

## Editorial

# A New Look at Earthquake Engineering: Simplification of a Complex Phenomenon

Natural phenomena act out of our control and most of the time the environment and people do not act as though they have been instructed. The existing know-how, research, guidelines, codes, and recommendations are not being completely used, implemented or put to work. A quick overview of the past events can substantiate this claim. After every major earthquake, it has been generally concluded that: "It was a surprising earthquake in the sense of ...; the ground motion characteristics being different than expected; the soil behavior and soil-structure interaction being different than expected; the failures were due to poor design and construction and due to ignorance of the ABC's of engineering principles, further code modifications, and more code refinements are required; and finally more research and funding are needed." These types of statements will be repeated, almost, after each earthquake.

To overcome this difficulty, I believe that "Earthquake Engineering Scientists" should modify their views of the present methodologies and approaches in favor of simplified, doable, affordable and socially acceptable solutions that answer and meet people's needs in a more direct and to the point approach.

Analyzing the success of medical doctors, their influence on people by creating an acceptable level of trust between themselves and the patients, shows that most of people's demands are being met by the use of simple and almost deterministic solutions based on pharmaceutical research which goes back to Avicenna's time. Prescription of medicine to a human body, with more complexity than earth's interior, is what engineers should envisage doing for the safety of the built environment using new technologies such as nanotechnology, smart materials, etc. If simple answers and understandable solutions are available to people, they will respond differently. Definitely the majority of people cannot effectively use the existing manuals and guidelines which they do not understand. They have never understood the causes of many diseases; However, they have used the prescribed medicines due to the confidence and trust that has been built (in most cases) between the doctors and people throughout the history.

Engineering issues and problems should be classified in order to provide appropriate and compatible answers to the level of the knowledge and expertise of the respective implementers and users. Special and vital structures require special class of engineering, and should be dealt with in the highest accuracy and reliability. However, common cases, such as housing, which bear most of the losses during earthquakes, should be put in prescriptive with simplified and easy-to-use solutions and approaches. There are millions of housing units of unreinforced masonry, wood, adobe and non-engineered buildings with similar deficiencies around the world. Can easy 1-2-3 or ABC solutions for upgrading and improving the housing safety be developed by "Earthquake Engineering Scientists" in such a way that can be implemented by any household? We should not expect these people to ask an engineer to come and make safety evaluations and after many calculations and drawings bring an unaffordable solution that can never be used or applied. The occupants of these housing units, if they had financial resources they would not live in unsafe buildings. Even for a simpler case, affordable housing models that low income people in rural areas of the world can use without being forced to violate the codes due to lack of funds do not exist. We have not even been fully successful in convincing the decision makers. Actually, all of these are not due to our lack of capability, but it is our duty to provide answers, because we know.

### **On Risk Communication:**

Moreover, in most cases, medical doctors have learned to communicate better with general public than earthquake engineers in creating concern and sensitivity on health related issues. I believe that more effort is required in having an effective earthquake risk communication. This requires simplification of risk mapping and risk

communication methodologies and having an innovative educational approach. The trust can be built through vulgarization or simplification of earthquake engineering knowledge. This is one of the hardest challenges ahead of us. As an example: Looking at holy books such as Quran, Bible or any long lasting literatures such as Shakespeare, Hafez or Moulavi's poems, we can notice that even though they address complex and advanced topics, but they can be easily read, understood and used by common people. Since they are multidimensional texts, everybody understands them to his/her level of knowledge. These texts have been created with highest level of know-how. It is a fact that the art of simplification of complex phenomena requires the highest level of expertise. Great people always talk simple, while novice experts talk complicated. We talk complex because our knowledge is not enough, or we have not diverted our knowledge in that direction. We always try to make the methodologies complicated, by adding new factors and new issues, which are absolutely required, justified and correct for complex and special structures. But we have not tried to simplify our approaches for simple and common cases such as housing units. I strongly believe that for unknown phenomena such as earthquakes, a simplified look at the problem is better.

In conclusion, an effective and innovative program should emphasize the translation of current know-how into simplified options and alternatives. In other words, the most progressed and developed sciences should evolve in the most simplified, understandable and doable, culturally acceptable instructions. Its implementation requires not only a multi-disciplinary approach, but also a comprehensive educational program for all people involved in the implementation of the seismic risk reduction measure. The key factor in the above actions is definitely to develop an innovative approach and changing our views for the future of earthquake engineering research, and being patient.

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