

“They Could Fail”

Engineers Warn About the Fragility of Structures

Engineers are raising concerns about buildings constructed before 1987 because they face a greater risk of collapse.

By Adriana Díaz Tirado

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At a time when Venezuela is recovering from two earthquakes, numerous concrete buildings in Puerto Rico, including critical infrastructure, that were constructed before 1987 face a risk of collapse during an earthquake. This is primarily due to deficiencies in their construction methods and the quality of their materials, according to a new analysis.

The report, presented in May by engineers José Sánchez Ferreira and Ricardo A. Herrera of the Earthquake Commission of the Puerto Rico College of Engineers and Land Surveyors, examines deficiencies in nonductile, or brittle, concrete buildings. These are structures that lack the ability to deform or dissipate energy without collapsing when subjected to severe forces such as earthquakes.

“We have to inform and educate people about the risk we face. This is real; it is not hypothetical. An earthquake could occur in ten years or in one month. We have a high seismic risk. We have concrete structures that could fail,” warned Sánchez Ferreira, who is based in California, during a video call with *El Nuevo Día*.

Sánchez Ferreira, who is also a project manager with Rutherford + Chekene, said that based on the images shared from Venezuela, many of the structures that collapsed likely had structural deficiencies.

According to Sánchez Ferreira, a nonductile building “was constructed during a period when building codes were not as rigorous.” In Puerto Rico, ductile design was not introduced into regulations until 1987. Puerto Rico’s current Construction Code dates from 2018 and incorporates local amendments adapted to the island’s geography, climate, and natural hazards.

However, Sánchez Ferreira warned that Puerto Rico does not have an accessible inventory identifying how many structures were built before 1987. Such an inventory would help the island develop a mitigation plan to address deficiencies amid its high seismic risk.

In May, the United States Geological Survey, or USGS, announced a new seismic-hazard map for Puerto Rico. The map, which had not been updated in 20 years, indicates that every part of the Puerto Rican archipelago and the U.S. Virgin Islands faces at least a **34% probability of experiencing significant ground movement sometime during the next 100 years.**

Meanwhile, in 2023 the Federal Emergency Management Agency, or FEMA, ranked Puerto Rico fifth on a list of U.S. states and territories expected to suffer the greatest losses from earthquakes.

Sánchez Ferreira said a new edition of FEMA's report is about to be released. During a workshop, FEMA and the USGS indicated that the risks to the archipelago may be much greater and that the amount of money needed following such events could increase by "approximately 100%." If that occurs, Puerto Rico would move into third place on the list, behind California and Washington.

"The point is to understand how many deaths, how many injured people, and how much money will be needed to restore these cities; how many shelters, how many trucks will be needed to collect debris, and for FEMA to prepare. That is the purpose of this report. Following the 2020 earthquakes, the USGS has been conducting assessments, identifying new faults, and updating its models," he explained.

When considering how exposed Puerto Ricans are, the engineer reviewed several aerial images showing the development of infrastructure between 1951 and 2026 in areas such as Condado and Hato Rey.

"It is a way of seeing how much infrastructure had already been constructed before 1987. You can see that by 1962 the expansion of construction was already taking place," he said, while showing historical photographs of the capital, where most buildings were erected without taking ductile-design techniques into consideration.

He said some of the construction deficiencies most commonly found on the island include **short columns**, as demonstrated by the collapse of several schools and homes in southern Puerto Rico during the 2020 earthquakes.

Another common deficiency is the "weak story" or "soft story." This structural problem is associated with a building's limited ability to withstand lateral loads, as occurs in houses or buildings with an open first level.

"We have vulnerability in nonductile construction, and we are only now seeing that materials we should have assumed were sound present another vulnerability. This is alarming. Here, in schools, children are present; these are places people may need to go for shelter in the event of a hurricane, earthquake, or flood," he said.

Drawing on his experience in California, a state that has passed legislation and sought to address this safety issue, Sánchez Ferreira mentioned several measures that could be taken to strengthen nonductile buildings in Los Angeles constructed before 1977 and that could be replicated in Puerto Rico.

For example, legislation addressing nonductile concrete buildings requires property owners to reduce the risk of collapse over a phased period of up to 25 years. The City of Los Angeles also has an online portal that allows the public to track which buildings have already been reinforced and how many remain.

“If you have not reinforced it after 25 years, you have to demolish it. It is very strict because human life is at risk. Every city must conduct an assessment, identify which structures face the greatest risk, and determine how they will address them through public policy,” he urged.

Photo caption

A residence in Yauco that collapsed as a result of the January 2020 earthquakes.

Key fact

34%: The probability that Puerto Rico and the U.S. Virgin Islands will experience significant ground movement during the next 100 years.

Extracted and translated from article

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