

## Summary of Terminal Evaluation

### 1. Outline of the Project

Country: Romania

Project Title: Project on Reduction of Seismic Risk in Buildings and Structures in Romania

Issue/Sector: Disaster Management

Cooperation Scheme: Technical Cooperation Project

Division in Charge: Disaster Management Team, Group III, Global Environment Department

Total Cost (at the time of evaluation): approx. 826,740,000 yen

Period of Cooperation

(R/D): 1 August 2002

Period of Cooperation: 5 years

(1 October 2002 - 30 September 2007)

Partner Country's Implementing Organization(s):

1) Competent Government Agency: Ministry of Transports, Constructions and Tourism (MTCT)

2) Implementing Agency: National Center for Seismic Risk Reduction (NCSRR)

3) Supporting Organization(s): National Institute for Building Research (INCERC)

Technical University of Civil Engineering, Bucharest (UTCB)

Supporting Organization(s) in Japan: Ministry of Land, Infrastructure and Transport (MLIT); Building Research Institute

#### 1-1 Background to the Project

Romania is prone to earthquakes. Earthquake damage tends to be concentrated in the capital city of Bucharest. On March 4, 1977, an earthquake of 7.5-magnitude on the Richter scale hit Vrancea County, near Bucharest, killing nearly 1,600 people or over 1,400 in Bucharest alone. The total damages stood at some two billion dollars or 1.3 billion in the capital alone. Some 70 percent of the damages, equivalent to about 1.4 billion dollars, were caused by building collapses. Vrancea County is located in a region where the Carpathian Mountain range changes its direction. Major earthquakes to date have concentrated in this region.

Statistical studies by seismologists indicate the recurrence period of a major earthquake in Vrancea County is thirty years, suggesting that another quake comparable to the 1977 quake in magnitude might hit the region around 2007. To reduce earthquake damage, it is necessary to retrofit buildings that might collapse during a major earthquake. The Romanian government designated 122 buildings in Bucharest as being most vulnerable and announced a plan to phase in anti-seismic reinforcement of these buildings. The problem was that Romania did not have sufficient seismic retrofitting techniques. In August 1998, the

Romanian government requested the Japanese government to provide a technical cooperation project aimed at improving and disseminating seismic retrofitting techniques in Romania.

In response to this request, the Japanese government decided to implement a project designed to reduce seismic hazards associated with building collapse through the transfer of Japanese seismic technology.

## 1-2 Project Overview

### (1) Overall Goal

Measures against earthquake-induced disasters in Romania are strengthened

### (2) Project Purpose

Improvement and dissemination of technology for reducing the risk of building collapse in case of great earthquakes are achieved

### (3) Outputs

- 1) Effective and low-cost retrofit techniques are developed by NCSRR and acquired by structural engineers.
- 2) Regulations/codes concerning seismic issues for both new buildings and existing ones are improved by MTCT/NCSRR.
- 3) Post-earthquake evaluation techniques of the damaged buildings are developed by NCSRR and acquired by structural engineers.
- 4) Disaster prevention education for the citizenry is improved by NCSRR.

### (4) Inputs (until the time of evaluation)

Japanese side:

Long-term Experts: 7 experts in cumulative total      Equipment: approx. 167,357,000 yen  
Short-term Experts: 37 experts in cumulative total      Local cost: approx. 44,940,000 yen  
Trainees received: 29 persons in cumulative total

Romanian side:

Counterparts: 39 persons  
Offices and other facilities: The central office at INCERC, and a branch office at UTCB  
Local cost: approx. 5,782,000 lei (approx. 95,958,000 yen) for four years

## 2. Evaluation Team

### Japanese Members

Number of Team Members: 3

- (1) Leader Kenji NAGATA JICA Senior Advisor
- (2) Project Monitoring Kenta ONO      Disaster Management Team, Group III, Global Environment Department

(3) Project Evaluation Akemi SERIZAWA Global Link Management, Inc.

