# TECHNICAL REPORT
# on
# LUZON EARTHQUAKE OF 16 JULY 1990, REPUBLIC OF THE PHILIPPINES
# with
# RECOMMENDATIONS FOR RECONSTRUCTION AND DEVELOPMENT

UNITED NATIONS CENTRE FOR HUMAN SETTLEMENTS (HABITAT)

Project PHI/90/F01
Mission to Assist in Reconstruction and Development
After the Philippines Earthquake of 16 July 1990

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# RECOMMENDATIONS FOR RECONSTRUCTION AND DEVELOPMENT

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**Expert Mission to Assist in Reconstruction and Development After the Philippines Earthquake of 16 July 1990**

PHI/90/FO1

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## EXECUTIVE SUMMARY

### The Earthquake of 16 July, 1990

The 16 July earthquake struck north-central Luzon, severing road and telecommunications links, and destroying homes, commercial establishments, factories and agricultural installations. According to the National Disaster Coordinating Council, over 1,200 people died, while more than 2,700 were injured. Overall, it is estimated that 120,000 people were left homeless, and property losses exceeded 15 billion pesos (US$555.5 million). Physical damage was generally confined to localized pockets, except in highland areas of Benguet and Nueva Vizcaya where it was extensive. The nation's capital, Manila, although badly shaken, suffered only modest damage.

The destruction caused by the earthquake is having serious repercussions on the lives and economic activities of not only the people directly affected, but of Filipinos in general. The problem of broken road links illustrates the point. The flows of goods and supplies for farmers and manufacturers have been choked and as a result people who barely noticed the seismic event now feel their standard of living decline in its aftermath. The earthquake has resulted in increased food prices and unemployment, and has added pressure on the national balance of payments.

Consequently, the earthquake has placed a heavy new burden on a nation already struggling with major economic and other problems. The affected physical environment, cities, towns, villages, and transport and other networks, will have to be rehabilitated for the economic and social systems to return to "normalcy". The estimated cost of reconstruction and associated development will be more than billion pesos, demonstrating the severe impact that such an event can have on the infrastructure and economy of a region. As the population grows, and investment accumulates in infrastructure and the built environment, the threat of ever-larger losses being inflicted by earthquakes also grows. This recent disaster has highlighted the need to develop a comprehensive national strategy to protect the nation's

population and investment from future strong earthquakes. The issues fall into three categories:

- Reduction of Earthquake Consequences
- Reconstruction Planning
- Programme Implementation

## Reduction of Earthquake Consequences

Multi-Hazard Mitigation: A multi-hazard protection plan should be developed using a database of the building stock, physical infrastructure and economic systems in the region, and the vulnerability to each element at risk to each of the hazards (earthquake, typhoon and other natural disasters). The plan should be drawn up prioritizing investment to produce the maximum reduction in threat to life, structures, and economic production.

Preparedness for Future Earthquakes and Other Natural Disasters: A national institution or administration should be established, either by creating a new body or by expanding the powers of the present National Disaster Coordinating Council to cover physical planning, engineering standards and professional education standards related to earthquake impact mitigation. This body should be capable of providing support and guidelines to regional development councils, national authorities and scientific institutions.

Professional Familiarity with Earthquake Protection Techniques: A Technical Assistance programme should be formulated to help professionals in the Philippines acquire information and to benefit from disaster mitigation experience of their counterparts in other countries. In addition, a general public information and education project should be undertaken through news and entertainment media.

Capabilities for Implementation of Protection Plans: The government should undertake a full review of methods and resources needed to implement disaster protection plans. Recommendations should be made, as appropriate, for revisions to procedures, manpower authorizations, and legal regulations.

## Reconstruction Planning

Strategic Policy for Reconstruction and Development: The National Economic Development Authority should design a strategic plan for the reconstruction and development of territory affected by the earthquake as an integrated area. The plan should provide guidelines to be used in assessing the priority of individual projects proposed from the individual regions. Technical Assistance should be used to acquire benefit of experience in other countries in post-disaster development planning.

Programme for Regional Transportation Network: Transportation infrastructure projects should be planned within the context of the regional development strategy. Integrated urban growth, industrial expansion, agricultural production, and service sector development should be considered. Repair and new construction needs should be assessed within this framework. During the planning phase (estimated duration 6 months) repair work for restoration of function should continue on vital linkages, but upgrading projects should await the design of the regional strategy.

