PRO-POOR INFRASTRUCTURE PROVISION

2 Disaster Management

DFID Department for International Development

This *Key Sheet* series is designed to brief government and donor staff involved in providing infrastructure facilities and services intended to benefit poor people. The sheets focus on the links between cross-cutting development issues and decision making. The series covers five topics:

1. Decentralisation
2. Disaster Management
3. Land Tenure
4. Social Exclusion
5. Employment

The aims of 'pro-poor' infrastructure provision are two-fold:

- to meet the basic service needs of poor people; and
- to contribute to improved livelihoods for poor people by enabling them to participate more fully in the economic, cultural and political institutions of society.

Pro-poor infrastructure includes both providing new facilities and related services to poor people, and improving the accessibility of existing facilities and services. Issues of design, pricing, and access rights are important.

These *Key Sheets* focus on shelter and buildings, water and sanitation, and transport. Energy and information and communication technologies can also be important.

Each *Key Sheet* provides an overview of the topic, then highlights the key issues in decision-making, illustrated by practical experience from Africa, Asia and Latin America. Key literature, websites and sources of expertise are given at the end of each sheet.

THIS KEY SHEET discusses the relationship between disasters and their management and pro-poor infrastructure provision. It focuses on natural and technological disasters, which raise a specific set of issues for infrastructure provision, and excludes conflict and disease, for which many of the issues discussed here are not relevant.

A *disaster* occurs when a *hazard* affects societies and economies to such an extent that they are unable to function normally. Natural hazards include events that have a rapid and instantaneous impact but are normally relatively short lived, such as floods, bush fires and earthquakes. They also include slower-onset events whose impacts are more gradual, such as drought and arsenic poisoning of groundwater. Industrial disasters can occur when technological processes or systems become unmanageable, e.g., chemical accidents and fires.

Disaster vulnerability and poverty

Whether or not the outcome of a hazard event is a disaster depends on people's *vulnerability* – their capacity to anticipate an event, cope with its consequences and recover. Vulnerability is determined by a range of factors, including population growth and density, the extent of unplanned urbanisation, the nature of physical assets and economic activities, and the state of the environment. The nature and scale of potential disaster losses is in constant flux, as human actions constantly alter vulnerability at the household and macroeconomic levels.

Disasters are no longer described as 'acts of God', impossible to anticipate or prevent. Recognition of the role of socio-economic factors is important and underlines the fact that technical solutions – appropriate siting, design and construction of infrastructure – are necessary but not sufficient. Vulnerability can be reduced significantly by, for example, adaptive livelihood strategies, careful and comprehensive emergency planning, and adequate response capacity.

Poverty and vulnerability to disasters are linked and mutually reinforcing. Poor and disadvantaged groups are usually the most vulnerable to and affected by disasters. Disasters, in turn, are a source of transient hardship and distress and a factor contributing to persistent poverty.

At the household level, poverty is the single most important factor determining disaster vulnerability, in part reflecting location of housing (e.g., on floodplains, steep slopes or contaminated land), primary types of occupation and limited access to financial and other resources. The poverty-exacerbating nature of disaster vulnerability is attributable not only to post-disaster related damage, temporary loss of income-generating opportunities and increased indebtedness, but also to deliberate risk-averting livelihood choices that poorer households may make. Poorer households may choose to forego the potential benefits of higher yielding crops in favour of more hazard-tolerant ones

Box 1
Types of disaster losses

As well as causing casualties and damaging buildings, disasters can affect normal productive activities and timely delivery of relief and rehabilitation supplies, through disruption of transport, telecommunication systems and energy supplies. They can also damage sewerage systems and water-supply networks, potentially resulting in increased water-borne disease.

Disaster losses are conventionally categorised as:

- **direct costs** – physical damage and destruction of capital assets, including social infrastructure and livelihood assets;
- **indirect costs** – knock-on disruption to the flow of goods and services (e.g., disruption of livelihood activities and outputs). This can have far-reaching consequences economically and socially;
- **secondary effects** – short- and long-term impacts of a disaster on the overall economy and socio-economic conditions (e.g., fiscal and monetary performance, levels of indebtedness, types of livelihood activity, the distribution of income, and scale and incidence of poverty). Disasters can also have long-term environmental effects.

