2.3. Output2

2.3.1【10】To study current public awareness regarding earthquake disasters (Activity2-1)

(1) Outlines

- Objectives have been set and the survey method and target groups have been chosen.
- Survey of 1300 samples has been conducted by local experts.

(2) Study Objectives

Objectives are set as follows;

- To prepare basic data on disaster awareness, disaster education, and community based disaster reduction activities of Tehran citizens;
- To comprehend the current status of disaster awareness, disaster education, and community based disaster reduction activities in Tehran Municipality;
- To comprehend effective factors to enhance disaster awareness and to promote preparedness activities for disaster reduction;
- To recognize the potential for community based activities in Teheran;
- Measure the knowledge, awareness, experiences, and Motivation regarding disaster management and Risk perception of Tehran citizens and estimate their preparedness for facing natural disasters.

(3) Hypothesis

Research Question was set as follows:

How can the mechanism of "taking measures for disaster management" be described in the context of Tehran?

(4) Theoretical Model

The logical structure of the Theoretical Model is based on the following five variables: knowledge, risk perception, recognition on importance of measures, and motivation on disaster management, taking measures, and social status, fatalism. This theoretical model explains relation among variables as is shown in the figure 2.3.1. The logic of theoretic reasoning is that: Experiences of past disasters, Experiences of participating in disaster education, Participation in DAVAM and community activities lead to Knowledge of disasters, then the combination of experiences of past disasters and knowledge of disaster management have a positive effect on citizens' risk perception. So, the cumulative and simultaneous presence of experiences of past disaster and knowledge of disaster management and risk perception and citizen recognition regarding the importance of measures for decreasing damages and increasing motivation for taking measures for disaster management. In this causal mechanism, motivation of disaster management leads to taking measures for disaster management.

The factor of knowledge of disaster management has an important role in the Theoretical Model, this factor directly and indirectly explains taking measures for disaster management through components of citizen's recognition about the importance of measures for decreasing damages and motivation regarding disaster management

The fatalism component as an external factor outside of the causal mechanism, can affect on Risk perception and taking measures for disaster management. Individual attribution, Social status and citizen residential zone are controlled variables. These variables represent the distribution of citizen in terms of their response to the questions.

This causal system is a combination of sum of paths that represent the direct and indirect causal effects of existing variables in the causal system cumulatively. Each of paths is distinguished by the sign (→).

Each variable such as "disaster knowledge", "risk perception", "motivation", "taking measure" are combination of questions whose numbers are 45, 26, 19, and 15 respectively. As for taking measures, questions on reinforcing own residential building, non-structural measures, safety measures of bed rooms, plan of evacuation places among family, understanding of code of conducts during emergency, preparation of emergency kit bags, understanding methods of first aid, buying insurance for fires, and that for earthquakes, and by utilizing fazzy method, the answers were quantified.

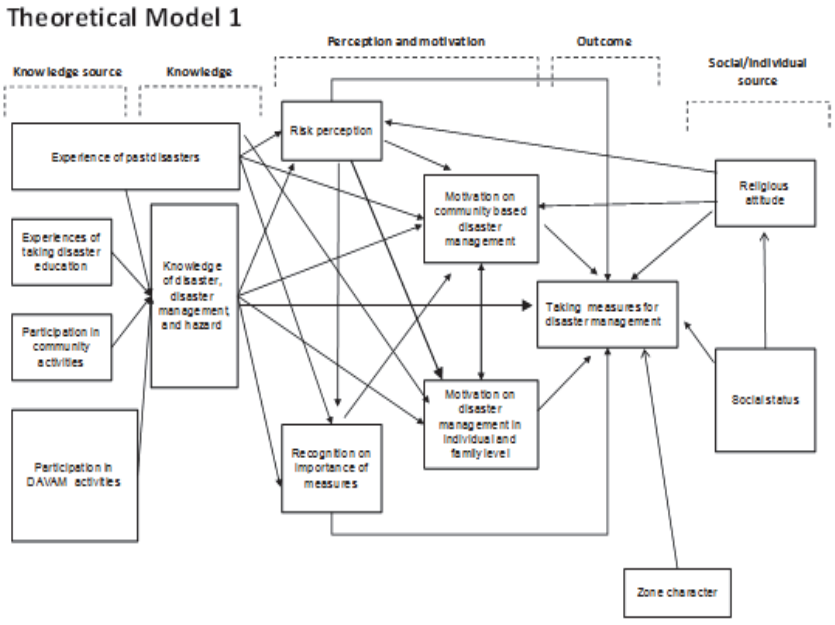


Figure 2.3.1 Theoretical Model

(5) Methodology of Survey

This project is based on a social survey so it was conducted by questionnaire survey. The survey was conducted from Nov 16 to Dec 30, 2012. The Observational Units were Tehran Citizens. The data processing, analysis and reporting were conducted in January - February 2013.

(6) Data Analysis

Questionnaire has been prepared and multiple (very rarely two or unlimited) choices were created by using mainly ordinary but sometimes nominal, ordinal scale. The data processing and data analysis were conducted by SPSS for windows and quantitative methods to understand the general characteristics. The fuzzy method is also used for quantitative analysis to change ordinal and interval scale to fuzzy scale. Frequency, percentage, mean, crosstab tables and the explanatory analysis techniques such as regression analysis technique for data analysis were used. The fuzzy method allows researchers to calibrate partial membership in sets using values in the interval between 0.0 (non membership) and 1.0 (full membership).

(7) Sampling Method

Sampling Method was probability-proportional-to-size sampling.

- Calculation of population in term of 22 districts in Tehran
- Determining the proportional distribution sample size by age and sex groups in each of the 22 districts. Distribution samples in terms of ten cases in each area, for example, if a district has 60 samples, 6 areas are selected from the district
- Selecting a block for each Area. In the example, we will have 6 blocks
- Selecting sample units by proportional distribution sample size of age and sex
- Selecting observational units by age and sex groups from households within each block.

(8) Surveyed Items

It is very important for each individual to understand risks, to acquire knowledge, and eventually to take measures. In the survey, risk perceptions, DRR knowledge, motivation for taking measures, and taking measures have been surveyed. Since awareness is subject to disaster education, training, and the environment, such items have been included in the survey.

Outlines of the survey are summarized in the following table. Samples are equally distributed for male and female. For special consideration for the female respondents, pairs of one male and one female surveyor have conducted the survey. The survey items are designed to become indicators to measure the effects of disaster education in the future. Due to rapid inflation and degradation of the economic situation, it took much more time to get the same number of samples than before.

Outlines of the survey are summarized in the following table.

Table 2.3.1 Outline of the Survey

Objectives	Establish baseline data regarding Citizens' awareness, disaster education, and DRR activities to measure effects of citizens' disaster education in the future at DRR museum.
Target Groups	Adults both male and female of 22 districts of Tehran municipality
Target Age Number of Samples	More than 18 years old Approximately 1,300 samples
Sampling Method	Numbers of samples are proportionate to the population and were taken from each district
Main Survey Items	Disaster experience, Experience of earthquakes Risk perception Knowledge of disasters and DRR Recognition of importance of DRR Measures for DRR Experience and types of disaster education Participation in and types of activities of DAVAM（DRR volunteer groups） and community based activities Motivation for local DRR activities and community based activities Personal attributes, locality, fatalism Needs and expectations for DRR museum

(9) Result of the Survey

According to the survey, following characteristics has been found. Experience of past disasters (0.29), participation in DAVAM (0.18), relate to disaster knowledge. Disaster knowledge relates to risk perception (0.23). Risk perception also relates to recognition on importance of measures (0.23). Knowledge of disaster management relates to recognition on importance of measures (0.12). Experience of past disasters and importance of measures are not significant. However, disaster experience relates to disaster knowledge (0.06). Risk perception relates to motivation on disaster management in individual and family level (0.23). Motivation on disaster management in individual and family level relates to Taking measure for disaster management (0.33). Fatalism leads to taking measures (0.6). Fatalism has negative impact on risk perception (-0.14). Higher the social status is, lower the fatalism becomes. Overall, the motivation for disaster management is the most significant component for promoting disaster reduction activities (taking measures for disaster management). The second most significant factor is knowledge. In the aspect of a behavior change model, knowledge cannot be assumed as the component affecting directly to disaster reduction activities. But knowledge has a strong relationship with disaster reduction activities. To change citizen's behavior for disaster reduction, knowledge should also be emphasized as an indirect component. To increase motivation, risk perception and recognition of the importance of measures are more effective than knowledge. The following figure shows the results of the path analysis.

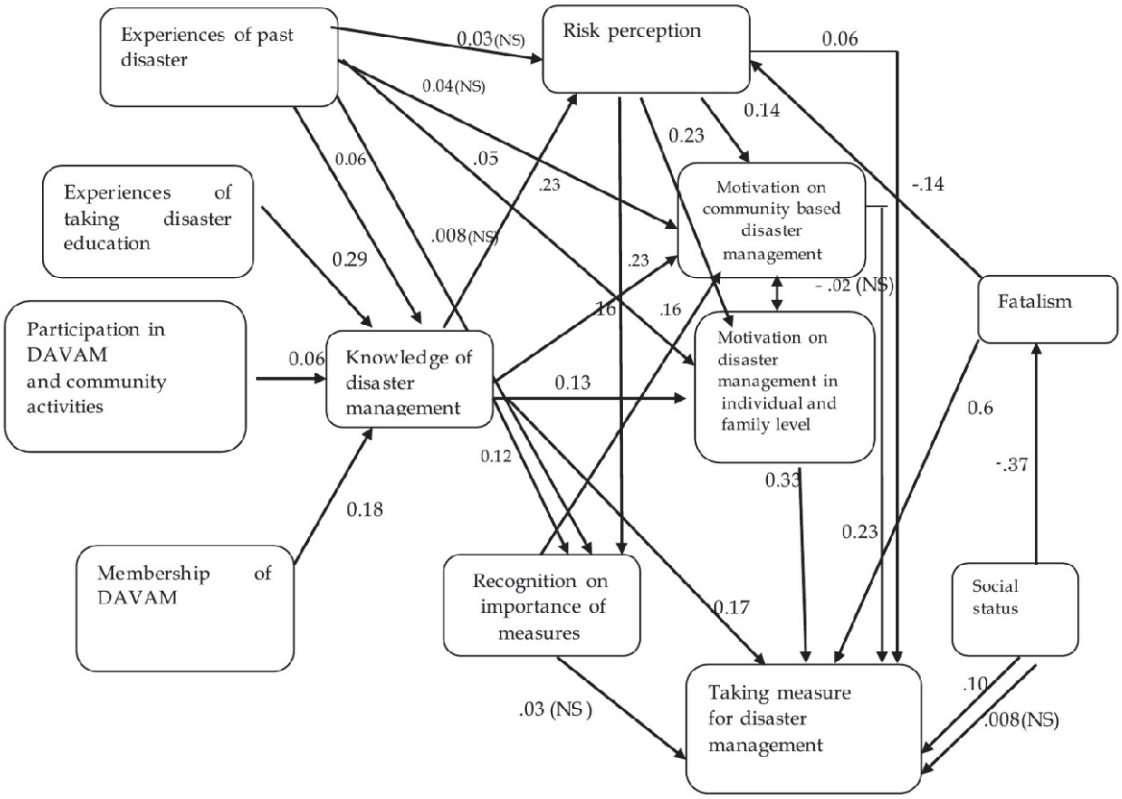


Figure 2.3.2 Result of Disaster Awareness Survey

Based on the discussion mentioned above, this report concludes the following as the suggestions on improvement of training and education for disaster management for the public in Tehran. Motivation for disaster management is the most important factor to inspire people to promote disaster reduction activities. Training and education should include programs or activities to increase the motivation of the public. TDMMO has been trained more than a hundred thousand citizens so far, trying all possible means. In the process of reviewing master plan for public disaster education, more effective way of training program needs to be identified. The social survey has shown the scientific causal effects, which would be a great input for the future design of the training program for citizens.

2.3.2 【11】To study the contents and effectiveness of the disaster education for the public in the past (Activity2-2)

(1) Outline

- To investigate the past disaster education activity records
- To analyses the result of the above investigation and disaster awareness survey in item【10】
- To study the improvement brought about by the methodology and contents of the education of citizens based on the above analysis result.

(2) Selection of institutions and organizations to be interviewed, which are conducting education activities for citizens

The JICA Expert Team decided to interview the institutions and organizations shown below, which are conducting education activities for citizens. Since several months were spent trying to make an appointment through TDMMO for interviewing UNDP and no progress had been shown, the JICA Iran Office kindly made an arrangement to hold a meeting and the JICA expert alone interviewed. For UNDP, the person in charge has been changed and interviewed mainly on the new projects, not on the past programs.

- Education and Public Participation Deputy, TDMMO
- Public Relations and International Affairs Office, TDMMO
- UNDP
- IIEES
- DAVAM (District 6 and 9)
- Main Office of Education, Teheran Municipality
- Social Service Organization, Teheran Municipality
- Fire Fighting and Safety Department, Tehran Municipality
- RCS
- Imam

(3) Questions and Style of interview

The interview was conducted mainly on the following items.

- Name and year of activity, scale of budget, Implementation body, Co-implementation body, Target group, purpose, Contents of activity, Curriculum of disaster education, Disaster education materials, Contents of evacuation and practical training, Activity plan, Contents of activities introduced by lessons learned from past earthquakes (Bam and Manjil etc.), Effect of activities, and Lessons learned from the activities
- Interview items for the Imam which have different characteristics from other groups; Experience of training regarding disaster management, Experience of presenting lectures on disaster or disaster management for ordinary people at worship or lecture meetings, Way of thinking regarding Islamic Fatalism, Organization of Imam, Possibility of training of Imam, Opinion on effective disaster education and training for citizens, Possibility and suggestions on disaster training for religious leaders

Interviews were conducted by the following methodology. TDMMO sent a letter to the interviewee first and then the interviewee visited TDMMO to attend the interview instead of TDMMO visiting the interviewee. Because of the particular situation in Iran, a watchman attended the interview and introduction of this project was prohibited. There was no exchange of opinions and only discussions based on the question sheet were conducted. For the budget scale and lessons learned, interpreted words sometimes became difficult to understand because the interpreter voluntarily edited the answer of the interviewee. Also, it was difficult to watch and/or obtain the reference data and disaster education materials of other organizations.

(4) Result of Interview

There is a working group under Teheran Municipality for disaster education. This working group has been established by the ordinance No.94 of the Tehran Municipality to attain one of the objectives of enhancing citizen's knowledge and skills on DRR. The chairperson is a member of RCS and 23 organizations are members of the group. The main activity is to issue certificates to citizens and students who attended the training class of 75 hours (by RCS), or 54 hours (by the Fire Fighting Dept.) and approve them as official volunteers. No shorter education courses are given by any organization. Each organization tends to target definite target groups in detail by age and job function. For educational materials, there are text books for professionals, booklets on fundamental knowledge regarding disaster management for the general public and leaflets on different themes of fundamental knowledge regarding disaster management, although we could obtain only TDMMO's materials. PPT materials which are used in the training course are extensive and cover all subjects comprehensively. As recent trends, almost of all organizations tend to create visual teaching materials. RCS distributes CDs and encourages self-learning.

【School】

In Iran, IIEES was the first organization to start the activities of disaster management for schools beginning in 1994 (from 1995 for schools in Tehran) by conducting evacuation drills. IIEES announce that the 11th Bahman of the Iranian Calendar will be the day of earthquake evacuation drills. IIEES prepared guidebooks for teachers on 'Military education' for the eighth grade, 'Biology' for the fifth grade, and 'Geoscience' and 'Geography' for high school. During the past 3 years educational videos were developed in which basic disaster management knowledge is presented for principals, teachers and students in 10 munities each.

By enquiring to the Main Office of Education, we found that they conduct evacuation drills, disaster management exhibitions, contests on disaster management activities, training on rescue & relief and theory of first aid (only by classroom lecture) for teachers. In schools, disaster management committees which consist of 4 groups, rescue & relief, firefighting, backup support and security should be organized. Every year, one school is selected for conducting training on the method of performing exercise training. These training sessions are utilized in teaching students the subject of 'Military education'.

In order to improve the quality of lectures on 'Geoscience' and 'Geography', 26 hours training for teachers is conducted and TDMMO sends lecturers. In the prior information programs, IIEES only conducted disaster education in schools, however it became obvious that TDMMO played an important role for schools. But TDMMO is not yet in the position of reconsidering or amending of the whole curriculum of disaster education.

RCS distributed self-learning CDs for 330 thousand high school students and 290 thousand secondary school students in Tehran in order to train RCS volunteers. After the self-learning, students receive 17 hours of first aid training and 18 hours further training. Then they are acknowledged as official RCS volunteers.

【Citizens】

TDMMO, Fire Fighting and Safety Dept. and RCS conduct trainings for the citizens, TDMMO mainly trains citizen volunteer groups, namely DAVAM, which an organization whose capacity has been built by TDMMO and distribute disaster management equipment and materials. The Fire Fighting and Safety Department give training to prevent tragic fire incidents in homes, which have been increasing recently. RCS trains RCS volunteers using their own programs. Priority areas are appointed in Tehran by TDMMO and the Fire Fighting Department, and in the whole of Iran by RCS. Training for citizens is conducted mainly in the priority areas. Mazandaran Province was selected and training was performed in 2012 when we did the interview.

RCS prepares 35 hour courses for citizens and 1,200,000 people receive training annually. In order to be a volunteer of RCS, another 40 hours of training is necessary. There are 3,500,000 RCS citizen volunteers in the whole of Iran. In addition to the practical training such as rescue and relief, lectures on disaster management are also given. From their experiences in the activities, RCS stated that ① Activity in Tehran is easier than in the agricultural villages because of the high educational level、② Direct training is more effective than a TOT method because the TOT method is conducted through several layers of teachers, therefore, direct training must be offered as much as possible, and ③ .After the Varzeghan Earthquake, the volunteer system worked well due to the volunteer training. RCS established a university course (bachelor) 18 years ago and 10 thousand students have graduated. A master's course was founded in 2012.

UNDP plan to standardize the training course for community based disaster management in the 5 year project from 2012 in which RCS takes the leading part.

TDMMO prepared education materials and leaflets on different themes for AMEKEN (disaster management officer of building units such as condominiums and commercial buildings), taxi drivers and so on other than for DAVAM. 15 thousand DAVAM members have been trained. Among the 374 mahalles in all of Tehran, in 171 mahalles, a disaster evacuation map is in the process of compilation (in 32 mahalles, maps have been distributed to citizens and in 37 mahalles, maps have been completed, and in the remaining 171 mahalles, the process has started.

TDMMO has implemented evacuation drills and distribution of disaster management equipment and materials. In the disaster bases, billboards and electrical boards are installed and send contents that are effective for raising awareness of disasters. TDMMO also produced 30 series of short videos on disaster education and they are utilized on the TVs in the street and utilized in the school curriculum. Disaster education materials for children such as backgammon and card games with messages are also produced. They translate the record of shake-out training in California and the Great East Japan Earthquake and publish their own reports. Thus, TDMMO undertake their voluntary research activities.

Standard education materials include classroom lectures on disaster phenomena, mechanism of occurrence, damage situation, response measures at outbreak, method of fixing furniture,

evacuation action, theory of disaster management and incident command systems. The standard education materials also include practical skills on first aid, firefighting, simple search & rescue and town watching.

As recent trends, the representative of the mahalle, which is the minimum administrative unit, is elected and a mahalle house with a room for disaster operation is constructed as the place for activities. (More than 300 mahalle houses have been constructed in the 374 mahalles in Tehran.) Because of such acceptance, new structures for regional disaster management activities are being established. It is considered fully possible to utilize these resources for disaster management activities.

For DAVAN's activities, outstanding points are well-known by the public, which include grant of incentives, the implementation of refresher training, training of paramedics, sufficient deployment of practical training equipment such as simple search and rescue tools, ensuring sufficient practical training hours and so on.

The JICA Expert Team heard the opinion from the Imam regarding the basic consideration related to the disaster management and disaster training for Imam, after long introductory remarks on the greatness of all areas of Iran. They said that they talk about things other than religious matters in the rate of 20 to 30 percent in the normal preaching. Especially after the Varzeghan Earthquake, they told the congregation that it is necessary to obtain the scientific knowledge about the mechanism of disaster, seismic resistant technology, etc. The JICA Expert Team heard their basic views on disaster management that the fatalism exists in most religions, however, it does not mean people do not have to do anything. It is necessary to consider how to prepare for the disaster, thus disaster management is indispensable. There is an organization unifying the administration of 1,800 Imams and training for all Imams is possible by official request. Also it is possible to associate the knowledge of the Qur'an and disaster management, to introduce to religious related media and to distribute brochures.

(5) Proposal for Improvement of Method and Contents of Public Education

1) Incorporation of Experience of Disasters and Lessons Learned into Disaster Education

Iran experienced the Tehran Earthquake in 1830, Manjil Earthquake in 1990, Bam Earthquake in 2004 and Varzeghan Earthquake in 2012. Especially, citizens in Bam and Varzeghan have disaster experience and their memories are fresh. However it is found from the interviews that no organization reflects their neither experiences nor lessons learned to their disaster education for citizens and students. Since RCS's disaster response report is supposed to provide valuable information, we tried to obtain it. But it was not possible because it is not open to the public. The JICA Expert Team tried to collect victim's voices and memories through a web-page, but this attempt was forced to be aborted. This is because these voices and information include undesirable things in the view of the government organizations and efforts of others to collect and arrange such information are not agreeable to those organizations. Thus, efforts to convey the disaster experience and lessons learned to posterity and utilization of these experiences and lessons in the disaster education will not proceed smoothly since the mentality of the concerned people is involved.

However, among the C/P personnel, it is understood that this information is necessary and it is connected to the motivation for the disaster preparedness. They also prepared an information

collection format for victim's experiences and lessons learned. Since we introduce Japanese examples of utilizing the problems, lessons learned and useful things into the disaster education, we expect in the future that the mentality of the government related officers will gradually change as harmonization is attempted and Iran's experiences and lessons learned can be applied to practical use. Utilization of disaster experiences is one of the main pillars of the subject of the disaster education.

2) Preparation of Compact Training Menus Making Participation Easy

The numbers of DAVAN groups which TDMMO has trained up to the present day include 15 thousand people. From the public awareness survey, the total rate of trained people from DAVAM, the District disaster organization and TDMMO is 4.1% and this shows that these groups have become more influential than the Fore Fighting Organization at 2.7% and IIEES at 0% although it has not yet reached the rate of 33.8% of schools or 11.4% of RCS. At present, it is difficult for DAVAM groups to be invited to long term training courses because most of members in DAVAM are housewives who have the free time. Not only TDMMO but other organizations also conduct comprehensive training with very long terms. Great efforts are required even for people having an interest in disaster management to continue the long term training in urban areas. In the years ahead, considering people who cannot participate in long term training courses, compact training courses must be prepared as optional choices.

3) Disaster Education Related to Countermeasures

From the disaster awareness survey, a general theme was found in which obtaining disaster knowledge, raising the recognition of the disaster risk and by raising the motivation for the countermeasures, the countermeasures actually take place. The final aim of the disaster education is the countermeasures to be actually performed and it is necessary to raise the motivation towards the countermeasures as a previous step. Curriculums of disaster education shall be coordinated towards effective countermeasures by including contents for busy people and people without interest in disaster management and by intentionally including contents raising motivation for the countermeasures.

4) Correspondence to Need for Getting Practical Knowledge

A total of 60% to 70% of the people want to get practical training on first aid, emergency lifesaving and firefighting as knowledge to be learned for disaster management. Such practical training needs to be done not only by classroom lectures but by experience-based training using the relevant equipment. The structure of the curriculum shall be prepared so that people can select the practical training after securing suitable space, equipment and lecturers.

5) Raising Knowledge and Motivation regarding Seismic Resistant Buildings which is the Ultimate Objective of Disaster Education

In the awareness survey, nearly half of the people incorrectly thought that there is a method to reduce the earthquake damage in addition to strengthening of buildings. It is found that awareness of the strengthening of buildings as the ultimate objective in the earthquake disaster management has not permeated to the public. In TDMMO's educational materials, detailed explanations with regard to the fixing methods for furniture are substantial while the weight of the contents for raising awareness of seismic strengthening of buildings is not high. Further, the subscription rate of earthquake insurance and fire insurance are 20% and 30 % respectively as indicated in the

awareness survey. It is said that people have a certain number of Persian carpets in their family and some people insure these carpets. Considering such social foundation that people can pay for safety and security, expenditure for seismic resistant construction is considered to be a potential possibility. Disaster education aims at the actual seismic resistant measures by formulating motivation regarding the seismic resistant buildings.

The JICA Expert Team emphasized that the creation of seismic resistant buildings is the ultimate objective of the earthquake disaster management even in the training of emergency behavior and compact training course. Further, training which helps the people recognize the necessity of seismic resistant buildings shall be adopted

6) Wide Dissemination of Disaster Management Knowledge

More than 60% of citizens want to get knowledge regarding appropriate behavior in an earthquake situation and preparation of an emergency bag. This result of the awareness survey shows that the fundamental knowledge has not been sufficiently disseminated. Continuous effort in which the basic knowledge and method of preparedness are conveyed widely to the public systematically and efficiently is still required and appeals to media and training of media representatives are also to be planned.

7) Planning and Implementation of Educational Program Suitable for Mahalle House which Supports Weak Regional Organizations

A very low rate of 13 % of Tehran citizens participate the general community activities except the disaster related activities. The ratio of male and female is roughly by 2 to 8. Most of the activities are religious activities and Basidj related activities. Basidj can be utilized as regional volunteers since Basidj has been organized and rooted in the region. TDMMO also recognize Basidj as important group in mahalle and give them roles of emergency response. Sports and PTA activities have very few participants at less than 1%. It is difficult to make use of existing organizations or to invite the participants to community activities. Therefore, it is necessary to plan events such as disaster drills and disaster events in which residents are interested, and to prepare educational programs which are easy to participate in. Also we grasp citizen's regional disaster activities in mahalle houses and make plans and implementation for compact and motivation improving educational programs considering the activities in mahalle houses.

2.3.3【12】To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans (Activity2-3)

(1) Outline

- Existing disaster education master plan for the citizens was reviewed.
- Master plan was revised, by reflecting the improved plan that was examined in activity【11】.
- Short term action plan (from 2 to 3 years) based on the master plan has been prepared.
- The results of emergency evacuation drills which are described later in activity 【18】were reflected in the master plan .

(2) Acquisition of existing master plan

The existing master plan was obtained after a long period of requesting. It was due to the need to obtain the superior's permission which took a long time. The volume of the plan was 5 pages of the main plan and the rest forms an appendix of about 30 pages.

(3) Result of review of master plan

The master plan on disaster education for citizens was developed in 2010 in accordance with Tehran Municipal Regulation 94. In the main plan, background, legal basis, objectives, planning period (5 years), priorities and important notices on carrying out the education for citizens are described. In the appendix, detailed educational steps for citizens with contents of education and materials to be referred to are clearly described. The overall impression is that the meaning of the master plan is different from the sense of Japanese plans. The main contents were about 3 pages, but the implementation guidelines are attached in the appendix for the practitioners, which has nearly 40 pages. Also the contents which can be guessed from the title in main contents are something different from what we imagined. The master plan seems to be meaning that the guidelines for preparation.

The structure and contents of the part of community based disaster management and education for citizens from the earthquake DRR action plans of Mie Prefecture, Wakayama Prefecture, Gifu Prefecture, Tokushima Prefecture and Kochi Prefecture were introduced. The examples were introduced in which these prefectures disclose the results of damage estimation and show how the earthquake disaster could occur in different seasons and different scenario earthquakes, and describes number of deaths, damage situation of infrastructure, etc., then set the concrete risk reduction goals with targeted decreased number of damages. Other examples on planning structure have been introduced; these prefectures define the issues, decide the important subjects based on the fundamental principles and policies and clearly describe the system of policies deciding actions, specifying the main organization in charge, supporting organizations, budget and organization in charge of progress management, and the method of monitoring and evaluation.

Although there are some parts that can't be applied to the Iranian situation such as budget and coordination issues, the major improvements have been plotted on the master plan because the policy system in which the action plan is decided is based on the high priority and fundamental policies and goal setting in which clear values are accepted. The educational contents of each

target group also have been clearly systemized and organized. Especially for the contents, priority items for each target group are defined clearly and education can be delivered focusing on these items. From the result of the social survey, 4 categories of disaster education were defined; namely, acquiring knowledge, risk perception, skills, and motivation. Furthermore, the learning goals for each target group are defined and essential contents of the 4 categories are further delineated. The place for the education, facilitator and implementing bodies for each target group are also clarified.

Advantages and improved points of the existing master plan are shown in the following.

Advantages

・Legal background of the master plan is defined.
・Target groups are clear and exhaustive.
・Necessity of collaboration and cooperation with other organizations is clearly described.
・Review Committee for disaster education of citizens has been established.
・Steps for implementation of disaster education for citizens are defined in detail.

Items for improvement

・Objectives of the disaster education of citizens can become more specific.
・Substantial goals of education of citizens can be defined utilizing the results of the damage estimation.
・Goals for each target group can be stated clearly.
・Concept of citizens' education can clearly described.
・Method of citizens' education can clearly described.
・Detailed methods of collaboration with relevant organizations can be made clearer.
・Methods of monitoring can be specified.

The master plan has been further developed with an emphasis on these points. C/P revised the new master plan with convincing expressions, based on their actual field experiences and the ground reality of Tehran after understanding the Japanese side's advice and intensions.

The main noteworthy contents of the improved master plan are as follows.

1. Results of the damage estimation are mentioned with numerical information. (This is very epoch-making in Iranian Government Administration in which staff pay close attention to the outflow of information held by the organization and do not disclose sensitive information.)
2. Numerical target is determined to be for the implementation of the disaster management training for 2.6 million people which corresponds to at least one person in each of the 2.6 million households in Tehran city over the next 10 years,
3. Priority areas of education contents for each target group with concrete objectives in 11 items are described. For example, for family, damage protection, minimum preparedness and establishment of emergency behavior at the occurrence of an earthquake are described, and for the mahalle level, organization and training of volunteer groups and special courses for staffs of TDMMO, Districts and Sub-districts are described.

4. In the first item of the above concrete objectives, the importance to indicate the possible solution to the citizens is clearly mentioned. Thus, a hierarchy is given for educational contents.
5. In the second item of the above concrete objectives, a strong attitude is shown that the need for earthquake-resistant construction should be disseminated widely as a citizen's culture and as a disaster education goal. In this section, 3 items are adopted as the strong determinations as follows: Firstly, to conduct awareness education so that citizens require higher quality in the selection of their residential building, Secondly, to teach citizens that simple, low cost and appropriate seismic retrofitting is available for improving their mentality believing the seismic resistant building is very costly and a fundamental reconstruction and retrofitting are required, and Thirdly, to explain the necessary improvement of construction materials, appropriate construction procedures, improvement of quality of construction at the site and dissemination of construction standards. For education on seismic resistant construction, different from other items, more specific and comprehensive goals are set and important points are emphasized.
6. An action plan is designed based on the hierarchical structure; which is goals-objectives-priority themes-priority actions-priority activities.
7. Fundamental and important problems become clear such as that citizens do not know how to respond when they face an earthquake and cannot take suitable actions which should be kept in mind as a background of the disaster education plan.

Table 2.3.2 Structure and contents of proposed master plan

Overall goals	Objectives	Priority Themes / Measure	Priority Actions	Main Actors	Supporting Actors	Short			
						93 14	94 15	95 16	96 17
Capacity building of residents of Tehran for risk reduction against natural disasters (EQ and urban disasters)	1 Creating correct view of personal and group behaviour								
		1 Disseminating solutions for DRR							
			1 Conducting DRR festivals for citizens	TDMMO	Municipality				
			2 Adopting simple experimental tools in the education programs	TDMMO	NA				
		2 Motivating more citizens for DRR							
			1 Framework of education contents of DRR museum	TDMMO	NA				
			2 Preparation of Education Programs of DRR museum	TDMMO	NA				
			3 Development of Education Contents of DRR museum	TDMMO	NA				
	2 Increasing awareness, preparedness and capacties of residents								
		1 Promotion of most important vital actions among families							
			1 Compiling education contents	TDMMO					
			2 Preparing programs for public media (animation, TV movie)	TDMMO	IRIB etc				
			3 Conducting public education at Mahalle houses / DRM bases	Districts	TDMMO				
		2 Enhancing school teachers, students, parents and children							
			1 Preparing guidelines for teachers	TDMMO	Edu. Dep.				
			2 Training basic DRR for 100 /1000 master teachers elementary and high schools	TDMMO	Edu. Dep.				
			3 Training practical trainings for 100 /1000 master teachers of elementary and high schools	Fire dep., RCS	Edu. Dep.				
			4 Education house for children (training of children by trained teachers?)	TDMMO	Fire dep., RCS				
			5 Organizing emergency management teams at schools	Edu. Dep.	TDMMO				
			6 Preparing wall newspapers at schools	Edu. Dep.	TDMMO				
			7 Training parents at 1000 elementary & high schools	Edu. Dep.	TDMMO				
	3 Being able to respond to natural disasters utilizing available resources								
		1 Further enhancement and expansion of DAVAM groups							
			1 Conducting DAVAM competitions for 374 groups	Districts	TDMMO				
			2 Meeting with CBOs (Inclusion of CBOs in DAVAM activities)	TDMMO	Districts				
		2 Further enhancement and expansion of AMAKEN							
			1 Training of 100 new AMAKEN groups	TDMMO	Districts				
			2 Refresher trainings of existing AMAKEN group	TDMMO	Districts				

It is to be noted that C/P take action in order to promote the process for approval of the action plan to the higher officials of TDMMO. From the view point of the budget, progresses have been initiated including the preparation of a budget and the plan is feasible enough to be implemented.

2.3.4【13】To prepare public education training tools and materials (Activity2-4)

(1) Outline

- Existing training tools and materials for citizens' DRR education are prepared
- Objectives and contents of disaster education by target groups were identified
- Based on the improved master plans in the activities of 【12】, tools and materials for citizen's DRR education have been prepared.

Figure 2.3.3 Examples of existing training materials

(2) Reviewing existing training tools and materials for Citizens' DRR education

Training tools and materials which TDMMO and other organizations have prepared have been summarized. Structure, training components, and time allocation of Japanese DRR training and education for citizens have been introduced and utilized as a checklist. Also, two axes of disaster phases (mitigation, preparedness, response and recovery) and actors (individual help, mutual cooperation, public assistance, and international cooperation) were used for identifying contents which need to be supplemented by counterparts. Separate sheets are prepared for information on hazards, general DRR, past disaster damage and the damage situation, which is not included in the matrix of two axes.

Table 2.3.3 Matrix for Analysis by Disaster Phases and Actors

Measures, current situation, limitation, problems, and others				
	Self-help	Mutual cooperation	Public help	External help
Mitigation	4 Necessity of vulnerability reduction 5 Neccessity of Self- help 6 Knowing non-structural measures	6 Knowing non-structural measures		
Preparedness	1 Familialize with hazards 2 Familialize with EQ 3 Familialize with DM 5 Necessity of self-help 7 Ability to diagnose the safe corners	3 Familialize with DM 7 Ability to diagnose the safe corners 16 Familializing with DAVAM & other DM groups, how to cooperate 18 Participating maneuvers	3 Familialize with DM	
Response	8 Right behaviors at EQ 9 Right behavior during 1st hrs and days 12 Right behavior at fires 15 Familiar with safe emergency evacuation	11 Familiar with the first aid after the disaster 13 Learning simple removal of debris		
	17 Familiar with sanitation principles in shelters			
Recovery	9 Right behavior during 1st hrs and days 10 Familiarization with tenting 14 Familiarization with disaster psychology and morals after a disaster 17 Familiar with sanitation principles in shelters			
Reconstruction	14 Familiarization with disaster psychology and morals after a disaster			

Hazard	1 Familialize with hazards 2 Familialize with EQ
Disaster Management	3 Familialize with DM 4 Necessity of vulnerability reduction
Past disasters	

The activities for self-help are covered in all disaster phases. For the category of mutual cooperation, the majority of the training modules are hands-on for public help, rare information is provided. As for the citizens, it is not easy to judge to what extent public help can function and which parts of individual or mutual cooperation need to be supplemented. Characteristic of the phases is that fewer components are on recovery and reconstruction. Thus, after the recovery and reconstruction, a feedback process to the preparedness and mitigation phases needs to be established.

Regarding the subjects of education, the fundamental solution for earthquake disaster problems, which is “strengthening of buildings”, is expected to be enhanced. More components are expected to be added regarding past disaster damage and experiences, which can enhance motivation for DRR.

As for training methodology, an “active learning” style in which the learners themselves participate in finding solutions during lecturers is recommended.

Considering the results of analysis, the basic policies for improvements is drawn as follows.

1. Inclusion of components for enhancing motivation for DRR
2. The ultimate goal of earthquake DRR which is strengthening of buildings is added
3. Learning methodologies are to be developed further; participants can arrive at solutions by experimenting and self-learning by stimulating curiosity and motivation through interesting and even entertaining workshops.

Table 2.3.4 Improved Components of DRR Education

	Measures, current situation, limitation, problems, and others			
	Self-help	**Mutual cooperation**	**Public help**	**External help**
Mitigation	・ Non-structural mitigation ・ Building vulnerability and structural mitigation	・ How to cooperate DAVAM and disaster management groups ・ Non-structural mitigation ・ Building vulnerability and structural mitigation	・ Roles of responsible organizations	・ Roles of responsible organizations ・ Roles of lifeline companies
Preparedness	・ Rescue bag ・ Safe and non-safe place (in house and work places) ・ Making family disaster management plan	・ How to cooperate DAVAM and disaster management groups ・ Development of Mahaleh disaster management plan ・ Making safety map and town watching ・ Vulnerable people	・ Roles of responsible organizations	・ Roles of responsible organizations ・ Roles of lifeline companies
Response	・ Behavior at the time of earthquake ・ Behavior in three days after earthquake ・ First aid, rescue, and relief ・ Behavior at the time of fire ・ Fire fighting ・ Removal of debris ・ Emergency evacuation ・ Disaster psychology and morals ・ Utilization and limitation of earthquake early warning system	・ How to cooperate DAVAM and disaster management groups ・ Disaster psychology and morals ・ Roles of volunteer (to work for their own community) ・ Vulnerable people	・ Roles of responsible organizations ・ Earthquake early warning system	・ Roles of responsible organizations ・ Roles of lifeline companies ・ Roles of volunteer
Recovery	・ Sanitation principles in emergency shelters ・ Disaster psychology and morals ・ How to make tents	・ How to cooperate DAVAM and disaster management groups ・ Sanitation principles in emergency shelters ・ Disaster psychology and morals ・ Roles of volunteer (to work for their own community) ・ Vulnerable people ・ Livelihood in evacuation shelter	・ Roles of responsible organizations	・ Roles of responsible organizations ・ Roles of lifeline companies ・ Roles of volunteer
Reconstruction	・ Disaster psychology and morals ・ Livelihood in temporary shelter	・ How to cooperate DAVAM and disaster management groups ・ Disaster psychology and morals ・ Roles of volunteer (to work for their own community) ・ Vulnerable people ・ Livelihood in temporary shelter	・ Roles of responsible organizations ・ Reconstruction plan	・ Roles of responsible organizations ・ Roles of lifeline companies ・ Roles of volunteer

Hazard	・ Earthquake as natural phenomenon ・ Geographical condition in Tehran ・ Magnitude and Intensity ・ Liquefaction ・ Natural environment in Tehran
Disaster management	・ Principles of disaster management ・ Disaster management bases ・ Necessity of self-help ・ Roles of DAVAM ・ Disaster management structure in Tehran and responsible organization ・ Link with natural environment, disasters, and development ・ Roles of Mahaleh (Mahaleh house)
Past disasters	・ Historical record of earthquakes in Iran ・ Overview of past earthquakes (response, recovery, and reconstruction) ・ Experiences of past earthquakes (livelihood) ・ Experiences of past earthquakes (lifeline damages) ・ Experiences of past earthquakes (responsible organizations) ・ Experiences of past earthquakes (Industry)

Regarding target groups, TDMMO has clear notions; there are two main categories, target groups and key groups. Target groups are sub-categorized by age; 4-6, 6-12, 12-18(considering the developmental stages), and adults. Adults are further sub-categorized A and B based on their education attainments. Adult A is those with an educational level of junior high school graduate or lower. Adult B is those with an educational level of high school graduate or higher. This is because the explanation can be weighted by differentiating time for allocation. As for key groups, imams, housewives, school teachers, taxi drivers, basij (volunteer group of the revolutionary army), and mahalle (smallest unit of public administration) managers Figure 2.3.4

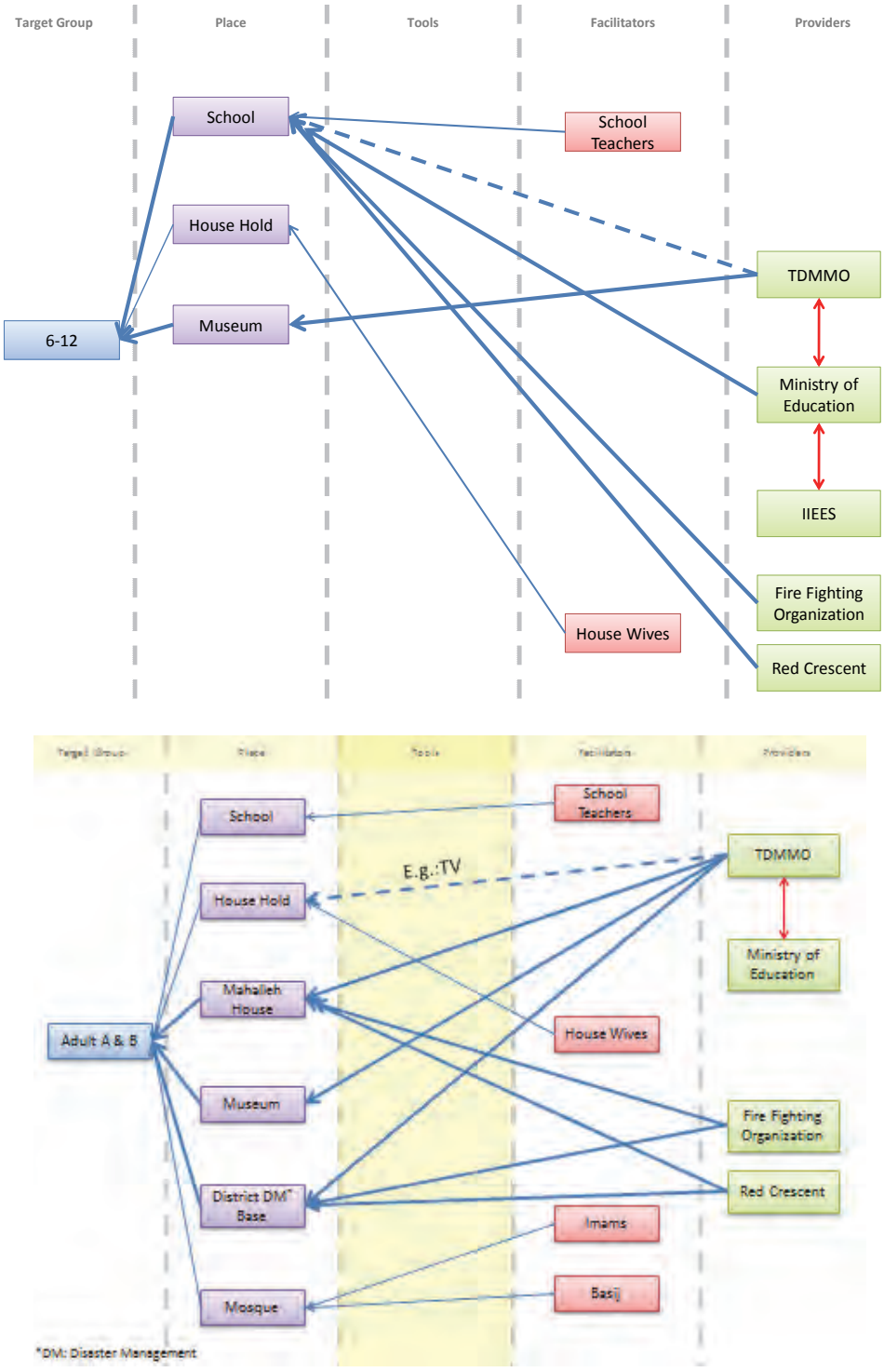


Figure 2.3.4 Example of Relationship between Target Groups and Key Groups

Based on the revised education contents, goals for each target group are identified, as shown in the Table 2.3.5. Furthermore, the results of social survey show that “disaster knowledge”, “motivation”, and “risk perception” are the key parameters. Especially since “motivation” directly link with actions of disaster risk reduction, improving disaster education by emphasizing to raise motivation is the key features. Achievements for each target group are delineated by four key parameters, namely “skill and ability”, “risk perception”, “motivation and interest”, and “knowledge”. Since the current programs are long and contents of knowledge are very much, the training programs have been revised to become more compact and effective.

Table 2.3.5 Goals of DRR Education for Target Groups

Target group	Goal
4-6 years old	They can take actions to save their own lives during and after an earthquake
6-12 years old	• They can take actions to save their own lives during an earthquake • They can motivate their family members to implement preparedness measures
12-18 years old	• They acquire basic knowledge regarding disasters and disaster management and can carry out self-help and mutual assistance; • They carry out the measures that they can be carried out
Adult A (18 years old or older with an educational level of junior high school graduate or lower)	• They acquire basic knowledge on disaster and disaster management and can carry out self-help and mutual assistance; • They carry out measures that can be carried out • They participate in Davam-led community activities
Adult B (18 years old or older with an educational level of high school graduate or higher)	• They acquire adequate knowledge on disaster and disaster management so that they can carry out self-help and mutual assistance; • They carry out measures that can be carried out • They participate in Davam-led community activities • They develop the capability and awareness that allows him/her to play a central role in the community
Imam (Religious leader)	In addition to the activities of adult B • They realize that preparedness for disaster management is necessary • They can carry out self-help and assist other people • They can motivate the community to measure the preparedness activities • They can reduce the fatalism factor in people's attitude
Housewives	In addition to the activities of adult A • They acquire basic knowledge on disaster and disaster management and can carry out self-help and assist family members during and after an earthquake • They can motivate other neighborhood housewives to measure preparedness activities • They can motivate the other neighborhood housewives to participate in Davam
Teachers	In addition to the activities of adult B • They realize that preparedness for disaster management is necessary • They can carry out self-help and assist their students • They can motivate the community to measure the preparedness activities • They know about the elements of school safety and can improve it. • They can transfer basic knowledge regarding disaster and disaster management to the students and students' parents
Taxi Drivers	In addition to the activities of adult A • They realize that preparedness for disaster management is necessary • They can motivate the passengers to measure the preparedness activities
Basij	In addition to the activities of adult A • They realize that preparedness for disaster management is necessary • They can motivate the community to measure the preparedness activities • They should be encouraged to get complimentary education to carry out neighborhood help

Target group	Goal
Mahalleh Managers (Local Leaders)	In addition to the activities of adult B • They realize that preparedness for disaster management is necessary • They can carry out self-help and assist others in the neighborhood • They can motivate the neighborhood residents to measure the preparedness activities • To be in charge in the mentioned activities
Member of Amaken (Such as, Residents of complexes, Occupants of administrative buildings and Sellers in Shopping malls)	In addition to the activities of adult A • They realize that preparedness for disaster management is necessary • They can carry out self-help and assist other of the Amaken's people • They can motivate the Amaken's people to measure the preparedness activities
Construction specialist (Such as Plumbers, Welders, Engineers, Builders…)	In addition to the activities of adult B • They realize the importance of their jobs in risk reduction
Media (Such as Journalists, Authors, Reporters, Newsman,…)	In addition to the activities of adult B • They realize that preparedness for disaster management is necessary • They can motivate the community to measure the preparedness activities
Volunteers of Mahalleh (Such as Volunteers of Davam, Shahriarane Javan, …)	In addition to the activities of adult B • They realize that preparedness for disaster management is necessary • They can motivate the community to measure the preparedness activities • They can transfer basic knowledge regarding disasters and disaster management to the neighborhood

Table 2.3.6 Training and Education Achievement by Target groups

Target group	Skill and Ability	Risk perception	Motivation and interest	Knowledge
4-6	• Response: self help (fundamental)	• Earthquakes occur in Tehran	• Learning response: self-help	• Hazard (fundamental) • Preparedness: Self-help(fundamental) Response: self-help (fundamental)
6-12	• Response: self help (fundamental)	• Earthquakes occur in Tehran • Building damage at the individual level	• Learning preparedness and response: self-help	• Hazard (fundamental) • Preparedness: Self-help(fundamental) Response: self-help (fundamental)
12-18	• Response: self-help (fundamental) • Response: Mutual cooperation (fundamental) • Preparedness: self-help (fundamental) • Mitigation: Self help	• Earthquakes occur in Tehran • Building damage at the individual level • Physical damage in Tehran • Capacity of individual level to cope with earthquake	• Learning preparedness and response: self-help • Learning response: mutual cooperation • Learning mitigation: Self help • Taking actions on mitigation: self help • Taking actions on preparedness: self help	• Hazard (Advanced) • Disaster management (fundamental) • Preparedness: Self-help(Advanced) • Response: self-help (fundamental) • Mitigation: Self help • Response: Mutual cooperation(fundamental) • Recovery: Self help
Adult A	• Response: self-help (Advanced) • Response: Mutual cooperation (Advanced) • Preparedness: Self-help(Advanced) • Preparedness: Mutual cooperation (fundamental) • Mitigation: Self help • Mitigation: Mutual cooperation • Recovery: Self help • Recovery: Mutual cooperation • Reconstruction: Self help	• Earthquakes occur in Tehran • Building damage at the individual level • Physical damage in Tehran • Physical damage at the individual level • Capacity of individual level to cope with earthquake • Capacity of community to cope with earthquake • Capacity of Tehran Municipality to cope with earthquake	• Learning preparedness and response: self-help • Learning response: mutual cooperation • Learning response: self-help (Advanced) • Learning response: Mutual cooperation (Advanced) • Learning preparedness: Self-help(Advanced) • Learning preparedness: Mutual cooperation (fundamental) • Learning mitigation: Self help • Learning mitigation: Mutual cooperation • Learning recovery: Self help • Learning recovery: Mutual cooperation • Learning reconstruction: Self help • Taking actions on mitigation: self help • Taking actions on mitigation: Mutual cooperation • Taking actions on preparedness: self help	• Hazard (Advanced) • Disaster management (fundamental) Response: self-help(Advanced) • Response: Mutual cooperation (Advanced) • Preparedness: Self-help(Advanced) • Preparedness: Mutual cooperation (Advanced) • Mitigation: Self help • Mitigation: Mutual cooperation • Recovery: Self help • Recovery: Mutual cooperation • Reconstruction: Self help • Reconstruction: Mutual cooperation
Adult B	• Response: self-help (Advanced) • Response: Mutual cooperation (Advanced) • Preparedness: Self-help(Advanced) • Preparedness: Mutual cooperation (fundamental) • Mitigation: Self help • Mitigation: Mutual cooperation • Recovery: Self help • Recovery: Mutual cooperation • Reconstruction: Self help	• Earthquakes occur in Tehran • Building damage at the individual level • Physical damage in Tehran • Physical damage at the individual level • Capacity of individual level to cope with earthquake • Capacity of community to cope with earthquake • Capacity of Tehran Municipality to cope with earthquake	• Learning preparedness and response: self-help • Learning response: mutual cooperation • Learning response: self-help (Advanced) • Learning response: Mutual cooperation (Advanced) • Learning preparedness: Self-help(Advanced) • Learning preparedness: Mutual cooperation (fundamental) • Learning mitigation: Self help • Learning mitigation: Mutual cooperation • Learning recovery: Self help • Learning recovery: Mutual cooperation • Learning reconstruction: Self help • Taking actions on mitigation: self help • Taking actions on mitigation: Mutual cooperation • Taking actions on preparedness: self help • Taking actions on preparedness: Mutual cooperation	• Hazard (Advanced) • Disaster management (fundamental) Response: self-help(Advanced) • Response: Mutual cooperation (Advanced) • Preparedness: Self-help(Advanced) • Preparedness: Mutual cooperation (Advanced) • Mitigation: Self help • Mitigation: Mutual cooperation • Recovery: Self help • Recovery: Mutual cooperation • Recovery: Public help • Reconstruction: Self help • Reconstruction: Mutual cooperation
Imam	Like Adult B	Like Adult B	In addition to adult B • building capacity	Like Adult B
Housewives	Like Adult A	Like Adult A	In addition to adult B • building capacity for family members	Like Adult A
Teachers	Like Adult B	Like Adult B	In addition to adult B • Motivating capacity building	• Training Methodology
Taxi drivers	Like Adult A	Like Adult A	In addition to adult A • building capacity	
Basij	In Addition to Adult B • Response: Public help	Like Adult B	In addition to adult B • Learning response: Public help • Learning recovery : Public help • Learning reconstruction: Public help • building capacity	In Addition to Adult B • Response: Public help
Mahalleh managers	In Addition to Adult B • Response: Public help	Like Adult B	In addition to adult B • Learning response: Public help • Learning recovery : Public help • Learning reconstruction: Public help building capacity	In Addition to Adult B • Response: Public help
Construction specialist	In addition to adult B • Reconstruction: Mutual cooperation	Like Adult B	In addition to adult B • Learning mitigation: Self help • Learning reconstruction :Public help	In addition to adult B • Mitigation: Public help • reconstruction: Public help
Media	Like Adult B	Like Adult B	In addition to adult B • building capacity	Like Adult B
Volunteers of Mahalleh	In Addition of Adult B • Response: Public help	Like Adult B	In addition to adult B • Learning response: Public help • Learning recovery : Public help • Learning reconstruction :Public help • Motivating capacity buildings	In Addition to Adult B • Response: Public help

Finally, sub-topics of DRR education were listed and for each target group and key group, main education components are highlighted and mode of delivery is identified. The following table shows the example of adult A.

