II. THE HOUSING SECTOR

Social sectors are, generally, those most seriously affected by natural phenomena According to the definition adopted for this manual, these are basically the housing, health and education sectors. The damage usually sustained by infrastructure, equipment and furnishings can generally only be repaired in the mid term. Moreover, the appraisal of destroyed assets must nearly always be performed in terms of replacement costs (which implicitly include the improvement of equipment and inputs, specially in the case of housing) In the case of repairs, on the other hand, the appraisal figure will be much closer to the market value of the asset in question.

1. INTRODUCTION

a. Definition, conceptual and institutional aspects

In this section, the methodology for evaluating damage to housing caused by a natural disaster is described. The term dwelling means every building destined to sheltering persons or families for purposes of habitation. Only that damage caused to "dwellings" will be analyzed and not that caused to what has been traditionally called the "housing sector", which includes urban infrastructure and equipment, nor does it include the industrial and commercial sectors, dedicated to construction materials and processes The damage to those elements is dealt with in Part Three· Infrastructure; and Part Four: Economic Sectors (Chapter II Industry and Trade) of this manual.

The deterioration or destruction of dwellings has general implications for the economy and the living conditions of the population, so that, in the analysis of these factors, it will be necessary to keep interrelations with other economic activities and social sectors in mind. Thus, expenditures in housing construction contribute to the overall formation of fixed capital in the economy. In the same way, variations in the housing construction rate have direct impact on the creation of jobs, as well as in the industrial areas related to construction. Given this interrelation, damage to the housing inventory will be relevant, in general, to the activities of the Ministries of Economy and Finance, and of Planning, and to the corresponding sector agency (Ministry or Institute of Housing and Urban Affairs), as a factor in the evaluation of the disaster, and also within policy design for the subsequent reinitiating of the economic development process

Action in the area of housing is an important aspect of social development policies Through that policy, governments attempt to satisfy the housing needs of the entire population (either recovering from current deficits or those caused by natural disasters) The evaluation of housing needs and the execution of action geared to satisfy those needs come within the sphere of interest and are the responsibility of central government bodies (Ministry or Institute of Housing and Urban Affairs), of regional governments or agencies and the municipalities

The evaluation of the damage to housing and the projection of reconstruction possibilities will make it possible, on the one hand, to determine their impact on employment and on the capacity of the industrial and commercial sector to provide the inputs necessary for the construction and repair of damaged dwellings The Ministries of Work and of Industry and Trade are responsible for these matters.

The evaluation of damage to housing will generate, in short, basic information for both national and international aid organisms participating in sector reconstruction activities

b. Evaluation methodology and application

Experience has taught that the evaluator will have approximately one or two weeks of notice prior to the visit to the disaster zone and, usually little more than one week in the affected zone, itself, in order to gather data and prepare a report. During the period prior to the visit, the evaluator should gather relevant information on the housing conditions in the disaster zone and prepare specific lists of institutions and persons with whom it will be necessary to establish contact. The evaluation process will lead to the elaboration of indicators which can be summarized in a matrix (see Chart 1)

The "dwelling unit" or "housing unit" is the simplest unit for quantifying sector damage The information obtained during field visits and that supplied by agencies which act during the emergency are usually expressed in terms of that unit. The statistical information codified in units such as "square meters constructed" can be converted into "housing units" by using an estimate of the average dwelling size, obtained from statistical information or on-site inspection

In the same way, home furnishings and equipment, which are usually found dispersed throughout the statistics, can be estimated in terms of average composition and value, per "dwelling", or by type of dwelling, as required by local conditions.

In order to satisfy the information needs indicated in Chart 1, the following steps should be taken, nearly simultaneously, given the scant time available:

i Delimitation of the area affected by the disaster;

ii. Evaluation of the situation prior to the disaster;

iii Identification of direct effects/damage,

iv Measurement of direct effects/damage;

v Appraisal/costs of direct effects/damage;

vi. Identification of indirect effects/damage;

vii. Measurement of indirect effects/damage;

viii. Appraisal/costs of indirect effects/damage;

ix. Identification of secondary effects,

x Evaluation of secondary effects,

xi. Formulation of commentary on the main damage to housing and its relation to the housing typology and the physical and socioeconomic context of the affected area;

xii. Gathering of information about the main reconstruction works/projects, their duration and possible budgets; and

xiii. Identification of those sector areas which need support for implementing reconstruction works.

c. Delimitation of the affected area

One of the initial tasks is to delimit the affected area in which evaluation activities will be concentrated. In this regard, the following information should be gathered.

- location and ways of access to the affected area:
- identification of the political and administrative bodies responsible for emergency and reconstruction activities in each region;
- identification of the organisms and sources of information about the economic and social indicators of the affected zone;
- programme of in-depth field trips.

Taking into account the available sources of statistical information, the administrative competencies of public organisms and the environmental characteristics of the country, it is considered necessary to identify. the total area affected by the natural disaster, the political and administrative divisions of the affected area (example: districts, provinces, departments, states, or regions affected); and the natural regions involved (example: forest, plains, coast, highlands, etc.).

As far as possible, the affected area should be marked on a map or plot of the country, indicating, as necessary, the political and geographical divisions mentioned above.

