Moreover, information on the effect of each ground condition to earthquake-motion is not sufficient, and the seismic standard based on such limited information is inadequate. This means that the retrofitting based on the present inadequate seismic standard may have some problems, because the level of input on earthquake- ground- motion includes some uncertain factors. Therefore, it is now necessary to implement earthquake observation to accumulate necessary data in order to solve problems such as these.

In regard to the present system of earthquake observation in Romania, there are three main earthquake observation networks (INCERC: National Institute for Building Research, INFP: National Institute for Earth Physics, and GEOTEC: Institute of Geotechnical and Geophysical Studies; a private company). These institutes have their own observation purposes. INCERC observes earthquake-motion for surveying the input of earthquake- ground- motion for building design. At present INCERC operates 85 seismographs, but about 70 of them are the antiquated analogue models. The number of digital seismographs in operation is only 15. The analogue seismograph is not now used in Japan for several reasons. As well as producing inaccurate data; it also takes time to process the data received and spare parts are not easily obtained. INFP's earthquake observation network comprises of 35 digital seismographs. These seismographs were installed by the Karlsruhe University in Germany, which has been implementing technical support on earthquake observation since 1995. The purpose of the observation is to elucidate and research on the mechanism of earthquake occurrence. The seismographs are generally equipped far from the city center to avoid ambient noise. In the earthquake observation network of GEOTEC, the seismographs are equipped in the dam sites of mountainous areas. GEOTEC owns 20 seismographs all over the country, of which most are analogue.

For properly evaluating input earthquake ground motion, it is necessary not only to survey local ground information but also to elucidate characteristics of earthquake motion transmitted from epicenter to urban areas. However, as far as the current system of earthquake observation and equipment owned by INCERC stands, it cannot be considered able to do this effectively..

To establish an ideal earthquake observation system, it is imperative to define the target observation points in the urban area and observe earthquake- motion densely and accurately. An effective system makes it possible to prepare a zonation map of the urban area by combining information on earthquake observation data, soil tests, underground structural elements, etc. This zonation map can be utilized by administrative organizations to take certain measures against earthquake disasters. Bucharest functions as the economic and political center of Romania, and MLPTL preferentially implements retrofit projects for the fragile buildings in Bucharest. It is therefore important to equip a dense earthquake- motion- observation network in Bucharest and closely monitor earthquake- ground- motion. The analyzed data would be extremely valuable for the retrofit project. From the view point of cost and implementation, however, it is difficult to equip a dense observation network which corresponds to the complexly of the earthquake-motion. It is more efficient to focus on narrow observation points and presume information on other points from the data of the existing observation points.

Therefore, it is now necessary to improve the present earthquake- observation- network system and be able to collect better earthquake observation data. To achieve this it may be seen to be necessary to exchange all the analog seismographs owned by INCERC for digital ones. However, this would be extremely expensive, and is therefore not the most effective way. It is instead desirable to construct a cooperative relationship with INFP, which has data from a digital network, and so be able to share data with them . However, it is necessary to have German approval to do this, and it may take one year to obtain the data.

(2) Concerning the present seismic standard (necessity of structural test)

As mentioned in 2-2-3(2), the seismic design standard is prepared according to "The Code for Earthquake

Resistant Design of Residential Buildings, Agrozootechnical and Industrial Structures (P100-92)". In this section, problems about this standard and other related standards "NP007-97 Code for RC frames"; "Code for RC Shear-Walls Structures(P85-96)"; "Code for Masonry Structures(P2-85)" were shown.

For instance, if "5.3.6. Reduction (behavior) factor RC structures" and "6.2.4.Drift limitation for RC structures" and "Appendix D: Improvement of RC structures detailing through contributions from P85-1996 and NP007-97" are looked at, a building structure is assumed to consume input energy of an earthquake by combination of structural strength and deformation capacity (ductility). Therefore, it is possible to reduce the structural strength depending on the ductility. Also the ductility of the whole structure is determined by the ductility of constituent structural elements such as column, beam, joint part, etc. However, in case of the buildings in Romania, the ductility of the structural element is not well recognized within P100/92 code. This is one of the biggest problems in the structural design and codes in Romania.

The structural ductility relates to the factors such as shapes of sectional areas, conditions of steel bar arrangement, types and strength of materials used, quality of construction etc. In addition, in the limit stage of structural ductility, it is seen that some members of the frame have already been destroyed. There are various kinds of destruction: bending failure, shear failure, splitting bond failure, anchoring failure, etc. Without a study of the effect of these factors to the failure mode, it is difficult to evaluate ductility of structural elements. Therefore, it is necessary to simulate such failures through structural testing and to develop evaluation techniques for structural ductility from the results of those tests..

In regard to the contents of NP007-97 Code for RC frames, they were composed under a certain assumption. In "6.1.3: Active reinforcement in RC beams cooperating with RC slabs," "6.1.4: Coefficients for design bending moments due to seismic action," and "6.1.5: Coefficients for design shear forces due to seismic action," etc., they need to be studied by structural testing, and amended appropriately. In the structural testing done by the Project, it is necessary to prepare both testing specimens; one is designed according to the regulation and the other one is designed by changing some factors in the regulation. Also it is important to apply the load to the specimen to simulate actual conditions of stress and deformation in the structural element properly.

4. Project strategy

4-1. Overall Project strategy

The core problem discussed in the PCM workshop is "There are many buildings which might collapse at the future big earthquake." Therefore, it was considered that the most important point was to retrofit the buildings securely; to save lives and minimize economic loss, even if a great earthquake occurred. To realize this it is necessary to promote effective building retrofit, and for this purpose it is clearly necessary to develop an effective and economically viable retrofit-work method.

