

## **RADIUS PROJECT IN SKOPJE, REPUBLIC OF MACEDONIA**

**Zoran V MILUTINOVIC<sup>1</sup>, Branka D STANOJEVSKA<sup>2</sup> And Risto PENOV<sup>3</sup>**

### **SUMMARY**

The IDNDR (International Decade for Natural Disaster Reduction) Secretariat of the United Nations launched the RADIUS (**R**isk Assessment Tools for **D**iagnosis of **U**rban Areas against **S**eismic Disasters) project to promote worldwide activities for reduction of earthquake disasters in urban areas. Based on objective criteria, on the information in the application forms and taking into consideration the regional distribution, out of 58 cities worldwide that applied for the case studies, the IDNDR Secretariat selected nine case study cities. The City of Skopje is one of the selected case study cities.

In close collaboration with the Section on Risk and Disaster Management of the Institute of Earthquake Engineering and Engineering Seismology, University "St. Cyril and Methodius", Public enterprises for physical and urban planning, Public enterprises for operation of regional and urban lifeline and utility systems, the City of Skopje and Government of Macedonia officials responsible for planning, protection and management of the city, and, under the supervision of Bureau de Recherches Géologique et Minières (BRGM), the City of Skopje conducted a case study. During a year and a half of RADIUS implementation the City of Skopje checked the policies and criteria used during its post 1963 earthquake development in order to: 1) confirm or redirect certain development aspects; 2) decide and prioritise the development; 3) assess and estimate the sustenance of its vital lifeline and utility systems; 4) decide the policy for the current planning cycle; and, 5) if necessary, undertake the adequate risk reduction measures.

The RADIUS in Skopje proved a fact that Skopje's approach 'PREVENTION BEGINS WITH PLANNING' is sound and should be favoured in future as a very first step, but also the tradition of the city in its efforts for sustainable development and physical organisation.

The paper present and outline and the physical context of the City of Skopje, its specific features, characteristics of the post-earthquake development and legislation framework used for its seismic protection, defines the principle and specific objectives assessed during the RADIUS performance, and, presents and discusses the organizational aspects of the project and its achievements. Particular emphasizes are given on the consensused Action Plan that, based on the Resolution adopted by the City Council (September 30, 1999), become a legal instrument of the City of Skopje for control and improvement of its seismic safety.

### **INTRODUCTION**

#### **The City Profile**

The City of Skopje is the capital of Republic of Macedonia, and constitutes its major political, economic, industrial, commercial and cultural centre. It is developed in the Skopje Valley on both banks of the upper course of the Vardar River. The Skopje Basin is lowland into which converge valleys from north, east and west. Three Macedonian rivers: Vardar, Lepenec and Treska enter the Skopje basin from west.

The urban area of the City of Skopje is developed only over one tenth of the area of the Skopje's valley; its length is about 33 km and it extends eastwards to a maximum of about 10 km. To the south of the city, it is intersected by many gullies carved out by storm water from the Skopska Crna Gora Mountains. To the west,

<sup>1</sup> Professor, Institute of Earthquake Engineering and Engineering Seismology, University "St. Cyril and Methodius", Skopje

<sup>2</sup> President, City Committee for Urbanism, Communal and Housing Affairs, Traffic and Protection of Human Environment

<sup>3</sup> Mayor of the City of Skopje

where Lepenec and Treska rivers flow into the Vardar River, it is flat. To the east, it is low-lying and marshy. To the south, the slopes of mountain Vodno rise steeply.

The Greater Urban Region (GUR) of the City of Skopje, extending over an area of 185,800 ha includes 16 Municipalities encompassing 160 settlements and 545,200 inhabitants. Seven, predominantly urban, Municipalities constitute the City of Skopje whose administration and management is extended over an area of 33,780 ha encompassing 45 settlements and 444,800 inhabitants. Nine semi-rural and rural Municipalities are extending over an area of 152,000 ha and encompass 115 settlements with 100,500 inhabitants. While managed locally, their development, organization, planning and management are in special relation with the City.

