LEARNING FROM DISASTERS

Yasemin Aysan

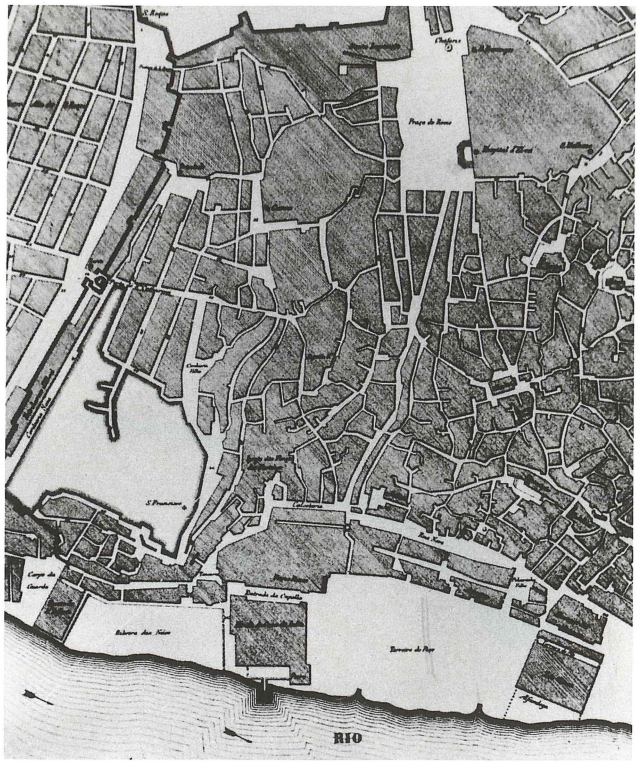
Natural disasters have claimed the lives of over three million people over the past two decades. As the first year of the International Decade for Natural Disaster Reduction draws to a close, Yasemin Aysan looks at natural disasters in the developing world and asks what lessons might be learned by architects and builders in reducing their catastrophic impact on the most vulnerable communities.

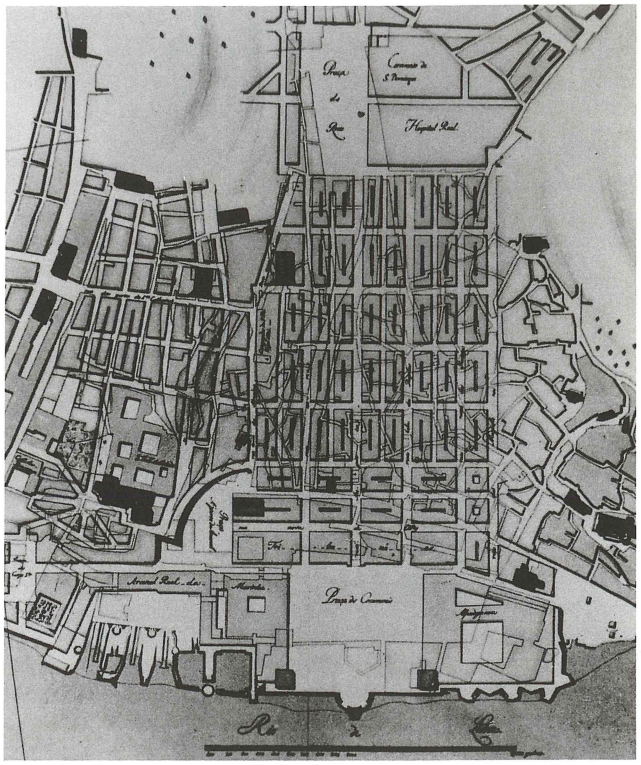
In the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the fountains of the great deep broken up, and the windows of heaven were opened. And the rain was upon the earth forty days and forty nights. In the selfsame day entered Noah, ... the sons of Noah, and Noah's wife, and the three wives of his sons with him, into the ark ... And the waters prevailed, and were increased greatly upon the earth; and the ark went upon the face of the waters.

