Shelter After Disaster

by: Ian Davis

Published by:
Oxford Polytechnic Press
Oxford Polytechnic
Headington
Oxford, OX3 OBP
United Kingdom

Paper copies are 4.75 British pounds.

Available from:
Oxford Polytechnic Press
Oxford Polytechnic
Headington
Oxford, OX3 OBP
United Kingdom


ISASTER
Davis

Yugoslavia... Guatemala... Nicaragua... these are only three of the Third World countries which have suffered catastrophic natural disasters within recent years. In this study Ian Davis, a Principal Lecturer in Architecture at Oxford Polytechnic, analyses the problems faced by the new homeless in these circumstances and the philanthropic reaction of the West. Indeed, he questions the validity of such imported shelter provision. The book also attempts to relate the problems of post-disaster shelter in its varying forms to the wider context of the overall development of vulnerable countries, most of which are in the Third World.

Shelter after Disaster also includes a unique historical survey of events such as the eruption of Vesuvius (AD 79), the Great Fire of London (1666) and the San Francisco earthquake (1906), relating the historical problems of reconstruction to those experienced today.

Ian Davis does not pretend to solve the problems of emergency shelter, but he has been able to draw on his considerable experience as a member of a UN advisory team, visiting many recent disaster areas during the critical periods of reconstruction. He presents a lucid account of what really happens and suggests several alternatives to current methods of shelter provision. His book will be of great interest to architects and designers and to all those directly or indirectly concerned with the co-ordination of disaster relief and the provision of aid.

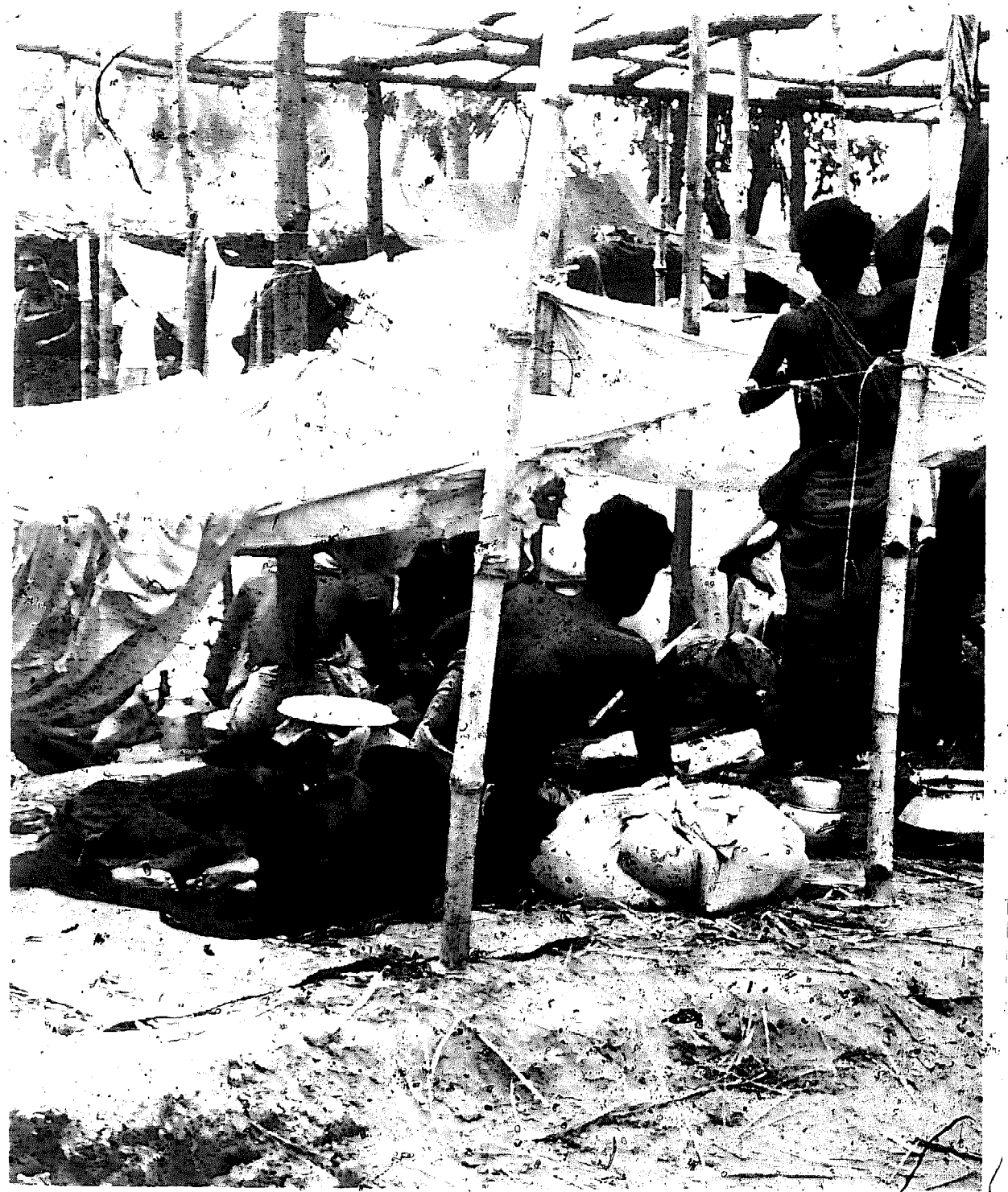
Jacket design by Rob Poulton. Illustration by courtesy of Barchild Construction UK Ltd. and Engineering News Record, New York.

OXFORD POLYTECHNIC PRESS

Headington Oxford OX3 OBP

U.K. Price £3.75 ISBN 0 902692 16 X

Shelter after Disaster



SHELTER AFTER DISASTER

Ian Davis

1978

Oxford Polytechnic Press

First published in 1978 by Oxford Polytechnic Press, Headington, Oxford OX3 0BP

Designed by Jeremy Burman Picture research by Mike Pigott

Picture research and production assistance by Tom Emanuel, Alison Martin and Rob Poulton

Edited by Peter Danckwerts

Set on an IBM composer in 10/11 pt. Press Roman at Gem Graphic Services, Didcot, Oxon

Photo Reproduction by Oxford Litho Plates Ltd.

Printed by Blackwell's in the City of Oxford

Bound at Oxford Polytechnic

ISBN 0 902692 16 X

To those . . .
within vulnerable homes, awaiting the next disaster

To those . . .
who survived the last disaster only to live within sub-standard shelters

And to those . . .
who are attempting to rectify both situations

CONTENTS

LIST OF ILLUSTRATIONS

LIST OF DIAGRAMS

ILLUSTRATION ACKNOWLEDGEMENTS

I am indebted to Oxfam, who generously gave me full access to their photographic files, with the result that a large number of photographs within the book came from this source.

I have attempted to locate all the sources of photographs to obtain full reproduction rights, but in the very few instances where this process has failed to find the original agency or photographer, I offer my apologies.

Other acknowledgements: Frontispiece, 'Brot für die Welt', Stuttgart; 2, 3, 4, Architectural Press Ltd; 11, William Taylor; 13, 32, Camera Press Ltd; 27, Tear Fund; 31, 39, Steven Sywalka; 36, Trans-East Press Agency, Greece; 37, FAO; 41, Ministry of Reconstruction and Resettlement, Ankara, Turkey; 45, Keystone Press Agency Ltd; 47, USAF, Aerial Reconnaissance Division, Southern Command, Panama; 54, Building Design; 63, Jon Cavanagh; 64, Fujimori Kogyo Co Ltd., Japan; 65, SIPA Press; 70, John Fairfax & Sons (Australia) Ltd.; 76, 93, Mary Evans Picture Library; 77, Guildhall Library, City of London; 78, Prints Division, New York Public Library (Astor, Lenox and Tilden Foundations); 80, 86, 87, 88, 89, California Historical Society; 81, 83, Bear Photographic Services, San Francisco; 84, San Francisco Chamber of Commerce; 85, Eric Swenson, United States Geographical Society; 90, Italian State Tourist Office; 92, O.K. Brehmer; 94, USSBS, National Archives; 96, Sport and General Press Agency; 98, Barchild Construction UK Ltd. and Engineering News Record, New York.

ACKNOWLEDGEMENTS

I would like to thank all those who have opened their homes, libraries, and memories as I have attempted to gather together this material on shelter after disaster.

In particular I would like to thank my tutors at University College, London, who not only steered me in a sensible direction, but also shared their vast experience and constantly encouraged me throughout four years of analysis. They are Professor Otto Koenigsberger and Professor Duccio Turin. Very sadly, Professor Turin was killed in an accident before seeing the fruits of his patience. I am particularly grateful for Fred Cuny's helpful comments on the draft manuscript of the book. There are in addition the staff of many relief agencies, in particular those in Oxfam and Tear Fund, who have played a vital part in sharing their perspective on these issues.

Within the text I have tried to credit all those whose ideas have contributed to my own, but where I have failed to do so, I offer my apologies.

I must thank, too, the staff and students of Oxford Polytechnic. The Department of Architecture generously spared me for a year to pursue these studies with undivided attention, and they have proved to be a constant stimulus and encouragement. More recently I must thank the staff and students on the Publishing Course at the Polytechnic, and Mrs. Phyllis Hambelton, who typed the manuscript, for tolerating my haphazard ways of working. The final form of this book is a tribute to their skill and enthusiasm.

Lastly, my gratitude to my family, who have come to see disasters in a rather personal light; without their patience and love, my involvement in this project would have ceased long ago.

Ian Davis
Oxford

January 1977

PREFACE

This book was written during the autumn of 1976. This was the worst year since 1927 for earthquakes, with fifteen major disasters of over 7.5 on the Richter scale, the worst European earthquake in Italy since Skopje in 1963, the most devastating earthquake in 500 years in Guatemala, and possibly 700,000 killed in China — a truly horrifying list.

But just as I was completing the text, a further major earthquake took place on 24 November in eastern Turkey. I have made corrections to the manuscript to include references to this new disaster, but it is still too early to digest the lessons from the tragedy. This is particularly tantalising since it is the first major disaster of the last five years where winter and high altitude exposure problems have become the dominant concerns of those involved in the relief operation. And since this topic has always been one of the crucial questions in such research, it is particularly frustrating to put the cap on my pen, when many of my statements will be challenged in the light of these events.

This, however, is the nature of the problem: events will teach us lessons and these lessons will overturn our tidy conclusions, and, I hope, lead to better solutions.

INTRODUCTION

Any consideration of emergency shelter provision following disasters prompts the immediate observation that there must be few subjects in the whole field of building on which so much effort has been expended, so much money spent, and yet, paradoxically, where so little is really known.

This modest study is an attempt to redress this situation. It comes at a time when there has been the most concentrated analysis of this problem ever attempted. The Office of the United Nations Disaster Relief Co-ordinator (UNDRO) in Geneva has recently been making the first international study of this problem, and by the time that this book is published I hope that the various questions I pose will have been answered as various items of essential evidence are produced.

Despite a gradual clarification of these issues our collective knowledge is still limited, and there are significant gaps in our understanding. For example, we still know little about the precise ways in which local communities function when they tackle their relief or reconstruction. We know little about the usefulness or long-term effects of our aid, whether it be tents or shelters. And there are geographical areas, such as Russia and China, where the approaches to relief or reconstruction are virtually unknown to us.

Overall, this study will reflect the bias of being based largely on documents in English, and also the bias of being written in England, at a safe, perhaps *too* safe, distance from the vulnerable conditions I have described. It is also limited by the extent of my own first-hand experience, which is of just eight disaster situations, most of which were earthquakes.

Since this is probably the first book to be written specifically on this theme; I have deliberately painted a broad canvas, while recognising that the prime focus is that of shelter needs, immediately after disasters.

I have not restricted myself to 'natural' disasters, but my experience has directed the study away from the 'man-made' disasters such as wars or refugee situations, which have certain unique characteristics.

Having established immediate shelter as my central concern, I have deliberately brought into the picture the pre-disaster context. Within Part I, I have attempted to show that the situation prior to the catastrophe is a crucial factor and may be the actual cause of the disaster. In Part II, I have set out in diagrammatic form the widespread myths which exist about disaster shelter, together with the facts which, I hope, will dispel these false beliefs. Then, in Part III, I have commented on the diverse strategies that are likely to be pursued in the immediate aftermath. Once again, I have avoided being 'boxed in' to a time phase called the 'relief period'. Any study of these topics rapidly shows that relief, rehabilitation and reconstruction, though definite phases, constantly overlap, and the immediate decisions made within days of a disaster have a habit of influencing long-term events.

Finally (and perhaps perversely) I have left the historical section to Part IV at the end of the book. In this way I have been able to look back and reflect whether the patterns of events I have attempted to define are purely mid-twentieth-century responses, or are more deeply rooted.

I will value the patience of readers in this first venture into print. I hope that this book will produce corroborative evidence, and where an ignorant dogmatism has crept into my ideas I will be grateful to hear counter-arguments. Both are necessary for the development of our knowledge.

1 Managua, Nicaragua, destroyed for the third time since 1885 in the earthquake of 23 December 1972

PART 1

a vicious spiral

This is the excellent foppery of the world . . . . we make guilty of our disasters the sun, the moon, and the stars: as if we were villains by necessity; fools by heavenly compulsion; knaves, thieves, and treachers by spherical predominance; drunkards, liars, and adulterers by an enforced obedience of planetary influence.

Shakespeare: *King Lear*

Housing and vulnerability

From man's earliest days, his very survival has been dependent on the great elemental powers, water, wind, sun, fire and earth. Each is vital for his existence and each can in turn threaten his puny hold on the planet's surface.

When the drizzle becomes a cascade, or the breeze a hurricane, man is involved in his classic struggle with the elements, and he has viewed the process in various ways: as an act of judgement, an omen, or 'an act of God', to quote the Lloyds underwriter.

For someone living within the comparative security of northern Europe (where the label *disaster* is more likely to refer to the collapse of sterling than to bricks and mortar!) it is extremely difficult to appreciate the extent of the risks which many communities face. To understand this I will discuss a vulnerable situation in England, and the way it is being treated.

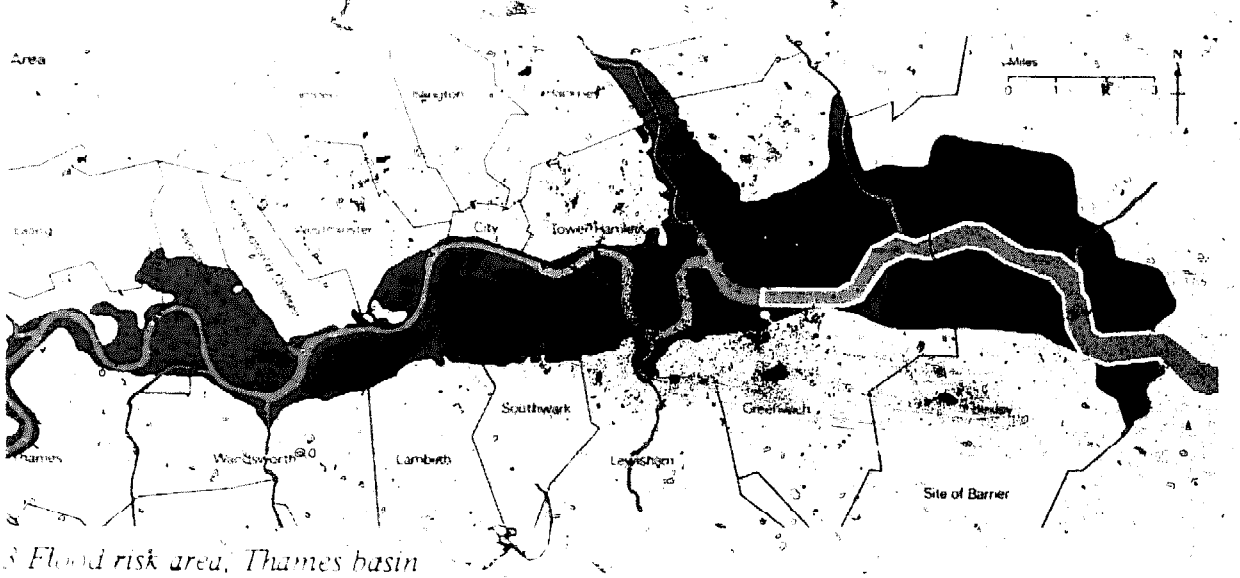
Few realise that within central London there is a very serious risk of flooding. This has been known for generations, and now a sum of £211 million is being spent on the Thames barrage and flood protection measures. Tony Aldous has observed that all that is needed is a combination of three factors: high tide levels, a high freshwater flow down the river and a surge of water up the Thames caused by meteorological conditions in the North Sea *(3)*.* If these conditions were to come together before the Thames barrage is completed in 1980 then London could face a major disaster, which in monetary terms alone has been estimated at £2,000 million in damage to property.

It is also significant that this risk has been steadily worsening because of three factors. First, the fact that London is sinking on its clay bed, as a result of a slight tilt of the south-eastern region. Secondly, tides are rising in height, and thirdly, building has progressively engulfed the traditional 'flood absorption' areas, such as the Kent and Essex marshes. In technical language, the hazard, or state of vulnerability, as in so many parts of the world, is increasing.

London is vulnerable to this one natural

*The italic numbers in parentheses refer to the References listed alphabetically.

2 Simulation of Parliament Square, London, under flood



3 Flood risk area, Thames basin

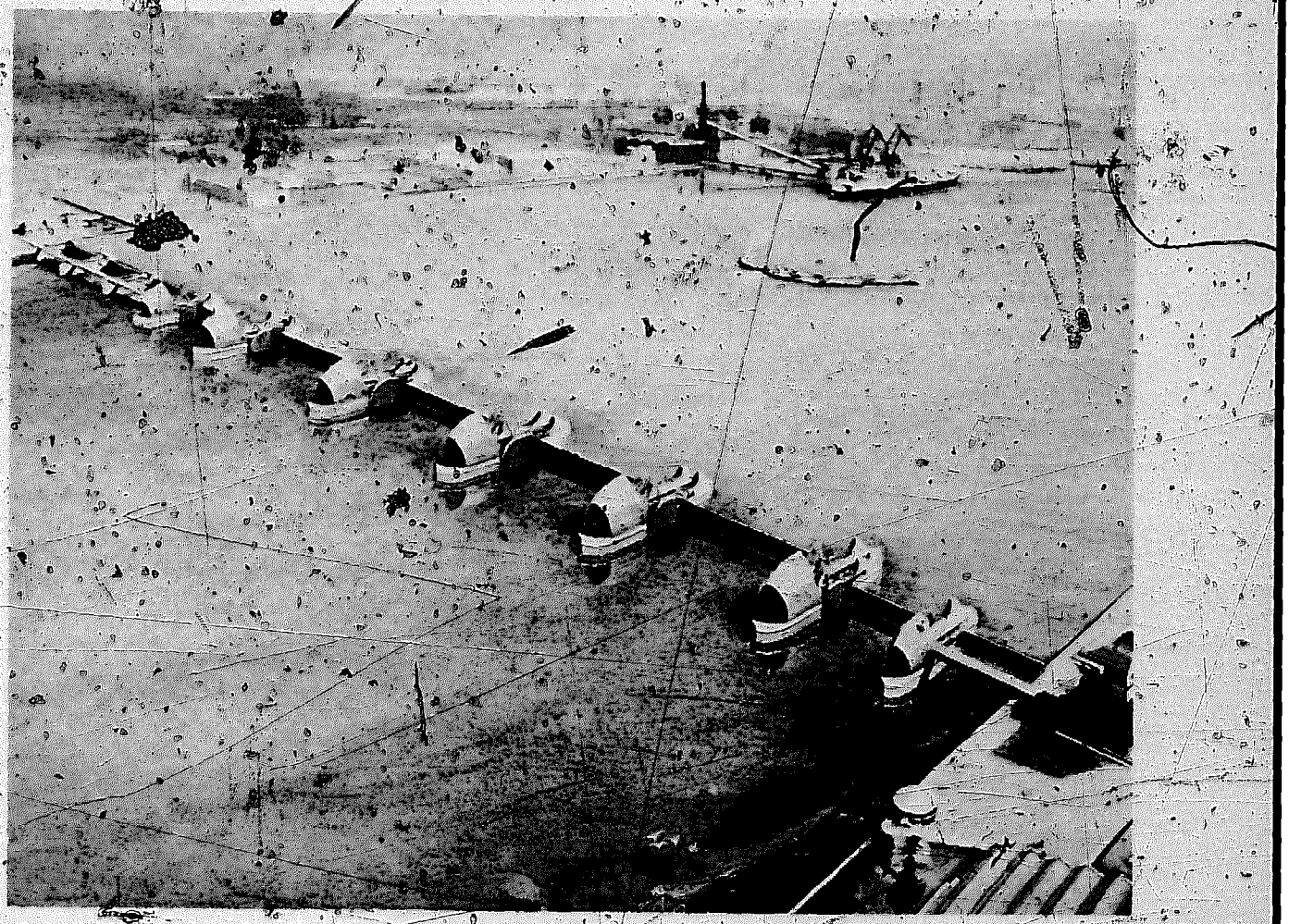
hazard – flooding – whilst many other metropolitan centres are vulnerable to multiple risks – flooding, earthquake and hurricanes. Manila and Kingston, Jamaica are in such situations, and there are some environments which are even more critically vulnerable. Such hazards derive from the prevailing conditions in a given situation.

Philip O'Keefe, an economist working with the Disaster Research Unit at Bradford University, has suggested that the best definition of a disaster is the interface between a natural or man-made hazard (for example an earthquake) and a vulnerable condition (badly constructed housing in a dangerous location) *(69)*.

This 'interface' is shown in Diagram 1. The flood protection measures in the

Thames estuary are an example of a preventative action which will remove the risk at present hanging over London. The measures are a direct result of the disaster in 1953, where 300 people died in the Canvey Island flooding. This is a characteristic pattern — a disaster occurs and public opinion forces apathetic officials to recognise a risk and spend money to remove it. An earlier example of this process was the introduction of building bye-laws to prevent wooden houses being built on over-narrow streets following the 1666 Great Fire of London *(28, 52, 74)*.

Essentially these are preventative or mitigation measures. Apart from isolated exceptions man has had little success in either predicting or preventing the vast natural forces that produce an earthquake or a flood, and his attention has therefore been



4 Artist's impression of Thames barrage (now under construction)

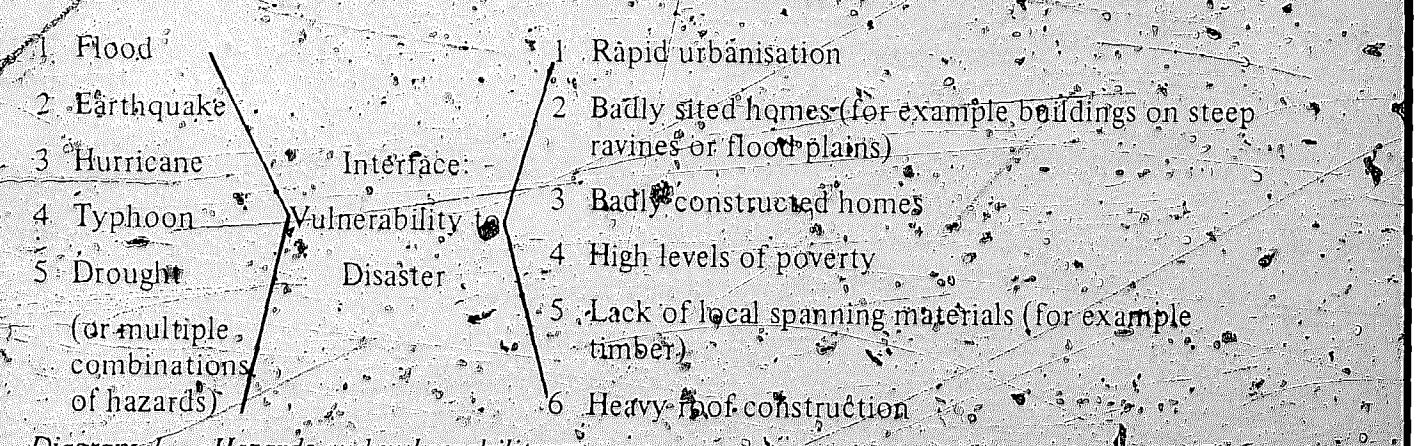


Diagram 1. Hazards and vulnerability

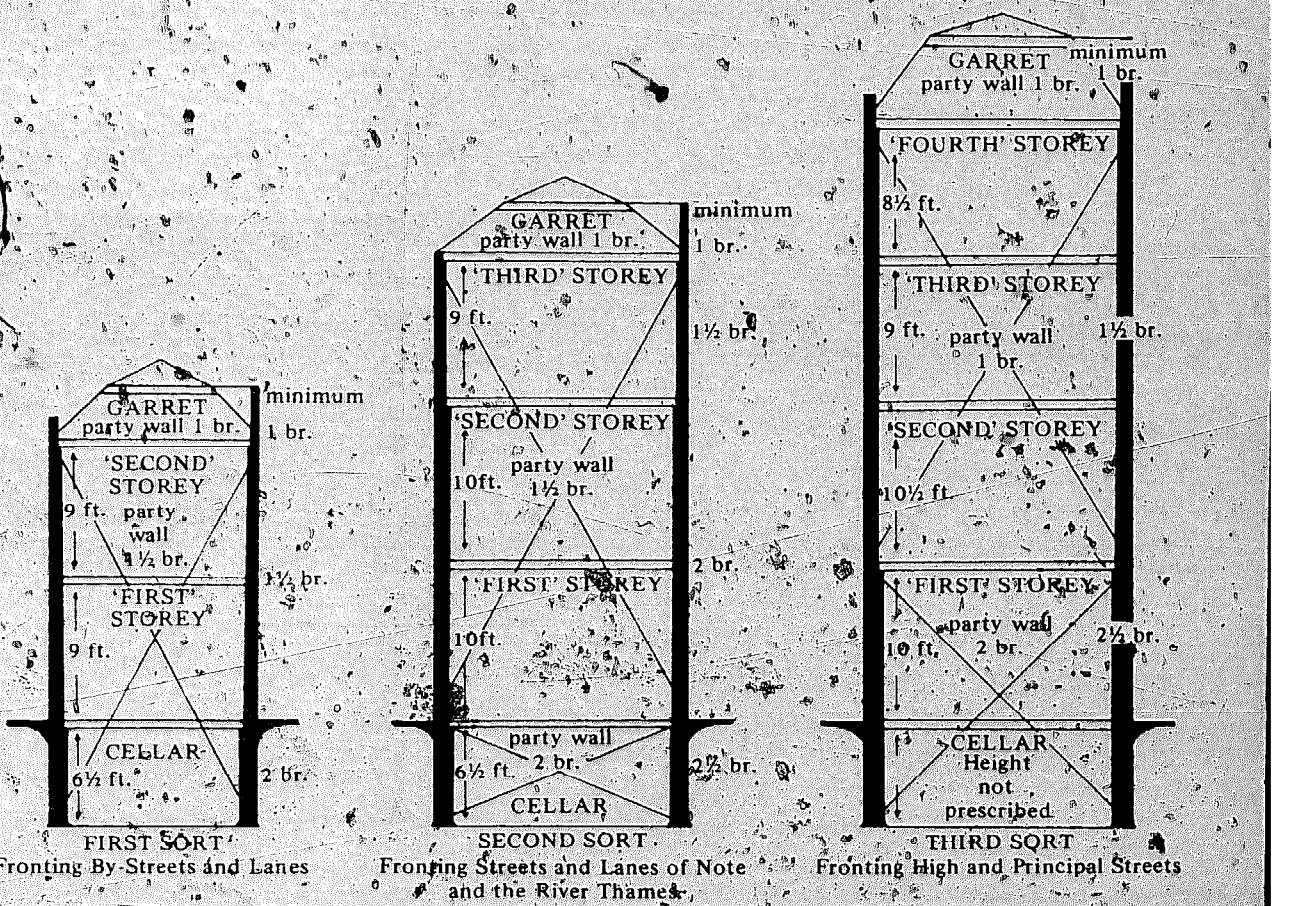


Diagram 2. London Rebuilding Act 1667

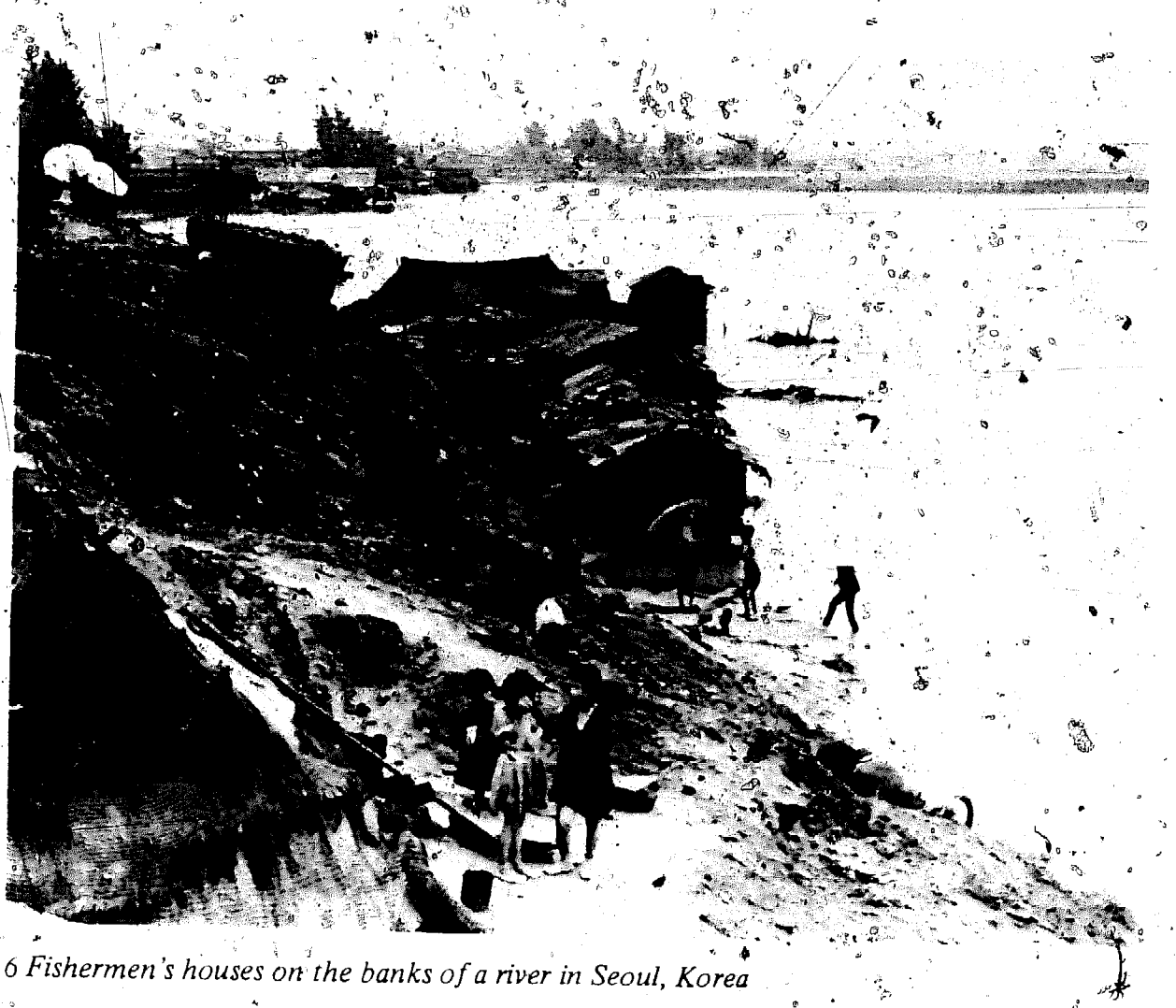
rightly directed to the other side of the interface – the 'dangerous conditions'.

Since floods, earthquakes and hurricanes recur in some places with relentless frequency, we may wonder why they don't result in changes. When a tidal wave demolishes a village, or an earthquake reduces a town to a dusty heap of rubble, it is logical to consider a new location, or a safer mode of construction. But man is a complex, irrational being and logic will probably always be the victim of expediency. To move the village above the flood plain means the loss of fishing rights – or the sacrifice of fertile farm lands. And these factors, which are everyday necessities, weigh heavily against a flood hazard with a return period of every 5-10 years.

Then, to rebuild a house in a safer manner may demand skills and materials unavailable in the locality. It is easy for visiting teams of expert consultants to shake their heads and write airily of 'widespread failures in domestic construction' resulting from the lack of lightweight roofs and 'tensile members' (wooden beams). From the point of view of the villager, however, standing amid his ruined house, these words are almost meaningless, since he would have to spend more money than he possesses to frame his house or support a light roof.

When we consider local housing which is vulnerable to earthquakes, and set the 'pros and cons' of safety alongside tradition, then the winner is all too predictable. On the side of safety, there is a house with a lightweight roof, probably built in an unfamiliar manner; the roof will need insulation if the house is to avoid becoming an oven in summer or a refrigerator in winter. This house will be safe against a massive earthquake. Now, set against this there is a traditional house, possibly with thick stone or earth walls capped with a solid roof of earth piled on rough timber rafters. This house provides the everyday comforts – cool

5 Lice, Turkey, following the earthquake of September 1975. Note the vulnerable site below rock formations



6 Fishermen's houses on the banks of a river in Seoul, Korea

every twenty-five years. This isn't the only place where the introduction of alien building styles has made poor people's traditional housing unsafe.

Another exception is the form of house that is built on stilts to withstand flooding.

9 Han River slums in Seoul, Korea. The slum residents were forced from their shanties during the 1965 Han River flood

10 Housing in Trinidad, Bolivia, with raised plinths to protect buildings from flooding. In this instance the flooding was so intensive that its level rose above the elevated floor level.

11 The Palace of Minos, Knossos, Crete. Note the wooden ring beam on the wall behind the columns

But here the hazard is probably an annual (or bi-annual) event, that coincides with a monsoon season and as such becomes a predictable 'everyday' occurrence within everyone's memory; and therefore it is a design factor considered when each house goes up.

The final exception is the modification of building techniques following constructional failures in disasters. Historical evidence of this emerged when Sir Arthur Evans excavated the Palace of Knossos in Crete, uncovering a structure built about 1650 B.C. The palace was probably built shortly after some catastrophe, perhaps a volcanic eruption or an earthquake. This may be the reason for the existence of the timber ring beams that occur throughout the palace: a form of lateral bracing to hold the structure together, in the event of earthquake forces.

Professor Nicholas Ambraseys of Imperial College, London, has written:

> After destructive earthquakes, towns were often rebuilt on an extensive plan with marked changes in building techniques such as unusual types of foundations, consisting of a grid of wooden beams on which the structures are built, the introduction of timber-bracing of houses and the abandonment of ordinary unreinforced brickwork. It is often assumed that these changes are due to techniques brought into a region by new settlers, or by invaders. This is not always the case *(7)*.

Ambraseys proceeds to show that timber bracing techniques have been adopted in areas without local timber supplies in order to produce safe structures. These areas include Anatolia, Crete and Northern Pakistan, and archaeological evidence going back over 2,000 years proves this point.

The traditional Japanese house has often been cited as an example of earthquake-proof construction. Evidence on this issue is slight, but it is conceivable that the lightweight

wooden frame structure of the traditional Japanese house has evolved to withstand the forces within an earthquake. Further, there are highly ingenious 'rocking foundation bearings' in some of these structures, which may have originated as a precautionary measure.

12 Kurdish man standing in the ruins of Lice, Turkey, declaring that the earthquake was the 'will of Allah'

It is important to note a further factor which may prevent communities from taking preventative action against disasters. This was shown to me very vividly whilst I was in Lice, a town that was totally wiped out in an earthquake in Turkey in September 1975. While I was walking around the stark ruins of this ghost town, an old Kurdish man came up to me. Despite my language difficulty, his sentiment was very obvious: 'It is the will of Allah', he declared, with a soulful look in the vague direction of Mecca.

In point of fact the buildings of Lice were built on the side of a mountain, and some of the houses were demolished when there were rockfalls, whilst others collapsed like dominoes, one falling on another. In addition many homes collapsed because of bad construction. These events probably account for the fact that 2,385 people were killed within Lice, and 1,800 houses were destroyed: a ratio of 132 deaths per 100 houses. Within the whole of Turkey the normal ratio of deaths to houses destroyed

13 The Katsura Imperial Villa in Kyoto, Japan. Its lightweight construction has survived earthquakes since it was built in 1640

14 Ruined town of Lice, Turkey

is 8.5 to 100 *(9, 92)*.

The exact population of Lice prior to the earthquake is very uncertain, but it is likely to be reasonably close to the census figure of 8,200. Therefore 1 in 6.8 died. This is an extremely high ratio, as is the ratio of deaths to houses destroyed, and it indicates the extreme vulnerability of the population in this region.

But the number of deaths also results from a cultural factor. The disaster occurred at 12 noon on 6 September. This is the eve of the Moslem feast of Ramadan, and each house was full of women and children preparing the traditional feast. Thus the casualties were almost exclusively female, since the men were in the fields or in the mosques *(23, 24)*.

It is clear that there are many cultural and economic obstacles that prevent the instigation of sensible preventative and mitigation measures. And in recognising that the target social group is the extremely poor, it is necessary to reflect that it may cost 15% more to construct a safe house *(60)*.

To summarise, the obstacles that stand in the way of house builders responding to these risks are: the long return period of many forms of disaster; the resistance that communities have to moving away to less vulnerable locations; a natural resistance to unfamiliar – and probably more expensive – building techniques; and the difficulty of education when disaster victims may view these events as the will of Allah, with the reaction 'who are we to prevent such a judgment or omen?'

But as we have seen, societies *after* a disaster have often taken action, such as the wooden ring beam in the Palace of Knossos, bye-laws after the Great Fire of London and the Thames barrage now under construction. All of these activities are responses to known hazards and previous disasters. Clearly, these are positive steps forward, but it is tragic that the mechanism that stimulates action is nearly always the manifest failure of previous methods of construction. For the future we can hope that changes will take place before the event.

Disaster, poverty and urbanisation

If an identical natural phenomenon affected three different geographical locations, it is conceivable that there would be three different results.

Taking, for example, an earthquake, we can observe that if it occurs in an unpopulated area it is clearly not a disaster but is better described as a natural

phenomenon. It may result in physical damage – landslides and possible damage to woodlands or agriculture.

Earthquake
1. No population
2. Well-constructed city
3. Badly constructed, ill-sited city

Diagram 3 Geographical variables

15 Housing in Guatemala city, showing badly constructed concrete blockwork with flimsy timber-framed roofing

If the earthquake occurs in a western-style city, where *buildings* have been well designed with earthquake-resistant construction, there will again be some damage but it will not be classified as a disaster.

Finally, there is the familiar pattern of an earthquake in a rapidly expanding city of the developing world. There the result is extensive damage and many casualties. A suitable definition would be a disaster, possibly a catastrophe.

Here we return again to Diagram 1 and see the relationship of hazard to vulnerability. The condition of vulnerability may relate to badly constructed buildings or it may relate to the siting of settlements – or most likely to both.

For example, housing in Guatemala city was vulnerable on two counts. First, it was made in adobe, a form of dried mud, and this material, when used in unreinforced walls, is lethal in earthquake zones. Secondly, many urban squatters died on the exposed steep slopes or ravines. Inevitably thousands died as landslides took their houses down the slopes *(40)*. This is a characteristic pattern – the urban poor possessing the worst land in the densest and most dangerous parts of a city *(100)*.

In fact, the study of disasters is almost by definition a study of poverty within the developing world, since this is where most

16 Ravine housing in Guatemala city

disasters take place. In a recent series of studies conducted by the staff of the Disaster Research Unit of Bradford University, direct relationships are established between disasters and poverty *(69, 100)*.

This team has produced statistics that clearly show a significant increase in disaster occurrence during the past fifty years. They point out that there is no evidence of significant change in geological or climatological factors; and therefore reasons for the increase must be sought elsewhere:

> If the probability is constant then logically the explanation of disasters must be sought in an explanation of the growing vulnerability of the population to extreme physical events . . . it is known that the frequency of natural disasters is increasing especially in undeveloped countries. Indeed the increased vulnerability of people to extreme physical events can be seen as intimately connected with the continuing process of underdevelopment

17 Houses in Tecpan, Guatemala: an example of thick adobe walls

recorded throughout the world. As population continues to expand and as resources continue to be controlled by a minority, the real standard of living drops for much of the world's

population. This population is increasingly vulnerable to environmental variation as the process continues. [69]

As we now watch the rapid process of urbanisation within the metropolitan cities of the third world, we can see a stage set being assembled for urban disasters, with casualties at a scale that are likely to occur on an unprecedented scale.