Planning Urban Development: Strategic Planning vs Master planning: Urban planning should be made a dynamic process guided by strategic objectives. The objectives should be reviewed as part of the annual budget process, and thoroughly updated at least once every five years.

Managing Urban Development: A set of guidelines for urban planners should be developed to incorporate building stock management techniques into the planning process. These include differential property taxation, planning dispensations, control of utilities supply, deconcentration of facilities, strengthening of key buildings, and disaster access route planning. The guidelines should be developed within a framework of seismic risk analysis in which building stock information, ground condition mapping, and expected earthquake shaking levels are used to assess areas and building types most at risk.

Metropolitan Concepts in Urban Development Planning: Several cities have outgrown their administrative boundaries and urban development is spilling over into adjacent municipalities. The autonomy of decision-making authority in each city and municipality must be reconciled with the need to coordinate urban development over an area that covers several administrative units.

Water Resource Development in Cities: As urban areas grow, their need for water often outstrips the capacity of local supply. Administrative mechanisms must be created to facilitate large scale, risk minimizing water resource development for areas covering several administrative (city/municipality) units.

Emergency Interim Building Code : An emergency interim building code should be quickly adopted to allow individuals who wish to rebuild immediately to do so. The interim building code should be strict enough to ensure that regardless of the outcome of the subsequent planning process, the new buildings will be in compliance with the plan.

**Programme Implementation**

Use of Local Building Companies: A practice should be established for the government to use locally-based contractors for reconstruction projects. Government procurement procedures may need adjustment. Also, assistance may need

to be offered to expand local contractor capability.

Integrated Plan for Building Materials: An integrated plan for building materials supply should be developed for reconstruction needs. Imported materials should be used only when national supply is not possible.

Straightening Tilted Buildings Using Local Companies: Technical assistance should be provided to help with technology transfer of engineering techniques for straightening tilted buildings.

Special Training for Building Contractors: The earthquake Building damage patterns suggest that construction contractors in the region have little experience in designing reinforced concrete for earthquake resistance, and that they need a better understanding of the engineering and construction principles involved. Training programmes for building contractors are needed to improve the quality of reinforced concrete design and construction. They should be practical in nature, giving information on earthquake forces and basic guidelines on good practice for building earthquake-resistant structures.

**TABLE OF CONTENTS**

## Chapter 1

## INTRODUCTION AND OVERVIEW OF MISSION

### 1. Earthquake of 16 July, 1990

The 16 July earthquake struck north-central Luzon, the main island of the Philippine archipelago, severing road and telecommunications links, and making rubble of homes, commercial establishments, factories and agricultural installations. According to the National Disaster Coordinating Council, more than 1,200 people died in the disaster (the second highest earthquake death toll in the country in this century), and more than 2,700 were injured. Property losses exceeded 15 billion pesos (US$ 555.5 million). More than 120,000 people were left homeless.

The type of damage differed with topographical and geological conditions, as well as with variations in the shock intensities as experienced in each locality. Physical damage was generally confined to pockets, except in the highland areas of Benguet and Nueva Vizcaya where it was more extensive. The damage in highland cities such as Baguio, although extensive was also localized. In this city damage was limited to individual structures. Often a particular structure was destroyed while those adjacent were virtually undamaged. Damage in the coastal city of Dagupan was exceptionally extensive. Fortunately, the nation's capital, Manila, although badly shaken, suffered only modest damage.

The destruction caused by the earthquake is having serious repercussions on the lives and economic activities of not only the area affected by the seismic activity, but throughout the country. The problem of broken road links illustrates the point. It has choked the flow of goods and supplies for farmers and manufacturers and as a result, has caused people who barely noticed the seismic event to feel their standard of living decline in its aftermath. The earthquake has had an impact on food prices, unemployment and the balance of payments deficit.

Although the immediate physical damage was limited to central Luzon island, the earthquake has placed a heavy new burden on a nation already struggling with major economic and other problems. The affected physical environment, cities, towns, villages, transport and other networks, will have to be rehabilitated for the economic and social systems to return to "normalcy". If however, reconstruction and rehabilitation efforts are properly carried out, they can

help revitalize the affected region and have strong positive effects throughout the country.

## 1.1 Macro-economic Impact

As a result of the earthquake, substantial losses are expected in the outputs of Regions I, II, III and CAR (regions comprising north-central Luzon) which together account for 15 percent of the country's domestic output. These regions are major producers of the country's supply of essential foodstuffs, accounting for more than 30 percent of the total value added in agriculture. The CAR produced nearly 50 percent of the country's total metallic mineral production in 1988. La Union and Benguet (provinces) are major tourist destinations.

