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SRG Post-earthquake Evaluation

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ABSTRACT

The Seismic Retrofit Guidelines (SRG) have been developed by the Engineers and Geoscientists British Columbia (EGBC) on behalf of the British Columbia Ministry of Education. SRG has been developed over a 15 year span that features five SRG editions. SRG has established best current practice for the seismic risk assessment and retrofit of all low-rise school buildings in British Columbia. EGBC recognizes SRG as best current seismic engineering practice for all low-rise buildings in the province.

SRG incorporates a library of fourteen (14) manuals that detail different aspects of the SRG performance-based methodology. Post-earthquake evaluation of buildings is the title of SRG Manual No. 10. SRG recognizes the need for both pre-event preparedness and efficient, effective post-event response.

SRG post-earthquake evaluation uses a performance-based methodology that is fully compatible with the SRG pre-event seismic risk assessment and retrofit provisions. The highlights of the SRG post-earthquake evaluation of damaged buildings include a series of training websites and inspection procedures augmented by instrumentation. Instrumentation provides invaluable assistance to the engineering inspector in the field and to the Emergency Operations Centre.in setting evaluation priorities.

Keywords: SRG, post-earthquake, damage evaluation, instrumentation

INTRODUCTION

As noted in the Abstract, the SRG post-earthquake evaluation guidelines have been developed by EGBC, the provincial engineering and geoscientists association. The SRG post-earthquake evaluation guidelines have been prepared for use by practicing structural engineers for the post-event evaluation of building damage. The development of these guidelines has been primarily funded by the BC Ministry of Education for the post-event evaluation of damaged school buildings. EGBC considers the SRG post-earthquake evaluation guidelines best current practice for the post-event evaluation of all low-rise buildings in the province.

NEED

The development of these guidelines has been initiated by EGBC in recognition of the need for advancing earthquake preparedness by both pre-event planning and post-event prioritized response. One of the key elements of the pre-event planning is the comprehensive training of structural engineers in the methodology and practice for post-event evaluation. Graphical training aides are addressed in a following section.

METHODOLOGY

One of the cornerstones of the SRG post-earthquake evaluation guidelines is the performance-based methodology adopted by the guidelines. These evaluation guidelines are fully compatible with the assessment and seismic retrofit practice detailed in accompanying SRG manuals. The primary objective of these guidelines is to quantify the field evaluation procedures within the context of a process that is heavily dependent on informed engineering judgement in the field. The introduction of a higher degree of objectivity in field evaluation will ultimately result in a less conservative, more resilient post-event response.

DAMAGE STATES

All earthquake damage identified in the field is assigned one of the four damage states summarized in Table 1. Damage States DS3 and DS4 are the crucial damage states that require building occupants to leave the damaged buildings immediately following the main shock. Damage State DS4 is an important indicator of the potential for total damage and partial collapse. Buildings with DS4 damage are assigned a high priority for search-and-rescue assistance.\

Table 1: Damage States

Damage State	Damage State Description
DS1	• Minor Damage • Low cost repairs • Safe in aftershocks • PPR Green
DS2	• Moderate damage • Repairable damage • Safe in aftershocks • PPR Green
DS3	• Heavy damage • Repairs potentially uneconomic • Unsafe in aftershocks • PPR Yellow
DS4	• Total damage • Demolition likely outcome • Unsafe • PPR Red

TRAINING

The focus of SRG post-earthquake evaluation training has been on-line training with in-person training restricted to annual training seminars. On-line training has been provided to local practicing structural engineers in the form of two EGBC websites. The two websites are SRG Post Responder Two and SRG Post Responder Three. Both websites make extensive use of videos to graphically present the primary evaluation procedures and damage indicators. The SRG Post Responder Two website includes a library of damage states, a pictorial record of the primary damage states for a range of different lateral deformation resisting systems (LDRSs).

FULL SCALE DYNAMIC TESTS

Senior EGBC structural engineers also have the option to attend an on-going series of full scale dynamic testing of a 50 m^2 one storey wood frame classroom with 20 metric tonnes of inertia mass on its roof. Results from this dynamic testing program at the University of British Columbia present opportunities for refining the overall SRG methodology and to test post-earthquake inspection practices.

PPR

The SRG Post Responder Three website features an advanced post-earthquake assessment tool that utilizes Prioritized Post-earthquake Response (PPR) technology. PPR is a combination of pre-event building assessment, installation of strategic ground motion sensors and training of building managers to use the PPR system. The application of PPR systems is restricted currently to a limited number of building campuses on Vancouver Island. The SRG Post Responder Three has a built-in library of PPR damage thresholds for a wide array of different types of low-rise buildings. If shakemap or other regional peak ground motion data is available, the structural engineer can generate an immediate estimate of the damage state for a specific low-rise building. Expansion of number of ground motion sensors in British Columbia will make this PPR-based damage assessment considerably more effective.

INSTRUMENTATION

Very few buildings on the west coast of British Columbia have strong ground motion instrumentation in place to quantatively measure earthquake damage. In the short term, the focus is on increasing the number of community-based ground motion sensors to facilitate improved PPR-based damage assessment.

OFCs

OFCs are an integral part of the SRG post-earthquake evaluation methodology. The principal OFCs current practice is pre-event OFC restraint to minimize injuries in the more probable minor or moderate levels of shaking. OFCs are assigned PPR damage thresholds in a similar manner to that for the structural performance of buildings.

HAZMAT

The current edition of the SRG post-earthquake guidelines highlights the need to include hazmat in critical post-event decision making for the reoccupancy of damaged buildings. To make post-event hazmat decisions rational and non-conservative, building owners are encouraged to prepare pre-event hazmat floor plans for their buildings. This pre-event initiative is in its infancy. Hazmat is the Achilles heel of resilient community response. The SRG post-earthquake evaluation guidelines will continue to expand its hazmat guidelines in recognition of hazmat's major impact on post-event building functionality.

CONCLUSION

Post-earthquake evaluation of building damage is one initiative in earthquake preparedness that is both highly cost-effective and very efficient in its implementation.

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