Table 2.3.7 Emphasizing Sub-topics and Mode of Delivery (In the case of Adult A)

Achievement	Main subject	Sub topics TDMMO Expert additions	Responsible organization	Possible ways of training	Contents provider	Availability of information/mate
Hazard	Earthquake as natural phenomenon	Reasons of occurrence of earthquakes Definition of earthquake Fault and types of it Plate tectonics Earthquake's features Unpredictability of earthquake	TDMMO	Theater-Book-Game- play-Movies-Experiment	TDMMO	Available
Hazard	Other hazard that is most probable in Tehran(Such as liquefaction, landslide, flood, fire, ….)	Types of hazard Types of natural hazard Types of man-made and technological hazard Most important propable hazard in the city of Tehran	TDMMO	Theater-Book-Game- play-Movies-	TDMMO	Available
Hazard	Geological condition in Tehran	Seismology of Tehran (geological condition of Tehran) Tehran's major faults and the map of them Damage estimation	TDMMO	Book-Movie-Brochure-Lecture	TDMMO	Available
Hazard	Second disaster	Landslide fire Liquefaction	TDMMO	Experiment-Book-Movie-Brochure-Lecture	TDMMO	Available
Hazard	Natural environment in Tehran	Tehran status being prone to floods Tehran status being prone to snow Tehran status being prone to storms Proximity to Damavand volcanic mountain Tehran status being prone to climate change High ground water levels	TDMMO	Book-Movie-Brochure-Lecture-experiment	TDMMO	Available
Disaster Management	inciples of disaster manageme	Definition of risk Definition of vulnerability Definition of disaster Definition of disaster management Comprehensive cycle of disaster management (mitigation,preparedness,response,rehabilitation) Reasons why disaster management is necessary Requires elements for disaster management Government measures for disaster management Necessity of participation of all people in disaster management	TDMMO	Book-Movie-Brochure-Lecture	TDMMO	Available
Disaster Management	Disaster management structure in Tehran and responsible organization	Introducing the TDMMO Introduction of disaster management headquarters Introduction of specialized committees andresponsible organizations Introduction of disaster management bases	TDMMO	Book-Movie-Brochure-Lecture	TDMMO	Available
Disaster Management	Nessecity of public participation	Nessecity of self help Individual measures (including self and family preparedness) Nessecity of mutual cooperation Importance of golden time	TDMMO	Inviting Victim--Expriment-Movie-Brochure-Lecture	TDMMO	Available
Disaster Management	Roles of mutual cooperation	Who are DAVAM groups and what is their roles? Who are AMAKEN groups and what is their roles?	TDMMO	Movie-Brochure-Lecture-Theater	TDMMO	Available

Past Disasters	Historical record of earthquake in iran and Overview of them (response, recovery, and reconstruction)	Historical record of earthquake in iran(<50 year- >5.5 Richter)	TDMMO	Expression of experiences(victims- witness)- Movie- Brochure- Lecture-	TDMMO	should prepare
		Affected area of each earthquake				
		Casualities of each earthquake				
		Response-Recovery-Reconstruction (Rudbar-Manjil)				
		Response-Recovery-Reconstruction (Bam)				
		Response-Recovery-Reconstruction (Varzeghan)				
Past Disasters	Experiences of past earthquakes (livelihood)	Experiences of past earthquakes (livelihood)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO	Expression of experiences(victims- witness)- Movie- Brochure- Lecture-	TDMMO	should prepare
Past Disasters	Experiences of past earthquakes (lifeline damages)	Experiences of past earthquakes (lifeline damages)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Past Disasters	Experiences of past earthquakes (responsible organizations)	Experiences of past earthquakes (responsible organizations)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Past Disasters	Experiences of past earthquakes (Industry)	Experiences of past earthquakes (Industry)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Mitigation (Self-Help)	Non-structural mitigation	Necessity of vulnerability reduction	TDMMO	Game- Movie- Drill-Book- Brochure- Lecture	TDMMO	Availabl e
		The importance of vulnerability of non-structural parts				
		Definition of non-structural parts				
		How to fix the non-structural elements				
		To change the order of putting the things in the house				
		Checking lifelines: electric and gas heating and cooling installations and their maintenance				
Mitigation (Self-Help)	Building vulnerability and structural mitigation	The types of Tehran's buildings and the structural and non-structural elements	TDMMO	Movie- Book- Brochure- Lecture	TDMMO	Availabl e
		Providing some strategies for people who are going to buy or rent a house (for reconstructing or changing the structure of the building)				
		The necessity to improve the buildings (if we are the owner)				
		The relative retrofitting				
Preparedness (Self-Help)	Rescue bag	The necessity to provide some supply stuff	TDMMO	Theater- Book- Game- play- Movie-Drill	TDMMO	Availabl e
		The required equipment for the rescue bag				
Preparedness (Self-Help)	Safe and non-safe place (in house and work places)	Diagnosing the safe and non-safe (dangerous) corners	TDMMO	Field work- Theater- Book- Game- play- Movie	TDMMO	Availabl e
		Necessity to change the order of putting the things in the house, office,school.				
		Determining the exit routes				
Preparedness (Self-Help)	Making family disaster management plan	Understanding the need to prepare a family disaster action plan	TDMMO	Book- Movie- Brochure- Lecture - Discussion	TDMMO	Availabl e
		induction of famiy disaster management plan & family discussions		Theater- Book- Game- play- Drill-Movie		
Response (Self-Help)	Behavior at the time of earthquake	Conditions of earthquake times (short time of shakings, damages during the escape, not to rush to the doors)	TDMMO	Theater- Book- Game- play- Drill-Movie	TDMMO	Availabl e
		How to shelter and necessity of protecting him/her self during earhquake		Drill- Theater- Book- Game- play- Movie		
		Actions that should be done 3 seconds after an earthquake		Drill- Theater- Brochure- Game- play-Movie		
		Actions that should be done 3 minutes after an earthquake				
		How to use communication devices				
		Actions that should be done 3 houres after an earthquake				
Response (Self-Help)	Behavior in three days after earthquake	Actions that should be done in three days after an earthquake	TDMMO		TDMMO	Availabl e
		Individual behavior for living in temporary shelters				
Response (Self-Help)	Safety confirmation	Checking your own and your family health plan	TDMMO	Drill- Brochure- Game- play- Movie	TDMMO	Availabl e
Response (Self-Help)	Behavior at the time of fire	Move in smoke and escape from fire	TDMMO +Fire fighting org.	Drill- Game- play-Movie- Field work	TDMMO +Fire fighting org.	should prepare
		methods of preventing fire spread and ignition		Drill- Game- play-Movie- Field work		
Response (Self-Help)	Fire fighting	Four groups of fires	TDMMO +Fire fighting org.	Drill- Movie- Field work- Game- Brochure	TDMMO +Fire fighting org.	should prepare
		Different types of manual extinguishers				
		Water taps and hoses- boxes and spools				
		How to extinguish small fires				
Response (Self-Help)	Removal of debris	Definition of debris	TDMMO	Drill- Movie- Field work- Game- Brochure	TDMMO	Availabl e
		Right behavior after the earthquake about dealing with debris				

Past Disasters	Historical record of earthquake in iran and Overview of them (response, recovery, and reconstruction)	Historical record of earthquake in iran(<50 year- >5.5 Richter)	TDMMO	Expression of experiences(victims- witness)- Movie- Brochure- Lecture-	TDMMO	should prepare
		Affected area of each earthquake				
		Casualities of each earthquake				
		Response-Recovery-Reconstruction (Rudbar-Manjil)				
		Response-Recovery-Reconstruction (Bam)				
		Response-Recovery-Reconstruction (Varzeghan)				
Past Disasters	Experiences of past earthquakes (livelihood)	Experiences of past earthquakes (livelihood)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO	Expression of experiences(victims- witness)- Movie- Brochure- Lecture-	TDMMO	should prepare
Past Disasters	Experiences of past earthquakes (lifeline	Experiences of past earthquakes (lifeline damages)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Past Disasters	Experiences of past earthquakes (responsible	Experiences of past earthquakes (responsible organizations)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Past Disasters	Experiences of past earthquakes (Industry)	Experiences of past earthquakes (Industry)(Rudbar-Manjil, Bam, Varzeghan)	TDMMO		TDMMO	
Mitigation (Self-Help)	Non-structural mitigation	Necessity of vulnerability reduction	TDMMO	Game- Movie- Drill-Book- Brochure- Lecture	TDMMO	Available
		The importance of vulnerability of non-structural parts				
		Definition of non-structural parts				
		How to fix the non-structural elements				
		To change the order of putting the things in the house				
		Checking lifelines: electric and gas heating and cooling installations and their maintenance				
Mitigation (Self-Help)	Building vulnerability and structural mitigation	The types of Tehran's buildings and the structural and non-structural elements	TDMMO	Movie- Book- Brochure- Lecture	TDMMO	Available
		Providing some strategies for people who are going to buy or rent a house (for reconstructing or changing the structure of the building)				
		The necessity to improve the buildings (if we are the owner)				
		The relative retrofitting				
Preparedness (Self-Help)	Rescue bag	The necessity to provide some supply stuff	TDMMO	Theater- Book- Game- play- Movie-Drill	TDMMO	Available
		The required equipment for the rescue bag				
Preparedness (Self-Help)	Safe and non-safe place (in house and work places)	Diagnosing the safe and non-safe (dangerous) corners	TDMMO	Field work- Theater- Book- Game- play- Movie	TDMMO	Available
		Necessity to change the order of putting the things in the house, office,school.				
		Determining the exit routes				
Preparedness (Self-Help)	Making family disaster management plan	Understanding the need to prepare a family disaster action plan	TDMMO	Book- Movie- Brochure- Lecture - Discussion	TDMMO	Available
		induction of famiy disaster management plan & family discussions		Theater- Book- Game- play- Drill-Movie		
Response (Self-Help)	Behavior at the time of earthquake	Conditions of earthquake times (short time of shakings, damages during the escape, not to rush to the doors)	TDMMO	Theater- Book- Game- play- Drill-Movie	TDMMO	Available
		How to shelter and necessity of protecting him/her self during earhquake		Drill- Theater- Book- Game- play- Movie		
		Actions that should be done 3 seconds after an earthquake		Drill- Theater- Brochure- Game- play-Movie		
		Actions that should be done 3 minutes after an earthquake				
		How to use communication devices				
		Actions that should be done 3 houres after an earthquake				
Response (Self-Help)	Behavior in three days after earthquake	Actions that should be done in three days after an earthquake	TDMMO		TDMMO	Available
		Individual behavior for living in temporary shelters				
Response (Self-Help)	Safety confirmation	Checking your own and your family health plan	TDMMO	Drill- Brochure- Game- play- Movie	TDMMO	Available
Response (Self-Help)	Behavior at the time of fire	Move in smoke and escape from fire	TDMMO +Fire fighting org.	Drill- Game- play-Movie- Field work	TDMMO +Fire fighting org.	should prepare
		methods of preventing fire spread and ignition		Drill- Game- play-Movie- Field work		
Response (Self-Help)	Fire fighting	Four groups of fires	TDMMO +Fire fighting org.	Drill- Movie- Field work- Game- Brochure	TDMMO +Fire fighting org.	should prepare
		Different types of manual extinguishers				
		Water taps and hoses- boxes and spools				
		How to extinguish small fires				
Response (Self-Help)	Removal of debris	Definition of debris	TDMMO	Drill- Movie- Field work- Game- Brochure	TDMMO	Available
		Right behavior after the earthquake about dealing with debris				

Response (Self-Help)	Emergency evacuation	Emergency evacuation process and types of it(How to evacuate)	TDMMO	Drill-Theater-Game- play-Movie- Field Work- Town Watching	TDMMO	Available
		Evacuation needs during disaster				
		Necessity of safe emergency evacuation				
		Map, centers and routes of safe emergency evacuation				
		Things to do in a place of safe emergency evacuation				
		Getting familiar with tenting				
Response (Self-Help)	Utilization and limitation of earthquake early warning system	Utilization and limitation of earthquake early warning system				
		Things to do in time of warning	TDMMO	Drill-Movie-Brochure-lecture	TDMMO	Available
Recovery (Self-Help)	Sanitation principles in emergency shelters		TDMMO	Drill-Theater-Game- play-Movie-Brochure-	TDMMO	Available
		Methods of controlling the insects and excreta				
		How to provide healthy drinking water				
		How to provide healthy food(Hygiene in cooking, fruit, vegtables,…)				
		How to prevent fire in emergency shelters				
		How to keep hygiene, WC,…				
Mitigation (Mutual-Cooperation) /Preparedness (Mutual-Cooperation)	How to cooperate DAVAM and other disaster management groups(such as Amaken)	Davam activities	TDMMO	Book-Movie-lecture-Brochure-	TDMMO	Available
		Activities of other disaster management groups				
		How to contribute and participate to the activities				
		How to become DAVAM members				
		Encouraging the volunteerism				
Mitigation (Mutual-Cooperation)	Non-structural mitigation	Necessity of vulnerability reduction	TDMMO	Drill-Theater-Game- play-Movie-Brochure-Lecture	TDMMO	Available
		The importance of vulnerability of non-structural				
		Definition of non-structural parts				
		How to fix the non-structural elements(in their buildings, Mahalleh,…)				
Mitigation (Mutual-Cooperation)	Building vulnerability and structural mitigation	The types of Tehran's buildings and the structural elements	TDMMO	Movie-Brochure-Lecture	TDMMO	Available
		hazards of old buildings and irregular structures in the district				
		non-technical and hazardous digging and excavation				
Preparedness (Mutual-Cooperation)	Development of Mahaleh disaster management plan and Vulnerable people and key people	knowledge of Disaster Weak, Disaster Resources, Key and Vulnerable People in Mahalleh	TDMMO	Town watching-Field work	TDMMO	Available
		Methods of Preparing Disaster Management Maps				
		Understanding the strengths and weaknesses in Mahalleh				
Preparedness (Mutual-Cooperation)	Making safety map and town watching	Familiarity with disaster management resources and important places may be involved in disaster management	TDMMO	Town watching-Field work	TDMMO	Available
		methods of preparing safety map & town watching map				
Response (Mutual-Cooperation)	First Aid, Rescue and Relief	Training how to treat the injured people	TDMMO + Red Crecsent society	Drill- Game-play-Movie-Brochure-Lecture	TDMMO + Red Crecsent society	Available
		Training how to stop bleeding				
		Training the correct way of treating the broken bones (splinting)				
		Training how to carry the injured people				
		The required first aid after the disaster(for some of key groups)				
Response (Mutual-Cooperation)/Recovery (Mutual-Cooperation)/Reconstruction(Mutual-Cooperation)	How to cooperate DAVAM and disaster management groups	Davam activities	TDMMO	Theater-Movie-Brochure-Lecture	TDMMO	Available
		Activities of other disaster management groups	TDMMO		TDMMO	
		How to contribute and participate to the activities	TDMMO		TDMMO	
Response (Mutual-Cooperation)/Recovery (Mutual-Cooperation)/Reconstruction(Mutual-Cooperation)	Disaster psychology and morals	Phases when disaster psychology is necessary	TDMMO	Movie-Lecture-Brochure-Inviting witness (rescuers)	TDMMO	Available
		Characteristics of symptoms	TDMMO		TDMMO	
		Support and handling	TDMMO		TDMMO	
Response (Mutual-Cooperation)	Roles of volunteer (to work for their own community)	volunteers role in rescue operations and Teriage	TDMMO	Lecture-Brochure-Inviting witness(NGO)	TDMMO	Available
		volunteers role in sanitation and treating				
		The role of volunteers in emergency evacuation centers.				
		the role of volunteers in informing the official rescue forces				

Response (Mutual-Cooperation)/Recovery (Mutual-Cooperation)Reconstruction(Mutual-Cooperation)	Vulnerable people and key people	Definition of vulnerable people and special needs	TDMMO	Movie-Lecture-Brochure	TDMMO	Available
		Definition of key people and their special abilities	TDMMO		TDMMO	
Recovery (Mutual-Cooperation)	Sanitation principles in emergency shelters	Individual sanitation in emergency evacuation centers sanitation of food and water in emergency evacuation	TDMMO	Drill-Movie-Lecture-Brochure	TDMMO	Available
		Correct method of disposal in emergency evacuation centers				
		the public sanitiation in emergency evacuation centers				
Recovery (Mutual-Cooperation)/Reconstruction(Mutual-Cooperation)	Roles of volunteer (to work for their own community)	Volunteers play a role in establishing livelihoods	TDMMO	Drill-Lecture-Brochure-Inviting witness(NGO)	TDMMO	Available
		The role of volunteers in emergency evacuation centers				
		Volunteers play a role in identifying vulnerable people and injured				
Recovery (Mutual-Cooperation)	Livelihood in evacuation shelter	Identify the set of activities required in emergency evacuation centers	TDMMO	Drill-Lecture-Brochure(guide lines)-Movie	TDMMO	Available
		Formation of working groups on nutrition, health, safety, security and emotional support				
		Methods of distribuion of facilities				
Reconstruction(Mutual-Cooperation)	Livelihood in temporary shelter	Identify the set of activities required in emergency temporary settlement	TDMMO	Drill-Lecture-Brochure(guidelines)-Movie	TDMMO	Available
		Formation of working groups on nutrition, health, safety, security				
Mitigation (Public-Help)	Roles of responsible organizations	Clarify the role of the responsible organization to develop guidelines and standards for prevention and risk reduction	TDMMO	Lecture-Brochure-Movie	TDMMO	Available
		Clarify the role of responsible organizations in renovation and retrofitting of old (traditional) zones (urban decay)				
		Clarify the role of responsible organization for preparation of hazard zonning maps				
		Clarify the role of responsible organization for preparation of disaster management maps				
		Clarify the role of responsible organization for the inclusion training materials in the curriculum of schools and universities				
		Clarify the role of the responsible organizations for the creation and design of early warning systems				
		Clarify the role of responsible organization in strengthening and retrofiting of infrastructure and lifelines				
Preparedness (Public-Help)	Roles of responsible organizations	Clarify the role of responsible organization in training improving of knowledge and skills of staff	TDMMO	Lecture-Brochure-Movie	TDMMO	Available
		Clarify the role of responsible organization of training awareness				
		Clarify the role of responsible organizations for the preparation and updating of equipment and facilities				
		Clarify the role of responsible organization to identify and mobilize evacuation centers and settlement				
		Clarify the role of responsible organizations for the coordination and maneuvering				
Response (Public-Help)	Roles of responsible organizations	Clarify the role of official organizations in the early and rapid response (search and rescue, emergency evacuation, rescue and first aid, etc)	TDMMO	Lecture-Brochure-Movie	TDMMO	Available
		Clarify the role of official organizations in the secondary response (debris collection, management, health, etc.)				
Response (Public-Help)	Earthquake early warning system	How inform and warn to the people	TDMMO	Drill-Lecture-Brochure-Movie	TDMMO	Available
		emergency evacuation				
		Warning critical infrastructure				
Response (Public-Help)	Roles of volunteer(NGO,..)	Cooperation and partnership with official forces in the initial response (search and rescue, emergency evacuation, rescue and first aid, etc)	TDMMO	Lecture-Brochure-Movie	TDMMO	Available
		Cooperation and partnership with official forces in secondary responses (debris collection, management, health, etc.)				

Recovery (Public–Help)	Roles of responsible organizations	Clarify the role of responsible organizations in temporary settlement				
		Clarify the role of Responsible Organizations in restoring jobs				
		Clarify the role of Responsible Organizations of psychosocial support				
		Clarify the role of Responsible Organizations for the management of health and sanitation				
Recovery (Public–Help)	Roles of volunteer(NGO,..)	Cooperation and participation with official forces in temporary settlement	TDMMO	Lecture–Brochure–Movie	TDMMO	Availabl e
		Cooperation and participation with official forces in job restoration				
		Cooperation and participation with official forces in psycholocial support				
		Cooperation and participation with official forces in health and sanitation management				
Reconstruction (Public–Help)	Roles of responsible organizations	Clarify the role of the responsible organizations for the repair and reconstruction of damaged infrastructure and Lifeline				
		Clarify the role of responsible organizations for residential rehabilitation and financial support				
		Clarify the role of responsible organizations for the revival of economical activities				
		Clarify the role of responsible organizations for psychological support and rehabilitation of people injured				
Mitigation(External–Help	Roles of volunteer(NGO,..)	Participation in research activities about vulnerability and risk reduction	TDMMO	Lecture–Brochure–Movie	TDMMO	Availabl e
		Participation in public training about risk reduction				
Mitigation and Preparedness (External–Help	Roles of responsible organizations and lifeline companies	Clarify the role of formal organizations in identifying informal, non–governmental sources and institutions				
		Clarify the role of formal organizationsto encorage informal & Non governmental institution & resources to participate in mitigation & preparedness activities				
Response(External–Help	Roles of responsible organizations and lifeline companies	Clarify the role of official & responsible organization in managing of communication between informal and NGOs involved in the crisis				
		Clarify the role of official & responsible organization in managing of coordination between informal and NGOs involved in the crisis				
Response(External–Help	Roles of volunteer	Collection, management and distribution of non–governmental aid	TDMMO	Lecture–Brochure–Movie	TDMMO	Availabl e
		Participation in the needs assessment and informing NGOs				
Recovery and Reconstruction (External–Help	Roles of volunteer	Participation & Cooperation with official forces in need assessment and informing NGOs	TDMMO	Lecture–Brochure–Movie	TDMMO	Availabl e
		Participation and Cooperation with official forces in managing of allocation of non governmental resources				
Recovery(External–Help	Roles of responsible organizations and lifeline companies	Clarify the role of responsible organization in need asseement and informing non official and non govermental organization				
		Clarify the role of responsible organization in managing of allocation of non official and non govermental				
Reconstruction(External–Help	Roles of responsible organizations and lifeline companies	Clarify the role of responsible organization in rehabilitation of lifelines and infrastructures				
		Clarify the role of responsible organization in use of Non governmental and non official abilities and rehabilitation of damage buildings and complexes				
		Clarify the role of responsible organization in restoration of economical activities				
		Clarify the role of responsible organization in psycological support & rehabilitation of casulties				
		Clarify the role of responsible organization in managing of financial support from private insurance companies				

2.3.5【14】Preparation of the basic concept, exhibition plan, exhibition scenario, floor spaces required, floor layout plan, exhibition equipment plan for each space and drawings of each section for the disaster management (Activity 2-5)

As a base for the planning of the Disaster Management Museum, the mission, function and objectives of the museum were developed in the beginning of the project, although TDMMO was inclined to rush to construct the building of the Disaster Management Museum when the project started.

The great need for the Disaster Management Museum has been understood by Teheran Municipality. TDMMO was expected to conduct the full-scale design work for implementation. However, since TDMMO does not have enough staff for the design work for this project, TDMMO decided to hire a consultant for the design work of building and exhibitions, and the JICA Expert Team supported the preparation of the terms of references for the consultant. An architect was hired by TDMMO to supervise the consultant's design work. The Construction of the Disaster Management Museum is listed in Tehran Municipality's 5-year development plan, and its budget has been prepared already.

The mission, objectives, function and basic concept of the exhibitions were formulated based on a study which included visiting similar type museums and disaster management centers in Japan during a C/P Training Program, visiting similar museums in other countries (organized by TDMMO), and conducting desktop studies of other museums in the world. The frameworks for exhibitions and exhibition contents were developed accordingly.

In the study, the Holy Defense Museum, which is also under the Teheran Municipality and opened in 2012, was visited to lean about preparation works and operation and management of the museum in Tehran.

(1) Mission of Disaster Management Museum

This Disaster Management Museum, under the jurisdiction of Tehran Municipality, is the only museum about disaster management in Iran. Tehran has a high potential for great earthquakes, but has not been affected by any great disaster in more than a century. Under these circumstances, the framework of the Tehran Disaster Management Museum has been developed as follows.

Table 2.3.8 Framework of the Teheran Disaster Management Museum (draft, as of December 2014)

Mission of the DMM	Communicating the importance of disaster mitigation and management to the people of Iran.
The Goals of the DMM	・ Increasing the sensitivity of citizens for natural disasters and especially earthquakes ・ Familiarizing the citizens with the concept of an earthquake and the effect of using mitigation and preparedness against earthquakes because it is a continuous threat ・ Raising the knowledge of post-earthquake problems by the target disaster management groups ・ Providing experience and actual feelings for the visitors about the natural disasters, especially earthquakes ・ Getting lessons from past disasters and providing knowledge for improving the decision making of the managers

The Objectives of the DMM	・ Raising the awareness of people about disaster management by providing information on past disasters, and the related scientific information. ・ Providing the latest information in the disaster management field and the achievements in the mitigation field, and promote people's actions ・ Providing public education for disaster management in the country (DAVAM groups schools, governmental institutes, …) ・ Providing practical training regarding different aspects of disaster management and mitigation to the people by holding workshops, exhibitions and simulators by which the people experience the disasters. ・ Establishment, development and updating of the disaster management data base and establishing a center for gathering the information and documents regarding the disasters in Tehran and Iran.
Target Disasters	Natural Disasters in Iran
Target Visitors	People in Iran and foreign visitors

(2) Function of the Tehran Disaster Management Museum (DMM)

The function of DMM was studied based on the function of disaster management centers and disaster museums in Japan and other countries.

Tehran DMM will have the basic four functions shown on Figure 2.3.5, and the "Exhibition and Publicity" and "Education and Dissemination" will be the core functions. Function as a disaster management base was also considered, but not retained.

The basic function of "Research & Investigation" will be developed based on the existing research activities of TDMMO. The details of the activity will be studied through coordination with IIEES and universities, which have been major "Research & Investigation" institutions for natural disasters and disaster management in Iran.

There is no facility or organization which collects information and objects related to disasters. For the basic function of "Collection & Conservation," TDMMO is planning to collect such information/objects from the areas which had great natural disasters.

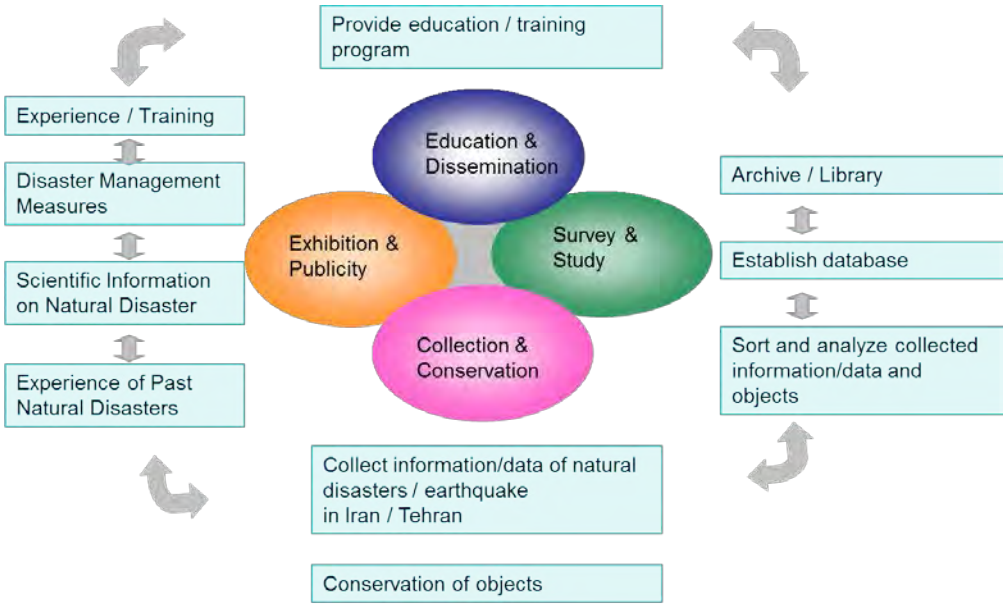


Figure 2.3.5 Function and activity framework of Tehran Disaster Management Museum

(3) Preparation of the Exhibitions of the Tehran Disaster Management Museum

1) Structure of the Exhibitions

In accordance with the above-mentioned mission and objectives, the contents and scenarios of the exhibition were prepared with consideration of the target group of visitors (see section 2.3.6).

The exhibitions of DMM will have the three axes presented below. Since Tehran has not had experience of a great natural disaster for more than a century, the first axis is to focus on getting people to notice and recognize the dangers and risks of natural disasters.

Increasing the sensitivity of citizens for natural disasters by sharing the experience of natural disasters in the past.	Provide scientific information and knowledge on disaster mitigation measures.	Provide education and training for disaster mitigation and management

With consideration of these three axes, the Exhibitions of Tehran DMM is planned to consist of the following four sections.

Table 2.3.9 Structure of the Exhibitions (Lorestan)

Section	Corner	
[I] Natural Disasters in Iran: *Learn from the experience of past natural disasters*	1) History of Natural Disasters	
	2) Major Serious Natural Disasters in the Past	・Bam Earthquake (Kerman) ・Varzeghan Earthquake (East Azarbayjan) ・Silakhor (Lorestan) ・Roodbar & Manjil Earthquake (Gilan) ・BooinZahar Earthquake ・Golestan Flood ・Qom Flood

	3) Natural Disasters in the World	
	4) Japan Corner	
[II] Scientific Information on Natural Disasters: *Learn about the mechanisms of natural disasters*	1) Earthquake	・Mechanisms of Earthquakes ・Earthquake Recording & Measuring methods ・Location and movement mechanisms of faults ・Liquefaction
	2) Others	・Flood ・Landslide ・Avalanche ・Sand Storm ・Volcano ・Others (Strong Wind, Forest Fire, etc.)
[III] Disaster Management Measures: *Learn about Disaster Management Measures*	1) Natural Disasters in Tehran	
	2) Damage Estimation in Tehran	
	3) Disaster Management Measures	・Personal preparation ・Building reinforcement / retrofitting ・Disaster Information System ・Evacuation Routes ・Emergency response services (Ambulance, Fire Fighting, etc.) ・Search and Rescue Equipment ・Shelter for Evacuation ・Stock for emergency (public) ・Disaster Management Base and activity of DAVAM ・Temporary houses
[IV] Trial/ Experimental/ Workshop	Trial/Experimental Corner of Natural Disasters & Disaster Management	・Earthquake Simulation ・Fire Fighting ・Evacuation in Smoke ・Rescue & First Aid ・Emergency Call
	Workshops	・Earthquake resistant structures and model-making ・Retrofitting Measures ・How to use disaster management tools ・Non-structural Materials Earthquake Resistant Measures ・Practice of Emergency/ Disaster Response

2) Contents of each Exhibition

The scenario of contents of each section of the exhibitions are prepared and summarized in the Menu of the Exhibitions. Target visitors were also defined by section and topics.

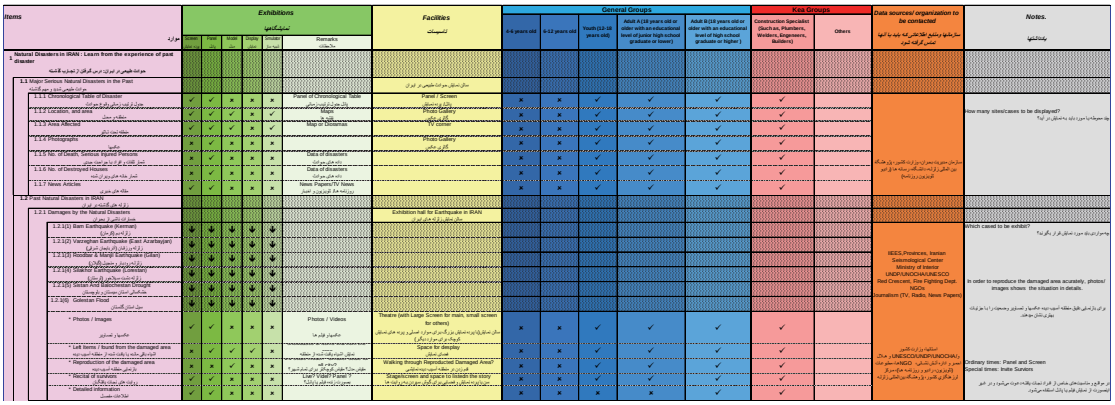
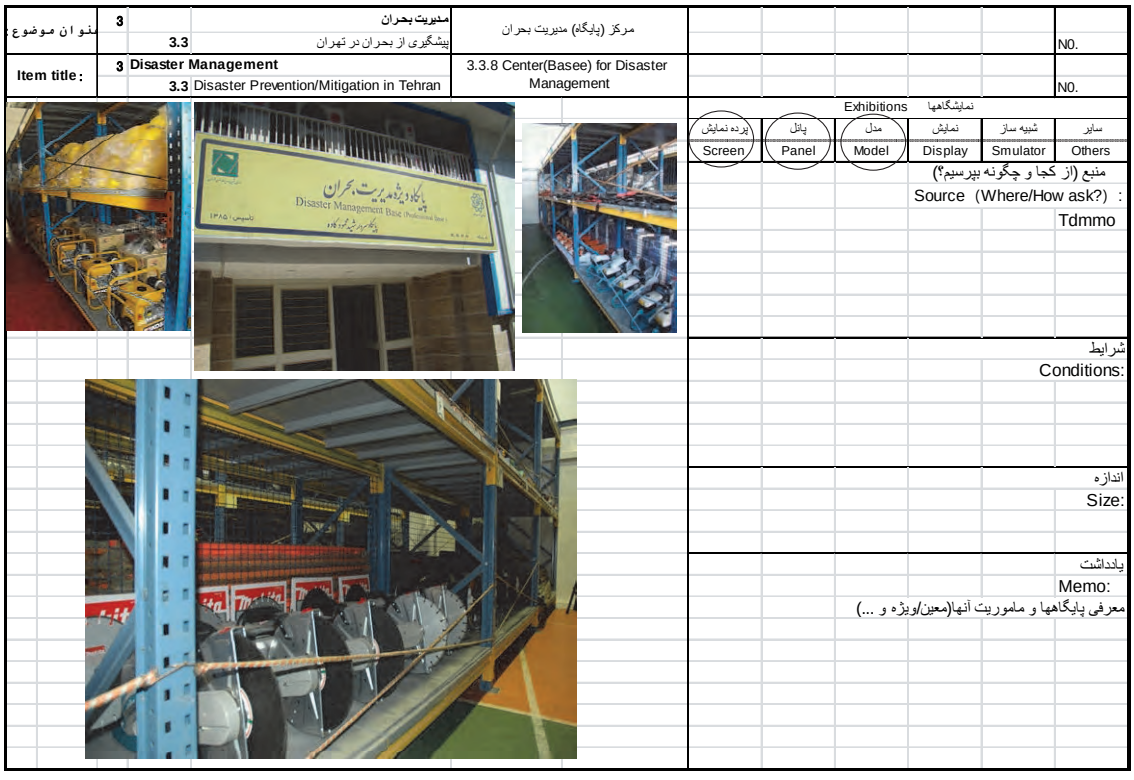


Figure 2.3.6 Menu of Exhibitions (example)

Exhibition contents, items to be exhibited, rendering of the exhibition, preferred exhibition methods, and messages to be delivered in each section were discussed among C/P members (which consisted of three deputies: a deputy of Education and Community Participation, a deputy of Mitigation and Risk Reduction, and a deputy of Technical and Civil Construction which was merged with the Mitigation and Risk Reduction). The results of this discussion are summarized in the exhibition item sheets, an example of which is shown below.

Hands-on exhibition methods will be recommended to be applied especially for the Information Science and Disaster Management Sections. Visitors will understand and remember the contents more effectively than normal types of display of objects or panels. It will also be effective for visitors to avoid feeling “museum fatigue” by seeing the objects and reading the explanations.



عنوان مورد :	2.1- زلزله‌ها و حوادث شاخص گذشته در ایران									
	12.1- خسارات ناشی از بحران									N0.
Item title :	1.2.1-1.2.3	Photos / Images								
	1.2-Past Natural Disasters in IRAN									
	1.2.1-1.2.3									N0.
منظور (پیام) این مورد		نمایشگاهها	می خواهید چه چیزی را نشان دهید (یا بگویید)						منبع (از کجا و چگونه بپرسیم؟)	
Message/Contents of the Item		Exhibitions	What you want to show (or tell)						Source	
(1) Bam (Kerman) Eearthquake		Photos/Models /Screens	Before and after earthquake, and after reconstruction							
زلزله بم (کرمان)			قبل و بعد زلزله و بازسازی							
(2) Varzeghan (East Azerbayjan) Earthquake			Earthquake last month. Many animal victims. Non structual hospital Varzeghan hospital was destroyed because of the unproper structure.							
زلزله ورزقان(آذربایجان شرقی)			زلزله سال91ورزقان/ تخریب و خسارت اجزای غیر سازه ای در سازه های جدید عامل اصلی خسارت(اهمیت مقاومسازی اجزای غیر سازه ای ساختمان)/از سرویس خارج شدن بیمارستان ورزقان/کشته شدن دام ها و....							
(3) Roodbar & Majil Earthquake			Geotechnical points/reviewing the earthquake regulation for strengthningthe building. Known for the revision of seismic regulation. Because of the Soccer Wold Cup, many young peopole were awake and servived.							
زلزله منجیل و رودبار			نکات ژئوتکنیکی حادثه/ تجدید نظر بر روی مقررات طرح لرزه ای بعد از این حادثه و بحث مقاومسازی ساختمان ها/ بدلیل همزمانی حادثه با جام جهانی فوتبال بسیاری از جوانان بیدار بوده و نجات یافتند							
(4) Silakhaor (Lorestan) Earthquake		عکس/مدل/صفحه نمایش	Imporatnce of lessons from experience of Bam.							
زلزله سیلاخور(لرستان)			the alarm of local leaders led to less injuries							
			اهمیت درس های آموخته شده از حادثه بم							
			اعلام احتمال زلزله توسط شهردار یا فرماندار باعث کاهش کشته ها شد							
(5) Booin Zahrah Earthquake			Important story from religious points of view							
زلزله بوئین زهرا			the renovation and reconstruction after earthquake should consider ppl 's culture							
			اهمیت توجه به فرهنگ و اعتقادات مذهبی مردم منطقه در بازسازی و نوسازی							
			مردم بدلیل اعتقاد به غصبی بودن و ... وارد منازل ساخته شده نگردیدند							
(6) Golestan Flood			Several attempt for prrevention less result. Know to lead to flood regulation. Human casuality & destruction of Golestan Natural Park caused this flood.							
سیل گلستان			تکرار حادثه / خسارات و							
(7) Ghome Flood			Importance/effectiveness of taking quick action, learned from the past flood.							
سیل قم (قمرود)			اهمیت سرعت عمل در تخلیه مردم/....							

Memo	* Summarise the importance/special features of each disater.	* خلاصه نمودن اهمیت/ مشخصات خاص هر یک از بحران ها
	* Education Group proposed to exhibit new building which was damaged/collupsed in the earthquake to show why it was colupsed.	* گروه آموزش پیشنهاد نمایش ساختمان های جدید که بر اثر زلزله آسیب دیده/ فرو ریخته بودند را برای نشان دادن علت فروریختن مطرح نمود.
	faults. (fault site will be a part of museum branch through city(urban one).	* گروه پیشگیری پیشنهاد کرد که بازدیدکنندگان به محل واقعی گسل ارجاع داده شوند (محل گسل از طریق موزه شهری (Urban Museum) شاخه ای از موزه خواهد بود.
	* Need to collect episodes of survivors and rescue team by making interviews to servivors or relevant authorities(red crecent)	* نیاز به جمع آوری روایت های بازماندگان و تیم امداد از طریق انجام مصاحبه با بازماندگان و مسئولین مربوط (هلال احمر)
	* Possibility of recital of servivors?	* امکان بازگویی از زبان بازماندگان؟
	* Public call for diaster memories could be announced to collect episodes by people who servived from the disaster.	* فراخوان عمومی خاطرات بحران برای جمع آوری روایت های بازماندگان حادثه
	* How people's businesses have been influenced by the disaster based on people's distinctive livelihood in different areas of Iran perhaps if the buisiness recover they could come back to real life	* چگونگی تاثیر گذاری بحران بر کسب و کار مردم با توجه به نوع معاش مردم در نواحی مختلف ایران. شاید در صورت بهبود وضعیت کسب و کار، مردم زودتر بتوانند به زندگی خود باز گردند.
	* Dr.Arab (specialist for flood and drought) may help to prepare (6) (7) and Sistan's drought.	* دکتر عرب (متخصص سیل و خشکسالی) می توانند در موارد (6) (7) و خشکسالی سیستان کمک کنند.
	* Sistan and Bolochestan Drought will be exhibit in 1.1.	* خشکسالی سیستان و بلوچستان در 1.1. نمایش داده خواهد شد.
	* Remembering our aim is to educate people and inform them, not make them feel threaten.	* به خاطر داشتن اینکه هدف ما آموزش دادن و اطلاع رسانی به مردم است نه اینکه در آنها احساس ترس ایجاد کنیم.

Figure 2.3.7 Exhibition Item Sheets (Exhibition contents, images, exhibition methods and messages to be delivered)

3) Collection of Information, Data and Objects for Exhibition

"Learning from Past Natural Disasters in Iran" is planned to be one of the sections of this DMM. However, information, data and objects related to past natural disasters, which could be exhibited in the DMM, have not been collected yet.

The necessity of collecting data and objects has been explained since the beginning of this project, and the C/P team contacted the Metropolitan Disaster Managers of provinces which experienced disasters in the past. Most of them accepted the request to collaborate with TDMMO for the preparation of the DMM. However, the data and objects still need to be found and collected.

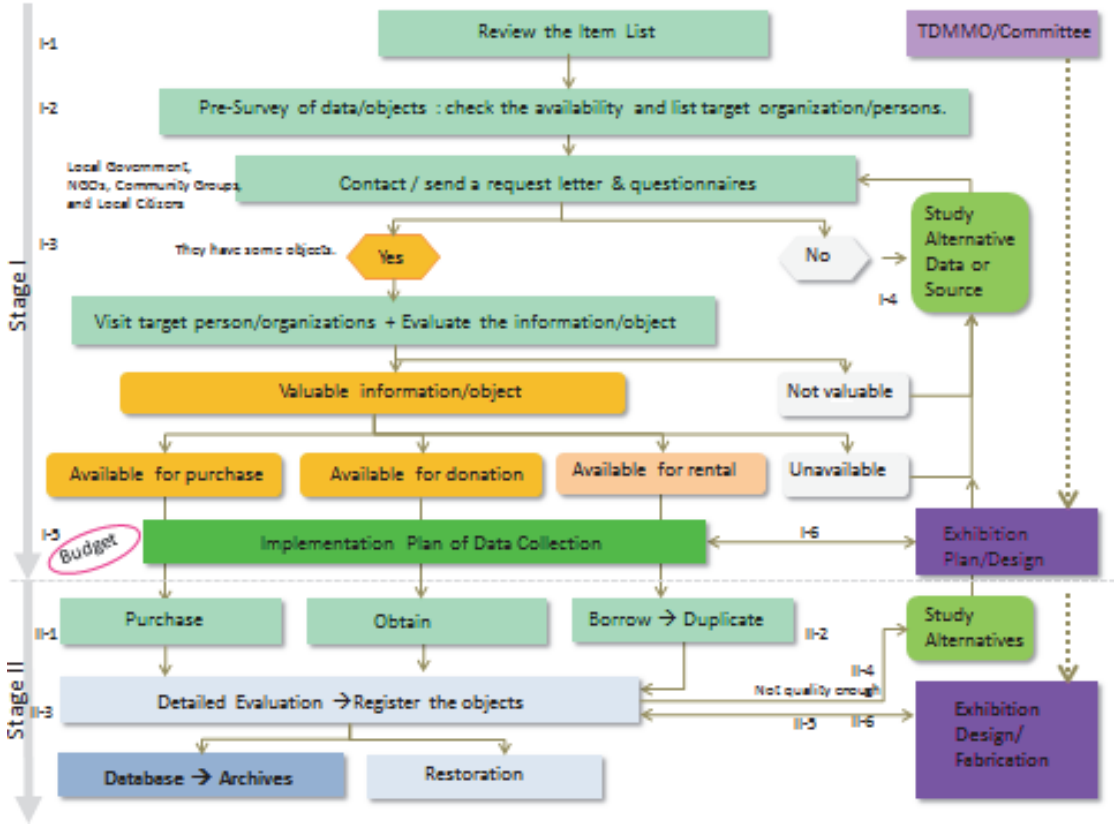


Figure 2.3.8 Procedure of Data/Objects Collection

4) Site of the Tehran DMM

a.Former Project Site

TDMMO was originally planning to build the Tehran DMM at a site within the Velayat Park in District 17 of Tehran, which was planned to be developed on the former military airport. The proposed site for the Tehran DMM was located in the museum zone of the Park, which consisted of approximately 1 ha of flat land. As a part of the Velayat Park, there is a common parking space for visitors, and the height of buildings was restricted to 20m (This height restriction was changed to 14m later on). The basic design of the DMM was prepared for this site in the first year of this project.

Figure 2.3.9 Original Site for the DMM in Velayat Park

b.New Project Site

In January 2013, TDMMO decided to change the location to a site in District 22, which is a newly developed area. The site is sloped, but has an approximate surface of 3ha. The site is adjacent to a large scale commercial development area called the "Thousand and one nights city," which contains an amusement park, 5 star hotels, and shopping malls. This area was developed with the expectation of becoming a holiday destination in Tehran, and there is a large park and a large lake in the south, and a Water Fall Park west of the amusement park. As site conditions are totally different than the original site (the site area tripled, land is sloped, and there is no restriction of the building height), it was necessary to make a new plan for the Tehran DMM.

Figure 2.3.10 New site for the Tehran DMM in District 22

In May 2014, it was noticed that there is a slight possibility to be hit by a landslide from the mountain behind the site. In order to ensure the safety of the DMM building, as a symbol of "Safety," a geological committee was organized by university professors. Based on their recommendations, three surveys (a geological survey of the area, a geotechnical survey of the site, and an RQD survey) have been conducted, and the design work on the museum building was stopped until October 2014.

5) Building Plan of DMM

According to the mission and objectives of the Tehran DMM, the concept of the building and the exhibition design for this museum are summarized as follows:

- Symbol of resilience to natural disasters.
- Visitor-friendly earthquake-resistant building– universal design for building and exhibitions
- Center of disaster management education – database and cutting-edge technology
- Interactive exhibition – Hands-on type exhibition
- Practical knowledge - opportunities for trial/experiments
- Environmentally friendly – Green Building design

Based on the plan for the exhibition scenario and contents, a floor zoning plan, a circulation plan, and the necessary floor area have been studied, and a conceptual floor plan was prepared for the DMM.

a.Composition of the Exhibition Area

Relationships among the exhibition sections are shown on Figure 2.3.11. Some contents of "III. Disaster Management Measures" and "IV. Trial/ Experimental/ Workshop" are closely related to each other. Functional relations of these exhibitions shall be taken into consideration for the layout and circulation plan.

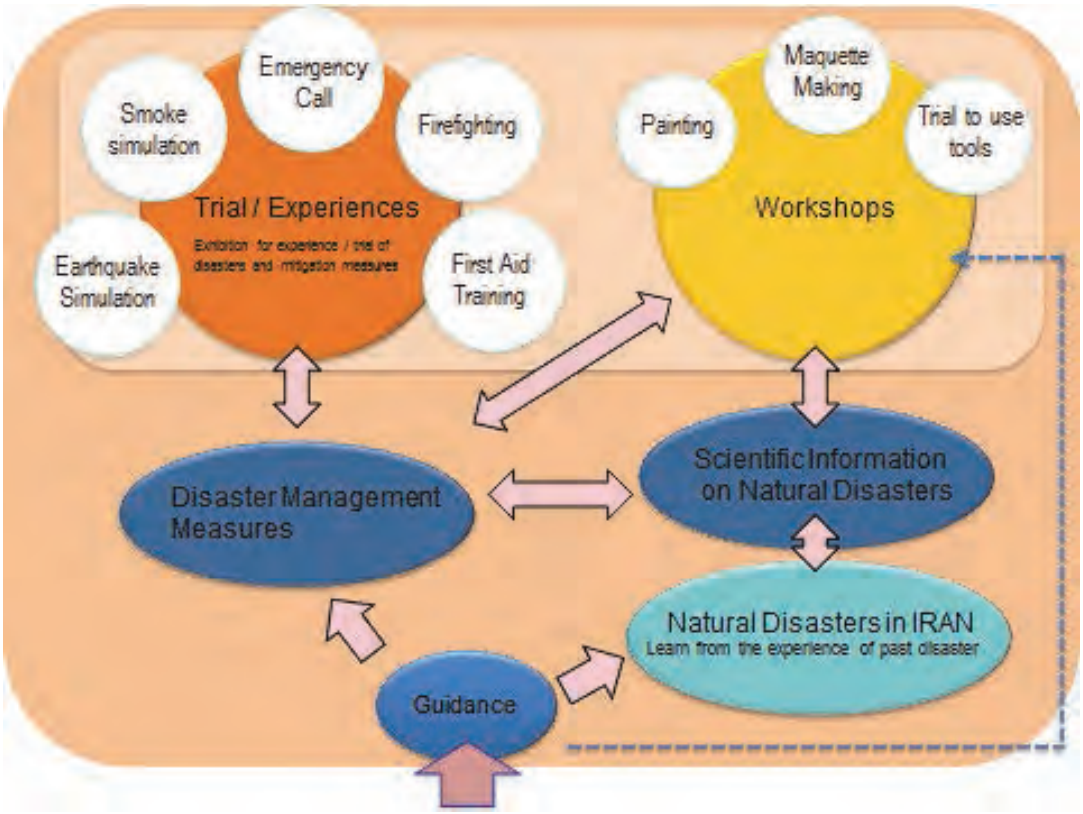


Figure 2.3.11 Composition of the Exhibitions

Some other facilities, such as a conference hall, meeting rooms, a library and office are also required, and these facilities should be directly accessible from the outside.

b.Circulation Route

Two types of circulation of visitors in this DMM were studied and discussed: a fixed /full menu route and a flexible route. The fixed /full menu route is not recommended; it is better to have some flexibility for encourage people to see and learn according to their interests.

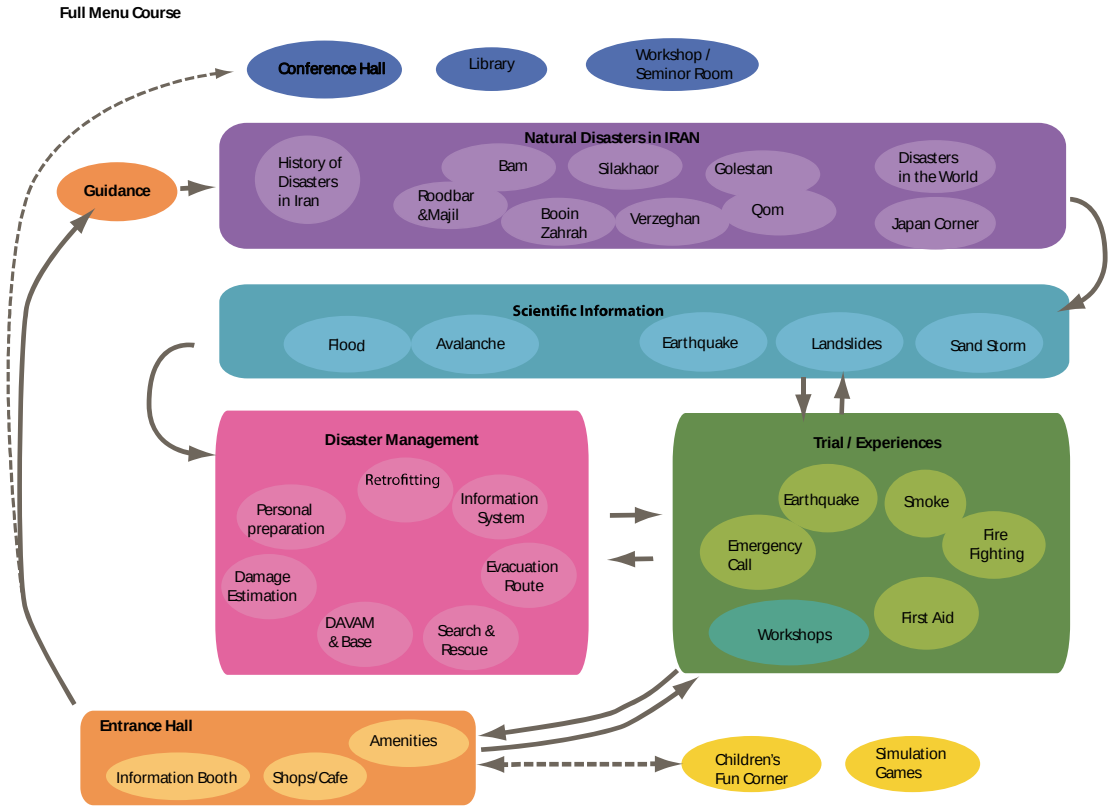


Figure 2.3.12 Study on the circulation route

c.Conceptual Plan

According to the above building concept, and the exhibition framework, several alternatives of the conceptual floor plan were prepared for the former site and the new site in District 22.

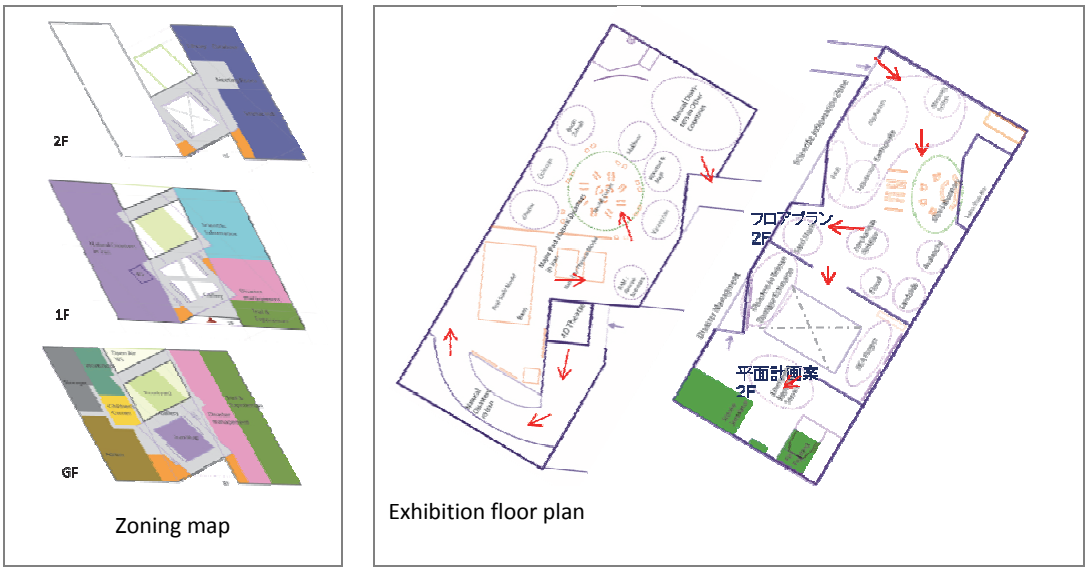


Figure 2.3.13 Conceptual plan of DMM for the original site

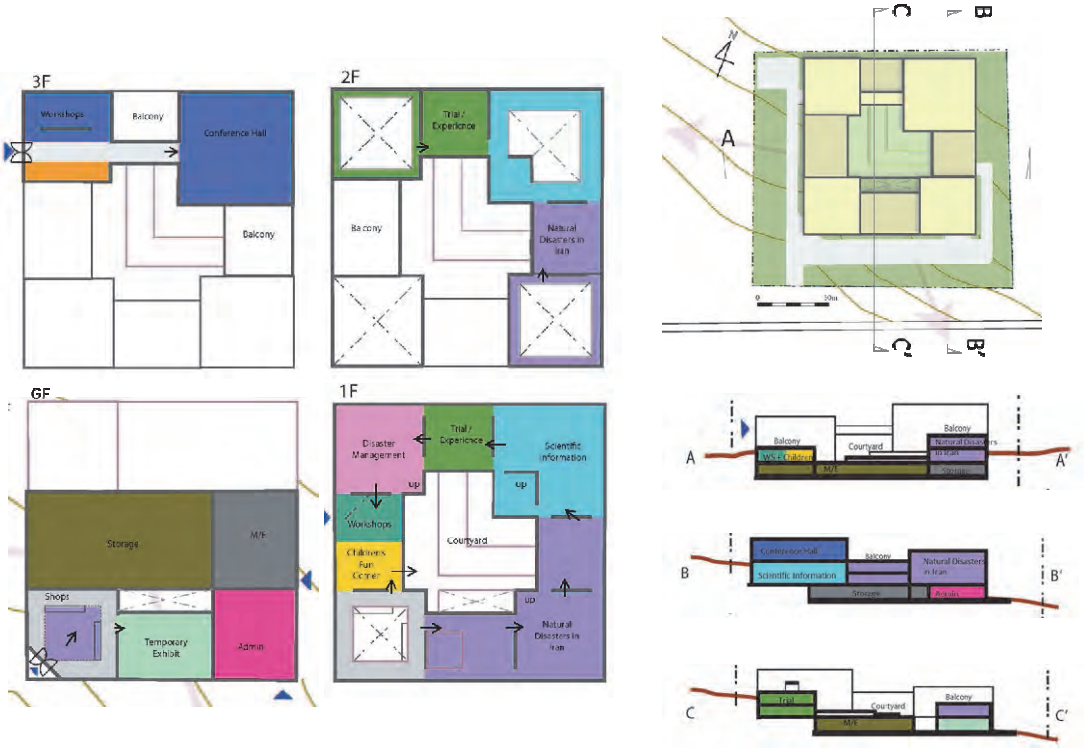


Figure 2.3.14 Conceptual plan of DMM for the new site

d.Plan of major Sections

a) Entrance Hall

To make a strong first impression to visitors, we suggesting the space for the entrance hall to show images and videos of different disasters (earthquake, fire, flood, landslide,) (brief exploration of Iran's natural disasters) with Iran map on the floor.

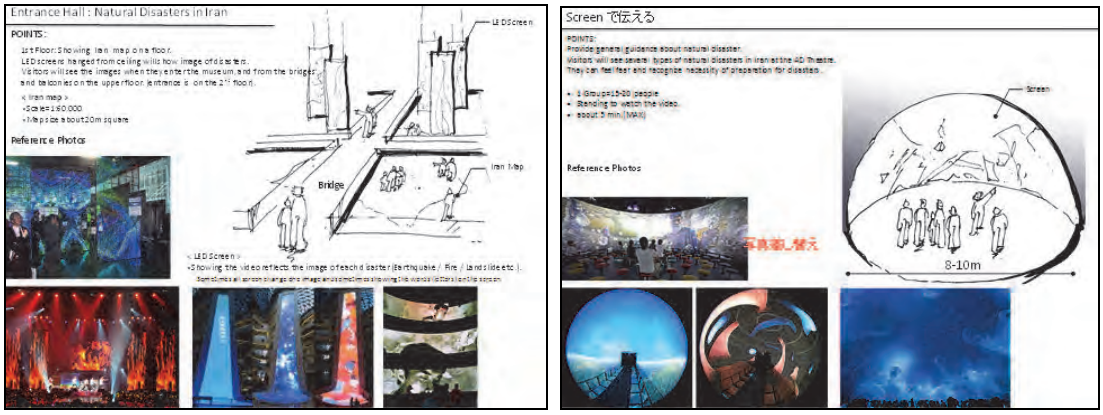


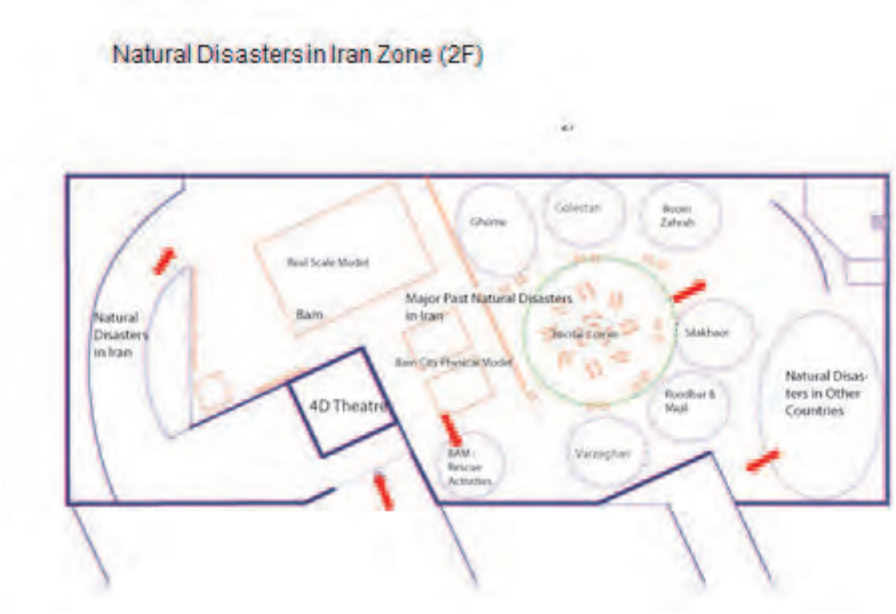
Figure 2.3.15 Rendering of Entrance Hall and 4D theatre

b) Natural Disasters in Iran

This section will start with a 4D theater of major natural disasters, and will include historical information on natural disasters in Iran, major natural disasters in Iran, victims' voices, and natural disasters in the world.

The historical part will be in the form of a corridor with some panels and screens installed along the route which show the history of the major disasters in Iran. Around 20 major disasters will be introduced in this part.

After an overall look over the natural disasters of Iran, the exhibit will focus on major disasters such as Bam, Varzaghan, Silakhor, Booyin Zahra, Roodbar and Manjil earthquakes and Qom and Golestan floods. The message to be delivered from each disaster has been defined.



