**ADVISORY SERVICES TO SUPPORT THE RECOVERY OF SCHOOL INFRASTRUCTURE IN A POST-EARTHQUAKE ENVIRONMENT**

**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 generate knowledge based on the evidence and analysis of the structural and non-structural performance of the school buildings in the areas most affected by the recent earthquakes in the country to inform and document the recovery process, in particular for the:

1. Design of the recovery strategy for school infrastructure
2. Seismic vulnerability reduction strategy for new school infrastructure and existing school infrastructure which will be intervened
3. Information platform to evaluate the building performance in future earthquakes

 **Activity 1: Evaluate the damage and structural failures of school buildings** based on the evidence collected from the field on the seismic performance of a representative group of school buildings. The damage will be correlated with the intensities measured or estimated (horizontal and vertical), considering prior damage due to corrosion for instance. This activity will also include the following: (1) field measurements of the dynamic properties of representative buildings damaged by the earthquakes, (2) evaluation of the damage to compound walls, and (3) consideration of cultural losses in schools with historic buildings.

**Activity 2: Evaluate the seismic performance of school buildings retrofitted before the recent earthquakes**. This analysis will collect evidence regarding the effectiveness of the retrofitting techniques used, as well as maintenance requirements. This includes field measurements of the dynamic properties of the representative group of retrofitted school buildings.

**Activity 3: Structural modeling and analysis of the most common structural typologies retrofitted and non-retrofitted** to evaluate the level of seismic performance. This includes (1) structural classification of school buildings according to the taxonomy proposed in the Global Library of School Infrastructure (GLoSI), to align efforts at the global level on the use of a standard taxonomy which facilitates knowledge sharing; (2) identification and description of the main structural typologies; (3) proposing a set of consistent criteria to determine representative index buildings for each of the typologies identified; and (3) modeling and structural analysis of the selected index buildings to evaluate seismic performance levels.

**Activity 4: Derive vulnerability/fragility curves** for each typology based on the results of previous structural analyses, using well-established methods. Compare these results with information on the fragility/vulnerability of similar typologies available in relevant technical literature.

**Activity 5:** **Structural modeling and analysis of retrofitting solutions** to improve the seismic performance of the most common structural typologies retrofitted and non-retrofitted for different levels of seismic performance. The analysis will consider the need for schools being used as shelters to achieve exceptionally high performance levels. This activity includes (1) identifying deficiencies and retrofitting needs for each typology, and (2) identifying and analyzing alternative retrofitting options based on structural performance requirements and cost/efficiency analyses.

**Activity 6:** **Propose recommendations to inform the recovery process regarding:**

1. Causes for the failure and damage in the school buildings with and without retrofitting
2. Interventions lines and prioritization criteria for the retrofitting of school buildings
3. Retrofitting techniques according to expected performance levels
4. Recommendations for the structural design of new school buildings
5. Updates to the regulatory framework (if necessary),
6. Improvements to the construction technologies of construction,
7. Strengthening the quality control process in the construction of school buildings,
8. Functional improvements in school facilities according to the existing regulations and programs
9. Information system with the retrofitted school buildings to monitor and evaluate their performance in future earthquakes.

**Activity 7:** **Carry out workshops, at the national and subnational level,** to disseminate results, with emphasis on the importance of informing the recovery process based on lessons learned from this recent earthquake and promoting an informed and evidence-based dialogue with civil society.

The consultant firmwill participate in technical working sessions via videoconference with the task team to discuss progress and results of the outlined activities.

# Deliverables

The consultant will submit the deliverables outlined below.

* Intermediate and final Technical Report, including files with main technical results
* National level workshop (1) and subnational-level (State) workshops (2-3)

# Timeframe and Work plan

The services of the consultant will be needed for an estimated period of 7 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 by the task team.

# Qualifications

* Extensive knowledge of seismic hazard, construction technologies and regulations in the country
* Research experience on structural and earthquake engineering, including modeling and structural analysis, vulnerability assessment, structural retrofitting
* Experience in design and implementation of structural retrofitting programs
* Human resources and technical capacity to carry out the consultancy and within given timeframe
* Extensive knowledge of the local context, including experience related to the education sector and school infrastructure
* Ability to apply and adapt best practices (national and international) related to school infrastructure
* Capacity to conduct field testing and laboratory, equipment and software to carry out analytical activities as described in the ToR
* Fluency in the local language(s) and good command of English
* **Project Lead**
* PhD in Civil Engineering
* +10 years of experience in structural engineering and managing projects on seismic retrofitting or related projects
* **Technical team**
* Composed of experts with experience in structural engineering, modeling and structural analysis, seismic performance of buildings, fragility and vulnerability curves, seismic retrofitting
* Composed of engineers studying and working in the field of civil engineering, in particular earthquake and structural engineering
* Relevant experience in the design and assessment of different structural typologies, such as load bearing masonry and reinforced concrete