To gather information about the size and characteristics of the affected area, recourse may be had to the national organism (or regional and local organisms) responsible for civil defense or emergency tasks; the entity responsible for the housing sector and other central government agencies, municipalities and regional governments; together with information in the press, and that provided by non-governmental organisms and individuals who work in the affected zone

Given the diversity of sources to be used, it will be necessary to cross verify them and, inevitably, to carry out on-site inspections as a complementary measure.

d. Evaluation of the situation prior to the disaster

Knowledge of the housing situation in the zone prior to the disaster will serve as the starting point for the evaluation and help avoid common errors, such as over-estimating damage In this regard, efforts to gather the following minimum information are considered important:

i. Number of dwellings in the affected zone, classified as· urban/rural; self-owned/ collective; and public or private property

ii Quality of the dwellings in the affected zone, classified by: permanent and semi-permanent. (See the definition of these categories below.) If this information cannot be obtained directly, it can be estimated on the basis of other data which describe:

- construction materials used (paper, cardboard, waste materials, brick, wood, adobe, etc.);
- the condition of the dwelling (good, very good, fair, poor, etc);
- the type of dwelling (hut, trailer, house, etc.)

This classification must be made on the basis of the appraisal of the local physical and socioeconomic conditions, as well as of the predominant type of dwelling in the area

iii Average dwelling size:
If these data are not available directly, they can be estimated on the basis of the following information:

- average number of inhabitants per dwelling
- average cost of affected dwelling, divided by the cost per square meter constructed

iv. Description of the main construction techniques and materials used in the affected zone.

Information should also be gathered with respect to·

i Number of dwellings in the affected zone· classified by: one-family/multi-family use and by a scale of construction costs. (See the definition of these categories below.)

ii. Number of inhabitants in the affected zone and number of inhabitants per dwelling.

iii. Typical furnishings of the average dwelling (defined as that which represents the majority of dwellings in the affected zone) or according to typologies which correspond to the categories indicated below

iv Construction, furnishings and equipment costs:

- at current market prices
- at factor costs (market prices, excluding indirect taxes)

Costs should be expressed in national currencies. In the event that some costs are expressed in other currencies (American dollars, German marks, French francs, etc), prices should be converted to national currencies, using an exchange rate to be determined with the corresponding Central Bank or the financial and economic authority of the country

e. Information sources

Information on the country and/or the zone affected by the disaster, with respect to housing conditions, can be found in:

i. National sources

- Censuses and periodic surveys.

  Population and housing censuses
  Statistical bulletins/annuals
  Property registers/listings
  Periodic surveys in the housing and construction sectors
  Construction permits/licenses
  Consumer price lists

- Data obtained directly from organizations, such as

  National Statistical Institute/agency
  Ministry/Institute of housing and urban affairs
  Ministry/Institute of planning
  Chamber of Construction
  Schools/associations/federations of architects and engineers
  Banks which finance housing
  Municipal governments
  Regional governments state/department/province
  Academic and research institutes related to· architecture, demographics, social sciences.

ii. Other sources

- Construction/commercial/industrial sector companies
- Chambers of commerce and of industry
- Newspapers: property listings

- Realtors
- Insurance companies

iii. International sources

- United Nations annuals or statistical compendia

  Statistical Yearbook for Latin America and the Caribbean (ECLAC),
  Compendium of Human Settlements Statistics (New York);
  Construction Statistics Year Book (New York)

- Data obtained directly from organizations such as:

  Latin American Demographics Centre (CELADE), Chile),
  Economic Commission for Latin America and the Caribbean (ECLAC,
  United Nations Centre for Human Settlements (CNUAH, Kenya); and
  United Nations Statistics Office (New York)

2. DIRECT DAMAGE OR EFFECTS

a. Direct effects, according type of disaster

As noted, direct effects are mainly those related to loss of capital or property Natural phenomena cause direct damage to housing, causing partial or total destruction. Earthquakes tend to produce structural damage (in rafters, columns, paved areas, bearing walls, etc.) and non-structural damage (light walls, installations, non-structural roofs, furnishings, equipment, etc.) in dwellings, due to the additional loads to which those elements are subjected by the earth's movements. Damage is also produced by permanent deformations of land (settling, slides, etc) used for housing

High intensity winds, associated with storms and hurricanes, also bring additional loads to bear on buildings, affecting both structural and non-structural elements In this case, however, the foundations and underground elements will suffer little or no damage. Other phenomena, such as floods, land slides and volcanic eruptions, tend to act in ways similar to those described above, bringing additional loads to bear on buildings deteriorating or destroying their components, deforming the land on which they rest, or making them useless because wind or water have deposited extraneous material in them (mud, ash, debris, etc).

Damage to structural elements is usually worse than other types of damage, often making it necessary to demolish or abandon the building Non-structural damage, although more visible, can often be repaired or only requires the replacement of some element which does not affect the building as a whole. Faults in the land may make it necessary to abandon the building or to execute stabilization works

b. Classification of dwellings

Given the brief time available to the evaluator, it is very difficult to generate detailed inventories of all damaged houses, so that it is necessary to extrapolate conclusions from the inspection of representative samples of damaged dwellings (not necessarily statistically valid). For this type of evaluation, it seems best to classify dwellings as described in Chart 2

As can be seen in Chart 2, the minimum consolidated information required is that relative to self-owned and collective housing; urban and rural, private and public. A typology of housing by construction type and cost will only be important in order to obtain a more exact calculation of the cost of the damage and must only be employed in those cases in which the differences among these typologies, together with the number of damaged dwellings, make separate accounting necessary. According to this criterion, and as justified in each particular case, the evaluator may employ other housing typologies, based on the predominant materials used in construction (wood, earth, concrete, etc.) or by building type (individual, up to four floors, etc.).

The definitions of the categories and typologies indicated in Charts 2 and 3 are:

- Urban dwelling: that located in urban settlements, according to the definition used in the country under study (Examples: in Peru, all settlements with more than 100 dwellings are urban; in Venezuela, all settlements with more than 2 500 inhabitants are urban).

- Rural dwelling: that located in rural settlements, under the same conditions as the previous definition.