One technical advisor

(4) Technical Advisor on Seismic Countermeasures Isao NISHIYAMA Director-General, Housing Department, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport

\* Mr. Nishiyama performed a number of duties for a smooth evaluation process, including making necessary literature and materials ready for use, ensuring coordination with the long-term experts, holding negotiations with the Romanian side; and providing useful advice for cooperation and evaluation.

Period of Evaluation

11 (Sun) - 25 (Sun) March, 2005

17 (Sat) - 25 (Sun) March, 2005 for the official team members

Type of Evaluation: Terminal Evaluation

### 3. Results of Evaluation

#### 3-1 Achievement Level

##### (1) Achievement status of the Outputs

*Output 1: Effective and low-cost retrofit techniques will be developed by NCSRR and acquired by structural engineers.*

- The seismic retrofitting manual has been drafted (1st draft) and will be finalized by the end of the Project.
- A total of eight technical seminars on this topic have been held with a total attendance of 263, as against the targets of eight seminars and 400 participants. These targets will likely be achieved as more seminars are scheduled after the manual is finalized.
- In a questionnaire survey on the participants, 85.9 percent of the respondents said they understood to content of the seminar, as against the target of 80 percent.

*Output 2: Regulations/codes concerning seismic issues for both new buildings and existing one will be improved by MTCT/NCSRR.*

- Three technical manuals on earthquake-resistant design--the seismic evaluation manual, the manual on seismic retrofitting manual [Output 1], and the manual on design input earthquake ground motion--have been drafted and will be finalized by the end of the Project. P100-1/2006 Seismic Design Code has been completed by UTCB with technical contribution from NCSRR.
- A total of 18 technical seminars on this topic have been held with a total attendance of 551, as against the targets of four seminars and 200 participants. The targets have already been achieved.

- In a questionnaire survey on the participants, 86.1 percent of the respondents said they understood the content of the seminar.

*Output 3: Post-earthquake evaluation techniques will be developed by NCSRR and acquired by structural engineers.*

- The post-earthquake evaluation manual has been completed. It has already been endorsed by MTCT.
- A total of three technical seminars on this topic have been held with a total attendance of 31, as against the targets of five seminars and 250 participants. These targets will likely be achieved as more seminars are scheduled.
- In a questionnaire survey on the participants, 93.8 percent of the respondents said they understood the content of the seminar.

*Output 4: Disaster prevention education for the public will be improved by NCSRR.*

- A total of seven non-technical seminars on earthquake disaster prevention for the public have been held with a total attendance of 643, as against the targets of five seminars and 250 participants. The targets have already been achieved.
- In a questionnaire survey on the participants, 90.2 percent of the respondents said they understood the content of the seminar.
- Of the planned publications for the public, the educational material on earthquake disaster prevention has been completed. The publication for the public on legal incentives for retrofitting is now being prepared.
- A questionnaire survey is planned for the readers of these publications.

Though not included in the PDM, the Evaluation Team has added Output 5 as shown below as the outputs of two activities: (i) Activity 5-1: To select the target buildings for introducing new seismic retrofitting technology; and (ii) Activity 5-2: To make proposals for retrofitting the target buildings.

*Output 5: Conditions necessary to apply the technologies developed by NCSRR will be set up.*

- The basic retrofitting design and approximate cost estimating, and retrofitting detailed design and structural calculation of the two target buildings have been completed. The detailed drawing and working drawing of them are now being prepared.

## (2) Achievement status of the Project Purpose

The Project Purpose will likely be achieved by the completion of the Project.

- The basic retrofitting design and approximate cost estimating, and retrofitting detailed design and structural calculation of the two target buildings have been completed. The detailed drawing and working drawing of them are now being prepared. The Project has already achieved the Indicator: Technology introduced by NCSRR is incorporated in the working design of seismic retrofitting works.