Gradually public awareness of this relationship between urbanisation, vulnerability and poverty is increasing. One of the themes of the 1976 United Nations Habitat conference was introduced by Juan Terra

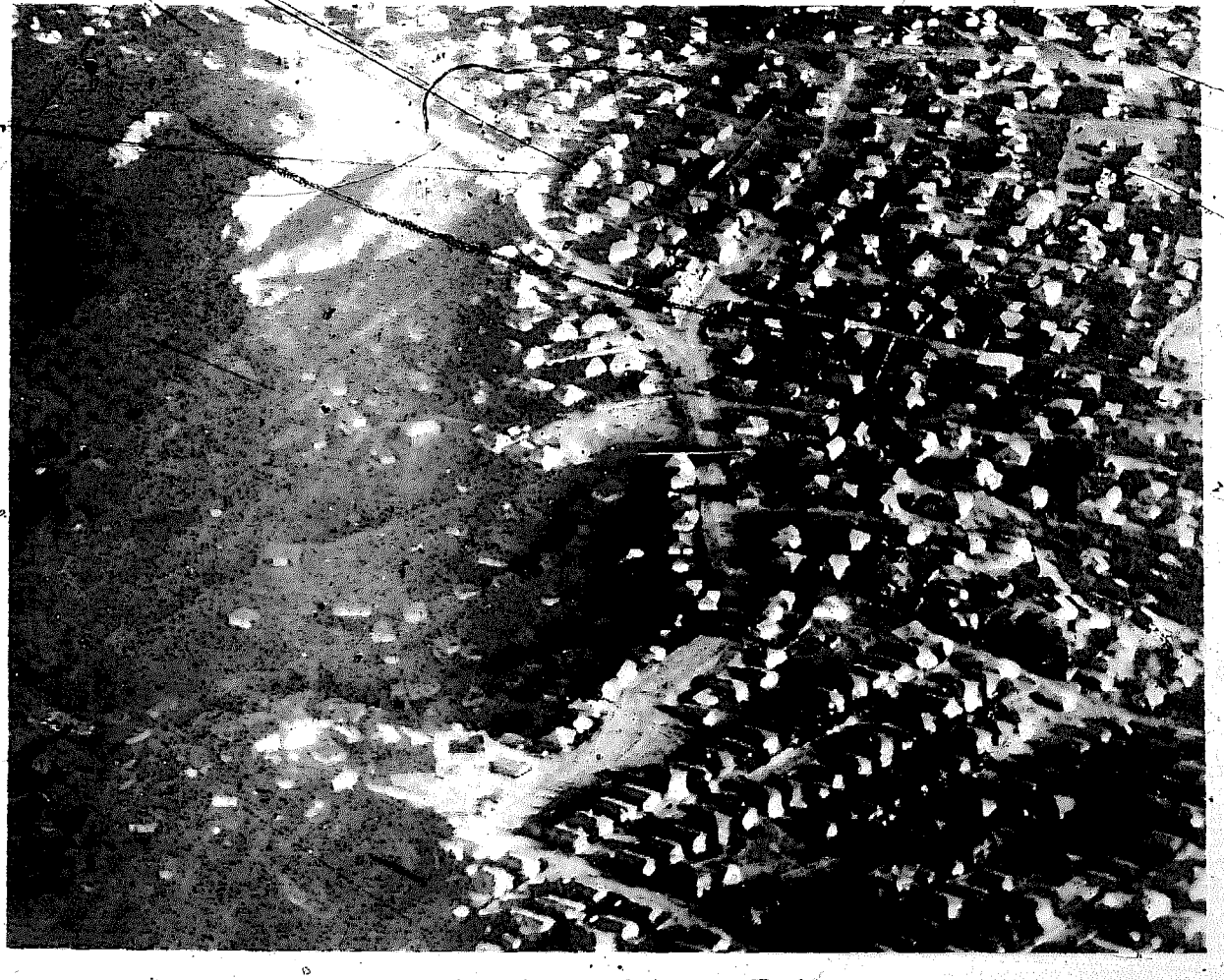
> In some Latin American cities three quarters of the population are living in inadequate accommodation ... in cities like Guatemala city, hundreds of thousands of homes spread up hillsides, where it is impossible to establish infrastructures. They destroy the vegetation cover, and cause erosion which in rainy climates threatens the very stability of the land-surface. [85]

Terra wrote this introductory paper in May 1975. Within nine months, an earthquake had destroyed 40% of Guatemala city's housing stock, a total of 59,000 houses, and almost without exception these houses were occupied by the urban poor.

As we listened to the various speakers at the Habitat conference it became increasingly apparent that this issue is primarily political, and that safe land will have to be released for the influx of migrants into the bulging cities of the third world. But for such a policy to take place, public opinion will have to be mobilised to exert pressures and speak for the squatters perched on dangerous ravines or living in flood plains.

The Bradford team have observed:

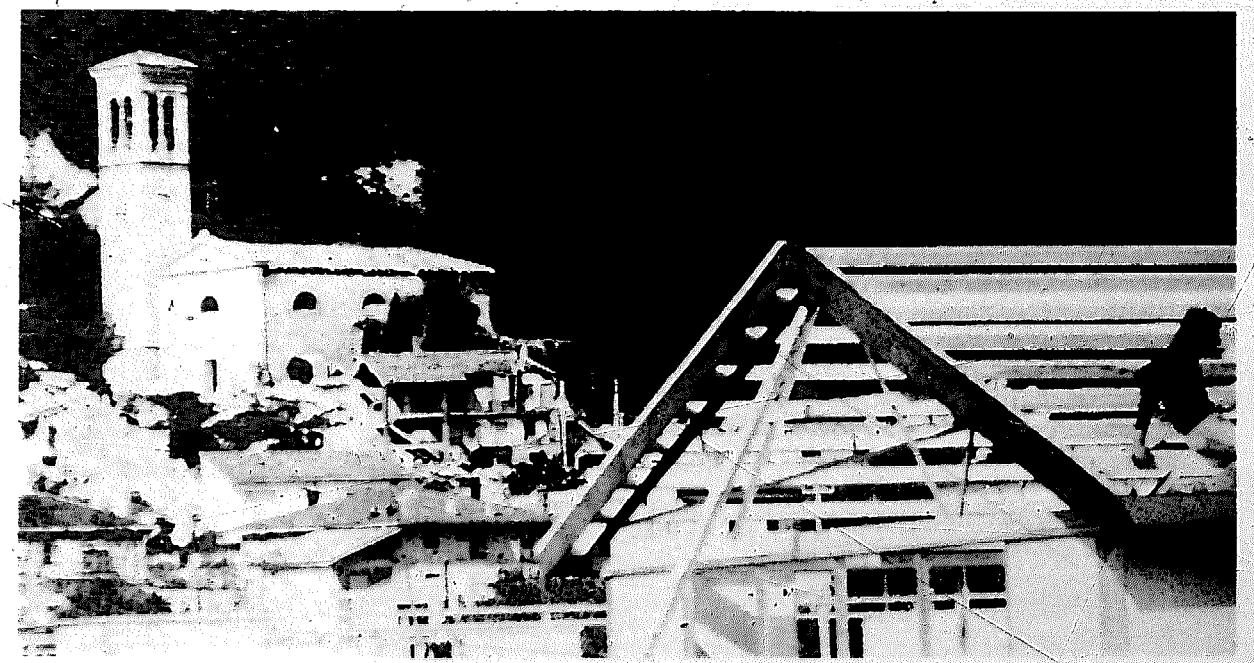
> They often live in the most dangerous and unhealthy places. It is no accident that San Juan (Puerto Rico) slums are frequently inundated by high tide; that



18 Two-storey squatter houses in the suburbs of Ankara, Turkey

Rio's infamous *favelas* climb slopes of alpine difficulty; that the poorest urban squatters in much of Asia live on hazardous floodplains. The poor are often clearly aware of their own vulnerability. Why else would the devastated slum dwellers of Guatemala City refer to the earthquake [of

19 Hillside 'favelas'. Squatter housing in Rio de Janeiro, all extremely vulnerable



20 The construction of temporary housing in Trasaghis, a town in Friuli, Italy, following the earthquake of May 1976

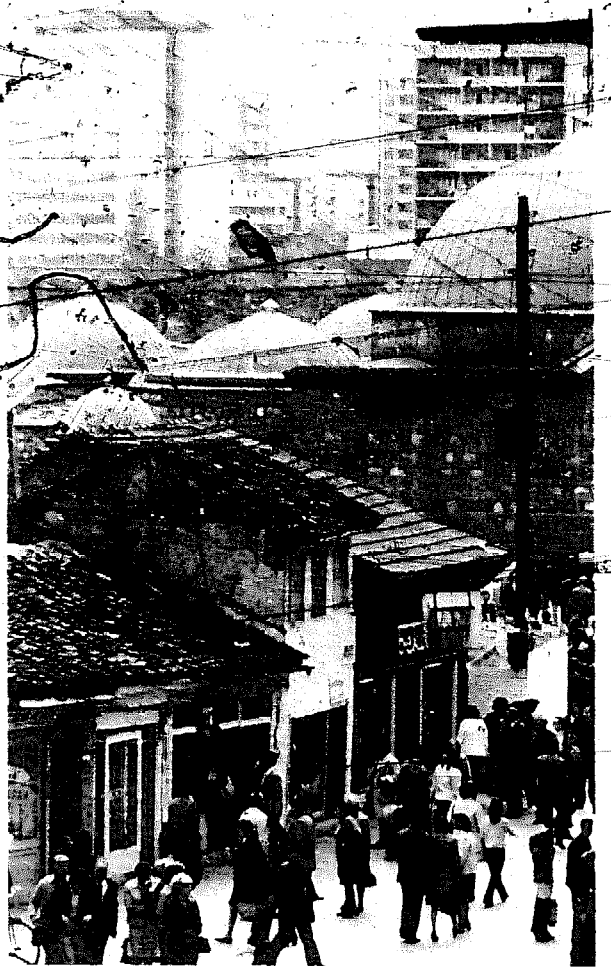
February 1976] as a 'class-quake'? *(100).*

The United Nations have obtained verification for this state of affairs. They find that 95% of all deaths directly attributable to disasters occur within developing countries. The remaining 5% of deaths occur within the well-publicised disasters of the developed world *(70).*

There are significant differences in the way developed and developing countries approach disasters. These relate both to pre-disaster control measures and to their approach to relief and reconstruction. In very broad terms the distinction can be summarised by saying that in the developed world we seek for *material solutions*, while in the developing world the solutions are primarily *social mechanisms*. Fred Cuny (a world authority in post-disaster housing and shelter needs) observed to me that in the technological world we attempt to *control the phenomena* themselves. We build dams to control floods: we 'seed' hurricanes with chemical bombs dropped out of aircraft to try to dissipate their fury; and we pump water into earthquake fault lines to lubricate them and prevent tremors. In contrast, the people of the developing world must take individual actions to *mitigate the results of the phenomena*. These may include building stronger houses or moving to live in a safe location.

Cultural values

21 The village of La Nueva Jutosa, Honduras, built after Hurricane Fifi, September 1974, showing contrasting forms of new housing – concrete block provided by CARE and traditional thatched homes



22 Skopje, Yugoslavia, showing the contrast between the traditional old town and the reconstruction which ignores local traditions

Any study of housing or shelter provision must begin with an analysis of what goes to make up 'normal housing' in a given community; housing that relates to local cultural patterns. This has to be the starting point of any investigations and it should not be viewed, as has so often happened, as a 'low-priority concern'.

Amos Rapaport has written:

> It is clear that we need to understand the underlying structure of a culture and its relation to the physical forms before we can design. This knowledge must be specific rather than general, both for design and implementation, and open-endedness may be an important consideration. We must study the vernacular forms since they show most clearly the relations between life styles, values and physical form, the relation of social structure to dwellings, dwellings to the larger environment and so on. The traditional housing and settlement forms, and their associated social and cultural patterns, should be seen as the point of departure rather than being ignored *(78)*.

Several questions must be asked on this issue. If housing is vulnerable to disaster risk, what then? Can changes be made in house

23 Lice, Turkey. This photograph was taken one year after the disaster; the tent is still in use, which probably indicates that the house is too small for an extended family. The bullock outside the house shows that the owners had taken their animals with them to the new location

24 Prefabricated houses in Lice, Turkey. 1,500 of these were built within sixty days of the earthquake in September 1975. (See Ill. 8 for traditional housing)

25 Prefabricated housing in Lice, Turkey, as modified by the occupants to give a protected front door and covering for animals

forms that avoid disturbing the subtle relationships described by Rapaport? Further, how far do these cultural values apply in the aftermath of a disaster? Are they niceties that can be disregarded in the race for survival? And who are the most suitable people to implement policies? If outside agencies or personnel are involved, how can they avoid transplanting whole sets of cultural values into an alien situation? *(19).*

I shall be constantly returning to this key issue throughout this book. We shall see three basic forms of response.

First, there are forms of housing or shelter which either ignore this entire issue or deliberately attempt to modify the cultural habits of the occupants. An example of this process is when officials have attempted to rehouse reluctant disaster victims in western-style prefabricated houses totally alien to traditional patterns *(9, 23, 24, 59, 84).*

Secondly, there have been attempts to produce 'universal' solutions. These have

26 West German Red Cross and Bayer polyurethane igloos in Masaya, Nicaragua

27 House built by EFICOR, a Christian relief consortium in Bangladesh, for a total cost of £52 in 1973. This technique is a development of existing housing techniques in Bangladesh

ignored the cultural issue altogether, or else assumed that people's living patterns are more or less identical throughout the world. One such product has been used in the mountains of Peru and Turkey and in the tropical plains of Nicaragua *(11, 29, 41)*.

Thirdly, there have been attempts at shelter that fully recognise these cultural issues and yet try to modify housing techniques where traditional patterns have produced unsafe homes. Examples of this process are currently in progress in Guatemala and Bangladesh *(20, 33, 41)*.

Casualties and damage

It is a rather cruel twist of fate that people are so often drawn, as by a magnet, to the very area where their lives will be cut short, or where they will see their homes demolished.

Earthquake fault lines often produce gushing springs of water, and in an arid climate people will naturally gravitate to these locations. A good example of this is Lice, the Kurdish town set on the lower slopes of the Tauras mountains, which was devastated by an earthquake in September 1975 *(24)*. I have already referred to the factors which draw people to flood plains, and also to the economic factors which leave families little option other than very dangerous locations for their homes. Paradoxically, and tragically, the major force that creates the 'magnetism' of vulnerable situations is the basic human need of survival. This may operate in the search for water for flocks of sheep, or there may be an abundance of fish in the river that is apt to flood. The most lethal magnet is probably the city. In the process of urbanisation people have to leave the land (as mechanisation of agriculture devours their jobs) only to live on the dangerous slopes of a Rio or Guatemala city.

So, when we look at the statistics of death and damage, we are left with one conclusion: they are all increasing, and this is in direct response to urbanisation. To put it another way, disaster mitigation measures have totally failed to keep pace with the speed of urban growth.

In recent years studies have been made of two major cities (both of which suffered disasters during this century) to see what scale of casualties and damage would result if earthquakes of identical intensity were to recur in the near future.

28 Lice, Turkey, showing a fertile valley with trees – a characteristic of fault locations

Diagram 4 indicates the projection made for San Francisco by Professor Robert Kates of Clark University, Worcester, Mass. (55).

The Japanese earthquake prediction centre has made a similar extrapolation for Tokyo. There the results are far more serious, since the population has grown by thirty times since 1923.

The factors that caused San Francisco and Tokyo to grow are many, but they may include the immediate surge of population that appears to follow disasters. Skopje, Managua, and more recently, Guatemala city have grown as a result of the sudden influx following their earthquakes. The reasons are obvious: reconstruction work and wages that

	Earthquake of 1906	Estimated consequences of earthquake in near future
Scale of Earthquake	8.3 (Richter)	8.3 (Richter)
Population:	400,000	3,100,000 overall conurbation
Deaths:	500	8,750 (22,000 injured)
Homeless:	220,000	500,000
Damage:	Entire commercial and industrial centre destroyed. 55% of all housing units destroyed.	100,000 homes unusable

Diagram 4. Casualty and damage projection: San Francisco

	Earthquake and Fire of 1923	Estimated consequences of earthquake in near future
Scale of earthquake	8.3 (Richter)	
Population:	400,000	12 million overall conurbation
Deaths:	140,000	500,000 – 1 million
Damage:	40% of all Tokyo's buildings destroyed, burning out 7 sq. miles of the downtown area. Approx. $3 billion US.	If the epicentre is under Tokyo, estimates suggest *total* destruction in 1.2 mile radius of epicentre, *50%* destruction in 3.1 mile radius. Both figures assume no fire.

Diagram 5. Casualty and damage projection: Tokyo

are well in excess of those in rural areas. Currently the rural peasants of Guatemala who earn no more than $2-$2.50 per day are moving in vast numbers to Guatemala city where they can earn up to $8 a day. All the evidence would suggest that they will never return to the rural areas.

It is difficult to calculate the full extent of the havoc caused by disasters. The US Department of State estimated that between 1 July 1970 and 30 June 1971 over 51 disasters took place (none of which was man-made). These disasters affected 68,000,000 people and caused 500,000 deaths *(68)*.

If earthquakes alone are considered, Professor Ambraseys estimated in 1971 that over 800,000 people had died since 1900, an average of about 14,000 per annum *(5)*. If we take just one year, 1973, there were 25 major disasters, which killed 110,000 people, disrupted the lives of 225 million people and cost more than £500 million. Accurate statistics for disasters are extremely difficult to obtain, but we are now certainly witnessing a rapid escalation of casualties.

Then if we take one major disaster like the Guatemalan earthquake of February 1976, about 99,000 dwelling units were destroyed in Guatemala city (40% of the city's housing stock). In addition 163,000 units were destroyed in rural areas (35% of the total number of houses in these areas).

In human terms, between 22,778 (the official figure) and 30,000 were killed in Guatemala, and 74,000-77,000 were injured. It has been estimated that 1,066,000 people were made homeless. This figure accounts for one-sixth of the total population of the country. In financial terms the World Bank have estimated the total reconstruction cost to be about $500 million. I have estimated this sum to account for about one-eighth of the current gross national product of the country *(102)*. (In comparison, the Managua earthquake of 1972 caused damage assessed at one half the GNP *(71)*.)

Perhaps the only way we can comprehend the scale of the Guatemalan tragedy is to make a comparison of what the damage percentage would imply if a comparable disaster had happened in Britain. Without changing the scale, the area of Guatemala affected by this earthquake is roughly a triangle, which would embrace Oxford to the west, Northampton to the north and London to the east. If one-sixth of Britain's population were homeless, this would amount to a higher total than the entire population of Greater London, approximately 9.3 million people.

In Guatemala one in every 232 people was killed. If this ratio of loss to total population was sustained in Britain, 241,000 would have been killed. Finally, in crude

29 The central areas of Skopje, Yugoslavia, in 1975 – thirteen years after the earthquake

30 Centre of Managua three years after its earthquake

financial terms, a disaster on the Guatemalan scale in Britain would cause damage equivalent to £11,939 million (one-eighth of our GNP).

Since it is difficult to relate figures of this magnitude to anything tangible, it is worth saying that, at 1975 prices, the *total* projected cost for building Britain's new city, Milton Keynes (for 250,000 people) was £1,000 million. Therefore, if a disaster affected Britain in the same ratio as that of Guatemala it would cause damage (in material terms) equivalent to the cost of building twelve cities – or developing Concorde twelve times over.

This is a rather long-drawn-out way of saying that the poorest countries are least able to afford their heavy losses, which in relative terms are enormous.

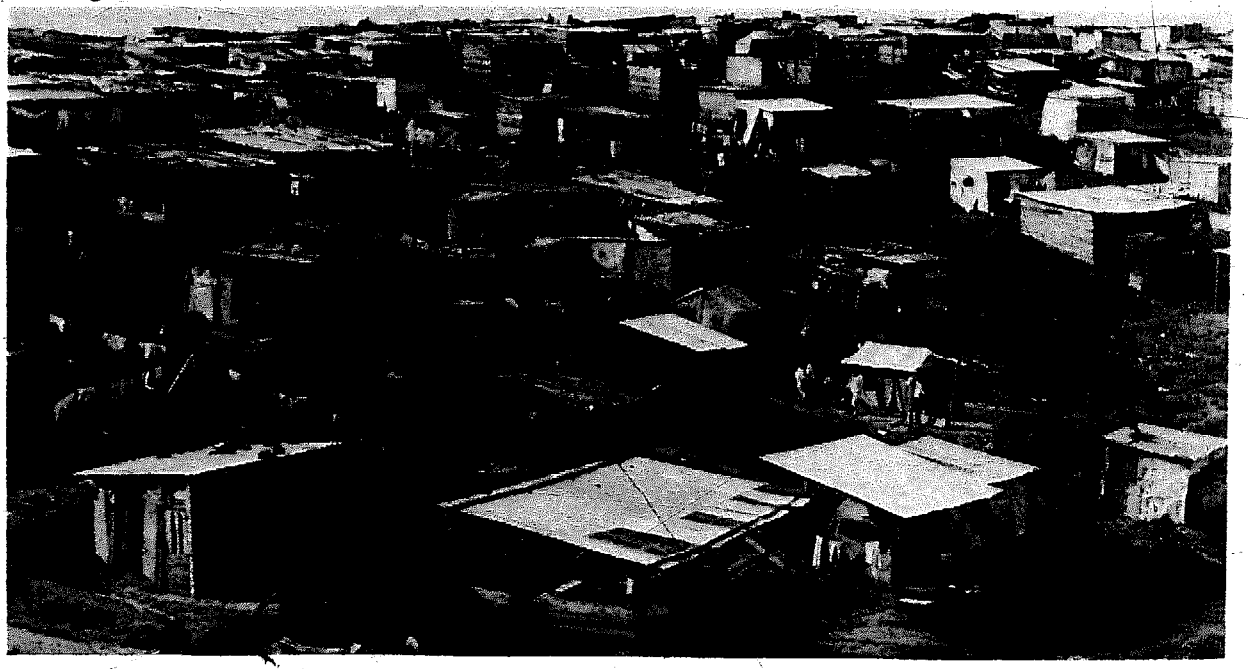
At present there are fifty to sixty developing countries which are characterised as *very* disaster prone. I have attempted to show this on Map 2 in Appendix B. Within these countries the annual damage from disasters far exceeds in absolute terms the external aid that they receive.

Precise statistics must wait for the world survey of disaster damage at present being undertaken by UNDRO. Already, however, we have some revealing statistics. As I have already said, it is significant that 95% of all disaster-related deaths occur in the developing countries. This percentage has to be seen against the fact that 66% of the world's population are living in the developing world. It is apparent that disasters and the damage they cause are a greatly neglected factor which inhibits the economic growth of vulnerable countries *(70)*.

One further aspect of the damage caused by disasters needs to be examined. This is disruption and the time needed for full recovery. On my visits to eight places that had been devastated by disasters, my overriding impression was that the recovery lags far behind the optimistic speeches that the politicians are wont to make, in which they promise a new city in five years (or whatever period will elapse before the next election). For example, Skopje was largely destroyed in 1963, and it received aid on a massive international scale, and also from within Yugoslavia. Yet despite this help Skopje is still unfinished. By the time completion comes there will be children fifteen years old, born after the earthquake of 1963 *(38, 91)*. The reasons for such delays are not technological: they are legal, political and economic.

I recently returned to Managua, where three years earlier the centre of the city had been destroyed. Wtihin these years massive progress has been made in the city, but it is still without a heart; the centre is a total ghost town *(71)*. Such facts are unknown to the layman, whose newspaper carries a 'disaster' story for only a few days.

We have seen in this section that



31 New squatter housing built in Guatemala city after the earthquake on a safe section of land

vulnerability may be the result of harsh exploitation of the poor by the affluent, and study of these issues shows the extent to which man's greed is a direct cause of death and injury. The exploitation relates particularly to land. A landowning family will resist all demands to release safe land for the houses of low-income families. The only solution here is land-reform and this is unlikely to happen without a revolutionary struggle *(25, 42)*.

Within the relief and reconstruction phases we can detect similar abuses of power: corruption that may divert relief funds and impede reconstruction.

Sadly, these abuses occur in high and low places. As a contribution to the relief of Managua, the government of Colombia donated 100 houses and 12 school rooms. After a careful survey of the occupants of each house we found that every single unit was occupied by families or friends of the President and his wife or high-ranking army officers. Not a single unit had been given to a disaster victim. It was also significant that this housing was the most lavish of all disaster aid housing and it was the only 'donor' system that was allowed to be built within the city boundaries *(37, 83)*.

I have attempted to look at the larger dimensions of disasters. First, casualties are increasing because of population growth and rapid urbanisation. Disasters cause massive damage when considered as a ratio of a country's total population or wealth. The protracted time taken for recovery can cause local disruption, which could easily extend to twenty years after a major urban disaster. Finally, the picture is incomplete without reference to exploitation and corruption, inevitable bedfellows of so many disasters.

This all contributes to a vicious spiral of poverty, vulnerability and underdevelopment, an intertwining of high exploitation, high population and high casualties.

32 Tent within the ruins of a house after the earthquake in eastern Turkey, November 1976

PART 2

from myth to reality

He bade me observe it, and I should always find, that the calamities of life were shared among the upper and lower part of mankind; but that the middle station had the fewest disasters.

Daniel Defoe: *Robinson Crusoe*

We have seen that the prime target of disasters is not the 'average' man; it is likely to be a poor family living in vulnerable conditions. The public image of disaster as a great leveller, striking families irrespective of social position, is just one of many myths. Poor media coverage has perpetuated a whole series of myths, and it is necessary at this point to look at the full range of misapprehensions and set them alongside the real situation.

Several important studies of these 'myths' have been made in the USA *(77, 98, 99)* and my observations confirm that they are also prevalent in Britain. This is understandable since we are subjected to similar pressures from the media. If the public hold incorrect views of these situations, it follows naturally that their attitudes will be coloured by them. This in turn may be the explanation for the decisions made in donor countries, which appear to be based on myths rather than reality.

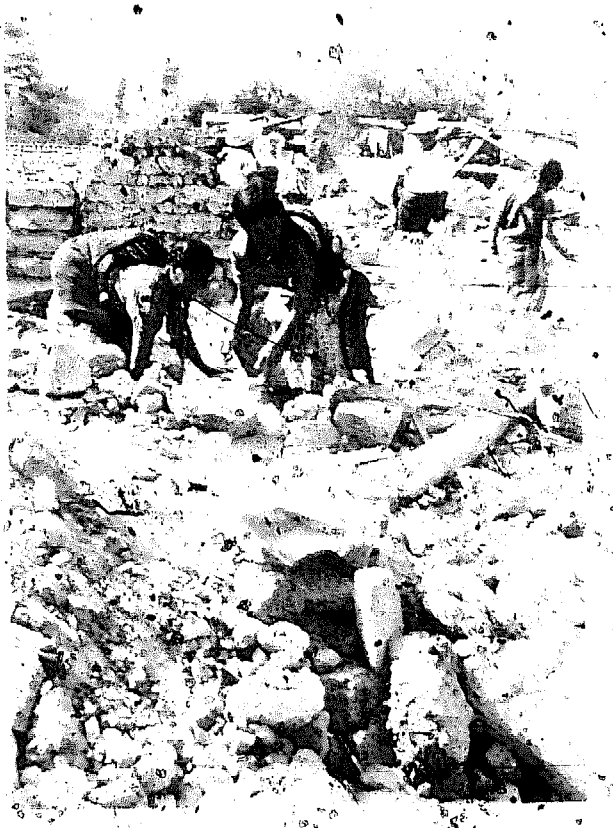
At the time of writing this book, the province of Van in eastern Turkey has been devastated in the sixteenth major earthquake of 1976. In listening to various newscasts and scanning the press coverage, I have found abundant examples of these myths. One example will suffice. A BBC radio correspondent on 30 November (the seventh day after the disaster) reported as follows: 'A serious obstacle to relief efforts has been the presence of newly erected tents set amongst the ruins; this has prevented the entry of army bulldozers in their clearing operations.'

In reality the situation is probably the precise reverse of the commentator's view of the facts. The obstacle to rapid recovery is likely to be the bulldozer, not the tent (see myth No. D2), and the tent, sited within the ruined walls of the owner's house, is the first poignant step to recovery and ultimate reconstruction (see myth No. B4).

It is, therefore, of prime importance to provide facts in place of myths, and then to disseminate this information to as wide a public as possible. To support the claim to 'reality' in the following charts, I have cited published works as evidence: all numbers refer to the References listed alphabetically. I have discussed some of these points in Part I, and I shall return to others in Parts III and IV.

MYTH ASSUMED SITUATION	REALITY ACTUAL SITUATION	EVIDENCE *(See References)*
(A) VULNERABILITY		
1. Disasters are caused by natural phenomena: earthquakes, floods, hurricanes etc.	Disasters are caused by natural phenomena *when they strike a dangerous condition.*	*25, 40, 42, 66, 69, 80, 100.*
2. Disasters strike all social groups, and affect rich and poor countries alike (they are *not* respecters of persons).	On the contrary, they affect the poor, in the poorest countries.	*21, 22, 25, 39, 40, 41, 42, 69, 76, 77, 100.*
3. Vernacular housing is a response to local needs and is built to withstand hazards.	It is built to withstand hazards only: 1) when a disaster has a frequent return period; 3) when societies modify their techniques after a disaster has exposed the vulnerability of their housing.	*7, 8, 13, 33, 35, 59, 66, 72, 79, 80, 92.*
4. Protection or disaster-mitigation measures are too expensive for poor countries.	Some measures may be very costly (e.g. the Thames barrage), but correct siting and simple constructional measures may add little to the overall cost of settlements.	*1, 2, 20, 32, 33, 35, 59, 66, 72, 80, 96.*
(B) SOCIAL ATTITUDES		
1. The public will show signs of panic or will be dazed into a state of inactivity.	No evidence to support this belief.	*8, 19, 22, 24, 39, 41, 44, 51, 58, 60, 76, 77, 89, 90, 98, 99.*
2. Local organisations are likely to be ineffective and inadequate.	The evidence indicates the reverse.	*22, 39, 41, 60, 65, 76, 77, 98, 99.*
3. Morale is likely to be low, with looting and other forms of deviant behaviour; a situation that rapidly deteriorates into chaos.	Again the reverse is likely to be true, except in drought, famines and refugee camps.	*39, 41, 76, 98, 99.*
4. People in a dazed condition will be passive, awaiting aid and assistance.	The reverse: the normal reaction being a highly motivated self-preservation instinct, enabling people to find solutions to their own problems.	*22, 24, 25, 37, 39, 40, 41, 42, 65, 76, 77, 87, 88, 89, 90, 98, 99.*
5. Following the disaster, there will be acute shortages of food, blankets and medical supplies.	A variable situation, but in most contexts goods will be locally available (exceptions may include widespread droughts and extensive famines).	*37.*

33 A village near Trasaghis in Friuli, Italy, crushed by falling rock in the earthquake of May 1976

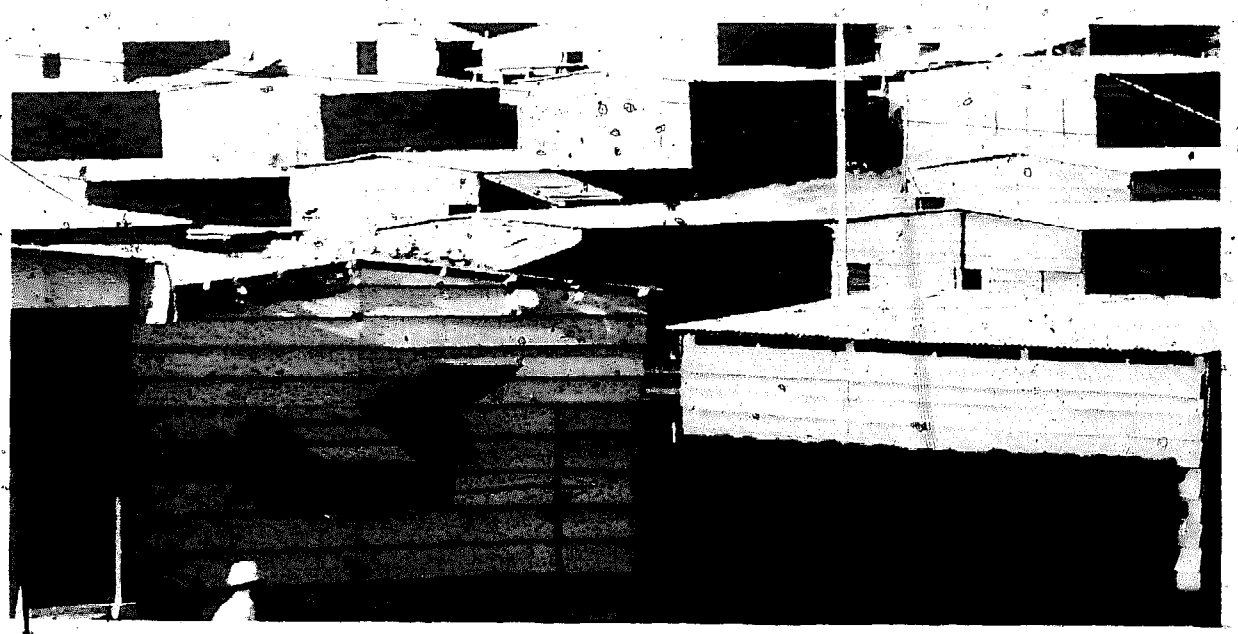


34 A family sorting through the rubble of their home in the San Martin Jilopeque, Guatemala

35 Drawing by W. Russell Flint of panicking crowds attempting to escape from San Francisco in 1906

ASSUMED SITUATION	ACTUAL SITUATION	EVIDENCE
6. After a disaster, people will eat unfamiliar food, from a desire to survive.	The reverse: all nutritional evidence suggests that people behave more conservatively than usual.	*19, 21, 60.*
7. There are serious risks of epidemics from bodies lying in the ruins.	No evidence of this risk; therefore no need to adopt measures such as ignition of ruins, which disrupt reconstruction processes by destroying building materials.	*44, 60, 65.*
(C) SHELTER NEEDS		
1. There is a need for officials to provide large volumes of emergency accommodation for homeless families.	The reverse: most families appear to go to official shelters only when all other alternatives have failed.	*19, 21, 23, 24, 25, 36, 37, 38, 40, 42, 65, 89, 98, 99.*
2. There are no clear patterns of behaviour relative to shelter provision.	People have clear preferences, which normally follow this order: 1) The homes of relatives or friends 2) improvised shelters 3) converted buildings – schools etc. 4) official provision.	*19, 21, 23, 24, 25, 36, 37, 38, 40, 42, 65, 89, 98, 99.*
3. Compulsory evacuation is an effective policy.	The reverse. All evidence from World War II onwards indicates the failure of such policies.	*23, 36, 37, 38, 39, 41, 50, 76, 77, 97, 98, 99.*
4. Tents are a very effective form of provision.	They can be most useful, but evidence suggests under-use, and that they often arrive too late to serve their function of emergency shelter.	*21, 24, 25, 31, 34, 36, 38, 39, 40, 41, 42, 90.*
5. In areas of high exposure risk, shelter needs become matters of life and death.	Obviously this is a critical need, but there is no evidence of deaths or illness directly related to exposure risks. The social mechanisms which exist in all societies to cope with everyday hazards still function after disasters.	*39, 41, 65.*
6. Following a disaster people will be prepared to live in unfamiliar forms of housing.	Societies are adaptable, but a form of cultural rejection has occurred in many instances when unfamiliar shelters have been provided.	*20, 32, 39, 41, 65, 76, 77, 87, 88, 89, 90.*
7. During the emergency period, people will be prepared to live in communal shelters.	The reverse: people tend to clutch to the family unit, and when facilities have been provided they have not been popular.	*39, 41, 76, 77, 90, 98, 99.*

36 Family after 1965 earthquake in Greece

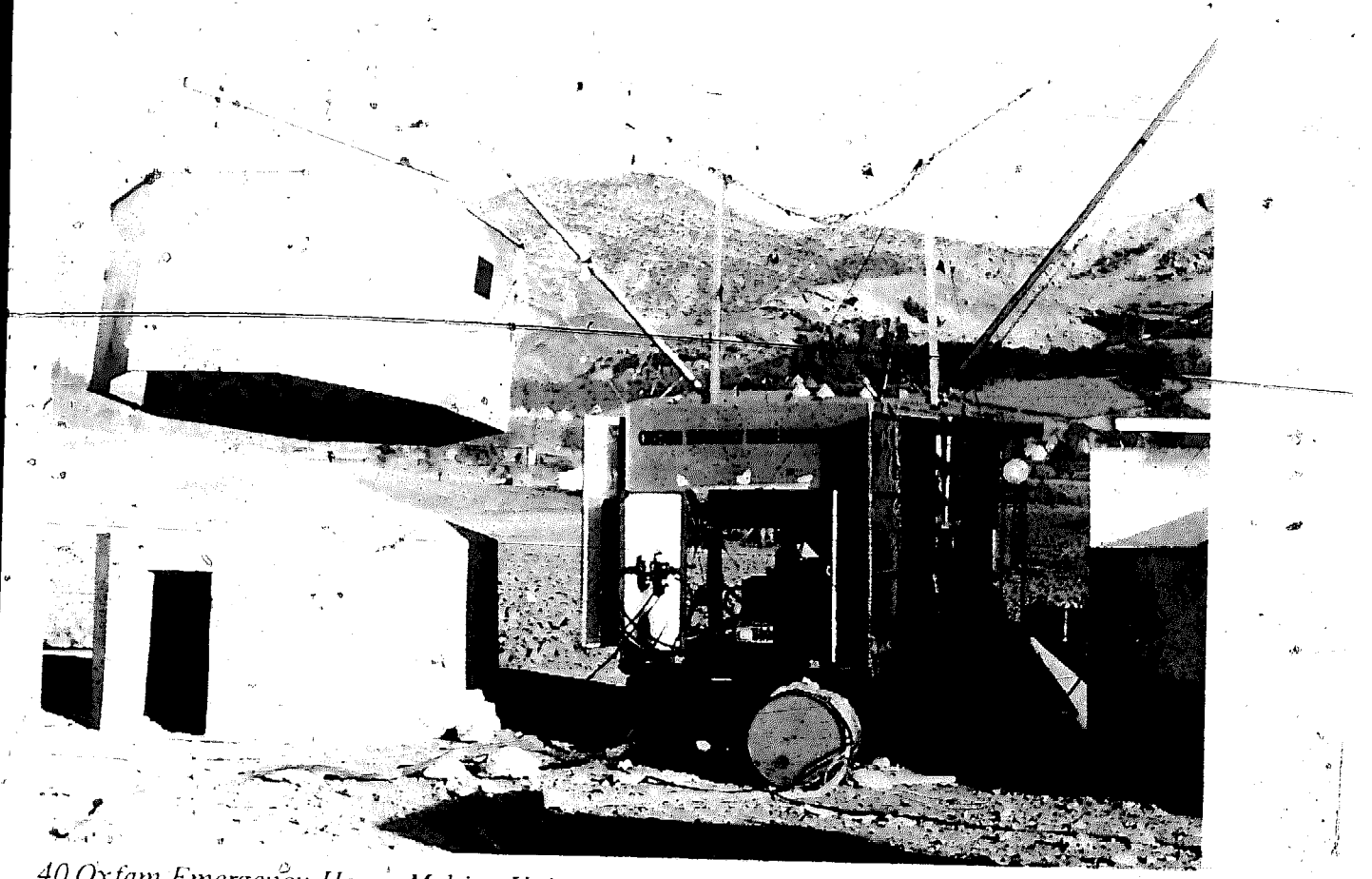


37 Emergency shelter in Managua, part of a US government aid programme for 11,000 wooden huts

38 Inflatable grain warehouse. Proposals have been made for using such structures as emergency shelter

MYTH	REALITY	
ASSUMED SITUATION	ACTUAL SITUATION	EVIDENCE
(D) RECONSTRUCTION		
1. Some form of temporary housing is needed prior to reconstruction.	Reconstruction, in the third world, usually starts immediately, and takes place irrespective of government plans for relocation etc.	*8, 32, 33, 34, 39, 40, 41, 42, 72, 87, 88.*
2. Clearing rubble is a first priority once people are rescued.	Apart from clearing streets to provide access routes, the rubble is best left for recycling into new homes.	*40, 42.*
3. Crash reconstruction programmes by agencies and governments are a highly effective way of solving housing needs.	The reverse is true. An indigenous response will *always* be the most rapid and effective form of provision, particularly of temporarily unemployed people to build their own homes.	*8, 22, 23, 24, 25, 32, 37, 39, 40, 41, 42, 51, 59, 71, 83.*
4. The ideal situation (in an area of high risk) is to relocate the community in a safe area.	In the few instances where communities have been relocated, the results have been unsatisfactory, particularly from social and economic standpoints.	*23, 24, 25, 36, 37, 39, 41, 71, 98, 99.*
(E) THE PROVISION OF AID		
1. Aid is given in response to the needs of disaster victims.	This may be the case; or it may be given in response to *perceived needs* of the victims. Or it may be given to satisfy the needs of a relief agency or donor government.	*22, 25, 38, 39, 41, 68, 77, 88, 98, 99.*
2. A rapid recovery is dependent upon a rapid influx of aid.	Often the precise reverse. A large influx of aid may inhibit the recovery mechanisms, the worst example being the development of 'dependency relationships' where local initiative is swamped.	*19, 21, 22, 25, 34, 37, 60, 68, 77, 83, 98, 99.*
3. The major proportion of post-disaster housing is likely to come from donor sources.	No evidence. Normally donor provision *from outside the country* is unlikely to amount to more than 20% of the total.	*24, 36, 37, 38, 67, 68, 91.*