The historical evidence indicates that calamities and disasters have disrupted the lives of people and societies for centuries. Though detailed description of many of these events are fragmentary and slender, major disasters such as the eruption of Vesuvius (AD 79) described by the Roman historian Pliny, the great fire of London (1666), and the earthquakes of Taxila near Islamabad (AD 25), Istanbul (1509), Lisbon (1755), San Francisco (1906) and Tokyo (1923) are relatively well-known due to the scale of damage and loss of life. It can be argued that many of these events became the catalyst for new architectural and urban forms. Archaeological discoveries in Taxila indicated houses rebuilt after the earthquake with very deep foundations; the London building acts restricted wooden houses being built on narrow streets and introduced regulations for party walls in terrace houses. The most grandiose rebuilding schemes changed the centre of Lisbon from irregular narrow streets into large boulevards and squares. The reconstruction following such catastrophes also provided the medium for training of builders in implementing safe construction techniques. Following the 1509 earthquake in Istanbul, which destroyed over a thousand houses, 109 mosques, many caravanserais, medreses, baths, fortifications and large sections of Topkapi palace, the Sultan mobilized a large workforce of 66,000 labourers and 3,000 master craftsmen together with 11,000 assistants. Historians state that the transition from masonry to wood frame construction in Istanbul was a result of this earthquake[1]. Three centuries later, the fires induced by the earthquake of 1855 in Bursa enforced the separation of houses and, this time, the use of masonry instead of timber frames for buildings where possible.

Many of the natural disasters of the twentieth century are much the same as those that have afflicted human kind since our beginnings. Earthquakes, floods, fires, volcanic eruptions and hurricanes continue to threaten lives and properties despite the experiences of centuries of calamities and post-disaster measures. The recent earthquakes in Iran, Armenia and Mexico; the floods in Andhra Pradesh and Bangladesh; hurricanes in the Caribbean

1. Lisbon before the 1755 earthquake and 30 years after, rebuilt on the lines of boulevards and squares. (Source: National Archives in Lisbon.)

