

# Damage, Loss and Needs Assessment Guidance Notes



3

Volume 3

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# Estimation of Post-Disaster Needs for Recovery and Reconstruction

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## Preface

Over the past years, both frequency and impact of disasters have been increasing worldwide. In the first decade of the new millennium a string of severe disasters hit countries on all continents. Most notable were the 2004 Indian Ocean earthquake and tsunami which claimed over 250,000 lives, the Haiti Earthquake which killed over 220,000 people and caused an economic impact equivalent to 120% of GDP, floods in Pakistan affecting 20 million people, but also additional earthquakes in Indonesia, floods and droughts throughout Africa, heat waves and fires in Europe, hurricanes in Central America, the Caribbean and the United States, and landslides triggered by typhoons in South East Asia.

The social impact of disasters is highest in developing countries, where poor populations are most vulnerable and least resilient. Economic impact of disasters amounted to 63 billion USD in 2009. By the turn of the century, damages from weather-related hazards can triple to \$185 billion annually, without taking climate change effects into account. Factoring in climate change could then add another \$28–\$68 billion from tropical cyclones alone, according to *Natural Hazards, Unnatural Disasters: The Economics of Effective Prevention*, a joint World Bank–United Nations publication, released in November 2010.

In order to reduce vulnerabilities of the natural and built environment, the understanding of the social, economic and financial implications of disasters is becoming a priority for governments. The Damage, Loss and Needs Assessment (DaLA) methodology, developed by the Economic Commission for Latin America and the Caribbean (ECLAC) in the 1970s, has evolved as a globally recognized and applied tool to quantify the impacts of disasters, and to determine the necessary financial resources to achieve full reconstruction and recovery. Consistently using this methodology identifies the socio-economic impact of any given disaster, as well as the exposure of sector assets. It also reinforces resilience by promoting the “Build Back Better” principles in reconstruction and recovery efforts.

The DaLA guidance notes presented here build on ECLAC's methodology. They aim at operationalizing the concepts for practitioners at government agencies, the World Bank and other national and international organizations, responsible for assessing the impact of disasters, and for developing recovery and reconstruction plans. Furthermore, the DaLA guidance notes expand the original ECLAC methodology by describing how to estimate recovery and reconstruction needs.

The guidance notes comprise three volumes i) Guideline for Task Team Leaders (TTL) in the Design and Execution of a Damage, Loss and Needs Assessment, ii) Conducting Damage and Loss Assessments after Disasters, and iii) Estimation of Post-Disaster Needs for Recovery and Reconstruction. Volume I, the guideline for Task Team Leaders, aims to facilitate the work of TTLs by providing the framework for conducting the assessment. It offers templates for sectoral TORs, survey questionnaires and other useful tools, and it describes in details how to plan, organize and carry out an assessment. Volume II guides the sectoral assessment team through the steps of conducting a Damage and Loss Assessment, and includes sample templates for determining damage and losses in each sector. It describes simplified procedures for estimating the value of destroyed physical assets and of changes or losses in the flows of the affected economy. Volume III illustrates how to derive the financial needs for recovery and reconstruction. This is done following a sector by sector damage and loss assessment, which itemizes distribution and priority setting based on geopolitical divisions, sectors of the economy, and different population groupings in the affected area. It also explains how to formulate a calendar of investments and to identify distribution channels for funding.

The guidance notes were commissioned by the Global Facility for Disaster Reduction and Recovery (GFDRR) of the World Bank. Building national capacities in disaster risk management and in post disaster impact assessment is a high priority for GFDRR, reflected in the cooperation agreement of the UN, EU and World Bank for conducting post-disaster needs assessments. Since 2006, GFDRR (a partnership of 36 countries and six international organizations committed to helping developing countries reduce their vulnerability to natural hazards and adapt to climate change) has been instrumental in assisting countries to incorporate risk reduction in development strategies, and in providing ex post disaster response through three financing tracks: (a) Track I, which promotes partnerships for advocacy and awareness-building; (b) Track II, which mainstreams DRR into country strategies, and finances analytical work and project preparation for disaster prevention and risk financing; and (c) Track III, which provides post-disaster needs assessments at governments' request, in collaboration with the UN, the European Union, and other partners.

GFDRR has conducted over 20 post-disaster assessments in the last three years, in countries such as Bangladesh, Myanmar, Burkina Faso, Senegal, Central African Republic, El Salvador, Samoa, Indonesia, Philippines, Lao PDR, Bhutan, Yemen, Cambodia, Bolivia, Namibia, Moldova, Haiti and Pakistan, and others. In these assessments, GFDRR particularly promotes self-reliance through capacity building in high-risk countries, which includes DaLA methodology training and sensitization for governments and other functionaries. To further strengthen capacities and adapt the methodology to country-specific circumstances, the experiences of these assessments are reflected in the three volumes at hand and will continue to be incorporated into future versions of these guidance notes.





## Acknowledgements

These guidelines were developed as part of GFDRR's effort to increase the capacity of professionals and sector specialists in conducting post disaster damage, loss and needs assessments while applying the DaLA methodology for evaluating the social and economic consequences of disasters. The intention of GFDRR is to operationalize the Damage, Loss and Needs Assessment Methodology by building on the original ECLAC *Handbook for Estimating the Socio-economic and Environmental Effects of Disasters*. The guidance notes intend to contribute to the broad and consistent application of the DaLA methodology. They were prepared by Roberto Jovel, DaLA specialist with substantive country assessment experience. Mohinder Mudahar contributed to the development of guidance for the agriculture sector.

We are grateful for the inputs and comments of external and internal experts and practitioners, whose contribution was instrumental in completing these guidance notes. Based on their experience in damage and loss assessment and recovery planning, the guidance notes have been refined to ensure their applicability.

Special thanks go to Alicia Barcena, Executive Secretary of ECLAC, Ricardo Zapata and numerous other ECLAC colleagues for their continued support and collaboration throughout the process. ECLAC's deep institutional and practical expertise has been invaluable for the review of the guidance notes. We are also grateful to our colleagues at the World Bank who provided helpful comments on various aspects of these documents. We would like to highlight the contribution of Sofia Bettencourt, Lead Operations Officer and Wolfgang Fengler, Lead Economist, who served as peer reviewers, along with colleagues from ECLAC.

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Susanne Quigley was the principal editor. The cover design of the guidance notes were prepared by Hernan Gigena. The WB Office of the Publisher provided design, composition, and printing services under the supervision of Adrian Feil.

## **Acronyms**

BOP	Balance of Payments
CIF	Cost, Insurance and Freight
DaLA	Damage, Loss and Needs Assessment
DRR	Disaster Risk Reduction
ECLAC	Economic Commission for Latin America and the Caribbean
ERL	Emergency Recovery Loan
EC	European Commission
EU	European Union
FOB	Free-on-board
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
MDG	Millennium Development Goals
MIC	Middle Income Countries
NGO	Non-governmental Organization
PDNA	Post Disaster Needs Assessment
SIC	Sector Investment Credit
SIL	Sector Investment Loan
SME	Small and Medium Enterprises
ToR	Terms of Reference
TTL	Task Team Leader
UN	United Nations
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WB	World Bank



# **I. Introduction**

## **1. General Considerations**

The estimation of financial requirements to bring an economy and society back to at least pre-disaster levels of development—and preferably with disaster-resilient conditions—is of paramount importance for affected governments, societal groups, as well as for the international community that is willing to assist in recovery and reconstruction.

Post-disaster needs assessments are carried out to comprehensively and unitarily establish a quantitative foundation to estimate the amounts, priorities, conditions and targets of resource allocations. Contributions come from several sources, including the affected government, the development and commercial banking system, private sector entities, individuals, as well as other local and foreign development partners.

To achieve a comprehensive estimation of needs for recovery and reconstruction, an assessment of disaster effects, impacts and needs should be all-encompassing—it should cover all sectors of social and economic activities. To be fully credible and reliable, needs should be estimated on a solid quantitative basis of disaster effects and impacts. The estimation of financial requirements must be made so that the different actors or stakeholders clearly understand the manner in which they have been assessed (this includes presentation in appropriate language), enabling the assignment of scarce resources to the recovery and reconstruction activities.

Once the estimation of needs is complete, responding to an agreed-upon strategy of recovery and reconstruction, many subsequent follow-up actions begin. On the part of the government's ministry of finance, this includes allocating the required additional fiscal resources to the national budget. The finance ministry also launches representations with the national development bank and with private banking associations to establish concessional credit lines for private sector recovery and reconstruction. The ministry of planning modifies the national development plans to

include the required post-disaster recovery and reconstruction objectives, while the government manages representations with the international community to obtain additional resources—financial and technical—to supplement the national contributions.

The estimation of recovery and reconstruction needs, therefore, should encompass all sectors of social and economic activity that are directly or indirectly affected—at the national, sectoral and personal levels. The spatial distribution of needs and the timing for delivery should be defined, as do all targeted individual population groupings, including men, women, children and the elderly, since they have different vulnerabilities and, therefore, different needs. Special focus is put on the particular needs of communities within the spatial and sectoral resource allocations.

## **2. Background**

Based on the original methodology for damage and loss assessment developed by the United Nations' Economic Commission for Latin America and the Caribbean,<sup>1</sup> the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR) has produced a set of guidance notes to facilitate the conduction of post-disaster assessments that lead to the estimation of recovery and reconstruction needs.

These guidance notes have three main volumes: first, a set of guidelines for the Task Team Leaders (TTLs) of such assessments, describing the details on how to plan, organize and carry out these activities. Second, sectoral guidance notes that describe simplified procedures involved in estimating the value of destroyed physical assets and of changes or losses in the flows of the affected economy. The third volume is this present set of guidance notes for the subsequent estimation of financial requirements to achieve post-disaster economic recovery and reconstruction.<sup>2</sup>

Guidelines for the estimation of needs for disaster risk reduction and for adaptation to climate changes are not part of this work, and would be covered separately.

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<sup>1</sup> *Handbook for Estimating the Socio-Economic and Environmental Effects of Disasters*, United Nations Economic Commission for Latin America and the Caribbean (ECLAC), Santiago de Chile, 2003.

<sup>2</sup> Volume 4, under preparation, is covering the analysis of disaster impact on macroeconomic variables and on household and personal income.

These guidance materials are intended for use by World Bank staff, affected government officials and other international or national institutions and experts that are involved in conducting post-disaster assessments. While these notes describe standard procedures for assessing damage, losses and needs, it is recognized that no two disasters are alike, and that the procedures should be adapted to the actual conditions at hand.

