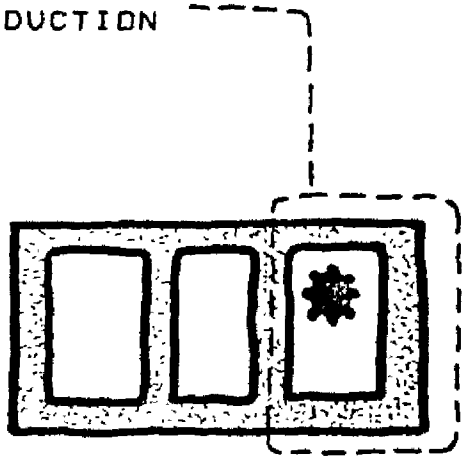
3 IMPLEMENTATION

5. EFFECTIVE IMPLEMENTATION OF A STRATEGY FOR RISK REDUCTION



Implementation involves converting a disaster mitigation plan into reality 'on the ground': it is the introduction, development, evaluation and maintenance of disaster mitigation measures. It is thus a vital stage in disaster planning and follows on from risk assessment and planning, since without implementation nothing is achieved.

Targets for Mitigation Implementation

The preceding sections of this manual have covered the process of Risk Analysis and Decision Making. In turning to the subject of implementation it is e ssential to recognise that protection is being provided with two objectives:

(a) to reduce deaths and injuries;
(b) to reduce property losses of buildings and economic assets.

These losses could be direct (i.e. immediate damage as a result of the disaster impact) or they could be indirect (i.e. longer-term damage to livelihoods as a result of a factory being out of production for a long period of time). Indirect losses are likely to be less tangible but can be of a greater, far-reaching social and economic impact than the highly visible direct losses.

Different measures are needed to select targets and address these situations, and the Decision Making process already identified has described a systematic way to determine suitable areas requiring protection.

In identifying targets for mitigation it is important to emphasise that they are all moving targets - none are static. As patterns of vulnerability rapidly change, due to such pressures of urbanisation, environmental degradation and population growth, assessment techniques, implementation strategies and mitigation actions will also need to adapt to relate to this dynamic context.

POLICY GUIDELINES

There are three key policy guidelines for the effective implementation of an integrated strategy to reduce risks from natural hazards:

- The major opportunity to develop and/or implement measures will occur in the wake of a major disaster. This is due to the temporary high profile of disaster preventive action, which should be taken advantage of to secure resources and decisions.

  Therefore, plans should be developed and where there are political or other obstacles to their implementation they should be maintained in readiness for implementation at the appropriate time, such as when a disaster provides the necessary opportuntity for swift action.

- Experience indicates that the poor are most at risk from disasters.

  Priority is necessary for appropriate measures to protect the the poor and their property. Such measures will include economic inputs and community level programmes.

- A balanced implementation strategy includes 'fail safe' measures which can be used if other measures are not acceptable or are not efficient.

  Therefore, it is advisable not to confine mitigation to a single measure, such as laws. Implementing hazard mitigation planning is strongest when there is an interrelated strategy of many parallel approaches.

These policy guidelines will affect the requirements and mechanisms to be adopted, the type of measures implemented, and the strategy and tactics adopted for implementation.

IMPLEMENTATION: REQUIREMENTS AND MECHANISMS

The plan of a castle symbolises a balanced strategy for risk reduction. Each bastion represents one of the necessary vital elements to protect lives and property. This castle metaphor is useful for two reasons: first, the implementation strategy has to be as strong as possible to resist the powerful and extreme forces that are uniquely experienced in a disaster. Secondly, just as many castles have collapsed by internal neglect rather than external pressures, the strategy has to be strong enough to withstand public and political apathy that inevitably prevails in the long period between the stimulus of major disasters.

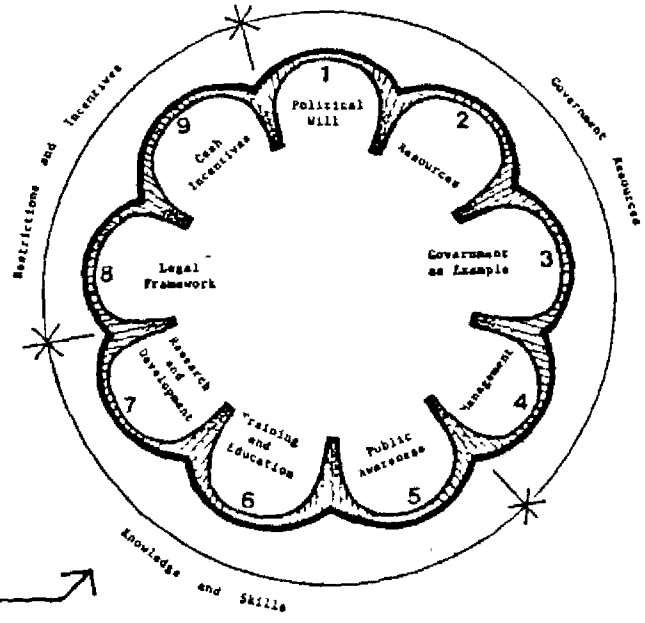


Fig 5.1 Castle Implementation Symbol

The following are nine crucial requirements and mechanisms for effective implementation: they are the bastions of the castle.