The implications of the earthquake for national development will be significant (particularly since they will be added to other factors contributing negatively to economic growth, namely the rise of petroleum import costs as a result of the Middle East crisis and other natural disasters such as the typhoon that devastated the central Visayas islands in November). The economy is expected to slow down reducing the growth of the GDP in 1990 by 1.2 - 1.3 percentage points from the pre-earthquake forecast of 4.3 percent. Correspondingly, GNP growth will slow by an estimated 1.2 - 1.6 percentage points from the original forecast of 4.8 percent. Although this refelcts the impact on the economy of the hostilities in the Middle East, it does not take into account the Visayas typhoon.

### 1.1.1 Balance of Payments

The surplus in the country's balance of payments (BOP) after the rescheduling of foreign debts and the infusion of new money is also expected to decline by US$73 million in 1990 from the pre-earthquake estimate of US$418 million due to the earthquake alone. The BOP effects of the earthquake will be felt largely by in the export and tourism sectors. Export receipts will likely contract following a reduction in the export volumes as a result of the disruption in production activities at the Baguio City Export Processing Zone (BCEPZ), Philex Mining and Benguet Mining, as well as of damages to the fishponds in Regions I, II, III, and to the tobacco plantations in Abra and La Union. Tourist receipts are expected to decline due to a drop in tourist arrivals in areas which have been heavily damaged, particularly Baguio which is a favourite tourist destination.

### 1.1.2 Prices and Employment

With the tightening of the food supply as a result of bottlenecks in the distribution from farm to market, the price of food in Metro Manila went up to 16.5 percent annualized rate of inflation in July from 13.5 percent in June. Although the situation was not replicated in other areas and food supply has already eased from the July situation, the

average consumer price index for 1990 will nonetheless increase from the original estimate of 11.7 percent to 13.4 - 14.0 percent.

Meanwhile, estimates of job losses directly attributable to the earthquake for the affected regions are as follows: CAR 8,556, Region I 11,345, Region II 10,500. ALthough there are no official reports yet available on the number of job losses resulting from the earthquake in Region III or the country as a whole, given the declines in production estimated during the year, the national unemployment rate could increase from the original estimate of 10.0 percent to at least 10.6 percent or by an additional 152,000 unemployed.

## 1.2 Impact on Major Economic and Social Sectors

### 1.2.1 Agriculture.

The overall economic losses caused by the earthquake far exceeded the costs of repairing the physical damage. While these costs reflect only the expenditures needed to re-establish function (e.g.: repairing and restocking fish-ponds), overall economic losses include among others: foregone income from existing crops affected by the earthquake; effects of disruption in distribution flows of agricultural output and inputs due to damages to infrastructure and the consequent transport problems; and, losses from displaced labour. Moreover, the disruption in the flow of goods and services to the affected region is currently causing a shortage of agricultural inputs. Since a substantial 40 percent of the country's rice growing area, and 52 percent of the vegetable growing area are located in the earthquake affected region, access to the region is essential to avert food shortages.

### 1.2.2 Industry, Trade and Tourism.

The greatest impact in terms of foregone revenues and opportunities is on the tourism. The losses in this subsector have been projected at a minimum of 1.5 billion pesos. The mining industry is also projected to have lost about 1.2 billion pesos from reduced production of gold, copper and silver. In manufacturing the gross value added is expected to be severely affected since the stricken regions contribute about 11 percent to the country's manufacturing output. Foregone revenues in manufacturing are expected to be around 250 million pesos by year end.

### 1.2.3 Health Sector.

The damages inflicted on health services facilities constitute a serious burden to the government not only in terms of rehabilitation and reconstruction costs, but also in meeting the service demand of the population. The replacement cost, estimated at 30 million pesos, will compound the bleak financial situation of the sector.

1.2.4 Housing.

The loss of over 25,000 housing units will strain the already troubled low income housing sector. Not only will these units have to be built, but there will be no units released by the tenants when they move to the new housing.

1.2.5 Education.

The damage suffered by educational facilities, whether partial or total, will add to the shortage of classrooms in the country. Educational standards will be impacted by the dislocation of earthquake affected families, and overcrowding in existing schools.

