Bond Reimbursement and Grant Review Committee Meeting Agenda

July 18, 2019
2:00pm - 4:00pm

Teleconference – School Finance Conf. Room
801 W. Tenth Street, Juneau, Alaska

Audio Teleconference available through free online WebEx application. Meeting Number 807 797 754
Toll call-in number 1-650-479-3207 (US/Canada)

Chair: Elwin Blackwell, acting

Thursday, July 18, 2019

Agenda Topics

2:00 – 2:05 PM — Committee Preparation
- Call-in, Roll Call, Introductions
- Chair's Opening Remarks
- Agenda Review/Approval

2:05 – 2:50 PM — Preventive Maintenance State-of-State

Publication Updates
- *Swimming Pool Guidelines*
- *Handbook to Writing Educational Specifications*
- *ASHRAE 90.1-2010 Checklist Update*

Action Item
- Approve Publications for Issuance/Regulation Update

2:50 – 3:40 PM — Subcommittee Reports
- Design Ratios (Dale Smythe)
  - *Energy Modeling Report – results/next steps*
- Model School (Don Hiley)
  - *Cost Model Enhancements – results/next steps*
  - *Model School Elements Update – evaluation*
  - *Cost Model as Cost Control Tool – draft policy*
  - *Standards Feasibility Study – results/next steps*
- Commissioning (Randy Williams)
  - *Credentialing Organizations - recommendation*
- School Space (Dale Smythe)
  - *September Workshop – next steps*

3:40 – 3:50 PM — BR&GR Calendar and Work Plan Review & Update
- Next Meeting Date

3:50 – 4:00 PM — Committee Member Comments

4:00 PM — Adjourn

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

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To: Bond Reimbursement & Grant Review Committee
From: School Facilities
Date: July 18, 2019

DEPARTMENT BRIEFING

Preventive Maintenance Update (PM State-of-the-State)

The Preventive Maintenance State of the State Report was issued on June 1, 2019, and is included in the packet with a charts showing compliance history. For the current FY21 CIP cycle, 44 of 53 school districts have certified preventive maintenance programs.

Districts that are not currently certified include:

- Aleutian Region
- Chatham
- Hydaburg City
- Lake & Peninsula
- Lower Kuskokwim
- Lower Yukon
- Pelican
- Skagway
- Southwest Region

Districts granted provisional certification and that are working with the department to develop a full year of evidence of plan adherence include:

- Galena City
- Bristol Bay Borough

Problem areas have included tracking and reporting energy consumption and maintaining maintenance and custodial personnel training plans and records.

Site visits for the upcoming fiscal year are scheduled to take place between September and April for the following school districts:

- Aleutians East Borough
- Cordova City
- Denali Borough
- Kake
- Kashunamiut
- Kodiak Island Borough
- Kuspuk
- Nenana City
- Pribilof Island
- Yakutat Borough

CIP Workshop 2019 Recap

The department offered a two-day workshop this year, with the first day devoted to the application and the second day to walking participants through conceptualizing a project and using the department's various tools to help develop information, then using that information to complete the application. This is the first year the department has presented this topic; feedback on the second day was positive overall.

Cost Model Update

The DEED Program Demand Cost Model, which is a tool used to assist school districts in estimating construction and renovation costs, was updated for 2019 and published June 14, 2019. This 18th Edition of the tool incorporated a number of line items enhancements identified by the Model Alaska School subcommittee; unfortunately the updated geographic cost factors were not revised in time to be included in this edition.

Legislative Action

Governor signed the operating budget (HB 39) with a 50% line item veto to the $39,389,000 REAA and Small Municipality fund formula calculation, for total funding of $19,694,500; the $97,820,500 allocation for state aid for costs of school construction under AS 14.11.100 was likewise reduced by 50%, for a reimbursement total of $48,910,250. Note that the 50% reduction to the state aid amount will also reduce the REAA fund calculation in two years.

The capital budget was signed by the governor and the $7,400,000 to fund "K-12 School Major Maintenance" was retained; no school construction grant funding was appropriated.

Committee Member Update

Senate member has been appointed; welcome Senator Cathy Giessel.

PM State-of-the-State

Report of DEED Maintenance Assessments and Related Data

AS OF 6/1/2019

District	Date of Last Visit	Year of Next Visit	Approved FAIS	Maintenance Management	Energy	Custodial	Training	R&R Schedule	Status	Maint. Program	Program Name	CIP Eligible
Alaska Gateway	3/30/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Aleutian Region	7/19/2011	2016	Y	N	Y	Y	Y	Y	5 of 6	W	Dude Solutions	No
Aleutians East	12/17/2014	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Anchorage	1/23/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Annette Island	12/3/2015	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Bering Strait	4/14/2019	2024	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Bristol Bay Borough	1/18/2019	2024	Y	Y	Y^P	Y	Y	Y	6 of 6	W	MC*	Yes
Chatham	3/6/2017	2022	Y	Y	N	Y	Y	Y	5 of 6	W	MC*	No
Chugach	1/26/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Copper River	3/31/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Cordova	1/13/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Craig City	11/14/2016	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Delta/Greely	3/28/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Denali Borough	3/24/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Dillingham City	2/2/2016	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Fairbanks	3/27/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	Web Help Desk	Yes
Galena	3/22/2018	2023	Y	Y	Y^P	Y	Y	Y	6 of 6	W	MC*	Yes
Haines	11/17/2015	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Hoonah City	4/17/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Hydaburg City	11/16/2016	2022	Y	N	Y	Y	N	Y	4 of 6	W	MC*	No
Iditarod Area	4/8/2019	2024	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Juneau	11/3/2015	2021	Y	Y	Y	Y	Y	Y	6 of 6	L	TMA	Yes
Kake City	2/4/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Kashunamiut	11/13/2014	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Kenai Peninsula	3/1/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Ketchikan	12/2/2015	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Klawock City	12/19/2016	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Kodiak Island	10/29/2014	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Kuspuk	2/24/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Lake & Peninsula	1/16/2019	2024	Y	Y	N	Y	Y	Y	5 of 6	W	Manager Plus	No
Lower Kuskokwim	3/25/2019	2024	Y	N	N	Y	N	Y	3 of 6	W	FileMaker Pro	No
Lower Yukon	3/20/2019	2024	Y	Y	N	N	N	Y	3 of 6	W	MC*	No
Mat-Su Borough	2/3/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Nenana City	3/26/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Nome City	4/28/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
North Slope Borough	5/21/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Northwest Arctic	2/23/2016	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Pelican City	4/9/2018	2023	Y	Y	N	Y	N	Y	4 of 6	W	Dude Solutions	No
Petersburg City	1/7/2016	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Pribilof Island	4/23/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Sitka City Borough	4/24/2017	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Skagway City	9/5/2018	2024	Y	N	N	Y	N	Y	3 of 6	W	Dude Solutions	No
Southeast Island	11/18/2016	2022	Y	Y	Y	Y	Y	Y	6 of 6	W	MPulse	Yes
Southwest Region	2/4/2016	2021	N	Y	Y	Y	Y	Y	5 of 6	W	Dude Solutions	No
St Mary's	3/18/2019	2024	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Tanana City	3/23/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Unalaska City	12/18/2014	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Valdez City	4/18/2018	2023	Y	Y	Y	Y	Y	Y	6 of 6	W	MC	Yes
Wrangell City	1/8/2016	2021	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Yakutat City	1/14/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
Yukon Flats	11/12/2018	2024	Y	N	N	Y	N	Y	3 of 6	W	MC*	No
Yukon-Koyukuk	11/15/2018	2024	Y	Y	Y	Y	Y	Y	6 of 6	W	Dude Solutions	Yes
Yupiit	4/7/2015	2020	Y	Y	Y	Y	Y	Y	6 of 6	W	MC*	Yes
In Compliance			52	48	46	52	47	53	43			43

Legend

N = Not in compliance
Y = In full compliance
Y^P = Provisional compliance
FAIS = Fixed Asset Inventory System

W= Web-based Computerized Maintenance Management System
L = Local Area Network (LAN) Computerized Maintenance Management System
* = Use MC (Maintenance Connection) through SERRC Service Contract
Bold - Site visit pending

"Year of Next Visit" dates are subject to change at the department's discretion. School Districts will be notified in a timely manner if scheduled visit dates listed on this report are altered.

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

Swimming Pool Guideline

P U B L I C A T I O N   C O V E R

July 8, 2019

Issue

The department seeks committee approval to send out the draft *Swimming Pool Guideline* for interim stakeholder use, and for presentation to the State Board of Education for adoption in regulation.

Background

Last Updated/Current Edition
Publication last updated in 1997. Current edition available on the department's website: (education.alaska.gov/facilities/ publications/SwimmingPool.pdf).

Summary of Proposed Changes
Proposed document incorporates the move toward a more clear and prescriptive document that provides maximum pool tank sizes and maximum facility sizes based on the number of students in the approved instructional learn-to-swim program. The publication is sited in regulation 4 AAC 31.020(a) and establishes department criteria to apply to AS 14.11.013(d) and AS 14.11.100(h).

Version Summary & BRGR Review
Drafts of the publication were presented to the committee at the following meetings:

October 17, 2018 – simple, straightforward update provided; discussed prescriptive option;

December 12, 2018 -- prescriptive draft presented that provided maximum pool tank sizes and maximum facility sizes based on the number of students in the approved instructional learn-to-swim program,

February 21, 2019 – revised prescriptive draft, removed Red Cross course references, provided table for allowable size based on students receiving instruction; further discussion and evaluation of draft, and

April 16, 2019 – committee proposed three amendments 1) make water-safety courses allowed mandatory courses (amendment failed), 2) allow AASA competitive swimming as an elective use, and 3) allow purchase of timing equipment; committee recommended department more clearly identified 'mandatory', 'elective', and 'community use'; committee approved for public comment.

Public Comment

Public comment period open May 13, 2019 through June 3, 2019. No public comments were received.

Options

Approve final publication for use by the department and adoption into regulation by the State Board of Education and Early Development.

Amend final publication and approve for use by the department and adoption into regulation by the State Board of Education and Early Development.

Seek additional information.

Suggested Motion

"I move that the Bond Reimbursement and Grant Review Committee approve the department's proposed update of the *Swimming Pool Guideline* and recommend the State Board of Education and Early Development proceed to update the publication reference in regulation."

Swimming Pool Guidelines for Educational Facilities

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ACKNOWLEDGEMENTS

Thanks to the Bond Reimbursement and Grant Review Committee members who reviewed the publication in its draft form and to those in the Department of Education & Early Development who were responsible for the predecessor to this document.

Originally published in 1983 by the State of Alaska, Department of Education as *Water Safety Facilities and State Financial Aid*. Published in February 1985 and in 1997 as *Swimming Pool Guidelines*.

Table of Contents

Introduction

Purpose

These guidelines have been developed to give assistance and direction to Alaska school districts in planning for school swimming pools, and to provide the department with a basis for review of applications submitted by school district for state participation in funding of pool facilities for educational purposed in Alaska. The direction for development of these guidelines comes from statute [AS 14.11.013(d) and 14.11.100(h)], which provides for swimming pools as an eligible project cost in projects approved for state aid under AS 14.11.

Eligibility for state aid for swimming pools from statutory grant funds through AS 14.11.011 (grant applications), is first subject to limitations in general space eligibility established under 4 AAC 31.020. After general space eligibility is determined, the specific provisions in this guide for swimming pool facilities for school use can be applied. Eligibility for state aid for swimming pools through debt reimbursement is governed by the provisions in AS 14.11.100 (state aid for costs of school construction debt). To the extent that state aid under AS 14.11.100 requires a recipient entity to meet space eligibility determinations under 4 AAC 31.020, those provisions will also apply to space related to swimming pool facilities for school use. If the provisions of AS 14.11.100 provide for state aid without regard to space eligibility, the specific provisions in this guide for swimming pool space eligibility will be applied. This guideline identifies standards for swimming pool size based on the documented educational program and student population receiving programed instruction. Thus, these guidelines are intended to help Alaska school districts determine what portion of swimming pool space is eligible for State funding as determined by the commissioner.

Common Issues

Evaluating a school district's eligibility for swimming pools space is often challenging. Educational programs related to pool facilities varies between districts. Consensus standards are not available which index those programs to exact amounts of either pool surface or building square footage. More often than not, pool facilities house a combination of school and non-school uses. Those use arrangements must be documented and may factor into eligibility determinations. In response to statutory requirements, certain features typically found in full-service pool facilities are not eligible for state participation. An understanding of these issues, up front, will help districts prepare requests for school swimming pools, and will streamline the eligibility determination process.

Eligible Uses and Curriculum

Swimming pool facilities are expensive both to construct and to operate. State participation in these costly facilities should be guided by the essential importance of the proposed uses and curriculum. School districts have freedom to develop a set of curriculum that meets all of their local objectives—even considering community uses. However, state participation will be targeted toward learn-to-swim programs. Specific criteria regarding eligible uses and student populations are covered in more detail in the section, *Allowable Pool Size*.

Joint-use Facilities

Understanding a pool facility's use and management by non-district entities and non-school programs is essential. In keeping with statutory requirements, the department has a responsibility to restrict the funding of recreational space. Under adopted regulation, the department must calculate and apportion costs for operations, maintenance, and capital renewal among sharing entities. In order to meet this obligation, information such as the following is needed from those with operational responsibility for the pool facility:

- Facilities that are not owned, or under the direct control of the school district must provide evidence of a joint use agreement with the owner that identifies the responsibilities of each party with respect to operations, maintenance, and capital renewal, each of which must meet the requirements of AS 14.11.011(4), over the life of the facility.
- Hours of use dedicated to the school district's instructional program are needed. If evidence of sole use for the district's K-12 program is not provided, state participation may be prorated based on the number of hours per school day in which K-12 school curriculum based education takes place in the facility, among other factors.

Ineligible Pool Elements

Statutes provide that allocations of state aid for school capital projects be restricted from single purpose recreational and sporting facilities and elements. Although this guide deals primarily determining a district's eligibility for swimming pool space, there are some necessary restrictions on certain pool features. The costs for facility features such as slides and saunas are required to be excluded prior to any calculations that use approved space to apportion eligible costs of state-aid.

Authority

Statutory Requirements

AS 14.11.013(d) provides that:

> The department shall reduce a project budget by the cost of those portions of a project design that the department determines (1) are for construction of student residential space, planetariums, hockey rinks, saunas, and other facilities for single purpose sporting or recreational uses that are not suitable for other activities; or (2) do not meet the criteria developed under AS 14.11.014(b) that are applicable to the project. This subsection does not apply to funding for swimming pools that meet criteria established by the department.

AS 14.11.100(h) requires the department to adopt standards on the size of swimming pools:

> An allocation under (a)(4) or (5) of this section for school construction begun after July 1, 1982, shall be reduced by the amount of money used for the construction of residential space, hockey rinks, planetariums, saunas, and other facilities for single purpose sporting or recreational uses that are not suitable for other activities and by the money used for construction that exceeds the amount needed for construction of a facility of efficient design as determined by the department. An allocation under (a)(4) or (5) of this section may not be reduced by the amount of money used for construction of a small swimming pool, tank, or water storage facility used for water sports. However, ***an allocation shall be reduced by the difference between the amount of money used to construct a swimming pool that exceeds the standards adopted by the department and the amount of money that would have been used to construct a small swimming pool,**** tank, or water storage facility, as determined by the commissioner. [*emphasis added*]

Department of Education & Early Development Review

AS 14.07.020(a)(11) provides that the department shall:

> review plans for construction of new public elementary and secondary schools and for additions to and major renovations of existing public elementary and secondary schools and, in accordance with regulations adopted by the department, determine and approve the extend of eligibility for state aid of a school construction or major maintenance project; for the purposes of this paragraph, "plans" include educational specifications, schematic designs and final contract documents; . . .

Plans for a swimming pool are to be submitted to the Facilities section of the Alaska Department of Education & Early Development as part of the standard review documents required by statute and regulation. At the educational specifications stage, plans must contain, 1) a detailed description of the planned pool program with anticipated uses, 2) detailed information about numbers of students to be involved in the various programs, and 3) the anticipated pool size, the support spaces needed and basic technical information on materials and systems desired. Subsequent submittals should provide drawings and details of the proposed swimming pool facility.

Authority

4 AAC 31.021(c)—see similar language at 4 AAC 31.060(j) for debt reimbursement—requires that:

> A grant application that includes new construction, addition of space, or replacement of space must include verification that
> (1) the enrollment of the attendance area will reach the design capacity of existing school facilities within two years.
> (2) the situation cannot be relieved by adjusting the boundaries of service area and transporting the children to nearby schools;
> (3) as demonstrated by commonly accepted demographic techniques resulting in population projections accepted as reasonable by the department, the proposed facility will reach and sustain design capacity within five years after the anticipated date of occupancy;

Educational specifications for the requested pool facility must include a projection of student population, in accordance with accepted methods, to a point of five years beyond the anticipated occupancy date of the facility.

4 AAC 31.060(c) provides that:

> A school facility for which state aid is sought under AS 14.11.011 or 14.11.100 may be built jointly with municipal and state offices, health clinics, community libraries, and other spaces if approved by the commissioner as to compatibility and separation of funds. The commissioner has final authority to determine the proration of space and cost in a jointly built project.

Educational specifications for the requested pool facility must include a projection of student population, in accordance with accepted methods, to a point of five years beyond the anticipated occupancy date of the facility.

For additional information on the data required for a determination of eligibility for state aid, see the section in this publication **Method for Determining Allowable Size**.

Factors in Determining Pool Design

Any swimming facility submitted for state aid by a public school district must be designed foremost for instructional purposes. Such design allows the teaching of basic swimming strokes, general water safety, boat safety, and lifesaving.

A pool design enabling the teaching and practicing of diving may be desirable, as may be a design that supports the opportunity for recreational swimming or fitness swimming, both valuable by-products of an instructional swimming program. These, and other uses should be considered in the overall facility design, however, no additional space will be assigned for these functions.

Also not to be overlooked is the possibility for the pool facility to act as a water supply for a fire suppression system. However, State funding is available only in support of the instructional program (K-12) or for a facility serving as an emergency water storage facility.

Pool design, therefore, will be determined by the district primarily by three factors: population, the instructional program, and any desired additional uses. The total program space requirements will be a combination of these factors. These factors will also need to be balanced with the available funding—both capital and operating—for the construction, capital renewal, and operations and maintenance costs for the facility.

Programs to be Offered

Pool instructional space is determined by the classes, mandatory and elective, to be offered and the student population to be served.

Mandatory Courses

Instructional program courses for K-12 students that are eligible for inclusion in determining a pool size for state-aid include the following:

- Basic swimming instruction, including stroke development, substantially similar in instructional content to the latest published American Red Cross learn-to-swim program.

Elective Courses

In addition to the mandatory courses, the following courses are allowable for consideration as part of an elective instructional program when the program is serving students in any grades K-12.

- Competitive swimming and diving, when part of an Alaska School Activities Association (AASA) sanctioned competitive swim-dive team. Club teams are not supported.
- Boat safety/Maritime: Instruction for students in such topics as overloading, personal flotation devices, maneuvering in rough water, high speed turning, capsizing, explosion and/or fire, and falling overboard. While many of these instructional areas will require

small boats and larger bodies of water, some of these topics can be taught and the necessary skills developed in a pool facility. In some of this coursework, the ability to turn a small boat, canoe or kayak end-for-end is important. Ideally, pool width should be twice that of the boat length.

- Drown-proofing/Survival: Formal drown-proofing is based on a system of self-rescue developed at Georgia Institute of Technology, particularly aimed at those who feel they will never learn to swim a regular stroke, but want to be able to save themselves in the event of an emergency. When combined with survival elements, lessons focus on personal water safety, use of personal flotation devices (PFDs), safe rescues of others, cold water survival techniques, hypothermia, and ice safety.
- Adaptive and Occupational/Physical Therapy: Instructional programs that provide students of all abilities and special needs the lifelong skill of being comfortable and safe in the water, as well as confident and independent in recreational activities.
- Scuba training: Diver courses, including those leading to certifications, in support of underwater activities.
- Water safety courses to develop and train instructors for the American Red Cross. These instructors qualify to teach lifesaving and to conduct water programs for all age groups.
- Water safety aide courses to develop and train young people in pool safety and the fundamentals of teaching swimming.

Community Use

If the pool will be available for community use in off-school hours, additional activities to be considered in planning are:

- Synchronized swimming training: For those individuals who are interested in the exacting and artistic demands that this activity has to offer.
- Infant training: This is a specialized offering, given by an experienced swimming instructor. Many infants have been given an excellent start as swimmers. Such training reduces the fear associated with water and reduces the time a student needs to learn to swim.
- Adult swimming courses: These courses prove to be surprisingly poplar for their social as well as instructional benefits.
- Swim to stay fit programs for persons who want a relaxing activity that maintains body tone. Individualized activity is stressed in this program.
- Survival training for the general public: A large number of people are concerned with being able to get themselves out of difficult situations.

- Rescue squad training: Most rescue squads feel that they should be prepared to handle all emergencies. There are many areas having potential water hazards which are protected by such squads.
- General recreational swimming for the public: Family nights, mother-daughter, father-son, and other combinations can provide a source of revenue to support pool operation.
- Water ballet training: For persons of all ages who enjoy group training and the artistic results that an exacting physical activity can produce. Water ballet allows for all ranges of talent.
- Fly and bait casting: Training practice can be provided.

Conceptualizing the Swimming Facility

- After the envisioned instructional program and other uses of the pool area have been determined, the complete swimming facility should be conceptualized.
- Adequate deck space for instruction must be provided. A minimum of 12 feet is recommended for this purpose.
- A minimum of 6 feet of deck space should be allowed on all other sides of the pool for safety. As many as 2/3 of the group will be out of the water at any one time.
- Equipment, office space, locker and shower rooms must be included and designed with a functional amount of space depending on population served.
- If diving is provided, ceilings should be at least 16 feet above the highest board surface. A one-meter board and 12 foot depth is the recommended minimum for diving. Diving programs are not allotted any additional space.
- Safety is of primary concern, a secure area for chemical storage should be provided, as well as a control station and first aid area. (For additional Health-Safety information see the Center for Disease Control website; www.cdc.gov/healthywater/swimming/aquatics-professionals/index.html)
- If the district desires to utilize the pool as a water storage facility for a fire suppression system, considerations for tying into the fire alarm system, providing backup power for pumps, water distribution, specifications for piping, sprinkler heads, etc. should be referred to a mechanical engineer or fire sprinkler design company. Some room for additional equipment may be required.
- Because of safety and health concerns, several agencies have regulatory authority covering a water safety facility. In addition to applicable uniform codes for building, mechanical, electrical, fire safety, etc., Districts must adhere to DOT/PF

barrier free regulations and Department of Environmental Conservation health and safety regulations, including those covering swimming pools. (18 AAC 30).

The following figures contain typical elements related to pool features that support both eligible instructional programs and pool features for other uses.

Figure 1 - Lane Dimensions and Water Depths

This figure illustrates typical minimum lane dimensions and water depths for learn-to-swim instructional programs. Illustrations are generally progressive from basic to more advanced programming. Requirements for diving instruction are also illustrated.

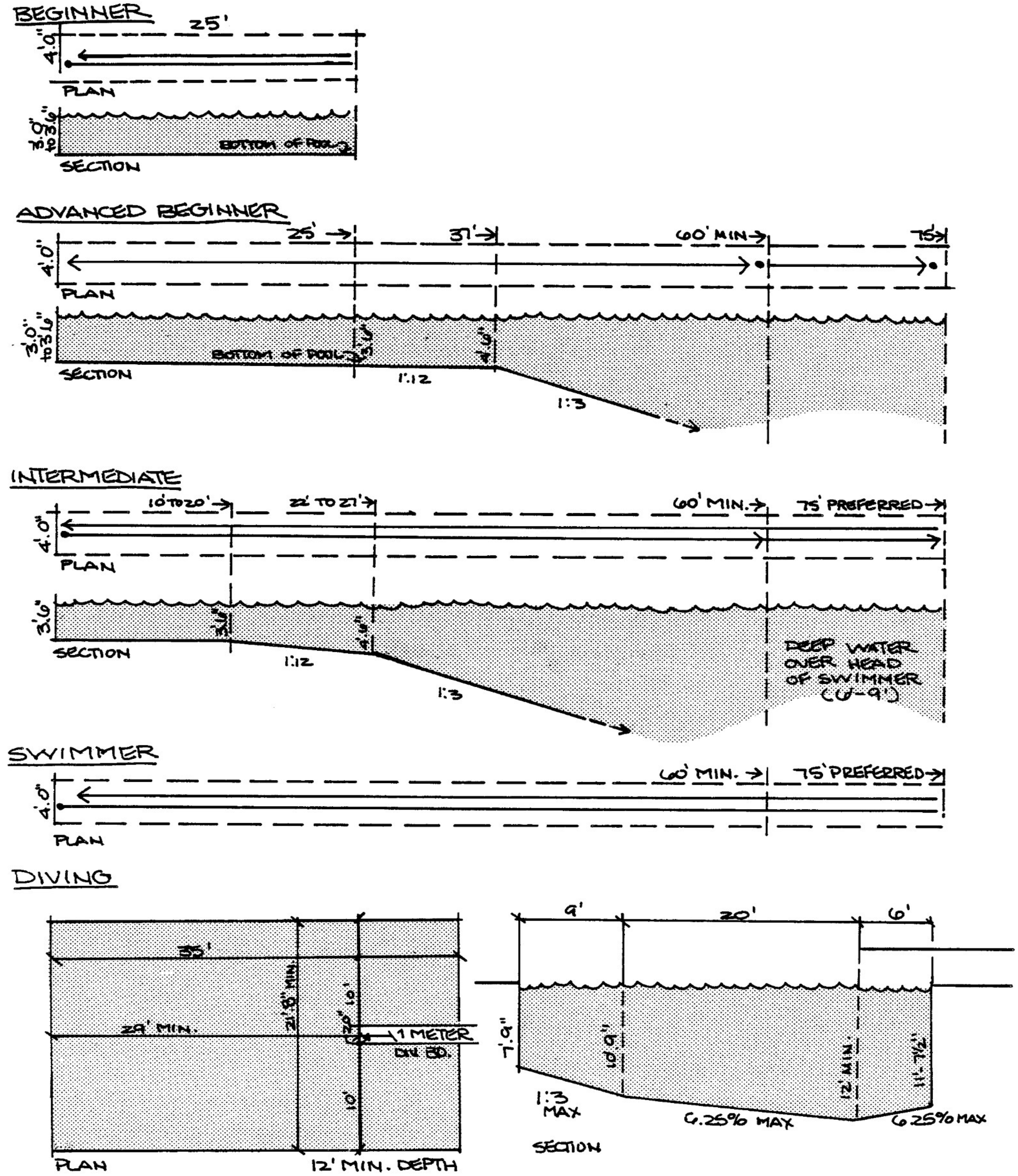


Figure 2 - Pool Layout

This figure illustrates one option for a pool design for combination Swimming/Diving program requirements. Others include Montreal and L-shaped layouts:

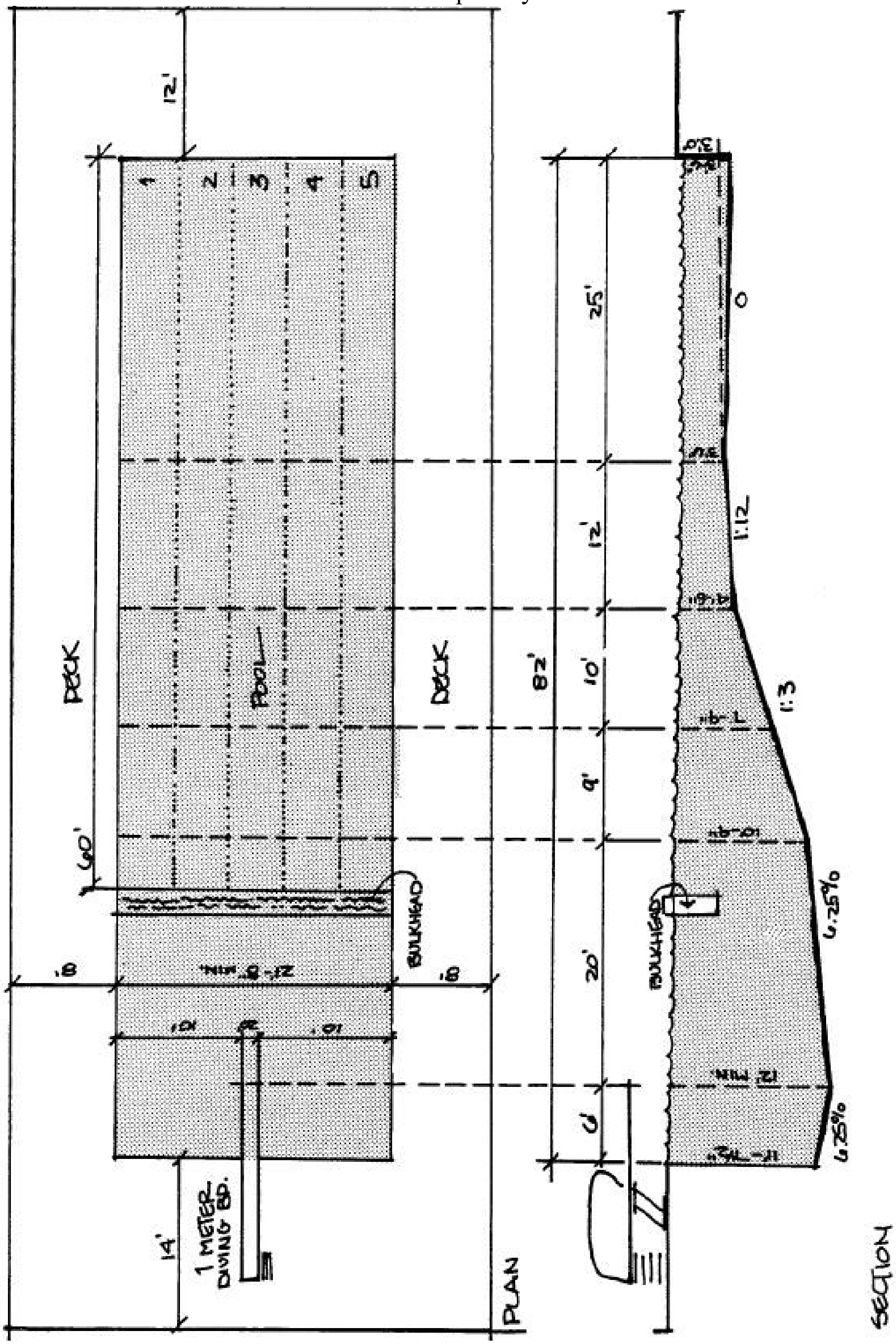
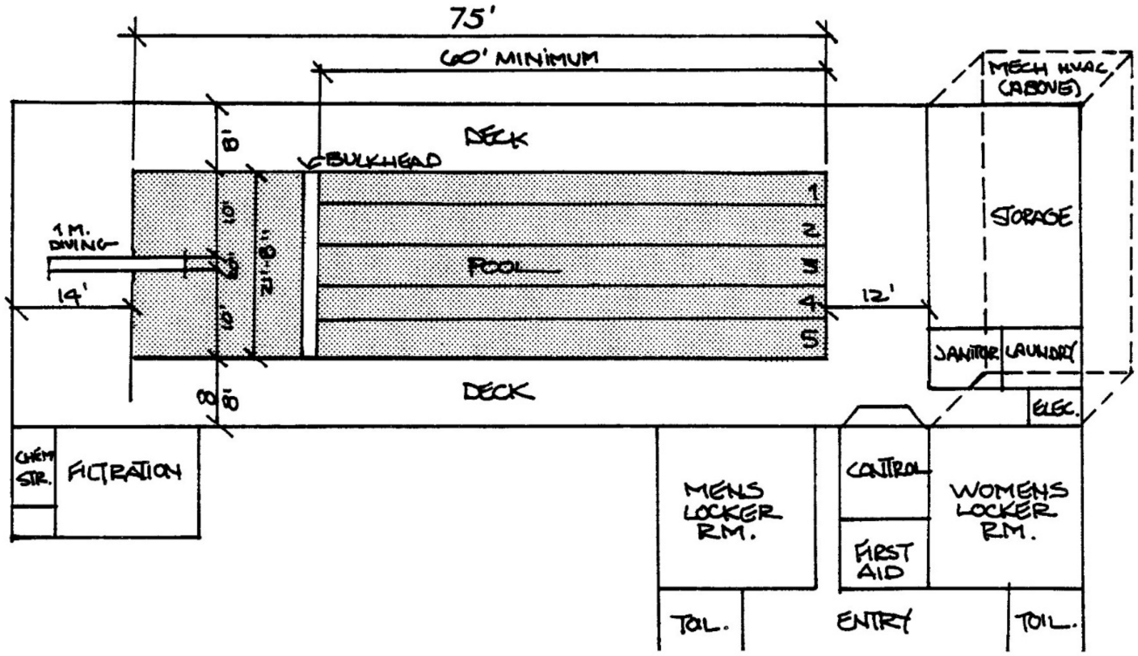


Figure 3 - Conceptual Layout



This figure shows a conceptual layout of a swimming pool facility using the eligible pool area shown in the **Pool Size Table** for an instructional program with between 201 -400 students.. For this size of pool, 8,500 square feet (sf) are allowed for the total building area.

Pool	1,650 sf
Deck	2,890 sf
Control	120 sf
First Aid	100 sf
Locker Rooms	750 sf
Laundry	70 sf
Janitor	80 sf
Mechanical/HVAC @ 7%	560 sf
Filtration	280 sf
Chlorine	30 sf
Chemical Storage	60 sf
Electrical	80 sf
Structural - Deck Equipment	340 sf
Toilet	240 sf
Circulation/Entry/Exit	630 sf
Interior Walls @ 3%	230 sf
Planning Factor @ 5%	385 sf
Total Area	8,500 sf

Operations, Maintenance and Repair

A district developing a swimming facility must take into consideration the following cost factors in planning the facility and incorporating it into the district's operating budget:

1. Annual routine and preventive maintenance and repair.
2. Major maintenance and renewal.
3. Utilities
4. Possible increased costs for additional instructors/staff.
5. Community use of pool could be a source of income but will also increase maintenance, repair, and staff cost.
6. Possible increased expenses to transport students to and from the facility.
7. Increased insurance costs, however, the possibility should be explored as to the feasibility of using the pool as a water reservoir, which may reduce the cost of fire insurance.
8. Life cycle cost of the proposed facility.

Allowable Pool Size

General Philosophy

For funding programs where state-aid is dependent on space eligibility, the total educational square footage, including the swimming pool facility, housing the population to be served must be at or below the space allowed under 4 AAC 31.020. If space eligibility is determined, pool size may also be limited based on the number of students served in by eligible instructional programs.

For funding programs where state-aid is available without regard to space eligibility, pool size will be based on an analysis of a district's instructional program and the resulting annual number of students receiving instruction in eligible programs, whether mandatory or elective.

Eligible pool size and total building area will be selected from the Pool Size Table based on the approved number of students receiving instruction in eligible programs.

Populations Served

The district will need to analyze the following information for a pool size determination. This information must also be provided to the Department of Education & Early Development:

Space Eligibility Determination

- Current district enrollment of the population to be served by the facility (K-12).
- Breakdown of enrollment by individual school and grade level.
- An enrollment projection for five years beyond the anticipated occupancy date by school and grade level.

Program Determination

A district developing an instructional plan must consider the following factors:

1. Type of aquatics program (e.g., learn-to-swim, drown-proofing/survival, special needs student OT/PT, competition, etc.). For potential programs, see **Programs To Be Offered**, earlier this publication, or refer to the latest published learn-to-swim guidance from the American Red Cross. This publication does not limit district or community aquatics programs; it does designate whether participants in those programs are included in the eligible population used to calculated state-aid for school pool facilities.

2. Whether the instructional programs are classified as Mandatory or Elective under the definitions in this guideline.

3. The following information for each instructional program:
   a Minimum hours (time) of instruction,
   b Number of students per class period,
   c Length of course, and
   d Number of class periods per day.

   This information is used to calculate the total number of students served by that program on an annual basis.

A sample Program Determination Worksheet is shown below. This type of tabular listing of programs and their elements is key to determining the number of students receiving programmed instruction per year for use in the Pool Size Table.

Program Determination Worksheet

Use the table below to document the instructional program.

Swimming Instructional Program Type	Mandatory or Elective	Minimum Hours Instruction	# of Students per Class Period	Length of Course Semester or ½ Semester	# of Class Periods per Day	Instructional Staffing	Total Students Served

Stipulations & Conditions

- A district's documented educational program associated with swimming pool use must be a board-approved curriculum.
- A district must provide evidence of a learn-to-swim program substantially similar in instructional content to the latest published American Red Cross learn-to-swim program.
- Only learn-to-swim programs (instructional curriculum) are considered mandatory; all other instructional programs will be considered elective.
- The minimum threshold for a district to qualify for state aid for a swimming pool facility is 100 students receiving instruction in a mandatory program.
- When counting the number of students receiving programmed instruction in the course of a year, a maximum of 30 percent of that yearly total can be those in elective coursework.

Ineligible Pool Elements

The following items are not considered as elements of a school swimming pool. The cost of these items will be removed from a project prior to any allocation of state aid which is based on an eligible pool size determination:

- Recreation accessories including slides, saunas, spas or hot tubs, whirlpools, and equipment that cannot be demonstrated to be integral to the instructional program;
- Non-swimming activities for the general public use;
- Locker rooms, offices, lobbies, etc. deemed in excess of those required for school district classes.

Method for Determining Allowable Size

Step 1 – Document the district's instructional program and calculate the number of students served, annually, in each program.

Step 2 – Review the minimum qualification regarding number of students served by the program. If the program serves fewer than 100 students, the district is not eligible for state-aid for a pool facility.

Step 3 – For programs serving 100 or more students, calculate the annual number of students served in mandatory programs and those served in elective programs. If the number of students in elective programs is more than 30 percent of the combined total, reduce the number of eligible students to match that cap.

Step 4 – Using the **Pool Size Table**, find the corresponding bracket in column one *Students Receiving Programmed Instruction per Year* in which the districts eligible number of students receiving instruction fits. The *Maximum DEED Pool Surface Area* and *Maximum DEED Facility Square Feet* are shown on the right side of the table.

Allowable Pool Size

Pool Size Table

Use the table provided below to determine the allowable pool size based on the total number of students served by the approved instruction programs.

Students Receiving Programmed Instruction per Year	Instructional Staffing	# of Students per Class Period	# of Class Periods per Day	Total Hours Instruction per Course	Allowable Pool Dimension	Maximum DEED Pool Surface Area	Pool Facility Factor	Maximum DEED Facility SF
100 - 200	1	10	4	100	15ft x 75ft	1125sf	5.5	6,190sf
201 - 400	2	20	8	200	22ft x 75ft	1650sf	5.2	8,500sf
401 - 600	3	30	12	300	29ft x 75ft	2175sf	5.0	10,875sf
601 - 900	4	40	16	400	36ft x 75ft	2700sf	4.7	12,690sf
901 - 1200	5	50	20	500	43ft x 75ft	3225sf	4.5	14,510sf
1201 +	5+	50+	20+	500+	50ft x 75ft	3750sf	4.0	15,000sf

Notes:

1. Approximately 10 students per instructional staff
2. Each instructional staff can teach one level to 400 students/year
3. The Pool Facility Factor incorporates 6ft pool decks on three sides, 12ft deck on one long side, locker rooms, administrative office space, pool mechanical, and circulation factor

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

A Handbook to Writing Educational Specifications

PUBLICATION COVER

July 8, 2019

Issue

The department seeks committee approval to publish *A Handbook to Writing Educational Specifications, 2nd Edition*.

Background

Last Updated/Current Edition
Publication was last updated in 2005. The current edition is available on the department's website: education.alaska.gov/facilities/ publications/EdSpec.pdf.

Authority
This publication is not listed in 4AAC 31.020 as a guide for planning educational facilities and does not have the force of regulation. However, the document develops and establishes the provisions of 4 AAC 31.010 Educational Specifications, and is used by DEED to establish compliance with this section of regulation.

Summary of Proposed Changes
This proposed publication updates the 2005 prior publication. The department has prepared this update to the publication based on input from the committee at both the December 12, 2018, and April 2, 2019 meetings and based on department experience administering state aid for school capital projects under AS 14.11. Key revisions/additions to the publication address the following:

- Furnishing & Equipment,
- Alternative Project Delivery,
- Sustainability Determinations.

Version History & BRGR Review
Drafts of the publication were presented to the committee at the following meetings:

December 12, 2019 – Overall minor changes to update nomenclature and document structure and add additional student population type from regulation.

April 16, 2019 – Revised draft included sustainability supplement and expanded information on building performance and FF&E requirements; committee approved for public comment.

Public Comment

Public comment period open May 6, 2019 through May 24, 2019. The department received public comment from four individuals. Both the comments, and the department's response through the Facilities unit are included with this paper.

BRGR Input and Discussion Items

Public comments can be summarized as follows:

- Clarity is needed on how the document will be used since it's not a regulation or cited in regulation.
- Requiring a list of FF&E in an education specification is too early in the project process.
- The handbook references as primary, population projection tools that are hard to complete with the data available in Alaska. The department should consider the 'average annual change' method as primary.
- Requiring a list of FF&E in an education specification will likely require that process to be repeated several times in the course of a project.
- It might be better to develop the project management subjects in the handbook as a separate publication or combine them with other similar publications.
- Often, years pass between education specification development and project funding and execution. Requiring FF&E as part of an ed spec will make it become outdated all the more quickly.

The department determined the need for improved planning (and execution) in the area of FF&E out-weighed any of the concerns presented. Adjustments were made to the FF&E planning tool (attached) to simplify the recommended FF&E data elements.

Options

Approve final publication for issuance and use by the department.
Amend final publication and approve for issuance and use by the department.
Seek additional information.

Suggested Motion

"I move that the Bond Reimbursement and Grant Review Committee approve the department's proposed update of *A Handbook to Writing Educational Specifications* for issuance and use by the department."

From: Mearig, Timothy C (EED)
To: "Aurora Corporate"
Subject: RE: Proposed Ed Specs Handbook
Date: Thursday, June 13, 2019 3:01:00 PM

Al,

Thank you for the comments. We plan to have this publication before the BR&GR Committee in mid-July for approval. Your comments, and this response, will be provided to the committee. Below are a series of numbered statements that I believe address your comments:

1. You are correct that the document is not a regulation, however, it may be used to implement the requirements of regulation.
2. Both statute and regulation require department review of educational specifications for projects whose scope includes certain types of work. The handbook will be used in this review and approval process. (See the Introduction for the stated intended uses.)
3. Within the CIP application process, certain projects require educational specification to be eligible for Planning points. The standard for measurement is "complete". Nothing in the proposed handbook changes this.
4. The handbook requires identification of recommended school equipment, identification of existing available equipment, and a presentation of such in a tabular form. Ed specs without this analysis and listing will not be considered complete.
5. A clear listing of FF&E requirements in an ed spec will provide necessary guidance to the entity responsible both for the design of the school and for the acquisition of the FF&E. It is an essential part of the school plan and is explicitly listed as such in regulation.
6. An appropriate level of detail for FF&E based on needs and available resources is solid planning and budgeting. The tool being offered with the handbook and shown as a sample was adapted from an actual FF&E solicitation and includes a commensurate level of detail. It is only a tool and can be adapted to fit any particular project.

Best Regards,

Tim Mearig, Manager
FSS/Facilities
Education & Early Development
907 465-6906 office
907 321-5564 mobile

From: Aurora Corporate <auroracorpinc@gmail.com>
Sent: Tuesday, May 7, 2019 10:02 AM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>
Subject: Proposed Ed Specs Handbook

Tim

Thanks for the opportunity to comment on the proposed changes to the handbook.

I am assuming that the document would in fact be a handbook and not a regulation. I'd be interested to know how the Department would use the handbook in evaluating ed specs when they are a requirement under the CIP application process.

As to the proposed changes, my only concern is with the new FF&E requirements. Inasmuch as the handbook states that the purpose of educational specifications is "to guide the design professional's design," I do not see how the spreadsheets would lend themselves to that purpose. This would particularly be the case wherein the owner would be providing the FF&E outside the construction contract. The level of detail is overkill in my opinion, especially in that the educational specifications might be prepared several years prior to the point at which FF&E would actually be purchased.

Al Weinberg

From:	Alaska Online Public Notices
To:	Weed, Lori (EED); Mearig, Timothy C (EED)
Subject:	New Comment on Public Comment Period for Publication "A Handbook to Writing Educational Specifications"
Date:	Tuesday, May 07, 2019 11:17:08 AM

A new comment has been submitted on the public notice **Public Comment Period for Publication "A Handbook to Writing Educational Specifications"**.

Submitted:

5/7/2019 11:17:07 AM

Gary Eckenweiler
geckenweiler@bssd.org

Unknown location
Anonymous User

Comment:

Well Done,

Very easy to follow.
The fact that reasoning and justifications for actions are included enhance the document and the process.
The flow of the guide is well done. Also explanations are clear.
Yes, well done and extremely helpful.

Thank you and your team, your teams hard work shows. We're fortunate to have solid school facility support at the state level.

You can review all comments on this notice by clicking here.

Alaska Online Public Notices

From: Mearig, Timothy C (EED)
To: "Don Hiley"
Bcc: Weed, Lori (EED) (lori.weed@alaska.gov); Marquis, Wayne R (EED); Larry Morris; Roys, Sharol A (EED)
Subject: RE: Public Comment Request: revised DEED publication "A Handbook to Writing Educational Specifications"
Date: Thursday, June 13, 2019 4:27:00 PM

Don,

Thank you for the comments. We plan to have this publication before the BR&GR Committee in mid-July for approval. Your comments, and this response, will be provided to the committee. Below are a series of numbered statements that I believe address your comments:

1. The handbook fairly treats the subject of student population projects, albeit from a broader perspective than what we are seeing specific to DEED. Cohort progression, based on some internal research, still holds the position as the primary student population forecast tool (ref. Washington OSPI's Enrollment Projection Study c.2008, etc.). We realize the challenges of it use currently in AK and would like to see if that could be addressed. I have added the issue you raised to a Facility section task list.
2. A clear listing of FF&E requirements in an ed spec will provide necessary guidance to the entity responsible both for the design of the school and for the acquisition of the FF&E. It is an essential part of the school plan and is explicitly listed as such in regulation. An appropriate level of detail for FF&E based on needs and available resources is solid planning and budgeting. The tool being offered with the handbook and shown as a sample was adapted from an actual FF&E solicitation and includes a commensurate level of detail. It is only a tool and can be adapted to fit any particular project.

Best Regards,

Tim Mearig, Manager
FSS/Facilities
Education & Early Development
907 465-6906 office
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From: Don Hiley <donh@serrc.org>
Sent: Friday, May 24, 2019 3:20 PM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>
Cc: Weed, Lori (EED) <lori.weed@alaska.gov>
Subject: RE: Public Comment Request: revised DEED publication "A Handbook to Writing Educational Specifications"

Tim,

I have a couple thoughts regarding the revised Ed Spec Handbook:

1. I feel the Annual Percentage Change method of calculating enrollment projections should be considered primary, with Survival Ratio listed as a secondary method. As discussed at the previous BRGR meeting, and at the CIP workshop, live birth data for small population areas has become extremely difficult to get from the State now, apparently due to HIPAA restrictions. This makes generating Survival Ration projections for a small school problematic at best. More importantly, the Department has always expected in the past to receive the standard Annual Percentage Change worksheet in addition to the Survival Ratio (or any other projection data used). Annual Percentage Change has been considered the "official" methodology, and Survival Ratio projections have typically been shown on the "District's Projection" lines in the Department's worksheet, which then averages them with the Annual Percentage Change projection to come up with a number accepted by the Department. In all the time that I have been using these tools, the Department has not accepted the Survival Ratio projection alone as a basis for calculating allowable space. If that policy has now changed, then the Department's space calculation worksheet tool should probably be changed to somehow reflect this.