- Three codes have been developed and drafted by UTCB with technical contribution from NCSRR: (i) P100-3/2006 Code for the Assessment and Design of Retrofitting Works Vol. 1 - Assessment; (ii) P100-3/2006 Code for the Assessment and Design of Retrofitting Works Vol. 2 - Retrofitting; and (iii) P100-1/2006 Seismic Design Code (including a chapter on input ground motion). These three codes will likely be finalized by UTCB and technically endorsed by MTCT by the end of the Project. Once put in force, the codes will become compulsory and therefore observed in the actual works.

## 3-2 Summary of Evaluation Results

### (1) Relevance

The Evaluation Team considers the Project highly relevant. The Project accommodates the needs of Romania. It is also consistent both with Romania's National Development Plan 2007-2013 and with the JICA Country Program for the country.

- A major earthquake is likely in Romania not in the distant future. The Romanian government is pressing ahead with its seismic retrofitting policy. Demand is high both for the development, improvement and dissemination of techniques for reducing the risk of building collapse and for disaster prevention education for the public.

- The JICA Country Program for Romania defines the Project as part of the infrastructure development program under the category of the second focus sector: promotion of industry, trade, and investment.

### (2) Effectiveness

The Project was appropriately designed to achieve the Project Purpose: To improve and disseminate technology for reducing the risk of building collapse during great earthquakes.

- The techniques developed and improved by the Project have been shared by structural engineers in Romania. Once put in force, these techniques will become mandatory as national standards.

- The Activity that was added to the PDM in the Mid-term Evaluation, that is, "working design of seismic retrofitting of the two target buildings," was useful in promoting the practical application of some techniques developed and improved by the Project.

Note that the indicators for the Project Purpose originally included the number of housing units retrofitted with the techniques of NCSRR. This indicator was replaced in the Mid-term Evaluation because it was considered inappropriate for the five-year Project in light of the fact

that the actual execution of seismic retrofitting works entails consensus building among the residents as well as financing.

### (3) Efficiency

The inputs have largely been put to effective use in achieving the Outputs.

- *Romanian inputs.* The Romanian counterparts were excellent. Although they were busy as academics or otherwise and many of them were involved in the Project on a part-time basis, they proactively participated in the project activities, making indispensable contribution to the successful achievement of the Outputs by this Termination Evaluation. If all the counterparts had been involved on a full-time basis, the efficiency of the Project might have been even higher. Nevertheless, it was difficult to secure full-time counterparts because the pay levels at national institutions are generally low. Though on a part-time basis, these excellent counterparts were instrumental in achieving the Outputs of the Project.

- *Japanese inputs.* The experts, equipment, counterpart training and other Japanese inputs were put to effective use in achieving the Outputs.

### (4) Impact

The objective of promoting seismic retrofitting, which corresponds to the Overall Goal of the Project, should be addressed at the technical, social and policy levels. The Project had a remarkable technical impact and a moderate social impact. At the policy level, however, the Project had only a limited impact.

- It is highly likely that the Overall Goal of “Measures against earthquake-induced disasters in Romania are strengthened” will be attained. It is not easy, however, to achieve the Indicator for the Overall Goal: Within 5 years after the completion of the Project, the number of housing units that have been evaluated and retrofitted or newly built by taking advantage of the outcomes of the Project will increase to such an extent to satisfy the stakeholders. This objective should be addressed at the social and policy levels as well. Coordination with not only NCSRR but also MTCT and the competent local authorities is essential to that end.

- *At the technical level.* It is likely that the techniques developed and improved by the Project will be used for actual seismic retrofitting works.

- *At the social level.* The Project has raised public awareness about the need for earthquake disaster prevention. More efforts should be made, however, to convince the residents of the buildings that need seismic retrofitting to accept actual works, which would entail long-lasting inconvenience on their part.

- *At the policy level.* Promotion of seismic retrofitting works falls under the responsibility of MTCT. In the process, it is necessary to ensure coordination with NCSRR and the competent local authorities.