The Master Plan area of the City of Skopje is extending over an area comprising the dominant part of the seven urban Municipalities, including the semi-rural Municipality of Saraj. Development, land-use and infrastructure planning in settlements outside the Master Plan area are regulated by the Urbanistic Documentation that must be compatible with the Master Plan of the City of Skopje and Regional Physical Plans of the Skopje Valley.

The city is developed on the banks of Vardar River. On the left bank of the river is old Skopje. New Skopje is situated on the right bank of the Vardar River, which major urbanization took place in the XIXth century, in the period between two World Wars, and, in particular, after the disastrous earthquake of 1963. The City of Skopje is the hub of major roads and an important junction between the states of this part of Europe. Almost 40% of Macedonia's industrial capacity are located in GUR of Skopje, out of which, 98% are located in the City of Skopje Urban Area. The city itself contributes about 45% to the GDP of Republic of Macedonia.

### **Specific Features of the City, its Development and Protection**

During its historic development the City of Skopje have been devastated several times. Skopje is also a city that survived a catastrophic earthquake in 1963 and has used the experience from this catastrophe in its further development. In planning of the city, its reconstruction and post-earthquake development considerations have been taken for the limitations imposed by seismogeological characteristics pertinent to the Skopje valley. The land-use pattern is carefully planned considering the seismic effects expected at individual locations due to possible future earthquakes.

The present planning process of the city space includes several sustainable levels. The process usually starts at country level (Physical Planning process that physically configure the economic development strategy within the country's space) and ends with detail urban planning as an operative instrument regulating the public demands and the various development strategy levels.

The most essential document for the city is the Master Plan. It is a mandatory administrative instrument, prescribing with the power of law the only permissible use of each plot until, after a fixed period of time (20 years) or in pursuance of a cumbersome and time-consuming procedure, the responsible authorities have formally approved specific alternations. Such a rigid harness is not to constrict and deform the organic growth of the City, but to guide it to the best advantage in the natural environment where it is developed and grows.

Following the 1963 Earthquake, the built environment of Skopje, and Macedonia as well, have been protected by abundant legislation. All construction had and has to comply with provisions of various codes, standards and ordinances, among which, the most essential are: 1) Technical Regulations for Design and Construction of Buildings in Seismic Regions of 1965 and 1981, (Official Gazette of SFRY No. 31/81, 49/82, 29/83, 21/88 and 52/90); 2) Technical Regulations for Repair, Strengthening and Reconstruction of Buildings Damaged by Earthquakes, Reconstruction and Revitalization of Buildings of 1985 (Official Gazette of SFRY No. 52/85); 3) Law on Construction of Capital Investment Facilities of 1990 (Official Gazette of SRM No. 15/90); 4) Law on Physical and Urban Planning, 1996 (Official Gazette of RM No. 4/96); 5) Other supplementary technical regulations, standards and ordinances.

Acting for the City Council, the City Committee for Urbanism, Communal and Housing Affairs, Traffic and Protection of Human Environment controls the conformity of all the construction and the development of the city functions with the principles (set of site-dependant urban design criteria) defined by the Master Plan in effect. At municipal level, the same responsibility for implementation of Detail Urban Plans is given to the Municipal Committees for Urbanism, Communal and Housing Affairs, Traffic and Protection of Human Environment.

The design and construction within the Master Plan area of the City is reviewed and controlled by the branch offices of the Ministry of Urbanism and Civil Construction with responsibilities as follows: 1) to issue construction licenses with clearly specified construction principles that follow the set of site design criteria defined for particular locations by the Detail Urban Plan, 2) to review whether design and construction details comply with the Codes in effect, other technical regulation and standards, 3) conducts site inspections at various stages of the construction process.

Sites of large projects are considered in terms of all available information on natural and man-made hazards and corresponding zonation/microzonation maps. If the location is in a potentially sensitive area, or should be used for construction of an industrial facility, essential facility, settlement development, high rise building structures and facilities, facilities which failure or malfunctioning could have disastrous effects on the environment and/or cause great material losses to the wider community, very detailed site-specific analysis shall be performed, which the contractor must pay for. Such analyses including the review of the compliance of elaborated designs and all other technical documents according with the Code in effect, standards and other legislation, are obligatory and defined by the Law for capital investments in Republic of Macedonia. Such analyses and reviews are performed by specialised institutions, such as the Institute of Earthquake Engineering and Engineering Seismology (IZIIS-Skopje), University "St. Cyril and Methodius", Skopje.