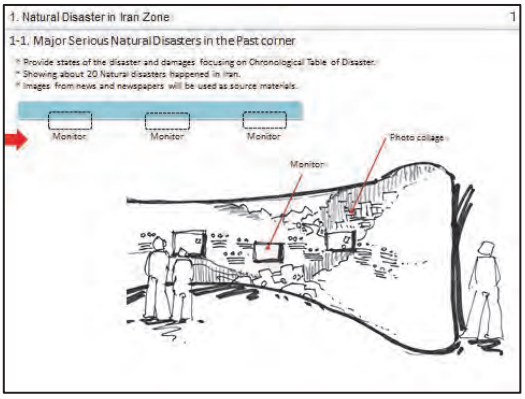


Image of exhibition for
"History of Natural Disasters in Iran"

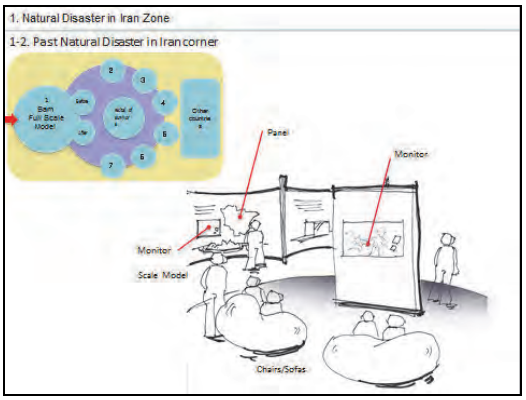


Image of exhibition for
"Major Serious Natural Disasters in the Past"

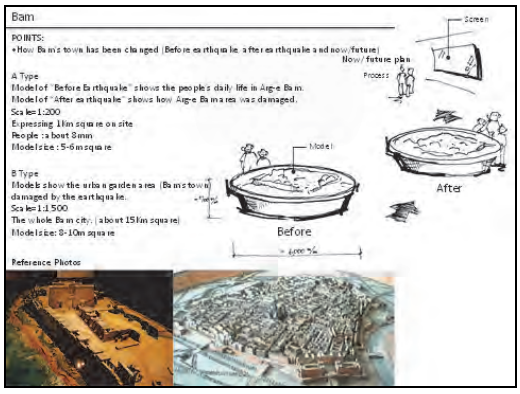


Image of model of Bam

Image of 1:1 model of damaged house

Figure 2.3.16 Image of exhibition for Natural Disasters in Iran

In this section, the survivors' memories will be introduced with the fact panels of each disaster. A 1:1 scale model of a destroyed structure, physical model of before and after the earthquake of Arg-e Bam or Bam City will be exhibited in this section.

In the part of the survivors' voice, visitors will be able to sit on benches or sofas and watch videos.

In the corner of natural disasters in the world, maps will show disasters that have occurred all over the world.

c) Scientific information section

The scientific information hall will present scientific information about earthquake mechanisms, movements and location of faults, measurement systems, liquefaction, flooding, avalanches, volcanoes, sand storms, and also the mechanisms and relations linking natural disasters (such as tsunamis and earthquakes).

In this part, the visitors will have an opportunity to do experiments about liquefaction and other disasters in a small laboratory.

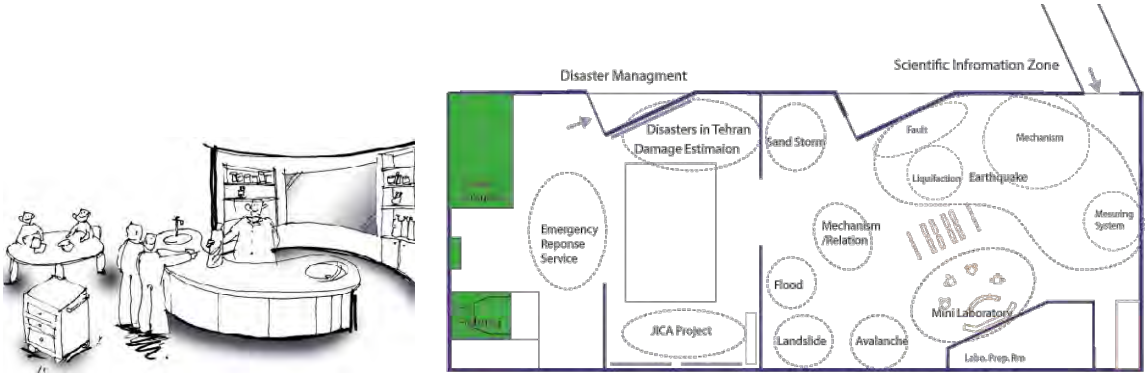


Figure 2.3.17 Rendering of Scientific information section

d) Disaster Management

The disaster management corner will start with disasters relevant to Tehran and their potential damage estimates, followed by sections to learn about disaster management measures, such as personal preparation, building reinforcement and retrofitting, disaster information systems, evacuation routes, emergency response services (Ambulance, Fire Fighting, etc.), search and rescue, shelters for evacuation, emergency necessities storage (public), disaster management bases, the role of DAVAM, and temporary evacuation housing.

A diorama model of Tehran will show the layout of the city: the location of parks, disaster management bases, emergency settlement sites, open spaces and emergency evacuation routes.

e) Trial and Experimental Corner

The Trial and Experimental section will be placed close to the Disaster Management section. This section will consist of a simulation section for earthquakes, smoke, firefighting, emergency calls, and of a first aid practice room.

Earthquake simulation will have two types of spaces:

- A corner of a house (for example kitchen), to practice non-structural retrofitting, evacuation, and so on.

- A simulator surrounded by a screen showing different situations at the time of earthquake. It is necessary for the earthquake simulator to be capable of using real earthquake records to replicate an earthquake in at least in the two dimensions and it should allow for an adjustment of the intensity of the simulated earthquake based on the visitor (children, adults, elderly, etc.).

A Children's fun corner is also important for this area. Some items from all parts of the museum which are specialized for children will be presented. Preferably, this part should be near an open space and on the ground floor so that families can meet in this area.

6) Basic Design

Because this DMM project became a priority of TDMMO and the budget for this DMM was secured, TDMMO decided to hire a consultant for the building design and exhibition design. The terms of reference for the consultant's work were prepared and the framework of the exhibition, and conceptual floor plan and circulation plan, and images of the exhibitions were included as pre-conditions for the design works.

Building design consultants were selected through a bid process from the shortlisted consultants which have experience with museum design. From among consultants, Naghshe Jahan Pars (NJP) was selected. The design works consists of two stages: the first stage is for data collection and basic design works and the second stage is for detailed design. The first stage started in June 2013, and all design works were originally planned to be completed by June of 2014.

However, after the development of alternative conceptual plans as the first phase of the first stage of work by November 2013, the design works stopped for 5 months because the selection of the preferred conceptual plan by TDMMO and approval by Tehran Mayor took time. Basic design work started again in April 2014.

The approved conceptual plan is shown in Figure 2.3.18, with an image of the fault.

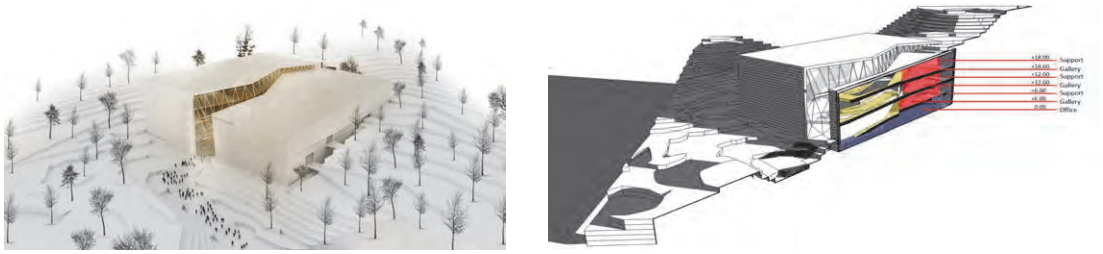


Figure 2.3.18 Conceptual plan approved by Tehran Mayors

However, due to the delay of the above mentioned issue of geological & geotechnical surveys, the design works were stopped again for 6 months, and restarted in October 2014. The result of the geological survey, which is expected to be reported in December, will be used in the structural design of the building.

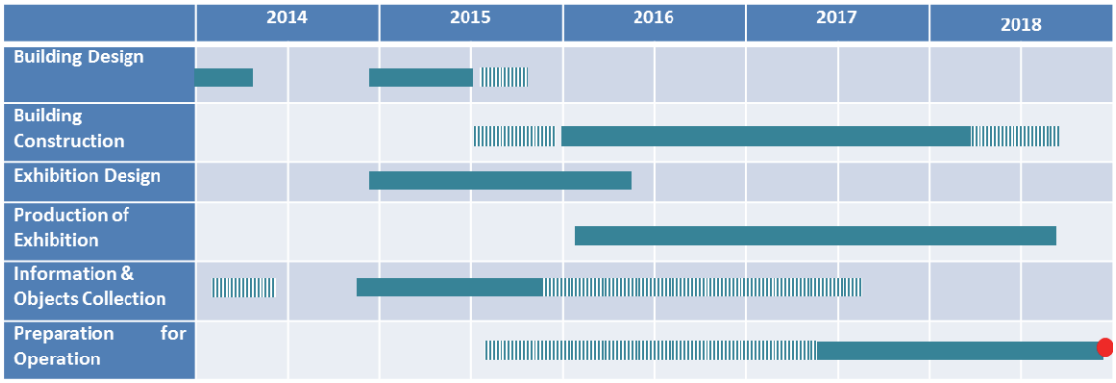
7) Database

This museum is planning to develop a database and archive of information and data related to disaster mitigation and management. The draft framework of the database design was prepared in this project, including methods of data collection, information to be registered, categories for registration, and a data sorting system.

8) Implementation Schedule

The tentative implementation schedule of this museum was prepared as shown below, with an assumption of 26 months of construction period based on the proposed schedule by the design consultants. However, this implementation schedule and construction period shall be reviewed according to the design of the building, especially after the review of the structural design according to the result of the geological and geotechnical surveys. Due to the delay of design work mentioned above, the opening of the DMM is expected to be at the end of 2018 at the earliest.

Table 2.3.10 Proposed implementation schedule for establishing of the DMM



A consultant is also planned to be hired for the exhibition work in parallel with the building design work after site issues are settled. The terms of references for the exhibition work were prepared.

The exhibition work contains several types of production works, such as film/images, physical models, graphic panels, object displays and simulators, and their design and production processes (necessary information, timing of hiring production company/manufacture) differ. The process of design and production of each exhibition method were summarized respectively, and the exhibition items were sorted by type of exhibition method. (Table 2.3.16)

9) Japan Corner

Having a Japan Corner was suggested by TDMMO, and the contents of the Japan corner were prepared as follows.

This Japan corner is planned to be a part of the “Disasters in the World” of “I. Lessons learned from Past Disasters”, and will consist of two parts: (I) sharing lessons learned from experience of great natural disasters in Japan, which is an earthquake-prone country like Iran, and (II) Japan’s support in the Disaster Management Sector in Iran.

Table 2.3.11 Contents of Japan corner

	Objectives	Items	Exhibition Methods
I. Experience of great natural disasters in Japan	Sharing lessons learned from great natural disasters in Japan. ・ Development of disaster management systems in Japan (Development of Laws/Acts, National Governmental Organizations, Local Public Organizations, Community Organizations, etc.) ・ Process of reconstruction of disaster-affected areas ・ Disaster mitigation and management preparedness by governmental organizations and communities	(1) History of natural disasters and development of disaster management systems	Chronological table Graphic Panels
		(2) Lessons learned from past great natural disasters (the Great Hanshin-Awaji Earthquake and the Great East Japan Earthquake, including introduction of reconstruction process)	Screen, Graphic Panels, Touch Panels
		(3) Recent disaster mitigation and management efforts	Graphic Panels
II. Japan's support in the Disaster Management Sector in Iran	Introduce projects and history of Japan's support in the disaster mitigation and management sector in Iran and Tehran	(1) Support projects for several activities related to disaster mitigation and management in Iran	Graphic Panels
		(2) Four projects related to disaster management of Tehran Municipality by JICA 1) Micro-zoning 2) Master plan 3) 72 hours 4) Disaster Risk Reduction	Graphic Panels

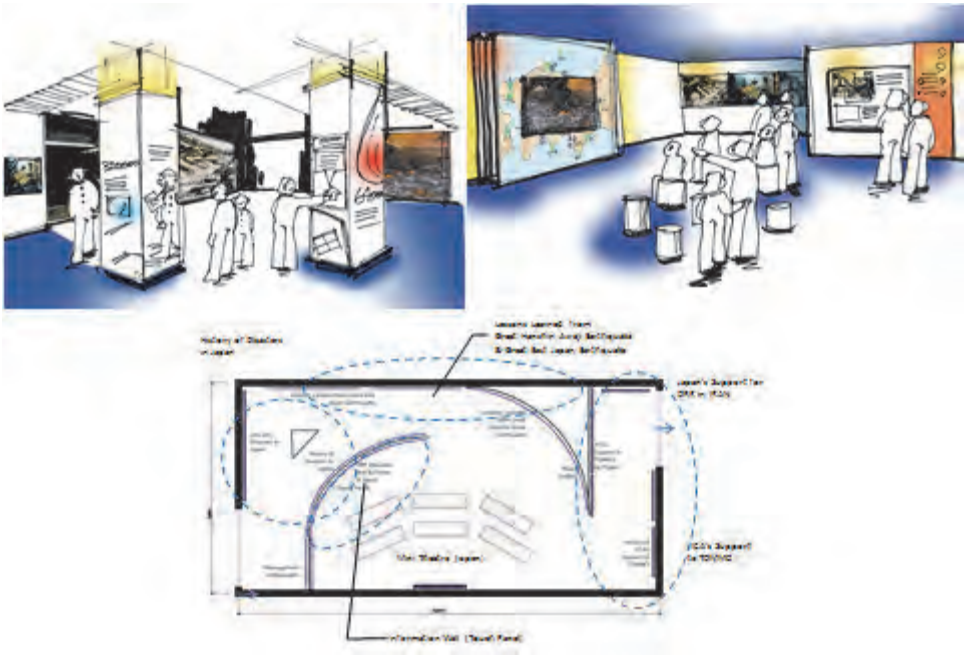


Figure 2.3.19 Exhibition image of Japan corner

Since this DMM will open in 4 years, it was agreed to only prepare an outline of the Japan corner in this project, which will be developed more and/or modified closer to the opening date of the DMM. It was agreed in the Minutes of a Meeting between the JICA Terminal Evaluation Team and TDMMO, signed on October 1st, 2014 to continue sharing information about progress of the Tehran DMM to decide the further support.

Details of contents are to be prepared according to the progress of construction work. It is necessary to select appropriate organizations which own information and materials to be exhibited and to request information/materials for Tehran DMM from those organizations. Also, it is essential to request professors/researchers to be academic supervisors for the contents.

The films/videos shown in the visited Disaster Management Centers and museums were well-received by the C/P members who attended the C/P training in Japan, and similar types of films/videos are strongly suggested to be shown in the Japan Corner. The films should show not only the serious impact of disasters, but also the mechanisms of the disasters, the situation during and after the disasters, the reconstruction process, and the lessons learned from disasters. The necessary arrangements for the rights of screen presentation, portrait rights, and showing rate (fee), should be settled for the Japanese films/videos.

Information about Japanese systems, technologies and experiences related to disaster management will be presented in the corner of each topic as well.

2.3.6 【15】To prepare a public education plan and program conducted at the disaster management museum (Activity2-6)

(1) Goals

Goals of citizens' DRR education were set as follows. As is shown in the goals, the following flow has been considered such as "acquiring disaster knowledge", "understanding risks", "understanding the importance of countermeasures", "nourishing motivation for countermeasures of DRR", and "implementing measures of DRR".

- Arousing the sensitivity of the citizens about national disasters and especially earthquakes
- Familiarizing the citizens with the concept of earthquakes and the effect of using mitigation and preparedness against earthquakes as a continuous threat, and also raising the knowledge of the target groups for encountering the post-earthquake problems
- Providing an experience for the visitors and an actual feeling about the natural disasters, especially earthquakes
- Getting lessons from the past disasters and providing a place for improving the decision making of the managers

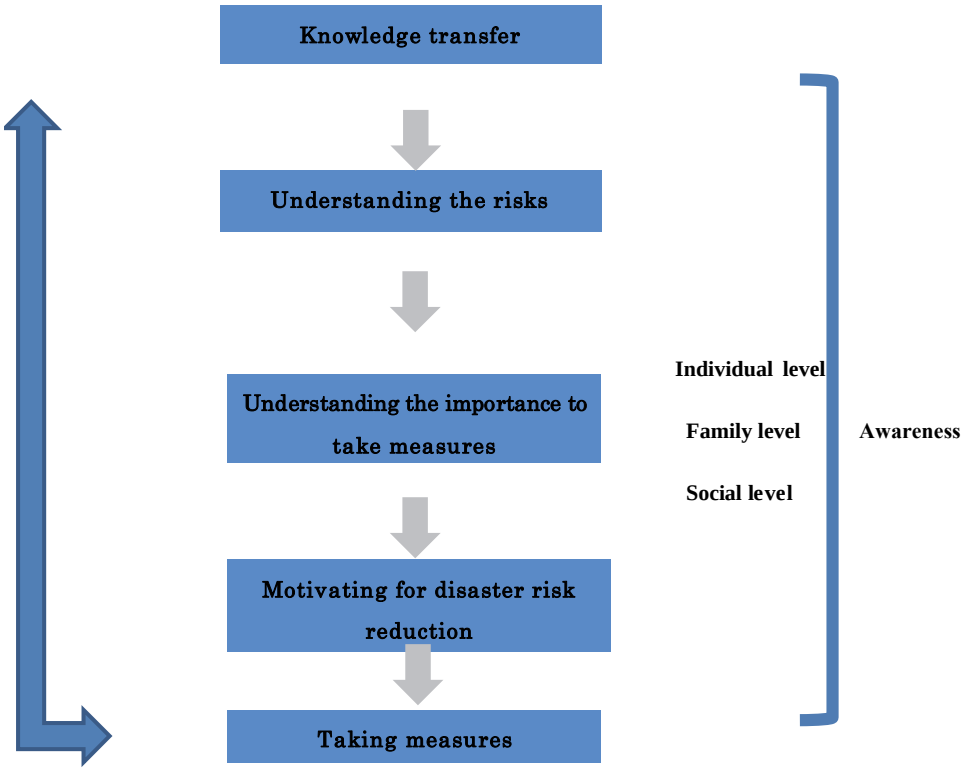


Figure 2.3.20　Concept of Citizens' DRR Education Plan

(2) Preparation of Citizens' education plan and program

The citizens' DRR education program by target groups has been prepared based on the following main components.

- Disaster experience and lessons learned in the past in Iran（including other countries' examples）
- Knowledge of earthquakes (earthquake mechanism, seismic wave propagation, ground motion, hazard and risk maps)
- Risk assessment, disaster preparedness, mitigation measures
- Appropriate actions during disasters, emergency response actions (firefighting, first aid, rescue and relief etc.)

Visitors to the DRR museum have been categorized into "General Target Groups" and "Key Groups". General Target Groups are sub-categorized by age groups such as 1) 4-6 2) 6-12, 3) 12-18 years old, 4) Adult A (education attainments are high school and below), 5) Adult B (collage and above). While Key Groups are sub-categorized into 1) Expert on DRR, and 2) others. Key Groups are basically DRR experts such as DAVAM, public officials on DRR, construction specialists, and trainers regarding DRR, who will train other groups. Special curricula will be designed based on the needs of the key groups.

As for the education plan for children, the program is designed based on the development stages. The younger the ages are, the more response actions are focused on, rather than the phenomena of disasters,

which requires a higher level of understanding. Goals by target groups are summarized in the following table, which coincides with the citizens' master plan of DRR.

Table 2.3.12 Goals by Target Groups

Target group	Goal
4-6 years old	• They can take actions to save their own lives during and after an earthquake
6-12 years old	• They can take actions to save their own lives during an earthquake • They can motivate their family members to implement preparedness measures
12-18 years old	• They acquire basic knowledge on disaster and disaster management and can carry out self-help and mutual assistance; • They carry out the measures that they can
Adult A (18 years old or older with an educational level of junior high school graduate or lower)	• They acquire basic knowledge on disaster and disaster management and can carry out self-help and mutual assistance; • They carry out the measures that they can • They participate in Davam-led community activities
Adult B (18 years old or older with an educational level of high school graduate or higher)	• They acquire adequate knowledge on disaster and disaster management and can carry out self-help and mutual assistance; • They carry out the measures that they can • They participate in Davam-led community activities • They develop the capability and awareness that allow him/her to play a central role in the community

Table 2.3.13 Education Components by Target Groups

Items / موارد	General Groups					Kea Groups	
	4-6 years old	6-12 years old	Youth (12-18 years old)	Adult A (18 years old or older with an educational level of junior high school graduate or lower)	Adult B (18 years old or older with an educational level of high school graduate or higher)	Construction Specialist (Such as, Plumbers, Welders, Engeneers, Builders)	Others
1 Natural Disasters in IRAN : Learn from the experience of past disaster **حوادث طبیعی در ایران: درس گرفتن از تجارب گذشته**							
1.1 Major Serious Natural Disasters in the Past حوادث طبیعی شدید و مهم گذشته							
1.1.1 Chronological Table of Disaster جدول ترتیب زمانی وقوع حوادث	×	✓	✓	✓	✓	✓	
1.1.2 Location, and area منطقه و محل	×	✓	✓	✓	✓	✓	
1.1.3 Area Affected منطقه تحت تاثیر	✓	✓	✓	✓	✓	✓	
1.1.4 Photographs عکسها	✓	✓	✓	✓	✓	✓	
1.1.5 No. of Death, Serious Injured Persons شمار تلفات و افراد با جراحت جدی	×	✓	✓	✓	✓	✓	
1.1.6 No. of Destroyed Houses شمار خانه های ویران شده	×	✓	✓	✓	✓	✓	
1.1.7 News Articles مقاله های خبری	×	✓	✓	✓	✓	✓	
1.2 Past Natural Disasters in IRAN زلزله های گذشته در ایران							
1.2.1 Damages by the Natural Disasters خسارات ناشی از بحران							
1.2.1(1) Bam Earthquake (Kerman) زلزله بم (کرمان)							
1.2.1(2) Varzeghan Earthquake (East Azarbayjan زلزله ورزقان (آذربایجان شرقی)							
1.2.1(3) Roodbar & Manjil Earthquake (Gilan) زلزله رودبار و منجیل (گیلان)							
1.2.1(4) Silakhor Earthquake (Lorestan) زلزله دشت سیلاخور (لرستان)							
1.2.1(5) Sistan And Balochestan Drought خشکسالی استان سیستان و بلوچستان							
1.2.1(6) Golestan Flood سیل استان گلستان							
* Photos / Images عکسها و تصاویر	✓	✓	✓	✓	✓	✓	
* Left Items / found from the damaged are اشیاء باقی مانده یا یافت شده از منطقه اسیب دیده	✓	✓	✓	✓	✓	✓	
* Reproduction of the damaged area بازسازی منطقه اسیب دیده	×	✓	✓	✓	✓	✓	
* Recital of survivors روایت های نجات یافتگان	✓	✓	✓	✓	✓	✓	
* Detailed information اطلاعات مفصل	×	×	×	×	✓	✓	
1.2.2 Experience of rescue/relief activities تجربه فعالیتهای امداد و نجات							
1.2.2(1) Bam Earthquake (Kerman) زلزله بم (کرمان)							
1.2.2(2) Varzeghan Earthquake (East Azarbayjan زلزله ورزقان (آذربایجان شرقی)							
1.2.2(3) Roodbar & Manjil Earthquake (Gilan) زلزله رودبار و منجیل (گیلان)							
1.2.2(4) Silakhor Earthquake (Lorestan) زلزله دشت سیلاخور (لرستان)							
1.2.2(5) Sistan And Balochestan Drought خشکسالی استان سیستان و بلوچستان							
1.2.2(6) Golestan Flood سیل استان گلستان							
* Person who worked for relief/rescue افرادی که در زمینه امداد و نجات کار کرده اند	✓	✓	✓	✓	✓	✓	
* Machines/equipment/instruments used f ماشینها و تجهیزاتی که برای امداد و نجات استفاده شده.	✓	✓	✓	✓	✓	✓	
* Episode of rescue team / relief activities بخشی از فعالیتهای گروه امداد و نجات	✓	✓	✓	✓	✓	✓	
* Relief activities فعالیتهای امداد	✓	✓	✓	✓	✓	✓	
1.2.3 Road to recovery from the earthquake مسیر بهبودی پس از زلزله	×	✓	✓	✓	✓	✓	
1.3 Natural Disasters in the other countries **حوادث طبیعی در دیگر کشورها**							
* Chronological Table of Disaster جدول ترتیب زمانی وقوع حوادث	×	×	✓	✓	✓	✓	
* Outline of natural disasters طرح کلی حوادث	×	✓	✓	✓	✓	✓	
* Location/Area affected محل و منطقه تحت تاثیر	✓	✓	✓	✓	✓	✓	
* Japanese Corner تجربه ژاپنی ها در زمینه نمایشگاه	×	✓	✓	✓	✓	✓	
2 Scientific Information on Natural Disasters **اطلاعات علمی درباره حوادث طبیعی**							
2.1 Earthquake زلزله							
2.1.1 * Mechanism : how the earthquake occur مکانیزم: زلزله چگونه رخ میدهد.	✓	✓	✓	✓	✓	✓	
2.1.2 * Muasuring system of the earthquake سیستم اندازه گیری بزرگی زلزله	×	✓	✓	✓	✓	✓	
2.1.3 * Fault : mechanism, location گسل: مکانیزم و محل	×	✓	✓	✓	✓	✓	
2.1.4 * Ground liquefaction روان گرایی خاک	×	✓	✓	✓	✓	✓	
2.2 Other Natural Disasters **حوادث طبیعی دیگر**							
2.2.1 Flood سیل	✓	✓	✓	✓	✓	✓	
2.2.2 Landslide رانش زمین	×	✓	✓	✓	✓	✓	
2.2.3 Avalanche بهمن	×	✓	✓	✓	✓	✓	
2.2.4 Volcano آتشفشان	×	✓	✓	✓	✓	✓	
2.2.5 Strong Wind تند باد	×	✓	✓	✓	✓	✓	
Mechanism مکانیزم	×	✓	✓	✓	✓	✓	

3 Disaster Management مدیریت بحران							
3.1 Earthquake / Natural Disaster in Tehran زلزله و حوادث طبیعی در تهران							
3.1.1 Earthquake / Natural Disaster in Tehran زلزله و حوادث طبیعی در تهران	×	✓	✓	✓	✓	✓	
3.2 Seismic Damage Estimation in Tehran برآورد خسارات ناشی از لرزه در تهران							
3.2.1 Seismic Damage Estimation in Tehran اگر حادثه رخ بدهد	×	×	✓	✓	✓	✓	
3.3 Disaster Prevention/Mitigation in Tehran مدیریت و پیشگیری از بحران در تهران							
Before Disaster قبل از وقوع بحران							
3.3.1 Personal preparation آمادگی فردی	×	✓	✓	✓	✓	✓	
3.3.2 Building reinforcement / retrofitting تقویت و مقاوم سازی ساختمان	×	✓	✓	✓	✓	✓	
If disaster will happen اگر حادثه رخ بدهد							
3.3.3 Information System سیستم اطلاعات	×	×	✓	✓	✓	✓	
3.3.4 Evacuation Route مسیر خروج	×	✓	✓	✓	✓	✓	
3.3.5 Emergency response services (Ambulance, Fire خدمات واکنش اضطراری (امبولانس، آتش نشانی و ..)	✓	✓	✓	✓	✓	✓	
3.3.6 Search and Rescue Equipment تجهیزات جستجو و نجات	×	✓	✓	✓	✓	✓	
3.3.7 Shelter for Evacuation پناهگاه تخلیه	×	✓	✓	✓	✓	✓	
3.3.8 Center(Base for Disaster Management مرکز (پایگاه) مدیریت بحران	×	✓	✓	✓	✓	✓	
3.3.9 Stock for emergency case (public) ذخیره برای مواقع اضطراری (عمومی و فردی)	×	✓	✓	✓	✓	✓	
3.3.10 Temporary houses خانه های موقت	×	✓	✓	✓	✓	✓	
JICA Project پروژه جایکا	×	✓	✓	✓	✓	✓	
4 Trial / Experiences تجربه و آموزش							
4.1 Earthquake زلزله							
* Earthquake Simulation شبیه سازی زلزله	×	✓	✓	✓	✓	✓	
	×	✓	✓	✓	✓	✓	
	×	✓	✓	✓	✓	×	
4.2 Fire آتش							
* Smoke simulation شبیه سازی دود	×	✓	✓	✓	✓	✓	
* Training of fire fighting آموزش آتش نشانی	×	✓	✓	✓	✓	✓	
* How to use the public fire distinguissure چگونه از آتش خاموش کن های عمومی استفاده شود	×	✓	✓	✓	✓	✓	
4.3 Emergency Call / Announcement تماس اضطراری و اطلاع رسانی							
* How to make a emergency call چگونگی برقراری تماس اضطراری	×	✓	✓	✓	✓	✓	
4.4 First Aid Training آموزش							
First Aid Training آموزش کمکهای اولیه	×	×	✓	✓	✓	✓	
4.5 Workshop کارگاه							
Disaster Management مدیریت بحران	×	×	✓	✓	✓	✓	
Maquette making ماکت سازی	×	✓	×	×	×	×	
Emergency evacuation and sheltering تخلیه اضطراری و اسکان	×	×	✓	✓	✓	✓	
Utilization of Search and rescue بهره برداری از تجهیزات جستجو و نجات	×	×	×	×	×	×	
Painting/drawing نقاشی	✓	✓	×	×	×	×	
Structural retrofitting مقاوم سازی سازه ای	×	✓	✓	✓	✓	✓	
Non-structural reinforcement مقاوم سازی غیر سازه ای	×	✓	✓	✓	✓	✓	

The necessity of information collection has been explained at an early stage of the project by introducing the case of the Disaster Reduction and Human Renovation Institution, based in Kobe Japan.

The necessity and importance of collecting information/materials related to the past disasters has been explained at the early stage of the project by introducing case of The Great Hanshin Awaji Earthquake Memorial Disaster Reduction and Human Renovation Institution, based in Kobe Japan, by JET as well as the Advisory Committee member. Information on the past disasters including materials which show the damages and real voice / episode of the victims are helpful to know about disasters and learn how to prepare for disasters, and effective for exhibitions.

The contents and sources of the displays in the DRR museum which originated in Iran will have strong impacts, if the materials are related to their own countries. That can raise more attentions as each individual's issues. The culture of handing over such knowledges will also create the culture

of disaster risk reduction. Thus, they need to be collected in Iran. Such contents can be the main attractive DRR education components in the museum. The examples of materials to be collected have been introduced. They are fork lore, disaster situations, actual responses, lessons, experience, and visual materials etc. Folklore are regarding local disasters, indigenous knowledge for disaster risk reduction, tips for mutual assistance, lessons learned. Disaster situations are that of infrastructure such as gas, water, sewage, roads, bridges, train, airports. Actual responses include opening of evacuation sites, assistance at evacuation sites, contents of assistance at evacuation sites, issues, impressive activities etc. Experience includes what is required for preparation before and after the disasters, what has been improved after experiencing disasters, what should be told to others, useful knowledge and tips for disaster risk reduction, and ideal efficient system to exist.

2.3.7【16】Prepare an operation and management plan for the Disaster Management Museum (Activity2-7)

Opening of the DMM will be at the end of 2018 at the earliest. Only the initial framework plan of the Operation and Management of the DMM was studied in this project. The necessary work items and schedule in the preparation stage were prepared. Surveys and interviews at other Museums in Tehran were conducted as reference for this work.

(1) Formulation of Mission, Goals, Objectives and Function of the Tehran Disaster Management Museum

Formulation of a clear mission statement and objectives which will be the basis of preparation work and operation and management of the DMM in the future, are the most important tasks of the operation and management planning at this stage.

As shown in the following conceptual diagram, the museum's functions, scope of operation and activities, and management plan will be developed in accordance with the set mission and objectives. Building and exhibition plans will be developed accordingly. （see Chapter 2.3.5）

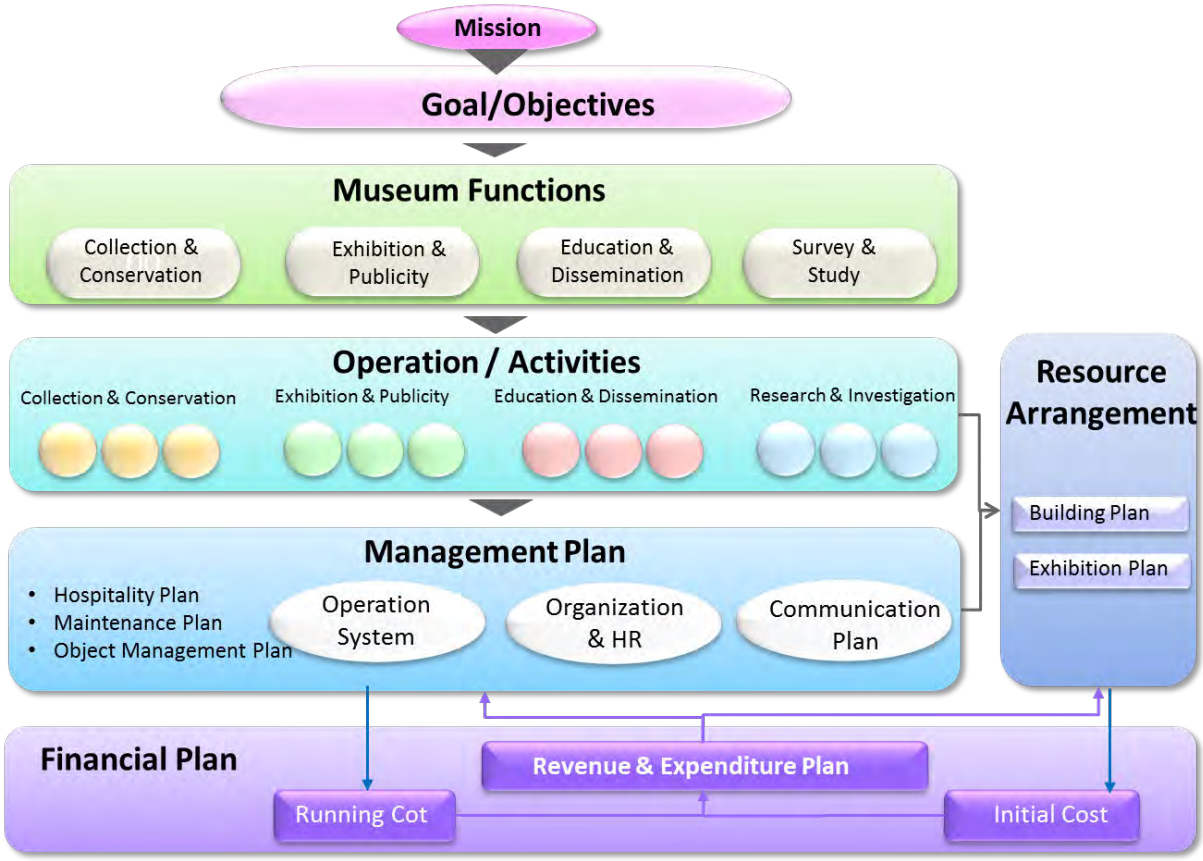


Figure 2.3.21 Conceptual diagram of museum planning

(2) Establishment of the DMM Preparation Office and Advisory Committees

Several kinds of preparation works are required to establish the disaster management museum, such as preparation of the museum's function and activity plan of each function, exhibition plan, exhibition contents, operation plan, building design and supervision of construction work, staffing and staff training, advertisements, and so on. In order to handle these complicated works, it is necessary to establish a preparation office in the preparation stage. Though the C/P for the Museum work was only from staff of the Technical and Civil Engineering Department (now it is a section under the Mitigation and Risk Reduction Department), it was expanded and included staff from other two departments, and the DMM Preparation Team was formulated after few months.

This DMM preparation consists of staff from three former departments of TDMMO: the Technical and Civil Engineering Department, Mitigation and Risk Reduction Department, and Education and Public Participation Department (currently two departments "Education and Public Participation" and "Mitigation and Risk Reduction"). This team arrangement made it possible to prepare the exhibition framework in a cross-sectional way.

For the smooth preparation of DMM, it is recommended to establish a DMM Preparation Office, and officially appoint the members of this office. The C/Ps' DMM preparation team will be core members, and persons from TDMMO's other departments, such as budget and accounting office, public relations dept., IT dept. etc. are also required to be members of this office.

In addition, the following two advisory committees are also proposed to be established for supporting the preparation of Museum Contents:

(1) Academic Committee: committee of professors and researchers from universities and research institutions. This committee will give advice for preparation of the exhibition contents plan and editorial supervision of contents production.

(2) Disaster Management Professional Committees: organizations related to the disaster management activities, such as the Firefighting organization, MES and Red Crescent, etc. This committee will provide advice for exhibitions related to their activities, mainly for the exhibitions of I. Natural Disasters in the Past and III. Disaster Management Measures.

These offices and committees are recommended to be established as soon as possible.

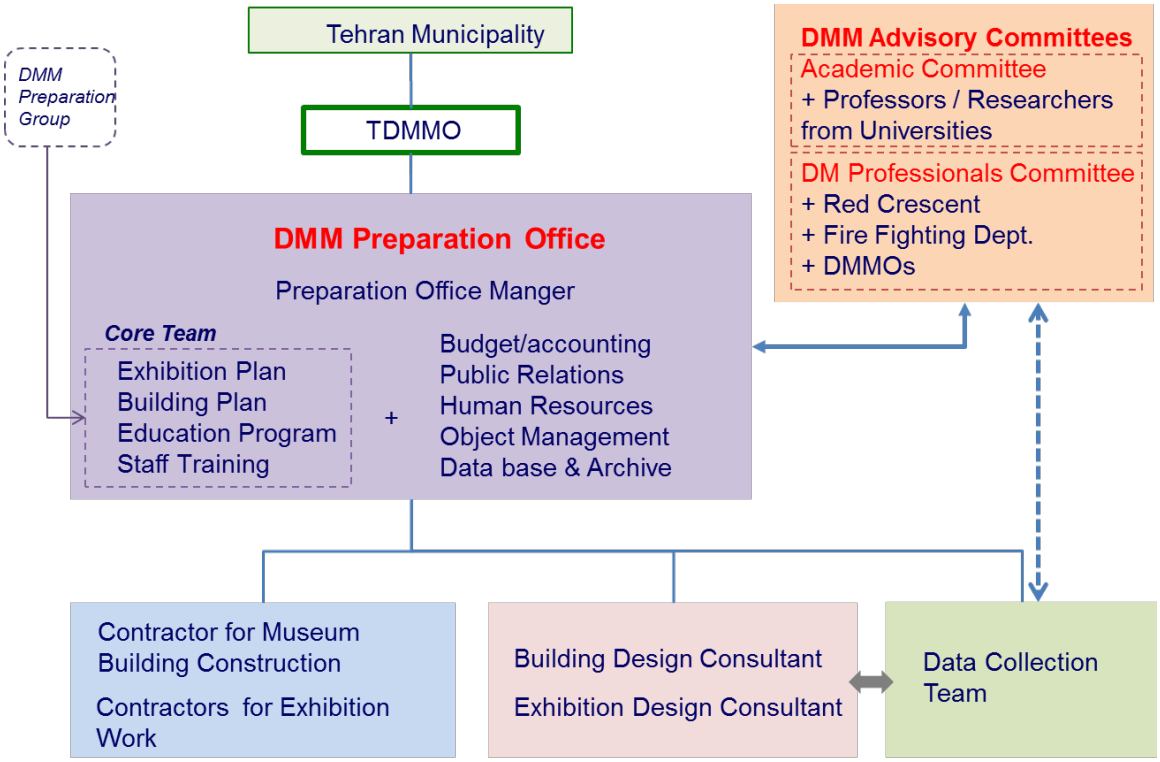


Figure 2.3.22 Proposed Organization for the Preparation Stage

(3) Organization of the Tehran DMM

It was decided by Tehran Municipality that the Tehran DMM will be operated directly under the president of TDMMO. The Figure below shows the proposed organization of the Tehran DMM (draft). This DMM will be supported by each department of TDMMO, and TDMMO staff who hold an additional positon in DMM and proper staff hired for the DMM. It will be desirable that the above mentioned preparation office members will be in charge of each department and section continuously.

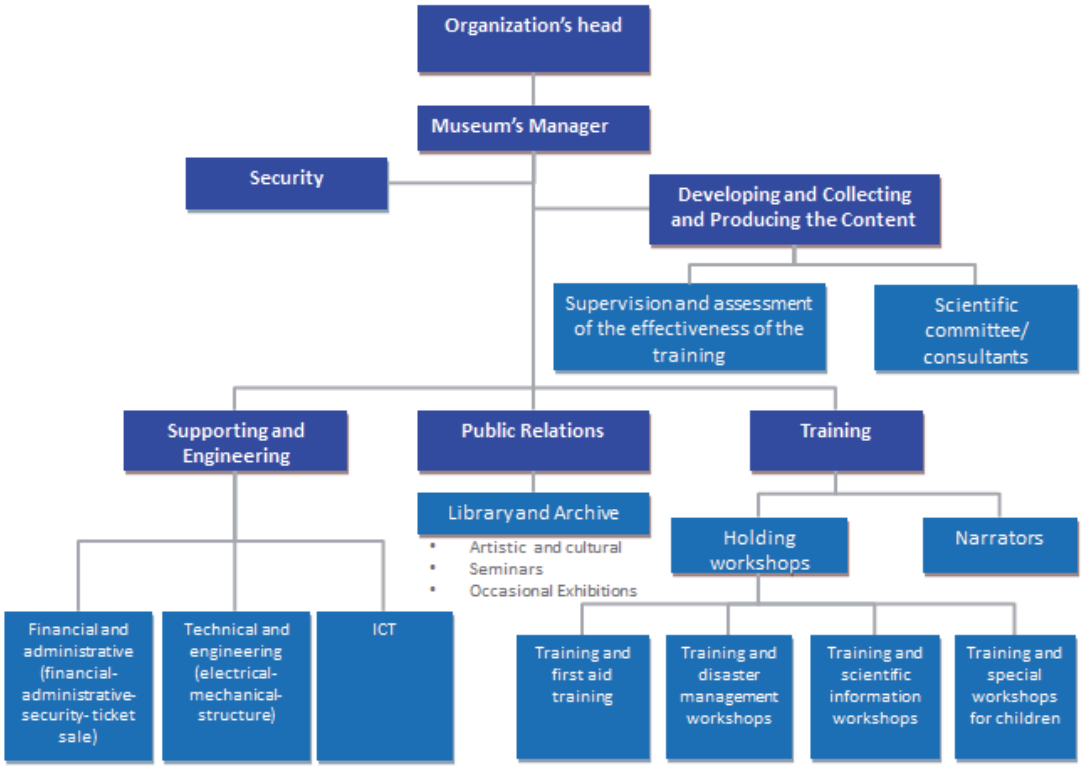


Figure 2.3.23 Proposed Organization for the Tehran Disaster Management Museum (Draft)

In parallel, the job description of each position was also drafted. These documents will be developed more in accordance with the further modification of the organization. For example, when details of the operation plan and exhibition plan are developed, sections / groups for each exhibition zone shall be set up within the Department of Developing and Collecting and Producing the Content department, and responsibility and role of each section/group shall also be defined accordingly.

(4) Human Resource Planning

Though the above proposed organization and number of staff has not been officially decided yet, the schedule of human resource plan until opening of the Museum is planned as follows.

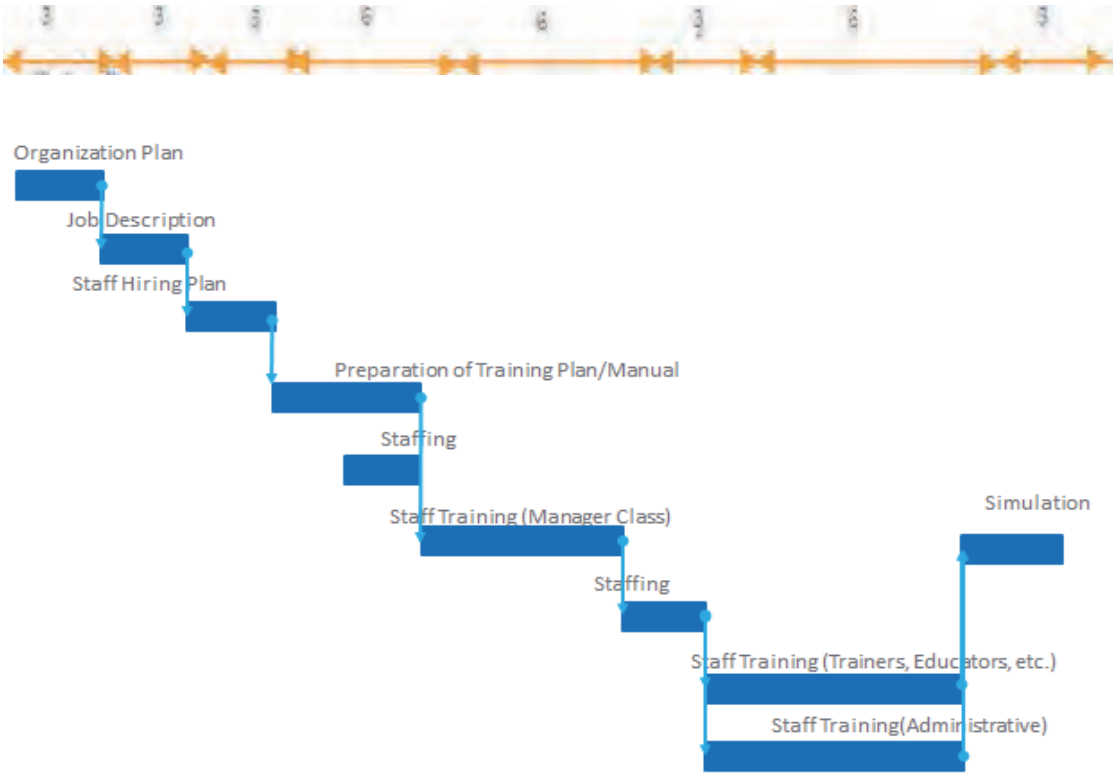


Figure 2.3.24 Schedule of Human Resource Plan

It is necessary to ensure that the museum is operated by capable staff members that have gone through adequate training in advance. It is also important that such training is carried out in the museum before opening of the DMM.

The plan for staff training is prepared by topics and by type of staff. It is also planned to ask for support for training from the related organizations such as the Culture and Heritage Institution, firefighting Organization, etc.

Table 2.3.14 Contents of training by type of staff and themes

Category	Course	Manager & Head of Deputy	Section Chief	Section Staff (by section)
Management	Management Principles of DMM	◎	○	○
	Operation Policy and Social Responsibility of DMM	◎	○	○
	TDMMO's Policy & Activities	◎	◎	○
Public Relations	Strategy for Public Relations and Promotion	◎	◎	○
	Linkage with media	◎	◎	△
	Museum goods and goods for DRR	○	○	○
DRR Education Program	Principle of DRR Eeducation	◎	○	△
	Exhibition and event planning	△	◎	○
	Exhibition guide and event management	△	◎	◎
Communication / Hospitality	Effective Communication incl. people's Perception of DRR	△	○	○
	Foreign Languages	△	△	◎
	Ethical Legal and Regulatory Aspects	◎	◎	○
	Quality Control of Services for Visitors	◎	◎	○
	Information System/Audio Visuals in the Museum	○	◎	◎
	Amenity Management	△	◎	○
Documents/ Objects Control	Collection, registration and storage of DATA/Objects in Museum	○	◎	○
	Digitization technology of materials (2D, 3D)	△	○	◎

(5) Plan for collaboration with other related organizations

For the preparation of exhibitions and operation of the Tehran DMM, TDMMO is going to ask for support from other organizations related to the disaster management activities, such as the Firefighting organization, Red Crescent, etc. Organizations to which TDMMO is planning to ask for their support are the following.

Table 2.3.15 Organizations which will be asked for support for Tehran DMM

	Preparation Stage	Training Stage	Operation Stage
Firefighting Organization	Exhibition related to the activities of the Firefighting Organization in a disaster	Methods to teach/train how to use fire extinguishers	Retired staff for the Firefighting training
Traffic Police	Exhibition related to the traffic police's activities in a disaster	-	-
Red Crescent	Exhibition related to the RC activities in a disaster	Methods to teach First Aid	Retired staff for the First Aid training
EMS	Exhibition related to the EMS activities a disaster	Methods to teach First Aid	Retired staff for the First Aid training
Institute of Cultural Heritage	Data Registration	Curatorship Data Registration	-
DMMOs (area affected by disasters)	Exhibition of past disasters in Iran	-	-

(6) Financial Plan

Because of its nature the Tehran DMM will be operated by the Tehran Municipality's budget. Similar to the other museums in IRAN and other countries, it is planned to charge a small entrance fee to the visitors to emphasize the importance of this museum.

At the same time, some exceptions are also planned: free for the children under 7 years old, seniors over 70 years old and half price for students and government staff.

In addition, with consideration of sustainable operation and flexibility of the activities by having some of its own income, a restaurant and café, shops, and event spaces are planned to be income sources.

(7) Visitor management

Three types of visitor management are considered: 1) group visitors, 2) visitors with a guide, and 3) free visitors (such as repeaters). Individual visitors will choose a tour with a guide or a free visit at the entrance.

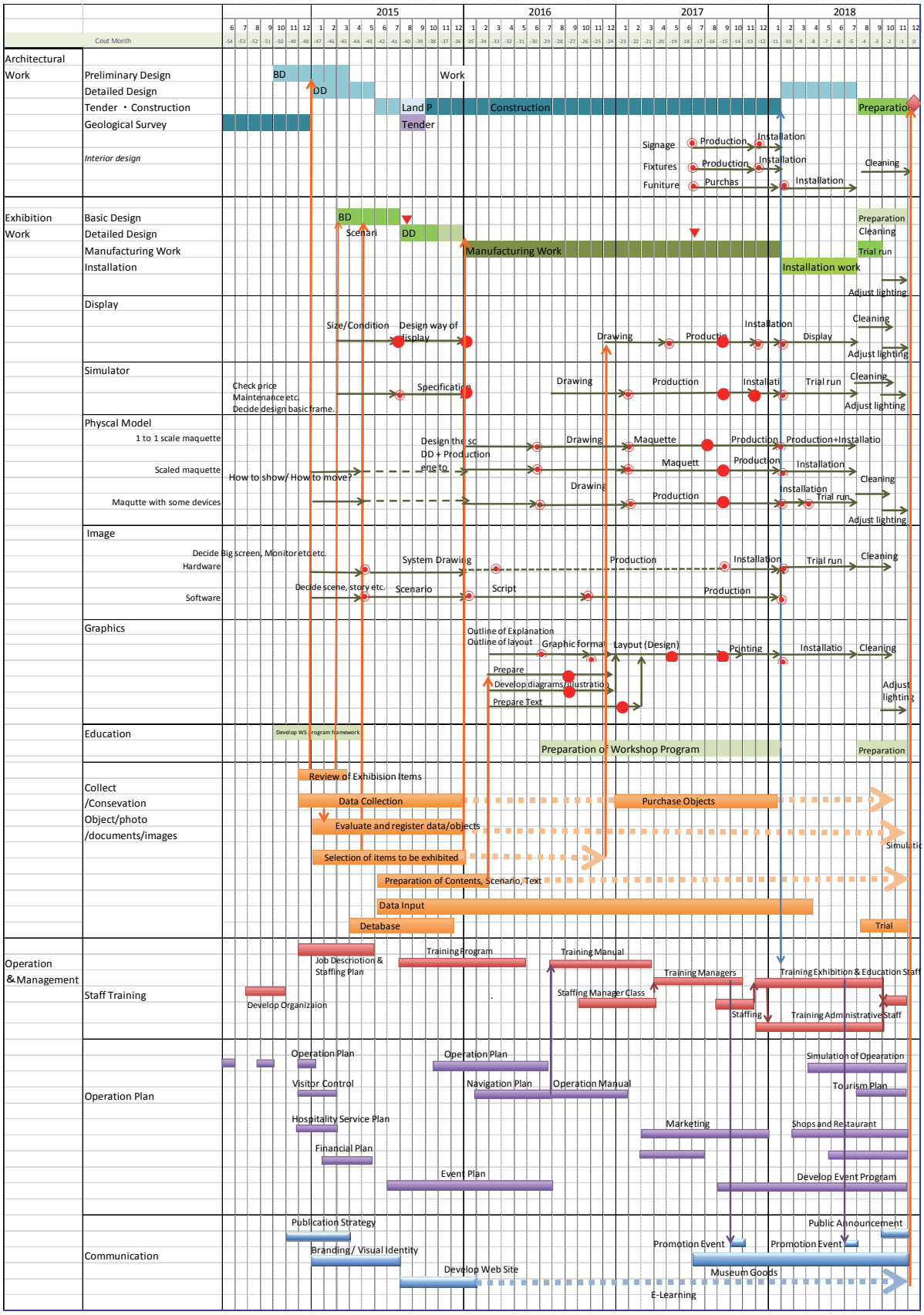
The main visitors in the weekdays will be group visitors, such as school pupils and students, government staff, private companies, and DAVAM groups, and it will be planned for each day of the week. Advanced booking will be required for group visits.

This visitor's management plan is the base for the floor plan and exhibition plan.

In addition, the other topics such as publication plan, amenity plan, and maintenance plan were also to be included in the operation and management plan of Tehran DMM.

In this stage, the overall schedule has been prepared as shown in the table below. These works shall be prepared in parallel with the construction of the building and exhibitions, and each plan should be coordinated with the others.

Table 2.3.16 Overall Implementation Schedule (Draft. As of Dec.2014)



Source: JET
Note: Draft schedule prepared in December 2015.

2.3.8【17】To hold workshops on the community-based disaster management (Activity2-8)

(1) Outlines

Seminars, workshops, and training are conducted on the following topics during special occasions and mostly during regular meetings with C/Ps.

【Seminars】
- Case study of DRR museum and Importance of 1st Hand References collected from the personal interviews and site reconnaissance of the damage areas such as records of disasters, damage situations, experience of victims and citizens
- Analysis of Disaster Awareness of Tehran Citizens

【Workshops】
- Reviewing Master Plans and case studies on various Japanese Master Plans on DRR Education Plans
- Considering curricula and case studies of DRR education / Policy on revising concepts and curricula
- Considering mode of delivery of DRR education
- Introducing active learning tools
- Considering scenario of TV programs
- Guidelines for preparing scenario, conducting drills, and method of evaluation
- Collecting data, lessons learned, Victims' voices of the past earthquake disasters in Iran
- Japanese cases of DRR surveys and suggestions for utilizing results
- Roles of media

【Training】
- Methodology of using active learning tools developed in this project
- Japanese card games
- Disaster education concepts for DRR museum
- Operation and management plan

Results of disaster awareness survey have been shared at seminars among TDMMO staffs, other relevant departments of the municipality, relevant public organizations, universities, academic institutes, and NGOs.

(2) Conducting Seminars and Workshops

In this project, C/Ps themselves conducted actual activities and took the responsibilities. The Japanese experts provided relevant information such as Japanese experiences. Based on that information, C/Ps have worked on relevant activities by themselves. Regular meetings have been conducted in the form of workshops on different types of topics through discussions. Specific presentations and discussions were requested by C/Ps during the process such as the role of media, awareness survey in Japan, etc., which are relevant to their own interests and their on-going other tasks. The C/Ps are quick learners and made great endeavors in accomplishing their own tasks. The C/Ps have digested what they have discussed and could apply in the ground the reality of Tehran, judging by their own experience. Eventually, the quality of output of the products has turned out to be higher than expected at the beginning of the project.

Seminar on social survey has been conducted, presenting the good results of correlating variables which lead to taking measures for disaster management. Participants were representatives of the different departments of the municipalities such as planning, social welfare, fire, disaster managers of each district, academic institutes such as universities and IIEES, and NGOs focusing on disaster risk reduction and humanitarian organizations. At the seminar, methodology for

disaster education has been discussed, various opinions were exchanged. Active learning materials have been introduced, and participants have shown interests and encouraged discussion among those who has experience of training citizens.

Table 2.3.17 Outlines of Seminars, Workshops and Training

Types	Titles	Dates
Seminar	Seminar on Exhibitions and Issues of Maintenance of DRR Museums	3.2.2013
	Seminar on Social Survey Results	4.12.2013
Workshop	Reviewing Master Plans and case studies on various Japanese Master Plans on DRR Education Plans	20.11.2012
	Considering curricula and case studies of DRR education Policy on revising concepts and curricula	30.10.2012 4.11.2012 7.11.2012 11.11.2012 12.11.2012 14.11.2012 27.01.2013 30.01.2013 6.2.2013 16.2.2013
	Considering mode of delivery of DRR education	4.2.2013 1.9.2013
	Active learning tools	1.9.2013 23.11.2013 21.1.2014
	Considering scenario of TV programs	2.12.2013 9.12.2013
	Considering guidelines for preparing scenario, conducting drills, and method of evaluation	26.11.2013 27.1.2014
	Collecting data, lessons learned, Victims' voices of the past earthquake disasters in Iran	12.2.2013 18.2.2013
	Japanese cases of DRR survey and suggestions for utilizing results	3.12. 2013
	Roles of Media	2.9.2013
	Preparing Cross Road Games through lessons learned of the past disasters	2.2.2015 8.2.2015
Training	Training on methodology of using active learning tools developed in this project	22.11.2014 25.11.2014
	Introducing Japanese card games	15.12.2014
	Training on disaster education concepts for DRR museum	17.2.2015
	Operation and management plan	17.2.2015

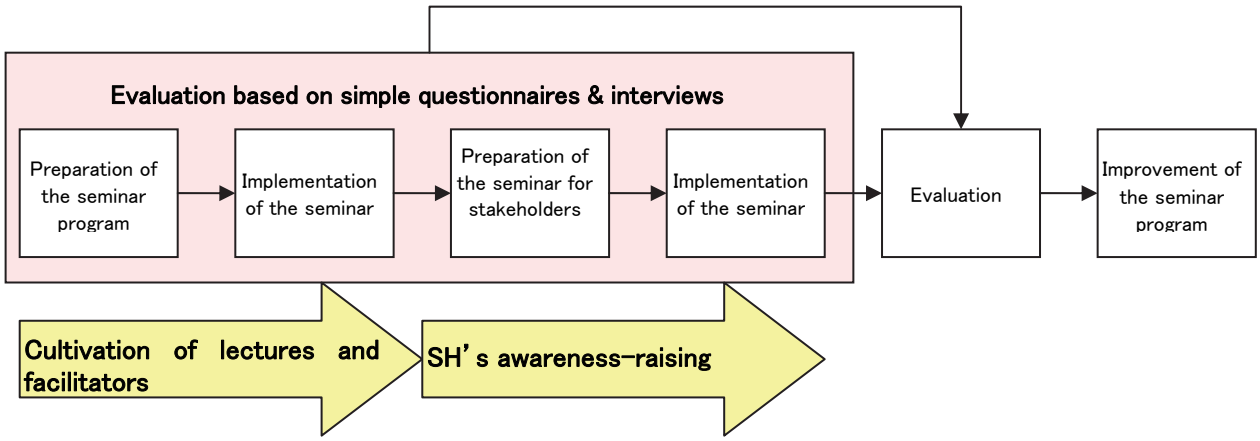


Figure 2.3.25 Framework of the Community-based Disaster Management

The "1st Festival of A Prepared City, Hello Resilient Tehran" has been conducted at Milad Tower (one of the most attractive places in Tehran) on 18th - 23rd October, 2014. About a thousand people including school teachers, students, DAVAM groups, and the general public participated. Prior to this event, C/Ps have given training to school teachers, students, DRR trainers, DAVAM, district DRR experts etc. using training tools which have been newly developed in the project.

