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A NATIONAL PLAN OF HAZARD REDUCTION

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SUMMARY

Using previously developed microzonation methods and techniques, and the experience applying them to urban planning, and to select the best location for engineering works, they were extrapolated to regional development planning. The method was applied to the Trifinio region in Central America and is being applied to the Grau region, one of the Peru's new 11 regions. A national plan of hazard reduction is being prepared summing up the multihazard reduction codes for each of the Peruvian regions, to which measures concerning the whole country are to be added. CISMID will play a key role implementing that plan. In this way, Peru is preparing its participation in the "International Decade of Hazard Reduction".

1. INTRODUCTION & BACKGROUND

Two processes started in Peru in 1970 & 1984, an agreement signed between the governments of Japan & Peru creating CISMID, the Japan Peru Center for Earthquake Engineering Research and Disasters Mitigation, and the proposal made by Dr. Frank Press to the international community to designate the years 1900 to 2000 as "The International Decade of Hazard Reduction", in 1984, have shaped the content of this paper, having the objective to prepare a draft of a national plan of disaster mitigation in Peru.

Detailed & systematic field surveys of earthquakes happened in Peru during the 1960s & 1970s, specially the 1970 event, which left 67,000 victims, and the experience preparing the repairing and retroffiting projects of more than 150 R.C. buildings and about 3000 masonry dwellings, damaged by those earthquakes (1)*, permited to reach the following conclusions:

a. More than 80% of the damages on R.C. and brick buildings were due to their inadequate structural & architectural configuration to take horizontal forces such as short columns, excentricity, weakness in one direction, lack of enough separation between buildings. Non-engineered adobe constructions with light roof fail at the corner and at the center of the walls upper border.

b. The natural soil conditions given by the soil characteristics, the geology and the topography has a clear and strong influence on the severity and extend of the damages. This is particulary true for the weak non-engineered adobe constructions. Its destructiveness is very sensitive to changes of seismic intensity of intermedia level VI, VII & VIII MM.

(*) Reference

Most of the problems relate to a), may be solved by adding and/or improving the arrangement of efficient elements to take horizontal seismic forces, such as R.C. shear walls to engineered buildings, and by adding continuos tie beams to the walls upper part of constructions with ligh roof.

So the effort, of the first author, from 1970 to date, was concentrated in trying to give some contribution to the second problem. Together with colleagues, who were the Peruvian counterparts of the Japanese Mission who made the first microzonation studies in Peru, in 1970 (2), microzonation methods and techniques - were developed, and then update, in 1977-78 (3). They were simplified in 1979 to have wider application in the urban planning of small and medium size human conglomerates (4). In 1982, the United Nations convened an expert group meeting, to prepare a document to advise the governments with disaster prone territories, not to expand any human conglomerate neither build important civil works, before microzonation studies are made (5). In 1986, the application of microzonation was extrapolated from urban planning to regional development planning, and then applied to he Trifinio region located in Central America. In 1984, Peru started its regionalization process. Its territory of 1'285,937 km2 with 24 departments is being transformed into 11 regions.

The national Plan of Disaster Mitigation consists of implementing the multihazard reduction codes for the Peru's 11 new regions, plus general considerations for the whole country.

2. MICROZONATION AND ITS APPLICATION TO DISASTER MITIGATION IN THE REGIONAL DEVELOPMENT PLANNING.

Using tools previously developed & applied to urban planning, microzonation methods and techniques started to be applied for disaster mitigation purpose in the regional development planning in 1986 (6) (7) (8) (9) (10).

The strategy to extrapolate the microzonation method from urban planning to regional planning, is as follow: since the microzonation investigations usually cover relative small areas, few km2, are detailed, it is not possible, nor necessary, to cover the whole region, with such a detail. In the case of Peru, a region, covers several tens of thousands of km2. So, it is necessary to give priority to the areas to be studied. The priority is decided after a regionwide diagnosis is made, selecting:

- The populations of fastest growing rate in the region
- Populations with physical safety problem and/or are highly vulnerable to natural disasters.
- The areas where important engineering projects are to be situated to optimize their location, increasing their safety and reducing their construction cost.

3. MULTI-HAZARD REDUCTION CODE FOR THE TRIFINIO REGION (TR)

3.1 The Trifinio Project and its environment.- In August 1987, the Organization of American States, Department of Regional Development, (OAS/DRD) asked one of the authors to evaluate the natural disaster hazard in the TR and to formulate especifif recomendations to be taken into consideration in the development projects for that region (8). The TR is an area of about 10,000 km2 of boundary zones of Guatemala, Honduras and El Salvador that the governments of those countries are trying to develop as an integrating effort in Central America. The projects started first, to protect rich flora & fauna existing in Montecristo mountain (2.418 m).

