

Colorado Earthquake Hazard Mitigation Council

A consortium of academia, government and private industry

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Geologists

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City and County of Denver

Private Consulting Firms

*Colorado Intergovernmental
Risk Sharing Agency*

U.S. Bureau of Reclamation

January 3, 2011

Kevin Klein, Division Director
Colorado Division of Fire Safety
690 Kipling Street, Suite 2000
Denver, CO 80215

RE: Policy recommendation on seismic design of schools

Dear Mr. Klein,

The Colorado Earthquake Hazard Mitigation Council prepared a policy recommendation for use by the Colorado Geological Survey when reviewing geologic and soils reports for public schools. The policy was sent to the CGS in October of 2008.

Since that time the State of Colorado has reorganized and now administers a more comprehensive plan for school permitting and inspections. Nonetheless, our recommendation is still pertinent. We are sending the recommendation to you since the Division of Fire Safety is responsible for the permitting and inspection of school construction.

Our policy recommendation relates to the seismic design of the schools. The recommendation and associated background information are in the accompanying document. Since our recommendation was written, the Western States Seismic Policy Council (WSSPC) has adopted a similar Policy Recommendation for the design and construction of new schools. The CEHMC is a member of WSSPC. WSSPC is one of four regional nonprofit earthquake consortia sponsored by FEMA.

Please contact us if you have any questions. Also, as part of your agency's implementation of the recommendation, the Colorado Earthquake Hazard Mitigation Council is willing to work with you to raise awareness of the recommendation in school districts and in the design professions, as well as to assist with setting up educational presentations.

Sincerely,



Robert C. Jackson
303-870-9334



John J. Nicholl, Jr.
303-740-2668

(Co-chairmen)

Enclosure: Policy recommendation

Colorado Earthquake Hazard Mitigation Council

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POLICY RECOMMENDATION TO THE COLORADO DIVISION OF FIRE SAFETY ON THE SEISMIC DESIGN OF PUBLIC SCHOOLS

January 3, 2011

The Colorado Earthquake Hazard Mitigation Council submits the following policy recommendation to the Colorado Division of Fire Safety for their use when reviewing building permit applications for public schools:

The International Building Code Seismic Design Category A shall not be used for design of schools in Colorado. Schools in Colorado shall be designed for a minimum of Seismic Design Category B. In addition, where the code would otherwise allow the use of Seismic Design Category B, the design requirements for the school shall be increased to Seismic Design Category C, as a minimum. The exemptions for non-structural attachments as allowed by ASCE-7-05: 13.1.4, or by ASCE 7-02: 9.6.1, shall not apply to schools.

Background information: Effective April 25, 2004 all public school construction projects in Colorado need to meet the requirements of the 2003 International Building Code. The design and construction is currently regulated through the State of Colorado, Department of Public Safety, Division of Fire Safety. A building permit application cannot proceed without a soils report and the results of consultation with the Colorado Geological Survey, as required by C.R.S. 22-32-124 (1). Although the local fire departments may be involved in the permitting, there is no other state-required involvement by local building departments and their plan reviewers and inspectors. While this may appear that the State is placing special emphasis on schools, there are many jurisdictions where almost the reverse is true. In the past, the state has not had the staff and processes in place to adequately review and inspect the design and construction of Colorado public schools.

The determination of the "Seismic Design Category" of a school, per the requirements of the International Building Code, is based on the spectral accelerations, as mapped by the United States Geological Survey, and on the site (soils) classification as determined by the geotechnical engineer. The Seismic Design Category increases in seismic resistance as a function of the letter; i.e., Seismic Design Category A is the least seismic resistant construction and Seismic Design Category F is the highest. Seismic Design Category A provides little or no actual resistance to any major earthquake. For the soils common on the plains, the transition from Seismic Design Category A to B occurs within the major population centers of the Front Range. Some municipalities and jurisdictions, including the City and County of Denver, have chosen to require the use of Seismic Design Category B as a minimum for all types of buildings. This requirement was created for a combination of reasons having to do with a lack of confidence in ground motion predictions where the seismic activity rate is relatively low and an uncertainty inherent in the simple method of testing for soil properties governing seismic response that is particularly pertinent for soils common to Colorado. It has been included as a

City of Denver amendment for Denver buildings ever since the 2000 International Building Code was first adopted by Denver. It has also been carried forth into the 2006 IBC as a Denver amendment. Members of the Structural Engineers Association of Colorado and City of Denver structural engineers comprise the sub-committee that approved the amendment.

The IBC assigns schools to a higher occupancy category than ordinary buildings. However, the use of Seismic Design Category A essentially negates this intent for structural seismic resistance. This fact, combined with the method the State has chosen to regulate design and construction of schools and also the factors that led the City of Denver and others to avoid the use of Seismic Design Category A, leads to a concern that schools may perform at a level below reasonable expectations should an earthquake occur. Therefore, we recommend that a higher Seismic Design Category be used for design of schools. The current (2005) version of ASCE 7, "Minimum Design Loads for Buildings and Other Structures," which is referenced by the 2006 International Building Code, has reduced the seismic design requirements for non-structural components from those required by the previous Uniform Building Code. Non-structural components include architectural, mechanical, electrical, and similar equipment and supports that are permanently attached to structures. Such non-structural components, according to the insurance industry, are responsible for roughly half of the damage and injury from significant earthquakes. Chapter 13, Section 13.1.4, of ASCE 7-05 lists exemptions for the seismic design of components. All mechanical and electrical components are exempted from seismic design in Seismic Design Category B structures. In higher Seismic Design Categories, all components are exempted if the structure is not designated as an "essential facility." The current version of the code does not recognize a school as an essential facility unless the school is officially designated as an emergency shelter. An essential facility is required to use a component "importance factor" greater than 1.0 for seismic design. This reduction in requirements for non-structural components is equivalent to recommending a public policy which holds that children, faculty, and staff are not important unless they happen to go to school in a structure designed and built as an emergency shelter.

The FEMA document "Risk Management Series, Design Guide for Improving School Safety in Earthquakes, Floods, and High Winds", published January 2004 as FEMA document 424, also recommends more stringent standards for schools for a variety of reasons. One reason is that schools are often used as shelters in an emergency, whether so designated or not, because the community is familiar with their locations. Failure of non-structural attachments can render the facility unsafe for immediate use as an emergency shelter.