Figure 2.3.26 The 1st Festival of A Prepared City, Hello Resilient Tehran

2.3.9 【18】To conduct emergency evacuation drills in designated Mahalle (Activity2-9)

(1) Outlines

- Overall outlines are shared among TDMMO, district, nahiye, mahalle, and NGO
- Choose mahalle where emergency evacuation drills are to be conducted（Ozgol Mahalle, district 1）
- Confirm evacuation routes and evacuation places
- Identify tasks of citizens, DAVAM, local organizations, public authorities and male and female roles.
- Identify necessary equipment in the community
- Based on the above activities, evacuation drills have been conducted and activity reports prepared
- Drills have been evaluated, based on the evaluation sheets and questionnaire feedback has been incorporated in the guidelines
- Based on the reviews and feedback, 2nd drills were conducted in district 9

(2) Emergency escape drills conducted

According to the TDMMO, the city of Tehran holds several types of practical escape drills – some meant for administrators engaged in disaster prevention, some others for general citizens, yet others for administration employees and part of the citizenry. Those drills designed for citizens are modeled after the fire drills without a scenario held for Mahales as part of a JICA project. Also, drills involving relevant organizations have been conducted as well, such as fire stations, Red Crescent Societies, the Traffic Police, the Religious Police, neighborhood schools, etc. In total,

since 2008, such drills have been held within five Mahales. Those drills, however, require a great deal of preparation and budget, since each of them involves several hundreds to a thousand participants, which means some traffic control as well as involvement of the Traffic and Religious Police are needed.

While those major drills are necessary, without doubt, some awareness surveys have found that many citizens are unaware of what to do in case of a disaster. Thus, multiple practical drills should be held for the citizenry, so they can learn, in ordinary times, what they should do in case a disaster hits, shortly after that, and several hours after, etc., in the chronological order. Also, they need to learn where the local evacuation places are and what they can expect to have and what roles they are expected to play in such places. Citizens need to experience such drills over and over again, until they are accustomed to them. For this reason, Mahales should take the initiative in organizing a system to hold local drills with more ease and frequency, so that residents below Mahale levels, such as streets, can have such drills. In this system, participants can utilize Mahale houses and other places for their activities, while District Offices, NGOs, and local organizations assist their Mahales.

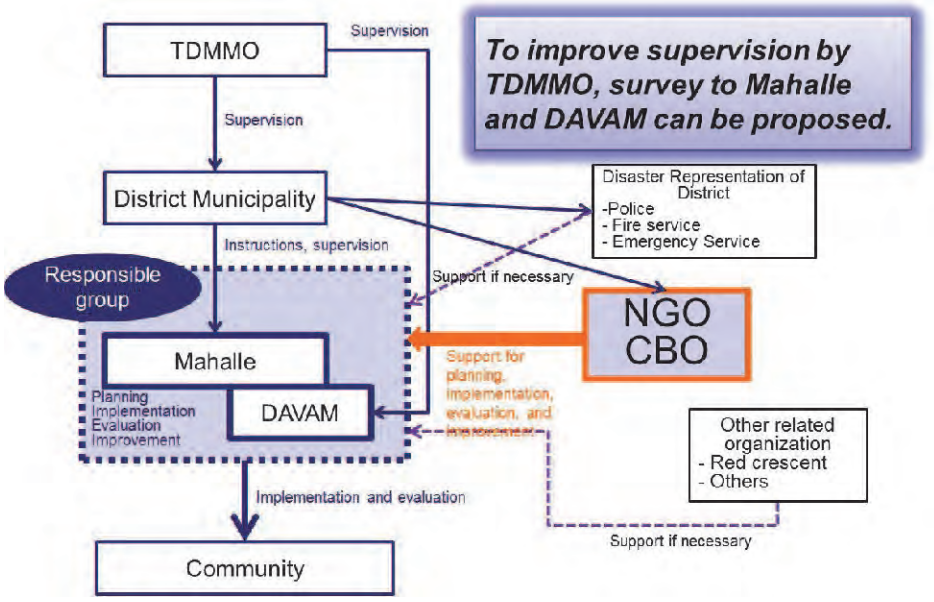


Figure 2.3.27 Structure of Implementing Drills in Mahalle

In such a new system, we have conducted pilot emergency drills in two districts whose social conditions are quite different from each other, and verified the emergency drill system. Thus guidelines have been prepared for having a drill, so the residents themselves can also organize such drills. The guideline contains some elements of fun as well, so citizens will be eager to continue to have such drills. The organizing system is resident-oriented, with NGOs and local organizations expected to play major roles. Since evaluation for improvement is the main purpose of conducting drills, checklists are also prepared, with which evaluators can answer the questions contained in it and identify what to improve.

The first one of the drills held in this new system took place in District 1, which is known for its high economic and social status. The drill was organized by Iran Rescue House, a DRR NGO that trains DAVAM and builds up a database of local buildings on commission from the TDMMO and the District Office, in collaboration with the District Office, the relevant Nahie and Mahale.

Together, they helped DAVAM and relevant residents, communicated with the relevant authorities and coordinated activities, prepared the scenario, made the preparations for the drill, and held rehearsals. Then, they held the drill. Also, in preparing the guidelines for having a drill, TDMMO, after learning from the advice such as current issues, future direction for improvements, what should be included in the guidelines of experts, created a draft. Then, we refined the items contained in the guidelines through learning from what actually took place in the preparations for the drill. The first drill's training results have resulted in the suggestions for improvement listed below.

■Proposals for Improvement

- Correcting the views on holding drills with special subjects
  - The drill is a measure for assessing the capabilities and identifying the strong and weak points
  - Perfection is not the ultimate goals and shortcomings for improvements need to be identified
- DAVAM groups need more professional training and need to enhance their knowledge and awareness regarding the disasters and role of DAVAM
- There is a need for training regarding disasters and empowerment of managers and municipality staff in different levels and different positions
- There is a need for designing an ICS system for all the management levels of a municipality and implementing them for the purpose of higher preparedness and coordination
- There is a need for more accurate definition of roles and expectations from the DAVAM members before, during and after the disasters regarding the skills and situation of the members and Mahalles
- Implementation of the main activities of the drill should be by DAVAM members who should also aid in establishing the self-confidence of the volunteers of this Mahalle
- Better communication and familiarity of DAVAM members and other Mahalles should be pursued
- Reinforcing the structure and better empowerment of the DAVAM members who were participating in the drill should be pursued
- Achieving an experience and guiding the DAVAM members to get closer to what is expected from them should be pursued
- Practicing the activities, coordination's, decision making and disaster management by the participants of the drill should be pursued
- Massive announcement and creating the participation spirit all over the mahalle should be pursued
- Arousing the sense of need for improvement of the activities in other mahalles should be pursued

The second drill's training results have presented to us the improvement suggestions and evaluations listed below. Both drills' results reveal one common problem to solve –the appropriate amounts of roles need to be allocated to the DAVAM members. Based on the lessons learned from the practice, the DAVAM members should consider how better to respond to local situations, in the coming months.

■Proposals for Improvements

- Allocate more time for preparation of conducting drills
- Provide more awareness raising on citizens' responsibilities, community tasks, and activities
- Allocate appropriate time for paintings of fake injuries
- Re-adjust unbalancing tasks among DAVAM members

■Advantages

- Attendance of many mahalle residents (more than 600)
- Attendance of Shorayari and mahalle managers
- All the planning and coordination were locally done among mahalle, DAVAM house, and shorayari
- Provided interesting education contents and training for community members

Furthermore, Drill Guidelines are prepared in the process shown in the following figure.

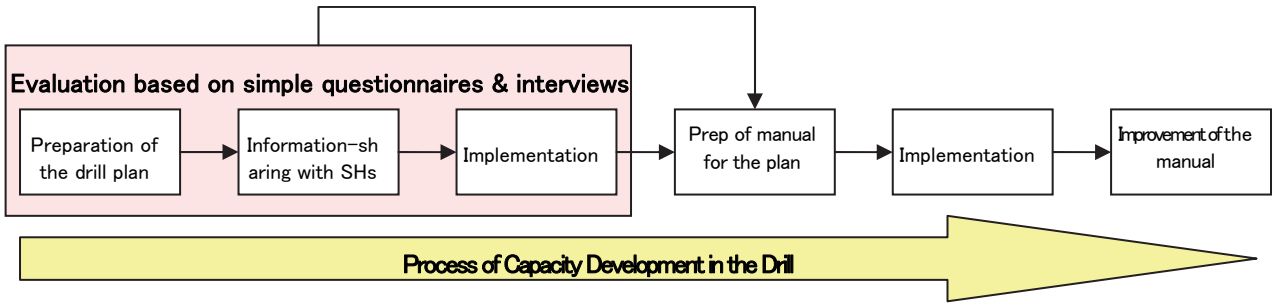


Figure 2.3.28 Planning and Implementation Process of Disaster Drills

Drill guidelines are structured as shown in Table 2.3.18. In the process of preparation, discussions were held among C/Ps and the expert team on the contents, and after the table of contents was agreed, sections are written by the C/Ps. In the actual implementation process of planning and evaluation of the drills, the guidelines are used for local stakeholders and user's feedback is incorporated into the guidelines for better understanding.

Table 2.3.18 Structure of Guidelines

Chapters	Title	Contents
1st	Concept	Introduction Application Terminology Purpose of guidelines
2nd	Planning and Program	Drill scenario Stakeholders and task allocation Training plan for DAVAM members Information dissemination plan at mahalle level Deciding necessary activities Preparation of task allocation table
3rd	Conducting Drills	Stages of emergency evacuation Safe emergency evacuation process Conducting competition games within the drills
4th	Evaluation	Evaluation Process
Appendix		Example of scenarios Example of tasks of stakeholders Registration form for evacuees Publicity materials for encouraging participation in the evacuation drills Appropriate actions during an emergency Table of task allocation during an emergency Explanation of DRR competition games Drill evaluation form

2.4. Output3

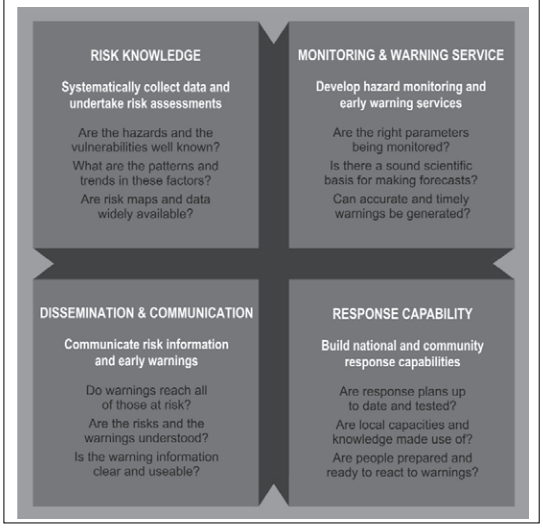
2.4.1【19】To prepare an improvement plan on early warning including the QD&LE system (Activity3-1)

(1) Outline

TDMMO installed 10 seismic stations for strong motion observation in Tehran and established a strong motion earthquake observation network through a previous JICA project named “Establishment of Emergency Response Plan for the First 72 hours after an earthquake". QD&LE system, which estimates damage and loss of buildings and citizens within a few minutes after earthquake, has been developed, too. This activity creates an overall plan to improve the early warning system, reflecting outputs from other activities, with existing QD&LE system and the strong motion observation network creating input data for the system. "The early warning system" in this section is defined as not only the Japanese emergency earthquake warning system, but also any disaster information system for an early stage of an earthquake disaster.

Firstly, the definition of "Early Warning" should be clear. According to the International Strategy for Disaster Reduction (ISDR), "Early Warning" is defined as "The provision of timely and effective information, through identified institutions, that allows individuals exposed to hazard to take action to avoid or reduce their risk and prepare for effective response. They also say, a complete and effective early warning system comprises four inter-related elements: (1) risk knowledge, (2) monitoring and warning service, (3) dissemination and communication and (4) response capability. In this project, activities 3-2, 3-3, 3-5, 3-6 are related to (2), 3-4, 3-7, 3-8 are (3), and part of 3-1 and 3-8 are (1) and/or (4).

Figure 1:
The four elements of people-centred early warning systems



Source: ISDR Platform for the Promotion of Early Warning.

In order for the system to provide early warning information that is to be received by the relevant person/organization, the following three requirements must be satisfied; (1) preparation of the early warning information, (2) specification of timing for each destination to be informed, and (3) establishment of communication methodology.

A pilot stage earthquake early warning system (EEWS) and seismic intensity quick information system (SIQIS) have been developed and an action plan has been created for future development as (1). A developed disaster information matrix describes the timing for each relevant person/organization listed as (2). And an improvement plan has been formulated for strengthen the existing communication network using a robust communication system for earthquakes as (3).

(2) Activity details

1) The whole picture of the early warning system as envisioned by the Iranian side

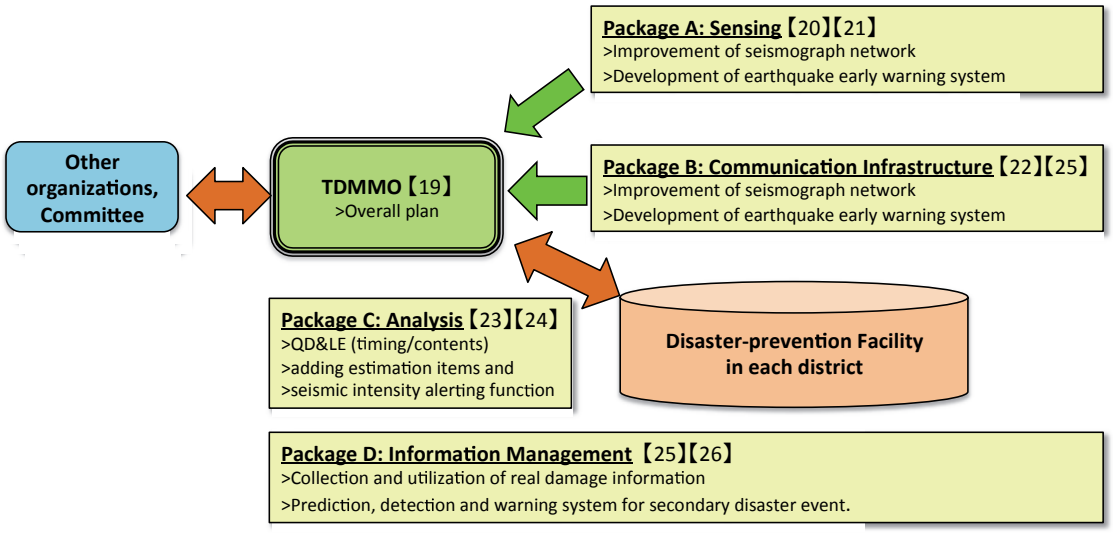


Figure 2.4.1 Activities in Output 3 and their relationship with the projects undertaken in Iran (Packages A–D)

The grand design for the early warning system envisioned by TDMMO is shared. TDMMO has planned Package-A to Package-D as shown in Figure 2-4-1-1.

Package-A involves earthquake detection and includes increasing the coverage of the strong-motion seismographic network by installing more seismographs than those that were installed in the previous project, and establishment of an early seismic warning system. Activities [20] and [21] are those concerned. Package-B involves the communication infrastructure and includes increasing the seismic resistance of the communication systems. Activities [22] and [25] are the relevant activities. Package-C is the analysis, including the QD&LE system, and involves adding to the system estimated items and quick alerting of the seismic intensity. Relevant activities are [23] and [24]. Finally, Package-D is the disaster information management and involves collection and utilization of post-earthquake information and a system for prediction, detection, and warning of secondary disasters. Activities [25] and [26] are the relevant activities.

2) Existing legislation, chain of order, roles and responsibilities of the organizations required to take emergency response, basic work flow, methods of collecting, analyzing, and sharing information, and policy of making decisions.

The role of TDMMO during a disaster in Tehran is clearly stated at" THE CONTENT OF THE SANCTIONED LAW FOR ESTABLISHMENT AND OPERATION/USE OF DISASTER MANAGEMENT SYSTEM OF CITY OF TEHRAN (160-557-10163)" enforced on 2004/8/11. That is, TDMMO will take any disaster management action on their own initiative; Tehran Disaster Management Head-Quarters (TDMH) will be established at TDMMO by gathering all of the relevant organizations. The disaster related information will be shared at TDMH and disseminated to the organizations. Therefore, after establishment of TDMH, detailed information related to a disaster can be collected and shared directly. The early warning system is required to be a reliable transmission of necessary and compact information before establishment of TDMH

and sharing information between TDMMO and the disaster support base in each district after establishment of TDMH.

3) Initial action plan under an emergency (e.g. booting up the Disaster Management Head-Quarters; securing staff members for the headquarters; collecting, analyzing, and delivering disaster information; establishing a system for emergency response activities with coordination among relevant organizations)

It is indispensable to ensure that firefighting, police, military, hospitals, the Red Crescent Societies, and others all move in a coordinated fashion. Although cooperation between TDMMO and the other organizations in the previous project seemed to have some difficulties, the current situation is changed to reach a realistic stage of cooperation with other organizations when a disaster happens by maintaining a good relationship with the other governmental/non-governmental organizations. As described, when Tehran is hit by a disaster, TDMMO establish TDMH with other relevant organizations and respond to the emergency. The early warning system must be improved reflecting any opinions/comments from other organizations to be more effective. Because valuable opinions/comments are never produced by a desktop imagination, it is recommended that while in actual operation, even if the system is incomplete, it should be improved by compiling the many opinions/comments received through continuous communication between relevant organizations and TDMMO.

2.4.2 【20】To prepare an improvement plan for the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS) (Activity3-2)

(1) Outline

While the 10 strong motion sensors installed in the previous project are being kept in good condition and the technology transfer regarding seismograph installation has been successful, TDMMO had initially planned to add 15 strong motion stations on to existing 10 stations by their own budget because the density of existing observation points was significantly low.

TDMMO had been eager to introduce an EEWS based on JMA's EEWS. Therefore, TDMMO had requested JICA to install seismographs with EEWS functions in the fault area estimated to be a potential source of a destructive earthquake for Tehran as below.

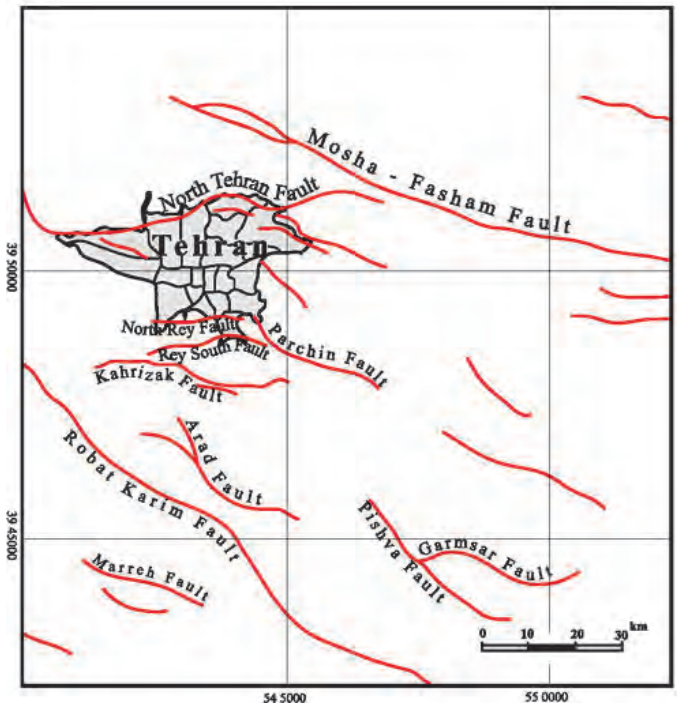


Figure 2.4.2 Faults near Tehran (http://atlas.tehran.ir/Default.aspx?tabid=240a)

In the project, potential locations for 15 new seismograph stations were nominated to improve the current seismograph network in Tehran Municipality not only for the QD&LE system but also for EEWS. Then, TDMMO constructed 4 station facilities by their own budget and added seismographs to the existing observation network.

In addition, under the Tehran 2014 5 Year Plan, a seismograph network plan consisting of 30 seismograph stations in Tehran including 10 existing stations, the 15 pre-planned seismograph stations and 5 newly planned stations, was formulated. The plan also considered seismograph networks operated by other organizations such as BHRC (Building and Housing Research Center). The network plan also contains a preliminary plan for 20 seismograph stations for EEWS as well.

Engineering skills for design and configuration of the seismograph network were transferred to C/Ps during the creation of a realistic and effective plan for the seismograph network in collaboration with the expert team and C/Ps.

Technical requests from TDMMO and proposals from the Team in response to those requests and outputs of the activity are summarized in Table 2.4.1

Contents of the activity are listed below;

1. Formulation of an initial seismograph network plan consisting of 15 observatory points.

2. Installation of 4 new seismograph stations by the plan.

3. To update the plan based on the Tehran 2014 5 Year Plan.

4. Drafting a primitive plan for an EEWS seismograph network outside Tehran

Details of the activities are described below.

Table 2.4.1 Summary of activities for the seismograph network

Items	Schedule Above: Julian calendar, Below: Iranian calendar		
	Apr. 2012~ Mar. 2013	Apr. 2013 ~ Mar. 2014	Apr. 2014 ~ Mar. 2015
	Year of 1391	Year of 1392	Year of 1393
Requests from TDMMO	Seismograph network plan consists of 15 points	Selecting 4 seismograph station sites that will be installed during this project	Seismograph network plan based on the 2014 5 Year Plan (total number of seismographs is 50)
Proposals & support from the Team	Nominated locations for seismograph stations. Supported evaluation of the environmental noise test and selected 15 locations	Selected 4 sites for the installation. Supported the detail design.	Formulated plan for 30 seismograph stations in Tehran and for 20 seismograph stations for EEWS outside the city borders
Outputs	・ Performing ambient noise test ・Submitted seismograph network plan consisting of 15 observatories.	・Decided 4 seismograph stations and drew the detailed plan for the stations . ・ Commenced construction for the 4 stations.	・complete construction at the 4 seismograph stations. ・Formulated seismograph network plans based on the 2014 5 Year Plan.

(2) Details of Activities

1) Planning of a seismograph network

At the beginning of the project, TDMMO planned to add 15 observation stations into existing seismograph network by their own budget. The Team supported allocation of additional stations from a technical viewpoint. The Team supported allocation of additional stations in technical viewpoint. Main role of the seismograph network is providing PGA (peak ground acceleration) distribution as fundamental information for emergency response just after destructive earthquake, such as where is highly damaged and need to concentrate resources in Tehran. Therefore, distribution of stations should be scattered homogeneously in Tehran. On the other hand, the stations should be allocated densely in the area where is big damage estimated. As a common sense for allocation of seismograph stations, it should be apart from vibration noise and electric noise as possible. Since big structures/buildings may affect observed earthquake data, stations should not be allocated near such structures and buildings. Addition, it should be considered that observed real earthquake data can provide important information for detailed tuning and improvement of existing QD&LE and EEWS system. For example, for evaluation and improvement of ground amplification factor distribution used in QD&LE, some of stations should be allocated on the bedrock. Considering cost-effectiveness, existing stations operated by other organization should be integrated in future. Secure place is one of the basic conditions for stations.

Therefore, the seismograph station sites were selected by the following policies:

1. To configure homogeneous seismograph stations in Tehran.

2. To prioritize higher estimated damage/loss areas for examples, and high population area or dense vulnerable buildings area.

3. To configure 4 or 5 stations near major faults around Tehran for future development of EEWS.

4. To configure 1 or 2 stations on the bedrock for studying characteristics of amplification.

5. To prioritize high ground amplification areas.

6. To consider the configuration of the seismograph networks operated by other organizations like BHRC for effective collaboration/sharing in the future.

On the other hand, the following conditions were taken into account in the viewpoint of operation for the site evaluation.

1. The place should be continuously used for many years, for example, the disaster supporting base of each district or a facility owned by Tehran municipality.

2. Ambient ground vibration noise should be at an acceptably low level.

3. Electricity and data communication lines should be utilized.

4. Earthquake disaster risk should be low. (Away from unstable walls, buildings and slopes)

5. Security against theft and destruction should be adequate.

6. No special structure which would cause abnormal vibrations like high-rise buildings or substructures, should be nearby.

7. No electrical noise generator such as high voltage power lines or electrical substations should be nearby.

After discussion with C/Ps taking into account the above conditions, 23 sites were selected as listed in Table 2.4.2. Then each site was investigated by both field research including noise measurement and/or a survey of the surroundings and then desktop studies based on existing information to evaluate its potential as an earthquake observation station. Finally, 15 sites were selected and are shown as yellow-green and yellow circles in Figure 2.4.3.

Methodology of noise evaluation was similar to that in the previous project.

The ground amplification factor was extracted from a JICA report "Tehran Microzonation Project in 2000" and a report issued by IIEES in 2011.

Electricity, communication lines, surrounding structures, topography, security, landowners and so on were checked using urban planning maps and the results of field observations.

Table 2.4.2 Evaluation List of Stations Related to Improvement of the Seismograph Network

		Fig. 1 List of Stations Relateed to Improvement of t					Table 1 Check Sheet of Stations for Additinal Seismograph Network											06 Mar 2013 (18. 12. 1391)
name	latitiude	longitude	district	basecode	basetype	Category	alter_for	owner	ambient noise (Z comp)	open_space	electricit	telephone	security	underground_facilities near by	ground anormally	Fill/Cut based on DEM bitween IY1343 & IY1374	SoilAmplif_ JICA	SoilAmFa ct_IIEES	evaluation issues to be attention
Ozgol	35.790192	51.496457	1	01-09-02-1	dedicated	proposed	----	TDMMO	0.011	available	ready	ready	ready	ok	naural/fill	0	1.0	1.6	ok
Shahrdari 2	35.776797	51.366117	2	02-01-01-0	multi purpose	proposed	----	TDMMO	0.023	limited	ready	ready	ready	ok	natural/cut	0.17004-	1.0	1.5	small space
Mellat Park	35.777944	51.406794	3	----	service/return to DMS in several	nominated	----	Tehran M	???	available	ready			Tunnel???	natural				Tunnel route
Shariati Water Museum	35.772900	51.441700	3	----	----	alternative	Mellat Park	Tehran M	????	available	ready	????	????	ok	natural	0.1676-	1.5	1.6	re-open or shatdown
Saghdoosh Street	35.759753	51.467609	4	04-03-01-0	multi purpose	proposed	----	TDMMO	0.055	available	ready	ready	ready	Metro Line ≒ 150m(UnderConst.)	Fill but excavated	2	1.0	1.5	construction yards relaated to Metro 3
Babai Highway	35.737855	51.628287	4	04-00-01-2	state	proposed	----	TDMMO	0.07	available	ready	ready	ready	ok	natural	No Data	No Data	No Data	high voltage elec
Sazman Barnameh	35.723979	51.300522	5	05-04-01-0	multi purpose	omitted	----	TDMMO	0.11	available	ready	ready	ready		natural	0	1.0	1.5	????
Bulvar Laleh	35.747506	51.297754	5	05-07-02-0	multi purpose	proposed	----	TDMMO	0.055	available	ready	ready	ready	ok	natural/fill	1	1.0	1.5	ok
Shahin	35.763917	51.316718	5	05-07-01-0	multi purpose	omitted	----	TDMMO	0.023	available	ready	ready	ready	Metro Line>150m	cut??	2-	1.0	1.5	---
Parvaz Park	35.788886	51.357587	5	----	----	omitted	----	TDMMO	????	available	---	---	????	ok	Fill 1m	1	1.0	1.5	Fill
Azad Islamic University	35.795840	51.315425	5	----	----	nominated	----	private	????	????	---	---	????	????	depend on exact location	61	No Data	No Data	Permission
Kuhsar Park	35.782987	51.283245	5	----	----	alternative	Azad Islamic University	????	0.03	available	no	no	????	ok	depend on exact location	55	1.0	1.0	no facilities
Laleh Park	35.709626	51.391284	6	06-02-01-1	dedicated	proposed	----	TDMMO	0.023	available	ready	ready	ready	Metro Line>150m	natural	0.4281-	1.0	1.6	ok
Bagheri Highway	35.727712	51.509454	8	08-01-01-0	multi purpose	omitted	----	TDMMO	0.03	limited	ready	ready	ready		cut??	1.20508-	1.0	1.5	not suitable
Fath Square	35.678715	51.337144	9	09-02-01-0	multi purpose	omitted	----	TDMMO	0.09	available	ready	ready	ready		cut??	1.4342-	1.0	1.6	---
Beryanak	35.670588	51.375718	10	10-01-01-0	multi purpose	proposed	----	TDMMO	0.055	available	ready	ready	ready	ok	natural/cut	0	1.2	1.5	ok
Vahdat Park	35.704804	51.483294	13	13-02-02-1	dedicated	proposed	----	TDMMO	????	limited	ready	ready	ready	basement floor ≒ 20m	natural	0.74585-	1.0	1.6	acceptable, no altanative
Zeytoon Park	35.662221	51.463414	14	14-05-01-0	multi purpose	proposed	----	TDMMO	????	available	ready	ready	ready	Metro Line>150m	natural	0.28455-	1.2	1.8	ok
Khavar Shahr	35.556071	51.560691	15	15-00-02-0	multi purpose	omitted	----	TDMMO	0.03	available	ready	ready	ready		natural	No Data	No Data	No Data	ok
Qiam Dasht	35.522192	51.643260	15	15-00-01-0	multi purpose	proposed	----	TDMMO	0.023	available	ready	ready	ready	ok	natural/fill	No Data	No Data	No Data	ok
Shahrak Sharifi	35.616068	51.343545	19	19-00-01-0	multi purpose	proposed	----	TDMMO	0.055	available	ready	ready	ready	ok	natural/fill	2	1.0	0.0	ok
Tehransar	35.702781	51.265141	21	21-01-01-1	dedicated	proposed	----	TDMMO	0.03	available	ready	ready	ready	ok	natural/fill	0.34375-	1.0	1.8	ok
Vardavard	35.733395	51.131115	21	21-03-01-2	state	proposed	----	TDMMO	0.055	available	ready	ready	ready	ok	natural	No Data	1.0	1.8	ok

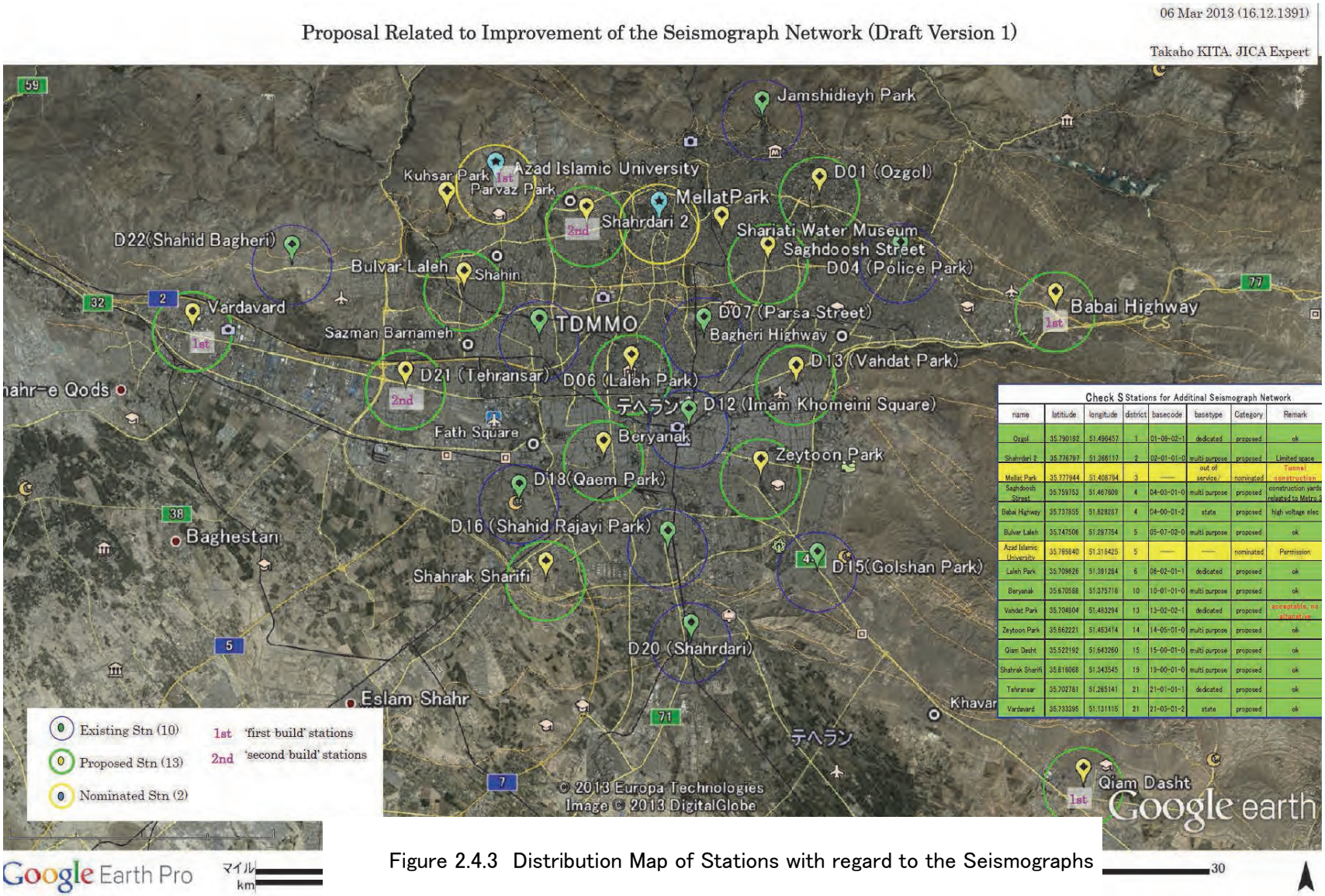


Figure 2.4.3 Distribution Map of Stations with regard to the Seismographs

2) Installation of 4 New Seismograph Stations

a.Site selection

TDMMO had secured its own budget for purchasing 15 seismographs at the beginning of the project. However, the number of seismographs decreased to 4 from 15 because of a precipitous fall of the Iranian currency.

Four sites in the marginal region of Tehran city were selected as new seismograph station sites. Effects of installation of the 4 seismograph stations were as follows:

① Coverage area of the seismograph network (and QD&LE) can be expanded to include the whole of Tehran city.

② Qiam Dasht station and Azad University station are close to active faults, the Parchin fault and North Tehran fault, respectively. These stations can contribute to the EEWS also.

③ The ground amplification factor in Tehran can be evaluated using the data from Azad University because it is located on the bedrock (with no amplification). Evaluation of the amplification factor contributes to improve the accuracy of calculation of PGA at each 250m grid in whole Tehran using limited data observed at observation stations.

TDMMO accepted the plan for expanding the seismograph network and decided to install 4 seismograph stations in this project.

b.Detailed Design and Construction of the Stations

Drawing the detailed design for the seismograph stations and construction of the stations were carried out by mainly TDMMO stuffs with assistances by the Team, following the design in the previous project.

A few of the existing stations had trouble with electrical short circuits caused by exposure to water and high moisture. Thus the following counter measures were advised by the Team.

① The top of the basement for a seismograph sensor should have a gentle slope or trenches in order to ensure dry conditions for the seismograph sensor (See Fig.2.4.2.2).

② Installing drainage pipes in the basement of the hand hole to drain water in case of heavy rain.

③ A roof should be built on the sensor base to keep the sensor dry.

④ The cable pipe configuration should be simplified. Hand-holes should not be installed at bending points in the cable route.

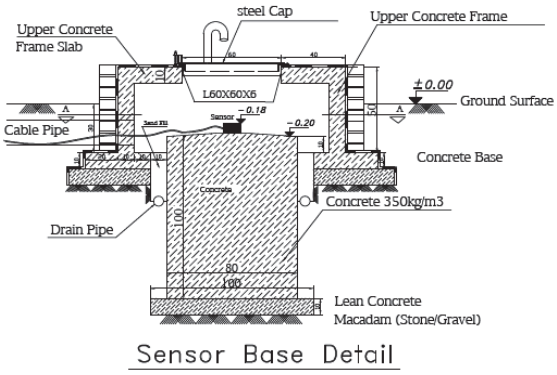


Figure 2.4.4 Design for basement

Solar power systems were introduced as backup power in case of a long power failure.

Because a new seismograph station called “Azad University” has no building or electricity, a different design than the other 3 new stations was employed with the following features:

- A sensor basement, observatory rack, communication antenna tower and solar power system are installed in a small designated place (5.5m×5.5m） .
- The place is surrounded by fence for security reasons.
- A power line has been extended from a switchboard in the university 1km from the station.
- A solar power system is provided as a backup power.
- A small observatory room is built with a heat-isolating material namely sandwich panels. Neither a fan nor air-conditioner is installed.
- The hand-hole for the sensor is waterproof and has drainage structures.

This basic design for Azad University is the same as that for the EEWS seismograph stations.

Photos of the construction works are shown in Fig. 2.4.2.3

The construction works for the 4 new observatories were completed in July 2014.

Figure 2.4.5 Construction Works for Azad University Observatory

c.Installation of Seismographs

Four sets of seismographs were delivered to TDMMO in the end of Nov. 2014. The new seismographs are currently being prepared for installation at the additional seismograph stations.

The seismographs procured by TDMMO are made by the same manufacturer and the specifications are the same as the existing ones, so that the seismographs can be easily added into the current QD&LE system.

Table 2.4.3 shows specifications for the 4 sets of seismographs procured by TDMMO.

Table 2.4.3 Specifications of Seismograph for the 4 New Seismograph Stations

Items	Name & Model Number	Specification
Sensor	CMG-5TC 5TC-MAA101000025L	Strong motion feedback accelerometer Three components Full-scale sensitivity from 0.1 to 4.0g Peak output±10V differential Weight 1.3kg
Digitizer	CMG-DM24S3 DM-24035P0U00511	3 channel broadband digitizer 24bit ADC Input voltage range: ±10V differential Absolute accuracy: 0.5% DSP sampling rate: 32kHz
Acquisition module	CMG-EAM EAMU-03SP0UE0124	Embedded Acquisition Module OS: Linux HDD: 40GB Communication: Ethernet Serial, Wi-Fi Seismic protocol: SEED, MiniSEED, CD1.1, GCF, GDI, SCREAM

The seismographs will be installed through the following procedures:

① Inspection of delivered instruments

② Initial setting for CMG-EAM (Embedded Acquisition Module) and Digitizer

③ Test observation for evaluation at an existing seismograph station

④ Registration of the seismographs for QD&LE system

⑤ Installation at the 4 new seismograph stations

⑥ Verification of data recording and data transfer

⑦ Long period observation test

The current stage is at number 6 of the above procedures as of October, 2015. These procedures were conducted by TDMMO supported by the Team.

3) Updating the Seismograph Network Plan in the Tehran 2014 5 Year Plan.

A plan for expanding the existing seismograph network is included in the Tehran 2014 5 Year Plan, as follows:

- Period of the 2014 5 Year Plan: 1393 – 1397 Iranian Calendar.
- Expanding plan: Expanding observation stations up to totally 50.

Based on the plan, TDMMO consider the policy below to expand stations:

- To allocate a total of 30 seismographs in Tehran city to enhance the QD&LE system. Ten existing seismograph stations and 15 stations planned by TDMMO at the beginning of the project (4 of 15 have been installed in the project) are included in the 30.
- To allocate a total of 20 seismographs outside of Tehran city for EEWS. The 4 pilot EEWS stations installed by activity 3-3 of the project are not included in the 20 seismographs.

TDMMO requested that the Team prepare a configuration plan for the 30 seismographs in Tehran city. A configuration plan of 30 seismograph stations that consisted of 10 existing stations, 4 newly constructed stations and 16 additional stations was formulated through discussions together with the Team and TDMMO C/Ps.

The Team and TDMMO C/Ps carried out field observations for the 4 nominated sites that had not been studied.

As the results of the observation, a 24 hour Medical Center in the Emergency Residence Complex of District 22 was selected instead of a nominated site in District 22 called Azad Shahr because of insufficient land area and unstable slopes located behind the proposed site.

The results of the field observation are summarized at Table 2.4.4.

The 30 proposed seismograph station sites are mapped as shown in Figure 2.4.6. Table 2.4.5 shows a list of 20 seismograph station sites excluding the 10 existing stations for QD&LE. Hatching colors in the Table 2.4.5 corresponds to the colors of the circles indicating the station sites in Figure 2.4.6.

Table 2.4.4 Conditions and evaluations of additional nominated sites

Name	Number	Coordinates	Site conditions with subjective evaluation				Site Evaluation
			Space	Structure & Soil	Noise level	Security	
Sardaran Park	05-02-01-0	35.758035°N 51.285214°E	ok	ok	ok	ok	Suitable
Khalij	18-00-01-0	35.657960°N 51.270429°E	ok	ok	ok	ok	Suitable
Abdol Abad	19-02-01-1	35.634563°N 51.362783°E	ok	ok	ok	ok	Suitable
Azad Shahr	22-05-01-0	35.733649°N 51.191062°E	Not adequate	Steep slope	ok	Poor	Un-suitable
Chitgar Park	22-04-08-1	35.74220°N 51.19068°E	ok	ok	ok	ok	Suitable

Table 2.4.5 List of Nominated Observatories for the 5 Years Plan

	Name	Latitude	Longitude	District	Basecode	Basetype	Category	Remark
1	Ozgol	35.790192	51.496457	1	01-09-02-1	dedicated	proposed in 2013	ok
2	Shahrdari 2	35.776797	51.366117	2	02-01-01-0	multi purpose	proposed in 2013	ok
3	Shariati Water Museum	35.772900	51.441700	3	----	not DMB but park under TM control	nominated again	re-open or shutdown
4	Saghdoosh Street	35.759753	51.467609	4	04-03-01-0	multi purpose	proposed in 2013	construction yards related to Metro 3
5	Babai Highway	35.738124	51.628293	4	04-00-01-2	state	Under construction	complete 1393
6	Sazman Barnameh	35.723979	51.300522	5	05-04-01-0	multi purpose	nominated again	Slightly high ambient noise
7	Azad Islamic University	35.793390	51.318482	5	----	----	Under construction	complete 1393
8	Sardaran Park	35.758035	51.285214	5	05-02-01-0	multi purpose	newly nominated	ok
9	Laleh Park	35.709626	51.391284	6	06-02-01-1	dedicated	proposed in 2013	ok
10	Fath Square	35.678715	51.337144	9	09-02-01-0	multi purpose	nominated again	ok
11	Beryanak	35.670588	51.375718	10	10-01-01-0	multi purpose	proposed in 2013	ok
12	Vahdat Park	35.704804	51.483294	13	13-02-02-1	dedicated	proposed in 2013	ok
13	Zeytoon Park	35.662221	51.463414	14	14-05-01-0	multi purpose	proposed in 2013	ok
14	Qiam Dasht	35.522412	51.643065	15	15-00-01-0	multi purpose	Under construction	complete 1393
15	Khalij	35.657960	51.270429	18	18-00-01-0	multi purpose	newly nominated	ok
16	Shahrak Sharifi	35.616068	51.343545	19	19-00-01-0	multi purpose	proposed in 2013	ok
17	Abdol-Abad	35.634563	51.362783	19	19-02-01-1	dedicated	newly nominated	ok
18	Tehransar	35.702781	51.265141	21	21-01-01-1	dedicated	proposed in 2013	ok
19	Vardavard	35.728994	51.146474	21	21-03-01-2	aiding provinces	Under construction	complete 1393
20	Chitgar Park	35.742200	51.190680	22	22-04-08-1	Medical Center	newly nominated	ok

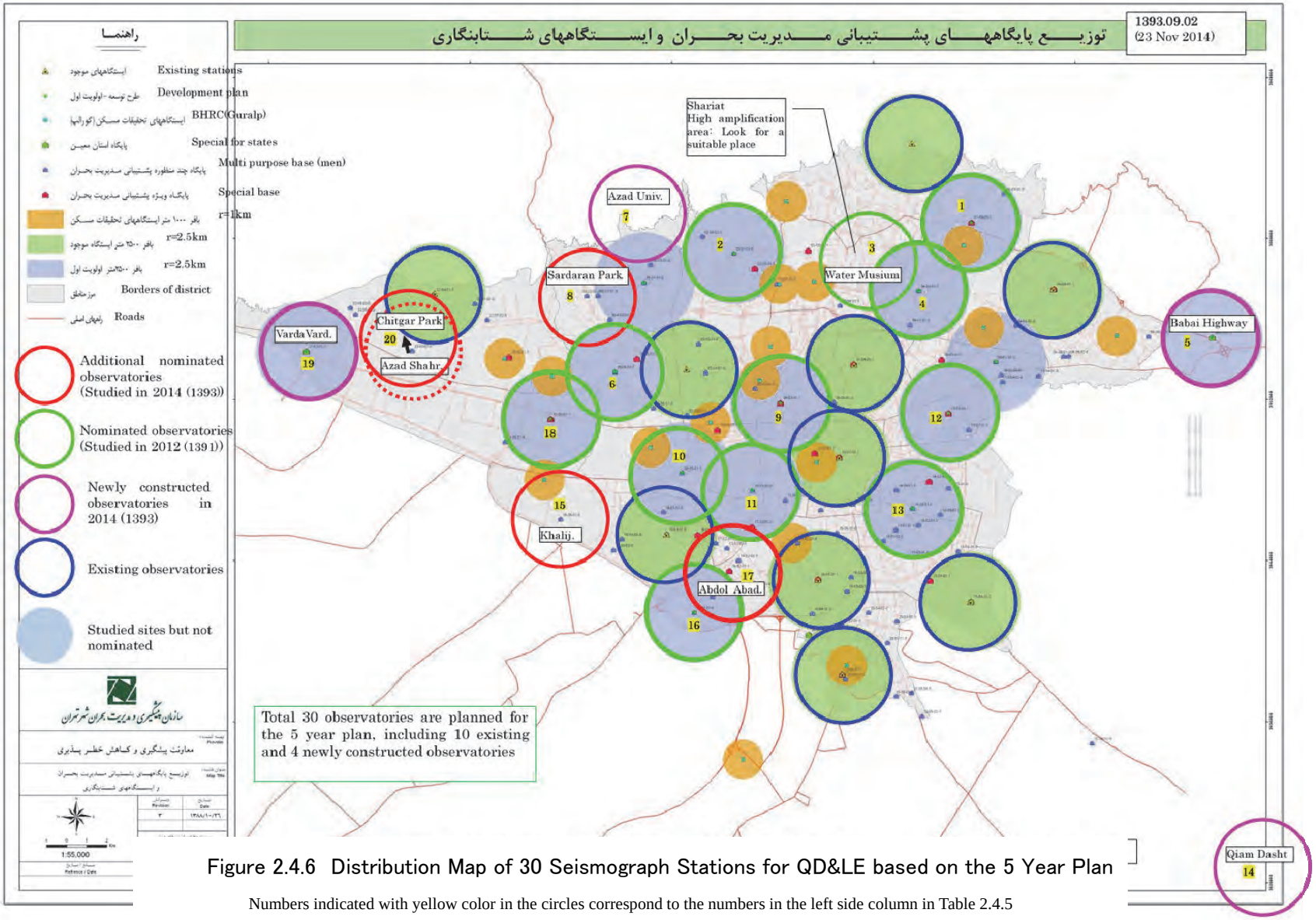


Figure 2.4.6 Distribution Map of 30 Seismograph Stations for QD&LE based on the 5 Year Plan

Numbers indicated with yellow color in the circles correspond to the numbers in the left side column in Table 2.4.5

4) Preparing a preliminary plan for the Seismograph Network for EEWS

According to the 2014 5 Year Plan, 20 seismograph stations for EEWS are planned to be installed outside Tehran.

Tehran Municipality contracted a research organization to study the seismicity of faults located in/around the Tehran region. The municipality also contracted to prepare a detailed plan for the seismograph network for EEWS.

Considering future perspectives of EEWS, the Team and TDMMO C/Ps discussed and prepared a preliminary plan for the seismograph network for the EEWS.

Policies for the configuration of the seismograph stations were as follows:

① To allocate a total of 20 seismographs.

② To configure seismograph stations to sandwich the major faults around Tehran.

③ To keep distances longer than 30km from Tehran city center to each station so as to provide more than 10 seconds from the initial observation of the P-wave at a seismograph to shaking at Tehran city center.

④ To consider the 4 seismograph stations installed for the pilot EEWS and a newly constructed seismograph station in Quam Dasht as parts of the EEWS seismograph network.

⑤ To consider locations of seismograph stations belonging to other organizations such as IGUT.

The proposed seismograph network for EEWS is shown in Figure 2.4.7. The coordinates (latitude, longitude) are shown in the figure.

It is noted that the plan is just a preliminary version to be revised/improved by further studies and final evaluation of the pilot EEWS.

	name	latitude	longitude
1	EEWS01	35.825563	51.785654
2	EEWS02	36.004881	51.782493
3	EEWS03	35.902373	51.592496
4	EEWS04	36.146003	51.618441
5	EEWS05	35.954846	51.376388
6	EEWS06	36.143818	51.254137
7	EEWS07	35.958011	51.087426
8	EEWS08	36.002017	50.829918
9	EEWS09	35.907783	50.655212
10	EEWS10	35.816847	50.871959
11	EEWS11	35.645964	50.767804
12	EEWS12	35.669808	50.986596
13	EEWS13	35.467962	50.922612
14	EEWS14	35.518704	51.199071
15	EEWS15	35.305893	51.147946
16	EEWS16	35.452444	51.417953
17	EEWS17	35.233907	51.549334
18	EEWS18	35.381885	51.868510
19	EEWS19	35.432792	52.156645
20	EEWS20	35.617871	51.803794

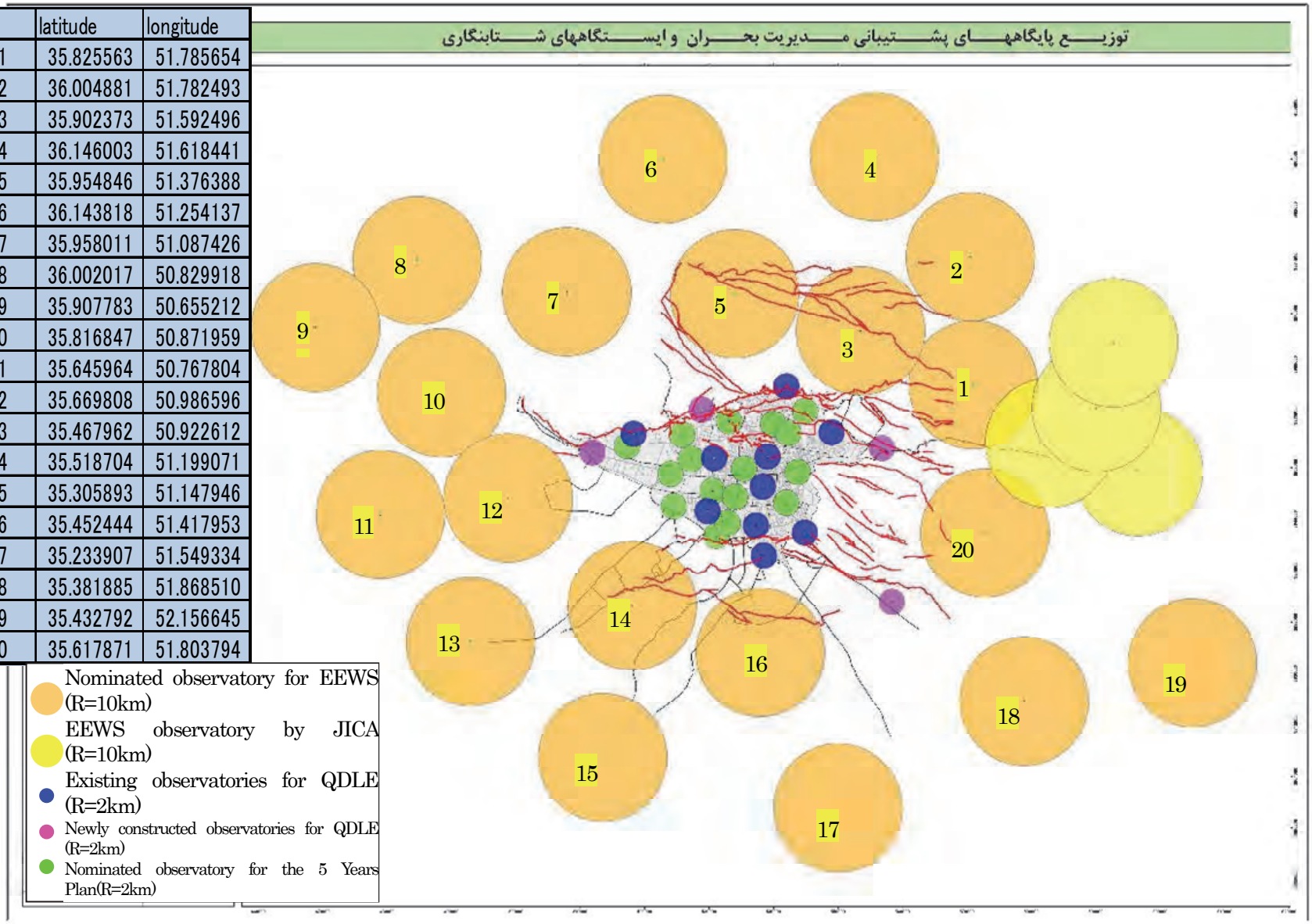


Figure 2.4.7 Draft Plan of Configuration of Seismograph Stations for EEWS

(3) Technology Transfer

Regarding the seismograph network, technology transfer during the previous project had been focused on how to select a seismograph station site, how to install seismographs, how to maintain the seismographs and how to perform quality checks. In this project, the Team transferred technologies mainly for planning of the seismograph network itself. The Team also followed up TDMMO's techniques which were transferred by the JICA experts in the previous project.

Technology transfer related to the seismograph network was mostly completed. Therefore, TDMMO has enough knowledge and technologies to achieve the 5 Year Plan by themselves.

The personal engineering skills of a few TDMMO's engineers had been significantly improved through their work in the project. However, no one had created a system to ensure that the engineers would be able to stay abreast of the latest technology because basically TDMMO is a governmental organization for good operation, not a technical institute for research and development. Even though the Team supported continual building of the skills of TDMMO's engineers by releasing technical manuals, it is TDMMO's responsibility to create a better environment to keep up with developing technologies and to develop new technologies by themselves. To recognize high value of technical items and human resources can be one of the solutions for TDMMO.

(4) Tasks for the future

The following are TDMMO's goals to be achieved in the seismograph network:

① To progress expansion of the seismograph network along the 2014 5 Year Plan step by step for achievement of enough dense of stations.

② To maintain the instruments and the system so that every seismograph station continues to function, because QD&LE system needs periodical update of building and population, the methodology of estimation can be improved, developed EEWS and SIQIS are just prototypes.

③ To maintain and update software for the EEWS, QD&LE and SIQIS.

④ To collaborate with other organizations such as BHRC and IGUT to improve the seismograph network by sharing observed seismic data.

⑤ To create action plans using information obtained by the seismograph network in case of an earthquake disaster. Cooperating and information sharing with research institutes such as IGUT, police officers, fire fighters, railway companies, traffic control, hospitals and other related organizations are necessary to reduce damage and loses.

⑥ To discuss methodology with IGUT for broadcasting to ordinary citizens so that information obtained by the seismograph network can be utilized for public disaster prevention.

2.4.3【21】To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organizations such as water, electricity, gas, fuel pipes, fire and safety services, and subways (Activity3-3)

(1) Outline

How to reduce the damage and loss when the next huge earthquake hits Tehran is the main task for TDMMO. TDMMO has been trying many countermeasures to reduce the damage and loss in this project and other projects, such as re-enforcement of buildings, improvement of high dense residential areas, and robust urban design for earthquakes. However, since it will take more than 40 years, TDMMO considers reducing the damage and loss within 40 years by implementing an earthquake early warning system (EEWS). Estimated users are same as Japan, such as 1) disaster management organization, 2) public/infrastructure organization, and 3) citizens. Disaster management organization uses EEWS for emergency response, public organization uses, for example, for automatic shutdown system or automated controlling system, and citizen use for self-help at a disaster. Because there is only one system in the world, officially operated as an infrastructure, TDMMO strongly wants to introduce EEWS owned by JMA into Tehran city. On the other hand, EEWS of JMA is one of the most advanced earthquake engineering applications to have been produced in the 40 year development period from its initial stage. However, the targeted earthquakes of the JMA-EEWS are mainly the massive quakes that are generated at the plate boundary as a subduction zone, in order to apply to Tehran, the algorithm needs to be rectified by optimizing to Tehran situation. Further, stable wideband communication infrastructure and dense observation stations are indispensable for the system to work correctly. Moreover, because the parameters used in the system are obtained from Japanese seismic data, applicability of the parameters must be evaluated using data observed in Iran due to the difference in geological conditions.