2. I reiterate my comments from the previous BRGR meeting in that I believe providing a comprehensive list of FF+E, including shipping weights and costs, is premature at the Ed Spec stage. While we have always provided a general list of equipment for each type of space in the Ed Specs, it has not looked like an order form, knowing that many changes will occur as the project moves along from planning through design and construction. That process may take considerable time due to funding limitations, and it's likely that equipment models and availability, among other things, will also change along the way. At some point, as the design firms up closer to construction, that exercise will need to occur. But it does not need to occur repeatedly prior to that. For that reason, this level of specificity is just not justified in the planning stage. In speaking with others since the proposed handbook revisions were originally presented, there seems to be general agreement on this. The FF+E spreadsheet provided is a nice tool, and should be quite useful, just later in the project.

Thanks,

Don Hiley
Facilities Program Manager
SERRC - Alaska's Educational Resource Center
210 Ferry Way, Juneau, Alaska 99801
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donh@serrc.org

From: Weed, Lori (EED) [mailto:lori.weed@alaska.gov]
Sent: Monday, May 6, 2019 10:15 AM
To: Mearig, Timothy C (EED)
Cc: Weed, Lori (EED)
Subject: Public Comment Request: revised DEED publication "A Handbook to Writing Educational Specifications"

TO: Interested Parties

The Department of Education and Early Development has revised its publication *A Handbook for Writing Educational Specifications*. This publication provides guidance for school districts and consultants in creating a program for design (i.e., educational specification) for school facility construction and improvement projects that meets department regulation 4 AAC 31.010. Main elements being addressed in this update include emphasizing requirement for tabulation of furnishing and equipment and providing a spreadsheet tool, alternative delivery considerations, and sustainability determinations.

If you are interested in commenting on the attached draft or supplementary spreadsheet tool, you may submit them through the online public notice or e-mail your comments to Tim.Mearig@alaska.gov no later than May 24, 2019.

Your feedback is appreciated, thank you.
~ Lori

Lori Weed
FSS/Facilities, School Finance Specialist II
Department of Education and Early Development
(907) 465-2785 | lori.weed@alaska.gov

From: Mearig, Timothy C (EED)
To: "Kathy Christy"
Bcc: Larry Morris; Weed, Lori (EED) (lori.weed@alaska.gov); Roys, Sharol A (EED); Marquis, Wayne R (EED)
Subject: RE: Response to the Draft Handbook to Writing Educational Speciifications.docx
Date: Thursday, June 13, 2019 4:00:00 PM

Kathy,

Thank you for the thorough review and well developed comments. We plan to have this publication before the BR&GR Committee in mid-July for approval. Your comments, and this response, will be provided to the committee. Below are a series of numbered statements that, though brief, I believe address your comments:

1. Ed specs are one of the latest, rather than first, documents to be developed in the Planning phase of a project. Many project parameters are known by the time an ed spec is needed including facility conditions, student populations and projected populations, available school space and school equipment, site selection, project budgets including those for construction, design, equipment, art, and project management. When these project parameters have been established, and ideally when funding is identified, it is time to assemble this project information and merge it with educational philosophies, goals, strategies, and functions to provide direction to design professionals. In the push to advance project priorities in the DEED CIP process, ed specs can often take on a life of their own and not be grounded in the reality of a specific project.
2. Your content analysis regarding the handbook section Scheduling and Responsibilities was helpful. With the exception of the key information on population projections you mention, this information in that section is not listed in 4 AAC 31.010 as a minimum element of an ed spec. We have flagged this for further review and possible relocation to an appendix rather than in the list of Essential Factors in a future update.
3. The handbook requires identification of recommended school equipment, identification of existing available equipment, and a presentation of such in a tabular form. Ed specs without this analysis and listing will not be considered complete. The handbook clearly states that such information must be updated after Design Development.
4. A clear listing of FF&E requirements in an ed spec will provide necessary guidance to the entity responsible both for the design of the school and for the acquisition of the FF&E. It is an essential part of the school plan and is explicitly listed as such in regulation.
5. An appropriate level of detail for FF&E based on needs and available resources is solid planning and budgeting. The tool being offered with the handbook and shown as a sample was adapted from an actual FF&E solicitation and includes a commensurate level of detail. It is only a tool and can be adapted to fit any particular project.
6. Your comments regarding the rapid changes in the world of school FF&E call for the knowledge base and role of the educational planner to be elevated not relegated with respect to FF&E. An educational planner preparing an ed spec can offer critical leadership if FF&E is a discussion (and requirement) during preparation of that document—much more so than if brought to the table eight months before a school opens.

Regards,

Tim Mearig, Manager
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From: Kathy Christy <christykj@gci.net>
Sent: Tuesday, May 28, 2019 10:10 AM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>; Weed, Lori (EED) <lori.weed@alaska.gov>
Subject: Response to the Draft Handbook to Writing Educational Speciifications.docx

Attached are my comments to the Draft Handbook. Thank you for the opportunity to comment. Obviously, from my comments I feel very strongly that the FF&E section is far too detailed at this level of project design. How can you have discussions and start identifying specific furnishings, let alone assign room numbers, when there isn't even a schematic design? This information may be better placed in the FFE Handbook, not the Ed Spec Handbook.

Response to the Draft Handbook to Writing Educational Specifications

Kathy Christy, ALEP Fellow

Capital Projects Manager

The ed spec is one of the first steps in the project development process. The intent of the Educational Specification is to define the proposed project to direct the development of the concept and schematic design to meet District program requirements working within DEED space regulations. Specific design solutions are not addressed at the ed spec stage. During schematic design compromises are made to utilization of space to best satisfy program goals while keeping within space limitations. It provides a guideline for design that may need to be altered as the project progresses.

Up to page 29 the draft primarily addresses wording clarifications for the specific development of the educational specification. I have no issue with these modifications However, from Page 30 on, although the information addressed is important for a future DEED applicant to know, it is generally not a component of the Educational Specification document. A suggestion is to create a new section in this handbook or refer readers to the Capital Project Administration Handbook for other information they need to know. The new section could be titled something like – Beyond the Ed Spec Important Considerations in Project Development.

It is essential that a District understand the information contained in pages 30-33 Project Budget and Financing, probably even before initiating the Ed Spec effort. Project Budget, of course, is an essential element of the grant application but it is not included in the Ed. Spec. To the inexperienced, how this information relates to Ed Spec development might be confusing.

Likewise, Scheduling and Responsibilities p 34-35 as presented, is somewhat out of place. The information relating to how the scheduled completion date impacts the population projections and space calculations should be addressed on page 13. The milestone details of project scheduling should be addressed in the supplemental section, if one is created. Again, assignment of responsibility and project delivery methods are not a component of the Ed Spec. and may be premature to discuss at this stage.

I am aware that the current handbook includes the Equipment and Furnishing Summary section. However, I recommend this section be significantly modified. I do not think that it is a productive use of time and money to produce a detailed list of FF&E at the Educational Specification stage. At this point a design has not been developed. It has not been determined how spaces will be configured or which spaces may be serving multiple use functions and what specific compromises of space allocation may occur to meet the structural realities of existing building or space limitations. There certainly are not room numbers to reference. I strongly disagree with requiring a detailed list of FFE at this stage.

The development of detailed FFE list and cost estimates are an important component of project development but it should not occur before Schematic Design and preferably after Design Development. The development of the detailed FF&E list should be a separate activity from the Ed Spec. I strongly recommend that the Guideline for School Equipment be revised and updated with this in mind. The Ed

Spec is not the time to count trash cans and chairs before there is a concept plan. The worksheet that was developed is a useful tool but at a later stage of project development.

The owner does need to identify the philosophy of the educational program as it relates to future FF&E selection within the Ed Spec. Examples of this include a discussion of built-in verses mobile furnishings , it is desired for teachers to "own" their classroom or rotate between classes, will instruction be mixed grade vs single grade classrooms or change every year. What type of workstation will teachers have? Is it desired for cafeteria tables be linear wall mounted tables or 6-person dining tables that can double as work tables? The answers to these questions all have an impact on the schematic design solutions.

For a school to support future changes in educational delivery and technology the design must be flexibility and agile and so must the furnishing. Manufacturers have gotten the message and are responding with new innovative solutions and continuing to develop new furniture solutions. At last fall's A4LE International Conference trade show there were a number of new major manufacturers responding to the need for FF&E supporting hands-on project-based learning opportunities. With more competition selection and quality is improving and costs are coming down. FFE is rapidly evolving.

It is important to recognize that 3 to 5 years, and very possibly more will pass between development of an ed spec and the completion of a project. Manufacturers of FF&E have become much or innovative and competitive in the last few years. School furniture is no longer a matter of desks, chairs and bookshelves that are never to be moved from their assigned location. It is important to recognize that furniture choices three years from now are going to be better than the options available today.

It is helpful at the FFE stage to know the general condition of existing equipment and if reuse of specific items is desired. For example, new weight room equipment or recently replaced kitchen equipment. However, a detailed inventory of existing equipment is best performed after development of schematic design so that it can be determined which existing items support the planned educational program. If an existing FF&E item does not support the planned development and it is still in serviceable condition it should be repurposed or transferred to another facility.

If it is useful for a District to include an FF&E listing in the ed spec they should be able to do so. However, for the majority of the projects I have worked on it is best to develop the detailed FF&E and technology list later in project development close to when orders will actually be placed.

A Handbook to Writing Educational Specifications

PRIMARY CONTRIBUTOR

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Facilities Manager
Alaska Department of Education & Early Development
Juneau, Alaska

CONTRIBUTORS

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Juneau, Alaska

Facilities Staff
Alaska Department of Education & Early Development

ACKNOWLEDGEMENTS

Thanks to the Bond Reimbursement and Grant Review Committee members who reviewed the publication in its draft form and to those in the Department of Education & Early Development who were responsible for the predecessor to this document including the work completed by Edwin Crittenden, FAIA, Nathan Coffee, Michael Morgan, PMP, and Sam Kito III, PE under their tenure at the Department of Education & Early Development.

This document was originally prepared under contract by the Southeast Regional Resource Center and published under a similar name by the State of Alaska Department of Education in 1985.

Table of Contents

Introduction

The initial step in the creation of a school facility that effectively meets the needs of students, teachers, administrators, and community members is the formation of a clear, concise, written facility program statement. This written program statement is the educator's opportunity to articulate the educational program of the school to the professional designer. The written program statement, through further development, becomes the "program for design" that articulates the scope and requirements for a completed facility. Educators have come to call this program for design an "educational specification." The success of the educational specification in communicating the school facility's needs to the professional designer plays a large part in the overall success of a school facility construction or improvement project.

The development of educational specifications is more a process of pre-design problem definition than a process of problem solving. It is important that the educational specifications, as thoroughly as possible, describe the facility's anticipated uses and identify the specific physical characteristics that will be required to house and promote the proposed activities. The educational specifications should provide detailed parameters to guide the design professional's design, rather than describe how the facility is to be constructed. A further discussion of the problem-definition process can be found in the *Creating Connections: The CEFPI Guide for Educational Facility Planning* published by the Association for Learning Environments (A4LE).

The elements that all educational specifications should contain are fairly exact; however, the processes used to develop the educational specifications and the manner in which the information is presented may vary. These differences in the development and presentation of the educational specifications can be attributed to a number of factors, including variations in community involvement, educational programs, and school sizes. It is important that all educational specifications attempt to:

- Involve educators and community representatives in the definition of educational needs;
- Enable school planners to better understand the purposes of the facility;
- Set goals for sustainability over the entire life-cycle of the facility;
- Help the designers to create a building that fits the educational program and needs of the community; and
- Eliminate oversights that are expensive to correct once construction is complete.

A well-prepared educational specification is an integral part in the creation of a building that enhances the learning environment, accommodates learning activities, and provides pleasant surroundings for occupants and visitors. A poorly developed educational specification generally results in a mediocre facility, or one that is marginally functional for education. It is the intent of this publication, *A Handbook to Writing Educational Specifications – 2019 Edition*, to provide a resource for school districts and educators that:

- Identifies the essential elements that an educational specification should contain;

- Outlines approaches and techniques utilized in the creation of an educational specification and overall project planning; and
- Improves the quality of an educational specification and its effectiveness in communicating to the architect the current and envisioned educational programs and goals for the facility.

State Requirements

By regulation 4 AAC 31.010, the Alaska State Department of Education & Early Development requires the chief school administrator, under the direction of the local school board, to be responsible for preparation of educational specifications for all new public elementary and secondary schools, as well as additions and renovations of existing facilities, for which state aid is sought. The question of whether a capital project requires educational specifications often arises for there are many capital projects, such as a roof replacement or mechanical upgrades, that do not require educational specifications. It is the department's policy to require educational specifications on any project that alters the configuration of the building's spaces or the manner in which those spaces are to be used. Therefore, all new school construction projects, additions, and renovations typically require educational specifications that include, at a minimum, the following elements:

- The current year and five-year post-occupancy projected attendance area enrollments in the grades *(grade levels)* affected by the facility;
- A statement of educational philosophy and goals for the facility;
- The curriculum to be housed by the facility;
- The activities that will be conducted in the facility;
- The anticipated community uses of the facility;
- The general and specific architectural characteristics desired;
- The educational spaces needed, their approximate sizes in square feet, their recommended equipment requirements, and their spatial relationships to other facility elements;
- The size, use, and condition of existing school spaces in the facility *(additions and rehabilitations only)*;
- The recommended site and utility requirements;
- The proposed budget and method of financing; and
- The technology goals of the curriculum and their facility requirements.

Additional regulations in 4 AAC 31.020 identify guides for planning educational facilities as well as the method of determining allowable square footage for a school facility. Regulations 4 AAC 31.021 and 31.060 stipulate the process of application for state aid for school capital projects. Regulation 4 AAC 31.022 outlines the requirements for review of capital project applications. Further information regarding the review and scoring of capital project applications is available with the CIP Application & Instruction packet that is distributed to all school districts each year. Regulations 4 AAC 31.030 and 4 AAC 31.040 address the review and approval of school construction plans. Copies of the school facility regulations are available in electronic form online through the Alaska legislature's website (www.akleg.gov) as well as in print form through commercial vendors.

A school district's six-year capital improvement project (CIP) plan is closely related to the educational specifications for a given project. The requirements of the six-year CIP plan are identified in statute AS 14.11.011 and regulation 4 AAC 31.011. Regulations 4 AAC 31.021 and 4 AAC 31.022 address the six-year CIP plan's relationship to and integration with a school district's CIP request. The six-year CIP plan is also a component of the overall district master plan. As such, it serves as support for individual programs for design and educational specifications.

The Process

Programming is the process that elicits and systematically translates the mission and objective of an organization, group, or individual into activity settings and building functions. Facility programming, through the process of educational specification development, precedes the traditional architectural design phase in the building delivery process. The primary resources for this programming task are the building occupants or users. It is their objectives and needs that the planning team must utilize to shape the educational specifications. The ultimate success of a school capital project rests on the effective communication between those who design and those who will use the built environment. The educational specifications are the communication tool that must bridge the gap between the building's users and designers.

Design for the Life of a Facility

A district can expect a facility to be in service for 30 or more years before a major renovation or remodel of spaces. Ensure the educational specification process has plenty of time to evaluate facility needs and goals.

An essential requirement of the process is to allow adequate time for the development of educational specifications prior to the initiation of architectural design. Time is needed for people to envision, review, revise, and re-think programmatic desires that will be translated into conceptual design. A "hurry-up" process does not allow for reflection by parents, students, faculty, and community members. Without sufficient lead-time, project elements and parameters may be set too quickly that may later prove undesirable.

After the need for a project is identified, the first step in the educational specification process is to establish a school building planning team or committee. The planning team should be kept small enough so that it can function as a group and not become unwieldy, yet the planning team should be large enough to include a cross section of students, teachers, administrators, parents, and community members. A team of eight to twelve members is probably sufficient for the task, however this may vary within each community. Membership on the planning team should be voluntary. Team members should have the interest and desire to be involved in the planning of the school project and should have a stake in the outcome.

The planning team will be required to formulate, organize and prioritize all ideas and input regarding what the school should be. They will serve as the impetus in the collection of information, as a review body of what is proposed, and as a communicator regarding the educational specification effort with the school staff, the student body, and the community. It is essential that people who are going to work in the facility (building principal if known, teachers, maintenance and custodial support staff, and students), if not serving on the committee, be invited to provide input in the process that shapes the facility. These are the people who will spend the bulk of their time in the facility after it is constructed. Desirable or undesirable building features will impact their daily lives. Although all community members may eventually be affected by the project, it is the responsibility of the school building planning team to ensure the successful programming of the facility.

The task and responsibility presented to the planning team may appear daunting, and in truth a good deal of thought, time, and hard work is to be expected. It is for this reason that the team may wish to employ an experienced school planning professional to assist in the development of the educational specifications. Many times the school planning professional can provide an established structure for the educational specifications and can serve as a facilitator to convert the team's ideas and concerns into a presentable final product. Experienced school planning professionals may also bring specific expertise and knowledge in areas related to the broader function of a facility over its entire life-cycle. If budget constraints limit the ability to hire a consultant or when a qualified individual is available from the school district staff, a local or in-house person may fill the position of facilitator. Under this strategy, focused effort may still be needed to fill specific gaps in knowledge or experience with outside expertise.

There are advantages and disadvantages to either approach. The local person has intimate familiarity with the community, understands the school district and its educational programs, and may be well known to the members of the planning team. However, the local individual may hold provincial views and biases that could reduce their effectiveness in resolving issues where planning team members hold conflicting views. The planning professional, "the expert from out of town," can point out provincial thinking without fear. The out of town expert can also bring new ideas for the group's consideration from planning experiences in other locations. One example of this might be establishing goals for sustainability and for high performance buildings. However, the expert may not be intimately familiar with the community's social and political makeup, thus they may not be able to fully understand the community's perspective.

Essential Factors

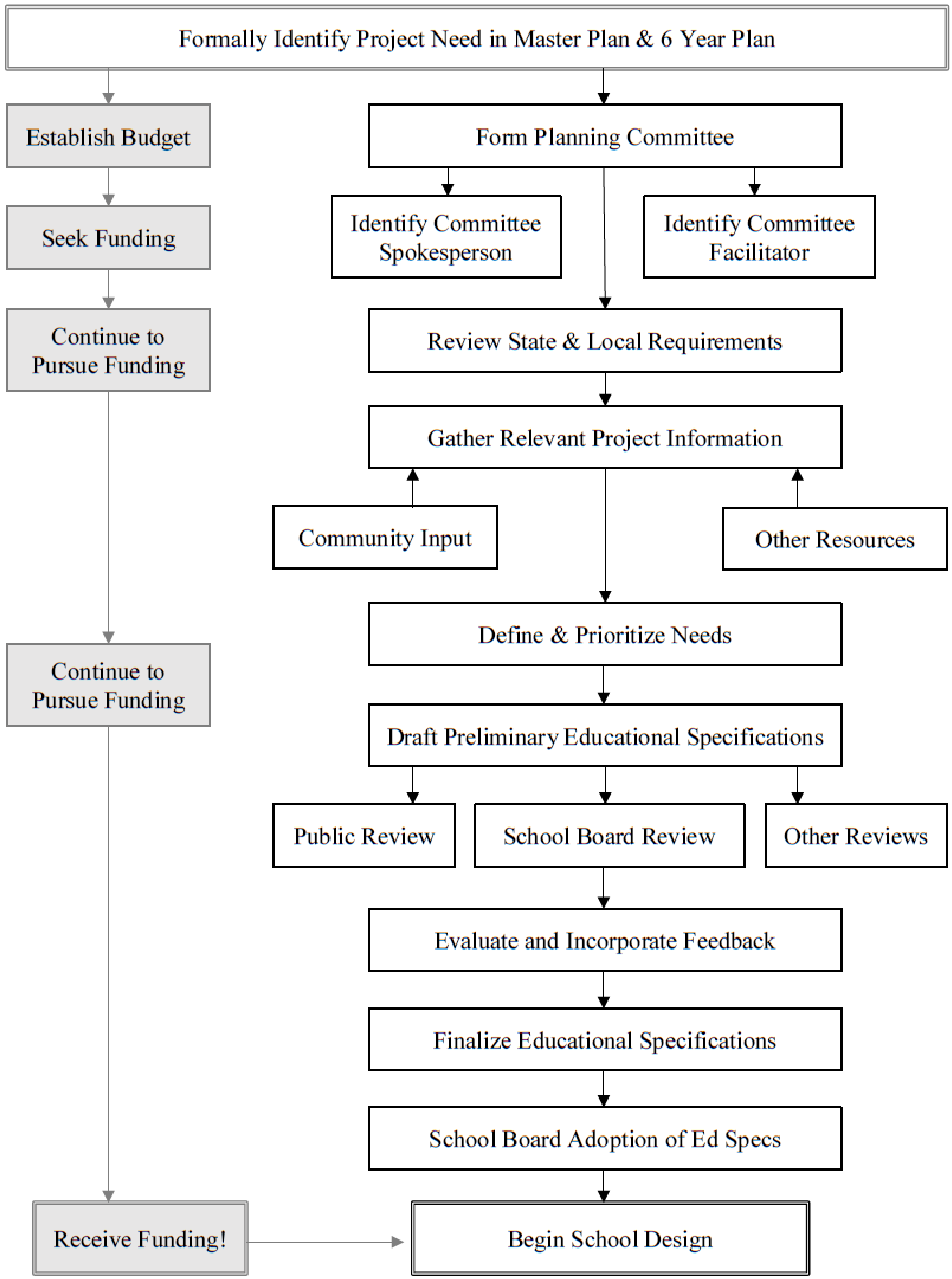
Regardless of the planning team's approach to the development of the educational specifications, the planning team and school planning professional, if used, must consider the following essential factors influencing educational specifications that are discussed in detail on the following pages:

- Project Rationale
- The Community
- Student Population Projections
- Educational Philosophy & Instructional Plans
- The School Site
- Environment for Learning
- General Design Considerations
- Activity Setting Descriptions
- Spatial Relationships
- Space Requirements Summary
- Furnishings & Equipment Summary

- Project Budget & Financing
- Scheduling & Assignment of Responsibility

These essential factors mirror the required elements of an educational specification as defined in 4 AAC 31.010; however, the last factor noted is excluded from the regulatory requirements. This omission is not due to lack of importance, for this factor is imperative in getting all the involved parties on the same page as to their role in the project. Early definition in the planning process of all participants and their responsibilities not only facilitates the smooth execution of the project, but can oftentimes save money and enhance the project by capitalizing on partnering opportunities within the community. It is for these reasons that the department believes this is an essential step in the process.

The Process


Formally Identify Project Need in Master Plan & 6 Year Plan
Establish Budget
Seek Funding
Continue to Pursue Funding
Continue to Pursue Funding
Receive Funding!
Form Planning Committee
Identify Committee Spokesperson
Identify Committee Facilitator
Review State & Local Requirements
Gather Relevant Project Information
Community Input
Other Resources
Define & Prioritize Needs
Draft Preliminary Educational Specifications
Public Review
School Board Review
Other Reviews
Evaluate and Incorporate Feedback
Finalize Educational Specifications
School Board Adoption of Ed Specs
Begin School Design

Project Rationale

The project rationale is a statement explaining why a project is being undertaken. Projects considered essential to conduct the educational program need a summary statement of justification. In other words, the project rationale defines the problem and answers the questions of "Why are we doing this project?" and "What is the project's intended use?"

An educational master plan that includes changes in the educational program, instructional plans, and future facility construction is important for all planning, whether for funding, scheduling, or facility design. The project rationale should be based upon documentation in the district's educational master plan and the current six-year CIP plan. The planning team should thoroughly review the data in these documents, revise it if necessary, and use it to reinforce the need for the proposed project.

The school district may or may not have a current master plan that addresses facility growth or change. If available, the master plan should be referenced in the educational specification, as should the six-year CIP plan. These documents should show the relative importance of the specific facility to the district as a whole and should also include the district facility policy. If an educational master plan is not available, the planning team should take additional steps necessary to ensure that the proposed project is coordinated with the district's long-range goals, rather than just the goals of a single facility. The project rationale may be expanded to explain the role the specific facility is intended to play in the achievement of current district goals or the future of the school district.

For additional assistance in developing facility master plans or examining issues related to long-range planning, reference should be made to the *Creating Connections: The CEFPI Guide for Educational Facilities Planning*, Unit C.

Examples of Project Rationales:

- Problem Definition: John Doe High School was constructed in 1910 and no longer functions adequately to deliver contemporary educational program offerings. Studies have shown that, for the intended use, the cost of adequate renovation would be greater than new construction and the existing building can be adapted for other use. Therefore, a new facility is deemed necessary.

  Intended Use: The envisioned facility will house the delivery of a technical and vocational educational program for 1,000 students in Grades 10-12.

- Problem Definition: The State Fire Marshal has condemned the Bureau of Indian Affairs Day School that was constructed in 1931 for elementary school children. The cost of renovation is estimated to be nearly the cost of new construction on a life cycle cost analysis basis. Therefore, construction of a new facility is proposed.

  Intended Use: This facility is intended to provide a comprehensive elementary and secondary educational program for 140 students in Grades K-12. It will also serve as a community educational, recreational, and civic center.

The above examples constitute brief and direct summaries of a project. They offer factual information (e.g., "this high school was constructed in 1910," and "studies have shown . . ." etc.). The information supports the conclusions drawn and the proposed solution that will be detailed by the remainder of the educational specifications.

The Community

A design team from outside the community or region may be retained to design the school project. For purposes of this section, a “community” is defined as the students, their parents, and the citizens of the proposed geographical area that the facility is intended to serve. To provide for that possibility, background information on the community should be provided. The educational specifications should describe the physical characteristics of the community, its cultural history, and its support infrastructure.

The socioeconomic characteristics of its citizens, employment opportunities, and anticipated growth in the community may also assist the designers in better understanding and meeting local needs. It is critical that the designers are aware of the current support infrastructure available in the community. Are sewage, potable water, and fire water utilities available or will they need to be developed on site? It is especially important to note the electrical generation capacity of the local power provider so that the designers may determine whether it will be able to provide sufficient power to the new facility.

Information on the surrounding terrain and the climatic conditions is necessary to design a facility that is responsive to the local environment. What are the extreme winter and summer temperatures? Is the community located in a flood plain? What is the direction of prevailing winds? Any social or environmental information that could help the design team establish parameters to guide their design should be provided, especially if it is information that the community feels strongly about.

Example:

> John Greenwood, founder of Greenwood Industries, established Greenwood, located in the Northwest Riverville Borough, in 1939. Most of the inhabitants of the community are of Southern European descent, mostly Italian, and are employed in skilled crafts at Greenwood Industries, a diversified manufacturer and the community’s main employer. An abundance of available natural resources and increased trade beyond regional boundaries indicate strong economic growth. In addition, the service sector of the community has experienced a steady increase in employment. The community’s population of 30,000 is concentrated in an area of approximately six square miles. However, commercial, industrial and residential areas are clearly demarcated because of strict planning and zoning requirements. Figures from the last U.S. census indicate an annual growth rate of 2%. The city’s planning office is currently projecting a five-year growth rate of 2.2% annually.
>
> The average low winter temperature is 10 degrees, while the average high summer temperature is 81 degrees. The wind blows from the north/northeast approximately 92 percent of the time with an average speed of 12 miles per hour. Greenwood is located on relatively flat ground and 85 percent of the city limits are in the flood plain of the Green River.

Important considerations beyond geographic and topographical data of the community include a description of the school district and the role that it, and its facilities, plays in the community. Are there other private schools, charter schools, or technical schools serving the community? Consider the role the school facility will play and what local residents will expect of it. Will it double as a community center? Community activities expected to be accommodated in the facility should be listed as specifically as possible. Community involvement in programming for design is often incorporated in the educational specification process. This can be done informally with community meetings or more formally with survey instruments and community research. To the extent practicable, a compilation of this data along with some analysis should be incorporated into the educational specification in either the Community section or in an appendix.

Much of the information suggested in this section can be obtained from previous planning documents and from the planning offices of the local government. There is also information available on the Department of Commerce, Community, and Economic Development's Alaska Community Database Online, located at: https://dcra-cdo-dcced.opendata.arcgis.com/. It is important that the community members, school district, and local government agree on this data.

Student Population Projections

Space Calculations

The State of Alaska has established guidelines for the maximum eligible space a project may include for a given student population. These guidelines are applicable to projects receiving state funding that propose to add or replace space and are outlined in regulation 4 AAC 31.020. The regulations utilize five different calculations to address five different population groups:

- Elementary: student groups in grades kindergarten through six.
- Secondary: student groups in grades seven through twelve.
- Mixed Grade: a combination of elementary and secondary students that doesn't include all grades of either.
- Secondary plus Sixth: a combination of grade six and two or more secondary grades.
- Combined refers to student groups in grades kindergarten through twelve.

While the eligible space calculations are somewhat complex in regulation, the department has published a spreadsheet to facilitate their use. The spreadsheet is available on the department's website (education.alaska.gov/facilities/facilitiescip)

Population Projection Methods

For projects that propose to add or replace school space, the projected student population at five-years post occupancy, the date five years after the proposed project is to be occupied, provides the base student population for determining the maximum eligible school space that the State will provide funding for in a given attendance area. Attendance area refers to the education service area in which the student population is located based on the location of high schools and feeder schools (ref. 4 AAC31.016). Thus, the student population projections are the cornerstone of project planning as they directly establish the design capacity and maximum eligible square footage of the proposed facility. The importance of accurate student population projections cannot be overstated.

Survival Ratio

The most common process used to project student populations is the survival ratio projection method. This method can be used effectively for both urban and rural schools; however, it is not as accurate for very small schools due to the large impact a single student can have on overall growth percentages. The basic premise of this projection technique is that future student populations can be derived from applying the ratio of students that historically advance from one grade to the next to the current student population. The ratio of student advancement from grade to grade is called the survival ratio and a different survival ratio is established for each grade transition. A ratio can also be established between live births in the attendance area and the student enrollment in kindergarten five years later. This ratio can be applied to recent live birth data in the attendance area to predict future kindergarten enrollments. The department has published two spreadsheets on its website that calculate survival ratio projections based on user-furnished student population data; one for “small population” and one for “standard population”.

Annual Percentage Change

Although less rigorous as a statistical model, the department has seen reasonable population projection results from the annual percentage of change in student populations averaged over a period of 5 years or more. As a comparison to straight line growth projections and survival ratio methods, this model can provide another tool with which to analyze historic trends. As with the survival ratio method discussed above, the department has published a spreadsheet on its website that uses the average annual change method to provide a projection based on user supplied historic population data. The spreadsheet also includes a section that, when provided with student population projections, will calculate a resulting average annual change percentage for use in comparison with historic data.

Projection Change Factors

Inherent in the survival ratio projection method and other statistical projection techniques (i.e. straight line growth, regression analysis) is the assumption that past growth trends will be repeated in the future. This assumption may be fine when applied to a controlled environment, but when statistical projection methods are strictly applied to actual school projects without consideration of other factors, the results can be deceiving. Therefore, it is important that the results of a statistical population projection be cross-examined and analyzed with all pertinent data to determine that it represents a realistic student population projection.

There are many factors that could influence future student populations; however, it is important to note that only if these factors are anticipated to *change in the future*, is it necessary to adjust a survival ratio calculation. For example, a district may see an increase in 7th grade student populations as students leave the private elementary schools. There is no need to adjust the survival ratio projection because of this factor. However, if the private school were to begin offering 7th grade, this could reduce the historic increase typically experienced by the school district’s 7th grade. Thus, the historic survival ratio between 6th and 7th grade should be reduced to reflect the changes in the private school program.

The difficulty in incorporating these factors into a student population projection is, first, determining the likelihood that a *change* in a factor will actually be realized and, second, assessing what sort of impact the *change* in the factor might have on the student population. If no change is anticipated for a particular, then the survival ratio population projection need not be adjusted. Below is a list of some factors that could affect school populations:

- Housing Availability – apartments, housing developments, dormitories, any where that students might live;
- Land Availability – is land available for future development of housing and business;
- Alternative Educational Programs – home schooling, cyber schools, charter schools, private schools, etc.;
- Success of Educational Program – pupil retention, school transfers, test scores;

- Employment & Economic Opportunities – development of business and industry can affect migration and family growth;
- Government Policy – from funding decisions to military development, decisions made by distant governments can greatly impact communities, and;
- Migration – often accompanies to one or more of the factors listed above.

It is important to reiterate that if no changes in the community are anticipated during student projection period, then an unaltered survival ratio student projection should adequately reflect future populations. If, and only if, there is some reason to suspect that future trends will change significantly from historic trends, then one may want to consider further evaluation of the factors that may change and how their change may impact future student populations.

Educational Philosophy & Instructional Plans

Educational specifications should be driven by the educational program offered and those educational activities planned to be offered in the future. The document should include the school board's philosophy, along with the educational goals and objectives of the program that the facility is expected to house.

A well-developed curriculum, instructional and supervision plan, and ongoing system of curricular and instructional evaluation should be referenced for inclusion as appendices. If they do not exist, it may be necessary to validate how well the district's goals are being achieved. Validation may consist of public opinion regarding the educational program offered and soliciting suggestions for changes or improvements. Surveys should be carefully constructed to elicit accurate and useful information. Remember, it is the educational program that drives the educational specifications.

Predicting future program offerings and curricular needs that the facility will house is a bit more difficult because it is necessary to separate educational faddism from sound educational practice. However, it can be done by careful assessment of general educational trends validated by the community members, the school board, current and former students, and the professional teaching staff. Including a statement of present and expected use of technology is also an essential requirement in describing a school's programmatic and curricular needs.

This section of the document should also describe the instructional support and general administrative support staff plans. Include an organizational chart to assist in this description. This alerts the design professional to the number of personnel that the school is expected to house, and in general terms, indicates the types of spaces they are likely to occupy. Also, include a statement of the teaching philosophy and methods advocated.

The School Site

Site selection is a separate, independent process that may precede or follow preparation of educational specifications. However, the educational specifications need to describe outdoor activities and their site requirements regardless of whether a school site has been selected or not. If a school site has already been selected, the planning team should visit it to evaluate its compatibility with the proposed outdoor activities and to determine if the site offers any special educational opportunities that the educational program may want to incorporate. If the site has not yet been selected, the planning team should identify the specific requirements that the envisioned site should have to promote the outdoor educational activities as outlined in the educational program.

Whether or not a site has been identified, the educational specifications should attempt to address the following site characteristics and development concerns:

- Desirable features that enhance the school's educational program;
- Natural features that should be preserved to enhance the aesthetic qualities of the learning environment;
- Treatment of pedestrian and vehicular traffic flows around and on the site;
- Community uses of the site or nearby open space sites that could be used to enhance both the community's and the school's needs;
- Location of site, centrally located in community versus outlying so that student transportation is required;
- The ratio of the attendance area which will be served by the school;
- The site's access to water, sewer, electrical power, arterial roads, and police and fire protection;
- The required onsite utilities. Will design and construction resources need to address onsite water acquisition and treatment, sewer treatment and disposal, bulk fuel storage, and power generation?
- The desired site development. What recreation areas and equipment are desired? What is required in the way of parking, student drop-off, and bus loading areas? To what extent is landscaping and planting desired?
- Potential demolition or relocation requirements of existing site structures and utilities.

The chosen site or sites should be reviewed with local community planning departments for area growth patterns, future expansion, and other land use factors. Also, the Department of Education & Early Development cites two publications in its planning guidelines that deal specifically with site selection: The *Creating Connections: CEFPI Guide to Educational Facilities Planning*, Unit F, and a department publication, *Site Selection Criteria and Evaluation Handbook*. The planning team and site selection team may find these publications helpful in the evaluation of potential school sites and complying with the department's site review and approval procedures.

The Environment for Learning

Harold Hawkins, of Texas A & M University, identifies three types of environment that affect a facility's occupants in Unit I, *Environment for Learning*, of the *CEFPI Planning Guide*. These environments are the:

- Physical, both the natural and built environment;
- Social, the relationship between and among students, staff, teachers and parents, and;
- Institutional, the organization of the school, its rules and regulations.

The educational specifications primarily define the physical environment. However, it is important to be cognizant of the relationships between all environments when developing the educational specifications. How the physical environment is defined can greatly impact the other environments. Hawkins identifies a number of features to consider when defining the physical environment and discusses how these features can impact the other environments.

The physical environment for learning as well as the social environment of a school building should be conducive to the teaching and learning process. The Department of Education & Early Development, in writing a program of studies with and for the Alaska regions, has stressed the necessity of preserving cultural pluralism in the schools and maintaining a meaningful cultural identity among rural Alaskan inhabitants. Though the department is speaking to the necessity of designing curriculum for such purposes, there is also a crucial need to design school buildings and learning environments that reflect and support such program goals.

Curriculum improvement goals view the students as "goal seeking": problem-solving bodies with the power to get meaning out of direct experience. This means that the learning environment must be an active support system to the teacher and learner. It must be designed and equipped to nurture knowledge acquisition. Architectural space can actively support or be passive to learning. Alaskan schools and the educational specifications that guide their design should necessitate a process to:

- Access the developmental needs of students, kindergarten through twelfth grade;
- Include important cultural determinants;
- Include community needs and wishes for a multi-purpose structure;
- Design buildings which reflect an architectural response suitable for the local Alaskan conditions; and
- Provide space on an activity level encouraging teaching and learning.

The idea of providing dynamic spaces that actively support learning and can be integrated into or enhance the curriculum is not a new one, however, educational planners and school designers could do a better job providing environments that actively support learning, rather than just house students. As a philosophy for design, one may want to consider taking the idea of the school environment actively supporting learning a step further by utilizing the built facility as an additional learning tool. Examples might be the overall ambiance of a space as conducive to the planned activities, graphics as direct teaching, exposed plumbing and heating as physics.

The Environment for Learning

The general ambiance of a school has a strong effect on the learning and teaching environment. The educational specifications should carefully review and explain this ambiance or distinctive atmosphere that is desired for the school. This is one of the most important guidelines for the designer, but it is also one of the most difficult for the educational specifications to communicate. The educational specifications should address attention to detail, variety of experiences, the building as a teacher, fitting into the environment, thoughtfulness in design, adequate space and flexibility, and sense of community as a means of describing the ambiance desired in the facility. A good deal of thought and research may be required to develop educational specifications that fully consider the impacts of the learning environment and effectively communicates the district's vision to the design professionals.

General Design Considerations

The general design considerations should be a set of instructions that the planning team requests the design professional to consider in the overall design of the facility. These considerations are meant to serve as a basic framework for the design and should not be too specific. The detailed requirements of the individual school spaces are to be addressed in the Activity Setting Descriptions section of the educational specifications, which will build upon the general considerations with design criteria applicable to the specific activity setting. The planning team should identify and briefly describe, at a minimum, the following general design considerations:

- Building design capacity and maximum eligible square footage;
- Desired focal point or features of the school, including primary and secondary focal points, i.e., commons, media center, auditorium, lobby, etc. Discuss the expression of these features as they relate to the exterior and interior of the building;
- Aesthetic qualities – Alert the design professional to desired/undesired textures, colors, shapes, ambiance, graphics, etc. Give clues as to the image the planning team wants the building to project, such as traditional, contemporary, rustic, etc.;
- Building construction standards – If the school district has established construction standards for their facilities, they should be referenced here. If not, then the desired physical characteristics of the building's construction should be developed in this section. These should be developed on a building system basis. The following is a brief overview of the building systems: Site, Foundation, Superstructure, Exteriors, Roof, Interiors, Conveyances, Mechanical, Electrical, Equipment, and Special Construction. Please refer to the department's publication *Cost Format* (current edition) for a more detailed account of these building systems;
- Building performance requirements – Building performance standards or goals may be part of a school district's construction standards document and incorporated in the educational specifications by reference, or they may need to be developed in this section. The department has adopted an energy performance standard (ref. 4 AAC 31.014(a)(7)) that must be met by all new construction and rehabilitations. This is an excellent starting point for development of these requirements within the educational specification. Building performance requirements can range from the level of control over the HVAC system given to the buildings occupants, to the life expectancy of the roofing system, to target energy utilization index. Several national and international standards have been developed to guide facility owners toward high performing, sustainable facilities. Appendix E is a resource for these considerations;
- Lighting requirements – Identify minimum lighting levels in the facility, preferred lighting configuration and controls, and the use of natural light in the facility;
- Communication requirements – Identify communication, public address, and technology services that must be provided throughout the facility;
- Security and visual access requirements – Outline security and supervision requirements for the facility. If the school district has a security plan, it should be referenced here. Coordinate these descriptions with those furnished in the Equipment and Technology section of the educational specifications;

- Site development requirements – Describe parking, circulation, service, outdoor activity, signage, and lighting requirements. Coordinate these descriptions with those furnished in the School Site section of the educational specifications;
- Describe other facilities or accessory structures that need to be considered in the placement of the school on the site, i.e. teacher houses, utility and storage buildings, and existing facilities to remain; and
- Describe any building value considerations, such as consolidation of like spaces, cost effective design on a life cycle basis, low maintenance and operation cost considerations, etc.

Obviously, not all of the different school spaces will directly adhere to the general design considerations. For example, the level of finishes in vocational shop space will differ from the general level of finishes throughout the remainder of the facility. One must attempt to identify the desired general characteristics that the design is to adhere to for the majority of the time. This eliminates the need to restate these general considerations in each activity setting description.

It may be helpful to both the planning team and designers, to divide this section into two parts. A broad base set of general considerations that addresses the overall building design and another, more detailed set of general considerations that addresses a group of similar spaces, such as classrooms or administrative offices. This sort of two-tiered approach allows for more specific detail that is pertinent to a group of like spaces to build on the general information that is provided for the building as a whole, thus reducing the redundancy of effort in the Activity Setting Descriptions section.

Activity Setting Descriptions

Educational specifications are premised on the belief that schools should be responsive to the curriculum to be taught in the new facility, as well as the needs of the students and staff that will occupy the building. Educational specifications should also provide for the desired community use of the facility without negatively impacting the primary educational use of the facility. To accomplish this end, it is necessary for the educational specifications to provide detailed descriptions of the uses and requirements of each space or "activity setting". The descriptions of the activity settings are the heart of the educational specifications and they are the basis of building design.

Identify Objectives

The school will be a collection of different activities or actions that are designed to meet various objectives that were identified during the planning process. These objectives may be in response to curriculum; to federal, state or local educational priorities; to staff analysis of the learner needs; to school administrators; or to the sentiment expressed by members of the community. Often, questionnaires are distributed among community members, school staff, and students in an effort to gather local input. It is important that these survey instruments be structured so that useful information can be distilled from the responses. It is also important that sufficient time is allowed so that a comprehensive list of objectives can be established that accurately defines the overall purpose of the school.

Identify Activity Needs

After the process of defining the school's objectives is complete, the planning team should identify the activities or actions that are required to satisfy the objectives. Each activity will suggest a set of "needs" that must be met in order for the activity to be successful. From these activities the physical requirements of the facility can be derived. In order to promote understanding and organization of these requirements, the planning team may want to consider and group the needs into the following three categories:

- Health and Safety Needs – the response to code requirements, hygiene considerations, and the protection from hazards;
- Functional Needs – the response to physical necessities or determinants and to the specific uses of each setting, and;
- Psychological and Aesthetic Needs – the response to the needs for physical comfort, sensory satisfaction, psychological support, and cultural adaptation.

The health, safety, psychological, and aesthetic needs of users are combined with the educational goals, the corresponding curricular methodology, and the related needs of the community. All of these elements together form the pre-programming database that defines the functional needs of each activity setting. While many of the required school spaces are known prior to the educational specification exercise, the process of identifying each activity area's needs validates the need for each space. The planning team may even discover that an unforeseen activity area is required to fulfill the facility's identified activities and objectives.

Defining Activity Space

Activity areas include the various spaces, such as classrooms, libraries, etc., that comprise the school facility. Activity areas are not limited to interior spaces so it is important that the educational specifications identify and define the requirements of outdoor activity areas as well. Activity areas should be described with a high degree of specificity and exactness. The descriptors that are essential to provide sufficient detail to the architect of the activity areas planned are as follows:

- Describe the activities that are anticipated to be conducted in the instructional plan. If the instructional plan is referenced, include specific page numbers that can be reviewed by the design professional. Describe small, individual and large group activities that will be conducted within a space;
- State the number of users, teachers, aides, and target student populations;
- Suggest the approximate size of the activity space in terms of square footage;
- Based on a desired group size, state the number of like spaces required by the student population;
- Describe requirements for large and small groups, as well as individual student and staff spaces;
- Describe the internal spatial relationships and the area's relationship to the school as a whole; and
- Describe the general ambiance desired in each, and potential modifications or alternates that might be desired for different teaching methods.

Space does not necessarily mean a "room." It can also mean an area within a room where a specific activity will be conducted, such as a messy activity, i.e., finger painting, which may require sink and different floor surfaces for ease in cleaning. It may be necessary to illustrate the internal spatial relationships of different spaces within an activity area using a bubble diagram or matrix.

It is important to consider the functionality of each space and activity setting. Each area must be closely examined to insure that it is programmatically functional. Identify the minimum area required to serve a given student population, and the maximum area. How many teaching stations are needed given a specific staffing pattern (e.g. pupil-teacher ratio)? Various mathematical methods may be used to make this determination. For example, what number of students will be participating within a program area during the class day/week, how often will the class meet and for what length of time during the class day/week, and the desired pupil-teacher ratio. How many periods of the day can the space be utilized? One hundred percent efficiency is impossible for an entire facility. However, many areas, such as general classrooms, can be programmed for every hour during the school day.

In writing the descriptions, the specific language is of particular importance in providing the designer direction. An example is the difference between the verbs "provide" and "provide for" as they relate to equipment, furnishings, and casework.

"Provide" means the designer will provide the space and the specifications calling for the equipment, furnishings, and casework in the contract documents and drawings.

"Provide for" means the designer will accommodate in the design of the space requirements for the equipment, furnishings, and casework that will be acquired by the owner. Avoid general descriptions such as "adequate," "some," "somewhere," "enough," "near," and "many."

Below are some other factors that should be considered when defining each activity setting. This is by no means a comprehensive list but rather a minimum list of considerations:

- Describe specific utility requirements. Include the number of electrical outlets needed and their desired locations. Identify specific water, gas, compressed air, and dry and wet waste disposal requirements as applicable to the specific space;
- Identify special acoustic and lighting requirements;
- Identify specific surface material requirements, floors, walls and ceilings;
- Identify bulletin board, writing board and tack board requirements. Mounting height should be specific for size of students. For bulletin boards and tack boards, it may be desirable to specify that all wall space not used for something else be covered with tack surfaces;
- Identify requirements for wall maps, projection screens, chart rails and other fixed teaching aids. Describe relationships of teacher activity to student activity areas and note teacher demonstration areas if required;
- Note specific environmental requirements such as special ventilation, natural lighting, special heating, and heat control;
- Note specific safety and health features required such as emergency eyewash stations in shops and chemistry laboratories. Note requirements where the instructor controls gas, compressed air and water. Note where automatic shutoff to specialized equipment is required, i.e., saws, lathes, planers, grinders;
- Explain audio-visual, television access and public address requirements as well as computer equipment and stations;
- Specify equipment, furnishings and casework to be located within the activity area. Often, instructors envision more equipment and furnishings than will fit within the instructional area. The burden of prioritizing should be upon the educator and spelled out in the educational specifications;
- Identify and describe internal areas and support spaces needed. Once again, the specific language used is important. There is a vast difference between the terms "adjacent to" and "in the proximity of";
- Identify special colors, textures and shapes required within an area. This is of particular importance for kindergarten, special education, pre-school, and primary classrooms;
- Identify area needed for display of student projects and project storage, large and small. Also, identify general storage requirements of each space, and;
- Identify and describe any other requirement that may be unique to the activity setting.