To get the objectives, the Trifinio Project (11) (12) and the informations gathered by the 3 governments in Guatemala City were reviewed, together with the method developed by OAS/DRD to formulate integrated regional development planning (12). In this way it was possible to undertand the scope & philosophy of the project, determine the most frequent natural disasters ocurring in the region, what data were lacking, and where to find them. Then the work

ing program was prepared executed including the field survey.

3.2 Multihazard Reduction Code (*).- The most frequent natural hazards occurring in the TR and included in this code are: earthquakes, volcanism, floodings, hurricanes, tropical storms, landslides, and soil erosion and deposition (9). The strategy use to include all disasters affecting the TR in an integrated hazard reduction code, consisted of studying each disaster, to have a good understanding of how the damages are caused, and where their effects are worse. So, it was concluded that the code should have two main parts. The firts, referred to buildings and public works locations; and the second, specifications with the building minimun lateral strength requirements. In general, buildings able to take seismic horizontal forces, are able to withstand high wind forces caused by hurricanes and tropical storms, except that light roofs need to be firmly fixed to the walls.

The dominant feature to select the best locations for human settlement and civil works is the topography. For floodings it is obvious and do not need any comment. Hurricanes behave like a big hose absorbing a huge amount of warm water from the oceans, and dischaging it on earth, loosing its strength When they hit high cold mountains like Montecristo in the TR, fast condensation occurrs, discharging volume of water in a short time, causing floodings, landslides and avalanches. Except for the threat of volcanic ash and gases which are controlled by the wind direction and speed, the most hazardous areas caused by volcanic eruptions, may be also delimited using topographic maps. Lava flows, hot avalanches, mudflows and floods, affect the volcano flanks and the beds of valleys and basin that head on volcanos. Landslides and other soil & water downslope movement, make critical the strip close to the border, the slope itself, and the deposition areas that again depend on the topography, and also on the soil characteristics.

Land use restrictions for urban occupation purpose, and to locate important civil works, were prepared according to the above conclusions, and previous experience respect to the soil, topographical and geological conditions, where seismic waves amplified more respect to nearby areas, with better natural conditions; due to of space considerations, the articles of the code itself are not included here.

4. PERU'S PROCESS OF REGIONALIZATION AND A NATIONAL PLAN OF HAZARD REDUCTION

According to the mandate of the Peru's 1979 Constitution the "National Plan of Regionalization" was approved, as part of the "Basis Law for Regionalization", by the Peruvian Congress, under the number 23678 in June 1984. It was modified and complemented by the Law 24650 of March 1987, and the Law 24792 of February 1988.

The main objectives of the regionalization is the country decentralization (In Lima is concentrated 28% of the country population and 70% of national gross output) and to get an harmonic and integrated economic and social development. It is one of the most important state structure reforms of the Republic. 1988 has been declared the "Year of Regionalization" in Peru. In this process the Peru's 24 departments covering an extension of 1'285,937 km2 are being transformed into 11 regions.

The strategy to have a national plan of hazard reduction for Peru, consists of summing up the integrated hazard reduction code for each of its 11 regions, to which general consideration concerning the whole country is to be added, and also, how institutions and persons interested in disasters prevention and mitigation are going to participate, to optimaze the use of the scarce available resources.

(*) After official adoption of the concerned governments

The region Grau with 41,147 km2 covering the former departments of Tumbes & Piura was created in March 1988, and will be the first to be studied by the Peru's National Institute of Planning from the point of view of regional disaster mitigation planning, with the participation of the authors and other persons.

The National capital region, Lima, is the country most important, and will continue to be for many years to come, so it is important to take substantial measures against disaster through some similar means being applied in Japan (14).

Countrywide disaster mitigation activities may be included in 3 fields.

a. Data Base. A national data bank is being organized to collect, compile and disseminate data on natural disasters ocurring in Peru, with the participation of all concerned institution and persons.

b. Research. A great effort is being made by CONCYTEC - The National Council of - Science & Technology - to encourage research activities in Peru. Its budget was increased 80 times in the last 2 years. To mitigate the destructive effects of natural disasters is one of its prioritary fields. On the other hand UNDRO - United Nations Office of the Disaster Relief Co-ordinator is trying to rise funds to assist the country in disasters preparedness in the most urgent projects, through Peru Civil Defense, with the participation of universities and other research institutions.

c. Education, Training & Diffusion. The Ministry of Education and the National University of Engineering have signed an agreement in May 1988. The second will advise the first to prepare programs and courses on natural disasters to be given in Peru's national system of education at elementary and secondary levels.

