Model 15th Ed.

6" metal, 20 gauge studs at 16" o/c and track

5/8" Type X gypboard

Tape and finish

1/2" cement board

1/2" plywood backing

2"x6" blockings

2 3/4" sound insulation

DOORS

3'0"x7'0" hollow metal frames

6'0"x7'0" hollow metal frame double door frames

3'0"x7'0" solid core doors

3'0"x7'0" solid core doors with glazed opening

Hardware for single doors

Hardware for double doors

Rolling grille at kitchen serving line

GLAZING

Relights in hollow metal frame

SPECIALTIES

Toilet partitions, HDPE

Toilet partitions, handicapped

Toilet accessories

Lockers

Chalkboards/white board

Tack boards

Fire extinguishers and cabinets

Signage

06 - INTERIORS

SUBCONTRACTOR

FLOOR

Carpet

Carpet inlays

Gym flooring, wood and channels

Mosaic ceramic tile

Vinyl tile

Sheet vinyl

Linoleum

Concrete sealer and hardener

BASE

4" rubber

6" coved

Ceramic tile base

Wood base

WALLS

Paint (3 coats)

Ceramic tile

Vinyl wall covering (14 ounce)

Model School Elements – DEED Cost Model 15th Ed.

FRP board

Carpet

CEILINGS

Acoustical ceiling tile glued to gypboard

Suspended acoustic ceiling

Suspended gypboard taped and sanded

Paint gypboard ceiling

PAINTING

Interior trim and sills

Single door frames

Double door frames

Doors

Paint miscellaneous metals

08 - MECHANICAL

PLUMBING

Cast Iron Waste, Vent Pipes and Fittings

4" diameter pipe

3" diameter pipe

2" diameter pipe

1 1/2" diameter pipe

4" floor cleanout

3" VTR

4" VTR

Hot and Cold Water Copper Pipes and Fittings

2" diameter copper pipe

1 1/2" diameter copper pipe

1 1/4" diameter copper pipe

1" diameter copper pipe

3/4" diameter copper pipe

1/2" diameter copper pipe

2" diameter coupling

1 1/2" diameter coupling

1 1/4" diameter coupling

1" diameter coupling

3/4" diameter coupling

1/2" diameter coupling

2" diameter fittings (tee/elbow)

1 1/2" diameter fittings (tee/elbow)

1 1/4" diameter fittings (tee/elbow)

1" diameter fittings (tee/elbow)

3/4" diameter fittings (tee/elbow)

1/2" diameter fittings (tee/elbow)

Clips and hangers to support pipes

Valves and gauges

1" insulation

PLUMBING FIXTURES

Model School Elements – DEED Cost Model 15th Ed.

Standard closet wall, flush valve and carrier

Standard closet, handicapped

Urinal, flush valve and carrier

Counter mounted lavatory basin

Mop sink

Stainless steel drinking fountain cooler with bottle refilling station

Stainless steel classroom sink

Work room sink

Nurse's sink

Three compartment sink

Hand sink

Shower stall and controls

Connection to kitchen equipment

2" to 3" diameter floor drain

Hose bib, non-freeze

119 gallon hot water generator

Circulation pump

20 GPM grease interceptor

HEATING

1,600 MBH cast iron oil/gas fired boiler, hot water/glycol complete with controls

10" diameter stainless steel flue and breaching, double wall

Flue cap

55 gallon expansion tank

Air separator, 3" strainer

Glycol make-up tank with feed pump

Glycol fluid

3" diameter circulation pump

3" diameter copper pipe

2 1/2" diameter copper pipe

2" diameter copper pipe

1 1/2" diameter copper pipe

1 1/4" diameter copper pipe

1" diameter copper pipe

3/4" diameter copper pipe

3" diameter coupling

2 1/2" diameter coupling

2" diameter coupling

1 1/2" diameter coupling

1 1/4" diameter coupling

1" diameter coupling

3/4" diameter coupling

3" diameter fittings (tee/elbow)

2 1/2" diameter fittings (tee/elbow)

2" diameter fittings (tee/elbow)

1 1/2" diameter fittings (tee/elbow)

Model School Elements – DEED Cost Model 15th Ed.

1 1/4" diameter fittings (tee/elbow)

1" diameter fittings (tee/elbow)

3/4" diameter fittings (tee/elbow)

Clips and hangers to support pipes

Valves and gauges

1 1/2" insulation

Cabinet unit heaters

Unit heaters

(2) rows fin tube and enclosure

COOLING (SUBCONTRACTOR)

10 ton, DX type electric air conditioner unit

Make-up system equipment

Refrigerant, 30 lbs. cylinder

2" diameter coolant supply and return pipes with fittings

1" diameter coolant supply and return pipes with fittings

2" diameter circulation pump

Valves and gauges

(2) rows coil (10 SF)

1 1/2" insulation

AIR SYSTEMS

32,000 CFM air handling unit

2,000 CFM to 3,000 CFM exhaust fan

750 to 1,500 CFM exhaust fan

200 CFM to 750 CFM exhaust fan

500 CFM VAV boxes

2 SF heating coils

Galvanized ductwork with hangers and connections

10" flexible duct

Outside air/exhaust louvers with bird screens

Dampers under 1 SF

1 SF to 2 SF dampers

2 SF to 5 SF dampers

1 SF to 2 SF motorized dampers

Small grille, register or diffuser

Medium grille, register or diffuser

Large grille, register or diffuser

2" insulation

2" lining

CONTROLS, TESTING AND BALANCE

Microprocessor, digital equipment, software and programming

DDC points

Thermostats

Thermostats with guards

Testing and balancing

Model School Elements – DEED Cost Model 15th Ed.

Commissioning

FIRE PROTECTION

Sprinkler riser and valves

Fire department connection

Wet sprinkler system throughout facility

Design fee and commissioning

GAS/FUEL OIL

1" diameter black steel pipe supply line including fittings

Connection to equipment

50 gallon day tank with duplex pumps

3/4" diameter black steel pipe including fittings

Valves

Connection to equipment

Testing

09 - ELECTRICAL

SERVICE AND DISTRIBUTION

1,600 amp main enclosed disconnect

MDP main distribution panel with 1,600 amp bus and fused switches

3 1/2" diameter rigid steel conduit and fittings

3 1/2" diameter x 90° elbow

2" diameter IMC conduit

1 1/2" diameter IMC conduit

1 1/4" diameter IMC conduit

1" diameter IMC conduit

500 KCMIL copper wire

#1/0 THHN copper wire

#2 THHN copper wire

#4 THHN copper wire

#4 ground wire (10'0") and connect to building

225 amp, 120/208V, 4 wire, 3 phase, 42 circuits, MLO subpanel

100 amp, 120/280V, 4 wire, 3 phase, 30 circuits subpanel

FIXTURES

2'0"x4'0" LED troffer

1'0"x4'0" LED troffer

4'0" surface LED wraparound

6" diameter surface wet location LED downlight fixture

LED high bay gym fixture

LED exit signs with battery

Self contained dual head emergency light

LED wall pack with cut off optics, building mounted exterior light fixtures

Recessed soffit LED fixture with tempered lens, tamperproof

DEVICES

Model School Elements – DEED Cost Model 15th Ed.