1.2.6 Environment.

The degradation of the environment in the mountain areas was aggravated by the tremor and consequent land and rock slides. The landslides have also affected low-laying areas as mudflows have moved downstream.

The forestry sector was affected as approximately 800 hectares of newly established plantations were washed away due to landslides while 1.13 million seedlings were covered by mudflows. Some 750 hectares of natural forest and old plantations were also damaged. The total cost of replacement is estimated at 21.4 million pesos.

In summary, the affected physical environment, cities, towns, villages, transport and other networks, will have to be rehabilitated in order that the economic and social systems can return to "normalcy". In fact, the massive investments that have to made in the affected area can and should be strategically placed so as to revitalize the economy of the region and the country.

This disaster has had significant effects throughout the country although the immediate physical damage was limited to central Luzon island. It follows that reconstruction and rehabilitation efforts, if properly carried out, can not only minimize the negative impact of the earthquake on the Philippines as a whole, but can indeed revitalize the affected region and have beneficial effects throughout the country.

## 2. Response Initiative of United Nation Centre for Human Settlements

In response to the disaster the United Nations Centre for Human Settlements (HABITAT) offered to field an expert mission to advice on reconstruction strategies and on the identification of possible technical assistance needs. After review of the reports on extent and nature of damage caused by the earthquake, and in consultation with the government, the following composition for the mission was decided:

**Mr. Ignacio Armillas**, Team Leader
Coordinator, Asia and Pacific Unit
Technical Cooperation Division
United Nations Centre for Human Settlements (HABITAT)

Urban Planner specializing in physical planning in earthquake prone areas.

**Prof. Jakim Petrovski**, Team Co-leader
Institute of Earthquake Engineering and Engineering Seismology
Skopje University, Yugoslavia

Earthquake Engineer, experience in urban and regional seismic risk assessment and mitigation planning.

**Dr. Andrew Coburn**
The Martin Centre for Architectural and Urban Studies
University of Cambridge, United Kingdom

Architect/Planner specializing in earthquake protection planning and vulnerability of non-engineered buildings.

**Dr. Arturo G. Corpuz**
School of Urban and Regional Planning
University of the Philippines

Regional Planner specializing in regional transportation and land use in developing countries.

**Dr. David Lewis**
Associate Professor and Chairman,
Department of City and Regional Planning
Cornell University, USA

Regional Development planner specializing in project design and programme management in developing countries.

## 2.1 Purpose of the Mission

To assist the Government of the Philippines in the identifying the major technical issues in relation to the selection of appropriate locations for reconstruction/relocation, in the reduction of structural vulnerability, and in the formulation of the terms of reference for a comprehensive regional redevelopment planning programme following the 16 July 1990 earthquake.

### 2.1.1 Specific Objectives

- To determine the extent of physical damage to human settlements, housing, infrastructure, and industry; and, to identify major systemic flaws that increase structural vulnerability;

- To develop proposals for mechanisms which should ensure effective implementation of rehabilitation, reconstruction,

and relocation projects;

- To formulate recommendations to the Government of the Republic of the Philippines and the United Nations Resident Representative, Manila, on assistance required for immediate recovery needs;

- To prepare a proposal (a) to evaluate the short-term recovery effort and (b) to formulate a for a long-term programme for regional development by integrating Government, NGO, multi- and bi-lateral aid.

2.1.2 Activities and Results of the Mission

The mission visited the Philippines from 22 November to 21 December 1990. The first week was spent on collection of data and information. Meetings were held with officials from the National Economic Development Authority (NEDA), the Housing and Urban Development Coordinating Council (HUDCC), the Philippines Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Philippine Institute of Volcanology and Seismology (PHIVOLCS), the Presidential Task Force for Earthquake Reconstruction, the Department of Public Works and Highways (DPWH); as well as officials from the UNDP/Manila Office and World Bank Consultants.

A week long field trip was undertaken during the second week of the mission. This trip covered Baguio and environs in the mountains; and, La Union, Agoo and Dagupan on the coast. The remaining time was spent in Manila reviewing the information gathered and preparing this report.

Day long seminars on "Earthquake Reconstruction, Seismic Risk and Vulnerability Reduction" were given by the team members. The seminars were presented in Baguio City (4 December), Dagupan City (7 December), and Manila (11 December). The seminars were attended by senior staff of the regional offices of NEDA in Baguio and Dagupan and senior staff of NEDA in Manila.

This report is the result of the mission, it contains the findings and recommendations elaborated by the team.