- Public sector dwelling: includes all dwellings which are the property of the central government, regional and local governments, and State companies.

- Private sector dwelling: includes all dwellings which are the property of individuals and private companies.

- Particular dwelling includes units such as houses, apartments, huts, tents, etc , in which each unit houses a family or home. These may be either individual one-family units or buildings with various units (multi-family).

- Collective dwelling: this category includes boarding houses, hotels, motels, boarding schools, convents and other establishments used for purposes of collective habitation.

- Permanent: that which, according to the materials and quality of the building, can be considered as a dwelling for permanent use and which provides adequate protection from the environment.

- Semi-permanent dwelling, includes units such as tents, huts, marginal dwellings, mobile dwellings, etc , made of non-durable materials and which do not provide adequate dwelling quality

According to the prevalent conditions in each case, dwellings can be grouped according to cost levels, as a means of classifying by social strata or income levels. For example:

i. expensive dwelling (building valued at more than US$15 000);

ii. mid-range dwelling (building valued at between US$5 000 and US$15 000),

iii low cost building (building valued at less than US$5 000).

c. Dwelling components liable to suffer damage

A natural disaster can destroy the basic components of a dwelling either partially or totally. In order to calculate damage with a certain degree of precision, it will be necessary to itemize the characteristics of the components of a dwelling and their cost. Those components and the types of damage they suffer are as follows:

i. Building

⇨ Structural elements (Rafters, columns, paved areas, bearing walls, foundations, etc.)

- Damage which may possibly be repaired.
  Type of damage: cracks, deformation, partial destruction
  Forms of repair: repair of the element, repair with additional reinforcement
- Damage beyond repair
  Type of damage: cracks, deformation, total destruction
  Action: replacement of the element and additional reinforcement, abandonment and replacement of the building.

⇨ Non-structural elements (partitions, interior installations, doors, windows, non-structural roofs, floors)

- Damage which may possibly be repaired:
  Type of damage cracks, deformation, partial destruction
  Forms of repair· repair of the element, repair with additional reinforcement, abandonment and replacement of the building
- Damage beyond repair

  Type of damage: cracks, deformation, total destruction
  Action: replacement of the element and additional reinforcement.

ii Furnishings

For the purposes of this evaluation, furnishings include: furniture (tables, chairs, beds, etc), kitchen and table utensils, clothing and other linen goods, domestic machinery and equipment (stove, washers, heaters, radios, etc.), and other items (ornaments, books, games, etc.)

It will be very difficult, in the brief time available, to evaluate which of these elements can be repaired and the degree (percentage) of damage they have suffered, so the evaluator should define two or three degrees of destruction for all furnishings, based on the inspection of the damage, to be applied to the dwelling or model dwelling

For example, 100% of furnishings destroyed,
50% of furnishings destroyed, or
25% of furnishings destroyed.

iii. Equipment

Some dwellings, both one-family and multi-family units, have equipment, apart from the usual interior installations (sanitary, electrical): for example, installations for air conditioning, electrical generators, pumps for drinking water or for the removal of sewage, incinerators and other mechanisms for the removal of solid wastes, elevators, security equipment, central heating, recreational equipment (swimming pool, etc), irrigation systems, etc. Much of this equipment is heavily used under certain conditions (high income areas in tropical cities), although the number of dwellings so equipped in the countries of the region is relatively small. The evaluator will find it necessary to adopt one of the following criteria for identifying damage to equipment:

- assume and describe a set of "basic equipment" for all affected dwellings, or
- assume and describe a set of "basic equipment" for a certain number or typology of affected dwellings (this will be the more common case).

As in the case of furnishings, it will be difficult to make a detailed inventory of deteriorated or destroyed units, if they are numerous. In that case, it is recommended that the evaluator define two or three categories of damage to be applied to the typical equipment of a dwelling, or the units of individual equipment which it seems reasonable to appraise

For example:

- damage which requires extensive repair;
- damage which requires minor repairs;
- total replacement of the equipment.

iv. Other aspects to be considered in the identification of damage to housing

Other direct damage Other works than those already mentioned must be performed so that the repaired or replaced dwelling will be the equivalent to that which existed previously. These should be appraised as direct damage and include the reconnection of public services (drinking water, sewage services, gas, electricity), demolition works and the removal of debris or other materials accumulated in the damaged dwelling.

Imported components. The evaluator should identify, list separately and appraise the content of imported materials and products in the dwelling or model dwelling.

The identification of imported elements which have been damaged or those which must be replaced with imported goods, is of great relevance given the impact of this factor on reconstruction activities and periods, as well as on the country's balance of payments. Depending on the natural conditions and the industrial development of the country, these may include such varied products and materials as wood, cement, construction iron, sanitary and electrical accessories, panels for roofing and walls (P.C V , fibre glass, asbestos-cement, etc.) and all kinds of furnishings and housing equipment.

d. Appraisal of damage

i **Building, furnishings, equipment and reconnection of services**. Some ways of appraising damage to housing are presented here, which, in all cases, have incorporated the criterion that a dwelling, or element of a dwelling, must be obtained which is functionally equivalent to that in place prior to the disaster, except in those cases in which what existed before was of very low quality, in which case the reconstruction process must involve a positive qualitative change. Certainly, the costs reported in this appraisal will not coincide with the real (depreciated) value of the destroyed goods, because it must also include, within the total price, the financial costs to be met in obtaining the resources necessary to provide a housing solution equivalent to that which existed prior to the disaster, with the exception mentioned above.