The Project also aims to introduce more appropriate seismic codes. Currently the necessary data (earthquake-motion and soil data) is not adequately collected and analyzed in Romania as explained in 3-2. In other words, the buildings in Romania have not been designed to an acceptable seismic design standard, which has been properly analyzed and evaluated. To provide Bucharest city with long-term resistance against earthquakes, it is therefore necessary to implement much higher and appropriately analyzed seismic design standard.

The Project also introduces post-earthquake evaluation techniques of damaged buildings, and a system for dispatching authorized structural engineers to the damaged site is explained. There is a currently a similar system[6]

[6]When buildings are damaged by earthquake, MLPTL takes charge of risk judgment of the damaged buildings according to the request of

in effect in Romania, and the technical manual[7] is available for structural engineers. However, the system is not as comprehensive as the Japanese one, which gives technical information on post-earthquake evaluation techniques of the damaged buildings to the building engineers and allows them to function as volunteers who can work on post-earthquake evaluation techniques for the damaged buildings. Romania has a similar need as Japan in this regard, and therefore it is possible to transfer expertise.

In addition, the Project implements the method designed to improve the citizens' preparedness for earthquake disaster. In order to minimize the effect of an earthquake, the Project provides disaster prevention seminar for the public. Romania has not done this to date. Although some disaster prevention manuals (for the general public, children, and school teachers) were published in Romania approximately 10 years ago, they are not edited in order that the public have their interests in the content of the manuals. Japan has far more experience for this type of manuals and publication..

4-2. Project strategy

The overall Project strategy as discussed in 4-1 is divided into four elements: i)The development of an effective retrofit method; ii)The development of an appropriate seismic design standard; iii)The dissemination of technical information on post-earthquake evaluation techniques to the structural engineers; iv) The improvement of disaster prevention skills for the public. Each element is detailed below.

4-2-1. Development of effective retrofit method

The Project examines the seismic performance on the buildings listed in the MLPTL's retrofit projects, and studies the methods of retrofitting to improve structural strength and ductility. Results of the examination and other technical information are to be disseminated to the structural engineers via manuals. The Project also holds some seminars for the structural engineers to disseminate the technological information.

MLPTL has a policy to promote the retrofitting of the most fragile 115 buildings in Bucharest that may collapse in the event of an earthquake. It plans to get the retrofit of all of the 115 buildings (3,320 apartments: refer to 7-7-3) started during the expected Project term (2002-2006). If they are retrofitted by the technology developed by this Project, it is assumed that 8,831 residents (3,320×2.66 people/apartment[8]) will benefit from the Project. Moreover, if the buildings for school and hospital (refer to 2-4-2) are retrofitted, the building users will also receive the benefit.

In addition, information on the newly developed technology by the Project is disseminated to the structural engineers including both experts and verifiers. It is most effective to disseminate the technological information to the structural engineers by holding a seminar, because they directly relate to the approval of drawings for retrofit-works. In relation to the best way to hold a seminar, it is felt they should be held once a year. The ideal number for the seminar attendance is felt to be 35 per class. The staff of UTCB, INCERC, and other institutions, as well as students who study structural engineering and technical staff of Civil Protection organizations as well as the aforementioned structural engineers are expected to be target group of seminar participants. It is even more important for those who live in dangerous regions such as Bucharest to attend these seminars.

Civil Protection Command, and MLPTL requests design companies to dispatch their staff to the damaged area.

[7]MLPTL prepares a technical manual on risk judgment for the damaged buildings. The manual is issued by IPCT (private design company). MLPTL distributes the manuals to persons concerned in disaster-prevention in each ministry, school staff, hospital, local government, and other private design companies.

[8]Number of residents per apartment (household) in Bucharest. This figure is based on the data of the 1992 census. This census is conducted every 10 years.

It is unclear how many seminar classes need to be held. If a seminar is held once a year, it is assumed that 175 engineers will take a lecture during the Project term. Of course, the technical manuals developed by the Project will be distributed to the seminar participants.

Table 9. Expected Number of Seminar Participants

	2002	2003	2004	2005	2006	Total
Seminar Participants	35	35	35	35	35	175

4-2-2. Development of appropriate seismic design standard

The Project implements experiments for seismic structural testing and studies on the methods of seismic design (shear strength and ductility, and displacement-based design). To develop these methods it needs to analyze: i) the frequency of earthquake occurrence and the intensity of earthquake; ii) the difference of earthquake intensity by location from the survey of strong earthquake motion; iii) soil characteristics and amplification of earthquake motion in the ground, and iv) ground information to evaluate earthquake risk. Based on these studies, the data of earthquake-ground-motion that affect on buildings are accumulated, and a design manual explaining the effect of earthquake-ground-motion is written (refer to the Prospective Results of 7-2). A draft of seismic standards is also prepared. Moreover, as well as 4-2-1, not only a manual is written, but also some seminars for the structural engineers are held. The technological information developed by the Project is disseminated to the structural engineers in this way. The method of holding the seminar is implemented as explained in 4-2-1. Technical manuals developed by the Project are also distributed to the participants during the seminars.

The newly developed or revised design standard contributes to design of the seismic proof buildings that will be constructed in the future. According to the census report issued in 1992, 274 buildings, the capacity of which is 6,400 residents, were constructed during the term of 1991-92 in Bucharest. If the statistical data is applied, during the length of the Project term (5 years), it can be assumed that 32,000 residents in 1,370 buildings will be able to live in the buildings designed according to the technology developed by the Project or by seismic design standard based on the data which will be appropriately analyzed.

In addition, ANL (National Agency for Housing) under the authority of MLPTL plans to construct 28,000 new apartments, as well as 38,000 apartments for younger families and 400 sports halls during the years of 2001-2004. It is possible to apply the newly developed or revised seismic design standards to the planned apartments and sports halls.

