URBAN PLANNING AND LAND ZONING

Abstract from statements by
Lloyd Cluff Woodward-Lundgren & Associates

Urban planning and land zoning must take the various geologic factors that influence seismic risk into account at a very early stage. The seismic risk problem is not a simple question of either planning or designing for complete protection or ignoring the problems altogether. From the point of view of society, neither of these alternatives is acceptable. To establish an acceptable, efficient, and practical solution requires a greater knowledge of the geologic hazards and their potential effects on works of man. This must be followed by interdisciplinary evaluations involving geology, engineering, and planning.

Many variable factors influence the degree of risk that may be associated with urban development within seismically active areas. These variables include geologic factors and land-use factors such as site or building occupancy, building height, structural system, and quality of construction.

It may be desirable to develop maps showing risk zones based on primarily geologic factors. It is then possible to develop land-use planning recommendations for land and building uses in various risk zones. To accomplish this, it is necessary to consider the following factors:

(1) the probable types of geologic risks, such as fault rupture, ground shaking, liquefaction, lateral spreading, and tsunamis;

(2) the ability to identify land areas where these types of geologic risks are possible;

(3) the ability to assign either qualitative or quantitative limits on the effects of these risks;

(4) the types of land and building uses and their socio-economic importance;

(5) the behavior of buildings and other improvements under seismic conditions.

Information will be presented from several case studies to illustrate the concepts that must be understood in order to provide practical and meaningful urban planning and land zoning in seismically active regions.

RESPONSE TO GEOLOGIC HAZARDS OF EARTHQUAKES

by

Robert E. Wallace

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It is axiomatic to say that the hazards of earthquakes stem from the "misbehavior" during an earthqauke of the ground on which we build and live. The nature of this "misbehavior" has been greatly misunderstood by many of those responsible for the administrative and technical decisions to reduce earthquake hazards. Furthermore, the state of earth sciences in its capability to specify the ground "misbehavior" quantitatively still leaves considerable to be desired. Nevertheless, what is known by earth scientists can be of great help in reducing the hazards.

The earthquake behavior of the ground can be considered in four categories:

(1) ground shaking;

(2) ground failure, including landsliding, cracking, differential settlement and liquefaction;

(3) surface faulting, and

(4) tectonic change, i.e., gross level changes of large regions.

Hazard reduction methods for coping with these four categories of ground behavior include:

1. For ground shaking - improvement of engineering design and practice, and the expression and regulation of these through building codes. Land zoning can be used to refine codes in recognizing the relation of shaking to local geology as quantification of that factor is improved.

2. For ground failure - land-use zoning techniques should be the primary response to these hazards, because engineering techniques commonly cannot cope with these problems economically. These hazards have been largely ignored but may actually exceed shaking as a hazard.

3. For surface faulting - risk-zoning and land-use planning can be very effective in reducing this hazard because of the strong tendency for many faults to break repeatedly on the same strand or branch.

4. For tectonic change - the main hazard occurs at a water-land interface, e.g., harbors and port facilities. The recognition and definition of potential land-level changes will suggest engineering responses such as dikes around critical facilities. Damage to biota - e.g., oyster beds - also may result from level changes.

The reduction of hazards will depend upon continued efforts to improve:

(a) the quantitative definition of geologic hazards through research and risk mapping;

(b) response to these hazards through improved engineering design and practice;

(c) improvement of regulatory and guidance techniques including codification and land-use planning; and

(d) disaster response techniques. None of the response techniques, however, can be entirely effective unless a very real idea is in hand of the possible, probable, and credible events created by an earthquake.

BUILDING CODES AND SPECIAL CONSTRUCTION ORDINANCES

by

Henry Degenkolb, Structural Engineer,
San Francisco

Mr. Degenkolb states the necessity of adapting building codes to earthquake hazards.

CCMS No. 9

TSUNAMI HAZARD EDUCATION: REPORT OF A PILOT STUDY

Abstract from a statement by J. Eugene Haas

Any disaster warning system has many links in the communication chain. If injury and loss of life are to be minimised, all of the links must function adequately during the crucial time period so that citizens in the hazard zone will receive the warning message promptly. But there are three equally critical elements which are frequently overlooked. The citizen must be able to interpret the warning message correctly, know the appropriate actions to be taken, and he must be motivated to take those actions.

An experimental tsunami hazard public education program was conducted as part of a research effort on the effectiveness of the tsunami warning system in Alaska. The experimental education program is described and the consequences are evaluated. Aternative solutions to the "citizen response" problem are discussed.