### **RADIUS OBJECTIVES IN SKOPJE**

The 1965 Master Plan of Skopje proposed and settled down the development policy on regional and city lifeline and utility systems. However, all the implemented policies considered mainly the assurance of services for the growing city. The 1985 Master Plan favoured and supported the same solutions and the primary goals directed by the 1965 Master Plan. Skopje is presently reviewing the 1985 Master Plan, actually elaborating its third Master Plan - the Master Plan 2000, with projection period of 20 years. All presently accepted policies will become a legal instrument with the power of law and will mandatory be implemented for the period of the next 20 years.

The recent urban earthquakes, however, demonstrated significant vulnerability and loss of function of urban lifelines and public utility systems, as well as the high reliance of modern urban areas on their utility and lifeline infrastructure such as power and other energy supply, water supply, transportation etc. Therefore, the City of Skopje decided to undertake a consistent check of policies and criteria used during its development in order to: 1) confirm or redirect certain development aspects; 2) decide and prioritise the development; 3) assess and estimate the sustenance of its vital lifeline and utility systems; 4) decide the policy for the current planning cycle; and, 5) if necessary, undertake the proper risk mitigation measures. For the stated needs defined are adequate principal and specific objectives (Table 1) to be achieved during the implementation of IDNDR/RADIUS.

### **ORGANIZATIONAL ASPECTS**

To achieve the formulated objectives, RADIUS has been integrated with two major projects - The Physical Plan of the Republic of Macedonia and The Master Plan of the City of Skopje. These two projects enabled RADIUS to communicate with wide planners and decision-making community, exchange the experiences and policies as well as assured bi-directional transfer of the data and the results.

Based on the Protocol for co-operation between the City of Skopje and the Institute of Earthquake Engineering and Engineering Seismology, University "St. Cyril and Methodius" - Skopje, the organisation, scientific and technical aspects as well as the entire co-ordination of the RADIUS Project during its year and a half implementation in the City of Skopje were carried out by the Section on Risk and Disaster Management (RDM/IZIIS) of the Institute and the City Committee for Urbanism, Communal and Housing Affairs, Traffic and Protection of Human Environment.

During the entire course of the RADIUS performance the RDM/IZIIS and the City Committee closely co-operated with the Public Enterprise for Physical and Urban Plans and the Institute for Physical Planning, Urbanism, Traffic and Environmental Protection of Macedonia - the institutions that are responsible for all levels of planning (national, regional, GUR of Skopje, City of Skopje, Master Plans and Detail Urban Plans) as well as planning of the regional and the City traffic development.

**Table 1. Principal and Specific RADIUS Objectives of the City of Skopje**

<p><b>Principal Objectives:</b></p> <ul style="list-style-type: none"><li>• Integration of all relevant data on natural, built and policy environment, with development of adequate information basis under the predefined GIS shell;</li><li>• Strengthening and, if possible, improvement of risk assessment and disaster management component in the process of subregional and master planning of the City of Skopje with particular emphasis on the vital lifeline and utility systems;</li><li>• Provision of crucial elements for deciding short and long-term priorities of an action plan; and,</li><li>• Raising the awareness of authorities, decision-makers as well as of the wide public to the seismic risks and other natural and man-made hazards that can affect the City of Skopje.</li></ul> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"><li>• Review of the seismicity of Macedonia and of the GUR of the City of Skopje; incorporation of all relevant data, results and findings in the Master Plan 2000 of Skopje;</li><li>• Comprehensive analysis of the vital City's social and physical lifelines and utility systems with development of damage scenarios for the decided scale scenario earthquakes;</li><li>• Review of the principles and elements of existing preparedness, emergency management and contingency planning at all levels relevant for protecting of the City against natural and man-made disasters; earthquakes, in particular;</li><li>• Identification of possible issues critical for the function of the City in emergencies caused by the decided scenario earthquake; and,</li><li>• Development of an economically justified short-term action plan that, at cost-effective basis, shall significantly reduce the effects of the scenario earthquake on the urban environment of the City of Skopje.</li></ul>
---