Organization Format

The planning team may want to organize the activity setting descriptions in a standard format to facilitate their use and clarity. Appendix B offers a possible format for organization of the activity setting's activities and needs. This chart or matrix should build upon the general design information and may address many of the same topics, but in greater detail. If a particular activity setting's general characteristics vary from those defined in the General Design Considerations, the variations should be identified. This chart may also be used as a checklist during the planning team's review of the project drawings and specifications to insure that the design professional has included those things that the educational specifications required.

Spatial Relationships

The educational specifications should include a summary of spatial relationships. This should be illustrated through either a bubble diagram or a matrix showing the desired spatial relationships of the entire facility. This is not intended to be a scaled school design plan; it is merely intended to demonstrate the desired adjacencies among the activity settings. Conceptual or schematic drawings should be left to the design professionals who will translate the educational specifications into a tangible building plan.

One may find it helpful to dissect the comprehensive relationship diagram for the school into a number of smaller, more detailed diagrams. An example of this would be defining the administrative area as a single entity in the comprehensive diagram of the school and then providing a second diagram that identifies the individual activity settings within the administrative area and their desired relationship to one another. It is important that the more detailed diagrams not lose sight of the broader spatial relationships that are defined in the comprehensive diagram.

It is important that the following factors are considered when establishing the spatial relationships for the facility:

- Public vs. private spaces – typically some parts of the school are desired to be more accessible by the public than others. Grouping public spaces together and providing direct relationships between them makes it easier to keep the private spaces private.
- Noisy vs. quiet spaces – again the grouping of like spaces will enhance the overall effectiveness of a buildings ability to provide spaces that facilitate learning. Obviously, it doesn’t make a lot of sense to have a gym and library directly adjacent to one another, even if they are both public spaces.
- Consolidation of like spaces – it is more efficient to construct a design that consolidates mechanical intensive areas such as restrooms, kitchens, etc. than one that spreads them out. This consideration may not be readily apparent in the spatial relationship diagrams, but it is something that should be kept in mind when evaluating a design professional’s proposed building design.
- Joint-use spaces – oftentimes a space can fulfill two or more purposes in a school design. Some examples of this are a small group room located adjacent to two or more classrooms or a community room that also houses music and consumer education activities. Grouping spaces and providing direct relationships between activities that may be able to take advantage of a joint-use space enhances a building design’s efficiency.

It is also necessary to illustrate complex, individual activity and/or academic discipline spatial relationships. For example: science suites composed of classrooms, laboratories, chemical storage, specimen storage, animal rooms and a plant room; or metal shops composed of multiple task areas such as welding, forging, storage, finishing, grinding, instruction, clean-up, student project, tools, etc. These detailed spatial diagrams that depict the intra-relationships within a complex activity setting should be provided in the Activity Setting Descriptions section for the specific activity setting. However, the relationship of the complex activity setting to other activity settings in the school should be included in the Spatial Relationship section.

As the planning team develops the spatial relationships between activity settings, the team may divide the building into four basic types of space: Instructional or Resource, Support Teaching, General Support, and Supplementary. Appendix C provides a breakdown of different school spaces and their categorization within the space structure. The Instructional or Resource areas are learning environments designed to house students and teachers involved in learning activities. The Support Teaching and General Support areas provide infrastructure to support the Instructional or Resource areas' achievement of educational goals; they do not necessarily house students. Some of the Support Teaching and General Support areas are more directly related to the learning and teaching functions than others; for example, the Auditorium serves more as a teaching area than the Kitchen. The Supplementary spaces are areas that support the overall function of the building; these are necessary building spaces required for the operation of the building not just as an educational facility, but also as a suitable, habitable structure.

It may be desirable to group spaces of a particular category together in a zone of the facility; for example, Supply Storage & Receiving and Mechanical/Electrical areas may have many of the same building requirements that would make it desirable to locate them close to one another, even though there is not a direct relationship between the two space types. Often, overlap between categories occurs based on the functional needs of a building, such as the direct relationship between corridors and classrooms. Other times, overlap occurs in response to the aforementioned factors that influence the spatial relationship of a building; for example, a facility's Gym, Auditorium, and Entry may be related because of their common inclusion in a community-use zone. The use of building zones may also help in depicting the desired relationships between the school spaces and any co-located functions such as health clinics or child care facilities.

Community-Use Zones

A school is an important facility in a community and is often used for community activities and events. Considerations for determining space relationships: method of community entry and access, available restroom facilities, need for convenient custodial, and ability to secure spaces and limit access to educational program spaces.

Space Requirements Summary

The Space Requirement Summary is a statistical square foot summary of all program spaces identified in the detailed activity area requirements. This summary provides a quick reference to the design professional to the space requirements of each activity setting. It also assists the planning team in determining whether functionality and balance have been maintained throughout the facility by enabling the comparison of space requirements between activity settings. Coordination between this section and the Activity Setting Description section is imperative.

The space guideline regulations define eligible space in terms of gross square footage that includes partition (wall) footprint area. Typically, educational planning documents state spatial requirements in terms of net square footage that excludes partition footprint area. The planning team needs to be aware of this distinction when preparing the space summary and clearly state how space is defined in the summary. If the planning team chooses to utilize a net square footage tabulation, then a percentage of the eligible project square footage must be set aside for the partition footprint area. Eventually, the conversion between net and gross square footage must be made. It is the department's belief that identifying spaces in terms of gross square footage in the educational specification facilitates the transition from educational specifications to an actual building design, the generation of a project construction budget, especially if the department's Cost Model estimating tool is utilized, and the subsequent evaluation of project design solutions.

The Space Requirements section should also define how "assignable" and "non-assignable" square footage is to be calculated. Non-assignable or supplementary space is primarily composed of circulation, restroom, mechanical, and partition footprint areas. Appendix D contains a breakdown of space categorizations. Categories A through C are assignable spaces, whereas Category D contains non-assignable spaces. The desired ratio or percentage of instructional assignable space to total square footage, generally 70% to 80%, should be defined. While the department does not regulate assignable and non-assignable space, the percentage provides a good indication as to the efficiency of a particular design solution, and as such, merits consideration by the planning team in the creation of the educational specifications and subsequent design evaluation.

Adjustments to the activity settings may be necessary to ensure conformity to state space requirements and budget allowances. This is the most critical activity in the entire programming effort for the school. Priorities may have to be established that balance the educational program and community use needs. The planning committee should keep in mind that it is planning a school facility that can accommodate the educational program rather than a "community center". Design of the school, however, should provide for use of the facility by the community to the extent possible.

Furnishing & Equipment Summary

Regulation 4 AAC 31.020(a)(4), referencing the department's publication entitled *Guidelines for School Equipment Purchases*, provides for and identifies equipment and furnishings that can be included in a school capital project budget. Generally, equipment and furnishings required for the facility to provide the intended educational program are eligible. However, the purchase of extra consumable supplies, such as toner cartridges, copier paper, light bulbs, etc., are not eligible capital project costs. Keep this in mind when defining the Furnishing and Equipment requirements of a facility in the educational specifications.

The general scope of necessary equipment purchases shall be a part of the educational specifications developed for the project. The document will provide the recommended equipment requirements for each space identified. Educational specifications shall include a tabular summary of the project's equipment and furnishing requirements. This list will identify and include existing equipment serving the educational program that can be used in the new, remodeled, or expanded facility. This summary should be coordinated with the equipment and furnishings requirements noted in the Activity Setting Description section. The school district's project manager will use this equipment summary to make initial budget projections for the project and to begin the process of equipment procurement based on the design team's design development (DD) documents. The department has developed a workbook to assist districts in developing a list of necessary furnishings, equipment, and technology. This tool is available on the department's website (education.alaska.gov/facilities/publications).

FF&E Estimating Tool

See Appendix F – Furnishings, Fixtures, and Equipment for a sample of the department-provided FF&E tabulation tool.

If the district has equipment and furnishing standards, it is important that they are either referenced or included in the educational specifications. This is especially important if the project architect's professional services include responsibilities for preparing furnishing, fixtures, and equipment documents, often referred to as FF&E documents. The identification of a specific make and model can be an invaluable tool in communicating district needs regarding quality and function. Such a standard is often used in procuring "or equal" items for inclusion in the project. While a complete list of furnishings and equipment may not be feasible until final design is complete, any additions to the list should be the exception. A thoughtful and thorough analysis of the project's FF&E requirements is essential in effective educational specifications.

Project Budget & Financing

Project Budget

The Department of Education & Early Development has prepared a tool entitled the *Program Demand Cost Model for Alaskan Schools* that is useful for conceptual construction cost estimates. Construction costs are established based on the project's type and size of the school spaces, the proposed foundation system, the site development requirements, the geographic project location, and the date of construction. A reasonable estimate of the building's base construction cost can be calculated by consolidation of the project's Space Requirements Summary into the Cost Model's space type categories. Additional assumptions regarding foundation systems, site development costs, and date of construction are required to complete the cost estimate.

Based on the estimated construction cost, an overall project budget can be established. The project budget should address the following budget categories.

Construction Management by Consultant

Construction management (CM) can be accomplished by either a private contractor (consultant), by district/borough staff, and in some cases both. For private contractors it should include anticipated costs for oversight of any phase of the project. Construction management includes management of the project's scope, schedule, quality, and budget during any phase of the planning, design and construction of the facility. The cost of construction management furnished by a private contractor is limited from 2% to 4% the cost of construction based on AS 14.11.020(c).

Land

Site acquisition costs are a project cost variable that is unrelated to construction cost. Budgets for site acquisition should include the actual purchase price plus title insurance, fees, and closing costs. Land value is established as the appraised value of the land not to exceed the amount for land in the project agreement. The eligibility of site acquisition costs is governed by 4 AAC 31.023(c)(2)(B) and 4 AAC 31.025. Land costs are excluded from project percent calculations.

Site Investigation

Site investigation costs are also a project cost variable unrelated to construction cost. Budgets for site investigation should include land survey, preliminary soil testing, environmental and cultural survey costs, but not site preparation. Site investigation costs are excluded from project percent calculations.

Design Services

The design services budget should include full standard architectural and engineering services as described in AIA Document B101-2017. Architectural and engineering fees can be budgeted based upon a percentage of construction costs. Because construction costs vary by region and size, so may the percentage fee to accomplish the same effort. Additional design services such as educational specifications, condition surveys, commissioning, and post-occupancy evaluations may increase fees beyond the recommended percentages. The recommended range for the standard design services is between 7% and 9% of the construction cost. Renovation design budgets might run 2% higher.

Construction

The construction budget should include all contract and force account work for facility construction, site preparation, and utilities. This is the base cost upon which other category's percentage costs are estimated.

Equipment/Technology

The equipment and technology budget includes all moveable furnishings, instructional devices or aids, electronic and mechanical equipment, with associated software and peripherals. Consultant services necessary to make equipment operational may also be included. It does not include installed equipment or consumable supplies, with the exception of the initial purchase of library books. Items purchased should meet the district definition of a fixed asset and be accounted for in an inventory control system. Equipment/Technology budgets have two benchmarks for standard funding: percentage of construction costs and per-student costs as discussed in DEED's *Guideline for School Equipment Purchases*. If special technology plans call for higher levels of funding, itemized costs should be presented in the project budget separate from standard equipment. The recommended budget for equipment and technology is the lesser of either 0-4% of the construction cost **or** between $2,300 - $3,800 per student depending on school size and type.

District Administrative Overhead

The district administrative overhead budget includes an allocable share of district overhead costs, such as payroll, accounts payable, procurement services, and preparation of the six-year capital improvement plan and specific project applications. The recommended budget range for indirect/administration expenses is between 2% and 4% of the construction cost.

District administrative overhead can also include costs incurred for construction management (see above) accomplished by district or borough personnel. Estimates for "in-house" construction management should include actual staff time allocated to the project, staff travel and per diem, and direct costs of telephone, etc. It should include construction management costs done by staff and all on site representation. The maximum for construction management by consultant and 'in-house' is 5%. The recommended budget for in-house construction management is 2% to 5% of the construction cost.

Percent for Art

This budget category addresses the statutory allowance for art in public places. Eligible project expenses in this category may fund selection, design and fabrication, and installation of artwork. The required art budget is 1% of the construction cost, except for projects in rural areas that require only 0.5% of the construction cost.

Project Contingency

The project contingency is a safety factor to allow for unforeseen changes in the cost of the project. Standard cost estimating by A/E or professional estimators includes a construction contingency in the estimated base bid. Because that figure is included in the construction budget, the project contingency is intended to address project changes and unanticipated costs in other budget areas. The project contingency is fixed at 5% of the construction cost.

Overall Guidelines

As a general rule, the overall project budget should not exceed 130% of the construction cost. However, the project budget defined in the educational specifications is a preliminary planning budget so many assumptions regarding the estimated scope of work and cost of the budget categories is required. It is important that these assumptions are documented in the educational specifications so that the design professionals are better able understand the scope of the project and assess the reasonableness of the budget. To formulate an accurate project budget the planning team may need to draw from a number of resources such as past project experience, professional publications, and the DEED Cost Model, etc. All relevant back up for the project budget should be included in the educational specifications.

Financing

It is important that the planning team identify the funding mechanism that the project intends to utilize to secure funding for the project. This will facilitate compliance by the design professionals with the pertinent regulations that may limit the eligibility of project costs. It is also important for the planning team to identify the required local contribution to the project and identify some methods that may be utilized to satisfy their contribution. It should be noted that nothing precludes school districts or municipalities from funding 100% of a project; however, with state assistance available, most entities choose to pursue the aforementioned funding mechanisms.

While there is little federal funding available for school construction or major school renovation projects, the State of Alaska has two funding mechanisms that provide financial aid for these types of capital improvement projects. Below is a brief overview of the eligibility requirements, application process, and fund allocation process of the two mechanisms.

Capital Improvement Project Grants

Capital improvement project (CIP) grants are available to all school districts and municipalities. School construction and renovation projects are typically funded through direct legislative funding allocations to the Department of Education & Early Development. The Bond Reimbursement and Grant Review Committee establishes the department’s CIP grant review process that determines eligibility, defines budget, and prioritizes the projects submitted annually by the school districts. The product of the department’s review is furnished to the Governor and Legislature, as is a recommendation of funding levels. Ultimately, the Legislature determines project funding levels. Refer to 4 AAC 31.021 and 4 AAC 31.022 for the regulations that govern the grant application process.

Upon receipt of legislative grant appropriation, the department establishes a project agreement with the recipient entity that defines the scope and budget of the project. Grant funds are distributed from the department to the recipient entity based on the achievement of predefined payment milestones identified in the project agreement. Participating share or local contributions for the grant projects varies by school district ranging from 2% to 35% of the total project cost.

Debt Reimbursement

The debt reimbursement mechanism is available to all school districts and municipalities that have the ability to sell bonds. Thus, the Regional Education Attendance Area school districts are not eligible to receive state aid through this funding mechanism. After debt authorization is issued by the legislature with an amendment to AS 14.11.100, the department accepts capital improvement project applications from the school districts. The department determines a project's eligibility based on statutes and regulations. A project agreement between the department and the school district or municipality is developed that defines the scope and budget for the project. After local approval of bond issuance to fund the approved projects, the project is undertaken. The department reimburses a percentage of the bond principal, interest, and transaction costs incurred by the school district or municipality based on their annual debt reimbursement request to the department. Refer to 4 AAC 31.060, 4 AAC 31.061, and 4 AAC 31.063 for regulations that govern bond projects.

Scheduling & Assignment of Responsibility

The educational specification should include a schedule or timeline for the proposed project. While the project schedule is most likely not set in stone at the educational specification stage of the planning and design process, it should provide a goal that the planning team deems reasonable and achievable in a best-case scenario. It is important to define the project schedule to determine the date of five-year post occupancy that is used in calculating the project student design population and, ultimately, the overall size of the facility.

The schedule will also enable design professionals to determine the most reasonable and effective solution to meet the project's requirements. For example, if the project schedule establishes the substantial completion date of a new facility to be in fifteen months' time and architectural selection has yet to occur, respondents to a design RFP may offer creative design solutions, such as use of a prototype design or a design build contracting methodology, that they may not have provided had the information regarding the desired project schedule not been provided. Alternative methods of contracting for construction, like design-build or construction manager/general contractor best value, must be approved by the department prior to solicitation. Reference the department publication *Project Delivery Method Handbook* for factors that can determine whether a particular method will meet the needs of a project.

The project schedule should identify at a minimum the following project milestones:

- Application for funding assistance;
- Design selection Request for Proposals (RFP);
- Award of design contract;
- Schematic design submittal, review, and approval;
- Design development submittal, review, and approval;
- Construction and bid document submittal, review, and approval;
- Advertisement for construction bids;
- Opening of construction bids;
- Award of construction contract;
- Notice to proceed with construction;
- 50% construction completion;
- Substantial construction completion;
- Building occupancy;
- Final construction completion; and
- Final project closeout and termination of project agreement.

If diligent thought and effort is put into drafting a project schedule, there will probably be a good deal more milestones established than those listed above. As these milestones are established, the planning team may want to identify whose responsibility it is to reach each milestone. The more effort and study dedicated to this effort, the more individuals and entities that will be drawn into the project's web of responsibilities. One can then begin to appreciate the magnitude and complexity of their undertaking. The educational specifications stage is not too early to alert persons involved to their anticipated schedule and duties.

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Appendix A – Population Projection Tools

Survival Ratio Average Daily Membership Projection

School District: enter school district name
Attendance Area: enter attendance area name
School Name: enter school name
Birth Growth Rate: 2.00%

BIRTH YEAR	LIVE BIRTHS	SCHOOL YEAR	ACTUAL AVERAGE DAILY MEMBERSHIP K	1	2	3	4	5	6	7	8	9	10	11	12	K-6	7-12	TOTAL
2005	8	FY 2011	13	6	6	9	9	9	6	6	4	5	1	6	3	83	25	83
2006	8	FY 2012	11	5	4	7	7	8	7	6	4	5	1	3	5	73	24	73
2007	8	FY 2013	7	4	5	6	6	8	6	7	1	6	7	1	2	66	24	66
2008	8	FY 2014	6	7	5	5	6	6	8	8	6	4	11	2	1	75	32	75
2009	8	FY 2015	3	3	7	5	5	5	6	7	6	6	7	5	1	66	32	66
2010	8	FY 2016	11	1	3	6	6	7	6	7	7	6	5	3	6	74	34	74
2011	8	FY 2017	14	3	1	3	6	5	8	10	8	9	3	4	1	75	35	75
2012	8	FY 2018	9	10	4	1	3	7	6	7	9	9	9	3	3	80	40	80
2013	8	FY 2019	7	9	8	4	2	3	10	7	7	8	4	7	1	77	34	77

SURVIVAL RATIO B-K	K-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
112.50%	56.76%	94.87%	105.71%	97.62%	102.08%	103.64%	111.32%	82.76%	117.78%	94.00%	63.64%	74.07%

BIRTH YEAR	LIVE BIRTHS	SCHOOL YEAR	PROJECTED AVERAGE DAILY MEMBERSHIP K	1	2	3	4	5	6	7	8	9	10	11	12	K-6	7-12	TOTAL
2014	8	FY 2020	9	4	9	8	4	2	3	11	6	8	8	3	5	39	40	79
2015	7	FY 2021	8	5	4	9	8	4	2	3	9	7	8	5	2	40	34	74
2016	8	FY 2022	9	4	5	4	9	8	4	2	3	11	6	5	4	44	31	75
2017	7	FY 2023	8	5	4	5	4	9	9	5	2	3	10	4	4	44	28	72
2018	6	FY 2024	7	4	5	4	5	4	9	10	4	2	3	6	3	39	29	67
2019	7	FY 2025	8	4	4	5	4	5	4	10	8	4	2	2	5	35	32	67
2020	7	FY 2026	8	5	4	4	5	4	5	5	9	9	4	1	1	36	30	66
2021	8	FY 2027	9	5	4	4	4	5	5	6	4	10	9	3	1	36	32	68
2022	8	FY 2028	9	5	5	5	4	4	5	5	5	4	10	6	2	36	32	68

ADM Projection Comparison

ADM Year: 2019
School District: District Name
School Name: enter school name
Project Number: enter project number
School Type: **enter school type**
Attendance Area: Attendance Area

Historical Attendance Area ADM by Fiscal Year

Fiscal Year	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	Average Annual ADM Change	Overall ADM Growth
Attendance Area Total ADM											

Future School ADM Projections by School Year

Projection Type	Current School Year ADM	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	2025-2026	2026-2027	Average Annual ADM Change	Overall ADM Growth
District's K-6 Projection											
District's 7-12 Projection											
DEED's K-6 Projection											
DEED's 7-12 Projection											

MS Excel files for these student population projection tools are available at the department's website (education.alaska.gov/facilities)

Appendix B – Activity Settings

The following is an example of information that can be identified relative to a specific activity setting:

Activity Setting: Kindergarten Classroom

Occupancy: 24 students, 1 teacher, 2 teacher's aides or parents

Area (SF): 1,200SF including toilet room

Height: 9' minimum

Natural Light: Minimum 5% of floor area with at least 10LF window seat for exterior viewing.

Floors: Entry, sink, and water closet areas to be a resilient sheet vinyl and the remainder of the floor to be carpeted. See district's construction standards for material specifications.

Walls: 1 storage wall, 1 teaching wall, 1 exterior wall, and 1 display wall. Teaching wall to have 12LF white board with tack rail above. Display wall to have tackable surface.

Ceiling: Acoustical treatment of ceiling desired.

Acoustics: Room to meet RC-25N as defined by ASHRAE. Acoustic treatment at ceiling.

Storage: Storage wall along corridor wall. Coat hooks, book cubbies, and boot shelf provided for 24 students. Lockable teacher's wardrobe and full height storage cabinet. Child height counter and sink with upper cabinets at adult height. Base cabinets along window wall with standard counter height and open shelves below.

Fixed Furnishings: 6' x 6' projection screen, paper towel and soap dispenser at sink, ~96SF of white board, ~64SF of tackboard.

Signage: ADA compliant

Plumbing: Sink with bubbler and anti-scald valve.

Heating: In-floor radiant heat desired.

Ventilation: System should be designed to meet reasonable requirements not maximum. Maintain 68F to 75F temperature range

Lighting: Natural light desired. Fixtures should have 3 switch settings for varied light levels. Maximum of 70 foot-candles at work surfaces.

Communications: Phone/intercom located near teaching station and TV monitor.

Security: Visual supervision of all areas from teaching station desired.

Audio/Visual: Cable outlet, TV bracket, and flat panel TV, with embedded CPU.

Technology: Wireless hub to connect 27 users to school network.

Equipment & Furnishings: (2) 72"l x 48"w x 24"d storage cases on rollers with pull-out bins, (6) 42" x 60" child height tables, (24) child chairs, (1) 36" x 60" teacher desk and chair, (1) 36" x 72" adult height table with (2) adult chairs, black.

Special Construction: 10LF window seat.

Flexibility: Geometry of the space should allow for flexible use of the space.

Durability: Painted wall surfaces to be washable & mildew resistant. Floors to mar, stain, and slip resistant

Functionality: Geometry of the space should enhance uses of the space.

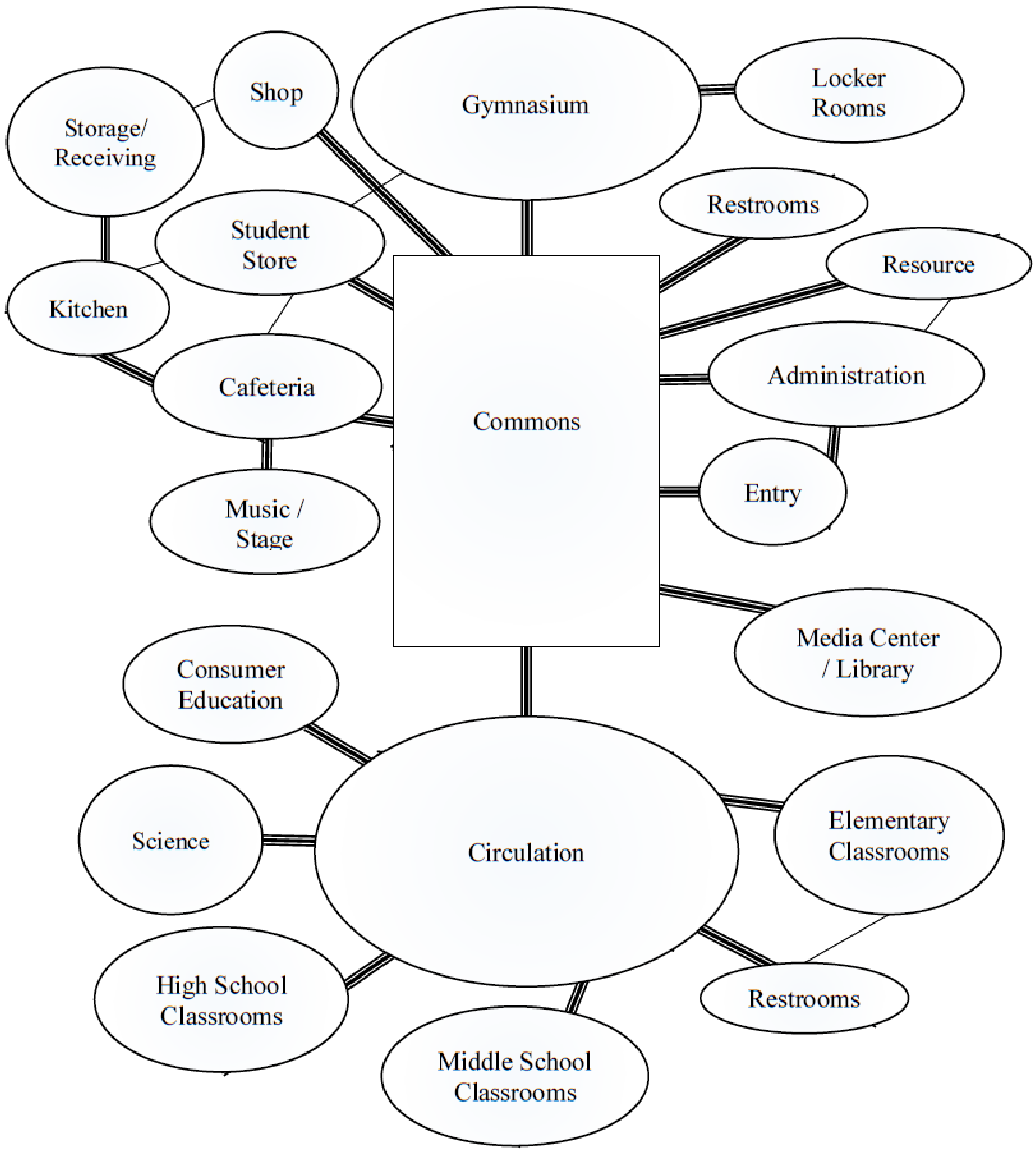
Ambiance: Playful not sterile, kid friendly not institutional.

Colors: Primary colors, avoid white and low chroma colors.

Adjacencies: Near: exterior access, other young student classrooms, private area. Not near: secondary students, primary circulation or gathering points.

Activities: Art, music, lettering, story time, show and tell, naptime, class instruction, small group, computer learning games, science projects, see kindergarten curriculum for additional information.

Appendix C – Spatial Diagram



Legend

——— Denotes close proximity of spaces

═══ Denotes direct connection of spaces

Appendix D – Space Types

Category A - Instructional or Resource

Kindergarten
Elementary
General Use Classrooms
Secondary
Library/Media Center
Special Education
Bi-Cultural/Bilingual
Art
Science
Music/Drama
Journalism
Computer Lab/Technology Resource
Business Education
Home Economics
Gifted/Talented
Wood Shop
General Shop
Small Machine Repair Shop
Darkroom
Gym

Category B - Support Teaching

Counseling/Testing
Teacher Workroom
Teacher Offices
Educational Resource Storage
Time-out Room
Parent Resource Room

Category C - General Support

Student Commons/Lunch Room
Auditorium
Pool
Weight Room
Multipurpose Room
Boys Locker Room
Girls Locker Room
Administration
Nurse
Conference Rooms
Community Schools/PTA Administration
Kitchen/Food Service
Student Store

Category D - Supplementary

Corridors/Vestibules/Entryways
Stairs/Elevators
Mechanical/Electrical
Passageways/Chaseways
Supply Storage & Receiving Areas
Restrooms/Toilets
Custodial
Other Special Remote Location Factors
Other Building Support

Appendix E – Sustainability Factors

Mandatory Performance Standards

1) American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 90.1 *Energy Standards for Buildings Except Low-Rise Residential Buildings* (2010 Edition).

Other Performance Standards

The department doesn't endorse or require the implementation of the following standards; however, each of them may be helpful in establishing performance requirements for school facilities.

1) Leadership in Energy and Environmental Design (LEED), US Green Building Council
2) Collaborative for High Performance Schools (CHPS)
3) High Performance Sustainable Building (HPSB) Guidelines
4) Green Globes® (2010), Green Building Initiatives

Sustainability Factors for Consideration

- Consumption goals for all heating fuels, water, and electricity.
- Consider level of complexity for maintenance and operation when selecting building systems, especially controls.
- Consider a site as close as possible to the majority of the student population served.
- Consider a site that provides ready access to necessary utilities, or that provides site characteristics that provide for on-site development of utility services.
- Consider a site with minimal impact on existing habitat, or consider a site that provides a clear opportunity for habitat restoration.
- Consider building orientation to take advantage of the site characteristics.
    - South facing windows to maximize natural light infiltration;
    - Use natural features to protect from wind loads;
    - Consider predominant wind direction when identifying window size and location;
    - Consider predominant wind, and snow drift direction when identifying door and building ventilation location; and
    - Consider that the majority of usage will take place during the school year (September-May).
- Consider joint-use of a school facility with other organizations such as community schools programs, community health programs, mental health programs, senior care or service programs or other programs compatible with the school mission.

- Consider co-location of school facility with a power generation entity for waste heat recovery.
- Consider choice of heating and ventilation alternatives that provide the district with the best combination of energy efficiency and ease of maintenance.
- Consider day-lighting alternatives that minimize the use of artificial lighting throughout the building while still provided for adequate insulation characteristics for the school location. Compare costs of alternative day-lighting strategies in terms of electricity cost, as well as anticipated heating costs.
- Consider strategies to minimize water use
    - Low-flow double-flush toilets;
    - Low-flow urinals;
    - Recapture of grey-water and treatment for non-potable water uses; and
    - Rainwater recovery systems.
- Consider rapidly renewable materials.
- Consider use of regionally available materials.
- Establish a minimum Indoor Air Quality (IAQ) standard and develop a process to monitor IAQ during peak usage.
- Establish a minimum acoustical performance standard and verify at commissioning.
- Establish a minimum classroom and hallway lighting level and verify at commissioning.

Appendix F – Furnishings, Fixtures, & Equipment

A furnishings, fixtures, and equipment (FF&E) spreadsheet tool has been developed to assist in tracking needs by room and activity space, as identified in educational specifications. Sample "Tabulation" sheet:

Projected Furnishings and Equipment

SAMPLE

School District:	**XYZ School District**
School Facility:	**ABC Elementary**
Date Tabulation Prepared:	**4/1/2019**
Project Equip/Tech Budget:	**$720,000.00**
Planning/Design Stage:	*Educational Specification*
Shipping Rate per Pound:	$0.19

Budget Category	Item Description	Unit	Qty Rqd	Qty OH	Qty Pur	Est. Weight	Target $ (Each)	Cost	Shipping Cost
Furnishings & Equipment	Entry Walk-off Mats (48" x 72")	ea	12		12	50	$100	$1,200	$114
Furnishings & Equipment	Literature rack, wall mounted, wood - 20wx36hx3d	ea	2		2	50	$200	$400	$19
Furnishings & Equipment	Side table - wood, 20"x20"	ea	2		2	50	$140	$280	$19
Furnishings & Equipment	Waste can, metal, exterior type, secure top	ea	1		1	150	$115	$115	$29
Furnishings & Equipment	Waste can, plastic, rectangular	ea	55	20	35	25	$15	$825	$166
Furnishings & Equipment	Waste can, stainless, flip top - 20x16x24h	ea	3		3	50	$60	$180	$29
Furnishings & Equipment	Waste can, metal, swing top, 14"x14"x35"H	ea	21		21	50	$180	$3,780	$200
Furnishings & Equipment	Waste can, metal, open, 14"x14"x35"H	ea	2		2	50	$180	$360	$19
Furnishings & Equipment	Office/Teacher desk - with tray, 2 box drawers, 2 file drawers	ea	32		32	300	$360	$11,520	$1,824
Furnishings & Equipment	Office/Teacher chair - ergonomic task with arms	ea	41		41	100	$200	$8,200	$779
Furnishings & Equipment	Office/Teacher chairs - ergonomic task w/o arms	ea	6		6	100	$95	$570	$114
Furnishings & Equipment	File cabinet, two drawer, legal, locking	ea	34		34	100	$215	$7,310	$646
Furnishings & Equipment	File cabinet, four drawer, legal, locking	ea	35		35	200	$280	$9,800	$1,330
Furnishings & Equipment	File cabinet, fireproof, four drawer, legal, locking	ea	8		8	200	$1,140	$9,120	$304
Furnishings & Equipment	Visitor chairs, lobby - upholstered, wood frame	ea	3		3	100	$140	$420	$57
Furnishings & Equipment	Visitor chairs, offices - upholstered, wood frame	ea	15		15	100	$140	$2,100	$285
Furnishings & Equipment	Adult stackable chair - sled-based type	ea	20		20	100	$35	$700	$380
Technology	Computer, office laptop	ea	7		7	50	$2,000	$14,000	$67
Technology	Computer, office desktop w/19" LCD	ea	4		4	100	$2,000	$8,000	$76
Technology	Computer, teacher laptop	ea	23		23	50	$2,000	$46,000	$219
Technology	Computer, student desktop	ea	103		103	50	$1,500	$154,500	$979
Technology	Student computer, laptops (existing)	ea	60		60		$0	$0	$0
Technology	Computer, electronic catalog (end of book stacks)	ea	2		2	50	$1,500	$3,000	$19
Technology	Computer, library server	ea	1		1	100	$3,000	$3,000	$19
Technology	30" Television	ea	17		17	200	$250	$4,250	$646
Technology	20" flat panel TV	ea	7		7	100	$400	$2,800	$133
Technology	Flat panel TV wall mount	ea	7		7	25	$45	$315	$33
Technology	Laser printer, color	ea	1		1	50	$1,000	$1,000	$10

BASE BID

Furnishings & Equipment	***Base Bid Subtotal***	***$56,880***	***$6,313***
Technology	***Base Bid Subtotal***	***$236,865***	***$2,199***
BASE BID	**BASE BID Total**	**$293,745**	**$8,512**

ALTERNATE BID #1

Budget Category	Item Description	Unit	Qty Rqd	Qty OH	Qty Pur	Est. Weight	Target $ (Each)	Cost	Shipping Cost
		ea					$0	$0	$0
		ea					$0	$0	$0
		ea					$0	$0	$0

Furnishings & Equipment	*Alternate Bid 1 Subtotal*	***$0***	***$0***
Technology	*Alternate Bid 1 Subtotal*	***$0***	***$0***
ALTERNATE BID 1	**ALTERNATE BID 1 Total**	**$0**	**$0**

BASE BID + ALTS	***BASE BID with ALTERNATES Total***	***$293,745***	***$8,512***

FF&E Budget Totals

SUMMARY Total	$302,257
Contingency @ 15%	$45,339
GRAND TOTAL	**$347,596**
Under (Over) Budget	*$372,404*

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

ASHRAE 90.1-2010 Checklist

P U B L I C A T I O N C O V E R

July 8, 2019

Issue

The department seeks committee approval of the *ASHRAE 90.1-2010 checklist* for use as part of the submittals in AS 14.11 funded projects.

Background

Last Updated/Current Edition
This is the original edition and will be available on the department's website.

Summary of Proposed Changes
Proposed worksheet document incorporates the move toward a more clear and prescriptive document that provides the requirements under ASHRAE 90.1-2010 and the means to prove compliance. This spreadsheet was created in response to AS 14.11.014(8) and 4 AAC 31.014(a)(7).

Version Summary & BRGR Review
Drafts of the publication were presented to the committee at the following meetings:

April 16, 2019 – Initial version presented to the committee and approved for public comment.

Public Comment

Public comment period opened June 14, 2019 and closed July 8, 2019. There were comments from three persons giving suggested edits or general comments. Both the comments, and the department's response through the Facilities unit are included with this paper.

BRGR Input and Discussion Items

Below are questions and comments from the BRGR during the April 16, 2019 meeting:

- There is a tool called Comp Check available on the Department of Energy website.
- Concern that the department would have to provide a new version if/when the code is updated.

Options

Approve final worksheet for use by the department.
Recommend changes to the worksheet and approve for use by the department.
Seek additional information.

Suggested Motion

"I move that the Bond Reimbursement and Grant Review Committee approve the department's proposed *ASHRAE 90.1-2010 Checklist* for use by the department."

DEPARTMENT OF EDUCATION AND EARLY DEVELOPMENT

ASHRAE 90.1-2010 STANDARD COMPLIANCE CHECKLIST PUBLIC COMMENT

JUNE 14, 2019 TO JULY 8, 2019

PUBLIC COMMENT RECEIVED	DEED RESPONSE
Voltage drop requirements should also refer to when the installation path is different than design. The calculation is the requirement of the contractor. *E. Carlson 6-14-2019*	Can add line under Electrical Inspection sheet requiring the contractor to calculate voltage drop if differs from design.
Receptacle control should be specific to where it applies so that it is not interpreted that it applies everywhere. *E. Carlson 6-14-2019*	Can add "where required" to the plan review sheet.
Initially electrically it looks like the DEED document wants a lot of low voltage lighting controls. These control schemes have shown that it can save energy/money when power is reliable, however when these controls are subject to spikes, surges and brownouts they tend to die first. When the controls die then maintenance has to go in and repair or more typically replace (with a more low tech solution). My opinion is the client will end up spending more time and $ on repairs than they would see on energy savings. *E. Carlson 6-14-2019*	Lighting controls are required by ASHRAE 90.1-2010.
My team at ASD did not have any comments regarding American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010. Thanks for the opportunity to provide input. *T. Fenoseff 7-8-2019*	Thank you for responding.
7.4.3 Add note indicating that insulation thickness shall be in accordance with table 6.8.3-1. *A. Schirack 7-8-2019*	7.4.3 specifically states to use table 6.8.3.A.
Add section 7.4.4.3 Outlet temperature controls *A. Schirack 7-8-2019*	Will add.
Add section 7.4.4.4 Circulating Pump Controls *A. Schirack 7-8-2019*	Will add.
7.4.4.2 Change wording 'Automatic time switches' to simply read: Controls shall be installed to automatically shut off the recirculating hot water and heat trace systems. *A. Schirack 7-8-2019*	Wording is from the wording in the code; however, suggested change is clearer and will be made.

PUBLIC COMMENT RECEIVED	DEED RESPONSE
6.4.3.4.1 Recommend deleting this section. Stair and shaft vents are uncommon in the construction styles utilized for rural schools. *A. Schirack 7-8-2019*	This checklist and corresponding code is not intended to be used only by rural projects. If this is not relevant for a project then there is a process for modifying the checklist.
6.4.4.1.3 Provide table references indicating insulation thicknesses required for each system. *A. Schirack 7-8-2019*	6.4.4.1.3 specifies which tables are to be used.
6.5.1.2 Water economizers are not utilized in rural systems. Recommend deleting section. *A. Schirack 7-8-2019*	This checklist and corresponding code is not intended to be used only by rural projects. If this is not relevant for a project then there is a process for modifying the checklist.
6.5.2.3 Delete dehumidification control. *A. Schirack 7-8-2019*	If this is not relevant for a project then there is a process for modifying the checklist.
6.5.2.4 Delete section on water economizers. *A. Schirack 7-8-2019*	If this is not relevant for a project then there is a process for modifying the checklist.
6.5.4.3 Delete chiller component of this section. *A. Schirack 7-8-2019*	If this is not relevant for a project then there is a process for modifying the checklist.
6.5.4.2 Chillers not utilized in school construction. Delete section. *A. Schirack 7-8-2019*	If this is not relevant for a project then there is a process for modifying the checklist.
6.5.4.4.2 Delete water cooled unitary air conditions from this section. *A. Schirack 7-8-2019*	If this is not relevant for a project then there is a process for modifying the checklist.
6.5.5.2 Delete this section. *A. Schirack 7-8-2019*	Will consider.
6.5.8.1 This is pretty uncommon in rural construction (only really applies to snow melt systems), I'd recommend deleting from this checklist. *A. Schirack 7-8-2019*	This checklist and corresponding code is not intended to be used only by rural projects. If this is not relevant for a project then there is a process for modifying the checklist.

From: Edward Carlson <edc@mba-consulting.net>
Sent: Friday, June 14, 2019 1:21 PM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>
Subject: ASHRAE 90.1_DEED_Checklist Comments

Tim
I have the following comments:

Voltage Drop requirements should also refer to when the installation path is different than design the calculation is the requirement of the contractor.

Receptacle control should be specific to where it applies so that it is not interpreted that it applies everywhere.

Initially Electrically it looks like the DEED document wants a lot of low voltage lighting controls.
These control schemes have shown that it can save energy / money when power is reliable, however when these controls are subject to spikes, surges and brown outs they tend to die first. The controls are the least robust of the electrical systems. When the controls die then maintenance has to go in and repair or more typically replace (with a more low tech solution). My opinion is the client will end up spending more time and $ on the repairs than they would see on the energy savings.

Most of the other requirements are just good design practice

Edward Carlson P.E.
MBA Consulting Engineers
3812 Spenard Rd
Suite 200
Anchorage Alaska 99517
907 274-2622

From: AJ Schirack <aschirack@rsa-ak.com>
Sent: Monday, July 8, 2019 8:04 AM
To: Mearig, Timothy C (EED) <tim.mearig@alaska.gov>
Cc: Brian Pekar <bpekar@rsa-ak.com>
Subject: Public Comment: ASHRAE Standard 90.1-2010 Checklist for School Construction Projects

Tim,

See below comments.

Thanks for putting this together. I've gone through and commented on the sections I thought were important to clarify; please note that there are a lot of reference to mechanical cooling systems that are not utilized in rural construction. I've tried to note all locations where they show up, but if I've missed any I'd recommend altering those sections as well.

- 7.4.3 Add note indicating that insulation thickness shall be in accordance with table 6.8.3-1.
- Add section 7.4.4.3 Outlet temperature controls
- Add section 7.4.4.4 Circulating Pump Controls.
- 7.4.4.2 Change wording 'Automatic time switches' to simply read: Controls shall be installed to automatically shut off the recirculating hot water and heat trace systems.
- 6.4.3.4.1 Recommend deleting this section. Stair and shaft vents are uncommon in the construction styles utilized for rural schools.
- 6.4.4.1.3 Provide table references indicating insulation thicknesses required for each system.
- 6.5.1.2 Water economizers are not utilized in rural systems. Recommend deleting section.
- 6.5.2.3 Delete dehumidification control.
- 6.5.2.4 Delete section on water economizers.
- 6.5.4.2 Chillers not utilized in school construction. Delete section.
- 6.5.4.3 Delete chiller component of this section.
- 6.5.4.4.2 Delete water cooled unitary air conditions from this section
- 6.5.5.2 Delete this section.
- 6.5.8.1 This is pretty uncommon in rural construction (only really applies to snow melt systems), I'd recommend deleting from this checklist.

Thanks

A.J. Schirack, P.E.

Mechanical Project Engineer | **RSA Engineering, Inc.**

670 W Fireweed Ln, Suite 200 | Anchorage, Alaska 99503

T: 907.276.0521 | D: 907.865.0583 | aschirack@rsa-ak.com

From:	fenoseff_thomas
To:	Mearig, Timothy C (EED)
Cc:	Weed, Lori (EED)
Subject:	Request for American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010 comments
Date:	Monday, July 08, 2019 8:57:35 AM
Attachments:	image001.png

Tim/Lori,

My team at ASD did not have any comments regarding American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010. Thanks for the opportunity to provide input.

TO: Interested Parties

4 AAC 31.014 Codes and Regulations for School Facilities requires school capital projects with state aid to comply with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2010. In order to implement this requirement, the Department of Education and Early Development has developed an Alaska-school specific checklist so that recipients of state-aid for school construction, their design consultants, and construction contractors can collaborate on meeting the standard in a way that benefits the parties. See the online public notice for the checklist and additional information.

To ensure consideration of your comments, please provide comments through the online public notice or by e-mail to Tim.Mearig@alaska.gov no later than 10 a.m. on Monday, July 8, 2019. Comments will be reviewed by the Bond Reimbursement and Grant Review Committee at its July meeting.

Your feedback to improve the proposed process is appreciated, thank you.

Lori Weed
FSS/Facilities, School Finance Specialist II
Department of Education and Early Development
(907) 465-2785 | lori.weed@alaska.gov

Respectfully,

Tom Fenoseff, PMP
Anchorage School District
Senior Director, Capital Planning & Construction
Office: (907) 348-5223
Fax: (907) 348-5227
Fenoseff_Thomas@asdk12.org

1301 Labar St.

Anchorage, AK 99515-3517

Educating All Students for Success in Life
www.asdk12.org

Department of Education & Early Development (DEED)
ASHRAE Standard 90.1-2010
Compliance Checklist

Worksheet Name	Worksheet Description and Instructions
Introduction	This checklist is designed for use by designers, reviewers, and project inspectors. Designers can use it to check themselves to insure the items listed are included in design. Reviewers can use it to check for design and provide feedback on design. Inspectors will have design parameters to inspect and assure the owner that the project is delivering the construction project requirementss. **Note:** These are the more common items that may be included in school construction or renovation projects. Other provisions within Standard 90.1-2010 may also apply.
Basic Instructions for Use	Initially the owner and consultant will review the checklist and indicate to the department what items in the checklist do not pertain to the project. Upon agreement those items will be struckthrough in the Description column and "Does not Pertain" will be entered in the Comment column. If, as design progresses, any item is determined to be required, the strikethrough will be removed and the comment changed to reflect the rationale.
Cover sheet	Include department project name, number, school district, and facility(ies).
Design Plan Review	This tab will be used throughout the design phase to document design and contract document elements needed for compliance. The first column indicates the design system.The second column lists the ASHRAE Standard 90.1 sections associated with the item in review. The third column is a description of the item. The fourth column is to document the appropriate design value for the item, as applicable. The fifth column is to indicate if the documents are in compliance, and the sixth column is for any comments including the location in the plans/specs. This sheet is to confirm that the consultant has supplied all required calculations for review. This will allow the department and owner to determine if Standard 90.1 is being met and whether designs may be under designed and not delivering requirements to meet needs or if there is overdesign that may increase construction and operating costs.
Foundation Inspection	The first column lists the ASHRAE Standard 90.1 requirements associated with the item in review. The second column is a description of the item. The third column is to enter the designed value of insulation, etc.; the fourth column is for field inspection verifying that construction meets requirements. The fifth column is to indicate whether the design and installation meets requirements, and the sixth column is for any comments. This sheet is to review design and installation. The cells with "NA" do not require insertion of values.

