**DEVELOPMENT OF REPRESENTATIVE FRAGILITY/VULNERABILITY LIBRARY FOR SCHOOL BUILDING TYPES**

**TECHNICAL GUIDANCE TERMS OF REFERENCE**

Disclaimer: The following technical guidance for terms of references (ToR) have been shortened to reflect essential points (scope of work, deliverables, timeframe and qualification requirements) to be included in the ToR. Every organization can then adapt the guidance to their standard ToR template.

# Objective and Scope

The objective of this consultancy is to develop a representative fragility/vulnerability library for the building types of a specific school building category (e.g. load bearing masonry, reinforced concrete, etc.), by providing technical expertise and producing relevant knowledge and products. The Consultancy has in particular the following specific objectives:

1. Identify the building types through a structural classification of the considered building category;
2. Conduct fragility/vulnerability assessment for the representative buildings of the identified group of building types and organize the library.

**Activity 1:** Develop a structural classification of the considered building category and identify it’s building types.

Task 1.1: Review available in-country and/or global data on school buildings in the considered building category.

Task 1.2: Prepare the structural classification of the considered building category and develop characterization of building types.

**Activity 2:** Conduct fragility/vulnerability assessment of representative buildings of the identified building types and organize the library.

Task 2.1: Identification and description of representative building for each of the building types identified.

* Propose a set of consistent criteria to determine representative buildings
* For each building type create a representative building and a quality range
* Collect specific data and example to characterize the vulnerability parameters of the structural classification

Task 2.2 Create structural models to determine fragility functions

* Review modelling techniques and software available to quantify seismic capacity of the building types identified;
* Determine the essential parameters needed to qualify the models and hence the needed data acquisition.

Task 2.3Perform a seismic assessment of the representative buildings for each of the building types identified for the considered school building category

* Using the most suitable choice of software identified in 2.2 in relation to the typology and data available, produce a seismic assessment. Analyze the seismic capacity versus seismic demand, with respect to different performance levels, using the most suitable analytical method.
* Repeat analysis for different values of the parameters to reflect typical variability ranges, and quality of construction.
* Conclude on typical resources required to conduct such analysis.

Task 2.4Compute fragility and vulnerability functions

* Using standard approaches available in literature, use the results of the previous analysis to compute fragility functions for each building type.
* Use the fragility functions and an agreed expected event scenario to determine the vulnerability functions for each typology.
* Provide commentary on uncertainties.

Task 2.5Organize a library of selected vulnerability functions for the identified building types

* Identify existing vulnerability functions used in the seismic assessment of the identified building types in different countries/regions, and the methods used to assign and derive these functions. Compare with the criteria derived in Task 2.4.
* Select a list of existing vulnerability functions for the identified building types, highlight the advantages/limitations of the methods used to derive these functions.
* Review criteria applied in different countries/regions for modification of the vulnerability functions in order to take into account defects, irregularities, construction quality and past retrofitting interventions. Evaluate the advantages/limitations of these criteria based on past experience.
* According to the results of this task, propose a set of criteria to assign different vulnerability functions, highlight potential differences among countries/regions.

Task 2.6 Critical assessment procedure to determine vulnerability of school infrastructure:

* Prepare manual for including data in the library and for the vulnerability functions selection.
* Compare vulnerability functions selected from the library and computed with the analytical approach.
* Provide commentary on uncertainties.

# Deliverables

The consultant will submit the deliverables outlined below.

Activity 1:

* + Structural classification and manual for the considered building category

Activity 2:

* + List of representative buildings with geographical relevance and parameters range
  + Report: recommendations on modelling tools and data requirements
  + Report: Results of seismic assessment
  + Library of selected vulnerability functions and associated manual
  + Report: Fragility and Vulnerability Assessment
  + Final Guidelines

# Timeframe and Work plan

The services of the consultant will be needed for an estimated period of 12 months. The firm to be contracted will provide their services in order to carry out the activities described under these Terms of Reference as required.

# Qualifications

The consultant to be contracted should meet the following requirements:

Team leader:

* Doctorate in Earthquake or Structural Engineering;
* More than 10 years of research experience in structural analysis, vulnerability assessment and structural retrofitting of masonry constructions;
* More than 10 years of experience coordinating research projects;
* Work experience in various countries, including developing countries;
* Fluent in English (both written and spoken).

Team member:

* MSc in Earthquake or Structural Engineering;
* Fluent in English (both written and spoken).