The guidance notes are in fact a supplement to the on-going GFDRR training program for World Bank staff and government officials of high-risk countries on the subject of damage, loss and needs assessment, and are intended for actual field use. Expansion and improvement of these notes will provide an up-to-date tool to facilitate the quantitative and reliable estimation of disaster impact and post-disaster needs for economic recovery and reconstruction.

### **3. Conceptual Framework**

Any disaster may bring about two main types of effects on a society and economy: total or partial destruction of physical assets, and subsequent changes or losses to the economic flows in the affected area.

The following are the basic *definitions of disaster effects* that have been adopted as part of the methodology, based on the experience since 1972 when it was first developed and applied:

*Damage:* total or partial destruction of physical assets existing in the affected area.<sup>3</sup> Damage occurs during and immediately after the natural phenomenon that causes the disaster, and is measured in physical units (i.e. square meters of housing, kilometers of roads, etc.). Its monetary value is expressed in terms of replacement costs prevailing just prior to the event.

*Losses:* temporary changes in the economic flows arising from the disaster. Losses occur from the time of the disaster until full economic recovery and reconstruction have been achieved, in some cases lasting over several years. Typical losses include the temporary decline in output and higher production costs in the productive sectors

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<sup>3</sup> Disasters may cause destruction of different types of assets, including buildings, infrastructure, equipment and machinery, furniture and household goods, means of transportation and storage, irrigation and drainage works, etc. Volume 2 of the GFDRR Guidance Notes provides full details of physical assets that may be affected in each sector of economic activity.



of agriculture, livestock, fishery, industry, trade and tourism; lower revenues and higher cost of operation in services (education, health, electricity, water supply and sanitation, transport and communications), as well as the unexpected expenditures to meet humanitarian assistance needs in the emergency phase. Losses are expressed in current values.

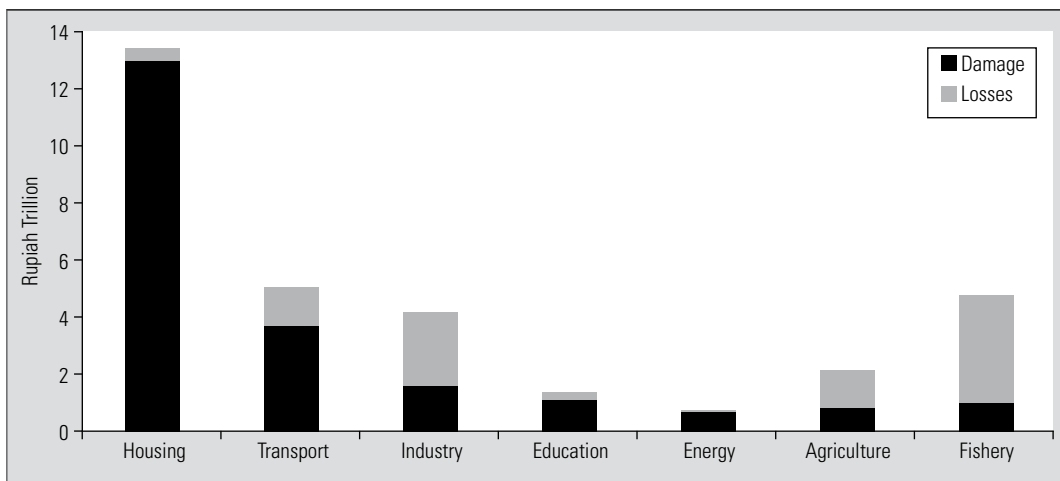
The quantitative estimation of damage and losses enables the analysis of *disaster impact* at different levels. At the macro-economic level, estimated sector-wide losses enable the determination of disaster impact on overall economic performance, in terms of temporary GDP growth modification. They also show the temporary negative changes in the balance of payments and trade, as well as in the fiscal position of the affected country. At the micro level, estimated sector losses are used to assess the decline in employment, and on personal or household income. Further refinements of disaster impact estimation enable the analysis of possible poverty aggravation due to the disaster.

Also, the quantification of damage and losses enables the estimation of financial requirements or needs to achieve full recovery of the economy—at the macro, sectorial and personal or household levels—and to reconstruct the destroyed and damaged assets. The value and the spatial, time and sectoral distribution of production losses are used to estimate the amounts required to achieve recovery of the economy; while the value and geographical and sectoral distribution of damage are used to estimate the financial requirements for reconstruction (see Figure 1.1 below).

The estimation of financial needs to achieve post-disaster recovery and reconstruction is based on an objective, quantitative and reliable estimation of the value of production losses and destruction of physical assets, and their breakdown by geographical areas, sectors of economic activity and focus on specific affected population groups.

Needs for recovery and reconstruction are estimated for both the public and the private sectors, since disasters affect the entire society and economy, and both these sectors will require financing. Some governments tend to concentrate on the needs for reconstruction of the publicly-owned destroyed physical assets, and often consider only the needs for recovery of publicly-owned economic activities. Since the public sector usually owns or manages only a relative small fraction of a country's economy, the practice previously described should therefore be discouraged, as it may lead to only partial post-disaster recovery and reconstruction and could leave out significant sectors and population groupings of the society.

**Figure 1.1 From Damage and Loss Assessment to Post-Disaster Needs:  
Aceh Earthquake and Tsunami, 2004**



Source: Bappenas and World Bank Report, 2005.

Note: Damage: indicates the efforts needed for reconstruction

Loss: indicates the efforts needed for recovery

Recovery program activities must be grouped together under specific sub-programs aimed at the restoration of personal and household income, restoration of basic services and lifelines, and the restoration and normalization of productive activities. Recovery activities should include interventions by the central and local governments, as well as by private sector entities.

The reconstruction program should be defined on the basis of a reconstruction strategy that, preferably under the “building-back-better” concept, will provide for quality improvement, technological innovation, the introduction of disaster resiliency through mitigation measures and, in some cases, relocation of strategic activities to safer areas. Whenever reconstruction requires more than one year, appropriate measures must be introduced to take into account the effect of multi-annual inflation.



## **II. Estimation of Recovery Needs**

### **1. General Considerations**

Disaster impact is assessed at the sectorial, macro-economic and personal or household levels, on the basis of the estimated values of production losses by sector. This impact assessment becomes the basis for financial requirements or needs estimations, that are non-subjective and quantitative, to ensure recovery of all economic and social activities.

In broad terms, economic recovery activities are essentially short- to medium term interventions designed to mitigate and shorten sectoral, macro-economic and personal or household disaster impact. Typical post-disaster recovery activities may include the following, which have to be tailored to the specific conditions of each case:

- Income generation schemes under the “cash-for-work” modality for the most affected population groups, especially applied to those individuals who are not credit worthy.
- Temporary shelter schemes for persons and households that have been rendered homeless.
- Education and health service rehabilitation and recovery activities, including provision of temporary facilities, disease outbreak prevention and control activities, etc.
- Rehabilitation of the basic services of water and sanitation, electricity, transport and communications.
- Re-initiation or reactivation of productive activities in agriculture, fishery, industry, commerce and tourism sectors, (providing inputs for crop re-planting; grants and soft-term credits for micro to medium-size enterprises, and temporary tax-relief measures for other enterprises).

As indicated earlier, some governments concentrate recovery only on those activities for which it has direct jurisdiction, and may leave out the last set of recovery activities listed above in the belief that the private sector has the capacity to recover productive activities on its own, (by resorting to insurance proceeds when available and/or to pre-disaster savings). This practice of

partial coverage of recovery needs should be discouraged to avoid very slow or limited economic recovery. Instead, governments should be reminded and encouraged to focus on private sector recovery as well, especially on informal or micro-level activities, in order to promote overall and fully inclusive economic development.

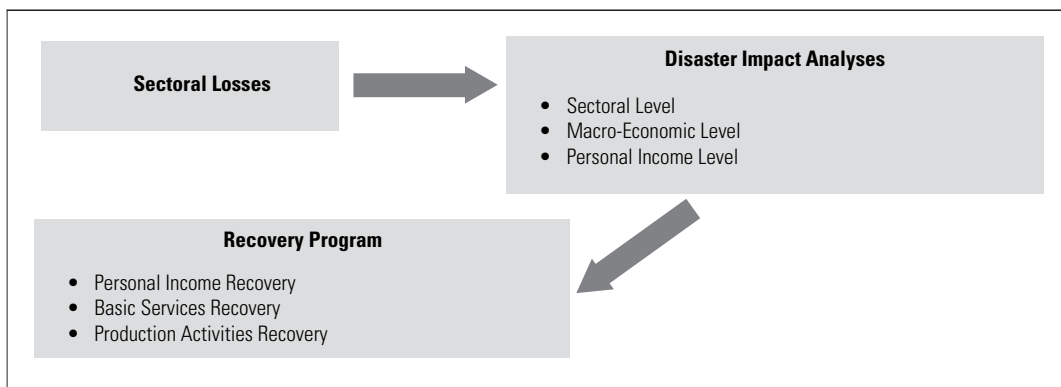
A comparison is normally made between the estimated values of losses and the value of sectoral GDP to determine which sectors of economic activity require specific recovery programs and activities. This establishes a measure of the sector's post-disaster affectation. Whenever the ratio is high, there's a need for a special recovery program with a scope that is defined on the basis of the estimated value of losses.

In fact, the financial requirements are a function of the value of losses in each sector, and must be determined by economists specialized in each sector, following the process described in Figure 2.1 below.

## 2. Estimation of Recovery Needs by Sector of Economic Activity

The following sections describe the procedure for the systematic quantification of post-disaster recovery needs in each sector of economic activity. The identified needs may not apply to all cases of disasters, as each has special features and characteristics, but they

**Figure 2.1 Process for Estimation of Post-Disaster Recovery Needs**



constitute a guide to the most usual recovery needs and to how their cost should be identified and estimated.

## ***2.1 Social Sectors***

The needs for recovery in the social sectors are estimated as a function of the value of assessed losses in each sector or sub-sector. In the case of housing, education and health, recovery needs are estimated as the value of higher costs involved in running the sector—such as temporary shelters, schools, and hospitals and the prevention and control of disease—minus the amounts already spent in post-disaster schemes that cannot be funded from the regular allocated government budget without negatively affecting other normal development activities. In the case of the temporary income earning through cash-for-work scheme, needs are estimated as the value of personal income losses (derived from the value of production losses, as described elsewhere in these guidance notes).

### **2.1.1 Personal or Household Income Recovery**

As part of the disaster impact assessment, estimates are made of the personal or household income losses arising from the disaster. These losses may in some cases continue for more than one year before full economic recovery is achieved.