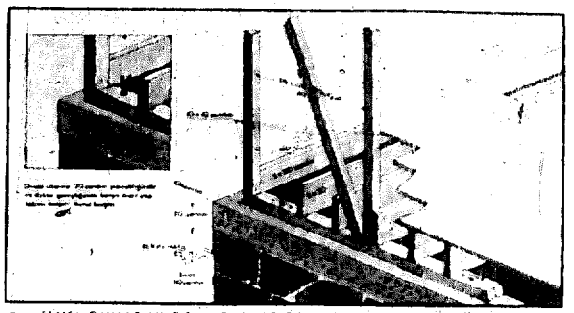
39 Four days after the earthquake in Guatemala reconstruction is already in hand



40 Oxfam Emergency House-Making Unit in operation following the earthquake in Lice, Turkey, September 1975

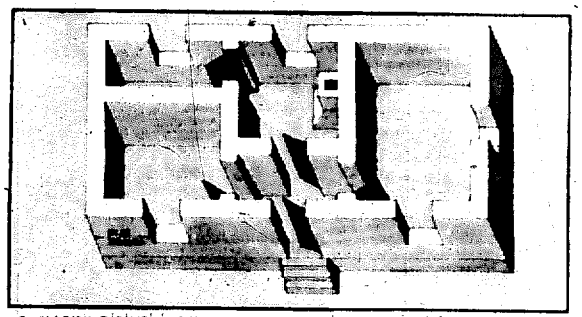
AHŞAP KARKAS YAPILARDA NELERE DİKKAT ETMELİ

1 YAPI İSKELETİNİ TEMELSİZ TAŞLARA OTURTMA. TABAN KİRİŞİNİN ALTI BOŞ BIRAKILIRSA YAPI SARSINTIDAN KOLAYCA YIKILIR

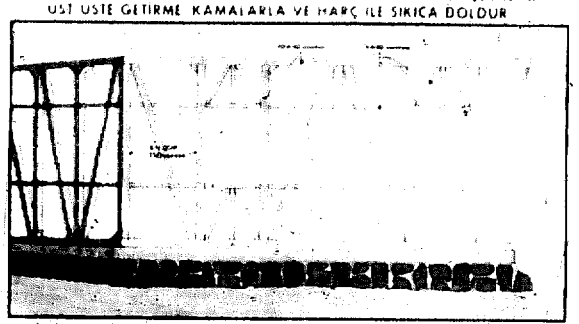


2 TEMEL DUVARINI OCAK TAŞI İLE GR. 3 ÖLÇÜ KUM 1 ÖLÇÜ KİREÇ VE ÇEYREK ÖLÇÜ ÇİMENTO İLE YAPTIĞIN HARÇ KULLAN BOŞLUKLARI ÜST ÜSTE GETİRME. KAMALARLA VE HARÇ İLE SIKICA DOLDUR

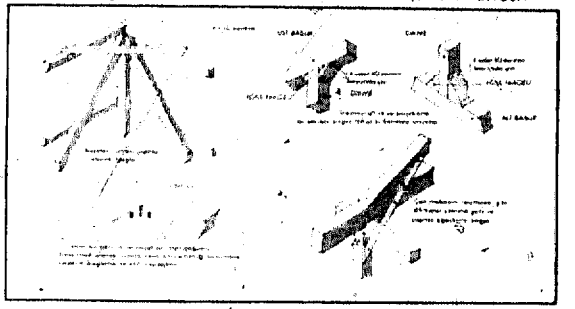
3 TAŞ TEMEL YAPAMAYACAKSAN EN ÇOK 1 METRE ARA İLE KATRANLANMIŞ KAZIK ÇAK. KAZIĞIN TOPRAĞA EN AZ 1 METRE GİRMESİNİ SAĞLA. TABAN KİRİŞİNİ BU KAZIK BAŞLARINA BAĞLA



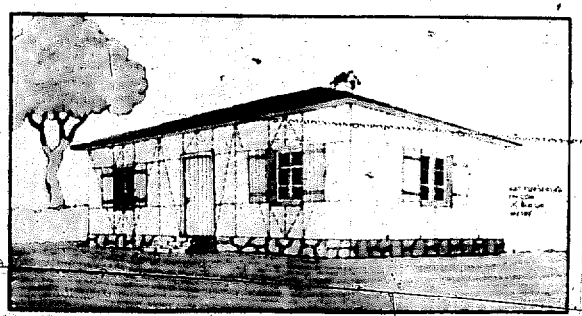
4 YAPINI GİRİNTİLİ ÇIKINTILI YAPMA. ENİ BOYU BİRBİRİNE YAKIN OLSUN. KAPI VE PENCERELERİ BİRBİRİNE VE KÖŞELERE YAKLAŞTIRMA



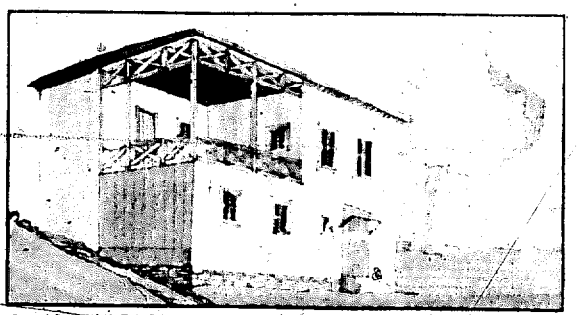
5 DİKME ARALARINI 1.5 METREDEN FAZLA AÇMA. DİKMELERİ HEM ÜST BAŞLIĞA HEM DE ÇAPRAZ AĞAÇLARLA BİRBİRİNE BAĞLA



6 DİKMELERİ VE ÇAPRAZ AĞAÇLARI EKLİ YAPMA. BÜTÜN BAĞLANTILARI PESİMDEKİLER GİBİ YAP



7 TEMEL DUVARINI YERDEN EN AZ 50 SANTİM YÜKSELT. YAPIYI GEREĞİNDEN FAZLA YÜKSEK YAPMA. İKİ KATLIDAN ÇOK AHŞAP YAPI YAPILAMAZ



8 ARALARINDA DOLGU DUVARI ÖRÜLMEYEN DİKMELERİN DE ALT VE ÜST TARAFLARINI BAŞLIKSIZ BIRAKMA.

9 BU ÖĞÜTLERE UYULMADAN YAPILAN YAPININ EN KÜÇÜK BİR DEPREMDE SONU BUDUR

41 Wall chart used in Turkey to educate the public in safe building techniques in earthquake areas

PART 3
filling the gap

Food, drugs and first aid are naturally the first items needed by the stricken homeless, but surely architects are in the enviable position of being able to authoritatively advise and prod UNO or WHO or UNRRA (if it still exists) into providing instant housing capable of being parachuted into disaster areas at short notice . . .

Right here in the U.K. we have one of the most powerful and respected architectural institutions in the world, and we have some of the world's more public-spirited architects. As members of RIBA it is the duty of British architects to demand of their institution that it should in its century and a half of sleepy inaction perform just one so-easily-accomplished shining deed by acting positively to encourage whatever acronymically-named international body with material advice to prepare NOW for future man-made or natural disasters by having to hand a supply of instant housing and the wherewithal for transporting it to the afflicted site.

Perhaps the RIBA might temporarily adopt the Donne-ish motto: Never send to know for whom the earth quakes; It quakes for thee.

The architect: editorial, March 1976

Three strategies

Having established the context of disasters and the realities of the various responses to them, I can now pursue the subject of shelter and housing needs.

It is important to emphasise at the outset that shelter must be considered as a process, not as an object. A specific product may form a *part* of the process, but as the preference scale on myth no. C2 indicates, donor shelters are low in priority. It is also worth emphasising that the western world is apt to view solutions in *material terms,* while

1	Normal housing — Disaster	Housing survival construction continues		Normal housing survives – thus there is no gap. This must be the ideal, to design and build structures that survive the hazard.
2	Normal housing — Disaster	Gap filled with temporary shelter and temporary housing	Resumption of normal housing	Normal housing is interrupted by the disaster. Thus a gap is formed in normal housing construction, and a gap of living accommodation caused by the destruction. The gap is filled by the provision of temporary shelter and possibly temporary housing.
3	Normal housing — Disaster	Gap filled with accelerated reconstruction	Resumption of normal housing	Normal housing is interrupted by the disaster. In this instance, however, the gap is filled by starting the reconstruction very early – thus preventing the need for temporary accommodation.

Diagram 6. Three strategies for shelter and housing following disasters

in the developing world they are sought in *social terms*. Dr. Fred Krimgold, an architect working on hazard research at Massachusetts Institute of Technology, has suggested that there are three basic approaches to shelter following a disaster. These are shown in Diagram 6.

While one of these strategies may be followed alone, it is more likely that all three will be operating simultaneously.

Strategy 1 — Housing survival

We have already considered some of the issues relating to the first of these strategies: the provision of housing that withstands the hazard. This must become the clear objective for national governments, international bodies and relief agencies. But, as always, there is a price to be paid for such security and that price is often political dynamite. In simple terms it implies land reform, to provide, within the price range of the poorest families, a safe, serviced plot of land, with security of tenure, in a location within reach of employment (not a three-hour walk from the urban centre). It also implies a variety of methods to modify traditional building techniques, where they are clearly vulnerable. It is instructive to watch present work in both Turkey and Guatemala, where this issue of retraining in building techniques is being taken very seriously.

A special ministry has been established in Turkey, the Ministry of Reconstruction and Resettlement, with the purpose of instigating preventative measures, as well as handling all relief activities. This measure is a response to the fact that Turkey is highly vulnerable to various forms of hazard – earthquakes, *tsunamis* (seismic waves, often called tidal waves), rock-falls, floods etc. However, the major threat is that of earthquakes and statistics obtained in 1965 show that 91.4% of the total surface area, and 95% of the entire population, are in earthquake zones.

The ministry has divided the entire country into zones with different degrees of risk (Diagram 7). This map was based on an analysis of past earthquakes, which showed that in Turkey an average of 1,223 people are

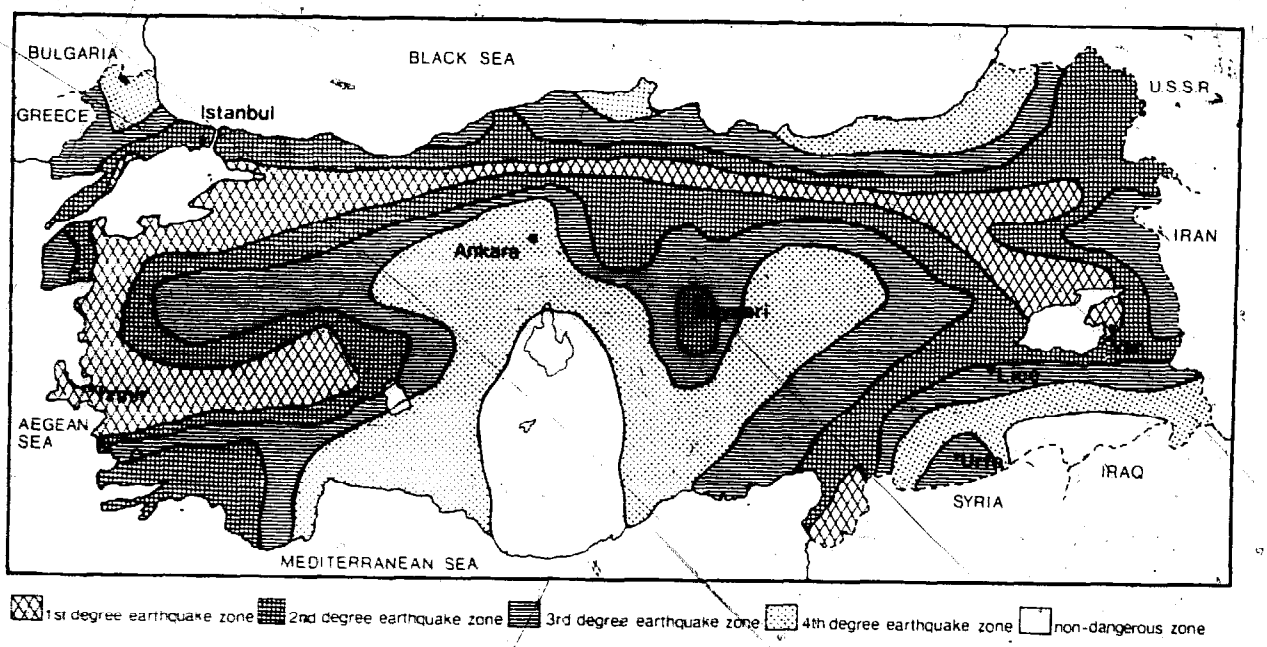


Diagram 7. Map of Turkey indicating vulnerability to earthquakes

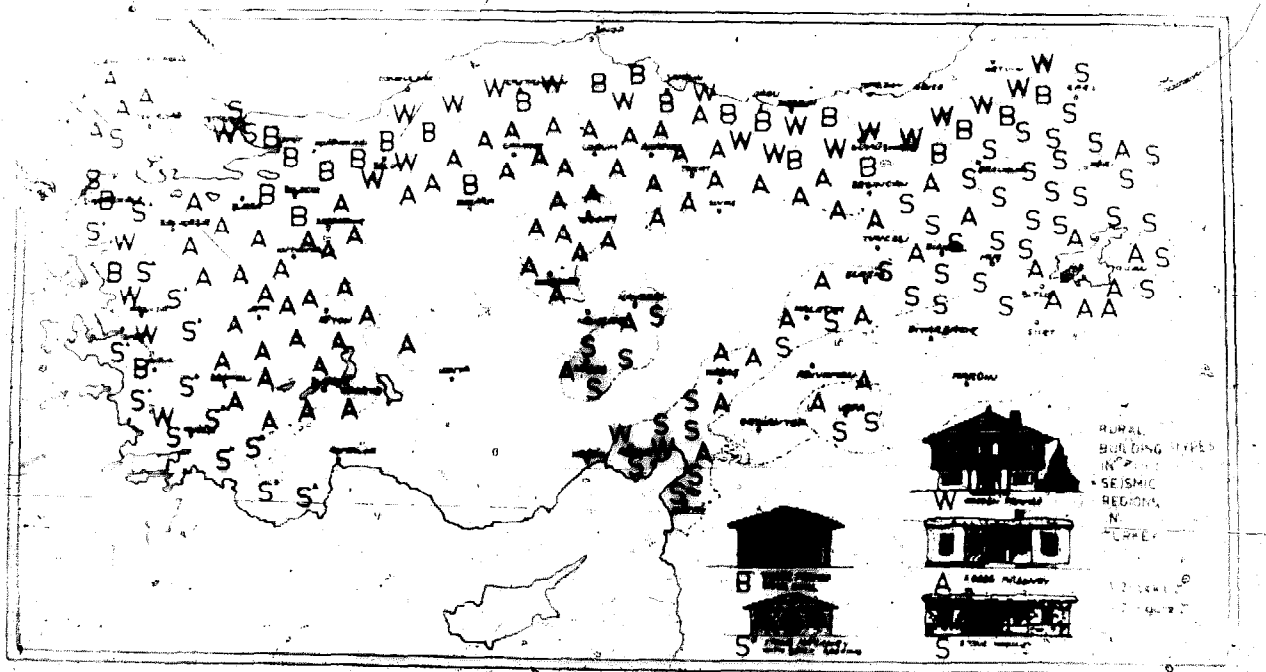


Diagram 8. Map of Turkey indicating construction types within the risk zones

killed and 7,526 buildings are destroyed annually *(92)*.

As part of the policy of lessening risk, an analysis was carried out to ascertain the types of vernacular building that exist within the country, their distribution, and their vulnerability as to siting and constructional form. Diagram 8 indicates the rough distribution of the various building types. In crude terms this diagram indicates the spread of these housing types within the major seismic zones of the country.

Of the five types of building indicated on Diagram 8 the frame structures B and W (built in areas with good supplies of timber) will probably be safe structures. However categories A and S, adobe or stone masonry construction, will be vulnerable. If a comparison of Diagrams 7 and 8 is made, it becomes all too clear that when category A or S housing is found in the 1st and 2nd degree earthquake zone, the next likely disaster areas are indicated.

The ministry carefully surveys the country to determine these vulnerable settlements, and instigate mitigation measures. These may take the form of relocating vulnerable communities, or of

strengthening existing structures *(9, 92)*. Clearly either action presents tremendous social and economic obstacles, when it comes to dealing with *existing* vulnerable settlements or house types. It is far easier and cheaper to include safety measures in new settlements than to introduce them into existing ones. Methods of disseminating information on safe house construction include radio and TV programmes and comic books, which are also being used in Guatemala *(33)* (see Diagram 9).

One of the most disappointing aspects of the massive reconstruction effort in Guatemala has been the fact that virtually all the relief agencies (including the government reconstruction housing programmes) have placed their emphasis on building large numbers of houses. Twenty-two out of the twenty-four housing programmes appear to have ignored the opportunity the disaster presented to instigate retraining procedures in safe construction *(88)*.

Taking the example of the clever advertising copy of Christian Aid, 'Buy a man a fish and you feed him for a day – Train him how to fish and you feed him for life', we can suggest: 'Give a man a safe home and you have housed his family – but train him how to build his own safe house and you have housed his family, and very probably his children's families, and his relatives and friends'.

Fred Cuny is directing a retraining programme in Guatemala, which has been instigated by Oxfam and World Neighbours *(33, 72, 88)*.

It is unique in that its central purpose is not directly to build houses. It is to support local organisations, particularly co-operatives, and promote earthquake-proof construction techniques that use traditional materials

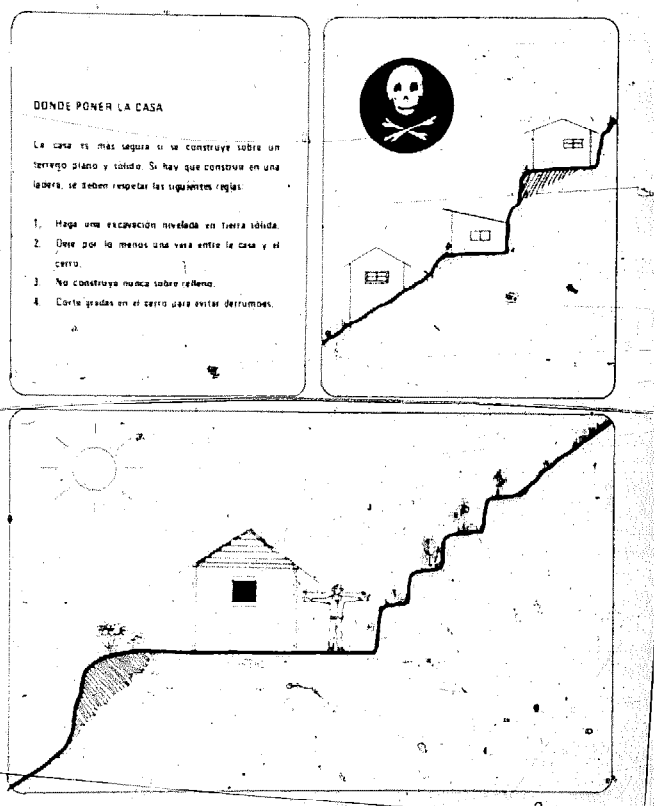
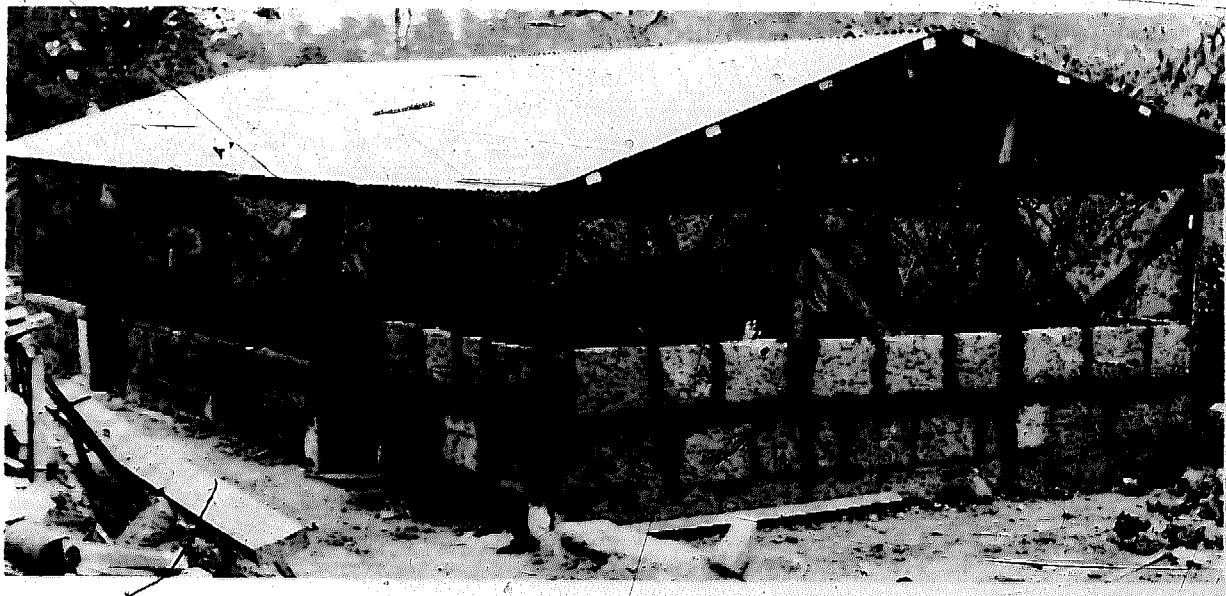


Diagram 9. A page from a comic book in use in Guatemala providing guidance on the correct siting of houses



42 Model house built by Oxfam and World Neighbours, using safe construction techniques

43 A new lightweight roof to replace the heavy tile roof which collapsed during the earthquake in Guatemala

44 Rural housing in eastern Turkey. These homes are built of dried mud (adobe) with very heavy roofs, and the gap between houses is very small – a highly vulnerable set of conditions

and existing (though developed) construction skills. The result is that the traditional character of the houses is retained while the structure is made safe. The programme consists of the following activities:

Salvage materials from destroyed or damaged homes.

Mount an extensive educational programme. This has resulted in cloth wall charts and a series of simple 'how-to-do-it' manuals in a comic book format, which define safe construction techniques (see Diagram 9).

Build a model house, using techniques (such as the introduction of timber and barbed wire bracing) that will ensure safety – next time. When this model house has been built in a given village, it often forms the focus of further educational activity.

The roofing, of corrugated zinc (locally called 'lamina'), is subsidised and is

distributed through local co-ops.

It is interesting that these Turkish and Guatemalan strategies are both putting reliance on a grass roots educational programme, in contrast to the often repeated injunctions for vulnerable countries to adopt planning controls, or instigate bye-laws to stop unsafe building in dangerous locations. Those who make lofty injunctions are often unaware of the almost total absence of planning controls in most countries of the third world, and the bye-law concept is often unrealistic, particularly in rural areas with high levels of illiteracy. These countries usually lack the money and manpower to enforce such regulations *(70)*.

Therefore, in aiming for the ideal strategy – housing that will survive the next hazard – the following points require emphasis:

1. Programmes can be instigated by capitalising on the visual impact of widespread damage, as in Guatemala.

2. Considerable emphasis should be placed on a grass roots form of response. Key individuals should be isolated within a vulnerable community - such as local builders, who can be taught safe techniques which they can then pass down the line.

3. It is necessary to question the philosophy being followed in Turkey of relocating vulnerable communities *(92)*. Naturally, the objectives are praiseworthy, but it must be recognised that the immense social and economic disruption caused by such an upheaval may constitute a minor disaster in itself. It is better to spell out the facts to a local community, provide an alternative site, and leave to them the decision whether or not to move. If they decide to remain, then place reliance on the strengthening of houses.

Following the earthquake in eastern Turkey on 24 November 1976, a total of 8,267 families, almost 50,000 people, were made homeless. The Turkish government made an announcement six days after the disaster that money was being made available for people to move to the warmer climate of the Turkish Aegean coast. The families would then be able to purchase new flocks of animals and other necessities and build

45 A family survey their wrecked home following the Turkish earthquake

46 Transport plane unloading at Guatemala airport

new homes. By day 9, the BBC reported that 4,000 out of the total 50,000 had accepted the offer; the remainder doggedly refused to move. On past evidence the likelihood of even these 4,000 moving is very slender.

4. It is most encouraging that the international community has now come to realise that it is the *small dwelling*, not built by contractors, not built in accordance with any earthquake-resistant codes, that is killing people. Therefore major studies have been undertaken to see how small buildings can be designed to withstand the various hazards, and this problem must increasingly become one of the major concerns of engineers, seismologists and architects. The studies that have been undertaken on vulnerability and the small dwelling have been selectively listed in the References listed according to subject.

For some this chapter is in the realms of fantasy. Cynical readers will be pessimistic about disaster mitigation measures and historically they are correct when they say that, human nature being what it is, it is most unlikely that people will bolt the stable doors *prior* to the horse bolting.

I have said that this is the 'ideal' strategy and clearly it is the one to aim for, and in aiming for it, it is necessary to maintain a 'grape shot' mentality. That is to say, by all means try to persuade governments to introduce planning controls, or bye-law codes; this is one part of the grape shot *(70)*. But probably far more important is the huge educational thrust which must take place at a grass roots level, *simultaneously* with the broad questions of national planning policies.

The issue presents a tremendous challenge to international agencies and their consultants, to relief agencies and their workers and to national governments and their officials. All these individuals are probably within one elevated social group. Can they understand the problems of a rural family whose house is vulnerable, a family who need answers to two simple questions — how and where can they build a safe home?

Sadly, if past experience is anything to go by, there has been neither the interest nor the will to make this needed effort to understand. And when it has been made by local co-ops or relief groups they have rarely had the answers available to these two pertinent questions.

Strategy 2 — Filling the gap

On Thursday 5 February 1976, I woke up and turned on a bedside radio. 'News is coming in', the commentator said, 'of a major earthquake in Guatemala city!' By lunch time satellite TV pictures were already appearing on our screens and the press had it on their front pages.

Two days later I was on a plane for Guatemala. The plane was full of pressmen, doctors, relief officials and volunteers. The

entire first-class section of the 747 Jumbo Jet had its seats taken out to make way for emergency supplies of medical goods and food. On our arrival in Guatemala, the airport was a scene of continuous activity: large jet transports unloading their relief supplies, reception tents for this or that agency, military command posts, and so on. One of my initial memories is of the wide variety of languages being spoken, and of the international diversity of the relief planes on the tarmac.

These events serve to underline certain basic propositions. First, we already live in McLuhan's 'Global Village', in an age of internationalism, with all the benefits and problems which this brings. Secondly, ours is an age of social awareness, and many of the officials and volunteers on the tarmac of Guatemala city airport were certainly there because of a genuine altruistic concern. Thirdly, we have a unique capacity for fast action, and this has happened to us almost unawares so that we take for granted our capacity to send a jet cargo 6,000 miles in half a day.

After a few hours in Guatemala I visited the US Agency for International Development (AID) director to try to obtain some reliable data on casualties and the extent of the damage. I was handed some sheets which were the helicopter pilot's completed reports on the rural areas *(40)*. I asked if there were any aerial photographs yet and a few minutes later I was able to see some of the completed air survey material.

This intelligence had already been professionally analysed, and very accurate data were given on damage and casualties, and all this information was completed within about sixty hours of the disaster. This is clearly a technological achievement, and it suggests that we may already be far ahead of ourselves in a technological sense. The problem here was what to do with the data: how to translate the flow of statistics into a tangible, logical response, in effect bringing these facts down to a human level. A galaxy of agencies are operating often in competition with each other, few having much idea where to focus their energy and resources. In Guatemala it was not until twenty-one days after the disaster that the *first* meeting of agencies was held to attempt to co-ordinate their shelter and housing programmes; a sign that matters may be out of step *(40)*. Our technological capacities may be highly sophisticated, the amount of money available may be enormous, and both may be available as a result of a massive social concern in 'donor' countries. But what is lacking is the knowledge of what is happening to the homeless families. We very rarely know their precise reactions and so we oversimplify their needs. Then there is confusion over the 'needs', of which there are actually three. First, the *real needs* of the homeless families, which may be very different from their *wants*. Secondly, there are the needs as we may perceive them – and these will certainly be coloured by our own prejudices. Thirdly, there are the needs of the donor government or agency. It is foolishness to pretend that these don't exist and don't exert their own subtle influence on the aid response.

Diagram 10 indicates the range of options that will probably exist during the early weeks following a major disaster. We have seen in myth No. C2 that there is a clear order of preference in the way the members of the affected population use the available shelter.

The eight categories a-h can be sub-divided in two ways.

First, into *social* and *physical solutions*. Items a and e (extended families and evacuation) are social solutions, while the remainder are forms of physical provision.

Secondly, the categories can be split into *local ad-hoc response* (for example squatter or improvised shelter) and *donor provision*, where help comes from external sources. These may be within the national government, or outside the country.

What unites these forces is that they are all concerned with filling the 'gap', even if they don't view the process as such.

Local, ad-hoc response

The major force in relief and reconstruction is that of the families themselves. Because our primary source of data in these matters is the material put out by agencies, we may obtain a false impression that the agencies are the major force at work after a disaster. I have suggested (in myth No. E3) that the involvement of external agencies is unlikely

47 Air photograph showing the effects of the Guatemala earthquake

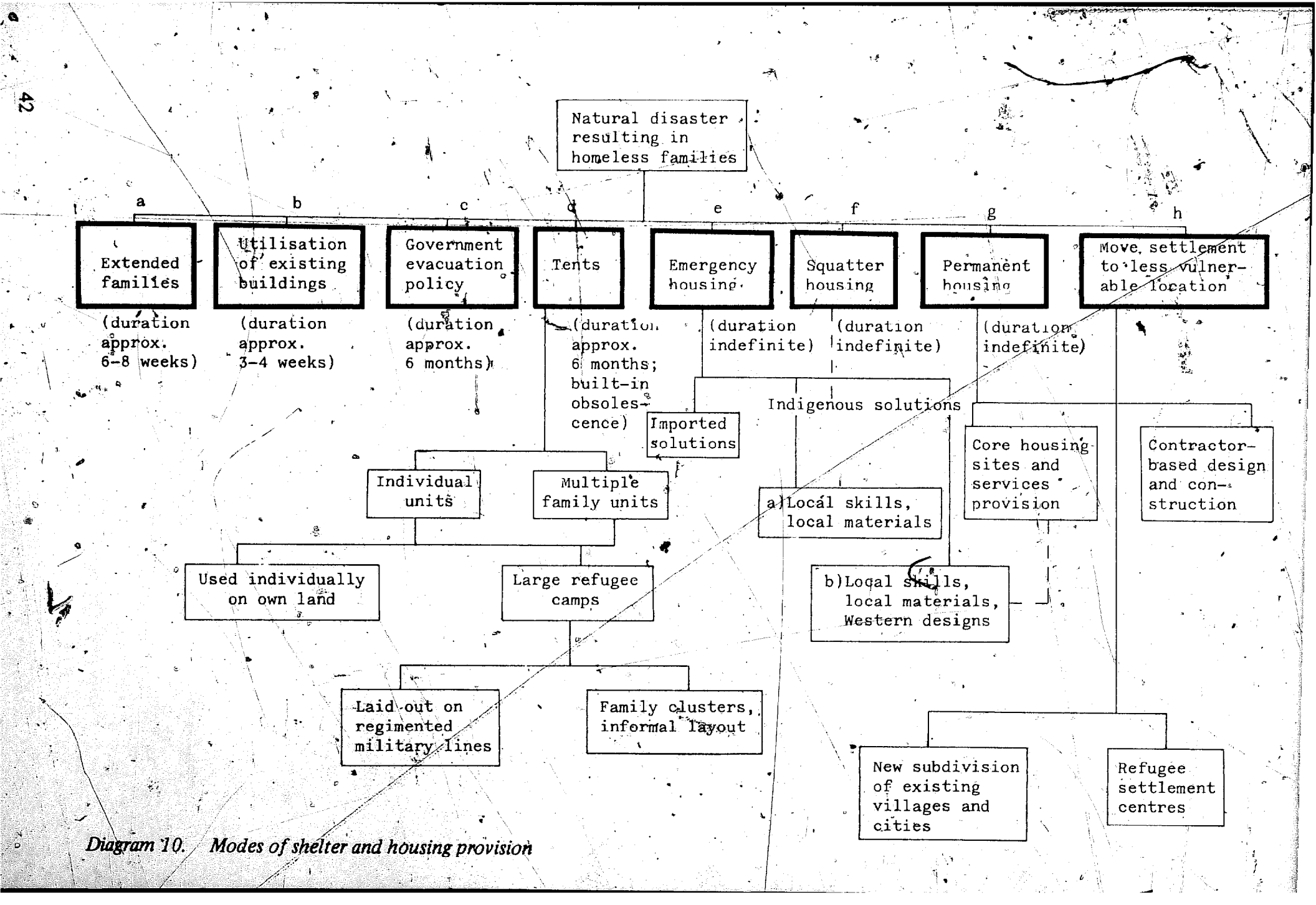
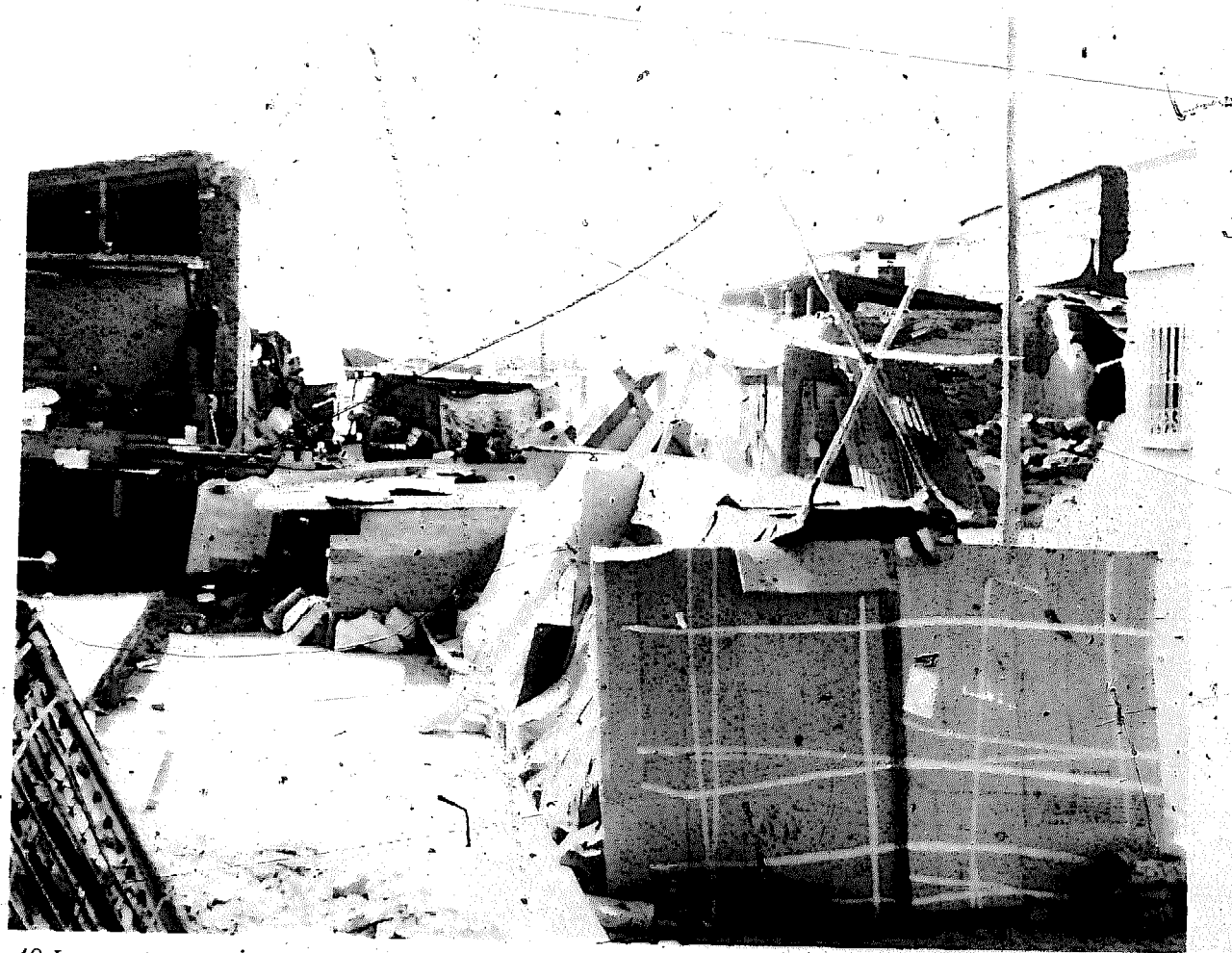


Diagram 10. Modes of shelter and housing provision

48 A night-time 'home' in Guatemala being taken down so that the truck can be used for day-time activities



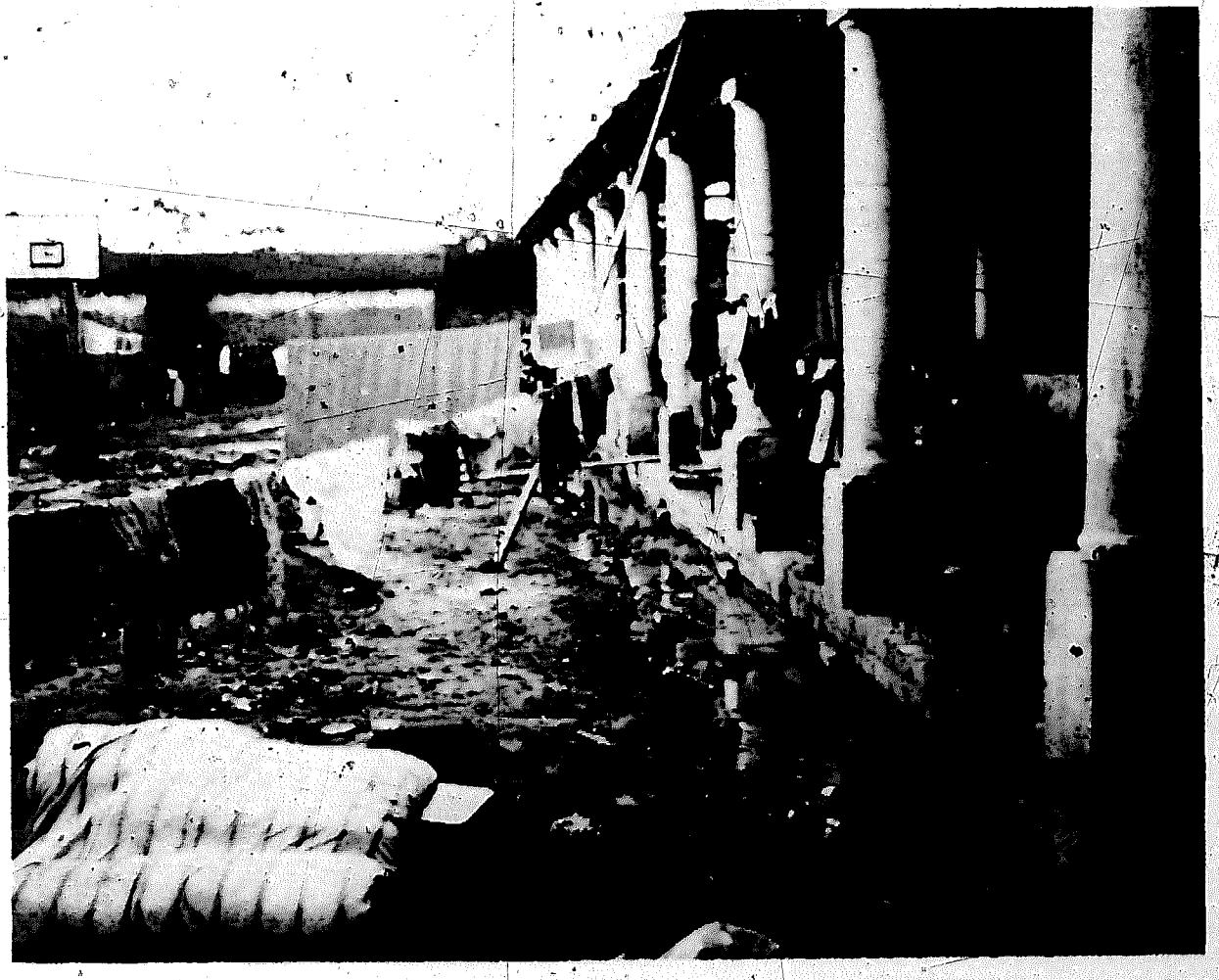
49 Improvised cardboard box and tarpaulin homes in the streets of Guatemala, four days after the earthquake

to amount to more than 20% of the total relief and reconstruction, the balance being an ad-hoc local response together with the response of the national government or local authority. Toni Hagan has noted that in the post-war situation in Bangladesh, out of a total housing need of 1.5 million units, the combined relief agencies managed to build a total of 450,307 housing units between 1972 and 1973. He then goes on to note that *one million* houses were probably rebuilt by owner/builders during the same period without any external assistance *(54)*.