Chart 3 displays the possible ways of estimating the magnitude of the damage on the basis of the "quantities" of labour, materials/accessories and equipment which it will be necessary to use in reparation or replacement works, which themselves are to be appraised by eventually applying the corresponding unit prices

The exercise indicated in the Chart will only be important in those cases which involve partial reparation or replacement of housing In cases of total replacement, it may be more useful to use universal units, such as "square meter constructed", instead of executing the burdensome exercise of calculating labour, materials and equipment separately Moreover, it is not necessary to have recourse to the detail provided in Chart

3, if universal measurement units already exist which incorporate the labour, materials and equipment values which constitute them.

ii. **Partial or total demolition of destroyed dwellings**. Natural disasters may cause damage to dwellings which make them unsafe, thus requiring partial or total demolition, prior to replacement It is advisable to estimate demolition works on the basis of the "housing unit" or a percentage of it (for example· the number of units to be 10% demolished, the number to be 25% demolished), thus making it possible to correlate these magnitudes with the appraisal of direct damage already mentioned.

Another form of assessment would be through the calculation of "square meters" of housing (buildings) to be demolished, which would have to be codified as "housing units" by applying an "average dwelling area"

Dwellings to be partially or totally demolished should be grouped in the same typologies employed by the evaluator for the appraisal of the direct effects, as already explained.

iii. **Removal of debris and material**

The works to remove debris and the material deposited during the disaster (mud, ash, solids, etc) may be grouped in two categories, which should be appraised separately:

- the removal of debris during the period immediately after the disaster, for the purpose of saving lives and property, clearing ways of access and for transport, etc., which should be calculated within the total costs of the emergency and, therefore, should not be included among the figures for direct damages contemplated in this manual as housing costs; and

- the removal of debris of destroyed or demolished dwellings in order to begin reparation or replacement works. Those costs are to be added to the figures for direct damage to housing

As in the case of demolition works, it is acceptable to estimate an "average volume" of debris or material to be removed (expressed in cubic meters) for each typology of dwelling selected in the specific situation to be evaluated.

f. Appraisal of direct damages or effects

i. **General criterion** The unit prices to be applied to the "quantities" of the kinds of damage listed in Chart 3 (for building, furnishings, equipment and reconnections), together with those related to the units of demolition and removal of debris, should correspond to current prices at the time of the disaster. They should be current market prices under normal conditions; that is, excluding possible distortions due to the speculative or inflationary situation generated by the disaster itself Those prices should

include all necessary costs (administrative, financial, etc) for incorporating inputs (labour, material or equipment) into reparation and replacement works, or tasks involved in the reconnection of services, or the demolition and removal of debris

Prices of imported materials and equipment should be determined in a way similar to that employed above, according to the information provided by suppliers. If this is not possible, CIF prices (which include transport and insurance to destination) are to be obtained, to which the necessary domestic costs of incorporating the input into the repair or replacement work should be added.

ii. **Buildings, furnishings, equipment and reconnections to services**. Charts 4, 5 and 6 present possible ways of facing the task of quantifying damage to housing, with regard to buildings, furnishings, equipment and the reconnection of services. They should only be used in cases involving the partial replacement of housing, because, when total replacement is necessary, universal units are to be preferred. For this reason, it is also recommended that estimates be made on the basis of damage to the "average dwelling" or for each type of dwelling deemed necessary, depending on the concrete situation

As noted above, it will not be necessary to enter into all the detail indicated in the Charts, if universal measurement units are used, together with unit prices which incorporate the labour, materials and equipment which constitute them In the case of total dwelling replacement, it may be more useful to use universal units, such as "square meter constructed", as indicated above.

iii. **Partial or total demolition of destroyed dwellings** Unit costs for demolition vary greatly, depending on type of dwelling, the materials employed in their construction and their location. In order to simplify the evaluation, it is recommended that global unit costs be estimated for the appraisal units described above. If this proves difficult, it will be necessary to estimate costs on the basis of the basic inputs to be used in demolition works: labour, equipment, and some materials (such as explosives)

Information about demolition costs can be obtained from the sources indicated below, as well as from companies in that type of work.

iv. **Removal of debris and material**. For debris removal, the most easily obtained price is that for a cubic meter. By multiplying this by the average volume per dwelling, the unit cost per dwelling will be obtained (according to the diverse types of dwelling selected) The evaluator must be sure that the unit prices to be applied or calculated include all the costs of labour and equipment necessary for the removal, transport and final deposit of the debris or material deposited during the disaster. The information on costs for the removal of the debris or material deposited during the disaster can be obtained from the sources indicated above or directly from companies specializing in demolition work, earth moving and transport of materials and aggregates.

g. Sources of information

Generally, information on the magnitude of damage will be obtained from organizations which operate in the affected zone and by on-sight evaluator inspections. Construction prices can be obtained from sector organizations or directly from suppliers.

i) **Sources of information on the magnitude of the damage**. The main source is the reports of organizations responding to the emergency, press reports, graphic material (area photographs, photographic records, films) and the reports or records of the evaluator's on-sight inspections

That data and other information obtained directly from organizations at work in the affected area, such as those of international aid: multilateral, bilateral, non-governmental (including the churches), from the central government· the civil defense agency, the Ministry/Institute of Planning; from municipal and regional governments; from non-governmental aid agencies· churches, non-governmental research and technical support agencies, sector institutes; and insurance companies.

ii) **Sources of information on unit prices**. These data can normally be obtained from periodical bulletins reporting construction sector prices, the documentation for contract bids for housing construction, reports on unit prices for housing prepared by the relevant governmental organisms, the price lists of suppliers of materials and equipment, indexes of price and salary variations, reports on diverse prices in the trade, construction and industrial sectors, and the press.

This type of information can also be obtained from domestic and international suppliers of material and equipment, chambers of construction, industry and commerce, national statistics institutes/agencies, the Ministry/Institute of Housing and Urban Affairs, Colleges/associations/federations of architects and engineers, academic and research institutes, construction companies and the press.