SEISMIC RISK MAPPING IN THE UNITED STATES

S. T. Algermissen and L. M. Murphy

ABSTRACT

Progress on seismic risk mapping in the United States is reviewed. The three critical factors in risk mapping are: (1) seismicity, (2) the response of local surficial geology to seismic waves, and; (3) regional geologic features and tectonic features related to seismicity. These factors are discussed and current research work is outlined. The form and content of a more advanced type of risk map are outlined.

DISASTER, PREVENTION AND HAZARD REDUCTION

R.J. Williams

The earthquake of 9th February, 1971, that shook the Los Angeles and surrounding areas had a rating of 6.6 on the Richter scale. The intensity of accelleration in the Sylmar and surrounding areas was probably as high as any that will be experienced in California. A reading adjacent to the Pacoima dam showed an accelleration of 102% which is the highest ever recorded in an earthquake. Fortunately the earthquake was localized and of relatively short duration, otherwise, it could have had a reading above 8. This earthquake had unique application in that it occurred in a metropolitan area and was the best documented earthquake to date. It was an excellent test of modern construction and building codes. It varied from an intensity higher than had previously been expected and decreased in the southern limits of the city to where no structural damage was noticed.

In general terms the one story wood frame dwellings performed in an excellent manner with only two partial collapses in the city. The high rise buildings in the downtown area approximately 20 miles from the area of high devastation had only negligible damage. While these high rise buildings were performing so well, older buildings in the same area that were built previous to earthquake design requirements were beginning to fail with 136 having to be vacated. Wood frame buildings two stories or more in height and some other buildings of modern construction showed a nominal amount of damage indicating that certain features in today's building codes should be reviewed. Our latest information indicates that within the city of approximately 750,000 buildings, there were 766 buildings vacated as being unsafe, 3,500 with major damage and 21,000 with minor damage. Considering the high intensity of the earthquake the conclusion is that modern design, construction, and code requirements performed in an excellent manner.

Buildings within the city were first required to be designed for earthquake in December 1933, following the Long Beach-Inglewood earthquake that claimed approximately 120 lives. In 1960 the design requirements were modified to provide for a pseudo dynamic application of earthquake forces. These same code revisions were adopted by other jurisdictions and are now applied on a wide basis. The City of Los Angeles, in 1947 required buildings built prior to December 1933, to have masonry parapets and appendages removed with walls anchored to the roofs to reduce the earthquake hazards in these old buildings. This program is now virtually completed and undoubtedly kept the casualty list from being much higher. Other city code provisions require light fixtures to be earthquake resistant, windows to be framed in resilient mountings to prevent shattering above the first floor and in 1965 required accelleographs to be installed in new buildings more than six stories in height.

The total death toll of 65 shows that of these 45 were in an older Federal hospital that was not designed for earthquake, 9 heart attacks, 2 were bridge failures and only 3 were due to building failures within the city, another 4 in county buildings and 2 miscellaneous.

Immediately following the quake the city departments were able to handle most of the emergency operations for police, fire, building inspection and water and power. The smaller city of San Fernando which had a higher percentage of older buildings had to rely on help from other agencies. The availability of helicopters by the city greatly expedited quick service and co-ordination. The pre-planned disaster plan also greatly aided in the emergency situation. Relief help such as Red Cross, Corps of Engineers, Office of Emergency Preparedness and others were of vital importance in helping to provide immediately to care for the displaced, injured, and distressed persons and in the clean-up and reconstruction period.

It is difficult to provide urban planning and land zoning relative to earthquake inasmuch as the prediction of locations of future earthquakes and date of occurrance is not practical at this time. Greater research and possible new development in earthquake amplification areas would be highly desirable and may aid in planning and zoning provisions.

RECOMMENDATIONS:

1. There should be a universal requirement for the more important buildings to be designed by a professional engineer or architect under construction code requirements.

2. Emphasis should be placed on additional research and study in seismic geology with high emphasis on seismic amplification or magnification.

3. Programs for corrective work on existing buildings not designed for earthquake should be established.

4. Planned community disaster programs should be required.

5. An acceptable level of risk factors should be developed.

6. Requirements of greater protection on vital facilities needed for disaster operations should be made.

7. Current code construction and design requirements should be revised for those failures observed.

GENERAL INFORMATION ON ORGANIZATION AND ACTIVITIES

FOR

EARTHQUAKE DISASTER RESPONSE IN TURKEY

by Alkut Aytun,

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INTRODUCTION

Anatolia has been an earthquake country throughout its history. Many settlements in various parts of Anatolia, have been destroyed by earthquakes, some several times. It is on the Alpide belt, which is responsible for the 15% of the world's destructive earthquakes(1).

Geological investigation shows that the land is marked through by active tectonic zones, and earthquakes happen for many millions of years.