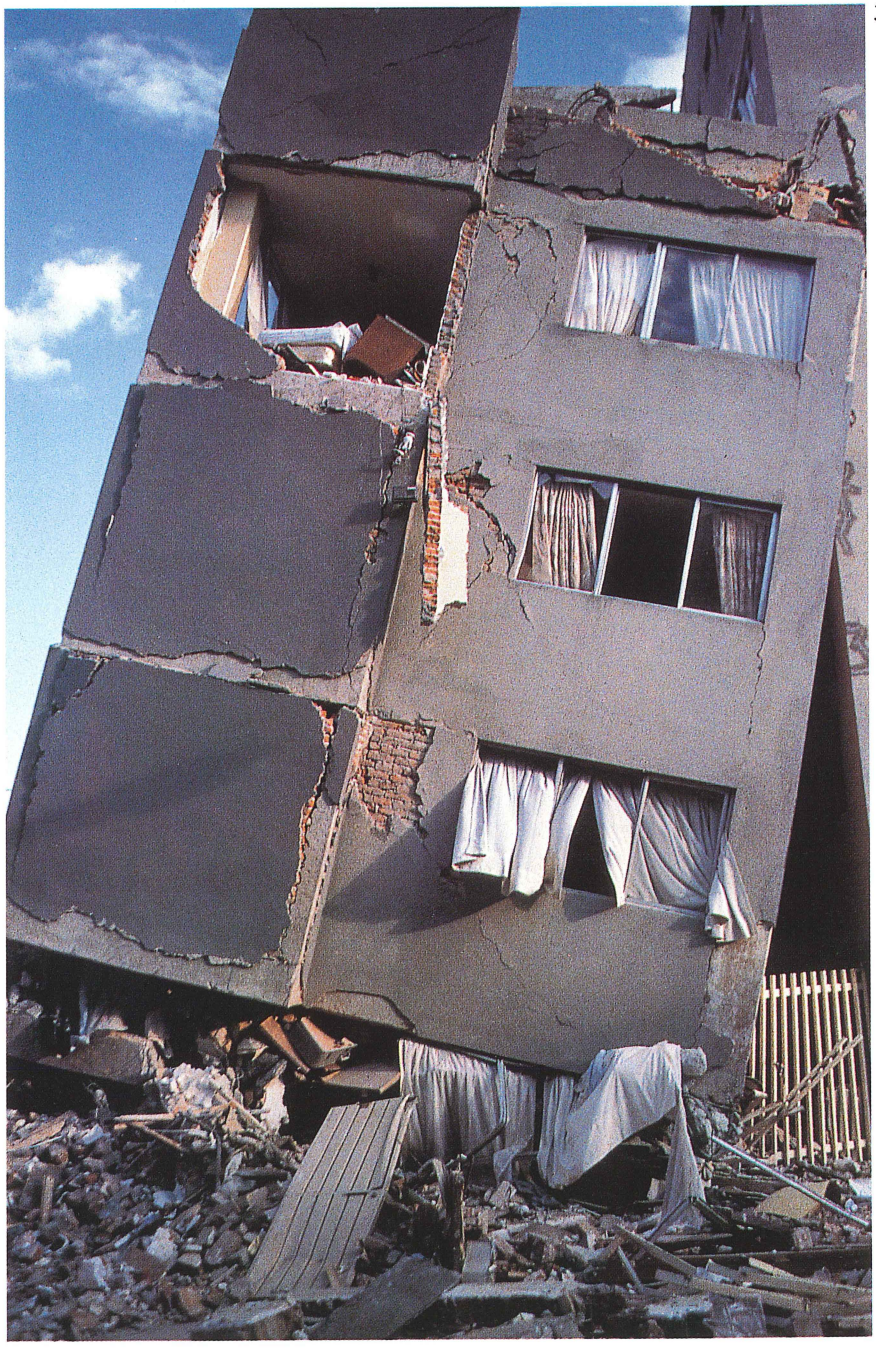




1

FATIHA HADDAR

2. Many engineered buildings, designed after Le Corbusier's 'construction on pilotis' principle collapsed after the 1980 El-Asnam earthquake in Algeria. Photo: Fatiha Haddar.



3. Poorly constructed concrete framed blocks of flats suffered damage during the Mexico earthquake of 1985.

resulted in human and economic losses far exceeding the impact of historical catastrophes. The unsettling question then is: Are these natural hazards increasing in numbers?

