Building Climate-Resilient Schools

Considerations for building schools to last a lifetime.

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Through good architecture, solid engineering practices, and quality construction, new schools are expected to have life spans of more than 50 years.

In the not too distant past, school district building committees were preoccupied with site selection, grade configuration, and the project's cost to taxpayers. Recently, committee discussions have increasingly included topics such as adding photovoltaic panels and other energy-saving features to the buildings.

In 2017, the American Institute of Architects adopted a forceful policy regarding the construction of new buildings including schools: *"The AIA supports and empowers members to create sustainable, resilient and adaptable communities through the power of design"* (American Institute of Architects 2017).

Environmentalist Jared Bloom (2019) wrote, "Sustainability and resilience are two sides of the same coin. While sustainable design and construction seek to protect the environment from damage by building construction and operation, resilience seeks to protect the building and its operation from the environment."

As districts consider designing and building new schools, they work with state-licensed architects who are supported by the AIA to ensure they will be sustainable, resilient, and adaptable. Table 1 outlines design considerations for sustainable, resilient, and adaptable school buildings.

Resilience to Climate Stress

Early in the process, the district's building committee will retain a design group to conduct a feasibility study, examine site and construction options, and prepare a schematic design of the new school for the district's consideration. The design group will do a careful examination to identify potential site hazards, assess vulnerabilities, and analyze impacts.

Site surveys will include a study of the geological material properties on a proposed construction site to

Table 1. School Building Design Considerations

Sustainable *In minimizing negative environmental impact*	**Resilient** *For mitigating risk from hazards, shocks, and stresses*	**Adaptable** *To changing conditions and possible re-purpose*
• Constructing with efficiency and moderation within the ecosystem	• Anticipating, preparing for, and responding to disturbances related to climate	• Coping with natural and human health events, i.e., pandemics
• Using renewable energy systems for heating and cooling	• Exploring multiple site locations using geotechnical and geo-environmental surveys	• Acknowledging current design may not be effective in solving future problems
• Achieving carbon neutral performance	• Implementing redundancy in building systems for backup	• Recognizing that some standards and techniques may be obsolete with the advent of climate change
• Preserving natural resources and water conservation	• Offering student social and emotional support	• Providing for increased building safety and security

allow design and construction of a stable structure that does not settle, deform, or crack. The shell of the building, including the steel superstructure, roofing, exterior walls, windows, and doors, must be resistant to environmental stressors such as wind, fire, and floodwaters.

On the interior, considerations include air quality, sound levels, illumination, and overcrowding.

State building codes and the *International Green Construction Code*, if applicable, regulate sustainable new building construction (International Code Council 2019).

The Federal Emergency Management Association (FEMA) provides building designers with research, data, and best practices through its *Building Science* program. Although FEMA considers building codes that meet a minimum standard, it is essential to build above the baseline and consider above-code alternatives. Spending more on the school's "envelope" will improve building performance and ensure it will remain storm-resistant for many decades.

Designers have been trained to conduct an "all-hazards vulnerability assessment" of your proposed new school, and you should welcome the opportunity to review their methodology and findings at an upcoming building committee meeting.

Resilience to Human Stress

Architect Stephen Turks (2018) wrote, "Contrary to widespread belief, resilience isn't just about preparing for and protecting against climate change-related stressors. It is also about economic and social stressors. As school designers, we must also consider the daily stressors that impact students' personal resilience—issues like safety and security, homelessness, hunger, income disparities, and healthcare inequities. When we do that, we can help schools be more successful."

The schematic design for the school may include secure perimeters and entrances and an entry sequence that allows for adequate control over visitor access. The floor plan configurations may include recommended shelter-in-place and lock-down features.

The school's health services offices should be designed to handle age-appropriate medical care for students; these include quiet timeout rooms and private areas where students take medications. Space must be set aside for professionals to work with at-risk students where students' social and emotional issues are addressed.

Resilience to Community Stress

Discussions at building committee meetings must include how the proposed building will support the community in a disaster event. The planning should provide a reassurance it will adapt well to being used as an emergency venue.

Ideally, the new school will have mostly electrically powered systems and 100% clean renewable energy with storage onsite and redundancy in building systems for backup. To serve as a community shelter, it needs emergency power, heat, water, food storage, and medical care supplies.

Designers can plan a strategic layout of the building if it is anticipated that it will be used as a refuge for the larger community. Academic areas can be secured and located away from gymnasiums and cafeterias.

It may be necessary to create separate areas to fulfill the school's obligation to protect children. Movable partitions with doors can optimize the space in large rooms. A backup power source, such as emergency generators

Table 2. SBO Task Checklist

In discussions with the architects	
✓	Ask the designers to repeat key details about what is being proposed through conversations. Committee members and the public may not respond to drawings, video animations, or augmented reality software.
✓	Be mindful of change orders and their impact on the project's budget. Are they necessary for code compliance or aesthetic appeal? Who requested them?
At annual district budget meetings	
✓	If necessary, propose creating a new position for "systems engineer," including salary and benefits. Many new schools' operations require an experienced engineer.
✓	Ensure an adequate preventative maintenance program is budgeted for the operations department. Warranties eventually expire.
Using metrics to sell the cost-worthiness of the project to the public	
✓	Continually collect data on the building automation systems (BAS) that efficiently control HVAC systems. Compare the utility bills at the new school to those of the old school and report on cost savings through energy efficiency.
✓	Work with the school's nurse to review respiratory-related student health records of those attending the new school to their records at a previous school. Have parents noticed a difference with their children who are asthmatic?
✓	Begin a longitudinal study on student test scores, comparing students at the new school with their cohorts who attended the old school. A new environment can be a strong motivator in student achievement.

or propane gas should ensure refrigeration for food and a source fo cooking.

SBOs are Resourceful to the Committee

Architect Rachel Minnery, FAIA, wrote this about the *principles of resilience*: "Discuss and incorporate resilience measures during pre-development, programming, and planning phases so as to think across scales in regards to the passive ability of a building to operate in the face of extreme events." Mitigation planning includes creating performance targets—designing, implementing, measuring, and evaluating.

The design team and the building committee may discuss building rating systems that can be used as design tools for buildings to meet resilience goals. This includes the *Leadership in Energy and Environmental Design* (LEED) certification program at the U.S. Green Building Council (USGBC). LEEDS building projects are third-party verified, which ensures they save energy, water, and other resources.

Purposeful involvement by SBOs at building committee meetings involves anticipating matters that should be resolved during construction and after project completion (see Table 2).

In Conclusion

Building a new school that is sustainable, resilient, and adaptable will be a formidable challenge for the district's building committee. In time, it may be viewed as a monument to your community's contribution to halt global warming.

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