Box 2
The role of Environmental Impact Assessment in disaster management

Environmental Impact Assessment (EIA) provides a framework for assessing the environmental impact of projects at their concept stage. It normally includes a detailed risk assessment. This process is established good practice and an integral part of most multilateral and bilateral donors' as well as governments' planning for infrastructure investment.

EIA plays an important part in identifying technological hazard risks and ensuring that appropriate measures are taken to prevent accidents. Where required by regulatory regimes (e.g., in the European Union for major industrial facilities), EIAs also include the development of a 'safety case', integrating safety concerns at stages of design, construction and operation.

Standard EIA guidelines include assessment of the potential impact of projects on natural hazards, but not vice versa. In consequence, natural hazard risks are often poorly managed or ignored. A more comprehensive approach to risk assessment would help both to strengthen resilience and to facilitate quicker, more effective post-disaster recovery.

which give more stable and secure but, in most years, lower earnings. In other circumstances, they may choose to accept risk in order to increase income – for instance, by continuing to farm on the slopes of active volcanoes.

Economic growth may not solve problems of disaster vulnerability. Instead, poor and disadvantaged groups can become differentially vulnerable. There may be breakdown of traditional familial support, declines in traditional coping measures, and increased occupation of more dangerous land. Without careful attention to needs assessment and design, increased provision of infrastructure and services can increase disaster vulnerability. For example, the construction of arterial roads from rural to urban areas can induce shifts in cropping patterns towards more marketable but less hazard-tolerant crops. It can encourage the movement of able-bodied people, leaving rural communities with insufficient labour to maintain community emergency defences and mitigation structures (e.g., dykes).

Recent trends
In recent decades there has been an escalation in the incidence of severe disaster events in both the developed and developing worlds. This has been in part due to a rise in vulnerability. Climate change is also believed to be increasing the frequency and severity of droughts, floods and cyclones.

The increased incidence of major disasters and the associated rise in the cost of post-disaster reconstruction efforts has forced the issue of risk management up the policy agenda of affected governments as well as of multilateral and bilateral donors and NGOs. Hazards are increasingly recognised as a potential threat to both sustainable development and poverty reduction initiatives.

Key issues in decision making

The following sections outline options for reducing vulnerability to disasters through appropriate planning, regulations, technical design, and delivery of infrastructure provision. The final section outlines options for ensuring that the response of infrastructure providers to post-disaster emergencies is appropriate to the needs of poor people.

Reducing vulnerability to disasters requires planning and capacity, and involves process and attitude as well as technology. High or increasing vulnerability is not inevitable. Appropriate needs assessment and design of infrastructure services can play an important role in mitigating vulnerability, for example as part of an expanded Environmental Impact Assessment process (see Box 2).

National policies and planning
- Take account of hazard risks in the determination of infrastructure priorities, policies and strategies. Strategic EIA already provides a tool for incorporating environmental impacts, including technological risk, into this process; analysis of natural hazard risk is also needed. This process requires strong institutional support and the involvement and commitment of governments, aid agencies and civil society. Political commitment is also needed at national and local levels to address longer-term risks (e.g., earthquakes).
- Involve engineers and other infrastructure service-providers in decision-making processes, ensuring that they are adequately briefed on the nature and particular requirements of the task.
- Undertake periodic vulnerability assessments, both nationally and at community level, in recognition of the dynamic and continuously evolving nature of vulnerability.
- Assess potential problems as well as benefits of disaster risk-reduction initiatives (see Box 3). This could be as part of an expanded EIA process. Investment in mitigation measures may alter but not reduce vulnerability (e.g., large-scale flood banks can damage drainage systems). Negative socio-economic consequences (e.g., displacement of communities) should be assessed.

- Develop water policies that promote sustainable extraction (see World Bank Poverty Sourcebook chapter on water) and allow adjustments in take-off or release of water dependent on seasonal forecasts. This may require changes to price tariffs for water and associated hydroelectric power (see Poverty Sourcebook chapter on energy) to encourage more rational use of resources.
- Develop policies that promote sustainable management of fuelwood (which should occur as much as possible at the community level) (see Poverty Sourcebook chapter on energy) in order to reduce deforestation. Policies should also encourage exploration and development of other forms of energy.
- Encourage the private sector, communities and individuals to consider the hazard risk implications of their own actions, both for themselves and for wider society. Vulnerable groups may need education and support to do this, particularly in areas exposed to a number of different hazards.
- Encourage the insurance industry to reduce catastrophic insurance premiums to domestic property and commercial policyholders who have implemented sufficient structural mitigation measures (e.g., hurricane shutters and roof connectors)