4-2-3. Dissemination of technical information on post-earthquake evaluation techniques to the structural engineers

In this Project, information concerning post-earthquake evaluation techniques, which involve quick inspection of damaged buildings, is collected and technical manuals explaining the methods of post-earthquake evaluation techniques are prepared. As well as 4-2-1, and as mentioned before, not only are manuals written, but some seminars for the structural engineers are also held. The manuals are then distributed to the seminar participants (refer to Prospective Results of 7-2).

4-2-4. Improvement of disaster prevention skills for the citizens

The Project investigates and analyzes disaster prevention preparedness of the citizens, and develops the disaster prevention manual that is more comprehensive and more familiar to the citizens than these ones which have been previously issued (refer to Prospective Results of 7-2). In addition some seminars for the public are held.

With regard to the seminars, the main target group of attendants is the group of owners (residents) in the Class I buildings, including the 115 buildings of Bucharest, which are recognized as the most fragile buildings. Moreover, it is also highly desirable that the schoolteachers of primary or secondary school attend. If the teachers who have participated in the seminar disseminate the content of the seminar to their students, the information is given to a much wider audience.. Therefore, two kinds of seminars are given: one is for a group of the residents who live in the Class I buildings; while the other is for groups of school teachers.

The number of the seminars held per year for each group is assumed to be one. While the number of attendants in a seminar for residents is assumed to be about 25, the number of attendants in a seminar for school teachers is assumed to be 15 for the purpose of giving lectures effectively. It is also assumed that four members of staff from the Project team can give lectures. If these targets are met, the seminar participants attending during the expected Project term (2002-2007) are estimated as follows.

Table 10. Expected Number of the Participants of Disaster Prevention Seminar per Year

	Residents in the fragile buildings	School Teachers	Expected number of the seminar participants (one year)
Lecturer 1	25	15	40
Lecturer 2	25	15	40
Lecturer 3	25	15	40
Lecturer 4	25	15	40
Total	100	60	160

Expected number of the seminar participants during the Project term (5 years) is 800 (=160 persons /year×5years).

5. Project design

From the content of the Project strategies explained in Chapter 4, the Project Design Matrix (PDM) has been designed as shown in 7-1. The composition of the Project can be clarified as follows.

The name of the Project is assumed to be "The Reduction of Seismic Risk for Buildings and Structures," the main target group is the citizens of Bucharest, and the Project term is assumed to be five years. "Outputs" will be achieved when "Activities" are done, and as a result, "Project Purpose" will be realized. "Overall Goal" is the project objective, which is expected to be attained 3 to 5 years after the project termination.

5-1. Overall Goal

1. Measures against earthquake-induced disasters in Romania are strengthened.

The expected achievement of this project is the reduction in casualties and economic loss caused by earthquakes.

5-2. Project Purpose

Improvement and dissemination of technology for reducing building collapse in the event of great earthquakes are achieved.

This Project Purpose does not just refer to the reduction of building collapse by retrofitting. It also emphasizes the importance of technology transfer from Japan to Romania through the Project.

5-3. Outputs, Activities, and strategy for the Activities

5-3-1. Outputs

The Project Purpose would be achieved when the four components described in 4-2 (i. Development of effective retrofit method, ii. development of appropriate seismic design standard, iii. Dissemination of technical information for restoration of earthquake-damaged buildings to the structural engineers, and iv. Improvement of disaster prevention skills for the public) work in a well-balanced way. These components can be assumed as "Outputs" by showing the following expressions.

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

5-3-2. Activities

To achieve each Output mentioned above, the following activities are required.

7-1 Activities for Output 1

Activity 1-1. To examine the building seismic performance listed in the MLPTL's retrofit projects
Activity 1-2. To support and evaluate MLPTL's retrofit projects
Activity 1-3. To study the methods of building retrofitting (strength and ductility, and displacement-based methods)
Activity 1-4. To prepare a manual explaining retrofit methods
Activity 1-5. To disseminate the technical information to structural engineers by seminar

2) Activities for Output 2

Activity 2-1. To prepare equipment and facilities for seismic struetural testing
Activity 2-2. To implement experiment and analyze data
Activity 2-3. To study the methods of seismic design (shear strength and ductility, and displacement-based design)
Activity 2-4. To prepare equipment for strong-motion earthquake record (underground, free field and building)
Activity 2-5. To collect ground information (micro tremor characteristic, underground soil condition) and analyze/accumulate the data
Activity 2-6. To prepare equipment and facilities for soil test/ investigation
Activity 2-7. To study the methods for soil testing
Activity 2-8. To accumulate the data on earthquake intensity corresponding to ground condition
Activity 2-9. To accumulate the data on input earthquake -ground-motion to buildings
Activity 2-10. To prepare the manual of input design earthquake- ground- motion
Activity 2-11. To disseminate the technical information to structural engineers by seminar
Activity 2-12. To prepare draft of technical manuals, regulations and new codes

3) Activities for Output 3

Activity 3-1. To collect information concerning post- earthquake evaluation techniques (quick inspection of damaged buildings and judgment of the degree of damage)
Activity 3-2. To prepare technical manual explaining the methods of post- earthquake evaluation techniques
Activity 3-3. To disseminate the technical information to structural engineers by seminar

4) Activities for Output 4

Activity 4-1. To investigate the level of disaster prevention preparedness of the citizens
Activity 4-2. To disseminate information on disaster prevention preparedness to the citizens by seminar
Activity 4-3. To publish printed matter concerning disaster prevention preparedness to the citizens

5-4. Inputs

5-4-1. Inputs from the Japanese side

1) Dispatch of experts (3 long-term experts are stationed at the Project site, and approximately 4 short-term experts are dispatched every year.)
2) Acceptance of counterpart training (approximately 3 persons are accepted every year.)
3) Equipment provision

5-4-2. Inputs from the Romanian side

1) Arrangement of counterparts and administrative staff
2) Allocation of an adequate budget
3) Adequate facilities are needed at the Project site

5-5. Important Assumptions and the Project-management risk by external factors

5-5-1. Important Assumptions

Important Assumptions (conditions important for the Project success, which can not be controlled by the Project) are as follows. In this Project, Preconditions, and Important Assumptions required to attain "Outputs" from "Activities" and to attain "Overall Goal" from "Project Purpose" have been designed.