Single switch

Three way switch

Keyed switch

Dual technology occupancy sensor

Occupancy sensor/switch

Wall switch with built-in motion sensor and control switch

20 amp duplex outlet

GFI duplex outlet

Quadraplex floor outlet

GFI 15 amp duplex outlet, weatherproof

50 amp special outlet

30 amp special outlet

Junction box with cover

Emergency light connections

Night light connections

100 amp, 4 pole electrical HID contactor

K-1900 photocell/time switch

30 HP, 3 phase, 208 volt motor connection

10 HP to 7 1/2 HP, 3 phase, 208 volt motor connection

5 HP to 1 HP, 3 phase, 208 volt motor connection

Fractional motor connection

Thermal switches

60 amp, 3 pole fused disconnect switches

Fused disconnect switches, weatherproof

10 HP combination motor starter/disconnect switch

Conduit and Wiring

1" diameter EMT conduit

3/4" diameter EMT conduit

1/2" diameter EMT conduit

#6 THHN

#8 THHN

#10 THHN

#12 THHN

FIRE ALARM SYSTEM (ADDRESSABLE)

16 zone fire alarm control panel, including standby batteries and charger

Fire alarm graphic annunciator

Manual pull station (break glass type)

Combination horn/strobe

Combination horn/strobe, weatherproof

Strobe only

Magnetic door hold release

Smoke detectors ionization

Heat detector

Duct detector

Model School Elements – DEED Cost Model 15th Ed.

Connect to trip circuit

Connect to TTB

Connect to intercom system

Tamper switch connection

Flow switch connection

Junction box

1" diameter EMT conduit

6 strand fire alarm wiring

DATA/TELECOMMUNICATION SYSTEM

4'0"x8'0"x3/4" AC grade plywood backboard

50-pair telecom termination blocks

19"x84" free-standing data equipment racks

Plug strips

48-port patch panels

Cable management panels

Fiber optic cable patch panels

Connection to fire alarm system

Single jack telephone outlets

Single jack data/telephone outlets

Two-jack data/telephone outlets

Three-jack data/telephone outlet

Four-jack data/telephone outlet

Two-jack data/telephone outlets, floor mounted

Four-jack data/telephone outlets, floor mounted

Three-jack data/telephone outlet, ceiling mounted

Wireless access points

Smartboard interface

Junction boxes

12" cable tray

4" diameter EMT conduit

3" diameter EMT conduit

1" diameter EMT conduit

3/4" diameter EMT conduit

Category 6 data cable

100 pair Cat 3 copper voice backbone

50 pair Cat 3 copper voice backbone

12-strand fiber

Single mode fiber

Ground bar

#2/0 bare copper ground

PUBLIC ADDRESS SYSTEM

Link module

Power amplifier

Equipment rack

Power amplifier

Model School Elements – DEED Cost Model 15th Ed.

AM/FM tuner

Cassette deck/CD player

Clock/speaker

Digital clock

Speakers

Speakers, weatherproof

3/4" diameter EMT conduit

4-pair Cat 3 wire

25-pair Cat 3 wire

SECURITY SYSTEM

12-zone security control panel with keypad, including stand-by batteries and charger

Headend equipment

Classroom door lockdown hardware/interface

Card readers

Door security contact

Glass break detector

Infrared motion detector, long coverage

Connection to fire alarm system

3/4" diameter EMT conduit

6-plenum security wire

Camera cable

SET, RESET AND LOCKDOWN FEATURES

Set, reset and lockdown system interface with door access system (allowance)

VIDEO SURVEILLANCE SYSTEM

Data network switch, VOIP network switches, VOIP server

CCTV server

Video recording and monitoring equipment

Interior ceiling mounted cameras

Exterior cameras, weatherproof heated enclosure

3/4" diameter EMT conduit

Category 6 cable

6 strand fiber optic cable

PUBLIC ADDRESS SYSTEMS (GYM AND STAGE)

Mixer/pre-amplifier

Eight channel auto/gate

Equalizer

Power amp

Power amp, dual channel

CD multi-player

AM/FM tuner

Speakers

Wireless receiver

Stand type microphones

Desk top microphones

Model School Elements – DEED Cost Model 15th Ed.

Wireless microphones

Microphone floor outlets

Microphone stands

Equipment racks

Over-voltage protection

Microphone cable

Cat 6 speaker cable

HEARING IMPAIRED AUDIO SYSTEM

Master transmitter

Slave transmitter

Infrared radiator with wire guard

Stethoscope style receiver

Lanyard style receiver

3/4" diameter EMT conduit

Cat 6 wiring

EMERGENCY POWER

150 KW oil-fired emergency diesel generator including accessories and fuel tank

Connection to leak detection system

Connection to level indicator

600 amp automatic transfer switch

600 amp emergency distribution panel

100 amp, 120/208 volt, 30 circuits MLO emergency panel

225 amp, 120/208 volt, 42 circuits, 4 wire, 3 phase MLO standby panel

1 1/4" diameter EMT conduit

2" diameter EMT conduit

2 1/2" diameter rigid steel conduit with fittings

#2 THHN copper

#1/0 THHN copper

#3/0 THHN copper

#4/0 THHN copper

MISCELLANEOUS

Testing and certification

10 - EQUIPMENT AND FURNISHINGS

SPORTS EQUIPMENT

Practice basketball goal, wall mounted (height adjustable)

Fixed basketball goal, structure mounted

Floor markings (subcontractor)

Floor inserts

Chinning bar

Climbing pegboard

FOOD PREPARATION AND LAUNDRY EQUIPMENT

Refrigerator

Freezer

Convection oven

Model School Elements – DEED Cost Model 15th Ed.

Stacked washer and dryer

Range with hood

Under counter refrigerator

PROJECTION SCREENS

70"x70" manual projection screen with glass beaded viewing surface at classrooms

FURNISHINGS

Horizontal window blinds

Rubber entry mat

Plastic Laminated Casework

9" deep x 12 3/4" high plastic laminated boot cubbies with (2) open face compartments with top shelf

Overall 20'0" long x 2'6" deep x 3'0" high (2) tier receptionist desk with doors, knee space, drawers one side and plastic laminated top

3'0" high base cabinet including top

36" wide x 2'6" high x 14'0" tub storage cabinets

4'0" wide x 7'0" high storage cabinets with adjustable shelves

3'0" wide x 7'0" high lockable cabinets with rod and shelf

2'6" high wall units

1'6" high open shelf units

Kitchenette base unit

Wall mounted cabinet

3'0"x3'0" music room and waiting closets

12" high x 17'6" wide cubbies in kindergarten

IMC stacks

13 - SITE AND INFRASTRUCTURE
General Contractor

SITE PREPARATION

Clear site, grub up roots and remove from site (excludes trees)

Staking and survey

SWPPP including inspection and maintenance

Dewatering pump

Excavate and remove material from site

Geotextile fabric

Type 2 filling and compaction, 4" minus

Dust control

Compaction tests

SITE IMPROVEMENTS

Type 2 filling and compaction, 4" minus

4" D1 base course

2" asphalt paving

Joint to existing

Marking

24" diameter, 14 gauge CMP culvert

Traffic sign, post and footing

Model School Elements – DEED Cost Model 15th Ed.