The value of personal or household income losses constitutes the ceiling for the cost of any cash-for-work schemes that may be designed to assist affected persons in earning income after the disaster. Such programs may be applied in combination with public sector schemes aimed at, for instance, demolition and removal of rubble, immediate road rehabilitation or repair programs. It can include other public works rehabilitation, such as water and sanitation, electricity, etc., and refers especially to community-level activities. The duration should be established on the basis of rehabilitation and repair requirements of the works, and could in fact be longer or shorter than the usual three-month period that many cash-for-work schemes last.<sup>4</sup>

When food-for-work programs are implemented simultaneously, the time and earnings of the cash-for-work program should be adjusted downward so that the combined value of food and

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<sup>4</sup> Some disaster relief organizations place an arbitrary limitation of three months (or 90 days) on the possible duration of cash-for-work schemes. However, personal or household income losses may actually last either longer or shorter, and income rehabilitation schemes should instead be tailored to the individual characteristics of each disaster.

cash income do not exceed the estimated value of personal or household income loss. This is to avoid creating dependency on such schemes and to instead foster self-reliance through productive activities.

Sometimes special schemes for *financing of women-entrepreneurs* (who are often not credit worthy) are carried out in order to ensure household income recovery, and these may involve cash grants and/or micro-financing. The financial needs for this scheme must remain under the ceiling of the value of personal or household income losses.

Sometimes special programs for *diversification of household income* may be required to ensure future income disaster-resilience.

### 2.1.2 Housing

Recovery activities in the housing sector may include temporary shelters for those rendered homeless, technical assistance in the repair of disaster-resilient housing units, and provision of free construction materials for home repairs and household replacement for the poor.

The cost and duration of any *temporary shelter scheme* would be determined when estimating the losses in the housing sector, and considering the parallel analysis of the construction sector's capacity to reconstruct the housing units that were destroyed by the disaster. The initial investment required and the unit cost of running such shelter schemes vary from one disaster to another, but information can be obtained from the persons in charge during the emergency stage.

Whenever the size and duration of the temporary shelter scheme require water supply and sanitation, electricity, transport and other essential services, the cost of providing these services should be added to the estimation of needs.

The *cost of demolition* of housing units that have not been fully destroyed and/or have been rendered structurally unsafe must be estimated. The *cost of rubble removal* to the street side and of housing cleanup must be taken into account as well.<sup>5</sup>

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<sup>5</sup> The cost of rubble or mud removal and disposal from the side street to sites where they would do no environmental harm is normally included as part of the environment sector.

### 2.1.3 Education

Recovery in the education sector may include the *reactivation of education activities* under special conditions to compensate students for the loss of educational opportunity. How this is determined depends on the normal characteristics and features of the specific country affected by a disaster, and the attributes of the disaster itself. Recovery activities may include:

- More intensive utilization of undamaged education facilities by establishing several daily “shifts” instead of the normal schedule.
- Rental of alternative premises which may not have been affected.
- Setting up temporary classrooms by using tents, containers, or other similar facilities.

These possible solutions involve additional costs that are estimated as losses in the education sector: the cost of renting alternative premises, the cost of acquiring tents or containers, the payment of teachers’ overtime in the case of multiple daily shifts, etc.

Another possible recovery scheme is *repairs to schools that have been used as temporary shelters* and that have sustained damage from overuse as housing facilities over a relatively long time period. Again, the cost of this school-cum-shelter scheme is estimated as a loss in the assessment.

Another common recovery activity is the immediate *replacement of education materials* and minimum equipment. This measure is urgent and must not wait until reconstruction begins.

Special schemes for fast track training of new teachers may be planned for large scale disasters that have a heavy toll on human life. The cost of such schemes is estimated as a loss in the assessment.

As indicated in the introduction, the needs for recovery are equal to the estimated losses in each scheme, minus the amounts already spent at the time of the assessment that cannot be covered by the government’s regular budget without jeopardizing normal development activities.

### 2.1.4 Health

The *recovery of health care capacity* is normally a first priority after disasters of any kind and magnitude. This may involve setting up temporary hospitals in either alternative suitable buildings, or in tents, until the destroyed facilities are rebuilt. The cost of renting alternative premises and setting up tent facilities to achieve minimum temporary health care, is estimated as a loss in the assessment.



Similarly, the *additional operation budget* required to finance supplementary personnel, or to pay overtime to existing personnel (over and above the regular government appropriations for the sector), is also estimated as a loss in the assessment. In addition, the cost of urgently replenishing stocks of medical supplies and medicines that have been destroyed due to the disaster should be estimated as a loss for the sector.

Often there is need to provide medium to long-term *medical treatment to injured persons, as well as psychological attention* to the affected population after disasters. The cost of such program is estimated as a loss for the sector.

*Preventing and controlling the possible occurrence of disease outbreaks* or epidemics is another important scheme after disasters, and is not a cost that is normally included in the country's regular budget. Under this heading falls the cost of public information campaigns, vaccinations, vector control schemes and monitoring of morbidity levels. It should be estimated as a loss in the assessment.

Lastly, whenever field studies<sup>6</sup> show that the disaster has caused food insecurity, a *temporary nutrition scheme* for mothers and children may be designed and implemented. The cost of such a scheme is, again, estimated as a loss in the assessment.

As indicated for the education sector, health recovery needs are equal to the estimated value of losses in each scheme, minus any amounts already spent at the time of the assessment and which cannot be covered by the regular budget of the government without negatively impacting the sector's normal development activities.

## 2.2 Productive Sectors

Recovery needs in the productive sectors—including agriculture, livestock, fishery, mining, industry, trade and tourism—are estimated as a direct function of production losses. Usually, the needs are a fraction of the value of production losses, which are the amounts required to re-start productive activities (in terms of the value of raw materials and inputs, or of working capital for the enterprises, or for the individual activities involved).

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<sup>6</sup> Under the agriculture sector, an explanation is provided on how to estimate food needs after disasters.

## 2.2.1 Agriculture

### 2.2.1.1 Crops

Recovery activities in the crop sub-sector normally include the *provision of inputs to re-plant the crops* that were eliminated by the disaster. This includes replacement of seeds, fertilizer, pesticides, rental of farm machinery, etc., when the farmers have lost all their savings<sup>7</sup>. These provisions can be in the form of in-kind grants for poor farmers, and/or appropriate lines of credit for farmers who are credit-worthy. In most countries, the ministry of agriculture keeps statistics on the costs of inputs for the production of each crop at the different levels of crop growth. An agronomist or agricultural economist should be able to estimate these values as a fraction of production.

In cases where the disaster has caused significant production losses, especially in the case of food crops, the population's food security may be compromised. Disaster-induced food deficits are estimated on the basis of a food balance quantification (see text box below), so that *food import needs* can be estimated and met through internal food re-assignments from food-surplus areas in the country, in-kind international donations, or outright food acquisitions from abroad. If foods are imported, the value of such imports is obtained by multiplying the volume of each type of foodstuff with its unit price on the international markets. It follows that the value of food imports needs normally is higher than the value of food losses caused by the disaster.

As part of the analysis of food deficit and security, it may be appropriate to implement or expand a temporary *international food assistance* scheme, financed by the World Food Program of the United Nations and/or by other international donor organizations and bilateral sources. The amount and value of such needs are, again, derived from the results of the food balance described below, and on the basis of the assistance policies of the donor institutions or countries.

The distribution of food assistance may be done as outright grants or as food-for-work schemes. Whenever using the latter, the cost and duration of any cash-for-work programs designed to provide income earning capability for the affected population must be adjusted downward by the value of the food provided.

Two options exist when the government decides to import foodstuffs from abroad, either instead of, or in addition to, international food assistance schemes. The government can do the

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<sup>7</sup> In one recent case of post-disaster activity, the government decided to acquire a relatively large number of farm machinery for farmers to rent in order to prepare their land and perform other farm activities. This provided an alternative possibility of restoring production, and financing was made available for this post-disaster need.

**Box 2.1 The Food Balance**

A food balance is an account of the food supply and consumption pattern over a specific period of time, usually one year, in a country or a smaller geographical area of the same.<sup>a</sup>

The food availability side of the balance is represented by the total quantity of foodstuffs produced in a country, adding the quantity of food imports and exports, and adjusted by the change in food stocks. On the food utilization or consumption side, the components include the amounts used to feed livestock, for seed purposes, any losses during storage or transportation, and the amounts available for human consumption.

An example of an annual food balance for a food product is shown in the table below, using tons as a unit.

<b>Availability</b>	<b>5,385</b>	<b>Utilization</b>	<b>5,385</b>
Domestic production	3,950	Animal feed	2,654
Importation	1,658	Seed	87
Stock variation	103	Processing	86
Exports	–326	Human consumption	2,335
		Other uses	223

<sup>a</sup> The Food and Agriculture Organization (FAO) of the United Nations has a data base in its website showing the annual food balance for most foodstuffs in each country of the world, and includes data up until 2007. More recent information may be obtained from the FAO office in the affected country.

importation through its appropriate agency, and/or private entities can handle the food imports. If the latter option is chosen, and especially if the imported volume is high and costly, the government may wish to reduce the negative impact on the affected families' budget by introducing a *temporary elimination or alleviation of food import duties*. It may also decide to offer such tax breaks on other agricultural inputs.

### 2.2.1.2 Livestock

Recovery activities in the livestock sector might include a scheme to *prevent and control animal disease*, since disasters of any kind can affect the animal stock.<sup>8</sup> When animal stock is affected,

<sup>8</sup> This is required due to death, stress or illness of the animals, arising after the disaster.

this in turn would negatively affect the provision of meat and other food byproducts, as well as traction force availability for the farmers and their families.

Drought and other hydro-meteorological disasters may require a scheme of *animal food provision and re-planting of pasture*. The needs for both schemes are estimated as losses in the assessment.

#### *2.2.1.3 Fishery and Aquaculture*

Recovery activities in fishery and aquaculture normally include a scheme of grants and soft-term credit for *restocking fry and fingerlings*, and may also include in kind donation of tools and gears for the fishermen. The amount of financing or needs for the credit program is estimated on the basis of a fraction of the value of production losses under fishery and aquaculture (usually 25 to 40 percent of the production losses).

#### **2.2.2 Industry**

There are basically three types of recovery activities in the industrial sector undertaken after disasters: *cash grants for recapitalization of micro-enterprises*, *special credit lines for recapitalization and production recovery of small to medium size industries*, and *temporary tax relief measures* for all enterprises in the sector.