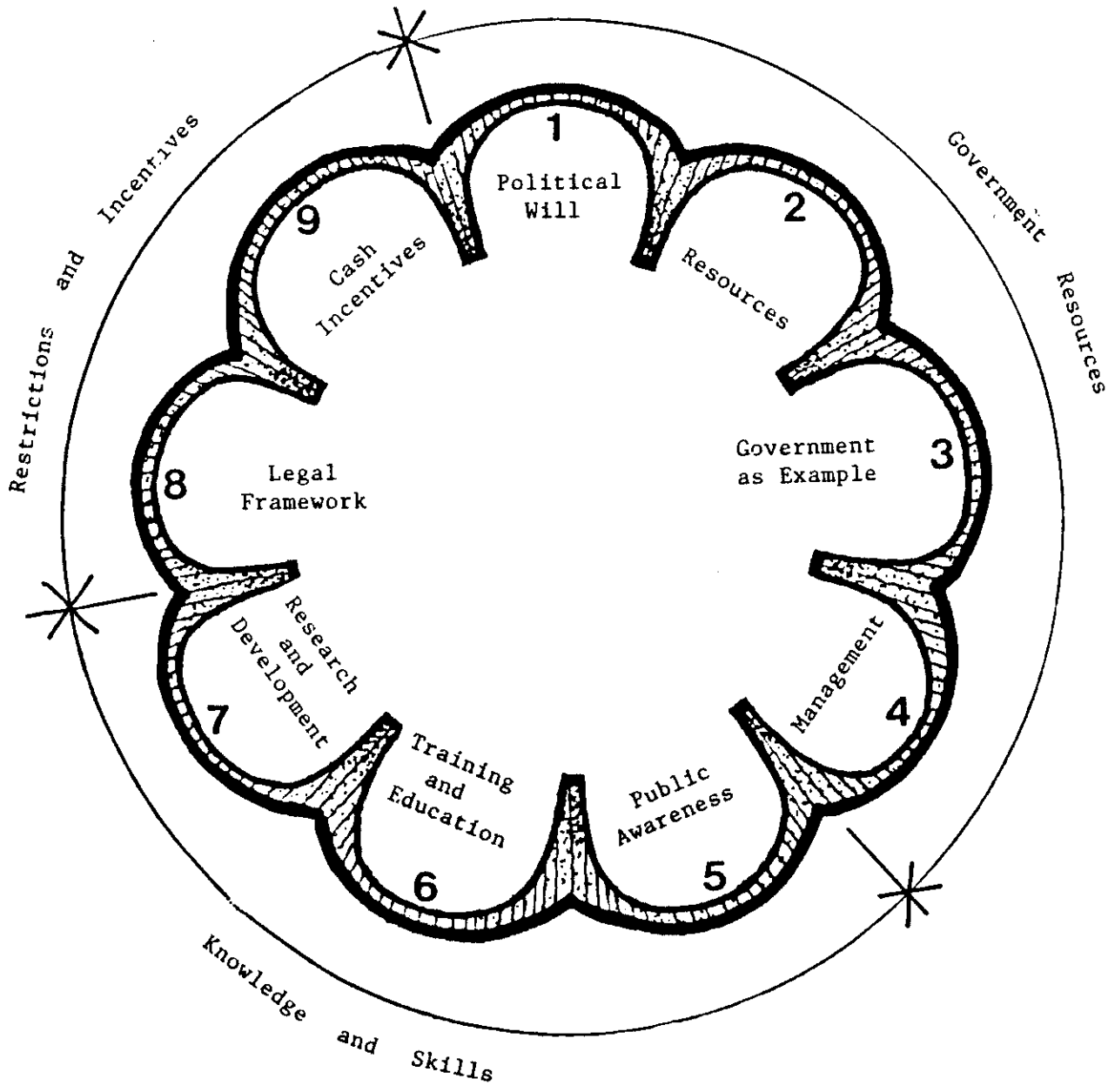
Governmental resources

1. Political will and commitment. Without strong pressure from the centres of political power in a given country to introduce, develop and maintain disaster protection measures, then all other activities are likely to be at best token responses. Political will is most likely to originate from the major failure of measures to counter a disaster. Therefore responsible and concerned officials may need to draft their proposals down to the last detail and await the inevitable disaster, which will serve as a catalyst and lead to positive and rapid action without the delay in plan formulation at that stage.

2. Resources. No disaster mitigation strategy can succeed without some resources, however modest, and the allocation of these resources from other competing government or private sources requires power to be exercised in favour of disaster mitigation rather than those other functions of government.

   Such effective management may grow out of the annual task of preparing the national budget. For the expenditure of modest sums of money on a continual basis, there are major potential benefits in lives that can be saved and property protected. This is both the aim and output of a balanced risk reduction strategy.

3. **Government Models.** An excellent way to communicate the need for safe environments is for governments to provide an example of safe practice so that all the buildings or services they construct and maintain are built to high safety standards. This will have two effects, firstly the designers, builders and engineers who construct in a safe manner will learn from this experience. Secondly, the physical environment will become progressively safer in key areas where protection is of paramount importance.


1
Political Will
2
Resources
3
Government as Example
4
Management
5
Public Awareness
6
Training and Education
7
Research and Development
8
Legal Framework
9
Cash Incentives
Government Resources
Knowledge and Skills
Restrictions and Incentives

4. **Leadership, management and co-ordination.** Strong relief management is well understood, but it remains unusual for any government, ministry, agency or even officials to have the overall responsibility for co-ordinating risk reduction actions. Laws can be drafted by one sector of a government which bear no relationship to how they will be implemented by another, for example how they are financed or taught. Such laws may even prescribe safety measures which have still to be developed by yet another government agency.

Therefore effective implementation of disaster mitigation requires strong management, to integrate all elements into a cohensive pattern. Disaster mitigation also requires foresight. Without this leadership and skills at many different levels of government, and in the private sector, implementation will be slow and patchy.