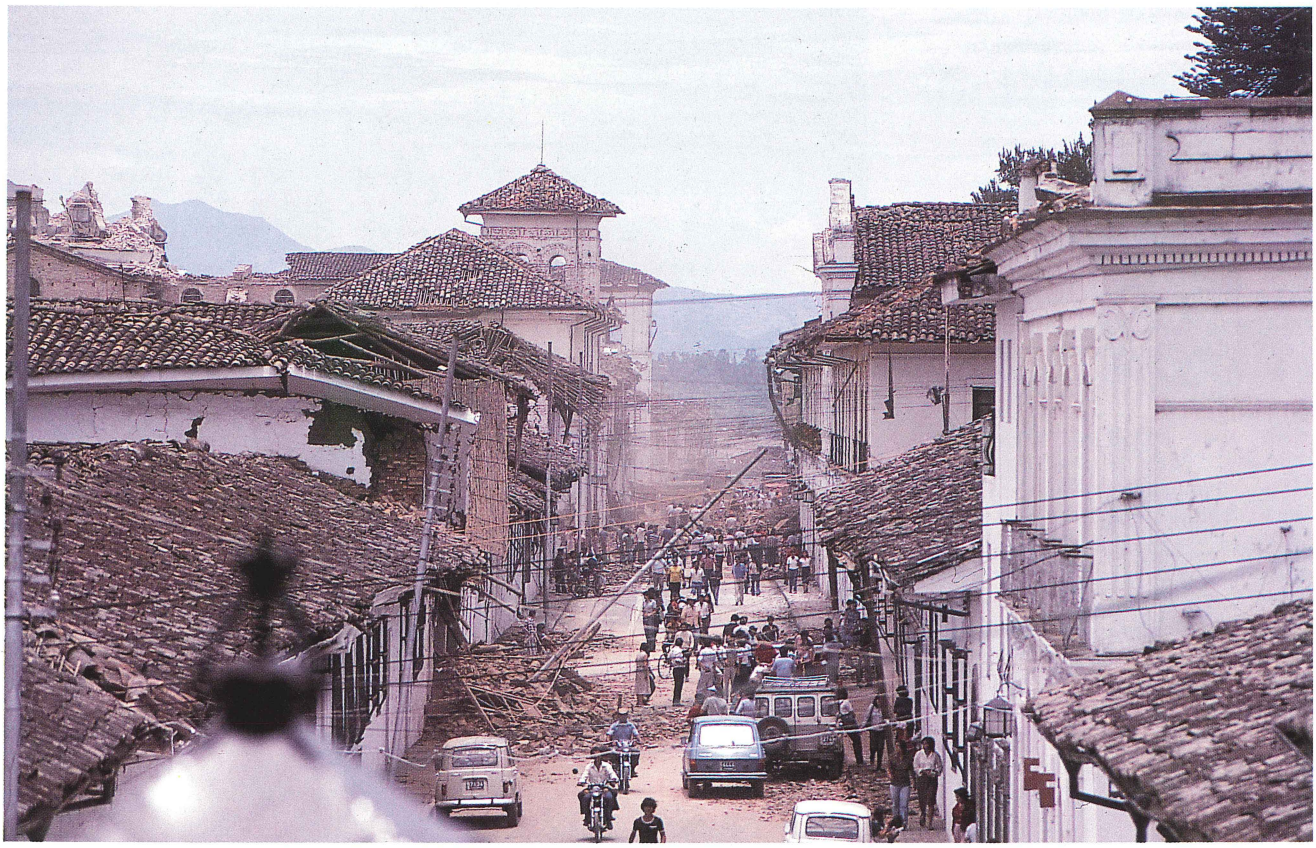
The most recent survey of disaster statistics clearly demonstrates that the average number of geologic, atmospheric and hydrologic disasters per year has not increased significantly[2]. There is not evidence, as yet, for a 'greenhouse effect' induced rise in sea level in the coastal regions of Bangladesh, or any indication of radical change in rainfall characteristics for Calcutta in the last 150 years which might have caused an increase in the severity of Ganges floods[3]. There is also no published evidence for a recent increase in the magnitude of floods or in sediment loads on the Ganges-Brahmaputra floodplains that can be attributed to the widespread assumption about Himalayan environmental degradation[4]. However, these are rightly held concerns and environmental impact studies certainly need to be undertaken to monitor the possible increase of future risks.

The answer to that unsettling question is more complex than it might appear. Reviews of the world situation indicate that while the number of disasters may not be increasing markedly, the catastrophic impact of these events in terms of loss of life is accelerating in developing countries (table 1). Increased vulnerability to disasters in the developing world is related not only to limited economic resources but also physical, socio-economic and ethnographic changes that have been taking place in these countries. In recent decades, there has been rapid population growth throughout the developing nations at an average growth of two to three per cent annually. This factor alone contributes to

Table 1

Region	Deaths Per Million
North America	31.5
Europe	38.57
Central America/Caribbean	918.16
South America	341.33
Asia	376.28
Africa (excluding droughts)	117.05
Australia/Oceania	323.5

(Based on data from Thompson 1982: 14-16).



