

Seismic danger and the people's education programme in Bulgaria

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ABSTRACT: Seismic danger in Bulgaria is relatively high. The fact that more than 60 years the country has not been affected by the strong earthquake (M bigger than 6.0) shows that seismic destructive potential increases more and more. On the other hand, the urbanization increases too and this leads to an increased probability for strong destructions after a powerful earthquake on the territory of Bulgaria. These facts require a more extensive programme which to provide the people's education for a correct behaviour in case of earthquake occurrence and a possibility to decrease the consequences of a catastrophic earthquake.

1 INTRODUCTION

Bulgaria is one of the most active earthquake countries in the Balkans—the most seismic area in Europe. For the first 20–30 years of this century more than 10 strong, destructive earthquakes with magnitude more than 6.5 have occurred there. Many losses of human lives and material damages have been observed.

A fact which shows that the destructive seismic potential increases is that after 1928 catastrophic earthquakes in Plovdiv area, there have not been so strong events on the territory of Bulgaria. Strong seismic events (M more than 6.5) have not occurred for the last 60 years and this seismic quiescence shows that the probability for occurrence of such an event increases every year.

The consequences of some recent destructive earthquakes are very important, too (Vrancea, Romania 1977, M = 7.2, 104 dead; Velingrad 1977, M = 5.3, many damages and surface effects as stonefalls and landslides Strazica 1986, M = 5.7, 3 dead and many injures and damages; also Vrancea 1986, 1990 with observed intensities V–VI M S K–64.)

All these facts support the idea that in so active country, with many consequences for the population, economic life and possibilities for secondary effects, an extensive educational programme must be established.

2 SEISMIC DANGER IN BULGARIA

In the beginning of 1980s different geological, geophysical and other maps were used to develop several maps of the seismic danger in Bulgaria (see Bonceva et al. (1982)). They show the distribution of the main seismic zones in Bulgaria and these ones which might be dangerous and affect the country, but are located outside the boundaries (Fig.1).



Figure 1. Map of the seismic danger zones in Bulgaria. Mmax is indicated. Triangles mark the seismic stations

For example the main sources are located in Bulgaria in the zones: Kresna (expected Mmax - 7.6–8.0), Plovdiv (Mmax - 7.1–7.5), Kaliakra

($M_{max} - 7.6-8.0$), G.Oriahovitsa ($M_{max} 6.6-7.0$) and Sofia ($M_{max} - 6.6-7.0$). As it can be seen, the most dangerous zones are located in the sothern part of the country, where the biggest human and economical potential is concentrated. It is also important to consider the outside sources -- the most important is Vrancea (Romania) ($M_{max} - 7.1-7.5$, depth - 100-150 km), but also the sources in Marmara sea, the Greek and the Yugoslavian ones (M_{max} up to 8.0 for all of them).

As a result of the influence of these zones, maps of the shakeability for different time periods have been constructed. They are important for a sense of building practice, because it is possible to use them as a basis for the building design codes and for the estimations of the construction coefficients as well (Fig.2).

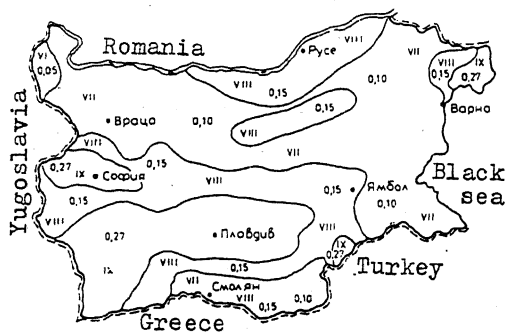


Figure 2. Seismic zoning shakeability map for Bulgaria (1 000 years). Expected MSK-64 intensities and design coefficient are indicated.

In the middle 1980's the scenario for the effects of the destructive earthquakes from the different seismic sources in Bulgaria was developed (Christoskov et al., 1984). It shows in general that the bigger part of the country would be affected if an earthquake with magnitude 7.0 or bigger occurs on the territory of Bulgaria. Many losses of people and buildings must be expected. Many secondary effects such as interruption of lifelines, fires, landslides, fallstones, destructions of dangerous containers with fuel, poisons and other dangerous materials must be expected, too. The consequences for the most populated zones (Sofia - Plovdiv) would be significant.

The secondary effects could be

divided in two parts - ecological - connected with the human activities (fires, poisons, etc.) and natural - such as landslides, fallstones, tsunamis, etc.