Knowledge and skills.

5. **Public awareness.** Via their taxes the public pays for risk reduction measures, and many will be involved directly or indirectly in their implementation, particularly their maintenance. Therefore the public needs to be informed about the nature of hazards, their vulnerability, and about safety measures. Also the 'motor' that drives a risk reduction strategy, and puts continual pressure on governments, is a heightened public awareness of the issues and opportunities for protective action.

At the specific level of preparedness planning the public will be directly involved in local community level safety precautions. Implementation of effective disaster mitigation is also likely to require developing new programmes or new works. This will require many different skills, from those of the disaster relief agency to those of the scientist and engineer.

6. **Training and education.** After a disaster strikes, a long term education programme is likely to be necessary to prevent the recurrence of similar disasters in the future. Therefore if buildings have failed in an earthquake, or crops have been lost through flood impact, then it will be necessary to educate architects or agriculturalists in techniques to resist these processes. Builders and farmers need to be trained how to apply improved hazard resistant techniques.

New laws requiring innovative measures will always imply that someone is trained to use them. Therefore this education element in disaster mitigation is vital, yet because of its low political profile it remains the most neglected of all the mitigation measures.

7. **Research and development.** Implem,entation will be effective and efficient if it builds on a continuing programme of rtesearch and debvelopment in all aspects of disaster mitigation, including risk assessment, planning, the effectiveness of alterantives measures and the perfornace of mitigation planning itself.

Restrictions and incentives

8. **Legal framework.** Laws represent restrictions for governments and communities but they are essential for disaster mititgation implementation for two reasons: first, they establish safety standards, and secondly, they constitute a vital element in public education.

However there are persistent problems in their introduction and use. Often they are hastily drafted and enacted after a disaster to express political concern. To achieve haste they may be based on an inappropriate model that relates to a totally different culture or economic situation. Thus, the California Seismic Design Code has formed the basis for earthquake safety codes throughout Latin America, in many highly inappropriate situations.

A further problem concerns law enforcement. Many poor countries simply cannot afford to set up an adequate system to enforce laws - and consequently legal controls lose their essential public respect.

The final problem concerns the relevance of laws to the poor. Frequently standards of building that require additional expenditure are enshrined in laws which are totally irrelevant to poor families. World Bank statistics indicate that just under 50% of the world's population of 5,000 million currently survive on an annual average income of $270 or less: to them the costs of disaster mitigation are an awesome burden.

9. **Cash incentives.** As a contrast to the 'stick' of legal constraints, cash incentives provide a 'carrot' that can offer inducements for individual families, entire communities or large companies to adopt disaster resistance.

Incentives can include cash grants or low interest loans to family units to make their homes more resistant to high winds. Or they can extend to an entire community who may use a 'community incentive grant' to raise the ground floor level of their homes to make them flood resistant.

Reduced insurance premiums can be used to encourage middle-income families to build above flood plains, and tax incentives can be offered to the private sector to comply with hazard resistant building codes in the design of office buildings, factories etc.

RISK REDUCTION MEASURES

Implementation includes using the many 'means' to apply specific safety measures. These measures are in two categories - those that are structural (i.e. flood barriers) and those that are non-structural (i.e. hazard/disaster warning systems).

These measures are normally developed through the difficult process of learning from failure, and devising improved ways to resist the forces of flood, high winds or seismic impact. They will be implemented in a wide variety of sectors: building construction, agriculture, forestry, industry and the essential 'lifeline' services - telephones, water, sanitation, roads etc.

The effectiveness of any of these risk reduction measures can be evaluated in two ways. First, by their general acceptance and normalisation, as they are absorbed into the broad programme of development as natural elements of good (or normal) practice. Secondly, by their testing in a disaster, followed by subsequent damage surveys

that will inevitably result in further fine-tuning of the safety measures.

STRATEGY AND TACTICS

Implementing an integrated disaster mitigation strategy will be speeded up when attention is given to the six key issues set out below:

* **The timing of measures and their introduction**: the need to capitalise on disaster impact (or even some other country's disaster) in order to stimulate political concern.

  Therefore, advantage must be taken of disaster situations to begin the process of disaster mitigation planning and implementation, even if this means that certain problems such as inadequate data have to be ignored in the short term.

* **Integrating the elements.** A continual need will exist to balance an effective risk reduction strategy - whilst integrating the various elements already identified.

  The order in which the measures are developed is of critical importance. Perhaps an ideal sequence would be: public awareness leading to political will, leading to management, leading to the parallel and interactive processes of drafting laws and the development or risk reduction measures. Finally training/education and cash incentives will be required to apply such measures.

  Most countries will have some of these elements already in place which may be highly effective. In this situation the strategy will be to develop other protection elements to support and build upon existing strengths, and begin the long process of constucting a mitigation measure which might not yet exist in any shape or form.

  Therefore, disaster mitigation should not concentrate on a single measure, but should adopt a multi-level approach involving a long time-scale.

* **Focussing on key areas where action is most needed.** The focus of the strategy will be on overall protection of an entire community and its property. However given limited resources and unequal patterns of vulnerability, the risk assessment and planning processes should identify priority targets for safety measures.

  This sharp focus should first be aimed towards the vulnerable poor. Secondly, it will be directed by certain criteria leading towards other priority targets such as:

  - the maxiumum number of people to be protected for given resources (i.e. protecting multi-occupancy buildings rather than individually occupied dwellings);

- 'lifelife services' (i.e. water, sanitation, medical facilities, communication systems etc);

- elements of long-term economic importance rather than short term (i.e. protect factories rather than shops);

- food stocks.