Recall that in most countries, the larger fraction of assets and productive activities of industry is in the hands of the private sector, and the same holds true of the trade and tourism sectors. Some governments may have ownership and operation of some industrial plants, and also trade and tourism facilities and operations. When estimating post-disaster needs, the temptation by the central government is to assume that the entrepreneurial owners of the industrial establishments don't face recovery needs. This, however, is a misperception—after disasters industries often face working capital shortages due to inadequate insurance coverage, and savings may not be sufficient to cover all post-disaster recovery needs. Instead, governments should be encouraged to determine the full amounts and types of recovery needs for the privately owned enterprises, and to make whatever representations necessary to ensure that the private banking system—with adequate guidance from the Central Bank and the National Development Bank—establishes adequate post-disaster credit lines for private sector re-capitalization. Such credit line on concessional terms (according to the magnitude of the disaster) should be established whenever the enterprise savings and insurance proceeds are insufficient to ensure prompt and full recovery of industrial activities.

The scope and financial requirements (or needs) for each of the above mentioned schemes can be defined as a function of the estimated value of industrial production losses. The following formula should be used for the estimation:

$$\text{Industry Recapitalization Needs} = B * \text{Production losses}$$

where B is a coefficient that usually ranges from 0.25 to 0.45, depending on the capital intensity of each type or branch of industrial activity. An experienced industrial economist, thoroughly familiar with the different types and sizes of industries in the affected country, should be able to estimate the value of the coefficient. Data obtained from the field survey and/or sample field survey carried out to ascertain post-disaster information, should also provide details on the sources and amounts of funding available to industry owners for re-capitalization, and which can be used to adjust overall re-capitalization needs. Such sources include savings, family remittances, insurance proceeds, and expanded credit from suppliers.

Needless to say, during the design stage of the special industry sample survey, the different industry branches included in the interviews must be defined on the basis of the national accounts of the affected area or country. Furthermore, information on the possible amounts of insurance to be paid to industry owners—both on assets destroyed and/or production losses—must be obtained by the experts dealing with the insurance sector.

### 2.2.3 Commerce

In the commerce sector, basically the same types of recovery activities can be undertaken as in the industrial sector: provision of *cash grants for re-capitalization of micro-traders*, establishment of *special credit lines for re-capitalization of small to medium size trade shops*, and *temporary tax relief measures*.

The need for the government to duly consider the recovery needs of the privately-owned enterprises to ensure their full economic activity apply to the trade sector as well. The same strategy should be followed since traders may not have sufficient working capital after disasters and this would limit the scope and speed of their economic recovery.

The scope and financial requirements for each of the above mentioned schemes can be defined as a function of the estimated value of sales losses. The following formula should be used for the estimation:

$$\text{Commerce Recapitalization Needs} = C * \text{Sales losses}$$

where C is a coefficient that usually ranges from 0.20 to 0.35, depending on the capital intensity of each type or branch of commercial or trade activity. An experienced trade economist, thoroughly familiar with the different types and sizes of trade establishments in the affected country, should be able to estimate the actual number. In the same manner as for industry, data obtained from the field survey and/or sample field survey carried out to ascertain post-disaster information should provide facts on the sources and amounts of funding available to trade owners for re-capitalization. This can be used to adjust overall re-capitalization needs, and may include use of savings, family remittances, insurance proceeds, and expanded credit from suppliers.

As in the case of the industrial sector, the list of different types of commerce to be included during the sample commerce survey must be pre-defined on the basis of the national accounts. The experts dealing with the insurance sector must obtain information on the possible amounts of insurance proceeds to be paid to commerce owners—both on assets destroyed and/or sales losses.

#### 2.2.4 Tourism

A typical recovery activity for tourism demand is special *information campaigns* conducted abroad—in the countries where the majority of tourists come from and/or in other countries that may be targeted for the future—to inform that tourism facilities have been repaired or reconstructed. The value of these needs is estimated as losses in the assessment, and may be shared between the private sector and the government.

To achieve recovery, special *credit lines for the re-capitalization of small to medium restaurants and hotels* may be opened through the development or commercial banking systems. This measure could be coupled with temporary tax relief schemes. The financial needs for these programs are determined as a function of revenue losses, and take into consideration information on the amount and scope of the sources of re-capitalization that tourism entrepreneurs may have available (including savings, insurance proceeds, and others).

The government of the disaster-affected country should be encouraged to assist the tourism entrepreneurs in their recovery, since they too are a source of development for the entire economy—they provide employment opportunities and generate considerable foreign exchange earnings and fiscal revenues. The government should participate in the financing of promotion campaigns

to inform tourists abroad about the recovery. It should also assist in generating adequate-term, disaster-recovery and recapitalization credit lines, channeled through the banking system, in a similar way as for the industry and trade sectors.

## 2.3 Infrastructure Sectors

For the infrastructure sectors, recovery needs may include urgent repairs required to restore minimum services of water and sanitation, electricity, transport and communications. Much of the urgent repair work can be done using available labor in cash-for-work schemes. In addition, recovery needs include financing of the temporary (and usually expensive) provision of basic services, such as tanker trucks to distribute water and other similar schemes. Often after disasters, a scheme can be included to freeze billing of water and sanitation, electricity and communications charges—at least for users who have a fixed-value monthly tariff—until those services have fully resumed.

In developing countries many of these services are in the public sector domain (except the transport enterprises, which are usually privately owned), and recovery is undertaken directly by government ministries or enterprises. Recovery needs are estimated as the difference between the value of total recovery demand minus whatever recovery activities can be financed from the regular operational budget of the public utilities or enterprises.

The value of recovery needs in infrastructure sectors is equal to the value of estimated losses that cannot be met by the suppliers of the services, minus the value of losses that have been already met at the time of the assessment.

### 2.3.1 Water Supply and Sanitation

In the water and sanitation sector, recovery activities may include a *temporary scheme of water purification* using larger doses of chemicals, or temporarily operating a salt-water purification plant. These are costlier-than-normal manners of providing safe drinking water to affected populations and the cost may be beyond the possibility of the affected utility enterprise or government.

Another typical activity is the *temporary provision of water using tanker trucks* and/or bottled water, whenever the regular distribution system has been compromised by the disaster. This higher cost for water distribution is estimated as a loss in the assessment, and its duration equals the time required to repair or reconstruct the damaged system.

The *temporary provision of portable sanitary latrines* in either urban or rural areas is another usual recovery scheme, which over time requires a more permanent solution through reconstruction of waste-water disposal systems. Again the financial needs of such scheme are estimated as a loss in the assessment.

Other recovery tasks may involve urgent *cleaning and repair of waste-water treatment and disposal facilities*. Its cost, again, is quantified as a loss in the assessment.

In cases with fixed monthly charges, billing for *water and sanitation service* can be suspended until the services have achieved normal delivery.

### 2.3.2 Electricity

Recovery in the electrical sector may include *urgent rehabilitation works* to restore a minimum supply of electricity, some of which may require payment of overtime to specialized workers. The costs involved is estimated as higher-cost losses in the assessment.

Whenever damage to power generation plants has occurred, recovery of electrical supply may require an *interconnection to other nearby undamaged electrical systems*, the costs of which would also be included as losses in the assessment.

As in the case of other basic services, a *freezing of electricity billings* can be adopted as a recovery measure until full service is resumed, at least in areas where no metering exists and a fixed rate is charged to users.

### 2.3.3 Transport

Recovery activities of the transport sector include urgent *restoration of minimum traffic flows* through destroyed road sections. Cash-for-work schemes may play a very important role, as may the acquisition and installation of Bailey-type bridges. The costs of such repairs are accounted for as losses in the assessment.

Another common recovery activity is the *dredging of port and river navigation channels*, to ensure a minimum of access and traffic flow after floods or similar disasters. Again, the costs of such schemes are accounted for as losses in the assessment.



#### 2.3.4 Communications

Typical post-disaster recovery activities in the communications sector include *urgent rehabilitation works to restore minimum communications* in the postal services, and in land-based and cellular telecommunications systems. Floods may damage key land-based switchboards and other equipment, and strong winds and earthquakes may cause dislocation of cellular antennas—both of these situations require urgent actions and equipment replacement in order to restore services. The costs of these repairs are estimated as losses in the assessment.

In this sector again, a *freezing of communications service billings* may be adopted as a temporary measure to assist at least fixed-rate users until full service is restored.

### 3. Temporary Tax Relief Schemes

Possible temporary tax relief to private enterprises and individuals to assist them in their recovery to normalcy after the disaster has been mentioned throughout the previous sections. The idea is for the central government to provide special support over a limited time period, in order to assist in the recovery of private revenues by temporarily alleviating their obligation to pay certain taxes.<sup>9</sup>

While the schemes may vary from country to country depending on the specific tax structure, and from disaster to disaster depending on the type of effects and needs, some typical examples include:

- Temporary reduction or freeze in the collection of value-added tax on selected sectorial production and sales.
- Temporary elimination of import duties on foodstuffs and other essential items required for recovery of production activities; and, conversely, temporary freeze on export duties of selected products to facilitate foreign exchange earnings.
- Temporary freeze on basic service charges of infrastructure works and services (water and sanitation, electricity, transport and communications) during the emergency phase.
- Non-collection of taxes for property that has been destroyed by the disaster (especially property that was uninsured), until it has been replaced or reconstructed.

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<sup>9</sup> This is of course possible only when the fiscal position of the affected government permits such reduction in tax revenues.

- There are many other possible tax relief schemes available to governments to alleviate the post-disaster cash situation of private individuals and enterprises. They can be combined with the expansion of appropriate-term credit to facilitate re-capitalization of enterprises and individuals, either through the development bank and/or the private banking system. While governments may not provide such financing, they can promote and in some cases provide a guarantee for such schemes that fall within the private domain. In any event, the temporary tax relief schemes conversely have a negative impact on central government revenues, in addition to the impact of relief expenditures, and must be assessed properly.



## **III. Estimation of Reconstruction Needs**

### **1. General Considerations**

As indicated in the introduction, the financial requirements (or needs) for reconstruction after disasters are estimated on the basis of the quantitative estimations of destruction of physical assets that need to be rebuilt. The destroyed assets may be owned by private or public sector entities, and the total needs for reconstruction must be estimated.

The way destroyed assets should be rebuilt is defined on the basis of a reconstruction strategy that is agreed upon by all stakeholders. If financing availability allows, the “building-back-better” concept should be adopted to ensure future disaster resilience and reduction of disaster risk. This approach takes advantage of the opportunity afforded by the disaster to improve living conditions and wellbeing in general for the affected population.

There are two main issues involved in the definition of reconstruction needs. First, the reconstruction strategy cannot be developed by the affected government alone; rather, all civil society should be duly consulted. To ensure full ownership and participation in post-disaster reconstruction, its support and acceptance must be obtained from all parties involved. Second, financial constraints may impose limits on the degree of risk reduction and disaster resilience adopted in the reconstruction strategy.