Regulatory framework

- Draw up and enforce land use zoning. This should delineate land use (e.g., location of buildings, roads, storage of fuels) according to the level and nature of localised risk, and with the objective of making sufficient safe land, located near to places of work, available to the poor. Mapping and zoning exercises should be undertaken as participatory processes, involving local communities and taking the specific activities and needs of poorer groups into account.
- Draw up and enforce appropriate building codes, and update them periodically to reflect technological advances. These should include options for low-cost, self-built housing. Sound design codes developed elsewhere (e.g., the New Zealand, Japanese or Californian building codes for construction in earthquake zones) can offer a good starting point. However, building codes based on those developed for other countries should be adapted to reflect local factors, including types of risk, commonly available building materials, and climatic and cultural factors. The Gujarat earthquake in January 2001 underlined the need to eliminate ground-floor ‘soft storeys’ (car-parking areas with slender pillars) in buildings located in earthquake zones.
- Disseminate awareness-raising leaflets on building standards to the general public, including sections on the potential dangers of unauthorized extensions to buildings (e.g., adding additional floors).
- Explore different ways of enforcing regulations, as this can be a problem in certain contexts, e.g., where levels of economic development and government capacity are low, and in informal settlements.

Infrastructure design and operation

- Brief engineers and building professionals on the particular disaster vulnerability of poor people, and how their needs can be taken into account in the design and provision of infrastructure services.
- Assess risks at the concept stage of all potential investment projects, including cost–benefit or related analyses that examine the vulnerability implications of alternative qualities and strengths (e.g., adequate drainage of roads). As part of this process, it is necessary to decide the design event that the investment is intended to withstand (e.g., a 1-in-50 year flood).
- Assess the hazard risk-mitigation properties of traditional designs, building techniques and materials. Incorporate useful, safe local designs and practices into building codes (see Box 4), but regularly assess the implications of any major changes in risk (e.g., as caused by climate change).
- Draw on other countries’ experience with developing safe designs. Design solutions can often be transferred between

Box 3
Flood control in Bangladesh

In 1987 and 1988, Bangladesh experienced serious floods, causing extensive damage. A Flood Action Plan was begun to find a solution to the country’s chronic flood problem.

However, by 1994 the Flood Action Plan had not resulted in the construction of any embankments. Moreover, it was the subject of much criticism and concern, partly reflecting the compartmentalisation of knowledge and interests between the contending groups. Engineers responsible for planning and implementing flood control works were primarily concerned with technical aspects, while environmental groups inside and outside Bangladesh strongly opposed the action plan, asserting that proposed structural interventions would have serious impacts on wetlands and biodiversity. Other criticisms included the serious impact that existing embankments had had in reducing floodplain fisheries production, a vital source of animal protein to the poor. It was also revealed that many existing flood-control schemes had low or even negative rates of return. The best returns had been achieved by smaller schemes with more modest environmental management objectives, such as submersible embankments for *boro* season rice and some coastal schemes.

The broad strategy now emerging in Bangladesh is to prioritise protection of concentrations of people and high-value assets in urban and peri-urban areas. There is also increasing emphasis on the transfer of systems management to beneficiaries, and proposals to introduce beneficiary responsibility and cost contributions.

Sources: Brammer, H. (2000)
Benson, C and E.J. Clay (2002)

Box 4
Traditional building technology and disaster management

Following an earthquake in Peru in 1990, an NGO began a housing reconstruction project using an improved form of traditional local building technology. An earthquake the following year demonstrated the ability of the houses built under the project to withstand earthquakes, resulting in increased adoption of the technology.

countries with minor modification (see Box 5).