Therefore, prioritisation is an essential part of implementation of disaster mitigation strategies.

* **Building an effective management system.** An effective management co-ordination system is essential, but as the castle symbol suggests, management may well be self-defeating if it is based upon a hierarchial model which is unresponsive to community needs. Rather, implementation needs to be a balanced participatory system in order to relate to the diversity of levels of community and to governmental agencies in the various sectors, ministries and administrative structures.

  Therefore, effective co-ordination will embrace all the spheres of government, the private sector, non-governmental agencies and the concerned community.

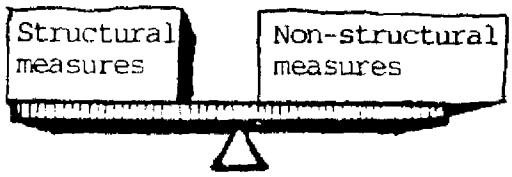
* Linking all disaster mitigation measures into normal practice. A successful strategy will be to 'lose' the risk reduction measure into normal practice. Put another way, risk reduction measures need to be absorbed intc the development programme of any hazard prone developing country.

  Architects, engineers, house builders, home owners and occupants in many developed countries have become so familiar with fire resistant building measures that they virtually cease to notice their existence. This may have the negative impact of creating a false sense of security, but in positive terms it means that fire protection has been absorbed into building practice and public awareness, causing a major but hidden reduction in vulnerability.

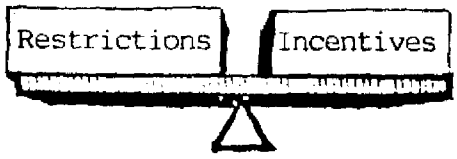
  A parallel of this process is to compare the way preventative medicine has been gradually accepted as a normal process of public health care in all responsible communities.

  Therefore, the aim in implementing preventative risk reduction measures will be to incorporate them into government structures, traditions, curricula, laws, training schemes, normal credit systems of financial incentives, political practices and public awareness.

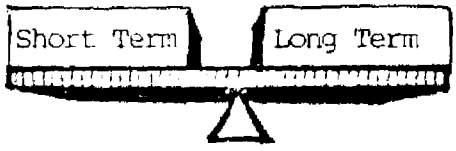
- **Maintaining a balance.** As has been repeatedly stated, mitigation is most effective when a variety of strategies are adopted (as the castle symbol of Fig. 5.1 indicated). In addition a diversity of implementation techniques are needed which will be indicated in the next section. These varied strategies and techniques should ideally operate in parallel. Therefore a subtle balance is needed between diverse forces rather than crossing a single course of action at the expense of another. The following five balances are typical examples:



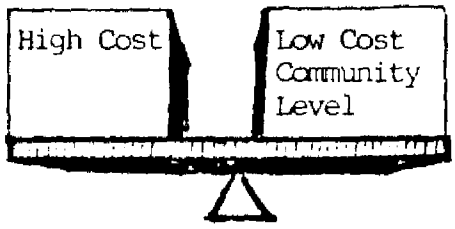
- Structural measures such as the actual strengthening of buildings against earthquakes balanced with a non-structural measure of training local builders to implement such techniques.



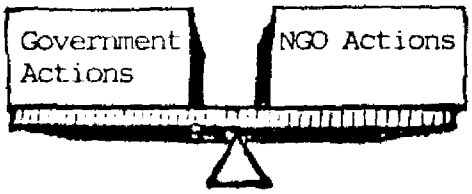
- Restrictions such as bye-laws or land-use controls balanced against incentives such as cash grants, tax remission to achieve safety, or for middle class and commercial targets the use of insurance.



- Short-term needs to achieve rapid results, such as building controls balanced against long-term needs like the developent of a comprehensive land-use planning system for all hazard-prone areas.



- High cost technical, or technological measures such as the development of a computer-based warning system balanced against the need to introduce low-cost community level measures that will be relevant to a non-technical, low-income public such as advice on the dangers of building homes on steep unstable slopes or on 'fill' within seismic areas or locations subject to landslides.



- Governmental actions such as the introduction of new seismic safety legislation balanced by activities undertaken by non-governmental organisations such as community based programmes to build flood walls to contain rivers to avoid damage to homes and settlements.

Therefore, an effective and carefully maintained strategy is likely to be a balance between many forces or activities, which may be in conflict with each other for funding support, or on account of their relationship to various government agencies or ministries.

Or, as can be seen in the above balances, the contrasts are between extremely varied criteria, which implies the need for well informed officials managing the mitigation process.

MITIGATION ACTIONS

Having adopted the strategy and tactics noted above, this section of the manual will address a number of practical actions that could result from this methodical approach. The focus will be maintained on building or building related measures. However, it is important to note that there are appropriate mitigation actions that can be followed in other sectors of environmental planning such as agriculture, forestry, soil stabilisation, fisheries and industry. But they all remain outside the scope of this project, with the exception of a brief reference to tree shelter breaks as they relate to the protection of human settlements.