In view of the urgent need to estimate the required financial reconstruction requirements or needs, compromises are necessary. On one hand, if the reconstruction strategy is not fully developed at the time of the needs assessment, at least the guiding principles need to be clear in order to make preliminary estimations of needs. Refinements can be made later when the reconstruction strategy is fully developed and agreed upon by all stakeholders. An alternative is to estimate a range of reconstruction needs depending on the degree of disaster risk reduction that is eventually agreed upon. Even if there are financial limitations, at least a minimum degree

of risk reduction can be adopted for the reconstruction of strategic assets—such as hospitals, schools and other key infrastructure.

The reconstruction program must indeed cover all assets that were totally or partially destroyed by the disaster. Also, it should define whether they are publicly or privately owned. The intention is to rebuild all assets to at least pre-disaster level and, preferably, with a reduction of future disaster risk. Whether the reconstruction programs target either public or privately owned physical assets defines the manner and channels of financing, and the coordinating role that the public sector plays.

Again, financial reconstruction needs are defined on the basis of the estimated values of damage, as derived during the assessment. Damage figures are then supplemented by the additional needs involved in the “building-back-better” concept, introducing the following possible features (see Figure 3.1 below):

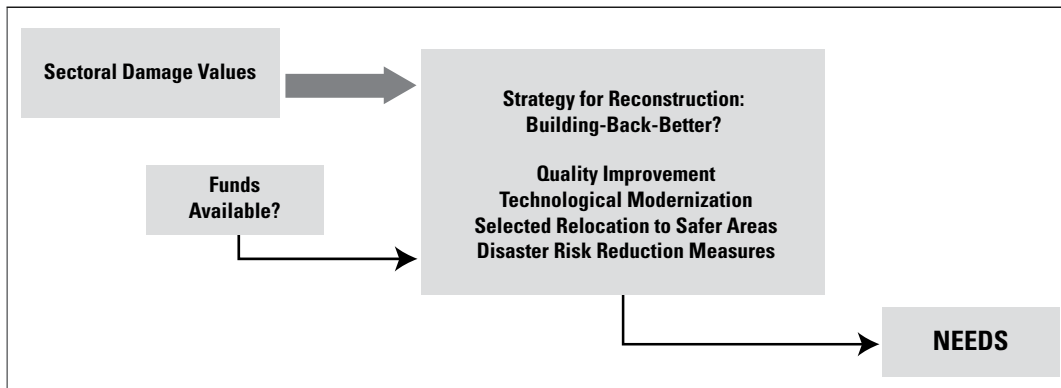
- Quality improvement of the destroyed physical assets, involving, for example, the provision of better quality housing for the poor.
- Technological modernization, including for example the introduction of more environmentally friendly energy utilization schemes, more modern industrial machinery and processes, etc.
- Disaster resilient standards, such as improved and stricter construction norms.
- In selected cases, relocation of strategic activities and facilities, such as schools and hospitals, to safer areas.
- Creation of special risk reduction schemes, for example introducing flood control schemes, establishing financial risk transfer schemes and funds for rehabilitation and reconstruction, etc.

The estimation of reconstruction needs is made on a sector-by-sector basis, using pre-defined common standards across the board, including the necessary adjustments for multi-annual inflation whenever the reconstruction program will last over several years. Usually, the estimations are made by engineers with specialized knowledge and experience in post-disaster reconstruction.

The following general formula may be used for the estimation of reconstruction needs in all sectors of economic activity (see again Figure 3.1):

$$\text{Reconstruction Needs} = \text{Value of Damage} + \text{Cost of (Quality improvement + Technological modernization + Relocation, when needed + Disaster risk reduction features + Multi-annual inflation)}$$

**Figure 3.1 Process for Estimation of Reconstruction Needs**



Typical schemes for reconstruction after disasters may include a combination of the following:

- Housing reconstruction and repair and household goods reposition, through cash grants and donation of construction materials for the poor<sup>10</sup>, and concessional, long-term financing for other housing reconstruction.
- Reconstruction, repair and retrofitting of strategic services such as hospitals, schools, and other social facilities.
- Reconstruction, repair and retrofitting of lifelines and other public infrastructure works and services.
- Appropriate credit for reconstruction, re-equipping, repair and retrofitting of private enterprise buildings and facilities, channeled through the private or development banking systems.

The financial reconstruction needs must be defined using criteria such as the sectoral and spatial distribution of damage, as determined during the assessment.

Before discussing details pertaining to specific sectors, please note that in some countries, national governments may wish to concentrate reconstruction activities on those assets that are publicly

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<sup>10</sup> Used in combination with technical assistance for the transfer of disaster-resilient techniques.

owned, and leave the private sector responsible for the remaining assets (which usually make up the larger fraction of the total assets destroyed). In addition, some governments may decide to directly assist the poorer fraction of the population through special subsidies (in some cases are called “compensations”) or through other grant schemes. This is of course a sovereign decision that must be respected. However, during the assessment, the entire value of public and private reconstruction needs should be estimated to ensure that full reconstruction can be achieved for the entire affected society and economy.

## **2. Estimation of Reconstruction Needs by Sector of Economic Activity**

The following sections describe the procedure for the quantification of post-disaster reconstruction needs in each sector of social and economic activity. The identified needs included here may not apply in all cases of disasters, as these all have unique features and characteristics, but this constitutes a guide on what the most usual reconstruction needs are and on how their cost is identified and estimated. The needs for reconstruction will always have a higher value than the estimated value of damage, which is the initial basis for estimation.

In the estimation of total reconstruction needs due consideration should be given to the availability of insurance proceeds, private sector savings, and family remittances from abroad to micro-entrepreneurs. Multi-annual inflation needs to be taken into account whenever the reconstruction will take longer than a year. Information collected from private sector sources through the sample survey of industrial and trade enterprises is very useful when determining private asset insurance, the availability of private sector savings and potential family remittances for micro enterprises.

Before entering into details on how to estimate reconstruction needs, it is important to recognize that the results of the estimation will depend on the contents of the adopted strategy for reconstruction. There may be cases where the strategy calls for reconstruction following a different type of development, and estimations would then have to follow such direction. However, in most cases the reconstruction strategy will likely direct the assessment team to rebuild using the same type of development, and to just add disaster-resiliency as its main feature. The methodology for needs estimation enables the assessment team to estimate the needs under any scenario.<sup>11</sup>

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<sup>11</sup> Some examples of changes required by the reconstruction strategy include constructing multi-family housing units instead of single-family units, abandoning old facilities and constructing new ones and many other similar schemes.

## 2.1 Social Sectors

The needs for reconstruction in the social sectors are estimated as a function of the value of assessed damage in each sub-sector. Regardless of the definition of the reconstruction strategy, which depends in part upon the availability of financing, the value of damage must be increased to make homes, schools and hospitals safer and to reduce future disaster risk in these strategic sectors.

Note that the value of damage is estimated as the amount required to rebuild or replace destroyed assets using unit costs prevailing in the affected area just before the disaster occurred. For the estimation of reconstruction needs, the unit costs will have to be increased in sufficient amounts to ensure future disaster resilience of the buildings that were destroyed.

The following general formula should be used for the estimation of reconstruction needs in each sector of economic activity (see again Graph 1-3):

$$\text{Reconstruction Needs} = \text{Value of Damage} + \text{Cost of (Quality improvement + Technological modernization + Relocation, when needed + Disaster risk reduction features + Multi-annual inflation)}$$

Depending on the adopted features of improvement within the reconstruction strategy for each of the sectors, the above formula might need to be modified.

### 2.1.1 Housing

There are several possible sub-programs that could be included as part of the reconstruction program for the housing sector, depending on the type of work to be done and on the possible sources and channels of financing.

Since the majority of housing units destroyed after disasters are privately owned, very often a special scheme of *soft-term credit for housing reconstruction* is adopted. While the central government may play a role in defining such a program, it is the private banking or development banking system that implements the program, with a proviso for the utilization of adequate standards or norms for disaster-resilient construction. In some cases this is accompanied by parallel programs of technical assistance and/or training of construction personnel to use such improved standards, as well as by government supervision for the implementation.



To estimate the value of reconstruction needs for the housing sector, the following formula is to be used:<sup>12</sup>

$$\text{Housing Reconstruction Needs} = D * \text{Housing Damage value}$$

wherein D is a disaster-resilience coefficient whose value usually ranges from 1.10 to 1.35. The actual value will depend on the improved degree of construction standards or norms required in the affected country—these standards would have been defined in the reconstruction strategy adopted after the disaster. Civil engineers or architects familiar with disaster-resilient construction standards will be able to define the coefficients.

In certain cases, a special program for *reconstruction of improved housing for the poor* is implemented. The unit cost for such improved quality housing units must be estimated on the basis of the improvement characteristics that also provide disaster resilience. Financing needs for this type of reconstruction program can be met through outright grants and/or largely subsidized credits, depending on the fiscal position of the affected country.

A similar sub-program of soft-term credit may be also implemented—or piggy backed into the one for housing reconstruction—aimed at financing *repairs of housing units* that were only partially destroyed or damaged, and adding retrofitting to ensure disaster resilience. The financial needs would be estimated in a similar fashion as for the first sub-program.

If the current location is unsuitable, *housing units can be relocated to safer areas*. Needs for financing are estimated following the pre-described procedures above, including the added cost of land acquisition, and provisions of basic services such as water and sanitation, and electricity.

When defining these sub-programs, the lowest interest rates and longest repayment and grace periods possible should be used as required by the post-disaster situation prevailing in the affected country.

In some countries, governments decide to assist the affected population with so called “compensation” or “incentives,” which in fact are subsidies to reconstruct housing units. They normally represent a fraction of the total cost of rebuilding a house. Owners of destroyed homes welcome such subsidies and frequently take advantage of salvaged construction materials to rebuild their

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<sup>12</sup> Needless to say, the formula must be applied separately to each type of housing unit that has been destroyed, and the corresponding disaster-resilience coefficient varies from one housing type to another.

homes, as well as personal savings and in some cases family remittances from abroad. However, technical assistance should be provided to ensure disaster-resilient standards of construction. Lower income families are the main target of these housing reconstruction schemes, but other home owners may still need credit to rebuild under concessional terms as warranted by the post-disaster situation.

Two issues are of particular importance in this regard: First, in estimating post-disaster reconstruction needs, the amounts of government subsidies must be supplemented with the amounts of required concessional credit in order to ensure that the entire affected society has access to means of reconstructing destroyed homes. The government should use all its means to provide guidance and encourage the development banks and commercial banks to offer the required credit lines to affected home owners. Second, whenever the government only provides the reconstruction subsidy, without providing technical assistance and supervision and without ensuring that the banks provide housing reconstruction concessional credit lines, the rebuilt housing units end up with sub-standard quality and do not provide disaster-resiliency. Putting it differently, home owners using only subsidies in fact increase future disaster risk when rebuilding.

