

A Report on the Benefits and Disadvantages of Prototypical School Design and Construction in Alaska



Prepared for the

Alaska State Legislature

through

The Alaska Department of Education &
Early Development

October, 2015



Introduction

Purpose of the Study:

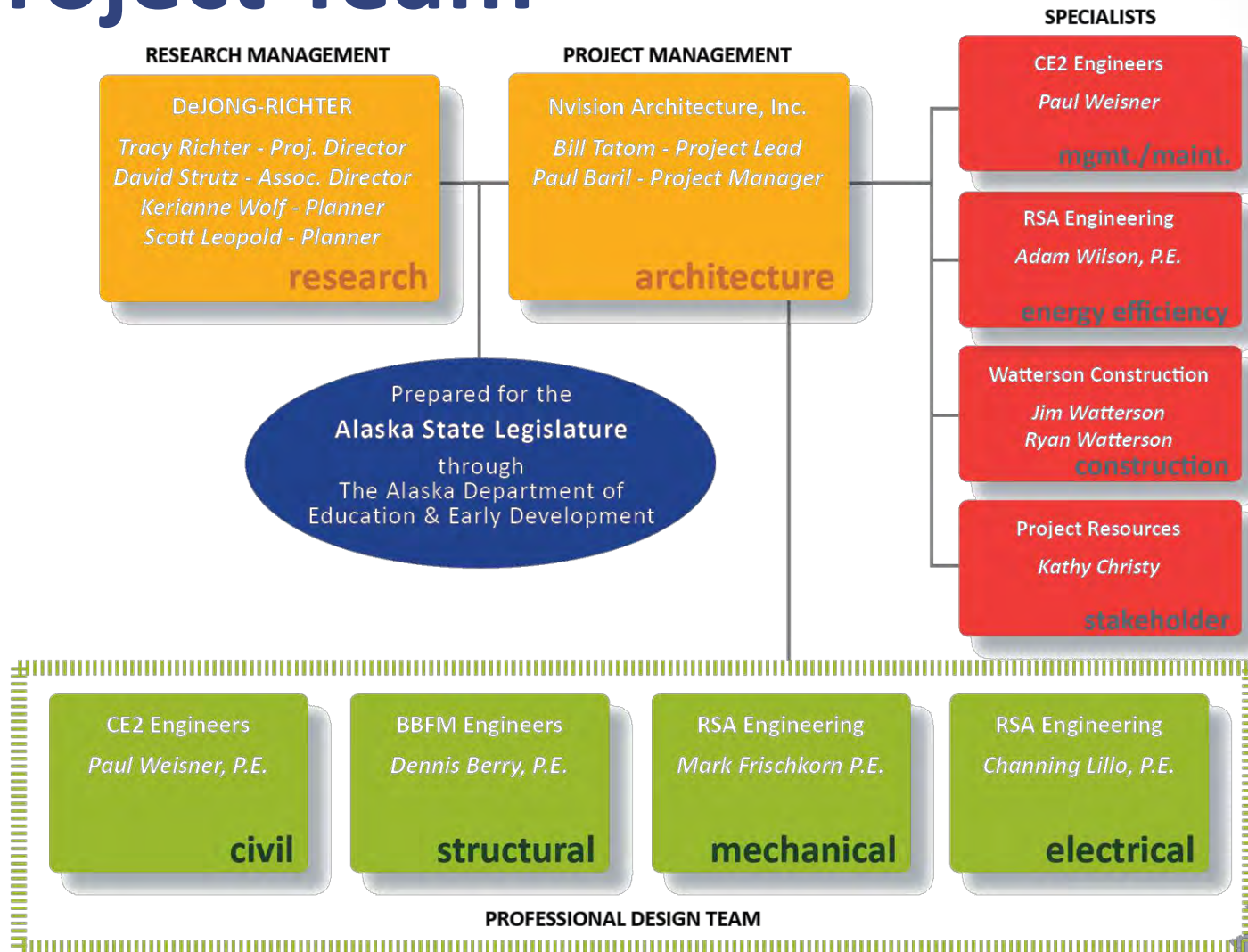
HB 278 Sec. 53

School Design and Construction Report

- The Department of Education And Early Development shall prepare and submit a report to the legislature on the benefits and disadvantages of using prototypical designs for school construction in both the railbelt and rural areas of the state.