The North Anatolian Fault Zone exhibits an especially interesting feature, which provides a field laboratory, where tectonic movements can frequently and clearly be observed, under quite suitable conditions. This zone has a series of ground fractures, where the chain of mountains join the valleys accomodating major rivers, flowing almost in east-west direction. As those rivers provide the required irrigation to the surrounding land, the valleys are mostly fertile agricultural areas with a population density higher than that in the mountainous areas. Lower parts of the chain of mountains offer a good route for highways, railways, energy and communication lines. So the regions exposed to periodical violent ground motion throughout the history, have always been the densely populated and important portions of the land, resulting in loss of life and damage, and in many cases, disasters.

The situation is not much different in the earthquake zones other than that of North Anatolian. In Western part of Turkey, several parallel active graben areas, trending in east-west direction, accomodate major rivers. The similar results, in view of loss of life and damage, can be observed, although the tectonic characteristics are quite different.

The blocks on each side of the North Anatolian Fault Zone, perform a relative movement, laterally and vertically. Lateral movement is right-handed and Northern moves down, in general. But the grabens exhibit mainly vertical movements, the portion in between moving down. Almost all of the destructive earthquakes occur on these two zones.

The mentioned characteristics of the settlements, cause some more indirect damage in addition to that of earthquakes. Thick alluvium layers and high underground water table, which are common aspects of the preferred settlements, are generally known as factors, increasing the rate of damage. The tectonic movements trigger or accelerate such phenomena as landslides and rockfalls. A considerably large area along the river courses within the mentioned earthquake zones, are apt to be exposed to flood disaster.

As a result, the areas of high seismicity, are almost equally subjected to the risk of other forms of disasters (flood, landslides, rockfall, avalanche etc.). Those facts make to deal with earthquake zones, quite a complicated task. It can be easily understood that the post-earthquake activities have to be many-sided.

PAST GREAT EARTHQUAKES IN TURKEY

In the following list, the important earthquakes of this century are given to visualise the severity of earthquake problem. It can be seen that, almost each year a destructive earthquake takes place.

No. (x)	Locality	Date	Epicentral Intensity (MM)
1	Malazgirt	19. 4.1903	IX
2	Murefte	8. 8.1912	X
3	Burdur	3.10.1914	IX
4	Torball	31. 3.1928	IX
5	Marmara Isl	4. 1.1935	IX
6	Kirsehir	19. 4.1938	IX
7	Dikili-Bergama	21. 9.1939	IX
8	Tercan	21.11.1939	IX
9	Erzincan	28.12.1939	XI
10	Develi	20. 2.1940	IX
11	Bigadic	15.11.1942	VII
12	Erbaa	20.12.1942	X
13	Adapazari	20. 6.1943	IX
14	Kargi-Ladik	27.10.1943	IX
15	Erbaa	26.11.1943	X
16	Bolu-Cerkes	1. 2.1944	X
17	Edremit	6.10.1944	IX
18	Van	28. 6.1945	VI
19	Denizli-Buldan	21.12.1945	VII
20	Varto	31. 5.1946	IX
21	Cerkes	13. 8.1951	IX
22	Hasankale	31. 1.1952	VII
23	Adana-Misis	22.10.1952	VIII
24	Yenice-Gonen	18. 3.1953	X
25	Karaburun	2. 5.1953	VII
26	Edirne	18. 6.1953	VI
27	Soke	16. 7.1955	VI
28	Eskisehir	20. 2.1956	IX
29	Marmaris	25. 4.1957	VII
30	Abant-Akyazi	26. 5.1957	IX
31	Inegol	2. 4.1959	VII
32	Marmaris	23. 5.1961	VII
33	Igdir	4. 9.1962	VIII
34	Balikesir	14. 9.1962	VII
35	Denizli-Buldan	11. 3.1963	VII
36	Tefenni	22.11.1963	VII
37	Divrik	14. 6.1964	VIII
38	Manyas	6.10.1964	IX
39	Varto	19. 8.1966	IX
40	Adapazari	22. 7.1967	IX
41	Pulumur	26. 7.1967	VI
42	Bartin	3. 9.1968	VIII
43	Demirci	23. 3.1969	VI
44	Alasehir	28. 3.1969	VII
45	Gediz	28. 3.1970	IX

Although earthquakes caused great harm for many years, interest and studies on this phenomena started only after the great Erzincan earthquake of 1939. The most disastrous earthquakes after 1939, and the resulted loss of life and property, are listed as follows:

Locality	Date	Loss of Life	Dwellings Destroyed
Erzincan	28.12.1939	40,000	135,000
Erbaa	20.12.1942	3,000	32,000
Erbaa	26.11.1943	4,000	40,000
Bolu-Cerkes	1. 2.1944	4,000	50,000
Van	28. 6.1945	300	2,000
Manyas	6.10.1964	23	5,500
Varto	19. 8.1966	2,500	20,000
Adapazari	22. 7.1967	86	7,100
Pulumur	26. 7.1967	97	1,000
Bartin	3. 9.1968	26	260
Alasehir	28. 3.1969	41	2,500
Gediz	28. 3.1970	1,086	15,000

It can be said that, 60,000 casualties and a loss of property of $600,000,000 (US) approximately were caused by earthquakes, since the beginning of this century.