Concrete curbs

4" concrete walks

Landscaping

Topsoil

Seeding

6'0" to 8'0" birch

8'0" to 10'0" mountain ash

6'0" to 8'0" crab apple

15" to 18" cotoneaster

3'0" to 4'0" spirea

1"x4" pine edging

Mulch wood chips

Site Furnishings

Building sign

Bike rack, 14 bikes

8'0" aluminum bench with back

24" square x 30" high trash receptacle

30'0" aluminum flagpole and concrete base

Playground

50'0"x60'0" game time composite play structure

Swing sets, 2 seat structure

4'0" crawl tube

Soccer goals (2 each)

2 1/2" thick interlocking rubber tiles, 24"x24" safety surface (6'0" rated fall)

Fence

6'0" high chain link fence

6'0"x10'0" gate

UTILITIES

Trench for gas pipe with bedding and tape

4" diameter sewer line

Manhole

Connect to existing

4" diameter DI water main and fittings

4" hydrant

4" valve, valve box and marker, 10'0" deep

Connect to existing

Excavate trench and backfill and tape

Testing and cleaning

5,000 gallon fire guard double wall above grade fuel oil tank

Leak detection system

Testing oil

1" diameter black steel pipe and fittings

Trench, backfilling and tape

4'0"x8'0" concrete pad

6'0" chainlink fence (small quantity)

Model School Elements – DEED Cost Model 15th Ed.

6'0"x10'0" gate

Testing

13 - SITE AND INFRASTRUCTURE
Subcontractor (Site Electrical)

POWER

4'0"x5'0" concrete transformer pad

6'0" chainlink fence (small quantity)

6'0"x3'0" gate

Utility transformer

Primary service

Trench, tape and backfilling

3/4"x10'0" ground rods, clamps and 10'0" #4 bare copper

#3/0 copper ground wire

4" diameter RGS conduit, concealed

Elbow

350 KCMIL secondary conductors, XHHW

Transformer connection and bushing

AREA LIGHTING

8" diameter x 15'0" extra strong driven steel pipe pile foundation with welded top

24" diameter x 36" concrete collars at base

6" square x 25'0" steel pole mounted to pile cap

250 watt LED fixtures with mounting arms

Trench, tape and backfilling

1" diameter PVC conduit

#10 wiring XHHW

DATA/COM

Trench, tape and backfilling

2" diameter PVC empty conduit

Pull wire for cable service

MISCELLANEOUS

Testing and certification

12 - GENERAL REQUIREMENTS AND PROFIT

Mobilization (temporary facilities)

Construction fence

Incidental freight

Final clean-up and demobilize

PROJECT OVERHEAD

Site office and temporary facilities

Equipment including part time mechanic

Tools, consumables, scaffold

Utilities, lighting, power and communications

Cleaning site/snow removal

Winter protection

Protection building/barriers

Testing, submittals, as-builts

Labor contract filing fee

Model School Elements – DEED Cost Model 15th Ed.

Remove construction debris

Fuel for equipment

Printing, photographs, videos

Permits (by owner)

Plan check and inspection fees

Project manager

Superintendent

Engineer

Scheduler and estimator

Shop and as-built drawings

Expediting

Quality control

Site staff/clerk

Home Office

Contractor's Mark-Up

Bonds and Insurances

14 - CONTINGENCIES

ESTIMATOR'S CONTINGENCY

The estimator's allowance for architectural and engineering requirements that are not apparent at an early level of design documentation

ESCALATION CONTINGENCY

The allowance for escalation from the date of estimate to the proposed bid date

Intentionally Blank

Substructure

Building System Summary: The substructure of a building consists of both foundations and below-grade construction enclosing useable areas such as basements. The department recognizes four sub-categories in this building system: Standard Foundations, Slab on Grade, Basements, and Special Foundations. These sub-systems are not mutually exclusive; components from within each may be necessary for a complete substructure.

Design Philosophy: Alaskan schools must be provided with an adequate foundation which responds efficiently, and effectively to building loads as prescribed in adopted building codes and to the conditions of the soils encountered at the school site. Substructure efficiency measures include minimizing the deadload of the building, limiting force resistance to the depth of the foundation, high soil bearing pressures, high friction load coefficients.

Model Alaskan School: The Model Alaskan School uses a steel reinforced concrete substructure consisting of perimeter stemwalls and footings, interior spread footings, and standard slab on grade; all of 4000psi concrete. Acceptable alternatives are detailed in the Level 4 listing that follows. See Appendix A, current edition, for detailed Model Alaskan School elements.

Standard Foundations

0211 Continuous & Column Footings
- Alt. 021110 - All weather wood (AWW) footings consisting of timbers and strongbacks are acceptable where soils are appropriate (i.e., low moisture, non-permafrost). AWW foundations must be supported by appropriate cost analysis.

0212 Foundation Walls – Model school includes foundation walls to frost depth per local conditions/codes.
- Alt. 021210 - Frost protected shallow foundations (FPSF) including perimeter insulation are acceptable when supported by appropriate cost analysis.
- Alt. 021220 – Concrete masonry units (CMU) foundation walls, with reinforcing, are acceptable.
- Alt. 021230 – AWW foundation walls consisting of framing and sheathing are acceptable where soils are appropriate, and must be supported by appropriate cost analysis.

0213 Foundation Wall Treatment – Model school elements include basic thermal and dampproofing treatments (see Appendix A) as anticipated to be required by local conditions/codes.

0214 Foundation Drainage – None at model school.
- Alt. 021410 – Perforated pipe footing drains are acceptable when required by local conditions/code.
- Alt. 021420 – Drainage mats and other water/moisture control measures are acceptable when required by site conditions and supported by appropriate cost analysis. Sites requiring underslab drainage should be avoided.

Substructure

Slab on Grade

0221 Standard Slab on Grade – Model school includes basic sub-base, reinforcement, moisture control, and trowel finish (see Appendix A) as anticipated to be required by best practice.

Alt. 022110 – Ground floor wood superstructure consisting posts, beams/frame walls, joists, and wood structural panels is acceptable when supported by appropriate cost analysis (e.g., in geographic regions where the cost of concrete is high). Insulation at floor assembly perimeters is included.

Alt 022120 – Ground floor steel superstructure consisting of beams/frame walls, joists, metal deck, and concrete is acceptable when supported by an appropriate cost analysis.

0222 Structural Slab on Grade – None at model school. Requirements for a structural slab to support extraordinary loads (vehicles, cranes, etc.) will be considered unique to a local educational program and will be funded locally.

0223 Trench, Pit, or Pad – None at model school.

Alt. 022310 – Nominal trench drains in support of Career Technology Education (CTE) are acceptable.

0224 Underslab Insulation – None at model school.

Alt. 022410 – Underslab rigid insulation is acceptable in support of FPSFs and where otherwise supported by an energy life-cycle cost analysis of the proposed heating system.

Basements – None at model school. Requirements for basement construction will be considered unique to local educational programs and will be funded locally.

0231 Basement Excavation/Backfill – N/A

0232 Basement Walls and Piers – N/A

0233 Basement Wall Treatment – N/A

Special Foundations

0241 Piling & Pile Cap – None at model school.

Alt. 024110 – A treated wood piling foundation including timber or engineered lumber pile caps, and required lateral bracing is acceptable where soil bearing pressures cannot support a standard foundation or where it is not cost effective to remove poor soils and replace with suitable fill.

Alt. 024120 – A steel pile foundation including steel or lumber pile caps and required lateral bracing is acceptable in conditions as stated for 024110.

0242 Caissons – None at model school. It is not anticipated that a caisson foundation would be required for an Alaskan school. If this foundation is proposed, it must be supported with an appropriate cost analysis.

0243 Grade Beams – None at model school. It is not anticipated that a grade beam foundation would be required for an Alaskan school. If this foundation is proposed, it must be supported with an appropriate cost analysis.

0244 Raft Foundation – None at model school. It is not anticipated that a raft foundation would be required for an Alaskan school. If this foundation is proposed, it must be supported with an appropriate cost analysis.