Project Team



Presentation Outline

Today's Presentation:

- Overview of the Study
- Review of Existing Research
- Statewide Data Gathering
- District Profiles and Site Visits
- Urban vs. Rural School Development
- Component Prototyping
- Conclusions



Overview of the Study

Methodology/Report Objectives:

- **Objective #1:** Conduct research at a national level to examine the successes and failures of prototypical school design and construction as a basis from which to start research at a local/state level.
- **Objective #2:** Gain a comprehensive understanding of Alaska's diversity with respect to culture, geography & climate and how these diversities influence school design and construction overall and in particular prototypical school design and construction.
- **Objective #3:** Reach out to various people groups of Alaska to gather first hand information related to their experiences in the utilization of prototypical design and construction in local schools.
- **Objective #4:** Create a well researched & documented report for presentation to the Alaska State Legislature that informs the body of the Benefits and Disadvantages of Prototypical School Design and Construction in Alaska.



Review of Existing Research

Summary of Existing National Research:

- No significant research available on the topic of facility prototypes for schools at any statewide level
- The most pertinent and report reviewed was a national research study sponsored by CEFPI which summarized prior studies conducted by other State DED's
- Summarized conclusions of these studies were useful in establishing context and understanding national & statewide trends



Review of Existing Research

Summary of Existing National Research:

- **National Study concluded:**
 1. State-run prototype school design programs are not practical and will not result in cost savings
 2. Prototype school design programs in large school districts where there are ample resources can ultimately result in significant savings in time and cost when a large number of school buildings are being built within a short time frame
 3. Documentation of cost savings related to the use of prototypes is lacking
 4. A “Kit of Parts” approach to prototype school design has been used successfully



Review of Existing Research

Summary of Existing Alaska Research:

- **The State of Alaska has previously inquired into facility prototyping several times**
 1. 1978 – State of Alaska Rural Prototype Analysis
 2. 1997 – The Prototypical/Standard Plan Dilemma
 3. 1998 – A Report to the Legislature, Legislative Resolve No. 55., Use of Prototype Designs in Public School Construction Projects
 4. BRGR Brief “Alaska Educational Facilities Prototypical Brief”
- **Overall, Alaska-specific literature on prototype schools is similar to national research**



Review of Existing Research

Existing Research Takeaways:

- Background research provided the Nvision research team a simple and concise framework for understanding the benefits and challenges of prototypical design strategies
- No record of any viable statewide prototypical school design and construction programs were found



Review of Existing Research

Existing Research Takeaways:

- **Research found four common variables that predict the viability of prototypical programs**
 1. **Growth** – is imperative because prototypes by definition are designed to be repeated
 2. **Enrollment Size** – is important because low enrollment areas are unlikely to need multiple reproductions of a design even in periods of significant population growth
 3. **Homogeneity** – is crucial because a standard design cannot be created for a group of users with diverse needs
 4. **Time** – is a challenge for prototyping because of changes to user needs and updated technologies/education delivery.



Review of Existing Research

Existing Research Takeaways:

- Diversity in geology, culture, climate, population and educational needs impact the viability of prototypical strategies across the country
- Since Alaska's environment, population, and educational needs are equally or potentially more diverse than the rest of the country, it can be anticipated similar challenges to implementing prototype programs will be experienced



Statewide Data Gathering

Request for Information:

- An RFI was distributed to all districts to collect quantitative data for analysis
- Purpose of RFI was to gain comprehensive understanding of districts' perceptions of design development variables
- The RFI was developed by the Nvision multi-disciplinary project team



Statewide Data Gathering

Request for Information Results:

- 33 districts responded to the RFI
- 8 districts reported that they previously used prototype schools
- Districts w/ significant student growth expressed interest in prototyping, while districts with low-to-moderate growth didn't
- District provided data regarding variable design influences specific to them

(Energy Source, Electrical, Water/Plumbing, Foundations Systems, Construction, and Alternative Energy)



Statewide Data Gathering

Request for Information Takeaways:

- Background research was confirmed: rapid growth in enrollments is necessary for prototypical programs to be economically viable
- As identified in background research, prototypes achieved success when district homogeneity, size and growth factors favorably aligned



Statewide Data Gathering

Request for Information Takeaways:

- RFI results suggested there were enough similarities in the conditions affecting utilities and construction to explore the viability of regionalized component prototyping
- Any prototyping program will need to limit diverse design challenges while generating a product that is repeated over a short period of time with little to no modification