4

5

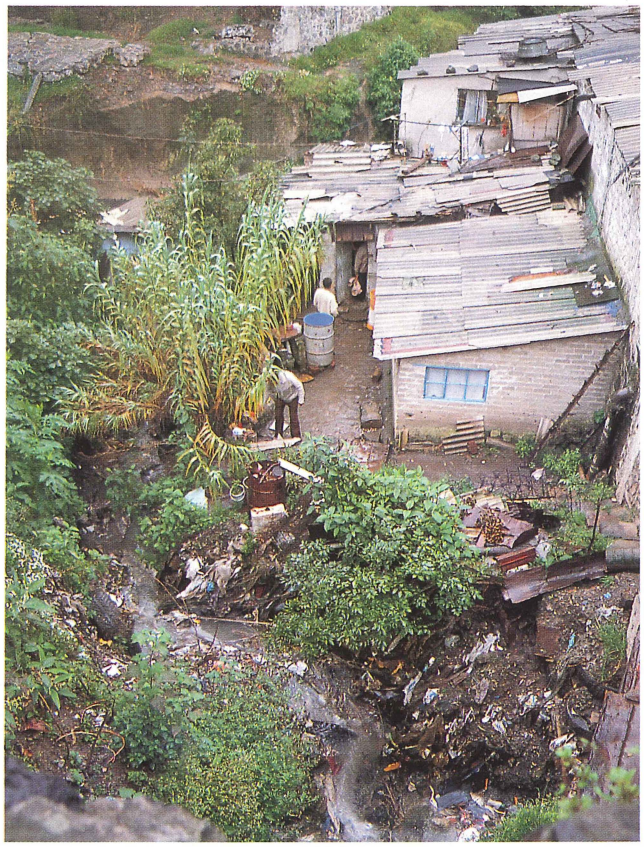
4. The historic centre of Popoyan, Colombia, after the 1983 earthquake. Timber rot, lack of maintenance and structural interventions to the buildings were the main causes of heavy damage.

5. The historic centre of Popoyan after reconstruction. The post-earthquake rebuilding of the city was used as an opportunity to train the builders and the public in safe reconstruction.

the expansion of settlements onto flood-prone land or hurricane-prone coasts. The population of active river flood plain in Bangladesh is thought to exceed one million and at least a further one million people inhabit similar insecure habitats in Meghna estuary, where people are also exposed to the hazards of tropical cyclones and storm surges. Clearly, it would be impractical in land-hungry Bangladesh to prevent people from occupying such unstable yet fertile land; much less to resettle such numbers in a less disaster-prone location.

While population growth puts at risk a higher number of people in both rural and urban areas, the rate of urbanization that has been occurring in developing countries presents a more complex problem of demographic and physical change. With the exception of cities like London, New York and Tokyo, the majority of cities with a population over five million are today in developing nations. It is crucial to recognize that fires have not been a major catastrophe in London since 1666, and the recent earthquake of Loma-Prieta in San Francisco took only over 100 lives. However, in cities like Istanbul and Bursa, once carefully-devised urban patterns and architectural details represent today only a fraction of the built environment swamped by uncontrolled urban development and seismically inappropriate building forms. Urban planning by the Ottomans could never have foreseen or attenuated the massive changes that many Turkish cities have undergone in the last 30 years.

Strictly enforced building codes and zoning laws may help to reduce disaster risk for developing countries, but the planners and local authorities in these nations are under constant pressure to increase densities so as to accommodate ever increasing urban populations. Besides, quality control is poor, codes are difficult to enforce; the new risks introduced by imported technologies and architectural forms are not well understood by the professionals. During the 1980 El-Asnam earthquake in Algeria, the widely practised stylistic trend of



6

7

8

'construction on pilotis', which followed from one of Le Corbusier's five principles, proved to be the wrong 'principle' in seismic zones. Failure of critical function buildings such as hospitals, due to inappropriate designs and poor quality construction puts professional ethics into question. During the hurricane of 1988 in Jamaica 80 per cent of hospital capacity was badly damaged; in the 1985 Mexico earthquake, 28 per cent of the much-needed bed capacity was lost by total collapse of five hospitals and severe damage of 22 hospitals.[5]