7-2 Preconditions for the Project

-A great earthquake does not occur before the Project is completed. -Unexpected severity of earthquake is not identified. (An unexpected earthquake does not occur from an unidentifi fault.)

(2) Important Assumptions (Condition that are required to attain "Outputs" from "Activities")

(Activities + Important Assumption i → Outputs)

-The Economic conditions of each country do not deteriorate. -Trained engineers remain active for ongoing projects.

(3) Important Assumptions (Condition that are required to attain "Overall Goal" from "Project Purpose")

(Project Purpose + Important Assumption ii → Overall Goal)

-Residents and users' consent on retrofitting works will be obtained. -Residents properly maintain building structure. (Residents do not damage or remove structural elements.) -Other concerned ministries owning buildings of primary importance finance retrofitting works.

5-5-2. Project-management risk by external factors

(1) Policy aspect

In the Action Plan of the Governance Program with effect until 2004, the earthquake disaster prevention is stated as an important matter. However, due to the possible change of the government after 2004, there might be a change in policy on earthquake disaster prevention in the future.

Romania, especially Bucharest, has been subject to earthquake damage many times up to the present. In the notorious 1977 earthquake, it was recorded that the number of people killed was 1,578 and the economic loss was 3 billion dollars. Therefore, the importance of earthquake disaster prevention may not diminish. However, it is possible that the budget allocation to earthquake disaster prevention field may be restricted, or transferred to other field.

(2) Economic aspect

As far as the GDP growth rate of the past ten years is considered, the symptom of positive growth (93-96 years) is sometimes seen, but negative growth (97-99 years) can also be observed. Clearly there is no stability in macroeconomics. If the Project is managed during a term of negative growth, there might be a direct influence on the budget allocation from MLPTL. In this case securing an adequate budget by joint research with other enterprises or by other methods becomes essential.

5-6. Project management and implementation structure

The Project is managed as the "Center" which is a new organization established based on the Government Ordinance under the responsibility of MLPTL. The "Center" will be established when the Project starts. The role of the Center is decided by MLPTL, although it is assumed that the Center's main activity will be to disseminate newly developed technologies which relate to retrofit methods, earthquake engineering, and methods which reduce the seismic risk for buildings and other structures. It will not be organized as a division of MLPTL in order that it can manage itself more flexibly (administration systems tend to be simplified in Romania). However, budget allocation and staff assignment for the Center are arranged under the responsibility of MLPTL. The director of the Center (Project manager: P/M) is appointed by the Minister of MLPTL. The P/M takes the responsibility for practical management. The Secretary of State of MLPTL functions as the Project Director, who is the head of the Project.

The layout of the organizational structure is shown in 7-7-4. Under the responsibility of the Project Director and the Project Management it consists of an administrative division; 4.5 persons and four technical divisions (i. Building retrofitting and Design codes: 7.5 persons, ii. Seismic observation network, Dissemination of knowledge annd training of engineers: 6.5 persons, iii. Technical experimentation for soil and structures: 8 persons, and iv. Dissemination of knowledge and training of engineers: 4.5 persons). Most of the members are researchers who befrom the fact that both INCERC and UTCB are top class institutes in the field of earthquake engineering in Romania, and the fact that they work together generally. More details on organizations and activities of UTCB and INCERC are explained below.

i) INCERC(National Institute for Building Research)

INCERC is as three branches (Iasi, Timisoara, and Cluj). The number of total staff is 374 (260 in Bucharest and 114 in the 3 branches). INCERC is involved in the revision of seismic design standards, and it was involved in writing of "The Code for Earthquake Resistant Design of Residential Buildings, Agrozootechnical and Industrial Structures (P100-92)," which is the latest seismic design standard.

INCERC has some research facilities for analyzing earthquake, fire, and sound, etc, and type and the scale of the facilities are similar to those of Building Research Institute (BRI) in Japan. In the laboratory designated for structural experiments, there is a reaction wall (testing area: W×L×H=24m×24m×12m, horizontal loads: 40-50mN, and maximum overturning moment: 200-250mN), which can be utilized for seismic experiment. However, some equipment (servo actuator, pumping unit, loading devices, and data acquisition facilities, etc.) used by this wall are not in operation. There are also two shaking tables (small table:3m×3m, and large table 6m×6m), but these are not operable either. The equipment specification is old, and it will therefore be necessary to install the equipment with newer specifications (refer to 7-7-5 for details of the equipment).

There is also an earthquake network facility, which is well operated. Part of the data is available to the public via Internet. There are a SMAC2 seismograph made in Japan, by which the 1977 earthquake was recorded, and the latest digital seismograph made by Kinemetrics in the basement of one laboratory. There are also 3 boreholes in the site.

ii) UTCB (Technical University of Civil Engineering, Bucharest)
UTCB has some civil engineering courses for under and post graduate students as well as Ph.D students. There are about 580 teaching staff and 6,300 students. There are 6 faculties, 1 department and 1 college. The university was established in 1818 originally named as The School of Land Surveying, and it became the university in 1948.

The university's budget is allocated from the Ministry of Education and Research (MER) according to the number of students. The Salary of teaching staffs is guaranteed. In addition, the budget of research activity is prepared by MER and other sources such as the European Community.

Some special periodicals are stocked in the library, and it is equipped with the latest computer network system. Many of teaching staff have done research in foreign countries (especially in France). Research level is relatively high. There are some machines for testing the strength of concrete, which are utilized for educational purposes.