Statewide Data Gathering

Regional Conferences:

- 7 Regions across AK
- Period of 2 weeks
- Each conference consisted of two events: site visits of schools and a public presentation and discussion
- Questionnaires were answered by target groups (District Personnel, Design Community, & Citizens)



REGIONAL CONFERENCE

The Department of Education and Early Development (DEED), along with Nvision Architecture and DeJONG-RICHTER, are hosting Regional Conferences to study the:

Benefits and Disadvantages of Prototypical School Design and Construction in Alaska

Barrow When: Monday, March 9 Where: Ipalook Elementary School, Room B142 Time: 3:00 - 6:00 p.m.	Fairbanks When: Tuesday, March 10 Where: Pikes Waterfront Lodge, Binkley Room Time: 4:00 - 7:00 p.m.
Bethel When: Thursday, March 12 Where: LKSD Boardroom - District Office Time: 4:00 - 7:00 p.m.	Kodiak When: Friday, March 13 Where: Kodiak High School Auditorium Drama Pod Time: 4:00 - 7:00 p.m.
Juneau When: Monday, March 30 Where: Thunder Mountain High School Time: 3:00 - 6:00 p.m.	Mat-Su Borough When: Tuesday, March 31 Where: Valley Pathway School Time: 4:00 - 7:00 p.m.
Anchorage When: Wednesday, April 1 Where: Anchorage School District Education Center 5530 E. Northern Lights Blvd. Time: 4:00 - 7:00 p.m.	

The Regional Conferences are designed to communicate with and gather local perspectives from community members, educators, facility managers and the professional design and construction industry as the basis for research within the State of Alaska. Each Regional Conference will feature the following:

- Presentation of National Research by DeJONG-RICHTER, a nationally recognized educational facility planning firm
- Questionnaires will be completed by everyone in attendance
- Interactive discussion and comments
- Public opportunity to have a voice in the research process



RSVP Preferred but not Required

RSVP to: admin@nvisionarch.com (please indicate conference location). Discussion will revolve around the Benefits and Disadvantages of Prototypical Facility Design and Prototypical Component/System Design by taking an intensive look at both the diversities and commonalities inherent within the State. For further information please visit our website at www.akprototypeschoolstudy.com. Your knowledge and opinion is valued, so please come to this event and join in the discussion.



Statewide Data Gathering

Statewide Conference:

- Hosted in Anchorage (centralized hub)
- Intended for District Personnel/Stakeholders statewide
- Unfortunately attendance was minimal
- Follow-up teleconferences conducted



STATEWIDE CONFERENCE

The Department of Education and Early Development (DEED), along with Nvision Architecture and DeJONG-RICHTER, are hosting a Statewide Conference to study:

The Benefits and Disadvantages of Prototypical School Design and Construction in Alaska

Anchorage

Date: Friday, April 3, 2015
Location: Anchorage Community Development
Change Point - Denali Room
6689 Changepoint Drive
Time: 8:00 a.m. - 12:00 p.m.

The Statewide Conference is designed to communicate with and gather local perspectives from the educational community exclusively. With the Regional Conferences complete, the Statewide Conference will be an indepth examination of the findings on a more intensive level with education professionals and facility operators. The research team will engage the audience through a work session that will involve discussion and analysis of both the national and statewide research results. This will be an excellent opportunity to further refine and shape the prototype study. The Statewide Conference being held in Anchorage provides you a second chance to let your voice be heard. With Anchorage being the hub of essentially all major commercial travel in the State, it has been chosen as the best location to hold this important conference. The Statewide Conference will feature the following events:

- Presentation of National Research by DeJONG-RICHTER, a nationally recognized educational facility planning firm
- Presentation of preliminary findings from Regional Conferences
- Focused questionnaires will be completed by everyone in attendance
- Interactive discussion and comments with education professionals
- Opportunity to have a voice in the research process



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District Profiles and Site Visits

North Slope Borough School District:

- Responsible for 12 schools
- Student population is currently stable
- NSBSD has never developed or utilized a prototypical school
- Building systems unique to Arctic conditions
- NSBSD was interested in the concept of prototypical system/components



District Profiles and Site Visits

Fairbanks North Star Borough School District:

- Responsible for 30 schools
- Student population is relatively flat and trending to a slight decline, though population does occasionally shift
- FNSBSD has 7 prototypical schools identified
- No obvious differences in building systems compared to many schools across the state
- FNSBSD indicated the use of prototypes has been successful and would continue use



District Profiles and Site Visits

Mat-Su Borough School District:

- Responsible for 37 schools
- Unique to all other districts, MSBSD student population is increasing
- Steady growth in student population since 1980's has resulted in a need to bring multiple schools online in a short period of time
- MSBSD identified 16 of their schools as prototypical schools

(5 of these schools were developed under a “basis of design” model vs. a traditional prototypical model)



District Profiles and Site Visits

Mat-Su Borough School District:

- MSBSD desires a strong independent voice for each community/school, “basis of design” allows for this.
- MSBSD indicated the use of prototypes has been successful and more so the use of the “basis of design” model is anticipated to be continually used
- MSBSD reported a desire to standardize as many systems and components as practical



District Profiles and Site Visits

Anchorage School District:

- **Responsible for more than 87 schools**
(By far the largest District in the State)
- **ASD student population is in slight decline**
- **ASD identified 18 of their schools as prototypical schools**

(These prototypes were developed from three different floor plans, and further investigation revealed that there were at least two other prototype plans.)

- **The district has also utilized prototype components like gymnasiums and MPR's**



District Profiles and Site Visits

Anchorage School District:

- Desires to create uniform community schools. District Wide Ed Specs have been developed for Elementary, Middle School, & High School programs
- ASD indicated they would strongly consider utilizing prototype plans in the future, given the success from the past
- ASD is also an advocate for component prototyping



District Profiles and Site Visits

Lower Kuskokwim School District:

- Responsible for 28 schools
- Student population seems to be experiencing a modest increase
- The district does not have a set of building standards, but develops individual Ed Specs for each school
- LKSD identified 8 of their schools as prototypical schools, w/ perceived success of the prototypes being mixed



District Profiles and Site Visits

Lower Kuskokwim School District:

- Diversity of sites & needs in the LKSD will be a chief concern in determining the viability of future prototype use
- LKSD expressed a very strong desire for component prototyping



District Profiles and Site Visits

Kodiak Island Borough School District:

- Responsible for 14 schools
- Overall the student population is stable, but dependent on the U.S. Coast Guard since a lot of their students come from USCG families
- KIBSD identified 3 village schools were constructed in the 70's as prototypes
- KIBSD was interested in standardized components primarily from an O&M perspective



District Profiles and Site Visits

Juneau School District:

- Responsible for 11 schools
- Overall student population is level and is anticipated to remain so in the future
- JSD develops Ed Specs on a per school basis and not district wide
- JSD identified 1 prototype school in their district – designed originally for South Central
- JSD confirmed the potential usefulness for component standardization



District Profiles and Site Visits

District Profiles Summary:

- Districts have unique and individual approaches to prototype development and implementation. Each believes its approach works best for them
- District philosophies toward educational program delivery models affect perception of how useful a prototype will be



District Profiles and Site Visits

District Profiles Summary:

- **Community involvement in the planning process may increase the likelihood that a prototype design will evolve and require modifications**
- **Historically, prototype designs have been modified to meet evolving needs. Adapted prototypes are considered to be both useful and effective**



District Profiles and Site Visits

District Profiles Summary:

- **Prototypical school designs that are constructed, evaluated, refined, and modified in response to evaluation and refinement of earlier designs have a greater success rate and generally provide greater return on investment**
- **There can be modest to reasonable savings on design fees. The more a design is repeated, the greater the savings can be**



District Profiles and Site Visits

District Profiles Summary:

- Repeated construction of prototypical designs tends to reduce risk which may reduce project construction cost
- High diversity in site configuration, geological characteristics, and climate discourage the usefulness of repeating a prototypical design. The more diversity a district has in project sites, the less likely a prototype will be an advantage



District Profiles and Site Visits

District Profiles Summary:

- District growth in student population and high demand for immediate relief in additional classroom space supports the use of prototypical design solutions
- Prototypical schools are perceived by the public as being a good use of public funds.



