

## USING THE WORLD HOUSING ENCYCLOPEDIA TO IMPROVE HOUSE EARTHQUAKE SAFETY

C. V. R. Murty<sup>1</sup> and A. W. Charleson<sup>2</sup>

<sup>1</sup> Professor, Dept. of Civil Engineering, IIT Kanpur, Kanpur 208016, India & Former Editor-in-Chief, World Housing Encyclopedia & former Editor-in-Chief, World Housing Encyclopedia

<sup>2</sup> Associate Professor, School of Architecture, Victoria University of Wellington, New Zealand & Editor-in-Chief, World Housing Encyclopedia

Email: cvrm@iitk.ac.in, andrew.charleson@vuw.ac.nz

### ABSTRACT :

This paper suggests several possible strategies that the World Housing Encyclopedia (WHE) might consider to reduce earthquake risk to housing worldwide. The first strategy can be thought of as a bottom-up approach. In this scenario WHE explicitly attempts to have its encyclopedia and published tutorials more extensively used. It contacts universities in interested countries with ideas and resource material to introduce their students to the challenges associated with improving the seismic resistance of housing. The second suggested approach, where the World Housing Encyclopedia plays a key role, can be considered more of a top-down initiative. It consists of seismic experts in developing countries working in parallel with major international aid and finance agencies to apply pressure on and monitor the extent to which governments encourage and provide seismic resistant housing. Both of these strategies are presented to stimulate discussion. They are not mutually exclusive. There is no disputing the need for action. It is a matter of discerning how the WHE can continue to make a difference. Any suggestions and comments from readers are most welcome.

**KEYWORDS:** Earthquake, resistance, safety, housing, information, dissemination

### 1. INTRODUCTION

The WHE project has already achieved a lot since its genesis at the 12<sup>th</sup> World Conference in Auckland, New Zealand (Brzev, 2004). This paper suggests a number of proactive steps the WHE could take to improve the safety of those millions of people both already living in and yet to live in seismically unsafe dwellings. How can the progress of the WHE project to date and the influence of its supporters be best harnessed to make a difference? Of course when addressing this question we must remember that WHE at present has extremely limited financial resources and also primarily relies on the efforts of volunteers. First, we review the actual progress made on the technical resources provided by the WHE, namely the encyclopedia and the tutorials. Then we suggest some concrete courses of action.

The suggestions made in this paper are intended to stimulate discussion and comment, and to act as catalysts for additional ideas that are capable of implementation.

#### 1.1. The World Housing Encyclopedia

Already the World Housing Encyclopedia (WHE) contains extensive and broad coverage of different housing types from different countries. At present there are a total of 136 reports, covering 13 basic housing and building types from 40 countries. But while there is still scope to increase the number of entries, this is the time to consider ways of encouraging more widespread use of the WHE material. How can we encourage people to use the WHE in ways that will eventually result in greater numbers of seismically safe houses?

One suggestion to encourage wider use among students is to have the WHE run an international competition. The competition would be primarily for university students, but also open for others. The crux of the competition is the submission of an essay or paper reporting on research, at least in part, based upon WHE material. Ideally the research would be aimed at improving the seismic performance of existing housing construction. The submission should not be longer than 10 pages including plans and photographs. A number of prizes for various categories would be awarded. The competition would be advertised in schools and colleges of architecture and civil engineering. The best three entries from each college would be judged and a national winner and runner ups announced and awarded prizes. National winning entries would be sent to the WHE to select international winners. Summaries of winning entries could be published in individual countries' Earthquake Societies' journals and useful information would be forwarded onto the WHE for possible further development and eventual inclusion into the Encyclopedia.

## ***1.2 Tutorials***

Currently, three tutorials are available on-line. They cover adobe, confined masonry and reinforced concrete frame buildings. A tutorial on stone masonry construction is underway and due for completion late 2008. Other tutorials are needed and some suggestions are listed on the WHE website. How can this excellent resource material be placed into the hands of those who can make a real difference? There is a need for active dissemination. Three possible approaches to encourage wider use of these materials are discussed below.

Consider, for example, the tutorials mainly written for engineers and architects, like those on confined masonry and RC frames.