Worksheet Name	Worksheet Description and Instructions
Framing Inspection	The first column lists the ASHRAE Standard 90.1 requirements associated with the item in review. The second column is a description of the item. The third column is to enter the designed value of insulation, etc.; the fourth column is for field inspection verifying that construction meets requirements. The fifth column is the indicate whether the design and installation meets requirements and the sixth column is for any comments. This sheet is to review design and installation. The cells with "NA" do not require insertion of values.
Insulation Inspection	The first column lists the ASHRAE 90.1 codes associated with the item in review. The second column is a description of the item. The third column is to enter the designed value of insulation, etc.; the fourth column is for field inspection verifying that construction meets requirements. The fifth column is the indicate whether the design and installation meets requirements and the sixth column is for any comments. This sheet is to review design and installation. The cells with "NA" do not require insertion of values.
Plumbing Inspection	The first column lists the ASHRAE Standard 90.1 codes associated with the item in review. The second column is a description of the item. The third column is to indicate if the documents are in compliance and the fourth column is for any comments. This sheet is to confirm that all requirements are inspected and confirmed for plumbing.
Mechanical Inspection	The first column lists the ASHRAE Standard 90.1 codes associated with the item in review. The second column is a description of the item. The third column is to indicate if the documents are in compliance and the fourth column is for any comments. This sheet is to confirm that all mechanical designs meet Standard 90.1 and are included in the documents and that installation meets those designs.
Electrical Inspection	The first column lists the ASHRAE Standard 90.1 codes associated with the item in review. The second column is a description of the item. The third column is to indicate if the documents are in compliance and the fourth column is for any comments. This sheet is to confirm that all electrical designs meet Standard 90.1 and are included in the documents and that installation meets those designs.
Final Inspection	The first column lists the ASHRAE Standard 90.1 codes associated with the item in review. The second column is a description of the item. The third column is to indicate if the documents or installation are in compliance and the fourth column is for any comments. This sheet is to confirm that all closeout documents are provided and all final inspections and commissioning is completed.

Department of Education & Early Development (DEED)
ASHRAE Standard 90.1-2010
Compliance Checklist

Project Number: ______________________________

Project Name: ______________________________

School District: ______________________________

Facility(ies): ______________________________

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Envelope	4.2.2, 5.4.3.1.1, 5.7	**Plans, specifications, and/or calculations provide all information with which compliance can be determined for the building envelope and document where exceptions are claimed**. Envelope tradeoff option (5.6) or energy cost budget (11) submitted for buildings with vertical fenestration area >40% or skylight area >5%.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.5.3.3	Below-grade wall insulation R-value.			Enter the Design Value and provide supporting calculations.
Envelope	5.5.3.5	Slab edge insulation R-value.			Enter the Design Value and provide supporting calculations.
Envelope	5.8.1.7	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping, and equipment maintenance activities.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.8.1.7.3	Insulation in contact with the ground has <=0.3% water absorption rate per ASTM C272.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	6.3.2, 6.4.4.1, 6.4.4.2	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.			Enter the Design Value and provide supporting calculations.
Envelope	6.4.3.8	Freeze protection and snow/ice melting system sensors for future connection to controls.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	6.4.4.1.5	Bottom surface of floor structures incorporating radiant heating insulated to >=R-3.5.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.4.3.4	Vestibules are installed where building entrances separate conditioned space from the exterior, and meet exterior envelope requirements. Doors have self-closing devices, and are >=7 ft apart.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.5.4.3a	Vertical fenestration U-Factor.			Enter the Design Value and provide supporting calculations.
Envelope	5.5.4.3b	Skylight fenestration U-Factor.			Enter the Design Value and provide supporting calculations.
Envelope	5.5.4.4.1	Vertical fenestration SHGC value.			Enter the Design Value and provide supporting calculations.
Envelope	5.5.4.4.2	Skylight SHGC value.			Enter the Design Value and provide supporting calculations.
Envelope	5.8.2.3, 5.5.3.6	U-factor of opaque doors associated with the building thermal envelope meets requirements.	~~NA~~		Enter the Design Value and provide supporting calculations.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Envelope	5.4.3.1	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, or weather stripped to minimize air leakage.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.5.3.1	Roof R-value. For some roof systems, verification may need to occur during Framing Inspection.			Enter the Design Value and provide supporting calculations.
Envelope	5.8.1.3	Blown or poured loose-fill insulation is installed only where the roof slope is <=3 in 12.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.5.3.1	Skylight curbs insulated to the level of roofs with insulation above deck or R-5.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.5.3.2	Above-grade wall insulation R-value.			Enter the Design Value and provide supporting calculations.
Envelope	5.5.3.4	Floor insulation R-value.			Enter the Design Value and provide supporting calculations.
Envelope	5.8.1.4	Eaves are baffled to deflect air above the insulation.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.8.1.5	Insulation is installed in substantial contact with the inside surface separating conditioned space from unconditioned space.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.8.1.7	Exterior insulation is protected from damage with a protective material.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.8.1.7.1	Attics and mechanical rooms have insulation protected where adjacent to attic or equipment access.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.8.1.8	Insulation intended to meet the roof insulation requirements cannot be installed on top of a suspended ceiling. Mark this requirement compliant if insulation is installed accordingly.	NA		Enter a reference as to where this is covered in the project documents.
Envelope	5.4.3.3	Weatherseals installed on all loading dock cargo doors.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	4.2.2, 6.4.4.2.1, 6.7.2	**Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions are claimed. Submit heat and ventilation calculations.**			Enter a reference as to where this is covered in the project documents.
Mechanical	7.4.3	Service hot-water piping systems insulated. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Mechanical	7.4.4.1	Temperature controls installed on service water heating systems (<=120 ºF to maximum temperature for intended use).	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.4.4.2	~~Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.~~ Controls shall be installed to automatically shut off the recirculating hot water and heat trace systems.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.4.6	Heat traps installed on non-circulating storage water tanks.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.4.1	Stair and elevator shaft vents have motorized dampers that automatically close.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.4.2, 6.4.3.4.3	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.4.4	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.9	Demand control ventilation provided for spaces >500 ft2 and >40 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.10	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.4.1.1	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.4.1.2	HVAC ducts and plenums insulated (R-Value). Reference Tables 6.8.2-A&B.	NA		Enter the Design Value and provide supporting calculations.
Mechanical	6.4.4.1.3	HVAC piping insulation thickness. Reference tables 6.8.3-A&B	NA		Enter the Design Value and provide supporting calculations.
Mechanical	6.4.4.1.4	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Mechanical	6.5.1, 6.5.1.1.1, 6.5.1.1.2, 6.5.1.1.3, 6.5.1.3	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.1.1.5	Means provided to relieve excess outside air during economizer operation.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.1.2, 6.5.1.2.1, 6.5.1.2.2, 6.5.1.3	Water economizers provided where required, meet the requirements for design capacity, maximum pressure drop and integrated economizer control and heating system impact.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.1.4	Economizer operation will not increase heating energy use during normal operation.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.2.1	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.2.2.3	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.2.3	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.2.4	Water economizer specified on hydronic cooling and humidification systems designed to maintain inside humidity at >35 ºF dewpoint if an economizer is required.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.3.1.2	HVAC fan motors not larger than the first available motor size greater than the bhp.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.3.2.1	VAV fan motors >=10 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.3.2.3	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.3.3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.3.4	Multiple zone HVAC systems have supply air temperature reset controls.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.4.1	HVAC pumping systems >10 hp designed for variable fluid flow.	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Mechanical	6.5.4.2	Reduce flow in pumping systems >10 hp to multiple chillers or boilers when others are shut down.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.4.3	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems >300,000 Btu/h.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.4.4.2	Hydronic heat pumps and water-cooled unitary air conditioners with pump systems >5 hp have controls or devices to reduce pump motor demand.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.5.2	Fan systems with motors >=7.5 hp associated with heat rejection equipment can operate at 2/3 of fullspeed and have fan speed controls.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.6.1	Exhaust air energy recovery on systems >=5,000 cfm and 70% of design supply air.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.7.1.1	Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10% of the hood exhaust airflow rate.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.7.1.2	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.7.1.3	Kitchen hoods with a total exhaust airflow rate >5,000 cfm meet exhaust rate requirements.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.7.1.4	Kitchen hoods with a total exhaust airflow rate >5,000 cfm meet replacement air, ventilation system, or energy recovery requirements.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.7.2	Fume hoods exhaust systems >=15,000 cfm have VAV hood exhaust and supply systems, direct makeup air or heat recovery.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.5.8.1	Unenclosed spaces that are heated use only radiant heat.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.4.2	Service water heating equipment meets efficiency requirements.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.4.4.3	Temperature controlling means shall be provided to limit the maximum temperature of water delivered from lavetory faucets to 110 F	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Mechanical	7.4.4.4	When used to maintain storage tank water temperature, recirculating pumps shall be equiped with controls tlimiting operation to a period from the start of the heating cycle to a maximum of five minutes after the end of the heating cycle.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.5.1	Combined space and water heating system not allowed unless standby loss less than calculated maximum. AHJ has approved or combined connected load <150 KBtu/h.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	7.5.2	Service water heating equipment used for space heating complies with the service water heating equipment requirements.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.1.1	Heating and cooling to each zone is controlled by a thermostat control.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.3.1	HVAC systems equipped with at least one automatic shutdown control.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.3.2	Setback controls allow automatic restart and temporary operation as required for maintenance.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.3.3	Systems with air capacity >10,000 cfm include optimum start controls.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	6.4.3.5	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	4.2.2, 6.7.2.3, 6.7.2.4	Plans document that systems are balanced in accordance with generally accepted engineering standards. Detailed instructions for HVAC systems commissioning included on the plans or specifications for >=50,000 ft2.	NA		Enter a reference as to where this is covered in the project documents.
Mechanical	4.2.2, 7.7.1, 10.4.2	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions are claimed. Service water pressure booster systems designed with pressure sensors, pressure reducers, and flow controls.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	4.2.2, 8.4.1.1, 8.4.1.2, 8.7	**Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed**. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Design Plan Review Checklist

System	90.1-2010 Section #	Description	Design Value	Complies? (Yes/No)	Comments
Electrical	8.4.2	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device where required.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	4.2.2, 9.4.4, 9.7	**Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting systems and equipment and document where exceptions are claimed.**	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.1.1	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft2.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.1.4	Primary sidelighted areas >=250 ft2 are equipped with required lighting controls.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.1.5	Enclosed spaces with daylight area under skylights and rooftop monitors >900 ft2 are equipped with required lighting controls.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.2	Exit signs do not exceed 5 watts per face.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.6.2	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	4.2.2, 9.7	**Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting systems and equipment and document where exceptions are claimed.**	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.1.7	Automatic lighting controls for exterior lighting installed.	NA		Enter a reference as to where this is covered in the project documents.
Electrical	9.4.3	Exterior grounds lighting over 100 W provides >60 m/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	NA		Enter a reference as to where this is covered in the project documents.

DEED ASHRAE Standard 90.1-2010
Foundation Inspection Checklist

90.1-2010 Section #	Description	Design Value	Field Verified Value	Complies? (Yes/No)	Comments
5.5.3.3	Below-grade wall insulation R-value.				
5.8.1.2	Below-grade wall insulation installed per manufacturer's instructions.	NA	NA		
5.5.3.5	Slab edge insulation R-value.				
5.8.1.2	Slab edge insulation installed per manufacturer's instructions and design.	NA	NA		
5.8.1.7	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.	NA	NA		
5.8.1.7.3	Insulation in contact with the ground has <=0.3% water absorption rate per ASTM C272.	NA	NA		
6.3.2, 6.4.4.1, 6.4.4.2	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.				
6.4.3.8	Freeze protection and snow/ice melting system sensors for future connection to controls.	NA	NA		
6.4.4.1.5	Bottom surface of floor structures incorporating radiant heating insulated to >=R-3.5.	NA	NA		

DEED ASHRAE Standard 90.1-2010
Framing Inspection Checklist

90.1-2010 Section #	Description	Design Value	Field Verified Value	Complies? (Yes/No)	Comments
5.4.3.1.2	Continuous air barrier is wrapped, sealed, caulked, gasketed, and/or taped in an approved manner.	NA	NA		
5.4.3.2	Factory-built fenestration and doors are labeled as meeting air leakage requirements.	NA	NA		
5.4.3.4	Vestibules are installed where building entrances separate conditioned space from the exterior, and meet exterior envelope requirements. Doors have self-closing devices, and are >=7 ft apart.	NA	NA		
5.5.4.3a	Vertical fenestration U-Factor.				
5.5.4.3b	Skylight fenestration U-Factor.				
5.5.4.4.1	Vertical fenestration SHGC value.				
5.5.4.4.2	Skylight SHGC value.				
5.8.2.3, 5.5.3.6	U-factor of opaque doors associated with the building thermal envelope meets requirements.	NA	NA		

DEED ASHRAE Standard 90.1-2010
Insulation Inspection Checklist

90.1-2010 Section #	Description	Design Value	Field Verified Value	Complies? (Yes/No)	Comments
5.4.3.1	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed or weather stripped to minimize air leakage.	NA	NA		
5.5.3.1	Roof R-value. For some roof systems, verification may need to occur during Framing Inspection.				
5.8.1.2, 5.8.1.3	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is <=3 in 12.	NA	NA		
5.5.3.1	Skylight curbs insulated to the level of roofs with insulation above deck or R-5.	NA	NA		
5.5.3.2	Above-grade wall insulation R-value.				
5.8.1.2	Above-grade wall insulation installed per manufacturer's instructions.	NA	NA		
5.5.3.4	Floor insulation R-value.				
5.8.1.2	Floor insulation installed per manufacturer's instructions.	NA	NA		
5.8.1.4	Eaves are baffled to deflect air above the insulation.	NA	NA		
5.8.1.5	Insulation is installed in substantial contact with the inside surface separating conditioned space from unconditioned space.	NA	NA		
5.8.1.6	Recessed equipment installed in building envelope assemblies does not compress the adjacent insulation.	NA	NA		
5.8.1.7	Exterior insulation is protected from damage with a protective material.	NA	NA		
5.8.1.7.1	Attics and mechanical rooms have insulation protected where adjacent to attic or equipment access.	NA	NA		
5.8.1.7.2	Foundation vents do not interfere with insulation.	NA	NA		
5.8.1.8	Insulation intended to meet the roof insulation requirements cannot be installed on top of a suspended ceiling. Mark this requirement compliant if insulation is installed accordingly.	NA	NA		

DEED ASHRAE Standrd 90.1-2010
Plumbing Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
7.4.3	Service hot-water piping systems insulated. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.		
7.4.4.1	Temperature controls installed on service water heating systems (<=120 ºF to maximum temperature for intended use).		
7.4.4.2	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.		
7.4.6	Heat traps installed on non-circulating storage water tanks.		

DEED ASHRAE Standard 90.1-2010
Mechanical Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
6.4.1.4, 6.4.1.5	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.		
6.4.3.4.1	Stair and elevator shaft vents have motorized dampers that automatically close.		
6.4.3.4.2, 6.4.3.4.3	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.		
6.4.3.4.4	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.		
6.4.3.9	Demand control ventilation provided for spaces >500 ft2 and >40 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.		
6.4.3.10	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.		
6.4.4.1.1	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.		
6.4.4.1.2	HVAC ducts and plenums insulated (R-Value).		
6.4.4.1.3	HVAC piping insulation thickness.		
6.4.4.1.4	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.		
6.4.4.2.1	Ducts and plenums sealed based on static pressure and location.		
6.4.4.2.2	Ductwork operating >3 in. water column requires air leakage testing.		
6.5.1, 6.5.1.1.1, 6.5.1.1.2, 6.5.1.1.3, 6.5.1.3	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.		
6.5.1.1.4	Return air and outdoor air dampers meet minimum air leakage requirements.		
6.5.1.1.5	Means provided to relieve excess outside air during economizer operation.		

DEED ASHRAE Standard 90.1-2010
Mechanical Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
6.5.1.2, 6.5.1.2.1, 6.5.1.2.2, 6.5.1.3	Water economizers provided where required, meet the requirements for design capacity, maximum pressure drop and integrated economizer control and heating system impact.		
6.5.1.4	Economizer operation will not increase heating energy use during normal operation.		
6.5.2.1	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.		
6.5.2.2.3	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.		
6.5.2.3	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.		
6.5.2.4	Water economizer specified on hydronic cooling and humidification systems designed to maintain inside humidity at >35 ºF dewpoint if an economizer is required.		
6.5.3.1.2	HVAC fan motors not larger than the first available motor size greater than the bhp.		
6.5.3.2.1	VAV fan motors >=10 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.		
6.5.3.2.2	VAV fans have static pressure sensors positioned so setpoint <=1/3 total design pressure.		
6.5.3.2.3	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.		
6.5.3.3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.		
6.5.3.4	Multiple zone HVAC systems have supply air temperature reset controls.		
6.5.4.1	HVAC pumping systems >10 hp designed for variable fluid flow.		
6.5.4.2	Reduce flow in pumping systems >10 hp to multiple chillers or boilers when others are shut down.		
6.5.4.3	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems >300,000 Btu/h.		

DEED ASHRAE Standard 90.1-2010
Mechanical Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
6.5.4.4.1	Two-position automatic valve interlocked to shut off water flow when hydronic heat pump with pumping system >10 hp is off.		
6.5.4.4.2	Hydronic heat pumps and water-cooled unitary air conditioners with pump systems >5 hp have controls or devices to reduce pump motor demand.		
6.5.5.2	Fan systems with motors >=7.5 hp associated with heat rejection equipment can operate at 2/3 of fullspeed and have fan speed controls.		
6.5.6.1	Exhaust air energy recovery on systems >=5,000 cfm and 70% of design supply air.		
6.5.7.1.1	Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10% of the hood exhaust airflow rate.		
6.5.7.1.2	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.		
6.5.7.1.3	Kitchen hoods with a total exhaust airflow rate >5,000 cfm meet exhaust rate requirements.		
6.5.7.1.4	Kitchen hoods with a total exhaust airflow rate >5,000 cfm meet replacement air, ventilation system, or energy recovery requirements.		
6.5.7.1.5	Approved field test used to evaluate design air flow rates and demonstrate proper capture and containment of kitchen exhaust systems.		
6.5.7.2	Fume hoods exhaust systems >=15,000 cfm have VAV hood exhaust and supply systems, direct makeup air or heat recovery.		
6.5.8.1	Unenclosed spaces that are heated use only radiant heat.		
7.4.2	Service water heating equipment meets efficiency requirements.		
7.5.1	Combined space and water heating system not allowed unless standby loss less than calculated maximum. AHJ has approved or combined connected load <150 KBtu/h.		
7.5.2	Service water heating equipment used for space heating complies with the service water heating equipment requirements.		

DEED ASHRAE Standard 90.1-2010
Electrical Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
8.4.2	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.		
9.4.1.1	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft2.		
9.4.1.2	Independent lighting control installed per approved lighting plans and all manual control readily accessible and visible to occupants.		
9.4.1.4	Primary sidelighted areas >=250 ft2 are equipped with required lighting controls.		
9.4.1.5	Enclosed spaces with daylight area under skylights and rooftop monitors >900 ft2 are equipped with required lighting controls.		
9.4.1.7	Automatic lighting controls for exterior lighting installed.		
9.4.2	Exit signs do not exceed 5 watts per face.		
9.4.3	Exterior grounds lighting over 100 W provides >60 m/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.		
9.6.2	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.		
8.4.1.1 8.4.1.2	Does installation path follow design? If not, contractor to perform voltage drop calculations.		

DEED ASHRAE Standard 90.1-2010
Final Inspection Checklist

90.1-2010 Section #	Description	Complies? (Yes/No)	Comments
5.4.3.3	Weatherseals installed on all loading dock cargo doors.		
6.4.3.1.1	Heating and cooling to each zone is controlled by a thermostat control.		
6.4.3.1.2	Thermostatic controls have a 5 °F deadband.		
6.4.3.3.1	HVAC systems equipped with at least one automatic shutdown control.		
6.4.3.3.2	Setback controls allow automatic restart and temporary operation as required for maintenance.		
6.4.3.3.3	Systems with air capacity >10,000 cfm include optimum start controls.		
6.4.3.5	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.		
6.7.2.1	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.		
6.7.2.2	Furnished O&M manuals for HVAC systems.		
6.7.2.3	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft2 of conditioned area.		
6.7.2.4	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.		
7.4.4.3	Public lavatory faucet water temperature <=110 ºF.		
7.4.4.4	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank.		
8.7.1	Furnished as-built drawings for electric power systems within 30 days of system acceptance.		
8.7.2	Furnished O&M manuals for electrical power systems and equipment.		
9.2.2.3	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans, which demonstrate proposed watts are less than or equal to allowed watts.		
9.4.3	Exterior lighting power is consistent with what is shown on the approved lighting plans, which demonstrate proposed watts are less than or equal to allowed watts.		

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

Design Ratios

SUBCOMMITTEE REPORT

July 8, 2019

Mission Statement

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).

Current Members

Dale Smythe, Chair
William Glumac
Randy Williams
Larry Morris, DEED
Lori Weed, DEED

Status Update

Recommendations from 2017 Report to the Legislature:

1) *Adopt the Alaska Climate Zones established by the Alaska Building Energy Efficiency Standard (BEES) and used by the Alaska Housing Finance Corporation.*

   Status: Confirmed with AHFC that the BEES Alaska climate zones can be used by the department as needed for development of ratios and potential regulations.

2) *Implement a school design ratio of Openings Area to Exterior Wall Area (O:EW).*
3) *Implement a school design ratio of Building Footprint Area to Gross Square Footage (FPA:GSF). This ratio would be applied to facilities in excess of 30,000 GSF.*
4) *Implement a school design ratio of Building Volume to Net Floor Area (V:NSF). .*
5) *Implement a school design ratio of Building Volume to Exterior Surface Area (V:ES).*

   Status: An RFP was issued late winter for cost estimating and energy modeling services to explore the results of the design ratio options. In February a team was selected and negotiations successful completed. The draft report has been reviewed and discussed within the subcommittee and review comments provided to the consultant. Final completion is anticipated the second week of July 2019. Department staff has created documents defining combinations of ratios with construction costs and energy savings to organize the results for use in informing potential policy recommendations. The subcommittee will continue to review the results of the modeling report and develop a list of recommended future steps for the department to consider.

Schedule

July 24, 2019, 2pm, pending receipt of final modeling results from consultant.

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

By: Larry Morris, Jr.
Architect Assistant

Phone: 465-1858

For: Bond Reimbursement & Grant Review Committee

Date: July 10, 2019

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Subject: Design Ratio Energy Modeling Results

P O S I T I O N P A P E R

Introduction

In 2018, the legislature adopted HB 212. This bill amended Alaska statute 14.11.017 to instruct the department to adopt standards for cost-effective school construction. The added statutory language reads:

> (d) The department shall develop and periodically update regionally based model school construction standards that describe acceptable building systems and anticipated costs and **establish school design ratios** to achieve efficient and cost-effective school construction. In developing the standards, the department shall consider the standards and criteria developed under AS 14.11.014(b). (emphasis added)

In consideration of this statute, the Bond Reimbursement and Grant Review Committee (BRGR) appointed a subcommittee tasked with exploring design ratios and how these ratios could be useful in cost-effective school construction. The subcommittee began by identifying potential design ratios and settling on four different ratios to study; exterior wall to wall openings (windows), building footprint to gross square footage (one vs multi story), building volume to net floor area (over-height ceilings), and building volume to exterior surface area. (building complexity).

The subcommittee then, in concert with the department, began calculating design ratios for numerous school construction projects that had been constructed over the previous years. This gave the subcommittee some reference to different designs and what ratios to expect. The next phase of investigating design ratios involved professional services to perform energy modeling and estimating construction costs.

Included in HB 212 was an appropriation for funds to hire consultants for establishing cost-effective school construction including design ratios. A request for proposals was issued requesting a consultant or consultant team to provide energy modeling, energy costing, and initial construction cost for the four design ratios. Each design ratio would have various iterations and design parameters. The deliverable would include initial construction costs, energy modeling to include energy usage, and annual energy costs. The team of HMS, Inc. and Coffman Engineering were the successful proposers.

After the initial scoping meeting between the consultant, subcommittee, and department, the consultant prepared and delivered their preliminary report for subcommittee and department to review. After comments were produced and communicated to the consulting team, on June 7th the final report was delivered. While there are some very serious issues with the final report (more on that later), I will try and use the information and make it useful for discussing design ratios/design practices that may be used to establish rules for delivering regionally centered cost-effective schools.

Discussion

The Building Energy Modeling Services report established a base school model that included a single story, 40,000 square foot building with 14% of the exterior wall being windows, a 2:12 pitched roof with all insulation above structure, a 14 foot exterior wall height, and no double height common area. The 40,000 square foot school was divided into 20,000 sq. ft. classroom, 7,300 sq. ft. administration, 5,000 sq. ft. commons and 7,700 sq. ft. gymnasium. For this base model, both initial construction cost and 20 year energy costs were modeled for Juneau, Dillingham, Bethel, and Wainwright. The modeling and estimating continued by altering the base school model by making the following changes:

1. Two story classroom wing
2. 7% exterior windows
3. 21% windows
4. 28% windows
5. 35% windows
6. Flat roof
7. 3:12 pitch roof
8. 12 foot height for exterior wall
9. 16 foot height exterior wall
10. 20% of the commons being double height
11. 40% of the commons being double height
12. 60% of the commons being double height

All of the iterations were performed singularly, none included a combination of the two or more design variables.

In order to develop a comprehensive look at each region's various costs for each model, I began assembling the construction costs into a spreadsheet. After assembling the costs into a spreadsheet I began putting costs for combinations of these design variables. I used the following method, as an example:

7% windows and 12' exterior walls = Base school + (7% windows – Base cost) + (12' walls – Base cost)

For Juneau = $16,587,279 + ($16,295,842 - $16,587,279) + ($16,446,000 - $16,587,279)
= $16,587,279 + (- $291,437) + (- $141,279)
= $16,154,563

Following this same process, I calculated numerous combinations of design, including all of the cost reduction items, to create the least expensive school and another with the highest costing items creating the most expensive. I calculated the differences as a percentage from base and lowest cost. I also included the difference in cost sorted from lowest cost to highest. The resulting list for Juneau is:

Building Design		Juneau	% diff from ba	% diff from lo		Cost differnce From Low
Low school price	$	15,997,390	-3.56%	0.00%	$	-
Base school w/7% windows	$	16,295,842	-1.76%	1.87%	$	298,452
2-story/flat roof/14% wind/14'walls	$	16,430,106	-0.95%	2.70%	$	432,716
Base school w/12" walls	$	16,446,000	-0.85%	2.80%	$	448,610
Base model-2 story	$	16,466,985	-0.73%	2.94%	$	469,595
Base Model flat roof	$	16,550,400	-0.22%	3.46%	$	553,010
Base School Model	$	16,587,279	0.00%	3.69%	$	589,889
Base school 3:12 roof	$	16,633,600	0.28%	3.98%	$	636,210
Base school w/16' walls	$	16,729,600	0.86%	4.58%	$	732,210
2-story/flat roof/21% windows/12' walls/20%	$	16,765,606	1.08%	4.80%	$	768,216
Base school w/20% double commons	$	16,816,000	1.38%	5.12%	$	818,610
Base school w/ 21% windows	$	16,835,337	1.50%	5.24%	$	837,947
1-story/flat roof/21% windows/12'walls/20%	$	16,885,900	1.80%	5.55%	$	888,510
Base school w/40% double commons	$	16,902,800	1.90%	5.66%	$	905,410
2-story/flat roof/21% windows/14'/40%	$	16,993,685	2.45%	6.23%	$	996,295
Base school w/ 28%windows	$	17,060,177	2.85%	6.64%	$	1,062,787
1-story/2:12/21%/14'/20%	$	17,064,058	2.87%	6.67%	$	1,066,668
Base school w/60% double commons	$	17,098,400	3.08%	6.88%	$	1,101,010
2-story/3:12/21%/16'/40%	$	17,219,206	3.81%	7.64%	$	1,221,816
Base school w/35% windows	$	17,309,425	4.35%	8.20%	$	1,312,035
1-story/3:12/28%/16'/40%	$	17,339,500	4.53%	8.39%	$	1,342,110
High school price	$	18,009,188	8.57%	12.58%	$	2,011,798

Lowest cost: Base Model: Highest Cost

I performed only nine different combinations but the same process could be used to produce many more.

The 20-year energy cost of the various designs were performed using the same process as was used for construction costs. I was a little concerned about mixing various designs and the reported costs of energy. Would a two story classroom effect a 20% double height commons? In looking at the energy modeling report, the various areas like classrooms, admin, and gymnasium were calculated separately. Therefore, I believe that utilizing the same process for energy as I did for construction is valid.

There are, however, some issues of concern with some of the energy cost reporting in the report. For example; the roof geometries have the flat ***and*** the 3:12 pitch roofs being more energy efficient than the base 2:12 roofs, except in Bethel. The report mentioned this problem in the modeling report (pg. 36) and it appears to indicate that maybe the modeling is not able to handle this design variable properly. In the June report version, there was an issue with Juneau's 16'-wall and the 60% double stack commons energy usages. I believe that these are math errors and requested that the consultant exam these values. The July report corrected the 16' wall but did not correct the 60% double-height commons. I believe this is still incorrect. I have made the adjustment in the Juneau spreadsheet. The resulting correction in the 16’ wall height is included in the Juneau tab.

After calculating the various energy usages, the Dillingham chart looks thus:

Building Design	Dillingham	% diff from base	% diff from low	Cost differnce From Low	20 yr Energy cost	Cost diff from lowest energy
Low school price	$ 19,553,749	-3.83%	0.00%	$ -	$ 2,978,294	$ 81,760
Base school w/7% windows	$ 19,923,587	-2.01%	1.89%	$ 369,838	$ 3,042,802	$ 146,268
2-story/flat roof/14% wind/14'walls	$ 20,136,678	-0.96%	2.98%	$ 582,929	$ 2,916,094	$ 19,560
Base school w/12" walls	$ 20,157,200	-0.86%	3.09%	$ 603,451	$ 2,896,534	$ -
Base model-2 story	$ 20,184,536	-0.72%	3.23%	$ 630,787	$ 2,934,153	$ 37,619
Base Model flat roof	$ 20,284,000	-0.24%	3.73%	$ 730,251	$ 2,920,509	$ 23,975
Base School Model	$ 20,331,858	0.00%	3.98%	$ 778,109	$ 2,938,568	$ 42,034
Base school 3:12 roof	$ 20,385,600	0.26%	4.25%	$ 831,851	$ 2,921,833	$ 25,299
Base school w/16' walls	$ 20,499,600	0.83%	4.84%	$ 945,851	$ 3,054,102	$ 157,568
2-story/flat roof/21% windows/12' walls/20%	$ 20,533,025	0.99%	5.01%	$ 979,276	$ 3,111,332	$ 214,798
Base school w/20% double commons	$ 20,610,400	1.37%	5.40%	$ 1,056,651	$ 3,114,548	$ 218,014
Base school w/ 21% windows	$ 20,624,321	1.44%	5.48%	$ 1,070,572	$ 3,055,891	$ 159,357
1-story/flat roof/21% windows/12'walls/20%	$ 20,680,347	1.71%	5.76%	$ 1,126,598	$ 3,171,778	$ 275,244
Base school w/40% double commons	$ 20,715,600	1.89%	5.94%	$ 1,161,851	$ 3,222,986	$ 326,452
2-story/flat roof/21% windows/14'/40%	$ 20,812,883	2.37%	6.44%	$ 1,259,134	$ 3,317,835	$ 421,301
Base school w/ 28%windows	$ 20,881,109	2.70%	6.79%	$ 1,327,360	$ 3,103,694	$ 207,160
1-story/2:12/21%/14'/20%	$ 20,902,863	2.81%	6.90%	$ 1,349,114	$ 3,231,871	$ 335,337
Base school w/60% double commons	$ 20,997,200	3.27%	7.38%	$ 1,443,451	$ 3,414,042	$ 517,508
2-story/3:12/21%/16'/40%	$ 21,082,225	3.69%	7.82%	$ 1,528,476	$ 3,317,370	$ 420,836
Base school w/35% windows	$ 21,157,596	4.06%	8.20%	$ 1,603,847	$ 3,167,880	$ 271,346
1-story/3:12/28%/16'/40%	$ 21,229,547	4.42%	8.57%	$ 1,675,798	$ 3,321,785	$ 425,251
High school price	$ 22,044,422	8.42%	12.74%	$ 2,490,673	$ 3,742,153	$ 845,619

In three of the zones, the lowest energy cost is not the same as the lowest construction cost, except in Wainwright. Also note that the energy costs tend to rise, generally, with the cost of construction. All four of the spreadsheets are attached.

Observations

As mentioned before, the costs of energy tends to rise with the cost of construction. In Wainwright, the highest cost of construction (one story/35% windows/16 foot walls/3:12 roof/ 60% double height commons) adds $3.3 million of construction costs to the lowest costing design (two story/7% windows/12 foot walls/flat roof/standard height commons) and adds $2.8 million to the 20 year energy cost. The range of construction cost differences far exceeds the range of 20 year energy differences.

The cost modeling for square footage to footprint (stories) only modeled the classroom wing for a ratio of .75. In a typical two story construction the 2nd floor extends to over the administration and even into the commons. This would reduce the ratio to closer to .70-.60 and would expect see lower construction and energy costs.

Windows with 14% exterior wall coverage is the lowest energy but come with higher construction costs. 21%, 28% and 35% windows are progressively higher construction and energy costs.

Construction costs of double height commons vary from expensive to very expensive and also add energy costs to the facility.

Recommendation(s)

While there can be cost/benefit discussions on some design ratios and concepts, there are some options that should be excluded from using AS 14.11 funds. These items add costs to construction that take funds from other eligible projects and also add ongoing energy costs to a district's operating costs. Those items are:

- Exterior windows should not exceed 21% in all regions. The value versus the costs associated with 21% windows should be discussed and possibly reduce the maximum amount to 14%.
- Double height commons should not exceed 20% of the floor area of the commons. There should be a discussion on allowing even 20%.
- Designs should be encouraged to utilize no higher than 14 foot walls.
- Two-story schools should be encouraged over single-story and a ratio of no more than .75 should be used and consideration of lowering it to .60.

Additional Considerations

Another set of ratios that may need some discussion is the ratio used for space allocation. This school has a student capacity of 250 students. Is a 7,700 square foot gymnasium an appropriate size? The cost model has the cost of construction for gymnasium space to be almost a third more expensive than classroom space. This discussion should include what sizes of gymnasiums are appropriate for various student populations.

Wainwright Construction and Energy Costs

Building Design	Wainwright	% diff from base	% diff from low	Cost Difference from Low	20 yr Energy cost	Cost diff from lowest energy	Notes
Low school price	$ 27,490,632	-3.18%	0.00%	$ -	$ 6,027,876	$ -	2 story/7% windows/flat roof/12' walls/standard commons/ classroom and admin
Base school w/7% windows	$ 28,008,844	-1.35%	1.89%	$ 518,212	$ 7,051,080	$ 1,023,204	
2-story/flat roof/14% wind/14'walls	$ 28,113,918	-0.98%	2.27%	$ 623,286	$ 6,631,355	$ 603,479	
Base school w/12" walls	$ 28,154,800	-0.84%	2.42%	$ 664,168	$ 6,892,781	$ 864,905	
Base model-2 story	$ 28,176,583	-0.76%	2.50%	$ 685,951	$ 6,917,307	$ 889,431	
Base Model flat roof	$ 28,330,800	-0.22%	3.06%	$ 840,168	$ 6,987,718	$ 959,842	
Base School Model	$ 28,393,465	0.00%	3.28%	$ 902,833	$ 7,273,670	$ 1,245,794	Single story/14% windows/ 2:12 roof/ standard commons/14' classroom & admin walls
Base school 3:12 roof	$ 28,472,400	0.28%	3.57%	$ 981,768	$ 6,988,709	$ 960,833	
Base school w/16' walls	$ 28,636,000	0.85%	4.17%	$ 1,145,368	$ 7,395,086	$ 1,367,210	
2-story/flat roof/21% windows/12' walls/20%	$ 28,685,119	1.03%	4.35%	$ 1,194,487	$ 6,741,490	$ 713,614	
Base school w/ 21% windows	$ 28,796,396	1.42%	4.75%	$ 1,305,764	$ 7,286,915	$ 1,259,039	
Base school w/20% double commons	$ 28,800,400	1.43%	4.76%	$ 1,309,768	$ 7,605,077	$ 1,577,201	
Base school w/40% double commons	$ 28,865,200	1.66%	5.00%	$ 1,374,568	$ 7,937,725	$ 1,909,849	
1-story/flat roof/21% windows/12'walls/20%	$ 28,902,001	1.79%	5.13%	$ 1,411,369	$ 6,951,481	$ 923,605	
2-story/flat roof/21% windows/14'/40%	$ 28,988,584	2.10%	5.45%	$ 1,497,952	$ 7,308,655	$ 1,280,779	
Base school w/ 28%windows	$ 29,119,659	2.56%	5.93%	$ 1,629,027	$ 7,472,354	$ 1,444,478	
1-story/2:12/21%/14'/20%	$ 29,203,331	2.85%	6.23%	$ 1,712,699	$ 7,618,322	$ 1,590,446	
2-story/3:12/21%/16'/40%	$ 29,372,719	3.45%	6.85%	$ 1,882,087	$ 7,417,817	$ 1,389,941	
Base school w/60% double commons	$ 29,406,000	3.57%	6.97%	$ 1,915,368	$ 8,454,455	$ 2,426,579	
Base school w/35% windows	$ 29,539,552	4.04%	7.45%	$ 2,048,920	$ 7,842,920	$ 1,815,044	
1-story/3:12/28%/16'/40%	$ 29,589,601	4.21%	7.64%	$ 2,098,969	$ 7,774,180	$ 1,746,304	
High school price	$ 30,873,557	8.73%	12.31%	$ 3,382,925	$ 8,860,160	$ 2,832,284	1-story/35% windows/16' walls classroom and admin/3:12 roof/60% double commons

Bethel Construction and Energy Costs

Building Design	Bethel	% diff from base	% diff from low	Cost Difference from Low	20 yr Energy cost	Cost diff from lowest energy	Notes
Low school price	$ 18,037,154	-3.51%	0.00%	$ -	$ 3,956,925	$ 223,484	2 story/7% windows/flat roof/12' walls/standard commons/ classroom and admin
Base school w/7% windows	$ 18,368,736	-1.74%	1.84%	$ 331,582	$ 3,820,345	$ 86,904	
2-story/flat roof/14% wind/14'walls	$ 18,516,822	-0.94%	2.66%	$ 479,668	$ 3,911,817	$ 178,376	
Base school w/12" walls	$ 18,538,000	-0.83%	2.78%	$ 500,846	$ 3,733,441	$ -	
Base model-2 story	$ 18,556,024	-0.73%	2.88%	$ 518,870	$ 3,785,746	$ 52,305	
Base Model flat roof	$ 18,654,000	-0.21%	3.42%	$ 616,846	$ 3,880,410	$ 146,969	
Base School Model	$ 18,693,202	0.00%	3.64%	$ 656,048	$ 3,754,339	$ 20,898	Single story/14% windows/ 2:12 roof/ standard commons/14' classroom & admin walls
Base school 3:12 roof	$ 18,749,600	0.30%	3.95%	$ 712,446	$ 3,890,947	$ 157,506	
Base school w/16' walls	$ 18,850,000	0.84%	4.51%	$ 812,846	$ 3,947,171	$ 213,730	
2-story/flat roof/21% windows/12' walls/20%	$ 18,933,099	1.28%	4.97%	$ 895,945	$ 4,237,960	$ 504,519	
Base school w/ 21% windows	$ 18,967,883	1.47%	5.16%	$ 930,729	$ 3,939,955	$ 206,514	
Base school w/20% double commons	$ 18,990,000	1.59%	5.28%	$ 952,846	$ 4,055,385	$ 321,944	
Base school w/40% double commons	$ 19,048,800	1.90%	5.61%	$ 1,011,646	$ 4,222,206	$ 488,765	
1-story/flat roof/21% windows/12'walls/20%	$ 19,070,277	2.02%	5.73%	$ 1,033,123	$ 4,346,174	$ 612,733	
2-story/flat roof/21% windows/14'/40%	$ 19,147,101	2.43%	6.15%	$ 1,109,947	$ 4,565,300	$ 831,859	
Base school w/ 28%windows	$ 19,202,669	2.73%	6.46%	$ 1,165,515	$ 4,001,409	$ 267,968	
1-story/2:12/21%/14'/20%	$ 19,264,681	3.06%	6.81%	$ 1,227,527	$ 4,241,001	$ 507,560	
Base school w/60% double commons	$ 19,310,000	3.30%	7.06%	$ 1,272,846	$ 4,454,250	$ 720,809	
2-story/3:12/21%/16'/40%	$ 19,399,499	3.78%	7.55%	$ 1,362,345	$ 4,583,053	$ 849,612	
Base school w/35% windows	$ 19,465,861	4.13%	7.92%	$ 1,428,707	$ 4,138,835	$ 405,394	
1-story/3:12/28%/16'/40%	$ 19,536,677	4.51%	8.31%	$ 1,499,523	$ 4,551,646	$ 818,205	
High school price	$ 20,295,855	8.57%	12.52%	$ 2,258,701	$ 5,168,186	$ 1,434,745	1-story/35% windows/16' walls classroom and admin/3:12 roof/60% double commons

Dillingham Construction and Energy Costs

Building Design	Dillingham	% diff from base	% diff from low	Cost differnce From Low	20 yr Energy cost	Cost diff from lowest energy	Notes
Low school price	$ 19,553,749	-3.83%	0.00%	$ -	$ 2,978,294	$ 81,760	2 story/7% windows/flat roof/12' walls/standard commons/ classroom and admin
Base school w/7% windows	$ 19,923,587	-2.01%	1.89%	$ 369,838	$ 3,042,802	$ 146,268	
2-story/flat roof/14% wind/14'walls	$ 20,136,678	-0.96%	2.98%	$ 582,929	$ 2,916,094	$ 19,560	
Base school w/12" walls	$ 20,157,200	-0.86%	3.09%	$ 603,451	$ 2,896,534	$ -	
Base model-2 story	$ 20,184,536	-0.72%	3.23%	$ 630,787	$ 2,934,153	$ 37,619	
Base Model flat roof	$ 20,284,000	-0.24%	3.73%	$ 730,251	$ 2,920,509	$ 23,975	
Base School Model	$ 20,331,858	0.00%	3.98%	$ 778,109	$ 2,938,568	$ 42,034	Single story/14% windows/ 2:12 roof/ standard commons/14' classroom & admin walls
Base school 3:12 roof	$ 20,385,600	0.26%	4.25%	$ 831,851	$ 2,921,833	$ 25,299	
Base school w/16' walls	$ 20,499,600	0.83%	4.84%	$ 945,851	$ 3,054,102	$ 157,568	
2-story/flat roof/21% windows/12' walls/20%	$ 20,533,025	0.99%	5.01%	$ 979,276	$ 3,111,332	$ 214,798	
Base school w/20% double commons	$ 20,610,400	1.37%	5.40%	$ 1,056,651	$ 3,114,548	$ 218,014	
Base school w/ 21% windows	$ 20,624,321	1.44%	5.48%	$ 1,070,572	$ 3,055,891	$ 159,357	
1-story/flat roof/21% windows/12'walls/20%	$ 20,680,347	1.71%	5.76%	$ 1,126,598	$ 3,171,778	$ 275,244	
Base school w/40% double commons	$ 20,715,600	1.89%	5.94%	$ 1,161,851	$ 3,222,986	$ 326,452	
2-story/flat roof/21% windows/14'/40%	$ 20,812,883	2.37%	6.44%	$ 1,259,134	$ 3,317,835	$ 421,301	
Base school w/ 28%windows	$ 20,881,109	2.70%	6.79%	$ 1,327,360	$ 3,103,694	$ 207,160	
1-story/2:12/21%/14'/20%	$ 20,902,863	2.81%	6.90%	$ 1,349,114	$ 3,231,871	$ 335,337	
Base school w/60% double commons	$ 20,997,200	3.27%	7.38%	$ 1,443,451	$ 3,414,042	$ 517,508	
2-story/3:12/21%/16'/40%	$ 21,082,225	3.69%	7.82%	$ 1,528,476	$ 3,317,370	$ 420,836	
Base school w/35% windows	$ 21,157,596	4.06%	8.20%	$ 1,603,847	$ 3,167,880	$ 271,346	
1-story/3:12/28%/16'/40%	$ 21,229,547	4.42%	8.57%	$ 1,675,798	$ 3,321,785	$ 425,251	
High school price	$ 22,044,422	8.42%	12.74%	$ 2,490,673	$ 3,742,153	$ 845,619	1-story/35% windows/16' walls classroom and admin/3:12 roof/60% double commons

Juneau Construction and Energy Costs

Building Design	Juneau	% diff from base	% diff from low	Cost difference from low	20 yr Energy Cost	Cost diff from lowest energy	Notes
Low school price	$ 15,997,390	-3.56%	0.00%	$ -	$ 1,472,572	$ 101,100.00	2 story/7% windows/flat roof/12' walls/standard commons
Base school w/7% windows	$ 16,295,842	-1.76%	1.87%	$ 298,452	$ 1,478,555	$ 107,083.00	
2-story/flat roof/14% wind/14'walls	$ 16,430,106	-0.95%	2.70%	$ 432,716	$ 1,412,597	$ 41,125.00	
Base school w/12" walls	$ 16,446,000	-0.85%	2.80%	$ 448,610	$ 1,371,472	$ -	
Base model-2 story	$ 16,466,985	-0.73%	2.94%	$ 469,595	$ 1,413,791	$ 42,319.00	
Base Model flat roof	$ 16,550,400	-0.22%	3.46%	$ 553,010	$ 1,393,843	$ 22,371.00	
Base School Model	$ 16,587,279	0.00%	3.69%	$ 589,889	$ 1,395,037	$ 23,565.00	Single story/14% windows/ 2:12 roof/ standard commons/14' classroom & admin walls
Base school 3:12 roof	$ 16,633,600	0.28%	3.98%	$ 636,210	$ 1,392,103	$ 20,631.00	
Base school w/16' walls	$ 16,729,600	0.86%	4.58%	$ 732,210	$ 1,495,333	$ 123,861.00	possible energy cost calculation error
2-story/flat roof/21% windows/12' walls/20%	$ 16,765,606	1.08%	4.80%	$ 768,216	$ 1,464,908	$ 93,436.00	
Base school w/20% double commons	$ 16,816,000	1.38%	5.12%	$ 818,610	$ 1,388,249	$ 16,777.00	
Base school w/ 21% windows	$ 16,835,337	1.50%	5.24%	$ 837,947	$ 1,496,455	$ 124,983.00	
1-story/flat roof/21% windows/12'walls/20%	$ 16,885,900	1.80%	5.55%	$ 888,510	$ 1,464,908	$ 93,436.00	
Base school w/40% double commons	$ 16,902,800	1.90%	5.66%	$ 905,410	$ 1,453,260	$ 81,788.00	
2-story/flat roof/21% windows/14'/40%	$ 16,993,685	2.45%	6.23%	$ 996,295	$ 1,572,238	$ 200,766.00	
Base school w/ 28%windows	$ 17,060,177	2.85%	6.64%	$ 1,062,787	$ 1,519,728	$ 148,256.00	
1-story/2:12/21%/14'/20%	$ 17,064,058	2.87%	6.67%	$ 1,066,668	$ 1,489,667	$ 118,195.00	
Base school w/60% double commons	$ 17,098,400	3.08%	6.88%	$ 1,101,010	$ 1,420,866	$ 49,394.00	possible energy cost calculation error
2-story/3:12/21%/16'/40%	$ 17,219,206	3.81%	7.64%	$ 1,221,816	$ 1,569,376	$ 197,904.00	
Base school w/35% windows	$ 17,309,425	4.35%	8.20%	$ 1,312,035	$ 1,498,912	$ 127,440.00	
1-story/3:12/28%/16'/40%	$ 17,339,500	4.53%	8.39%	$ 1,342,110	$ 1,550,622	$ 179,150.00	
High school price	$ 18,009,188	8.57%	12.58%	$ 2,011,798	$ 1,622,103	$ 250,631.00	1-story/35% windows/16' walls classroom and admin/3:12 roof/60% double commons

BUILDING ENERGY MODELING SERVICES

Final Report prepared for DEED

JULY 10, 2019

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BUILDING ENERGY MODELING SERVICES

Final Report

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Date
July 10, 2019

Contents

List of Figures and Tables

List of Acronyms

ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AHU	Air Handling Unit
BBS	Building Breakdown Structure
BEES	Building Energy Efficiency Standards
BEM	Building Energy Model
BR&GR	Bond Reimbursement and Grant Review
BTU	British Thermal Unit
BTUH	BTU per hour
CCF	One Hundred Cubic Feet
CF	Cubic Feet
CFM	Cubic Feet per Minute
DEED	Department of Education and Early Development
DX	Direct Expansion
ECM	Energy Conservation Measure
ECI	Energy Cost Index = Annual Energy Cost / Building Square Footage
Eff	Efficiency
EPS	Expanded Polystyrene
EUI	Energy Utilization Index = Annual Energy Consumption in kBTU / Building Square Footage
fc	Foot Candles
GPM	Gallons Per Minute
HP	Horsepower
HVAC	Heating, Ventilating, and Air-Conditioning
IAT	Indoor Air Temperature
IMC	International Mechanical Code
kBTU	Thousand BTUs
kWh	Kilowatt-Hour
lb(s)	Pound(s)
LED	Light Emitting Diode
MBH	One Thousand BTUs per Hour
MMBTU	One Million BTUs
MPR	Multi-purpose Room
O&M	Operations and Maintenance
O/A	Outside Air
OAT	Outdoor Air Temperature
OH	Overhead
R	R-Value
SF	Square Foot\Feet
VAV	Variable Air Volume
VSD	Variable Speed Drive

1. Introduction

HMS Inc. (HMS), along with Coffman Engineers, Inc. (Coffman) were tasked with developing a Building Energy Modeling (BEM) study, this report includes the findings and recommendations. The report has been developed for internal use within the Alaska Department of Education and Early Development (DEED), while being available to the general public.

