Facilities Seismic Safety in Public Schools:
A Ten Year Mitigation Plan

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Risk = Hazard X Vulnerability

Geologic Hazards in Utah

Geologists have warned for nearly 100 years that a big earthquake striking Utah, and more specifically the Wasatch Front, is not a matter of "if" but "when." Peak ground acceleration along the I-15 corridor from Box Elder County to Washington County will vary from a low of 15-20 to a high of 40-45 percent g (percent of falling due to gravity)–a building design parameter. See the attached Peak Ground Acceleration and Quaternary Faults map provided by the state Automated Geographic Reference Center (AGRC) with data provided by the State Geographic Information Database (SGID).

We have been told recently by University of Utah geologists that the chance of a large earthquake along the Wasatch Front during the next 50 years is about one in four; earthquakes of a magnitude 7.0 occur on average about every 200 to 300 years in this area. We also know that these large earthquakes occur about each 1,300 years along the Salt Lake City Segment of the Wasatch Fault (one of ten independent segments of the larger fault) and that the last one occurred about 1,300 years ago. Besides the shaking, most of the area from mid-Box Elder County–along the valley floors roughly where I-15 is located–to Juab County are expected to suffer High to Moderate-to-High liquefaction–wherein the saturated, sandy soils act like quicksand and buildings are likely to sink or suffer significant foundation damage in these unstable conditions.

Site-Specific Building Vulnerability

There are 23 school districts (750 schools) plus approximately 50 charter schools housing about 84% of all Utah students (430,000) daily along this potentially high earth movement corridor of the state. Many of these public school structures were built prior to the introduction of seismic building design[1] parameters–first introduced into the Uniform Building Code (UBC) and adopted by the State of Utah in the early 1970s[2]. Some buildings have been retrofitted to include the seismic code elements in effect as of when they were remodeled or expanded. Many have some–but not all–seismic reinforcing structural elements built into them as they were initially designed because they were built after the early 1970s; this is because the building code generally

[1]Preliminary studies show about 58% of Utah school buildings were built before 1975.

[2]The state has since adopted the International Building Code, promulgated by the International Code Commission (ICC).

changes on a three-year cycle and the required seismic building standards have changed over the years. The most recently completed school buildings will have the highest seismic structural elements incorporated into the designs, and will require little if any seismic retrofitting.

The Ten-Year Mitigation Plan

The ten year mitigation plan begins with a three-step process to determine first how big the problem is (the vulnerability):

1. Ask each school district and charter school that is located in the high-probability seismic area of the state to complete a building-specific seismic review of all facilities. This seismic review can be accomplished using FEMA's (Federal Emergency Management Agency) "Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook." This site-specific review involves studying the building drawings as well as a quick walk-through of the structure. With the help of school district building officials and structural engineer consultants, this seismic review will prioritize specific building needs for retrofitting, concentrating on those structures needing the most attention. It is a good way of focusing resources on the actual need for retrofitting the basic infrastructures to make the school safer for its occupants.

   We anticipate that this building review will cost school districts and charter schools from $300 to $600 per structure, plus travel. There will be some cost savings due to economies of scale in larger school districts and where school designs are duplicated, though each site needs to be evaluated independent of potential seismic findings to also focus on overall life-cycle costs of each building. The expected total statewide cost is approximately $250,000 to $500,000 (including some travel costs). We recommend that, if possible, funds be made available to school districts and charter schools to allow USOE to reimburse districts and charters for these costs and not create an unfunded mandate.

2. Suggest to school district and charter school boards that they create a seismic safety committee[3] to look at the results of the building-specific seismic reviews and develop a district/charter policy statement and criteria for prioritizing each building into an overall plan and time-line to deal with mitigating the seismic hazards. In addition, it is recommended that school districts and charter schools consider contracting with the state's newly contracted school facilities capital and

[3]Possibly made up of the seismic review consultant structural engineer, building architect, the School District Building Official, facility director/staff, someone representing the public, people representing teachers and building level administrators, and others as needed.

maintenance management providers–Asset Evolution (AE) and Facility Management Engineering (FME)–to appropriately analyze the data and allow the district/charter board to make the best possible long-term facility management decisions within the context of delivering the best education for children. See the attached Criteria for Assessing Buildings provided by Asset Evolution.

3. Encourage local school district and charter school boards to create a facilities financial implementation plan committee tasked with establishing the dollar costs and outlining the final implementation of the plan.

Because the costs to implement a facilities seismic safety plan are expected to be significant, it is recommended that the State Board of Education ask the State Legislature to participate with school districts and charter schools in funding the established plans. It is recommended that the State Board of Education ask the Legislature for $25 million each year for ten years, with each $25 million from year two through ten increased by an index reflecting the increased cost of construction, so that the total appropriated at year ten will have the same buying power that is has in year one. Districts and charters will apply for these seismic safety grant funds each year on a competitive basis, using criteria established by USOE–which will include a building-specific seismic review, a long-term mitigation plan which includes the total cost of facilities ownership–including life-cycle costing–good quality costs estimates and a reasonable time line. School districts and charter schools must match the legislative seismic grant funds, dollar for dollar, so that the $25 million becomes $50 million each year, and the ten year mitigation becomes $500 million plus, after inflationary increases.

Criteria for Assessing Buildings

Designed use vs. Current Use/Future Use

- What was the building designed for?
- What is the building being used for now?
- How compatible is the original design with the current usage?
- How flexible is the building for accommodating future occupants?

Building Systems (Utilities, HVAC, etc.)

- Can the building provide a comfortable environment?
- Is the building adequately wired for communications and computer technology?
- How close to capacity is the building and can it handle additional loads with reasonable expense?
- How energy efficient is the "envelope" of the building?
- Are existing utility lines to the building adequate?

Adaptability/Limitations

- How adaptable is the building structurally?
- Can it be remodeled easily?
- Are there structural, mechanical, or technological limitations that affect the desirability of the building?

Operational Cost Efficiency

- How efficient is the building for a capital costs and investment standpoint?
- How much will be spent to keep the building functional vs. The cost of replacing it?
- Current data on capital cost effectiveness

Space Efficiency/Layout

- Is the space functional?
- Are the rooms too small or too large?
- Is the building well-suited to campus standards?
- Are the circulation paths good and are the rooms accessible?
- Are the classrooms/classroom layouts adequate?
- Are the offices suited for faculty and staff?
- Are the offices accessible to students?
- Are there security problems with the existing layouts?
- Is the space suitable for space use?

Site Efficiency/Building footprint

- Is the amount of land required for the building footprint efficient relative to the gross square feet available?
- Is the shape of the building efficient?
- Is the building too high or not high enough for its location?
- Is the building efficient relative to its location (maximizing the space)?