5-7. Prior obligations and prerequisites
The matters which should be negotiated between Japan and Romania for successful implementation of the Project are as follows.
5-7-1. In respect to Japan
(1)Dispatch of experts
(2)Establishment of a domestic technical committee
(3)Acceptance of counterpart for training
(4)Preparation of the list of equipment needed in the Project

5-7-2. In respect to Romania
(1) Preparation of necessary site, buildings, and facilities for the Project
(2) Necessary number of counterparts (C/P) and administrative staff (It is expected that the C/P, who has other routine work to do, will devote sufficient time to the project.)
(3) A adequate budget for managing the Project will be provided (including the fund necessary for various experiments, preparation of the manuals, etc.)

6. Project justification
6-1. Effects
6-1-1. Effects on the development policy framework
The Government prepared the system to promote retrofit of fragile buildings by a legal framework in 1994. However, since then, the retrofit- work has not been progressing extensively. The main reason why the retrofit-work is not progressing is not only due to lack of budget, but also due to lack of effective retrofit techniques. Through this Project, it is expected that the retrofit- works will be promoted, because effective retrofit techniques will be developed by the Project and then applied to the building construction. It is hoped therefore that the project will have far reaching effects..

6-1-2. Effects for the institutional framework
There is a legal framework, which is concerned with seismic design in Romania. However, the current one has not been prepared using appropriately collected data. One of the aims of this Project is to improve seismic design through collection and analyzing of data The Project also contributes much to the review of the laws, codes, and notifications, etc. which relate to seismic design.

6-1-3. Socio-cultural impact
(1) Features of beneficial group

The residents who live in the buildings categorized in Class I and who therefore live in the buildings for which retrofit-work will start belong to an immediate benefit group. These buildings which can be found in the city center of Bucharest are multi-storied and are used for general residential houses (apartments). The residents of these apartments are not categorized in a certain social class, or any other distinction of job, sex, race and religion, etc. Therefore, the beneficial group is a general one. In addition, structural engineers and school teachers who attend seminars can be included in the beneficial group.

(2) Scale of beneficial group

115 buildings are expected to be retrofitted- by contractors during the Project term (five years), although it depends on the scale of MLPTL's budget allocation. This equates to the possible saving of the lives of 8,831 people (refer to 4-2-1). The residents who live in 1,370 newly built buildings, for which construction will start during the project period will also be beneficiaries.

Concerning the retrofit work of the buildings for schools and hospitals, if their retrofitting is executed, the building users will obviously receive the benefit of the technology developed by this Project. However, when these retrofits(especially, retrofitting by contractor) will be executed is unclear. It depends on the level of funding from other supporting organizations. Therefore, target year to complete the retrofitting cannot clearly defined, and so they cannot be included in the beneficial group within the scope of this project.

Finally, those who attend a seminar prepared by this Project (800 general citizens (500 residents and 300 school teachers) as well as 175 structural engineers) are regarded as beneficiaries. If 300 school teachers who attend a seminar on disaster prevention explain the seminar content to their students, 10,500 students could acquire the information (300 teachers×35 students per teacher or class). This way is indirect and unpredictable, but the possible effect could well be great.

(3) Content of benefit

Residents who live in the buildings categorized in Class I and their properties will be saved from earthquake damage. Also, the number of victims caused by the collapse of building should be reduced.

6-1-4. Effects from the technical standpoint

(1)Number of persons receiving education on new technology

The following groups would be candidates to receive education on new technology. However, this project attaches more importance to the contribution of earthquake-resistance reinforcement of buildings through revision of standards and preparation of manuals than to capacity building of the Center through technology transfer.

i) The expected number of members: 27.5 persons including a Project director and a Project manager; 7.5 persons in the field of Building retrofitting and Design codes; 6.5 persons in the field of Seismic observation network, 8 persons in the field of technical experimentation for soil and structures; and 4.5 persons in the field of Dissemination of knowledge and training of engineers;.

ii) The number of engineers who participate in the technical seminar:175 persons (verifiers, experts, and others)

iii) Citizens who participate in the seminar on disaster prevention skills: 11,300 people (800 citizens who attend the seminar and 10,500 students who learn about the seminar content from the teachers who attended the seminar)

iv) Others (including UTCB students)

(2) Contents of technology transfer

i) The development of an effective retrofit method

Effective retrofit techniques which are suitable for structural characteristics of buildings in Romania.

ii) The development of an appropriate seismic design standard

Technology is required to develop appropriate seismic design standard based on earthquake observation and soil data

iii) The dissemination of technical information on post- earthquake evaluation techniques to the structural engineers, and the development of a system which the seminar participants volunteer to act as post-earthquake evaluators

iv) The improvement of earthquake disaster prevention skills for the citizens

An effective method for earthquake disaster prevention through holding seminars and producing manuals

6-1-5. Economic benefits

As the technology which minimizes damage to buildings, as well as their total collapse is introduced in Bucharest, it is clear that the economic loss due to earthquakes is reduced. As Bucharest is such an economically important city, it is vital to protect Bucharest from earthquakes in order to minimize Romania's economic losses. In the 1977 Vrancea earthquake, it was recorded that about 3 billion dollars of damage was caused. Of which about 2 billion dollars was in Bucharest. Moreover, a sum of 1.4 billion dollars or 70 percent of total economic loss in Bucharest was due solely to building collapse, so from a numerical standpoint we can see that the proportion of cost attributed to building collapse in Bucharest is quite large. Therefore preventing the risk to buildings categorized in Class I in Bucharest from earthquake disaster will contribute greatly to minimizing economic loss.