It was the objective of the project and report to help DEED inform future projects on efficient school design and parameters for evaluating school design efficiency, primarily in terms of cost. The report provides initial construction cost and operating cost analysis of four distinct design ratios within four climate zones throughout the State of Alaska as defined by the Building Energy Efficiency Standards (BEES), the Alaska Housing Finance Corporation's amendment to the International Energy Conservation Code. The school models, construction and energy costs developed for this report use real world pricing but are conceptual in nature. The variables for consideration within the study are limited to the climate differences of the four zones and the impacts of design ratios selected, not on alternative building materials.

2. Project Overview

2.1 Development

A kick-off meeting was performed on March 5, 2019 to determine the scope of BEM study, the meeting was conducted by HMS along with Coffman for DEED. A scoping report was developed by HMS and Coffman March 7, 2019 and revised on March 15, 2019. This report detailed the scope as noted in section 2.2.

From the kick-off meeting it was determined the intent was to assist in the development of cost-effective design criteria for schools in various Climate Zones. The locations chosen were considered representative of the four Climate Zones. It was determined during the initial meeting that the total school cost, as opposed to component cost, would be considered. As well, the utility cost would be City/Town specific and not an average of the Climate Zone.

An additional meeting between HMS/Coffman and DEED and the BR&GR was conducted on March 12, 2019 to review the initial scoping document. Significantly, it was decided that the study would be limited to 20 years for Utility costs, Geographic Factors developed by HMS would be used in determining location specific initial construction costs, and that if additional iterations needed to be considered the modeler would inform DEED.

2.2 Scope

The model is representative of typical Alaskan construction, with certain design features chosen as representative of those schools receiving the majority of recent funding.

The study focused on the changes in design ratios and the impact on the cost of construction and operations and maintenance (O&M). It is meant to look at how certain ratios could affect the lifetime cost of a project on a holistic level, combining initial construction cost and utility costs over time. Since this study examines the impact of a range of independent variables, a control element was needed from which to measure those impacts. To provide this control, a base model school for the project was developed between the design team, DEED and the Bond Reimbursement and Grant Review (BR&GR) Committee. The base model school is intended to represent a quality school facility that matches common current design materials and techniques. With the variety of climates, soil types, and school configurations across the state, no single prototype could represent all the common building systems, components, and educational spaces for each location. However, the model selected is representative of typical Alaskan construction, with certain design features chosen as representative of the current school construction projects receiving the majority of state-aid.

The inherent challenge in developing a model such as this is the balance between ideal and pragmatic. While ASHRAE guidelines provide direction for modeling a building, there is no "real-world" factor included. The modeler must make assumptions of performance, actual operating behaviors and hypothetical design decisions. Increasing the challenge in this project is the spectrum of construction methods, materials and options to design for in Alaska with its spectrum of climates and local conditions. Design teams need to balance available budget, local conditions, and climate in each school design. For example, an engineer might choose a much higher level of heating system redundancy for a school in Climate Zone 9 versus Climate Zone 6. This study does not aim to replicate each permutation or possibility in a school at each climate zone, as these are subjective and can vary widely amongst designers.

Table 1 on the next page shows the considerations, selection and additional comments for the scope of the BEM study.

BUILDING ENERGY MODELING SCOPE SUMMARY		
Considerations	**Selection**	**Comments**
Standard School	40,000 SF	See Table 2 and Figure 1
Locations per BEES zones Locations per BEES zones	Zone 6 - Juneau Zone 7 – Dillingham Zone 8 – Bethel Zone 9 – Wainwright	Location will be source for weather and utility data Utility data assumes uniform pricing, with no complex rate schedules or structures
Standard Systems	Mechanical systems throughout will be of identical design and sized for conditions	Systems are sized appropriately for the different locations, but all use the same basis of design. Sizing is automatic in eQUEST for the maximum load during the specified occupied periods.
Design Ratio 1	Openings Area to Exterior Wall Area (O:EW)	(O:EW) – 5 model iterations at 7-35% opening to wall area. Door quantity and size remaining the same, only window size varies
Design Ratio 2	Building Footprint Area to Gross Square Footage (FPA:GSF)	(FPA:GSF) – 2 model iterations, single vs two story construction of the classroom wing
Design Ratio 3	Building Volume to Net Floor Area (V:NSF)	(V:NSF) – Three separate sub-ratios to study effects of roof pitch (flat and 3:12), wall height increase, and double height space per percentage of building at common areas.
Design Ratio 4	Building Volume to Exterior Surface Area (V:ES)	(V:ES) – Iterations of varying shape and configuration while maintaining building systems and baseline O:EW. Alternate iterations were T-Shape, L- Shape, complex U/H Shape, and 50% offset gym
Utility Cost	Per city/town selected at each location	Utility escalation will be included at 3% annually.
Initial Cost	Cost of initial cost of construction	Not to include land purchase, site costs or other non-construction project costs. Geographic cost factors will be utilized for each location

Miscellaneous Considerations	School Population: 283 Occupied hours: 800 to 1700, 5 days per week Months: August 15th to May 31st Study Lifetime: 20 year	School population and hours provided by client. School population includes students and staff.

Table 1 – Building Energy Modeling Scope Summary

3. Design Ratios

For the BEM, HMS and Coffman focused on four building ratios determined likely by the BR&GR Committee to have a significant impact on efficiency for new schools throughout Alaska, based on energy use and related construction cost factors. For each design ratio, several sub-iterations are listed below.

3.1 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".

Primarily chosen as an energy efficiency ratio, the report will focus on changes in openings area (doors/windows) in relation to exterior wall area. The base model will be used with the only changes considered at each location the percentage of openings area. As determined through analysis, the study will have five model iterations at 7% through 35% (with 7% increases). It is assumed that door size and quantity will remain constant for each iteration. In order to maintain consistency with the roof pitch portion of the study, the calculation of the O:EW ratio excludes the area of the gable end above the plenum in the model school's 2:12 roof when determining the size of the windows. This prevents a recalculation of the window area percentage when the above-plenum gable ends of the building change during the roof pitch study, meaning that the window size is kept identical regardless of roof pitch. This way, the total window area for the flat pitch roof is kept the same as the total window area for the 2:12 and 3:12 roof, and the only difference between the models will be the area of the gable ends themselves. This helps avoid confusion in the results in determining whether differences are due to the changed window size or the gable end.

3.2 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".

Equally important for energy and construction costs, the study will focus on the analysis of one and two stories design. The base model will be used for the single-story analysis; a second model will be developed for the two-story with classrooms stacked. To be considered in the report will be the additional cost of elevators and their maintenance cost over the 20-year study period. The total square footage of the two-story classroom wing remains the same, it is split into two 10,000 SF floors. Although an elevator is included in initial construction costs and O&M costs, no elevator energy consumption is modeled for the school. It is assumed that elevator use would be sporadic and unlikely to have a significant effect on energy consumption.

3.3 Building Volume to Net Floor Area (V:NSF)

Building Volume is defined as "all conditioned cubic square footage within a buildings 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".

Three sub-ratios will be considered by the design team to model differences in variable volume design options

Roof Pitch – Two iterations will be studied, flat roof and 3:12 pitched roof, and the roof space is considered heated.

Exterior Wall Height – Three iterations will be developed, each with the exterior wall height being the variable studied. The wall height for the classroom and admin spaces will be adjusted in a range from 12 feet to 16 feet. For modeling purposes, this height includes an assumed plenum, but disregards the common 2 feet soffit below the building.

Double Height Space – Three iterations of the base model will be tested, each with different percentage of double height construction space as compared to the floor area. The three design percentages will be 20, 40 and 60%, note that the double height percentage applies to the MPR/Commons space. (5000 SF)
The net floor area will remain constant from the base model for this iteration and the building volume will be the independent variable.

3.4 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".
Figure 17, along with figures 18, 19, and 20 provide concept level complex shapes that are currently being considered. Note that the volume will remain constant from the base model, for this iteration the exterior surface area will be the independent variable. The primary driver for this design ratio is building shape and complexity of exterior enclosure. Five iterations are modeled:

1. Linear Baseline
2. T-Shaped Building
3. L-Shaped Building
4. Complex Shape
5. Gym Off-Set

4. Base Model School

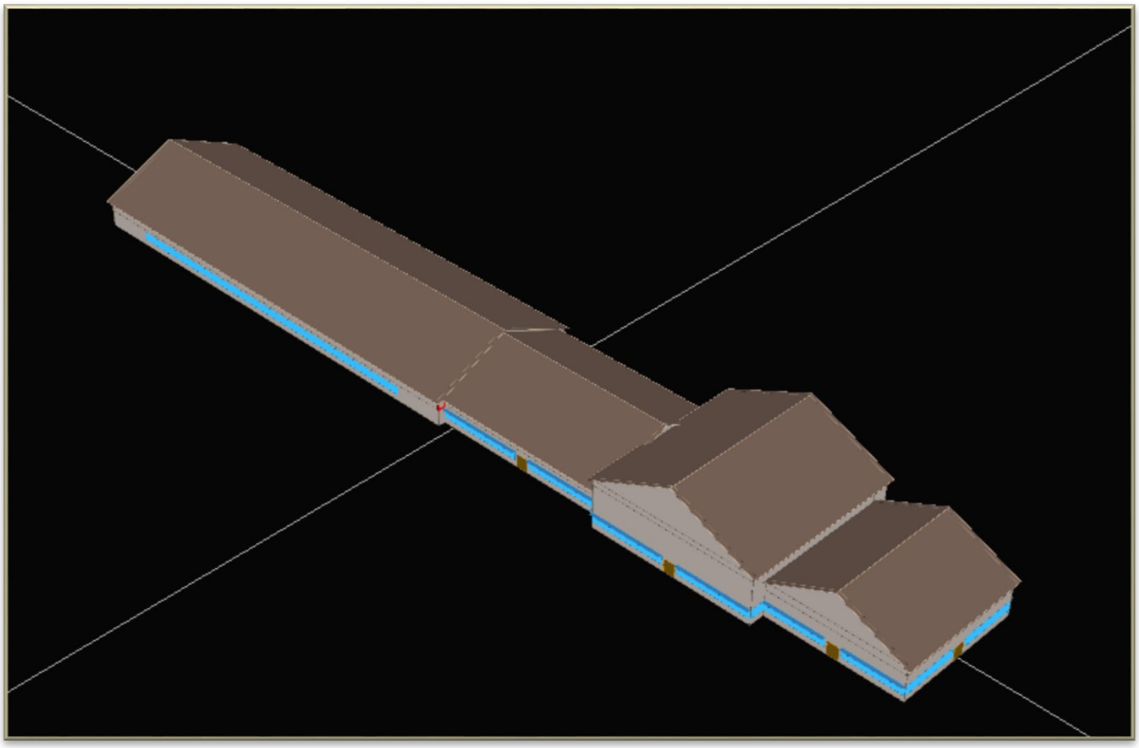

Figure 1- Rendering of Base Model School

In conjunction with DEED and the BR&GR Committee, a standard design was chosen for the base model that represents a normed allocation of school space by functional area, while also being easy to modify for the design ratios being studied. It is understood that not all schools within the State of Alaska are designed to the same standards as listed in **Table 2**, however the listed basis of design has been acknowledged as representative of acceptable parameters for design of a 40,000 square foot school. The study focuses on the impacts of design ratio changes related to volume, square footage and associated changes to shape and building design. It is not intended to study alternative building materials or designs and their impact on cost.

BASE MODEL SCHOOL		
Parameter	**Accepted**	**Comments**
Square Footage	40,000 SF	Average approximate size based on example schools

BASE MODEL SCHOOL		
Exterior Wall Height	Classroom – 14 ft. Admin – 14 ft. MPR – 18 ft. Gym – 26 ft.	System designed for ASHRAE 90.1 Zone 8 Minimum Standards U-Assembly value of 0.084[1]
Roof	2:12 Pitch	System designed for ASHRAE 90.1 Zone 8 Minimum Standards (U-Assembly value of 0.038)
Windows	Low-E, Double Pane	Clear glass, ¼" thick panes, with a ½" air gap. Window frames are 1.3" wide insulated vinyl clad type with a thermal break. Windows were assumed to be fixed, and not opened during the study.
Mechanical and Electrical Systems	Fuel Oil Boilers VAV system LED Lighting	Fuel-oil hydronic systems, auto-sized by the modeling software for each location and each iteration. Each of the 2 boilers are sized at 50% of the maximum load experienced associated with the models' weather file. Hydronic heat is distributed throughout the building and modeled with a Variable Speed Drive pump. Pump size and boiler were adjusted for each model to meet heating requirements and avoid excessive unmet hours. A VAV system consistent with typical HVAC design for schools. An air handling unit serves each design space. No mechanical cooling is included in the VAV systems. During scoping, heat recovery was eliminated from the project. An economizer is included in the design. There is no high-limit on the economizer, as there is no mechanical cooling.

[1] Note that U-value for an assembly can be dramatically different than the U-value of the insulation used, as the assembly considers thermal bridging effects from structural elements. This provides a realistic accounting for actual wall, roof and floor conductance.

BASE MODEL SCHOOL		
Mechanical and Electrical Systems (cont.)		Hydronic baseboard provides supplemental heat during the day and primary heat at night. Ventilation air is based on ASHRAE 62.1 standards. LED lighting was assumed for all spaces. Lighting density is based on recent lighting school remodels using LED lights. This exceeds current minimum energy codes but is more typical of current construction practices. DDC systems are not explicitly modeled in the program, but all systems are modeled per typical DDC controlled sequences. The cost estimate does include DDC.
Area by Space Type	Classroom – 20,000 SF Admin – 7300 SF MPR/Commons – 5000 SF Gym – 7700 SF	These areas will be consistent throughout the various model iterations
Floor Construction	Elevated soffit, insulated	Assumed as most typical currently funded design
Openings	14% of exterior wall area	DEED provided the design team with average opening percentages from 19 schools. This is inclusive of doors and windows. Gable ends were excluded from wall area in calculations
School Population	283	Base capacity – 246 5% crowding/other – 12 Total student population – 258 Instructional staff – 19 Non-instructional staff – 6 Typical classroom occupancy – 18

Table 2 – Base Model School

4.1 Basis of Cost Estimates

The goal of the Base Model School estimate was to develop an estimate tool that would be customizable over many design iterations, as well as transparent and repeatable in execution. The scope of the model school was a 40,000 square foot school, with several key design guides to help structure the overall estimated construction cost. Excluded from the estimates are the development of site construction costs, or project costs such as land purchasing and A/E design fees.

The construction cost estimate is developed using a general Building Breakdown Structure (BBS). This was chosen as the most transparent estimating structure available to easily identify the changes in cost for exterior enclosure, structure and other areas of work affected by the design ratios. The estimate cost quantities are based on the energy model developed by Coffman, as well as typical quantity assumptions from take-offs of similar sized school projects provided by DEED.

Based on current material, equipment and freight costs. Labor rates are assumed as A.S. Title 36 working 60 hours per week, with a premium time adder of 16.7%. Unit costs were developed using RS Means 2019. In addition, HMS historical costs and commercially available material costs were utilized where appropriate. Labor costs for each disciple are included in **Appendix E.**

Home office overhead and job office overhead (OH) are included as percentage mark-ups for the purpose of this conceptual cost estimate. Home Office OH includes costs such as administrative and other costs associated with running the business. Job Office OH includes field office, field management and supervision, and utilities.

For transparency, freight and anticipated imported work force and related costs are broken out. The labor workforce for each location was reviewed for anticipated local and imported work force. For imported workforce, travel, per diem and lodging was considered. For locations north of the 63rd parallel a 1.3% addition to labor costs was added to adjust labor rates.

Prime Contractor Mark-ups	
Job Office OH	12%
Home Office OH	3.5%
Bonds	1.5%
Profit	8.5%

Table 3 – Prime Contractor Mark-ups

Sub-contractor Mark-ups	
Job Office OH	10%
Home Office OH	2.5%
Profit	8.5%

Table 4 – Sub-contractor Mark-ups

Adjusting the estimates per the selected locations are critical when developing programmatic costs throughout Alaska. When designing a project in Alaska, it is necessary to consider support for imported labor. The design criteria considered for this project are structural, shortages of skilled labor throughout Alaska in remote locations, high costs of freight and travel, long equipment rental durations, complicated logistics, and increased risks anticipated by contractors. A geographic factor has been added before a general contingency to cover such costs.

The initial cost of the model school includes a 15% estimator's contingency. Traditionally the estimator's contingency is to cover design unknowns for concept and early design level projects, 'known-unknowns'. The 15% contingency for the model school adjusts the overall initial cost of the project to cover the items of the project that will statistically occur.

Cost Estimate Assumptions and Exclusions

- Standard construction contract without restrictive bidding clauses, bidding to open and competitive.
- Site work, A/E design fees, administrate and management costs and escalation are excluded from the initial cost estimate.
- Assembly assumptions are listed below

It is assumed for costing purposes that the structure will be elevated and the foundation will be a piling system. The structure is assumed as a simple steel frame as both most common and the most cost-efficient design for the model school. As the structure is elevated, the exterior envelope includes an underfloor soffit. The exterior envelope is based on the minimum standards for ASHRAE 90.1. Interior construction is based off the 18th Edition of the Program Demand Model School. Spaces are modeled at the same temperatures, and therefore no heat transfer is modeled across interior partitions. Interior frame walls are included in the model to account for thermal mass. They are assigned on a geometric zonal basis, there is no specific wall pattern or design.

Heating systems are based on fuel-oil boilers for all locations. Equipment sizing, including boiler sizing and pump sizing was provided by the BEM designer. The sizing of the systems varied for each location and design iteration. The conceptual cost estimated for HVAC equipment was based upon the required sizing in CFM and MBH/GPM for the AHU's and the Boilers/Circulation Pumps for both systems. Larger boilers and pumps also directly influenced the cost of the distribution system and terminal units for the conceptual schools. All equipment sizing can be seen in Appendix D. Ventilation systems are assumed as Variable Air Volume (VAV) systems with an air handler unit for each of the four building zones. As with the heating systems, the BEM designer provided all equipment sizing for the air handling units.

4.2 Design of Energy Model

All buildings were modeled using eQUEST 3.65. eQUEST is a full 8,760 energy modeling program, meeting ASHRAE Guideline 140 requirements for an energy modeling program. It is the graphical user interface developed by the U.S. Department of Energy utilizing the DOE 2.3 calculation engine. It is commonly used for LEED energy models, capable of modeling multiple complex systems and schedules. The 8,760 refers to the hours in a single year, and the program uses hourly weather data to calculate a building's energy consumption. During design, an engineer will consider the likely worst-case scenario for a building and choose equipment to handle that single event. An energy model is instead concerned with how the building performs during the hours in between the worst hours of the year.

Per DEED standards, all new school buildings in Alaska are required to meet ASHRAE 90.1-2010 minimums. In practice, there is limited enforcement of this standard, and it is incumbent on the design team to balance practical requirements with compliance. In developing the scope of this project, 90.1 was used to inform scoping decisions, envelope and equipment. However, the models were neither developed in strict compliance with ASHRAE 90.1 nor its modeling guidelines in Appendix G. In some cases, such as lighting, the minimums were exceeded to be more consistent with current construction practices. In others, such as the envelope, an element from 90.1 was used for a single climate zone and applied across all applicable cases. In order to try to make the models most applicable for current construction, a likely construction method or material was chosen over a strict code-based requirement. The decisions were made using the team's experience with recent projects. Some compromises were necessarily made to keep the project within scope and reduce modeling and estimating effort where it was judged not to significantly impact the overall results.

The modeler inputs building geometry, constructions, lighting designs and mechanical equipment type. The user also inputs building population and schedules, i.e. when rooms are occupied.

Building infiltration is modeled identically throughout all of the models at a uniform 0.038 CFM/ft2 of wall area for exterior walls and 0.001 CFM/ft2 for floor area. Infiltration is modeled based on a fraction of the calculated maximum and the current hour wind speed per the weather data. The model does not consider wind direction. There is no modeling of stack effect as it is complex and very building specific to perform properly and with the relatively low height of the base model it is considered unlikely to have a major impact on the results. Similarly, the model does not consider possible effects due to temperature variations and wind gradients with the taller variations from the base model school. There are so many assumptions required to model infiltration that there is low confidence that one method is meaningfully different than another, and the complex calculations and modeling effort required would not necessarily result in a definitively more accurate model. Note that ASHRAE 90.1 does not specify infiltration calculation requirements other than models must be compared using the same methodology for infiltration calculations, as is done in this exercise.

The modeling software calculates equipment size for each location and iteration. It takes input for population, ventilation requirements, and internal/external heat sources and calculates the necessary size for heating and ventilation equipment based on peak loads throughout the year. DOE weather data was used for sizing equipment within the program. Equipment sizing of major equipment was relayed to the cost estimator.

Equipment types for this exercise were selected to be typical for a school construction in moderately remote places. Typical efficiencies and performance curves were assumed. No new or emerging technologies were assumed. Similarly, neither renewable energy nor purchased energy were investigated as part of this project. Equipment was modeled and estimated at actual load conditions. ASHRAE recommends that specific design day criteria is used in actual design calculations, but this methodology was not used as it would add significant burden to the modeling effort. Several models were compared against the design day data and minimal differences were found, justifying the chosen approach.

In certain cases, such as boilers, equipment is only sold in discrete sizes, e.g. 500 MBH, 750 MBH, 1000 MBH, etc. In developing the model, the issue of whether to attempt to use these discrete size steps was considered. However, it was decided to use the continuously varying sizes auto-selected by the program. Each manufacturer has their own range of sizing, and while there are broad similarities, there is not an industry standard. Additionally, the cost estimating model does not track specific sizing for the same reason, as in this example, it uses a "per-BTU" method for a broad range of boiler sizes. Thus, attempting to capture these sizing steps was eliminated from the study. The same logic was used on the other equipment, including Air Handlers and pumps.

The ventilation system is modeled as a VAV AHU utilizing Variable Speed Drives (VSD) drives for the fans and full shut-off terminal boxes in each zone. Each shell (Classrooms, Admin, Gym and

Commons/MPR) has a dedicated AHU. Each AHU has a pre-heat and heating coil. The program requires a cooling coil installed as part of the system, but the coil is scheduled off and does not run. An economizer is modeled in the program to provide needed cooling air. An external static pressure of 2.0 inches is assumed for each AHU. The AHU's are modeled as fully ducted for both supply and return. All air is ducted back to the AHU instead of through an open plenum area above the ceiling. The AHU's are scheduled to operate during building occupancy and shut down at night. Outside air quantities, which have a major impact on energy consumption, are calculated using ASHRAE 62.1 guidelines and modeled accordingly. There is no outside air brought into the building when the building is unoccupied. No heat recovery is modeled, as it is not always installed in schools. ASHRAE 90.1 guidelines do require heat recovery in 6.5.6.1, but there are numerous exceptions that allow a designer to not install it. For this study, DEED agreed to not include HRV's.

The hydronic system is modeled as two identically sized forced-draft cast iron boilers. Each boiler is sized for 50% of the maximum load, based on the weather file and peak heating load. The size of the boilers varies according to location and heating requirements. A constant volume pump runs whenever the boilers activate to provide minimal flow through the boilers. A secondary VSD pump circulates heating water through the entire building. All spaces share the same heating plant. The boilers are set on a demand schedule, only operating when there is a call for heat. All zones are modeled as two-way valves, meaning that the pump reduces speed whenever a zone is not calling for heat through either its VAV terminal unit or its baseboard. Baseboard and VAV terminal units are sized automatically for all zones by eQUEST. The program automatically sets interior zones to operate on an outdoor reset schedule, this was changed by the modeler to operate thermostatically. The hydronic system operates on an exterior air temperature reset schedule, adjusting the heating supply temperature from 180°F to 160°F in linear proportion with the Outside Air Temperature (OAT) as it rises from 0° to 45°F. During unoccupied hours, only baseboard is used to heat the building, the AHU's are off.

In discussions with DEED personnel, it was decided to model the entire school as exclusively using LED fixtures, even though this exceeds minimum required standards. LED lighting is the dominant type used in recent designs and is proving cost effective. Lighting design is a complex subject, outside of this project's scope. To model lighting, several past school designs using LED fixtures were analyzed for typical W/SF (wattage per square foot) densities for room type, such as classrooms, corridors, gyms, etc. That wattage was then applied to the equivalent space types in the model. Lights were assumed to be on completely during school hours regardless of the season;

there are no daylight sensors modeled. Similarly, no occupancy sensors are modeled. Daylight and occupancy sensors were not explicitly modeled. In order to model them correctly, the modeler needs specific information on the design of each space, anticipated room colors, lighting intensities and a myriad of other data that are not available. If the modeler was to make assumptions for the data, it is no more valid than not including the sensors at all. Similarly, while current guidance recommends modeling occupancy sensors at a 10% reduction in overall lighting energy, this again was felt to be within tolerances of potential lighting designs and could be ignored to reduce modeling complexity. Note that the sensors are likely to be installed in a current generation school and are included in the cost-estimate.

Exterior lighting is modeled uniformly across all climate zones, there is no variation for the different lighting needs at the different locations. Interior lights are modeled as shown in Table 5 – Lighting Density:

Lighting Density	
Room Type	**W/SF**
Classroom	0.54
Corridor	0.58
Gymnasium	0.85
Restroom	0.42
Storage	0.45
MPR	0.67
Kitchen	1.08
Office	0.64
Library	0.64

Table 5 – Lighting Density

All iterations of the building were modeled with identical roof and wall assemblies. This was done to eliminate complications in analysis between changes in construction type and the actual changes due to the geometry iterations. As construction types and techniques vary widely across the state, a conservative option was chosen of using assembly values proscribed by ASHRAE 90.1-2010. ASHRAE recognizes only two climate zones in Alaska, 7 and 8. Zone 8 was chosen as the basis for all four locations and walls and roof were modeled appropriately. Based on ASHRAE 90.1 Appendix G's baseline description that defines energy modeling for compliant buildings, the walls were modeled as steel framed with 6" stud on 24" centers. The roof was modeled with insulation entirely above the deck. Minimum assembly U-values from Table 5.5-Zone 8 were used for the assemblies. Assembly values consider thermal bridging and end-effects for wall and roof construction. These affects significantly reduce the wall's overall thermal performance below that of the insulation rating used in the wall.

While walls and the roof were modeled per Standard 90.1, the basis of design for Appendix G direction is an unheated slab on grade. As many locations in rural Alaska are not slab on grade, the team deviated from Appendix G and modeled the building as an elevated structure on piles. The bottom of the building is exposed to ambient conditions. In order to model the soffit space, the plenum above the building was increased to account for the additional unconditioned space below the building. Because of the way the energy calculations are performed, there is not a difference in energy consumption, and modeling was significantly less effort. The floor is modeled as heavily insulated, with an assembly U-value of 0.027. This is maintained as constant across all models.

Windows are modeled according to ASHRAE 90.1-2010 requirements for climate zone 8. They are modeled as double pane, zero tint windows with an overall assembly U-value of 0.35. This includes framing, which is modeled as insulated vinyl with a thermally broken frame. Windows are modeled as non-operable. The model assumes that windows remain closed throughout the year, and no natural ventilation takes place.

5. Location Data

ASHRAE divides Alaska into two climate zones as a basis for energy modeling. However, due to the variety of climates and size of Alaska, the committee decided that the climate zones were too broad to accurately reflect potential building effects in the state and chose to follow the BEES climate zones. BEES (Building Energy Efficiency Standards) is a collection of amendments and modifications to the International Energy Conservation Code and is established as part of the Alaska Housing Finance Corporation (AHFC) requirements for their residential mortgage loans and energy rebates. The BEES amendments to the IECC split the state into a total of 4 climate zones, as shown in Table 6.

Table A301.1(1) Climate Zones for Alaska by Census Area			
Zone 6	Zone 7	Zone 8	Zone 9
Juneau	Aleutians East	Bethel	North Slope
Ketchikan Gateway	Aleutians West	Denali	
Prince of Wales	Anchorage	Fairbanks North Star	
Sitka	Bristol Bay	Nome	
Skagway-Hoonah-Angoon	Dillingham	Northwest Arctic	
Wrangell-Petersburg	Haines	Southeast Fairbanks	
Yakutat	Kenai Peninsula	Wade Hampton	
	Kodiak Island	Yukon- Koyukuk	
	Lake and Peninsula		
	Matanuska-Susitna		
	Valdez-Cordova		

Table 6- Climate Zones (Alaska Housing Finance Corporation, 2019, https://www.ahfc.us/application/files/1013/7393/1537/ak_bees_2009_ashrae_std_62_2_2010.pdf)

The different climate zones are differentiated by the Heating Degree Days for each census bureau. Heating degree days are a convenient way to estimate overall heating usage, as they are a measure of the amount of time the location is below a certain fixed temperature, in this case 65°F. Heating degree days do not differentiate between areas that are consistently cool year-round, but relatively mild, such as the Aleutians, against areas that have very cold temperatures for shorter amounts of time. However, the BEES designations are helpful and more useful to compare buildings than the ASHRAE climate distinctions.

5.1 Selected Sites

The selected sites for each zone were Juneau, Dillingham, Bethel and Wainwright for zones six through nine respectively (see Table 7 – Location Weather Data). They were chosen based on a combination of climate zone and location to use “middle of the road” values for costs. The location criteria for selecting the sites included city population and access for construction (e.g., materials could be barged in) in order to keep prices comparable with the other towns in the study. Wainwright was selected instead of Utqiagvik as it is reliant on fuel oil for heating, whereas Utqiagvik is not, and would not have appropriate price information.

Location	***HDD (65 F)***	***Design Heating Temp (ASHRAE 99.6%)***	***Design Cooling Temp (ASHRAE 1 %)***	***Weather File***
Juneau	8304	4.5 F	70.1 F	TMY\JUNEAUAK.bin[2]
Dillingham	11223	-20.0 F	66.1 F	TMY2\AK_Dillingham_(AMOS).bin
Bethel	12557	-27.3 F	68.8 F	TMY2\BETHELAK.bin
Wainwright	19228	-39.9 F	54.0 F	TMY2\BARROWAK.bin[3]

Table 7 – Location Weather Data

Apart from Wainwright, all are of sufficient size to have an available DOE weather file. The weather file is a compilation and average of typical meteorological conditions for each hour of the day over the course of a minimum of five years. The weather file is used by the energy modeling program to simulate conditions, including temperature, humidity, cloud cover, sunlight intensity and wind speed. The U.S. Department of Energy collates data from locations around the country and publishes the data on their website. (http://doe2.com/index_wth.html)

It is important to note that these sites were selected solely as representative of the climate zone and to have a specific source for utility costing information. The models are not meant to represent a specific location, but rather a potential site in that climate zone. As this is not a study meant to compare the differences between identical schools in different climate zones, the exact location is not critical, and should not be used as a comparison for future school performance at the specific city site.

5.2 Utility Rates

O&M cost data was developed using current utility rate data, and modeled building energy usage. For each selected location, fuel oil and electricity rates were researched for pricing the consumption of utilities of the model schools and the many iterations. Utility data was collected on 5 April 2019 for the selected locations. Rates are listed below in Table 8 – 2019 Electricity and Fuel Oil Rates**,** electricity cost is calculated using cents per kWh used and a yearly service fee from the

[2] There is no TMY2 data available for Juneau. TMY data was collected and averaged between 1948-1980, TMY2 data was collected from 1961-1990. Both data sets are acceptable for use by ASHRAE, there is no difference in quality. TMY2 data set includes additional data which could affect radiative cooling, a minor impact for this climate zone.

[3] Wainwright does not have a DOE TMY file for weather use, so Utqiagvik (Barrow) is the most similar. As this project is not specifically a Wainwright study, but all of Climate Zone 9, this is presented as an acceptable alternative.

energy provider, fuel cost is calculated using dollars per gallon consumed. Additional information is provided in Appendix F, including source data for the rates provided.

After the pricing for consumption of electricity and fuel oil for the model schools were calculated, escalation is applied to the yearly total at 3% per annum to demonstrate the 20-year life expected cost of utility consumption.

2019 Electricity and Fuel Oil Rates			
	Electricity		Fuel
Location	¢/kWh	$/year	$/gal
Juneau	8.82	$ 315.72	$3.17
Dillingham	40.09	$ 840.00	$3.98
Bethel	37.50	$ 60.00	$4.61
Wainwright	12.51	$ 2,040.00	$7.30

Table 8 – 2019 Electricity and Fuel Oil Rates

6. Results

Methodology: After establishing the base model as described above, that model was run for each of the locations. As eQUEST was originally developed for a California market, effort was required to adjust the base model to meet performance needs. This included changes to standard baseboard operation and VAV airflow minimums so that the model maintained desired space temperatures through the year. The energy modeling software records "unmet" hours, or hours in the model where the space temperature is found to have deviated from the thermostat set point by more than a degree. ASHRAE 90.1 Appendix G requires that a valid model has fewer than 300 total unmet hours per year. To resolve unmet hours, the baseboard heat output in the zones that showed unmet hours was increased until the number of hours was below 300. Once the base model school performed adequately and met performance requirements, the model was adjusted for each of the different studies. The adjusted model was then run for each of the different climate zones. Once the models were run, their performance was reviewed again for unmet hours, and the models adjusted until hours again were below 300 per year.

Energy Models are best used as a comparison tool. Their power is the ability to perform huge amounts of calculations using the inputs from the modeler.

In creating the model, numerous assumptions and decisions were made to standardize school operation and use. Schools play numerous uses in different communities, and are operated in very different ways, so it is impossible to accurately model each permutation of occupancy or design throughout Alaska. Where information was not directly available, the energy modeler must use experience and industry standard assumptions to account for likely energy uses. Examples of this include miscellaneous energy loads such as kitchen, refrigeration and office equipment. The intent was not to model a specific school, or perfectly represent the energy consumption of a school, but to have a reasonable model with which to make comparisons.

Energy models are best used as a comparison tool. Their power is the ability to perform huge amounts of calculations using the inputs from the modeler. It is a challenge to use energy modeling programs for prediction, and the purpose of this study is not to accurately predict the amount of energy any of these buildings will use. A building's energy consumption is affected by the weather, the number of occupants, the quality of the maintenance, the true hours of occupancy and even quality of construction. Accurately reflecting all of the potential effects is difficult, and outside the scope of this project. Therefore, it is important to understand that the results shown here are best used to compare the impact that changing window size could have on a building, or the relative importance of a double height commons area. As much as possible, conditions are kept the same between models, so the only variable is the study component. Otherwise, it becomes very difficult to interpret the results.

The charts and Table 9 below show the overall breakdown for energy use at each location. The percentages change slightly with the various iterations, but all follow a similar trend, with space heating taking up the largest percentage of building energy use.

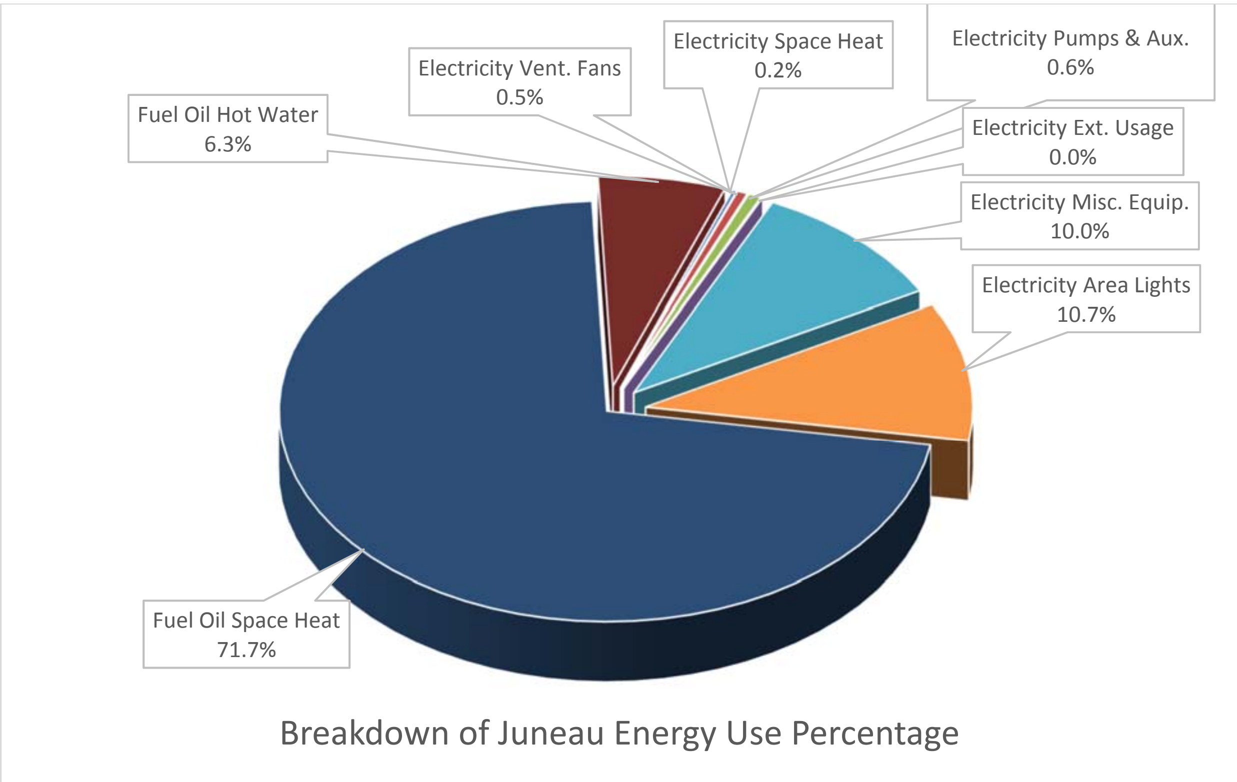

Figure 2 Juneau Energy Use Percentage

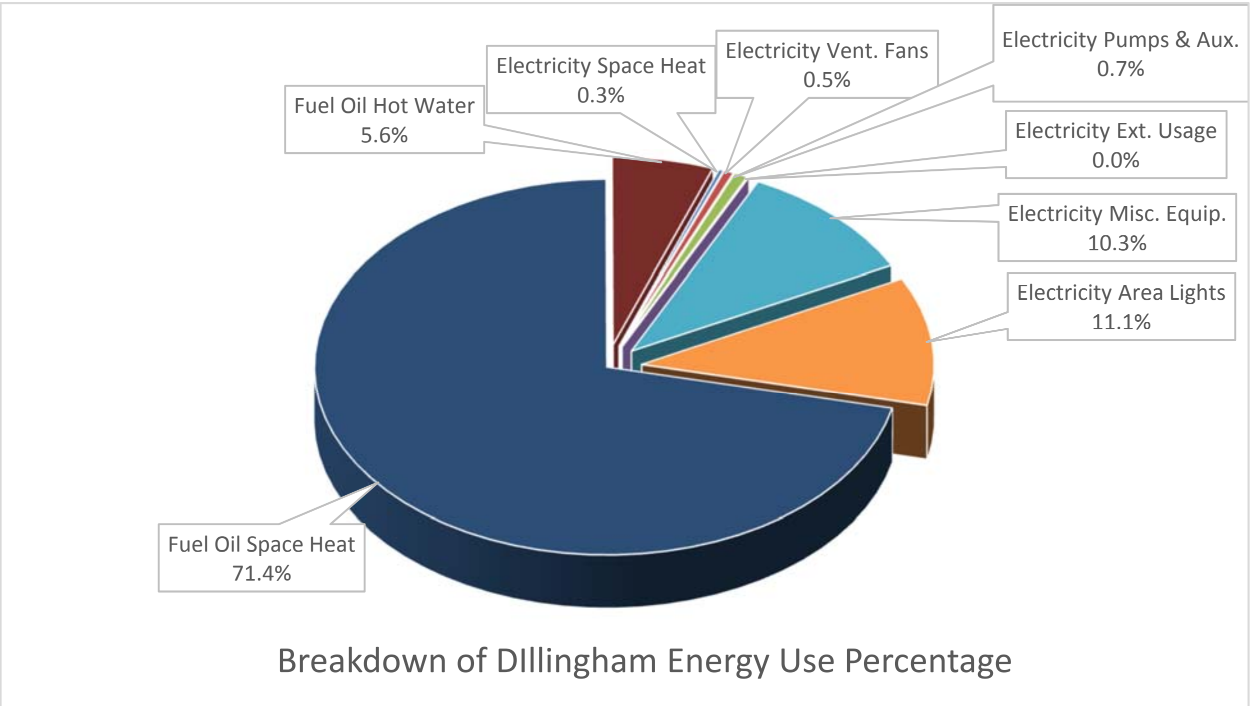

Figure 3 Dillingham Energy Use Percentage

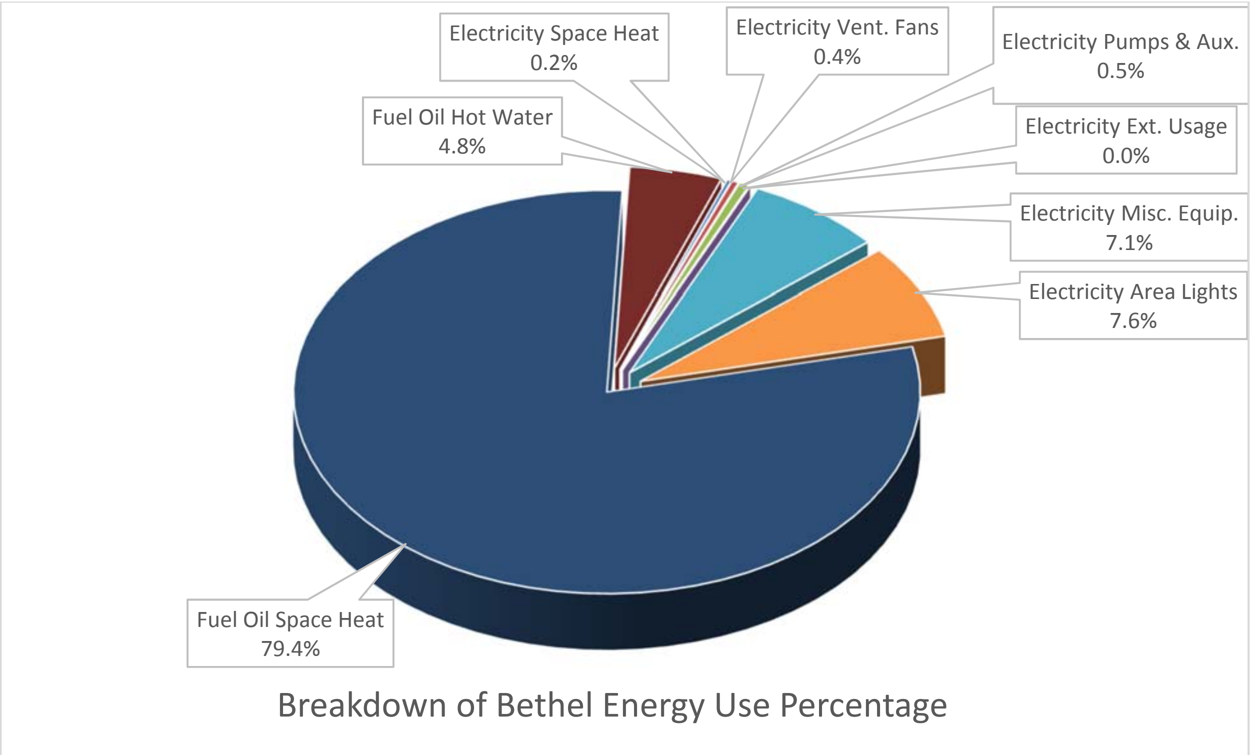

Figure 4 Bethel Energy Use Percentage

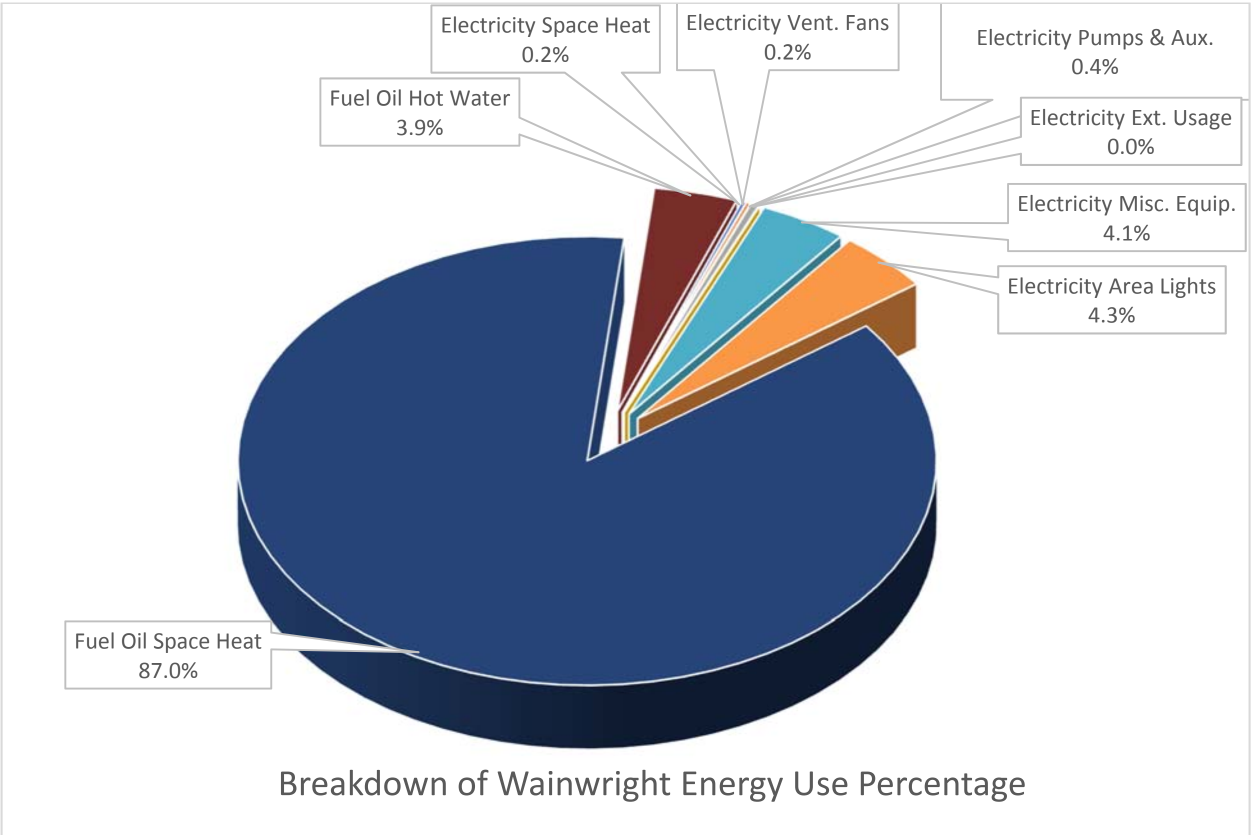

Figure 5 Wainwright Energy Use Percentage

%Energy Consumption per City				
Usage	Juneau	Dillingham	Bethel	Wainwright
Electricity Space Heat	0.2%	0.3%	0.2%	0.2%
Electricity Vent. Fans	0.5%	0.5%	0.4%	0.2%
Electricity Pumps & Aux.	0.6%	0.7%	0.5%	0.4%
Electricity Ext. Usage	0.0%	0.0%	0.0%	0.0%
Electricity Misc. Equip.	10.0%	10.3%	7.1%	4.1%
Electricity Area Lights	10.7%	11.1%	7.6%	4.3%
Fuel Oil Space Heat	71.7%	71.4%	79.4%	87.0%
Fuel Oil Hot Water	6.3%	5.6%	4.8%	3.9%

Table 9- Energy Use Breakdown

The results from the modeling efforts are tabulated and graphically shown below. For clarity, the initial cost is represented as an overall square foot cost (Initial cost divided by 40,000 square feet), while the utility cost is graphically shown for the first year's total fuel and electricity cost. Included in the results are the total initial cost of the school as well as the first 20 years of utility cost including escalation.