### ***1.2.1 Direct Approach to Professionals***

With the assistance of the International Association of Earthquake Engineering (IAEE), IAEE delegates of individual member country earthquake engineering societies will be contacted by WHE. They will be formally advised of the tutorials and requested to inform their members of them. Members would be invited to download copies to use themselves and to give them to building officials and other local construction industry professionals.

If possible, meetings could be held where a local respected expert speaks to the tutorial(s) and commends its (their) content to the audience. In many cases the material in the tutorials represents quite radical departures to existing building design and construction practices.

### ***1.2.2 Building Bridges Between Universities and Construction Practices***

WHE collects the addresses of schools and colleges of civil engineering and architecture in counties wanting to participate. It then writes to the Deans of these schools outlining its concern regarding the seismic risk of existing and even new construction. It requests they participate in a trial international program to educate students regarding seismically safe housing.

This idea assumes that most civil engineering and architecture students have no significant exposure in their courses to housing design and construction, especially for those people who live in seismically vulnerable dwellings. It will require some parts of schools' curricula to be squeezed or adjusted to make room for this additional, albeit not too extensive material.

Structured as a class exercise or assignment, the program would involve pairs of students making approximately five visits to house construction sites over a period of between three to six months for the purpose of observing, learning and analysing current construction practices. Each pair of students would follow the construction process of one dwelling. Their institution would provide a letter of introduction to help them

win the confidence of the contractor in order to gain access to the site. Students would note down observations, focussed by the use of a checklist WHE would prepare based on a typical WHE house report. This would ensure coverage of construction materials, workmanship, connections and components. The students would then produce a report for in-course assessment. This project might be worth say 10% to 20% of the marks for one of their courses.

The report would compare observed practice with best-practice as outlined in locally appropriate guidelines (or the IAEE non-engineered guidelines) given to them by their professor. Students would also reference one or more of the most relevant entries from the Encyclopedia. Upon completion of their report, which is *not* given to the contractor or others responsible for the housing sites visited in case the report is critical, the students return to the site and give a copy of the guidelines as a gift to the contractor, thanking him or her for their educational experience.

WHE might be able to pay a small amount to each institution to cover the cost of photocopying the local guidelines – one copy for each student, and one for each group of two students to be given to the contractor.

It might be possible to arrange a low-key prize giving ceremony to which all the builders and contractors were invited. Small awards would be given for the best student work and a short presentation would commend the guidelines to attendees. One can imagine other benefits of such a gathering.

After the first year, the program would be reviewed to assess its effectiveness and to decide upon its future. This model of disseminating information is based on how school children bring information home with them for the sake of informing the parents. Both the children and their parents benefit.

### *1.2.3 Building Bridges Between Universities and Practicing Professionals*

This final idea is similar to that above. But rather than visiting a housing construction site directly, students would visit a local civil or structural engineer or architect with a request to use one of their projects to undertake a similar exercise as outlined in the idea mentioned above. At the end of their study of construction practices, the students would also give the professionals copies of an appropriate tutorial or set of construction guidelines as a thank you gift.

This approach has the potential to encourage practicing professionals to increase their awareness and engagement with issues related to the seismic performance of housing.

## **2. ESTABLISHMENT OF A GLOBAL HOUSING EARTHQUAKE SAFETY NETWORK**

The aim of this network is to transfer technical information on housing seismic safety worldwide through technical communities to earthquake-prone countries. The players in such a global network, outlined graphically in Figure 1, are:

- *Global Housing Task Group*: an international network of professionals with specialized knowledge in earthquake-resistant housing technologies and with international experience. The Editorial Board of the WHE has the requisite expertise and experience;
- *Global Housing Partners*: a network of international agencies who provide international funding to development projects in countries with seismically vulnerable housing stock. UNDP, UNCRD and BRI (Japan) are examples of multi-lateral agencies with such a profile;
- *Country Housing Task Group in each country*: a national network of professionals with a good knowledge of issues related to national housing. This task group will champion housing earthquake safety needs in each country by liaising with the Global Housing Task Group to benefit from globally available technology. The County Housing Task Group will lobby governments, agencies and organizations to improve earthquake safety in housing projects implemented in the country; and a

- *Country Housing Network* in each country: a collection of all governmental and other building-related organization professionals in that country.