EARTHQUAKE ZONING MAP OF TURKEY

The studies to make the first earthquake zoning map of Turkey, have been initiated after the great Erzincan earthquake of 1939. The map was completed in 1945 and promulgated by the Ministry of Public Works. This map has been revised several times, and sometimes was accompanied by a list of cities and towns (1948, 1949, 1961 and 1963). The existing map, in use now is of 1963. With this map, Turkey has been divided into four zones, according to the observed maximum intensities and proximity to the fault zones.

Recently the work to improve the zoning map, by the Ministry of Reconstruction and Resettlement, is completed. The new map has been prepared, adopting the principles, suggested by UNESCO 1964 Paris Meeting. It distinguishes five zones, with respect to a combination of factors, some of them being: map of epicenters, observed maximum intensities, return periods of intensities equal to or greater than VII, seismic energy release, seismo-tectonic features, etc.

REGULATION FOR CONSTRUCTION IN EARTHQUAKE ZONES

The conditions to be realised for construction in earthquake zones are given in this regulation. The first regulation of this kind in Turkey, has been prepared by Ministry of Public Works in 1940, after the impetus of

Erzincan (1939) earthquake. It has been revised six times up to now (1944, 1948, 1949, 1953, 1961, 1968). The one that is in effect now, is of 1968. The major improvement in this, is the adoption of dynamic approach in obtaining the design earthquake forces. Each zone in the map is associated with a horizontal coefficient in the regulation.

Although the map and the regulation cannot be claimed as perfect, it is clear that observing the rules will, in great extent, reduce the loss of life and property. Control and supervision are of vital importance in this respect.

DISTRIBUTION OF LAND AND POPULATION WITH RESPECT TO EARTHQUAKE ZONES

Basing on the existing "Earthquake Zoning Map of Turkey", and 1965 population census, the land and population of Turkey, are distributed into earthquake zones as follows:

Earthquake Zone (x) (degree of seismic risk)	(sq.km)	(sq. miles)
I	134,857	52,068
II	212,110	81,892
III	99,847	38,551
-	327,996	126,637
TOTAL	774,810	299,148

(x): Zone I has the highest risk - is considered free of danger.

Earthquake Zone (x) (degree of seismic risk)	Urban population	Rural population	Total population
I	2,807,462	4,676,921	7,484,383
II	3,773,483	5,559,358	9,332,841
III	974,058	3,138,034	4,112,092
-	3,250,813	7,211,289	10,462,102
TOTAL	10,805,816	20,585,602	31,391,418

Finally, population and land area percentages of earthquake zones, are given in the following table:

Earthquake Zone (degree of seismic risk)	Land percentage	Population percentage
I	17.4%	23.8%
II	27.3%	29.7%
III	12.9%	13.1%
-	42.3%	33.3%
TOTAL	100. %	100. %

It can be concluded that 45% (or ½) of the country is exposed to serious seismic risk, and 53% (or ½) of the population are under serious earthquake danger.

The above figures impose Turkey to be aware of the earthquake hazard and to take measures to prevent loss of life and to minimize loss of property.

IMPORTANCE AND NATURE OF DISASTER RESPONSE ACTIVITIES

It is the goal of every earthquake-prone country, to provide permanent protection against the effects of the earthquakes. But no country can claim that this is fully reached. Every year destructive earthquakes occur and cause thousands of loss of life. In Turkey, where most of the local types of construction are not earthquake-resistant, post-earthquake activities must be effective in order to prevent the expansion of the disaster.

The most distinguished feature of post-disaster activities, is the urgency. As life and health are concerned, rapid measures must be taken. If the disaster affects the life of the general public, the local economy usually is not able to recover itself. The local authorities are also affected by the earthquake, so the national authorities must be engaged. In Turkey, the settlements are spread around and transportation poses a serious problem. Dealing with post-disaster affairs, requires great effort and initiative, within the frame of the legislation. Involvement and support of national, even international agencies are needed, depending on the scale of the disaster. Much depends on the efficacity of the plans to be prepared in advance.

SCOPE OF EARTHQUAKE DISASTER RESPONSE ACTIVITIES

The most urgent need, after a settlement has been stricken by earthquake, is for rescue and relief. Although it is very well known there are concrete examples from recent earthquakes that the urgency and keenness in this respect, can save considerable number of lives (Gediz Earthquake).