6-1-6. Impact to the environment

In the Project activities, the focus is placed on the i) development of an effective retrofit method; ii) development of appropriate seismic design standard; iii) dissemination of technical information on post- earthquake techniques to the structural engineers; iv) improvement of disaster prevention skills for the citizens (i-iv relate to PDM Outputs). These activities will not have a great influence on the environment, although the installation of some seismographs and boreholes may influence to environment to some degree. Yet compared to a large-scale infrastructure construction such as a dam or road construction, the influence to environment is very small.

6-1-7. Confirmation of Important Assumptions that are required to attain the "Overall Goal" from the "Project Purpose"

The important assumptions that are required to attain the "Overall Goal" from the "Project Purpose" have been set as follows the: i) residents and users' consensus on retrofitting works will be obtained; ii) building structure will be properly maintained by residents. Residents must not damage or remove structural elements.); iii) other concerned ministries owning buildings of primary importance will finance retrofitting of their buildings.

Important Assumption i) was set because the Project does not have authority to move residents out of their apartments by force, and Important Assumption iii) was set because "Center", which was established for implementing the Project, was not an organization designed to finance retrofitting.

Regarding Important Assumption ii) according to a point raised in the PDM Workshop some residents destroy or remove structurally important elements in the building to make their residence space more comfortable. Therefore, this was also set as an Important Assumption because the Project cannot control such the residents' activities.

6-2. Possibilities and prediction of the achievement of the Project Purpose

6-2-1. Logical aspect of the plan

The content of the Project is explained in the Project Design Matrix (PDM) (refer to 7-1) which was prepared based on the result of a workshop. The project Purpose "Improvement and dissemination of technology for reducing building collapse in case of great earthquakes is achieved." was set as a core component of the Project, and four

Outputs (i. Effective and low-cost retrofit techniques are developed by the Center and acquired by structural engineers; ii. Regulations/ codes concerning seismic issues for both new buildings and existing ones are improved; iii. Post- earthquake evaluation techniques of the damaged buildings are developed by the Center and acquired by structural engineers; iv. Disaster prevention education for the citizens is improved by the Center.) have been set as the means to fulfill the Project Purpose. In addition, Activities to fulfill the Outputs have been set. The overall Goal has been set so that it is expected to be fulfilled after achievement of the Project Purpose has been achieved. Each stage of the Activities→ Outputs→Project Purpose→Overall Goal is connected by a logical purpose-means relation. It has also been planned in line with the contents of the Inputs and the Project term (five years).

6-2-2. Relevance of the Project Purpose

Project Purpose was set as the "Improvement and dissemination of technology for reducing building collapse in case of great earthquakes is achieved." This does mean that there is a feeling just to increase number of persons (counterparts) who have acquired improved technology. The Project Purpose is achieved when the clear effect has been confirmed. (e.g. when i. Sufficient number of buildings have been retrofitted by the technology developed in the Project; ii. Sufficient number of buildings have been designed using newly developed seismic design standard; iii. The engineers have acquired post-earthquake evaluation techniques of damaged buildings; iv. The ability level of disaster prevention preparedness of citizens has been increased or improved,). In this Project, such criteria or verifiable indicators for the Project Purpose have been set. The clear criteria for judging the achievement of the Project Purpose are useful for implementing or evaluating the Project.

6-2-3. Advantage of Japanese technology

(1)Technical level of earthquake engineering in Japan

The United States, New Zealand, and some European countries as well as Japan are known as earthquake prone countries. If the number of researchers working in earthquake engineering and technical level of the countries are looked at, Japan and the United States are the most outstanding.

The United States might be better in the viewpoint of theoretical approach, but in the viewpoint of practical approach on earthquake engineering (evaluation of seismic capacity and structure strengthening), Japan is ahead of the United States. As "technology on practical earthquake engineering" is a key respect in this Project, cooperation with Japan is of great benefit for Romania.

(2) Technical level of institutions concerning earthquake engineering and seismology in Japan

Regarding the technical level of earthquake engineering and seismology in Japan, the technical level of the expected core cooperating organizations: Building Research Institute (BRI)/ National Institute for Land and Infrastructure Management (NILIM) will be examined. In addition, the practical level of retrofitting of the private construction companies in Japan will also be examined, and JICA's experience in the similar projects will be taken into account. Finally the technical level of universities/ research institutes will be inspected..

i) Building Research Institute (BRI)/ National Institute for Land and Infrastructure Management (NILIM), Ministry of Land, Infrastructure and Transport

BRI/NILIM is an organization concerned with research into building matters, and plays an important role in technical co-operation with other countries. In the field of earthquake engineering related to technical co-operation, BRI/ NILIM has dispatched many experts according to the consignment from JICA. It has conducted 20 or more investigation and cooperation for earthquake disasters including the Iran earthquake that occurred in 1962 as well as the earthquakes in Turkey and Taiwan in 1999.

Moreover, BRI/NILI's experience in the international relation is impressive. It has accepted 1,101 trainees (seismologists and earthquake engineers) from 83 developing countries since 1962. It also contributes to

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instructing overseas trainees, and several Romanians are included among the trainees.

ii) Similar projects by JICA

JICA has implemented other three projects, which are similar to this one. Those are i)"Japan-Peru Center for Earthquake Engineering Research and Disaster Mitigation"(1986-1991), ii) "Disaster Prevention Center in the United Mexican States"(1990-1997), and iii) "The Project for the Establishment of Earthquake Disaster Prevention Center in the Republic of Turkey"(1993-2000). In addition, JICA is implementing another project "Continuation and Improvement of the Seismological Monitoring System For Earthquake Preparedness and Risk Assessment"(2000-2002) in Kazakhstan. JICA has been continuing its technical support on the projects relating to earthquake disaster prevention for the past 15 years.

iii) Technical level of private construction companies in Japan

A variety of retrofit techniques have been developed by private major construction companies. The developed retrofit methods are now adopted and practiced all around Japan.