0245 Arctic Foundation System – None at model school.

Substructure

Alt. 024510 – An arctic foundation system consisting of thermopile (with or without helical ribs, pile extensions, steel or lumber pile caps and required lateral bracing is acceptable where soils consist of continuous or discontinuous permafrost.

0246 Other Special Foundations – None in model school. If a special foundation not defined in this guideline (e.g., sheet pile, etc.) is proposed, it must be supported with an appropriate cost analysis.

Foundation systems are typically far more expensive in Alaska than in other parts of the country. Usually foundation system options are limited by the soil conditions of a particular site. As it affects the cost of site development, the soil conditions of the selected site also play a large part in the cost of the foundation system and determining the number of foundation system options that are acceptable on a given site. Thus, the quality of soils should be given significant weighting when evaluating site options.

Due to the relative high cost of foundation systems, consideration should be given to the construction of two-story structures for school facilities exceeding 40,000 GSF. The cost savings of a two story structure is not only limited to the foundation system. When evaluating the potential cost savings of a two-story design versus a single story, other building systems, such as roofing, vertical circulation, and exterior wall, should be considered. The shipping weight of the potential foundation system as well as the installation cost should be taken into consideration when evaluating foundation system options. Building sites whose soil conditions allow the use of standard concrete foundations are preferable to sites that require piling foundations.

Design Criteria

- Multi-story construction shall be considered and presented as a schematic design option for all school structures over 40,000 GSF
- Where appropriate for soil conditions, standard concrete foundations are almost always the preferred foundation system
- Where soils are of low moisture content, all weather wood foundations should be considered for facilities smaller than 20,000 GSF
- Where appropriate for soil conditions, foundation systems utilizing a heated crawlspace with perimeter closure are preferable to foundation systems that utilize an elevated building with an air space between the underside of the building and grade

Substructure

Design Ratios:

1. Total building deadload/GSF.
2. Ton rebar/CF concrete.
3. CF concrete/GSF

Mechanical - 08

Building System Summary: The mechanical systems of a building provide a wide variety of functions related to sanitation, occupant comfort, manufacturing processes, and protection of structure. They can range from simple to complex. In addition to major source and distribution systems, a building's mechanical systems also include automation and controls systems; these areas are often the point of integration with the building's electrical systems. The department recognizes five sub-categories in this building system: Plumbing, HVAC, Integrated Automation, Fire Suppression, and Special Mechanical Systems. These sub-systems are not mutually exclusive; components from within each may be necessary for a complete mechanical system.

Design Philosophy: Mechanical systems join Interiors as one of the higher cost building systems and similarly account for ~10-12% of a project's total construction cost. Mechanical systems include plumbing, HVAC, sprinklers, and other piped or ducted distribution and exhaust systems. Also, like Interiors, Mechanical Systems are subject to initial cost savings by specification of materials or equipment, but oftentimes the reduction in initial cost is offset by increased maintenance and operation costs over the life of the system. It is important that the cost effectiveness of all material and equipment specifications is evaluated on a life cycle basis.

Model Alaskan School: The Model Alaskan School uses commercial grade mechanical systems developed primarily in response to building codes and standards adopted in 4 AAC 31.014. Model school Level 3 systems are as described in each following section. Acceptable alternatives are detailed in the Level 4 listing that follows. See Appendix A, current edition, for detailed Model Alaskan School elements.

081 – Plumbing: The model school uses piped potable water and wastewater plumbing distribution systems with supply from third-party utilities and connections to commercial quality fixtures.
0811 Plumbing Fixtures – The model school includes the following schedule of plumbing fixtures:

Fixture Type	Location	Quantity
Wall-mounted 15" toilet w/manual flush valve	K-2 toilet rooms	Note 1
Wall-mounted 17" toilet w/manual flush valve	3-12 toilet rooms	Per code
Wall-mounted urinal w/manual flush valve	3-12 toilet rooms	Per code
Counter-mounted lavatories w/manual faucet	Toilet rooms	Note 1; per code
Wall-mounted mop sink	Custodial closets	2

Mechanical - 08

w/manual faucet		
SS single bowl sink w/manual faucet	Classrooms	16
SS double bowl sink w/manual faucet	Workroom	1
SS wall-mounted handwash sink w/touchless faucet	Nurse & Kitchen	2
SS 3-compartment sink w/faucet	Kitchen	1
SS drinking fountain cooler w/bottle fill	Corridors/Gym/Commons	3
Stall shower w/control valve and head	Locker rooms	6

Note 1 – Primary grade classrooms serving Pre-K – 2nd grade are provided with dedicated toilet rooms adjacent to the classroom. Fixtures include a toilet and a sink/lavatory.

081110 Alt – Secondary school should consider adding the following based on program needs:

Fixture Type	Location	Quantity
Chemical resistant sink	Science classroom	Note 1
Eye wash station	Science classroom	Per code

Districts are encourage to develop their own standards for plumbing fixture specifications based on operations and maintenance factors using life-cycle cost analysis principles.

0812 Plumbing Equipment – The model school includes the following plumbing equipment:

Equipment Item	Location	Quantity
Kitchen Equipment	Kitchen	Note 1
Laundry Equipment	Varies	Note 1
Hose bibs	Mech. Room & Exterior	3
120g hot water generator	Mechanical Room	1
Circulation pump(s)	Mechanical Room(s)	10
20GPM grease interceptor	Kitchen	1

Note 1 – See Equipment & Furnishing – 10 for equipment requiring plumbing connections.

Mechanical - 08

08082 – HVAC: Heating includes cast iron gas/oil boilers providing glycol/hot water to terminal devices via copper distribution piping and circulating pumps. Ventilation is provided through ducted supply and return systems driven by air-handling units. Exhaust consists of room and exterior mounted fans with rigid ducting. Cooling consists of a central direct expansion unit with insulated pipe distribution to terminal devices.

08083 – Integrated Automation: Integrated system automation is a microprocessor based head-end unit tied to digital devices.

08084 – Fire Suppression: Fire protection is a distributed wet pipe system with necessary riser/valves/heads.

08085 – Special Mechanical: Fuel storage and supply is a dual-fuel natural gas/heating oil system including a double-wall AST, day tank and steel distribution piping.

Plumbing systems have the most potential for cost savings because they are not required throughout the facility by code, whereas HVAC and sprinkler systems are. Consolidation of plumbing systems to core areas to limit piping runs and reduction of the overall plumbing fixture count are design decisions that limit a project's plumbing cost. Fine-tuning the design of the HVAC systems can also generate cost savings. Oddly, even in Alaska, cooling requirements typically govern duct sizing. By designing the cooling system to an actual rather than fire code room occupancy, establishing a higher acceptable maximum temperature, and incorporating operable windows into the design calculations, duct sizes can be reduced, thus reducing air handler capacity and potentially mechanical space required. Wet sprinkler systems are less expensive than dry systems, so reducing or eliminating the need for dry sprinkler systems will reduce the cost of the facility.

