Improved building construction ?

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It is a truism, repeated after all earthquakes, that building construction is in need of improvement. The 1999 Turkish earthquakes and the 2001Gujarat earthquake are the most recent examples, but construction limitations and shortcomings were exposed at Kobe (1995) and at Seattle (2001) as well. The quality of self-build rural and domestic construction has rightly received attention in recent years but, as the evidence repeatedly shows, urban, high-rise "designed" building cannot be left to itself. What are the requirements for improved building construction ?

The nature of building construction

All forms of building construction facilitate expedient or even illicit practices by a process of legitimate physical cover-up of construction stages. As each stage of construction is completed, it is covered over and concealed by a subsequent stage, from foundations under the ground through to the last coat of paint. Whether self-build or not, temptation and opportunity for shortcuts and omissions is boundless. No doubt, the term of illicit "cover-up" derives from these processes in building.

For there to be as much certainty as possible about construction quality, periodic, even constant, independent inspection of buildings under construction is necessary. Though legislation may exist as building regulations, codes, standards and guidelines, legislation is insufficient without regular, strategic, informed and reliable inspection.

Structural resistance in designed buildings, to earthquake or cyclonic forces for example, depends upon assessed or predetermined values. In all such structures there is a design level, conditioned in part by cost and factors of practicality, which may be overcome by an earthquake (or wind or flood) of greater magnitude. "Earthquake-proof" absolute resistance is not usually feasible.

Inspection, control and effectiveness

Construction control aims to ensure building security on behalf of current and future occupiers, users and passers-by, in accordance with defined local parameters and requirements, and comprises for example:

- separation of design, specification and tendering/bidding from construction itself
- multidisciplinary site inspectorate (engineers, architects, clerks-of-works)

- regular testing and recording of materials in use
- regular inspection and recording of construction in progress
- periodic and final payments for construction only when deemed to have been completed as specified

The construction industries in Britain and in the USA, rich and developed countries of the global north, have long histories of construction control, often influenced by catastrophe. In spite of this, failures and corruption continue to occur. If this is the case in developed countries, then there are questions about how effective such legislation can be, how it can be achieved, and how long it will take in most other countries.

Construction in some less-developed countries is evolving so as to eventually eradicate some shortcomings. Even where this is the case, it will be a long time before indigenous construction practice can consistently and pervasively achieve a quality of building construction so that all buildings are able to resist even moderate earthquakes, both in their primary structure and in their secondary elements.

Large construction companies, medium and small construction groups and self-builders will all need to be monitored, modified and inspected on all of their construction sites for appropriate compliance and quality achievement. This supported by but in addition to legislation which may be in place. For this to happen requires a volume, strength and persistence of political and personal commitment by very many trained people for lengths of time much longer than their working lives. And it requires people and a system able to deter and to resist the temptations of corrupt practice. Even when and where all this is achievable, there will be backlogs of previously built buildings.

In the meantime, there will be more earthquakes, in the same countries and in other countries. Yes, improved building construction is needed, but in addition, so are a broad spectrum of other measures to do with buildings, incorporated into the overall processes of national development.

Development in earthquake-prone places

Measures for more comprehensive earthquake disaster reduction commence with

- comparative assessment of sites for exposure and earthquake risk
- appropriate building form
- building arrangement, relationship and juxtaposition
- equitable inclusion of small domestic buildings as well as large and commercial ones

- equitable dispersion of communities and services and accessibility to communications and resources for self-reliance and survival.

In Turkey for example, even if construction had been adequate, there would still have been an earthquake disaster - though with fewer casualties. Some buildings inevitably would have failed and roads, bridges, power lines, telecommunications, water and fuel supplies would have been disrupted. Villages and rural communities would have been isolated, and *tsunamis* would have inundated coastal fishing and tourist venues. The poor would still have been living in sub-standard dwellings - because the poor always do - and the poor would still have been highest amongst the casualties, both in urban older buildings, shanty settlements, and in rural areas.

The population of North-western Turkey increased exponentially since 1945; the population of Istanbul having increased fifteen times in thirty years. The north-western region in which the1999 earthquakes occurred, has the highest population density of all and contains more than twenty percent of Turkey's national population. The province of Kocaeli, offshore of which was the earthquake's epicentre, had a population density of 260 people per square kilometre - amongst the highest in Turkey. A centralised government has attracted migration to the capital, and to other cities now so devastatingly destroyed. In a country severely prone to earthquakes, concentration of population anywhere is to be countered - until such time as zones of earthquake risk and vulnerability can be geologically and geographically identified.

Significantly, this year's earthquake in Gujarat similarly occurred in one of India's most industrially developed and most densely populated states. Rather than waiting for catastrophe to recur in Turkey or India, as they have in the past and will in the future, and rather than depend only on search and rescue, it would indeed be "better to invest in normality than in catastrophe" by wider adjustments in development strategy:

- First; all development sectors need to take on board the earthquake potential, not just those for civil defence and rescue, nor even only for building construction. Issues seemingly not relevant to earthquakes often bear the greatest consequences
- Second; high density populations need dispersal over time for more appropriate risk-related geographical balance. With reconstruction programmes now necessary in India and Turkey, there is the opportunity
- Third; not only is rehousing required, but also redistribution of clinics and hospitals, education in all grades, and social services of all kinds. These to be equitably commensurate with present and future, urban and rural, populations. Sustainable economic development requires all these and communication, transportation and marketing facilities as well. As much attention

needs to be given to existing rural and agricultural areas, both currently damaged and those undamaged

- Fourth; multiple series of small and diverse projects for reconstruction and development are required, not massive ones. In the face of the image of massive catastrophe, it is myriad seemingly inconspicuous measures that are the most effective for normal self reliance and quality of life, before, between, during, and in the aftermath of disasters. Though we read of national catastrophes, they are made up of myriad community and domestic small ones.

James Lewis RIBA has worked on construction inspection as resident/site-architect in the United States, Hong Kong and the United Kingdom, on earthquake reconstruction in Algeria, on hurricane-resistant construction methodology in the Caribbean, on the design of new buildings and the inspection and evaluation of buildings under construction in Bangladesh, and on the impact of flooding on buildings. He is Visiting Fellow in Development Studies at the University of Bath, consultant in hazards and human settlements, and author of Development in Disaster-prone Places (IT Publications, London. 1999).

James Lewis
Datum International
datum@gn.apc.org
www.datum-international.eu

http://www.radixonline.org/resources/improvedbuildingconstruction.doc