An excellent co-operation was also established between RADIUS and: 1) the Ministry of Defence - Sector for Civil Protection with its City branch; 2) the Ministry of Interior - Administration and Sector for Protection Against Fires, Explosions and Hazardous Substances; 3) the Republic Institute for Health Protection (Ministry of Health); and, 4) the Pedagogical Institute (Ministry of Education) - the institutions that would be in the first front line to respond should an emergency occur in the City of Skopje, as well as with all public enterprises operating the major infrastructure of the City of Skopje: 1) the Public Enterprise for Electric Power Supply of Skopje; 2) the Public Enterprise for Water Supply and Sewer of Skopje; and, 3) Makpetrol AD, Directorate for Gasification.

The seismicity, vulnerability, and damage assessments were performed by IZIIS - Skopje as the most competent institution in the field in the country. The disaster management aspects were accessed by the specialists from the relevant administrations responsible for management of emergencies. The action plan, based on the weak points identified during the course of the RADIUS case study implementation, is consensus and proposed by all relevant subjects.

Such a co-operation strengthened considerably the links between the professionals of different profile (planners, engineers, city lifeline and public utility operators), and the City of Skopje and Government of Macedonia officials responsible for planning, protection and management of the city in regular, but also in incident conditions and during emergencies.

## **ACHIEVEMENTS**

The implementation of the RADIUS Project in Skopje overlapped with other major emergencies that occurred in the region and in the country. While awareness on earthquake (and other natural and man-made) risk significantly increased among the professionals, particularly among the planners and decision makers, the general public recognition was not at the same level. However, the memory of 1963 earthquake is still quite strong and the population of Skopje is fully aware of the earthquake risk and its possible consequences, particularly the elder and mid-age generations of the citizens.

The RADIUS project and its achievements (Table 2) relevant to the citizens of Skopje have often been reported in the newspapers and by electronic media. TV media, in particular live program URBAN that monitors, discusses and comments all problems related to urban development and urban life of the city, reported several times on RADIUS and RADIUS activities in Skopje. Special programs of URBAN dedicated to RADIUS and the earthquake related risk issues were broadcasted after the kick-off meeting, and on July 26, 1998 and 1999 being the 35<sup>th</sup> and 36<sup>th</sup> anniversaries of Skopje earthquake. All media, electronic and other, reported extensively the RADIUS Workshop held in the period March 1-3, 1999. The RADIUS objectives, achievements and the proposed Action Plan (Table 3) have been, and still are, extensively reported in the media, particularly after its adoption by the City Council.

The initiative of the association of architects, journalists specialised in such affairs, and other enthusiasts respecting the culture of life, people, history and urban environment of Skopje was finalised by constitution (May 1999) and promotion of URBIS - a non-governmental organisation on urban culture. URBIS has eight boards, one of them being the board for education of the population on protection in the case of natural/or man-made disasters. Among the others, one of the principal activities of this board is communication with population (citizens of Skopje) on communal (lifeline and public utility) affairs of the City of Skopje. The other boards aimed to support the continuation of RADIUS spirit and promotion and implementation of RADIUS results and achievements beyond its administrative closure are: 1) board for protection of city's cultural heritage; 2) board for evaluation of city's urban issues; and 3) board for public communications.

However, the most crucial achievement of RADIUS in Skopje is the Action Plan (Table 3) and the set of short term initiatives and studies that in a short run and at cost effective basis are expected to assure more realistic basis for Skopje's disaster management, urban planning and engineering design efforts.