Design Criteria

- Boilers should be designed to burn #2 diesel fuel or natural gas where available
- Hot water should be generated from the heating system boilers, rather than by a separate heat generating burner
- Sinks or other plumbing shall not be provided in standard classrooms that serve grades 4 and greater
- Ventilation systems shall be sized per the estimated room occupancy rather than the fire egress code occupancy

Mechanical - 08

- Maximum interior design temperature for ventilation system design shall be 75 degrees Fahrenheit or greater
- Where operable windows are furnished, design of the ventilation system shall incorporate the cooling and ventilation capacity of the windows

Design Ratios:

1. Plumbing fixtures/GSF.
2. Heating Capacity Btu/GSF.
3. AHU CFM Capacity/GSF; /BVol

BR&GR MODEL ALASKA SCHOOL SUBCOMMITTEE

By: Don Hiley
SERRC
Phone: 465-6906

Date: July 27, 2017

File: g:\br&gr\subcommittees

For: BR&GR Model School Subcommittee **Subject:** Mechanical Project Challenges w/Cost Model

Committee Topic Paper

Issue

What are some of the areas where the current DEED Cost Model falls short of providing data for estimating mechanical projects?

Discussion

The list below is the result of looking at 19 projects for which SERRC is preparing FY19 funding applications for submission to DEED in September 2017. The 19 projects are a subset out of ~80 projects total.

The mechanical project types that don't fit well in the Cost Model include:

- Boiler replacement
  - biggest number over the years
- Hot water generator replacement
- Partial plumbing replacement
  - Both heating and domestic water, waste lines would apply as well.
- Water and sewage treatment
- Fire suppression
  - Both for mist, and for partial conventional system work
- Mechanical controls
  - Less sophisticated than DDC

Conclusions

In order to adequately estimate these projects, the Cost Model would have to be revised to include additional mechanical line items.

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Appendix B

Public Comments

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From: Craig Fredeen <cfredeen@coldeng.com>
Sent: Tuesday, October 17, 2017 11:59 PM
To: Mearig, Timothy C (EED)
Subject: BR&GR Model School input

Tim,

Very nice report on the Model School committee. Not an easy task. I did have a couple comments on that report:

1. Under Space Allocations, A4LE has been wanting to have a discussion with EED regarding the revision of the square footage calculations to accommodate envelope widths and mechanical space exemptions. With the increase in energy efficiency, this will increase the wall thickness and count against total square footage for the facility. I believe the request was to change the total square footage verbiage to be interior of the building envelope. Also, there is a direct correlation between maintenance costs and the size of mechanical rooms. Because mechanical and electrical spaces count 1 for 1 against classroom space, these rooms are considerably squeezed. We'd like to recommend that mezzanines and penthouses be exempted from the square footage caps. These are typically inexpensive ways to house mechanical equipment. I know the above are big changes to add without input from the committee, but maybe just add a blurb in there recognizing requests for modifications to square footage calculations in regard to building envelope and MEP spaces.
2. There are some items missing from the Model School Elements for mechanical systems. Also, the Mechanical Construction Standard is a bit out of date. That's the way we designed rural schools 15 years ago. Definitely different preferred strategies for facilities where natural gas is available. Is this document up for review and if so, can I get a Word version of the document? Same with the Model School Elements section. I can make recommendations using Track Changes and send it back to you for consideration.

I saw in the PM State of the State that there are several standards up for renewal/update. I'm particularly interested in the following:

- School Design and Construction Standards Handbook
- Alaska School Facilities Preventative Maintenance Handbook
- Architectural and Engineering Services for School Facility Construction

Where can I find a copy of these?

Thanks!

Craig Fredeen, PE
President | Principal Mechanical Engineer
COLD CLIMATE
ENGINEERING, LLC
PO Box 240866, Anchorage, Alaska 99524
(907) 441-1567 | cfredeen@coldeng.com

BR & GR
DESIGN RATIOS SUBCOMMITTEE
Comments For Consideration

Gary Eckenweiler
BSSD, Facilities Director

11/9/17

Subcommittee Members,

Listed are comments for consideration

Recommendation #2 (O:EW)

I would be in favor of a **lower O:EW ratio** for the following:

a. Natural light is extremely important but it doesn't take an entire exterior wall of windows to give adequate light. I feel less but strategically place window would offer a quality interior natural light effect.
b. In windy climates like BSSD windows are one of our larger maintenance expenses. We are continually fixing mechanisms and experience full failures as early as 15 years. The glass vendors love us! Our most troubled areas are classrooms with the entire exterior wall length being window. The lack of framing structure between each window creates a week point, that moves in the wind, which loosens casing and loosens window edges allowing argon to escape. We see this in quite a few of our schools. With a lower O:EW ratio designers may look at getting away from continuous long banks of windows.
c. With LED lighting being used the cost of offsetting natural lighting with electric lighting isn't as big of a deal. Also LED replicates the spectrums of natural lighting much better.
d. And of course the difference between r-5 and r-30 but as time factors in windows are not their original r-value and leak.
e. Less windows less problems.

Recommendation # 3,4&5 (FPA:GSF), (V:NSF), (V:ES)

Maybe (V:ES) best defines the goals of these three recommendations.

I would be in favor of a tighter ratio, which would push simplistic building shapes in our climate region.

a. When you live in windy N.W. AK practicalities take over, especially in construction, to a point where unpractical stands out like a sore thumb.
b. Rectangular, fewer wings, lower roof pitch and fewer rooflines are all things folks deem as practical. The local critics will quickly criticize unpractical buildings and praise simplicity.
c. Keeping construction funds in the interiors of the facility has a much greater positive impact on educational environments.
d. We have all seen some incredibly beautiful designs utilizing simple shapes.

From: fenoseff_thomas
Sent: Wednesday, November 15, 2017 1:13 PM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>
Cc:

Subject: ASD comments and executive summary to the DEED BR&GR committee

Mr. Mearig,

Thank you for the opportunity to provide comments and be part of the process in developing criteria for cost-effective school construction in Alaska. Attached you will find comments from Krista Phillips, our Planning and Design Supervisor, and Kristin Heusser, our Plans Reviewer/Cost Estimator. Each brings a wealth of experience and knowledge about designing and building schools in Alaska. In reviewing each of their comments, I think they raise some salient points that should be addressed by the committee. Here are the highlights:

1) Criteria for cost-effective school construction should take into account the differences between rural and urban cost of construction. The definition of "core" education may differ significantly given these two settings.
2) Criteria should take into consideration the availability of human resources, and specifically, practical level of credentialing.
3) The recommendation should use more refined definitions of terms and specific goals for those terms, such as in commissioning.

If you have any questions regarding these comments, please feel free to contact me.

Respectfully,

Tom Fenoseff
Anchorage School District
Senior Director, Capital Planning & Construction
Office: (907) 348-5223
Fax: (907) 348-5227

1

Anchorage School District

Capital Planning & Construction
1301 Labar Street • Anchorage, AK 99515 • 907-348-5156 • www.asdk12.org/capitalplanning

November 12, 2017

Tim Mearig, Facilities Manager
State of Alaska
Department of Education & Early Development
School Finance & Facilities
PO Box 110500
Juneau, Alaska 99811-0500

Re: Comments on Criteria for Cost-Effective School Construction

The Anchorage School District is pleased to submit the following comments on the changes proposed by the BRGR and DEED.