THE IMPLEMENTATION OF MITIGATION MEASURES

1. Environmental Measures

These can be dividedinto two categories, firstly the environmental measures described below:

Environmental Measures that relate to the Safe Siting of Settlements

(See Figure 1 for a visual description)

Fig. 1. DIAGRAM INDICATING THE RANGE OF CERTAIN ENVIRONMENTAL PROTECTION MEASURES TO PROVIDE PROTECTION FROM CYCLONES, FLOODING, EROSION AND LANDSLIDE

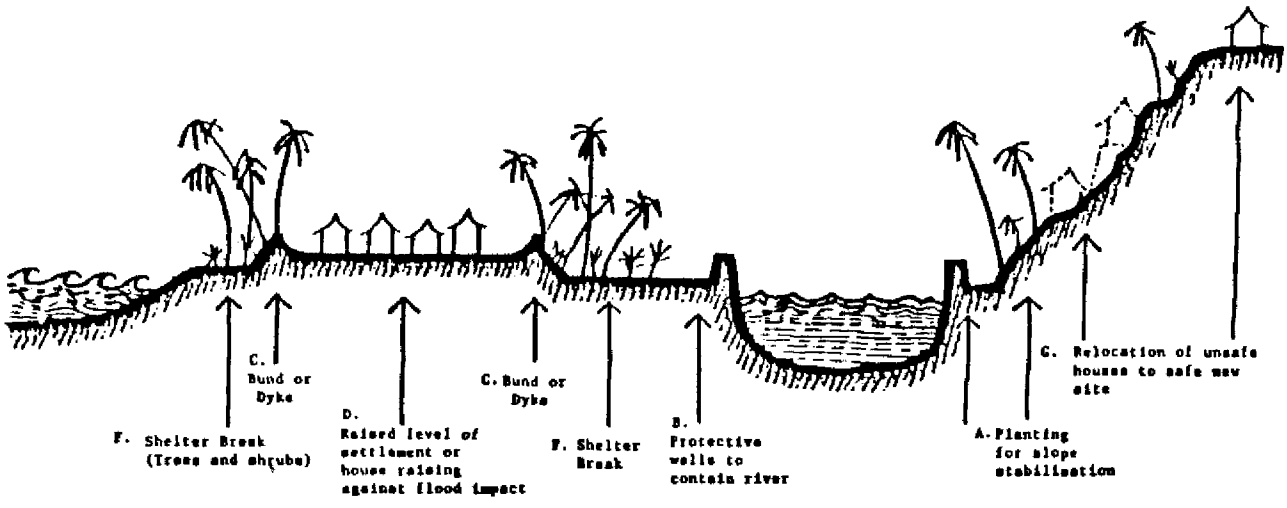
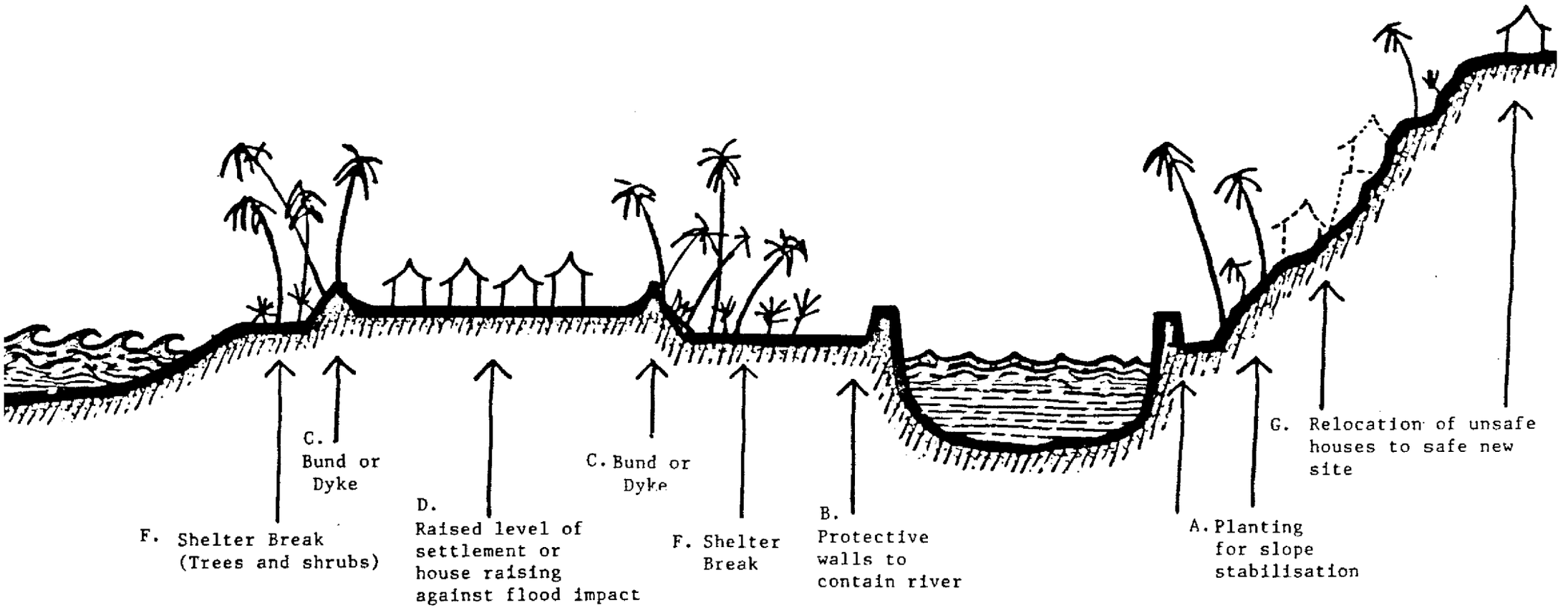


Fig. 1. DIAGRAM INDICATING THE RANGE OF CERTAIN ENVIRONMENTAL PROTECTION MEASURES TO PROVIDE PROTECTION FROM CYCLONES, FLOODING, EROSION AND LANDSLIDE



This diagram indicates the following typical measures:

A. Slope Stabilisation
(against earthquake induced landslides, rain induced landslides, erosion, mudslides, etc.)

B. Protective walls to contain rivers
(against slow-rising and flash flood impact).

C. Protective bunds or dykes
(against flood or cyclone induced coastal surges).

D. Raising the level of settlements or individual house units
(against flood impact, cyclone induced coastal surges or tsunamis).