Other groups of activities can be put under the names: "Investigation and Evaluation of Damage", "Temporary Housing", "Permanent Housing" and "Public Facilities". These can be divided into sub-divisions.

LEGISLATION FOR NATURAL DISASTER RESPONSE

The earthquakes have affected the settlements in Anatolia in historical times. There are examples from Hellenic, Hittite, Seljuk, Byzantine and Ottoman civilizations, that important settlements were damaged. There are also quite a number of records on the post-disaster activities in damaged cities and towns (e.g. Istanbul Earthquake of 1509). The comprehensive activities of government response started only after the great Erzincan Earthquake (27th December, 1939), that killed 40,000 people and destroyed 29,000 dwellings. This earthquake raised the attention of governmental and technical authorities, in great extent. The parliament passed a special legislation (Act No. 4263) for aid to the survivors of the Erzincan Earthquake. The earthquake disaster activities following this event, were administered within the provisions of Acts Nos. 6409, 6610, 6683 and 7010, each for an individual earthquake. The Ministry of Public Works was of primary concern in reconstruction, although other Ministries were involved in other aspects. In 1958, the Ministry of Reconstruction and Resettlement was established, with the Act No. 7116, and the activities on disasters were transferred to the new Ministry. A more comprehensive Act (No. 7269) came into effect in 1959. It was amended by Act No. 1051, in 1968, which is still in effect. A rough outline of this Act is given in Appendix I.

Five regulations are applied to administer the detailed activities, in conjunction with Act No. 7269-1051:

1. "Regulation On The Criteria To Determine Whether A Natural Disaster Affects The Life Of The General Public."

2. "Regulation On Emergency Aid Organization And Programs, Related To Natural Disasters."

3. "Regulation On The Criteria To Be Used In Determination Of The Individuals To Be Aided."

4. "Regulation On The Reduction From The Cost Of Buildings Or Amount Of Indebtment, Within The Frame Of Post-Disaster Reconstruction."

5. "Regulation On Procedures Of Expenditure Out Of The Fund, Provided By The Act No. 7269-1051."

ORGANIZATION FOR DISASTER RESPONSE

The post-earthquake activities were administered by the Ministry of Public Works, until the establishment of the Ministry of Reconstruction and Resettlement (1958). In 1965, the General Directorate of Natural Disaster Affairs was established, within the Ministry. After the Varto (1966) Earthquake, an "Executive Board For Earthquake Regions" was established. This is considered a temporary board, and broad powers are given to the General Directorate of Natural Disaster Affairs, being the main institution for post-disaster response.

EMERGENCY AID ACTIVITIES

It is clear that emergency activities cannot be planned after the disaster has occured. The planning activity is performed in advance, as shown in the Paragraph 4 of Act No. 7269-1051, and in accordance with the "Regulation On Emergency Aid Organization And Programs Related To Natural Disasters". The main burden is on "Provincial Rescue and Relief Committees" to be established by Governors. Civil Defence Code (No. 7216), has parallel provisions, with respect to emergency activities, their planning and implementation. Governors have been given enormous powers and initiative for those activities. Co-ordination of powers of all institutions, charging the persons responsible with certain duties, diverting the vehicles or instruments to be used, and purchasing the required materials can be given as examples. For execution of these powers, it is not necessary to wait for the declaration stating that the disaster affects the life of the general public.

Immediately following the Gediz (28th March, 1970) Earthquake, the above mentioned committees were established in the provinces and towns. A central committee was also established by the following authorities:

Undersecretary of Ministry of Domestic Affairs.

Undersecretary of Ministry of Public Health.

Undersecretary of Ministry of Reconstruction and Resettlement.

Head General of Turkish Red Cross Association.

The following sub-committees were established in the affected cities and towns:

1. Emergency rescue and ruin removal sub-committee.
2. Tent distribution and accommodation sub-committee.
3. Health affairs sub-committee.
4. Food distribution sub-committee.
5. Sub-committee for evaluation of damage.

additionally, security, economic, social and employment and fuel measures were taken.

PREPARATION FOR PERMANENT HOUSING

The main objective of the post-disaster activities, is the permanent housing. The preparatory stage for permanent housing, can be divided as follows:

- "Determination Of Individuals, To Be Aided".
- "Provision Of Settlement".
- "Provision Of Technical Assistance".
- "Allocation Of Building Materials".

INVESTIGATION AND EVALUATION OF DAMAGE

Investigation of the affected area is done by the Earthquake Research Centre of the Ministry of Reconstruction and Resettlement. As earthquakes are considered a full scale vibration test of structures and facilities, the damaged and undamaged structures are studied. The Universities and other research institutions also co-operate in the investigation. There have been cases of co-operation with UNESCO and foreign experts, in this subject.