The basic idea of retrofit method is to improve the toughness of existing pillars and walls by strengthening them (increasing their sections). This method is the one used in Romania, although retrofitting by increasing sectional area of structure segments (pillar and wall) with reinforced concrete is not generally adopted in Japan. It is getting popular in Japan to retrofit with special steel braces. This method helps to make the time length required for the work less. Moreover, for some buildings in Japan, seismic control device is installed in the necessary part (pillar and wall) to control building vibration and to mitigate earthquake damage.

iv) Technology on earthquake observation by university/ research institutions

In Japan, earthquake observation research started at Tokyo University under the authority of the Ministry of Education. Japan has 100 years or more experience in the field of earthquake observation research. There are currently many large scale projects under operation such as: joint research by universities and research institutions; ocean bottom seismograph observation; nationwide micro-earthquake network; earthquake tidal wave electromagnetism observation with submarine cable use and construction of an overseas network (POSEIDON Plan).

6-3. Efficiency

6-3-1. Efficiency of Outputs to Inputs

The equipment planned in the Input (refer to 7-1 and 7-5) is used for structural experiment and earthquake observation. It is expected that the input scale is relatively large. However, the equipment is essential to operate the Project, and for getting Output2 achievement.

The Romanian side will be required to prepare the necessary space for the equipment and pay for the cost of maintenance. It is considered that the input in this area from the Japanese side is minimized.

6-3-2. Efficiency of Impacts to Inputs

(1) Efficiency concerning retrofit project

When the Project ends, 8,831 residents in the 115 buildings (3,320 apartments) in Bucharest (refer to 4-2-1) are expected to be protected from damage by a subsequent great earthquake. This is regarded as a quantitative effect of the Project. Moreover, 175 engineers (seminar participants) as well as counterparts can be regarded as direct beneficiaries. These quantitative effects are regarded as the Project effect (refer to 6-1-4).

In addition, concerning the projects by the Ministry of Education and Research and Ministry of Health and Family, if their retrofit-works are started by contractors during the Project term, the Project effect will be enlarged. In

Bucharest, it is expected that people who use the listed buildings (2 school buildings and 13 university buildings) can be regarded as the direct beneficiaries (refer to 2-4-2 (2), the exact number of beneficiaries is uncertain.), and the 4,090 patients in the 13 hospital buildings that are planned to be retrofitted are regarded as the direct beneficiaries (refer to 2-4-2 (3)). Simultaneously, concerning public and important buildings (refer to 2-4-2 (4)), if their retrofitting is done by contractors, the people who use the buildings are regarded as the direct beneficiaries.

(2) Efficiency concerning development of seismic design standard

As 1,370 buildings, in which 32,000 will reside (refer to 4-2-2), are expected to be constructed in Bucharest during the Project term, it is expected that they are to be designed and constructed with regard to a new seismic design standard developed by the Project. Therefore, the 32,000 future residents are regarded as the beneficiaries. Moreover, 175 engineers (seminar participants) as well as their counterparts can also be regarded as direct beneficiaries.

Moreover, concerning the 66,000 buildings that ANL plans to construct during the term of 2001-2004, it is possible to partly apply the seismic design standard developed by the Project to these buildings. Therefore, the residents of the buildings should be included in the beneficial group.

(3) Efficiency concerning dissemination of technical information on post-earthquake evaluation techniques

175 engineers (seminar participants) as well as counterparts are regarded as direct beneficiaries (refer to 6-1-4(1)).

(4) Efficiency concerning improvement of disaster prevention skills for the citizens

11,300 citizens (seminar participants) as well as 28 counterparts are regarded as direct beneficiaries (refer to 6-1-4(1)).

6-4. Relevance

6-4-1. Relevance of Japan's ODA

Although the immediate beneficiaries who are technically transferred are seismic engineers and geophysicists, the final beneficiaries are the common citizens, regardless of social class, sex, job, and race, etc. We can see the fairness in this Project, and therefore this Project is eligible for supporting by ODA.

Moreover, in terms of the benefits to the public, it is gratifying to provide a qualitative social service, by securing the safety of citizens' life and property, and to help construct better social and economic infrastructure. If such viewpoints are considered, it is difficult to implement disaster prevention service within the private sector. Therefore, it is necessary to work it solely within the public sector instead. It is appropriate to implement this Project by ODA.

6-4-2. Country plan of operation

The Ministry of Foreign Affairs and JICA have not prepared their "Country plan for cooperation" for Romania yet. However, JICA considers environmental considerations including "Disaster prevention" as an important element. Moreover, JICA states, "Environment should be considered as a global issue." In addition, their definition of environment considerations is categorized into 14 sections[9]. If the "Disaster prevention" section is looked at, it explains the necessary measures that must be taken for prevention of natural disaster like eruption of volcanoes, landslides and earthquakes.

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[9] Air pollution, water pollution, combined pollution, waste management, energy conservation/ alternative energy, sewage, water supply, forest maintenance/ afforestation, disaster prevention, biodiversity, natural resource management, environmental education, environmental administration/ management, and environmental action ability improvement

Moreover, in 2002 some 100th anniversary of cultural exchange celebrations are planned by the Japanese Embassy in Romania. As the Project is expected to be started in 2002, it is a good opportunity to explain more about the importance of the Project to the persons concerned with the Project as well as the citizens of Romania and Japan in general.

6-4-3. Needs of Romania

MLPTL is about to retrofit buildings with high seismic risk, and thus reduce damage by building collapse. This is much related to the content of the Overall Goal. It relates closely to keeping the economic growth rate of 4.5-6 percent per year, which is mentioned in the content of the Governance Program Strategy in the economic field. Moreover, concerning the area of earthquake disaster prevention of the Action Plan (2001-2004), there are statements about the development of seismic design standard. This is expected to be prepared by the Project. Therefore, the Project activities meet the needs of this Action Plan.