3. INDIRECT EFFECTS

a. General observations

Together with the loss of capital and property involved in the destruction of housing (direct effects), there are other indirect effects of the disaster, related to:

i the necessary costs involved in obtaining dwellings equivalent to those in existence prior to the disaster (together with those costs already considered as arising from the direct effects)

ii. Other costs or losses (in the production of goods and services or income) to the family or the nation arising from the direct damage caused to housing In coherence

with the general criterion for this manual, the costs considered in this category will include only those incurred after the emergency stage.

For the purpose of calculating them in categories similar to those employed for direct effects, it is recommended that indirect effects be classified as: urban and rural; public and private

A basic criterion for the identification of indirect effects is that they should be easy to express as costs and to add to direct effects, in order to calculate the total damage caused by the disaster Although the damage to housing has other additional effects on economic and social conditions within the country, these may be considered as "secondary" effects and are treated below.

In Chart 7, the indirect effects to be taken into account are presented

b. Assessment and appraisal of indirect effects

i **Stabilizing the ground and protection of dwellings**. In some cases, repair and replacement works, the reconnection of services, demolition and debris removal must be complemented by other works to ensure the quality of the repaired dwellings under normal conditions and a minimum of protection in the event of another disaster. This category includes works to stabilize the ground affected by settling or sliding (earthquakes, land slides, etc.) or those undertaken to provide protection against flooding.

The typologies and costs of stabilization and housing protection works are too varied to be classified, so that the analyst should determine the main works required in each situation and, insofar as possible, express them in terms of a generalized "housing unit" or, if this is not possible, for the total number of dwellings which will be affected by this type of work It will be very useful for the evaluator to break down stabilization and protection works into their basic components of labour, materials and equipment, making it easier to obtain unit prices

Information on costs for land stabilization and housing protection works can be obtained from the same sources mentioned above in the section on direct effects

ii. **Relocation of housing occupants and uninhabitable settlements**. All costs arising from the need to relocate the inhabitants of housing damaged by the disaster to new or provisional places of residence, together with the relocation of families and settlements located in dangerous localities or those vulnerable to new disasters are included in this section. For the purposes of this manual, movements undertaken in the emergency stage are not taken into account The analyst should establish a degree of certainty that the relocation activities being evaluated are feasible to be performed, prior to their inclusion in the calculation of damage To this end, the

five UNDRO requisites for evaluating the possible success of a relocation should be applied.

- the consent of the community affected,
- the availability of safe land, at a cost which the community (or the State) can bear;
- the proximity to sources of employment or social services;
- the provision of services and facilities for the construction and financing of housing;
- the existence of services and facilities for the construction and financing of housing.

Costs to be considered in this section include the cost of transportation to the new or provisional place of residence; the costs of preparing the land to be occupied temporarily or permanently, both those destined to physical preparation (including services for drinking water and disinfecting) and those involved in the purchase or rent of the land to be used; when this involves the provision of temporary (non-emergency) dwellings, that cost is included here; and also the administrative, legal, financial, etc. costs implicit in this activity.

To perform the appraisal, it is best to take the family (understood here as the occupants of a damaged dwelling) as the basic unit of measurement. The calculation of costs per family will make it possible to add them to the other direct and indirect damage already accounted for Some costs, such as those for transportation, will be easier to calculate per "person", but they can be converted into costs per family by applying an estimate of average family size for the zone or country under study. The necessary data can be obtained from public or private companies which specialize in the transportation of persons and cargo The evaluator should verify the information about transportation with the data obtained for the specific evaluation of that sector (See the Chapter on the transportation sector in Part Three of this Manual).

The costs involved in the preparation of land are very diverse and difficult to typify They may involve works such as. the opening of access roads, surveying and laying out plots, leveling and preparing land, and the installation of basic services (latrines, water spigots, etc). The evaluator should select the most relevant activities to be undertaken to attend to one family and apply the corresponding unit costs. Those costs, together with those for provisional housing (which are not the emergency shelters) may be obtained from the same sources mentioned in the previous section, as well as from those mentioned earlier.

iii. **Additional transportation needs of displaced families to their centres of work, education, etc** Families displaced to localities far from their original place of residence may incur additional transportation expenses as they travel to their habitual places of work and services Such expenses are usually assumed directly by the families; however, it may happen that the public sector will occasionally cover

part or all of them As in the case of "relocation", it will be best to take the "family" as the unit of measurement To arrive at that level of aggregation, the evaluator should estimate the average additional daily transportation expense for each member of a family representative of all the families affected in this way. Individual expenses will be accumulated to yield the average expense per family.

The additional daily expense per family is then multiplied by the number of days estimated before the situation returns to normal, thus yielding the total cost for transportation. Transportation costs can be obtained from the same sources indicated in section ii) above

iv. **Loss of income from rent not paid to the owners of damaged dwellings** The inventory of dwellings in a country generates income for the owners which is the value of the rent paid for those units, when they are rented Those same income flows should be attributed to dwellings occupied by their owners in order to reflect the loss of comfort (damage) they suffered as a result of the damage to their dwellings

When a certain number of dwellings are totally or partially destroyed, the (real or attributed) flow of income arising from the use (or rental) of those dwellings ceases Given that precise identification the number of cases in which this occurs as a result of the disaster may be very difficult, the evaluator should presume that income is lost only in the case of dwellings which have been totally destroyed or rendered uninhabitable. The value of the indirect damage calculated in this section will be equal to the amount of the "lost contribution to the national economy of the income attributed to housing", which is considered as a secondary effect (See section 4).