Other Ministries too, conduct investigation for their own purposes, e.g. Ministry of Public Works for schools and other official buildings, State Waterworks for water facilities etc.

Evaluation of damage, provides basic knowledge to assess the extent of loss of property, and is a major step for repair and construction activity. It also provides basis for the declaration of the disaster, as affecting the life of the general public.

The classification is as follows:

- No damage.
- Light damage.
- Moderate damage.
- Heavy damage.
- Destroyed.

DETERMINATION OF THE INDIVIDUALS TO BE AIDED

The term "individual to be aided" means the individual who can claim to receive aid for new housing, depending on the Act No. 7269-1051. "The Regulation On The Criteria To Be Used In Determination Of The Individuals To Be Aided" shows in detail, the procedures to be followed for this purpose. The regulation indicates the solutions of any problems that may arise, such as withdrawal etc. An outline of this regulation is given in Appendix IV.

PROVISION OF NEW SETTLEMENTS

Unless another disaster is considered probable and/or the present settlement is objectionable, the reconstruction activities are performed on the same settlement. Otherwise a new location is selected. Usually the governing factor is the comparison of the cost of preserving the location with preventive measures, and the cost involved for moving to a new location. Paragraphs 16 through 26 of the Act No. 7269-1051 bring provisions on this subject.

The Department of Geological Investigation (of the General Directorate of Natural Disaster Affairs) carries out the required geological and soil studies for settlements. Recently the importance of microzoning is realised and the new settlement for Gediz town is studied from this point, to guide town planners.

ALLOCATION OF BUILDING MATERIALS

It is essential to provide building materials in sufficient quality and quantity, to complete the construction activity without delay. Especially timber, reinforcement bars and cement are the materials subject to allocation from the sources. The allocated materials cannot be used for other purposes.

CONSTRUCTION ACTIVITIES

Construction in the damaged area is the final activity. Usually one of the following three methods are used:

- Construction bids.
- Department construction.
- Aided self-help.

The first and second methods can only be used for housing in large numbers. In the second method, the Ministry of Reconstruction and Resettlement constructs itself through its own organization and staff. In this case too, parts of the work can be given to constructors.

Aided self-help method envisages the co-operation of the individual and the state. The individual is provided with technical and administrative assistance, and the loan is delivered in instalments. The preparatory services are also provided by the Ministry. Experience has showed that this method is very useful in various respects, but introductory training is essential at the beginning.

PUBLIC FACILITIES AND SERVICES

Although the term "public facilities" has a broad meaning, here only the following are referred: roads, water, electricity and sewage. In this frame, public facilities can only be provided for the settlements, experienced a natural disaster, affecting the life of the general public. The Ministry provides the necessary network and connections. The work can be transferred to municipalities and other public institutions, such that the expenses be provided by the Ministry.

Expenditures for mapping, reconstruction planning, designing, public facilities etc. are not included in the cost of dwellings, provided to the individuals.

The individual reimburses the amount within 20 years, without interest. In certain cases, reduction as much as 50% can be made. The conditions for the reduction, are given in the "Regulation On The Reduction From The Cost Of Dwellings Or Amount Of Indebtment, Within The Frame Of Post-Disaster Reconstruction". A rough outline of this, is given in Appendix V.

The individual is also exempted from various taxes, following a disaster, affecting the life of the general public. Annuation of debts is also provided in certain cases. The Act No. 1319 on Real Estate Tax, Act No. 1318 on Finance, and Paragraph 42 of the Act No. 7269-1051 have provisions on exemption.

ON THE VALUE OF HISTORICAL RECORDS OF EARTHQUAKES

by N.N. Ambraseys

(See pages 6-1 to 6-9)

DE LA VALEUR DES RAPPORTS HISTORIQUES SUR LES TREMBLEMENTS DE TERRE

par N.N. Ambraseys

(Voir pages 6-1 à 6-9)

La législation italienne pour les constructions dans les zones sismiques

La législation italienne actuelle, par rapport aux dispositions pour les travaux de construction, et comportant des prescriptions particulières pour les zones sismiques, a été émanée en 1962 et est formée de deux parties.

La première contient les normes techniques générales, applicables dans tout le territoire national et, par conséquent, aussi dans les localités sismiques; la seconde contient des normes particulières, dont l'application est obligatoire seulement dans les Communes, ou dans leurs parties, qui en relation à leur degré de sismicité et à leur formation géologique, sont comprises dans les listes spéciales et divisées en deux catégories.

On a voulu, ainsi, disciplinaire selon un plan le territoire tout entier, dans le but, soit d'avoir une vision globale en ce qui regarde la marche du phénomène dans les différentes régions italiennes, soit, et surtout, pour que dans les zones reconnues sismiques de I[e] et II[e] catégorie, soient appliquées toutes les prescriptions dont il a été question précédemment.