6.1 Building Openings to Exterior Wall Area (O:EW)

Shown are the results from modeling a 40,000 square foot (SF) school in the selected locations with varying amounts of openings. Doors were assumed constant throughout the modeling, the only changes to the exterior closure were the window counts. The model includes the cost differences of the windows to exterior wall as well as the mechanical equipment sizing differences required to show all the results from the opening to exterior wall area.

While energy costs varied for the (O:EW) design iterations, the overall cost, initial cost with the 20-year utility cost, increased with each step up in openings to exterior surface area. This was primarily attributed to the increased cost for initial construction, and the minimal impact on utility savings. It appears that from an energy consumption, 14% is the optimal O:EW for zones 6, 7 and 8. Zone 9 behaves differently, as the smaller the window the less utility required. In the three similar zones, there is enough sunlight available to heat the building through the windows to offset the heat loss through the fenestration. However, in Zone 9, the heat loss through the windows exceeds heat gathered regardless of window size, and the smaller the window the better. However, it is worth noting that the variations are on the order of 2 to 8% energy cost, and these are relatively small overall in comparison to the total cost of the building. Additionally, windows were increased in size uniformly for all spaces, and most likely would not be made as large in certain spaces like the gymnasium. Design teams should consider the impact of daylight on student activities and maximize it where feasible.

Note that the energy modeling study did not include day light sensors capable of detecting light levels in spaces and reducing the lighting when appropriate. If the sensor were installed, there would most likely reduce energy consumption by a higher amount for each increase in window size. However, with the inclusion of LED lights in the space, the total reduction in lighting would most likely not make a sizable contribution to energy consumption, especially compared to the heating costs.

City	Design Ratio	Construction Cost	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Juneau	0.07	$16,295,842	$407.40	$55,026	$17,774,419
Juneau	0.14	$16,587,279	$414.69	$53,676	$18,038,067
Juneau	0.21	$16,835,337	$420.89	$55,692	$18,331,792
Juneau	0.28	$17,060,177	$426.51	$56,558	$18,579,905
Juneau	0.35	$17,309,425	$432.74	$55,783	$18,808,337
Dillingham	0.07	$19,923,587	$498.09	$113,240	$22,966,389
Dillingham	0.14	$20,331,858	$508.30	$109,368	$ 23,270,620
Dillingham	0.21	$20,624,321	$515.61	$113,727	$23,680,212
Dillingham	0.28	$20,881,109	$522.03	$115,506	$23,984,803
Dillingham	0.35	$21,157,596	$528.94	$117,895	$24,325,476
Bethel	0.07	$18,368,736	$459.22	$142,177	$22,189,081
Bethel	0.14	$18,693,202	$467.34	$140,682	$ 22,473,377
Bethel	0.21	$18,967,883	$474.20	$146,628	$22,907,838
Bethel	0.28	$19,202,669	$480.07	$148,915	$23,204,078
Bethel	0.35	$19,465,861	$486.65	$154,030	$23,604,696
Wainwright	0.07	$28,008,844	$700.23	$262,411	$35,059,924
Wainwright	0.14	$28,393,465	$709.84	$271,052	$ 35,676,745
Wainwright	0.21	$28,796,396	$719.91	$271,188	$36,083,311
Wainwright	0.28	$29,119,659	$728.00	$278,089	$36,592,013
Wainwright	0.35	$29,539,552	$738.49	$291,880	$37,382,472

Table 10 – Building Openings to Exterior Wall Area Results

Figure 6 through Figure 9 illustrate the initial cost per square foot and combined fuel oil and electricity utility costs per year for openings to exterior wall area in the selected locations, and nonlinear change to utility cost.

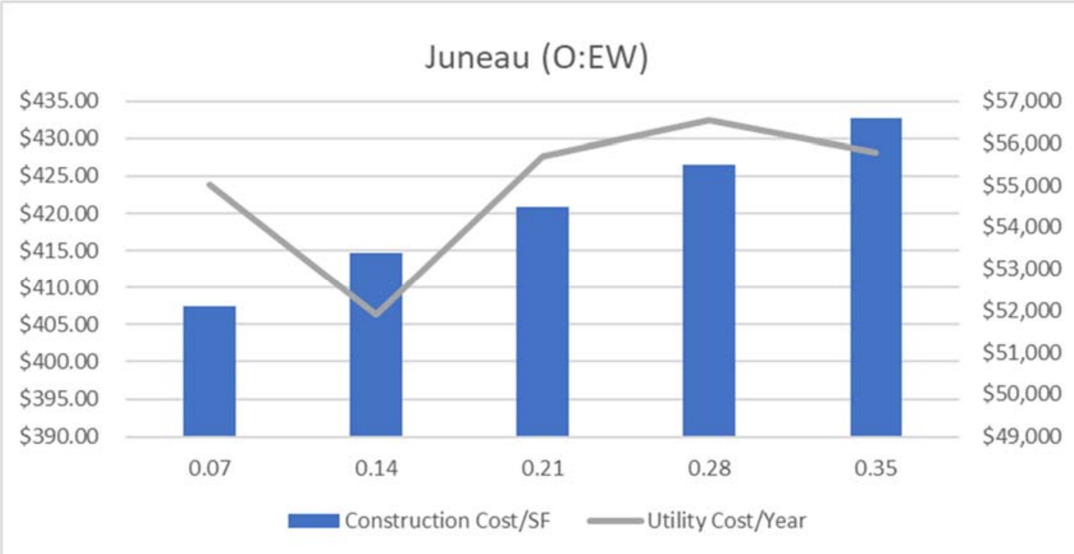

Figure 6 – Juneau Initial & Utility Cost versus Ratio (O:EW)

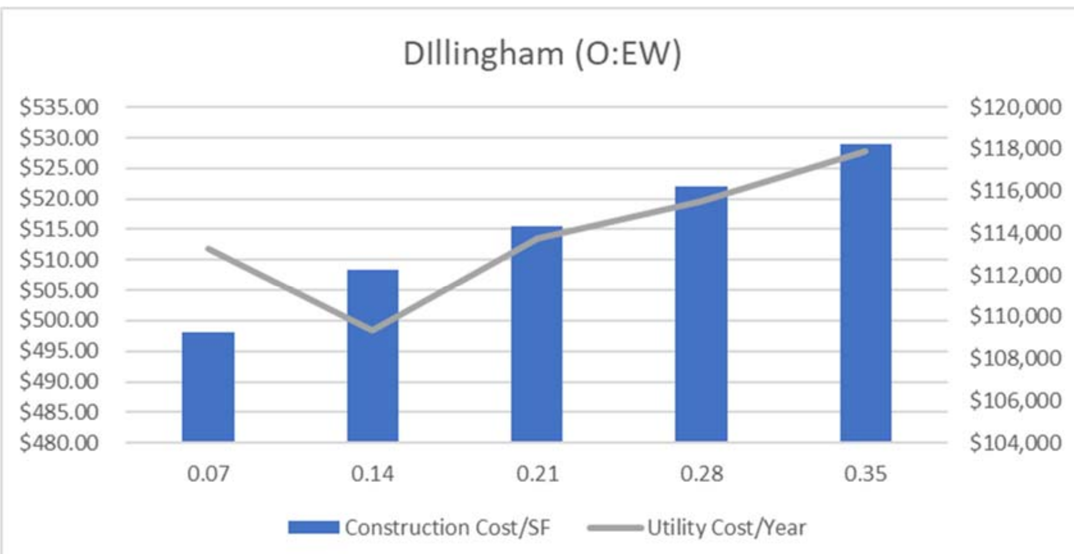

Figure 7 – Dillingham Initial & Utility Cost versus Ratio (O:EW)

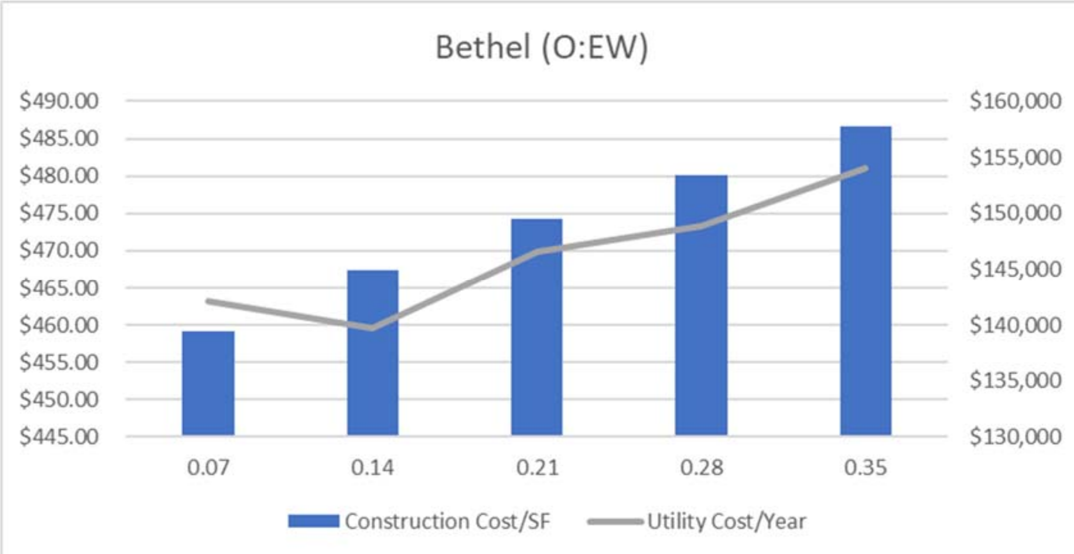

Figure 8 – Bethel Initial & Utility Cost versus Ratio (O:EW)

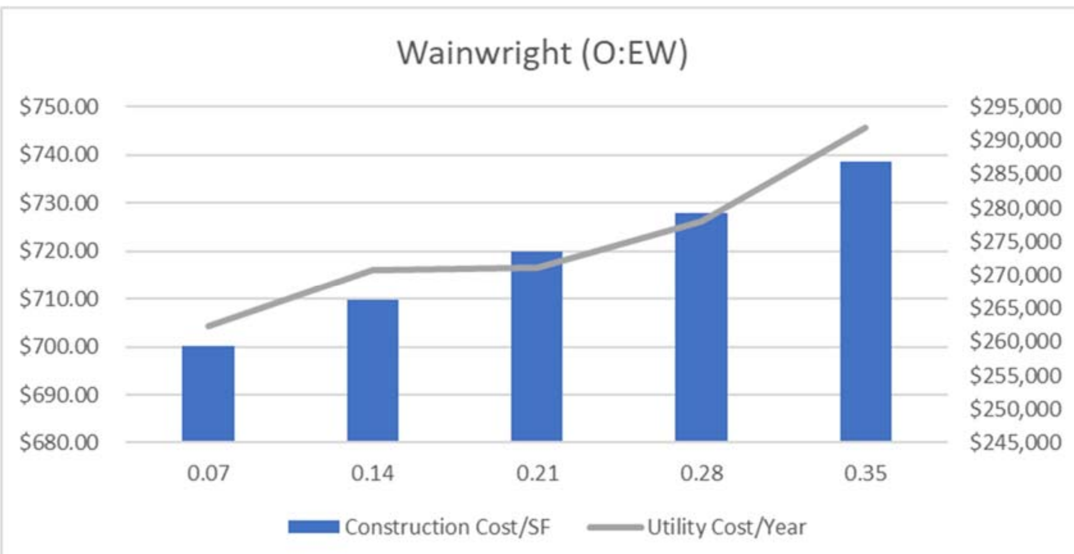

Figure 9 – Wainwright Initial & Utility Cost versus Ratio (O:EW)

6.2 Building Footprint Area to Gross Square Footage (FPA:GSF)

The base model is modified to add a second story to the classroom wing. The intent of this study is to ascertain whether energy is saved by reducing the overall exterior surface area of the building and reducing energy loss through the roof of the classroom wing. It was decided to only look at the classroom wing, as the other spaces contain room types such as the gym or kitchen that are unlikely to be put onto a second floor. The school is identical to the baseline school, with a 14% O:EW and the same envelope constructions. The second floor has a plenum under the roof, ostensibly for expected ductwork and other building components. The roof pitch remains 2:12. All spaces besides the classroom remain the same.

Although the cost estimate includes the initial and lifetime O&M costs for an elevator, the energy model ignores any potential elevator energy use. It is thought that the elevator would not be used frequently, if at all, during normal school operation, and would have a negligible impact on building energy use. Depending on elevator technology and utility pricing scheme, an elevator could have an impact on energy use if there were peak kW charges and the elevator motor was large.

The two-story cost model takes into account the reduction in underbuilding soffit and roof square footages. While these two reductions drastically reduce those particular system costs of the initial construction, there is an increase in overall structural frame cost, elevator and elevator shaft construction as well as stairs and additional anticipated requirements for accessibility and egress.

Results show improvement in lifetime costs, and mixed results in lifetime utility costs. The difference in utility costs is minor, with the maximum being 5% improvement for Climate Zone 9, while the other zones are negligible. This can be attributed to reduced heat loss through the consolidation of both the underfloor soffit and the roof area. Analysis shows that the increased height of wall does collect more heat during certain seasons as the elevated wall “catches” more sunlight for longer periods of time, which evens out utility costs for the three less cold zones.

City	Design Iteration	Design Ratio	Construction Cost	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Juneau	Single Story	1	$16,587,279	$414.69	$53,676	$18,038,067
Juneau	Two Story School	0.75	$16,466,985	$411.68	$52,615	$ 17,880,776
Dillingham	Single Story	1	$20,331,858	$508.30	$109,368	$ 23,270,620
Dillingham	Two Story School	0.75	$20,184,536	$504.62	$109,197	$ 23,118,689
Bethel	Single Story	1	$18,693,202	$467.34	$140,682	$ 22,473,377
Bethel	Two Story School	0.75	$18,556,024	$463.91	$140,889	$ 22,341,770
Wainwright	Single Story	1	$28,393,465	$709.84	$271,052	$ 35,676,745
Wainwright	Two Story School	0.75	$28,176,583	$704.42	$257,433	$ 35,093,890

Table 11 – Single- and Two-Story Results

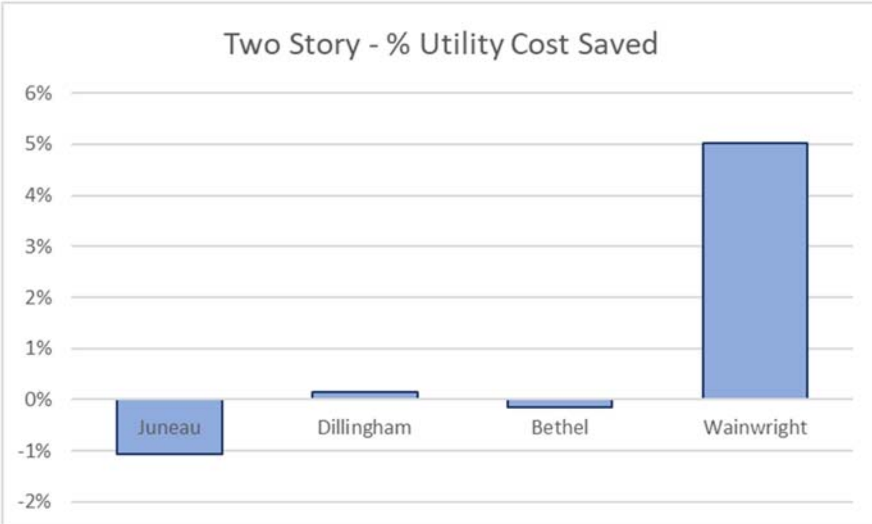

Figure 10 – Two Story % Utility Savings per location

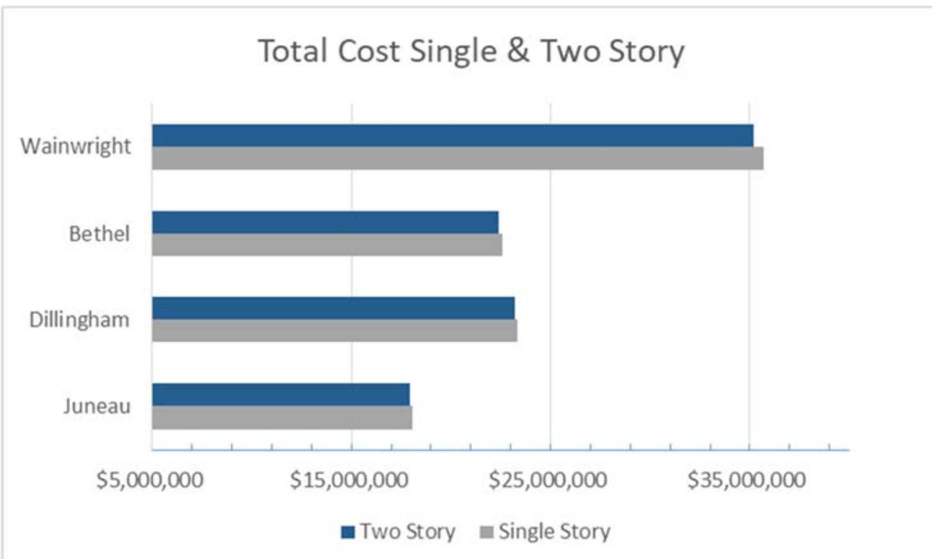

Figure 11 – One and Two Story Initial & 20 Year Utility Cost Comparison

6.3 Building Volume to Net Floor Area (V:NSF)

There are three subsets of study in this experiment. The first is an exploration of the effect of exterior wall height on total building cost and total utility cost. The second experiment is the effect on building costs when roof pitch is varied between flat and steep. Finally, the effect of increasing commons area double height percentage, analogous to a clerestory or a double height entry common, is looked at.

a. Wall Height

For the wall height study, the height of the exterior walls is raised in the model for the Classroom and Administration areas. All other components in the base model are kept the same, including plenum height, soffit size and roof pitch. The O:EW is maintained for an overall 14 percent opening. The results are in line with expectations, in that the heating energy use is less as the size of the building is reduced and there is less volume to heat. Note that while the internal volume of the building reduces, there is no change to the outside air required to meet occupant ventilation needs. This is calculated based on a combination of occupant number and floor area. Since these two items are static throughout the various iterations, the volume of outside air remains constant even if the total volume of supplied air changes.

b. Roof Pitch

Two scenarios are investigated for the roof pitch study. The first is a flat roof, and the second is a steep roof, modeled at a 3:12 pitch. These are compared against the baseline 2:12 roof pitch. For the model, there is an unconditioned plenum above the rooms, and the roof insulation is all above deck. For the pitched roofs, the attic space above the plenum is not directly conditioned, but there is no thermal barrier between the plenum and the roof, so any heat modeled as passing through the uninsulated ceiling will be in the plenum space. However as described above, the ventilation system is modeled as fully ducted, so the space above the rooms and the attic are not used as return plenums and are not room temperature. There is minimal difference between the three models. It is likely that in real world conditions, the pitch of the roof may have more impact due to complex environmental interactions with wind exposure and stack effect, however the modeling software is not capable of determining these.

c. MPR/Commons Height

To model the double height portion of the study, the MPR room was split into three separate shells, and the interior shell height was doubled. See Figure 12 Commons Height-40% for an example of the appearance of the model three different iterations were performed, where the raised portion is modeled at 20, 40 and 60% of the MPR square footage. Once eQUEST calculated the necessary geometry changes, the zones were rejoined and modeled. Except for the common area, all other aspects of the model are the same. There was an adjustment required to the heating system sizing to account for the greater heat loss through the additional walls, but all else remained the same. Note that the eQUEST model does not consider fluid dynamics and assumes that all spaces are maintained at the same temperature. There is no consideration of thermal gradations in the doubled space. This means that although the upper portions of the raised space would be higher, and the thermal delta across the roof and wall would also be higher, the model is incapable of quantifying this. Also, the model does not include windows on the raised portion but maintains the same percentage of window to wall ratio as the baseline.

Unsurprisingly, there is a significant increase in the amount of heating energy associated with doubling the commons room height. Each increase in area of the doubled region shows an increase in the amount of energy consumed to heat the space and offset heat lost through the double height walls.

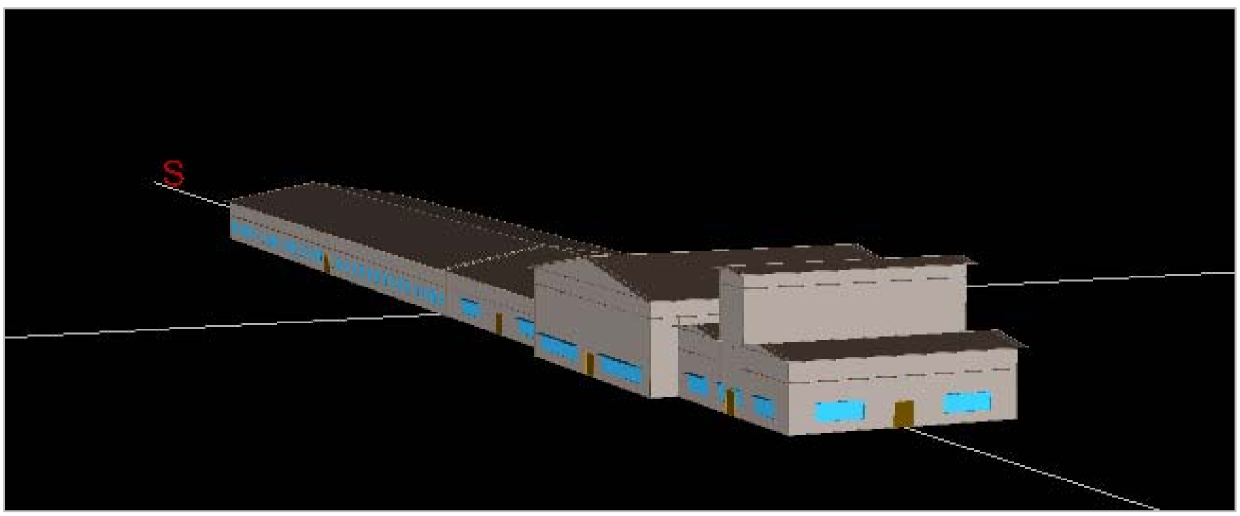

Figure 12 Commons Height-40% area

Table 12 shows the design ratio for each iteration along with the initial cost per square foot, total utility cost per year and the combined initial construction and 20-year utility cost.

City	Design Iteration	Design Ratio	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Juneau	Flat Roof	18.53	$413.76	$51,873	$17,944,243
Juneau	3:12 Roof Pitch	18.57	$415.84	$51,808	$18,025,703
Juneau	12' Ext Wall	17.19	$411.15	$52,091	$17,845,692
Juneau	16' Ext Wall	19.92	$418.24	$$55,650	$$18,224,933
Juneau	20% DBL Height Commons	19.01	$420.40	$57,314	$18,204,249
Juneau	40% DBL Height Commons	19.46	$422.57	$60,158	$18,356,060
Juneau	60% DBL Height Commons	19.91	$427.46	$64,583	$18,519,266
Juneau	Base Model	18.56	$414.69	$53,676	$18,038,067
Dillingham	Flat Roof	18.53	$507.10	$108,689	$23,204,509
Dillingham	3:12 Roof Pitch	18.57	$509.64	$108,738	$23,307,433
Dillingham	12' Ext Wall	17.19	$503.93	$107,797	$23,053,734
Dillingham	16' Ext Wall	19.92	$512.49	$113,661	$23,553,702
Dillingham	20% DBL Height Commons	19.01	$515.26	$115,910	$23,724,948
Dillingham	40% DBL Height Commons	19.46	$517.89	$119,946	$23,938,586
Dillingham	60% DBL Height Commons	19.91	$524.93	$127,056	$24,411,242
Dillingham	Base Model	18.56	$508.30	$109,368	$ 23,270,620
Bethel	Flat Roof	18.53	$466.35	$ 144,412	$22,534,410
Bethel	3:12 Roof Pitch	18.57	$468.74	$144,804	$22,640,547
Bethel	12' Ext Wall	17.19	$463.45	$138,943	$ 22,271,441
Bethel	16' Ext Wall	19.92	$471.25	$146,897	$22,797,171
Bethel	20% DBL Height Commons	19.01	$474.75	$150,924	$23,045,385
Bethel	40% DBL Height Commons	19.46	$476.22	$157,132	$23,271,006
Bethel	60% DBL Height Commons	19.91	$482.75	$165,768	$23,764,250
Bethel	Base Model	18.56	$467.34	$140,682	$ 22,473,377
Wainwright	Flat Roof	18.53	$708.27	$260,053	$35,318,518

City	Design Iteration	Design Ratio	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Wainwright	3:12 Roof Pitch	18.57	$711.81	$260,090	$35,461,109
Wainwright	12' Ext Wall	17.19	$703.87	$256,520	$35,047,581
Wainwright	16' Ext Wall	19.92	$715.90	$275,213	$36,031,086
Wainwright	20% DBL Height Commons	19.01	$720.01	$283,028	$36,405,477
Wainwright	40% DBL Height Commons	19.46	$721.63	$295,408	$36,802,925
Wainwright	60% DBL Height Commons	19.91	$735.15	$314,639	$37,860,455
Wainwright	Base Model	18.56	$709.84	$271,052	$ 35,676,745

Table 12 – Volume to Net Floor Area Results

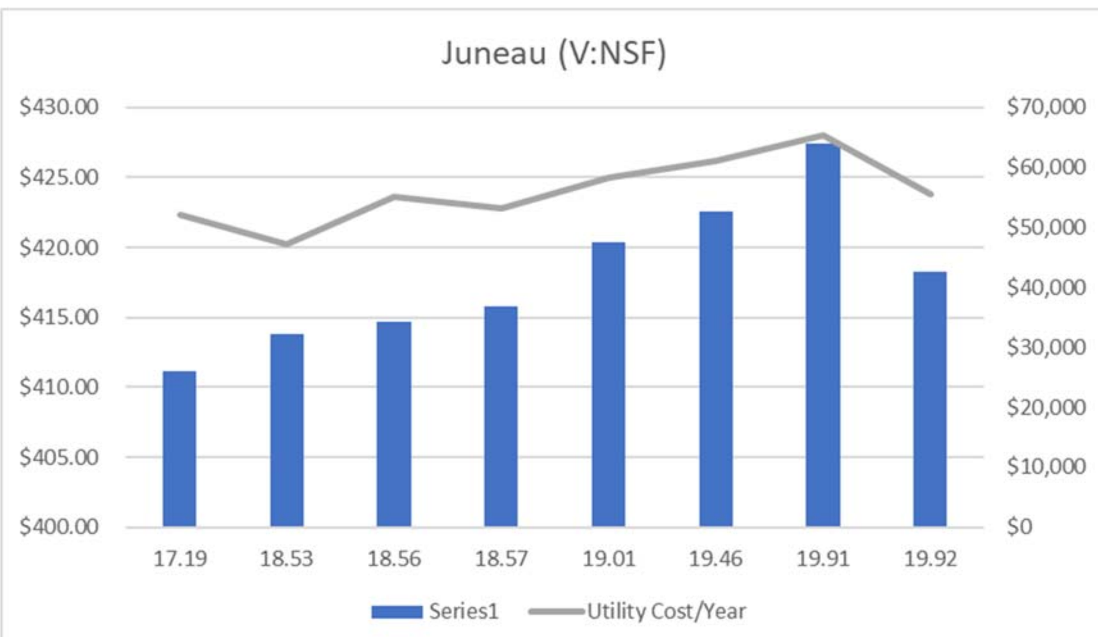

Figure 13 – Juneau Volume to Net Floor Area

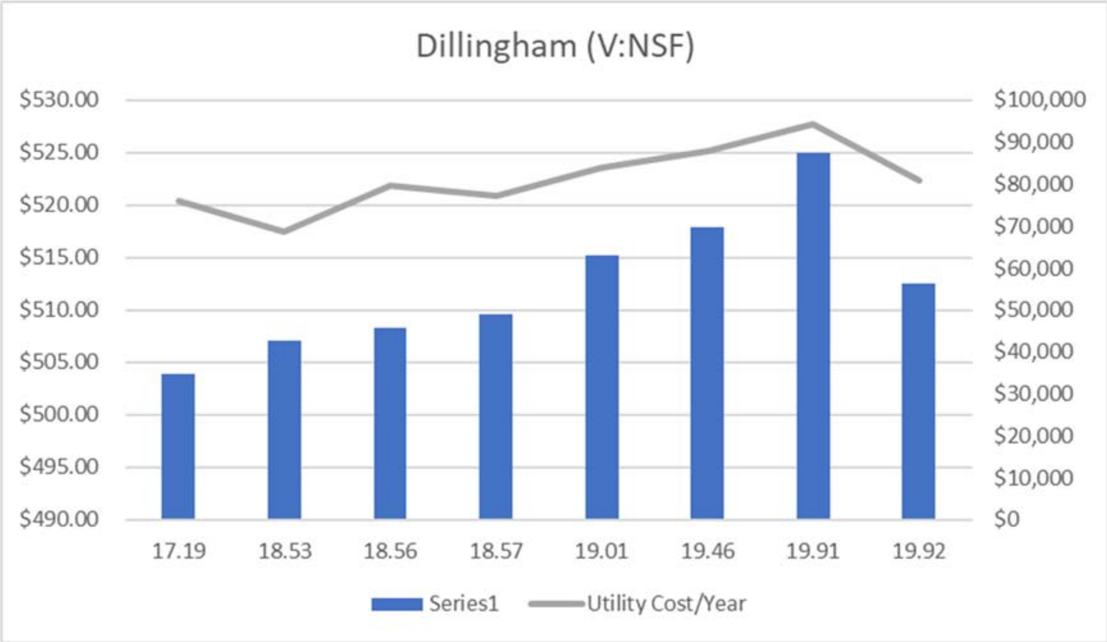

Figure 14 – Dillingham Volume to Net Floor Area

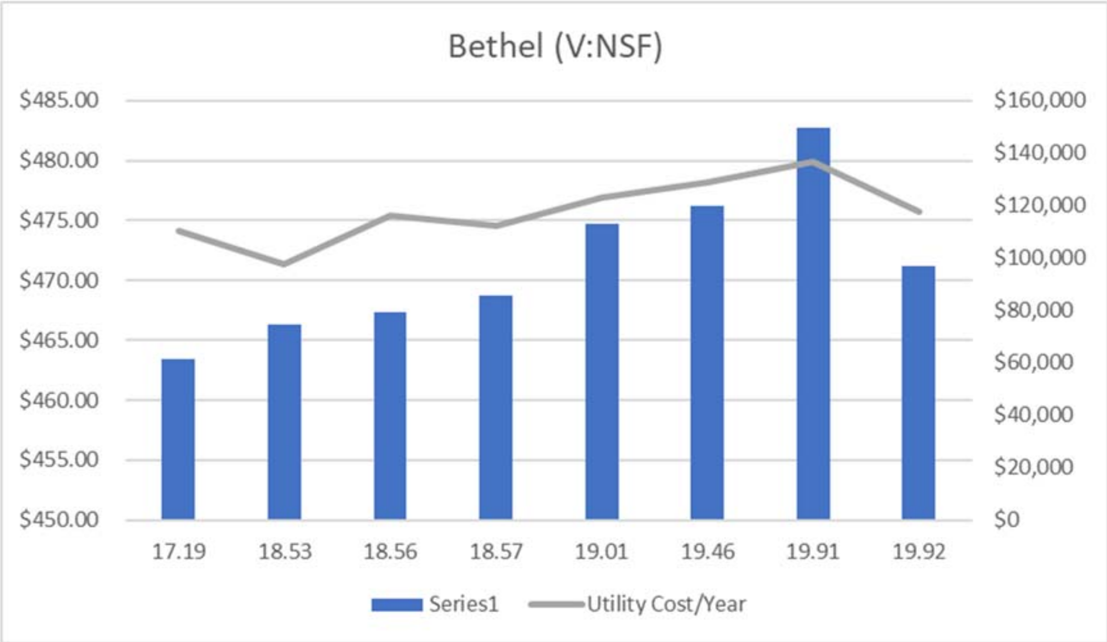

Figure 15 – Bethel Volume to Net Floor Area

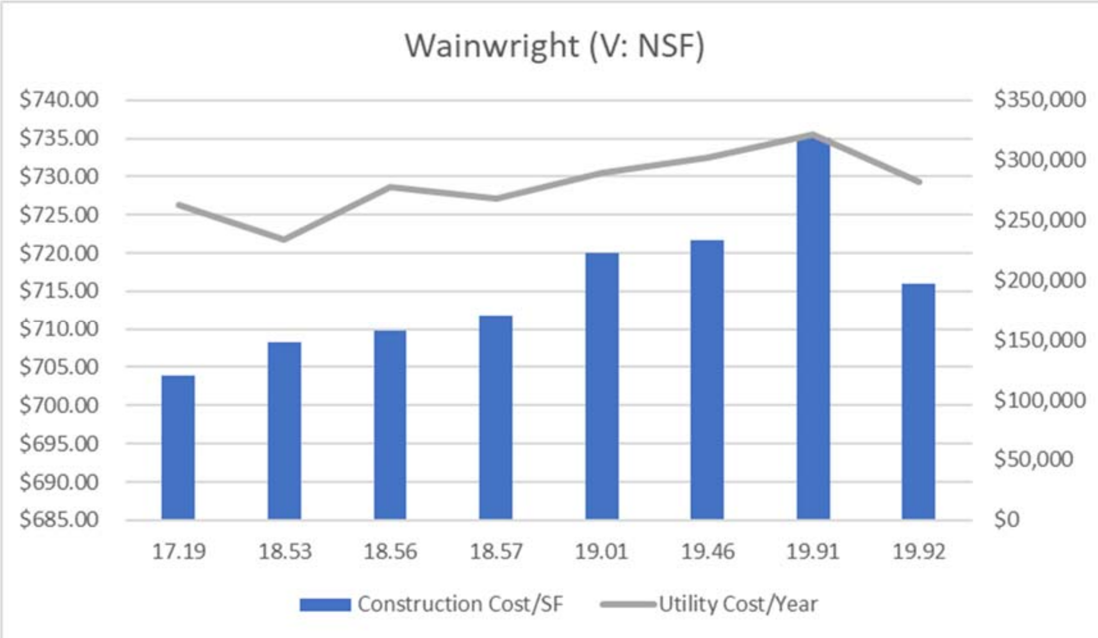

Figure 16 – Wainwright Volume to Net Floor Area

6.4 Building Volume to Exterior Surface Area (V:ES)

The last portion of the study reviews the impact of building shape and complexity on energy consumption and overall lifetime cost. As it is impossible to study all of the permutations in building layout and design, the intent of this study is to look at the relative potential impact a building's volume to exterior ratio may have on costs. In trying to keep the models within the realm of possibility, certain constraints to the available ratios are used. It is assumed that all classrooms need at least one exterior wall for daylighting, and that the Gym and MPR are kept as squares, as dictated by their planned usage. All spaces maintain the base model's square footage. The model variations identified for study are a "T-shaped" classroom wing (Figure 17), an "L-shaped" school where the classroom wing is rotated perpendicular to the rest of the blocks (Figure 18), a Complex shape, with a "H-shaped" classroom wing and a "U-shaped" Administration wing (Figure 19), and a 50% offset gym shape (Figure 20). Other than the shape changes, all aspects of the buildings remain identical to the baseline building. Note that in some cases, the surface area of the different shells does change to accommodate walls that are exposed or hidden as their relationship with the neighboring shell varies.[4] Walls between shells are modeled as interior walls, there is no heat loss between shells at planes where they touch. Where necessary, equipment sizes are adjusted to

[4] The models were reviewed at each new ratio to ensure that walls were appropriately modeled as exterior or interior.

account for any different heating plant or AHU requirements. Window to exterior wall ratios were maintained at the same level as the base model, and roof pitch remains at 2:12.

There does not appear to be a clear correlation between the V:ES ratio and energy consumption across the different climate zones, other than the off-set gym (V:ES ratio of 6.92). As described in other sections of the report, the complex dynamic between solar loading and infiltration may be coming into play here and making it difficult to point to one single recommendation for the entire state. The T-shape is the most energy efficient for all climates, and the offset gym is the least, but the other configurations vary in their cost-effectiveness. Reviewing the building's peak load components report (LS-D in the eQUEST simulation output), conduction through windows appears to play a larger component in the coldest zones and is less of a relative factor in the warmer zones. Again, it's worth noting that while envelope concerns play an important factor in energy consumption, other components, especially ventilation, also are important, and those will remain the same regardless of ratio.

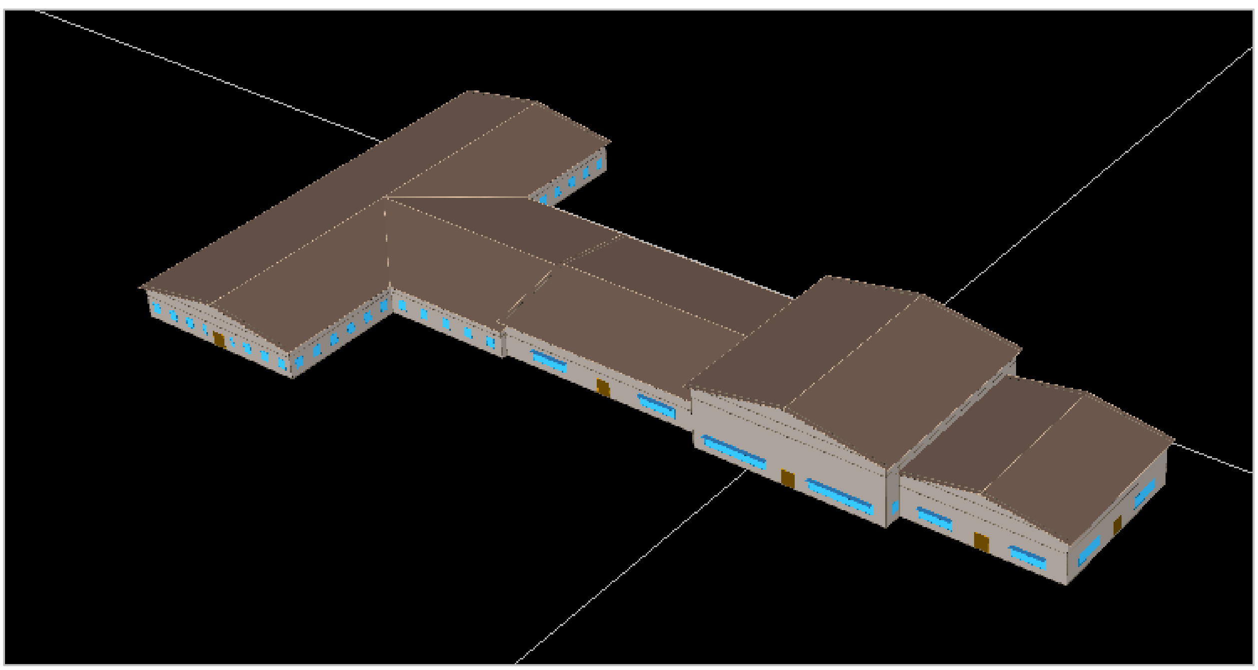

Figure 17 Ratio V:ES (7.10) T-Shaped Building

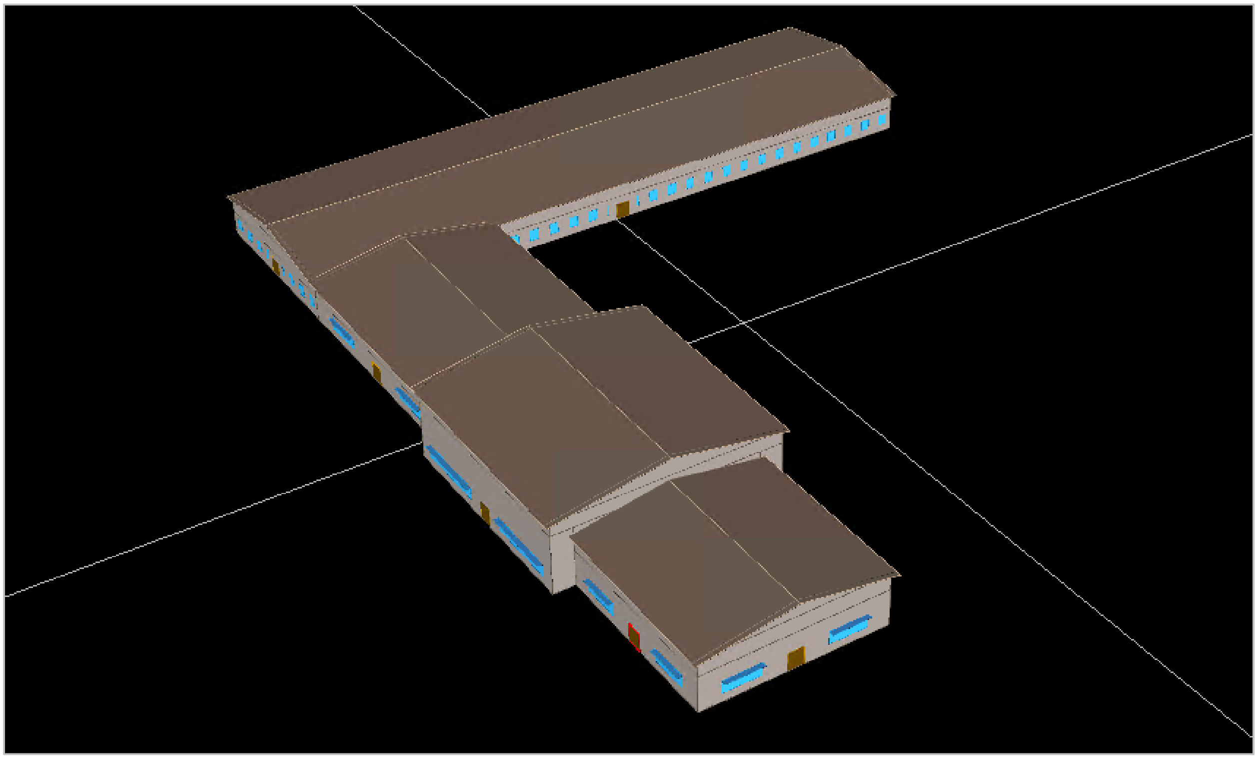

Figure 18 Ratio V:ES (7.02) L-Shaped Building

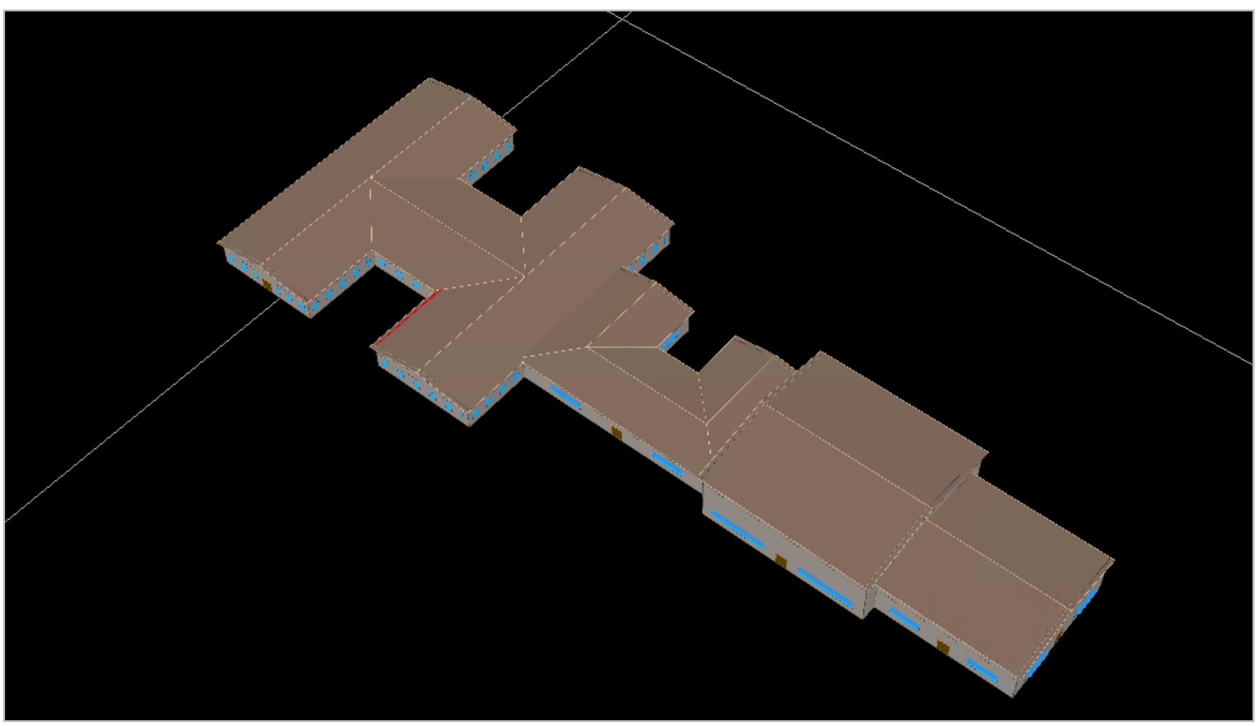

Figure 19 Ratio V:ES (6.82) Complex Shape

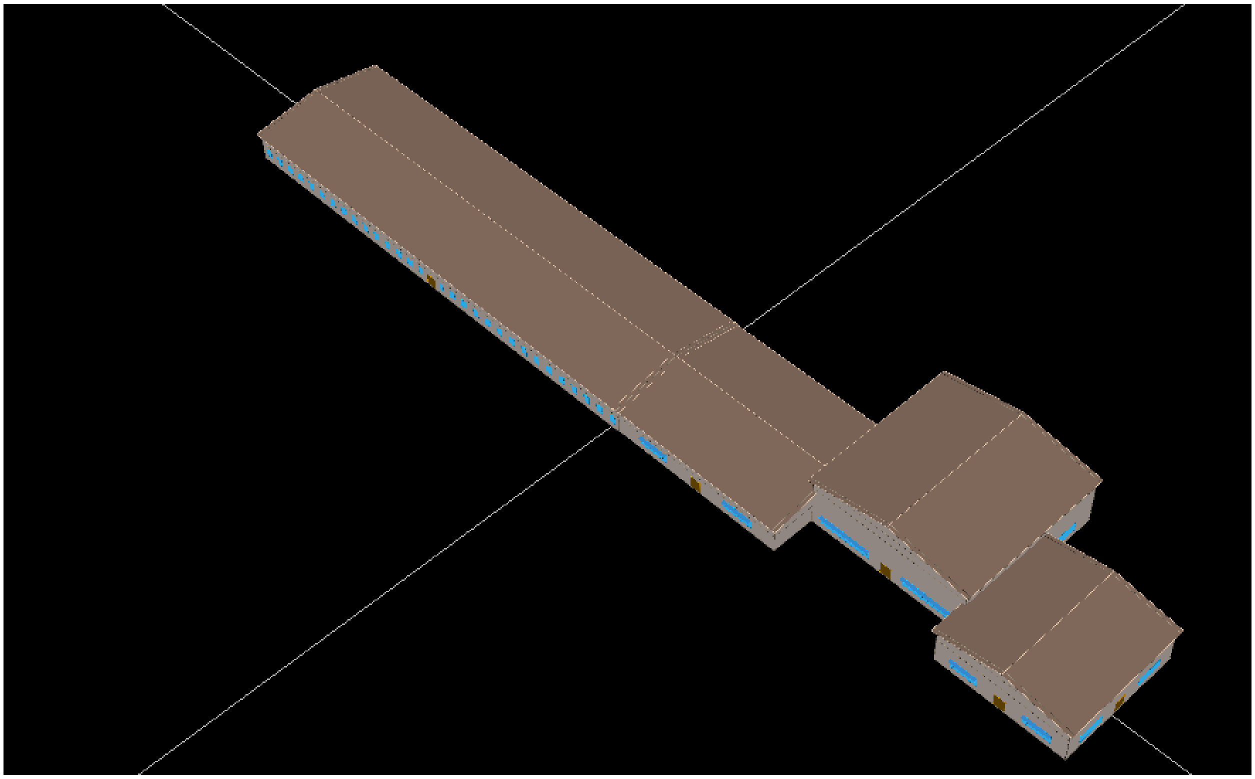

Figure 20 Ratio V:ES (6.92) Offset Gym

City	Design Iteration	Design Ratio	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Juneau	T-shape structure	7.12	$414.51	$51,544	$17,965,003
Juneau	L-shape structure	7.02	$415.79	$51,996	$18,028,561
Juneau	Complex structure	6.82	$419.04	$52,683	$18,177,203
Juneau	50% Gym offset	6.92	$416.21	$60,121	$18,263,758
Juneau	Base	7.05	$414.69	$53,676	$18,038,067
Dillingham	T-shape structure	7.12	$507.78	$108,306	$23,221,144
Dillingham	L-shape structure	7.02	$509.65	$109,336	$23,323,817
Dillingham	Complex structure	6.82	$513.69	$111,041	$23,531,246
Dillingham	50% Gym offset	6.92	$508.72	$120,813	$23,595,135
Dillingham	Base	7.05	$508.30	$109,368	$ 23,270,620

