## Part 1: Presented by National Research Council Canada

### New Seismic Risk Screening Tools for Existing Buildings in Canada

This workshop presents an overview of a new seismic risk management framework developed by National Research Council Canada (NRC), with a focus on newly developed two-level seismic risk screening tools for existing buildings in Canada. A multicriteria and multilevel seismic risk management framework is to ensure an acceptable and consistent level of risk for existing buildings in Canada with a focus on minimizing threats to life safety. The framework consists of three levels: (1) Level 1: Preliminary Seismic-Risk Screening Tool (PST); (2) Level 2: Semiquantitative Seismic-Risk Screening Tool (SQST); and (3) Level 3: Seismic Evaluation Guideline (SEG).

Level 1 (PST) was developed based on a number of key criteria (seismicity, benchmark code edition, consequences of failure, and remaining occupancy time) to assist in exempting existing buildings from further assessment without the need for a site visit.

Level 2 (SQST) consists of three key components: (1) structural scoring system that quantitatively assesses the structural seismic risk based on the probability of collapse; (2) non-structural components scoring system that qualitatively evaluates the seismic risk of non-structural components based on the seismic demand of critical non-structural components; and (3) ranking procedure that prioritizes buildings with potentially unacceptable seismic risk for the Level 3 (SEG) based on structural and non-structural components priority indices.

The Level 3 (SEG) aims to identify the building deficiencies that lead to unacceptable seismic risk for existing buildings. The Level 3 – SEG consists of three evaluation procedures: Tier 1: Quick Evaluation Procedure, Tier 2: Deficiency-Based Evaluation Procedure, and Tier 3: Detailed Evaluation Procedure.

The focus of this workshop is to provide training on the use of Level 1 (PST) and Level 2 (SQST), including hands-on exercise.

## Part 2: Presented by National Center for Research on Earthquake Engineering (NCREE) of Taiwan

### Seismic Retrofitting Program of School Buildings in Taiwan

Recent reconnaissance reports revealed that elementary and high school buildings are particularly vulnerable structures in Taiwan. Therefore, enhancements to the seismic capacities of the school buildings through retrofitting are urgently required. However, there are 3,763 elementary and high schools in Taiwan, and the total number of buildings may be as high as approximately twenty-seven thousand. Without careful planning, the budget could easily be exceeded due to the large number of buildings. Adopting an effective strategy using economical technologies and systematic prioritization is essential for this school retrofitting project to be successful. The government of Taiwan has launched a project to upgrade the seismic

performance of school buildings, and a total of $2.5 billion US dollars was budgeted from 2009 to 2022. The objective of this presentation is to report on the strategy and progress of this seismic retrofitting project for school buildings in Taiwan. Moreover, the technology of seismic evaluation and retrofitting will also be introduced.

**Nonlinear Responses of Buildings under Seismic Loading and Introduction of 5D SmartES Platform for Structural Health Monitoring**

The National Center for Research on Earthquake Engineering (NCREE) has developed the 5D SmartES platform. This platform is used to build 5D smart National Taiwan Museum platform for structural health monitoring. This platform uses 5D concept to shorten synchronization of 5D and real-world information, which can integrate static and dynamic data, databases, IoT and 3D models on a user-friendly platform. In this study, numerical modelling and simulation of National Taiwan Museum by LiDAR Scan and environmental testing are proposed. The frequency of earthquake occurrence is much higher in seismic zone. Moreover, heritage was built earlier, and the probability of structure failure is much higher than that of other types of buildings. Therefore, it is necessary to use finite element (FE) models to predict the structural behavior of heritage when subjected to earthquakes. This paper focuses on an establishment of a FE modeling of National Taiwan Museum, the oldest museum in Taiwan since 1915 in the Taipei Basin. Before FE modeling, 3D model must be established. Structural drawings are used when creating 3D model. In order to verify whether the original structural drawings are accurate, it is necessary to compare the point cloud model and correct the errors of structural drawings. 3D model is accurately established after correction. Then, elements are created. Material properties, boundary conditions, and environmental conditions are set by using finite element software to obtain FE modeling. Comparing natural frequency and mode shapes of in situ experimental measurements, it indicates that FE modeling is correct. Therefore, FE modeling is used for subsequent analysis.