GENERAL COMMENTS:

- What is the expected life cycle for a school/school addition to be designed and constructed under these proposed criteria?
- Criteria for cost-effective school construction should take into consideration the differences between urban versus rural cost of construction
  - Consider differing levels of criteria for urban versus rural conditions
  - What other northern design regions 'best practices' (Canada, Scandinavia) were researched related to Design Ratios?
- An examination of 'Design Ratios' is very much an examination of 'best practices' in basic design methods applied to our variety of northern design regions. To gain licensure in the state of Alaska, architects must pass a licensing board-approved supplemental course focusing on northern region design. Consider how this course and potential DEED requirements for Design Ratios overlap and are synergistic, and/or conflict in any manner.
- Criteria for cost-effective school construction should take into consideration availability of human resources: qualified educational, maintenance, and operations staff/recruiting
  - Consider differing levels of credentialing criteria for urban versus rural conditions
- What analysis has been done to consider the three proposed sets of criteria together?
  - What is the definition of 'cost-effective' as it relates to these three sets of criteria?
  - What is the definition of 'adequate education' as it relates to these three sets of criteria?
  - Should there be a fourth criteria to measure/assess functional and programmatic design of schools? Efficiency and savings comes first through flexible, appropriately planning: the building program (list of spaces, adjacencies,

and sizes) must define all spaces required, prior to these proposed three criteria being utilized. It makes sense to ensure this component meets the goals of efficiency prior to review of the proposed three criteria.

- Assumed order of these criteria in terms of sequence of use in review for efficiency and educational adequacy:
  - *Planning/Programming – unidentified as part of this review and comment*
  - Design Ratio
  - Model School
  - Commissioning

COMMISSIONING:
Recommendation #1
Comment: What are the specific goals for savings as a result of commissioning (i.e., initial cost of construction, target percentage of first cost, target percentage of life cycle cost, etc.)? Once defined, this may inform when and if commissioning should be required.

Recommendation #2:
Comment: 1. - School districts outside urban areas may struggle to retain credentialed CxA entities; increased in overall life cycle costs associated with non-local CxA entities who may perform commissioning in lieu of local entities should be considered
Comment: 2. – defer to KH comments

Recommendation #3:
Comment: 1. – defer to KH comments
Comment: 2. – Building Envelope - Potential exists for an incomplete building envelope upgrade to occur [i.e., reroof with portion of exterior walls receiving upgrades, but not all; consider how to test and/or measure outcomes on partial building envelope upgrades

DESIGN RATIOS:
Recommendation #1:
Comment: 1. – Clarify if adoption of four BEES climate zones would be substituted for the two climatic regions noted in ASHRAE 90.1 or would ASHRAE 90.1 be replaced as the standard with BEES exclusively.

Recommendation #2:
Comment: 1. – What 'best practices' in educational design were researched during the development of this Recommendation #2? In order to define "good" versus "bad" of an effective range of O:EW ratio, let's be certain we understand as many intimacies/impacts associated with example projects as noted in "Recent School Project Design Ratios Data Set". Again, what northern design regions beyond Alaska were explored? The research and decision-making data should reach beyond Alaska, as there are many northern design regions around the world employing high-performance northern school design. Also, the concept of implementing a range of school design ratio of O:EW needs to be weighed against impact to student learning. Much health research tells us that humans must have the opportunity to connect visually and physically with the outside. Even though there are many months of darkness in Alaska, students and staff should be afforded the opportunity to visually connect with the natural environment, regardless if its daylight or dark, i.e., windows. The human connection between the built environment and the natural environment is necessary for learning and wellbeing. Also, does this apply to new construction only or additions, as well?

Recommendation #3:
Comment: 1. – See above "General Comments", bullet point 2 above. Same comment applies here. The practice of design of an efficient building footprint is a basic component of 'good northern design'.
Comment: 2. – no comment.
Comment: 3. – Was 30,000 GSF as the trigger for FPA:GSF ratio based on historical or contemporary typical school footprints? Based on trigger of energy loss to a footprint larger than this and therefore an operational cost trigger? In Anchorage School District, our current ed specs call for nearly 70,000 GSF of space for an elementary school, which represents our smallest school facility in size; therefore, this FPA:GSF ratio requirement would apply to all new schools within ASD and (assuming) any additions to any schools if designed over 30,000 GSF.

Recommendation #4:
Comment: 1. – See above "General Comments", bullet point 2 above. Same comment applies here. The practice of design of efficient spatial building volume is a basic component of 'good northern design'.
Comment: 2. – Assuming building volume of concern is all normally occupied conditioned space, not unconditioned space—clarify.

Recommendation #5:
Comment: 1. – This criteria seems very similar to Recommendation #4. Data not provided; needs more clarity.
Comment: 2. – Assuming building volume of concern is all normally occupied conditioned space, not unconditioned space—clarify.

MODEL SCHOOL:
Recommendation #1:
Comment: 1. – Agree with further development of the Program Demand Cost Model in lieu of another method of cost estimating. Considerations include how to gain most relevant information (from whom in industry and how to seek/receive input).

Recommendation #2:
Comment: 1. – Agree with establishment of an ongoing process of reviewing and establishing components and systems and current costs of a model school. Considerations include how to gain most relevant information (from whom in industry and how to seek/receive input)

Recommendation #3:
Comment: 1. – Reference made in commentary to national standards and/or other states' design standards. What standards were reviewed outside of Alaska? Quality and longevity should be the driving force of a statewide standard for building systems. Example "sub-structure" standard states buildings over 40,000 GSF should be considered as two story solutions, not one story. How does this relate to "Design Ratio Criteria" as noted in their Recommendation #3 – 30,000 GSF as size threshold?

Recommendation #4
Comment: 1. – This recommendation is challenging by nature of applying one definition to "core education". Every geographic location in Alaska that delivers education has specific needs regarding elements of a school and its site. Elements in one community that may be defined as "core" may not be defined as "core" in another. How to balance the need for cost-effective funding strategies and the need for education to provide core purposes based on community culture? Consider how this recommendation can be marketed as a partnership opportunity. It's currently written with an undertone that does not recognize the benefit school property

provides to communities which ultimately result in betterment of quality of life and economy for all Alaskans. Again, this may be a recommendation that needs to be analyzed based on urban and/or non-urban settings, as there are significant differences between core education in an urban setting versus a non-urban setting. What is the definition of 'adequate education', 'maximum education', and 'non-core amenities'?

Please do not hesitate to contact me at 907-348-5200 if you have any comments or questions with this communication.

Sincerely,

Krista Phillips, Planning & Design Supervisor
ASD Capital Planning & Construction

Enclosures

BR&GR Commissioning Subcommittee

Cost Effective School Construction Criteria
Draft Recommendations
October 13, 2017

Subcommittee Members
BR&GR Committee: Mark Langberg (chair); Bill Murdock
Department Staff: Wayne Marquis
Industry Partners: JaDee Moncur, Support Services of Alaska; Craig Fredeen, Cold Climate Engineering; Brittany Hartmann, Legislative Staff

FINANCIAL STAKEHOLDER

Purpose of Subcommittee
Under AS 14.11.014(b)(3), propose standards and criteria for commissioning of school projects with state-aid; identify costs for appropriate allocation of resources.

Subcommittee Activity
The subcommittee met throughout the summer to discuss Commissioning issues. In addition to acknowledging the preceding purpose-statement, the subcommittee reviewed and adopted the following mission statement (Subcommittee Resource #2):

> *To provide minimum criteria and expectations to test the performance of a school's mechanical, electrical, plumbing, fuel, controls and envelope systems; to promote energy efficiency of the school and save operational costs over the life of the building.*

Building commissioning (Cx) was recognized as adding value to a school district's overall mission of education by maximizing the operational efficiency of its school facilities. Since commissioning is building-specific, benefits are also gained at the individual school level. The subcommittee reviewed commissioning protocols and practices and determined that commissioning criteria should be developed in the following broad categories: mechanical, fuel oil, electrical, controls, and building envelope.