6-4-4. Participatory plan

This Project was planned by holding a PCM workshop (two days). The participants were not only staff from MLPTL but also members from UTCB, INCERC and private companies including IPCT and Project Bucharest. The participants in the workshop are listed in 7-7-6.

6-4-5. Project management system

In terms of the management system, the Project is supervised by MLPTL, the organization in charge of earthquake countermeasures for buildings, (refer to 7-7-4). Therefore, the State Secretary (SS) of MLPTL functions as a Project Director and the Secretary General (SG) may substitute the State Secretary's responsibility in case the State Secretary in not available. The Project Manager (P/M) takes responsibility in the site works. Even if the cooperation period ends, the Project is supervised by MLPTL. MLPTL is responsible for applying the achievements of the project to new policy measures. With respect to overall responsibility, the SS has the main duties and the SG is the peripheral. Normally, the SG acts as deputy to the SS. Besides, the SS is a politically appointed post while the SG is a permanent post. In case the SS is replaced as a result of transfer of power that may result from the election scheduled in 2004, the SG remains in the post to secure the continuity of the project.

The P/M is a director of the Center who has management ability. Four technological divisions are arranged under the P/M, and in each division, the persons in charge are already being clarified. Moreover, a list (refer to 7-7-7) showing persons in charge of each "Activities" of PDM has been written, which clarifies who is responsible for each activity.

6-4-6. Evaluation and monitoring system

Evaluation and monitoring system during the Project term are planned by the following procedures. The Project activities will be

(1) Monitored by the Project Team (Experts and Counterparts) and report progress of the Project to JICA and chairperson of the Joint Coordinating Committee every six months;

(2) Monitored by the Joint Coordination Committee once a year;

(3) Evaluated by the JICA Mid-term evaluation Team in the third year of the Project;

(4) Evaluated by the JICA Project Evaluation Team six months before the termination of the Project;

(5) Evaluated by the JICA some years after the termination of the Project.

6-5. Sustainability

6-5-1. Institutional aspects

The organization for managing the Project or "Center" will be established when Japanese cooperation begins. Staff personnel are almost arranged and the relations of responsibility of leading staffs: Project Director (P/D), Project Manager (P/M) and division leaders have already been clarified. It is expected that the P/M has management ability attained by his experience. The plan is that the Center will be managed under the responsibility of MLPTL. Moreover, continuous support from MLPTL is assured even after the Project termination.

6-5-2. Financial aspects

MLPTL is going to set aside around 170,000 dollars per year for the Project management (around 112,000 dollars for staff personnel). The Project relies on MLPTL for all financial matters. However, continuous support on budget allocation from MLPTL is assured even after the Project termination.

6-5-3. Social and technical aspects

(1) Social aspect

Residents who live in the buildings categorized in Class I, are the main concern of the retrofit project. Some residents wish for retrofitting to begin as soon as possible, even if temporary houses are not prepared for them. If such houses are not forthcoming, they will try to find out alternative houses (e.g. their relatives' houses) by themselves. Moreover, the residents, especially residents in Bucharest, consider that, if their buildings are retrofitted, their value will be increased. From such circumstance, nearly all residents fully accept and indeed welcome the need for retrofit work..

(2) Technical aspect

Most Project staff who will be assigned belong to UTCB and INCERC. They are both well-evaluated institutes, which have experience in the fields of earthquake and structural engineering. Most staff have already participated in some international projectss, and they actively exchange information with other researchers in foreign countries. Five of the staff have experience in the research of earthquake engineering in Japan. There are no particular technical problems. When more staff are needed, MLPTL will employ them themselves..

6-6. Preliminary evaluation

This project aims to improve aseismic retrofitting techniques, disseminate those techniques to structural engineers and draft revision of construction regulations/codes, thus to contribute to the improvement /revision of seismic regulations/codes and level up the seismic retrofitting techniques of structural engineers, for progress in safety level of the buildings and structures against earthquake.

As for the organization, the establishment of the Center has been approved; the allocation of Center staff has been confirmed. It is also confirmed that the Center is co-managed in partnership with UTCB and INCERC under the supervision of MLPTL.
As for the budget, the entire necessary budget to run the Center is secured by the government.

MLPTL commit itself that the fruit of the project like improvement of retrofitting techniques, revision of codes for seismic and construction standards shall be put into practice and be utilized with lawful enforcement not only in MLPTL retrofitting program but also in private sectors.

MLPTL, UTCB and INCERC jointly express there strong will that outcome of the project after the termination of the project shall be-applied in long-range countermeasures for earthquake disaster. It is also confirmed that MLPTL commit itself to take overall responsibility for the effective utilization of and budget allocation for the equipment in accordance with the protocol between the MLPTL and UTCB/INCERC.

Taking all the above matters into consideration, this project benefits the society in large and thus is deemed relevant as ODA program.

7. Appendixes

7-1 PDM

7-2 Plan of Operation (PO)

7-3 Achievement Plan by every 6 month

7-4 Dispatch of Experts (tentative)

7-5 Counterpart Training Plan (tentative)

7-6 Prospective results and related activities

7-7 Flowchart to put the products of the Project into practical use

7-8 Terms of Reference (TOR) for long-term experts

7-9 Terms of Reference (TOR) for counterpart personnel

7-10 Major equipment list

7-11 Others

7-11-1. Earthquake epicenters in and around Romania

7-11-2. Organization Chart of disaster prevention countermeasures

7-11-3. Buildings with more than 5 stories built before 1940 in Bucharest and identified as having highest risk of collapse in case of strong earthquake

7-11-4. Project implementation organization structure

7-11-5 Organization Chart of MLPTL and Center

7-11-6. INCERC's facilities concerning the Project and their current conditions

7-11-7. List of Participants of the PCM Workshop

7-11-8. Tentative staff list categorized by Outputs and Activity of PDM

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