De cette division en zones est née la carte sismique d'Italie, grâce à laquelle on reconnaît facilement que la partie plus fréquemment et plus intensément sujette aux mouvements sismiques, est la région centrale et méridionale, comprise dans une vaste bande sismique, qui partant du Maroc, traverse l'Italie, la Grèce, et la Turquie, pour terminer au Golfe Persique.

La réglementation a été établie pour proportionner d'une part toute cette délicate matière aux progrès de la science et de la technique, et renforcer d'autre part, les sanctions civiles et pénales par l'observance de ses prescriptions, dictées, naturellement, pour la sauvegarde de l'intégrité publique et privée.

Etant donné la longue et malheureusement triste série de crises sismiques qui ont ravagé l'Italie dans ces soixante-dix dernières années, on a eu la possibilité de constater comment les constructions faites selon les données de la technique, ont validement résisté aux sollicitations dérivant des secousses sismiques.

Toutefois, tous les règlements qui se sont succédés en Italie, depuis le jour où le problème sismique s'est posé, ont toujours ressenti le manque de données instrumentales de relèvement. La question a été résolue dans le passé en adoptant une réglementation plutôt rigide et sévère, surtout par rapport à la hauteur des édifices, le manque de données précises rendant extrêmement prudent le législateur, puisqu'il s'agissait de sauver des vies humaines.

En outre, aux limitations de hauteur des édifices, on apposait un calcul peu compliqué de structures à châssis, sujettes à des forces conventionnelles horizontales.

La nécessité d'une nouvelle réglementation pour les constructions dans les localités reconnues comme sismiques, a été sentie peu de temps après l'émanation de la législation en vigueur, et cela parce que le progrès de la recherche scientifique sur ce sujet a mis davantage en évidence la disproportion des lois actuelles.

Tout ceci a eu un effet nettement déprimant sur le développement des régions déjà les plus déprimées de notre territoire national, étant donné que ces régions figurent parmi celles qui sont les plus touchées par les mouvements sismiques.

Cette nécessité s'est montrée encore plus urgente à la suite du mouvement sismique qui a touché en janvier 1968 la Sicile occidentale, détruisant complètement les centres de Gibellina, Montevago, Salapacula et d'autres.

C'est pourquoi, le Ministère des Travaux Publics a constitué une Commission chargée de formuler une réglementation technique pour les constructions en zone sismique, qui substituera la réglementation actuelle.

Cette Commission, au cours de ses travaux, a retenu opportun de ne pas limiter ses soins à une révision des lois en vigueur, mais elle a prédisposé un programme de travail pour un temps plus long, afin de préparer, soit même en phases successives, des règles techniques répondant aux recherches scientifiques les plus récentes en la matière et sur la base des plus importants relèvements sismiques.

Le problème pourra être affronté seulement après avoir doté l'Italie d'un réseau complet de stations "accélérométriques", aptes à fournir les données nécessaires pour la préparation d'une réglementation moderne.

Il n'était, pourtant, pas possible d'attendre si longtemps les données qu'aurait fourni le réseau, à cause du temps assez long qui caractérise la répétition dans une même localité de l'activité sismique.

On a remédié à ceci en utilisant temporairement les données obtenues par l'étude des tremblements de terre du monde entier et en particulier de ceux de la Californie.

On a analysé pour cela les "sismogrammes" disponibles (une centaine environ) relevés dans différentes zones de la surface terrestre.

Pour faire cela, selon l'état actuel des connaissances, on a retenu que le coefficient sismique par rapport à un certain édifice d'un certain type de construction et, par conséquent, d'une certaine ductilité, peut dépendre avec une approximation suffisante de deux grandeurs seulement: la période et le coefficient d'amortissement du premier mouvement de vibration.

Les registrations qui ont été analysées (environ soixante) ont été réunies en trois groupes.

Le premier comprend les registrations des tremblements de terre californiens, sur lesquelles sont basés les critères des projets les plus répandus.

Le second groupe de tremblements de terre regarde encore la Californie et renferme des phénomènes ayant des caractéristiques particulières en ce qui concerne la durée et la distance de l'epicentre. Les "accélérogrammes" ont enregistré quelques unes des accélérations les plus élevées qui se sont vérifiées durant les mouvements sismiques.

Les tremblements de terre du troisième groupe ont été observés en d'autres pays: ils présentent des caractéristiques très différentes entre elles. Les mouvements sismiques de Lima et de Koyona, en effet, sont caractérisés par une forte contribution de grande fréquence, tandis que ceux de Mexique ont comme caractère propre la presque totale absence d'une fréquence supérieure à un cycle par seconde.