Other focus areas of subcommittee review included:

- Responsibilities that are common to commissioning agents – commissioning tasks can cross traditional disciplines (e.g., building controls (mechanical), building envelope (architectural), etc.). Qualifications and certifications are becoming important.
- Standards and certifications for commissioning agents or commissioning authorities – as commissioning transitions from a specialty to a dedicated profession, there are a growing number of professional and trade associations offering certifications in this area.
- The points in a facility's life-cycle where commissioning can be effective – commissioning has traditionally been tied to the closeout of capital projects; however, the emergence of retro-commissioning has brought attention to the value of ongoing commissioning throughout the building life-cycle.

MAINTENANCE NEEDS TO REVIEW THIS ALSO AS IT MENTIONS ON-GOING COMMISSIONING.

TRAIN ON-SITE PERSONNEL.

Recommendations & Requests for Comments
The following subcommittee recommendations are proposed for consideration by the BR&GR committee for inclusion in a December report to the Alaska state legislature. The subcommittee

has specific requests for comments on its recommendations below, but welcomes all comments on potential implementation of commissioning standards for school construction.

General Comment Requests:

1. *Any known conflicts of the proposed recommendations with state laws or municipal codes.*
2. *Potential or known duplication of proposed standards with items in established building codes, adopted standards, or district facility standards.*

Recommendation #1
In support of cost-effective school construction, adopt standards for commissioning of building system in new schools, major additions, and major renovations constructed with state aid. Standards should assist the department in ensuring school projects meet required energy standards.

Basis: The value of commissioning increases with the complexity of the systems in a facility. Since the complexity of school capital projects with state aid ranges from simple to complex, commissioning should generally only be required on new schools, major additions, and major renovations. There may be smaller projects, focused on one or more of these broad categories of systems, which would be appropriate to be commissioned. Since commissioning is a growing field and is touching more and more building systems, required commissioning standards (in support of cost-effective school construction) should focus on commissioning elements related to meeting required energy standards.

Comment Request: Comments related to when commissioning should be required for projects funded with state aid.

Recommendation #2
Commissioning funded with state aid should be accomplished by a qualified commissioning agent/authority (CxA). The base requirement for a CxA should be an industry-recognized certification but options should be available for alternate qualifications sufficient to help guide the district to the desired level of Cx appropriate for the given project.

Basis: Certifications can be helpful in establishing credentials and high standards should be the norm. However, certain conditions may require flexibility and an alternate path to establishing qualifications on a project-basis. MUST BE BETTER DEFINED OR THE ONLY FORMAL DEFINITION WITH BE STAKEHOLDER TYPE CERTIFICATIONS. NEED TRAINING, CERTIFICATION, EDUCATION FOR MAINTENANCE.

Comment Request:

1. *Comments regarding establishing proper credentials for CxA entities sufficient to ensure return for investment.*
2. *CxA qualifications and responsibilities proposed in Commissioning General Overview (Subcommittee Resource #3).*

Recommendation #3
In support of cost-effective school construction, develop and adopt criteria for commissioning in five areas: mechanical, fuel oil, electrical, controls, and building envelope. Criteria should be provided as tools for districts to use in contracting for Cx services or for performing Cx in-house when permitted.

MAINTENANCE SHOULD COMMENT; ESPECIALLY IF 'ONGOING' OR RETROCOMMISSIONING.

Basis: Minimum standards for commissioning criteria, updated on a regular basis to conform to industry best practices and current building systems, will provide a basis for the state aid. Standards define expectations and result in greater clarity and equity across all projects.

Comment Request:

1. *Comments regarding the development and maintenance of commissioning criteria at the state level.*
2. *Commissioning standards in the five recommended areas, proposed in Subcommittee Resources #4 through #9.*

Subcommittee Resources

The resources below were researched or developed during the subcommittee process and informed the recommendations of the committee. The majority of these documents are available in prior BR&GR committee packets for review (https://education.alaska.gov/Facilities/BRGR/). Certain items are attached, as noted, for simplicity in reviewing the draft recommendations in this document.

1. Meeting Notes/Recordings
2. Mission Statement
3. Commissioning General Overview – 8-21-17 Draft (Attached)
4. Mechanical Systems Commissioning – 8-18-17 Draft (Attached)
5. Fuel Oil Systems Commissioning – 8-18-17 Draft (Attached)
6. Electrical Systems Commissioning – 8-18-17 Draft (Attached)
7. Control Systems Commissioning – 8-18-17 Draft (Attached)
8. Building Envelope Commissioning – 8-18-17 Draft (Attached)
9. Building Envelope Commissioning CSI Spec – 8-22-17 Draft (Attached)

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

COMMISSIONING GENERAL OVERVIEW

Commissioning shall be the responsibility of a single person charged with organizing and leading the commissioning efforts for the project.

Commissioning Authority (CxA):

INTRODUCES FINANCIAL STAKEHOLDER SERVICES.

- Be certified in commissioning from ASHRAE, Building Commissioning Association (BCxA) or another recognized standards organization.
- Could be an independent third party, or
- Could be a member of the design team, or
- Could be an employee of the school district, or
- Could be an employee of the contractor

VERY WEAK LANGUAGE.

CxA Responsibilities may include the following (as determined by contract requirements):

- Coordinate commissioning of the mechanical, electrical, fuel oil, controls, and building envelope commissioning sections.
- Coordinate with Contractor's Commissioning Representative (CCR) and commissioning team.
- Create a Commissioning Plan
- Create commissioning checklists
- Create Functional Performance Tests
- Witness the Functional Performance Testing
- Work to resolve issues found during commissioning
- Create Commissioning Report
- Coordinate with owner maintenance personnel for training

NEED ORG CHART.

FLESH OUT DOCUMENTATION.

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

MECHANICAL SYSTEMS COMMISSIONING

Coordinate commissioning of this section with other systems as noted in the electrical, fuel oil and controls commissioning sections.

Mechanical Systems to be commissioned include:

- All life safety interlocks and safeties including but not limited to:
  - Boiler safeties, emergency shut-down
  - Combustion air systems
  - Duct smoke detectors and associated code shut-downs
  - Smoke damper activation
  - Fire suppression systems including fire water storage and suppression activation. These may be delegated to AHJ review and approval.
- General: S → AUTHORITY HAVING JURISDICTION. NO ABBREVIATIONS.
  - Occupied mode and unoccupied mode operation for all systems
  - Remote monitoring and alarm generation
- Plumbing System:
  - DEC regulated system parameters are maintained
  - Facility domestic water supply (well pump, storage, etc.) function
  - Domestic hot water generation, tempering valve operation, high temperature alarm
- Heating System:
  - Hydronic system supply temperature control including heat plant operation
  - Distribution system control including circulation pump operation and failure sequences
  - Terminal heating unit operation including room temperature control
- Ventilation System:
  - All damper positions to be visually verified during operation
  - Central ventilation unit controls:
    - Fan operation
    - Outside air, return, and relief air damper operation
    - Air temperature control including coil operation
    - Demand ventilation control sequences
  - Terminal ventilation unit operation
  - Building pressurization controls
  - Exhaust air operation

NOTES ON COMBUSTION AIR...?

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

FUEL OIL SYSTEMS COMMISSIONING

Coordinate commissioning of this section with other systems as noted in the mechanical, electrical and controls commissioning sections.