### **ACTION PLAN AND FUTURE INITIATIVES AND PLANS**

Despite the economic limitations characteristic for the post-earthquake development, the City of Skopje succeeded in acquiring and maintaining a considerable degree of seismic protection, incorporating adequately the potential threats from seismic effects in the process of planning and decision making as to the use of land within the city's urban area. However, due to the large concentration of population and material property in the Skopje's region, a collision between developed built environment (and its value) and the natural environment (seismicity) is created in the Skopje's Master Plan Area. Moreover, the functional organisation and development of the space are controversial, with trends that are also in conflict with the natural seismicity factor. Selection and adoption of spatially less vulnerable development schemes can hardly regulate the present problems. Consequently, it was concluded that the meaningful seismic risk reduction can be achieved only by strict application of adequate technically consistent and economically justified measures of seismic protection.

The City of Skopje formulated its Action Plan along this line (Table 3), focussing presently all its efforts on improvement of prevention and preparedness that should assure multi-faceted engineering and legislative framework for protection of the city and its infrastructure systems as well as its total further development.

The Information on "*Implementation and Results from the IDNDR/RADIUS Project in the City of Skopje*" was brought to the attention of the Council of the City of Skopje. At its 38-th Session, held on September 30, 1999, the City Council adopted a Resolution (Table 4) authorising the City Committee to, within its competence and mandate, undertake all necessary actions for effective implementation of the Action Plan outlined and proposed under the RADIUS Project in Skopje. The formal implication of the Resolution of the City Council is that the RADIUS Action Plan becomes a legal instrument of the City of Skopje for control and improvement of its seismic safety in a given seismic environment.

The RADIUS project is approaching its administrative end. However, the achievements and the professional awareness created a strong stimulus for professionals and the City authorities to continue along the traced line. The general initiatives and the needs of the City are presented in the Action Plan (Table 3), however, many facets of technical origin (Table 5) are calling for continuous action and consistent research. Among many needs identified, selected are only the indispensable ones (Table 5) that, at cost effective base, in short run will assure more realistic basis for all disaster management, urban planning and engineering design efforts.

**Table 2. General RADIUS Achievements in the City of Skopje**

- Development of an Urbanistic Information System (UIS) on the built environment of the City of Skopje. For permanent updating, handling and future development of UIS the responsibility is given to the Public Enterprise for Physical and Urban Plans. RADIUS most directly contributed by GIS layers and complete information on educational and health care buildings and facilities.
- Review of the Seismicity of Macedonia and of the GUR of Skopje in all the necessary details. Developed were corresponding GIS layers (tectonics, faults, earthquake epicentres, soil bearing capacity for urban area of Skopje, depth of quaternary deposits, etc.) as well as given were adequate recommendations that are already incorporated in the Physical Plan of the Republic of Macedonia (May-June, 1998) and 2000 Master Plan of the City of Skopje (October, 1998).
- Vulnerability and serviceability analyses of the city's vital lifeline and utility systems (water supply system, gas system, city road system and electric power supply system) have been performed, including the recommendations on elements that should be improved. Development of elements for disaster preparedness and emergency response plans of public enterprises operating particular lifeline or public utility.
- Vulnerability and physical loss analyses have been performed for education and health care buildings and facilities, and adequate recommendations for short- and long-term strategy on disaster mitigation have been provided to the Ministry of Education and the Ministry of Health as institutions relevant for operation and maintenance of these structures.
- Reviewed were the principles and elements of disaster management and emergency response plans of the City of Skopje as well as of the Plan for Protection of the City Against Fires. Findings and recommendations are provided to the Ministry of Defence - Sector for Civil Protection and Ministry of Interior - Administration for Protection Against Fires, Explosions and Hazardous Substances.
- Efforts have been made to assure the continuation of RADIUS initiative by integrating it in to the global perspective of the planning of the City of Skopje over the period of next 10 years. The Ministry of Science of the Republic of Macedonia supported the initiative by allocating funds until the July 2001. The City of Skopje, in co-operation with the Skopje's RADIUS team will continue with its promotion in order to assure additional funds.
- The awareness on earthquake (and other natural and man-made) risk is significantly increased among the professionals, in particular among planners, urbanists, engineers, decision-makers, and municipal and city authorities.
- For certain issues being recommended, the Council of the City of Skopje has already adopted decisions for their implementation.