After disasters with extremely high death toll, the housing reconstruction needs may have to be adjusted downward in view of the fact that the number of affected families requiring a housing unit is lower than the number of families occupying the area previously.<sup>13</sup> In such rare cases, special surveys have to be carried out to ascertain the number of houses to be rebuilt, before the housing reconstruction program and needs can be estimated.

### 2.1.2 Education

The estimation of reconstruction needs in the education sector follows a similar pattern as that of the housing sector, and normally requires special attention in view of its strategic social importance for overall development. And since most countries have a mix of public-sector owned and privately-owned schools, separate reconstruction schemes—with different financing characteristics—may consequently have to be implemented.

Both private and public schemes strive for *reconstruction of destroyed schools* under a “building-back-better” strategy to ensure future disaster resilience through strict enforcement of improved construction standards and, possibly, improved quality of education facilities. A program of public

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<sup>13</sup> Such cases have occurred, for instance, in the recent disasters of the Banda Aceh tsunami in 2004 and in the 2010 Haiti earthquake.

school reconstruction executed by the central government through its own ministry of education, and/or through private sector enterprises, should be coupled with a program of soft-term credit for reconstruction of private schools. In some cases, the cost of replacing destroyed furniture and equipment is included in the reconstruction needs, unless it has been covered under the recovery needs to provide temporary education services for the affected area.

In the estimation of reconstruction needs for the education sector, the following formula may be used:<sup>14</sup>

$$\text{Education Reconstruction Needs} = E * \text{School Damage value}$$

wherein E is a disaster-resilience coefficient whose value usually ranges from 1.10 to 1.50. The actual value adopted depends on the improved degree of construction standards or norms required in the affected country (which would have been defined in the reconstruction strategy adopted after the disaster). Civil engineers or architects familiar with disaster-resilient construction standards are able to define those coefficients.

In addition, to ensure disaster-resilience also of schools that were not affected by the disaster, but which may face disaster events in the future, the “building-back-better” strategy may call for the *structural retro-fitting of undamaged or partially damaged facilities*. The costs for this must be estimated on an *ad hoc* basis, with architects and structural and civil engineers defining the new standards that retro-fitting should aim for. They should also estimate the additional required funding.

In certain cases, depending on the type and severity of the disaster, *relocation of schools to safer areas* may be necessary, and the additional costs involved—which might include land acquisition, and basic services provision (water, sanitation, electricity, etc.)—should be included in the estimation of needs.

### 2.1.3 Health

Three main types of disaster reconstruction schemes can be undertaken in the strategic sector of health, following similar lines as for the housing and education sectors. The corresponding needs must be estimated.

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<sup>14</sup> As in the case of the housing sector, the formula must be applied separately to each type of school that has been destroyed, and the corresponding disaster-resilience coefficient may vary among school types.

The reconstruction *strategy for hospitals and other health facilities*, using improved, disaster resilient standards<sup>15</sup> (as defined in the building-back-better strategy), needs to be defined, and its financial requirements estimated. This scheme should include reconstruction of both public and private sector facilities, with due provisions for the different manners of implementation. To shorten the duration of operating temporary health facilities that were established immediately after the disaster, the calendar for this scheme should be clearly determined. This will reduce the suffering of the affected people and areas, and will minimize the cost of operation.

For the estimation of reconstruction needs in the health sector, the following formula is used:<sup>16</sup>

$$\text{Education Reconstruction Needs} = H * \text{Hospital Damage value}$$

wherein H is a disaster-resilience coefficient, whose value ranges from 1.10 to 1.50. The actual value depends on the improved degree of construction standards or norms defined in the reconstruction strategy adopted after the disaster. Again, structural and civil engineers who are familiar with disaster-resilient construction standards would be able to define those coefficients.

A scheme of *structural retrofitting of hospitals and health facilities* may also be required, to ensure that undamaged or lightly-damaged units are able to withstand the impact of future disasters and continue its function of health care provision uninterruptedly.<sup>17</sup> The financial needs are estimated by specialized structural or civil engineers after defining the standards for retrofitting and the degree of disaster resilience to be achieved.

In some cases, it may also be necessary to carry out a scheme of *relocation of hospitals and other health facilities to safer areas* with lower disaster risk. The financial requirements for this scheme should include not just the cost of the new structures, but also the cost of land acquisition and of basic service provision.

There have been some cases where, after major disasters, rather than reconstructing the same type and number of hospitals and associated facilities, the health sector authorities in the affected

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<sup>15</sup> It is essential to rebuild health facilities that will not be destroyed after disasters of any type, and also to ensure that the provision of health care will continue to function efficiently after disasters in order to provide the population with the required attention.

<sup>16</sup> As in the case of the housing and education sectors, the formula must be applied separately to each hospital or facility that has been destroyed, and the corresponding disaster-resilience coefficient varies from facility to facility.

<sup>17</sup> Such is the case of the Safe Hospital Campaign, presently under implementation in many countries with assistance by the World Bank, the WHO and other international organizations.

country decided to take advantage of the opportunity brought about by the disaster to adopt a different strategy and organizational structure. They have built a different, more effective health care system, which is more adapted to the more recent socio-economic conditions of the population.<sup>18</sup> The financial needs for such reconstruction would of course be different—either higher or lower—than the results obtained by applying the above formula for estimation of reconstruction needs.

## *2.2 Productive Sectors*

Reconstruction in the productive sectors of agriculture, livestock, fishery, industry, commerce and tourism refers to the replacement or repair of physical assets destroyed or damaged by disasters. Again, following a post-disaster “building-back-better” strategy, those assets are rebuilt with the inclusion of improved, disaster-resilient standards to ensure continued availability after disasters, and reducing the negative impact of such events in the future.

The needs for reconstruction in the productive sectors are estimated as a function of the value of assessed damage in each sub-sector. Depending on the availability of financing, the estimated value of damage must be increased to make productive infrastructure safer in the future.

The value of damage is estimated as the amount required to rebuild or replace destroyed assets using unit costs prevailing in the affected area just before the disaster occurred. For the estimation of reconstruction needs, however, those unit costs will have to be raised to ensure disaster resilience and technological innovation of the infrastructure works, equipment and machinery destroyed.

In most cases, productive sector activities and assets are in the domain of private entrepreneurs who may be covered by insurance. While the responsibility for reconstruction would thus fall on the private sector, it's essential that the government ensures soft-term credit availability for reconstruction through the development bank and commercial banks to guarantee full recovery and reconstruction. In addition, direct government interventions may be required to assist lower-income entrepreneurs—especially those in the informal sectors—through reconstruction grants or subsidies.

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<sup>18</sup> That was the case, for instance, of the health sector reconstruction in El Salvador after the 1986 earthquake which resulted in a more efficient health system for the country.

## 2.2.1 Agriculture

### 2.2.1.1 Crops

In the agriculture or crops sector, destruction of physical assets normally includes irrigation and drainage systems and works, storage facilities for agricultural inputs and/or production, as well as in-farm roads, etc. Usually, repair and reconstruction of such physical assets are essential and urgent to ensure continued production, be it of seasonal, annual or permanent crops.<sup>19</sup>

The agriculture or crops sector has three main types of possible reconstruction schemes, first, a program for *reconstruction of irrigation and drainage systems* using improved, disaster-resilient standards. This would normally need to be carried out very quickly to ensure continued productive crop activities in the disaster affected areas.

The second possible program is that of *reconstruction of storage facilities* for agricultural inputs and products, again using improved construction standards.

The estimation of the financial requirements for these programs can be made using the following formula:

$$\text{Agriculture Reconstruction Needs} = A * \text{Agriculture Infrastructure Damage value}$$

wherein A is a disaster-resilience coefficient, whose value ranges from 1.10 to 1.30, depending on the improved degree of construction standards or norms defined for this type of structures (and which was included in the reconstruction strategy adopted after the disaster). Again, civil or agricultural engineers familiar with disaster-resilient construction standards are able to define the value of those coefficients. It's evident that the above coefficient will vary from one type of structure work to another, depending on its production function in the sector.

A third program is for *replanting permanent trees and plantations*. This is required in order to eventually recover the production levels of a plantation whenever permanent trees or plants have been destroyed by the disaster. In most countries there are no market values for the destroyed assets (trees and plants), and the financial needs for such a program must be estimated on the basis of the cost of re-planting, preferably using disaster-resistant varieties. Agricultural engineers

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<sup>19</sup> In the case of permanent plantations, reconstruction may include the re-planting of trees and of pasture lands which have been destroyed or uprooted by a disaster. These are in fact essential assets to enable production.

and agronomists should conduct this type of estimation, taking advantage of concurrent or recent schemes of planting permanent trees in the affected region or country.

#### 2.2.1.2 *Livestock*

Disaster destruction may decimate the animal stock and affect associated physical facilities. Animal stock is required for production of meat, milk, cheese and other similar products, as well as for the provision of traction in the different agricultural activities, and—if destroyed by a disaster—must be replaced at the earliest in order to ensure livelihood and food availability for the population.

For reconstruction purposes, two main types of schemes are defined and implemented: first, a program of *animal stock replacement*, aimed at disaster-resilient species that can perform better in the affected areas while providing livestock production and traction force. In-kind provision of animals for the poor and government-subsidized credit schemes for acquisition of animal stocks can be used in this type of program. Second, a program of *reconstruction of facilities* according to improved, disaster-resilient standards or norms may be used. This program may include grants to poor livestock owners, and also soft-term credit lines focusing on SMEs. It can also include partial government subsidies.

The financial requirements for such programs are estimated on the basis of the value of damage for the physical assets and for the animal stock, with due increments for the improved and disaster-resilient features that are adopted in the reconstruction strategy. The following two formulas can be used for such estimation:

$$\text{Livestock Replacement Needs} = L * \text{Value of animal stock}$$

wherein  $L$  is a coefficient for the introduction of disaster-resilient animal varieties, and whose value ranges from 1.10 to 1.30. The actual value of the coefficient depends on the degree of desired resilience (compared to the existing animal stock). An experienced veterinarian can define the coefficient.

$$\text{Livestock Infrastructure Reconstruction Needs} = Li * \text{Value of Livestock Infrastructure}$$

wherein  $Li$  is a disaster-resilience coefficient, whose value ranges from 1.10 to 1.30, depending on the improved degree of construction standards or norms required for this type of structures, according to the reconstruction strategy. Again, civil or agricultural engineers familiar with disaster-resilient construction standards are able to define the coefficient.