Therefore, a pilot scale EEWS consisting of a limited number of stations was developed. Technical transfer for the system development was conducted through the development process, giving support to understanding JMA's earthquake early warning system in detail. Simultaneously, development of an optimized algorithm for Tehran has been proceeded, then an action plan was drafted by picking necessary tasks for a practical/operational EEWS to be applied to Tehran city in the future.

Specifically, the 14 activities listed below were conducted.

① To hold seminars/workshops for understanding the principle/theory of earthquake early warning systems.

② To hold weekly seminars to understand detailed algorithms for processing at station/center.

③ To study/plan the configuration for the locations of observation stations.

④ To create specifications for the seismographs, recorders/controllers, and communication equipment.

⑤ To create specification for station side software and server side software.

⑥ Procurement of seismographs and recorders/controllers.

⑦ To support the purchase of peripherals and communication equipment.

⑧ To supervise software development.

⑨ To support construction of the observation stations.

⑩ To support inspection and installation of the seismographs and necessary items.

⑪ To support inspection/evaluation of software.

⑫ To conduct field communication tests between all stations and TDMMO.

⑬ System evaluation of pilot system operation.

⑭ To develop an action plan.

A record of activities is shown at Table 2.4.6.

Table 2.4.6 Record of activities for pilot EEWS

Activities \ Yr	1st yr				2nd yr				3rd yr				Extension	
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
(1) Seminars/workshops for understanding principle and theory of EEWS														
(2) Weekly seminar to understand detailed algorithm for processing at station/center														
(3) Configuration of location of observation stations														
(4) Specification of seismograph, recorder/controller, and communication equipment														
(5) Specification of station side software and server side software														
(6) Procurement of seismographs and recorder/controllers														
(7) Supporting to purchase peripherals and communication equipment														
(8) Supervising software development														
(9) Supporting construction of observation station														
(10) Supporting inspection and installation of seismograph and necessary items														
(11) Supporting inspection/evaluation of software														
(12) Conducting field communication test between all stations and TDMMO														
(13) System evaluation of pilot system operation														
(14) Development of an action plan														

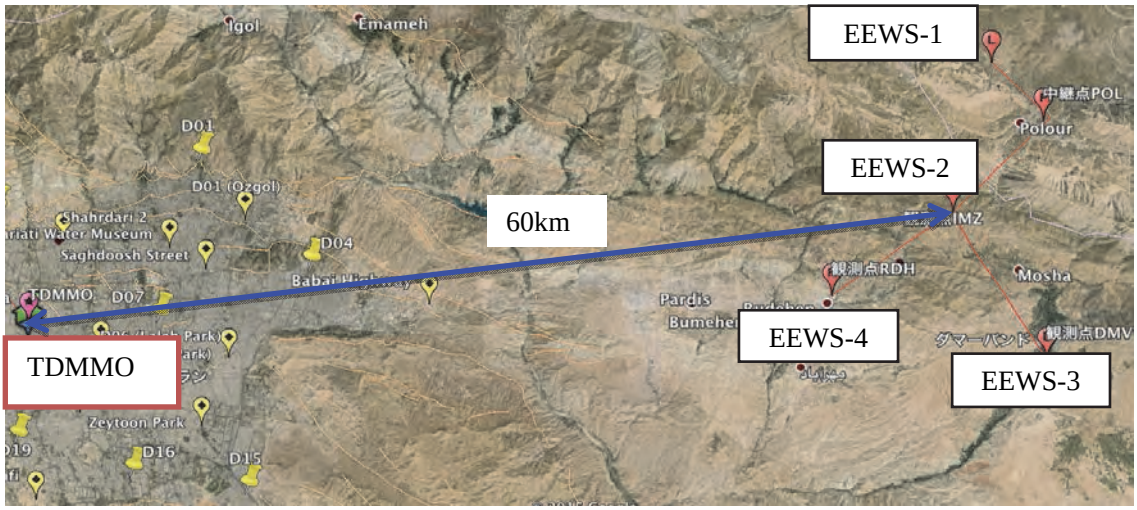


Figure 2.4.8 Geometry of stations and TDMMO

Figure 2.4.9 shows the configuration of the pilot EEWS, Figure 2.4.10 shows the software structure. Flow charts of the station side software and server side software are shown at Figure

2.4.11 and Figure 2.4.12, respectively. Photos of station facilities are shown from Figure 2.4.13 to Figure 2.4.17. Donated seismographs and controllers are shown at Figure 2.4.18, a photo of an inspection is shown at Figure 2.4.19. Figure 2.4.20 shows the communication network system structure and a photo of the communication equipment is shown at Figure 2.4.21.

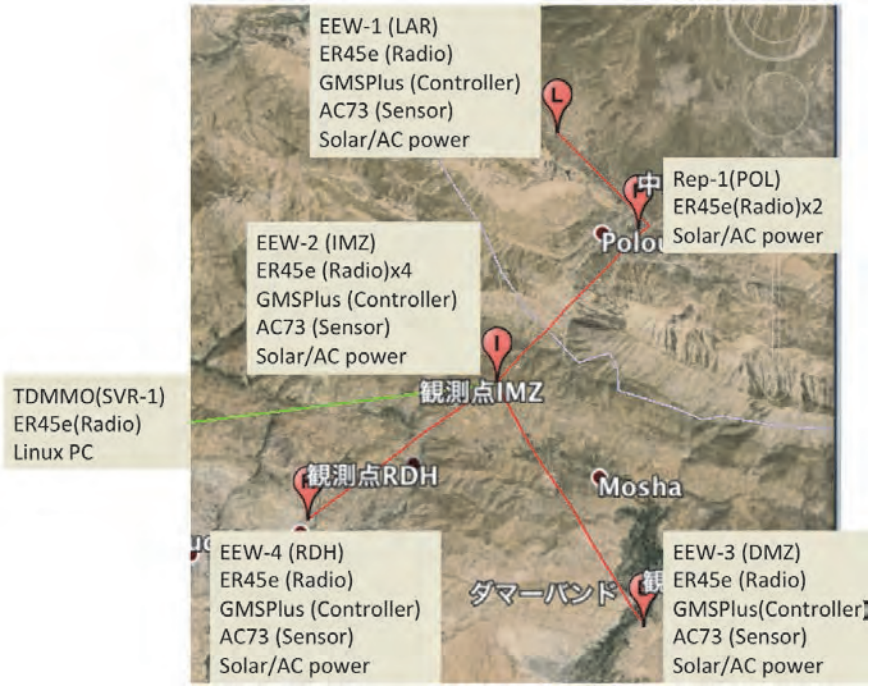


Figure 2.4.9 EEWS configuration (4 stations, repeater, TDMMO)

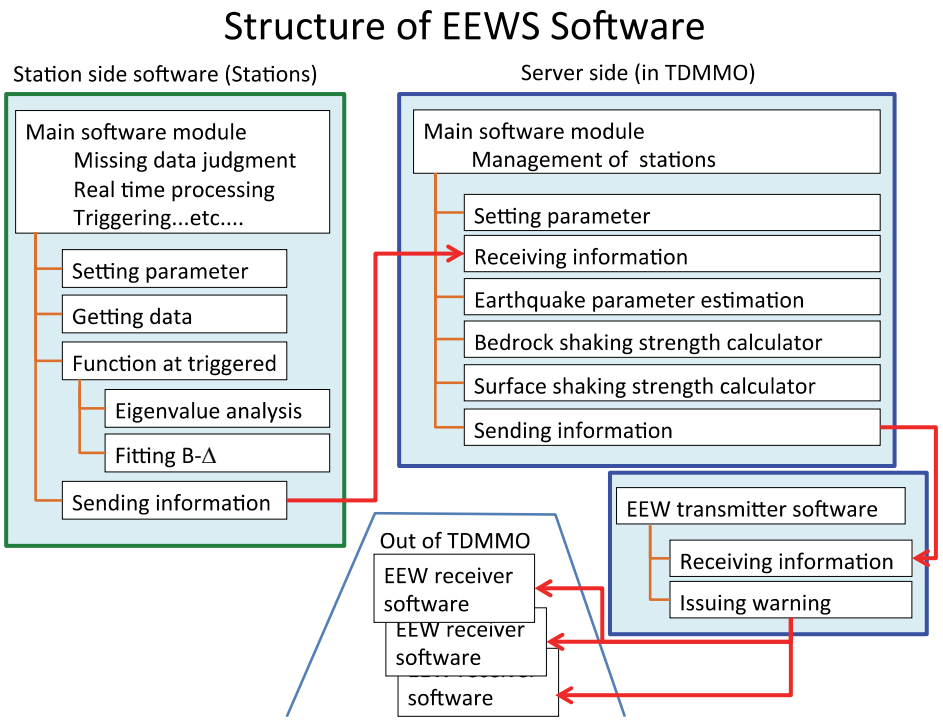


Figure 2.4.10 Software structure

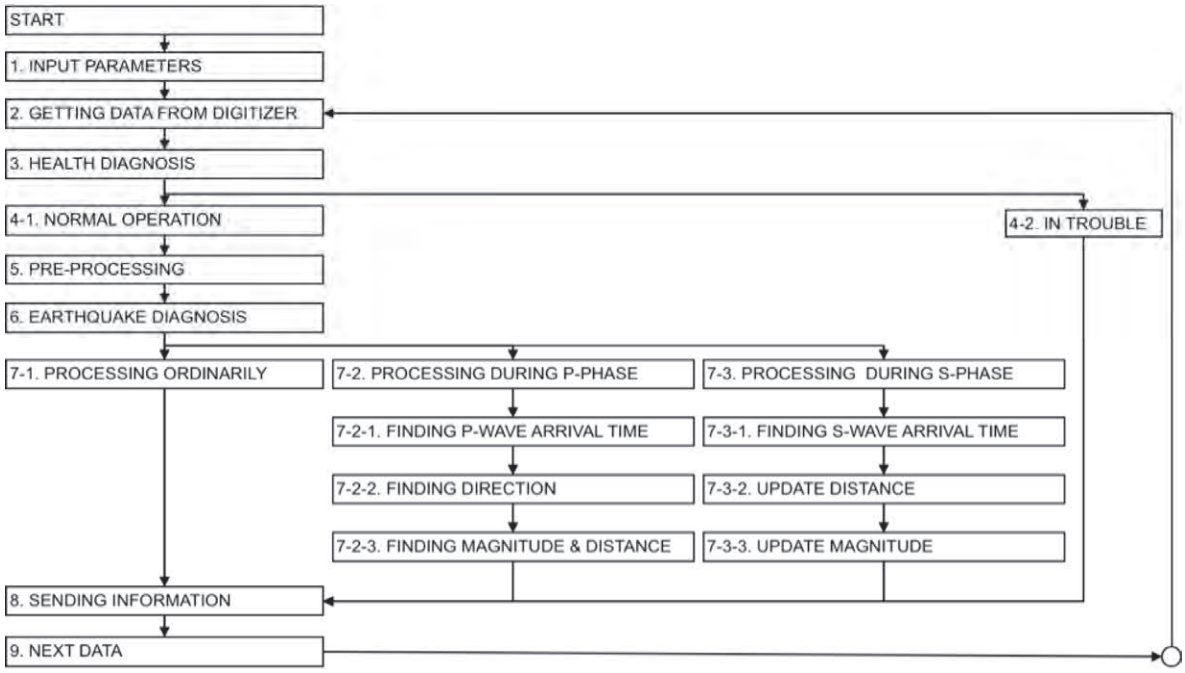


Figure 2.4.11 Flow chart of station side software

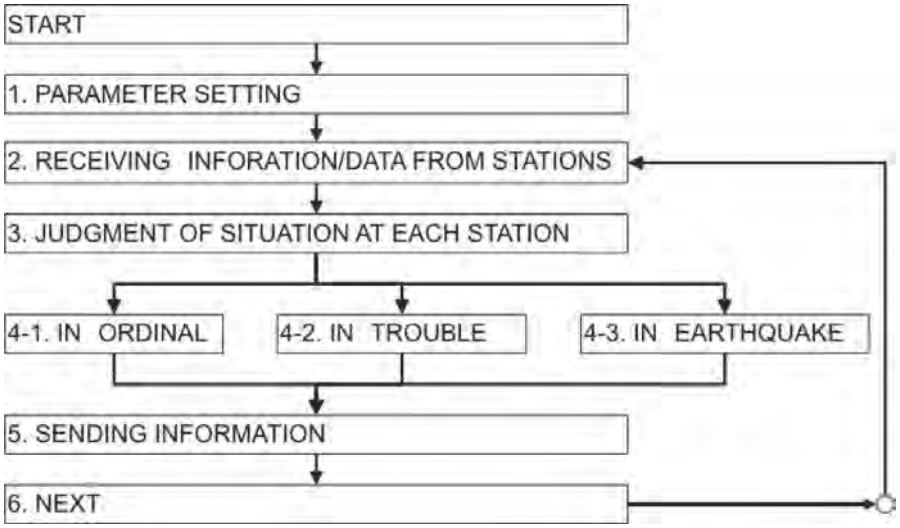


Figure 2.4.12 Flow chart of server side software

Figure 2.4.13 Station facility :EEW-1(Lar Dam Gate)

Figure 2.4.14 Repeater site :Rep-1(Polour Residential Area)

Figure 2.4.15　Station facility:EEW-2(Imam Zadeh Mountain)

Figure 2.4.16　Station facility:EEW-3(Damavand TV tower)

Figure 2.4.17 Station facility:EEW-4(Rudehen Mammadagi Park)

Figure 2.4.18 Donated seismic equipment

(Upper left: Sensor, Upper right: GPS, Lower: controller)

Figure 2.4.19 Inspection of seismic equipment

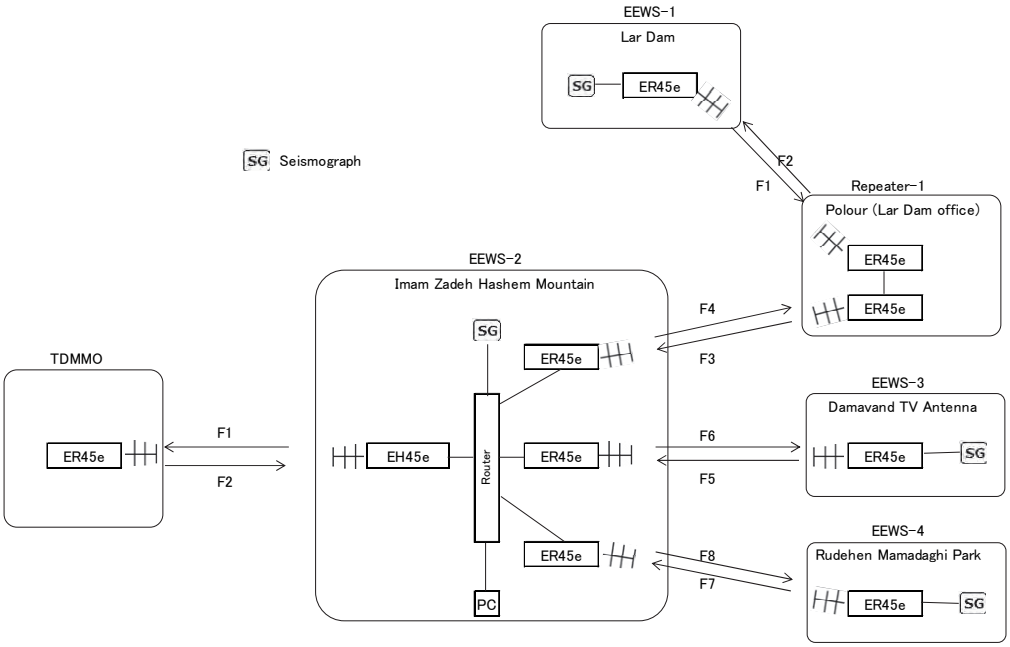


Figure 2.4.20 Communication network system structure

Figure 2.4.21 Communication equipment

(Upper left: channel separator, center: Radio (ER45e), right: Yagi antenna)

Detailed activity is described below.

(2) Detailed activities

1) Understanding of JMA-EEWS and providing the algorithm

The history of development, theoretical background, implementation, record of operation, and detailed algorithm are covered in a lecture using "Technical information regarding the outline and processing method of an earthquake early warning (2008)" published by Japan Meteorological Agency and related papers. Additionally, a workshop on EEWS was held on 2012/9/24 by TDMMO inviting relevant organizations, including the national government and at the workshop a JICA expert made a presentation regarding EEWS.

A detailed algorithm of JMA-EEWS was provided through four weekly seminars, which explained the subject starting with the theoretical background and continuing on to implementation and simulation of actual processing on an Excel sheet.

2) Hardware: procurement of four seismographs and controllers

Seismographs used for EEWS need to have enough dynamic range and stable performance to sense very small signal any time, because EEWS uses very small waveform at P-wave first arrival to estimate magnitude and epi-center location of an earthquake. Especially in this project, since it is the world first case to apply the algorithm of JMA (Japan Meteorological Agency) to outside of Japan, unknown factors related to hardware must be reduced. Therefore, selection of seismographs for the pilot EEWS must be carefully. At the beginning of the project, the same model of seismographs used at previous project was selected because its performance was already evaluated and applied to actual field. However, because of the increase in international economic sanctions, equipment that had been planned to be used at the beginning or the project could not be procured. The JICA Expert Team had to search for a supplier and to conduct performance tests in the field. Then GMSPlus+AC73 manufactured by GeoSIG co. in Switzerland were selected. The JICA Iran office procured the equipment with technical support by the expert team. Procurement was delayed around four months from the original schedule and the equipment was delivered on 2014/5.

3) Software: providing specifications for station side and server side software

Two types of software are necessary for JMA-EEWS, which are station side software and server side software. SRS (Software Requirement Specifications) were developed and provided. TDMMO ordered a software developer to develop EEWS software based on the SRS. The station side software was developed in October 2014, and the server side software on January 2015.

4) Supporting to establish communication network system

Since the pilot site is located in a mountainous area with poor communication infrastructure and is 60km from Tehran, a 400MHz radio communication system, which was used for IGUT (Institute of Geophysical University of Tehran), which is the organization that owned the nationwide seismic network in Iran, was employed. Application of permission to use the frequency band, procurement of communication equipment, and planning of station/repeater allocation using a simulation tool were supported.

A communication line between EEW-2 and TDMMO was established and confirmed by a simple communication test on 2014/12/16.

Actual performance of the communication network system was confirmed by a continuous data transfer test on 2015/8/2-4. The packet loss ratio is 0% at the best (TDMMO and EEW-2) and 0.00462% at the worst (TDMMO and EEW-1).

5) Supporting station allocation and construction of station facilities

Station allocation was planned based on the policies below.

- The target area is around Mosha fault that locates ten's km apart from Tehran (since EEWS uses difference between P and S wave arrival, too close epi-center can not applicable), is the biggest one of scenario earthquakes used at the Microzonation 2000.
- Overlapping the target fault (Mosha fault) to evaluate whether calculated direction of epi-center is correct or not.
- Around 10km apart from each other to utilize travel time difference effectively.
- Must be seen from TDMMO as the main repeater site.
- The main repeater site must see all other stations or repeaters.
- Stations should be kept secure.

Four station sites, EEW-1 to EEW-4 and one repeater site were selected. EEW-2 acts as the main repeater site.

Stations and repeater sites are listed at Table 2.4.7.

Table 2.4.7 Location of stations and repeater

Station name	ID	Location	Lat	Lon	Elev(m)
EEW-1	LAR	Lar Dam Gate	35.883500°	52.027006°	2690
EEW-2	IMZ	Imam Zadeh Mountain	35.792508°	51.996880°	3204
EEW-3	DMV	Damavand TV tower	35.702505°	52.067164°	2090
EEW-4	RDH	Rudehem Mammadagi Park	35.742454°	51.915049°	1957
REP-1	POL	Polour Residential Area	35.848814°	52.064615°	2275

Designs of the station and repeater facilities were drafted by TDMMO based on the concept explained by the expert team and completed after discussions with each other.

6) System evaluation of test operation

The pilot system has been in trial operation from May 2015. Fortunately, real waveforms have been obtained on more than five occasions when earthquakes occurred within 100km from the station sites. The JICA Expert Team confirmed the pilot system has been working. Further, important data has been provided that can be used to study the applicability of JMA-EEWS to Tehran.

7) Development of an action plan

An action plan was formulated for future development of a practical version of EEWS for Tehran.

Figure 2.4.22 shows a tentative roadmap for total development. Since the EEWS developed at this project is just a pilot system, evaluation of the system should extract insufficient parts or items to be corrected for improvement of practical EEWS applying to Tehran. Then, the solution will be found by analyzing the items. According to the solution, action plans for each user will be created. Each user will act following to the plan. Simultaneously, a practical EEWS will be developed. The practical EEWS will be tested and evaluated. The practical EEWS will be revised forward to the final operational system. Simultaneously, education to public will be conducted such as what is EEWS and how to response to the warning. Further, legislation for EEWS will be processed and prepare full scale operation. Test operation will be done about 3 years to extract fatal problems and corrected. These processes are based on the case of introduction of EEWS in Japan, and necessary processes to issue warning to public.

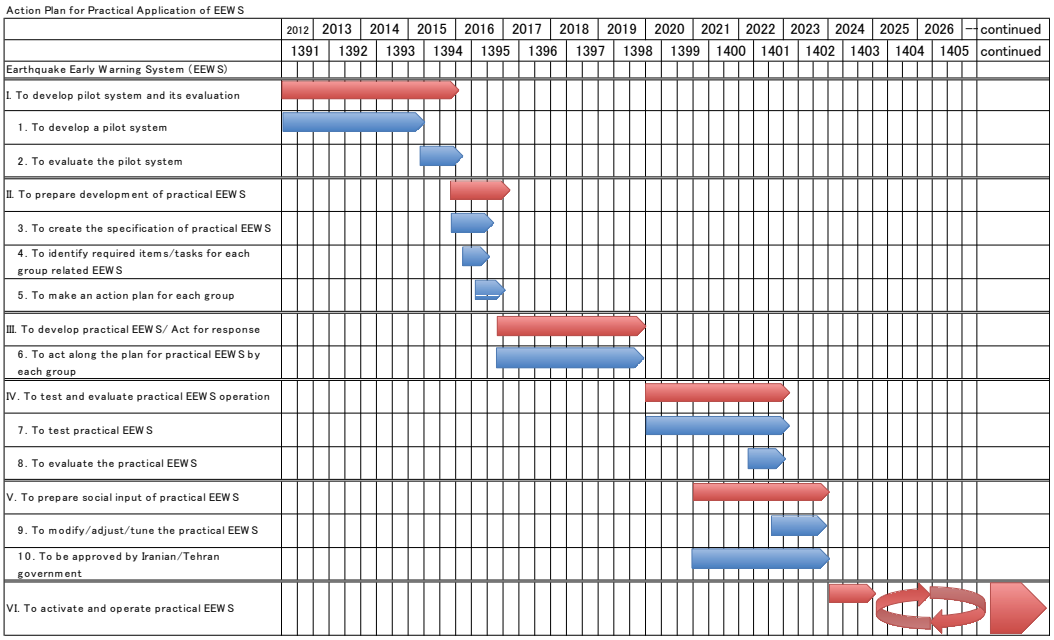


Figure 2.4.22 Tentative roadmap for practical EEWS development

(3) Technical transfer

Technical transfer was not achieved easily because EEWS is one of the most advanced and complicated technologies in the world. Advisors of TDMMO can understand the theory and application from a scientific point of view, but were not familiar with the implementation nor

software specifications. The IT section of TDMMO can understand what should be included in the "Software requirement specifications", but are not familiar with geophysical and seismological theory nor what is necessary for disaster management. Technical staff in TDMMO, which is the main counterpart can understand the total configuration of the EEWS, however their understanding of the scientific and IT detailed parts is not perfect.

Nevertheless, TDMMO had studied more and more compared with the situation at the beginning of the project, while 4 times weekly seminar, ten's technical meeting and hand calculation using Excel sheets, so technical transfer has been progressing. The JICA Expert Team believes cooperation with each expert in different areas can start to develop a practical EEWS with some supporting by Japanese side at suitable timing.

(4) Tasks for the future

The EEWS developed in the project is only a pilot system. The system must be evaluated and problems must be extracted to study realistic procedures for development of a practical version of EEWS.

Following tasks are proposed to solve within 1 or 2 years.

① To continue analysis of station/server software and fix any bugs.
② To maintain the system and periodically evaluate by retrieving recorded data.
③ To parallelize the communication network lines using 5.8GHz long distance wifi and existing 400MHz radio.
④ To evaluate applicability of B-Δ method using Iranian data of bigger earthquake (more than M5) and adequacy of many parameters used in the system as for Iranian conditions.

⑤ To continue improvement of the station/server software.
⑥ To study and plan to develop suitable communication infrastructure to alert, since only SMS and Internet are available but insufficient of immediacy.

For the development of practical EEWS, following items should be considered.

① Optimization of station allocation
Feasible station configuration with not only technical view point but also cost-effectiveness.

② Timing of warning, destination and response for warning
What information should be issued to whom, when and how.

③ The best communication system
Suitable communication system for data transferring from station to server, and for issuing warning from server.

④ Legislation for full-scale operation
A legal base for issuing warning to the public.

⑤ Period and contents of test operation of practical EEWS
Period and test method considering very lower seismicity than Japan.

⑥ Education and public relations
Dissemination of how to response the warning and what is the EEWS to the public.

⑦ Development of receiver equipment
Receiver device to get warning at user side.

⑧ Preparation of infrastructure to be used for EEWS
Communication system/line, hardware like server computer, infrastructure, and staffs.

2.4.4 【22】To strengthen data communication system for the QD&LE system based on investigations of communication systems, recommendation of suitable systems and development of backup lines (Activity3-4)

(1) Outline

Requirements of communication system used for QD&LE system are real time performance and robustness. The amount of data is less than 64kbps, which is relatively small for modern technology. However real time performance which guarantee to transfer the data every second and robustness to keep connection even at destructive earthquake are indispensable for the system. Establishment of backup communication lines is one of the most important issues for emergency response. TDMMO understand the vulnerability of MPLS line used for the current QD&LE system, and try to develop new network using robust communication line. In the project, firstly, the current communication system in Tehran was studied and a plan for improvement of the communication lines was developed. Then the proposed system was applied to the communication system between TDMMO and two existing seismic stations.

(2) Activity details

1) Study of current communication system

The following seven types of communication systems are available in Tehran city.

a) Wireless communication system using dedicated frequency
b) Wireless communication system using public frequency
c) Fiber optic network owned by Traffic control
d) 3G mobile data network
e) MPLS or ADSL for public users
f) WiMAX for public users
g) Satellite modem

TDMMO and JICA Expert Team excluded e), f), and g) for this study because: e) MPLS is known as the worst vulnerable system because it will disconnect at earthquake since it draws cables between buildings to buildings, walls to walls; f) the network of WiMAX in Tehran is unstable; g) Satellite communication system is difficult to get permission from CRA (Communication Regulation Authority). Regarding with cost-effectiveness, a) and b) does not need to pay for usage even the initial cost is relatively high for antenna construction and equipment, and operation cost is for electricity and periodical maintenance; c) does not need to pay because it is owned by Tehran municipality; d) needs to pay for amount of data because of services by private company, even initial cost is relatively low for mobile router and SIM cards.

a) Wireless communication system using dedicated frequency

The Iranian seismic observation network system operated by IGUT employed a wireless communication system of 400MHz band. The system was the first candidate in the project, but CRA (Communication Regulatory Authority) mentioned that the 400MHz frequency band in Tehran was saturated and additional allocation was not possible. Therefore the 400MHz system was rejected from the candidates. However, because the 400MHz frequency was available outside of Tehran, the system was used for the pilot EEWS.

b) Wireless communication system using public frequency

Wireless communication system using frequency band of free licenses such as 2.4GHz and 5.8GHz are commonly seen in Tehran. Though 2.4GHz is saturated, 5.8GHz has more capacity not only for earthquake observation but also for videoconferencing and IP phones. Necessary equipment is easily gotten and there are some technically skilled companies in Tehran. An antenna leaflet shows that the possible distance of communication is up to 100km, which is enough distance for the communication network system in Tehran. To be noted is the effect of earthquake shaking because the beam width is very narrow.

c) Fiber optic network owned by Traffic control

The Tehran Traffic Control Center (TTC) monitors traffic conditions at intersections using totally 600 digital cameras networked by fiber optic lines. The fiber optic cables are laid underground and the structure of the server building is strong, therefore the network is robust to withstand earthquake shaking. However, since the network is owned and operated by a different organization; TTC, it is noted that changing configuration and troubleshooting cannot be done by TDMMO themselves.

d) 3G mobile data network

Recently, 3G mobile data service is expanding, such as the service by RighTel in Tehran. Table 2.4.8 shows the service condition of RighTel in 2013 and 2014. In 2014, most of Tehran city is inside of its service area. Some high-speed networks can be established with low initial investment by 3G services because it is similar with normal mobile phone service. However in case of disaster, huge amount of connection concentrated will lead congestion (saturation of connection capacity). In addition, to keep low cost operation, amount of traffic should be small as possible, because it charges for amount of data transferred.

Table 2.4.8 Survey result of RighTel service area

No.	Location			2013			2014				
	Name	Latitude	Longitude	Survey Date	Signal Strength dBm	Signal Strength ASU	Survey Date	Signal Strength dBm	Signal Strength ASU	Net Type	Data State
1	TDMMO	35.73	51.34	2013/5/8	-85	15					
2	D1	35.72	51.33				2014/4/27	-71	21	hsdpa+*42.2mbps	data connected
3	Jamshidieyh Park	35.82	51.46				2014/5/3	-87	13	gprs*55kbps	disconnected
4	D2	35.76	51.37				2014/5/3	-61	26	hsdpa*7.2mbps	data connected
5	D3	35.77	51.4				2014/5/3	-65	24	hsdpa*7.2mbps	data connected
6	D4	35.72	51.33				2014/4/27	-99	7	umts*384kbps	data connected
7	Babai Highway	35.64	51.41	2013/5/8	-107	3	2014/5/20	-103	5	umts*384kbps	data connected
8	D5	35.73	51.31				2014/5/11	-91	11	hsdpa*7.2mbps	data connected
9	D5.Azad Univ.	35.8	51.32								
10	D6	35.72	51.33				2014/4/23	-83	15	hsdpa*7.2mbps	disconnected
11	D7						2014/4/23	-87	13	hsdpa*7.2mbps	disconnected
12	D8						2014/4/23	-91	11	hsdpa*7.2mbps	disconnected
13	D9						2014/4/26	-85	14	hsdpa*7.2mbps	data connected
14	D10						2014/4/26	-101	6	hsdpa*7.2mbps	data connected
15	D11						2014/4/26	-103	5	hsdpa*7.2mbps	data connected
16	D12						2014/4/26	-97	8	hsdpa*7.2mbps	disconnected
17	D13	35.7	51.48				2014/5/6	-87	13	hsdpa+*42.2mbps	data connected
18	D14	35.67	51.47				2014/5/6	-95	9	umts*384kbps	data connected
19	D15	35.62	51.47				2014/5/6	-83	15	hsdpa*7.2mbps	data connected
20	Golshan Park	35.62	51.49	2013/5/8	-83	17	2014/5/10	-63	25	hsdpa*7.2mbps	data connected
21	Qiam Dasht	35.52	51.64	2013/5/8	out of service		2014/5/10	-77	18	hsdpa+*42.2mbps	data connected
22	D16	35.64	51.41				2014/5/19	-87	13	hsdpa*7.2mbps	data connected
23	D17	35.65	51.37				2014/5/19	-75	19	hsdpa*7.2mbps	data connected
24	D18	35.65	51.34				2014/5/7	-73	20	hsdpa*7.2mbps	data connected
25	Park Ghaeem	35.65	51.32				2014/5/7	-85	14	hsdpa*7.2mbps	data connected
26	D19	35.63	51.36				2014/5/7	-51	31	hsdpa*7.2mbps	data connected
27	D20	35.75	51.3				2014/5/21	-95	10	hsdpa*7.2mbps	data connected
28	D21	35.7	51.27				2014/5/14	-79	17	hsdpa*7.2mbps	data connected
29	Vardavard	35.7	51.15	2013/5/7	-65	24	2014/5/14	-57	28	hsdpa*7.2mbps	data connected
30	D22	35.74	51.25				2014/5/14	-69	22	hsdpa*7.2mbps	data connected
31	Shahid Bagheri	35.75	51.2	2013/5/8	-93	10	2014/5/14	-93	10	hsdpa*7.2mbps	data connected
32	Kuhsar Park	35.8	51.3	2013/5/7	-85	14					
33	Parvaz Park	35.8	51.4	2013/5/7	-77	18					

2) Improvement plan

Through tens of technical discussions and collaboration of field communication test with C/P, requirement of communication system, technical characteristics and initial/operation cost were shared with C/P clearly. As a result, fiber optic network, 5.8GHz wireless network, and 3G mobile data network are selected as earthquake resistive communication systems available in Tehran for an improvement plan.

The main framework is as below.

a) Changing over from MPLS to fiber optic network

The main network is changed from MPLS to fiber optic network operated by TTC. TTC must agree to keep the highest communication priority in a disaster situation for TDMMO.

b) Utilization of 5.8GHz long distance wireless LAN

5.8GHz long distance wireless LAN is used as an alternative line for the areas where a fiber optic network is available, and as the main line for the areas where the fiber optic cannot be used. An antenna tower is necessary however since all management issues such as construction, procurement, and maintenance can be under the control of TDMMO, the network system should be established with the highest priority.

c) 3G mobile network as an alternative line

If the 5.8GHz wireless LAN is the main line, or the 5.8GHz cannot be used as an alternative line, the 3G mobile network is used as the alternative. The mobile company must agree to keep the highest communication priority during a disaster situation for TDMMO.

3) Activities for improvement plan

The following are activities for creation of the improvement plan.

a) To study the availability of the 5.8GHz long distance wireless LAN by simulation
The strength of the radio waves using the 5.8GHz long distance wireless LAN from all stations/bases to TDMMO was studied by simulation software called Radio Link with radio parameters such as frequency, power of the transmitter, characteristics of the antenna, distance between antennas and presence of obstacles. SRTM3 was used for topographic data. Table 2.4.9 shows the parameters used for the simulation.

Table 2.4.9 Parameters used for simulation

Power of transmitter		0.5W	
Antenna gain		28.5 dBi	60cm parabola
Cable loss		0.2 dBm	2m coaxial
Height of antenna	TDMMO	70m	
	Stations	20m/6m	

An example of the output figure from the simulation software is shown at Figure 2.4.23. Table 2.4.10 shows the result of the simulation. Vardavard, Shariati, Saghdoosh, Qiam dasht, Ozgol, and Vahdat need repeater stations because they cannot be connected directly to TDMMO.

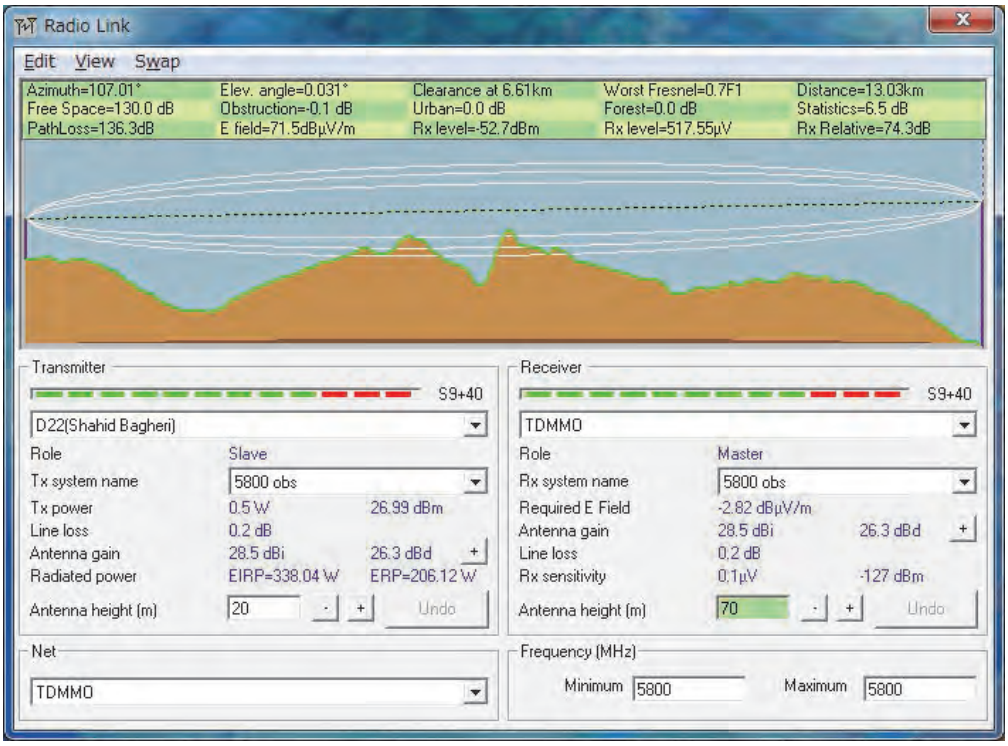


Figure 2.4.23 An example of an output figure from the simulation

Table 2.4.10 Result of simulation for 5.8GHz wireless LAN

	No.	Site Name	Location			Antenna Height 20m		Antenna Height 6m		Result
			Latitude	Longitude	Distance (km)	Rx level (dBm)	Rx level (uV)	Rx level (dBm)	Rx level (uV)	
Existing Site	1	TDMMO	35.725	51.33981						
	2	Jamshidieyh Park	35.82508	51.46441	15.81	−56.2	347.03	−49.8	727.03	Good
	3	D04 (Police Park)	35.76043	51.54176	18.64	−54.0	447.92	−58.5	265.54	Good
	4	D07 (Parsa Street)	35.72673	51.43172	8.29	−49.9	718.36	−51.4	600.09	Good
	5	D12 (Imam Khomeini Square)	35.68514	51.42328	8.74	−50.8	644.68	−44.2	1377.63	Good
	6	D15(Golshan Park)	35.62025	51.495	18.21	−52.8	513.57	−49.9	718.02	Good
	7	D16 (Shahid Rajayi Park)	35.63042	51.41154	12.34	−49.2	772.45	−48.0	895.23	Good
	8	D18(Qaem Park)	35.65108	51.32858	8.28	−51.0	629.03	−43.6	1477.62	Good
	9	D20 (Shahrdari)	35.5881	51.42448	17.02	−51.0	628.30	−51.0	630.91	Good
	10	D22(Shahid Bagheri)	35.75937	51.20175	13.03	−52.7	517.55	−57.4	300.31	Good
Planning Site	1	Vardavard	35.73339	51.13111	18.85	−95.7	3.65	−99.9	2.27	Bad
	2	Shahrdari 2	35.77681	51.36611	6.23	−66.0	112.06	−67.3	96.67	Good
	3	Shariati Water Museum	35.7729	51.4417	10.62	−110.1	0.70	−112.7	0.52	Bad
	4	Saghdoosh Street	35.75975	51.46761	12.16	−100.6	2.08	−104.2	1.38	Bad
	5	Babai Highway	35.73785	51.62829	26.06	−65.4	119.60	−110.6	0.66	Good/Bad
	6	Bulvar Laleh	35.74751	51.29775	4.54	−43.7	1465.89	−43.7	1462.18	Good
	7	Azad Islamic University	35.79584	51.31543	8.17	−48.7	825.73	−48.6	834.78	Good
	8	Beryanak	35.67059	51.37572	6.86	−41.5	1884.12	−42.3	1709.93	Good
	9	Zeytoon Park	35.66222	51.46341	13.15	−51.3	611.92	−50.3	682.76	Good
	10	Qiam Dasht	35.52219	51.64326	35.46	−116.2	0.34	−119.8	0.23	Bad
	11	Shahrak Sharifi	35.61607	51.34354	12.11	−46.5	1054.90	−62.9	160.60	Good
	12	D01 (Ozgol)	35.79019	51.49646	12.11	−92.5	5.34	−95.4	3.80	Bad
	13	D06 (Laleh Park)	35.70963	51.39128	4.95	−45.5	1191.90	−44.1	1389.93	Good
	14	D13 (Vahdat Park)	35.75975	51.46761	12.16	−100.6	2.08	−104.2	1.38	Bad
	15	D21 (Tehransar)	35.70278	51.26514	7.17	−46.7	1032.80	−45.4	1204.53	Good

Figure 2.4.24 shows the proposed communication network structure for 5.8GHz. The proposed repeater site is shown at Table 2.4.11.

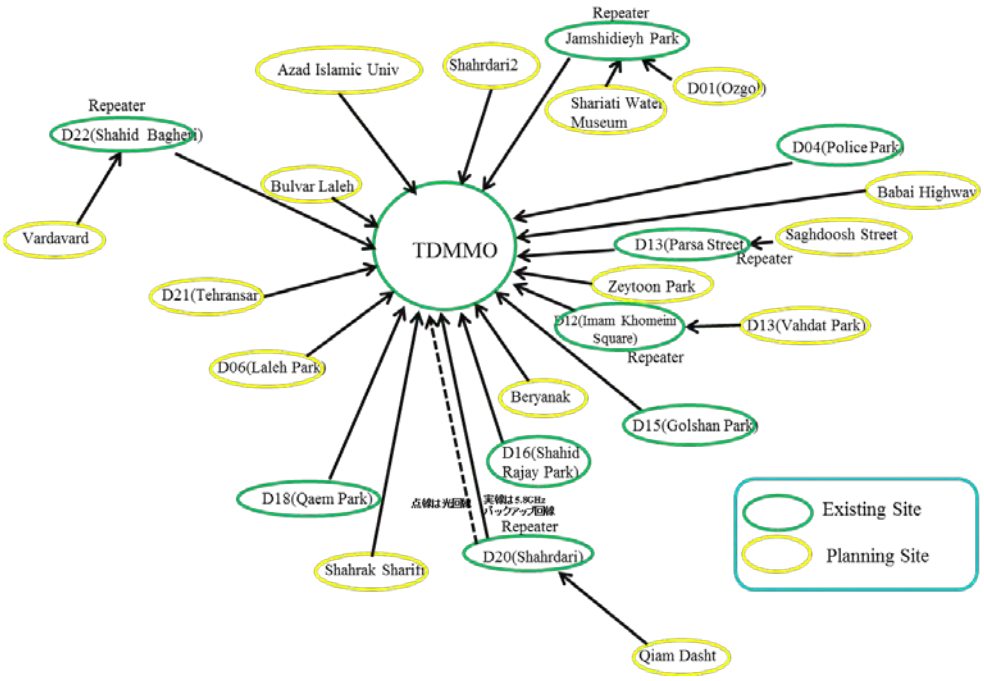


Figure 2.4.24 Proposed communication network structure for 5.8GHz

Table 2.4.11 Proposed repeater sites

Repeater site	Stations necessary to use repeater
D22(Shahid Bagheri)	Vardavard
D20(Shahrdari)	Qiam Dasht
D12(Imam Khomeini Square)	D13(Vahdat Park)
D13(Parsa Street	Saghdoosh Street
Jamshidieyh Park	Shariati Water Museum、D01(Ozgol)

The simulation considered two cases of antenna heights, 20m and 6m. However, the effect of buildings was not considered. Antenna height for actual operation should be 30 to 40m to overcome any building effect.

b) Field test of 5.8GHz long distance wireless LAN

A field test of the 5.8GHz wireless LAN was conducted between D22 and TDMMO. As a result, it was found that the strength of the radio signal obtained was adequate in the case of no obstacles. A test for the relationship between signal strength and the divergence angle from the true direction shows that the connection was stopped in the case of an 8 degree misalignment, however no disconnection was observed within +/-4 degree misalignment, but the S/N was 10dB, which was 20dB lower than for the direct alignment and bandwidth was decreased to 100kbps. Therefore, communication is possible even during earthquake shaking.

c) Installation and operation of 5.8GHz wireless LAN to D22 and Azad University.

TDMMO installed the 5.8GHz wireless LAN to D22 station, and established a connection in May 2014. Seismic data has been received from D22 through the 5.8Gz network without any serious problems. Additionally, TDMMO installed the network to Azad University where a new station was installed in September 2014 and established connection.

Figure 2.4.25 Field communication test near D22

e) Analysis of communication status of 5.8GHz during a heavy sand storm

A heavy sand storm hit on 2014/6/2 in Tehran. The velocity of the wind was 100km/hour (27.8m/s), which caused 4 deaths and more than 30 injured. The effect of the extreme weather on the 5.8GHz long distance wireless LAN between D22 and TDMMO was analyzed. Figure 2-4-4-4 shows the result regarding how many packets could be received every minute. The number of packets decreased to 3.3% at the worst condition, because the radio waves were scattered by the water and sand along the line of site causing very low S/N. One more backup communication line is necessary for such abnormal situations.

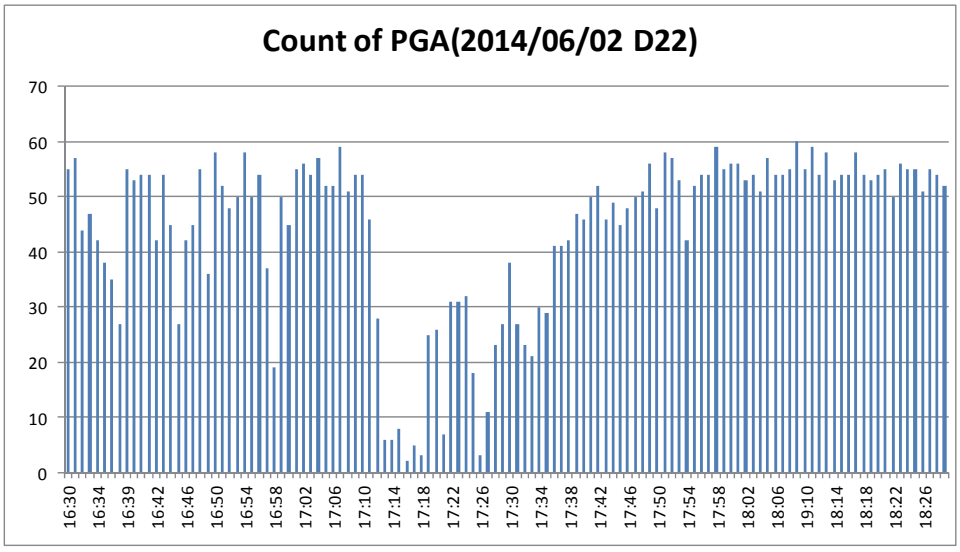


Figure 2.4.26 Receiving packets during a heavy sand storm (17:10 to 17:30)

f) Communication test for 3G mobile network

Tests using a 3G modem of RighTEL were supported.

The D15 network, one of the existing stations was connected to a 3G modem and a transfer test to TDMMO was conducted. The data could be transferred but IP routing using a private address could not be applied.

Testing for connection for point to multi-point was conducted. Two points to one point connection was confirmed.

Connection testing using a 3G modem at Rudehen where an EEWS station is located was conducted on 2014/11/19. A connection was established and no packet loss was observed between Rudehen and TDMMO, however the response time was 90ms at the shortest and it was sometimes in the hundreds.

(3) Technical transfer

The following technical skills and knowledge were transferred. At the beginning of the project, C/Ps at TDMMO do not have enough knowledge of technical characteristics of each communication system and all rely on suppliers. Question and requirement to suppliers for establishment of communication system were not appropriate because of insufficient understandings. Through tens of technical discussions and OJT at collaboration of field communication test, following technical transfer was completed.

1) How to create technical specifications (understanding the technical contents)

How to create technical specifications for equipment for 5.8GHz long distance wireless LAN and 400MHz radio communication, including instruction for installation was transferred.

2) Simulation of radio communication system

Simulation software (Radio Link) for design and configuration of radio communication systems was provided and instruction regarding simulation and understanding and evaluation of the result were transferred.

3) Checking and inspection after installation of radio communication equipment

Items for checking and inspection after installation of communication equipment by a contractor were transferred.

(4) Tasks for the future

TDMMO is recommended to allocate necessary budget and implement the improvement plan. An MOU or an agreement between TDMMO and TCC or RighTEL is indispensable. The design of the networking technology is not sufficient for effective use of the equipment for stable networking (because of its too complex configuration), or for easy expansion of the network nodes. To design and establish an effective, flexible, and robust network is a future task. In order to improve the network, high-skilled network expert should support TDMMO. In case of lack of such human resources in Iran by long-term international sanctions, Japanese side should provide more support for this item.

2.4.5【23】To increase number of items covered by the QD&LE system in addition to buildings and casualties (Activity3-5)

(1) Outline

TDMMO have been wanting to increase the number of QD&LE items from the beginning of the previous project. However, in the previous project, TDMMO took years to discuss the damage estimation methodology and software engineering. Three items, PGA interpolation, building damage estimation and human damage estimation, were implemented. TDMMO had been wanting to increase the number of QD&LE items even after the previous project, but no more items were added at the beginning of this project in April, 2012.

The team of this project reviewed 14 additional QD&LE items TDMMO wanted in the criteria of input data availability, damage estimation method availability, and importance after an earthquake shock. Three additional QD&LE items, which are hospital damage estimation, bridge damage estimation and debris volume estimation, were selected, and added into the QD&LE system.

In addition, the software model of the QD&LE system is revised. The reason TDMMO had not yet succeeded to increase QD&LE items is that all the systems were planned to be in one large program which requires a longer time to develop and test. In this project, increasing QD&LE items became easier because all the additional QD&LE items are designed as standalone engines.

Technical transfer to increase QD&LE items has been realized by OJT with counterparts, including selecting QD&LE items to add, defining the damage estimation methodology, collecting data, coding and testing the damage estimation engine.

(2) Activity

1) Selecting additional QD&LE items from TDMMO's proposal list

TDMMO had shared a proposal list for additional QD&LE items with JICA in 2011. TDMMO gave JICA the updated list in 14, April, 2012, as follows.

1. Estimation of volume of post-earthquake debris
2. Damage estimation for Hospitals
3. Damage estimation for bridges
4. Estimation of post-earthquake emergency resources
5. Modification and updating the earthquake simulation methods
6. Estimation of post-earthquake geotechnical hazards (liquefaction, un- equivalent compression of ground which causes underground-pipe and/or building damage, land slide, fault rupture etc.)
7. Damage estimation for transportation systems
8. Damage estimation for water and waste water systems

9. Damage estimation for Natural gas systems
10. Damage estimation for electrical power systems
11. Damage estimation for fires following an earthquake
12. Defining client server outputs (WEBGIS outputs)
13. Damage estimation for post-earthquake hazardous material release
14. Estimation of direct and indirect economic losses

The resources of the project team were not adequate to develop all these items in parallel. The project team decided to develop additional QD&LE items in turns. In order to select the 1st additional item, the project team discussed the comparing criteria, and then compared the list of proposed items.

The comparing criteria concluded by this project are shown in Table 2.4.12. The project team comparing the proposal list items not only by priorities in the beginning of quick response, but also possibilities to be realized in the project schedule.

Table 2.4.13 is the score of the proposal list items. The project team selected the highest items, which are hospital and bridge damage estimation, among Activity 3-5 items.

TDMMO and JICA had different conclusions on debris volume estimation. The JICA Expert suggested that debris volume should be calculated based on real damage surveys instead of the QD&LE building damage estimation because debris volume estimation is not necessary until quick rescue has been finished and debris volume could be calculated more precisely based on a real damage survey. In addition, damage estimation for disaster management planning is recommended to be calculated other than QD&LE system, because QD&LE system requires stable and automated calculation just after earthquake while damage estimation for planning requires for many cases of which simulation input and parameters are changed. However, debris volume estimation is selected as a QD&LE item because of TDMMO's strong request. Although TDMMO did not clearly explain why TDMMO strongly request debris volume estimation, some of the TDMMO experts wanted to use QD&LE system for its planning purpose.

Table 2.4.12 Criteria to Compare Potential QD&LE items

Criteria	Status	Score
A. Activity defined in PDM	Activity 3-5	3
	Activity other than 3-5	2
	Not defined	1
B. Data Availability in TDMMO	Updated data is ready	2
	Old data is ready	1
	Not ready	0
C. Data Access Permission Possibility for JICA Expert	Permission is ready	2
	Permission is not ready, and data source is TDMMO	1
	Permission is not ready, and data source is other than TDMMO	0
D. Calculation Model Availability	Ready	2
	Old model is ready	1
	Not ready	0
E. Usage of Quick Estimation of Probabilistic Damage	Useful for quick response, even probabilistic information	3
	Useful for quick response, but probabilistic information would mislead emergency response	2
	Lower risk in Tehran	1
	Not for quick response	0
F. Priority requested by TDMMO on 14, Apr. 2012 (*1)	Higher Priority	3
	Middle Priority	2
	Lower Priority	1

*1 Priority requested by TDMMO on 14, Apr. 2012 in the discussion of Work Plan

Table 2.4.13 Score of Proposal List Items

ID	Item	Activity ID	A	B	C	D	E	F	Total
1	Estimation of post-earthquake debris	3-5	3	1	2	1	2	1	12
2	Damage estimation for Hospitals	3-5	3	1?	2	1	2	3	36
3	Damage estimation for bridges	3-5	3	2	1	2	2	3	72
4	Estimation of post-earthquake emergency resources	3-5	3	0	0	0	2	3	0
5	Modification and updating the earthquake simulation methods	-	1	0	0	0	3	1	0
5.1	Updating TEDES using soil amplification model from IIEES	-	1	2	1	2	3	1	12
5.2	Updating TEDES using fragility curve from IIEES	-	1	2	1	2	3	1	12
5.3	Updating TEDES using building data from IIEES	-	1	2	1	2	3	1	12
5.4	Updating TEDES using population data from IIEES	-	1	2	1	2	3	1	12
5.5	Updating TEDES using epicenter-fault-magnitude-attenuation model	-	1	2	2	0	3	1	0
6	Estimation of post-earthquake geotechnical hazard (liquefaction, un-equivalent compression of ground which causes underground-pipe and/or building damage, land slide, fault rupture etc.)	3-8	2	0	0	0	3	1	0
6.1	Estimation of post-earthquake land slide	3-8	2	0	0	0	3	3	0
7	Damage estimation for transportation systems	3-5	3	1	2	0	2	3	0
8	Damage estimation for water and waste water systems	3-5	3	1	2	1	2	3	36
8.1	Damage estimation for water systems	3-5	3	1	2	1	2	3	36
9	Damage estimation for Natural gas systems	3-5	3	1	2	1	2	3	36
10	Damage estimation for electrical power systems	3-5	3	1	2	1	2	3	36
11	Damage estimation for fires following earthquake	3-5	3	1	2	1	2	1	12
12	Defining client server outputs (WEBGIS outputs)	3-7	2	1	2	2	3	3	72
13	Damage estimation for post-earthquake hazardous material release	3-8	2	1	2	1	1	3	12
14	Estimation of direct and indirect economic losses	-	1	0	0	0	0	1	0

2) Software Design

a. Modularization

The QD&LE system developed by the previous project was all-in-one software, in which all the modules, such as seismic information receiving module, damage estimation modules, mapping modules and warning submission modules, were deeply dependent on each other. This design is

the reason why adding or substituting any module of QD&LE is difficult. This project discussed a new software design that creates modules that are independent and adding or substituting modules will be easier.

Because of shown as "Additional QD&LE Softwares" in Figure 2.4.27, additional software is composed of damage estimation modules and a module manager.

This module manager detects earthquake via SQL server of QD&LE system. Once earthquake is detected, it triggers new estimation modules.

As the 1st stage of additional software, estimation modules for bridge damage, hospital damage and debris were developed as standalone binary executables, and they read input data and write output data directly with an SQL Server.

In order to control these standalone binary executables, a module manager is newly designed. This module manager detects earthquake via the SQL server of QD&LE system. Once an earthquake is detected, it triggers new estimation modules.