E. Flood control measures
(these include land drainage, water storage, warning systems, water flow controls).

F. Planting of shelter breaks
(against cyclone force winds by varied tree or shrub planting measures).

Note: Planted shelter breaks against cyclone wind speeds will be of two types, firstly a belt along exposed coastal areas of up to several hundred metres wide to break up the severe force of winds and also to stabilise sandy soils against erosion caused in storm surges, and also circular planting belts surrounding entire exposed settlements. The circular form is essential due to the rotation of cyclone winds there will be no obvious prevailing direction of winds. (This is the reason why the shelter break appears twice on Figure 1.)

G. The relocation of settlements

This is an option in certain severe situations but there will be strictly limited opportunities to relocate particularly unsafe settlements at risk from all types of hazard. (See page 46, item 4.2 - Relocation of settlements in Shelter after Disaster, UNDRO, United Nations 1982, for a fuller treatment of the relocation issue.)

2. Building Safety Measures

These are related to three diverse contexts:

(1) Reconstruction planning
(2) New building within hazar-prone areas
(3) The existing building stock.

The first reconstruction context is the easiest option to apply in view of the availability of funds and high political necessity to take appropriate and tangible action to rebuild. Normally it is not difficult to incorporate safety measures into this process.

The second 'new building' context is never an easy path, but is can occur particularly in the aftermath of a disaster when there is a high level of sensitivity to the need for improved safety to people and structures.

The third 'existing building stock' context is formidable in the scope and scale of what is required. Existing buildings/settlements may be regarded as perhaps 95% of the problem in most countries whilst categories (1) and (2) may together constitute as little as 5%. Therefore selected targets need to be identified by adopting a stong prioritisation poilicy that will start with'lifeline buildings (see page 52.)

CONTEXT 1

Reconstruction Planning

Reconstruction offers thebest'environment' for the introduction of new safety measures. The measures described in the subsequent sections can be uniquely introduced at this time. However, there are two major conflicts to note;

- The frequent conflict between FAST and SAFE reconstruction.

- The necessity to balance the forces of REFORM (which should always include safety measures) with the even more powerful forces of CONSERVATISM, where authorities and citizens desire to replicate theexisting settlement.

Evidence would suggest that the forces of reform and conservatism need to be carefully balanced since the demands of safety (or urban improvements that don't relate specifically to hazard reduction) are obviously essential. But in addition the equally potent demand for cultural continuity is a necessity for the community in order to retain the image of the previous destroyed or damaged settlement, in the rebuilt environment.

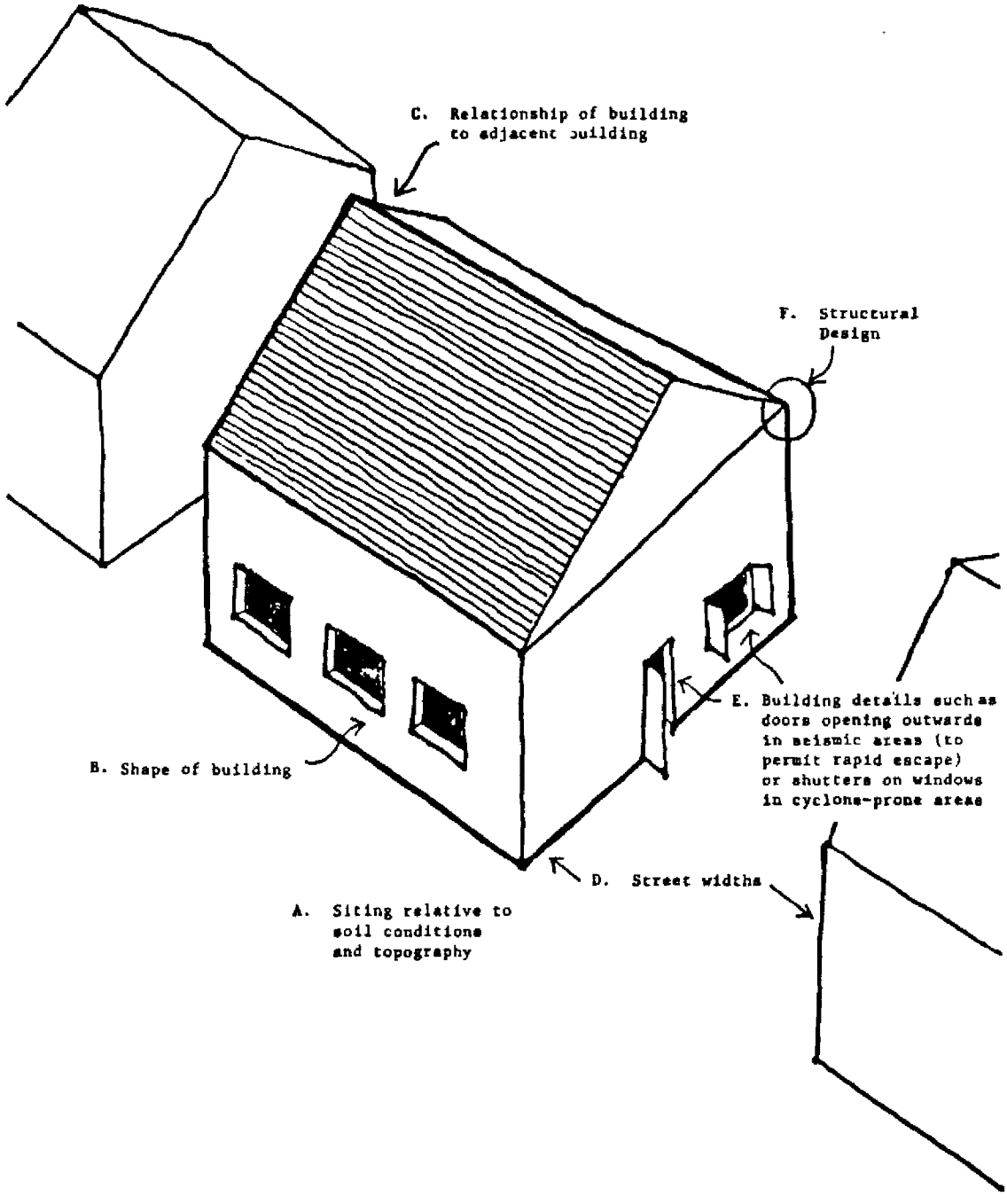
For further information on the opportunities in reconstruction planning to introduce mitigation measures, see item 4.1 'Reconstruction: The Opportunity for Risk Reduction and Reform', pages 39-45, Shelter after Disaster, UNDRO, United Nations, 1982.