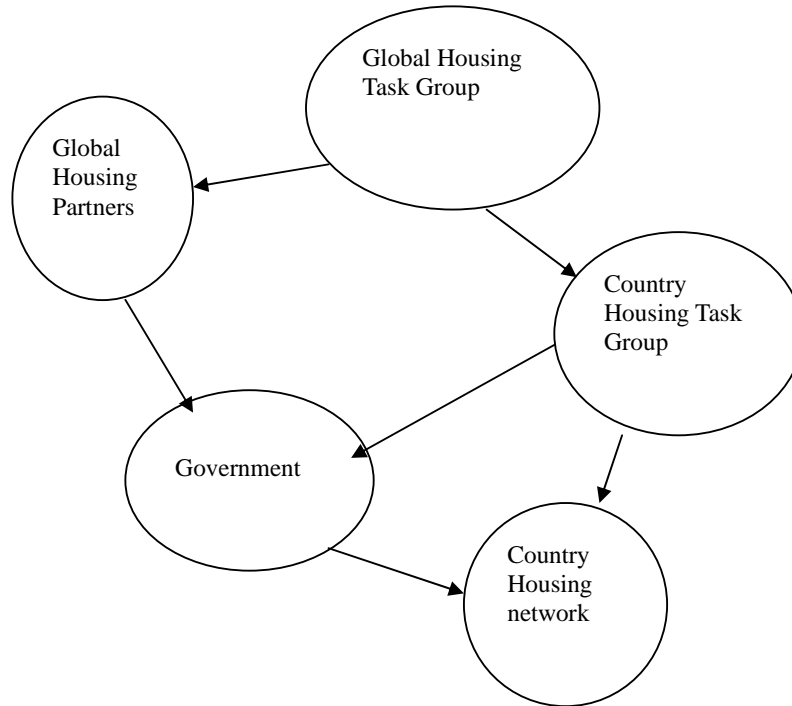


Figure 1 Diagram of the Global Housing Earthquake Safety Network.

### 2.1. The establishment and roles of these groups

- *Global Housing Task Group*  
As mentioned previously it could comprise the WHE Editorial Board which is in the position to access the best available worldwide knowledge on the earthquake safety of housing. It also has the responsibility to communicate with Global Housing Partners. It would provide them with information and encourage them to adopt policies that insist upon or at least promote earthquake-resistant construction for any of the housing projects they are involved with.
- *Country Housing Task Groups.*  
These groups could comprise in-country experts in earthquake engineering with a concern for housing. Ideally the chairpeople of such groups will be members of that country's national earthquake engineering society committee. They will be joined by respected and knowledgeable professionals who are able to help improve the technical quality of housing construction in their country. Their key role is to guide, advise and monitor their governments and any other housing organizations on minimally acceptable earthquake safety norms and provide technical know-how. They may request the Global Housing Task Group to provide them with specific resource materials.

Country Housing Task Groups would work on a number of fronts including:

- *New Housing Projects and Seismic Retrofitting for different housing types:* offering guidance by (i) providing policy and strategy, (ii) recommending best global practices, (iii) recommending the required technology for ensuring cost-effective earthquake-resistant construction, and (iv) improving and preserving vernacular construction, all within the scope of locally available materials and skills.



- *Post-earthquake region-specific shelter designs and re-building (replacement) housing:* after most damaging earthquakes, post-earthquake shelters are the first priority. Country Housing Task Groups can participate with governments prior to the occurrence of earthquakes to plan and stockpile the technology, skill-manpower and raw material for construction of such shelters. Also, most governments are often under tremendous pressure to undertake reconstruction in a very short time frame. Hence, this activity is implemented under intense political pressure and instant solutions are being sought by governments to provide housing alternatives.

Each country must set modest goals initially, with time targets, achieve them and build confidence. Improving earthquake safety is a long-term process.

### **3. CONCLUDING COMMENT**

While one advantage of earthquake-resistant housing is its increased sustainability due to reduced losses after damaging earthquakes, there is a need for greater integration of other sustainability issues. For example, given the increasing cost of energy and its dwindling availability, earthquake engineering interventions should be try to take a broader view within a regional context. It would be a wonderful outcome if earthquake resistant houses not only require less energy for heating and cooling but are more comfortable to live in. Admittedly it is difficult enough to design cost-effective seismic resistance without concern about energy sustainability. Herein lies a challenge for researchers.

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