The corresponding loss of housing income is obtained by multiplying the number of totally destroyed dwellings by the average value of the rent for those same dwellings. In order to make that value uniform with that to be estimated for secondary effects, the average rent used will be that employed by the economic authorities in national surveys (which is usually that used in surveys of household expenses).

v. **Lost public sector income from unpaid taxes on damaged dwellings**. In normal circumstances, the inventory of housing in a country generates income for the public sector (central or local governments), in the form of land taxes. In some countries, however, a large percentage of that inventory is not adequately registered and, therefore, does not produce tax revenue.

When a certain number of dwellings are totally or partially destroyed, they may cease to generate tax revenue, thus reducing public sector income from that area. In order to estimate that public sector loss, the evaluator should first determine that the number of destroyed dwellings, subject to taxation, and the amount of tax revenue in question are significantly great to justify their calculation and inclusion in the list of damage.

The value of this type of indirect damage will also be important in the calculation of secondary effects on the gross domestic product and public sector finances (See the following section 4 and Part Five of this Manual).

The loss to the public sector arising from uncollected tax revenue is equal to the amount of tax paid per average dwelling (dwelling representative of the destroyed dwellings), multiplied by the number of dwellings totally destroyed which had been subject to taxation prior to the disaster

4. SECONDARY EFFECTS

Together with the direct and indirect effects described in earlier sections, the destruction of housing produces several secondary effects on the economic and social conditions of the affected population and the country, as a whole, which become apparent some time after the disaster As is known, those effects are not added to the direct and indirect effects For the purposes of this evaluation, a qualitative or, perhaps, a quantitative assessment of the impact of the disaster on diverse indicators of the economic and social conditions in the country affected should be made, so that the evaluator may study and integrate them.

This section indicates several particularly relevant secondary effects arising from the destruction of housing, such as:

i. loss of income, which would normally be generated by or imputed to housing rental;

ii. variations in housing sector employment rates;

iii. effects on the balance of payments;

iv effects on the public sector;

v. effects on inflation.

a. Loss of housing rental income to the national economy

The inventory of dwellings in a country generates an income equivalent to the product of the number of dwellings, multiplied by the value of the rent actually paid, plus that imputed to owner-occupied dwellings. When a certain number of dwellings disappears, having been destroyed by a natural disaster, the income normally generated by the corresponding activity (housing rentals) will be affected (See Part Three of this Manual).

The corresponding loss of rental income is obtained by multiplying the number of dwelling totally destroyed by the value of the average rent imputed to those dwellings

b. Variations in housing sector employment rates

A disaster may affect housing sector employment rates in the following ways:

i. Increase employment in reconstruction works;

ii Reduce employment due to the temporary closure of conventional construction activities at the time of the disaster;

iii. Create employment in emergency activities.

In this section, only the evaluation of variations in the number of jobs will be addressed, because the costs of the job positions created are dealt with in the appraisal of repair/replacement works (case i) or emergency works (case iii). Experience shows that the loss of jobs due to the closure of housing construction (case ii) is normally slight and, therefore, may be excluded, if the evaluator so determines

Given that, due to factors not directly related to the disaster, reconstruction works may extend into the mid- and long-terms, it is recommended that the impact on employment be studied "only" in the short term; that is, during the year or two, at most, after the disaster

Increases in employment can be estimated on the basis of the investment made in reconstruction works during the year following the disaster, dividing it by the investment necessary to create one job in the country under study (it is worth noting that research has shown that, in Latin America and the Caribbean, between US$ 3 000 and US$ 7 000 of investment in "conventional" housing construction are needed to create a job/year);

Jobs lost due to the closure of works (if deemed necessary) the final cost (finished) of the works paralyzed by the disaster should be calculated and divided by the investment necessary to create a job while the conventional works are paralyzed

c. Effects on the balance of payments

The destruction of housing and subsequent reparation and replacement works may have significant impact on the county's volumes of imports and exports of goods and services Some of the flows of goods and services and of capital, which may occur between the country and abroad and which may affect the balance of payments, are discussed here.

i. Imports of materials, inputs and equipment for the reparation and replacement of housing The need for additional imports, as a result of the disaster, should be calculated. The appraisal of additional imports should be based on the calculations made for the quantification and appraisal of the imports component of the direct damage (See the previous section)

ii. Cash income from loans and donations for emergency and reconstruction works. Those values can be estimated on the basis of the costs of the emergency phase and the foreign currency component estimated for reconstruction projects.

iii Cash income for the payment of secondary insurance on damaged housing. In the case of housing, the total amounts arising from secondary insurance may be very small, however, the evaluator should ascertain the facts before proceeding with the evaluation

iv. Income loss from exports not realized, because national production of housing materials and components (example: cement, iron, hardware, etc.) normally geared for export will be employed during the transition process to cover reconstruction needs.

d. Effects on the public sector

The destruction of housing and subsequent reconstruction works may have significant impact on the finances of the public sector Here, only two of the most relevant aspects of this issue should be taken into account.

i Increased public sector expense/investment needed for reconstruction works in the housing sector. This greater expense can be calculated on the basis of the costs estimated for reconstruction projects.

ii Reduced public sector income arising from lower tax revenues from dwellings totally destroyed These values can be calculated on the basis of what was indicated above

e. Effects on inflation

Normally, during the evaluation period, it will be possible to make only a very rough estimate of the impact of the destruction of housing and the demand for construction materials on the prices of those products. To this end, the evaluator can be guided, to a degree, by comparing prices prior to the disaster with those in effect during the evaluation itself. Future trends for the period deemed relevant for the calculation of secondary effects must be evaluated jointly with the macroeconomist and the evaluator of the industrial sector, who will indicate current stocks of materials and the country's capacity to produce and distribute them.