The whole plan is shown in Figure 2.4.27.

b. System Requirements

System Requirements of additional QD&LE items are the same as those of the original QD&LE system because additional QD&LE items should run with the original QD&LE system.

c. Damage Estimation Methods

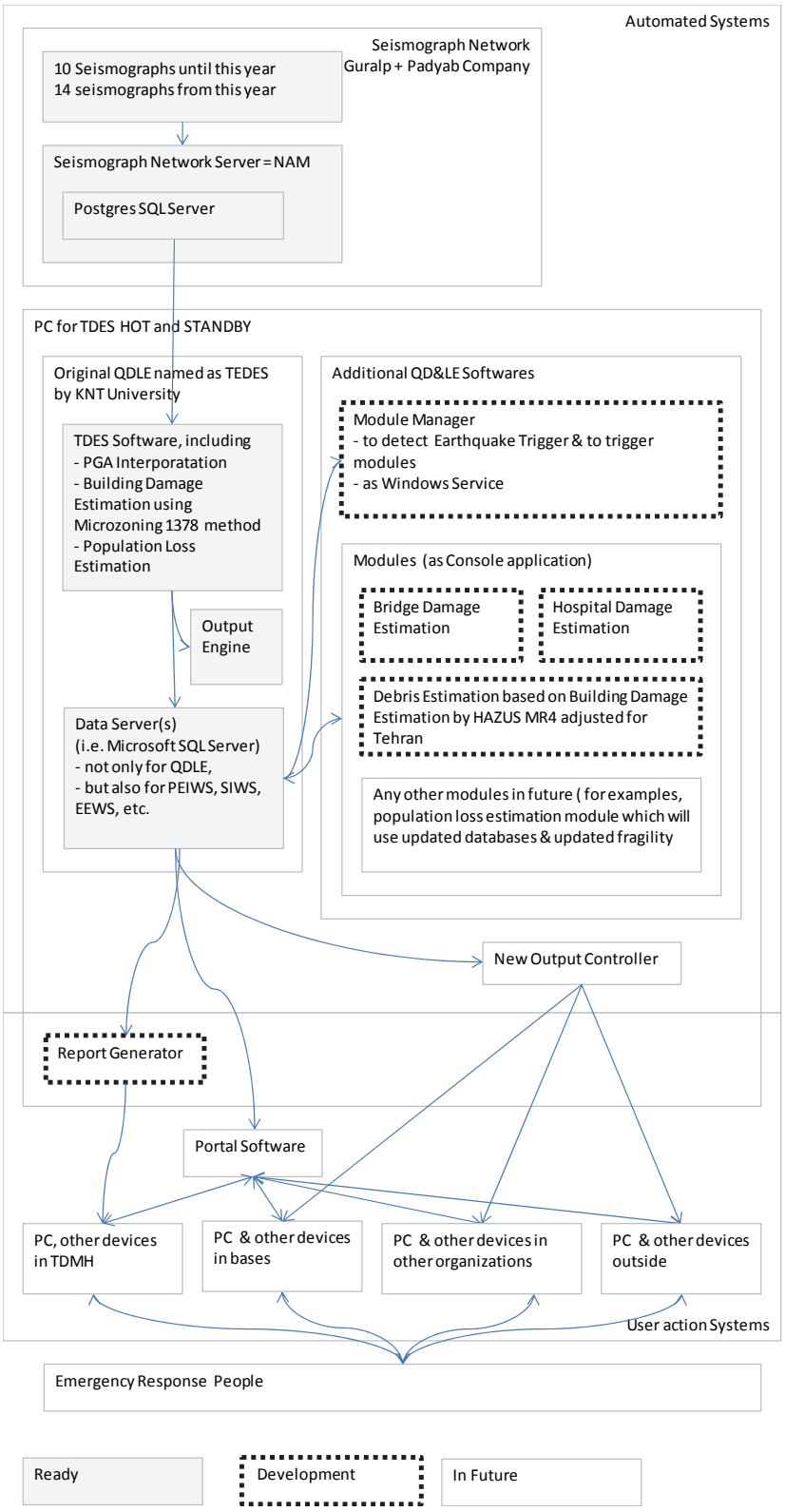
It is better to apply a damage estimation model based on the building characteristics and damage survey outputs of Tehran or Iran. However, building damage survey outputs in Iran are generally created without ground motion monitoring data. In response to the strong proposal of some experts of TDMMO, the project decided to apply HAZUS MR5 method of FEMA of USA until damage survey information of real Iranian earthquakes will be available in adequate detail.

Advantage of HAZUS MR5 method of FEMA of USA is a method continuously improved by the scientist in USA, and authorized by FEMA of USA. Its disadvantage is its parameters which have been developed for normal structures in USA. Characteristics of structures in Tehran might be different because structure design and construction quality control is different from those in USA. Therefore, damage parameters suitable for the structures in Tehran are expected to be different from those in USA.

d. Output of additional QD&LE items

Outputs of QD&LE items are expected to be shared with all relevant quick response organizations including district disaster management centers. TDMMO plans to develop an Intranet system such as a disaster management portal or Web-GIS. In order for these systems to show additional QD&LE items seamlessly, outputs of additional QD&LE items are designed to be stored in SQL database. For the time being before the information sharing system is developed, temporary software is developed to read the QD&LE outputs from the SQL database and to display s results.

Software documents have been prepared and are in the approval process of TDMMO.



Functions in Gray were developed in the previous project. Functions in thick dotted lines were developed in Activity 3-5 of this project.

Figure 2.4.27 General Components Diagram of QD&LE System

3) Software Development and Testing

Software was started to be developed by a system engineer of the IT Group of TDMMO, supervised by a counterpart of TDMMO. In the project period, the original supervisor quit from TDMMO for his military service and other counterparts took responsibility for it. TDMMO contracted with the system engineer to continue the project because he quit TDMMO.

Software was tested in the following conditions, then revised until it passed the tests.

(1) Standby test for continuous 30 days

(2) Triggering test for earthquake

(3) Damage simulation test by comparing all the damages calculated by alternative methods

4) Recovery of Original QD&LE System

Additional software to be developed in Activity 3-5 of this project is the modules shown with dotted rectangle in Fig. 2.4.5.1. These additional software modules assume all the ready software developed in the previous project is operated stably.

In June, 2014, NAM, which is one of the core components of the original QD&LE system, stopped. According to the counterparts, the hard disk became full, and the system could not be restarted. This might be because TDMMO had changed NAM's configuration to save 20 times more data per second for their pilot study. The service engineer of the distributer newly installed the latest version of the firmware, and configured it for TDMMO.

The QD&LE system ceased to function as expected. A module of the QD&LE system failed to import NAM's data and displayed error messages. According to the analysis of its source codes and error messages, the table schema of PostgreSQL of NAM is corrected, which made QD&LE import NAM's data correctly.

QD&LE still did not work correctly because QD&LE did not receive approximately 1/3 of the data. According to the analysis on NAM and QD&LE software shown in Figure 2.4.28, data transfer from CMG-DM24 to Scream! PC is continuous, and data transfer from gdi-base to database is failed so often. In this data transfer path, it was found that gdi2dbi dies every few minutes. Because source code of gdi2dbi is not open to public, engineers of the manufacturer and distributer are trying to solve this error. This issue is not yet solved in December 2015.

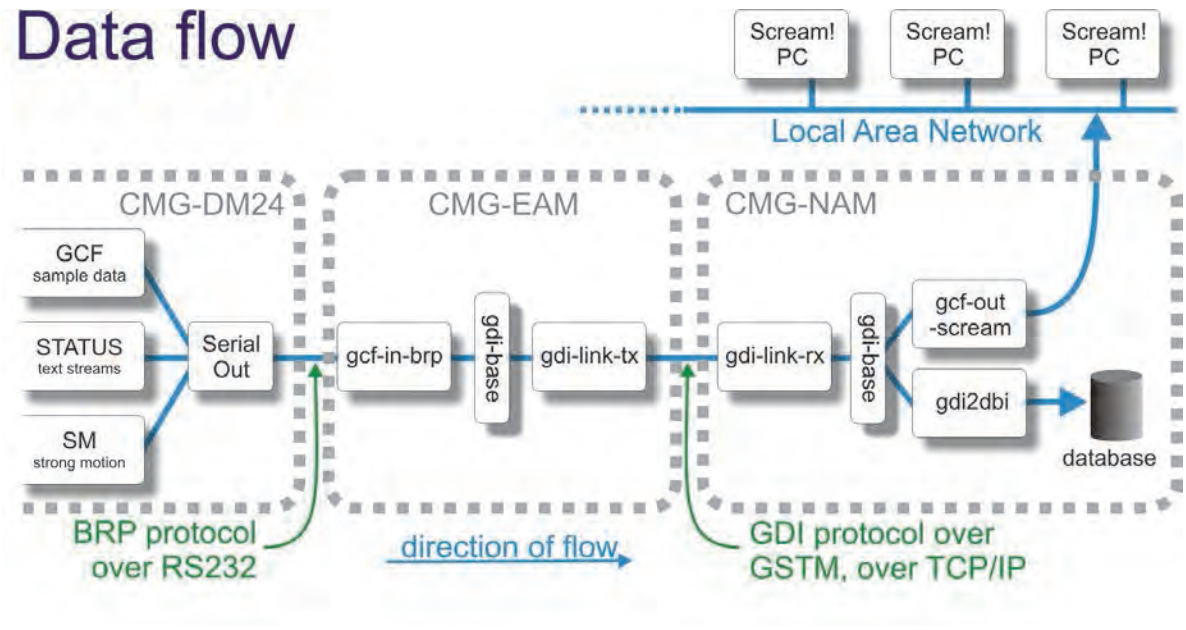


Figure 2.4.28 Data Flow (Source: MAN-BSP-001 of Guralp Company)

Note: CMG-DM24 is the digitizer to convert from seismograph analog data to digital data. CMG-EAM is the digital equipment to store the digitalized data and forward it to other equipment by Internet Protocol. These equipment are installed at each seismograph station. CMG-NAM is the digital equipment to receive and manage digitized data from stations. BRP＝Block Recovery Protocol, GCF = Güralp Compressed Format, GDI = Güralp Data Interconnect protocol, GSTM = Güralp Secure TCP Multiplexor, rx = receiver, TCP/IP = Transmission Control Protocol/Internet Protocol, tx = transmitter

(3) Technical Transfer

In the previous project, TDMMO ordered a software engineering group to develop an all-in-one system. TDMMO expected to develop a totally new version and even adding additional QD&LE items.

In this project, modularization is introduced. Additional QD&LE items have been developed by selecting items to be implemented first, and to develop them one by one. TDMMO will add additional QD&LE items one by one from now on.

In addition to this, technical transfer has succeeded in the two fields that TDMMO requires and that are not described in PDM, as follows.

There was no expert remained in TDMMO who can calculate damage simulation, although JICA trained some experts in previous projects. As the result, TDMMO wished to use QD&LE system not only for quick response but also for damage estimation for TDMMO's planning. QD&LE system became too complicated to increase items. In this project, in order to test the increased items, TDMMO counterparts have manually calculated the damage simulation many times using Excel in order to check the additional QD&LE engine. They became accustomed to calculating it manually. TDMMO will not require QD&LE system for TDMMO's planning purpose It makes TDMMO's damage simulation work easier. It will make additional QD&LE items in the future simpler because the OFFLINE damage simulation will not need to be implemented in the QD&LE system.

TDMMO counterparts have practiced recovering the original QD&LE components. This has improved their maintenance skill.

(4) Issues Remaining

Issues in the current QD&LE system are as follows.

① According to an interview with the QD&LE weekend operators, if an earthquake hits, they would wait until their commanders come before taking any action. Because QD&LE is the system to support quick response just after an earthquake, it would be better for TDMMO to define their initial duties even without their commanders. An initial operation manual and its practice are important.

② Some of the current configurations of the original QD&LE system are the same as the default configuration of the QD&LE system, and different from those at the conclusion of the previous project. For examples, PGA interpolation is configured at ground surface level although it was planned at seismic bedrock level. It is better to control QD&LE configuration periodically.

③ The TDMH system is vulnerable. For example, spare NAM and standby hardware for QD&LE are not ready. It is recommended that spare hardware should be ready and some key spare parts should be ready.

④ Because the QD&LE system was developed with the IP address framework of the MPLS network, it is not compatible with the IP address framework of the fiber optic network of Tehran Municipality. In order to supply QD&LE information to the disaster management committees, the IP address framework of QD&LE system should be converted from MPLS address framework to Tehran Municipality fiber optic network.

⑤ Damage estimation model of FEMA of USA is applied to the additional QD&LE items because the Iranian earthquake damage information was not adequate. In order to improve the damage simulation accuracy, it is better to study the relationship between ground motion and Iranian building damage, and to update the QD&LE damage simulation models.

⑥ The average time from hardware damage until its recovery is generally longer than it should be. The reason for each incident was different. For example, the hard disk became full, both of the RAID HDD were damaged, there was no system backup to restore, the person who knows the system had retired. In order to minimize off-service time, it is important to improve maintenance level by improving maintenance and management, sharing know-how such as by making, sharing and maintaining manuals, and quickening approval for repair and replacement.

2.4.6【24】To install a seismic intensity early warning system for emergency response and public awareness (Activity3-6)

(1) Outline

Japan has an environment which allows every citizen to receive information about a seismic intensity distribution just after an earthquake event because the seismic intensity display systems are linked with such broadcast services as TV, radio, cable broadcasting, Anti-Disaster Radio Communication System, local government information system and so on. In addition, people who are involved in the central and local governments, lifeline companies, education and so on have enough knowledge to estimate the disaster levels from the seismic intensity information. In an earthquake disaster, they are also able to perform appropriate emergency response based on their emergency response plans which have been provided in advance.

On the other hand, in Iran, it is difficult for each local functionary to take appropriate initial actions due to lack of information about seismic intensities.

With the aim of emergency response and raising public awareness, the Team studied an SIWS (Seismic Intensity early Warning System) that suits the situation in the Tehran Municipality using the seismographs that already exist. The Team developed the SIWS and added it into the QD&LE system.

The IGUT (Institute of Geophysics University of Tehran) is the only organization that can send out seismic information regarding earthquake events in Iran. It was, however, not necessary to negotiate with the IGUT because this SIWS was developed as a closed system within TDMMO.

(2) Details of the Activities

1) Discussions and Development

Through discussions with the C/Ps, regarding the need for SIWS, the following points were agreed upon:

- If the seismic intensity can be immediately evaluated for the disaster areas, it would allow us to accurately estimate the damage and loss because seismic intensity is determined based on the damage to buildings and the mental and physical influences on people caused by the earthquakes. It differs from the damage estimation by PGA (Peak Ground Acceleration).
- The seismic intensity is indispensable to decide the initial actions and emergency response in an earthquake disaster.
- Instrumental Seismic Intensity determined by JMA (hereinafter referred to as JMASI) is an exclusive seismic intensity scale which can be directly calculated by observed waveforms of ground accelerations. Therefore, JMASI can be determined automatically, rapidly and objectively
- Appropriate conversion from JMASI to MMI (Modified Mercalli Intensity), which is commonly used in Iran, is necessary.
- The seismic intensity at local sites should be calculated and displayed at the local stations. And then, the seismic intensities at every local station should be collected at TDMH. Because

emergency response for earthquake disaster must be activated even in case of lost network and no information come from TDMH.

Based on the above discussions, the Team designed SIWS so that the Instrumental Seismic Intensity was calculated at each seismograph station, and then, the seismic intensities were displayed both at the local station and at TDMH.

Figure 2.4.29 is a schematic diagram of the SIWS and Figure 2.4.30 shows information flow with regard to SIWS.

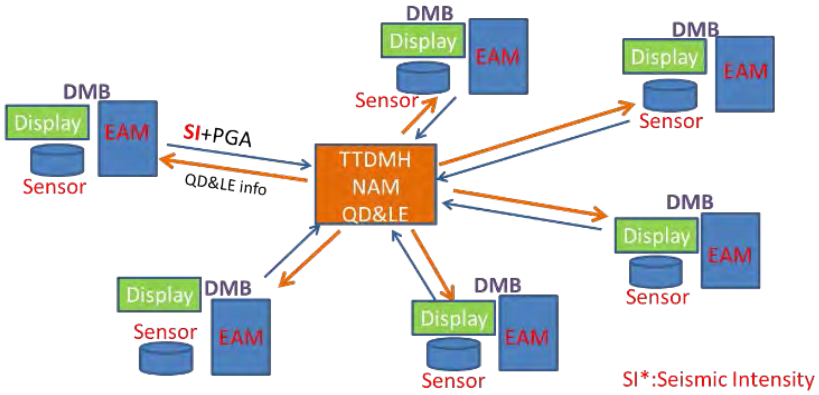


Figure 2.4.29 Schematic Diagram of SIWS

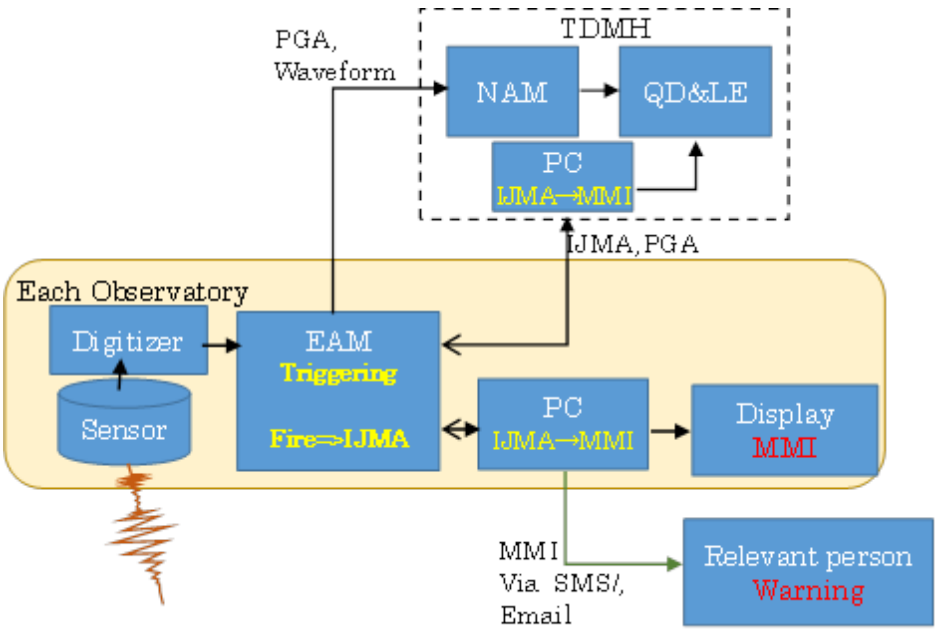


Figure 2.4.30 Information Flow with regard to SIWS

Information flow of SIWS designed by the Team is as follows:

① Applying Triggering function in EAM (Embedded Acquisition Module), Instrumental Seismic Intensity is calculated by EAM if earthquake waves which have accelerations greater

than the threshold level are observed. The calculated Instrumental Seismic Intensity by EAM (hereinafter referred to as IJMA) is saved in a local tablet PC which is linked to the EAM.

Initial setting of the Triggering function was decided by C/Ps and the Team as follows:

Type of triggering: Level trigger

Threshold: 4gal in both horizontal components

Filter: Band pass filter from 0.1Hz ～10Hz

Length of pre-trigger: 30s

Length of post-trigger: 60s

Max record length (excluding length of re-trigger): 120s

Vote Weight/ Vote threshold: 1000/1000

② IJMA is converted to MMI using the conversion table shown in Table 2.4.14. Table 2.4.14 was presented based on the relationship between I_{JMA} and I_{MMI} shown in Figure 2.4.31.

③ MMI is displayed on the screen of the tablet PC. A warning is issued in a red colored display if the MMI scale is great.

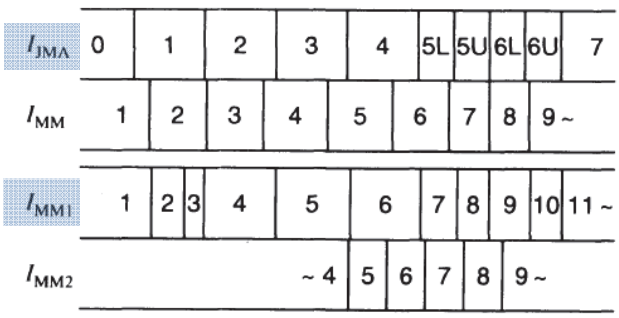
④ Information about the MMI scale is delivered via either SMS or Email to designated destinations which have been registered on a mailing list in advance.

⑤ Procedure ①~④above can be operated not only by the local site but also by the TDMH side.

⑥ A warning can be displayed on the PC screen if the data transmission between EAM and the local tablet PC is not established for a prespecified number of minutes

Table 2.4.14 Conversion Table from SI_{JMA} to MMI

Instrumental sI ($SI_{cal.}$)	< 0.5	< 1.0	< 1.5	< 2.5	< 3.5	< 4.5	< 5.0	< 5.5	< 6.0	< 6.5	>= 6.5
SI_{JMA}	0	1	1	2	3	4	5-	5+	6-	6+	7
MMI	I	II	III	IV	V	VI	VII	VIII		X	XI



Takashi Kunugi, 2000, Relationship between Japan Meteorological Agency Instrumental Intensity and Instrumental Modified Mercali Intensity Obtained from K-NET Strong-motion Data, Jishin, Vol53 No.2, P89-93

Figure 2.4.31 Comparison between JMASI and MMI

Relationship between I_{JMA} and I_{MMI} shown in Figure 2.4.31 refers to a technical paper (Trifunac and Brady, 1975). Even though the reference studied the relationship between the old version JMASI and MMI, this relationship is often referred to by many papers which study the relationship between the current JMASI and MMI. Therefore, Figure 2.4.31 is used for the initial conversion table.

2) Development of a Software for SIWS

The Team had initially intended to develop software for SIWS in which JMASI can be calculated from observed seismograms, and then the calculated JMASI can be converted to MMI. A beta version of software which calculates JMASI from seismograms had already been developed. On the other hand, it was noticed that the recent Guralp EAM's firmware (Software build number 10000 and later) is equipped with a function for calculating Instrumental Seismic Intensity. In order to shorten the development period, it was decided to utilize this function to obtain IJMA by updating the firmware from build number 3016 to the latest build number 13672.

The Team and TDMM's C/Ps developed software which can convert IJMA to MMI and can display the results on a PC screen. This software works on a Windows PC which is linked with EAM via the same network.

An outline of the software developed for SIWS is shown in Table 2.4.15. An example of a display of SIWS is shown in Figure 2.4.32.

Table 2.4.15 Outline of SIWS software

Items	Specifications	Script files
Operation Software, Development language	OS: Windows7 Development environment: XAMPP 1.8.3-5 Appach, Mercury Development language: PHP script	
Input	"fetchIntensity.bat" controlled by "Windows Task Scheduler" is running every minute to watch IJMA in EAM. Using RSS , IJMA files can be extracted from EAM and copied to the PC if any new files are created.	fetchIntensity.php fetchIntensity.bat
Processing	Conversion from IJMA to MMI. Up-date MMI every minute. Watching connection between EAM and the local PC.	Index.php
Output	Displaying MMI (together with PGA and IJMA). Warning is issued if connection between EAM and the local PC fails.	

The developed software which has been installed on a Windows 8.1 tablet PC is working at an existing seismograph station for evaluation purposes (Figure 2.4.33).

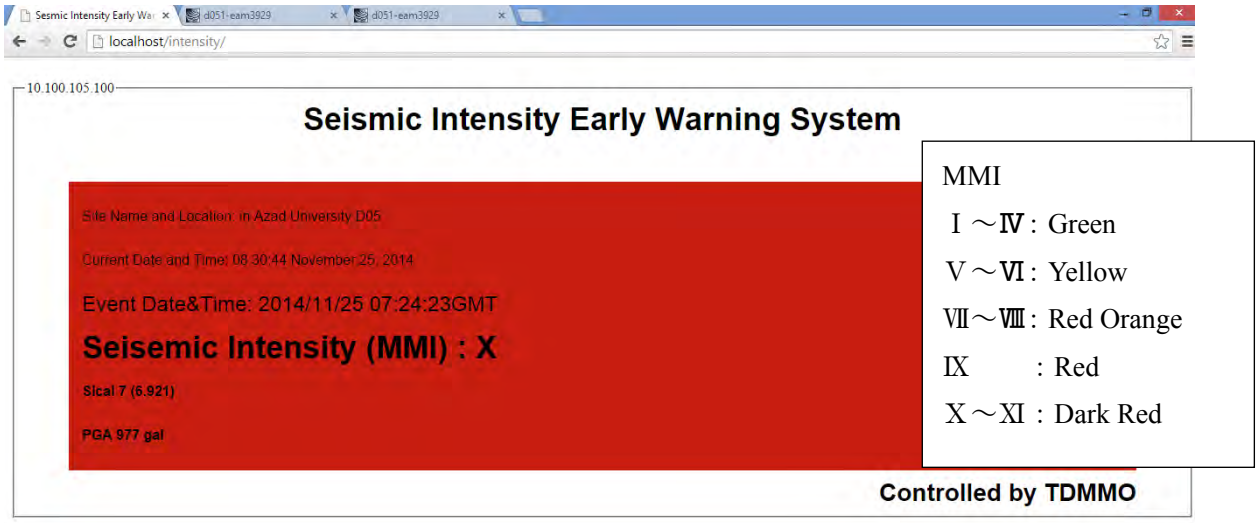


Figure 2.4.32 Example of Display of SIWS

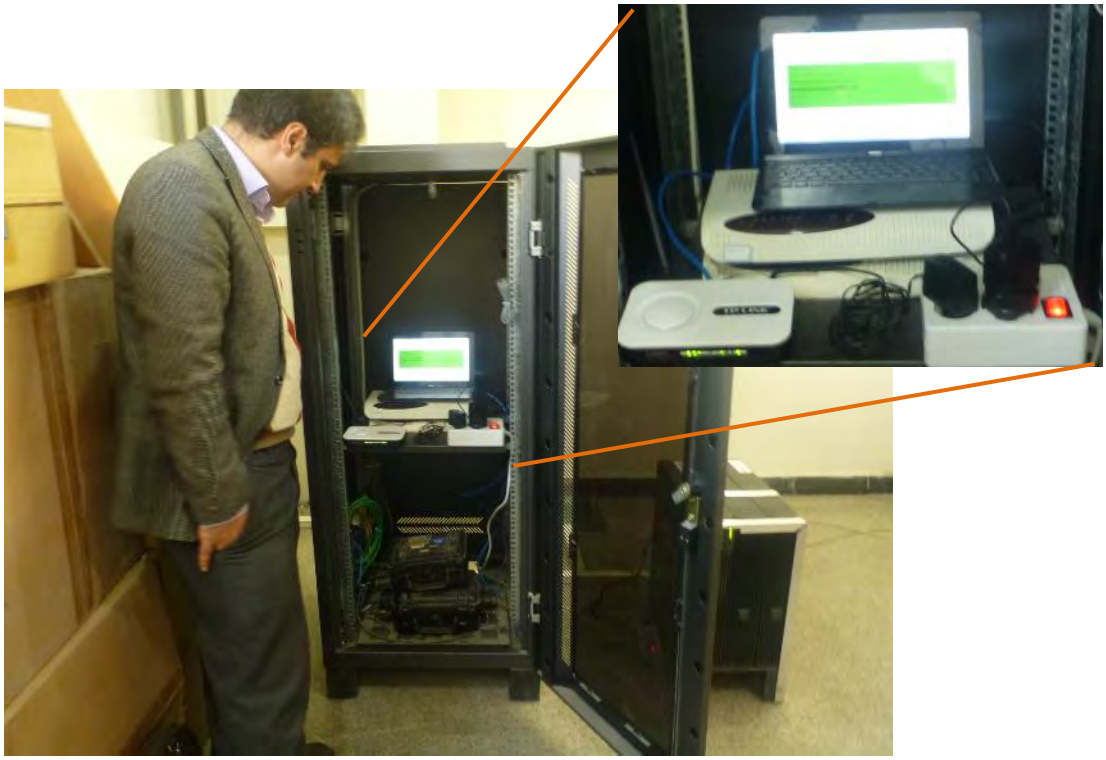


Figure 2.4.33 Installation of SIWS at a seismograph station D04

(System rack is fixed on the floor and powered by UPS with 72 hours)

3) Accuracy of IJMA

Guralp EAM (Embedded Accession Module) Platinum is equipped with a function to generate Instrumental Seismic Intensity (IJMA).

In order to utilize IJMA for SIWS, the accuracy of IJMA was verified by the following two relationships:

① Relationship between JMASI which is officially announced by JMA and calculated seismic intensities using software the Team coded (hereinafter referred to as $JMASI_{JET}$)

② Relationship between $JMASI_{JET}$ and IJMA

Based on the evaluation results regarding the accuracy of IJMA, it was concluded that IJMA values can be handled the same way as JMASI values are.

The evaluation steps were as follows:

First, 52 seismographs which were recorded during *The off the Pacific coast of Tohoku Earthquake 2011* were utilized to calculate $JMASI_{JET}$. Results of these $JMASI_{JET}$ were compared with JMASI officially announced for the same observatories. It was verified that $JMASI_{JET}$ were equivalent as JMASI (Figure 2.4.34)

Second, the relationship between IJMA and $JMASI_{JET}$ was studied. Instead of actual earthquake records, waveforms which were obtained by a seismograph which was placed on a table and was shaken by hand were utilized. IJMA values which were generated by EAM connected to the sensor and $JMASI_{JET}$ values calculated with the same waveforms were plotted (Figure 2.4.35). It was also verified that IJMA were equivalent to $JMASI_{JET}$.

Regarding the conversion method from IJMA to MMI, the conversion table shown in Table 2.4.14 will be utilized as a tentative method. However, this conversion method must be modified if further seismic intensity data is accumulated and studied.

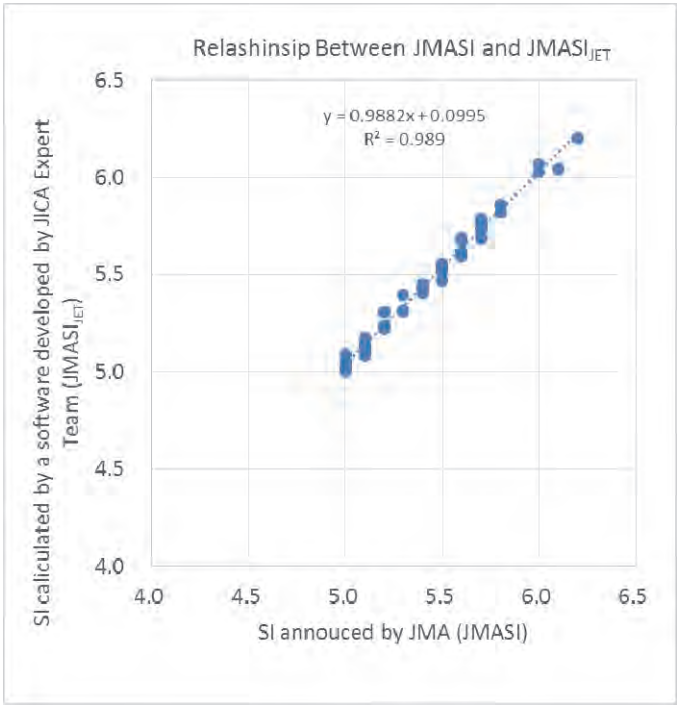


Figure 2.4.34 Relationship between official JMASI recorded at *The off the Pacific coast of Tohoku Earthquake 2011* and JMASI$_{JET}$ which were calculated by software developed by the Team

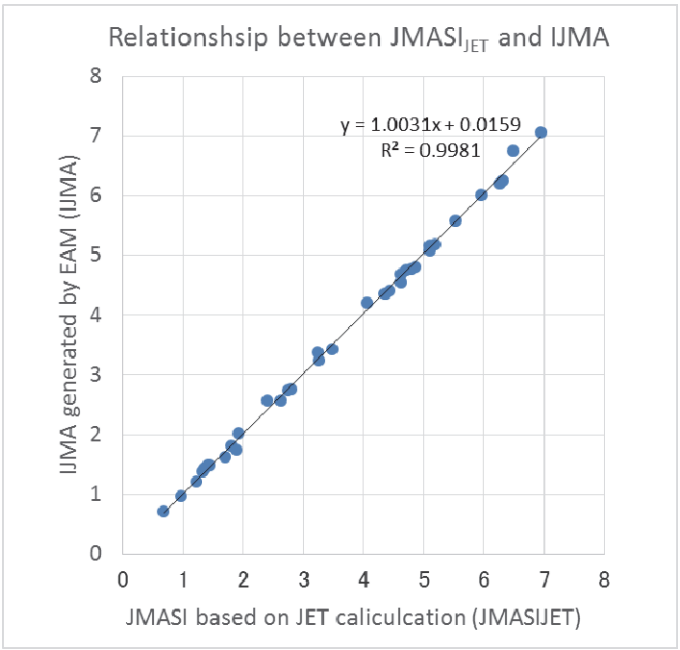


Figure 2.4.35 Relationship between JMASI$_{JET}$ which was calculated by software developed by the Team and JMASI which were calculated by EAM

4) Addition of Seismic Intensity Information to QD&LE

The system was designed so that Seismic Intensity in MMI scales can be delivered to designated destinations via either SMS or Email. Fig. 2.4.6.7 shows an example of an Email that was delivered regarding the Seismic Intensity Information.

SIWS will be upgraded with an additional function in which Seismic Intensity Information can be added to the QD&LE system so that the information can be accumulated on the database together with PGA and other information. The information can be delivered to designated organizations and functionalities via SMS or Email in case of an earthquake emergency.

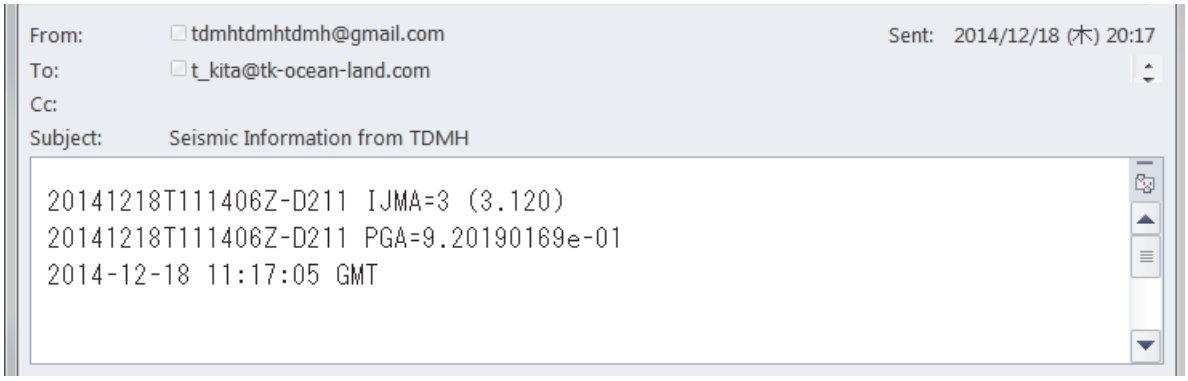


Figure 2.4.36 An example of an Email of Seismic Intensity Information delivered from TDMH

(3) Technology Transfer

The Team provided basic information and software with regard to the SIWS to TDMMO's C/Ps. In addition, the importance of the SIWS is well understood by the relevant people in TDMMO. IT group of TDMMO understood meaning of the data, how to receive the data from existing system, calculation method of JMA seismic intensity, how to display data through Internet, and how to transfer the data. Then, IT group developed a Seismic Intensity Web-delivery System on supervising by expert. Thus, it is evaluated that the technology transfer related to seismic intensity to TDMMO's C/Ps is already complete.

(4) Issues

In order for the prototype of SIWS to work practically and effectively in case of an earthquake disaster, it was verified by both sides of the Team and TDMMO that TDMMO must tackle the following subjects relating to SIWS.

① To improve the conversion method from IJMA to MMI based on further studies of the relationship between MMI scales and damage and loss information.

Though Instrumental seismic intensity scale used by IJMA is only one in the world which can be calculated mathematically using earthquake waveform without any subjection, MMI is a value from damage evaluation with human judgment. On the other hand, MMI is generally used in the world and TDMMO uses MMI at disaster education. Therefore the system calculates IJMA and converts to MMI using empirical function. Since the empirical function depends on local situation, suitable function should be selected or found to convert IJMA to MMI in future.

② To immediately add information written in Farsi on the SWIS display which is currently only indicated in English.

Since possible user is Iranian people, Farsi version should be developed.

③ To tune up such parameters as Triggering based on the results of the test operation.

Configuration to start calculation and display at how big earthquake detected should be tuned.

④ To improve the software for SIWS stable operation.

Implementation of network-based software should be evaluated and improved its stability and performance through continuous operation. Items to be improved are, for example, timing of data transfer or delivery of seismic intensity, reduction of unnecessary network traffic, how to retry if network error happens, revising to smaller and better processing code.

⑤ To improve the robustness of system security relating to such communication tools as SMS and Email.

To prevent hijacking to delivery wrong messages or to destroy the system, robustness for security should be improved.

⑥ To improve the function for adding seismic intensity information into the QD&LE system.

QD&LE system and the seismic intensity system are operated individually. Though these two systems use different data from same seismograph stations, basically, PGA by QD&LE and SI by the system should be displayed parallelly and integrated. Since seismic intensity relates to damage more tightly than PGA, quick damage and loss estimation should be based on seismic intensity rather than PGA in future. Thus, the seismic intensity system should be integrated to QD&LE system.

Finally, it was agreed that the following administrative measures were necessary to operate SWIS effectively:

- To promote emergency response plans based on seismic intensity scales in case of an earthquake disaster.
- To promote public awareness about the relationship between seismic intensity scales and disaster levels in order for SIWS to be utilize effectively.

2.4.7 【25】To improve the current multi-layered warning system for more effective emergency response activities (Activity3-7)

(1) Outline

In the previous project, the following warnings were incorporated into the QD&LE system for effective emergency response activities

1. Warning sounds in TDMH (Automatic, whenever an earthquake is detected at more than threshold)

2. Warning print out of damage estimation at the printer and plotter in TDMH (Automatic, whenever earthquake is detected at more than threshold)

3. Warning SMS and e-mails of damage estimation (Automatic, whenever earthquake is detected at more than threshold)

4. Sharing damage estimation at Portal Website of TDMH (Automatic, whenever earthquake is detected at more than threshold)

At the beginning of this project, it was a problem that most of the warning functions of the QD&LE system were generally not configured, although the QD&LE warning system was still online.

At first, the project team of activity 3-7 developed a plan for warning delivery, what, when, how, and to whom. It was named the "Earthquake Information Matrix". In order to be approved in TDMMO, it was discussed and updated several times.

In order to improve the warning contents, a seismic intensity distribution information warning, which is the most primary warning information in Japanese disaster response, was implemented, using the output of Activity 3-6.

The SMS engine applied in the previous project depended on copper line ADSL and MAGFA service of which the seismic vulnerability had been not evaluated. As an improvement for the warning delivery method, a new SMS engine is applied. It directly sends SMS via the 3G network of which access is wireless.

TDMMO has not yet defined the delivery targets of SMS, e-mail and web site access permission. The activity 3-7 team started pilot usage of the system for the counterparts of output 3.

(2) Activity

1) Issues Review

At the beginning of this project, the following issues were identified via review of QD&LE operation.

1. Warning sounds were active only for demonstration hours. This was because the signal line from the computer to the speaker was generally unplugged.

2. SMS warnings were not delivered. It was because no mobile numbers except samples were registered in the QD&LE address book, the new router was not configured to route between the QD&LE system and the SMS engine, and the MAGFA SMS service with TDMMO was suspended.

3. E-mail warnings were not delivered. It was because no e-mail addresses except samples were registered in the QD&LE address book, the SMTP server used by QD&LE system was OFF, and the new router was not configured to route between the SMTP server and the Internet.

4. The portal web site was not available for QD&LE output. It was because configurations of the portal web site and QD&LE did not match each other, and the portal web site was not accessible outside of TDMH.

The common problem for all of these issues was that warnings are not yet defined in terms of what, when, how, and to whom

2) Designing Warnings

TDMMO was not able to define detailed specification of warning system because TDMMO had not defines requirement of warning in detailed. For examples, in the discussion of debris estimation for additional QD&LE items, some counterparts discussed for debris volume on emergency road network. Others discussed for total debris volume of the city.

In order to solve this issue, the project decided to compile the detailed specification of warning system, including specification of information (When and which organization requires), specification of information collecting or estimation, and methodology to deliver the information. This process is not necessary in Japan because it is defined in emergency response plans, and not necessary to be defined in system designing stage.

Based on the warning design summary developed in the previous project (Figure 2.4.37), the activity 3-7 team developed it as an Earthquake Information Matrix by the procedure below;

1. Necessary information for quick response activities was enumerated.

2. All the information is related to quick response activities categorized by 20 committees for the Emergency Response Plan of Tehran.

3. Necessary timings of all information were identified.

4. Methodology was discussed regarding how to develop information . This means how information will be estimated, collected or compiled, and by which organization.

5. Methodology of information delivery was discussed.

The 1st draft Earthquake Information Matrix was developed in December, 2013 by the Activity 3-7 team. Based on the discussions with TDMMO and other disaster response organizations, an explanation document was created, and then the matrix and explanation document were revised It seems that it has been in the queue for final revision and approval since September 2014. , . The

cover page of the draft final explanation document is shown in Figure 2.4.38. The draft final matrix is shown in Figure 2.4.39.

Content	Condition	Destination						Extent				Resolution			
Content	Condition of Output T: Triggered, N(p): Normal, Periodical, N(e): Normal, Eventually	E-mail	SMS Maintenance responsibilities	SMS Disaster Operation responsibilities	Data ERCC information system	Plotter (A0) ERCC information system	Printer (A3) ERCC information system	Content detailed	Whole Tehran	Every Sub-Region	Every District	by Station	by District	by Nahiyeh	by Data resolution of Building and Polygon	Issue before discussion
Periodical Report on Accelerograph Network	N (Montyly)	X						?								- Events configurable by SCREAM - List of TDMMO's need items
Health Warning on Accelerograph Network	N Eventually		X					?								- Events configurable by SCREAM - List of TDMMO's need items
Current PGA and Health situation table	N Every Second				X			PGA and Health of station	X			X				
Current PGA and Health situation map	N Every Second				X				X			X				
Earthquake is monitored	T		Any Earthquake	Human - recognizable Earthquake				MMI of stations	X			X				- Definition of "Human recongizable Earthake" - Evaluation of SMS networks vulnerability - Selection of network
MMI of Accelerograph Stations	T				X		X		X			X				- How many seconds are necessary to be waited to find maximum in sequencial PGA? - Conversion Equation from PGA to MMI
PGA interpolation result table	T				X			Interporated PGA	X				X	X	X	- Interpolation model
PGA interpolation result map with station location symbol	T				X	Whole Tehran			X	X	X		X	X	X	
MMI distribution table	T		(s) Whole Tehran	(s) Whole Tehran	X			Interporated MMI	X				X	X	X	- Conversion Equation from PGA to MMI
MMI distribution map with station location symbol	T				X	Whole Tehran			X	X	X		X	X	X	- Conversion Equation from PGA to MMI
Heavily damaged or collapsed building table	T			(s) Whole Tehran	X			- Number - Ratio	X				X	X	X	- Damage calculation model
Heavily damaged or collapsed building map	T				X	Whole Tehran		- Number - Ratio	X	X	X		X	X	X	
Casualty table	T			(s) Whole Tehran	X			- Number - Ratio	X				X	X	X	- Casualty calculation model
Casualty map	T				X	Whole Tehran		- Number - Ratio	X	X	X		X	X	X	

Figure 2.4.37 Warning Design Summary Developed in the Previous Project

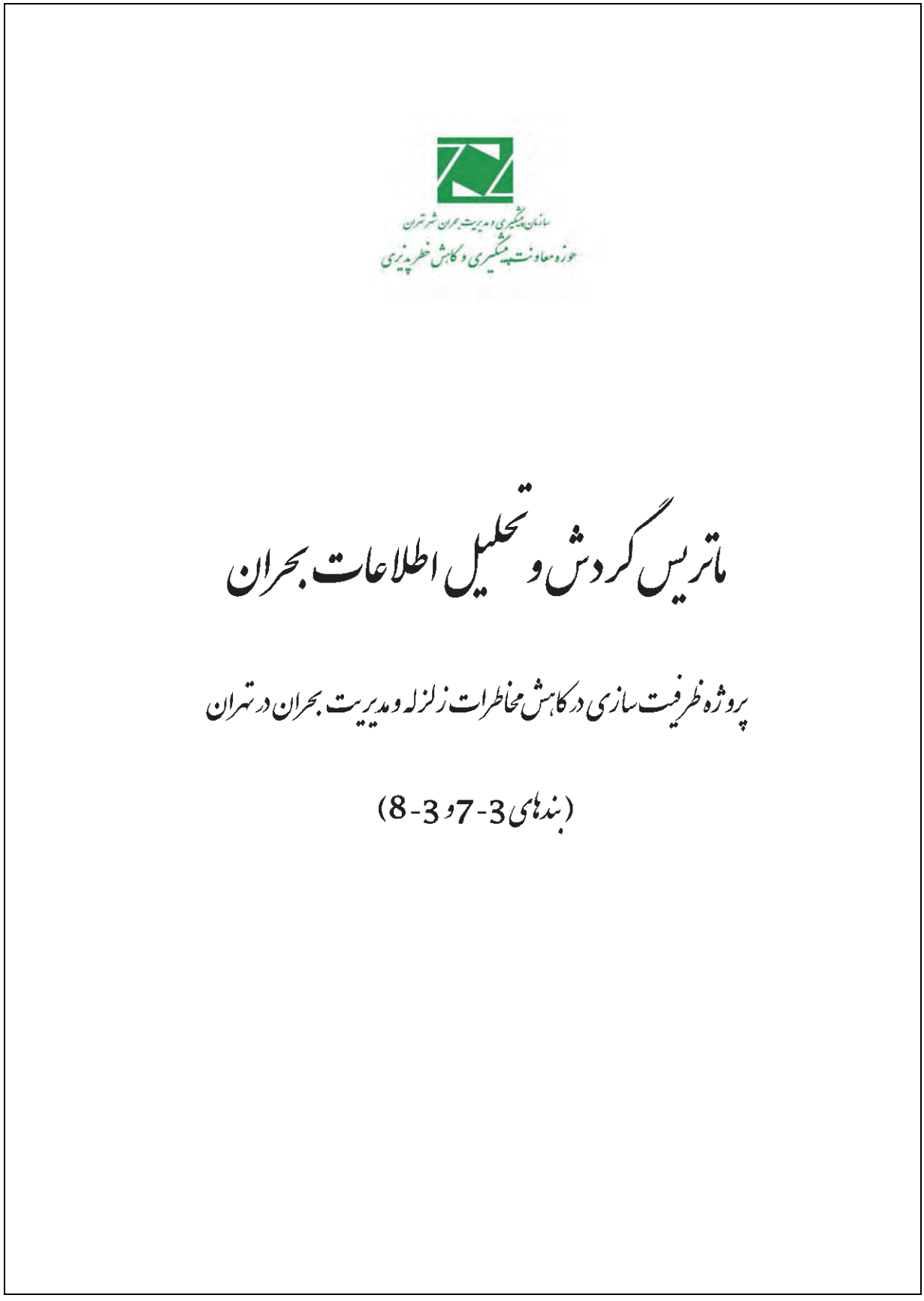


Figure 2.4.38 Cover of Draft Final Document on the Earthquake Information Matrix

ماتریس گردش و تحلیل اطلاعات بحران

Necessary Information for Quick Response

Methods to Estimate, Collecte, Compile, Issue and Delivere Information

Information to be shared — Proposal by TDMMO Experts & JICA Experts for Activity 3-8

Category	Necessary Inforamtion for Response Activities	1 Search & Rescue جستجو و نجات	2 Triage and evacuation of casualties تریاژ و تخلیه مجروحین	3 Hygiene and medical treatment بهداشت و درمان	4 Firefighting and dangerous chemical services آتش‌نشانی و مواد خطرناک	5 Debris removal آواربرداری	6 Emergency accommodation and food اسکان و تغذیه اضطراری	7 Transportation and burial of the corpses انتقال و تدفین اجساد	8 Providing mental / psychological and social health تامین سلامت روانی و اجتماعی	9 Lifelines شریانهای حیاتی	10 Information technology and communication ارتباطات و فناوری اطلاعات	11 Providing fuels سوخت رسانی	12 Traffic and transportation ترافیک و حمل‌ونقل	13 Logistics coordination هماهنگی لجستیک	14 Temporary accommodation اسکان موقت	15 Warning and information dissemination اطلاع رسانی و هشدار	16 Coordination of supporting provinces هماهنگی استانهای معین	17 Legal and justice affairs امور حقوقی و قضایی	18 Security and discipline امنیت و انتظامات	19 Damage assessment ارزیابی خسارات	20 Public cooperation مشارکتهای مردمی	District Disaster Management مدیریت بحران منطقه	When need? 1st information: before earthquake	After ellapse, before main shock	Within a few of 10 minutes after main shock (for Quick Response)	Within few hours after main shock (for Quick Response)	Within 72 hours after main shock (for Quick Response)	Anytime when started (for Quick Response)	After 72 hours after main shock (for Recovery and Reconstruction)	Updates information whenever user needs	How: Initial by Estimation	Initial by Real Information	Update by Real Information	Contents By Which Org.: Estimation by	Real Information: Supplied by	Compile by	Delivery start from	Delivery Method: to Persons for Quick Response (SMS, etc.)	to organizations (MPLS, FibreOptic, GPRS, UMTS, 5.8GHz, etc.)	Mass media (Radio, TV, etc.)	Contents: Text upto 160 characters in Pinglish	HTTPs Protocol (Portal etc.)	Voice	Schedule: Sending data without information user action (Automatic & push)	Sending information whenever user requested (pull)	Data format	Other comments
Earthquake Forcasting	Earthquake forecasting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓											TDMMO	TDMMO, IGUT	TDMMO	TDMMO	✓	✓	✓	✓			✓		signal, text	
	Aftershock forcasting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓												TDMMO	'TDMMO, IGUT	TDMMO	TDMMO	✓	✓	✓	✓			✓		signal, text	
hazard information	EEWS	✓	✓	✓	✓					✓	✓	✓				✓			✓	✓		✓		✓							✓	✓		TDMMO	TDMMO	TDMMO	TDMMO	✓	✓	✓	✓			✓		signal	Not to Mass Media in pilot stage
	Intensity distribution	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓							✓		---	TDMMO	TDMMO	TDMMO	✓	✓	✓	✓	✓		✓	✓	map, signal, text	Not to Mass Media in pilot stage, initial data may need correction and may help in damage estimation
	Location and Type of risk that is probable	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓				✓		✓	✓	---	Fire fighting, and any organizations which may cause secondary accidient	TDMMO	TDMMO		✓			✓	✓	✓	✓	map	
Damage information	Building damage	✓			✓	✓	✓								✓		✓			✓	✓	✓			✓					✓	✓		✓	TDMMO	Committee of "19. Damage Assessment"	TDMMO	TDMMO		✓			✓	✓		✓	map	
	Routes condition (Available or not)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓				✓	✓	✓	✓	TDMMO	Deputy of Traffic & Transportation (DTT)	DTT	DTT	✓	✓	✓	✓	✓			✓	map	Estimation for Disaster Imagination, Real Information for Quick Response
	Traffic condition (Heavy traffic or not)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓				✓		✓	✓	---	Deputy of Traffic & Transportation (DTT)	DTT	DTT	✓	✓	✓	✓	✓			✓	map	
	Hospital availability	✓	✓	✓	✓								✓							✓		✓				✓				✓		✓	✓	---	Committee of "3.Hygiene and medical treatment	TDMMO	TDMMO		✓			✓			✓	text , map	
	Count of Death							✓								✓	✓	✓		✓		✓				✓				✓	✓		✓	TDMMO	Committee of "19. Damage Assessment"	TDMMO	TDMMO		✓				✓		✓	map	
	Count of Injured	✓	✓	✓	✓											✓	✓	✓	✓	✓		✓				✓				✓	✓		✓	TDMMO	Committee of "19. Damage Assessment"	TDMMO	TDMMO		✓				✓		✓	map	
	Count of Lost	✓				✓										✓	✓	✓	✓	✓		✓				✓				✓		✓	✓	---	Committee of "19. Damage Assessment"	TDMMO	TDMMO		✓			✓	✓		✓	map	
	Location and Type of secondary events started	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓	---	Fire fighting, and any organizations which may cause secondary accidient	TDMMO	TDMMO		✓			✓	✓	✓	✓	map , text	
	Volume and type of debris along the emergency road network					✓																✓				✓				✓		✓	✓	---	Urban service Deputy (USD)	USD	USD		✓			✓	✓		✓	map , text	
	Volume and type of debris at the level of city					✓																✓							✓	✓	✓		✓	TDMMO	Committee of "19. Damage Assessment", Head of "5. Debris Removal"	TDMMO	TDMMO		✓			✓	✓		✓	map , text	
	Count of homeless people						✓															✓					✓			✓	✓		✓	TDMMO	Committee of "19. Damage Assessment", Head of "5. Debris Removal"	TDMMO	TDMMO		✓			✓			✓	map , text	
	Damages to water system						✓													✓		✓				✓				✓		✓	✓	---	Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to gas system																			✓		✓				✓				✓		✓	✓		Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to power system						✓													✓		✓				✓				✓		✓	✓		Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to telecommunication systems																			✓		✓				✓				✓		✓	✓	---	Management HQ of telecom companies, Committee of "10. IT & com."(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to sewage network																			✓		✓				✓				✓		✓	✓	---	Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to fuel distribution systems													✓						✓		✓				✓				✓		✓	✓	---	Management HQ of National company for refining and distribution of oil products of Iran (Tehran district)	TDMMO	TDMMO		✓			✓			✓	map, text	
Secoundary event	Damages to water system	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓	---	Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to gas system	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓		Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to power system	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓		Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damage to inducement industry and factory (hazardus material)	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓		Committees of 4" Firefighting and dangerous chemical services	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
	Damages to fuel distribution systems	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓		Committees of 11"Providing fuels												
	Damages to sewage network	✓	✓		✓											✓			✓	✓		✓						✓		✓		✓	✓	---	Management HQ of lifeline companies, Committee of "9. Lifelines"(L)	TDMMO	TDMMO		✓			✓	✓		✓	map, text	
Needs	Additional supply needs - water and/or food						✓			✓												✓					✓		✓			✓	✓	---	Committees of "19 Damage assessment" & "6. Emergency accomodation"	TDMMO	TDMMO		✓			✓	✓		✓	text	
	Additional supply needs - fuel											✓										✓					✓		✓			✓	✓	---	Committees of 1, 2, 4-7, 9-14, 16, 18 and 19	O.C.EOC	O.C.EOC		✓			✓	✓		✓	text	
	Additional supply needs - Emergency accomodation						✓															✓					✓		✓			✓	✓	---	Committees of "6. Emergency accomodation" and Committee of 19 (L)	Com. 6	Com. 6		✓			✓	✓		✓	text	
	Additional supply needs - Temporary accomodation														✓							✓					✓		✓			✓	✓	---	Committees of "14. Temporary accommodation" and Committee of 19 (L)	Com. 14	Com. 14		✓			✓	✓		✓	text	
	Additional supply needs - vehicle and machinery													✓								✓					✓		✓			✓	✓	---	Committees of 1, 2, 4-7, 9, 11, 12, 14, 18 and 19	TDMMO	TDMMO		✓			✓	✓		✓	text	
	Additional supply needs- rescue team	✓															✓					✓						✓		✓		✓			Committees of 1	com. 1	com. 1					✓	✓		✓	text	

Green cell means that they have been discussed and updated once.

O.C.EOC: Emergency Operation Center of Oil Company

Figure 2.4.39 Draft Final of Earthquake Information Matrix

3) Improvement of Warning System

The seismic information warning was not ready in QD&LE although it was deemed to be necessary information for all the committees. It was implemented as follows;

a.Preparing an Environment for the Pilot System

It takes times to procure a new server. Instead, the Activity 3-7 team planned to select an execution environment with the following criteria. (1) Using existing hardware. (2) Easy to move the pilot system to the professional server hardware whenever it becomes ready to use.

For the hardware for the pilot system, the team selected the SCREAM-PC which was supplied by JICA in the previous project. PHP was selected for the system development framework on which it is relatively easy to upgrade warning systems. Mercury on XAMPP was selected for the SMTP server. For sending SMS, an Android mobile phone and "SMS Modem" software from the "shixuan.lu" developer was connected to the network of TDMH by Wi-Fi. All of these combinations are appropriate to develop the pilot warning system and to move to a stable server system.

b.Developing a Multi-Layered Seismic Intensity Information Collecting System

The developed system collects the intensity information from RSS of EAMs. In order to use the main and backup data communication methods between EAM and NAM, it is designed to use port 8000 to 8011 of NAM that uses GSTM failover service for EAM and NAM communication.

- A script to collect seismic intensity and to create warning queues whenever earthquake is detected.
  C:\data\PortalScream\sample\intensity\ fetchIntensity.php

- Reference regarding RSS of EAM
  http://www.guralp.com/platinum/xmlns/gdi-trig-atom.cgi

c.Developing a Multi-Layered Seismic Intensity Warning Sending System

The developed system sends any queued warning by SMTP server and SMS modem. Although there is one set of hardware for each SMTP server and SMS modem, the system is applicable for more multi-layered hardware using an automatic routing updating system commonly found in Internet technology.

- A script to send queued messages by SMS and E-mail
  C:\data\PortalScream\sample\ pushInfo.php

- Reference regarding SMS Modem
  https://play.google.com/store/apps/details?id=com.diafaan.gsmmodememulator&hl=en

d.Developing a Web User Interface

A web user interface is developed for intensity warning, to which any PC on the Municipality Fiber Optic Network, MPLS Network used by QD&LE and 5.8GHz network used by QD&LE can connect

- Access URL from Municipality Fiber Optic Network
  http://10.33.246.203/sample/intensity/

- Access URL from MPLS and 5.8GHz network of QD&LE
  http://10.100.14.203/sample/intensity/

(3) Technical Transfer

Throughout the production of the Earthquake Information Matrix to determine what, when, how, and to whom to declare warnings, the counterparts of TDMMO exercised to develop and improve its warning system for more effective emergency response activities.

TDMMO has experienced the method to improve the current multi-layered warning system for more effective emergency response activities.

(4) Issues Remaining

Issues remaining within the Earthquake Information Matrix and multi-layered warning system for more effective emergency response activities are as follows.

① The draft Earthquake Information Matrix has not yet been approved. It is necessary to be approved this as a basic information plan for disaster management by related committees. In addition, in the future, it should be updated whenever the relationship between organizations or the disaster management plan are updated.

② The developed pilot system is vulnerable because it depends on a 5 year old PC which is near to the end of its expected life, email is sent via ADSL on vulnerable normal copper lines, the default configuration of XAMPP, and the web server lacks authentication and unencrypted information transfer. In addition, it is not easy for the normal disaster management centers to access the portal website because they need to access it with an IP address instead of domain name. These areas were expected by TDMMO because there are many Iranian IT experts are available in Tehran. It is recommended to move the system from the vulnerable pilot system environment to a secure system environment.

③ As of December, 2014, only the addresses of Activity 3 team members are registered in the warning system. It is recommended to explain the system to all the disaster response people of TDMMO and other organizations, and then register their contact information in the system.

2.4.8 【26】To prepare a plan to introduce a post-earthquake (secondary events) information and warning system (Activity 3-8)

(1) Outline

In the previous project, the QD&LE system was led by scientific experts in the fields of earthquake monitoring and damage estimation. It made the system mainly to display and distribute the damage estimation, and not to collect and compile information from disaster response organizations other than TDMMO.