### 2.2.1.3 Fishery and Aquaculture

Disasters may result in the destruction of physical assets that are essential for the sub-sectors of fishery and aquaculture: boats and engines for artisan and commercial fishing activities, docking and other associated infrastructure, ponds and other associated facilities, and equipment for aquaculture activities. During the reconstruction stage, replacement or reconstruction of these assets must be addressed efficiently using—again—improved, disaster-resilient standards, thus assuring their future sustainability.

There are three possible components of reconstruction for this sector. The first one refers to the *replacement of boats and engines* with improved capacity, quality and technology for artisan and commercial fishermen. Depending on the target population, this may include in-kind donations of equipment for the poor or artisan fisher folk and/or concessional credit lines for the acquisition of equipment for SMEs that engage in commercial fishing activities.

The second scheme refers to *reconstruction of docking and other associated facilities* using improved, disaster-resilient standards. These facilities are usually publicly owned and operated.

The third scheme covers the *reconstruction of aquaculture ponds* and associated equipment replacement, using improved and disaster-resilient standards. This scheme provides for soft-term credit programs channeled to SMEs via the development banks and/or the commercial banks.

The following formula is used for the estimation of financial requirements for reconstruction in this sector:

$$\text{Equipment Replacement Needs} = F * \text{Damage to Fishing Equipment}$$

wherein  $F$  is a disaster-resilient coefficient whose value ranges from 1.10 to 1.35, depending on the desired degree of capacity, quality improvement and disaster resiliency defined in the reconstruction strategy. Fishery experts with long-standing experience in the sector are able to define the value of this coefficient.

$$\text{Reconstruction Needs} = Fi * \text{Damage to Fishery Infrastructure}$$

wherein  $Fi$  is the fishery and aquaculture infrastructure disaster-resilient coefficient, whose value ranges from 1.10 to 1.40, depending on the degree of disaster resiliency defined in the “building-back-better” reconstruction strategy. Civil engineers and fishery/aquaculture experts with long-standing experience in this sector should define the values for each case.



### 2.2.2 Industry

It is very common that disasters destroy physical facilities, machinery and equipment in industrial enterprises. It becomes necessary to reconstruct or replace those assets using improved standards for disaster resilience, as well as with technological innovations that may increase output efficiency after the disaster.

Two types of post-disaster reconstruction schemes can be expected—although each case of disaster has specific characteristics that require individualized solutions. The first anticipated scheme is the *reconstruction of industrial facilities and replacement of industrial machinery and equipment*. It should use disaster-resilient construction standards and technologically improved machinery and equipment, through special, soft-term credit lines for SMEs, channeled through the development or commercial banks. The second is a scheme of government-subsidized *micro-industrial enterprise reconstruction* and equipment replacement, again using disaster-resilient standards and technological innovation measures.

Use the following formula for the estimation of financial requirements for these two types of schemes:

$$\text{Industrial Reconstruction Needs} = I_r * \text{Damage to Industrial Facilities}$$

where  $I_r$  is a coefficient for disaster resilience reconstruction whose value ranges from 1.10 to 1.40, depending on the degree of disaster resistance that is defined in the reconstruction strategy. Industrial or mechanical engineers, with special expertise and relevant experience in each type or branch of industry affected by the disaster can define the correct value of the coefficient.

$$\text{Equipment Replacement Needs} = I_e * \text{Damage to Industrial Equipment and Machinery}$$

wherein  $I_e$  is a coefficient of technological innovation with a value ranging from 1.00 to 1.40, depending on the efficiency in technological production that is adopted in the reconstruction strategy. Again, an industrial or mechanical engineer with experience in each type and branch of affected industry should define the value of the coefficients.

### 2.2.3 Commerce or Trade

Similar to in the industrial sector, trade or commercial facilities and their furniture/appliances may be destroyed by the disaster. A scheme should be defined for the *reconstruction of trade or commerce facilities, their furniture and equipment*, under improved, disaster-resilient standards. Here again,

to meet the needs of SMEs, such reconstruction may be achieved through the establishment of appropriate soft-term credit lines channeled through the commercial banks. A government-subsidized scheme of financing can be made available for micro-traders that are not credit worthy.

The financial needs for these schemes may be estimated on the basis of the following formula:

$$\text{Trade Reconstruction Needs} = Tr * \text{Trade Asset Damage}$$

wherein  $Tr$  is a coefficient for disaster resilience whose value ranges from 1.10 to 1.35, depending on the comparison between construction standards pre- and post-disaster, as defined in the reconstruction strategy. Civil engineers dedicated to construction of commerce facilities should be able to define the value of this coefficient.

#### 2.2.4 Tourism

As in the trade sector, the tourism sector may sustain physical asset destruction due to disasters. A program for *reconstructing hotels and restaurants* and for replacing destroyed furniture and equipment is formulated in the reconstruction strategy. The required financing may be channeled through the commercial banks. In the case of small-to-medium sized hotels and restaurants, soft-term credit lines may be established, and the government may implement a subsidized credit line for micro-entrepreneurs.

The financial needs for these schemes may be estimated on the basis of the following formula:

$$\text{Tourism Reconstruction Needs} = Tur * \text{Tourism Asset Damage}$$

where  $Tur$  is a coefficient for disaster resilience with a value ranging from 1.10 to 1.35, depending on the comparison between construction standards pre- and post-disaster, as defined in the reconstruction strategy. Civil engineers dedicated to construction of tourism and restaurant facilities are able to define the value of this coefficient.

### 2.3 Infrastructure Sectors

As for other types of sectors, needs for reconstruction of infrastructure works are estimated on the basis of the value of their asset damage or destruction. Depending on the criteria defined in the reconstruction strategy, risk must be reduced in these key sectors, and the value of damage

is increased accordingly to ensure that infrastructure works and services are built stronger to face future hazards.

The value of damage is estimated as the cost to rebuild destroyed assets using the unit construction costs that prevailed in the area just before the disaster occurred. For the proper estimation of reconstruction needs in infrastructure, the pre-disaster unit construction costs must be increased in sufficient amounts to ensure future disaster resilience. In addition, multi-annual inflation is included whenever the reconstruction program is expected to last more than one year.

In many cases, only parts or sections of the infrastructure works are fully destroyed, while others sustain partial damage or destruction. It is very common that the parts that were fully destroyed were originally designed and constructed using faulty or insufficient criteria, and that after the disaster such weaknesses are exposed. In such cases, disaster-resilient criteria for reconstruction should be adopted, and may include longer bridge spans and relocation, different design characteristics for bridges and culverts, a different alignment and length of road sections, tapping a different water source, etc. The value of damage only serves as a reference and the cost of reconstruction using improved, disaster-resilient standards may need to be estimated from scratch by the engineers on the assessment team.

In other cases where there's only partial damage to infrastructure, repairs or rehabilitation would be required, but not necessarily full reconstruction. An example is the partial damage to road carpeting after floods, where only re-surfacing is sufficient. Needs for rehabilitation would of course be a fraction of the cost of total reconstruction. In some countries, the tendency is to take advantage of a disaster by completely rebuilding a road, on the assumption that this represents an opportunity for upgrading partially damaged roads. However, in a world of limited resources for development, this practice is better avoided.

### **2.3.1 Water Supply and Sanitation**

Rehabilitation or reconstruction of water supply, sanitary disposal of sewage and solid waste usually ranks high in any reconstruction strategy because of its strategic value to the population's wellbeing. Depending on the special characteristics of each affected area or country, separate reconstruction schemes may have to be defined for either public or private sector systems, but should be included in an overall program for the entire sector.

In this sector, again, it is quite possible that only rehabilitation is required rather than full reconstruction, depending on the degree and extent of destruction. In any case, parts or components

of the systems may require full reconstruction using disaster-resilient standards, or resorting to alternative, remote, or more costly water sources.

The estimation of needs for *reconstruction in the water and sanitation sector* is made using the following formula:<sup>20</sup>

$$WSS \text{ Reconstruction Needs} = Wss * \text{Damage Value}$$

where  $Wss$  is a disaster-resilience coefficient with a value which is normally greater than 1.0. Appropriate values of  $Wss$  are estimated by the sanitary engineers on the assessment team. The actual number is based on the degree of disaster resilience to provide safe and reliant water and sanitation services, as defined in the reconstruction strategy.

The above formula should be used when entire systems or sub-systems require full reconstruction. However, for cases where reconstruction is needed only partly, the formula should be applied to the relevant components only. In cases where alternative water sources need to be tapped because of quality changes in the existing water source, reconstruction needs are estimated without regard to the value of damage that was calculated during the assessment. Sometime certain components (such as the alignment and length of a pipeline, or the placement of a storage facility or treatment plant) may have to be altered using different design standards or locations. The corresponding reconstruction needs, again, may have no relation to the estimated value of damage of the destroyed original assets.

Similarly, after the assessment it may become obvious that *structural retro-fitting of water and sanitation system* components is required to increase disaster resilience. The additional needs for such schemes are estimated by the sanitary engineers of the assessment team after carefully defining the standards for retro-fitting.

In certain cases, it may be necessary to relocate *selected water and sanitation system components into safer areas* to achieve a lower risk profile in the future. In addition to the estimated reconstruction costs for the components, the financial needs for such scheme should include the cost of land acquisition and other basic facilities required.

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<sup>20</sup> The formula must be applied separately for each sub-sector (water supply, waste-water disposal and solid waste disposal) and also broken down by either urban or rural, and by public and private sector schemes.

### 2.3.2 Electrical Sector

As explained before, electrical sector companies usually have stocks of equipment and supplies in warehouses that can be used to replace damaged or destroyed units after the disaster. Nevertheless, there are cases when damage is extensive and a full reconstruction scheme is required to restore production and distribution of electricity, which are essential for all development activities.

In such cases, financial *needs for reconstruction of electrical systems* may be estimated using the following formula:

$$\text{Electrical Sector Reconstruction Needs} = \text{Elc} * \text{Damage Value}$$

where Elc is a disaster-resilience coefficient with a value which is normally greater than 1.0. The actual values of Elc will be estimated by the electrical engineers on the assessment team (based on the defined degree of disaster resilience in the reconstruction strategy, which might entail adopting stricter standards for wind and lightning resistance, etc.).

When requiring only the *replacement of equipment* or certain components of the system using the available stocks, the cost of reconstruction equals the value of the items that have been used, so that the enterprise can re-stock its warehouses and be ready to face future similar events. The needs in this case are equal to the replacement cost of the equipment used in the rehabilitation.

When *relocation of electrical system components* is necessary, or when power lines must be re-aligned using alternative routes, the needs equal the value of damage using improved standards, plus the cost of land acquisition for relocation or re-routing.