One of the overriding impressions of Guatemala city during the first week after the earthquake was of the thousands of improvised shelters, throughout the affected zones, and huddled in the city parks. It is estimated that 50,000 of these simple makeshift shelters were produced within the first twenty-four hours *(40)*.

The Managua disaster of December 1972 confirms this local ability to cope and resolve shelter problems. In this city it would appear that 250,000 people were homeless, and owing to government policies of expelling people at gun point from the ruins of their homes they had no option other than to leave the city. A census taken a month after the earthquake indicated that no less than 90% had been absorbed by families and friends. The census figures for just four of the outlying towns indicated that no less than 130,000 had moved in with friends or relations in these towns. Seven weeks after the earthquake a further census revealed that 80,000 were still in their adopted homes *(36, 37, 67)*. The graph (Diagram 11) contrasts the refugees in extended families with those in a camp site in the same town, Masaya, which is fifteen miles to the south of Managua.

We cannot deduce from these examples that a similar response will take place in other situations. For example, the extended family 'sponge' cannot function in the long-term disasters such as the Sahel drought, for the obvious reason that everyone is affected.



50 Existing buildings form a very valuable resource for housing for homeless families: a converted convent in Trinidad, Bolivia

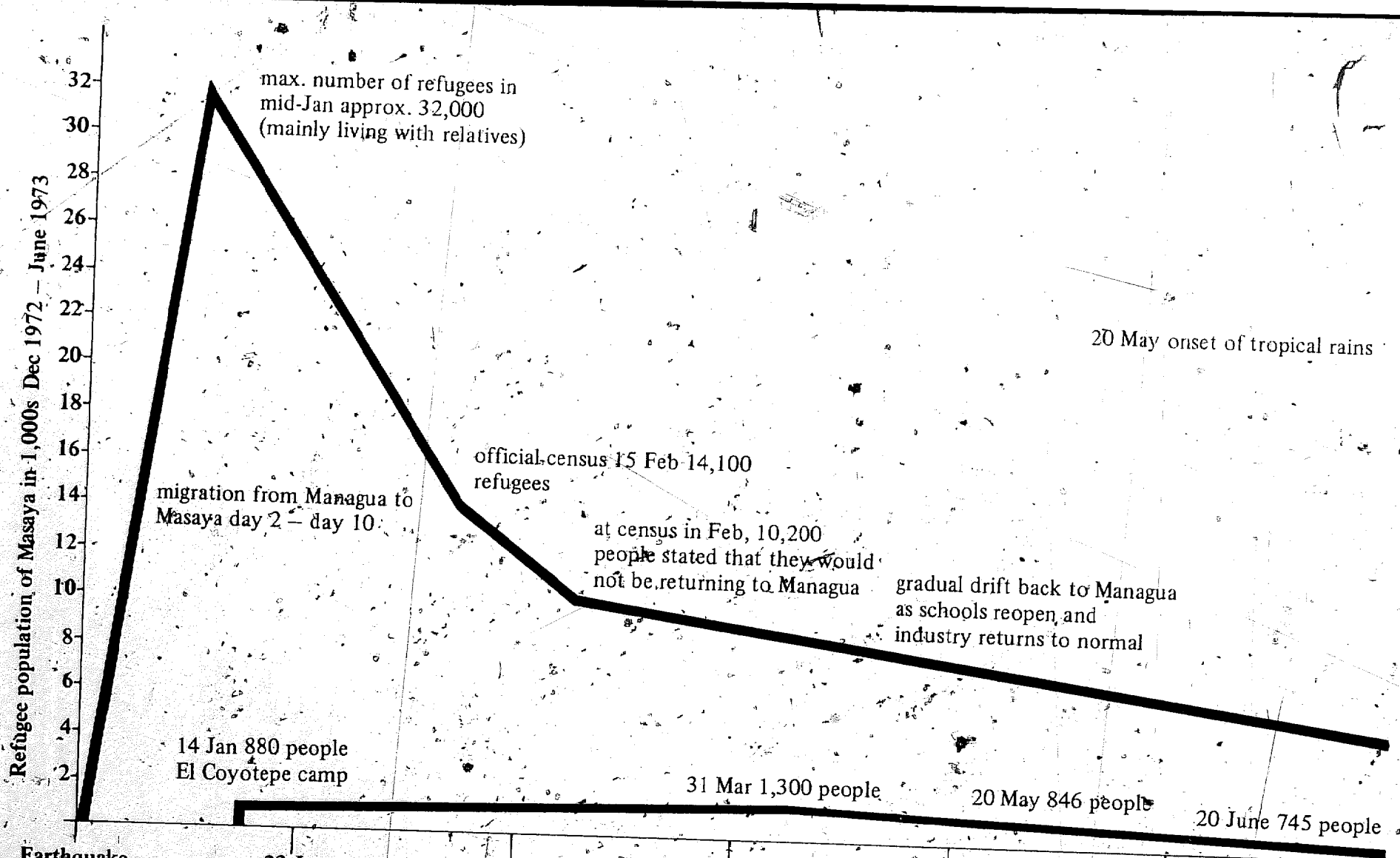
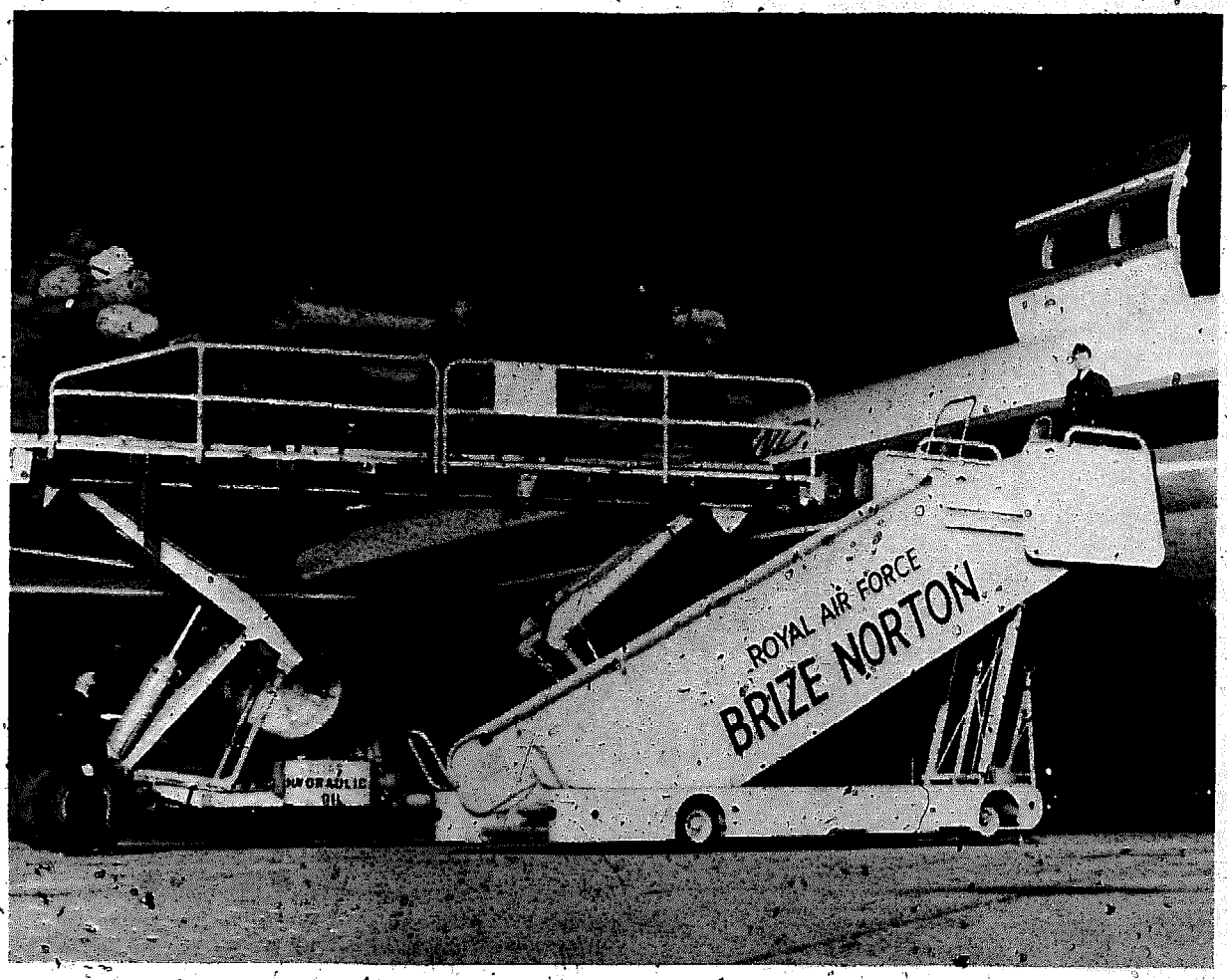


Diagram 11. The ratio of refugees in extended families, and in a refugee camp in Masaya, Nicaragua



51 Loading Oxfam supplies at RAF Brize Norton

Another context where it won't function is the refugee camps of Bangladesh, or Bengal, where people have been uprooted from their environment. Perhaps, even in rural situations like the major Turkish earthquakes of 1975 and 1976, where there are self-sufficient villages with little outside contact, we would be wise not to expect such a local response to meet people's needs; and initial studies confirm this *(24)*.

However, in urban areas, particularly where urbanisation has been rapid (and this applies to most cities in the developing world), there will exist strong rural links for most, if not all, families, and this is of great benefit after a disaster.

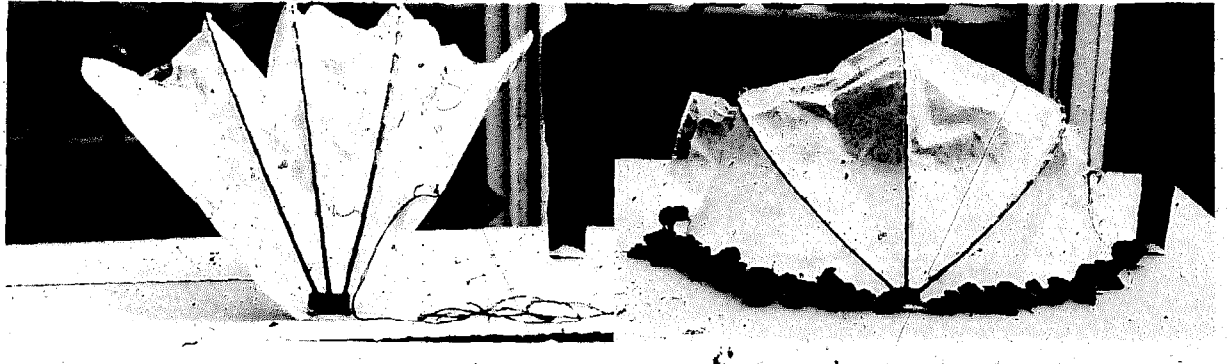
Donor provision: Rationale

To understand this fully, we have to recognise that relief agencies obtain massive press coverage in any major disaster and this is the only time they get free publicity. The first question on the interviewer's lips is: 'What is Oxfam or CARE, or Save the Children doing?' Or at a governmental level, what is the British or the American government doing? The public expects, and often receives, a visible response from the relief agency, and we are all familiar with newsreel clips of large jets being loaded in the dead of night at some remote military airfirld. *News at Ten* switches to another topic, and the public is satisfied that this or that agency is doing its job, and inevitably the donations flow in at a massive rate.

If we ask the question, 'Is it necessary to send goods half way round the world?' the answer has to be in two parts. In terms of shelter provision the answer is almost certainly, 'No, it isn't' – at least as far as the needs of the homeless families are concerned. But the needs of the relief agency or government may result in an opposite response.

In addition to the problem of vested interests there is the problem, faced by all donor agencies, of the 'culture gap'; all too often they have entered a post-disaster situation with a blythe self-confidence which may be wholly misplaced. Dr. Schumacher

52 Emergency shelter devised by Mr. Ferris in 1971 for 'Hope Structures'. This unit has never been used in a disaster



53 First-year student project by Bob Finch at Oxford Polytechnic, 1971

has written about this process:

> Astonishingly, the aid-givers simply assume that *they* have the appropriate knowledge to help the poor: they think they know and therefore rush straight into 'projects'. But what makes them think that they know how to bring help to destitute villages, when they have no such villages in their own countries? What makes them think that they can teach poor people how to use their labour power with virtually no capital, when the entire experience and education of these experts derives from societies where labour is secure and capital plentiful? *(82)*.

The whole phenomenon of 'donor' provision of shelter is comparatively recent and I have found no evidence of emergency housing (other than tents) being given by

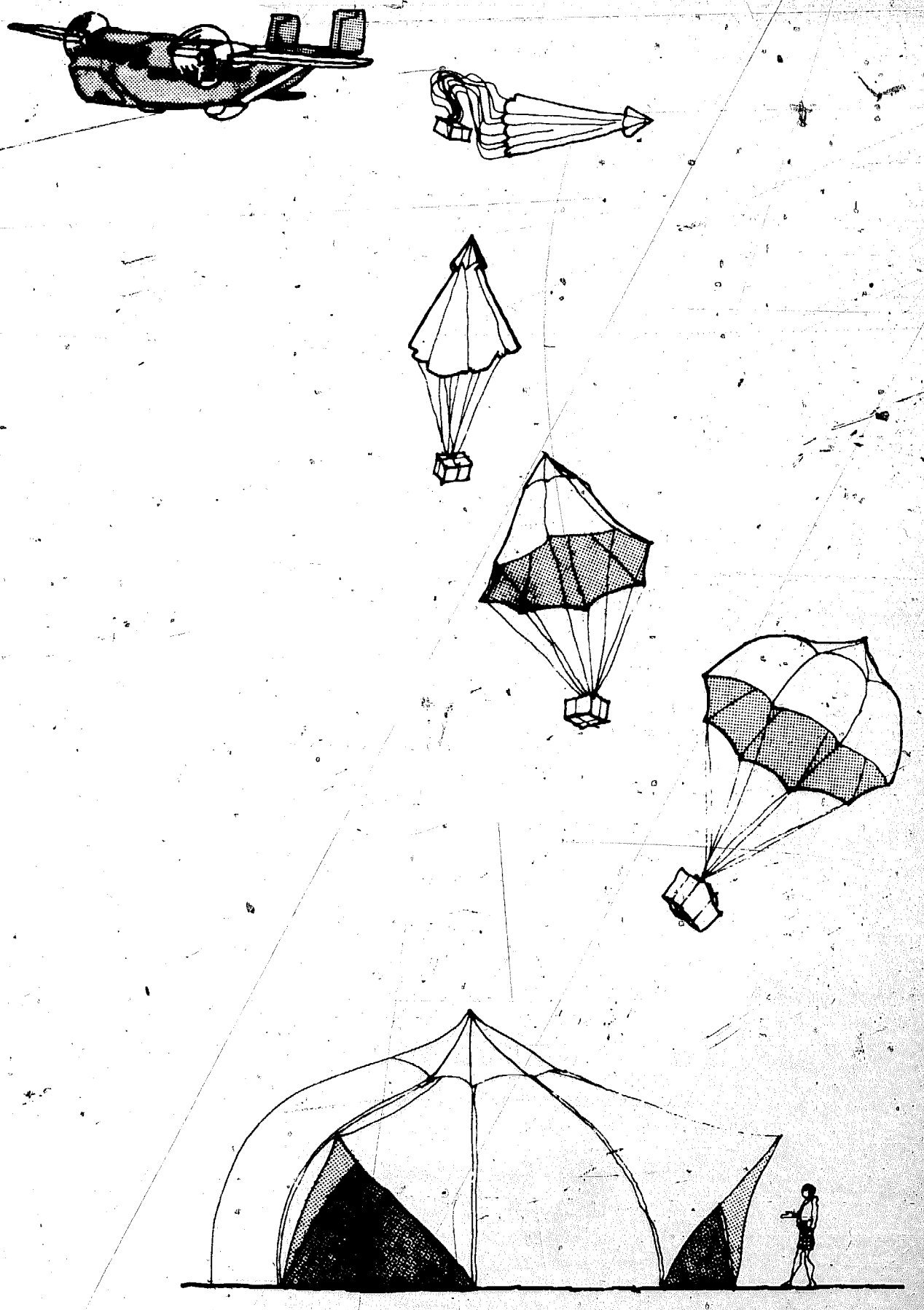


Diagram 12. The Moss air-drop shelter

one country to another prior to World War II. Therefore, the provision of shelter can be seen as coinciding with the development of aid, rapid transportation, and the growing spirit of internationalism mentioned earlier, and also the continual increases in disaster casualties *(39, 41)*.

Donor provision: Western solutions

In this situation there has been no shortage of ideas: having visited various relief agencies in Geneva and Washington I found that a familiar pattern was for the officials to say 'Emergency Housing', and walk over to a filing cabinet which virtually overturned as it was opened. The drawers were bulging with '57 varieties' of shelter types. The vast majority of these concepts mercifully have never left the drawing board or filing cabinet, but this seems no deterrent to the ingenuity and persistence of designers *(11, 12, 32, 39, 41)*. The reason for this is perhaps that architects and industrial designers have seen this problem (wrongly) as relatively simple and well defined. And it uniquely combines many of the preoccupations of students and designers: social awareness; advanced technology; mobility and impermanence *(54)*.

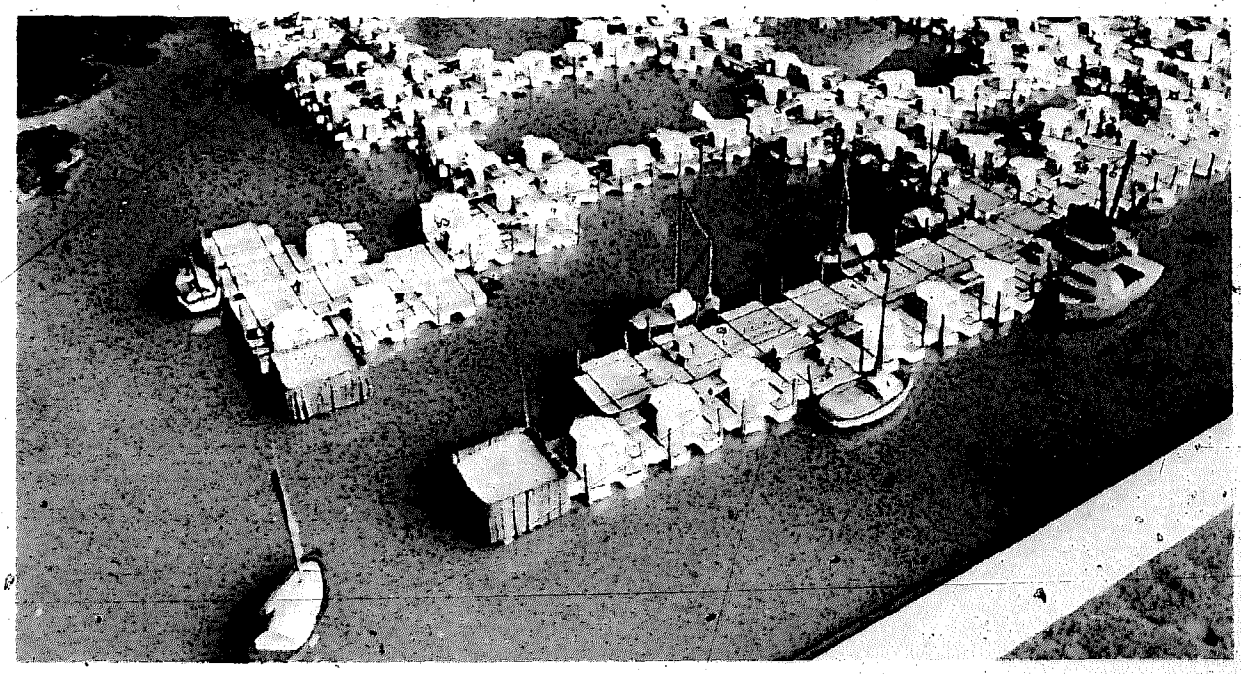
Some of the proposals have been bizarre in the extreme. Perhaps the crowning example is that of the Moss Air-drop Shelter, a project devised on the principle that a unit is: 'jettisoned from an aircraft' and 'through the differing accelerations of the air-resistant membrane and the fast descent payload, is opened to its stable position in the air, landing upright and ready for immediate use' *(32)*.

A measure of the public interest in such ideas can be gauged from the statement about Moss in *Time* magazine:

> 'But Moss the tentmaker will not be fully satisfied until someone buys his favourite idea – an already tested shelter that can be rushed to earthquake, or other disaster-stricken areas. Carried over the site by helicopter and released in mid-air, it opens like a parachute and drops softly to earth, ready for immediate occupancy *(86)*.

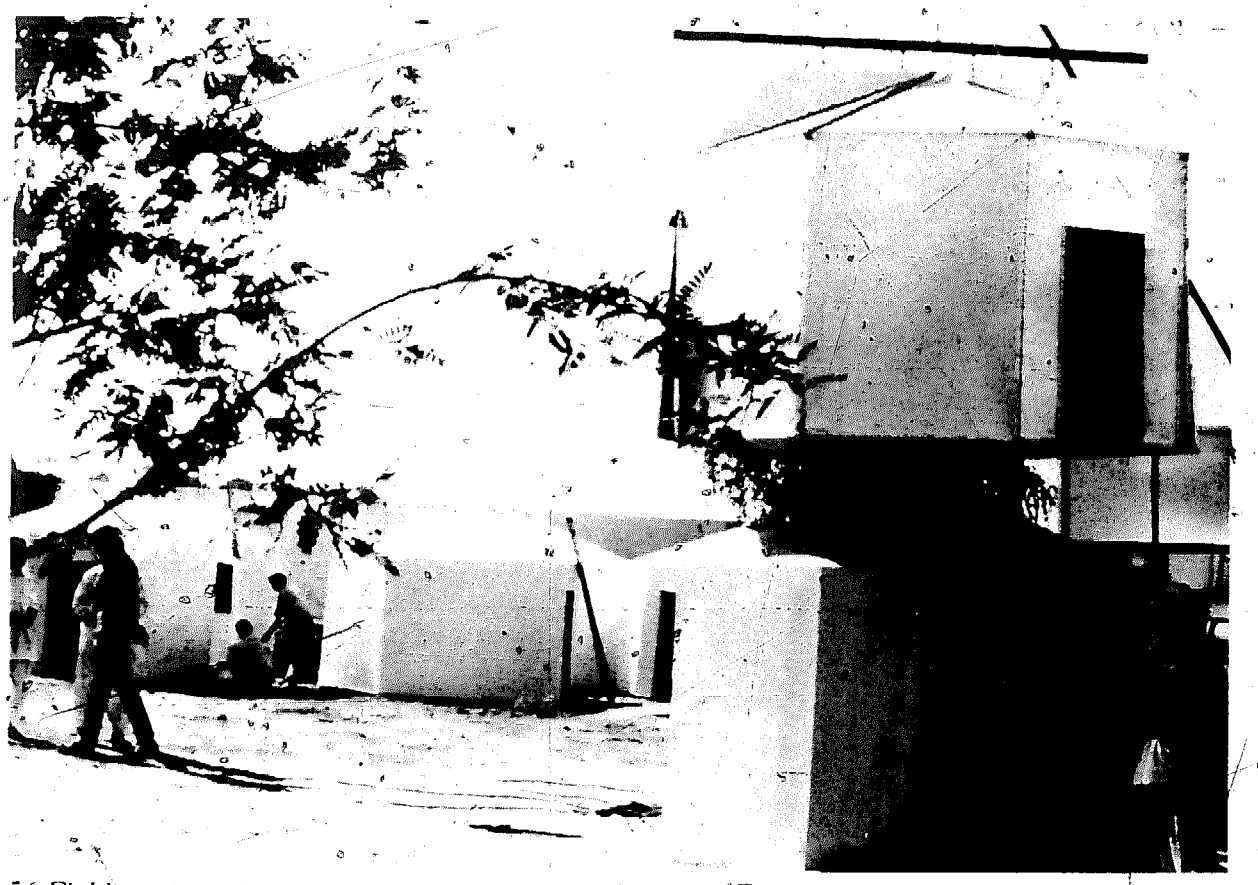
Perhaps one issue that Mr. Moss has still to consider is how to give his helicopter pilots a crash course in town planning! Michael Menzies comments on this

> . . . prepossession western technologists have with devising 'cunning technological packages' labelled 'post-disaster emergency housing' which, far from being installed in any disaster situation, reach their zenith within the pages of the ubiquitous 'glossy' monthly magazines *(63)*.



54 Prizewinning competition entry of floating emergency shelter for Bangladesh by Philip Hilliar of Bath University

55 West German Red Cross and Bayer polyurethane igloos at Masaya, Nicaragua



56 Field testing of the Oxfam hexagonal units in Pakistan, 1974

57 *An example of the way families modified the polyurethane domes in Nicaragua*

UNESCO and the International Union of Architects chose Emergency Shelter as the subject of their student competition timed to coincide with their Twelfth Congress held in Madrid in July 1975. In the absence of any guidance to competitors on sensible and realistic criteria, this inevitably produced a vast array of clever but (for reasons to emerge later) largely irrelevant ideas *(54)*.

Some fairly short-lived attempts have been made to provide 'universal' donor systems of emergency shelter. Perhaps the two that come immediately to mind are the West German Red Cross/Bayer polyurethane igloos (over 1,400 have been produced for use in Peru, Nicaragua and Turkey) *(11, 12)* and the Oxfam polyurethane hexagonal igloos, first used in Lice, Turkey, where a total of 453 units were used.

I have gone into some detail elsewhere on both the origin and performance of these systems *(36, 37, 39, 41)*. In addition, Jon Cavanagh made a detailed study of the use of the Oxfam units in Lice *(24)*, Paul and Charlotte Thompson recently examined those in Peru *(90)*, and a team from the School of Architecture in Stockholm has made a study of the domes in Gediz, Turkey *(84)*.

There have been many criticisms of these and similar products, and this may be the reason that both systems have now been abandoned *(29)*. These criticisms include:

Cultural unacceptability of alien forms of housing. (See Myths Nos. B6 and C6.) It must be said, however, that some of the igloos in Peru, Nicaragua, Turkey and Lice are still being lived in very happily, a fact that tells us something of the adaptability of societies.

Timing. This is often wrong, since the shelters have tended to arrive too late to fulfil their role of filling a gap. For example, in Peru the first units were occupied 60 days after the disaster *(39)*, while in Managua the delay went up to 148 days *(36)*. The Oxfam units took a total of 60 days to reach Turkey in 1975 *(24)*.

Fire risk. Adrian Greeman has questioned

whether a relief agency has any business to subject disaster victims to high fire risk in the igloos. He writes:

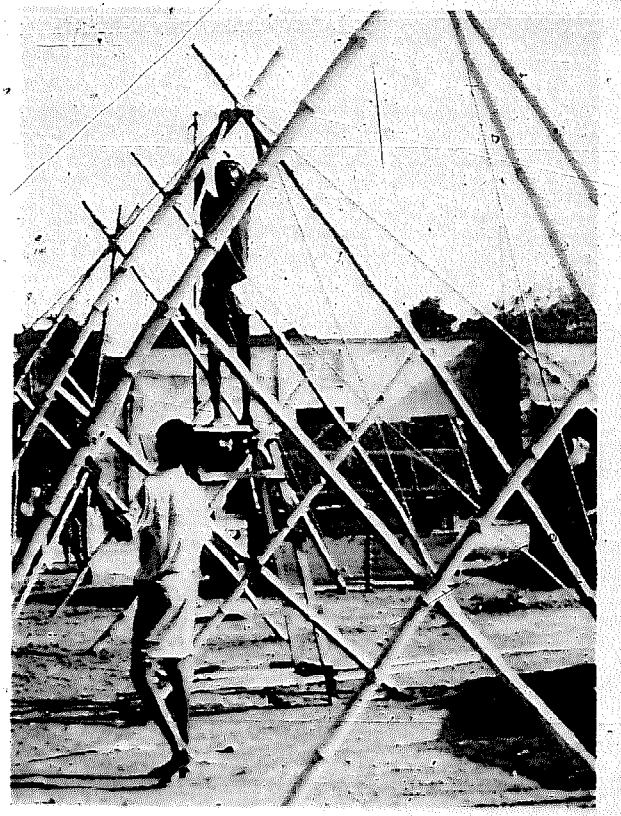
> The foam ignites easily, burns quickly and gives off lethal cyanide fumes. Residents are being warned not to have open fires near the huts . . . advanced technology brings advanced problems: should charities suspend the safety standards of the advanced countries? *(49)*

Cost. When transport costs and development costs are added, it becomes apparent that these igloos cost as much a square metre as fully serviced permanent housing. (And in Lice, permanent housing was in position prior to these 'emergency' houses *(24).*)

Work. The shelters generated little or no local employment – a vital need in any post-disaster situation *(8).*

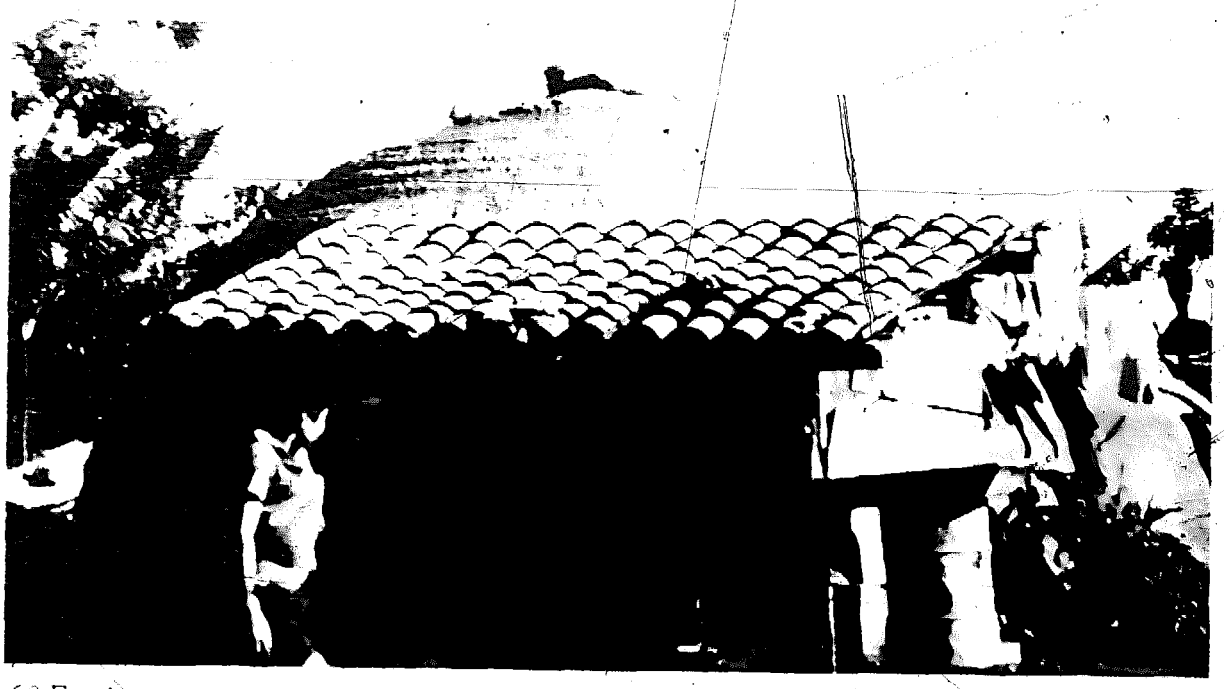
Donor provision: Low-technology solutions

I have written at length on these high-



59 Carnegie-Mellon 'A' Frame housing in construction in a Bangladesh refugee camp

58 Further examples of modification in Nicaragua



60 Further examples of modification in Nicaragua

61 Completed 'A' Frame housing at Demra, Bangladesh

technology solutions. However, there have been donor systems which have not relied on advanced technology – and in general these have been more effective. The reasons for this are that housing using low technology is more likely to come within the price range of disaster victims, it is probably better suited to local cultural patterns and climate, and it will probably generate local employment.

One of the most significant developments

62 Nomad tents in eastern Turkey

63 Tents provided by Red Crescent in use in Lice, Turkey, eight weeks after the earthquake

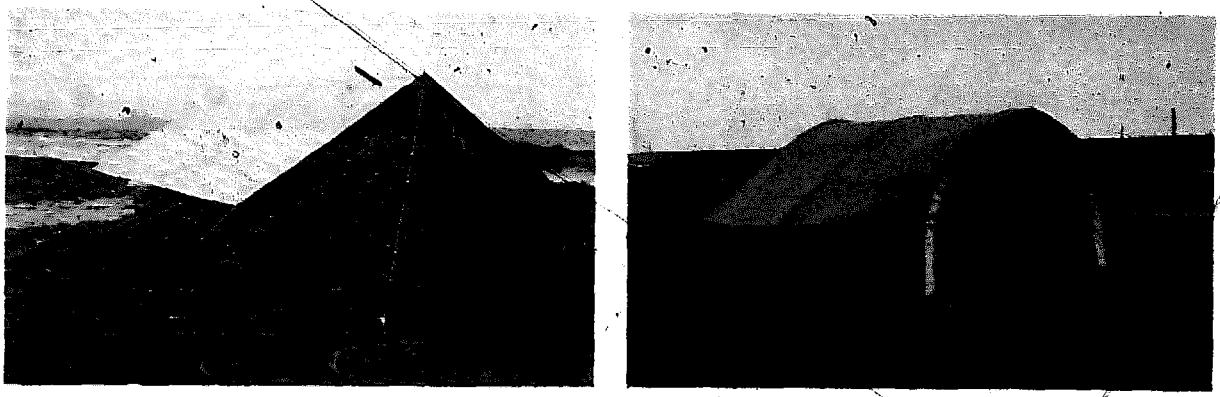
in low-technology shelters is the work being undertaken at Carnegie-Mellon University, under the direction of Volker Hartkopf and Charles Goodspeed *(20)*. Working with Fred Cuny, this team has developed a proposal that relies on indigenous materials and indigenous building skills. But the expertise of advanced technology has clearly been necessary to devise their 'A' frame structure, which withstands cyclone force winds. (The term 'A' frame derives from the form of structure, as shown in the photograph.) This method, now being used in Bangladesh, would *seem* to be a model approach. It clearly results from a careful analysis of an existing situation. The research has included a study of local cultural, economic and climatic factors, as well as a study of the performance of local vernacular housing. However, an ultimate test of any donor system is whether it is adopted (perhaps with local modification) by the families building their own homes. And early reports from Bangladesh would indicate that this system, with all its qualities, has had little impact on new construction approaches *(20, 39, 41)*.

Another donor 'system', if we can call it that, has been the use of 'lamina' or of corrugated iron or zinc sheet. In Guatemala, the bulk purchase of this material has shown itself to be a very effective policy. Oxfam and World Neighbours have broken all records over the amount they have spent on this product. By July 1976, five months after the earthquake, they had spent £854,000 on this metal roofing, the largest financial allocation in Oxfam's history *(72)*.

This lamina has many obvious advantages over total systems of temporary shelter in that it can be used initially for shelter – set over a few sticks or an 'A' frame house – and then re-used for a more permanent house.

Donor provision: Tents

But the most typical low-technology donor product is clearly the tent, and for thousands

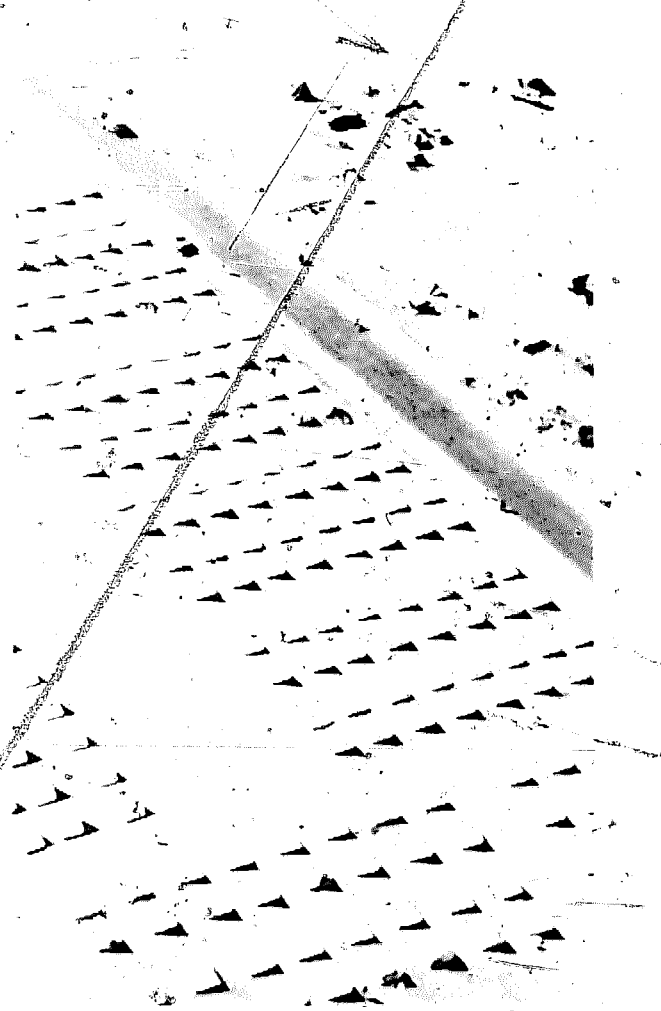


64 Japanese disaster tents purpose-made in woven polythene

of years it has probably been the basic form of emergency shelter. Tents also constitute one of the few types of mass shelter that are stock-piled. AID keep stockpiles in various key parts throughout the world. Europe, Asia, Africa and Latin America. These stockpiles contain up to 10,000 frame tents. The Red Crescent in Turkey and Iran also stockpile bulk supplies of up to 20,000 ready for use. These are manufactured by refugees of one disaster, ready for the next one.

One significant problem is the rapidly rising cost of tents and their weight in transit, and for this reason it is hoped that the plastic, woven polythene tents being developed specifically for post-disaster use by a Japanese firm, Fujimori Kogyo Co. Ltd., will be a success *(47)*. These tents were developed to a specification worked out by Jurg Vittani of the League of Red Cross Societies *(95)*. Thus far they have been used in South East Asia – after floods and earthquakes in the Philippines, as well as Vietnam, Laos and Cambodia. However, as yet no reports have been provided on their performance.

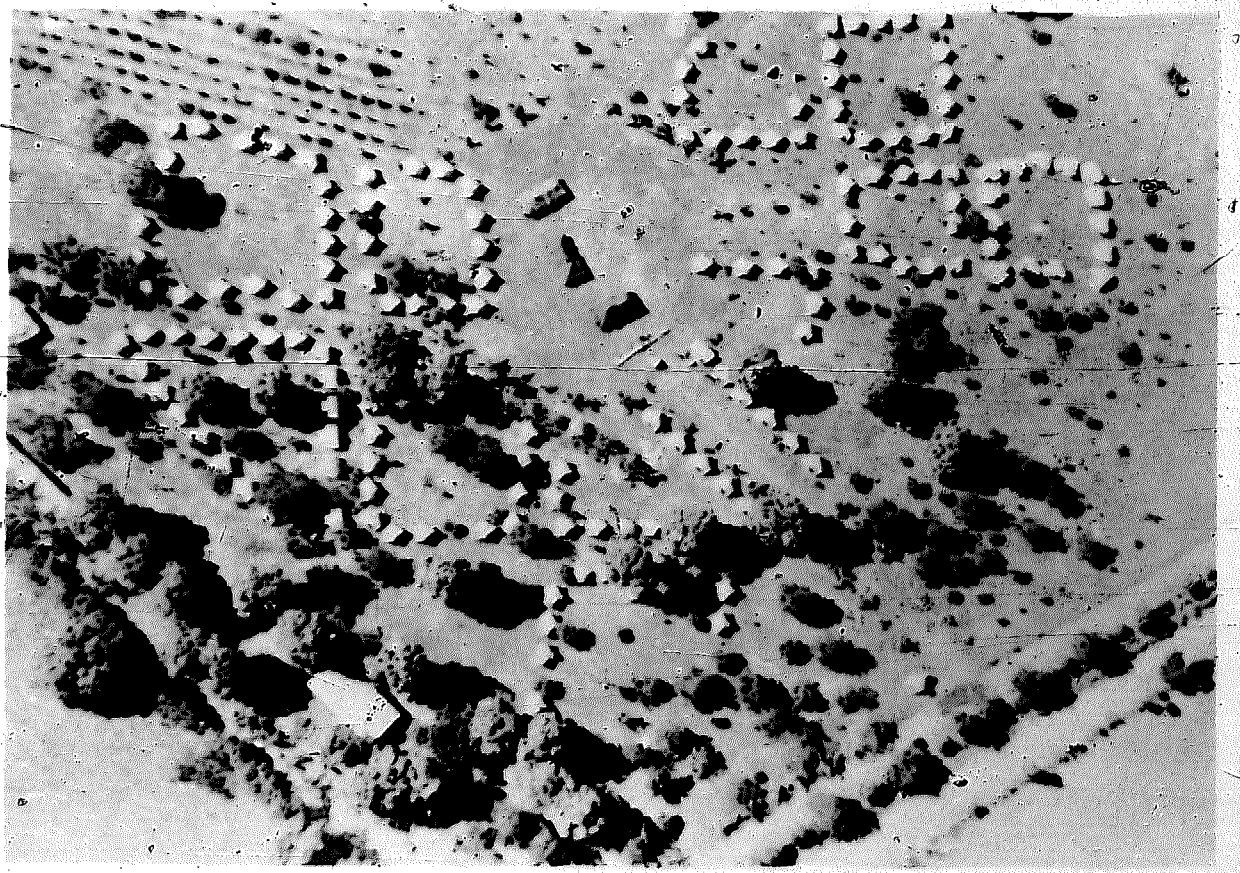
The various reports on the layout of refugee camps by Fred Cuny are of considerable interest since they represent the only attempt, to my knowledge, of town planners applying their particular skills to the problems of camp layouts *(30)*. The layout that Cuny worked out for El Coyotepe camp in Nicaragua produced a humane environment in sharp contrast to the regimented military camps *(31)*. This resulted in far higher occupancy figures. The basic principles were the use of family clusters, localised cooking and sanitation units.