District Profiles and Site Visits

District Profiles Summary:

- Districts reported no difference between a prototypical design and a non-prototypical design when it comes to the effectiveness of education delivery
- Similar program requirements support use of a prototypical school design whereas diversity in program requirements discourages effective prototypical use



District Profiles and Site Visits

District Profiles Summary:

- Elementary school program requirements are generally the same, which may endorse the use of prototypical design
- Middle and high schools have more diverse program requirements, which tends to discourage prototype use



District Profiles and Site Visits

Key Takeaways From Facility Site Visits:

- **Design Adaptation**

Prototypical schools are typically not designed to be site specific, adaptation of the site or the prototype plan is required to create a workable solution

- **District Growth**

With the exception of MSBSD and to a modest extent LKSD, districts interviewed either had stable or declining student populations

- **Education Specification Development**

Every district interviewed, Ed Spec development on a per school basis took place to some level. ASD and MSBSD were the only ones with district wide Ed Specs



District Profiles and Site Visits

Key Takeaways From Facility Site Visits:

- **Facility Prototype Use**

Of the 7 districts visited, six (all but NSBSD) had used prototypical schools in the past as a means to satisfy demands of student population growth and/or need

- **Long-Term O&M Costs**

It was the unanimous opinion of the facilities staff & design/engineering professionals encountered at the regional conferences that long-term O&M savings would exceed upfront costs from any facility or component prototyping venture

- **Use of Program Components**

Rural districts indicated that commonly used program components (like gymnasiums and kitchens) could be viable for prototype design



Urban vs. Rural School Dvlpmt.

Urban vs. Rural Summary:

- The urban vs. rural factor provides a lot of diversity which increases the potential that a prototype school would be unsuccessful
- Site visits were intentionally scheduled to visit a mix of urban and rural communities
- The urban vs. rural factor affects
 1. Design Approach
 2. Student Populations
 3. Program/Functionality
 4. Building Construction/Material Procurement
 5. Construction Labor and Equipment
 6. Operations and Maintenance



Urban vs. Rural School Dvlpmt.

Urban vs. Rural Summary:

- **Communities/districts utilizing prototype designs were typically larger districts that have greater population bases, since rural communities are typically smaller, prototypes tend to be impractical**
- **Communities/districts that utilized prototype design typically did so in response to rapid population growth and its impact on classrooms needed to maintain desired student-teacher ratios**



Urban vs. Rural School Dvlpmt.

Urban vs. Rural Summary:

- Rural communities with significant geographical diversity typically do not utilize prototype designs
- Communities/districts that have significant differences in school size requirements as a result of isolated student populations are less likely to have success with a prototype

(Individual rural community schools tend to vary in size more than schools in urban districts. Large urban districts may have the ability to modify school enrollments by shifting boundary lines making homogeneous school sizing a possibility)



Component Prototyping

Overview:

- Existing research precluded no prior documentation related to the use of prototypical components existed, so the team utilized its own depth of professional experience to create a resource document (Chapter 5) to help explore the benefits and disadvantages of prototype components specific to Alaska
- This analysis is broken down by engineering **type** (i.e. Civil, Structural, Mechanical & Electrical)



Component Prototyping

Overview:

- Design, selection, and implementation of component systems is greatly affected by Alaska's diverse climate, geography, geology, and other diversity factors.



Legend



Component Prototyping

Civil Engineering:

- Civil systems in Alaska are greatly influenced by climate, soil conditions, site conditions, and the difficulty & cost of bringing services such as water/sewer to remote locations
- Beyond Alaska as a whole, there can also be a wide range of diversities affecting civil systems within a region or school district
- Rural communities located off the road system have unique construction challenges which impact civil systems greatly



Component Prototyping

Structural Engineering:

- Structural systems in Alaska are highly influenced by design variables such as climate, soil conditions, site topography, available materials, and overall building size
- With huge diversities across Alaska, structural design becomes a highly individualized and site-specific effort
- Diversities present unique challenges to prototype design, but doesn't preclude prototype methodology altogether



Component Prototyping

Mechanical Engineering:

- Mechanical systems in Alaska are highly influenced by climate, available energy sources, building size, construction method, water supply, and availability of properly trained and skilled O&M personnel
- Each region of the state has a variety of differences in all these factors
- Within similar climate regions there is some opportunity to reduce variability in mechanical systems for prototyping



Component Prototyping

Electrical Engineering:

- Electrical systems in Alaska are not affected nearly as much by diverse locations as they are by the other engineering systems
- Once electricity enters a building it is no different than any other and the electrical systems are broken down into power systems, lighting, and special systems
- Prototyping electrical systems will be challenged by continued rapid advances in electrical technology



Conclusions

Facility Prototyping:

Benefits

- At the district level only, there is potential for economic savings both in short term capital gains and in long-term operational and maintenance efficiencies when initial designs are well-thought-out, tested by construction, evaluated, and modified as may be necessary to minimize deficiencies.
- Growth in district student population can be efficiently and quickly accommodated through the design, development, and construction of prototype schools.
- Prototype schools promote districtwide uniformity or equity within the physical environment of the school facility itself.