According to the disaster management plan of Tehran Municipality, when earthquake occur, all the organizations are designed to cooperate in groups of 20 committees. In the 20 committees, TDMMO is responsible for warning dissemination as the 15th committee "Warning and Information Dissemination".

As the first step all earthquake damage potentials in Tehran City, including secondary ones, were enumerated.

Next, methodology to collect, compile and circulate damage information efficiently was studied using 2 sample fields.

Then, it is compiled into the Earthquake Information Matrix of Activity 3-7 as the improvement plan of QD&LE system.

(2) Activity

1) Enumeration of earthquake damage including secondary ones.

In the process developing the Earthquake Information Matrix, the project team enumerated earthquake damage including secondary ones. They are classified into the following categories based on the discussions with TDMMO and related organizations.

For examples in the field of transportation structures damage, structure types were individually enumerated according to the damage estimation, such as bridges, tunnels, pedestrian bridges, etc. The project team reclassified all of them for the information users. In case of any type of transportation structure damage, it is reclassified into route availability.

1. Damage information
    a. Building damage
    b. Route condition (Available or not)
    c. Traffic condition (Heavy traffic or not)
    d. Hospital availability
    e. Count of Deaths
    f. Count of Injured
    g. Count of Missing
    h. Location and Type of secondary events started
    i. Volume and type of debris along the emergency road network
    j. Volume and type of debris at the city level
    k. Count of homeless people
    l. Damage to water system
    m. Damage to gas system
    n. Damage to power system
    o. Damage to telecommunication systems

p. Damage to sewage network
q. Damage to fuel distribution systems

2. Secondary events
   a. Damage to water system
   b. Damage to gas system
   c. Damage to power system
   d. "Damage to dangerous facility and factory (hazardous material)"
   e. Damages to fuel distribution systems
   f. Damages to sewage network

2) Methodology to collect, compile and circulate damage information efficiently.

As a pilot study, the project team studied route availability because it will be necessary for all of the committees.

At first, TDMMO designed a plan of which route availability information will be collected, compiled and circulated by TDMMO itself, and a Mission Plan for Information Gathering/Data Collection in the Transportation Unit, which was compiled on 23rd, September 2013. Two persons in each district disaster management base are designated to collect information. TDMH is designed to collect information by traffic monitoring with video cameras and from district disaster management bases, then compile and share them. The index of the plan was as follows;

- Goal
- Overview
- Program Domain
  1. Location domain
  2. Timeline domain
- Methods of Information Gathering
  - Cameras of the Traffic Control Center
  - "Mahalle" traffic control centers
  - Location Based Services (LBS)
  - Damage evaluation at levels of I, II, III
    - Damage evaluation at level I
    - Damage evaluation at level II
    - Damage evaluation at level III (Bridges and technical buildings unit of technical deputy of Tehran municipality)

This methodology has two potential issues: (1) The number of data collecting persons is too few and (2) The number of TDMH staff is too few. In order to make the team efficient for dealing with a potential earthquake, it is necessary to increase the number of staffs and to have training and maneuvers frequently. Some additional plans are required, such as cooperation with organizations which collect and compile route information daily, or contract with road maintenance companies which is common in Japanese municipalities.

On 30th, November 2013, the project team held discussions regarding TDMMO's plan with organizations which are expected to be involved with route management. Most of these organizations explained to TDMMO that they have already developed their cooperation system with the Traffic police, firefighting, red crescent and any other emergency response organizations

and that through this cooperation system they exchange their information at the traffic control center of the municipality. It is ready not only for normal days but also for applicable for disaster conditions. TDMMO held discussions with the traffic control center and related organizations from 11, February, 2014, and then concluded that it is better to strengthen the existing cooperation system for earthquakes and even use it in earthquake. The counterpart compiled a new plan on 2nd September 2014, titled the Operation Plan for Information Gathering/Data Collection in the Transportation Unit. Its index is as follows;

1. Introduction
2. Overview
3. Program scope
3.1 location scope
3.2 Timeline scope
4. The program assumptions
5. Methods of info collection in the ordinary situation
6. Study of the latest situation and the effective factors regarding traffic management
6.1 The traffic control centers
6.1.1 The list of the traffic control centers of Tehran city
6.1.2 Specifications of the control centers
6.1.2.1 The main centers
6.1.2.2 The local centers
a. The local traffic control center in the north
b. The local traffic control center in the east
c. The local traffic control center in the west
d. The local traffic control center in the south
e. The local traffic control center in the center
6.1.2.3 Centers for tunnels
6.1.2.4 The traffic control center of RAHVAR Police
6.1.2.5 The management center of the roads of the country (the road maintenance and transportation organization)
6.1.2.6 The control center of NAJA
6.1.3 The role of the traffic centers after an earthquake
6.2 Info collection
6.2.1 The monitoring cameras
6.2.1.1 The specifications of the monitoring cameras
6.2.1.2 The roles of the monitoring cameras after the earthquake
6.2.2 The urban traffic count devices
6.2.2.1 Specifications of the traffic count devices of Tehran city
6.2.2.2 The roles after the earthquake
6.2.3 The speed limit enforcement system on the highways
6.2.4 The representatives of the organizations
6.2.5 The field forces
6.2.6 New methods of information collection
6.2.6 GMPCS technology
6.2.7 Other methods
6.2.8 General recommendations

6.3 Sending the information
6.3.1 Different types of information sending systems
6.3.1.1 Telephone lines
6.3.1.2 Optical fiber lines
6.3.1.3 Wireless services
6.3.1.4 Satellite communication
6.3.1.5 The mobile satellite communication service
6.3.2 The roles after an earthquake
6.4 Info analysis
6.4.1 Before the earthquake occurrence
6.4.2 The role after an earthquake
6.6 Notification
6.6.1 Before the earthquake
6.6.2 The role after the earthquake
6.7 Information sharing

Next, the project team selected a fuel leak from tanks located at the foot of Alborz Mountain, as a pilot study of a secondary disaster. The team then interviewed the fuel storage expert that was in charge of disaster management. In July, 2014 they started to compile a plan. The main framework of the plan is as follows;

- The fuel storage expert will investigate the damage
- He/she will report the damage to TDMMO. In addition, if damage is found which may cause secondary damage, TDMMO, the related district municipalities, disaster management personnel of related districts and the local administration offices will cooperate to announce the secondary damage and, if necessary, request evacuation and guide the local people away from the danger.
- Some additional communication methods must be installed, such as the 5.8 GHz dedicated digital wireless links.

3) Plan to improve QD&LE system

The project team concluded that interviews and cooperation with other organizations on risk management is advantageous. They revised the Earthquake Information Matrix compiled by Activity 3-7, as a plan to improve the QD&LE system.

(3) Technical Transfer

Throughout the 2 pilot studies above, JICA Experts gave a technical transfer to confirm available resources and requirement for post-earthquake information and warning, by the counterparts of TDMMO involving traffic police, firefighting, red crescent, traffic control center and oil storage organizations. The counterparts of TDMMO experienced to develop the Earthquake Information Matrix, which is the core of the QD&LE system improvement plan. In addition, they became familiar with preparing a plan to introduce a post-earthquake (secondary events) information and warning system based on discussion with disaster response organizations.

(4) Future Issues

Issues regarding post-earthquake (secondary events) information and warning system planning are as follows.

1) TDMMO had requested that the JICA Expert Team guide disaster information system planning because there are many professional system engineers available in Tehran, and they can easily to communicate with TDMMO because of their Farsi capability. As a result, a plan was developed via Activity 3-8. TDMMO is recommended developing a real system through cooperation with system engineers for communication, a website and GIS.

2) In order to design a system which will be really appropriate for quick response after an earthquake, it is important for stakeholders to recognize and share system requirements. This means that it is better to have CPX and then revise post-earthquake (secondary events) information and warning system plans.

3. THE PROJECT IMPLEMENTATION OPERATIONAL CHALLENGES, INGENUITY AND LESSONS LEARNED

3.1. General

3.1.1 Project implementation challenges

(1) Limitation of activities caused by economic sanctions

The international community has imposed economic sanctions against Iran since January 2012. The project has been affected by the economic sanctions in various ways from the beginning.

The most significant influence of the economic sanctions on this project was the purchase of four seismometers. At the beginning, it was expected that it would be possible to purchase the same seismometers as the previous project, which are made by Guralp, but it was impossible to purchase them because of the economic sanctions. The project team gathered seismometers which can be purchased in Iran that had the same specifications as the previous ones. It took a considerable amount of time to locate the seismometers.

(2) Establishment of Project implementation organization

The project team made the effort to establish a project implementation organization within a counterpart organization. At the beginning the project team tried to hold frequent meetings with the project manager who was assigned to this project. Since the project manager quit the organization, and for about 6 months new project manager was not assigned and the official communications between the JICA team and the counterpart organizations has been hampered. To improve the condition, both side discussed, and meetings with project director were realized whenever necessary and the communication gap problems were resolved.

(3) Effective and efficient technical transfer

Because of limitations in the dispatch schedule of the Japanese expert to Iran, the Japanese expert concentrated on technical discussions and instruction to the counterpart personnel. The Japanese expert and counterpart personnel discussed the results again when the Japanese experts returned to Iran. The questions from the Iranian counterpart personnel were sent via e-mail.

(4) Flexible project implementation

During the course of the project, there were several issues raised that changed the implementation of the project, such as construction of the disaster management museum which has had its location changed from the original site. Accordingly, the construction schedule also has changed. The JICA team made adjustments to accommodate the new construction schedule as much as possible and to change the dispatch schedule of the Japanese expert.

(5) Establishment of relationship of mutual trust

The relationships in the disaster management fields in Iran and Japan have endured for more than 15 years, especially in Tehran. Mutual understanding of the disaster management field has moved deeper in both countries. The project was implemented based on such mutual understanding and trust and the JICA team would like to establish mutual trust with counterpart personnel.

3.1.2 Ingenuity for Challenges

(1) Thorough Discussions with counterparts

The Japanese expert carried out extensive discussions with not only counterpart personnel but also the technical advisor of TDMMO and supplier of goods and equipment. Intensive discussions may solve the future problems.

(2) Activities to motive counterpart personnel

The JICA Expert Team introduced many advanced examples and efforts made by Japan as well as other countries to attract the attention of the counterpart personnel. In addition, counterpart training in Japan, which was scheduled three times during project period, also made effective use of active participation in the project activities.

(3) Promotion of disaster resilient society in Iran

During the course of the project, many requests were received from various organizations, such as international, mass-communication, and other disaster management organizations, regarding disaster management seminars and presentations. Basically, the JICA Expert Team tries to fulfill as many of those requests as possible to contribute to establishment of disaster resilient societies.

It is believed that the Japanese disaster management technology and experience were applied in Iran. One of the reasons for the long term cooperation in the disaster management field between Iran and Japan could be that attitude of the JICA Expert Team.

(4) Selection of activities based on the ability of the counterparts

The ability of counterparts in Iran is high compared to other countries and implementation capacity also very high. The JICA Expert Team sets a goal to raise the level even higher and engages in discussions and gives instruction.

(5) Hands on approach

When problems happen at a project site, the JICA Expert Team and counterpart personnel go to the site and collaborate on a solution for the problems. This is so that after the project is completed, the counterpart personnel themselves can determine the nature or the problems and their solutions.

3.1.3 Lessons learned

(1) The importance of project management by looking ahead to minimize the risk

In the implementation process of the project, by internal and external factors, there are many issues may create significant negative impact to the project.

As described before, issues on procurement of equipment in the condition of economic sanctions, change of the museum construction site, and delay of project activities caused by taking time to get consensus with CPs. However, with frequent communication with CPs, and utilization of past experience in Iran, expected risks could be minimized. This is definitely basic method, but it was an important lesson learned to implement the project smoothly without significant delay.

(2) The importance of correspondence at the time of absence of experts in Iran

Although different density of experts dispatched by the respective outputs, as described before, for project operational management, absence period of experts is long, it will affect the timely operation of the project. With several efforts were made such as follow-up by the experts for other outputs, shifting the dispatch timing of experts for Output as much as possible, follow-up with e-mail communication, and follow-up during C/P training in Japan, and etc., and with these efforts, tried to minimize delay of the project. However, since it is not completely become a perfect countermeasure, further devise is necessary for future project.

3.2. Output 1

3.2.1 The project implementation operational challenges

(1) The project implementation challenges

1) Delay of project activity due to spending time on making agreement on contents of the activity of the Output

At the commencement of the Project, TDMMO strongly requested to discuss the detailed design components of the Output 1 project activities, and to start work after confirmation by both sides. In addition, the Department of Traffic and Transportation of Tehran Municipality started a project which overlaps with the project components sub-contracted to IUST (Iranian University of Science and Technology) beginning in September 2011 just before commencement of this project, which has the project title "Determination of the post-earthquake transportation emergency and rescue network in Tehran", and therefore, it was necessary to implement both projects in coordination, and the need to coordinate the demarcation of project activities by grasping the current condition of the contracted project is recognized.

For discussion and agreement regarding detailed activities, after the commencement of the project, a series of intensive discussions were held that consumed the entire period of the first assignment, as a result, both sides agreed on the project activities. Also, for demarcating activities with IUST, it is expected to be coordinated by TDMMO along with the Department of Traffic and Transportation, however this could not be clarified. Even after a significant amount of time, no progress could be confirmed in the project. However, in November 2012, since it has been found out that progress of project by IUST could not show certain progress, Output 1 activities were started in earnest after that time. Therefore, there was a delay of about half a year in the start time.

2) Technical transfer to improve the level of understanding by introducing Japanese cases and experiences and CP Training in Japan

In order to introduce the Japanese case and experience to the CP in a way that helps them to be to see it with their own eyes, offering them more than just lectures is key in implementing the effective technical transfer. Therefore, in the CP Training in Japan a separate program was created for each outcome in this project making it possible to carry out training specific to the content that directly results in activities. This is best implemented at an early stage, however, due to scheduling issues, it could only be held 2 years after commencement of the project. But, it is

still effective to check the input from the JICA Expert Team in Iran through presentations and discussions that he made at the beginning of the project.

(2) The project management challenges

1) Difficulty in following up with the limited assignment available to the JICA Expert Team in Iran

The amount of time that the Japanese experts could spend in Iran for Output 1 was severely limited throughout the entire project, and visits were once in every six months. Therefore, continuous consultations could not be implemented smoothly through only e-mail communications. Therefore, when coming back after a 6 month gap, both sides needed to refresh discussions held in the former visit, and this also shortened our discussion time for every visit.

2) Changes to the CP personal from Iran

It could happen to any project, but due to the transfer or retirement of CPs, the responsible CPs has changed several times, so that the technical transfer had to be repeated from the beginning to the successor. Due to this, the project implementation, especially on the vulnerability assessment of bridges and formulation of a Seismic Resistant Plan was delayed.

3) Effective implementation of activities by employment of GIS engineer

In TDMMO, due to many of its own projects being currently in progress, and the fact that only 2 GIS staffs are currently working fulltime, there was reason for concern regarding the project progress. Although technology transfer of GIS techniques is included in this project, it is not effective to utilize important human resources to work on easy digitizing works, and the GIS engineer hired to support the activities for Output 1 also devoted time to the various detailed studies for upgrading of ERN, and helped drastically in the entire Output 1 activities.

3.2.2 Ingenuity for Challenges

(1) Ingenuity for the project implementation operational challenges

1) Innovation to make up for the delay in project activity due to spending time in coming to an agreement on the contents of the activity of the Output

In Output 1, in order to be able to operate ERN smoothly, there are many activities that need to be implemented including, upgrading of the existing ERN, formulation of a variety of necessary plans to be able to operate ERN, implementation of exercises in order to check the formulated plans, and holding seminars to understand the project activities. In order to recover from the delay in the progress of Output 1 activities, both the Japanese and Iranian sides need to share the same clear image of the outcomes, because of this realization, during the time that the JICA Expert Team stayed in Iran, intensive discussions and workshops were held, on average twice a day, and during the period that the JICA Expert Team was absent, the CP has worked hard to process the project activities. In addition, follow-up was carried on by mail, as well as utilized during the training in Japan. There were also great efforts from the CP, who eventually was considered to have been able to obtain more results than was originally planned. It is to be appreciated that, in this project, mutual trust is most important, and it has been actively focused on to promote close communications.

(2) Ingenuity for the project management challenges

1) Ingenuity for the Difficulty in following up with the limited amount of time available for the JICA Expert Team in Iran

The same as indicated in the previous discussion regarding the innovation needed for recovering from the delay in progress at the beginning of the project, in order to reduce the impact of the limited amount of time available for the JICA Expert Team in Iran. Later, properly follow-up time was allocated in order not to cause any more delays in the project activities. In addition, at the project implementation stage, the needed input from the Lifeline expert was limited due to the lack of update data, volume of work for the formulation of the Seismic Resistant Plan is far greater than initially expected, therefore, the duration of the expert's assignment period was reconsidered. Due to this reallocation of assignment, the delay could be caught up effectively.

3.2.3 Lessons learned

(1) Impact associated with the consensus of the project activities at the time of commencement of the project

As described before, for the items of activities for Output 1, due to the strong intention from TDMMO, every items including detail activities needed to be agreed before actual commencement of the Output 1 activities through discussions with experts. In addition, Technical Deputy of Tehran Municipality was implementing similar project with IUST, therefore, it was necessary to confirm demarcation of project activities. This condition caused great pressure to the limited assignment period of experts for Output 1. Also, since the activities of Output 1 is being implemented as part of the ordinal activities of TDMMO, there is also the intention to carry out further detail, which does not match with project schedule and it became one of the reason for delay of the project implementation. TDMMO efforts to deepen the project activities are expected, however, considering the planned schedule of the project, it is also necessary to make understand of importance of formulation of outcomes within given timeframe, therefore, it was promoted to ask them to continue the activities after the project implementation. It can be considered that delay of the project implementation could be minimized if at the time of project formulation, necessary information and contents on recent efforts of vulnerability assessment implemented by TDMMO could be provided.

(2) The impact due to differences in both the recognition of such vulnerability assessment method

Because the project is supported by Japan, from the fact that Microzoning Study was implemented based on Japanese Methodology, for various analysis methodology in the project, it is expected to apply Japanese methodology with comparison of others. Since the C/P side implemented with other methodologies in other countries in recent years, vulnerability assessment was implemented by Iranian side applying several methodologies, which increased work load and caused delay of the project implementation. In the future, if microzoning would be revised, issues on which methodology to be applied could be an issue, therefore, at the planning stage, these needs to be considered and discussed.

3.3. Output2

3.3.1 The project implementation operational challenges

(1) The project implementation challenges

1) Understanding of necessary procedure for DMM Establishment

In order to create a museum easy to run and having effective exhibition, its mission, function and exhibition contents should be studied at first. However, TDMMO tended to focus on the construction of the museum building, and the exhibition will be prepared accordingly.

Since TDMMO decided prefer this DMM having function as a museum as well, not so called "disaster management center", information and objects for exhibition are required to be collected from the area affected by the great disasters in the past.

2) Delay of DMM building design work due to the change of the site and necessity of geological survey

Tehran DMM was originally planned to be built at a site within the Velayat Park in District 17 of Tehran, and preliminary design work was developed for the site. However, in January 2013, TDMMO decided to change the location to a site in District 22, which is a newly developed area. The site is sloped, but has an approximate surface of 3ha. Preliminary design was required to be modified accordingly.

6months later than change of site, the consultant for the DMM building design was selected. The consultant prepared preliminary design of the DMM building. However, it took 5 month for selection and approval of the preferable design.

The design work restarted in April 2014, but stopped again from May 2014 due to the little possibility to be affected by a landslide from the mountain behind the site. To ensure the safety of the DMM building site, as a symbol of "Safety," three geological surveys have been conducted. The design work restarted in September 2014 and draft basic design was prepared, but they will revise after receiving the result of surveys.

3) Necessity of visiting and having experiences by C/Ps

Some of the C/Ps have visited disaster management centers/museums in Japan as a part of the past C/P trainings in the former project, but most of the C/Ps had not and had some difficulties to understand about discussions on the role of DMM and exhibition contents. This was one of the reasons C/Ps prioritized to work on building design of DMM rather than collecting information.

4) Information Gathering on Past Disaster Situations and Lessons Learnt

There are two main policies of improving master plan for the citizens' DRR training, which are 1) Including components to raise "motivation" for DRR in the citizens' education and training program. To do so, 2) including past disaster situations in the chronological order, sympathetic and appealing disaster experience of victims, and lessons learned of the past earthquakes in the education program in order to raise motivation for DRR actions.

Therefore, efforts to collect such experience and information have been made through researching existing publications and interviews of the victims and public officials who were in charge in the disaster situations. The collected information are planned to be utilized in the DRR museum in

near future. C/Ps have become very much aware of the necessity, however the process of realizing it required appropriate explanations and time for other stakeholders. Publications of other organizations were not easy to be obtained. The personal interviews have not been taken place, since victims and concerned public officials' schedule did not fit within the project period.

5) Collaboration with Civil Society Organizations

In the drills, collaboration with local civil society organizations has been tried because drills need to be frequently conducted in smaller scale units. In the district 1, existing DRR organizations are active enough even to train DAVAM groups. Drills are conducted under the responsibilities of districts. However, the drills which have currently been conducted were usually very big requiring lots of efforts and costly to conduct frequently. In most cases, local organizations are not active enough except for religious based organizations, and even they exist, the mentality of public officials is not accustomed to incorporate local civil society organizations.

6) Learning from Training in Japan

Social conditions are different from Iran and Japan. Although Japanese experts introduce Japanese examples or ideas, it is not so easy for Iranian side to comprehend fully what Japanese side explains.

(2) The project management challenges

1) Organization for establishment of Disaster Management Museum

In the beginning of this project, "museum planning" was thought as the museum building planning, the C/Ps for the Museum were limited to the staff from Technical and Civil Engineering Deputy. In addition, this deputy is mainly working on the civil engineering, and there were a needs to be strengthening to handle architectural and exhibition works.

On the other hand, this museum was listed in the priority project of Tehran Municipality, and it was planned to start construction in 2014. Although, intensive works towards implementation was required, the detailed design work seems beyond staff and capacity of TDMMO.

2) Change of the person in charge of the Tehran DMM, and delay of the work

In the beginning of the third year of this project, the leader of C/Ps' museum preparation team passed away. The internal organization of TDMMO was changed accordingly, and person in charge of the DMM among C/P were changed. The work was taken over relatively smoothly to the person in charge of the education program of the DMM, but there was some delay for the geological survey and design works due to the reorganization process.

3) Information Sharing

Special attention needs to be taken and certain time is required for the necessary information to be shared to Japanese experts. Enough time needs to be allocated and flexibilities are necessary for acquiring necessary information.

3.3.2 Ingenuity for challenges

(1) Ingenuity for the project implementation operational challenges

1) Understanding of necessary procedures for DMM Establishment

The importance of reflecting the operation and management plan, and exhibition plan of the DMM in the DMM building plan has been explained repeatedly from the beginning. It has been understood by the C/P team and the consultant for exhibition design, and an NGO or a consultant is going to be hired for collection of data and objects.

The difficulty in collecting data and objects has been recognized after the pre-survey conducted in the first year by C/Ps. TDMMO has investigated the possibility of hiring an outside organization for implementation of this work, but it has not been approved yet.

2) Delay of DMM building design work due to the change of the site and necessity of geological survey.

Due to change of the project site, the concept of the building design had to be changed totally according to the size and feature of the land. However, the scenario and contents of exhibition, which developed in the first year could be used for the tender and contract documents for the DMM design consultants, and it helped to save time.

3) Consideration regarding Information

In Iran information is a very sensitive issue; even the critical and necessary information for conducting the Project takes quite a long time to be provided. Sometimes the schedule has been delayed, but flexibility to adjust the plan was needed in consideration of the organizational and cultural differences.

The importance of collecting information & objects, especially for the primary source, related to the disasters was explained to C/Ps by a member of domestic advisory committee who is from the Disaster Reaction and Human Renovation Institution (DRI). Necessary documentation work and procedure for grant/purchase/rental of the information & objects, and for their exhibits were also explained to C/Ps.

4) Collaboration with civil society organizations

Responsibilities of local based organizations with mobility are defined in the guideline of conducting drills and proposed in the framework of conducting local drills. The framework was put into practice and verified in the actual drill conducted. However, it was a great opportunity as one of trial to promote locally based small scale drills.

5) Learnings from Japanese Examples

In the previous project, due to gender constraints, it was almost desperate to expect female participants to be attended in the counterpart training in Japan. However, in this project, 3 people out of 5 participants were female who had been actually engaged in the project of Output 2. A few female C/Ps could join the training program in Japan and could meet in Japan, different types of actors such as DRR consultants, NGOs, citizens, public officials, trainers of research institutes etc. and could feel their thoughts and attitudes which can only perceive with direct experiences. Although, it is not enough but the C/Ps who attended training in Japan made their efforts to share their utmost experiences and interpret the Japanese situations to other colleagues of TDMMO,

which made the further activities going smoother and more effective in the long run. Japanese experts also felt that common understandings have been created more, after the trainings.

(2) Ingenuity for the project management challenges

1) C/P team for preparation works for Tehran DMM

For the museum planning, the Museum Preparation Team was established with members of the Education and Public Participation Department and Mitigation and Risk Reduction Department in addition to the Technical and Civil Engineering Department. This arrangement has smoothed the preparation works for the educational program and exhibition plan. A cross-sectional team organization and discussions made it possible to establish a base for further comprehensive preparation works for establishing the DMM.

For the future work, it was recommended to establish the DMM preparation office, which includes staff from the departments responsible for public relations, finance and accounting, and the preparation team will be a core member of the office.

For design works, it was recommended and decided to hire consultants for the design of buildings and exhibitions and the JICA Expert Team supported preparations of the technical specifications. The consultant for exhibition works has not been hired yet, but will be hired when the site survey works are completed. However, it has not been approved within TDMMO, to hire a consultant or NGO for data and object collection works.

2) Contrivance on Information Collection of Past Disaster Experiences

Some of the past experiences are useful to the citizens; however some are not welcomed by certain public officials. Also the timing that the Japanese side had been planning is not appropriate for the Iranian side. Japanese examples and experiences have been transferred to the C/Ps who do the actual implementation, therefore, when the appropriate time comes, it is expected that the best choices for Iran will be carried out.

3.3.3 Lessons learned

(1) Effect of visiting and having experiences by C/Ps

C/P training for Output 2 was conducted in the second year of this project. It was very effective for C/P to visit some disaster management centers and museums in Japan and see the exhibitions related to the disaster management.

This experience helped C/Ps to understand importance of exhibitions' stories showing not only seriousness of disasters, but providing lessons learned from disasters and disaster management measures. In addition, necessity and importance to start collecting information and objects which can be exhibited in the DMM has also been recognized by C/Ps.

(2) Organization for establishment of Disaster Management Museum

Collaboration with the other organizations, such as local government, NGOs, and universities, etc. is necessary to prepare contents of the Exhibition of DMM. Though it was difficult to start this collaboration during this project, it is strongly recommended to establish the collaboration system with outside institutes in early stage.

(3) Information collection of past disaster experience

Sensitive issues need to be considered and well adjusted. Certain time needs to be considered ad allocated for coordination.

(4) Collaboration with civil society organization

By considering status quo, level of attainment needs to be examined and revised. However, ideal picture of the goals need to be presented and understood among the stakeholders.

(5) Consideration of female counterparts for training in Japan

Female counterparts may have some constraints in the public administration system to travel to outside of the country. Special explanation to higher level of authority and certain time for coordination is necessary to avoid inefficiency for further project implementation due to lack of earnest female counterparts.

3.4. Output3

3.4.1 The project implementation operational challenges

(1) The project implementation challenges

1) System development on technical cooperation

Output 3 had to develop functional systems rather than just understanding or sharing knowledge by seminars or workshops. The range of the technical transfer spreads out over wide area, and the types range from theory to application, and supervising.

In activity 3-3, since the Japan Meteorological Agency did not agree to cooperate to provide the same algorithm as the earthquake early warning system operated in Japan, development of EEWS codes could only refer to insufficient published information. Further, the pilot EEWS could only install four stations comparing with the 1000 stations for JMA-EEWS. Additionally, there was no available communication infrastructure that was indispensable for EEWS to function. The condition of the pilot EEWS development was totally different from the Japanese case, therefore, the software specifications were hard to fix.

Activity 3-5 started with the investigation of the existing source codes and continued to improve the codes and add functions. However, technical skill in programing was not essential for staffs in TDMMO, which is the disaster management organization of Tehran, and therefore, the policy for the activity needed to be revised.

2) Procurement under the international economic sanctions

The international economic sanctions were enhanced and reinforced just after starting the project. As a result, planed necessary equipment for EEWS development could not be imported to Iran or was delayed many days.

Additionally, long-term sanctions led to the lowering of Iranian currency and the subsequent inflation of the prices of equipment and software development. Consequently, the amount of

equipment had to be decreased and it took more time to process the purchasing. This delayed the schedule by several months.

3) Dispatch schedule of experts

The dispatch schedule of the experts had been considered for synchronizing with the delivery of the necessary equipment to work more efficiently. The unpredictable delivery caused by the sanctions made it hard to fit the schedule of the experts.

(2) The project management challenges

1) Departure of the project manager

Suddenly, the project manager (Mr. Mozafari) left TDMMO in February 2013. There has been no project manager since that time. The absence of a project manager led to less communication between the project director and the experts/staffs.

2) Concentration of the load on a specific counterpart

Because of the above situation, the work load was concentrated on one specific counterpart. Because the counterpart understood the total concept of output-3, the work to be done by project manager was loaded onto the counterpart and this negatively affected his ability to execute the original tasks that were to be done by the counterpart.

3.4.2 Ingenuity for challenges

(1) Ingenuity for the project implementation operational challenges

1) System development through technical cooperation

OJT was employed for the activity with periodical workshops and seminars. The JICA Expert Team recommended outsourcing the work, that was not essential for TDMMO, to private companies or institutes, and supporting supervising the contractors. For activity 3-3 EEWS, the basic specifications were developed mainly based on published technical materials in Japan including additional results from interviews with researchers. Specifications for server side software were developed considering the sensor layout of only four stations and the requirements of TDMMO. The final specifications were based on a different algorithm from the one that JMA-EEWS and were developed through discussions with the counterpart.

2) Procurement under the international economic sanctions

Initially, it was not possible to procure the planned seismographs and controllers. The JICA Expert Team had to start searching for a supplier and investigating performance. Through a performance test that consisted of shaking a table and continuous earthquake observation for one month, seismographs and controllers manufactured by GeoSIG in Switzerland were selected and procured. The delay from the original work plan was approximately 4 months.

The number of seismographs and controllers planned to be procured by TDMMO for improvement of QD&LE was decreased from 10 to 4 because of inflation of the price due to the declining currency. The delivery was delayed 6 months because of the sanctions.

The falling value of the currency also led to inflation of the software development cost. It also caused more delays in the procurement process. The delivery was delayed 2 months.

Procurement of communication equipment for the EEWS that was planned to be procured by TDMMO was also delayed 3 months.

The international economic sanctions are external factors. However it is regrettable to say that no better solution for procurement was found.

3) Dispatch schedule for the experts

Basically, dispatch of the experts was scheduled with considerable flexibility correspond to the delay of delivery. The schedule can change if the delay is made known two weeks before dispatch. However, sometimes, date of delivery was not made available until just the day before dispatch, in such a case, schedules could not change. Absence of a project manager was one of the reasons for the delay of information.

(2) Ingenuity for the project management challenges

1) Concentration of the load on a specific counterpart

Dispatches of four experts were shifted so as to not overlap with each other for reducing the load on the specific counterpart, even when there were closely related activities such as 3-2, 3-3, and 3-4. Although those activities should be simultaneously progressed, because the counterpart was working alone, dispatches of 3-2, 3-3, and 3-4 were separated. The essential solution was increasing the number of counterparts, but this was not realized.

3.4.3 Lessons learned

(1) To imagine one or two alternative ways

In order to progress as the work plan or PO, imagination of realistic troubled or obstructed situation is more important while daily activities. JICA Expert Team must imagine and prepare before facing trouble or problem, keep in mind such unwelcome situation must come and every trial must be fail. To prepare one or two alternative way to progress in our mind can provide better result at the end of the project.

(2) Effect of OJT

OJT is the most effective for output-3 as development of system to run in real world, though workshops or seminars are not sufficient for technical transfer. For example, no one can install a seismograph by only desktop learning, but collaboration with skilled expert in actual installation work can build a good relationship of trust and can transfer skills and technology what the expert has.

(3) Technical development in practical way as "down-to-earth"

Advisors of TDMMO are researchers in University or Institute. They consult TDMMO for highly technical issues, however sometimes their opinion were too much academic and research-oriented. To control project activities to focus on providing the most practical output can develop the better result.

3.5. Challenges of project implementation and process for solution of challenges, Items for Iranian side to be implemented for each activity, Involvement and Capacity development of Iranian side

Table 3.5.1 shows the Challenges of project implementation and process for solution of challenges, Items for Iranian side to be implemented for each activity.

Table 3.5.2 - Table 3.5.4 show the Involvement and Capacity development of Iranian side for each Output.

Table 3.5.1 Challenges of project implementation and process for solution of challenges, Items for Iranian side to be implemented for each activity

Activity			Challenges of project implementation and process for solution of challenges	Future issues	Items for Iranian side to be implemented
Output 1	1-1	To upgrade the emergency road networks in consideration of the expansion of Tehran, the location of important facilities inside and outside of Tehran and others	It seems to be difficult to control general vehicles completely from all routes of ERN at the time of earthquake based on the heavy traffic congestion and roughness of traffic manner from normal time. Therefore, for the setting of ERN, Iranian side proposed the plan to allow the general vehicles to pass a part of ERN. JICA Expert Team emphasized the ERN should be for only emergency vehicles according to the difficulties of traffic control. Both side discussed and respecting Iranian proposal and actual traffic situation in Tehran, ERN was determined in consideration of utilization of BRT lane as the lane for the emergency vehicles and minimization of traffic control point.	If the ERN is not well-known and does not disseminated in advance to each relevant organization and residents, ERN cannot be operated functionally for the smooth passage of emergency vehicles. In the future, it is necessary to consider the well-known and dissemination measures so that ERN can be operated effectively.	It is important for TDMMO to cooperate with Traffic Police for the dissemination of ERN. Specially, TDMMO should introduce and explain the ERN to the organizations which are responsible for an emergency response. In addition, preparation and issue of mark for emergency vehicles is to be considered. A case of Japan was provided by the JICA Expert Team and CP training. Moreover, for the residents, preparation of public relations materials such as brochure and installation of sign board for ERN on the road are to be considered. TDMMO are already considering these items.
	1-2	To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways	It is required to secure the redundancy of the emergency road network in order to make the emergency response and transportation available when some part of the network happens to be damaged. At the beginning of project, the gap about the definition of multiple and alternative network was occurred in both side. Iranian side had assumed that multiple and alternative network will be planed separately from ERN. However, JICA Expert Team advised that the ERN itself should be included the multiple and alternative network in consideration for the simplification of operation and the Japanese case. Through the repeated discussion, presentation and persuasion, eventually it was determined in the form which JICA Expert advised.	For the utilization of other transportation means, route maps were overlaid with ERN. In the future, especially the future development of subway is to be considered for revision.	For the utilization of other transportation means, the coordination and relationship building with each relevant organization are required in consideration for the actual operation. Concretely, it seems to be important for Iranian side to describe the detail role and responsibilities in SOP and strengthen collaboration with relevant organizations by utilizing the implementation of drills.
	1-3	To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and water, gas, electricity and telecommunication lines, etc. and their interactions	There are several issues in the process of Activity 3-1, such as 1) Most of Lifeline is composed with line structure buried underground and difficult to identify the condition visually, 2) limitation to obtain data due to security reasons, 3) difficult to identify all network due to long length, 4) most of lifelines are not managed by different authorities other than Tehran Municipality, and caused difficulty to implement the project activity. Therefore, in the process of data collection, series of meetings and presentations are made and promoted to understand the necessity. Locations where ERN and Lifelines cross have high risk of cause disturbance for road opening at the time of Earthquake occurrence, and for the future efforts by Iranian side, this risk needs to understand, and data collection and clarifications were made.	Presentations on Vulnerability Assessment Method of Lifeline in Japan were made and proposed to apply for Vulnerability Assessment of ERN at series of meetings with CPs, , however, Iranian side prefer to apply HAZUS developed in the USA due to past experience and limitation of data availability and applied HAZUS method for the project. For the future, detail information for lifeline must be collected and further detail vulnerability assessment needs to be implemented.	Through formulation of Draft Instruction, this effort dedicated to clarify and disseminate to the relevant lifeline authorities the information that lifeline facilitates may cause malfunction of ERN as secondary disaster where mainly intersect with ERN. From now on, further detail investigation to identify relation between ERN and lifeline should be carried out furthermore to implement more detail vulnerability assessment.
	1-4	To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels	Mainly the seismic performance evaluation of the bridge was studied, since the vulnerability of the bridge was more significant than the other road structures. It is needed to obtain some information of the target bridge such as the structural shape and internal reinforcement diameter and the re-bar arrangement of bridges in order to evaluate the seismic performance of the bridge, however it was not impossible. Therefore, the structural shape of the bridge were directly measured, and the re-bar arrangement and the diameter of the reinforcement were estimated to obtain a standard design of Tehran City. Expert team explained the ductility design used in Japan to the CPs side as the seismic performance evaluation method of the bridge, and the seismic performance of the main bridges were calculated by the same method by the CPs side. About the retrofitting method of the bridge that the seismic performance is low, expert team explained Japanese seismic retrofitting method to the CPs side based on the case of the Tehran City by the field survey results.	About the seismic performance evaluation of the bridge, it is necessary to improve the accuracy of the seismic performance evaluation of the main bridges based on the information of the internal reinforcement of the bridge, since it is based on the estimated information.	In Japan, if the specifications of the bridge are unknown, the seismic performance of the bridge is evaluated after confirming the shape of the structure and the reinforcement of the diameter and arrangement by measuring the shapes and chipping the internal reinforcement in the field. It is necessary to improve the accuracy of the seismic performance evaluation of the bridge by the same method.

Activity			Challenges of project implementation and process for solution of challenges	Future issues	Items for Iranian side to be implemented
Output 1	1-5	To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future	For Operation and Maintenance Plan of the Emergency Road Networks, at the beginning of commencement of the project, two components were considered to be formulated, 1)the ”Manual for Revision of ERN” to be able to revise ERN showing procedures of revision, and 2) “SOP for Securing ERN” which contains procedures to secure the emergency road network by implementing road opening, traffic control, and others after occurrence of an earthquake disaster. However, due to a strong request form the Iranian side who will utilize the plan, it has been decided that in this plan only “SOP for securing ERN” would be retained, since the contents of “Manual for Revision of ERN” has been prepared separately as activity report by TDMMO. For “SOP for securing ERN”, at time of considering components, since Iranian side does not have experience, Japanese examples were introduced and discussed step by step for each procedures, and formulated mainly by Iranian side. In the process of listing up relevant organizations, clarifying roles and responsibilities, and considering procedures for each activities to secure ERN, issues considering Iranian conditions were discussed and formulated by building consensus step by step. And for the component of SOP, there were difference of idea between Iranian and Japanese side, however, expert team respected the idea of Iranian side as much as possible and formulated SOP.	“SOP for securing ERN” must be approved as official manual to realize actual operation of ERN by relevant organizations. And, it is expected to improve and clarify the contents by making the contents more detail.	It is necessary by TDMMO to implement more dissemination efforts of “SOP for securing ERN” to relevant organizations in order to realize actual operation of ERN.
	1-6	To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan	For the Draft Instruction, at the beginning,, table of contents were prepared based on the idea that the document is for vulnerability assessment purpose from the intention of Iranian side, however, TDMMO does not have direct authority to instruct lifeline companies, and for the administration of buildings as well, therefore, through discussions, both sides recognized importance to disseminate information to those authorities on importance of ERN and risk reduction at the occurrence of Earthquake, and formulated the Draft Instruction to disseminate such information.	Since there were limitations for obtaining information on Structures, and lifelines adjacent to ERN as well as TDMMO does not have direct authority to instruct to those management entities, it is promoted to disseminate information on importance on ERN, and at the process of improvement of seismic resistance, it is expected to prioritize at the location adjacent to ERN.	With TDMMO that coordinates operation of ERN, each lifeline companies, and Technical Deputy of Tehran Municipality issue building permission expected to understand importance and smooth operation of ERN. In order to achieve this, frequent coordination among stakeholders are expected and actual improvement efforts needed to be started as soon as possible.
	1-7	To hold seminars and workshops on the plans related to the emergency road networks	-	-	-
	1-8	To hold Simulations (Drills) utilizing the disaster scenario based on the result of the damage estimation and in consideration of the emergency road networks	In the Work plan of this project, in order to verify the effectiveness of plans formulated through this project, Implementation of Drills using DIG had been planned. However, TDMMO asked the JICA Expert Team to carry out a more practical drill which can make the participants experience the simulated situation after a disaster. Since C/Ps had less experience for drills, as shown in 2.2.8, the drills were carried out with three steps. In Addition, though the C/Ps of Output1 are mainly from mitigation and risk reduction deputy at TDMMO, for the drills, the staffs of education deputy, who are familiar with drills, were in charge of drills in consideration for dissemination to the ward level and community level.	Especially, for the CPX, since it was first experience to carry out for all participants, most of participants were confused how to process the CPX. Therefore, in the future, it is required that the drill will be carried out periodically and the framework of drills to be obtained the issues will be established.	As shown in the future issues, it is required that the drill will be carried out periodically. Furthermore, the result of drills should be utilized the revision of SOP and it is important that implementation itself of drills make strengthening cooperation with related organizations.
Output 2	2-1	To study current public awareness on the earthquake disaster	Current training programs require long hours such as 30 hours to attend. TDMMO has clear vision of outreaching more citizens. Thus, the results of the survey, especially the identification of the factors which lead to disaster risk management actions, has become useful to prepare training curricula with scientific reasoning. In the future, training will be conducted for the citizens at the Museum. The Social Survey will serve as the baseline data to compare the changes in the future.	Implementation of social survey in cooperation with municipality social dep. or allocation of budget for periodic survey will be an issue.	Reviewing training program by target groups ideally every five years.
	2-2	To study the contents and effectiveness of the disaster education for the public in the past	Interviewing with IIEES, UNDP, Education dep. Fire dep., Red Crescent Society has been conducted, however sharing information has certain limits.	Information sharing is an issue.	Knowledge and experience sharing and coordination is expected.

Activity			Challenges of project implementation and process for solution of challenges	Future issues	Items for Iranian side to be implemented
Output 2	2-3	To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans	Sharing Master Plan requires much time than expected.	Certain duration of time is necessary for approval of sharing information.	Reviewal and revision of the Master Plan edeally every 5 years
	2-4	To prepare public education training tools and materials	Some of the training program for citizens are quite long (some requires more than 30 hours)	To make the education programs concise and revise them to link them with the actions for disaster risk management.	Including acivities for raising motivation effectively by selecting training materials by target groups.
	2-5	To prepare and finalize the basic concept, display plan, circulation scenario, floor plan, spaces required, and equipment plan for each space and a drawing of each section for the disaster management museum	* TDMMO tended to focus only on the building design and construction of the museum building, with the exhibit preparation to follow later. The experts repeatedly explained the importance of preparing exhibition and operation plans by showing examples from other museums. Visiting other museums in Tehran helped C/Ps to understand the importance of preparing scenarios and contents of exhibitions and the operation plan during the early stages of planning. * In particular, the importance of collecting original objects and first-hand information from victims has been understood by the preparation team members as a result of a lecture conducted by a domestic support committee member and counterpart training programme, and a series of discussions with the experts. However, coordination with other organizations before collecting objects/data has taken a long time. * With regards to the building design, the design consultant was hired by TDMMO, and the preliminary design was prepared, however, the land issue has not been resolved yet. TOR for the exhibition design consultant is ready.	In order to create effective and impressive exhibitions, and ensure the museum is opened on schedule, it is necessary to start collecting the objects/data for exhibition at earliest possible time through cooperation with other local governments and organizations.	Facility planning: - basic design, detailed design, cost estimation, preparation of budget, preparation of the tender documents - implementation of tender procedures, construction work (TDMMO to supervise construction) Exhibition planning: - collection of objects/data for exhibition (records of past disasters, scientific information, episodes of victims, lessons from past disasters) - evaluation and selection of the collected objects/data, necessary procedures to use the collected objects/data for exhibition (ownership, copyright, etc.) - hiring of consultants for exhibition design and preparation and academic supervisors for auditing contents of exhibitions, - detailed design and production of exhibits (graphics, photos, films, physical models, etc.)
	2-6	To prepare a public education plan and program to be conducted at the disaster management museum	Training programs for the visitors have been prepared and included plans for special events to maximize the opportunities to motivate the visitors to be prepared for the disaster risk reduction.	It is necessary for the museum visitors to arouse interests.	Conducting appropriate needs assessment, feedbacks of the visitors' needs on training programs, and devise for increasing repeaters to the museum.
	2-7	To prepare an operation and management plan for the disaster management museum	* Since there will be more than 4 years before opening the museum, decision on the operation plan has not been made by TDMMO. However, the issues to be studied or planned in the early stage were explained to the preparation team members, and that team drafted the framework of the museum operation and management plan.	* It is necessary for the framework of the operation plan, which was prepared by the museum preparation team, to be officially approved by TDMMO. Specifically, establishing the Museum Preparation Office and selection of members and the person in charge are required to be implemented in the early stage.	Necessary preparation works to open DM: * Establish Disaster Museum Preparation Office * Organize the academic/scientific advisory committee (outside TDMMO) * Prepare operation and management plan (detailed) * Design organization for the DMM operation, assign the key personnel, and employ staff * Prepare the operation manual and conduct staff training * Develop education programmes and prepare for the event programmes * Develop strategy of publication and community and prepare publication materials * Select tenants and develop Tehran DMM original goods
	2-8	To hold workshops on the community-based disaster management	Current training programs require long hours such as 30 hours to attend. TDMMO has clear vision of outreaching more citizens. Thus, the results of the survey, especially the identification of the factors which lead to disaster risk management actions, have become useful to prepare training curricula with scientific reasoning. In the future, training will be conducted for the citizens at the Museum. The Social Survey will serve as the baseline data to compare the changes in the future.	Implementation of social survey in cooperation with municipality social dep. or allocation of budget for periodic survey will be an issue.	Reviewing training program by target groups ideally every five years.
	2-9	To conduct emergency evacuation drills in designated Mahalle	Interviewing with IIEES, UNDP, Education dep. Fire dep., Red Crescent Society has been conducted, however sharing information has certain limits.	Information sharing is an issue.	Knowledge and experience sharing and coordination is expected.

Activity			Challenges of project implementation and process for solution of challenges	Future issues	Items for Iranian side to be implemented
Output 3	3-1	To prepare an improvement plan on early warning including the QD&LE system	Less understanding of EEWS. Through OJT during all activities supported to understand EEWS.	Coordination of so many related organizations.	To realize developed plan.
	3-2	To prepare an improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS)	Because know-how for site survey of environment for installation, technical issues were transferred through collaboration of field work.	none	To realize developed plan.
	3-3	To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organizations such as water, electricity, gas, fuel pipes, fire and safety service, and subways	Lack of understanding of JMA's EEWS algorithm, missing of drafting specification for software development, lack of supervising and management of software development process, and small capacity of IT office were main problems. Weekly seminars, workshops, and daily technical meeting or OJT solved the problems.	Detailed evaluation of developed pilot system, extraction of items to be improvement for a practical system, drafting software specification of the practical system, supervising and management of development, inspection of the developed practical system, education and dissemination to public, legislation, detailed plan for station allocation, negotiation to the land owners, selection or development of communication system, getting permission of communication system, and procurement of necessary equipment.	To proceed development of practical EEWS based on the action plan and to prepare future operation.
	3-4	To strengthen data communication systems for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines	Most of tasks were outsourcing, but after frequent technical meeting supported to understand and establish responsibility.	Design and implement of flexible and robust network system.	To install communication system and establish communication network.
	3-5	To increase items of the QD&LE system in addition to buildings and casualties	Because of TDMMO's wish to implement many additional items at once, detailed design could not be started for any of additional items. By changing the software design from all-in-one to combination of modules, detailed design could be started one by one.	Additional items of the QD&LE system	To keep the TDMMO experts who can design additional items of the QD&LE system, or to develop followers, and to maintain software documents
	3-6	To install a seismic intensity early warning system for emergency response and public awareness	Missing how to calculate seismic intensity, and lack of understanding how to utilize seismic intensity at emergency response, Daily technical meeting and OJT solved the problems.	Development of operational version.	To develop an operational system based on developed prototype and integrate to QD&LE system, then provide to each district.
	3-7	To improve the current multi-layered warning system for more effective emergency response activities	Designing without users was misleading the conclusion. Throughout explanation of and discussion on initial plan to potential user organizations, system design for necessary and realistic warning system was promoted.	Continuation of warning system improvement	To keep explanation on emergency response to related organizations, and to continue necessary specification
	3-8	To prepare a plan to introduce a post-earthquake (secondary events) information and warning system	Designing without information collecting capacity of related organization was misleading the conclusion. Throughout information collecting capacity study of related organizations, system design for necessary and realistic information collecting/warning system was promoted.	Introduction of a post-earthquake (secondary events) information and warning system	To prepare detailed plans and to realize the plan developed.

Table 3.5.2　Involvement and Capacity development of Iranian side for Output1

Output	CPs	Name	1. Mitigation & Risk Reduction Deputy	2. Education & Public Participation Deputy	3. Passive Defense Deputy	4. Preparedness & Response Deputy	5. Financial & Administrative Deputy	11. Information Technology Office	12. Advisors to President	1-1 To upgrade the emergency road networks in consideration of the expansion of Tehran, the location of important facilities inside and outside of Tehran and others	1-2 To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways	1-3 To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and water, gas, electricity and telecommunication lines, etc. and their interactions	1-4 To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels	1-5 To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the	1-6 To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan	1-7 To hold seminars and workshops on the plans related to the emergency road networks	1-8 To hold Simulations (Drills) utilizing the disaster scenario based on the result of the damage estimation and in consideration of the emergency road networks	**Involvement and Capacity development of Iranian side**
1	Leader	Mr. Montazerolghaem							✓	✓	✓	✓	✓	✓	✓	✓	✓	For Output1, as C/P, mainly the staffs of mitigation and risk reduction deputy at TDMMO were involved in this project. C/Ps were divided into 2 groups, C/Ps who are responsible for the structure such as seismic resistant of bridges and C/Ps who are responsible for the planning. C/Ps were actively involved for each activity based on the advice from JICA Expert Team. Concretely, JICA Expert Team showed the case of Japan, contents of activities and policies, Iranian side implemented actual activities and formulation of plans. Based on this, JICA Expert Team confirmed these activities by C/Ps, advised and corrected course. For setting up of ERN, technical transfer such as method of set up and analysis was implemented as the capacity development, and C/Ps were now able to modify and analyze by themselves. For the formulation of various plans, it was the first experiences for C/Ps and the progress had not been proceeded for a while at the beginning of this project. However, JICA Expert Team introduced the case of Japan, example for table of contents and detail contents, thus the capacity of C/Ps was built such that C/Ps could formulate various plans by themselves. The Command Post Exercise was also first experiences for C/Ps. Therefore, this drill was conducted by JICA Expert Team initiatively. However since the processes of CPX were implemented with technical transfer, C/Ps were now able to conduct CPX according to this project. Furthermore, C/Ps were now able to conduct TTX as well.
	CPs	Mr. Alikhani	✓							✓	✓	✓	✓		✓			
		Mr. Shamshiri	✓									✓	✓		✓			
		Mr. Samadzadegan	✓										✓					
		Mr. Sa'eed	✓							✓	✓							✓
		Mr. Ahmadi (GIS)	✓							✓	✓							
		Ms. Mirza Hashemi		✓													✓	✓
		Ms. Sharifi	✓							✓	✓			✓			✓	✓
		Ms. Iranpour	✓															✓
	Non CPs	Ms. Moradbeigi		✓													✓	✓
	Past CPs	Mr. Mohammadi	✓							✓	✓							
		Mr. Balayi	✓							✓	✓	✓	✓					
		Mr. Zakizadeh	✓										✓					
Number			10	2	0	0	0	0	1	7	7	4	6	2	3	4	6	

Table 3.5.3 Involvement and Capacity development of Iranian side for Output2

Output	CPs	Name	1. Mitigation & Risk Reduction Deputy	2. Education & Public Participation Deputy	3. Passive Defense Deputy	4. Preparedness & Response Deputy	5. Financial & Administrative Deputy	11. Information Technology Office	12. Advisors to President	2-1 To study current public awareness on the earthquake disaster	2-2 To study the contents and effectiveness of the disaster education for the public in the past	2-3 To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans	2-4 To prepare public education training tools and materials	2-5 To prepare and finalize the basic concept, display plan, circulation scenario, floor plan, spaces required, and equipment plan for each space and a drawing of each section for the disaster management museum	2-6 To prepare a public education plan and program to be conducted at the disaster management museum	2-7 To prepare an operation and management plan for the disaster management museum	2-8 To hold workshops on the community-based disaster management	2-9 To conduct emergency evacuation drills in designated Mahalle	**Involvement and Capacity development of Iranian side**
2	Leader	Ms. Saleh	✓											✓		✓	✓		As for Output 2, besides 3 core experts of education dep., various personnel from the same dep. and mitigation dep., have joined. Since experts of education dep. themselves have rich experience of training different target groups and key groups, they understand the issues. Experts could accomplish the tasks by themselves after discussion, studying Japanese experiences, and getting guidance. Tasks were done by the groups of experts at the beginning of the project, but later in the progress of the project, each expert has been enhanced enough decision making capacities to accomplish the allocated tasks. The experts are very enthusiastic about researching other countries cases and improved their own training materials. Sometimes they requests necessary information from Japanese cases to analyze and tried to apply it into their own activities. They maintained the high motivation all through during the project and performed the activities effectively. The Museum Preparation Team who worked on planning the Tehran Disaster Management Museum were staff from the Mitigation and Risk Reduction Deputy and the Education and Public Participation Deputy. The preparation team members, with advice from experts, actively studied about the DMM. Based on the subjects raised, and benchmarks and examples from Japan and other countries introduced by the expert team, the preparation team members studied contents and prepared the draft plan. The expert team reviewed the plan and provided advice on modifications. TDMMO made necessary decisions for the process to develop design works and hire the design consultant, while the experts supported to prepare the TOR. The draft design prepared by the consultant was reviewed by the C/P based on the reviews and discussion points by the experts.
		Mr. Kalhori		✓															
	CPs	Ms. Sara Keshani	✓											✓	✓	✓	✓		
		Mr. Ahmad Heidari	✓											✓					
		Mr. Majid Amjadi	✓											✓					
		Mr. Javad Chabokpour	✓											✓					
		Dr. Marzie Moradbeigi		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	
		Ms. Ameneh Ashtari Mahini		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	
		Ms. Mirza Hashemi		✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	
		Mr. Amir Rengin Kaman	✓							✓							✓		
	Non CPs	Ms. Nikkhah	✓											✓					
		Mr. Shahin M Yeganeh	✓																
	Past CPs	Mr. Goodarz Goodarznia	✓							✓		✓		✓			✓		
Number			9	4	0	0	0	0	0	5	3	4	3	10	4	5	7	3	

Table 3.5.4 Involvement and Capacity development of Iranian side for Output3

Output	CPs	Name	1. Mitigation & Risk Reduction Deputy	2. Education & Public Participation Deputy	3. Passive Defense Deputy	4. Preparedness & Response Deputy	5. Financial & Administrative Deputy	11. Information Technology Office	12. Advisors to President	3-1 To prepare an improvement plan on early warning including the QD&LE system	3-2 To prepare an improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS)	3-3 To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organizations such as water, electricity, gas, fuel pipes, fire and safety service, and subways	3-4 To strengthen data communication systems for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines	3-5 To increase items of the QD&LE system in addition to buildings and casualties	3-6 To install a seismic intensity early warning system for emergency response and public awareness	3-7 To improve the current multi-layered warning system for more effective emergency response activities	3-8 To prepare a plan to introduce a post-earthquake (secondary events) information and warning system	**Involvement and Capacity development of Iranian side**
3	Leader	(Ms. Saleh)	✓															Technical transfer at output-3 was mainly obtained by OJT through collaboration work with C/P rather than seminars or workshops, because the tasks are not only transfer knowledge or technical skills but also development systems actually running in the real world. Therefore, most of the outputs of activity-3 are provided by collaboration of C/P and expert team. Especially, Mr. Norouzi of Mitigation & Risk Reduction Deputy has been actively contributing all of activities, and understood whole vision of output-3. At activity3-3, Mr.Norouzi and Dr. Heydari understood the contents very well and developed their capacity as they could answer and persuaded by their own words for questioners at a seminar held for estimated EEWS users at the late stage of the project term. Capacity of Mr. Tajadod and Ms. Giyahchin at IT office were built as they could develop a prototype of Seismic Intensity Web-delivery system on supervising by expert team. Dr. Shomali and Dr. Moradi who are advisors of TDMMO contributed EEWS from theoretical aspect and observation system establishment, and they could enhance their capacity and knowledge through the collaboration work. Ms. Sharifi led activity 3-7 and 3-8 and drove the meetings with disaster related organizations, and then she created a disaster information matrix on supervising by expert team. Mr. Shodja acted as a responsible of QD&LE system operation, joined field works frequently for improvement of communication system and establishment of EEWS communication network and then he could supervise local suppliers. Mr. Bolbolvand and Mr.Haydari were engaged in construction work for additional strong motion observation stations and EEWS stations. One of the sites was located at the top of mountain which elevation is 3200m in snow of 3m thickness. They completed their tasks by extreme hard work. Mr.Alikhani studied and confirmed methodology for damage estimation of additional items on supervising by expert team. Mr. Afshari investigated source code of existing system and developed new codes for additional damage items to be estimated. Ms. Mohammadi updated database necessary for additional damage items. As stated above, not only C/P but also many Iranian staffs contributed to the activities and collaborated many field works with expert team, accordingly, total technical transfer and comprehensive capacity enhancement was achieved.
	CPs	Mr. Rahim Nourozi,	✓							✓	✓	✓	✓	✓	✓	✓	✓	
		Dr. Reza Haydari,	✓							✓	✓	✓						
		Ms. Mohammadi (GIS)	✓											✓		✓	✓	
		Mr. Shodja,				✓				✓	✓	✓	✓		✓			
		Mr. Tajadod						✓				✓	✓	✓	✓			
		Mr. Alikhani	✓											✓				
		Mr. Afshari						✓						✓				
		Ms. Sharifi	✓							✓						✓	✓	
	Non CPs	Mr. Bolbovand	✓								✓	✓						
		Mr. A Heydari	✓								✓	✓	✓					
		Dr. Moradi							✓	✓	✓	✓	✓		✓			
		Dr. Shomali	✓							✓	✓	✓	✓		✓			
		Dr. Yaminifar							✓	✓	✓	✓	✓		✓			
		Mr. Mahyari	✓								✓	✓	✓					
		Mr. Giyahchin						✓				✓		✓	✓			
		Mr. Naghavi							✓									
		Mr. Ardi				✓							✓					
		Mr. Kheirabadi				✓												
	Past CPs	Dr. Karkouti	✓							✓	✓	✓			✓			
		Mr. Balayi	✓											✓				
Number			12	0	0	3	0	3	3	8	10	12	9	7	8	3	3	

4. ACHIEVEMENT OF PURPOSE OF THE PROJECT

4.1. Purpose of the project

Purpose of the Project：

In the three areas of road disaster management, community disaster management and early warning, preparedness for response against earthquake disaster of Tehran Municipality is improved.