5. ROLE OF CISMID IN IMPLEMENTING THE NATIONAL PLAN OF HAZARD REDUCTION

CISMID is going to play a key role in implementing of the national plan of hazard reduction in Peru. As user, for engineering and disaster mitigation planning purposes of geologic & hydrologic hazards data, recorded, collected & processed by different Peruvian research centers, it can be a good coordinator and organizer of multinstitutional projects, such as the National Bank of Natural Disasters (15).

On the other hand, CISMID has been conceived and is being built and equipped, to do research on earthquake engineering and to develop or to adapt new building technologies, and to give services at national level, and then to its neighboring countries. Disaster mitigation planning is the other prioritary field of CISMID.

The CISMID Structural Lab., Geotechnical Lab., Computer Center, National Disasters Data Bank, Disaster Mitigation Department, Library and services on educational, training and diffusion areas, have been or are going to be equipped, with the lastest model instruments, thanks to the cooperation of the Japan International Cooperation Agency. JICA is also sending experts to Peru as advisers (7) (14) (15) (16) and is training 25 CISMID staff members in Japan from 3 to 12 months periods during 1986 to 1990.

Some of the CISMID equipments & facilities are: A computer IBM 9375 model 60 including graphics system with many terminals & PC's. Reaction wall & testing floor able to test 1/2 scale 5 stories buildings, triaxial dynamic test, a number of digital strong motion accelerographs, TV filming & editing, printing, etc.

Training & education are also prioritaries activities of CISMID. Seminars, symposiums, and short courses on earthquake engineering and disasters mitigation have been offered to participants from all over the country, and will continue to do so. A master course on urban, regional and national developing planning with great emphasis on disaster mitigation is being organized. CISMID is advising the Ministry of Education in preparing programs and courses on natural disasters. At its request, the Peruvian Government has declared May 31 st, aniversary of the 1970

earthquake, "The National Day of Education and Reflexion on Natural Disasters", which will involve important diffusion programs to the general public and students.

Most of the CISMID members are former participants of courses given at the International Institute of Seismology and Earthquake Engineering, BRI, MOC, Government of Japan. Some other bear advanced degrees from well known American universities.

6. CONCLUDING REMARKS

A national plan of hazard reduction has been prepared through regional level diagnosis and elaboration of measures against disasters. Peru is being reorganized into 11 new regions. For each of them, multihazard reduction codes are to be prepared by the National Institute of Planning, to which measures concerning the whole country are to be added.

The process to reach to planning at national level is taking more 20 years in Peru, starting from the seismic design code and its application to buildings during the 1960s, and passing through microzonation method & techniques development, and their application to urban & regional planning for disaster mitigation purpose, during the 1970s and part of the 1980s.

The plan has not been completed yet, but is being applied in the parts that will not change, and is being improved, and hopefully it will be ready by 1990, that Peru, can participate in the "International Decade of Hazard Reduction" in an organized way.

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Fig. 1

PERU & ITS 11 NEW REGIONS

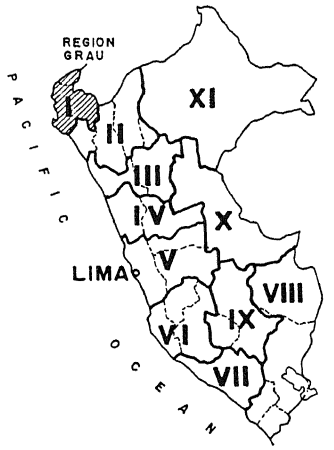
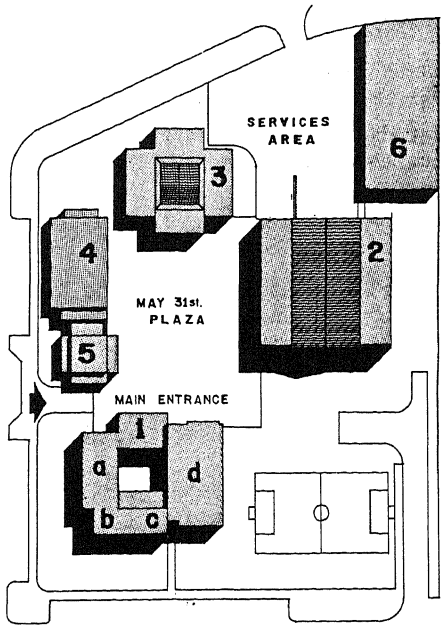


Fig. 2

CISMID



1. ACADEMIC & ADMINISTRATION BUILDING
   a) Computer Center
   b) Natural Disasters Data Bank
   c) Library
   d) Classrooms
2. STRUCTURAL LAB
3. GEOTECHNICAL LAB.
4. AUDITORIUM
5. EXHIBITION HALL
6. SERVICE BUILDING

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