The risk due to urban disasters is not confined to new buildings. In the majority of developing countries historic centres once occupied by high income groups are now turned into multiple occupancy, high density tenements for low-income groups. Often with absentee landlords and low rental revenues, such buildings receive little or no maintenance. Their structural resistance is often further weakened by repeated disasters, damage followed by centuries of cosmetic repair, and haphazard modifications to the buildings. The Popoyan earthquake of 1983 in Colombia devastated the Colonial Centre of the city which was built four centuries ago, taking into account the seismic risk. Similarly, the 1985 earthquake of Mexico City hit hardest the historic centre, damaging culturally valuable buildings occupied by large, low-income families. Damage in both cities is repaired with the incorporation of seismic safety measures and upgrading of living standards. The inhabitants are provided with public awareness programmes and given skills to safeguard the future maintenance of historical buildings. However, in many disaster-prone countries of the developing world, the interest, if any, in protecting cultural and architectural heritage against natural calamities still targets only monuments and 'important' building.[5]

Above all, perhaps the most vulnerable population in developing nations are the inhabitants of small dwellings; the informal houses and the non-engineered buildings in cities, towns and villages. Where the most basic shelter needs are not met by the authorities, the poor and the urban migrants are forced to occupy

6. and 7. Squatter housing in Mexico City. Landslides and flash floods are common disasters.

8. The Historic Centre of Mexico City. Lack of building maintenance and high density occupancy resulted in heavy collapse and high casualties.

9

9 The town of Mangadah after the 1982 earthquake in the Yemen Arab Republic. Loss of traditional building skills, lack of maintenance and scarcity of timber were among the factors for building collapse.

10. Rural buildings in the Yemen Arab Republic. New building materials such as concrete in many developing countries are replacing the traditional ones. The risks induced by them are yet to be tested.

10

high-risk sites such as ravines, river floodplains and steep slopes. They are outside any building or zoning regulations and live in dangerous structures. In Guayaquil, Lima, Caracas and Rio de Janeiro it is the shanty towns that are in the path of landslides. The rural materials and skills are no longer applicable to the urban conditions and safer building materials either are too expensive or their behaviour in earthquakes, floods and hurricanes is not well understood.

The scarcity and cost of traditional building materials and the loss of fine buildings skills is a problem also faced in many rural areas. As the recent earthquake in Iran and many others in Turkey and Pakistan proved, well-constructed and maintained timber-framed buildings often perform better than other structures.[6] However, environmental degradation and population explosion force people to look for alternative material such as concrete, breeze blocks and iron sheeting. New materials require new construction skills which are often acquired 'on the job' without necessarily understanding the fundamental safety principles. In Bangladesh, the increased use of roofing sheets to replace traditional thatching materials and bamboo when not properly attached to the structure was a major source of casualties during recent cyclones and tornadoes. In Iran, the quickly erected steel-frame buildings collapsed due to the failure of simple spot welds and heavy masonry infill.