L'ensemble de ces trois groupes de registration peut être considéré représentatif pour une vaste catégorie de mouvements sismiques éventuels.

Des études faites sur ces différents mouvements terrestres on a pu déduire que pour des structures rigides, et précisément pour des structures ayant une période propre inférieure à huit dixième de seconde, il ne convient pas de choisir une fonction quelconque - coefficient sismique/période - en l'absence d'informations sur les grands mouvements sismiques italiens.

C'est pourquoi, pour des structures rigides on a retenu opportun d'effectuer le choix d'un coefficient sismique précautionnel et non lié à l'analyse dynamique de la structure.

Pour ce qui regarde des valeurs d'une période supérieure à huit dixième de seconde, on a cherché une relation entre le coefficient sismique et la période, sur la base des "occillogrammes" observés.

Pour ce qui se rapporte aux "effets de coupe" qui se présentent aux étages les plus élevés des édifices, on a adopté le critère suivi par l'"Uniform Building Code", qui prescrit d'augmenter convenablement la force qui agit à l'étage supérieur et de distribuer le reste de cette force aux autres étages.

Quant aux limitations de hauteur encore prévues dans les nouveaux règlements, en phase d'élaboration avancée, il est à remarquer que celles-ci se rapportent uniquement aux édifices à panneaux portants et à ceux en maçonnerie.

Ceci parce que:

- pour les premiers, il n'a pas encore été acquis une expérience suffisante par rapport à leur comportement sous l'action sismique et il est, par conséquent, raisonnable d'observer un certain degré de prudence -

- pour les seconds, la limitation de leur développement vertical est né d'un comportement peu propre de ce genre de structure sous l'action sismique.

Les propositions de la susdite Commission ont été soumises a l'examen du Conseil Supérieur des Travaux Publics qui a exprimé un avis favorable et elles formeront l'objet pour la demande d'une nouvelle réglementation plus conforme aux progrès de la science et de la technique.

SCENARIO FOR THE SAN FERNANDO, CALIFORNIA EARTHQUAKE

From US Department of Commerce National Oceanic and Atmospheric Administration

An earthquake has occurred approximately two hours ago at 07:32 local time in the San Gabriel Mountains about 20 miles north of downtown Los Angeles. The magnitude has been calculated at 7.8 on the Richter Scale. An area of extreme damage extends from San Fernando north to the foothills and from Santa Suzanna Pass in the west to Sunland and La Crescenta in the east. Other areas of destruction include a strip six blocks wide, extending south from Van Norman dam to the Sepulveda Flood Control Basin; and downtown Los Angeles. Instances of major damage have occurred in Newhall, Fillmore, Piru and Castaic and in northern Los Angeles including Burbank, Glendale, Pasadena, Hollywood, Beverly Hills, Alhambra and Inglewood. The shock was felt from the Mexican border north to Parkfield, Fresno and Bishop and from the Pacific east to the Arizona border and Las Vegas. The population was largely out of doors on its way to work. There was rush hour traffic on all major freeways. Offices and shops were staffed to about 20% of normal, and school children and non working mothers were at home.

SCENARIO FOR THE NIIGATA EARTHQUAKE

From US Department of Commerce National Oceanic and Atmospheric Administration

On 14th May, 1971 an earthquake of Richter magnitude 7.5 occurred at 38°21'N, 139°11'E at 01:01 in the afternoon. The meizoseismic area included the northern half of the Niigata sedimentary basin, but the macroseismic area extended north and south for a total distance of 1,200 km from Hokkaido in the north to the vicinity of the eastern end of the Inland Sea in the south. The shock had its maximum destructive effects at Niigata about 40 km from the epicenter. A tsunami was generated. The population was just returning to work and to school; in rural areas, families were in the fields. The weather was clear; however, extremes of destruction occurred in alluvial areas where the water table was high and soil compaction was low.

THE SAN FERNANDO, CALIFORNIA EARTHQUAKE OF FEBRUARY 9, 1971

Prepared for The Office of Emergency Preparedness,
Executive Office of the President,
Washington, D.C.

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SYNOPSIS

Immediately following the San Fernando, California earthquake (February 9, 1971), a team from the Building Research Division of the National Bureau of Standards' Institute for Applied Technology, surveyed the damage to buildings and other structures. The areas investigated included the Newhall-Saugus area, the San Fernando Valley, and downtown Los Angeles. This interim report consists of photographs, most of which were taken by the team.

The full text may be obtained from:

Building Research Division,
Institute for Applied Technology,
National Bureau of Standards,
WASHINGTON, D.C. 20234,
U.S.A.

SCHEMATIC TABLES ON THE ORGANIZATION OF CIVIL PROTECTION IN ITALY

(see/voir pages 4.1 to/à 4.4)