CONTEXT 2

New Buildings within Hazard-prone Areas

The new building work can be in the reconstruction context (as noted above with its special considerations) or within the normal process of new development (see Fig. 2 for a diagramatic representation of the measures to achieve safety).

Fig. 2. SUMMARY OF MEASURES TO ACHIEVE SAFETY IN THE DESIGN OF NEW BUILDINGS



SUMMARY OF SAFETY FACTORS

A. Hazard Resistant Siting

This will relate to soil conditions, topography, avoidance of unstable slopes, seismic faults, proximity to flood-prone coastal or river situations.

B. Configuration of Buildings

This relates to two factors, firstly that of urban form and the proximity of one building to another, and secondly to the shape of a building relative to hazard impact. For example, certain shapes of buildings (rectangles) have a higher seismic resistance than other

forms (L shaped or E shaped structures). In a similar manner the configuration of buildings is vitally important in cyclone-prone areas.

C. Relationship of Building to Adjacent Buildings

In earthquake, landslide, and cyclone hazards one building can severely damage another as it moves, collapses or as debris is blown from it to another structure. Therefore the proximity of one building to another is highly critical, and it will vary according to the specific hazard. Inevitably this factor raises a conflict in areas of high density such as squatter settlements where every available square metre of land is developed. In new zoning controls it is essential to incorporate requirements that control building relationships, with specific advice on the spacing of buildings.

D. Street Widths

A related issue to the proximity of buildings is a concern to preserve street widths to approximately twice the height of buildings. This requirement is for two reasons, firstly in the case of earthquake impact falling debris will pose less of a hazard in wide streets, rather than very narrow ones for people who have managed to escape from their homes. Secondly, if streets are two narrow it is always a major problem for emergency vehicles (ambulances, fire engines, etc) to gain access for rescue or fire-fighting purposes.

However, it is pragmatic to recognise the conflicts in this advice in hot climates where shade is needed or in high density zones where wide streets diminish already meagre land holdings.

E. Building Details

The development of behaviourial studies of occupants of buildings during disaster impact is revealing important data on such matters as the most effective escape routes, whether external doors do need to open outwards in seismic areas, etc. In addition, window and shutter details are critically important in areas subject to high winds in order to avoid a building's roof being blown off by internal pressure.

F. Structural Design

There are obvious design implications in creating structures to resist the impact of abnormal seismic, wind or flood water forces. Whilst knowledge is well established for high investment building technology (engineered structures) there are extensive vernacular building traditions where there is very limited knowledge of precise structural safety requirements. This is an appropriate target for research and development initiatives.

CONTEXT 3

Existing Building Stock

Attention to this category can involve physical measures as well as planning measures. (See Fig. 3 for a summary of measures to achieve safety in the improvement of existing structures.)