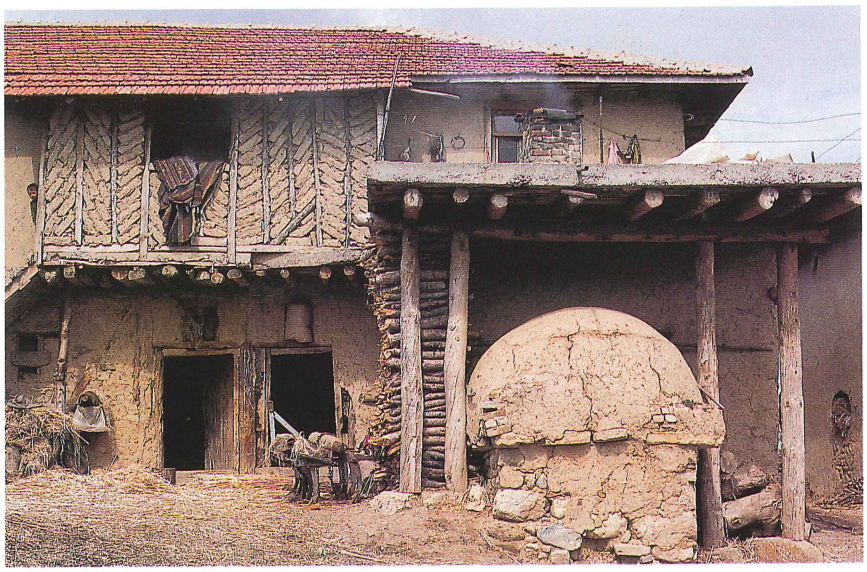
Projects such as OXFAM's *Builders Training Programme* after the 1982 earthquake in the Yemen Arab Republic, the post-disaster housing schemes in the aftermath of the 1987 Ecuador earthquake and the 1988 floods in Bangladesh, are attempts to improve the hazard-resistance of traditional buildings by promoting traditional skills. However, 'urbanization of the mind'; the values attached to modernity and the rising aspirations in some rural parts of the developing world, may resist the idea of returning to tradition.

11. The village of Aksaklar in western Turkey. New building materials such as concrete are used alongside traditional ones in most earthquake-prone parts of Turkey.

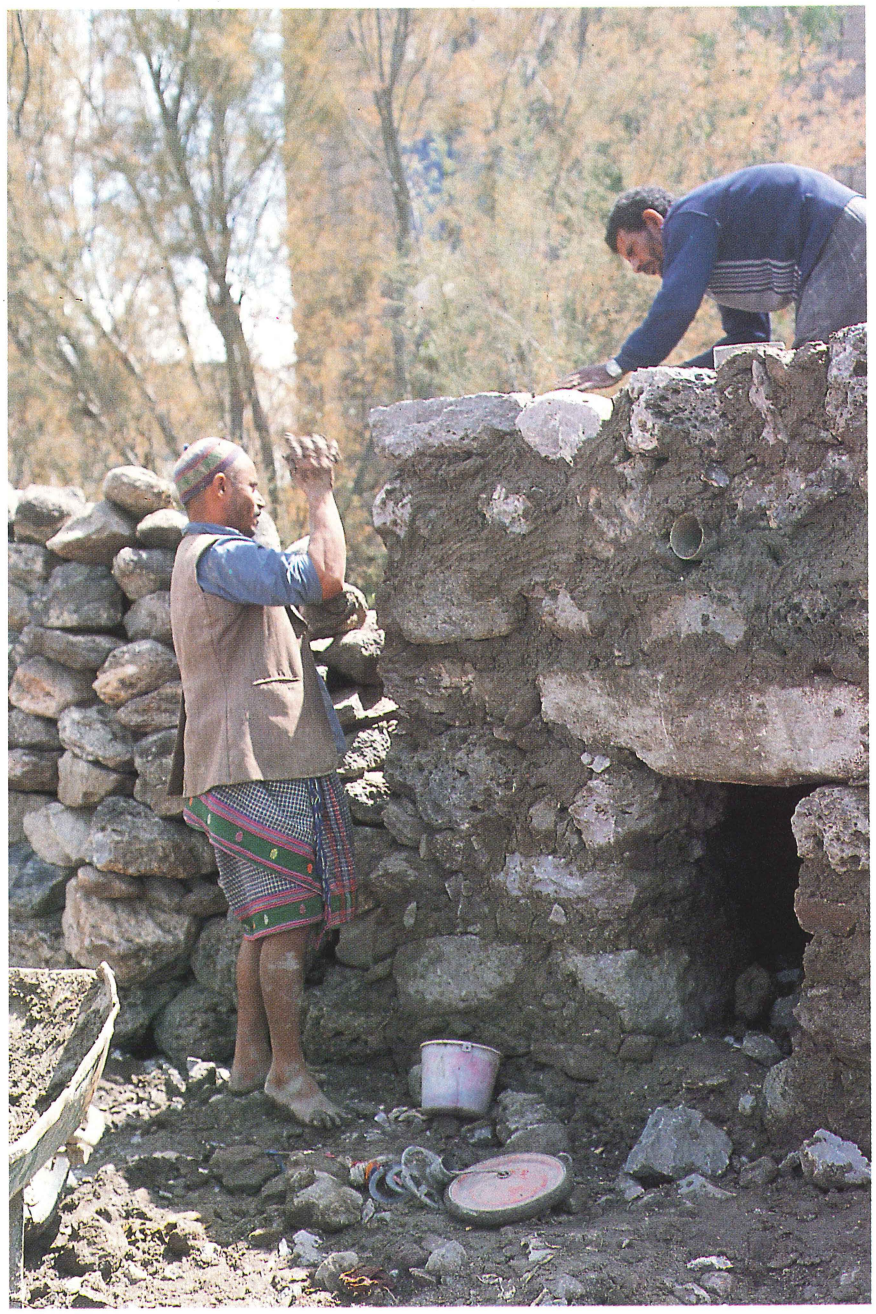
12. After the earthquake in the Yemen Arab Republic many houses were quickly repaired or rebuilt without much improvement of the traditional techniques. OXFAM's Builders Training Programme targeted the village builders.