Fuel Oil Systems Commissioned Outline:

- Prior to Functional Performance Testing:
  - Fill up tanks
  - Test Hi / Low level, leak detection and overflow alarms
  - Test circulation pumps operation (supply and return)
- General:
  - All sequences will be tested as approved by the designer
  - Alarm generation and remote monitoring (when present) will be demonstrated
- Controls:
  - Must provide support for Functional Performance Testing
  - Provide Functional Performance Testing results for review
- Fuel Oil Systems to be commissioned:
  - All standalone controlled devices
  - All Direct Digital Control (DDC) controlled devices (when present)
  - Large and small day tank controls integration

VENTS OPERATING PROPERLY

DOES THIS SPECIFY CERTAIN EQUIPMENT? OR IS STANDARD NOW ON STANDALONE EQUIPMENT?

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

ELECTRICAL SYSTEMS COMMISSIONING

Coordinate commissioning of this section with other systems as noted in the mechanical, fuel oil and controls commissioning sections.

Basic Electrical Systems to be commissioned include:

- Uninterruptible Power Supply
- Standby/Emergency Generator System
- Auto Transfer Switch – Standby
- Auto Transfer Switch – Emergency
- Grounding Systems – Power / Telecom
- Motor Starters / Variable Speed Drives (VSD)
- Lighting Control Systems
- Lighting Fixtures
- Secondary Transformers
- Electrical Distribution Equipment

When included as part of the project, electrical Special Systems to be commissioned may include:

- Fire Alarm System
- Security Systems
- Closed Circuit Television
- Audio Video Systems
- Paging System INTERCOM
- Entry Intercom System
- Telecom Distribution System
- Telecom Optical Fiber Distribution System

SPECIALTY EQUIPMENT; SHOP

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

CONTROLS SYSTEMS COMMISSIONING

Coordinate commissioning of this section with other systems as noted in the mechanical, fuel oil and electrical commissioning sections.

Controls Systems Commissioning Outline:

- Prior to Functional Performance Testing:
  - Point to point testing complete
  - Calibration complete
  - Self-testing of control sequences
  - Graphics complete
  - Connection to remote viewing complete
  - Complete log of changes from original sequences of operations ← AND WRITTEN INTO AS-BUILTS.
  - Test and Balance for air and hydronic systems

Test and Balance Verification (if required by contract): ← SHOULD BE REQUIRED IF TYPE OF WORK IN CONTRACT.

- General:
  - All Sequences will be tested as approved by the designer
  - Remote monitoring and alarm generation will be demonstrated
- Controls:
  - Must provide support for Functional Performance Testing
  - Provide Trending after Functional Performance Testing for review
- Controls Systems to be commissioned:
  - All DDC controlled systems
  - All standalone controlled devices
  - Boiler controls integration
  - A/C system controls integration

Bond Reimbursement and Grant Review Committee

Commissioning Standards Subcommittee

BUILDING ENVELOPE COMMISSIONING

Mandatory building envelope testing shall apply to the following types of construction:

- New facilities
- Additions over 2,000 SF
    - Testing to be limited to the addition.
    - Testing may be waived by DEED if logistics of isolating the addition for testing are deemed impractical.
- Major renovations to building envelope as deemed by DEED.

Building envelope commissioning shall include:

- The air leakage rate of the building envelope shall not exceed 0.40 cfm/SF at a pressure differential of 0.3 inches water gauge (75 Pa) in accordance with ASTM E 779 or an equivalent method approved by DEED.

Recommended testing includes the following:

- A vapor barrier integrity visual inspection be completed prior to installation of interior finishes.
- Thermal imaging testing of the building envelope.

A guide CSI Specification is available from DEED to provide owners and designers recommendations for how to complete the air leakage and thermal imaging testing.

BRGR ENERGY EFFICIENCY BUILDING ENVELOPE SPECIFICATION

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes:
   1. Infrared Inspection of Building Envelope
   2. Pressure testing for air leaks

B. Related Sections:
   1. Exterior doors and jambs
   2. Exterior windows and glazing
   3. Vapor retarder
   4. Air Barriers
   5. Sill Sealer
   6. Sealants
   7. Insulated-core Metal Wall Panels
   8. Metal roof panels
   9. Structural insulated panels
   10. Fiberglas insulation

1.03 SUBMITTALS

A. Thermal Imaging Camera make, model and information defining the unit's thermal sensitivity

1.04 QUALIFICATIONS

A. Thermographer Qualifications
   1. Lead thermographer shall have at minimum an active Level II Certification

CERTIFIED BUILDING COMMISSIONING PROFESSIONAL?

PART 2-PRODUCTS

2.01 INFRARED CAMERA/THERMAL IMAGING CAMERA

A. Thermal imaging camera shall have a thermal sensitivity of 0.18 degrees Fahrenheit at 86 degrees Fahrenheit. Camera shall have ability of download still frame images into an electronic Thermographic Report

2.02 BLOWER DOOR/PRESSURE TESTING

PART 3-EXECUTION

3.01 PREPARATION

A. Ensure building envelope is completed including all related items from 1.02, B.

B. Prior to inspection building shall be brought to temperature/acclimated for a minimum of 48 hours. RADIANT SYSTEMS MAY TAKE AWHILE TO REACH STASIS.

C. Test requires a minimum difference in temperature between ambient air and building interior of 18 degrees Fahrenheit. SUGGEST MAKE ROUND 20 DEG. F

D. Building shall be negatively pressurized with a pressure differential of ? pascals for the Blower Door test

From: Mary Cary
Sent: Wednesday, November 15, 2017 11:10 PM
To: Mearig, Timothy C (EED)
Subject: Public Comment: Criteria for Cost-Effective School Construction - Draft Recommendations 10/13/17

Tim,

My commendation goes to the considerable time and effort spent by the members of these three BRGR Subcommittees to develop Draft Recommendations for Cost Effective School Construction Criteria. I believe it would would have been benefical for each of the committees to have had representation from both rural and urban educators. It is all too easy to loose perspective that the main purpose of these facilities is to support effective student learning, and we need to look at sustainable future trends and not necessarily continue to support and maintain the current resource-consuming facilities. This involves a big picture statewide conversation as to future educational delivery options based on Alaska fiscal reality.

Commissioning can provide overall environmental with long term cost benefits and should be included as a design/construction standard service. Commissioning of existing facilities with funding to correct deficiencies should be considered as the benefits to the ongoing maintenance and operational costs would be significant.

I'd encourage a more performance-based approach to design in lieu of an overly prescriptive approach (design ratios) to meet energy goals.

Thank you for the opportunity to comment.

Sincerely,

Mary Cary, AIA

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Mary Cary, AIA

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Appendix C

BR&GR Membership

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Bond Reimbursement and Grant Review Committee

As of: March 1, 2017

Member	Appointed	Re-appointed	Term Expires
Heidi Teshner — Chair Commissioner or Commissioner's Designee	Commissioner's Designee		
Representative Sam Kito III House of Representatives Member	Appointed by Speaker		
Senator Anna MacKinnon Senate Member	Appointed by President		
Mark Langberg Professional Degrees & Experience in School Construction	03/01/2016		02/28/2019
Dale Smythe Professional Degrees & Experience in School Construction	03/01/2017		02/28/2021
Robert Tucker Experience in Urban or Rural School Facilities Management	03/01/2016		02/28/2019
William Murdock Experience in Urban or Rural School Facilities Management	03/01/2017		02/28/2021
Doug Crevensten Public Representative	03/01/2016		02/28/2019
Don Hiley Public Representative	03/01/2017		02/28/2021

Members appointed by commissioner unless noted. See AS 14.11.014 and 4 AAC 31.087.