City	Design Iteration	Design Ratio	Initial Cost/SF	Total Utility Cost /Year	Initial + 20-year Utility Cost
Bethel	T-shape structure	7.12	$466.92	$145,385	$22,583,134
Bethel	L-shape structure	7.02	$468.79	$142,454	$22,579,331
Bethel	Complex structure	6.82	$472.51	$158,476	$23,158,351
Bethel	50% Gym offset	6.92	$469.11	$158,476	$23,022,617
Bethel	Base	7.05	$467.34	$140,682	$ 22,473,377
Wainwright	T-shape structure	7.12	$708.83	$255,996	$35,231,595
Wainwright	L-shape structure	7.02	$713.12	$273,080	$35,862,502
Wainwright	Complex structure	6.82	$718.61	$265,538	$35,879,481
Wainwright	50% Gym offset	6.92	$712.20	$306,494	$36,723,483
Wainwright	Base	7.05	$709.84	$271,052	$ 35,676,745

Table 13 – Volume to Exterior Surface Area Results

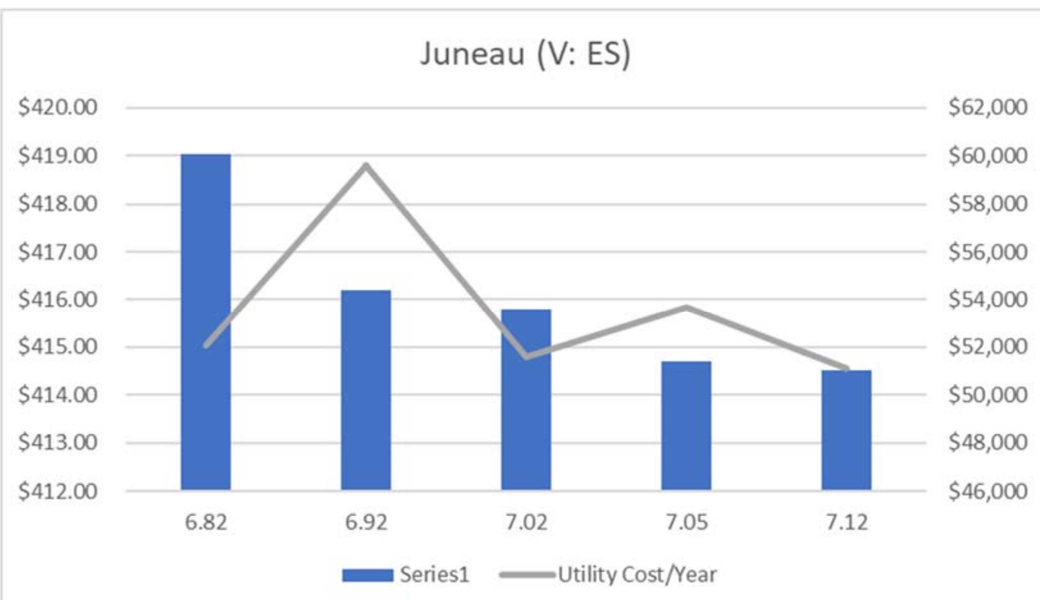

Figure 21 Construction and Utility Cost Versus (V:ES) - Juneau

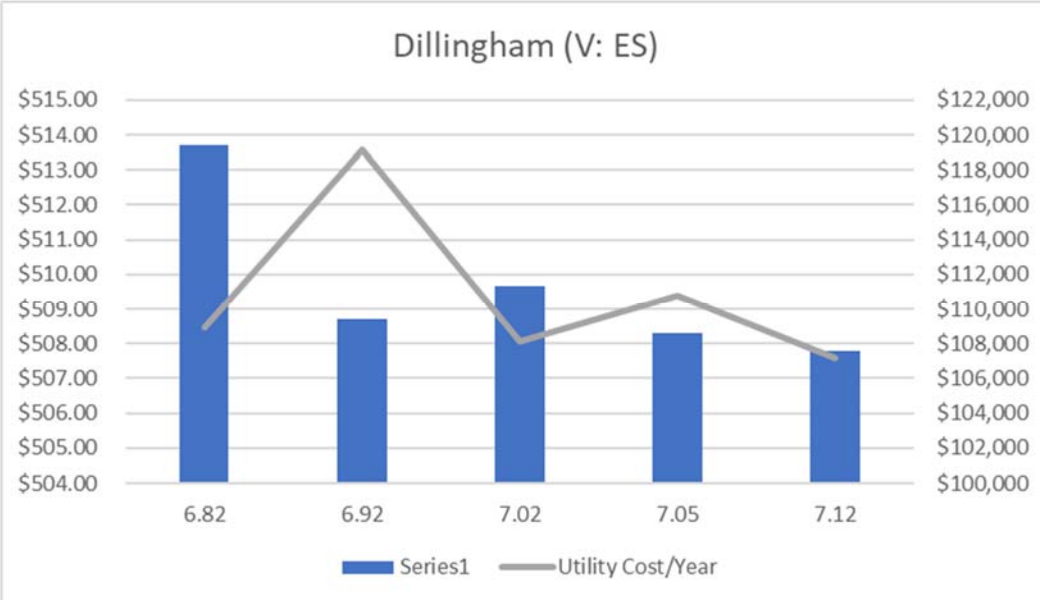

Figure 22 Construction and Utility Cost Versus (V:ES) - Dillingham

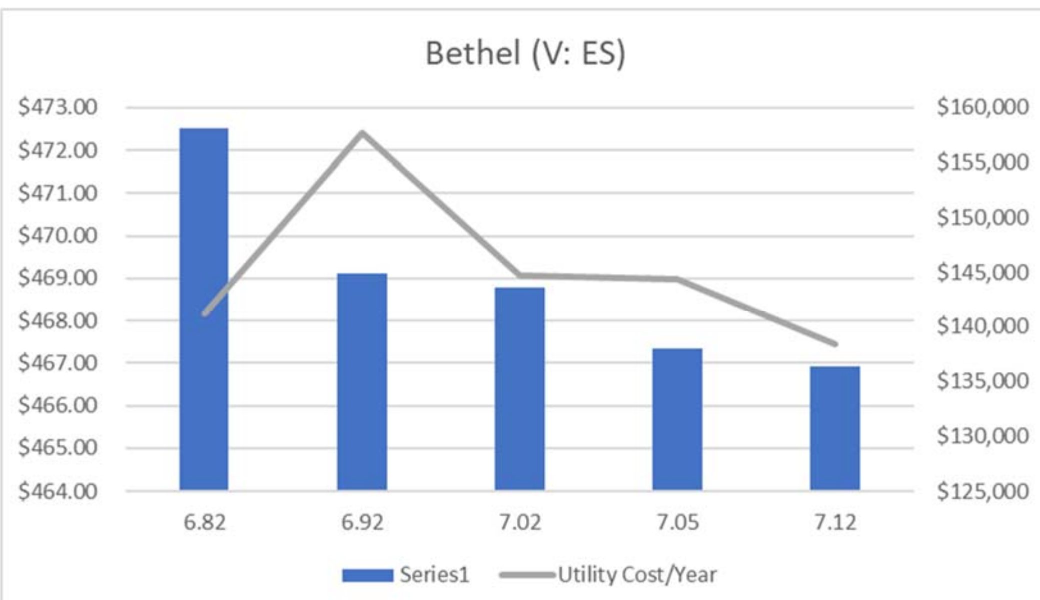

Figure 23 Construction and Utility Cost Versus (V:ES) - Bethel

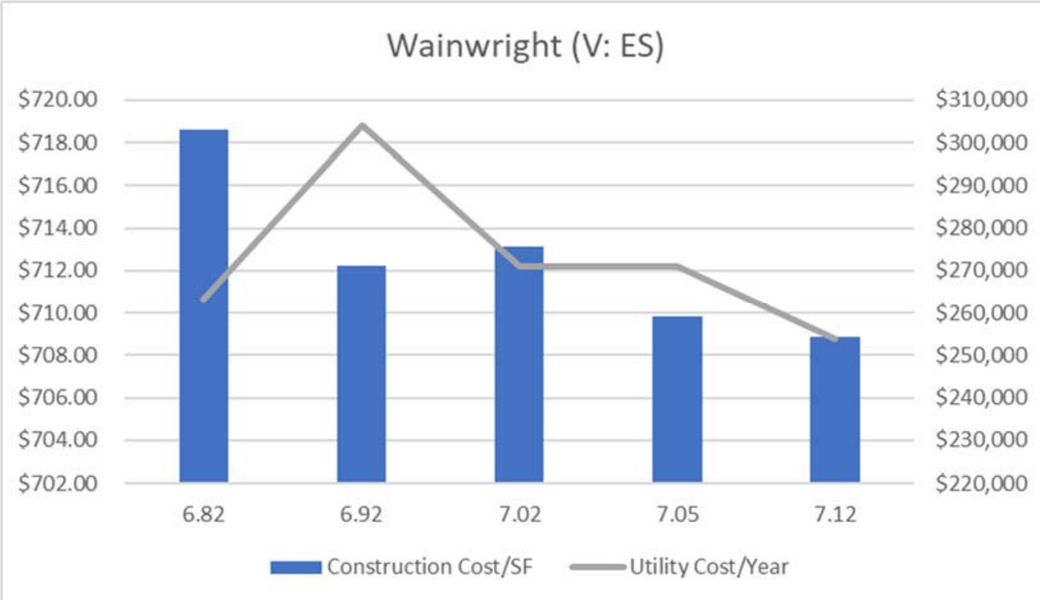

Figure 24 Construction and Utility Cost Versus (V:ES) - Wainwright

7. Conclusions and Recommendations

Overall, the study demonstrated the complex and dynamic interaction between construction costs and energy consumption, and the size, shape, and myriad other decision determinants made during the design process. Energy models attempt to take into account all these interactions and calculate the energy entering and leaving the building. For example, window opening size at first appears to be straightforward, as even the best quality window has significantly less insulation than a mediocre wall. However, as seen in the modeling results, reducing window size does not correlate directly. Even in Alaska, sunlight can provide a significant amount of heat, and as window size increases, the benefit to the building from the sun increases. However, as the impact of the sun increases, the ventilation system may need to grow in response to counter the heat gain from the sun during warmer months. Similarly, as LED lighting is adopted there is less heat output from the lights into a space and the heating system is required to make up the difference. In the case of lighting, the trade-off is minimal, as hydronic heat is currently much less expensive than electricity used for lighting. Each iteration of the study, and each location, saw similar dynamic results. As seen in the results, it is difficult to make blanket statements about ideal design ratios—especially with respect to energy consumption.

7.1 Ratio Cost Impact

(O:EW) Ratio:

After analysis of the factors, several key points showed up in the data. While energy costs varied for the (O:EW) design iterations the overall cost, initial cost with the 20-year utility cost, increased with each step up in openings to exterior surface area. This was primarily attributed to the increased cost for initial construction, and the minimal impact on utility savings. It appears that for Zones 6, 7 and 8 from an energy consumption standpoint, 14% is the optimal O:EW. In Zone 9, the smaller the window the less utility required. However, the 20-year cost, including construction costs shows the overall cost difference is relatively negligible, and design teams should not limit daylight excessively as an energy savings technique.

(FPA:GSF) Ratio:

Results show improvement in lifetime costs, and mixed results in lifetime utility costs. The difference in utility costs is minor, with the maximum being 5% improvement for Climate Zone 9, while the other zones are negligible. This can be attributed to reduced heat loss through the consolidation of both the underfloor soffit and the roof area. Analysis shows that the increased height of wall does collect more heat during certain seasons as the elevated wall "catches" more sunlight for longer periods of time, which evens out utility costs for the three less cold zones.

(V:NSF) Ratio:

As described in section 3.3, there were three subsets of the Volume: Net Square Footage study; Exterior Wall Height, Roof Pitch and MPR/Commons Height Percentage.

Exterior Wall height showed little overall variation, except in Climate Zone 8. The other three locations showed a maximum of 1% variation (positive and negative) for initial construction cost, and a range of 0-5% for utility cost. Initial cost with utilities was 99%-102% with minor variance depending on location. The higher utility costs were associated with the raised roof in the two colder climate zones (8 and 9)

Roof Pitch Analysis indicated negligible variations in utility analysis. See section 6.3.b for data on the energy consumption results. From a cost standpoint, there was similarly negligible variation, from 99.7% to 100.2% for initial construction cost, and the same results for the combined initial construction cost and 20-year utility. This is across all zones. Roof pitch does not appear to vary significantly enough in terms of overall cost to make a strong recommendation for a specific ratio.

MPR/Commons Height, measured as a percentage of the MPR/Commons room doubled in height, did show variations for utility cost and construction cost in each zone. The initial construction cost ranged from 101-102% for the 20% Double Height Commons, was 102% for 40% Double Height Commons, and a maximum of 103-104% for the Double Height Commons. Utility variations followed a similar rising pattern, with variations of an increase in costs from 3-6% for 20%, 9-11% for 40% and 13-19% for the 60%. Overall, the cost range for varied from 102%-106% for total Construction and 20-year utilities, with the largest increase in the two colder zones. As a rule, the more the commons area raised height, the higher the cost of construction and utility.

(V:ES) Ratio:

When reviewing the volume to exterior surface, every location had a similar result, that at a ratio of 7.12, the T-shaped configuration had the lowest initial construction cost and the lowest utility cost per year. Typically for this ratio, the larger the number the lower the cost for initial construction cost, interestingly for Dillingham and Wainwright that was not the case with 6.92 (50% gym off set). However, when evaluating the construction cost, as well as utility cost, the 50% gym off set iteration was the most expensive in every location studied, due to the high utility cost. The fact that the more complex shape (V:ES 6.82) did not follow this trend does not invalidate the study. As mentioned above, building interactions with the environment are complex, and the more complex shape appears receives more solar loading during shoulder season than the offset-gym run, offsetting some of the heating load. It is a delicate balance to take advantage of this potential and cannot be predicted purely from the ratio itself.

7.2 Recommended Future Studies

This was a study of several defined building design ratios; however, during analysis of the models it became apparent that there were many variables that could affect construction cost and utility cost that were outside the scope of this project, but have the potential to have large value impacts on design. Future studies that may be considered include the following:

1. HRV units: A study across the climate zones to test whether HRV's (Heat Recovery Ventilators) are worth the additional cost. HRV's recover some of the energy used to heat ventilation air but come with increases in maintenance and electrical use. They are often nearly double the size of a similar capacity air handler and require larger structure and space to accommodate them. Typically, calculations on the cost benefit for an HRV do not take into account the added structure and space required for a large, commercial unit.

2. Supplementing fuel oil boilers with electrical heat: As described above, design engineers necessarily choose equipment to keep the school functioning normally at the extreme end of the temperature spectrum for the location. One alternative would be to study the cost of using relatively small equipment capable of efficiently satisfying the schools heating needs for a certain percentage of the load and using electricity to supplement for the short-term extreme conditions.
3. Window types, including both insulation value and shading: Windows in this study were modeled as uniformly low emissivity and completely translucent. A future study could examine the benefits of high-performance glass, different emissivity values, and tinting. As discussed in the body of the report, sunlight can have a major impact on the building's energy use, both positively and negatively, so a thorough analysis could help highlight the true year-round impact of high-performance windows.
4. Wall and Roof insulation values and construction types: In order to standardize as much as possible in the study, these values were kept at the minimum level allowed by current energy code guidelines. It could be beneficial to perform a similar study across the climate zones for the relative merits of different assemblies.
5. Foundation types: Similar to the walls, a single foundation type was used. Although some regions almost exclusively use piles because of permafrost, other regions may be able to use other foundations. A study reviewing the overall cost of construction could be helpful for design teams as they make the initial decisions on building design.
6. Alternative Energy: As costs for alternative energy drop and technologies advance, it would be helpful to examine how alternative energy sources such as solar or wind could play into the overall life cycle cost of the school. This could be coupled with results from this study to review the relative importance of roof pitch to accommodate the P/V panels.
7. Area Type Usage: Both a qualitative and quantitative study could be developed for analyzing the square footage of the separate area types associated with the school models. An example would be gym size or commons space and the optimal sizing for location, population and usage balanced against cost. The most valuable design ratio would have the greatest ratio between functionality and performance against cost.

7.3 Final Thoughts

Overall, the intent is that this study, and the analyzed building ratios, will provide guidance to the BR&GR Committee and DEED sufficient to develop cost-effective construction standards. The ratios studied should aid in understanding the relative impact of design decisions and how those choices may affect the cost and operation of the building.

The ratios studied were chosen as practical studies, based on realistic school applications, ratios and designs. Necessarily the scope excluded ratios that would never be accepted for real world construction. We hope that during the design process, stakeholders are able to balance the information in this report along with the more intangible aspects of a building to provide the best value and experience for our schools.

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Alaska Housing Finance Corporation. (2019, 04 30). Retrieved from Alaska Housing FInance Corporation-Climate Zones: https://www.ahfc.us/application/files/1013/7393/1537/ak_bees_2009_ashrae_std_62_2_2010.pdf

The Gordian Group, Inc. (2019). RSMeans Facility Guide 2019.

Appendices

Appendix A: Base Cost Estimate

Appendix B: Summary of Cost Data

Appendix C: Energy Reports

Appendix D: Heating and Ventilation Equipment Sizing

Appendix E: Utility Costs

Appendix F: Labor Rate

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

Model School

S U B C O M M I T T E E   R E P O R T

July 8, 2019

Mission Statement

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.

Current Members

Don Hiley
Jim Estes
Dana Menendez, ASD
Tim Mearig, DEED
Sharol Roys, DEED

Status Update

Recommendations from 2017 Report to the Legislature:

1) *Enhance the Cost Model for possible use as a cost limit standard to 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.*

Task 1: Prepare scope, issue an RFQ, award and manage the update.

Status: Cost Model enhancement has been completed by HMS. The 18th Edition is much more complete than previous versions, and now provides more flexibility in the variety of projects that can be estimated. Some usability and functionality issues were found after delivery, but have now been resolved. The updated version is available to public online.

Task 2: Develop regulations, as needed, to establish the Cost Model as a cost limit for projects.

Status: Subcommittee to prepare analysis of need and make recommendation to BR&GR. This has not yet been scheduled. Issues found in the latest version illustrate the difficulty in broadening the Cost Model's scope, and will likely take at least one or two more iterations to work out issues needed to complete this task.

The subcommittee is recommending transfer of the committee work plan elements listed below from the subcommittee to the department:

1.1.1	Cost Model As Cost Control Tool		May 18-Dec 20
1.1.1.1.	Analyze, Recommend Cost Model As Cost Control	~~Subcommittee~~Dept	Jul 2019

1.1.1.2.	Draft Regulation Language For Cost Control Use	~~Subcommittee~~Dept	Jan 2020
1.1.1.3.	Review Draft Reg Language, Recommend To State Board	Committee	Mar 2020
1.1.1.4.	Manage Regulation Development And Implementation	Dept	Dec 2020

2) *Establish a process of reviewing model school elements within the Cost Model so that those updates become researched, vetted, and intentional.*

Task 1 & 2: Develop a best-practice strategy for updating model school elements in conjunction with HMS, Inc.. Analyze effectiveness of BR&GR vs. consultant vetting.

Status: Subcommittee and department staff provided a great deal of input and feedback into development of the 18th Edition just delivered. More user feedback is anticipated as this version is put into practice during the FY21 CIP cycle. The department will keep the committee apprised of feedback received. Committee should maintain current roll of reviewing model school element changes proposed in each new edition.

3) *Develop Model Alaskan School standards by building system (ref. DEED Cost Format) needed to ensure cost effective school construction.*

Task 1: Complete outline-level standards for remaining seven systems.

Status: Department has not produced additional draft sections for subcommittee review.

Task 2: Conduct an independent feasibility and cost/benefit analysis on developing outline standards into comprehensive state-level model school standards.

Status: A contract was awarded to the McDowell Group to conduct the feasibility study, which was completed and delivered on July 5, 2019. Along with Department staff and BRGR Committee members, a number of people in state and provincial governments in the US and Canada were interviewed as part of the study. These interviews looked not only the implementation, but also the motivation in adopting standards by these different entities. School equity and efficiency/sustainability appear to be at least as much, if not greater factors in developing standards as cost savings for many.

The study provided good information about potential costs for developing and implementing a standard, either by Department staff or by contracting much of the work out to a consultant. The assumption has been made that implementation of a standard would likely result in cost savings due to relatively low cost to develop and update the standard versus the amount spent on school construction and renovation. A tool was developed, along with the report, to aid in putting together a cost benefit analysis.

Other issues discussed by the subcommittee, but not resolved, include:

- The cost/benefit analysis is not complete. Information required to make use of the tool provided will take more time and effort to gather.
- Not much input from outside A/E professionals to this point.
- Not much discussion of the downsides of their standards, if any, by other entities. What were pitfalls/lessons learned?
- What is the appropriate level of detail for the standards? Some areas possibly more specific or general than others. Are performance based standards more appropriate for some things?
- Can the standard be maintained over time and not become outdated?
- How do standards integrate with other codes adopted by the state and/or municipalities?
- How do the building systems standards integrate with other aspects of the cost effective construction mandate?

Task 3: Review analysis and publish a handbook or regulations as recommended.

Status: Pending. Anticipated cost of $50,000 is not funded.

4) *As part of describing a Model School, identify school elements that do not further the core educational mission of the school.*

Task 1: Review current Topic Paper and include in Report to Legislature.

Status: Completed January 2018.

Task 2: DEED to develop regulations that define non-core amenities based on legislative direction.

Status: No current action. DEED could use the Legislative Proposal process to advance. Subcommittee would need to make recommendations to Committee. BR&GR recommendations to department.

Schedule

No subcommittee meetings currently scheduled.

Alaska School Facilities Building Systems Standards
Feasibility Study

PREPARED FOR:

Alaska Department of Education and Early Development

July 2019

McDowell GROUP

Alaska School Facilities Building Systems Standards

Feasibility Study

PREPARED FOR:

Alaska Department of Education and Early Development

July 2019

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McDowell GROUP

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List of Tables

Executive Summary

The Alaska Department of Education and Early Development (DEED) contracted with McDowell Group to explore the feasibility and benefits of developing Alaska school facilities building systems standards as directed in Alaska Statute (AS) 14.11.017(d).

The State of Alaska funds a high proportion of school facility construction and indirectly funds facility maintenance and operations. The State, therefore, is motivated to consider implementing standards that would result in cost-effective school construction while minimizing future maintenance and operating costs.

In states/provinces contacted for this research, educational equality and equity were the primary motivations for developing facilities standards, rather than cost savings. Environmental and efficiency considerations were also initial objectives of implementing standards. Standards developed by other states/provinces also vary in their complexity and detail, with construction and building systems standards often included as a chapter in a more detailed planning document.

McDowell Group used a combination of secondary research and executive interviews to estimate costs to develop and periodically update building system standards. Interviews were conducted with Bond Reimbursement and Grant Review (BR&GR) Committee members, school facilities professionals in other states/provinces, DEED Facilities staff, and other professionals.

Building System Standards Development and Update Costs

Two scenarios were considered for developing and updating standards: the first led by DEED staff and the second led by contractors.

In-house development of standards is expected to cost between $58,000 and $60,000, including DEED staff time and professional services expense for a contracted technical review of draft standards. Contractor-led development is expected to cost between $119,000 and $131,000, including standards drafting by an architecture firm and DEED staff project management and support costs. Implementation costs are expected to total approximately $7,000 in both scenarios. These costs include staff time related to review and approval of standards by the BR&GR Committee and the State Board approval process.

Due to existing DEED staff workloads, in-house development of standards is expected to require two years to complete, while a contractor-led process is expected to take one year. The financial costs estimated in this study do not account for the opportunity cost of delays in other DEED Facilities staff work which would likely be impacted by in-house standards development.

While other states/provinces and districts have a variety of methods and schedules to update standards, interview research found that regular standards updates are critical to ensure continued relevancy and use of the building systems standards. Standards should be updated every year to ensure continued use.

Average annual update costs are expected to range between $5,200 and $8,700 if performed by department staff. This range reflects the recommendation to contract with a professional architecture or engineering firm every three years to conduct a more detailed review of standards. The cost of annual updates is expected to average between $11,300 and $12,500 annually if led by a contracted firm. Staff costs associated with BR&GR Committee review of the annual updates is expected to cost $1,500 regardless of in-house or contractor-led update. These annual costs are based on the average time estimated to update standards and will likely be higher or lower in individual years based on the extent and complexity of required changes.

School Facilities Building Systems Standards
Development and Annual Update Costs, by Development Type

Category	In-House Costs	Contractor Costs
Development Costs		
Draft Standards Development	$51,000 - $53,000	$112,000 - $124,000
Implementation	$7,000	$7,000
Total Development Costs	**$58,000 - $60,000**	**$119,000 - $131,000**
Update Costs		
Standards Update Costs	$3,700 - $7,200	$9,800 - $11,000
Committee Review Costs	$1,500	$1,500
Average Annual Update Costs	**$5,200 - $8,700**	**$11,300 - $12,500**

Source: McDowell Group

Benefits of School Facilities Building Systems Standards

Building systems standards have the potential to result in overall cost savings for the State and local school districts. Because school districts contract for construction and maintenance services, estimating statewide cost savings associated with building systems standards is difficult. Standards may either increase or decrease construction costs for new facilities. However, increasing efficiency and component quality is expected to reduce lifecycle operating and maintenance costs, relative to what those costs would be in the absence of standards. Due to existing deferred maintenance, reducing life cycle costs on new facilities may not reduce overall maintenance spending by the State or local school districts.

Additional non-financial benefits of implementing standards will likely include enhanced efficiency of DEED review of construction applications and improved cost forecasting by the State and local districts.

Introduction and Methodology

Introduction

The goal of this project is to consider the feasibility and benefits of developing Alaska school facility building systems standards. These system standards will identify the quality and/or quantity of systems and components needed to ensure cost-effective school construction in Alaska.

Background

In 1993, the Alaska State Legislature, with AS 14.11.014, created the Bond Reimbursement & Grant Review (BR&GR) Committee, within the Department of Education & Early Development (DEED). AS 14.11.014(b) directed the committee to do the following (among other responsibilities):

- *Develop criteria for construction of schools in the state; criteria developed under this paragraph must include requirements intended to achieve cost-effective school construction;*
- *Recommend to the board necessary changes to the approval process for school construction grants and for projects for which bond reimbursement is requested;*
- *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.*

In 2001, the BR&GR Committee, along with DEED, initiated a targeted effort to produce cost-effective school construction criteria. This initiative included drafting standards but was discontinued in 2002 due to staffing changes. In April 2017, the BR&GR re-established a subcommittee charged with continuing the development of construction standards. In December 2017, the BR&GR Committee delivered a report to the 30th Alaska Legislature titled *Criteria for Cost-Effective School Construction*[1]. Criteria #11 of that report recommended the development of "Model Alaskan School standards by building systems to establish the quality and/or quantity of system components needed to ensure cost effective school construction across the state." The Committee also cited the department's broad authority to revise a project's scope and budget, noting that standards would provide transparency to this process and contribute to standardized review of project proposals.

In 2018, passage of House Bill (HB) 212 added the following subsection to AS 14.11.017(d):

- *The department shall develop and periodically update regionally based model school construction standards that describe acceptable building systems and anticipated costs and establish school design ratios to achieve efficient and cost-effective school construction. In developing the standards, the department shall consider the standards and criteria developed under AS 14.11.014(b).*

As one response to this mandate, DEED completed a template for proposed construction and design standards by building system, vetted this template through the BR&GR, and began drafting construction standards

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[1] Report to the Legislature on Criteria for Cost Effective School Construction, Bond Reimbursement & Grant Review Committee, December 2017.

sections based on that template.[2] This project, the *Alaska School Facility Building Systems Standards Feasibility Study*, was the DEED's next step in the process of determining how best to complete the development of model school construction standards for Alaska.

Scope of Work

This study included two basic components: 1) a feasibility analysis intended to determine how best to develop model school construction standards for Alaska, and 2) development of a cost/benefit modeling tool to compare the costs and benefits Alaska could realize with development and implementation of model school standards.

1. **Feasibility Study** – The feasibility study evaluates the anticipated time and cost to complete, implement, and maintain state-level model school standards. Utilizing the methodology and research tools described below, the feasibility study considered whether the State of Alaska should develop and maintain standards in-house or contract for the development and maintenance of standards. Further, under those options, the study considered whether the State should complete current draft standards or adapt existing standards, either from other states or relevant national standards.
2. **Cost-Benefit Model** – An Excel model was constructed to support comparison of the time and costs to complete, implement, and maintain system standards against possible benefits. Those benefits might include cost savings (capital, maintenance or operating), improvements in the quality of the school facility, or even improvements in educational delivery. The primary research task was designed to identify as accurately as possible the costs associated with developing and maintaining school standards. Research also qualitatively addressed main components of cost savings the department and school districts could realize as a result of standards implementation. Quantifying the potential benefits was outside the scope of this research; however, the Excel model developed includes a framework for benefits analysis.

Research Methods

Secondary research: Secondary research was conducted to identify other state-level agencies that have pursued or published school design and construction standards, including 'in-house' standards establishing cost effective building systems and components or state-specific adaptations of national standards (i.e., LEED, Collaborative for High Performance Schools (CHPS), etc.). This initial secondary research informed the executive interview process, described below.

Executive interviews: Interviews were conducted with a total of 29 "key informants" or project stakeholders. These included:

- Members of the BR&GR Committee (seven interviews)
- DEED Facilities staff (five interviews)
- Officials from other states/provinces with experience in developing and maintaining school construction standards (12 interviews)

[2] Construction & Design Standards Section Template 2019 and School Design & Construction Standards Handbook 2019 DRAFT, Finance & Support Services/Facilities, Alaska Department of Education and Early Development.

- Other knowledgeable professionals, including district-level facilities managers and consultants (three interviews)

A primary purpose of these interviews was to learn about others' experiences regarding the benefits, costs, and challenges associated with developing model school standards. Interviews were also used to assess costs and benefits of in-house development versus contractor development of school standards. Interviews with DEED Facilities staff were critical to understanding the in-house time required to complete the current draft standards.

School Construction Standards

This chapter summarizes interview research findings related to motivations for developing standards and the structure of standards created outside of Alaska. State education departments and districts often have varied motivations for implementing school facility standards and standards differ in both complexity and content. While interview participants were expressly asked to address the building systems portions of their standards, these factors influenced each state or districts perceived costs and benefits from implementing standards.

Motivations for Developing Standards

Construction cost savings did not primarily motivate the implementation of school construction and building systems standards among states interviewed. Many participants noted that educational equality and equity were the main drivers for the creation of standards. Environmental and energy efficiency were also primary considerations in some participant states/provinces' decision to implement standards, including energy and water conservation. Many states/provinces were motivated by quality in construction and increasing school facility lifespans.

The following sections briefly outline motivations for implementing school facility standards among states/provinces which participated in this study.

Alberta (Canada)

The province has technical design requirements for all government infrastructure projects. The goal for schools is to deliver buildings that exceed by 30% the government's baseline construction quality and energy efficiency standards.

Arkansas

Standards were developed in response to a Supreme Court ruling that ordered the state to identify equitable standards for school facilities.

Colorado

An initiative to increase energy efficiency and building sustainability across the state prompted the state architect's office to implement LEED requirements for all state-funded buildings. As school construction is separate from the architect's office, the Capital Construction branch of the education department created building guidelines that incorporate a choice of three existing green building certification programs into school construction, including CHPS, LEED for Schools, and Green Globes.

Maine

The governor directed the development of standards to provide equitable facilities across the state. The focus of the building standards is on a minimum quality standard for school facilities and the state funds 100% of the costs incurred to meet required or recommended criteria. Due to high state funding, construction guides serve as a mechanism to control project size and construction costs. Life cycle costs, high-performance, and green buildings, flexibility, construction and maintenance costs, and durability are essential themes of Maine's construction guide.

New Jersey

The New Jersey School Development Authority fully funds and manages school construction in 30 districts as mandated by the state Supreme Court to provide students with equal access to education through equitable school facilities. The current set of standards are designed to streamline the design-build process to deliver quality schools on time.

New Mexico

A lawsuit brought against the state in 1999-2000 found the state did not treat all districts equally as required by the state constitution. As such, the state changed the funding structure for schools, now funded through oil and gas proceeds, and developed the New Mexico Public School Facilities Authority, which assessed and ranked all existing schools. The result is a set of adequacy standards for existing schools and another set that builds upon those for new school construction projects.

Ohio

In 1997, the standards were created to provide equal opportunity to all students in Ohio through equitable school facilities, as directed by the legislature. The overall goal is equality, but a focus on planning for quality, pricing, and materials is secondary.

Saskatchewan (Canada)

After assessing the province was ten years behind in school capacity, Saskatchewan created a model standard to build a set of nine school sites, with 18 total schools, around a common design (for each site, two schools (one public, one private) with a shared gym, community center and childcare center connecting the schools). The goal is to reuse the developed standard for future projects.

Washington

Schools in Washington are designed and built through local districts and must incorporate green, sustainable, high-performance aspects into building and renovating schools that are state-funded. Schools can use either LEED for Schools or Washington Sustainable Schools Protocol (WSSP) options. The WSSP is a self-certifying process modeled after CHPS but heavily adapted to fit the needs of Washington state. Certification is required for schools receiving any form of state capital funding and heavily encouraged for non-state-funded school.

Standards Structure

Of states/provinces participating in this study, all standards development began by integrating existing state and international building codes. Standard codes referenced include American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), National Fire Protection Association requirements, and the International Green Building Code.

Many states/provinces have more extensive standards than those outlined in *Alaska's School Design and Construction Standards Handbook*, with construction and building systems standards included as a chapter in a more detailed school planning document. Other content often included are education specifications or square footage assignments.

Facility standards vary in format and use of technical language based on the intended audience. Standards for use by designers or engineers are more technical and often include architectural or engineering diagrams, while standards written for school district or other stakeholder use are often more user-friendly and rely less on technical language. The standards also vary in the precision of their writing due to their inclusion in statutory regulations and requirement for review by legislative committees. In addition to required components, some standards specify either premium features that districts may elect to pay for or materials that are not allowed in school construction.

The following sections briefly describe the content and structure of school facility standards among participating states/provinces.

Alberta (Canada)

The Cost Management Standards and Technical Design Requirements outline the expected building quality, what materials not to use in building, what design characteristics are not allowed, and funding ratios for different locations. The province-wide, highly detailed, Technical Design Requirements establish a baseline for all government buildings. Additionally, schools have specific requirements in different areas, including sustainability, structural, mechanical, electrical, acoustical, municipal and environmental engineering, radon mitigation, and guidelines for wildfire protection. As part of sustainability requirements, all new construction and significant renovations are required to achieve at least a LEED Silver certification. ASHRAE standards are a base for mechanical systems standards as is the International Building Code as a whole.

Arkansas

Building systems standards are a chapter in the more extensive School Facilities Manual that includes not only building standards but master planning guides, education specifications, and additional guidelines recommended for performance or construction items. There is also an allowance for variances if approved by the state.

Colorado

The Public School Construction Guidelines are a brief document outlining the codes to use, which codes apply to specific building aspects, and a section on school safety and security. Building performance guidelines refer readers to the High Performance Certification Program and additional optional standards available. There is an emphasis on sized-right schools and life-cycle of buildings.

Maine

School planning documents are broken into three guides: one for educational specifications, that informs the rest of the design process; space standard allocations for square footage; and the construction and renovation guide that contains specs like site planning, exterior, and interior finishes, HVAC, electrical, and other requirements. To provide flexibility and minimize updates, the construction guide allows some variability for new technologies and products to be considered. A focus on energy efficiency, life-cycle costs, and recyclable materials emphasize the need for high performing schools. International building codes and others like ASHRAE, International Energy Conservation Code, and National Fire Protection Association standards and all state codes are a base starting point, and additional requirements build upon these in relevant categories. These standards are written for both school districts and designers; while technical, they are also relatively user-friendly.

New Jersey

The School Development Authority (SDA) Material and Systems Standards have two main parts: Design Requirements outlining highly detailed requirements for materials and systems and a document with technical drawings and plans for construction details. These documents are primarily for use by designers and SDA staff and are written for a professional audience. Some sections in the standards are under development and are bridged with other resources including performance specifications that list required performance factors for various materials and systems, design bulletins, and other addendums for standards of components like acoustics and commissioning. Collectively, these additional documents allow for updates more frequently and quickly than the standards document, and many are the results of feedback during the design-build process.

New Mexico

The existing school standards called Adequacy Standards are a statutory document that assesses schools based on minimum square footage and performance characteristics to ensure the state graduation requirements can be met through the building; deficient schools receive a calculated update cost to bring them up to adequate quality.

New school construction projects must follow the Adequacy Planning Guide going beyond and builds on the Adequacy Standards. These standards also set out limits for what the state funds and what the district must fund. The New Mexico Public School Facilities Authority is also the project manager for all state-funded school projects, which increases their ability to oversee compliance. Requirements are clearly laid out, as well as best practices for consideration. HVAC and control standards have a separate guide, referenced in the Adequacy Standards.

Ohio

School Construction Standards have two volumes: one for use by districts and written for that audience, and a technical components document. The standards begin with national building codes which are then exceeded in many areas, like fire sprinkler requirements. Components and specifications are based on a 50-year building lifetime standard. Project planning and preparation are state-funded and overseen by a state planner who meets with districts to develop their project. The standards include all requirements necessary to certify as LEED Silver at a minimum. The district document is user-friendly, while the construction document is more specific and relatively technical with graphs, charts, and diagrams.

Saskatchewan (Canada)

The project standards emphasized output and performance with a focus on energy efficiency, abuse-resistant materials, and innovation. To keep these standards relevant for the variety of sites and future projects, lifespans for materials and performance were listed instead of specific materials. Some material types are required in specific educational spaces, like carpeting in libraries.

Washington

Districts have local control over the school planning and building process but must conform to High-Performance School Buildings Program requirements either through LEED certification or through the self-certifying WSSP protocol if applying for state funds. Both use a rating program based on points allocated for different categories in sustainability, site preparation, water usage, waste reduction, natural lighting, and material specifications. The WSSP contains a section on incorporating the design and building process as well as future building systems monitoring into the school's curriculum. While the WSSP is a technical document with an elaborate point system, it is written for non-facilities district and school staff.

Study Findings

The following sections describe the financial costs and benefits associated with the development and upkeep of state building systems standards. Estimates are based on interview research with school facilities professionals in Alaska and several other states.

Standards Costs

This section describes costs associated with initial development and periodic update of state building system standards. Two scenarios are considered for standards development and update: the first in which processes are led by DEED staff and the second in which the processes are contractor-led.

Development Costs

Building systems standards development may be led either by department staff ("in-house" development) or a contractor firm or firms ("contractor" development). In-house standards development is expected to cost between $58,000 and $60,000 based on prevailing contractor rates. Contractor-led development is expected to cost between $119,000 and $131,000. While contractor-led development has a higher expected cost, an in-house standards development project is expected to require more time due to existing staff workloads.

The following sections describe in detail the expected costs associated with each development process.

Table 1. Expected Development Costs by Development Type

Cost Category	In-House Development	Contractor Development
Development Costs	**$51,000 - $53,000**	**$112,000 - $124,000**
Department staff costs	$37,000	$22,000
Professional services contract costs	$14,000 - $16,000	$90,000 - $102,000
Implementation Costs	**$7,000**	**$7,000**
Total	**$58,000 - $60,000**	**$119,000 - $131,000**

Source: McDowell Group

IN-HOUSE DEVELOPMENT

This section considers the costs associated with standards development led by DEED staff. In-house standards development is expected to require two full years, with a total expected cost between $51,000 and $53,000. While DEED staff have the expertise to develop draft standards, interview research findings suggest a technical review by a contracted firm or firms would be important for standards development.

Table 2. In-House Development Costs by Cost Category

Cost Category	Year 1	Year 2	Total
Department staff costs	$18,000	$19,000	$37,000
Professional services contract costs	$6,000 - $7,000	$8,000 - $10,000	$14,000 - $16,000
Total	**$24,000 - $25,000**	**$27,000 - $29,000**	**$51,000 - $53,000**

Source: McDowell Group

Staff Costs

Interview participants familiar with the DEED Division of Finance and Facilities agreed the department staff have the expertise and ability to consult with other professionals necessary to lead development of the building systems standards. Two staff members with the following job class titles would have the highest level of and most direct involvement with draft development: Technical Engineer 1/Architect 1 and Architectural Assistant. Based on previous project time requirements and the current draft template status, developing a full building systems standards draft would require an additional 450 hours of staff time, approximately two hours each week for both staff members. Estimated staff hours to develop the standards draft are expected to be divided between the staff positions indicated above. Staff costs to develop the standards draft are estimated at $34,500.

Developing standards in-house would probably require the involvement of additional division staff in support activities. This includes coordination of any special meeting held to address this project by a staff member in a School Finance Specialist position. These activities would likely require 40 hours over the entire project, an estimated $2,500. Additionally, this project would likely require a low number of hours by the Director of Finance and Support Services related to project oversight, a cost of approximately $200 over two years. These estimates exclude staff involvement in the BR&GR Committee review process and the Legislative approval process.

Professional Contract Costs

Interview participants noted that the BR&GR Committee and other organizations like the Association for Learning Environments (A4LE) could provide a technical review of standards drafted by department staff at no cost. Several states and school districts solicited feedback and review from contractor firms who are often involved in school construction projects in their area through personal communications, rather than a formal contracting review process. This informal review was helpful for states and districts in gaining additional knowledge of the best standards and creating buy-in with contractor firms.

While participants found the informal review of the draft standards helpful, several participants also recommended contracting formally with engineering or architecture firms to provide a technical assessment of standards produced in-house. Interview participants especially noted outside technical review as essential to address regional standards differences and stressed the importance of contracting with Alaska firms familiar with the state’s climate regions.

Engineering or architecture firm technical review can be performed either at intervals throughout the development process or when state staff have created a full standards draft. States like Maine collaborated with firms throughout the standards development process and interview participants suggested that periodic consultation with a contracted firm throughout the development process would be most effective if standards were developed in-house. Benefits of this process include early review and the ability to engage a broad set of expertise.

Costs for both review throughout the development process or a single review of the draft standards are expected to vary between $14,000 and $16,000 based on prevailing contractor rates.

Project Duration

While interview participants suggested department staff have adequate expertise to develop draft standards for review by additional professionals, several participants noted in-house standards development would likely require more time to complete due to the ongoing workload of existing staff. Interview research found states and districts that dedicated staff resources to the project full time completed standards drafts in a shorter time period compared to those whose staff were also engaged in ongoing department work. Given the current size and workload of the Facilities staff, in-house standards development is expected to require two full fiscal years.

The costs outlined in this study do not account for the potential delay in other DEED staff work which may be impacted by in-house standards development.

CONTRACTED DEVELOPMENT

This section considers the costs associated with standards development led by a contractor firm or firms. Development led by a contracted firm is expected to require only one year, with a total expected cost between $109,000 and $125,000.