65 Regimented layout of tents by military personnel, San Pedro, Sacatapeqez, Guatemala

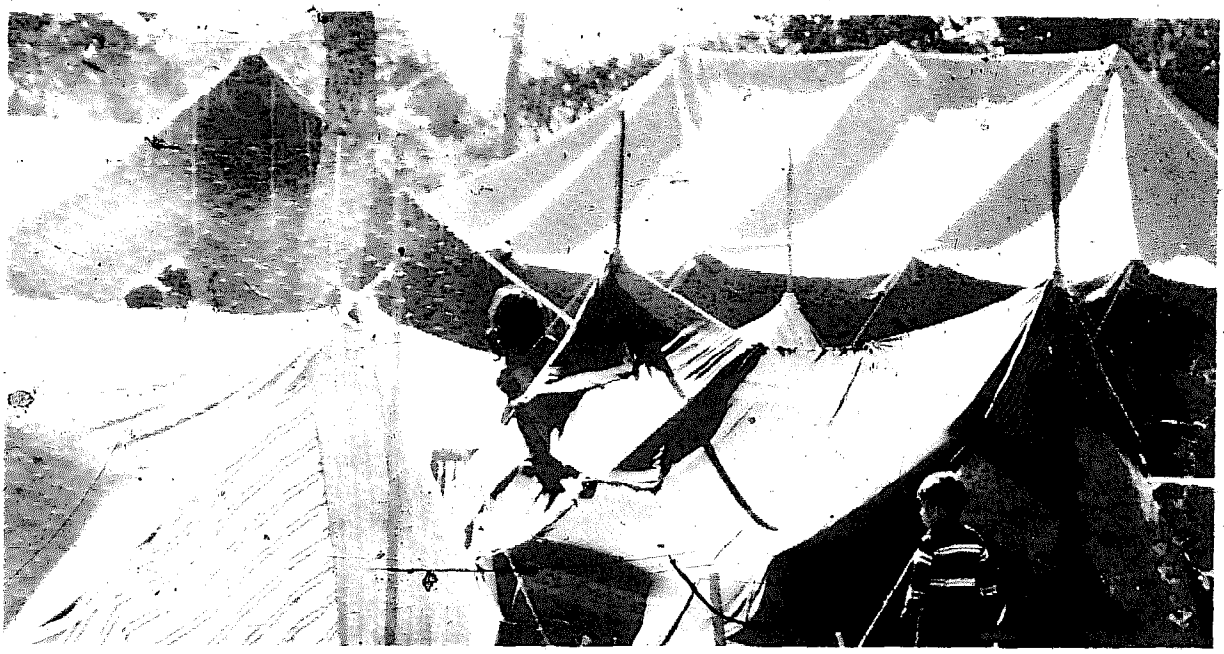
The obvious problems of tents are high winds and extremes of heat and cold. Another problem is that the homeless often bring scraps of furniture with them, which can easily puncture the fabric. It is also very surprising that agencies with the experience of AID stockpile American 'vacation-style' tents – although they have recently started producing a more sturdy model. The punishment from climate, intense use for a

66 Sears High Wall Chalet tents in use in Masaya, Nicaragua, fourteen weeks after the earthquake



67 Layout of tents designed by Fred Cuny, at Masaya, Nicaragua

period of three to nine months and furniture damage, makes many tents most unsuitable for post-disaster shelter. This is the reason why agencies like Oxfam use only heavy-duty tents. Perhaps the unique advantages of tents are their 'built-in obsolescence', the fact that they can be erected within hours, and their relative lightness and compactness



68 Emergency camp in Chimaltenango, Guatemala, seven days after the earthquake. Some tents are orthodox, others improvised

69 Emergency camp in Buia, Friuli, Italy, four months after the earthquake of May 1976. By this time only 20% of the site was occupied

for bulk transit.

One rather surprising realisation is that tents are grossly underused after disasters. In Managua, the US army 'after action report' puts matters with military precision:

December 22	earthquake
December 29	200 tents erected to date
	89 tents occupied
January 2	242 tents erected to date
	161 tents occupied
	82 tents used for administration purposes *(93)*

Professor Quarantelli of the Disaster Research Centre at Ohio University told me that the great blessing of tents is that there are always plenty of spares, and that is where the relief officials will be staying!

There would certainly have been plenty of space for a convention of relief officials in the tents of San Martin, in Guatemala. The army set up 3,000 tents that the German government had donated. After two weeks *seven* of these were occupied, and this was in spite of threats that the army would force

people out of the ruins into the tents at gun-point *(25)*. The reasons for the lack of use are not hard to find. As with so many disasters, the residents of San Martin needed to be near their animals and household belongings and a camp site on the outskirts of town is not suitable for either.

At the time of writing, a massive relief operation is in progress in Turkey following the earthquake of 24 November 1976. Of all the major disasters of the previous five years this poses some of the most critical shelter problems, in view of winter exposure dangers, with temperatures at night descending to -11° C. Many of the tents were far too flimsy for these conditions, and the authorities requested polar tents with internal heating systems. The US government responded by sending a total of 1,120 of these tents which arrived in the affected area within forty-eight hours. By the tenth day it was estimated that 10,000 winter duty tents had arrived at the airport in the town of Van, although a careful census of tents on 17 December indicated that 6,647 had been delivered.

The question that was in the mind of John James, the *Guardian* reporter, on Saturday 4 December (day 10) was what became of these tents – he writes:

> In a visit to the worst-hit settlements of Muradiye and Caldiran – I did not see one such tent being occupied by a homeless family. Plenty of them had been erected, but these were either unoccupied, or under Turkish army guard, or else occupied by the Turkish troops.

James then visited a supply depot:

> A destitute crowd was pressing around the entrance to the dump, calling for food and tents. Soldiers were keeping them back and an officer told them to be patient, that their demands would be met village by village. But at the other side of the dump, screened from the crowd by trucks and piles of supplies, three comparatively well dressed men were helping themselves while the soldiers looked on.

The thieves are recorded for posterity on TV films which were broadcast over British networks. Against mounting international pressure, the Turkish authorities issued statements to contradict such reports, and two men were taken into custody on theft charges on day 13 in the town of Van. On day 14 the Turkish premier had to answer opposition questions in parliament. He rejected suggestions of corruption as 'exaggerated rumours'.

I have dwelt on this at length to show something of the problem when a highly sought-after, highly expensive relief object (in this case a polar tent costing up to $600) arrives in a disaster situation. It may well be the case that the cash value on the black market of such an object would be far higher than a man's annual wages – and almost certainly far higher than the purchase price of a peasant house built out of local materials.

The situation in eastern Turkey may well yield very vital evidence as to what is needed in conditions of extreme exposure. The technique used by armies all over the world in cold conditions of digging a tent into the ground to get ground warmth and wind protection does not appear to have been adopted, or so the press photographs would indicate. (See Diagram 13.)

There have been many proposals for the use of inflatable structures, or large marquee tents, which can be subdivided internally into small cubicles for individual families. Although there are obvious cost benefits in such proposals, there remains the apparent dislike of families for multi-family units (see myth No. C7). An example of this can be seen in Caldiran, eastern Turkey, where forty twenty-person tents had been erected by day 10, and yet they were totally unoccupied.

Donor provision: Summary of external sources

I must summarise. Of all the myths in Part II, probably the most significant is C1, the popular misconception that there is a gap waiting to be filled by external sources. With the possible exception of famine, refugee camps and war, we can confidently state that local initiative is well able to fill this shelter gap. The particular problem of areas of high exposure risk may well be clarified when full evidence emerges from the Turkish

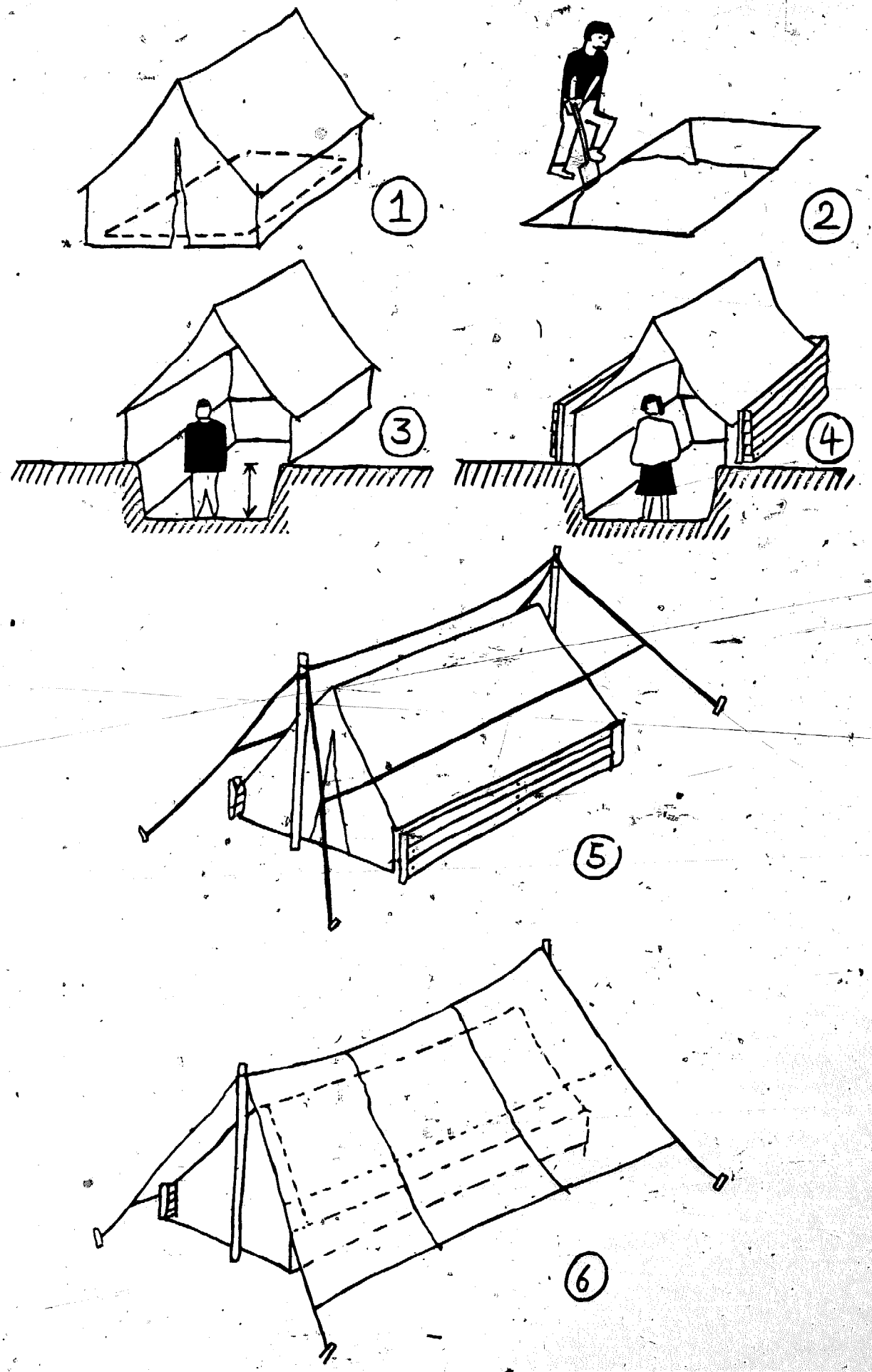


Diagram 13. Field drawing of erecting tents

earthquake of November 1976; but it is worth restating that we have not as yet found any evidence of deaths from exposure following a natural disaster.

The fact that a western product is almost certainly not required (and this may even include the supply of tents) is a matter that needs to be communicated to the decision makers of relief agencies and governments. It also has to be stated to designers and to manufacturers who may be tempted to get spin-off publicity.

There are four questions that donor governments or relief agencies should ask of any housing or shelter product that they consider sending to a disaster zone:
How quickly will it be occupied? (If it is beyond a week it will be probably too slow.)
How much work will its construction generate? (This is a valid question even with an emergency shelter programme.)
How 'universal' is it? (Will it be rejected on cultural grounds like some of the donor systems in the refugee camps of Bangladesh?)
How much does it cost? (Add development and transit costs to materials and labour, and then compare it with what this currency could purchase locally.)

If, as we must suspect, donor products of most kinds relate more to the needs of manufacturers and agencies in donor countries than to the local needs in affected zones, then officials should think very hard on those issues. And the money that used to go on goods for the long flight round the world can be used instead by experienced officials to purchase badly needed materials in nearby towns and neighbouring countries to affected areas. This was how Oxfam purchased its lamina sheeting in Salvador, for Guatemala, and it is a model pattern for donor provision, an excellent 'gap filler' *(72).*

The problem of shelter will probably continue to fascinate designers and students indefinitely; but for any significant development to be made, they must begin to recognise that this role is one of support or partnership with the people in question. This is impossible to achieve without close contact with the vulnerable population. Such contact would render obsolete the clever ideas worked out in the comfortable drawing offices of London and New York. Fred Cuny has summarised three priorities:

1. Designers must work with, instead of designing for, the people.
2. Any designer trying to introduce change must begin with what the people already have; that means not only the shape, size etc., of the structure itself, but also the indigenous materials, skills and other resources available in the normal housing process.
3. The whole idea of developing housing cannot be divorced from the entire development approach. It makes no difference if the house is earthquake resistant if the person hasn't made the choice himself to participate and accept what he is being presented with.

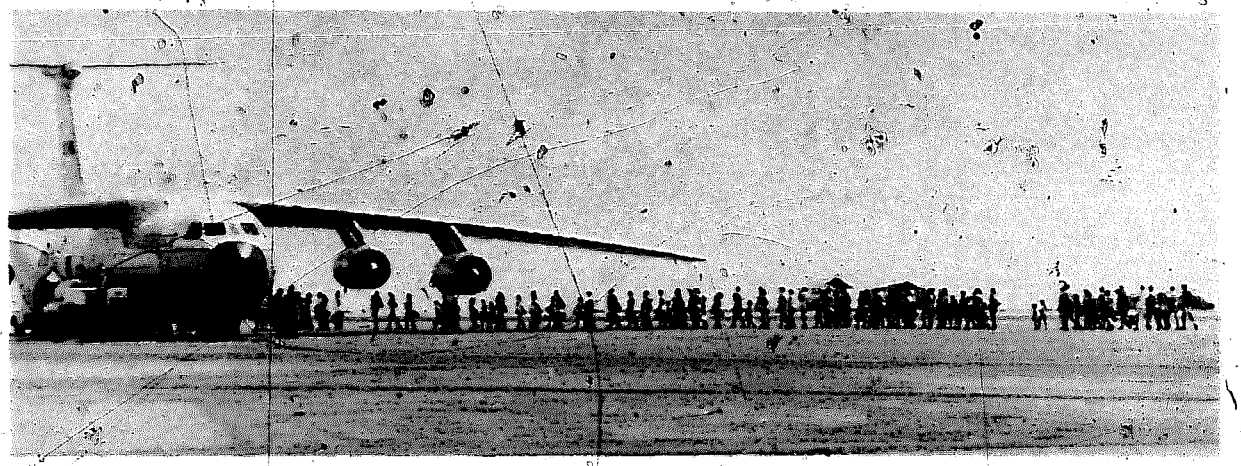
Any real understanding of donor provision must recognise that both the giver and the receiver have needs to be satisfied. And as more evidence comes to light it becomes very clear that disaster aid is part of the international aid market. Both relief agencies and donor governments have mixed motives. A recent example of this emerged after the earthquake in the Philippines of 16 August 1976, when 8,000 died and an estimated $100 million damage was sustained. The *New York Times* carried a report that the US Embassy in Manila had made contact with the government of the Philippines to see if a rapid agreement could be reached on American air bases; if so there would be no obstacle to the flow of aid to the 35,000 homeless families.

It is this type of report and the vast inappropriateness of perhaps 90% of all donor shelter provision that encourages us to speculate whether most societies would not do better to follow the example of Mexico, the Philippines and China. These countries have decided that donor provision is likely to create more problems than it solves. Future studies must consider the success or failure of their unaided relief and rehabilitation procedures.

Donor provision: National governments

We have seen from the section on myths that we are prone to exaggerate the importance of the donor role, and in turn to minimise the role of national governments.

Clearly they have the potential to fulfil



The evacuation of Darwin following Cyclone Tracy, Christmas 1974

the major role in the immediate relief phase, and also in the reconstruction period. Their aid may be administered by national emergency committees, or national reconstruction committees, as in the case of Skopje and Guatemala. Or administration may take place at a local level, as in Friuli, Italy. In this instance every village has its own resources, and its own emergency administration.

One very effective procedure for governments to follow is to use existing facilities for shelter provision – schools, churches, all public buildings. Naturally, they can be used for only a very short time, but this may be all that is needed to fill the gap, since the gap is likely to be only a few days pending the start of reconstruction activity. The resource of existing buildings is immensely valuable, and for this reason all public buildings in vulnerable situations should be built to high factors of safety.

Another action governments are often tempted to pursue is that of evacuating all people not specifically involved with search, rescue or relief activities. Of all procedures, the results of this can be confidently predicted. Studies of wartime London have shown that at any one time more 'evacuated' children were returning to London than were being dispatched out of the city (after the first great evacuation) *(27)*.

In Skopje 150,000 left the city within the first three weeks. However, families disliked being split up and virtually all had returned within four months *(38, 91)*. In more recent times the classic evacuation is that of Darwin, Australia. At the time of Cyclone Tracy, the population of Darwin was 47,000. Within six days of the disaster 36,000 had been evacuated to towns at least 1,700 miles from the city. The remaining 11,000 men stayed behind to commence reconstruction work. By 15 March, 10 weeks after the cyclone, the population had risen to 27,500 and by September, 9 months after the cyclone, it was 38,000 *(50, 97)*.

The twin desires – to return to one's home, and to remain with one's family – appear to be so powerful, particularly in periods of stress, that people will tolerate any degree of discomfort to achieve them. Once again, there is a conflict, and the obvious benefit of having all non-essential personnel out of the area has to be set against the social upheaval that enforced evacuation measures will create.

In this section, I have looked at the various responses of Strategy 2. (See Diagram 6.)

The major gap fillers are local people often acting unaided. I have looked at the role of donors and considered the real or imagined gap which they try to fill. Finally I have seen the potential for local governmental provision.

Strategy 3 — Accelerated reconstruction

If it is not possible to achieve strategy 1 (the continuation of housing through the disaster)

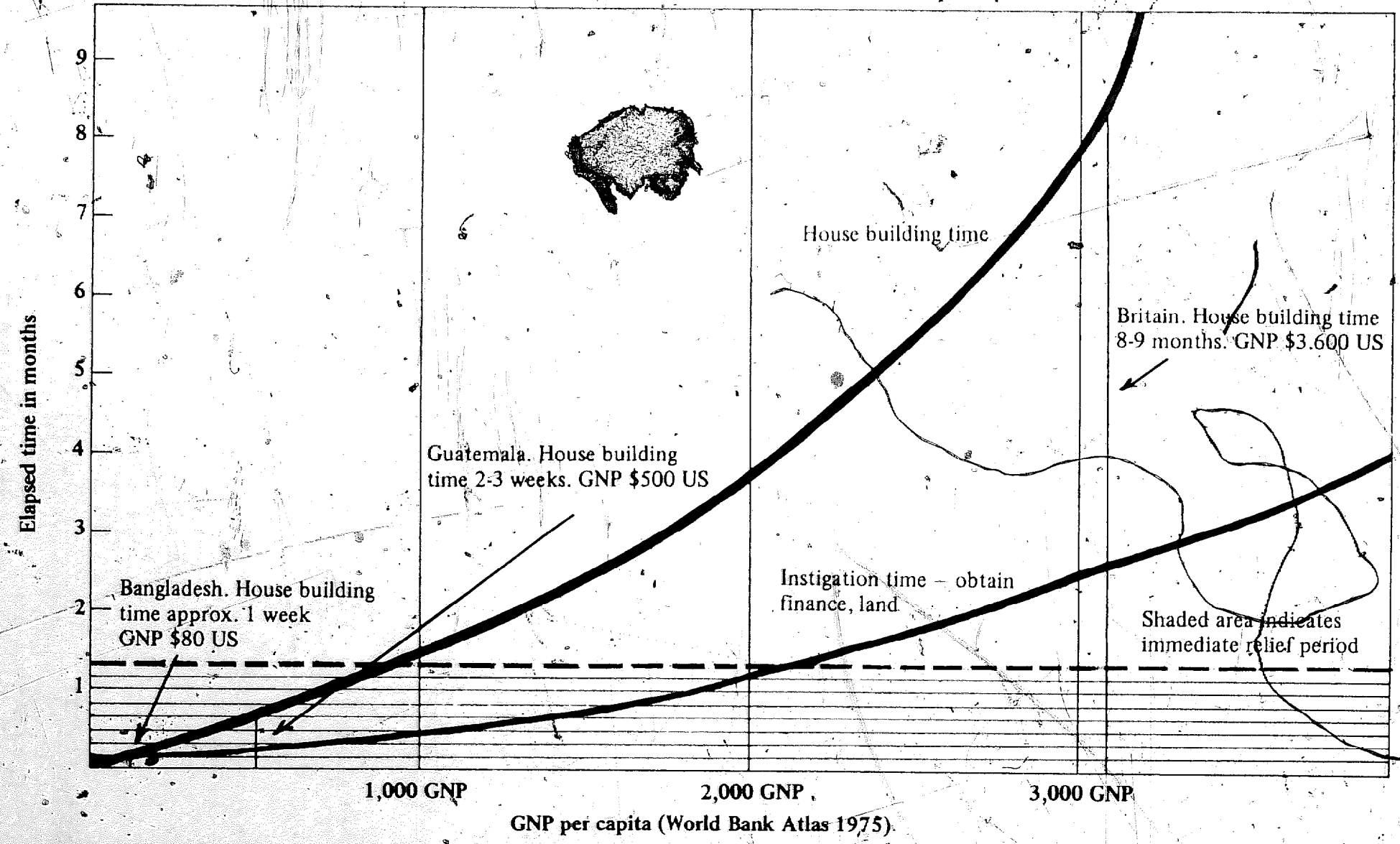


Diagram 14. Graph to show relationship of construction period to national wealth

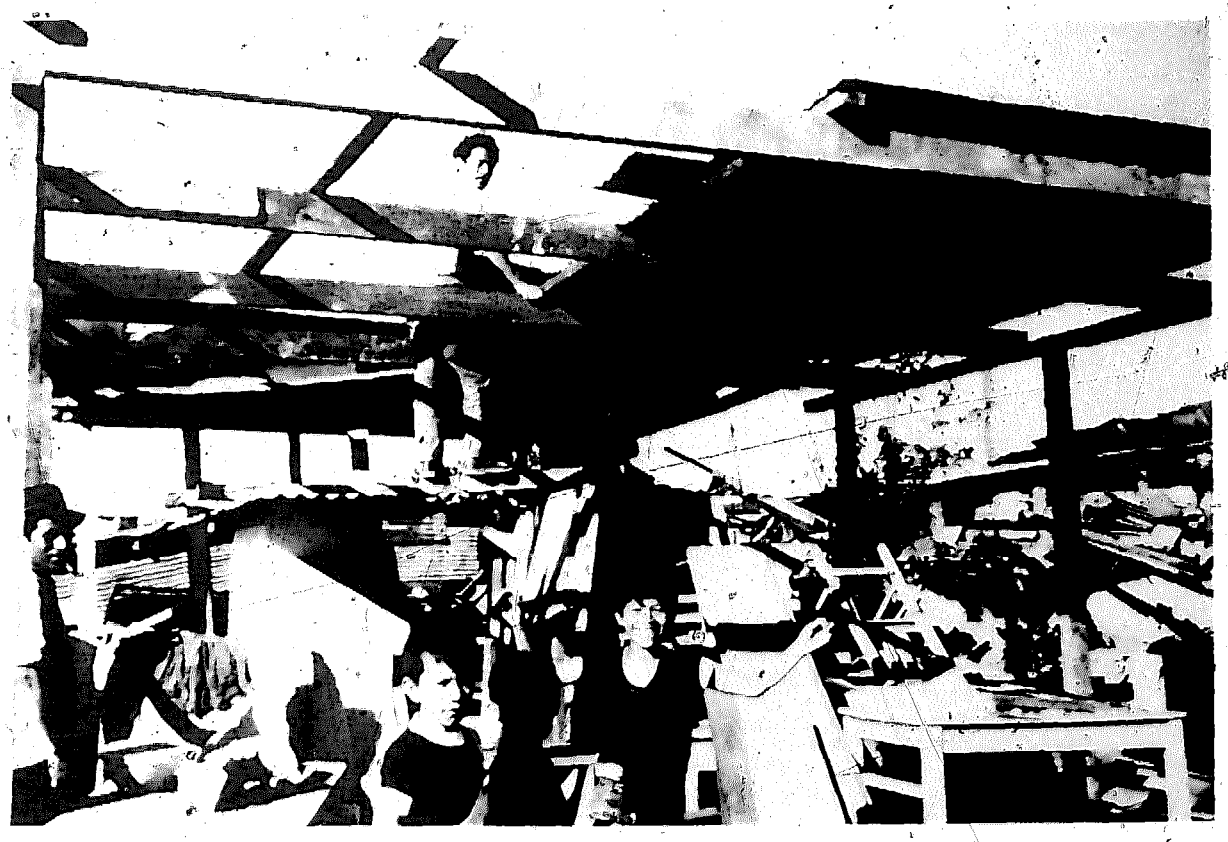
(see Diagram 6), then by far the next best strategy will be to achieve rapid reconstruction (strategy 3). This will again close the gap, but in a far more effective way than the two-stage approach of strategy 2, which is very wasteful of money, scarce materials and of manpower.

In considering third world housing it is important to note certain images which colour our thinking. The distinction which we draw in the west between, for instance, the semi-detached home and the summer beach hut may too easily spill over into our consideration of permanent and temporary housing in a totally different context. Most housing for the people who are homeless after a disaster will be 'temporary' by our standards. It is not unusual for a simple house in Asia or Latin America to be built in a couple of days at a fraction of the cost that some relief official considers 'proper' for a permanent home.

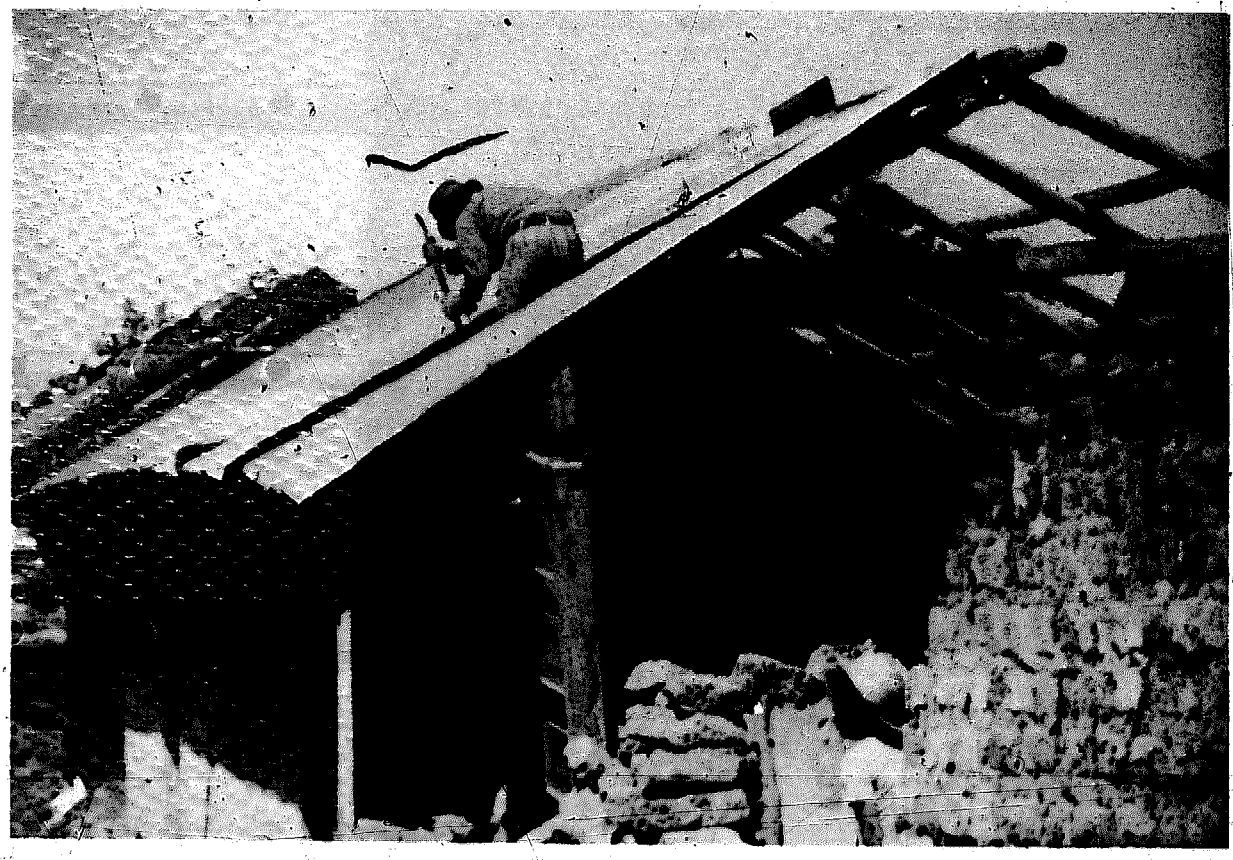
The relationship between speed of construction and an economic situation can be seen in Diagram 14. Very approximately this graph shows a vital relationship, that of national wealth to the construction time of building. Obvious facts emerge — in a poor country house building is very rapid, and can be thought of in terms of *days*, whilst in the 'developed' world it is a matter of months. The dotted line on the time co-ordinate represents the approximate extent of the 'emergency period'. It follows therefore that if the construction time of a normal low-cost home falls *within* this line, then clearly permanent reconstruction and emergency shelter are two names for the same house.

Another myth that colours our thinking is to imagine housing as a static, complete entity, when in actual fact it is always evolutionary. I am grateful to Fred Cuny for his comments on this process in the light of his Guatemalan experience:

> The houses start off with a very small structure of usually only one room, used as sleeping quarters for the entire family. Over a period of time, usually a long number of years, the house acquires more rooms and eventually becomes a formal home. The implications of this are that when any type of structure is introduced, be it an emergency shelter, a temporary structure or a long-term structure, it must from the very beginning be very strong because people

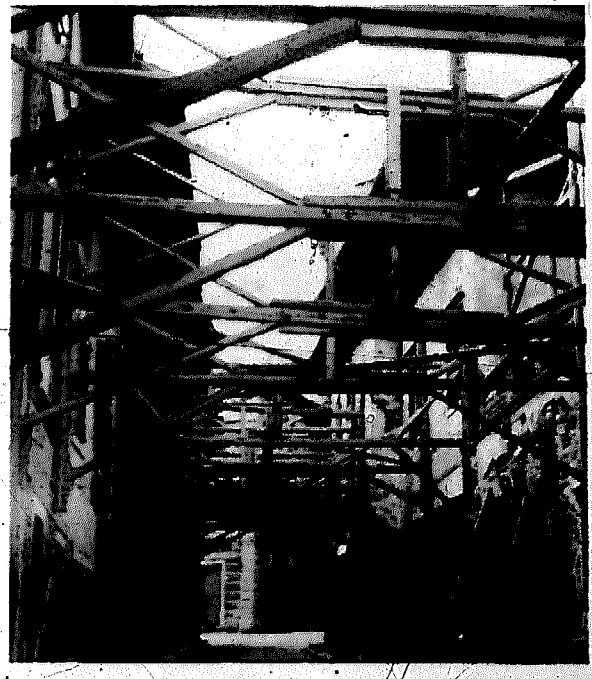


71 Rebuilding a home in Guatemala city



72 A man reconstructing the roof of his house in Chimaltenango, Guatemala, in corrugated iron sheet. The previous roof of heavy tiles collapsed and already, six days after the disaster, he is using a different approach, either because he lacks the skill to tile his roof, or in response to the obvious failure of the previous technique

will continue to use that house in its original form and incorporate it into the long-term structure which evolves. One of my major criticisms of the housing that was introduced into Guatemala by many of the relief organisations was that it did not take this evolutionary process into consideration. Many organisations put up only a frame intending for the people to put up wood or corn cane walls. While that was safe to begin with, experience has shown that over a period of years, the walls will come down, the frame will remain, and the walls will be filled in with adobe or other heavy materials. Thus, the structure which ends up ten years from now may be exactly the same shape or form as the original safe structure, but will be unsafe because of the change in material. The lesson, therefore, is that the emergency shelter or temporary house must be designed for



73 Gemona, Italy. Wooden shoring to support the facades of the historic town prior to reconstruction. But this all collapsed in the second earthquake, September 1976

its ultimate state in the evolutionary process.

One of the overriding impressions of the first six days after the Guatemala earthquake was of feverish reconstruction activity. In any group of houses, there would be groups at work, straightening corrugated iron sheet, rebuilding frames and so on. And it is true to say that unless events occur to prevent it, reconstruction will take place like a reflex.

The factors that can inhibit or prevent the process taking place are: the enforced evacuation of a destroyed city (as in Managua); the burning of rubble (a vital re-building resource); or the acute uncertainty engendered when local politicians make early pronouncements about the possibility of moving the settlement to some new and safer location. (A favourite preoccupation, particularly when politicians own land in the favoured site!)

In Nicaragua, a local development organisation, FUNDE, and also CARITAS built (or donated materials for owners to build their own houses) a very extensive number of houses long before the 'temporary shelters' were constructed. This was done by the process of infiltration, where units were built in small areas, back gardens or odd scraps of ground, thus obviating the need for a lot of bureaucratic approvals *(36)*.

A more recent example of this rapid house-building process is that of Lice, where 1,500 prefabricated (permanent) houses were completed by the Turkish government by 10 November, eight weeks after the earthquake. This is undoubtedly the fastest building programme of any recent disaster, but the speed was highlighted by the fact that the Oxfam 'temporary' or emergency shelters were being constructed *after* these units were complete *(24)*.

The obvious conclusion is to concentrate all resources on a rapid housing recovery with *permanent* housing, while relying on tents, existing buildings and the extended family 'sponge' to hold the population during the construction period. The major concerns of such a rapid housing programme will be: siting relative to future disasters; the use of local materials where available; and the use of labour-intensive rather than capital-intensive systems, thus providing work for the homeless people. George Atkinson, in his study of reconstruction after disaster, comments on the need to mobilise local labour:

> To begin with, the organisation of relief falls for special bodies and outside agencies. But soon, very soon if possible, all who are able-bodied should participate, increasingly in their normal employment. Too often it happens, especially in poorer countries, that large numbers of able-bodied men stand idle, living on relief while outsiders get busy on reconstruction. Not only is such a happening demoralising to the able-bodied, but it wastes much needed resources *(8)*.

It is worth emphasising that the word 'temporary', when applied to housing, is a myth; that the 'temporary' prefabs of World Wars I and II are still being lived in in Britain is testimony to this fact *(62)*. A further example was recently recorded by Larry Baldassaro *(10)*. He describes the plight of 45,000 people still living in appalling conditions in 'temporary' barracks, Quonset huts, following the 1968 Sicilian earthquake. In this instance there has been an 'out of sight, out of mind' attitude, when the temporary shelter has removed all official will properly to house these earthquake victims.

In contrast, the Italian authorities have been more active following the Friuli earthquake in northern Italy in 1976. A decision has been taken to rebuild all the historic towns and villages as they were prior to the disaster. In consequence each house will be rebuilt over a five-year period by the government. Already elaborate steps have been taken to shore up historic façades, number the bricks of arches that will have to be temporarily demolished and so on, although, tragically, many of these shored-up façades collapsed in the further earthquake of September 1976. In order to accommodate the population during this period of reconstruction, the government assigned architects and planners to each community. They then drew up plans for 'temporary housing'. This provision is for

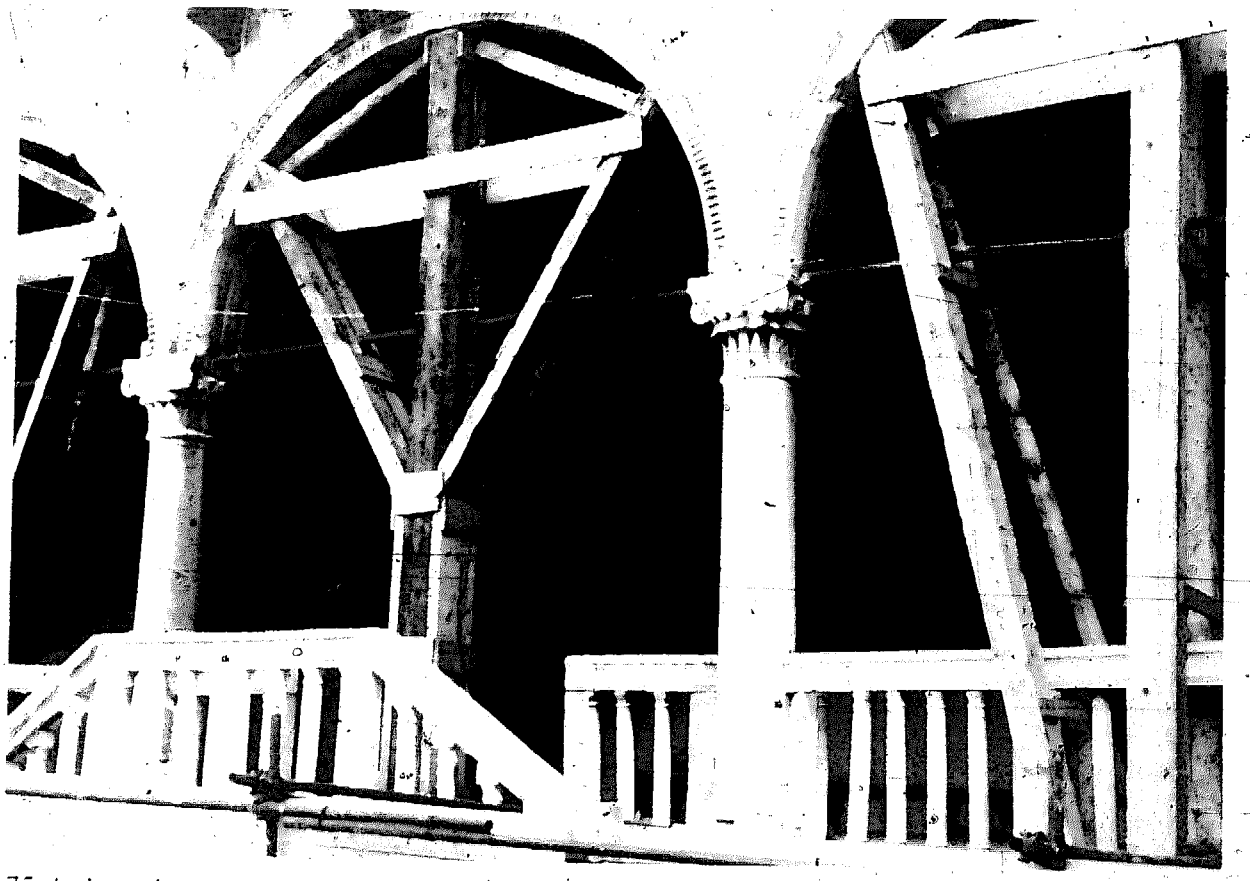
centrally heated, fully serviced prefabricated units. They cost on average between £5,000 and £8,000 per house unit. Naturally the question which will be asked repeatedly over the next few years is, 'can any government afford this type of two-stage policy?' The officials I talked to in Friuli explained that they realised that the 'temporary' homes would stay for good but they had in mind the tourist development of the neighbourhood, and this would be the major use of the homes once their temporary occupants returned to their original houses.