### (5) Sustainability

The Project is highly sustainable at the technical level but there is room for improvement at the organizational and financial level.

- *At the technical level.* The technical capacity of the Romanian counterparts is so high that they can sustain the activities at NCSRR on their own, including the use and O&M of the equipment. However, their capacity to raise the public awareness is insufficient. They are a group of researchers by nature and may not have strong interest in awareness-raising. The sustainability in this respect should be strengthened after the completion of the Project.

- *At the organizational level.* NCSRR, which has been established to implement the Project, will remain relevant after the end of the Project because the need for promoting earthquake disaster prevention and seismic retrofitting will remain unchanged. It is urgently necessary, however, to identify post-project activities of NCSRR and the organizational arrangements for such activities. The Japanese side has made a series of request to that effect to the Romanian counterpart, which is now studying a future organizational structure that would make more effective use of the outcomes of the Project. A new structure may need staff or awareness building activities.

- *At the financial level.* The Romanian side is also considering the financial aspect of NCSRR after the completion of the Project. Being a national institution, NCSRR faces a number of legal and institutional constraints. Among them are the difficulty of securing staff due to low levels of pay and the possibility that O&M of the equipment will be made difficult due to financial and legal factors. NCSRR may need to explore the possibility of providing services under contract as part of its revenue-generating efforts.

### 3-3 Contributing Factors

(1) The Romanian counterparts already had some knowledge about seismic retrofitting and designing techniques at the launch of the Project. Five key members participated in the JICA training and acquired skills and knowledge with some of the Japanese experts.

(2) Articulation between C/P training in Japan and the short-term expert assignment regarding the issues of the Project provided useful opportunities to address them.

(3) Improvements to the Indicators in the Mid-term Evaluation allowed the project stakeholders to share the understanding of the Purpose and Outputs of the Project.

(4) The supporting framework in Japan, involving Building Research Institute, and the National Institute for Land and Infrastructure Management of MLIT, and others, has been firmly established and highly functional.

### 3-4 Conclusion

The Project Purpose and the Overall Goal are considered relevant because they are consistent with MTCT's policy on seismic hazards and Japan's aid policy for Romania.

The Project has been highly evaluated in the following aspects:

- The Project provided the first opportunity for the seismic retrofitting design using the state-of-the-art technology to be applied for pilot-type buildings in Romania.
- The Project has prepared a manual for educating pupils and students about earthquake disaster prevention.
- The Project organized many seminars and meetings for the residents of vulnerable buildings, pupils and students, and engineers, and successfully raised their awareness about seismic hazards and their management.
- State-of-the-art equipment has been provided to the Romanian counterparts, who have put it to effective use.

Support toward the achievement of the Outputs and a high level of ownership by NCSRR, the Project Purpose will likely be achieved by the end of the Project as planned. Technology transfer has been properly conducted through daily activities and training based on the strong partnership between the Japanese experts and the Romanian counterparts.

Nevertheless, there is some room for improvement in raising the achievement level of the Project Purpose toward the Overall Goal. Specifically, it is necessary to promote actual seismic retrofitting works by making better use of the outcomes of the Project. Viable means to that end include developing a quality control system for such works and taking advantage of MTCT's framework for institutional and financial support. This issue should be addressed as soon as possible.

### 3-5 Recommendations

[On the activities during the project period]

#### (1) Endorsement of technical manuals and guidelines by the Romanian government

To achieve the Project Purpose, it is necessary that MTCT, the competent agency of the Romanian government, endorses the technical manuals and guidelines that have been developed in the Project. To date, the technical committee of MTCT has endorsed the seismic design code and the post-earthquake evaluation manual. The Evaluation Team recommends that the Project encourages the endorsement of other manuals and guidelines.

#### (2) Publication of the project outcomes

The Evaluation Team recommends that the Project encourages the publication of a booklet on seismic retrofitting and preparedness for earthquake disasters, as prescribed in the PDM.