**Table 3. The Action Plan of the City of Skopje**

- Revision and improvement of the Code of Technical Regulations for the Design and Construction of Buildings in Seismic Regions, i.e., the Building Seismic Design Code presently in effect (enforced in 1981);
- Development of Code of Technical Regulations for the Design and Construction of Engineering Structures in Seismic Regions. Some provisions for design of bridge structures and water and sewer systems are enforced by the 1964 Seismic Design Code. Since then, no revisions have been made; neither provision for seismic design and construction of other lifeline systems have been developed and/or included.
- Mandatory verification of seismic safety and stability of all buildings and facilities classified in Category I (Section II, Article 4 of the Building Seismic Design Code in effect) and buildings of any kind and use higher than 20m.
- Mandatory verification of seismic safety and stability of all buildings of any kind and use being upgraded for more than 10% in the height or by 10% in the weight.
- Strengthening of the process of technical control and site construction inspection at various stages of the construction process.
- Revision and updating of the Plan for Protection of the City of Skopje Against Fires enforced in 1986.
- Establishment of City (or National) Centre for Management of Natural and Technogenic Disasters that, at the City level will be responsible for response, situation, risk and knowledge management.

**Table 4. Resolution of the Council of the City of Skopje /Excerpt/**

<b>CONCLUSIONS</b>	<b>Relevant to Item 7 of Annotated Session Agenda /Information on Implementation and Results from the RADIUS Project in the City of Skopje/</b>
1.	The current interest in the matter presented in the Information, i.e., the need of undertaking concrete measures in the sense of permanent prevention due to the exposure of the City of Skopje to natural hazards whose effects and extent of the effects can even be of devastating nature, do impose that the Information be submitted to the competent ministry and other competent organs and institutions for the purpose of realising in practice the proposed ( <i>by the Mayor of the City of Skopje</i> ) Action Plan.
2.	To improve the process of technical inspection of structures during their construction, i.e., to improve review and inspection in all the phases of construction, it is necessary to launch an initiative for modification ( <i>improvement</i> ) and amendment of the Law on Construction of Capital Investment Structures, the Law on Physical and Urban Planning and the Law on Inspection During Construction.
3.	The conclusions shall be adopted and enforced by the City Committee for Urbanism, Communal and Housing Affairs, Traffic and Protection of Human Environment.

**Table 5. Future Initiatives and Plans**

1.	The 1965 Microzonation Map of the City of Skopje, as a legal instrument for urban planning, land development and implementation of Seismic Design Code in the urban area of the City of Skopje, should be revised and a new one elaborated based on up-to-date methods of analysis of all available data and results accumulated for the last 35 years;
2.	The geotechnical data accumulated in various institutions and companies for the last 35 years should be collected and carefully analysed and mapped by using all the advantages of modern GIS technologies;
3.	The cadastre of underground lifelines, public utilities and other underground facilities shall be elaborated and incorporated in UIS and City GIS. This initiative has already been approved by the City Council, but the resolution is not in effect, yet;
4.	To assure rational elements for implementation of the Detail Urban Plans for the western part of the city's centre and for the Old City Core situated on the left bank of the river Vardar, as well as to provide data for improvement of the traffic solutions in the listed areas, it is necessary to elaborate a "collapse map" - a map that will additionally provide all information on the possible blocking potential of existing street network, and on the elements for planning of emergency response, search and rescue;
5.	Assessment and mapping of man-made hazards for GUR of Skopje is necessary in order to define the autochthonous and collateral potential of this risk class in the City. The initiative has already been recognised and approved by the City Council;
6.	The casualty potential of the Skopje is estimated based on scenarios that either 500 years Return Period (RP200 = MSE) or RP500 (LSE) earthquake shall take place at 24:00 - the time when the dominant part of the Skopje's population occupies the residential buildings. The scenarios do not consider the daily population dynamics. It is necessary to provide estimates for earthquake occurrence at 12:00 based on the identified daily dynamics of population, occupancy rate of the public and administrative buildings, their location, building typology and seismic vulnerability;
7.	The essential facilities in Skopje are designed by implementation of Importance Factor $I_p=1.5$ . It is necessary to re-evaluate their functional safety for MSE and LSE scenario earthquakes according to the performance design principles. Priority shall be given to Government and City Administration buildings, headquarters of the institutions and specialised services for emergency response, health care and education buildings and facilities.