- Invest in structural mitigation measures (e.g., dams, dykes) where these are proven to reduce risk, supporting small-scale community initiatives as well as major public works. But bear in mind that these can encourage movement of people, businesses, and assets into high-risk areas.
- Locate and design essential services, critical facilities (fire-fighting, police, shelters, power generation) and infrastructure (bridges, highways, airports, rail systems) so that they can be maintained after a disaster, to support both immediate relief efforts and reconstruction and rehabilitation.
- Make basic, good-quality training in construction skills, methods and standards widely available.
- Collate and disseminate case studies of both successful and less successful mitigation initiatives, covering different types of projects, efforts and community actions, their application in varying contexts, and the factors influencing their level of success.
- Collate and disseminate examples of cost-benefit and related analysis of risk-management measures. Hard choices have to be made about levels of mitigation investment, relating both to dedicated infrastructure and the standard to which other facilities (e.g., jetties, wharves and other port facilities) are hazard-proofed. Also tradeoffs between the quality and quantity of infrastructure provision (e.g., lower quality roads are cheaper to build but could be far more damaged in the event of a flood). In reality, however, natural hazard risks are often simply ignored rather than options for mitigation explored. Better knowledge and appreciation of relative costs and benefits could help encourage improved risk management practices (see Box 6).
- Get engineers with specific experience in structural hazard mitigation and knowledge of local natural hazard risks in the project area to review individual project designs.
- Ensure adequate operation and maintenance of both structural mitigation measures and other infrastructure (e.g., roads, drains) to enhance hazard resistance, including initiatives to promote community capacity and responsibility.

Emergency response

- Strengthen infrastructure aspects of government, NGO, private sector and community emergency preparedness capacity, including emergency contingency plans, early warning and evacuation systems, training of personnel and stockpiling of supplies.
- Maximise local sourcing of labour and resources in reconstruction efforts (perhaps phased in as communities begin to overcome their trauma). Labour-intensive techniques may provide the poor with income-earning opportunities, supporting them in the recovery process.
- Undertake careful planning and design of the reconstruction process, exploiting opportunities presented by a disaster to reduce future vulnerability, take advantage of new technologies and help meet community needs, rather than simply replacing like with like as fast as possible. This process should include participatory planning exercises and an assessment of the livelihood implications of proposed changes.
- Encourage appropriate financial contingency planning, such as the setting up of disaster funds or some form of insurance, to strengthen government and private-sector capacity both to spread the costs associated with disasters over time and to recover effectively. With increased resources of their own, governments will also have greater capacity to set their own priorities in the management of relief and rehabilitation operations. It will also minimise the extent that post-disaster assistance displaces planned infrastructure projects.

Box 5
Transfer of technology for disaster management

Research on Californian stucco design and wire-mesh cladding to provide earthquake resistance to existing buildings is of direct relevance to many developing areas, particularly Latin America, where modern stucco construction is a stylistic development of traditional techniques.

Websites and expertise

- Discussion forum for alternative perspectives on vulnerability reduction: www.anglia.ac.uk/geography/radix
- Natural Hazards Center at the University of Colorado, Boulder, Colorado: www.colorado.edu/hazards/
- ProVention Consortium: www.proventionconsortium.org
- UNDP Emergency Response Division, Disaster Reduction and Recovery Programme: www.undp.org/erd/disaster.htm
- UN International Strategy for Disaster Reduction: www.unisdr.org/
- World Bank Disaster Management Facility: www.worldbank.org/dmf/
- World Bank *PRSP Source Book*: www.worldbank.org./poverty/strategies/chapters/

Box 6
USAID/OAS Caribbean Disaster Mitigation Project

In 1993 the United States Agency for International Development (USAID) and the Organization of American States (OAS) launched a Caribbean Disaster Mitigation Program. Activities under the project included promotion of hazard-resistant building practices and standards, and a retrospective analysis of public and private projects in the Caribbean that have suffered damage from tropical storms.

One of the principal lessons was that disaster mitigation is difficult to sell to politicians who believe 'Our nation is too poor to afford the required standards.' The challenge of this and similar programs is to demonstrate that it is cost-effective to invest in mitigation of natural hazards.

One of the projects studied was a deepwater port in Dominica constructed to handle exports and imports more efficiently. One year after completion, hurricane David hit the port, requiring restoration/reconstruction work equivalent to 40% of the original cost. Building the facility to a higher standard, able to resist David-force winds, would have added only 12% to the original construction cost. This shows clearly that incorporation of hazard and vulnerability information into the earliest stages of project design or reconstruction is essential to ensure both hazard resilience and lowest costs over the life of the project. But there can be problems with the use of incorrect or inadequate hazard information and when designers are pressured to maintain the lowest possible construction cost.

Source: www.oas.org/en/cdmp/

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These Key Sheets have been produced by the Overseas Development Institute on behalf of DFID.
They are available on the Internet at: www.odi.org/keysheets/

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April 2002