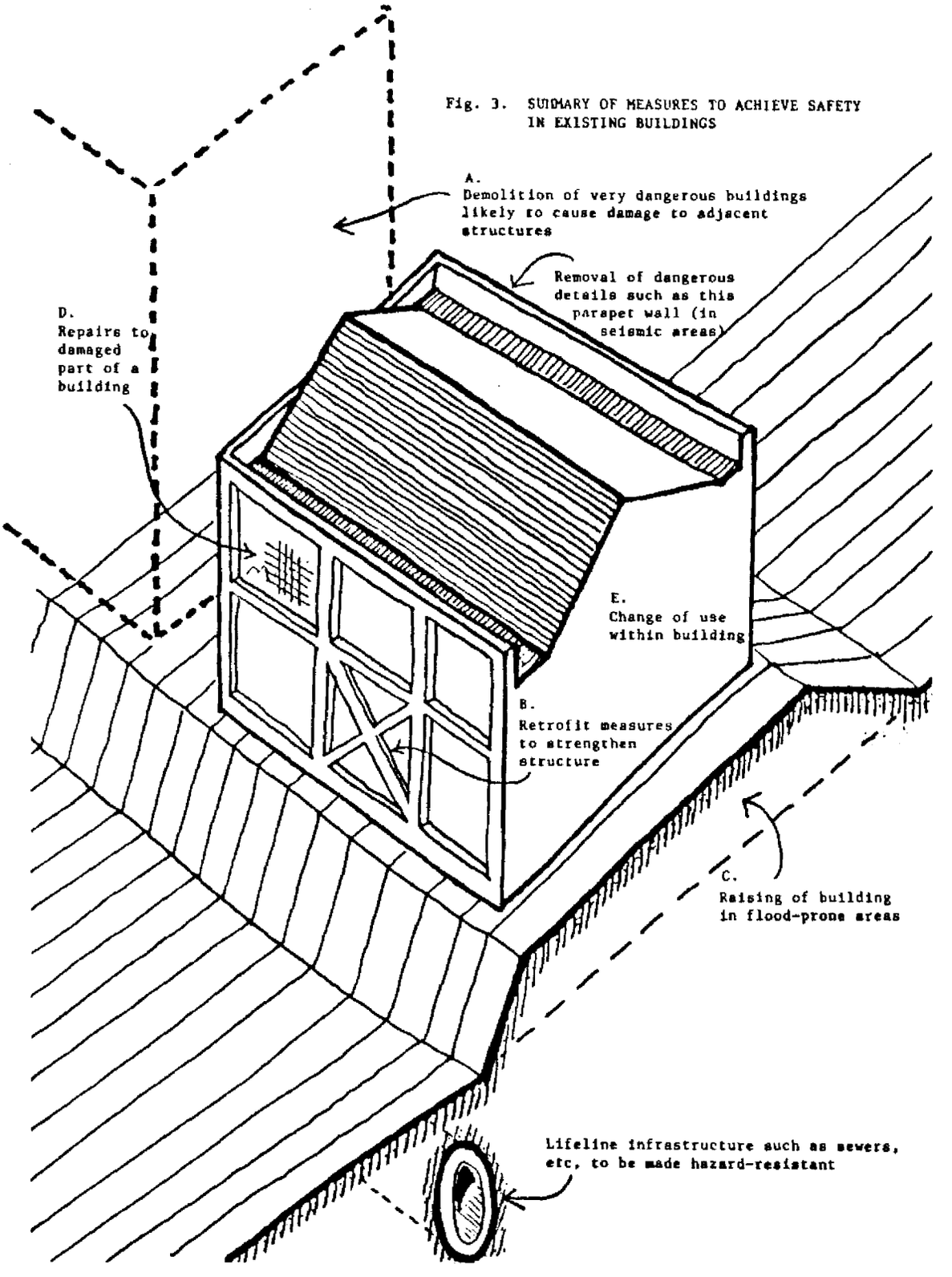


Fig. 3. SUMMARY OF MEASURES TO ACHIEVE SAFETY IN EXISTING BUILDINGS

PHYSICAL MEASURES

A. Demolition of Unsafe Buildings

In certain instances where buildings have been severely damaged in a disaster, where they are highly vulnerable, or where they are a lifeline installation, demolition may be the only appropriate solution. However, given economic realities this will be a rarely used option.

Demolition may relate to specific unsafe building elements, such as unbuttressed parapet walls, tall unreinforced chimneys, etc.

B. Retrofit

Structural measures will neet to be adopted. Typical examples of this process in a seismic region could be to remove dangerous parapet walls, or to insert structural measures such as sheer walls or triangulated bracing. In areas subject to high winds, measures could include strengthening the roof structural connections, installing shutters on all windows, and in buildings within surge areas to modify the substructure so that all supporting walls are at right angles to the flow of flood waters.

In view of the vast cost in strengthening all buildings against hazard impact it is necessary to be highly selective and a subsequent topic - 'Lifeline Measures'(see below) will address the issue of establishing priorities.

C. House Raising

In flood-prone areas it may be possible to rebuild a house on a raised base. (This is particularly appropriate for timber frame structures.

D. Repairs

A neglected area of the subject is the need to repair damaged structures in a safe manner. Specialist advice will generally be needed here since damage will weaken a structure that may be highly vulnerable to future hazards. Therefore repairs will be needed that are structural rather than cosmetic.

PLANNING MEASURES

E. Change of Use

Following a structural analysis of buildings, certain vulnerable structures may need to change their patterns of use. For example, a warehouse, with minimal occupation may replace a workplace with multiple occupation.

In all the above actions to reduce risks a recurring theme has been the need to develop priorities, both in new building and more specifically in attention to the existing building stock. Therefore the following topic can relate to all three contexts of Reconstruction, New Building and the Existing Building Stock.

LIFELINE MEASURES AND GOVERNMENT MODELS OF SAFE PRACTICE

A priority focus of governments will be on the safety of roads, bridges, water supplies, sewage systems, electrical and telephone services, and strategic buildings such as radio/TV stations, medical buildings, police stations, buildings of public assembly, schools, etc.

OUTPUTS FROM IMPLEMENTATION

The output of an effectively implemented risk reduction strategy is protected lives and property, increased local self-reliance, and an

educated population able to plan itself to reduce its vulnerability to future disasters.

But in much more specific terms effective implementation will apply with a sharp focus to certain lives that are particularly at risk, and on property that a given community cannot afford under any circumstances to lose. This will be the minimum standard of protection, but above this, as the strategy expands, it can embrace all areas of life.

In very few countries the development of protection will need to 'start from scratch' - with minimal measures in place. In most countries (whether industrialised or developing) some of the measures listed here and in the full Manual will already exist - but they may need to be developed.

What is needed is a long time perspective, recognising that it may take at least 50 years to implement measures step by step to build up a strong 'castle' of integrated risk reduction.

But to reach the end of this road requires the first step to be taken. That is where this Executive Summary, and the full Manual, will provide both the map for planning that route and certain key information on the necessary technical details for building a sound, long-lasting and socially responsive approach to disaster mitigation.