Conclusions

Facility Prototyping:

Benefits

- **Prototype schools contribute to efficiencies in maintenance staff training and operational understanding of equipment and systems leading to greater energy efficiency.**
- **There is no discernible or measurable difference in the delivery of education making it any more or less desirable than a non-prototypical school.**



Conclusions

Facility Prototyping:

Disadvantages

- Most districts are currently experiencing static or declining student enrollments. The need for new school construction related to increased student enrollments is thereby diminished.
- Most districts have significant diversity in geologic/soil conditions, topography, climate, community populations, and energy sources (conventional or alternative). Diversity adversely influences the utilization of prototype designs.
- Districts generally encourage community involvement in the school planning process and invite personalization of schools, which in turn can lead to programmatic changes. The greater the public voice and involvement in the design process, the greater the chance of introducing changes within the design will negate the use of a prototype.



Conclusions

Facility Prototyping:

Disadvantages

- Differing educational programs for elementary, middle (junior high), high school, and K-12 schools, would require multiple prototypes solutions. (This does not preclude the value of prototyping for any one of the programs.)
- Districts with extreme diversity in design variables have the potential for creating inefficient over-designed schools.



Conclusions

Component Prototyping:

Benefits

- Standards for highly effective component systems could theoretically produce long-term savings for districts through the use of energy efficient components and creating O&M efficiencies.
- Increased efficiency in O&M staff training could theoretically result in optimal equipment performance, improved energy efficiencies, and operational cost reductions.
- Increased potential for economic advantage through quantity purchasing agreements may be achievable. Also, potential conveniences and repair efficiencies may be afforded in parts warehousing and supply.



Conclusions

Component Prototyping:

Benefits

- Component prototyping is currently encouraged and desired by many districts across the state.
- Potential for information sharing with other districts may be initiated. Equipment recommendations and maintenance techniques can be shared if regional application is considered appropriate.



Conclusions

Component Prototyping:

Disadvantages

- **Component systems would need to be identified by associated environmental requirements (and constraints), modified for a diverse range of facility sizes, and require multiples of the same system to be designed and constructed within a short timeframe to realize any theoretical cost savings. The probability of aligning these three factors into an economical prototypical program is unlikely.**
- **The rapid pace of component innovation would require near constant monitoring of available products to select components with the best performance, efficiencies, and cost.**



Conclusions

Component Prototyping:

Disadvantages

- With minimal growth currently projected for many district student enrollments, component prototype applications will most likely be related to retrofitting existing facilities in the foreseeable future. Replacement components must be compatible with existing systems in aging schools, potentially limiting any perceived effectiveness. Careful evaluation of existing systems across the district would be necessary prior to any decision to utilize a certain pre-selected system.
- Specific components have the potential to become proprietary and potentially reduce competition and increase cost through sole source procurements. (State regulations currently do not allow for sole source procurement; therefore, 4AAC31.080 would possibly need to be modified.)



Conclusions

Component Prototyping:

Disadvantages

- School facility size dictates appropriate component sizing. Various sized versions of the component prototype would need to be developed or modified for appropriate facility application.



Conclusions

Conclusion Summary:

- Across the nation, statewide facility prototyping was found to be impractical as a result of overwhelming diversities
- Alaska's own set of unique diversities only increase the probability of impracticality
- There is potential for success using prototypical school models at the individual district level when there is homogeneous school/enrollment size, and program requirements in combination w/growth



Conclusions

Conclusion Summary:

- **Statewide component prototyping is fundamentally challenged by the same factors as statewide facility prototyping**
- **When diversity is minimized and multiple schools/building systems are needed over a short period of time, prototypical design & construction is a feasible consideration**
- **Component prototyping at the district level and possibly the regional level demonstrates the greatest potential for viability**