One very fascinating aspect of the policy being pursued in Friuli is its relationship to the Sicilian situation discussed by Baldassaro *(10)*. Following a very fervent press campaign which highlighted the details of the Sicilian fiasco, the government (with a general election looming) decided to embark on this highly expensive two-stage operation, which may be doomed to failure.

Professor Otto Koenigsberger has succinctly summarised the relationship of relief to reconstruction and of indigenous response to official provision.

> There are really four principles. 1. Relief is the enemy of reconstruction. Therefore minimise relief. 2. Even the minimal relief operation stretches the public sector executive capacity to the utmost. Therefore avoid paternalism. The public sector must not touch any jobs the people can do themselves. The last thing the public sector should do is the construction of houses, of any kind. 3. Under the immediate impact of a disaster people are ready to change long-standing methods and customs. Therefore act quickly to introduce improved construction methods and bye-laws. 4. Quick action means planned action. It is no good starting making plans after the event. The plans must be ready beforehand, including four vital checklists. (a) Emergency legislation, particularly with regard to the use and occupation of land. (b) New and extended city layouts, that's for re-modelling as well as for growth. (c) New construction systems and byelaws. (d) Most important, a role casting plan, because the disaster is the curtain raiser to a big drama and the action will not take place unless every role in the subsequent action is filled by an actor *(58)*.

74 Patzicia, Guatemala. A family working on the reconstruction of their house



75 A shored-up arch in Gemona, Italy

PART 4
historical perspectives

And God saw that the wickedness of man was great in the earth, and that every imagination of the thoughts of his heart was only evil continually . . . And God said unto Noah . . . 'Make thee an ark of gopher wood; rooms shalt thou make in the ark, and shalt pitch it within and without with pitch' . . . 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, and Shem, and Ham, and Japheth, 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.

Genesis vi, vii

When Noah and his family climbed into the Ark, they were entering a disaster shelter of a rather special kind, built as a piece of meticulous pre-disaster planning. This must be one of the earliest recorded examples of shelter provision against disaster, in this case an 'act of God' in a very literal sense.

Within this section I want to look at various disasters in history, drawing wherever possible on primary sources of information or, if these are unavailable, on secondary records of these events. The evidence of shelter provision in history is very fragmentary and slender, as will be seen. In my researches I have found only one reference prior to the Great Fire of London of 1666. This is a very brief reference which states that Amīr Khusrau Dihlavī Ijāz-I Khusravi, a poet who lived in Persia between 1253 and 1325, lived in a tent following the collapse of his house in the rainy season.

Although the central theme of this chapter is that of shelter and housing provision, I have deliberately strayed into peripheral areas where there are items of interest. For example, the subjects of aid provision, public morale and reconstruction are closely interrelated, and I have not hesitated to compare previous patterns of human behaviour with current attitudes.

Famine in Judea c. AD 41–54

In addition to the account of the Flood, there is another story of a disaster in the Bible, with an early example of aid or 'donor provision'. This is the account in Acts xi: 27. of the sending of aid from the church at Antioch to Jerusalem, where a famine had been prophesied:

> Agabus stood up and foretold by the Spirit that there would be a great famine all over the world; and this took place in the days of Claudius. And the disciples determined every one according to his ability, to send relief to the brethren who lived in Judea; and they did so, sending it to the elders by the hand of Barnabas and Saul.

Eruption of Vesuvius AD 79

In the same era the Roman historian Pliny wrote a meticulous description of this eruption. He describes the relief efforts of his uncle, in a letter he wrote to Cornelius Tacitus:

> He gave orders for the warships to be launched and went on board himself with the intention of bringing help to many more people . . . he hurried to the place where everyone else was hastily leaving, steering his course straight for the danger zone. He was entirely fearless, describing each new movement and phase of the portent to be noted down exactly as he observed them. Ashes were already falling, hotter and thicker as the ships drew near, followed by bits of pumice and blackened stones, charred and cracked by the flames; then suddenly they were in shallow water, and the shore was blocked by the debris from the mountain *(75)*.

Pliny goes on to describe the situation on the mountain slopes:

> My uncle tried to allay the fears of his companions by repeatedly declaring that these were nothing but bonfires left by the peasants in their terror, or else empty houses on fire in the districts they had abandoned *(75)*.

The family within the house were faced with a dilemma whether to remain indoors or to go into the open. But with ashes filling the courtyard they feared they would be trapped within the building – they were almost literally between the devil and the deep blue sea.

> Outside, on the other hand, there was a danger from falling pumice-stones, even though these were light and porous; however, after comparing the risks they chose the latter . . . As a protection against falling objects they put pillows on their heads tied down with cloths.

This is a 2000-year-old example of resourcefulness when a disaster occurs: it is also a very vivid picture of the relief efforts that were made, although the account is tantalisingly brief and we are left in doubt as to the success of the relief mission.

Earthquakes in history

The study of past earthquakes has taken on a vital impetus in the light of modern skills in

evaluating earthquake risk to assist in the prediction of future disasters.

In China, scientists have studied documents spanning a 3000-year [illegible] and this knowledge has assisted the suc[illegible] predictions of earthquakes. These are far from foolproof, however, as is evidenced by the earthquake of Tangshan in July 1976 where up to 700,000 have been reported killed.

The studies of Professor Nicholas Ambraseys have been mostly related to historical earthquakes in the eastern Mediterranean basin *(4, 6, 7)*. He has plotted earthquakes, in the dimensions both of time and of geographical distribution. Some very significant discoveries relevant to housing provision and early earthquakes have emerged from this work.

One of his historical studies is of the Taxila earthquake which occurred in Northern Pakistan (near Islamabad) in AD 25. The significant archaeological discovery here was of houses rebuilt after this earthquake in a stronger form, with special precautions to make their foundations secure. In some instances the new foundation depth was as much as five metres deep. Ambraseys and his research team have also found this change in foundation depth in Syria and Southern Anatolia. Further, he found that the new buildings were built only one or two storeys high, where there had previously been three-storey structures.

This team also found examples of the switch from stone walls to timber bracing in parts of Anatolia, Crete and Northern Pakistan. Thus, an overall pattern emerged of radical change in building techniques following certain disasters.

Lincoln earthquake 1185

Holinshed, the Tudor chronicler, wrote:

> In 1185, on the Monday in the week before Easter, chanced a sore earthquake through all the parts of the land, such . . . as . . . had not been heard of in England since the beginning of the world . . . Stone houses were overthrown and the great church of Lincoln rent from the top downwards *(26)*.

This is the sum total of knowledge of the earthquake. It took about two hundred years to rebuild the cathedral, which was infinitely more sumptuous than its predecessor.

Great Plague of London 1665

Only one aspect of this disaster concerns us here. This is the massive evacuation that took place, on such a scale as to result in a capital city that was virtually deserted *(28)*.

Daniel Defoe was only five years old at the time, but he later used his memory and interviews to set down a contemporary account of the disaster. He records the dilemma of a London shopkeeper.

> I now began to consider seriously with myself concerning my own case, and how I should dispose of myself; that is to say, whether I should resolve to stay in London or shut up my house and flee, as many of my neighbours did. . . I had two important things before me; the one was the carrying on my business and shop . . . in which was embarked all my effects in the world; and the other was the preservation of my life in so dismal a calamity as I saw apparently was coming upon the whole city *(43)*.

Great Fire of London 1666

We can be grateful that Samuel Pepys and John Evelyn kept diaries when the Great Fire of London took place. Inevitably, they were preoccupied with the dramatic events of the first week in September 1666. However, the diaries give fascinating glimpses of the plight of the homeless families. John Evelyn wrote:

> Here we saw the Thames cover'd with goods floating, all the barges and boates laden with what some had time and courage to save, as, on the other, the carts, &c. carrying out to the fields, which for many miles were strew'd with moveables of all sorts, and tents erecting to shelter both people and what goods they could get away *(45)*.

> Many thousands now have nowhere to lay their heads and the fields are the only receptacle which they can find for themselves and their goods; most of the late inhabitants of London lie all night in the open air, with no other canopy over them, but that of the Heavens *(46)*.

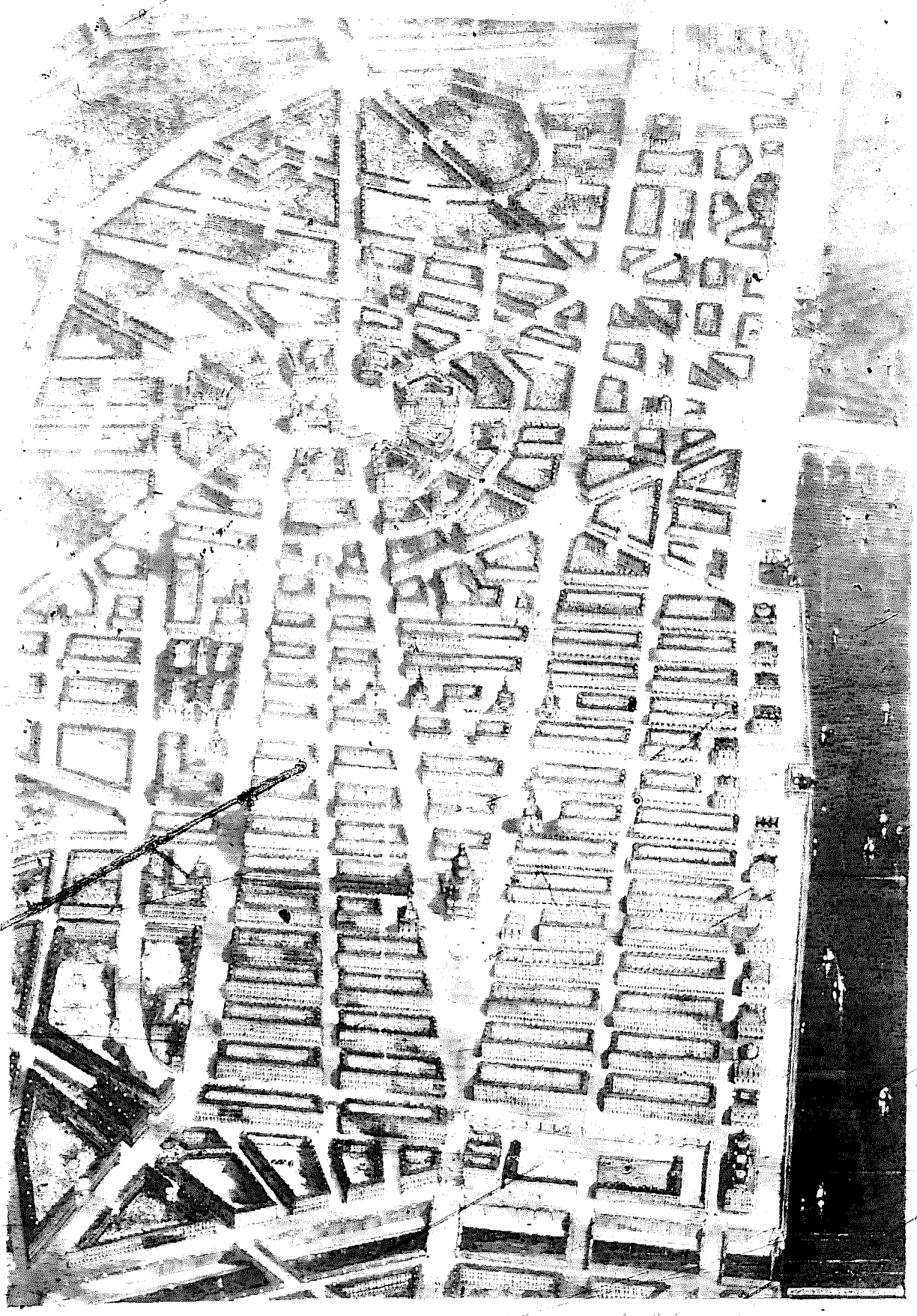
Evelyn believed that there were over 200,000 refugees dispersed upon the fields of Highgate and Islington, with the majority in Moorfields: 'People of all ranks and degrees dispers'd, and lying along by heapes of what they could save . . .' *(46)*.

Amazingly only four people were killed, while those made homeless numbered about 100,000 (one in six of London's population at that time). Careful surveys were carried out of the damage, and it was found that 13,200 houses were destroyed in an area of 436 acres. The estimated cost of rebuilding these homes was calculated at £3.9 million. This sum is contained within the total £20.7 million estimated as the cost of rebuilding the destroyed areas, but this estimate included £2 million for rebuilding St. Paul's Cathedral *(52, 73, 79)*.

Our knowledge of what happened to the ruined buildings is much greater than our

"HIGHGATE FIELDS DURING THE GREAT FIRE OF LONDON, IN 1666."—PAINTED BY E. M. WARD, A.R.A.—(EXHIBITION OF THE ROYAL ACADEMY.)—(SEE PRECEDING PAGE.)

76 A Victorian view of the plight of the homeless, after the Great Fire of London, camping out in Highgate



The Great Fire of 1666 engraving of Wren's plan for the reconstruction of the City of London

understanding of what happened to the refugees. We do have a few facts. King Charles rode out to Moorfields to address the homeless. He promised them £500 worth of bread and he also provided tents for them, and the City of London gave permission for temporary building in the open spaces north of the City walls. Three days after the fire broke out a royal proclamation ordered all the authorities in neighbouring parishes to provide lodgings for the destitute. The proclamation required that all towns and cities should 'without any contradiction receive the said distressed persons and permit them the free exercise of their mutual trades'. We know that traders set up work in Ipswich and Oxford as a result of this proclamation *(79)*.

My study is concerned with immediate relief, and not primarily with reconstruction issues. But it is worth blurring the distinction to note in the wake of the Great Fire a whole series of post-disaster characteristics, patterns that reappear in subsequent catastrophes in major urban centres or capital cities *(28, 79)*.

1. A vulnerable condition was the basic cause of the disaster. London was a mass of very narrow streets of tall wooden houses, all highly vulnerable to fire, and the flames spread quickly.

2. The refugees living in improvised homes (tents, shacks, etc.) were gradually absorbed by those whose homes had survived. This was encouraged by royal proclamations.

3. Bold, near-Utopian plans were produced. (Wren's first plan was completed within fourteen days, but Evelyn had beaten him by three days with his proposals!) These plans were for wide streets and long vistas, in sharp contrast to the higgledy-piggledy nature of the old City. But as so often in subsequent centuries, expedience, money and private interests triumphed over the bold dreams of innovators.

4. I have already mentioned (see Diagram 2) that bye-laws were introduced after the Fire to prevent the next disaster – while the charred City was still smoking. Since there has not been a similar disaster in the subsequent 300 years, we can congratulate the City fathers on their foresight!

The reconstruction after the Fire is a further example of radical change being triggered off by a catastrophe. It is a reminder that when officials have to contend with public uproar on top of financial loss, conditions are ripe for either reform or repression. Mercifully for London the former resulted.

Lisbon earthquake 1755

At 10 a.m. on 1 November 1755 Lisbon (perhaps the most prosperous European capital of the eighteenth century) was ravaged by a massive earthquake. This created total havoc, widespread loss of life and extensive fires within the city. Just twenty minutes later, seismic sea waves or *tsunamis* engulfed the ruined city, causing further damage and casualties. Perhaps as many as 60,000 people died in the cataclysm, and it became the source of widespread philosophical debate throughout Europe *(56)*.

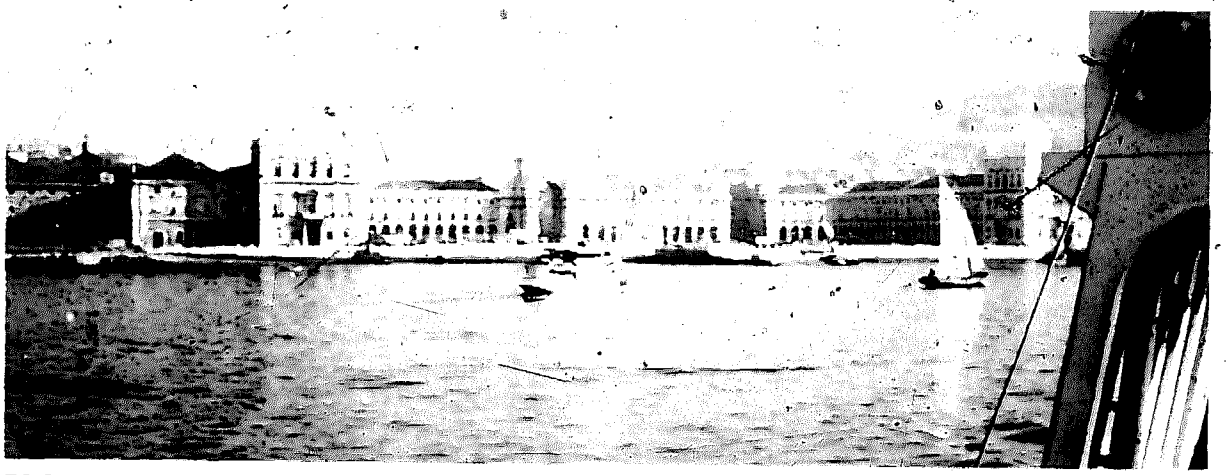
This event, coupled with the earthquake that had devastated Lima, Peru in 1746, had a profound effect on Voltaire, and three years after the Lisbon tragedy he wrote his very witty comedy *Candide*, a novel dealing with the problems of evil and human suffering posed by such events as earthquakes *(94)*.

The earthquake appears to have been a 'classquake' rather like the Guatemala disaster in that the casualties were almost without exception from the poorer sections of Lisbon society, with just two deaths from the nobility.

The relief operation was handled largely by local priests and nuns, and it was carefully documented by contemporary historians. Antonio Pereira de Figueiredo described the form of improvised shelter:

> The general desire was to get out of buildings into tents or huts, and to sleep in the garden rather than indoors, even if one's home still stood safe and sound, and for this reason the great camps on the high and open places round the city

78 Eighteenth-century engraving of the destruction of Lisbon



79 Lisbon rebuilt after 1755 earthquake

were for a long time crowded communities, in spite of the initial discomfort and squalor of the miserable bivouacs of matting, planks, and sail-cloth under which many of the squatters spent their first nights *(74)*.

T.D. Kendrick, from whose book the above account is taken, comments on the relief operation:

> A particularly difficult problem was the control of refugees from the city. They were finding their way all over the country, and among them were thieves, escaped prisoners and rascals of all kinds, in addition to a large number of able-bodied craftsmen and labourers who were needed in Lisbon. A system of passes had to be introduced, and the provincial governors instructed to send back to the capital all those who had escaped to a distance without very good reason *(57)*.

So we can see the authorities trying to reverse the mass migration from the capital into the surrounding rural areas. Then there was the problem of temporary shelters which Kendrick comments on:

> Another urgent business was the provision of temporary shelter for the homeless and the collection of material for making huts. Profiteering in wood, of which there was a shortage, was stopped, and

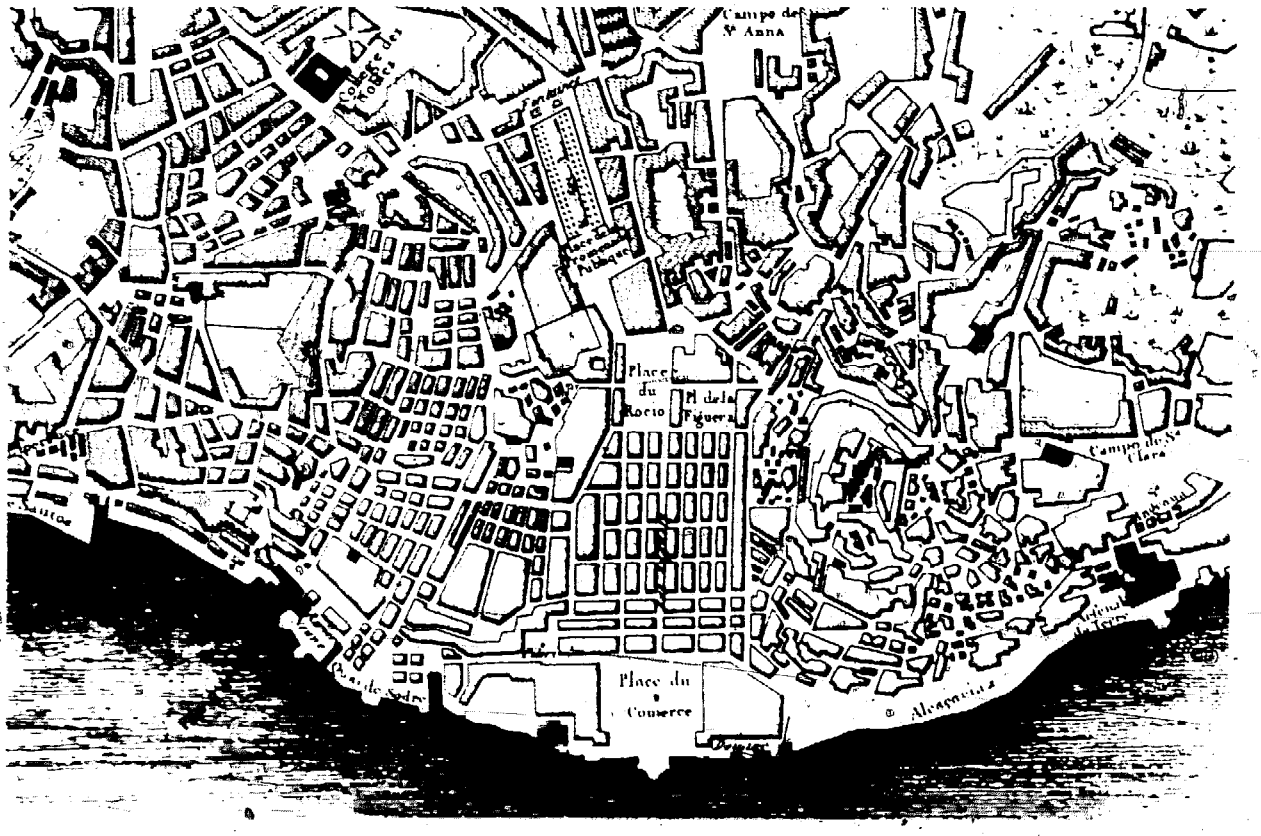


Diagram 15. Map of Lisbon indicating reconstruction following the earthquake

> all available supplies were commandeered for Lisbon. Rents of land used for the erection of emergency hutments were controlled. People were encouraged to return, where possible, to their homes, and landlords were not allowed to evict their tenants from surviving dwelling-houses, and those who kept lodgings were not allowed to put up their prices *(57)*.

One major problem in the relief phase was to find accommodation for whole communities of nuns, whose convents had been destroyed in the disaster.

Thus the situation in Lisbon finds echoes in recent disasters. The efforts the authorities made to control people (probably in vain?) are very reminiscent of Skopje or Managua. The voluntary movement of the population to regions far away from the city is not the normal behaviour pattern, and it may have been the result of terror – a response to the aftershocks which followed the earthquake. Within the week after the disaster there were a further thirty tremors and shakes. By August 1756, ten months after the event, five hundred aftershocks had been recorded.

Another similarity with present conditions is the reference to spiralling costs of materials in demand, in this instance wood. At the time of writing the demand for corrugated iron sheet in Guatemala has created a similar spiral on the price structure. It has been estimated that 9,000 temporary wooden buildings were erected in Lisbon within six months of the Lisbon earthquake.

Although the Utopian dreams of Evelyn and Wren were never realised in the rebuilding of London, the most grandiose schemes were implemented in Lisbon, through the dictatorship of King Joseph I and his minister the Marques de Pombal. Pombal pushed through his plans with a ruthless efficiency and by 1785, thirty years after the disaster, the entire city centre had been rebuilt on the lines of the boulevards and squares of the French 'place royale'.

Irish potato famine 1845–9

Although it did not destroy buildings, this disaster illustrates certain attitudes over the giving or receiving of aid. Cecil Woodham-Smith has written a moving account of the tragedy:

> Much of this obtuseness sprang from the fanatical faith of mid-nineteenth century British politicians in the economic doctrine of *laissez-faire*, no interference by government, no meddling with the operation of natural causes. Adherence to *laissez-faire* was carried to such a length that in the midst of one of the major famines of history, the government was perpetually nervous of being too good to Ireland and of corrupting the Irish people by kindness, and so stifling the virtues of self reliance and industry *(101)*.

John Kenneth Galbraith commented on this attitude in his recent TV series:

> Few things in life can be so appalling as the difference between a dry, antiseptic statement of a principle by a well-spoken man in a quiet office, and what happens to people when that principle is put into practice . . . The response of the British Government to the potato blight was according to Ricardo and Malthus. The dry, antiseptic principle was enunciated by Charles Edward Trevelyan, the permanent head of the Treasury: 'Trade', Trevelyan advised, 'would be paralysed' – that was his word – if the government gave away food to the Irish and so interfered with the profits of business enterprise *(48)*.

It is probable that one and a half million Irish people died, many as a result of this economic theory. Their deaths are a further reminder of the two-pronged nature of relief, with donor interests likely to win in any conflict over priorities. In talking to officials in government offices or embassies in Central America, I have heard similar views to these of the politicians of the mid-nineteenth century. One seasoned official told me: 'Nature has its own way of dealing with over-population, and it's probably wise not to interfere in the process.'

San Francisco earthquake 1906

This disaster was the first major urban earthquake of this century. Diagram 4 indicates the scale of damage. Set against the $525 million estimated damage, the relief grants were pitifully inadequate. The US government gave $2.5 million and foreign governments contributed a total of $474,211 (which included a gift from Britain of $6,570). In terms of shelter provision, there was widespread contemporary documentation, which included (perhaps for the first time) photographic coverage.

The earthquake destroyed 250,000 homes and resulted in 300,000 people sleeping outdoors during the first days after the disaster. This total, as in all earthquake situations, included both the homeless and those who were too frightened to return to their homes lest there should be a further earthquake. By June the total had dwindled to less than 50,000 and by July to 25,000. In the autumn, (five months after the earthquake) the permanent population of all emergency camps was down to 17,000.

There are many excellent studies of the San Francisco earthquake; in one of these studies, William Bronson has written:

> The makeshift shelters of blankets and rags which helped shield two hundred thousand from the rain after the fire didn't last for long. Tents issued by the military replaced them, and the beginnings of the permanent camps which were to dot the City's parks and reservations for more than a year were

established. The problem of housing a city in which three fifths of the dwellings had burned was met in many ways. And in the final analysis, most of the people solved it for themselves *(14)*.

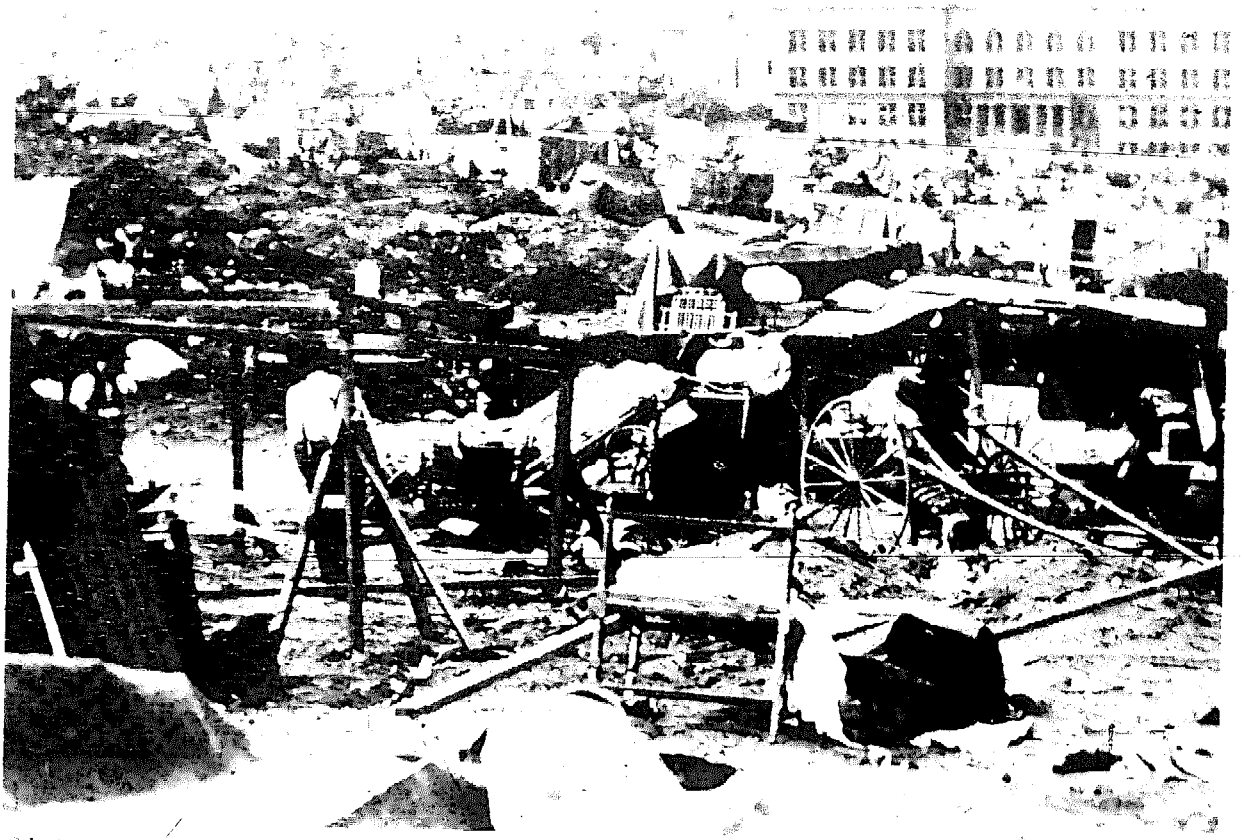
Following the disaster, the full range of shelter options was available. Thousands of women and children were bundled off to spend the summer with friends and relatives, while others moved in with the fortunate citizens whose homes had been spared. The combined relief committee established a sub-committee purely concerned with the refugee camps. Their task was to replace the canvas shelters with wooden huts or 'cottages' as they liked to call them.

In a dozen locations the committee built 6,000 of these two-room huts. These units cost $2 per month rent, which was collected by the camp directors, army officers who operated as 'benevolent despots', ruling their camps with a strong hand. Mayor Schmitz queried whether the conditions of the camps, particularly one in a Golden Gate parkland setting, were rather too salubrious. 'I'm only afraid these people will never want to leave their new homes here.' This attitude is reminiscent of the authorities' views in Ireland, and not without its counterpart today whenever we hear the outrage of press or politicians at the featherbedding effects of social welfare provision.

After the cottages had been occupied for just under a year the exodus began. The unique event here was that the exodus was of cottages as well as people. The enterprising occupants succeeded in jacking the huts off their foundations and in fitting wheels to them, and then with suitable horse or mule power the huts were moved to private lots. To this day some of these wooden cottages still remain as garden sheds, but now they are almost unrecognisable.

The committee spent a further $600,000 on building a further 1,400 houses for people who had sufficient cash to match the money spent by the committee. As an incentive the owners got a financial discount if they sited these homes in the burned area of the city, a very unpopular area for reconstruction *(15)*.

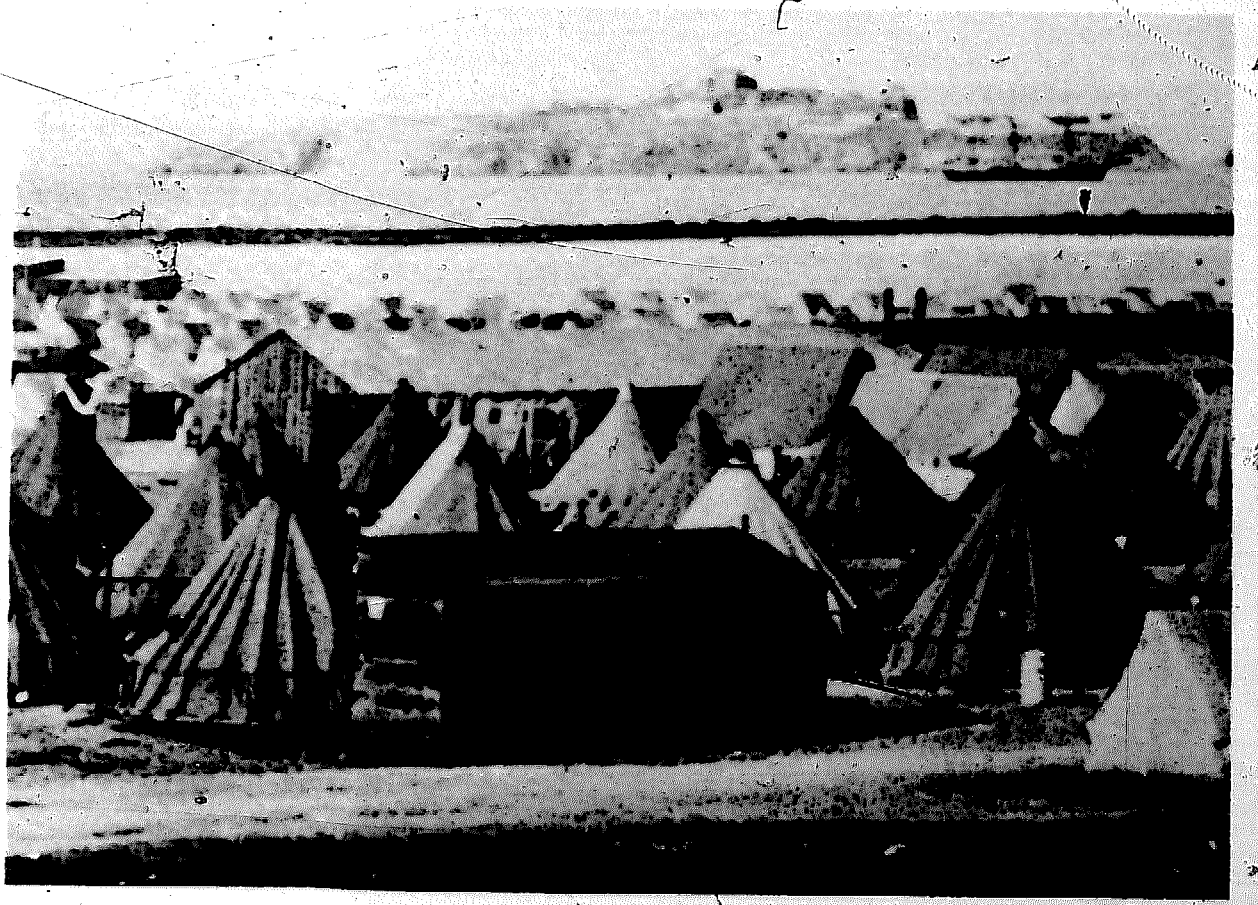
80 The spread of the fire which followed the San Francisco earthquake



81 An improvised home in San Francisco

82 A further example of improvisation

83 Improvised home and refugees' belongings in Golden Gate Park, San Francisco



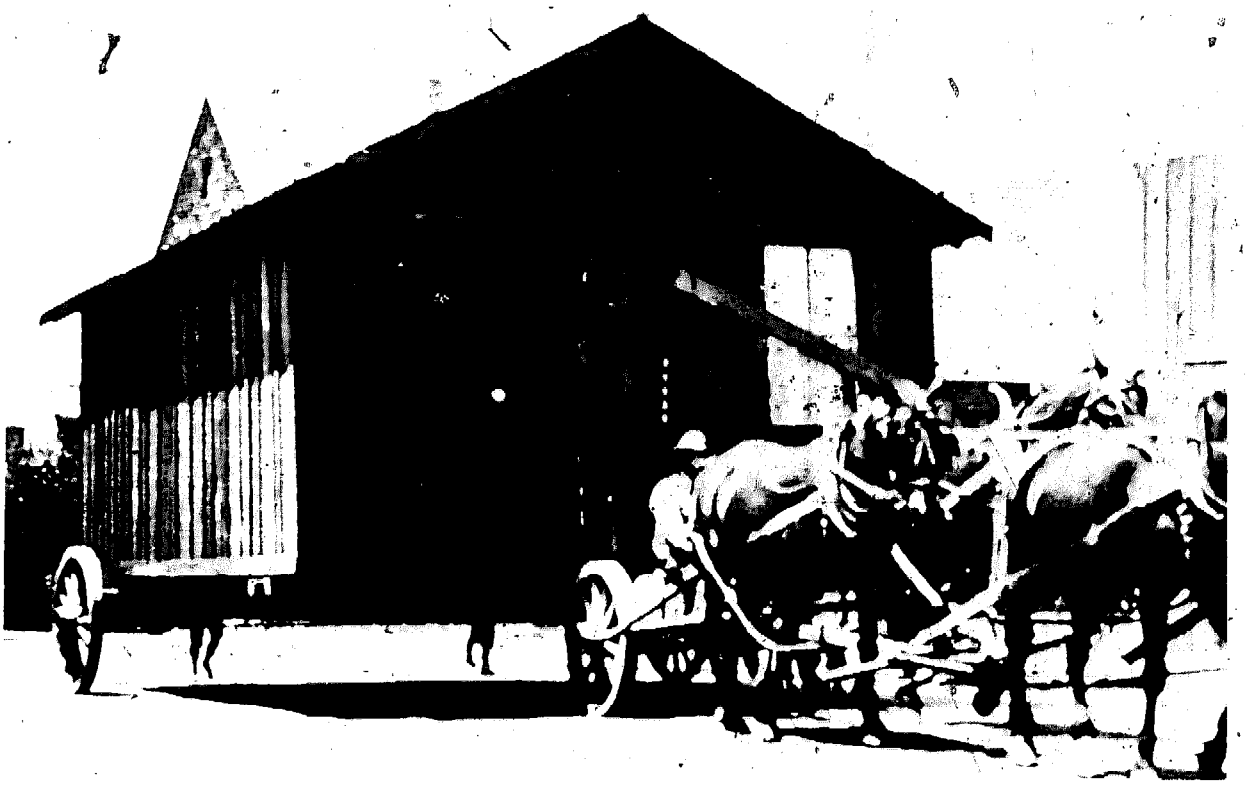
84 Harbor View emergency camp with Alcatraz in the background. This site was used for several months and housed the toughest and most unmanageable group of refugees

85 Emergency camp in San Francisco

86 The Park Presidio Drive site

87 Lobos Square Camp (now called Funston Playground)

88 5,600 huts were built on this emergency site in Park Presidio Drive



89 A temporary house being moved to a permanent site in the summer of 1908 (after about nineteen months on its original site). Note the legs of the small boys pushing the house from the rear

Reggio-Messina earthquake 1908

Unfortunately, we don't have such detailed knowledge of other disasters in the early part of the century as we possess for San Francisco. Two years after this major disaster, the Sicilian city of Messina and the city of Reggio on the Italian mainland were destroyed. There were massive casualties which may have included 50,000 deaths. We can deduce something of the post-disaster situation (in the era before rapid relief became a characteristic pattern) from the eye-witness account of a Swedish doctor, Axel Munthe, who described the situation in his best-selling autobiography – *The story of San Michele*. He writes:

> [what] I did in Messina was very little compared with what I saw hundreds of unnamed and unrecorded people do at the peril of their lives. I myself was in no peril except that of dying from hunger and from my own stupidity. It is true that I brought a number of half-suffocated people back to life by means of artificial respiration . . . I know that I dragged single-handed an old woman from what had been her kitchen but I also know that I abandoned her in the street screaming for help, with her two legs broken. There was indeed nothing else for me to do until the arrival of the first hospital ship, no dressing material and no medicine whatsoever was obtainable *(64)*.

Following this earthquake the local authorities rebuilt the city of Messina, with every kind of earthquake-proof form of construction. So successful was this approach that although 4,000 tons of Allied bombs were dropped on the city during 1942, very few of the buildings collapsed. The technique was firstly to provide a massive ground slab of reinforced concrete, in place of individual foundations for buildings. Secondly, each building was

90 Modern Messina, reconstructed after the earthquake of 1908

framed in reinforced concrete (with maximum spans of 5 metres). Thirdly, heights were limited initially to two storeys, but this was relaxed in the 1930s to allow for structures up to four storeys. Finally, the spacing of houses and the new street widths were calculated to provide fire breaks *(13)*.

Messina was probably the first complete town to be rebuilt with comprehensive earthquake-resistant construction. And the use of reinforced concrete construction in 1908 is a remarkably early use of this material.