## CONCLUSIONS

The recent political and economic developments in the region since 1990 diverted the attention of planners, engineers, decision-makers and other professionals from problems that, due to adverse impact of environmental factors, could be generated in the country and the City of Skopje as its most developed part. Moreover, the political and economic transition of the country, caused significant weakening of large construction and design companies, enabled the impact of small private companies in large construction works as well as caused considerable decrease in the level of technical control and site inspection of construction works. The adverse

economic developments preserved also genesis, up-to-date development and improvement of legislation for engineering protection of investments at all stages of their design and construction.

During its year and a half implementation, the RADIUS project strengthened considerably the already weakened links between the professionals of different profiles, and the City of Skopje and Government officials responsible for planning, protection and management of the city in regular, but also in incident conditions and emergencies. RADIUS also pointed out the present weaknesses in the design and construction process that may decrease the already assured and planned seismic safety level of the city. It assured data integration, processing and presentation according to world wide implemented standards. Under the RADIUS initiative reviewed was the present emergency response policy and improvements were proposed. Critical assessment of vital city lifeline and utility systems was made, identified were weak points and proposed measures that with integrated and co-ordinated effort of the City Authorities, public enterprises and governmental institutions will, at cost-effective base, improve some aspects of city's disaster management and emergency response.

Implementation of RADIUS in Skopje resolved some problems and proposed the improvement of the disaster management and emergency response. In particular, this year and a half initiative increased the awareness of the professionals on seismic risk and related problems. The RADIUS initiative in Skopje proved a fact that Skopje's approach 'PREVENTION BEGINS WITH PLANNING' is sound and should be favoured in future as a very first step, but also the tradition of the city in its sustainable development and Physical organisation.

Not all the problems were resolved. Many of them were even not touched. However, they are recognised, the awareness and professional framework is laid down. With assistance and the willingness of the City Authorities, they will gradually be resolved and the results implemented through the regular city planning procedure - the Master Plan of the City of Skopje and the Detail Urban Plans.

From many aspects, not only the professional, the RADIUS in Skopje was a great success. It was a project that acted as a catalyst, offering an opportunity to spectra of professionals and Institutions to work together and share their experience, what was not of a common practice before. RADIUS refreshed the old tragic memories, but also strengthened all professional efforts and desires of citizens of Skopje to assure the development of their City in a way that respect people, the environment, and the culture of safe and fruitful life.

## REFERENCES

- Milutinovic, Z. (1996), *Disaster Preparedness in Republic of Macedonia*, Proceedings of the Pan Pacific Hazards '96 Conference, Vancouver, British Columbia.
- Milutinovic, Z. et al. (1998), *Exposure and Preparedness of Republic of Macedonia to Natural and Man-made Hazards*, National report, Earthquake Preparedness Workshop, National Interagency Civil-Military Institute's and Southeastern Europe Defence Ministers, Memphis, Tennessee.
- Milutinovic, Z. et al. ( 1998) *Spatial Plan of Republic of Macedonia – Exposure and Protection Against Seismic Hazards*, Report IZIIS 98 – 29.
- Milutinovic, Z. et al. (1998), *Master Plan of the City of Skopje – Seismic Conditions in the Wider Urban Area of the City of Skopje*, Report IZIIS 98 – 42.
- Milutinovic, Z. and B. Stanojevska (1999), *Disaster Management and Urban Planning - Achievements and Experiences of the City of Skopje, Republic of Macedonia*, Proceedings of the Workshop of Urban Settlements and Natural Disasters, Istanbul, Turkey.
- Milutinovic, Z. et al. (1999), *Implementation of IDNDR/RADIUS in the City of Skopje, Republic of Macedonia*, IZIIS- Skopje, Final Report.
- Petrovski, J. and Z. Milutinovic, editors, (1995), *Second Phase of Study for Disaster Preparedness Plan, Disaster Preparedness Plan for Organisation of the Activities of Red Cross of the Republic of Macedonia*, IZIIS-Skopje/International Federation of Red Cross and Red Crescent Societies.