A general recommendation for sector evaluators, specially those of the housing sector, is that they work closely with the macroeconomist to obtain the necessary information and harmonize criteria for the calculation of the flows mentioned above.

5. RECONSTRUCTION PERIOD AND WORKS

a. General observations

The purpose of including this section in the chapter on housing is to present a description of the special characteristics of the housing under analysis and its surroundings in the disaster zone which are believed to have been determinant of the magnitude and type of damage caused to those dwellings. The analysis of these characteristics will make it possible for the evaluator to put forward general recommendations for the execution of reconstruction works, including measures geared to prevent or mitigate the impact of a future occurrence of natural phenomena of similar intensity. Finally, it is recommended that an estimated calendar of activities and expenses for reconstruction works be included in this chapter, in order to guide government and other aid organization activities

The most common types of dwelling in the affected zone and the impact produced in them by the disaster (structural and non-structural) should be described The construction materials most commonly used in the area, their quality, their behaviour during the disaster, and their adequacy to the most common construction typologies should also be included. Finally, the placement of the dwellings and the physical characteristics of their surroundings (soils, geology, topography, etc.) which may have affected housing resistance to the disaster should be indicated. A brief list of recommendations about the most relevant aspects of the reconstruction process is included here, as follows:

i. Technical characteristics of housing repair, the processes to be applied and the materials to be used. The same for the construction of new housing.

ii The placement or relocation of housing according to the characteristics of the surroundings Need for preparatory works, if it is impossible to relocate dwellings situated in vulnerable places.

iii. Economic and input supply aspects of reconstruction works.

iv. Organizational and institutional questions related to the execution of reconstruction works (community participation, technical assistance, training, institutional coordination, etc.).

List of research projects and technical cooperation activities designed to develop these recommendations in greater depth and support reconstruction works These projects should address four main issues: construction and repair techniques; costs and materials, institutional organization and coordination; and housing location.

List of reconstruction/rehabilitation projects, in which the amounts of investment needed should be indicated, together with possible sources of financing national resources and foreign loans or donations

b. Programming reconstruction works

Programming reconstruction and its corresponding budget in order to generate an hypothesis about the amounts and time periods during which investments should be made for reconstruction works, together with estimates of their impact on public sector finances and its institutional capacity to execute those works.

The following aspects should be taken into account in the programming of reconstruction works:

i existence of economic resources and normal execution periods for the allocation and utilization of those resources,

ii institutional and organizational capacity for reconstruction works, taking into account the role to be played by the public sector, the private sector and civic organizations;

iii. the supply of inputs for reconstruction works, including human resources, materials and equipment, and considering that, in some cases, it will be necessary to import them,

iv. the time needed to design, plan and organize reconstruction activities, and

v. climatic and physical aspects (for example, the length of the rainy season which would hinder reconstruction works or the time deemed necessary for a flooded zone to drain and become apt for the realization of reconstruction works).

The evaluator should obtain information about the aspects mentioned above from public and private sector organizations, as well as from direct observation during the evaluation. This information will make it possible to programme the number of housing units and the amount of investment in housing in terms of annual periods for the entire reconstruction period, or for a period agreed upon, according to the programming needs of the country under study

Chart 1
SUMMARY OF EFFECTS ON THE HOUSING SECTOR

Effects of the disaster	Cost (Millions of monetary units)					Reconstruction or reparation period (months)
	Total 1/	Public 2/	Private	Rural	Urban	
a) Direct effects: (i+ii)						
i. Reparation						
ii. Replacement						
Imported component 3/						
b) Indirect effects:						
c) Sub Total (a+b)						
d) Secondary effects:						

1/ Total cost corresponds to the sum of costs for the urban and rural categories, which will be equal to the sum of public and private costs.
2/ The number of publicly owned dwellings is usually not significant. Nevertheless, it has been retained as a separate category for the sake of coherence with the global classification of damage, which separates public from private damage.
3/ The imported component refers both to repairs and replacements; they should not, then, be added together.

Chart 2
CLASSIFICATION OF HOUSING

Category	Typology of privately owned dwellings			Collective dwellings 1/
	Total number of dwellings	By type of construction	By cost	
By location				
Urban				
Rural				
Total 2/				
By ownership				
Public				
Private				
Total 2/				

1/ Experience indicates that the great majority of collective dwellings should be considered to be permanent and have similar construction costs, within each category

2/ The total number of urban and rural dwellings is equal to the total of public and private sector dwellings

Chart 3

UNITS FOR MEASURING THE REPAIR OR REPLACEMENT OF HOUSING COMPONENTS (INCLUDES INPUTS)