3 EDUCATION PROGRAMME

As a result of all these investigations and after several destructive earthquakes at the end of 1980's a questionnaire has been distributed, to establish the knowledge among the people concerning the seismic danger in Bulgaria, earthquake prediction problems, peoples's behaviour before - during - and after an earthquake (Ranguelov and Spassov (1987)). The result shows that the level of education increases rapidly after the earthquake occurrence, due to the peoples interest and massmedia influence and then (for example in 2-3 years) fastly decreases. Very few people (about 25%) know what they must do for their protection before, during and after a strong earthquake. Practically nobody knows something about aftershock activity and almost nothing about the authorized organisations for the reparation and reconstruction works.

The result of this inquiry was the creation of a TV movie (Ranguelov & Spassov (1991)), showing the main rules for selfprotection and the correct behaviour of the people and also the main physical and geological reasons for the earthquake occurrence.

The next step in this direction was the preparation of a small booklet with the same purposes (Ranguelov et al., (1988)).

Due to many cases of rumours, distributed by the massmedia and connected with the predictions of expected earthquakes, some cases of panic and inadequate reactions have appeared among the people. We consider that the main reason for this is the insufficient knowledge of the institutions, people and journalists. To avoid this situation, it is very important to increase the possibility of an adequate behaviour using wide education programme such as those proposed by the international institutions - IASPEI, IDNDR etc.

For this purpose a people educational programme at the different level of users is suggested. It consist of three levels:

The first level - for the decision makers and the responsible persons for the safety, reparation and restoration works connected with the official and governmental institutions,

such as Civil Defence, Commission for the disaster prevention and similar.

For them the education programme must consist of:

1. General information about the seismic danger on the territory of Bulgaria. Data for the seismic zoning maps, the most dangerous seismic zones and their influence on the big cities factories, NPP's, etc.

2. Microzoning technics and safety guides for the special objects (NPPs, dams, high buildings and so on).

3. Usual aftershock activity behaviour for the main sources - usual length and time duration for the different magnitudes of expected earthquakes.

4. General information about the space distributions of phenomena connected with secondary effects - landslides, possible interruption of lifelines, fires, floods etc. and information for the possible prevention actions - i.e. automatical disconnection of electricity power supplies, water and gas pipes etc.

The second level - for the representatives of safety commands:

1. General information about the seismic zoning of the region.

2. Information about the specific development of the aftershock activity.

3. Information about the seismic safety of the different constructions of the buildings and the distribution of dangerous industrial products and technologies.

4. Information about the possibilities for automatic disconnection of the lifelines such as electricity, gas, hot and cold water etc.

The third level - for all people - using all forms of education - school universities, massmedia etc.

1. General questions about the seismic zoning of the country, local regions and seismic danger zones.

2. General information about the seismic safety of the buildings, factories, dangerous industrial products and secondary effects.

3. Complete information about the correct behaviour before, during and after an earthquake depending on the power of the event and the distance from the source.

4. Data about the authorized organizations for the restoration and safety works.

To avoid the rumours - exact information must be supplied by the scientific responsible institutions together with the civil defence authorities for the massmedia, governmental institutions and the whole people.

4 GENERAL RECOMENDATIONS

Using the experience up to now, it is necessary to paid attention to the main problem: EDUCATION - PRACTICE - INCIDENT - RESULTS. The relations in this formula give us a possibility to hope that more human lives and money would be saved and general safety would increase.

The whole society must be educated for an adequate behaviour during a seismic dangerous situation.

The government must pay attention for the correct distribution of the correct information among the people, using all its possibilities - educational system, massmedia, scientific potential - to protect the people lives and the material culture of the society.

REFERENCES

- Boncev, E. et al. 1982. A method for compilation of seismic zoning prognostic maps for the territory of Bulgaria. Geol. Balcanica. 12.2:3-48.
- Christoskov, L. et al. 1986. A scenario for the effects of strong earthquakes on the territory of Bulgaria. Nat. Conference, Sofia: 5-143 (in Bulgarian).
- Ranguelov, B. and Spassov, E. 1987. The preparedness and needs of education for the earthquake danger in Bulgaria. Bulg. Geoph. J. XIII, 3; 80-84.
- Ranguelov, B. and Spassov, E. 1991. The anger of the earth. 23' movie. BTV. I channel, Sofia.
- Ranguelov, B. et al. 1988. The behaviour of the people during earthquake. Sofia: G. Kirkov.