Tokyo earthquake and fire 1923

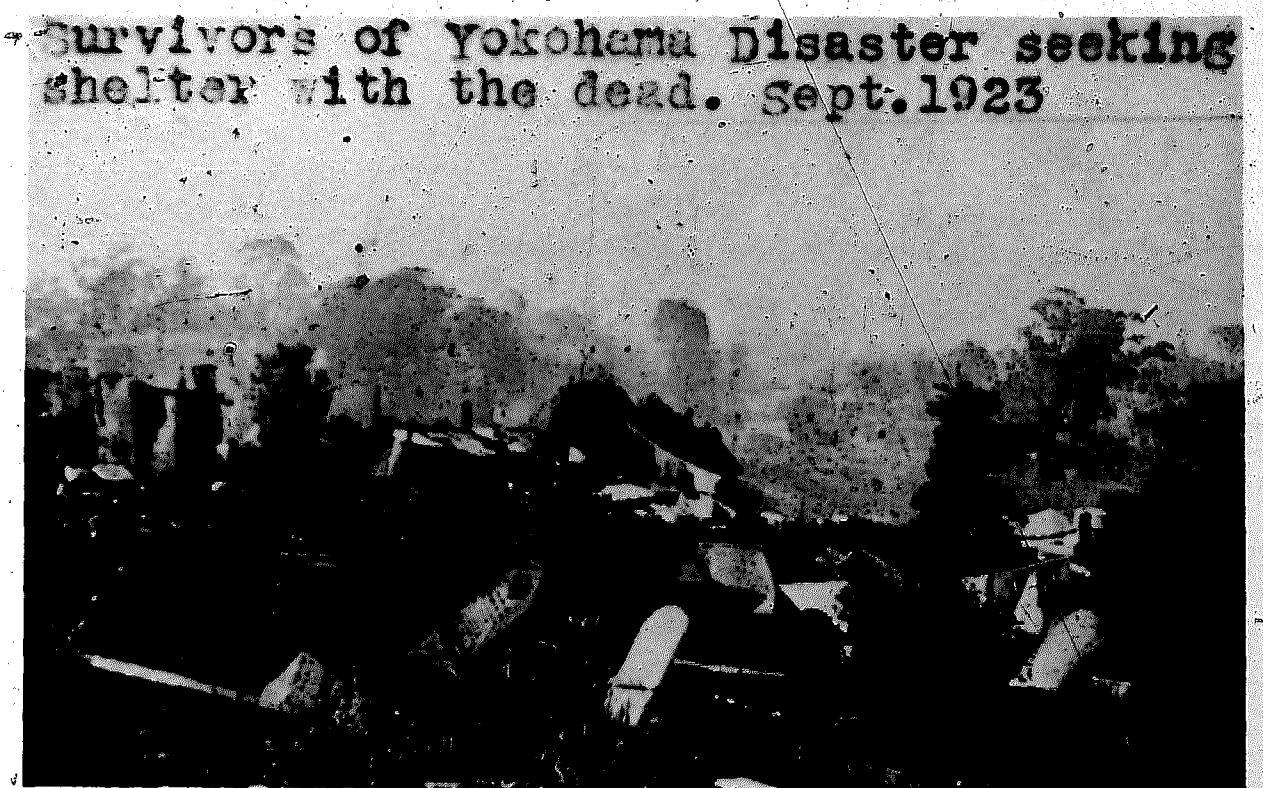
The earthquake covered an area of 1,800 square miles. The casualties were enormous: 140,000 killed, 100,000 injured and massive property damage. In all 380,000 buildings collapsed and a further 700,000 were burnt in the fire that followed the earthquake. The *tsunami*, or seismic wave, was over 36' high, and it swept across the Sagami Bay to destroy 155 houses and kill a further 60 people.

As a result of the damage a total of 6,000,000 people were made homeless in Tokyo and Yokohama. Many built temporary shacks of wood in the scorched, still-smoking ruins of their old homes. 12,000 refugees were taken by lifeboats and fishing smacks and were placed aboard the *Empress of Australia*, which was moored in Yokohama harbour. The bewildered city authorities of Tokyo sent cables to the Lord Mayor of London requesting any advice they could offer, as a result of London's reconstruction after the Great Fire 257 years earlier.

I have yet to discover any reliable accounts of temporary housing provision in Tokyo. The photographs indicate the familiar pattern of wooden huts and improvised shacks.

One feature of the Tokyo earthquake that gets into all the architectural history books is the story of the survival of Frank Lloyd Wright's Imperial Hotel, because of its earthquake-proof construction, of which Wright was particularly proud.

I have compared the Tokyo situation with that of San Francisco in Diagrams 4 and 5.



91 Improvised shacks for homeless families within the cemetery of Yokohama

92 Improvised homes in Tokyo, 1923

93 Wooden shacks built within scarred ruins following the fire and earthquake

World War II 1939–45

In the two great man-made disasters of this century, the two world wars, we can find examples of shelter provision which dwarf all post-disaster housing provision in their vast scale. Even the great Finnish architect, Aalto, produced detailed designs for emergency wartime shelters *(81)*. But the wars also yielded very useful information on social behaviour in stress situations *(27)*. I have already referred to wartime studies of evacuation in writing about Skopje and Darwin in Part III, strategy 3.

In one of the major studies of emergency housing provision during the Second World War, Fred Ikle has made a careful analysis of Hamburg. Within a few days in 1943 half of the city's houses were destroyed. Ikle writes:

> At first, after the raids, the administration and the public expected that a programme for the construction of emergency homes would provide shelter for the homeless. People were even urged to assist the building workers by labouring on their prospective homes on Sundays . . . However five months later, no more than 4,625 emergency homes had been erected, accommodating less than 2% of Hamburg's homeless *(53)*.

Ikle proceeds to quote data from a housing census the German authorities carried out in October 1943. This is to describe the types of accommodation used by the citizens of Hamburg two and a half months after the heavy air raids.

Ordinary dwellings	90.2%
Institutions and hotels	2.0%
Rooms converted into dormitories	0.6%
Camps and barracks	2.9%
Cottages or shacks in allotment gardens	3.8%
Bunkers, offices, stables etc.	0.5%

7.8%

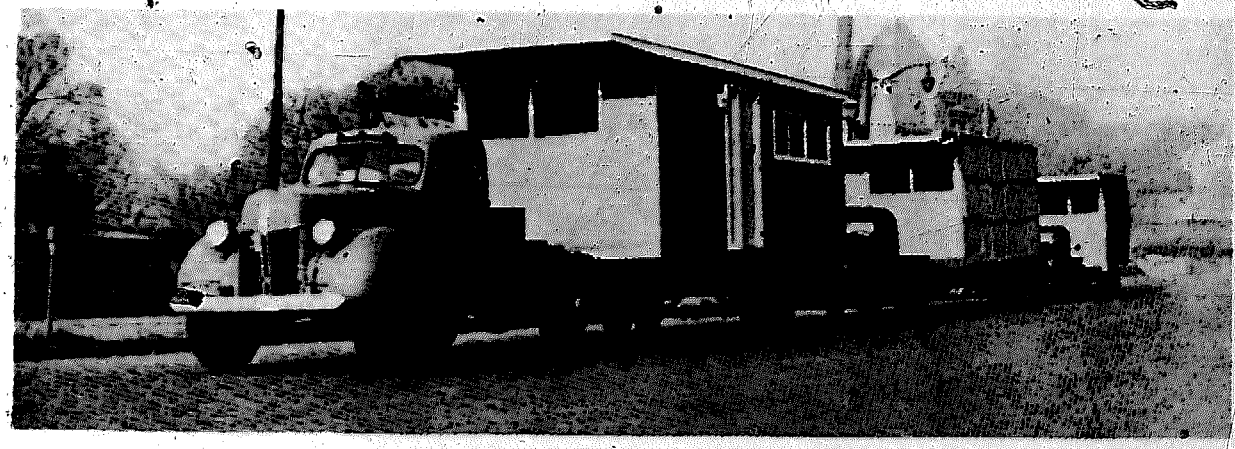
Ikle then relates the 7.8% in emergency accommodation, to figures for other cities.

Berlin in 1946	3.6%
Hiroshima in 1948	4.2%
Kobe in 1948	4.7%
Yokohoma in 1948	5.9%

These very small percentages are on a par with findings from 'natural disasters' (see myth no. C1).

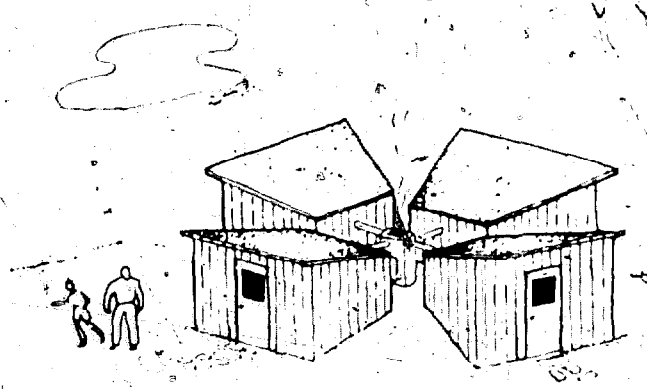
There is not sufficient space to comment on the prefabrication of 'temporary' homes;

94 Emergency housing after the World War II raids on Berlin

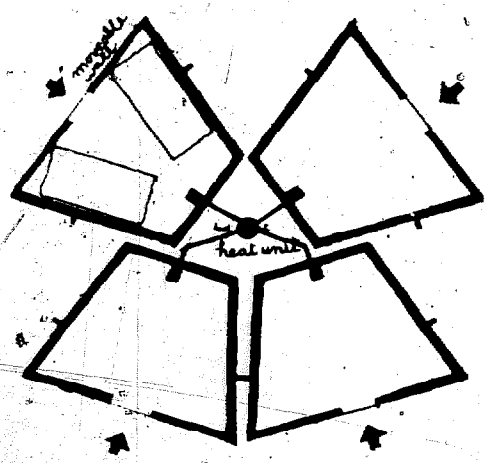


95 Temporary homes en route to their destination

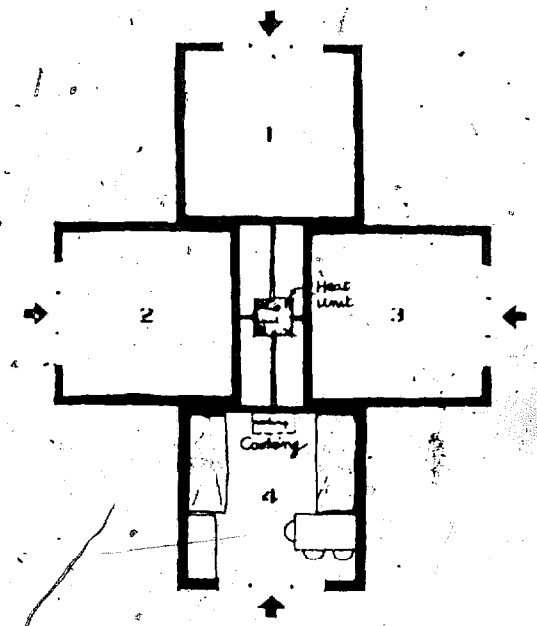
(1) PRIMITIVE SHELTER : TRANSPORTABLE



These shelters are designed solely to give temporary emergency shelter. They are so constructed that they may be nested in a group of four and trucked to the site. They are assembled again, functioning as four separate shelters, grouped around a central heating unit. These shelters are moved from place to place, being of a tent-like character but more stable and warm.



(2) PRIMITIVE SHELTER : MOVABLE



This is asomewhat heavier type than the previous shelter, and once placed upon the site it is intended it shall stay there. However, in the beginning they as well will, shelter four families. After a more permanent stage is reached, these shelters will be regrouped to form a normal home for one family, as shown in the designs.

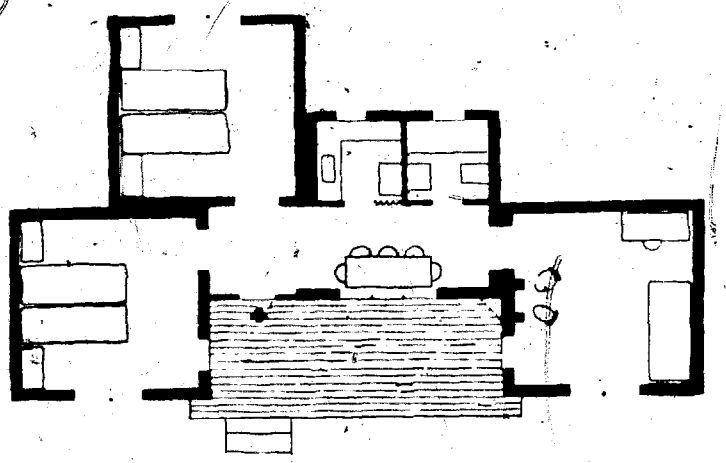
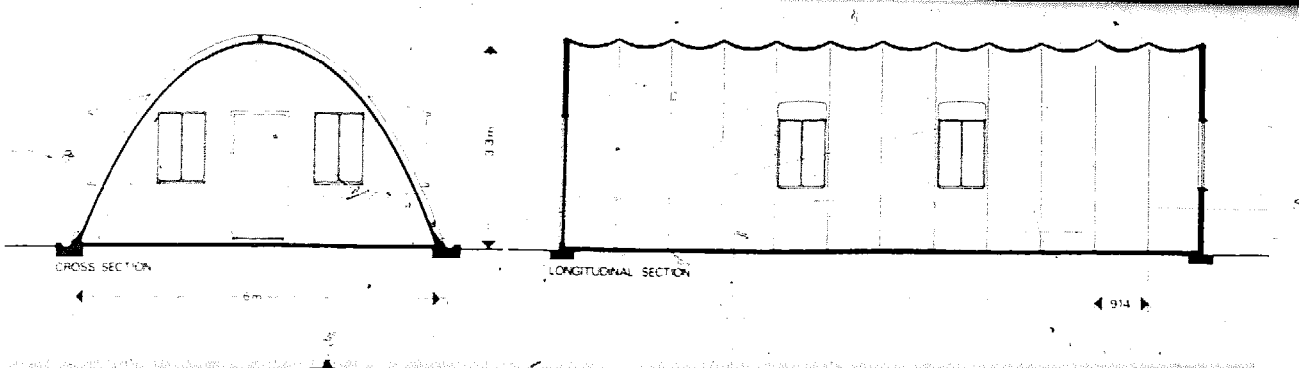
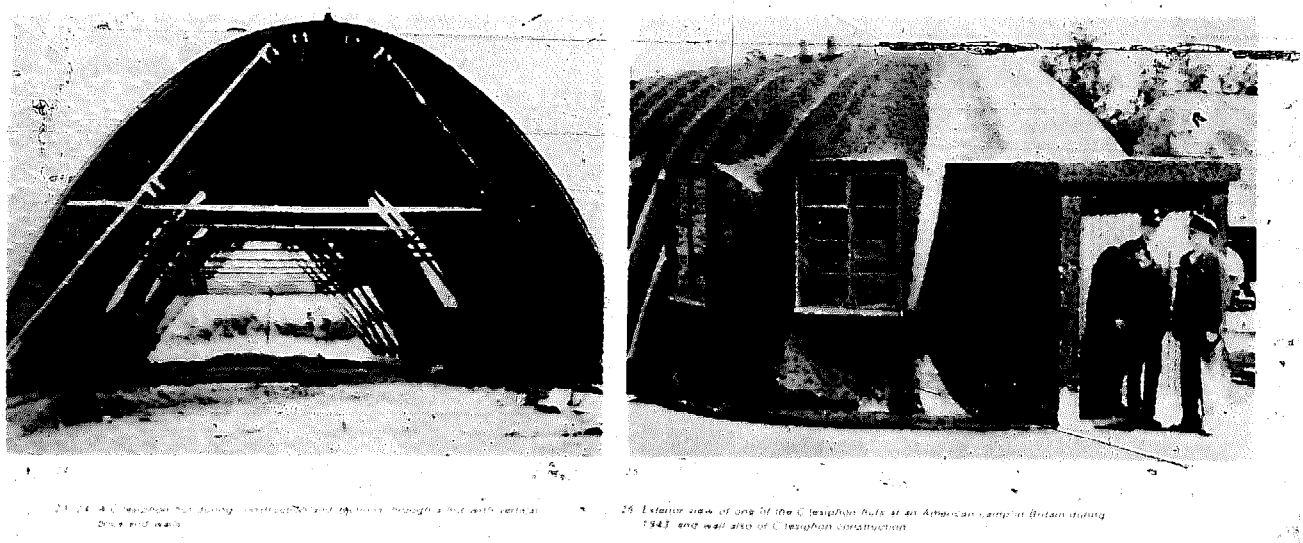


Diagram 16. Design for World War II emergency shelter by Alvar Aalto





96 The C'tesiphon huts that were built in vast quantities throughout the south of England prior to D Day

this has been covered extensively elsewhere *(61)*. Two conclusions must follow from any study of the bewildering array of 'prefab' homes.

First, as I have noted already, they are still with us – and some date from the First World War. This is an important comment on the words 'temporary homes', which belong to the language of politicians, slick salesmen and, sadly, some relief officials.

Secondly, the prefabs were built in an astonishingly short space of time, such was the pressure to re-house 'blitzed' families. Speed of erection had also been a characteristic of military construction programmes during the war. Immediately prior to D Day the South of England became a vast camp where 3.5 million troops had to be housed. Sixty per cent of them were billeted with families but this left 1.4 million to be housed in hutments *(62)*.

CONCLUSION

This has been a fascinating and yet highly tantalising search. So often the contemporary narrator stops short of any comment on shelter needs. But even with these slender items of evidence, taken from a small set of historical disasters, significant behaviour patterns emerge. And when the uniformity of behaviour, observed in various historical disasters, is considered together with the uniformity of behaviour seen over a wide contemporary *geographical* distribution of disasters, we can confidently make certain assertions.

Firstly, human improvisation and inventive resourcefulness are general characteristics, which are totally predictable. Diverse examples are the pillow protectors after Vesuvius or the wheels that were fixed under the San Francisco disaster 'cottages'.

Secondly, tents have a very extensive pedigree. From the Great Fire of London to Lisbon.

Thirdly, disasters can become the catalysts for disaster prevention measures.

The deep foundations of Taxila; the London Building Acts; and the reinforced concrete frame structures and fire breaks of Messina.

Fourthly, fine architecture can follow in the wake of tragedies. Lincoln and St. Paul's Cathedrals, the Wren churches of the City of London, the new Lisbon of Pombal, and the wide streets of Messina all illustrate the legacy of disasters.

Fifthly, when offered the choice, people put temporary housing very low on the preference list. San Francisco and Hamburg.

George Atkinson has also looked back on past disasters, and analysed the patterns of behaviour that tend to follow them. There is:

> . . . a wave of enthusiasm for planning, sometimes accompanied by the lobbying of planners; an attempt to determine the cost and to seek aid far and wide; a period of great realism as resources are balanced against plans; a waning of enthusiasm as the problems which reconstruction poses become more complex and less easy to solve; a sifting out of carpet-baggers as prospects of easy pickings recede; if fortune is kind the setting up of a reasonably effective reconstruction organisation . . . or if fortune is less kind, the wasting of resources on over-ambitious and ill-advised projects which enrich almost as many pockets as they rehouse homeless families *(8).*

97 Squatter homes in Dacca, Bangladesh

EPILOGUE

By glancing over the events of history, and by looking closely at contemporary disasters, I have attempted to find patterns.

There will be exceptions to any expected forms of behaviour, such as the looting and atrocities that appear to have followed the Tokyo earthquake of 1923. It is wise, therefore, at this stage of knowledge, to avoid dogmatism and I realise that at times I may have drawn premature conclusions from limited factual evidence.

I hope I have conveyed some of the complexities of the subject. Future studies cannot be carried out in isolation: they will succeed only if the investigators recognise that the architect needs the seismologist, the relief official, the economist and the anthropologist (to name a few of the interdependent professions).

One of the complexities is the variety of attitudes that can be detected or exposed in any analysis of relief provision. Initial, basic assumptions may well be very naive or totally false, and this above all else curbs any optimism that matters are improving. Sadly, the three assumptions that we cannot take for granted are: that societies show any concern to learn from the past; that all officials in international and government offices have a genuine concern for the welfare of the victims; and that aid is always given altruistically.

It is wise to recognise the seedier sides of the problem. I have found, in making detailed investigations of certain products, that their existence as disaster relief is not a response to the needs of the particular disaster. Rather it is the result of an individual's whim, or sales pressures, or aid quotas from a donor agency. When one questions the logic with local or even international officials the indignant shrug is a good indication of the level of concern for the recipients of misplaced aid. Mercifully this is in contrast to the genuine concern of others who are constantly striving to understand the real needs and provide sensible answers.

In conclusion, I must restate the aim of emergency shelter, since this may have been lost in the issues I have covered. It is to provide protection for a vulnerable family. It may take the form of a product, or it may be a process. It could start as a sheet of corrugated iron which would ultimately become the roof of a house.

In providing this protection, any donor must be aware of the long-term consequences of his actions. The future form of the new settlement and even the long-term economic development of a community is being determined in the early decisions that are made while flood waters are receding, or dust still hangs in the air.

98 House improvised after the Chimbote earthquake of 1970

REFERENCES LISTED ALPHABETICALLY

The numbered list of references given below covers the various texts referred to within this book. Many of these texts have been produced for private circulation and may be difficult to trace. Readers are advised to check the following basic sources for references on this and related topics.

MANNING, Diana M. *Disaster technology: an annotated bibliography.* London Technical Group. Pergamon, Oxford, 1976.

OFFICE OF THE UNITED NATIONS DISASTER RELIEF CO-ORDINATOR (UNDRO). *Bibliography: the provision of shelter following disasters.* Commonwealth Association of Architects, London, 1977; and UNDRO, Geneva, 1977. This bibliography is a part of the project referred to on p. xv.

UNITED NATIONS ASSOCIATION. *A review of new developments in the field of international disaster relief.* United Nations, New York, 1976.

US DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD) and FEDERAL DISASTER ASSISTANCE ADMINISTRATION (FDAA). *Directory of disaster related technology.* US Department of Housing and Urban Development, 1976.

Numbered alphabetical list of references

1. AGENCY FOR INTERNATIONAL DEVELOPMENT (AID). *Methodos de construccion con adobe.* AID, US Embassy, Mexico City, 1974.
2. AGENCY FOR INTERNATIONAL DEVELOPMENT (AID). *Un sistema de armadura para construcciones de bajo costa.* AID, US Embassy, Mexico City, 1974.
3. ALDOUS, Tony. 'If London floods'. *Architects journal,* 3 Nov. 1976, pp. 826-8.
4. AMBRASEYS, N.N. 'Value of historical records of earthquakes'. *Nature,* vol. 232, no. 5310 (Aug. 1971), pp. 375-9.
5. AMBRASEYS, N.N. 'Earthquake hazard and emergency planning'. *Build international,* Jan/Feb. 1972, p. 38.
6. AMBRASEYS, N.N. 'Earth sciences in archaeology and history'. *Antiquity,* vol. 1, no. 47 (1973), pp. 229-31.
7. AMBRASEYS, N.N. 'Earthquakes in history'. *UNESCO courier,* May 1976, pp. 24-9.
8. ATKINSON, G.A. 'Reconstruction after disaster: the planning problems posed'. *Proceedings of the Town and Country Planning Summer School,* University of Nottingham, 1962, pp. 108-15.
9. AYTUN, Alkut. 'General information on organization and activities for earthquake disaster response in Turkey'. Paper 31.1, *Secours en cas de désastres naturels tremblements de terre,* vol. 2, Committee on the challenges of modern society, NATO, 1971.
10. BALDASSARO, Larry. 'Waiting in the wreckage. Sicily's earthquake zone'. *The nation,* 13 Sept. 1975, pp. 198-201.
11. BAYER-CHEMIEWERKSTOFF. *Schnell herstellbar.* Schaumstoff-Rundhauser aus Hartmoltopren, 1972.
12. BAYER-CHEMIEWERKSTOFF. *Bayer igloos for Nicaragua.* Press release by Bayer, Feb. 1973.
13. BIRD, Eric. 'An earthquake resisting town. Lessons from rebuilt Messina'. *Builder,* 18 Mar. 1960, pp. 543-4.

14. BRONSON, William. *The San Francisco earthquake: the earth shook the sky burned.* Doubleday, New York, 1959, p. 118.
15. BRONSON, William. *The San Francisco earthquake*, pp. 122-7.
16. BUILDING RESEARCH ESTABLISHMENT. *Building in earthquake areas.* Overseas building notes no. 143. Building Research Establishment, Garston, Watford, 1972.
17. BUILDING RESEARCH ESTABLISHMENT. *Tropical building legislation: model regulations for small buildings.* Building Research Establishment, Garston, Watford, 1973.
18. BUILDING RESEARCH ESTABLISHMENT. *Repair and renovation of flood damaged buildings.* Digest no. 152. Building Research Establishment, Garston, Watford, 1973.
19. CARMACK, Robert M. *Anthropological analysis of the earthquake in western Guatemala.* Report for AID, US Embassy, Guatemala city, 1976.
20. CARNEGIE-MELLON UNIVERSITY. *Feasibility test of an approach and prototype for ultra-low-cost housing.* Report by Advanced Building Studies Department, Carnegie-Mellon University, Pittsburg. Submitted to AID, Washington, 1975.
21. CATHOLIC INSTITUTE FOR INTERNATIONAL RELATIONS (CIIR) and OXFAM TEAM. *Report to the British relief agencies on Coyotepe refugee camp Masaya Nicaragua.* Report by the team that assisted in the administration of the camp. CIIR, July, 1973.
22. CATHOLIC INSTITUTE FOR INTERNATIONAL RELATIONS (CIIR). *Honduras: anatomy of a disaster.* CIIR, London, 1975.
23. CAVANAGH, Jon and JOHNSON, Fiona. 'Earthquakes and pre-fabs'. *Ecologist*, vol. 6, no. 3 (1976), pp. 104-6.
24. CAVANAGH, Jon. 'Shelter after natural disasters'. B.Arch. dissertation, School of Architecture, University of Newcastle-upon-Tyne, 1976.
25. CHERRITT, Ian. *The Guatemalan earthquake.* War on Want, London, April 1976, p. 10.
26. CLIFTON-TAYLOR, Alec. 'The medieval world' in *The spirit of the age.* Quotation from Holinshed. BBC, London, 1975, p. 38.
27. COLLIER, Richard. *The city that would not die. The bombing of London, 10-11 May 1941.* Dutton, New York, 1959.
28. COWIE, Leonard W. *Plague and Fire. London 1665-66.* Wayland, London, 1970, pp. 87-110.
29. CRIBBEN, John and WILSON, Peter. 'Two approaches to scientific aid for disaster areas'. *Nature*, vol. 250 (Aug. 1974), pp. 526-7.
30. CUNY, Fred. *Refugee camps and camp planning.* Base studies, Reports 1, 2 and 3, Intertect, Dallas, 1972.
31. CUNY, Fred. *Report on the Coyotepe refugee camp in Masaya, Nicaragua.* Intertect, Dallas, Feb. 1973.
32. CUNY, Fred. *Relief operations guidebook: housing section III.* Intertect, Dallas, 1975.
33. CUNY, Fred. *Como hacer una casa mas segura.* Republic of Guatemala Rural Education Ministry, May 1976.
34. CUNY, Fred, PEREZ, Julian and PARKER, Jinx. *A report on the refugee camp and housing programs in Choloma Honduras for the refugees of Hurricane Fifi.* Intertect, Dallas, 1975.
35. DALDY, A.F. *Small buildings in earthquake areas.* Building Research Establishment, Watford, 1975.
36. DAVIS, Ian. *Managua, December 23, 1972. The provision of shelter in the aftermath of natural disasters.* Report on housing strategy, Dec. 1972 - Sept. 1973. Research and Development Group, Department of Architecture, Oxford Polytechnic, Jan. 1974.
37. DAVIS, Ian. 'Disaster housing: a case study of Managua'. *Architectural design*, Jan. 1975, pp. 42-7.
38. DAVIS, Ian. 'Skopje rebuilt; reconstruction following the 1963 earthquake'. *Architectural design*, Nov. 1975, pp. 660-3.
39. DAVIS, Ian. *Emergency shelter.* Part of symposium on emergency housing and shelter convened by Disaster Unit and Disasters Emergency Committee, Jan. 1976, pp. 1-47. (Ref. 41 is a condensed version of this paper.)
40. DAVIS, Ian. *Guatemala shelter and housing policy in weeks 1-3.* Research and Development Group, Department of Architecture, Oxford Polytechnic, May 1976.
41. DAVIS, Ian. 'Emergency shelter'. *Disasters*, vol. 1, no. 1 (1977), pp. 23-40.

42. DAVIS, Ian. 'Housing and shelter provision following the Guatemala earthquakes of Feb. 4 and 6 1976'. *Disasters*, vol. 1, no. 2 (1977).
43. DEFOE, Daniel. *A journal of the plague year*. Everyman, London, 1948, pp. 8-9.
44. EPIDEMIOLOGY, INTERNATIONAL JOURNAL OF. 'Disaster epidemiology'. *International journal of epidemiology*, vol. 4, no. 1 (1975), pp. 5-7.
45. EVELYN, John. *Diary*, 3 September 1666. Dent, London, 1973.
46. EVELYN, John. *Diary*, 7 September 1666.
47. FUJIMORI KOGYO CO. LTD. *Hy.Py. Specification and description of disaster tents*. Fujimori Kogyo Co. Ltd, Tokyo, 1973.
48. GALBRAITH, J.K. 'Prophets of classical capitalism'. *Listener*, 13 Jan. 1977, p. 38.
49. GREEMAN, Adrian. 'Oxfam building polyurethane foam houses for refugees'. *New scientist*, 27 Nov. 1975, p. 530.
50. HAAS, Eugene. *The consequences of large-scale evacuation following disaster: the Darwin Australia cyclone of December 25 1976*. Working paper no. 27, University of Colorado, Boulder, 1976.
51. HAGEN, Toni. *Note on the work of the voluntary agencies in Bangladesh 1972*. ICVA, Geneva, Mar. 1973.
52. HEARSEY, John N. *London and the great fire*. Murray, London, 1965, p. 149.
53. IKLE, Fred Charles. *The social impact of bomb destruction*. University of Oklahoma Press, 1958, p. 67.
54. INTERNATIONAL UNION OF ARCHITECTS (IUA). *IX Student competition XII World Congress of the International Union of Architects*. IUA, Paris, 1975.
55. KATES, Robert and HASS, Eugene. *Study of San Francisco*. Project for research on urban reconstruction following natural disasters. Joint research project by Graduate School of Geography, Clark University, Worcester, Mass. and the Institute of Behavioural Science, University of Colorado, Boulder, Colorado, 1975.
56. KENDRICK, T.D. *The Lisbon earthquake*. Methuen, London, 1956, pp. 24-52.
57. KENDRICK, T.D. *The Lisbon earthquake*, p. 51.
58. KOENIGSBERGER, Otto. in a private communication with the author dated October 1976. This was part of his tutorial supervision of a Ph. D. project.
59. KRIMGOLD, Fred. *Pre-disaster planning: the role of international aid for pre-disaster planning in developing countries*. Published by Avdelningen för Arkitecktur, Kth. Stockholm Skrift, 1974.
60. LECHAT, Michael F. 'The epidemiology of disasters'. *Proceedings of Royal Society of Medicine*, vol. 69. (June 1976), pp. 421-6.
61. MALLORY, Keith and OTTAR, Arvid. *Architecture of aggression. A history of military architecture in North West Europe 1900-1945*. Architectural Press, London, 1973.
62. MALLORY, Keith and OTTAR, Arvid. *Architecture of aggression*. p. 195.
63. MENZIES, Michael. 'Earthquake victim survival and rehabilitation'. Urban Design dissertation for Diploma in Architecture, Scott Sutherland School of Architecture, Aberdeen, 1971, p. 4.
64. MUNTHE, Axel. *The story of San Michele*. Murray, London, 1929, p. 275.
65. MURLESS, BOWDEN, RIVERS and HOLT (London Technical Group). 'Disaster shelter and rehousing: physiological and social factors'. Part of symposium on emergency housing and shelter convened by the Disaster Unit and the Disasters Emergency Committee, Jan. 1976, pp. 78-94.
66. NORTH ATLANTIC TREATY ORGANISATION (NATO). *Disaster assistance (flood mitigation)*, no. 2. Committee on the challenges of modern society, NATO, 1970.
67. NUNEZ, Cristobal Rugama. 'Activities of the national emergency committee; report on the Managua earthquake'. Paper in *The Managua earthquake: report of proceedings*, vol. 2, pp. 913-28. Earthquake Engineering Research Institute, Oakland, California, 1973.
68. O'KELLY, Elizabeth. *Aid and self help*. Charles Knight, London, 1973, p. 12.
69. O'KEEFE, Philip, WESTGATE, Ken and WISNER, Ben. 'Taking the naturalness out of natural disasters'. *Nature*, vol. 260 (15 April 1976) p. 566.
70. OFFICE OF THE UNITED NATIONS

DISASTER RELIEF COORDINATOR (UNDRO). *The protection of human settlements from natural disasters.* United Nations Habitat Conference. June 1976.

71. OSORIO, Ivan. 'Managua rebuilds a city from earthquake ruins'. *Geographical magazine,* May 1976, pp. 460-4.

72. OXFAM – Vecinos Mundiales. *Programme summary statements.* A review of the Kuchubal programme. Oxfam, Oxford, 1976.

73. PEPYS, Samuel. *The diary of Samuel Pepys.* Account for 2-14 Sept. 1666. Bell, London, 1970, pp. 267-81.

74. PEREIRA DE FIGUEIREDO, Antonio. *Rerum lusitanarum ephemerides,* Lisbon, 1761. *Diário dos successos de Lisboa desde o terremoto até o exterminio dos Jezuitos,* Lisbon, 1766. Quoted in Kendrick, *The Lisbon earthquake,* ref. 56, pp. 50-2.

75. PLINY. *The letters of the Younger Pliny.* Trans. Betty Radice. Penguin, Harmondsworth, 1963, pp. 166-8.

76. QUARANTELLI, E.L. and DYNES, Russell R. 'When disaster strikes: it isn't much like what you've heard and read about'. *Psychology today,* Feb. 1972, pp. 67-70.

77. QUARANTELLI, E.L. and DYNES, Russell R. *Images of disaster behaviour myths and consequences.* Preliminary paper no. 5, Disaster Research Center, Ohio State University, Columbus, Ohio, 1972. (An expanded version of ref. 76.)

78. RAPAPORT, Amos. 'The ecology of housing'. *Ecologist,* Jan. 1973, p. 10.

79. REDDAWAY, T.F. *The rebuilding of London after the Great Fire.* Edward Arnold, London, 1951.

80. REPS, William, ed. *Design siting and construction of low-cost housing and community buildings, to better withstand earthquakes and storms.* Report prepared for AID, Washington, 1973.

81. ROYAL INSTITUTE OF BRITISH ARCHITECTS (RIBA). 'Emergency housing for refugees and in solution of immediate post-war housing problems'. *Journal of the Royal Institute of British Architects.* May 1941, pp. 119-21.

82. SCHUMACHER, E.F. 'What is happening to intermediate technology?' *Frontier,* vol. 15, no. 2, summer, 1972.

83. SNARR, D. Neil and BROWN, E. Leonard. 'Report from Managua'. *Sela,* Wilmington College, Ohio, Mar. 1975, pp. 4-5.

84. SWEDISH COUNCIL FOR BUILDING RESEARCH. *Swedish aid to post-disaster housing.* Swedish Council for Building Research, Stockholm, 1975, pp. 81-110.

85. TERRA, Juan Pablo. *Critical Problems of human settlements in Latin America.* Position paper for United Nations Habitat Conference, Vancouver, 15 May 1975, p. 4.

86. TIME MAGAZINE. 'Moss the tentmaker'. *Time,* 26 July 1976, p. 60.

87. THOMPSON, Charlotte and Paul. *Survey of reconstruction housing in Honduras 1½ years after Hurricane Fifi.* Organisation of American States, Bogota, May 1976.

88. THOMPSON, Charlotte and Paul. *Reconstruction of housing in Guatemala.* Organisation of American States, Bogota, July 1976.

89. THOMPSON, Charlotte and Paul. *Preliminary report on post disaster housing in Chile.* Organisation of American States, Bogota, Aug. 1976.

90. THOMPSON, Charlotte and Paul. *Preliminary report on post disaster housing in Peru.* Organisation of American States, Bogota, Oct. 1976.

91. UNITED NATIONS (UN). *Skopje resurgent.* UN, New York, 1970.

92. UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANISATION (UNESCO). *Country monograph of Turkey.* Produced for the intergovernmental conferenee on assessment and mitigation of earthquake risk. UNESCO, Paris, 1976, pp. 26-52.

93. UNITED STATES ARMY SOUTHERN COMMAND. 'After action report. Disaster area survey team, Managua, Nicaragua, 1972'. 3rd Civil Affairs Group (Airborne), 5 Feb. 1973.

94. VOLTAIRE. *Candide.* Penguin, Harmondsworth, 1958, p. 33.

95. VITTANI, Jurg. *Etude d'un type de tente idéal pour les actions de secours.* Ligue des sociétés de la Croix-Rouge, Geneva [n.d.].

96. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, WASHINGTON. *Proposed minimum standards for permanent low-cost housing and for improvement of*

existing sub-standard areas. Department of Housing and Urban Development, Washington, 1972.

97. WEBBER, D.L. 'Darwin cyclone: an exploration of disaster behaviour'. *Australian journal of social issues*, vol. 11, no. 1 (1976), pp. 54-63.

98. WENGER, Dennis and PARR, Arnold. *Community functions under disaster conditions.* Research report no. 4, Disaster Research Center, Ohio State University, Columbus, Ohio, 1969.

99. WENGER, DYKES, SEBOK and NEFF. 'It's a matter of myths; an empirical examination of individual insight into disaster response'. *Mass emergencies*, vol. 1 (1975), pp. 33-46.

100. WISNER, Ben, WESTGATE, Ken and O'KEEFE, Philip. 'Poverty and disaster'. *New society*, 9 Sept. 1976.

101. WOODHAM-SMITH, Cecil. *The great hunger.* New English Library, London, 1962, p. 408.

102. WORLD BANK. *Guatemala: impact of earthquake.* World Bank report, 16 Mar. 1976, M76-171, p. 2.

REFERENCES LISTED ACCORDING TO SUBJECT

This list is confined purely to the references quoted in this book.

Pre-disaster planning
3, 59, 70, 80.

Techniques for building safe houses in vulnerable situations
1, 2, 9, 13, 16, 17, 18, 20, 32, 33, 34, 35, 40, 42, 59, 66, 80, 84, 87, 88, 89, 90, 92, 96.

Emergency shelter – initial 72-hour period
5, 9, 21, 24, 30, 31, 36, 37, 39, 40, 41, 44, 47, 50, 58, 60, 65, 76, 77, 84, 91, 93, 95.

Tents
14, 21, 24, 30, 31, 34, 36, 39, 40, 41, 47, 86, 90, 91, 93, 95.

Donor shelters
11, 12, 20, 23, 24, 29, 32, 36, 37, 38, 39, 41, 49, 54, 59, 63, 72, 84, 87, 88, 89, 90, 91, 95.

Indigenous shelter
1, 2, 8, 16, 20, 24, 29, 32, 33, 35, 36, 39, 40, 41, 42, 58, 80, 87, 88, 89, 90.

The rule of the extended family
19, 27, 36, 65, 76, 77, 97, 98, 99.

Evacuation policies
14, 27, 36, 50, 53, 67, 76, 77, 91, 97, 98, 99.

Prefabrication techniques
8, 9, 10, 23, 24, 32, 36, 59, 63, 87, 88, 89, 90, 91.

Reconstruction of towns and cities
5, 8, 9, 10, 13, 14, 16, 23, 28, 37, 38, 42, 51, 52, 53, 55, 56, 63, 67, 71, 79, 83, 87, 88, 89, 90, 91.

Cultural factors in post-disaster relief and reconstruction
8, 10, 14, 19, 21, 23, 25, 32, 36, 37, 38, 39, 40, 41, 42, 44, 50, 60, 65, 68, 77, 78, 83, 84, 87, 88, 89, 90, 97, 98, 100.

Flood conditions
3, 18, 20, 22, 34, 66, 70, 80, 87.

Earthquakes
4, 5, 6, 7, 9, 10, 13, 14, 16, 19, 23, 24, 25, 26, 33, 35, 36, 37, 38, 40, 42, 55, 56, 59, 63, 67, 70, 72, 74, 80, 83, 88, 89, 90, 91, 92, 102.

Wind storms
3, 20, 34, 50, 70, 87, 97.

Disasters prior to 1945
4, 6, 7, 13, 14, 26, 27, 28, 43, 48, 52, 53, 56, 64, 73, 74, 75, 79, 81, 94, 101.

World War II
27, 53, 61, 81.

Skopje
38, 91.

Bangladesh
20, 30, 39, 51.

Managua
12, 21, 31, 36, 37, 67, 71, 83, 93.

Hurricane Fifi
22, 34, 39, 87.

Turkish earthquakes
7, 9, 23, 24, 59, 63, 84, 92.

Darwin
50, 97.

Guatemala
19, 25, 33, 40, 42, 72, 85, 88, 102.

APPENDIX A: SUMMARY CHARTS

The table which appears on the following twelve pages summarises the effects of six recent disasters and the kinds of relief work and reconstruction activity that followed them. These disasters have been chosen because I have had direct personal experience of them, either as an observer or as a consultant.