#### (3) Quality control techniques for seismic retrofitting works

The Project should continue its activities aimed at making the achievement of the Project Purpose and Outputs more certain. Although the improvement of the techniques for seismic retrofitting design and their dissemination to engineers in Romania is a major achievement, proper quality control of seismic retrofitting works is crucial for making effective use of these



improved techniques. The Evaluation Team recommends that NCSRR undertake activities designed to encourage engineers, architectural design firms and contractors to improve their quality control techniques for seismic retrofitting works.

(4) Clarification of the role of NCSRR in the post-project setting

NCSRR has been established as the key institution for implementing the Project. It should continue its operations to make use of the outcomes of the Project in a sustainable manner. The Evaluation Team recommends determining the policy of post-project operations of NCSRR as soon as possible during the project period.

(5) Approach to the execution of seismic retrofitting works

It is clear that improving and disseminating the relevant techniques are insufficient for starting the execution of seismic retrofitting works soon. The Evaluation Team recommends that the Project conduct case studies on such topics as how to ensure coordination among NCSRR, MTCT, and the competent local authorities, and how best to minimize inconvenience on the part of the residents during seismic retrofitting works.

[On the post-project activities]

(6) Support for seismic retrofitting works

The techniques that have been introduced to Romania in the Project should be put into practice in actual seismic retrofitting works. The Evaluation Team recommends that NCSRR continue its support for such works.

(7) Effective use and appropriate O&M of the equipment

The Project has been making efficient use of the equipment provided by JICA in its efforts to achieve the expected outputs. This practice should be continued even after the completion of the Project in order to achieve the Overall Goal, as well as the Project Purpose. The Evaluation Team recommends that NCSRR work together with MTCT and other organizations concerned to put the equipment to effective use and properly maintain it toward the continued improvement and dissemination of the techniques.

(8) Continuation of disaster education

The Project has had a positive impact on disaster preparedness of local communities through disaster education as part of its activities aimed at achieving Output 4. The Evaluation Team recommends that NCSRR continues its disaster education as one of its main activities to raise the public awareness about the need for seismic retrofitting.

(9) Cooperation with neighboring countries

Many countries around Romania are also prone to seismic risks, with many building vulnerable to earthquakes. The Project plans to organize seminars designed to disseminate the outcomes of the Project to these countries during the project period. The Evaluation Team

recommends that NCSRR continue and develop activities aimed at reducing seismic risks in cooperation with the neighboring countries.

### 3-6 Lessons Learned

#### (1) Importance of quality control of seismic retrofitting works

The process of implementing seismic retrofitting can be divided into the design and execution phase. In the design phase, a range of seismic evaluation techniques and earthquake-resistant technologies are important requirements. In the execution phase, the capacity of the contractors and quality control by engineers are some of the important factors. The Project has focused on the design phase, assuming that the execution phase should be covered by post-project activities. It has become clear, however, that a seismic retrofitting project that uses new technology should include activities aimed at improving quality control techniques that take account of the execution phase, as early as its project design process.

#### (2) Need for activities aimed at increasing the disaster preparedness of the public

A major earthquake has a longer cycle than other natural disaster. For example, the recurrence period of a major earthquake in Bucharest is considered about 30 years. Many people do not know or remember earthquake disasters. For a project aimed at reducing seismic risks, it is important to raise the disaster preparedness of the public through disaster education activities that offers a clear picture of what earthquake hazards are like.

### 3-7 Follow-up Status

Recognizing the importance of improving and disseminating the quality control techniques for seismic retrofitting works in order to promote such works, NCSRR has made a request to the Japanese members of the Termination Evaluation Team for an extension of the Project. The purpose of the extension is to improve the quality control techniques based on the design techniques that have been improved by the Project. The Japanese members, noting that the importance of quality control of seismic retrofitting works was recognized in the recommendations and lessons learned in this Terminal Evaluation, have decided to bring the request back home, consult with the Japanese stakeholders on the possibility of further assistance, and respond to the Romanian government.