Table 3. Contracted Development Costs by Cost Category

Cost Category	Total Costs
Department staff costs	$22,000
Professional services contract costs	$90,000 - $102,000
Total	**$112,000 - $124,000**

Source: McDowell Group

Professional Contract Costs

Several states' standards development processes were led by national contractor firms which specialize in developing school facility design standards which often include building systems standards. National firms often subcontract with engineers or other professional firms where specific expertise is required. Services may consist of stakeholder engagement or legislative process work.

While national firms have significant expertise in standards development, several interview participants stressed the importance of engaging Alaska contractors due to the specialized nature of construction throughout the state. Participants agreed that firms with construction experience in Alaska's four climate zones would be best positioned to develop building systems standards which incorporate the significant regional variation in the state.

Based on contracting primarily with an Alaska firm (or firms), which may subcontract specific components of standards development, this project is expected to require professional services costs between $87,000 and $99,000 based on prevailing contractor rates. Additionally, the contracted firm or firms will likely require reimbursement for travel costs to meet with department staff. Estimated travel expenses of $3,000 are based on four people traveling to Juneau to meet with staff, either in a single site visit or multiple individual visits. Combined contracted firm costs between $90,000 and $102,000 are estimated for contractor-led development.

Selection of a national contractor to lead the standards development process is expected to result in higher costs, including significantly higher travel costs from a destination outside Alaska.

Staff Costs

In several states, contractor-led development processes also required department staff involvement throughout the standards drafting period. The project is expected to require the Technical Engineer 1/Architect 1 to devote between one and two hours per week to the project, including contractor update meetings and other project management duties. Additionally, a School Finance Specialist is expected to devote an average of half an hour to one hour per week to the project, also including coordination of contractor update meetings.

These activities would likely require 250 hours over the entire project, an estimated $22,000.

Project Duration

Several interview participants suggested a contractor-led standards development process could be completed in less time compared to an in-house process due to the contractors' ability to dedicate professionals to the project. Interview research found states and districts whose standards development process was led by a contracted firm required approximately one year to prepare a draft for the Legislative process.

ADAPTED STANDARDS

Numerous building system-specific standards exist which could be included in a set of Alaska standards. For example, ASHRAE publishes standards often cited in other building system standards. However, neither interview research or secondary research uncovered a national building systems standard which conformed to the standards designed as outlined in the department *School Design and Construction Handbook Draft*.

ASHRAE publishes the *Advanced Energy Design Guide for K-12 School Buildings* manual for free use by states and districts. This guide does include guidance on components of a complete building systems standards, including guidance for envelope and roof construction. This resource could provide guidance for a subset of Alaska-specific standards.

The US Green Building Council publishes the LEED for Schools manual, which provides a building construction and operations/maintenance rating systems adapted to K-12 school facilities. This resource is referenced by select states/provinces that participated in this research; however, their use of LEED varies. Alberta and New Jersey both incorporate LEED standards into their building systems standards. Colorado and Washington cite LEED as one option for high-performance certification but allow districts to choose which building standard they prefer. Various review and submission fees and processes apply to facilities seeking LEED certification. Interview research found that many districts prefer other high performance certifications due to the additional compliance costs charged by architectural and engineering contractors.

Many states use the CHPS criteria as a guide for building standards or require that buildings are CHPS-certified. CHPS publishes a set of national criteria that may be used by states and districts with no licensing fee. States or districts certifying schools using the CHPS criteria pay an annual membership fee. Due to significant differences in Alaska construction and climate zones, it would be difficult for Alaska districts to comply with the national CHPS criteria. To use CHPS as a building standard, Alaska would need to adapt the standards as have other states like Colorado, Washington, and several states in the Northeast. This would require the State to pay both annual CHPS membership fees and an annual licensure fee.

Due to the incompatibility of national standards with the draft building systems standards compiled by DEED, the standards development costs considered in this study do not include any costs to adapt national standards to Alaska. If DEED chose to adapt CHPS for use in Alaska, the State would pay a one-time licensing fee of approximately $10,000 and an annual state-wide membership fee of approximately $5,000.[3] Licensing fees grant access to the CHPS logo and core criteria for adaption; however, no adaptation services are included in this cost.

Implementation Costs

Implementation of building systems standards will require review and approval of standards by the BR&GR Committee. This process will require the involvement of the Director of Finance and Support Services, Technical Engineer 1/Architect 1, and a School Finance Specialist and is expected to cost $3,000 in staff time.

The implementation process will require approval and adoption of the standards by reference into regulation by the State Board of Education and Early Development (SBOEED). This process will include staff time to prepare for and attend at least two meetings of the board and will cost an estimated $3,000. The BR&GR Committee and SBOEED implementation process is expected to require the same level of staff time regardless of how the standards are developed (in-house or contracted development). The implementation process is not expected to require Legislative approval. Legislative hearings and approval would increase staff time and costs required.

Interview participants recommended that information sessions held for facility construction firms or other stakeholders could be helpful to inform stakeholders and prepare firms for new standards. Department staff could offer one to two hour online sessions to inform stakeholders following the approval process. Assuming the department has necessary online tools to host meetings, holding two information sessions would cost approximately $1,100 in staff time, including presentation preparation and time to conduct sessions.

Table 4. Implementation Costs by Cost Category

Cost Category	Total Costs
BR&GR Committee Review and Approval	$3,000
State Board Meetings and Regulation Process	$3,000
Information Sessions	$1,000
Total	**$7,000**

Source: McDowell Group

Update Costs

Interview participants from outside Alaska had a variety of methods to update standards, ranging from informal updates based on stakeholder recommendation to a formal update process led by a contractor. Interview research found necessary standards update frequency is related to the level of detail and specificity in the states/provinces' overall facility standards, which often include requirements beyond building systems standards. Interview participants noted that standards included in building systems, like ASHRAE standards, changed more frequently compared to non-building system parts of other states/provinces' facility standards such as educational standards which experience less frequent change. Interview participants noted that

[3] CHPS licensing and membership fees were approximated through interview research with states that have adapted CHPS. Fees are likely to vary and may be higher than these quoted fees.

technology and safety standards changed most frequently, two categories not currently included in the department's *School Design and Construction Standards Handbook*.

Interview research found that regular standards updates are critical to ensure continued relevancy and use of the standards. Several interview participants noted that their state or district spent considerable time and money to update outdated standards after failing to review their documents regularly. Findings suggest state building systems standards should be reviewed and updated annually to ensure continued relevancy and use.

Additionally, the department should provide an avenue for stakeholders to submit requests for standards changes for review. Other states ask stakeholders to submit change requests via email, which are compiled for consideration during the update process. Participants noted this has been a successful process to ensure standards are updated appropriately.

The next sections estimate time and costs required to perform annual standards review and update. Review and update costs are based on the average time estimated to update standards annually and may be higher or lower in individual years based on the size and complexity of required changes. Average annual update costs are expected to range between $5,200 and $8,700 if performed by department staff and $11,300 to $12,500 if performed by a contracted firm.

Table 5. Average Annual Update Costs by Update Type

Cost Category	In-House Update	Contractor Update
Update Costs	**$3,700 - $7,200**	**$9,800 - $11,000**
Department staff costs	$3,700	$1,600
Professional services contract costs	$0-$3,500	$8,200 - $9,400
Committee Review Costs	**$1,500**	**$1,500**
Total	**$5,200 - $8,700**	**$11,300 - $12,500**

Source: McDowell Group

IN-HOUSE UPDATE

Study findings suggest in-house review of standards should be performed annually. In-house standards review is expected to require the involvement of the Technical Engineer 1/Architect 1 and an Architectural Assistant, with a combined 40 hours necessary for review and update each year. Staff update costs range from an estimated $3,500 in the first year following implementation to $4,000 in the fifth year following implementation due to staff cost inflation.

Additionally, it is recommended that the department engage a contractor firm every three years to perform a more detailed review of the standards every three years, aligning with statewide update of the Building Life Safety Code.[4] Contractor review by an Alaska firm or firms is expected to cost between $3,000 and $3,500 in the third year following standards implementation based on contractor rates and expected inflation.

[4] Alaska adopts an updated version of the International Building Code every three years. The state is currently in the process of adopting the 2015 International Building Codes.

Table 6. In-House Update Costs by Cost Category

Cost Category	Year 3	Year 4	Year 5	Year 6	Year 7	Average
Department staff costs	$3,500	$3,600	$3,700	$3,800	$4,000	$3,700
Professional services contract costs	$0	$0	$3,000 - $3,500	$0	$0	$600 - $700
Total	**$3,500**	**$3,600**	**$6,700 - $7,200**	**$3,800**	**$4,000**	**$4,400**

Source: McDowell Group

CONTRACTED UPDATE

Study findings suggest contractor-led standards updates should be performed annually. While exact professional services costs may vary due to the complexity or amount of necessary changes, professional services are expected to cost between $8,000 and $10,000 annually in each of the first five years following implementation.

A contractor-led update process would require department staff involvement. The process is expected to require the Technical Engineer 1/Architect 1 to devote approximately eight hours annually to the update process, including contractor update meetings and other project management duties. Additionally, a School Finance Specialist is expected to devote approximately four hours to the update process annually, including coordination of contractor update meetings. Staff costs would range from an estimated $1,500 in the first year following implementation to $1,700 in the fifth year following implementation due to staff cost inflation.

Table 7. Contractor Update Costs by Cost Category

Cost Category	Year 3	Year 4	Year 5	Year 6	Year 7	Average
Department staff costs	$1,500	$1,550	$1,600	$1,650	$1,700	$1,600
Professional services contract costs	$8,000-$9,000	$8,000-$9,000	$8,000-$9,000	$8,500-$10,000	$8,500-$10,000	$8,200-$9,400
Total	**$9,500-$10,500**	**$9,550-$10,550**	**$9,600-$10,600**	**$10,150-$11,650**	**$10,200-$11,700**	**$9,800-$11,000**

Source: McDowell Group

BR&GR COMMITTEE REVIEW COSTS

Standards updates are expected to be reviewed and approved by the BR&GR Committee annually. This process will require the involvement of the Director of Finance and Support Services, Technical Engineer 1/Architect 1, and a School Finance Specialist. Staff costs are expected to range from $1,500 in the first year following implementation to $1,700 in the fifth year following implementation due to staff cost inflation.

REGULATION UPDATE COSTS

Standards are expected to be adopted by reference in regulation by the SBOE. Annual standards updates are assumed to be included in routine updates by the Facilities staff, requiring no additional staff time or costs for presentation preparation.

Standards Benefits

Between FY2006 and FY2015, State aid for school capital projects, including construction and major maintenance, totaled nearly $2.0 billion (an average annual of nearly $200 million).[5] Additionally, school districts spent an average $278 million annually on facilities operations and maintenance.[6] Based on estimates of standards development and maintenance costs as outlined in previous sections, a State aid cost savings of less than one-tenth of a percent is expected to outweigh standards implementation costs at the highest standards cost estimate.

Every participating state and province, as well as members of the BR&GR Committee, were asked about the potential for financial and other benefits of implementing school facility building systems standards. While most participants indicated financial benefits are difficult to quantify, interview research identified three broad categories of cost savings likely to result from implementing standards: construction cost savings, facility maintenance cost savings, and operating cost savings. Operating and maintenance cost savings are expected to outweigh any increase in construction costs that could result from higher quality standards.

Interviews with representatives from Alberta, Maine, and New Mexico indicated standards clearly distinguish what materials and systems the state/province will pay for as part of school construction costs and what items must be paid for with other resources. Interviewees said this both reduced construction costs and prevented overbuilding of schools both size- and aesthetics-wise, which likely reduces maintenance and operating costs compared to previous construction.

Several interviewees suggested cost-savings will result from quality construction and paying close attention to life-cycle costs instead of initial costs in the planning process, though they also noted these initial construction costs would likely be greater. Many standards focus on 40- to 50-year building requirements regarding school building quality. While this may lead to higher initial construction costs, maintenance costs will likely be lower than current maintenance and renovation requirements for previously constructed facilities. BR&GR Committee members indicated reducing costs in small ways will result in overall cost savings. Committee members suggested ensuring quality materials and reducing energy costs will contribute to overall cost reductions and contribute to having high-performance features in school buildings.

High-performance school features like energy efficiency and water conservation were mentioned in most interviews and the importance of sustainable buildings, evidenced by Energy Star reporting in states like Washington and Colorado, show the resulting water and energy savings translate to money saved by the school district. Members interviewed on the BR&GR Committee and DEED staff indicated district-level operating costs would be lower and energy savings should be noticeable.

One interviewee mentioned writing in the use of tried-and-tested materials and not experimental components could reduce costs and improve building quality. This sentiment was echoed by states that have standards which restrict premium products for the sake of aesthetics and preference compared to quality and long-term benefits.

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[5] CIP Grant Requests and Funding, FY2006-FY2015 provided by DEED.
[6] School district facilities operations and maintenance spending based on school district audit documents as compiled by DEED.

School districts that use standardized systems can benefit from bulk-ordering maintenance supplies and spare parts. Due to significant variation in the size of Alaska school districts and logistic issues in rural Alaska, these benefits may be difficult to realize for some areas of the state.

Other Benefits

Interviewees with professionals in states which heavily fund school construction found building standards led to more equitable school facility construction. Other non-financial benefits noted by interview participants include enhanced credibility and reliability in department review of construction applications. Some participants found building systems aided districts and the state in more reliably forecasting construction costs and planning for future capital requirements.

Regarding high-performance features, many interviewees (supported by secondary research) noted the proven benefits of better learning environments from high-performing, greener schools. Beyond saving money, clean indoor air quality, and natural and well-lit schools environments are better for students, and the student-led monitoring of energy and water usage can be a learning opportunity. Washington has a section in their WSSP called Integration, Education, and Operation, which details ways for students to learn not only from the building planning and construction process, but also through monitoring and maintaining the energy, water usage, and other performance topics for their school buildings.

Cost/Benefit Model Description

This section describes the attached Excel file titled *DEED – Building Systems Cost Benefit Model*.

Summary

This worksheet provides a summary of annual and total of development and update costs and the framework for assessing standards benefits. This worksheet is linked to the following worksheets:

- *Development Costs,*
- *Update Costs*, and
- *Benefits*.

This worksheet also provides a framework to consider the annual expected benefit of standards in an average year based on historic state construction, maintenance, and operations spending. The model multiplies average annual construction spending (as entered in cell B25) by the expected cost savings estimated using specific facilities' historic data in the *Benefits* worksheet to estimate the expected construction benefit. Similarly, average annual maintenance and operating spending (as entered in cell B30) are multiplied by the estimated maintenance and operations cost savings.

The final component of this worksheet is a framework for estimating the cost/benefit ratio of standards under the two scenarios: in-house or contractor-led development and update. Costs including all development, implementation, update, and review costs for all seven years used in this analysis are divided by the expected annual benefits (as estimated in cell B34).

Development Costs

This worksheet provides an estimate of total and annual development costs, based on the assumptions described in the proceeding sections, for the two development processes: in-house and contractor-led. The following are key assumptions:

- DEED staff costs are expected to increase annually based on future salary increase rates and historic benefits cost rates. Additional details can be found in the *Staff Costs* worksheet.
- Professional services costs are based on a contractor rate of $200 per hour, which is the high end of the expected cost range between $175 and $200 per hour.
- Contractor travel costs are based on non-peak season expenses. Additional details can be found in the *Sources* tab.
- Implementation costs are expected to be constant regardless of in-house or contractor-led development.

Update Costs

This worksheet provides the best point estimate of average annual standards update costs in each of the first five years following standards implementation (Year 3 through Year 7). The following are key assumptions:

- DEED staff costs are expected to increase annually based on future salary increase rates and historic benefits cost rates. Additional details can be found in the *Staff Costs* tab.
- Professional services costs are expected to increase by five percent every three years, with hourly rates of $210 in Years 3 through 5 and $220.50 in Years 6 and 7.

Cost Scenarios

This worksheet was developed to give users the ability to observe the effect of different assumptions on development and update cost estimates. The worksheet provides a range of development and cost estimates based on variable development in hours required, professional services contractor rates, and contractor rate inflation. Users may enter up to four different assumption "scenarios" for development or update costs.

Development hours and contractor rates (in columns B through E and rows 11 through 12) can be changed to describe additional development cost scenarios. Update hours, contractor rates, and contractor rate inflation (in columns H through K and rows 11 through 13) can be changed to describe additional update cost scenarios. Total cost estimates will automatically adjust to reflect new entries in these cells.

This worksheet is not referenced in any of the other worksheets and, therefore, changes will not be reflected in the *Summary*, *Development Costs*, or *Update Costs* worksheets.

Benefits

This worksheet provides a framework for considering the expected costs of construction, maintenance, and operating a school facility constructed under building system standards compared to actual costs associated with recently constructed facilities. This framework is designed to estimate the percent construction, maintenance, and operating cost savings that would result from implementing standards.

Historical facility-specific data from a school facility constructed in the past ten years is intended to be entered in Column B. Users are then expected to estimate the theoretical construction, maintenance, and operating costs which the facility would have incurred if it had been constructed under building systems standards. Entering these estimates results in facility-specific cost savings (benefits) and percent cost savings which can be applied to overall State aid spending.

As an example, general information related to the Kwethluk K-12 school, constructed in 2015, has been entered in Column B rows 4-9 to illustrate that the costs estimated should be facility-specific. This worksheet can be copied multiple times for use in examining a variety of school facility construction projects.

Appendix A: Interviewees

Alaska

- Cathy Giessel, Alaska State Senator/BR&GR Committee Member
- Dale Smythe, Senior Architect, Bettisworth North Architects and Planners/BR&GR Committee Member
- David Kingsland, BR&GR Committee Member
- Don Hiley, Facilities Director, Southeast Regional Resource Center/BR&GR Committee Member
- Heidi Teshner, Director, Department of Education and Early Development, Finance & Support Services/BR&GR Committee Member
- Jim Estes, Director, Matanuska-Susitna Borough School District, Facilities/BR&GR Committee Member
- Larry Morris, Architect Assistant, Department of Education and Early Development, School Facilities
- Lori Weed, Lands Management & Project Support, Department of Education and Early Development, School Facilities
- Randy Williams, Associate Mechanic Engineer, PDC Engineers/BR&GR Committee Member
- Sharol Roys, Project Support, Department of Education and Early Development, School Facilities
- Tim Mearig, Facilities Manager, Department of Education and Early Development, School Facilities
- Tony Weese, Capital Planning and Construction Manager, Matanuska-Susitna Borough School District, Facilities
- Wayne Marquis, Preventive Maintenance Program, Department of Education and Early Development, School Facilities
- Yuki Janson, Project Manager, Anchorage School District, Capital Planning and Construction

Alberta

- Sean Singer, Director of Project Delivery, South Alberta Infrastructure-Learning Facilities Branch, Alberta, Canada

Arkansas

- Brad Montgomery, Director, Arkansas Division of Public School Academic Facilities and Transportation, Facilities Division
- Darrell Tessman, Assistant Director, Arkansas Division of Public School Academic Facilities and Transportation, Facilities Division

Colorado

- Andy Stine, Director of Capital Construction, Colorado Department of Education
- Cheryl Honigsberg, Regional Program Manager, Colorado Department of Education, Division of Capital Construction

Maine

- Scott Brown, Direct of School Facilities, Maine Department of Education, Facilities and Construction

New Jersey

- Gregory Voronov, Managing Director, Program Operations, New Jersey School Development Authority
- Ritchard Sherman, Director of Facilities and Strategic Planning, New Jersey School Development Authority

New Mexico

- Jonathan Chamblin, Executive Director, New Mexico Public School Facilities Authority

Ohio

- Eugene Chipiga, Architect and Senior Planner, Ohio Facilities Construction Commission

Saskatchewan

- Phil Pearson, Executive Director, Saskatchewan Ministry of Education, Infrastructure

Vermont

- Cassandra Ryan, Fiscal and Regulatory Compliance Coordinator, Vermont Agency of Education, School Operations

Washington

- John McLaren, Northwest Washington Regional Coordinator, Washington Office of Superintendent of Public Instruction-School Facilities & Organization
- Morgan Powell, Program Manager, Washington Office of Superintendent of Public Instruction, School Facilities & Organization
- Nancy Johns, Coordinator for High-Performance Schools, Washington Office of Superintendent of Public Instruction, Retired
- Randy Newman, Associate Director of School Facilities, Washington Office of Superintendent of Public Instruction

Other

- Chuck Warner, President, Warner Concepts LLC

Appendix B: Additional Interview Comments

Suggestions and Recommendations from Interviews

Interviewees offered feedback that was not necessarily within the scope of work but is valuable for the development process. Specifically, at the end of interviews, participants were asked: ***Do you have any other suggestions or recommendations for a state considering creating construction standards?***

- *Technical aspects: be as prescriptive as possible, especially on the size of facilities, so that local school authorities know exactly what does and does not have room for negotiation.*
- *Have a list of estimated costs the state funds by component on their website. We recommend putting together a standard like this if cost reduction is the goal.*
- *Couldn't imagine running a program without these standards in place. Standards are especially in the interest of taxpayers. Because quality, safety, energy efficiency, etc. is laid out, everyone knows exactly what the state pays for. The better the system you have in place, the more respected process, the better the chances to secure funding (for districts especially). Standards also provide credibility for your department.*
- *Generally, the two-guide model is a good strategy. Some existing schools would be too expensive to bring up to "new school" standards. We have their own standards that deal with space, and it's a short list that makes sure the school is the right size and has the ability to meet the state's graduation requirements (like vocational, physical, music education, etc.). These are standards that can apply to all schools, regardless of age/structure type, student population, etc. New projects have an updated standard and must meet additional key requirements to receive state funding.*
- *The Funding Formula is helpful also and is done in conjunction with the legislature. It sets out the funding ratio between state/local funds, based on the size of the district, replacement costs, land valuation, and population density.*
- *Find/consult an Education Planner, a person who can provide the benefit of knowledge. Also, creating Education Specifications (like learning/teaching models for the state, project-based learning, team teaching, etc.) helps with construction standards so you can design your standards to support and achieve those learning goals and facility needs.*
- *The Lean consultant was a great source, because they identified areas of waste that will save money not just initially, but also over time. It's important to talk to the maintenance and facilities staff at the district level when creating standards because they know how much it costs to maintain these buildings and materials and would understand if more training was required, or special equipment.*
- *There are places where being specific, like the type of flooring (carpet, hard surface) and places where you shouldn't be too specific, like IT, where systems can be out of date quickly or don't factor in remote school access.*
- *Rural schools have a hard time with overly sophisticated systems, and many schools have misplaced expectations of what the standards and savings will be, or they don't have the ability to properly maintain systems to see those high-level savings. Some rural schools don't have the staff training or numbers to handle the maintenance on new systems and this needs to be factored into the standards. And costs like having a remote-control system monitor in a big city can be difficult, especially if they*

aren't accounted for from the beginning. The state now urges not just advanced systems, but systems that can be maintained by the districts. Remote and rural schools require thinking beyond the basic standards.

- *Starting with an existing program like CHPS or Green Globes and using what you can and building up from there could be a good fit.*
- *Consider setting a high standard goal that is hard to achieve, but that you can waive for those that can't reach it, especially if the school wouldn't recoup the costs.*
- *The way standards are written, to save on construction costs. They must account for the fact that writing them too specifically could end up costing far more to build if the cost of certain materials skyrockets. The best bet would be performance-based standard requirements, not necessarily specific brands or material makeup. You see this in districts' master plans and Ed. Specs, that are far outdated and require the use of old Cat5 cables in classrooms, which are outdated by Cat6 cable, or even not hard wiring in technology in many places. Technology should focus on performance, just like siding, roofing, etc. Giving a required service life and wind ratings for siding would let the market provide the product, and while you might have higher initial costs, maintenance costs are where you want to focus. That is where districts and the state could save money.*
- *Districts likely wouldn't be upset or find it difficult to adapt to new standards, because they already expect stipulations from the state, because that's where the money comes from. These new standards would likely only affect new buildings, and major renovations that basically remodel an entire existing school, so the standards would be easily accounted for.*
- *Adopting and modifying national standards is fine for things like fire safety, and basing standards off the international building code, or energy efficiency standards and adapting them to fit Alaska's needs.*
- *To really have good standards, consult with the design community, especially because of the climate range and overall uniqueness of the state, would be necessary to make sure the standards are effective and useful. And local input and influence, and experience should be encouraged. There are four major construction zones in Alaska, and firms and individuals with experience constructing similar sized projects, and especially schools, in each zone should be consulted to provide input into what standards are appropriate for the different regions and assist in creating standards for the whole state.*
- *Depending on what is included in the standards, you might need an Architect, Structural, Mechanical, Electrical, and Civil Engineers. These people should be experienced and/or from within Alaska. They are also important because the standards need to be forward thinking, current, and tested. Nothing experimental, but nothing antiquated or that will be outdated by the time they implement and/or update standards.*
- *LEED is hard to implement in Alaska particularly due to a requirement to source some local materials, which isn't feasible state-wide. CHPS might be adaptable, but not necessarily fully adoptable. A cookie-cutter approach is not ideal in Alaska, given the range of climate, geography, and accessibility. Ideally, a checklist to go through with reasonable requirements, like siding, roofing, quality, control systems, etc., that would work across the state would be a good approach.*
- *If the standards are too detailed, it might hinder the ability to maintain and stay up to date with changing needs. It is better to be a little less detail specific.*
- *The state needs to promote outreach and make sure people know about the standards and potentially offer education classes, so districts and others know how to comply.*

- *The regional aspect is really important. In some of discussions we talked about having a single standard so one person/group could do maintenance everywhere. This isn't realistic given our different regions.*
- *Utilize research-based methods in the standards, the Cold-Climate Housing Research Center at UAF, and other state resources to provide Alaskan knowledge. Creating standards for the uniqueness of Alaska with substantiated research to back them up is critical for the success of these standards and for building durable, energy efficient schools.*
- *Space and school model standards are helpful (gross square footage requirements for component space) and leaving room for allowances in some areas, as is recognizing when to build in flexibility to standards.*
- *Schools and districts can use the Energy Star Portfolio Manager for free to monitor if the building and products are meeting expected performance, and cost savings.*
- *If you don't already do it, it is important to have annual post-occupancy evaluations and allow the school stakeholders to give feedback on the performance of the building and materials to see if their expectations are met.*
- *The Mindful Materials Database is an extensively reviewed list of sustainable building materials with good search and filter options. CHPS recommends it now instead of their own old materials list.*
- *Looking at performance standards and beginning the process by understanding/knowing how to achieve performance requirements written into the design process could be a good method to develop standards. For instance, require schools to operate below energy use intensity of 32 and let that drive the HVAC and window product selection.*
- *Recommended consultants included:*
    - *Civil engineer*
    - *Energy modeler*
    - *Education planner*
    - *Geotechnical engineer*
    - *Lean consultant*
    - *Mechanical engineer*
    - *Resource conservation manager*
    - *Structural engineer*
    - *Technical writer*
    - *Engineering experts with construction experience in each Alaska region*

Appendix C: State, Provincial, and U.S. Standards

- Alberta, CA: Technical Design Requirements
  - School-specific elements are included in relevant subsections
- Arkansas: Arkansas School Facilities Manual
  - Chapter 7: Building Systems
- Colorado: Public School Facility Construction Guidelines
- Maine: Planning Documents
  - Construction-specific document: Standards & Guidelines for New School Construction & Major Renovation Projects
- New Jersey: Design Standards
  - Materials and Systems Standards Manual portion of standards
- New Mexico: Statewide Adequacy Standards and Adequacy Planning Guide (note that an update is currently in progress)
  - Design Guidelines for HVAC and Controls
- Ohio: Ohio State Design Manual
  - Volume Two contains construction and design requirements
- Saskatchewan, CA: Project Information from the Ministry of Education
  - Project Information from SaskBuilds
- Washington: High-Performance School Buildings Program
  - Washington Sustainable Schools Protocol

U.S. Standards

- ASHRAE: Advanced Energy Design Guide for K-12 School Buildings
- CHPS: National and adapted standards
- LEED: LEED for Schools – New Construction and Major Renovations

Alaska Building Systems Cost Benefit Model

Summary

Development Costs

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total Cost
In-House Development	$24,004	$27,214	-	-	-	-	-	$51,217
Complete Contractor Development	$112,376	-	-	-	-	-	-	$112,376
Implementation Costs	-	$6,960	-	-	-	-	-	$6,960

Update Costs

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Average Annual Cost
In-House Update	-	-	$3,483	$3,597	$6,655	$3,836	$3,962	$4,307
Contractor Update	-	-	$9,627	$9,676	$9,726	$10,145	$10,198	$9,874
Committee Costs	-	-	$1,462	$1,510	$1,559	$1,610	$1,663	$1,561

Facility Calculated Benefits

	Average Annual Benefit
Construction Cost Benefits	$0
Maintenance Cost Benefits	$0
Operating Cost Benefits	$0

Total Benefit Calculation

Construction Costs	
Average Annual Construction Costs	
Percent Cost Savings	#DIV/0!
Expected Benefit	#DIV/0!

Maintenance/Operating Costs	
Average Annual Maintenance/Operating Costs	
Percent Cost Savings	#DIV/0!
Expected Benefit	#DIV/0!
Expected Annual Benefit	#DIV/0!

Cost/Benefit Ratio		
In-House Development & Update Ratio	#DIV/0!	$87,514
Complete Contractor Development & Update Ratio	#DIV/0!	$176,510

Facility Calculated Benefits

Facility Description

Name: Kwethluk K-12 School
District: Lower Kuskokwim
Climate Zone: 8
City: Kwethluk
Square Footage: 46,959
Construction Year: 2015

Facility Actual Costs Compared to Theoretical Costs with Standards

	Average Historic Facility Cost	Average Cost with Standards	Average Annual Benefit	Avg Benefit per SQFT	Percent Savings
Construction Benefits	$0	$0	$0	$0	#DIV/0!
Maintenance Benefits	$0	$0	$0	$0	#DIV/0!
Operating Benefits	$0	$0	$0	$0	#DIV/0!

Construction Benefits

Building System	Historic Construction Cost	Construction Cost with Standards	Expected Benefit
Site Work	**$0**	**$0**	**$0**
Site Prep			$0
Site Improvements			$0
Site Structures			$0
Site Utilities			$0
Substructure	**$0**	**$0**	**$0**
Superstructure	**$0**	**$0**	**$0**
Exterior Closure	**$0**	**$0**	**$0**
Exterior Walls			$0
Exterior Glazing			$0
Exterior Doors			$0
Roof Systems	**$0**	**$0**	**$0**
Interiors	**$0**	**$0**	**$0**
Partitions			$0
Doors			$0
Finishes			$0
Fixed Furnishings			$0
Conveyors	**$0**	**$0**	**$0**
Mechanical systems	**$0**	**$0**	**$0**
Plumbing			$0
HVAC			$0
Fire Protection			$0
Special Mechanical			$0
Electrical systems	**$0**	**$0**	**$0**
Service/Distribution			$0
Lighting			$0
Power			$0
Special Systems			$0
Total	$0	$0	$0

Maintenance Benefits

Building System	Average Annual Historic Maint. Cost	Average Annual Cost with Standards	Expected Benefit
Site Work	**$0**	**$0**	**$0**
Site Prep			$0
Site Improvements			$0
Site Structures			$0
Site Utilities			$0
Exterior Closure	**$0**	**$0**	**$0**
Exterior Walls			$0
Exterior Glazing			$0
Exterior Doors			$0
Roof Systems	**$0**	**$0**	**$0**
Interiors	**$0**	**$0**	**$0**
Partitions			$0
Doors			$0
Finishes			$0
Fixed Furnishings			$0
Conveyors	**$0**	**$0**	**$0**
Mechanical systems	**$0**	**$0**	**$0**
Plumbing			$0
HVAC			$0
Fire Protection			$0
Special Mechanical			$0
Electrical systems	**$0**	**$0**	**$0**
Service/Distribution			$0
Lighting			$0
Power			$0
Special Systems			$0
Total	$0	$0	$0

Operating Benefits

Utility System	Average Annual Historic Facility Cost	Average Annual Cost with Standards	Expected Benefit
Utilities	**$0**	**$0**	**$0**
Heating Fuel			$0
Electricity			$0
Water and Sewer			$0
Solid Waste/Refuse			$0
Other	**$0**	**$0**	**$0**
Custodial			$0
Grounds			$0
Insurance			$0
Lease			$0
Total	$0	$0	$0

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

Commissioning

SUBCOMMITTEE REPORT

July 8, 2019

Mission Statement

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.

Current Members

Randall Williams PE, PDC Engineers, Chair
William Glumac, UIC Construction
Wayne Marquis, DEED

Industry Partners

Craig Fredeen, Cold Climate Engineering
JaDee Moncur, Support Services of Alaska

Status Update

Recommendations from 2017 Report to the Legislature:

1) *Set standards for which projects require/receive commissioning.*

   Status: Completed; regulations approved for issuance by Lt. Governor.

2) *Set standards for commissioning agents.*

   Status: In Progress. Meeting held July 8, partial re-start of Subcommittee tasks. Anticipate meeting in August to validate list of approved credentialing organizations for review by full committee at next meeting.

   Below are excerpts from two nationwide guide spec templates regarding Commissioning (Cx) Certification. MasterSpec focuses on the qualifications of the individual, while Uniform Facility Guide Specification (UFGS) has options for both Firm level and Individual level certification.

   The regulation 4 AAC 31.900 (32) defines commissioning agent as "an individual who is certified with a recognized standards organization approved by the department". Therefore, we should focus on the Individual certifications. Those certifications in **bold** are in both guide specs and could be considered endorsed for approval by the department. The others should be discussed further in subcommittee.

(MasterSpec Section 019113 General Commissioning Requirements):

1. Certification of commissioning-process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.

   a. Certified Commissioning Professional, by Building Commissioning Association.
   b. Commissioning-Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
   c. Accredited Commissioning-Process Authority Professional, by University of Wisconsin.
   d. Accredited Commissioning-Process Manager, by University of Wisconsin.
   e. Accredited Green Commissioning-Process Provider, by University of Wisconsin.

(UFGS 01 91 00.15.10 Total Building Commissioning):

1.8 COMMISSIONING FIRM:

Provide a Commissioning Firm that is certified in commissioning by one of the following:

1. the AABC Commissioning Group (ACG);
2. the National Environmental Balancing Bureau (NEBB);
3. the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB),
4. the Building Commissioning Association (BCA);
5. the Association of Energy Engineers (AEE).
6. [The Commissioning Firm may employ a commissioning professional certified by the University of Wisconsin-Madison or the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) as required in paragraph LEAD COMMISSIONING SPECIALIST as an alternative to certification of the Commissioning Firm.]

The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning.

1.8.1 LEAD COMMISSIONING SPECIALIST

The Commissioning Firm must provide a Lead Commissioning Specialist (CxC) that has a minimum of five years of commissioning experience, including two projects of similar size and complexity, and that is one of the following:

1. a NEBB qualified Systems Commissioning Administrator (SCA);
2. ACG Certified Commissioning Authority (CxA);
3. ICB/TABB Certified Commissioning Supervisor;
4. **BCA Certified Commissioning Professional (CCP);**

5. AEE Certified Building Commissioning Professional (CBCP);
6. University of Wisconsin-Madison Qualified Commissioning Process Provider (QCxP);
7. **<u>ASHRAE Commissioning Process Management Professional (CPMP).</u>**

3) *Develop system-specific commissioning criteria for use in scope of services.*

Task 1: Develop outline-level standards; get BR&GR approval.

Status: Presented to committee 12/4/17 with "envelope" criteria in draft. Subcommittee to finalize all and present to BR&GR.

Task 2: Conduct an independent feasibility and cost/benefit analysis of creating comprehensive commissioning standards for Alaska school projects.

Status: Currently not funded. Subcommittee could meet to develop a study scope as directed.

Task 3: Review analysis and publish a handbook or regulations as recommended.

Status: Pending.

Schedule

No subcommittee meetings currently scheduled.
Tentative plan to meet in August.

State of Alaska **Department of Education & Early Development**
Bond Reimbursement & Grant Review Committee

School Space

S U B C O M M I T T E E R E P O R T

July 8, 2019

Mission Statement

[DRAFT] Review accuracy and adequacy issues relative to the state's space allocation guidelines and recommend updates that support the board of education's mission and vision for Alaska public education.

Current Members

Dale Smythe, Chair
Jim Estes
Don Hiley
David Kingsland
Larry Morris, Jr., DEED

Status Update

Accuracy issues include:

1) Possible formula anomaly in mid-population K-12 scenarios,
2) Precedent and interpretation variations based on terminology and practice.

Adequacy issues include, among others:

1) Net vs gross space,
2) Electrical/mechanical space,
3) Storage in remote areas, and
4) Identify unintended consequences/cost of current regulation.

Schedule

No subcommittee meetings have been held to date, members have met informally to discuss potential timing and agreed to wait until early August prior to and as preparation before the A4LE meeting.

The Alaska Chapter A4LE is targeting a space workshop in late August, 2019.

Department of Education & Early Development
Division of Finance & Support Services/Facilities

Work Topics for the BR & GR Committee

As Of: July 18, 2019

BR&GR 2019-2020 Work Items	Responsibility	Due Date
1. CIP Grant Priority Review – [(b)(1)]		
1.1. FY20 MM & SC Grant Fund Final Lists (4 AAC 31.022(a)(2)(B))	Committee	Mar 2020
1.2. FY20 MM & SC Grant Fund Initial List	Committee	Dec 2019
2. Grant & Debt Reimbursement Project Recommendations – [(b)(2)]		
2.1. Six-year Capital Plan (14.11.013(a)(1); 4 AAC 31.022(2))	Dept	Annually, Nov
3. Construction Standards for Cost-effective Construction – [(b)(3)]		
3.1. Model School Costs (DEED Cost Model)		
3.1.1. Geographic Cost Adjustments		Aug 18-Jul 19
3.1.1.1. Prepare Statement Of Services (complete)	Dept	Sep 2018
3.1.1.2. Solicit, Award And Manage Contract (complete)	Dept	Dec 2018
3.1.1.3. Review Public Comment (complete)	Dept	Feb 2019
~~3.1.1.3.~~3.1.1.4. Finalize to Incorporate Comments	Dept	Jul 2019
3.1.2. Cost Model Enhancements (site work + MM items)		Oct 18-Jun 19
3.1.2.1. Prepare Statement Of Services (complete)	Subcommittee	Oct 2018
3.1.2.2. Solicit, Award, Manage Contract (complete)	Dept	Jun 2019
3.1.3. Model School Analysis & Updates (Allowable Elements)		Apr-May 19
3.1.3.1. Establish Procedures For Updating The Model School	Subcommittee	Jun 2019
3.1.3.2. Implement Model School Updates W/Committee Resource	Committee	Apr 2019
3.1.3.3. Evaluate Success Of Committee-Driven Updates	Subcommittee	Jun 2019
3.1.3.4. Develop Statement Of Services For Consultant Update	Subcommittee	Aug 2019
3.1.3.5. Solicit, Award, And Manage Model School Update	Dept	Apr 2020
3.2. Cost Standards		
3.2.1. Cost Model As Cost Control Tool		May 18-Dec 20
3.2.1.1. Analyze, Recommend Cost Model As Cost Control	Subcommittee	Jul 2019
3.2.1.2. Draft Regulation Language For Cost Control Use	Subcommittee	Jan 2020
3.2.1.3. Review Draft Reg Language, Recommend To State Board	Commmittee	Mar 2020
3.2.1.4. Manage Regulation Development And Implementation	Dept	Dec 2020
~~3.2.1.~~3.2.2. Cost/Benefit, Cost Effectiveness Guidelines	Dept	TBD
~~3.2.2.~~3.2.3. Life Cycle Cost Guidelines	Dept	TBD
3.3. Commissioning	Committee	2018
3.3.1. Project Categories Requiring Commissioning	Committee	2018
3.3.1.1. SBOE Action on Regulation (complete)	Dept	Feb 2019
3.3.2. Commissioning Agent Qualifications	Committee	Jul 2018
3.3.2.1. SBOE Action on Regulation	Dept	Feb 2019
3.3.2.2. Recommend Approved Credentialing Organizations	Subcommittee	~~May~~ Jul 2019
3.3.2.3. Propose Approved Credential Organizations	Committee	~~Jul~~ Sep2019
3.3.3. System Requirements for Commissioning (complete)	Committee	2018
3.3.3.1. SBOE Action on Regulation (complete)	Dept	Feb 2019
3.4. Model School Building Systems Standards		
3.4.1. State Building Systems Standards		Mar 19- Dec 20
3.4.1.1. Complete CostFormat Outline of System Standards	Dept	May 2019
3.4.1.2. Review Outline Model School System Standards	Committee	May 2019
3.4.1.3. Develop Services For Feasibility Analysis (complete)	Subcommittee	~~Apr~~ May 2019
3.4.1.4. Solicit, Award, Manage Feasibility & Cost/Benefit Analysis	Dept	~~May~~ Jun 2019
3.4.1.5. Review Feasibility Report On Comprehensive Standards	Subcommittee	Jul 19-Sep 19
3.4.1.6. Recommendation on Standards Development	Subcommittee	Sep 2019
3.4.1.7. Solicit, Award, Manage Final Standards Development	Dept	Jun 2020
3.4.1.8. Implement System Standards Via Regulation As Needed	Dept	Dec 2020
3.4.1.9. Coordinate with A4LE to maintain model school standards	Biennially	
3.4.2. School District Building Systems	Dept	TBD

BR&GR 2018-2019 Work Items	Responsibility	Due Date
3.5. Design Ratios		
3.5.1. Climate Zones		Aug-Nov 18
3.5.1.1. Confirm Availability of BEES for use in Design Ratios	Subcommittee	Aug 2018
3.5.1.2. Compare use of BEES vs. ASHRAE; are regs needed	Subcommittee	Sep 2018
3.5.1.3. Recommend Regulation To State Board	Committee	Jun 2019
3.5.1.4. Manage Regulation Development And Implementation	Dept	Dec 2019
3.5.2. Baseline Design Ratios [(O:EW), (FPA:GSF), (V:NSF), and (V:ES)]		Sep 18-Jun 20
3.5.2.1. Prepare Statement Of Services For Energy Modeling	Subcommittee	Jan 2019
3.5.2.2. Compare Existing School Ratios And Energy Use	Subcommittee	Jan 2019
3.5.2.3. Solicit, Award, Manage Energy/Cost Analysis	Dept	Jun 2019
3.5.2.4. Recommendations on Ratios	Subcommittee	Jun19-Sep19
3.5.2.5. Manage Regulation Development And Implementation	Dept	Dec 19-Jun 20
4. Prototypical Design Analysis – [(b)(4)]		
4.1. Seek Peer Consensus on Reuse of School Plans and Systems		
4.1.1. Develop and Schedule AEC Peer Workshop on Reuse	Committee	TBD
4.1.2. Update Aug 4, 2004 Committee Position Paper	Committee	TBD
4.2. Develop CIP Application Response to Reuse of School Plans/Systems		
4.2.1. Draft Criteria to Reward Reuse of School Plans/Systems	Dept	Feb 2019
Approve Criteria to Reward Reuse of School Plans/Systems	Committee	Apr 2019
4.2.2. Draft Criteria to Evaluate Reuse of School Plans/Systems	Dept	Feb 2019
Approve Criteria to Evaluate Reuse of School Plans/Systems	Committee	Apr 2019
4.2.3. Draft Criteria to Require Reuse of School Plans/Systems	Dept	Feb 2019
Draft Criteria to Require Reuse of School Plans/Systems	Committee	Apr 2019
4.3. Codify Regulations As Needed for Reuse of Plans/Systems Policy		
4.3.1. Make Recommendations to State Board on Prototypes	Committee	July 2019
4.3.2. Manage Regulation Development and Implementation	Dept	Sep 2019
5. CIP Grant Application & Ranking – [(b)(5) & (6)]		
5.1. FY21 CIP Draft Application & Instructions	Dept	Apr 2019
5.1.1. Facility Condition Survey Minimum Standards	Dept	Dec 2019
5.1.2. Reuse of School Plans (See item 4.2)		
5.1.3. Emergency Rater Scoring Matrix	Dept	TBD
5.1.4. Priority Weighting Factors Review	Dept	TBD
5.2. FY21 CIP Final Application & Instructions	Committee	Apr 2019
5.3. FY21 CIP Briefing – Issues and Clarifications	Dept	Dec 2019
6. CIP Approval Process Recommendations – [(b)(7)]		
6.1. Publication Updates		
6.1.1. Program Demand Cost Model for Alaskan Schools	Dept	Annually, May
6.1.2. Alaska School Facilities Preventive Maintenance Handbook Final	Dept	Jun 2019
Alaska School Facilities Preventive Maintenance Handbook Final	Committee	Dec 2019
6.1.3. Swimming Pool Guidelines - Initial	Dept	Dec 2018
Swimming Pool Guidelines - Final	Committee	Jun 2019
6.1.4. Handbook to Writing Educational Specifications- Initial	Dept	Feb 2019
Handbook to Writing Educational Specifications - Final	Committee	Jun 2019
6.1.5. Guide for School Facility Condition Surveys - Initial	Dept	Aug 2019
Guide for School Facility Condition Surveys - Final	Committee	Dec 2019
6.2. New Publications		
6.3. Regulations		
6.3.1. Cost Model as Cost Control Tool (see item 3.1.3)	Dept (w/Cmte)	
6.3.1.1. Draft Regulation	Dept (w/Cmte)	Jun 2019
6.3.1.2. SBOE Public Comment on Regulation	Dept	Sep 2019
6.3.1.3. Review Public Comments from SBOE Comment Period	Committee	Nov 2019
6.4. Baseline Design Ratios (see item 3.5.2.4)	Dept (w/Cmte)	
6.4.1.1. Draft Regulation	Dept (w/Cmte)	Sep 2019
6.4.1.2. SBOE Public Comment on Regulation	Dept	Dec 2019
6.4.1.3. Review Public Comments from SBOE Comment Period	Committee	Jan 2020

BR&GR 2018-2019 Work Items	Responsibility	Due Date
6.4.2. Reuse of School Plans and Systems (see item 4.3)	Dept (w/Cmte)	
6.4.2.1. Draft Regulation	Dept (w/Cmte)	Sep 2020
6.4.2.2. SBOE Public Comment on Regulation	Dept	Dec 2020
6.4.2.3. Review Public Comments from SBOE Comment Period	Committee	Jan 2021
7. Energy Efficiency Standards – [(b)(8)]		
7.1. ASHRAE 90.1		
7.1.1. DEED Checklist		Jan – Jun 19
7.1.1.1. Develop DEED Specific Review Checklist	Dept	Apr 2019
7.1.1.2. Review Checklist for Public Comment	Committee	Apr 2019
7.1.1.3. Review Public Comment/Finalize Checklist	Dept (w/Cmte)	Sep 2019
7.1.1.4. Add Appendix to Project Admin Handbook?	Dept	Sep 2019
7.1.2. Standards Updates		
7.1.2.1. Evaluate ASHRAE 90.1-2013 for adoption	Dept	Jul 2019
7.1.2.2. Draft Regulations, if warranted	Dept (w/Cmte)	Sep 2019
7.1.2.3. Review Public Comment from SBOE Comment Period	Committee	Jan 2020

Projected Meeting Dates

April 16-17, 2019 (Juneau), CIP Application
July 18, 2019 (Teleconference), 2:00 – 4:00p
September 5, 2019 (Teleconference), 2:00 – 4:00p
December 4, 2019 (Anchorage-TBD), Full day, CIP