Components	Labour	Materials (includes accessories and equipment)		Equipment used for repairs and replacements	
	Domestic	Domestic	Imported	Domestic	Imported
Unit of measurement	Days or man/hours by:	Quantity of materials (cement, pipe, wire, doors, windows, etc.) or furnishings and equipment by:		Days or machine/hours by:	
Structure					
Repairs: Foundations	Lineal meter of average section (e.g. 0.06 x 0.7 m foundation)				
Rafters/columns	Average unit (e.g. 2.5 x 0.4 x 0.3 m column) lineal meter of average section (e.g. 0.4 x 0.3), m^2 surface, m^3.				
Floors/walls	Average unit (e.g. 2.2 x 4 x 0.3 m wall) average thickness (e.g. 0.15), m^3				
Repair and reinforcement	Same as above, but including reinforcement works				
Replacement (irreparable damage):					
Land preparation [1]	M^2 (includes excavation, plotting, etc.)				
Foundations	M^3				
Rafters/columns	M^3, average unit (3 m metal rafter)				
Floors/walls	M^3, average thickness (e.g. 0.15) m^3				
Non-structural elements					
Repairs: Partitions/dry wall	M^2				
Water/sewage	Water hook-up,[2] sewage hook-up, lineal meter exterior sewage (includes accessories)				
Electricity	Electrical inlets/outlets[3] (includes accessories)				
Roofs	(non-structural) m^2				
Carpentry	Number (doors, windows, etc.)				
Repair and reinforcement	Same as above, but including reinforcement works				
Replacement	Same as above (including all tasks from surveying to conclusion)				
Furnishings					
Partial replacement Minor	Inventory of furnishings destroyed in average dwellings with minor damage (approx. 25% destruction)				
Major	Inventory of furnishings destroyed in average dwellings with major damage (approx. 50% destruction)				
	Inventory of furnishings in average dwelling totally destroyed				
Equipment					
Repairs Minor	Inventory of repair work on equipment units with minor damage (25% destruction)				
Major	Inventory of repair work on equipment units with major damage (50% destruction)				
Replacement	Inventory of equipment units to be replaced (totally destroyed)				
Other					
Reconnection to services	Number of reconnections				

1 Does not include demolition, removal of debris, etc.

2 Each hook-up for sanitary units (e.g. garden spigot, kitchen faucet, etc.) Includes average materials per dwelling (pipe, accessory unions, sanitary apparatus, etc.)

3 Each electrical inlet or outlet (e.g. sockets, lamp outlet). Includes average materials for each dwelling (wire, tubing, lamps, etc).

Chart 4
LABOUR INPUT FOR REPAIR OF DAMAGED DWELLINGS

Description	Units (example)	Domestic		
		Quantity	Unit Price	Totals
Structures				
Repairs (with or without reinforcement)				
- Foundations	Man/days			
- Rafters/columns	"			
- Floors/walls	"			
Replacements (irreparable damage)				
- Land preparation	"			
- Foundations	"			
- Rafters/columns	"			
- Floors/walls	"			
Non-structural elements				
Repairs (with or without reinforcement)				
- Partitions/dry wall	"			
- Water/sewage	"			
- Electricity	"			
- Roofs	"			
- Carpentry (doors, windows, etc)	"			
Replacements (irreparable damage)				
- Partitions/dry wall	"			
- Water/sewage	"			
- Electricity	"			
- Roofs	"			
- Carpentry (doors, windows, etc)	"			
Furnishings				
Replacements (minor: approx. 25%, major: approx 50%, total)	"			
Equipment				
Repairs (minor. approx. 25%, major: approx 50%, total)	"			
Replacement	"			
Other				
Reconnection to services	"			
Total				

Chart 5
MATERIALS INPUTS FOR REPAIR OF DAMAGED DWELLINGS

Description	Units (example)	Domestic			Imported		
		Quantity	Unit price	Totals	Quantity	Unit price	Totals
Structures							
Repairs (with or without reinforcement)							
- Foundations	m^3 concrete						
- Rafters/columns	m^3 concrete						
- Floors/walls	m^3 concrete						
Replacements (irreparable damage)							
- Land preparation							
- Foundations	m^3 concrete						
- Rafters/columns	m^3 concrete						
- Floors/walls	m^3 concrete						
Non-structural elements							
Repairs (with or without reinforcement)							
- Partitions/dry wall	m^2 stucco plus paint						
- Water/sewage	Number of sewage hook-ups						
- Electricity	Number: electrical inlets/outlets						
- Roofs	m^2 clay tile (including trusses)						
- Carpentry (doors, windows, etc.)	Number: doors and windows						
Furnishings							
Replacements (minor: approx. 25%, major: approx. 50%, total)	Inventory of damage						
Equipment							
Repairs (minor: approx. 25%, major: approx. 50%, total)	Inventory of damage						
Replacement	Number of units destroyed						
Other							
Reconnection to services	Number						
Total							

Chart 6

EQUIPMENT USED IN THE REPAIR OF DAMAGED DWELLINGS

Description	Units (example)	Domestic			Imported		
		Quantity	Unit price	Totals	Quantity	Unit price	Totals
Structures							
Repairs (with or without reinforcement)							
- Foundations	Mixer/hours						
- Rafters/columns	Mixer/hours - crane – vibrator						
- Floors/walls	Mixer/hours - crane – vibrator						
Replacements (irreparable damage)							
- Land preparation	Mixer/hours						
- Foundations	Mixer/hours						
- Rafters/columns	Mixer/hours - crane – vibrator						
- Floors/walls	Mixer/hours - crane - vibrator						
Non-structural elements							
Repairs (with or without reinforcement)							
- Partitions/dry wall	"						
- Water/sewage	"						
- Electricity	"						
- Roofs	"						
- Carpentry (doors, windows, etc.)	"						
Replacements (irreparable damage)							
- Partitions/dry wall	Crane/hours						
- Water/sewage	"						
- Electricity	"						
- Roofs	"						
- Carpentry (doors, windows, etc.)	"						
Furnishings							
Replacements (minor: approx. 25%, major: approx. 50%, total)	"						
Equipment							
Repairs (minor: approx. 25%, major: approx. 50%, total)	"						
Replacement							
Other							
Reconnection to services							
Total							

Chart 7
INDIRECT EFFECTS ON THE HOUSING SECTOR

Description	Total 1/	Cost per category			
		Urban	Rural	Public	Private
Stabilization, housing protection					
Relocation of settlements					
Additional transportation					
Rental income lost					
Public sector income lost					
TOTAL					

1/ The total cost corresponds to the sum of the costs for urban and rural categories, which will be equal to the sum of public and private sector costs.

Note: When determining costs, market prices, current at the time of the disaster, are used.