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE AT CURRENT VALUES	VALUE OF AID AT CURRENT VALUES
Earthquake	Skopje, Yugoslavia	26 July 1963	1,070	4,300	Approx. 50,000 homes destroyed or damaged	150,000	£800 million	Unknown
			PRE-DISASTER POPULATION 200,000					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	Approx. 5,000	1,711	1. Quonset huts (125) 2. Nissen huts (20) 3. Hexion framed housing (1,566) 4. Caravans (79 approx.) 5. Tents Individual tents approx: 4,505 Marquees: 464	In initial 8 months 14,000 units Overall 1963-73 35,000 built units	A galaxy of prefabricated units from Czechoslovakia, Finland, Poland and Switzerland. Heavy construction flats from Roumania and Russia. 82% of the initial 14,000 houses were provided by the various republics of Yugoslavia.
	% OCCUPANCY Approx. 60%	% OCCUPANCY Uncertain. Perhaps 70%			

EMERGENCY SHELTER POLICY		TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
A contingency organisation, STAB, assumed control. Within 24 hours tents were provided for 25,000 people. An evacuation policy was implemented and 150,000 women and children left the city within 3 weeks.	60,000 men were available for cleaning, repairing and erecting housing. 1,711 'temporary' houses were built (1,566 by War on Want UK and a team of Royal Engineers). They were intended for eventual agricultural use.	Tents were erected very rapidly and were used for 3-4 months. People moved from them to the 1,711 temporary homes. Some remained in these homes (which still exist); others moved to the prefabricated homes.

RECONSTRUCTION POLICY	A decision was made to requisition land to build 14,000 houses to house a total of 70,000 people. Repairs to existing houses were undertaken to provide housing for, 50,000. A new, safe plan for the city was devised and implemented. This included an international competition for the design of the city centre.	**TIMING OF RECONSTRUCTION - (MONTHS, YEARS, FROM DISASTER)** Within 8 months, 14,000 houses were built. They are still in use, in modified form. By 1976, when the population of the city had risen to over 430,000 (double that of 1963), a total of 35,000 living-units had been built. In 1977 the city centre is nearing completion.
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. The contingency organisation was highly effective. 2. The tents were not all used. 3. The evacuation policy was partially effective (all returned within 3-4 months). 4. The ability to requisition land contributed to the rapid reconstruction of houses. Another contributory factor was the massive aid received from East European and Western sources (82 countries). 5. Overall there was a balanced, diversified approach to shelter provision, which satisfied the need, in spite of the exposure threat of cold weather, which came 3 months after the disaster. 6. The estimated damage total was £800 million, while the overall cost of reconstruction is approaching the figure of £14,000 million.	

KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHORS EVALUATION)	1. Skopje resurgent. United Nations, 1970. (ref.91)	2. Skopje: the rebirth of a city. Skopje city assembly, 1976. (text in Macedonian)	3. Ambraseys, N.N. 'Seismic environment: the Skopje earthquake of July 1963'. Revue de l'union internationale de secours, no.5 (Sept. 1966).	4. Davis, Ian. 'Skopje rebuilt'. Architectural design, Nov. 1975. (ref.38)

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE : CURRENT VALUES	VALUE OF AID : CURRENT VALUES
Earthquake	Managua, Nicaragua	23 December 1972	6,000-10,000	20,000	50,000	200-240,000	Estimates vary from $350 million to $850 million	
			PRE-DISASTER POPULATION 430,000					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	360 in Masaya approx. 1,600 in Managua	11,635	Tents Igloos Wooden huts	Unknown but approx. 30,000 houses	Wooden huts - by US AID grant - now upgraded; and all types, concrete block, brick etc. primarily by private sector; numerous agencies - FUNDECI, CEPAD, World Bank etc. - were heavily involved with a wide variety of housing, mainly in outlying towns.
	% OCCUPANCY 60% Masaya 10-20% Managua	% OCCUPANCY Initially, 35% of AID huts, 45% of igloos			

EMERGENCY SHELTER POLICY	TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
1. A policy of evacuation was implemented using all nearby towns. 2. The government built camp-sites in Managua but these were very little used, since the extended family 'sponge' was the major factor in absorbing up to 90% of refugees. 3. The government with US AID built 11,635 wooden huts. 4. The W.German Red Cross built approx. 500 polyurethane igloos. 5. Many local agencies built permanent houses in this emergency period.	In Managua 40 tents in 2 days. In Masaya 40 tents in 3½ weeks. (followed by the remainder of the total of 1,960 tents). The initial group of US AID huts were completed 14 weeks after the disaster. The igloos were first occupied 5 months after the disaster. Certain local agencies, like Caritas and FUNDE, built simple wooden houses within 3 weeks of the disaster.

RECONSTRUCTION POLICY	1. A policy of reconstructing the city on the same site - this is being implemented with twin policies of deconcentration and decentralisation. 2. New construction codes were implemented. 3. A new ministry was formed to control reconstruction. 4. With the freezing of decisions on rebuilding the urban centre, the private sector has developed the perimeter sites of the city, a process that had already started before the earthquake.	**TIMING OF RECONSTRUCTION (MONTHS, YEARS, FROM DISASTER)** At present it is estimated that it will take 10-15 years (i.e. until about 1990 - and a total of about 18 years after the disaster). Total cost of reconstruction between 1975 and 1978, $226 million.
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. The decision to order the total evacuation of the city must be seriously questioned. The urban waste land that still exists is a memorial to that decision. 2. The extended family 'sponge' was highly effective. 3. The German igloos (which have not been used since Managua) arrived very late, and were under-used despite free distribution. 4. The AID wooden huts were ineffective as emergency provision: they were remotely sited, insufficient attention being paid to infrastructure. 5. Reconstruction by the private sector has been rapid, on the periphery of the city.	
KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHOR'S EVALUATION)	1. Davis, Ian. Managua, December 23, 1972. Report on housing strategy, Dec.1972 - September 1972. Oxford Polytechnic, Jan.1974. (ref.36)	2. CIIR & OXFAM Team. Report on Coyotepe refugee camp Masaya Nicaragua. CIIR, London, 1975. (ref.21)
	3. Nunez, Christobel Rugama. Activities of the national emergency committee: paper at symposium on Managua. Earthquake Engineering Research Institute, Oakland, California, 1973. (ref.67)	4. Ivan Osorio 'Managua rebuilds a city from earthquake ruins'. Geographical magazine, May 1976. (ref.71)

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE : CURRENT VALUES	VALUE OF AID : CURRENT VALUES
Hurricane Fifi	Honduras	18-20 September 1974	8,000	Unknown	3,400 destroyed 2,000 damaged	142,000	$449 million total, including $29 million housing	
			PRE-DISASTER POPULATION Unknown					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	Extensive use of tents on various sites.	Nil	Tents	1,212 post-disaster houses - all built by relief groups.	1. Tilt-up concrete housing. 2. 6 systems of wood construction. 3. 5 systems of concrete construction.
	% OCCUPANCY high	% OCCUPANCY -			

EMERGENCY SHELTER POLICY		TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
Several large refugee camps were established. The largest was built in Choloma to house 318 families (1,831 people) built on very regimented lines. In addition there were improvised homes, but the extended family system does not appear to have functioned very effectively. Existing buildings, i.e. schools, were used as temporary provision.		No data available.

RECONSTRUCTION POLICY	There were the major programmes of house building - each by voluntary agencies. In addition CARE distributed roofing materials to 5,324 houses. The housing has all been built above the flood plain, on the side of the hill, but is still vulnerable in many instances due to poor 'cut and fill' techniques.	**TIMING OF RECONSTRUCTION (MONTHS, YEARS, FROM DISASTER)** Colonia Canada 181 homes - 7 months Colonia Care 44 homes - 3 months Mennonite project 22 homes - 6 months CEDAN project 134 homes - 5 months
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. One of the new housing settlements, 'Colonia Canada' in Choloma, is interesting in that it evolved from a refugee camp of 488 families to a settlement of 181 houses (with 200 planned for later addition). 2. There was a marked absence of governmental provision of shelter and new housing. 3. There was also a marked lack of local involvement in the refugee camps and in rehousing programmes, many of which were culturally unsuited to local conditions. 4. The distribution of aid was concentrated in certain centres such as Choloma. This set in motion a spiral of 'dependency' with adverse long-term consequences. 5. Many of the housing systems have not been easily modified. 6. Most of the emergency housing was built very rapidly, and there was an absence of 'donor systems' from external sources.	
KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHOR'S EVALUATION)	1. Thompson, Charlotte & Paul. Survey of reconstruction housing in Honduras: 1½ years after Hurricane Fifi. Organisation of American States, 1976. (ref.87)	2. Cuny, Fred, Perez, Julian and Parker, Jinx. Report on the refugee camp and housing programs in Choloma, Honduras Intertect, Dallas 1975 (ref.34)
	3. Honduras: evaluacion preliminar de las perdidas y efectos del huricane Fifi en la Comportamiento economico national. Tegucigalpa, 30 Sept. 1974.	4. CIIR Honduras: anatomy of a disaster. CIIR, London, 1975. (ref.22)

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE : CURRENT VALUES	VALUE OF AID : CURRENT VALUES
Earthquake	Lice, Turkey	6 September 1975	2,385	3,339	7,605 homes destroyed or damaged	Approx. 5,000	Estimated at $34 million	$14.8 million
			PRE-DISASTER POPULATION 8,093 approx.					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	3,681	463 igloos	Various types of tent: ridge, pole and chalet types. Polyurethane hexagonal igloos provided by Oxfam. Permanent housing after 2 months.	1,568 in 2 months 5,805 in 9 months	The standard Turkish post-disaster prefab house, timber frame with asbestos cement infil, and corrugated iron roof. Various similar designs from France, Finland and Switzerland.
	% OCCUPANCY 90%	% OCCUPANCY Very low			

EMERGENCY SHELTER POLICY		TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
The Ministry for Reconstruction and Resettlement decided that the town of Lice was in a highly vulnerable site and prevented people from re-building their ruined homes. A new, safe, flat site was chosen 1 mile from Old Lice, and on this site the prefab homes were built. Initially tents were used and Oxfam provided polyurethane units; it was proposed to build 800 units but only 463 were actually built.		Tents were in use within 2 weeks. The 1,568 new prefab homes were completed by day 54. The first Oxfam units were produced by day 60.

RECONSTRUCTION POLICY	As can be seen above, the Turkish government policy is that of rapid new buildings on safe sites. The initial 1,568 homes will be supplemented with a further 4,165. In addition, various foreign governments provided housing. For example the village of Yunluce is being built by Switzerland, with 50 homes. The West German government is building some houses and schools in Kulp, and the Libyan government is rebuilding Taprak, at a cost of $1 million US.	**TIMING OF RECONSTRUCTION (MONTHS, YEARS, FROM DISASTER)** A total of 5,805 houses is planned. 3,900 were completed by June 1976 (9 months after the disaster). 46% of the planned 2,776 houses being built with foreign assistance.
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. The Turkish ministry have a very rapid capacity for building and to build this quantity of houses within 2 months is a considerable achievement. 2. However, in doing so they paid little attention to the cultural pattern of the Kurdish people who live in them. The houses are climatically unsuitable for the harsh climate, and they ignore the people's need to be close to their animals. 3. The housing being built by the Swiss at Yunluce has not been designed with cultural preconceptions. 150 animal shelters are being incorporated into the development, thus recognising the need for families to be close to their animals. 4. Of the 463 Oxfam igloos built, 44 were damaged, thus leaving 419. In a visit to Lice 12 months after the disaster, the author could only find 3 units still in use, but some will be used in the outlying regions. On grounds of cost, timing, and cultural issues, the units were a failure, and the future development of this programme has been abandoned by Oxfam. 5. The town received over $11 million in aid from Arab countries.	
KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHOR'S EVALUATION)	1. Cavanagh, Jon 'Shelter after natural disasters'. School of Architecture, University of Newcastle-upon-Tyne, 1976. (ref.24)	2. Mitchell, Captain William. The Lice earthquake in south eastern Turkey. A geography of the disaster. US Air Force Academy. Colorado 1976.
	3. Lice deprimi (a record of the rebuilding in 54 days) Report in Turkish by The Ministry of Reconstruction and Resettlement, Ankara, Turkey, 1975.	4. Cavanagh, Jon and Johnson, Fiona. 'Earthquakes and pre-fabs'. Ecologist, vol.6, no.3 (1976). (ref.23)

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE : CURRENT VALUES	VALUE OF AID : CURRENT VALUES
Earthquake	Guatemala	4 February 1976	27,000	Estimates 40,000-77,000	Total 222,261 Guat.city 58,750 Rural areas 163,501	1,660,063	Estimates vary $500 million-$750 million	US govt.: $7.5 million in aid, $17.5 million for reconstruction
			PRE-DISASTER POPULATION Unknown					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	10,000+	Unknown	Tents. Improvised houses. 2 programmes of temporary housing	Unknown	By May 1976, 4 months after the disaster, 24 differing agencies were implementing reconstruction programmes using: Block housing Frame/roof schemes Cement/asbestos panel system Wooden housing Steel, block wood combination
	% OCCUPANCY Very low	% OCCUPANCY Unknown			

EMERGENCY SHELTER POLICY		TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
	No real policy existed, except for a government programme to build 100,000 temporary houses with military support. This was programmed to take 100 days but was largely ineffective.	Tents were installed within 2-3 weeks. Approximately 50,000 improvised homes were built within 24 hours of the disaster. Corrugated iron sheeting was being distributed for temporary shelter within 2 weeks.

RECONSTRUCTION POLICY	The major focus of the entire reconstruction programme was rapid building. The majority of house-building programmes have taken place in rural areas. It took approximately 6 months for urban projects to commence.	**TIMING OF RECONSTRUCTION (MONTHS, YEARS, FROM DISASTER)** No data available
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. There was a massive process of improvisation of housing - a very valuable resource in the post-disaster context. 2. In general tents were under-used. 3. One major reconstruction programme has placed its full emphasis on retraining in safe constructional techniques. 4. Lamina and corrugated iron sheeting, which was purchased in vast quantities, fulfilled a vital role as temporary shelter, which could then be re-used as roofing for the permanent housing. 5. The question of rehousing the residents of the squatter settlements in Guatemala city is highly political and demands major land reforms.	

KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHOR'S EVALUATION)				
1. Thompson, Charlotte & Paul. *Reconstruction of housing in Guatemala.* Organisation of American States, 1976. (ref.88)	2. Oxfam - Vecinos Mundiales: Programme summary statements. A review of the Kuchbal programme. Oxfam, 1976. (ref.72)	3. Carmack, Robert M. *Anthropological analysis of the earthquake in Western Guatemala.* Report for AID. Guatemala, 1976. (ref.19)	4. Davis, Ian. *Guatemala shelter and housing policy in weeks 1-3.* Oxford Polytechnic, 1976. (ref.40)	

DISASTER TYPE	LOCATION	DATE	NO. KILLED	NO. INJURED	NO. OF HOUSES DESTROYED	NO. HOMELESS	VALUE OF DAMAGE : CURRENT VALUES	VALUE OF AID : CURRENT VALUES
Earthquake	Friuli, Italy	6 May and 15 September 1976	900-1,000 in May. 12 in Sept.	200+	30,527 destroyed in both earthquakes; 7,850 damaged in May.	62,000 in May, rising to 70,000 in Sept.	£330 million £33,000 for each of 10,000 families.	
			PRE-DISASTER POPULATION Unknown					

STATISTICS OF SHELTER AND HOUSING PROVISION	NO. OF TENTS PROVIDED	NO. OF TEMPORARY HOUSE UNITS	TYPES OF SHELTER PROVISION USED	NO. OF HOUSE UNITS BUILT SINCE DISASTER	TYPES OF NEW HOUSING
	Tent-cities in all major towns	Unknown	Tents. 125 railway carriages. Hotels on the Adriatic coast (during Winter season). Each town - temporary prefabricated houses.	Unknown	Unknown, but a wide variety of temporary systems - 2 local firms and systems from Finland and Norway.
	% OCCUPANCY 60% initially, reducing rapidly	% OCCUPANCY			

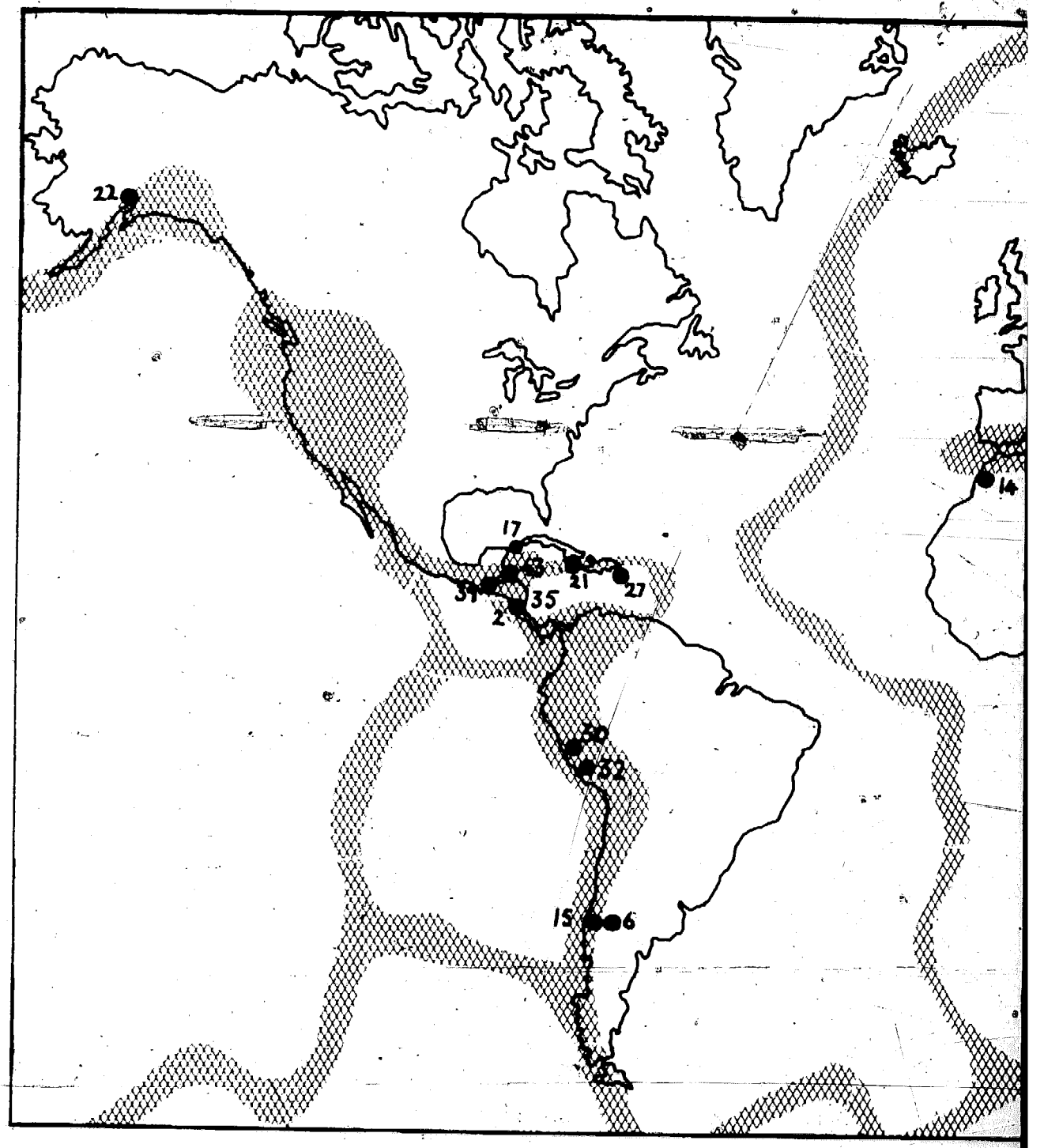
EMERGENCY SHELTER POLICY	TIMING OF EMERGENCY PROVISION (DAYS, WEEKS, MONTHS FROM DISASTER)
1. Tent cities built in each town or village, mainly of tents from Italian military sources. 2. Indigenous control of each local situation. 3. Many able-bodied families left immediately for Turin or Milan, leaving elderly in the tents. 4. Hotels were offered and after the end of the high tourist season in the middle of September these were made available on the Adriatic coast; 20,000 people stayed during the winter. 5. Railway coaches made available at Gemona. 6. Mobile homes were used as temporary provision throughout the affected region.	Tent cities built within 1 week.

RECONSTRUCTION POLICY	The policy is: 1. To filter all government finance through local reconstruction units in each town. 2. To rebuild the historic towns as they were - estimated time 5-8 years. 3. Meanwhile to build prefab homes costing £5-8,000 each - which will be provided for each family. These will then be used after completion of historic homes, as tourist provision.	**TIMING OF RECONSTRUCTION (MONTHS, YEARS, FROM DISASTER)** Initial prefabricated housing was donor provision from Germany, Scandinavia etc. By October (5 months after the first earthquake) the Italian government had still not begun to build their house units.
SUMMARY OF MAJOR LESSONS FOLLOWING THIS DISASTER	1. The decision to delegate relief and reconstruction policy to each town/village is an interesting one, which is unlike normal pyramid structures. 2. The relief operation was undertaken in the context of much pressure from the media, who had reacted against the corrupt practices of the 1968 Sicilian earthquake. 3. The two-stage policy - (1) temporary housing (very expensive) then (2) rebuilt homes - is highly expensive and unlikely to be fully implemented. 4. 5 months after the disaster Italian provision was still bogged down with bureaucracy, and houses were still not begun. 5. The hotels on the Adriatic coast provided emergency accommodation for 20,000 during the winter months. 6. Many able-bodied people left Friuli very rapidly to find work and may not return.	

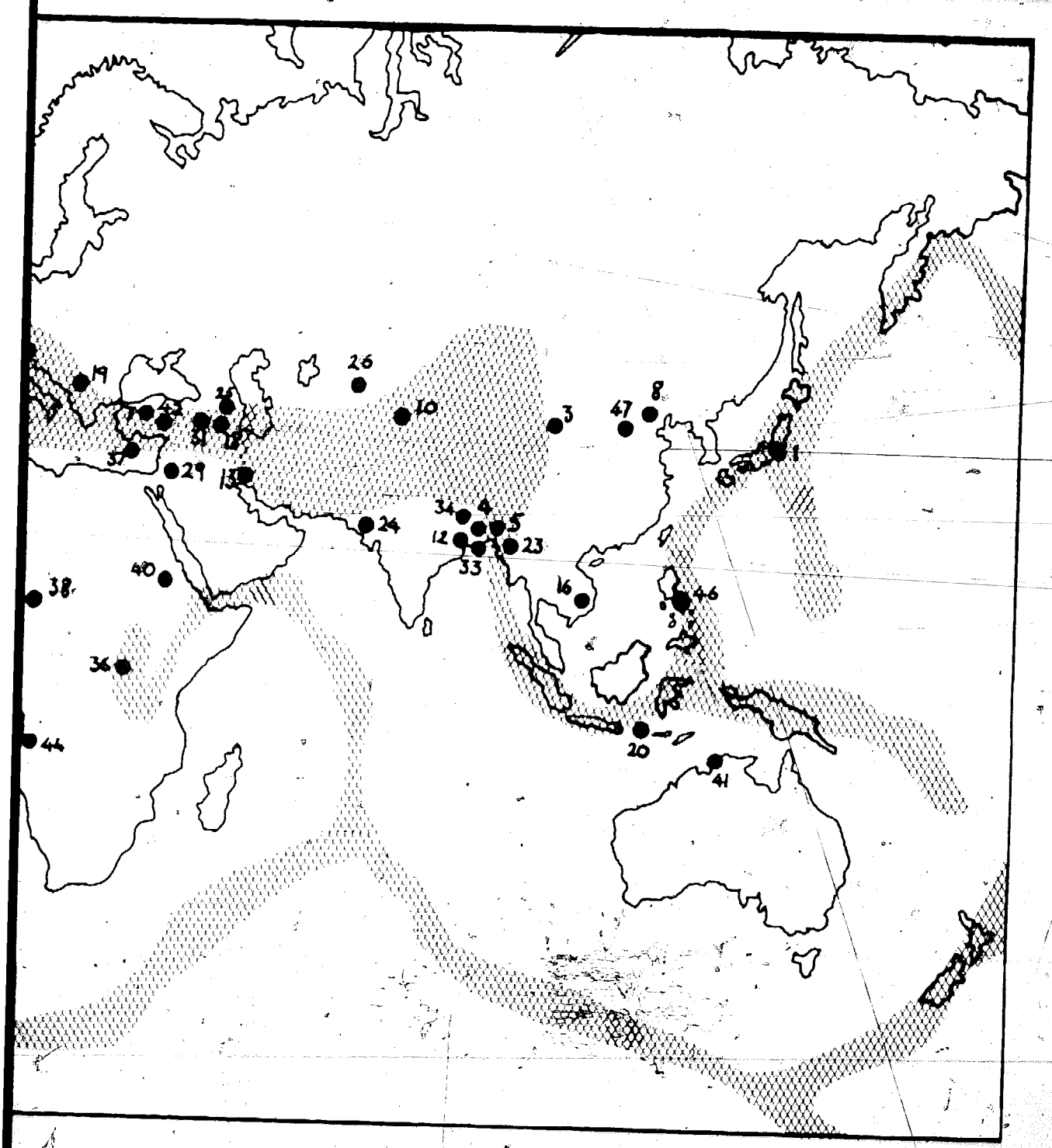
KEY SOURCES OF REFERENCE - IN ORDER OF IMPORTANCE (AUTHOR'S EVALUATION)	1. Dalle tende alle barrache Special issue on the village of Osoppo Il Dunto (Udine) 1 Sept.1976.	2. 'The survivors take charge of their future' Economist 15 May 1976.	3. Schwartz, Walter. 'Quake victims confront unknown' Guardian, 24 Sept.1976. 'Aid for the 'quake victims: too little, too late' Guardian, 21 Sept.1976.	4.

APPENDIX B: MAPS

The incidence of disaster and the world's earthquake belts 1920-76



Date	Town	Country	Disaster	Homeless	Killed	No.
1923	Tokyo & Yokohama	Japan	Earthquake & Fire		200,000-250,000	1
1931	Managua	Nicaragua	Earthquake	100,000		2
1932	Kansu Province	China	Earthquake		70,000	3
1935		India & Pakistan	Earthquake		50,000	4
1936		East Pakistan	Cyclone		22,000	5

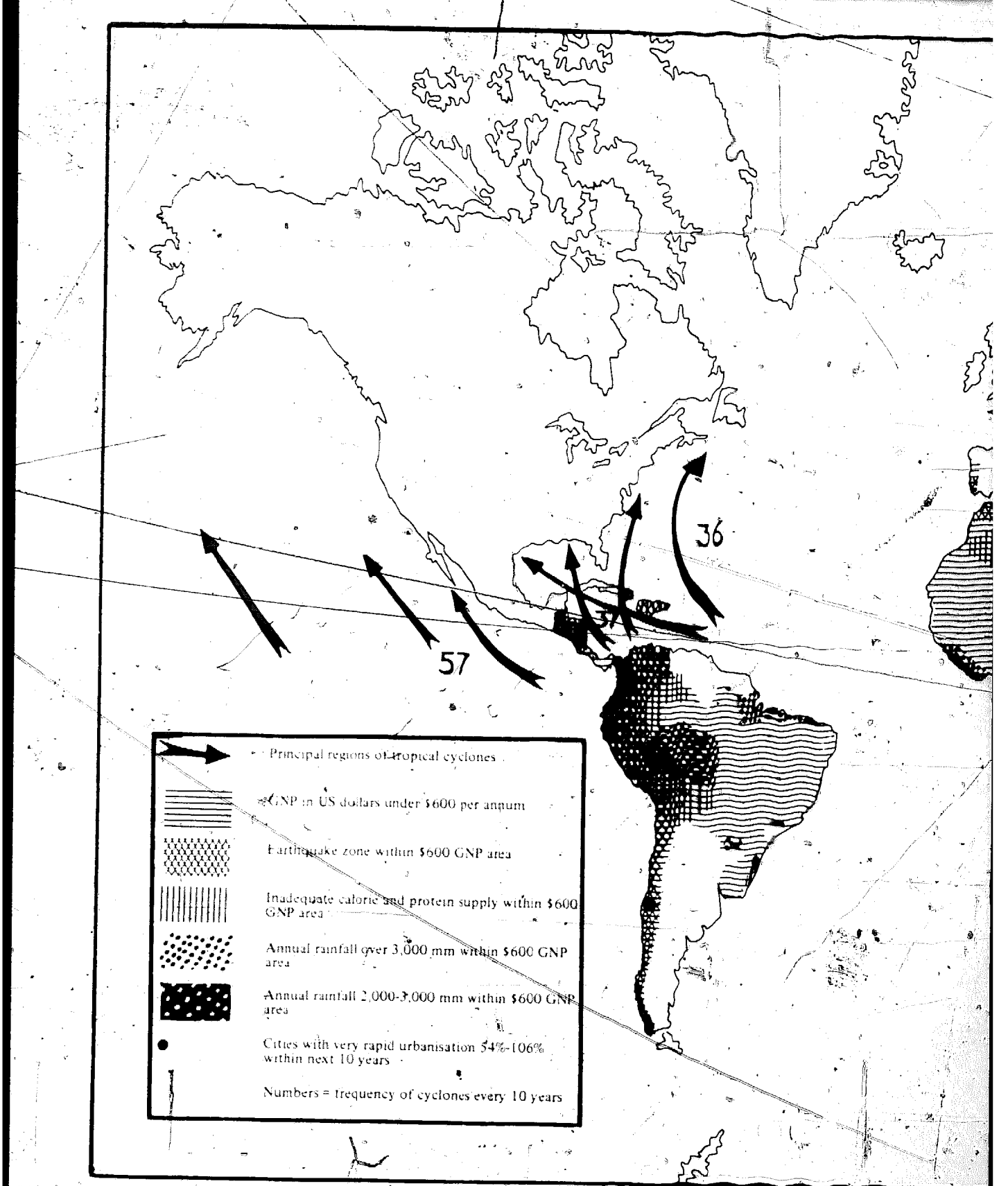


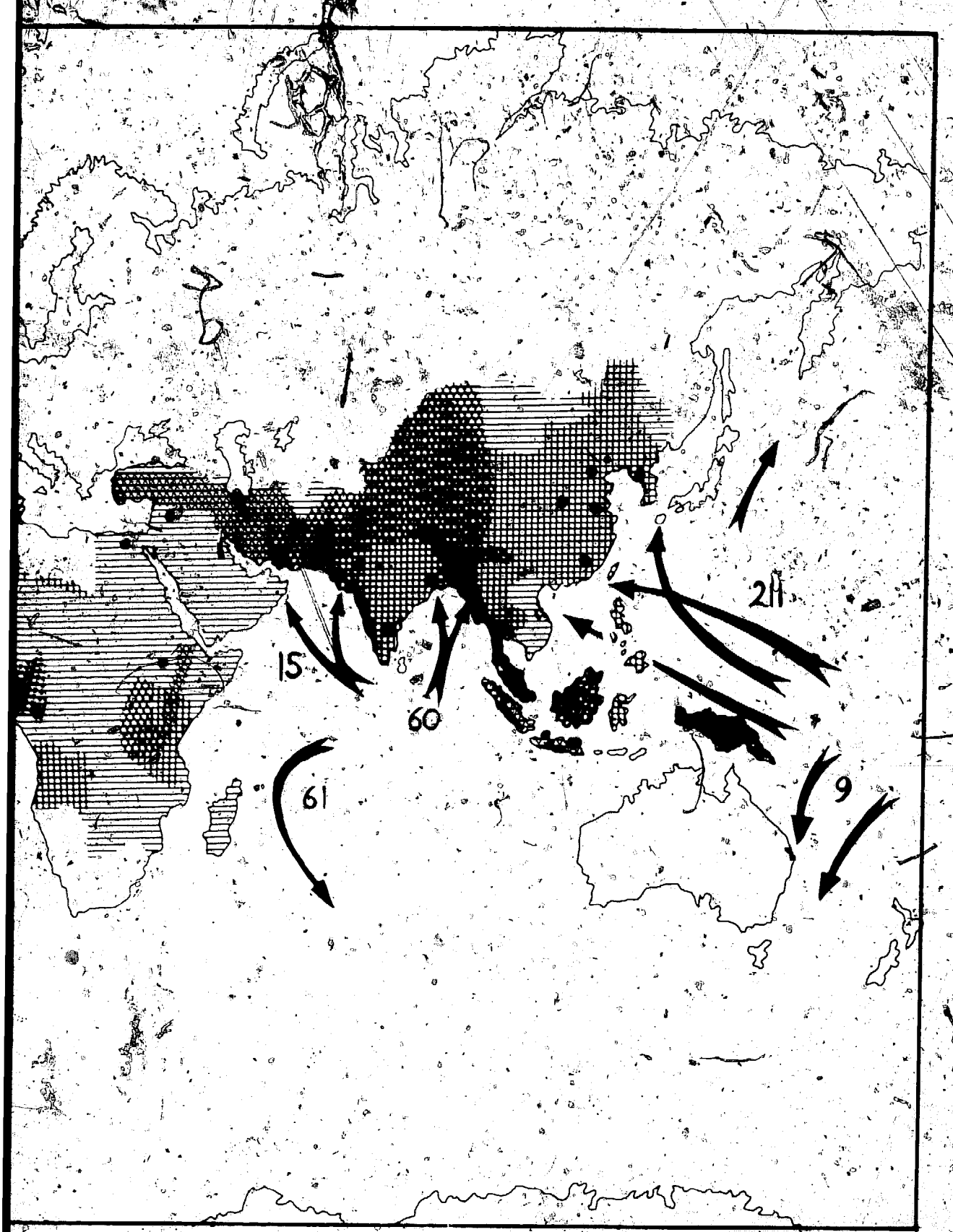
Date	Town	Country	Disaster	Homeless	Killed	No.
1939	Chillan	Chile	Earthquake		30,000	6
1939	Erzincan	Turkey	Earthquake		30,000	7
1939	Tientsin	China	Floods		200,000	8
1939-45	SECOND WORLD WAR				40 million	9
1949	Tadzhik	USSR	Earthquake, Landslide		20,000	10
1953	Essex	England	Floods		119	11
1953		Holland	Floods		1,800	11

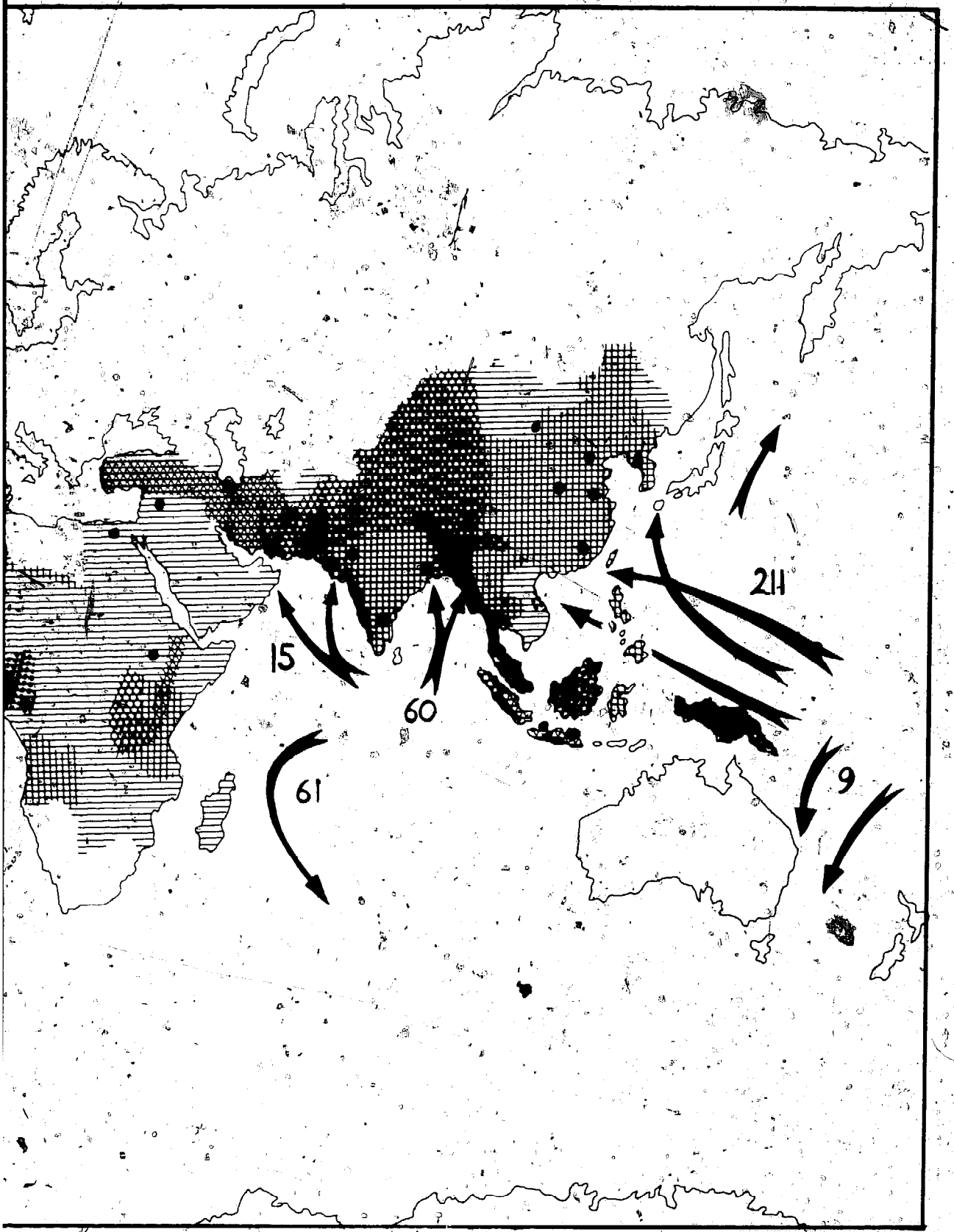
Date	Town	Country	Disaster	Homeless	Killed	No.
1955		India & Pakistan	Floods	4,500,000		12
1957		N. & W. Iran	Earthquakes		4,000	13
1960	Agadir	Morocco	Earthquake		17,000	14
1960	Concepcion	Chile	Earthquake	60,000 homes destroyed	5,700	15
1960-75	VIETNAM WAR				1,800,000	16
1961	Belize	British Honduras	Hurricane Hattie		400	17
1962		Iran	Earthquake		12,000	18
1963	Skopje	Yugoslavia	Earthquake	100,000	1,070	19
1963		Bali	Volcanic Eruption	85,000		20
1963		Caribbean Area	Hurricane Flora		7,190	21
1964	Anchorage	Alaska	Earthquake		114	22
1965		E. Pakistan	Cyclone, Flood	6,000,000	36,000	23
1965	Karachi	W. Pakistan	Cyclone, Flood		10,000	24
1966		Turkey	Earthquake	100,000	2,470	25
1966	Tashkent	USSR	Earthquake	250,000		26
1966		Caribbean Area	Hurricane Inez	100,000 homes destroyed		27
1967-70	BIAFRAN WAR				1,100,000	28
1967-70	ARAB-ISRAELI WAR				75,000	29
1967		Peru	Earthquake			30
1970	Gediz	Turkey	Earthquake	90,000 11,000 homes destroyed	1,089	31
1970	Chimbote	Peru	Earthquake &	500,000	50,000	32

Date	Town	Country	Disaster	Homeless	Killed	No.
			Landslide	100,000 homes destroyed		
1970	Chittagong	Bangladesh	Cyclone & Flood		300,000	33
1971	BANGLADESH WAR			11,000,000 1,560,000 homes destroyed	1.5 million	34
1972	Managua	Nicaragua	Earthquake	200,000-240,000 50,000 houses destroyed	6,000	35
1972	BURUNDI MASSACRE				90,000	36
1974-5	CYPRUS WAR				5,000	37
1972-5		Sahel	Drought		Unknown	38
1974	Choloma etc.	Honduras	Hurricane Fifi	142,000	8,000	39
1974-5		Ethiopia	Drought		Unknown	40
1974	Darwin	Australia	Cyclone Tracy	11,000	50	41
1975	Lice	Turkey	Earthquake	Approx. 5,000 15,000 homes destroyed	2,385	42
1976		Guatemala	Earthquake	222,261	27,000	43
1976	ANGOLAN CIVIL WAR				Unknown	44
1976	Friuli	Italy	Earthquake	70,000	900-1,000	45
1976		Philippines	Earthquake & Tsunami	28,716	3,203	46
1976	Tangshan	China	Earthquake		650,000	47

Map to show vulnerability to disasters


36
57
Principal regions of tropical cyclones
GNP in US dollars under $600 per annum
Earthquake zone within $600 GNP area
Inadequate calorie and protein supply within $600 GNP area
Annual rainfall over 3,000 mm within $600 GNP area
Annual rainfall 2,000-3,000 mm within $600 GNP area
Cities with very rapid urbanisation 54%-106% within next 10 years
Numbers = frequency of cyclones every 10 years


15
60
61
24
9


211
15
60
61
9

INDEX