### 2.3.3 Transport and Communications

In the transport sector—especially in the case of road transport—there are basically two options for estimating reconstruction needs: one, estimating the cost required to bring the road to its pre-disaster condition through rehabilitation works; and, two, estimating the cost of replacement of the road through full reconstruction or extensive repairs. *Rehabilitation of roads* is the pertinent option when roads were in a bad state of repair or maintenance prior to the disaster, or when they were initially constructed using out-of-date design criteria (or, for example, when they lack adequate drainage). In the first case, rehabilitation does not include a change of the original route, or an increase in road traffic capacity. The second option involves the *full reconstruction of roads* when they have been effectively destroyed and rendered useless. Full reconstruction is also the option when the road requires a different and improved design criteria, location, and layout

or route in order to ensure uninterrupted functioning in case of future disasters. It possibly aims to also increase traffic flow capacity.

Which option to adopt is only obvious after the overall reconstruction strategy is fully defined by all stakeholders, and whenever sufficient funding is available. Both in cases of rehabilitation and full reconstruction, the height and span of bridges should be increased to accommodate the highest possible river levels, bridge approaches should be protected to avoid erosion, adequate drainage capacity must be provided in all culverts and ancillary drainage works, and adequate slope protection should be added to avoid landslides onto the new road.

In both cases, the financial needs for reconstruction are estimated using the following formula:

$$\text{Road Transport Reconstruction Needs} = RT * \text{Road Transport Damage}$$

where RT is a disaster-resilient coefficient with a value greater than one. Its final value corresponds to the criteria included within the reconstruction strategy and is defined by the transport engineers who are part of the assessment team. (The value of the RT coefficient for reconstruction increases whenever relocation and/ or different design criteria are required.)

In the case of *reconstruction of communications* systems, the following formula is used for the estimation of financial needs:

$$\text{Communications Reconstruction Needs} = Cr * \text{Communications Damage}$$

In which Cr is a coefficient for disaster resiliency that has a value greater than 1.00 for reconstruction of systems and facilities that will ensure continued services after future disasters.

Two possible options may be applied in the reconstruction strategy: rehabilitation as is and/ or reconstruction with criteria for future disaster risk reduction. In the first case, the original standards of design are maintained; in the second case, improved, disaster-resilient standards are adopted to reduce risk. The value of Cr must be defined by the assessment team based on the adopted reconstruction strategy.

The following table (Table 3.1) summarizes possible schemes of post-disaster recovery and reconstruction for the main sectors of economic activity.

**Table 3.1 Potential Post-Disaster Recovery and Reconstruction Needs**

Post-Disaster Needs for		
	Recovery	Reconstruction
<b>Social Sectors and Activities</b>		
Personal/ household income generation	<ul style="list-style-type: none"> <li>• Cash for work scheme, with ceiling based on value of personal income losses</li> <li>• Scheme of special cash grants and micro-credit for women entrepreneurs</li> <li>• Special training programs to diversify family income sources</li> </ul>	
Housing	<ul style="list-style-type: none"> <li>• Temporary shelter scheme for persons rendered homeless, over the time period required for full reconstruction</li> <li>• Demolition of housing units, and removal of rubble or mud to side streets</li> <li>• Training of specialized labor on disaster-resistant reconstruction</li> <li>• Temporary tax relief scheme on suspension of property taxes for destroyed or damaged homes</li> </ul>	<ul style="list-style-type: none"> <li>• Concessional credit or government-subsidized scheme for housing reconstruction under disaster-resilient standards</li> <li>• Grants scheme for reconstruction of improved-quality housing for the poor</li> <li>• Relocation of housing units to safer areas and provision of basic services</li> </ul>
Education	<ul style="list-style-type: none"> <li>• Scheme for reactivating education activities, renting temporary alternative facilities, setting up of tent schools, or establishing several daily shifts in undamaged schools</li> <li>• Urgent provision of education materials, furniture and equipment.</li> <li>• Repair of schools used as temporary shelter scheme</li> <li>• Accelerated training of teachers</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction of public sector schools and soft-term credit provision for reconstruction of private sector schools, following improved construction standards and norms</li> <li>• Structural retro-fitting of undamaged or lightly-damaged schools to ensure future disaster resilience</li> <li>• Relocation of schools to safer areas and provision of basic services</li> </ul>
Health	<ul style="list-style-type: none"> <li>• Recovery of health care provision capacity, through temporary hospitals and clinics</li> <li>• Increase in operational budget to finance additional health provision activities and replenishment of destroyed medical supplies and medicines</li> <li>• Medium to long term medical attention to injured persons and psychological attention to affected population</li> <li>• Prevention and control of increases in morbidity due to changes in environmental conditions, including public information campaigns, vaccination, vector control, etc.</li> <li>• A program of nutrition for mothers and children, whenever the assessment reveals that a food deficit has resulted from the disaster</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction of public and private sector hospitals and associated facilities, using improved, disaster resilient standards</li> <li>• Structural retro-fitting of undamaged or lightly-damaged hospitals to achieve disaster resilience</li> <li>• Relocation of hospitals and associated facilities to safer areas, including land acquisition and provision of basic services</li> </ul>

*(continued on next page)*

**Table 3.1 Potential Post-Disaster Recovery and Reconstruction Needs** *(continued)*

Post-Disaster Needs for		
	Recovery	Reconstruction
<b>Productive Sectors and Activities</b>		
Agriculture	<ul style="list-style-type: none"> <li>• Provision of seeds and other inputs for re-planting of crops, either as grants or special credit schemes</li> <li>• Temporary provision of food to affected population, bringing products from other food-surplus areas in the country and/or abroad</li> <li>• Temporary food imports and international food assistance schemes</li> <li>• Temporary alleviation of food import duties and other taxes</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction of agriculture infrastructure with improved, disaster-resilient standards, for:</li> <li>• Irrigation and drainage systems</li> <li>• Storage facilities for agricultural inputs and production</li> <li>• In-farm roads and other agriculture works</li> <li>• Replanting of permanent plantations and pasture lands, using disaster-resistant varieties, financed through soft-term credit lines</li> </ul>
Livestock	<ul style="list-style-type: none"> <li>• Prevention and control of animal disease</li> <li>• Provision of animal feed and replanting of pasture</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement of animal stock for production and traction purposes, using disaster-resilient species, through in-kind grants for the poor and soft-term credit for SMEs with possible government subsidies</li> <li>• Reconstruction of associated livestock infrastructure, using disaster-resilient standards, through in-kind grants for the poor and soft-term credit for SMEs with possible government subsidies</li> </ul>
Fishery and aquaculture	<ul style="list-style-type: none"> <li>• In-kind provision of fingerlings</li> <li>• Special credit lines for small fishery and aquaculture enterprise repairs and re-capitalization</li> </ul>	<ul style="list-style-type: none"> <li>• Replacement of boats and engines with improved capacity and quality, through in-kind grants for artisan fishermen and soft-term credit lines for SMEs</li> <li>• Reconstruction of public docking and associated facilities, using improved, disaster-resilient standards</li> <li>• Reconstruction of aquaculture ponds and associated facilities, using improved standards and quality, through grants for the poor and credit lines for SMEs</li> </ul>
Industry	<ul style="list-style-type: none"> <li>• Cash grants for micro-enterprise recapitalization and recovery of production</li> <li>• Special, soft-term credit lines for SME recapitalization and production recovery</li> <li>• Temporary property tax relief schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Soft-term credit lines for reconstruction of destroyed industrial facilities, using disaster-resilient standards, and for replacement of industrial machinery under technological innovation conditions, channeled through the development and private banking system</li> <li>• Government-subsidized scheme for reconstruction of micro-sized industrial facilities under improved construction standards and with technologically improved machinery</li> </ul>

*(continued on next page)*



**Table 3.1 Potential Post-Disaster Recovery and Reconstruction Needs** *(continued)*

Post-Disaster Needs for		
	Recovery	Reconstruction
Trade or Commerce	<ul style="list-style-type: none"> <li>• Cash grants for recapitalization of micro-traders</li> <li>• Special credit lines for recapitalization of small to medium size traders</li> <li>• Temporary property tax relief schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate-term credit for reconstruction of trade or commerce facilities, and for replacement of minor equipment and furniture, channeled through commercial banks</li> <li>• Government-subsidized reconstruction program of micro-industrial facilities and replacement of equipment</li> </ul>
Tourism	<ul style="list-style-type: none"> <li>• Information campaigns to promote return of tourists</li> <li>• Credit Scheme for recapitalization of small to medium sized hotels and restaurants</li> <li>• Temporary property tax relief scheme for damaged hotels and restaurants</li> </ul>	<ul style="list-style-type: none"> <li>• Government-subsidized credit program for reconstruction of micro-sized hotels and restaurants</li> <li>• Soft-term credit lines for reconstruction of small to medium size hotels and restaurants, channeled through development bank and commercial banks</li> </ul>
<b>Infrastructure Sectors</b>		
Water Supply and Sanitation	<ul style="list-style-type: none"> <li>• Temporary scheme of drinking water purification</li> <li>• Temporary distribution of drinking water through tanker trucks or other means</li> <li>• Temporary provision of portable sanitary latrines</li> <li>• Urgent cleaning of waste-water treatment and disposal facilities</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction of urban and rural, public and private, water supply, waste-water and solid waste disposal system components, and replacement of machinery and equipment</li> <li>• Structural retro-fitting of existing undamaged water and sanitation system components to achieve disaster risk reduction</li> <li>• Relocation of selected water and sanitation systems to safer areas</li> </ul>
Electricity	<ul style="list-style-type: none"> <li>• Urgent rehabilitation works to restore minimum electricity supply</li> <li>• Scheme of interconnection to nearby undamaged electrical systems</li> </ul>	<ul style="list-style-type: none"> <li>• Reconstruction of destroyed electrical systems, and replacement of electrical equipment and machinery, using disaster-resilient standards</li> <li>• Relocation of selected electrical system components to ensure disaster resilience</li> </ul>
Transport	<ul style="list-style-type: none"> <li>• Urgent rehabilitation works to restore minimum traffic flows in road networks</li> <li>• Provision of temporary Bailey bridges to restore minimum road traffic</li> <li>• Urgent dredging of port and navigation channels</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation of roads using original design criteria, to return roads to pre-disaster standards</li> <li>• Reconstruction of roads using improved, disaster-resilient standards, and involving relocation of assets when required</li> </ul>
Communications	<ul style="list-style-type: none"> <li>• Urgent rehabilitation of post offices, land-based and cellular telecommunication system components</li> </ul>	<ul style="list-style-type: none"> <li>• Rehabilitation of communications systems using pre-disaster design and construction standards</li> <li>• Reconstruction of communications systems involving relocation and disaster-risk reduction features</li> </ul>