At a recent conference in Oxford Polytechnic *Disasters and the Small Dwelling*, attended by Non-Governmental Organizations (NGOs) and researchers from 19 different countries, understanding the social, cultural and physical dynamics of this shift was identified as the key to successful future risk mitigation programmes.

At the onset of the International Decade for Natural Disaster Reduction (IDNDR), declared by the United Nations and supported by 93 countries, architects, planners, and educational institutions in developing countries have a unique opportunity: to become aware of the increasing disaster vulnerability of communities and the means to reduce risks – and thereby save lives and protect property.



11



12

REFERENCES AND BIBLIOGRAPHY

1. Danismend, I.H., *Izahli Osmanli Tarihi Kronolojisi,* Istanbul: Turkiye Yayinevi, vol. 1, 1947, pp.416-417.

2. Thompson, S.A., *Trends and Developments in Global Natural Disasters,* 1947-1981, Natural Hazard Research, Working Paper #45, Boulder: Institute of Behavioural Science, University of Colorado, 1982.

3. Brammer, H., Floods in Bangladesh: Flood Mitigation and Environmental Aspects, *The Geographical Journal,* vol. 156, no.2, July 1990, pp.158-165.

4. Ives, J.D., and Messerli, B., *The Himalayan Dilemma: Reconciling Development and Conservation,* London: Routledge, 1989.

5. Aysan, Y., et. al., *Mitigation of Urban Seismic Risk: Actions to Reduce the Impact of Earthquakes on Highly Vulnerable Areas of Mexico City,* Report of Bilateral Technical Cooperation Project between the Governments of Mexico and United Kingdom, 1989.

6. Aysan, Y., and Oliver, P., *Housing and Culture: A Guide for Future Policy Making on Housing in Seismic Areas, Oxford Polytechnic,* for Overseas Development Administration, 1987.

PHOTOGRAPHS BY THE AUTHOR UNLESS OTHERWISE STATED.

DR. YASEMIN FATMA AYSAN TRAINED AS AN ARCHITECT AT THE MIDDLE EAST TECHNICAL UNIVERSITY IN TURKEY. SHE IS NOW DIRECTOR OF THE DISASTER MANAGEMENT CENTRE, OXFORD POLYTECHNIC, WHERE SHE ALSO TEACHES IN THE SCHOOL OF ARCHITECTURE.