＜Indicators＞

1.Plan for emergency road management is shared within the current technical committee

2.Short term (2 to 3 years) Action plan for civic enlightenment and training is prepared

3. System of transferring early warning information to stakeholders works.

4.2. Achievement of Project Purpose

4.2.1 Summary of Result of Terminal Evaluation (implemented in September 2014)

A terminal evaluation was conducted during the period between 10 September and 1 October 2014. The JICA Expert Team cooperated in executing this terminal evaluation survey. The conclusions of the evaluation are summarized as follows;

(1) Result of Evaluation（5 Categories Evaluated）

Table 4.2.1 Evaluation Grid and the Result

Evaluation Grid	Evaluation Result
Relevance	The relevance is very high. The Project's objectives are supported by the National Development Plan and the policy for Tehran Municipality. The Project also responds to the needs of residents of Tehran for earthquake risk reduction. It is valid for Japan to support the sector because of Japan's experience in disaster management and the long-lasting relationship between both sides.
Effectiveness	The effectiveness is high. The developments of operational and functional ERN, the Master Plan and training program that can be applied for CBDM and the seismic intensity early warning system have been almost completed.
Efficiency	The efficiency is high. The Project has mostly completed activities and outputs for outputs 1 and 2, however, it is not yet certain whether EWS under output 3 can be completed by the end of the Project duration.
Impact (Prospective)	The prospective impact is very high. There are many opportunities and scopes to scale up the Project's outputs such as EWS and ERN at the national level. The project's outputs such as a training program for CBDM and disaster education can be further rolled out to other municipalities and schools.

Sustainability (Prospective)	The prospective sustainability is high. All the plans developed by the Project will be adopted by respective organizations. The organizational and personnel sustainability is high. TDMMO needs to promote the plans to respective agencies to secure the budget for implementation.

In addition, at the time of the terminal evaluation, the evaluation survey team underlined contributing and hampering factors which illustrated the effective performance of the project.

(2) Contributing Factors

- TDMMO took the initiative to mobilize their resources to conduct some of the project activities.
- TDMMO officials, experts and consultants were diligently engaged in the managerial, technical and operational aspects of the Project. Their strong commitment attributed to the accomplishment of the Project with high quality.

(3) Hampering Factors

- The economic sanctions that have been increasingly stringent since 2011 affected the implementation of the Project, particularly for the procurement of inputs.
- The change of the site for the construction of the disaster management museum caused delay in the development of the exhibition plan and the operation and management plan.

4.2.2 Extension of the Project Period

After the start of the project, the economic sanctions against Iran were enhanced in 2012, as a result, the installation of the equipment (seismometers, etc.) that had been originally planned became difficult, which caused a delay of about eight months from the schedule that was originally planned since the adjustment of specifications that do not conflict with the economic sanctions and performance test of the equipment was required. According to the above-mentioned delay, as indicated in 4.2.1, the activity 3-3 "To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organizations such as water, electricity, gas, fuel pipes, fire and safety services, and subways" became difficult to complete within the initial project period (until February 2015).

Under these circumstances, JICA and TDMMO understood the necessity of extension of the project activity for activity3-3. And both sides agreed that the following five issues are prerequisite conditions for the extension and these issues shall be achieved by the Iranian side by the middle of December 2014.

① Donated 4 seismometers (AC73) and controllers (GMSPlus) are installed and working as planned.

② Condition II. : Data communication system connecting stations, repeaters, and TDMMO is established.

③ Station side software is developed and installed in each controller at the station and they are all working.

④ Server side software is developed and installed in the server computer at TDMMO and they are all working.

⑤ Relationship between the seismometer supplier, the software developer, the communication company, the land owners of all stations, and TDMMO is well maintained and shall not affect the follow up assistance.

From November 2014, the JICA Expert Team and TDMMO have been evaluating the progress of the five prerequisite conditions. Both sides obtained common understanding regarding current progress of the five issues as attached. Therefore, the project period was extended for about 9 months.

4.2.3 Achievement at the end of the project

Achievement level of purpose of the project for each output is indicated as follows;

(1) Output 1

＜Indicator＞

1. Plans formulated in the project are shared with related organizations in the existing technical committees.

This has been 100% attained. In the process of formulation of plans for Output 1 of the Project, member organizations of emergency traffic and transportation committees were involved through discussions and participation in disaster management exercises, and received inputs from them. And, draft plans were explained to the relevant organizations, as well as widely shared after completion. The following plans will be mainly utilized with the organizations indicated below.

Table 4.2.2 Plans developed and main user organizations

Name of Plans	Main User Organizations
Seismic Resistance Plan	Civil and Technical Deputy of Tehran Municipality
Draft Instruction (Buildings)	Urban Development and Architecture Deputy of Tehran Municipality
Draft Instruction (Lifelines)	Lifeline Companies
Operation and Maintenance Plan of ERN	TDMMO, Relevant Organizations (Traffic and Transportation Deputy, Urban Services Deputy, Relevant Agencies in Districts, Traffic Police, etc.)

(2) Output 2

> **＜Indicator＞**
>
> 2. Short term action plans (from 2 to 3 years) in the improved master plan on public training and awareness for the earthquake disaster management are achieved.

This has been 100% attained. Regarding the one year action plans, some have already been implemented, as progress has been favorable. As for 2-3 year action plans, disaster education for schools is the major activity. Training of school teachers initially and later students are planned to receive DRR education. Detailed activity planning and budgeting has already taken place with the education department, which makes the implementation very feasible.

(3) Output3

> **＜Indicator＞**
>
> 3. System of transferring early warning information to stakeholders works.

1) Extension of project period

As indicated in 4.2.2, after starting the project, international sanctions on Iran were tightened and expanded. As a result, the model of seismic equipment planned to be procured and used for activity 3-3 had to be changed. It took totally 8 months to locate other equipment that could be used for the purpose, to test the real performance in the field, and to revise the specifications for developing the system. Since activity3-3 was eventually delayed 6 months in total despite efficient work to shorten the delay, the project period for activity3-3 was extended until October 2015.

2) Achievement of project purpose

This has been 100% attained. Information for early warning is prepared, destination and timing are specified, and communication method is established.

5. RECOMMENDATIONS TO ACHIEVE OVERALL GOAL

Overall goal and indicators are shown as follows;

Overall Goal : Integrated preparedness for response of Tehran Municipality against earthquake disaster is improved

＜Indicators＞

1. Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area is revised based on the outputs of the project.

2.Priority actions following the master Plan are implemented

JICA's cooperation with the earthquake disaster management in Tehran has a long history. Tehran improves its earthquake disaster management capability step by step. JICA implemented two development projects and two technical cooperation type projects. "The Study on Seismic Microzoning of the Greater Tehran Area" (1999-2000) estimated the number of causalities could be up to 380,000. "The Comprehensive Master Plan Study on Urban Seismic Disaster Prevention and Management of the Greater Tehran Area" (2003-2004) is an effort to formulate a systematic seismic disaster management plan in the three phases: normal situation, emergency situation and reconstruction and to identify priority projects. "The Project for the Establishment of an Emergency Response Plan for the First 72 Hours after an Earthquake" (2006-2010) aims at improving the capacity of Tehran to respond swiftly and properly under emergency through three outputs: the emergency response command system is improved; a quick damage and loss estimation (QD&LE) system is developed and operated; and the emergency evacuation plan and capacity are improved. Furthermore, it is proposed to implement the priority projects identified in the Master Plan Study, to enhance the earthquake disaster management capacity in Tehran. "The Project for Capacity Building for Earthquake Risk Reduction and Management in Tehran" was under implementation through three outputs; the Emergency Road Network; Disaster Management Education/Disaster Management Museum, and the Earthquake Early Warning System. The priority projects proposed by the master plan study have not been fully implemented so far, Tehran will continue to improve disaster management activities and updating the master plan study will be required.

5.1. Priority Projects identified by the Master Plan and their Status of Implementation

The summary of priority project implementation status and two types of projects covered are shown as follows;

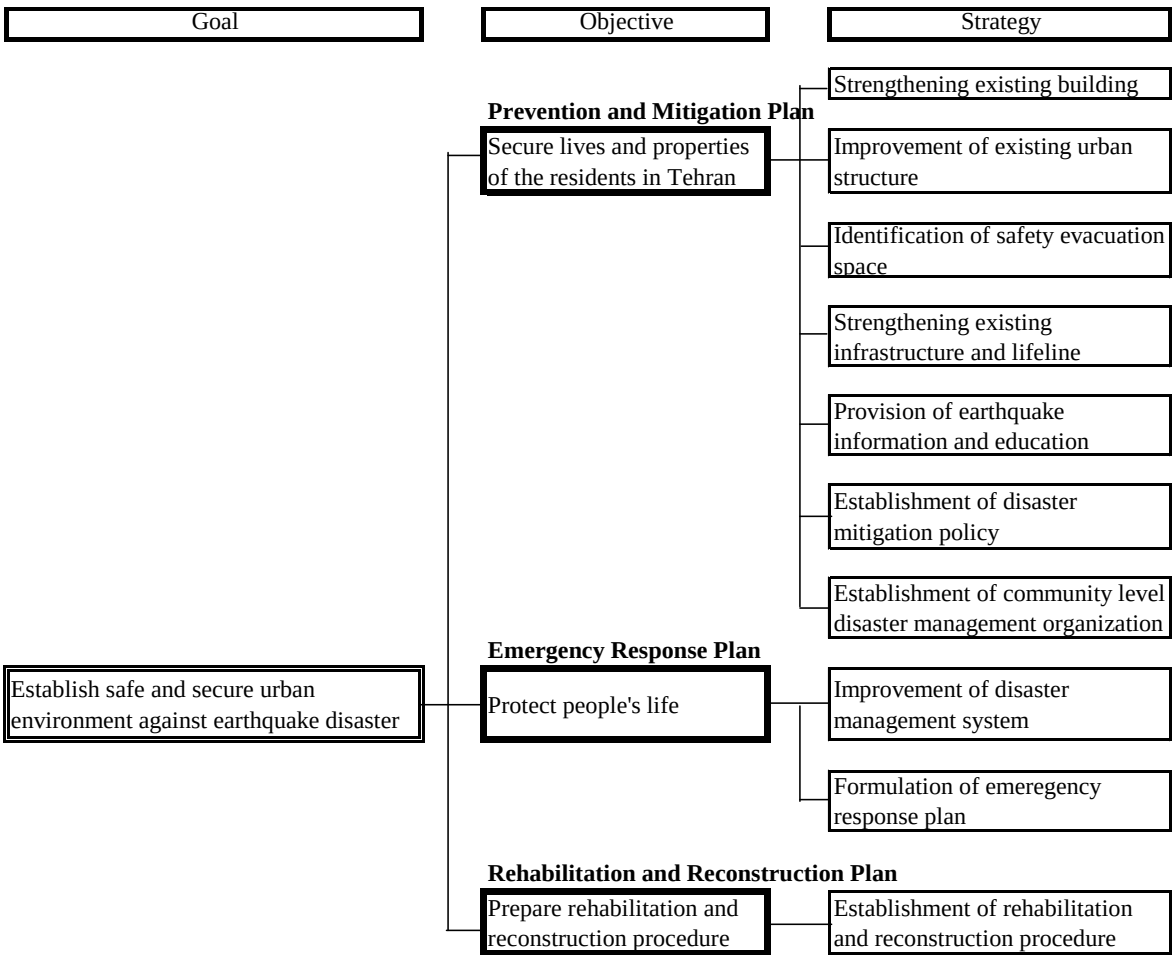
In the master plan study completed in 2004, the goals, planning period, objectives, and strategies were set. Target period of the master plan is from 2004 to 2015 and 2015 is the end of the target period.

Table 5.1.1 Summary of the Master Plan Study

Goal	To establish an urban environment safe and secure against a potential earthquake.
Planning Period	Short term (2004-2006) Medium term (2007-2010) Long term (2011-2015)

Objectives	To secure the lives and properties of the citizens of Tehran; To protect citizen's lives after the event; and To prepare for rehabilitation and reconstruction.
Strategies	Strengthening existing buildings Improvement of existing urban structure Identification of safety evacuation spaces Strengthening existing infrastructure and lifelines Provision of earthquake information and education Establishment of disaster mitigation policy Establishment of community level disaster management organizations Improvement of disaster management systems Formulation of emergency response plans Establishment of rehabilitation and reconstruction procedures

The master plan study identified 10 priority projects, which include structural and non-structural measures for the earthquake disaster management plan. The framework of the master plan study is shown as follows;



Source: JICA Study Team, 2004

Figure 5.1.1 Framework of the Master Plan

The master plan study also identified 155 projects for every strategy.

The 72 hours project and this project have been implemented based on priority projects which were identified by the master plan study. A total of 15 priority projects were selected as the core projects and other outputs were implemented as a group.

The following table shows the coverage of the projects proposed in the Master Plan through this project and the 72 hours project.

Priority Project Name	Urgent Project Name
Strengthening and Replacement of Existing Public Buildings	1.New-creation of "Specification of Building Diagnosis on Seismic Resistance and Strengthening"
	2.Seismic Diagnosis of Important Public Buildings
Promotion of Strengthening of Existing Private Buildings	1.Establishment of Governmental Financial Assistance Scheme for Strengthening of Residential Buildings
Improvement of Building Quality	1.Research of Strengthening Scheme for Masonry Structure
	2.Establishment of Committee for Building Quality Improvement
	3.Revision of Building Construction Appraisal System
	4.Capacity Development of Double Checking Office of Tehran Municipality
Promotion of Urban Redevelopment for Disaster Prevention	1.Installation of Disaster-Proof Living Zone System
Provision of Regional Evacuation Sites and its Facility	1.Formulation of Emergency Evacuation Plan and Manual
Strengthening and Replacement of Bridges along Major Road Network	1.Preparation of Plan
Strengthening of Water Supply Facility and Network	1.Preparation of Strengthening Plan for Facilities and Networks
	2.Preparation of Emergency Response Plan
Installation of Central Control System for Natural Gas Distribution System	1.Reinforcement of Gas Distribution Facilities and its Office Buildings
	2.Reinforcement of Gas Distribution Pipe Networks
	3.Design and Construction of Remote Shutdown System
	4.Design and Installation of Seismometers
	5.Training and Maintenance
Establishment of Model Schools for Disaster Education with Different Characteristics at Tehran Municipality Level	1.Establishment of Model Schools for Disaster Education
Designation of Model Communities for Organization of Community Level Disaster Management Group and System	1.Designation of Model Communities for Organization of Community Level Disaster Groups and System
Tehran Disaster Mitigation and Management Center - Institutional Capacity Building	1.Institutional Capacity Building
Establishment of Emergency Traffic System in Tehran	1.Analysis of Current Traffic Flow and Estimation of Traffic Flow in Emergency
	2.Study on Emergency Road Network
	3.Study on Emergency Traffic Control System
Installation of New Disaster Information and Telecommunication Network	1. F /S on Strengthening of Telecommunication Network in Teheran
	2.F/S on Installation of New Disaster Network in Teheran City
Strengthening of the Emergency Response Capability and Capacity of the Tehran Fire Fighting and Safety Services Organization	1.Formulation of Emergency Response Operation Plan
Strengthening of Emergency Response Capacity for the Governmental Health Organization	1.Formulation of Health Disaster Management Plan in Tehran

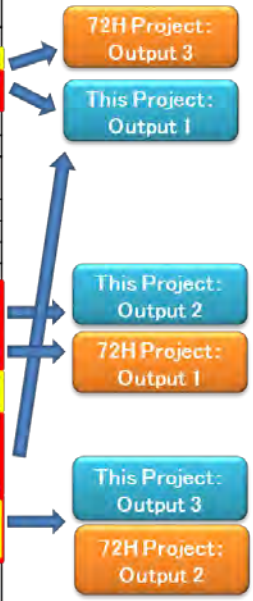


Figure 5.1.2 Coverage of projects proposed in the master plan

As a result, both the projects have been implemented based on priority projects proposed by the master plan study. Other structural measures related to building retrofitting improvement have not been implemented. The area redevelopment project has been implemented in some parts of the districts and improvement of infrastructure has been implemented by each infrastructure company.

5.2. Towards Achievement of Overall Goal

The overall goal of this project is "integrated preparedness for response of Tehran Municipality against earthquake is improved" and indicators are as follows;

1. Comprehensive Master Plan on Urban Seismic Disaster prevention and Management for the Greater Tehran area is revised based on the outputs of the project.

2. Priority actions following the master plan are implemented

The Master plan study has seen 10 years pass since its beginning and the target year for completion is 2015. TDMMO intends to establish the Master plan to include other natural disasters. The Master Plan study should be formulated so as to review and update the existing situations and identify priority action activities.

Appendix 1
PDM

Annex I Logical Framework (Project Design Matrix Version 1: PDM1) May 30th, 2012

Project Name: Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
Project Duration: From April, 2012 to February, 2015 (35 months)
Implementing Agency: Tehran Disaster Mitigation and Management Organization (TDMMO)
Project Site: Tehran Municipality
Target Group: Counterpart, related organizations, communities

Modifications are underlined.

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
[Overall Goal]			
Integrated preparedness for response of Tehran Municipality against earthquake disaster is improved.	- Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area is revised based on the outputs of the project. - Priority actions following the master plan are implemented.	- Revised and latest version of Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area - Implementation reports	-
[Project Purpose]			
In the three areas of road disaster management, community disaster management and early warning, preparedness for response against earthquake disaster of Tehran Municipality is improved.	1. Plans formulated in the project are shared with related organizations in the existing technical committees. 2. Short term action plans (from 2 to 3 years) in the improved master plan on public training and awareness for the earthquake disaster management are achieved. 3. Early warning to related organizations[1] is functioned.	1. Result of activities conducted by counterparts by the time of the final evaluation of the Project 2. Project reports 3. Project reports, Operation records	- Disaster management institution and policy of Tehran Municipality are not fundamentally changed. - TDMMO and related organizations are properly budgeted and staffed. - Cooperation relationship with other partners is maintained for relief and rescue activities.
[Outputs]			
1. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to road management against earthquake disaster are improved.	1-1. The emergency road networks are upgraded. 1-2. A redundancy plan of emergency road networks is formulated. 1-3. A seismic resistant plan for emergency road networks is formulated. 1-4. An operation and maintenance plan for road networks is formulated. 1-5. A draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks is formulated. 1-6. Seminars and workshops on the plans related to emergency road networks are held for counterparts and related organizations more than ●[1] times. 1-7. Simulation (Drill) related to emergency road networks are held more than ●[1] times.	1-1. Project reports, The emergency road networks 1-2. Project reports, Redundancy plan 1-3. Project reports, Seismic resistant plan 1-4. Project reports, Operation and maintenance plan 1-5. Project reports, Instruction 1-6. Project reports 1-7. Project reports	- Most of trained staff continue working as counterparts. - Expected large earthquake does not occur during the project period.

[1] It shall be determined within 6 months after the commencement of the project.

Project Design Matrix (PDM)

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
2. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to community-based disaster management against earthquake disaster are improved.	2-1. An exhibition plan of the disaster management museum is formulated. 2-2. Short term action plans (from 2 to 3 years) are formulated. 2-3. An operation and management plan of the disaster management museum is formulated. 2-4. Workshops on the community-based disaster management are held using training tools and materials developed in the project more than 12 times by counterparts. or Workshops on the community-based disaster management are held using training tools and materials developed in the project more than 12 times by more than ●[1] trained counterparts. 2-5. More than 12 of professional staff for the disaster management museum are educated and trained based on a public education plan and program formulated in the project.	2-1. Project reports, Exhibition plan 2-2. Project reports, Short term action plans 2-3. Project reports, Operation and management plan 2-4. Project reports, Training tools and materials 2-5. Project reports, Public education plan and program	
3. Capabilities of TDMMO for formulation of plans related to early warning and operation, maintenance and management of the system including the QD&LE system installed in the previous project are improved.	3-1. An installation plan of seismographs is formulated. 3-2. A pilot scale earthquake early warning system with seismographs is installed. 3-3. Backup communication line for the QD&LE system is established. 3-4. The QD&LE system incorporated more than ●[1] Items is functioned. 3-5. A plan to introduce a post-earthquake (secondary events) information and warning system is formulated. 3-6. A seismic intensity early warning system is demonstrated.	3-1. Project reports, Installation plan 3-2. Project reports 3-3. Project reports, Operation records 3-4. Project reports, Operation records 3-5. Project reports, Plan for the post-earthquake information and warning system 3-6. Project reports	

Project Design Matrix (PDM)

Narrative Summary	Inputs		Important Assumption
[Activities]	[Inputs]		
1-1. To upgrade the emergency road networks introducing new methodology, in consideration of an expansion of Tehran, the location of relevant facilities for disaster emergency operations in/out of Tehran and others 1-2. To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways 1-3. To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and lines of water, gas, electricity and telecommunication, etc. and their interactions 1-4. To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels 1-5. To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future 1-6. To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan 1-7. To hold seminars and workshops on the plans related to the emergency road networks 1-8. To hold Simulation (Drill) utilizing disaster scenario based on the result of damage estimation and in consideration of the emergency road networks	Iranian Side 1. Counterpart Personnel - Project director - Project manager - Traffic management - Bridge earthquake-resistant engineering - Building earthquake- resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Administrative Officials 2. Facility and Equipment - Project office - Necessary information and data - Backup communication system - Others as necessary 3. Project Implementation Budget - Disaster management museum and the exhibits - Education tools and materials - Mahalle scale disaster drills - Installation of backup communication system for the QD&LE system (e.g. Construction of antenna towers) - Installation of seismographs and data processing computers, power supply and data transmission system for EEWS - Software development for EEWS and the QD&LE system - Others as necessary 4. Others - Joint Coordinating Committee (JCC) - Necessary committees	Japanese Side 1. Expert - Chief advisor - Disaster risk management - Traffic management - Bridge earthquake-resistant engineering - Building earthquake-resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Project coordinator 2. Equipment - 4 seismographs for EEWS - Others as necessary 3. Counterpart Training in Japan - As necessary 4. Others - Advisory committee -Supervision of software development	- Necessary information and data from counterparts and other organizations are obtained by the commencement of the project. - Relationship between TDMMO and related organizations is maintained through the exciting technical committees. [Pre-condition] - Full-time staff of TDMMO are assigned to the project based on formal administrative order.
2-1. To study current public awareness on the earthquake disaster 2-2. To study the contents and effectiveness of the disaster education for the public in the past 2-3. To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans. 2-4. To prepare public education training tools and materials 2-5. To prepare and finalize basic concept, display plan, circulation scenario, floor plan, spaces required, equipment plan for each space and drawing of each section for the disaster management museum 2-6. To prepare a public education plan and program conducted at the disaster management museum 2-7. To prepare an operation and management plan of the disaster management museum 2-8. To hold workshops on the community-based disaster management 2-9. To conduct emergency evacuation drill in designated Mahalle			
3-1. To prepare an improvement plan on early warning including the QD&LE system 3-2. To prepare an improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS[2]) 3-3. To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organization such as water, electricity, gas, fuel pipes, fire and safety service, and subways 3-4. To strengthen data communication system for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines 3-5. To increase items of the QD&LE system in addition to buildings and casualties 3-6. To install a seismic intensity early warning system for emergency response and public awareness 3-7. To improve the current multi-layered warning system for more effective emergency response activities 3-8. To prepare a plan to introduce a post-earthquake (secondary events) information and warning system			

[2] EEWS is the system to issue early warning by estimating magnitude and epicenter (distance and direction) using P-wave.

Attachment B Project Design Matrix Version 2 (PDM2) December 7th, 2013

Project Name: Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
Project Duration: From April, 2012 to February, 2015 (35 months)
Implementing Agency: Tehran Disaster Mitigation and Management Organization (TDMMO)
Project Site: Tehran Municipality
Target Group: Counterpart, related organizations, communities

Modifications are underlined.

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
[Overall Goal]			
Integrated preparedness for response of Tehran Municipality against earthquake disaster is improved.	- Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area is revised based on the outputs of the project. - Priority actions following the master plan are implemented.	- Revised and latest version of Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area - Implementation reports	-
[Project Purpose]			
In the three areas of road disaster management, community disaster management and early warning, preparedness for response against earthquake disaster of Tehran Municipality is improved.	1. Plans formulated in the project are shared with related organizations in the existing technical committees. 2. Short term action plans (from 2 to 3 years) in the improved master plan on public training and awareness for the earthquake disaster management are achieved. 3. Early warning to related organizations is functioned.	1. Result of activities conducted by counterparts by the time of the final evaluation of the Project 2. Project reports 3. Project reports, Operation records	- Disaster management institution and policy of Tehran Municipality are not fundamentally changed. - TDMMO and related organizations are properly budgeted and staffed. - Cooperation relationship with other partners is maintained for relief and rescue activities.
[Outputs]			
1. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to road management against earthquake disaster are improved.	1-1. The emergency road networks are updated. 1-2. A redundancy plan of emergency road networks is formulated. 1-3. A seismic resistant plan for emergency road networks is formulated. 1-4. An operation and maintenance plan for road networks is formulated. 1-5. A draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks is formulated. 1-6. Seminars and workshops on the plans related to emergency road networks are held for counterparts and related organizations more than 5 times. 1-7. Disaster Imagination Game (DIG) related to emergency road networks are held for counterparts and related organizations more than 3 times.	1-1. Project reports, The emergency road networks 1-2. Project reports, Redundancy plan 1-3. Project reports, Seismic resistant plan 1-4. Project reports, Operation and maintenance plan 1-5. Project reports, Instruction 1-6. Project reports 1-7. Project reports	- Most of trained staff continue working as counterparts. - Expected large earthquake does not occur during the project period.

Project Design Matrix (PDM2)

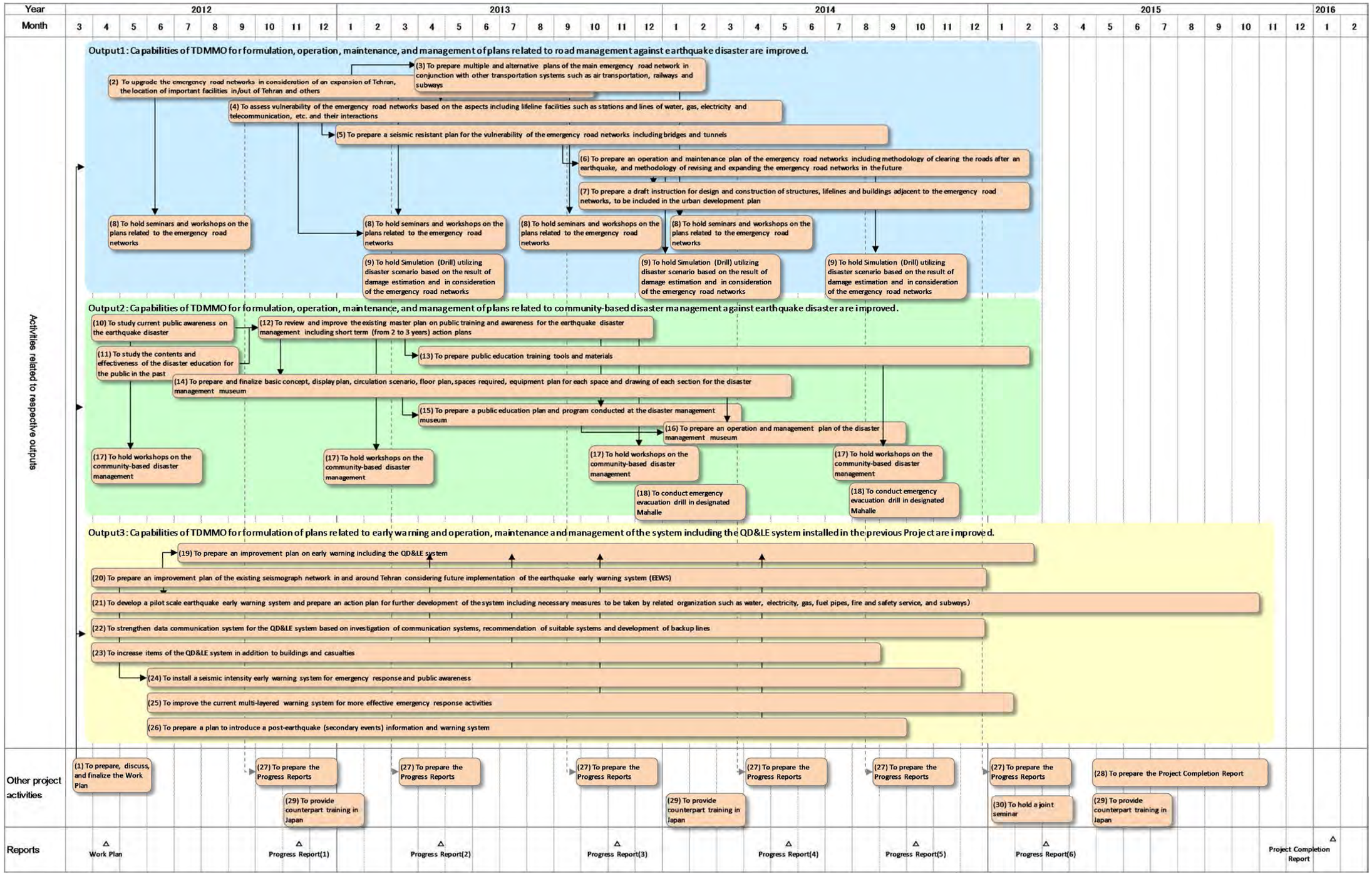
Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
2. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to community-based disaster management against earthquake disaster are improved.	2-1. An exhibition plan of the disaster management museum is formulated. 2-2. Short term action plans (from 2 to 3 years) are formulated. 2-3. An operation and management plan of the disaster management museum is formulated. 2-4. Workshops on the community-based disaster management are held using training tools and materials developed in the project more than 12 times by more than 6 trained counterparts. 2-5. More than 12 of professional staff for the disaster management museum are educated and trained based on a public education plan and program formulated in the project.	2-1. Project reports, Exhibition plan 2-2. Project reports, Short term action plans 2-3. Project reports, Operation and management plan 2-4. Project reports, Training tools and materials 2-5. Project reports, Public education plan and program	
3. Capabilities of TDMMO for formulation of plans related to early warning and operation, maintenance and management of the system including the QD&LE system installed in the previous project are improved.	3-1. An installation plan of seismographs is formulated. 3-2. A pilot scale earthquake early warning system with seismographs is installed. 3-3. Backup communication line for the QD&LE system is established. 3-4. The QD&LE system incorporated more than 3 Items is functioned. 3-5. A plan to introduce a post-earthquake (secondary events) information and warning system is formulated. 3-6. A seismic intensity early warning system is demonstrated.	3-1. Project reports, Installation plan 3-2. Project reports 3-3. Project reports, Operation records 3-4. Project reports, Operation records 3-5. Project reports, Plan for the post-earthquake information and warning system 3-6. Project reports	

Project Design Matrix (PDM2)

Narrative Summary	Inputs		Important Assumption
[Activities]	[Inputs]		
1-1. To upgrade the emergency road networks introducing new methodology, in consideration of an expansion of Tehran, the location of relevant facilities for disaster emergency operations in/out of Tehran and others 1-2. To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways 1-3.To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and lines of water, gas, electricity and telecommunication, etc. and their interactions 1-4. To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels 1-5. To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future 1-6. To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan 1-7. To hold seminars and workshops on the plans related to the emergency road networks 1-8. To hold Simulation (Drill) utilizing disaster scenario based on the result of damage estimation and in consideration of the emergency road networks	Iranian Side 1. Counterpart Personnel - Project director - Project manager - Traffic management - Bridge earthquake-resistant engineering - Building earthquake- resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Administrative Officials 2. Facility and Equipment - Project office - Necessary information and data - Backup communication system - Others as necessary 3. Project Implementation Budget - Disaster management museum and the exhibits - Education tools and materials - Mahalle scale disaster drills - Installation of backup communication system for the QD&LE system (e.g. Construction of antenna towers) - Installation of seismographs and data processing computers, power supply and data transmission system for EEWS - Software development for EEWS and the QD&LE system - Others as necessary 4. Others - Joint Coordinating Committee (JCC) - Necessary committees	Japanese Side 1. Expert - Chief advisor - Disaster risk management - Traffic management - Bridge earthquake-resistant engineering - Building earthquake-resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Project coordinator 2. Equipment - 4 seismographs for EEWS - Others as necessary 3. Counterpart Training in Japan - As necessary 4. Others - Advisory committee -Supervision of software development	- Necessary information and data from counterparts and other organizations are obtained by the commencement of the project. - Relationship between TDMMO and related organizations is maintained through the exciting technical committees. [Pre-condition] - Full-time staff of TDMMO are assigned to the project based on formal administrative order.
2-1. To study current public awareness on the earthquake disaster 2-2. To study the contents and effectiveness of the disaster education for the public in the past 2-3. To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans. 2-4. To prepare public education training tools and materials 2-5. To prepare and finalize basic concept, display plan, circulation scenario, floor plan, spaces required, equipment plan for each space and drawing of each section for the disaster management museum 2-6. To prepare a public education plan and program conducted at the disaster management museum 2-7. To prepare an operation and management plan of the disaster management museum 2-8. To hold workshops on the community-based disaster management 2-9. To conduct emergency evacuation drill in designated Mahalle			
3-1. To prepare an improvement plan on early warning including the QD&LE system 3-2. To prepare an improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS) 3-3. To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organization such as water, electricity, gas, fuel pipes, fire and safety service, and subways 3-4. To strengthen data communication system for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines 3-5. To increase items of the QD&LE system in addition to buildings and casualties 3-6. To install a seismic intensity early warning system for emergency response and public awareness 3-7. To improve the current multi-layered warning system for more effective emergency response activities 3-8. To prepare a plan to introduce a post-earthquake (secondary events) information and warning system			

Appendix 2
Work Flow Chart

Work Flow Chart



Appendix 3
Plan of Operation

Plan of Operation Version 3

Revised on 20141218

Project Name: Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
Project Duration: From April 2012 to October 2015 (43 months)

Activities	2012									2013										2014										2015							
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
(1) Capabilities of TDMMO in regard to road management against earthquake disaster are improved.																																											
1-1 To upgrade the emergency road networks introducing new methodology, in consideration of an expansion of Tehran, the location of relevant facilities for disaster emergency operations in/out of Tehran and others																																											
1-2 To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways																																											
1-3 To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and lines of water, gas, electricity and telecommunication, etc. and their interactions																																											
1-4 To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels																																											
1-5 To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future																																											
1-6 To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan																																											
1-7 To hold seminars and workshops on the plans related to the emergency road networks																																											
1-8 To hold Simulation (Drill) utilizing disaster scenario based on the result of damage estimation and in considerlation of the emergency road networks																																											
(2) Capabilities of TDMMO in regard to the community-based disaster management against earthquake disaster are improved.																																											
2-1 To study and current public awareness on the earthquake disaster																																											
2-2 To study the contents and effectiveness of the past disaster education for the public in the past																																											
2-3 To review and improve the existing master plan on public training and awareness for the earthquake disaster management																																											
2-4 To prepare public education training tools and materials																																											
2-5 To prepare and finalize basic concept, museum display plan, circulation scenario, floor plan, spaces required, equipment plan for each space and drawing of each section																																											
2-6 To prepare a public education plan and program conducted at the disaster management museum																																											
2-7 To prepare an operation and management plan of the disaster management museum																																											
2-8 To hold workshops on the community-based disaster management																																											
2-9 To conduct emergency evacuation drill in designated Mahalle																																											
(3) Capabilities of TDMMO in regard to early warning including the QD&LE system installed in the previous project are improved.																																											
3-1 To prepare an improvement plan on early warning including the QD&LE system.																																											
3-2 To prepare an plan improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS)																																											
3-3 To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organization such as water, electricity, gas, fuel pipes, fire and safety service, and subways																																											
3-4 To strengthen data communication system for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines.																																											
3-5 To increase items of the QD&LE system in addition to buildings and casualties																																											
3-6 To install a seismic intensity early warning system for emergency response and public awareness.																																											
3-7 To improve the current multi-layered warning system for more effective emergency response activities.																																											
3-8 To prepare a plan to introduce a post-earthquake (secondary events) information and warning system.																																											
Joint Coordinating Committee																																											
Evaluation																																											
Training in Japan — Output 1																																											
Training in Japan — Output 2																																											
Training in Japan — Output 3																																											
Training in Japan — DMMO																																											

Appendix 4
Dispatch record of Japanese experts

Dispatch record of Japanese experts

Name			Duration in Iran (days of stay)				Total Days
			1st FY Apr 2012 － Mar 2013	2nd FY Apr 2013 － Mar 2014	3rd FY Apr 2014 － Mar 2015	4th FY Apr 2015－	
1	Ichiro Kobayashi	Chief Advisor/Disaster Risk Management	4/9-4/23 (15) 9/16-9/25 (20)	12/8-12/27 (20)	9/9-10/3 (25) 2/1-2/20 (20)	10/4-10/18 (15)	115
2	Osamu Nishii	Deputy Chief Advisor/Disaster Risk Management	4/5-4/26 (22) 1/31-2/26 (27)	11/18-12/12 (25)	4/10-5/4 (25) 11/27-12/23 (27) 2/9-2/23 (15)	8/6-8/19 (14)	155
3	Ryoji Takahashi	Deputy Chief Advisor/Traffic Management	5/17-6/5 (20) 10/29-11/17 (20)	4/1-4/25 (25) 10/10-11/3 (25) 1/13-2/6 (25)	5/8-5/27 (20) 9/4-10/3 (30) 2/5-2/24 (20)		185
4	Hiroshi Adachi	Bridge Earthquake-resistant Engineering	5/17-6/10 (25) 9/2-9/26 (25)	4/1-4/25 (25) 10/3-10/27 (25)	5/8-6/1 (25) 9/4-10/3 (30)		155
5	Akio Hayashi	Building Earthquake-resistant Engineering	5/17-6/5 (20)	4/1-4/25 (25) 10/3-10/27 (25)	5/8-5/27 (20)		90
6	Katsu Kato	Urban Disaster Management	5/22-6/10 (20) 11/6-11/30 (25)	4/8-4/30 (23) 10/3-10/29 (27) 1/13-2/6 (25)	9/4-10/3 (30) 2/5-2/24 (20)	5/3-5/17 (15)	185
7	Seiji Kamioka	Lifeline Disaster Management	5/17-6/5 (20) 9/2-9/26 (25)	4/1-4/25 (25) 10/3-10/27 (25)	5/8-6/1 (25) 9/4-10/3 (30)		150
8	Yuko Sasa	Museum Planning and Operation	4/5-4/26 (22) 7/7-7/26 (20) 10/8-11/6 (30) 1/28-2/21 (25)		5/8-6/4 (28) 9/4-10/3 (30) 11/27-12/26 (30)		185
9	Kino Sawanobori	Museum Exhibition and Interior Design	7/7-7/26 (20) 10/8-11/11 (35) 1/28-2/26 (30)	11/25-12/12 (18)			103

Name			Duration in Iran (days of stay)				Total Days
			1st FY Apr 2012 － Mar 2013	2nd FY Apr 2013 － Mar 2014	3rd FY Apr 2014 － Mar 2015	4th FY Apr 2015－	
10	Koichi Shiwaku	Community-based Disaster Risk Management	7/2-7/26 (25) 10/25-11/15 (22) 1/22-2/18 (28)	11/16-12/10 (25) 1/6-1/30 (25)			125
11	Tomoko Shaw	Plan and Program for Disaster Education and Training/Community-based Disaster Risk Management	7/1-7/20 (20) 11/12-12/6 (25) 1/29-2/22 (25)	4/8-4/30 (23) 8/19-9/13 (26) 11/18-12/13 (26)	8/18-10/3 (47) 11/17-12/19 (33) 1/27-2/20 (25)		250
12	Takaho Kita	Seismograph Network	9/6-9/30 (25) 2/11-3/7 (25)	9/20-10/14 (25) 2/8-2/27 (20)	6/1-6/27 (27) 11/3-12/5 (33)		155
13	Sugio Imamura	Early Warning System	4/5-5/17 (43) 9/2-10/1 (30) 11/14-12/30 (47) 2/21-3/13 (21)	9/8-10/14 (37) 11/24-12/30 (37) 1/26-2/14 (20)	5/15-6/13 (30) 8/28-10/10 (44) 11/27-12/23 (27) 2/2-2/20 (19)	4/17-5/7 (21) 7/31-8/20 (21) 10/1-10/18 (18)	415
14	Hiroyuki Maeda	GIS and Database Management/Software Engineering	4/5-4/20 (16) 9/6-10/9 (34) 2/2-3/13 (40)	4/25-5/24 (30) 9/12-10/11 (30) 11/21-12/20 (30) 2/2-2/21 (20)	5/8-6/6 (30) 8/23-10/6 (45) 2/1-2/20 (20)		295
15	Yoshio Kato	Communication System	4/5-4/26 (22) 9/6-9/30 (25) 2/11-3/7 (25)	4/30-5/24 (25)	5/22-6/20 (30) 11/3-11/25 (23)		150
16	Hiroto Yamauchi	Project Coordinator/Assistant for Earthquake Early Warning System	4/5-4/26 (22) 9/13-9/27 (15)				37
Total							2,750

Appendix 5
List of participants of counterpart training in Japan

List of participants of counterpart training in Japan

Period		Name	Organization	Visited Institutions and Course
Counterpart Training in Japan (Earthquake Early Warning)				
10 Dec - 21 Dec, 2012	1	Mr.NADI Mohsen	Vice President, TDMMO	1. Japan Meteorogical Agency (JMA) 2. NIED(National Research Institute for Earth Science and Disaster Prevention) 3. Kogakuin University 4. Tohoku University 5. Kesennuma City 6. NHK(Japan Broadcasting Corporation) 7. National Disaster Medical Center 8. Minato City 9. NTT(Nippon(Japan) Telegraph and Telephone Corporation) DOCOMO INC. 10. Kobe Municipal Government 11. Hyogo Prefectural Government 12. Disaster Reduction and Human Renovation Institute
	2	Mr.MOZAFARI Abdollah	TDMMO	
	3	Mr.SHODJA Seyed Ali	TDMMO	
	4	Mr.HEIDARI Reza	TDMMO	
	5	Mr.SAFI ARIAN Reza	TDMMO	

Period		Name	Organization	Visited Institutions and Course
Counterpart Training in Japan (Road Disaster Management)				
22 Feb - 6 Mar, 2014	1	Mr.NADI Mohsen	Vice President, TDMMO	1. Kobe Municipal Government 2. Hyogo Prefectural Government 3. Hyogo Earthquake Research Center (E-defense) 4. Hyogo Prefectural Emergency Management and Training Center 5. West Nippon Expressway Company 6. Osaka Gas Engineering Co.,Ltd 7. Ishinomaki city（Story teller, NEWSee, Downtown Creative Reconstruction Committee） 8. Tokyo Metropolitan Government 9. National Police Agency / Metropolitan Police Department 10. Waterbus Cruise (Tokyo Mizube Cruising Line) around Tokyo for viewing several Bridges 11. Tokyo National Highway Office(Ministry of Land, Infrastructure, Transportation and Tourism Kanto Regional Development Bureau) 12. Cabinet Office
	2	Ms.SHARIFI Khadijeh	TDMMO	
	3	Mr.FATTAHI Homayoun	Tehran Traffic Control Center Tehran Traffic Control Company	
	4	Mr.SHAMSHIRI DAREINI Hessam	TDMMO	
	5	Mr.ALIKHANI Mohammadreza	TDMMO	

Period		Name	Organization	Visited Institutions and Course
Counterpart Training in Japan (Disaster Education and Museum)				
22 Feb - 6 Mar, 2014	1	Ms.SALEH Fatemeh	TDMMO	1. Disaster Reduction and Human Renovation Institute 2. Kobe Municipal Government 3. Plus arts 4. Planning and Reality of Disaster Museum by Prof. Murosaki, Emeritus Prof. Kobe Univ. 5. Hokudan Earthquake Memorial Park 6. Ishinomaki city（Story teller, NEWSee, Downtown Creative Reconstruction Committee） 7. Honjo Bosai Kan (Life Safety Learning Center) 8. Educational contents for promoting safer constructions by Prof. Fukuwa, Nagoya Univ. 9. Rescue now 10. Edo Tokyo Museum 11. Sona AREA, Tokyo Rinkai Disaster Prevention Park 12. Transferring Scientific Knowledge of Disasters by Dr. Nouguchi 13. Cabinet Office
	2	Ms.ASHTARIMAHINI Ameneh	TDMMO	
	3	Mr.FATEHI MANESH Keivan	District One of Tehran Municipality	
	4	Ms.KESHANI Sara	TDMMO	
	5	Mr.FAYEZ POUR Mohammad	Safety & Security Department Tehran Municipality	

Period		Name	Organization	Visited Institutions and Course
Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran - Training for Disaster Managers of Megacities				
17 May - 28 May, 2015	1	Mr.SADEGHI Ahmad	President, TDMMO	1. Hyogo Earthquake Research Center (E-defense) 2. Hyogo Prefectural Emergency Management and Training Center 3. Hyogo Prefectural Government 4. Disaster Reduction and Human Renovation Institute 5. Ishinomaki city（Story teller, NEWSee, Downtown Creative Reconstruction Committee） 6. Cabinet Office, Tokyo Rinkai Disaster Prevention Park 7. Tokyo Metropolitan Government 8. Sumida City Government 9. Honjo Bosai Kan (Life Safety Learning Center) 10. Japan Meteorogical Agency (JMA) 11. Fire and Disaster Management Agency/ Metropolitan Fire Department
	2	Ms.SALEH Fatemeh	TDMMO	
	3	Mr.MODIRROSTA Hassan	Deputy Mayor, Urban Services Deputy, Municipality of Alborz Province	
	4	Mr.BAGHBAN NEZHAD Abolghassem	Advisor to Mayor & Director, Disaster Management, Municipality of Mashhad	
	5	Mr.JOWKAR Rahim	Technical Assistant, Fire Fighting, Municipality of Shiraz	
	6	Mr.MORADI Ahmadreza	Manager, Disaster Mitigation and Managment Center, Municipality of Isfahan	
	7	Mr.HASSANNEZHAD AMJADI Masoud	Manager, Disaster Managment, Municipality of Tabriz	
	8	Mr.ALAVIRAZAVI RAVARI Akbar	Head of Center, Disaster Managment Center, Municipality of Kerman	
	9	Mr.JAFARI Fereydoun	Senior Expert, Communication and International Affairs Center, Municipality of Tehran	
	10	Mr.MORADI Mohsen	Head, Office, Tehran	
	11	Ms.VAZIRPOUR Shabbou	TDMMO	

Appendix 6
List of Procured Equipment

List of Equipment

No	Equipment	Specification	Quantity	Total Price	Place of Use	Date of Handover
1	GIS Software	Arc View 10.0	1	JPY 1,150,000	TDMMO	Oct.13, 2015
2	GIS Software	Spatial Analyst	1		TDMMO	Oct.13, 2015
3	GIS Software	Network Analyst	1		TDMMO	Oct.13, 2015
4	A3 Color Printer	Epson Stylus Photo 1410	1	USD 517	TDMMO	Oct.13, 2015
5	Multi-function printer	Sharp AR-5520D	1	USD 1,936	TDMMO	Oct.13, 2015
6	Computer	GIGABYTE H61MS2-B3 + SAMSUNG 22inch LCD	2	IRR 39,500,000	TDMMO	Oct.13, 2015
7	GPS receiver	GeoSIG RS-232	4	IRR 3,938,810,618	TDMMO	Oct.13, 2015
8	Triaxial Force balance Accerometer	GeoSIG AC73	4		TDMMO	Oct 13, 2015
9	GMSplus Measuring System	GeoSIG	4		TDMMO	Oct 13,2015

Appendix 7
Minutes of JCC

Minutes of Meeting
on
The Work Plan
for
The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
in
The Islamic Republic of Iran

Agreed Upon
between
The Tehran Disaster Mitigation and Management Organization (TDMMO)
and
Japan International Cooperation Agency (JICA)

Tehran, June 2, 2012

Mr. Mohsen Nadi
Vice President
Tehran Disaster Mitigation and Management Organization

for Mr. Ichiro Kobayashi
Chief Advisor/Disaster Risk Management
JICA Expert Team

Witness:

Mr. Yasuto Takeuchi
Chief Representative
JICA Iran Office

On the occasion of commencing "The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran (hereinafter called "the Project"), the JICA Expert Team submitted fifteen (15) copies of the Draft Work Plan to the Iranian side on April 17, 2012, and Joint Coordination Committee Meeting was held on 2 June, 2012 at the conference room in TDMMO. The contents of the Draft Work Plan were explained and no objection was made by the attendance with regard to the general direction and activities of the Project. The attendance list is attached in Attachment A.

Subsequently, TDMMO and the JICA Expert Team together with JICA Iran Office discussed in more detail the contents of the Draft Work Plan based on the Record of Discussions of the Project agreed upon between TDMMO and JICA on December 18, 2011.

The following are the subjects discussed and agreed upon between the Iranian and Japanese sides.

1. Acceptance of the Draft Work Plan

Representing the Iranian side, TDMMO accepted and agreed upon all outputs of the Draft Work Plan prepared by the Japanese side represented by the JICA Expert Team.

For Output 1, Technical Outline was discussed and agreed between both sides, and details in sub-activates will be discussed and agreed in the course of the project.

2. Counterpart Personnel

The Japanese side confirmed that sufficient number of counterpart personnel from TDMMO was allocated for the successful implementation of the Project.

TDMMO submitted to the Japanese side a list of counterpart personnel that is no different from the list agreed upon within the Record of Discussions signed between JICA and TDMMO on December 18, 2011. The list of counterpart personnel is attached in Attachment B.

Both sides recognized that frequent replacement of the Counterpart (hereinafter referred to as "C/P") personnel has had negative impacts on the progress of past JICA projects. In order to minimize such impacts, TDMMO and JICA Expert Team have both confirmed to take the following measures to minimize such impacts:

- Save in common folders and all relevant documents by each output;
- As both sides find it necessary, video tape seminars and workshops conducted in the Project, whenever necessary;
- Ensure that C/P personnel in charge are fully committed to taking over the activities and outputs of the Project to their successor in case of replacement; and
- Share with all Project members appropriate documents and data on the progress

of the Project through a common share folder.

3. Procurement of Seismographs

The Japanese side expressed their concerns over procurement of seismographs and explained to the Iranian side that, in consideration of the environment surrounding Iran, purchasing seismographs is not easy. The Japanese side therefore requested for Iranian side's cooperation in discussing this issue further.

The Iranian side called for a meeting with a Russian supplier of seismographs on April 17, 2012. Some members of the JICA Expert Team attended this meeting and exchanged information and opinions with this supplier.

The Japanese side told TDMMO that, in view of the overall schedule for Output 3, tendering of the procurement of seismographs is scheduled no later than December, 2012. TDMMO acknowledged this schedule.

4. C/P Training in Japan

The Iranian and Japanese sides both confirmed that a total number of 15 counterpart personnel (five from each of the three Outputs) from the Iranian side will participate in the C/P trainings held in Japan.

The Iranian side asked for its timely implementation and suggested the training to be carried out in September, 2012 for Output 2 and 3, and in October, 2012 for Output 1.

The Japanese side agreed upon this schedule and promised that discussions will be made for proceeding in making necessary arrangements in this regard.

5. Office Space and Equipment for the JICA Expert Team

The Iranian side explained that a room was prepared for the Japanese side for successful implementation of the Project.

With this regard, the Japanese side expressed their concerns over the size of the room provided. The Japanese side told that in consideration of the large number of experts that would use the room and the equipment needed for effective implementation of the project, it was too small, particularly in a time when the number of experts increases. For this reason, the Japanese side requested for an additional room to be prepared.

TDMMO acknowledged the request but told that preparing an additional office space was not easy.

The Japanese side requested for additional items of furniture to be provided by TDMMO.

6. Information and Data for Project Implementation

JICA Expert Team requested the Iranian side to provide information and data needed for smooth and effective implementation of the Project.

TDMMO responded that they would make their best effort to provide such information and data in a timely manner to the Expert Team.

7. Project Design Matrix (PDM)

The Japanese side requested the Iranian side to decide on the blank spaces in the Project Design Matrix (PDM) no later than the submission of the Progress Report (1) scheduled in early October, 2012.

The Iranian side agreed on this matter.

8. Promotion of the Advertisement of the Project to the Public

The Iranian and Japanese sides confirmed the importance of advertising the Project to the public. Therefore, it was agreed that the Expert Team, in cooperation with TDMMO, will make efforts to effectively advertise the Project to the public so that people in Tehran would have a good understanding of the Project's objective, activities, and outcomes. Through this advertisement, it is also expected to contribute to raising people's awareness of disaster management.

It was also agreed that method for nationwide advertisement would be discussed and advertised taking into account the progress of the Project.

End

Attendance Sheet for the Joint Coordination Committee Meeting

June 2, 2012
Tehran Disaster Mitigation and Management Organization (TDMMO), Tehran

1.	Mr. Mohsen Nadi Vice President Tehran Disaster Mitigation and Management Organization (TDMMO) Tehran	In Chair
2.	Mr. Abdollah Mozafari Deputy Head of Mitigation and Risk Reduction TDMMO	
3.	Mr. Alireza Sabeti TDMMO	
4.	Mr. Montazerolghaem TDMMO	
5.	Ms. Saleh TDMMO	
6.	Mr. Yasuto TAKEUCHI JICA Iran Office Chief Representative	
7.	Mr. Ryoji TAKAHASHI JICA Project Team	
8.	Mr. Akio HAYASHI JICA Project Team	
9.	Mr. Seiji KAMIOKA JICA Project Team	
10.	Mr. Hiroshi ADACHI JICA Project Team	
11.	Mr. Katsu KATO JICA Project Team	

Attachment B

List of Counterpart Personnel

Category		Output 1		Output 2		Output 3	
Top Managers		Project Director: Mr. Azizallah Rajabzadeh (President of TDMMO)/Mr. Mohsen Nadi (Vice President of TDMMO) Project Manager: Mr. Abdollah Mozafari (Deputy Head of Mitigation and Risk Reduction of TDMMO)					
Project Coordinator		Project Coordinator: Mr. Alireza Sabeti, and International Relations Office					
Level 1 (Iranian Deputy Head and Manager of TDMMO)		Mr. Montazerolghaem		Ms. Saleh, Mr.Emami		Mr.Mozafari	
Level 2 (Iranian Advisers)	Internal	-		-		Dr. Shomali, Mr. Montazerolghaem, Dr. Moradi, Dr. Yaminifard	
	External	Dr. Tashakori (Amir abir Head of Research Center of ITS) or Dr. Shahidi or Dr. Pourzahedi or Dr. Malek or Dr. Taghizade		Dr. Mahaki (General Manager of Cultural and Social Studies in Tehran Municipality) or Dr. Kambod Amini (Head of Disaster Management Group-iiees)		Dr. Hassani (Shahid Abbaspour Research Center-Assoc. prof.) or Dr. Ghaemmaghamian (iiees Assis. Prof.) or Dr. Nazariha (Assist. Prof. in the Faculty of Natural Disaster – Uni of Tehran)	
Level 3 (TDMMO sections associated with the Project Outputs)		Mr. Balaei and Ms. Mohammadi (GIS) (Deputy of Mitigation and Risk Reduction)		Ms. Nikkhah (Deputy of Mitigation and Risk Reduction) and Ms. Mirzahashemi (Deputy of Training and Public Participation)		Mr. Rahim Nourozi, Mr. Reza Haydari, Mr. Balaei, Ms. Mohammadi (GIS) (Deputy of Mitigation and Risk Reduction)	
		Mr. Navazande and Mr. Rouzbehani (Deputy of Operation and Preparedness)		Ms. Keshani (Civil and Technical Breue); Mr. Radnia and Ms. Vazirpour (Public Relation Office); and Mr. Salimi (Deputy of Operation and Preparedness) Public Relation Office		Mr. Shodja (Deputy of Operation and Preparedness) Ms. Giahchin and Mr. Tajadod (IT Unit)	
Level 4 (Organizations related to project Outputs)		Teammate name	Section	Teammate name	Section	Teammate name	Section
		Mr. Tashkorihashemi	Deputy of Transportation – Tehran Municipality		Deputy of Social-Tehran Municipality		Telecommunication Company
			Traffic Control Company		Red Crescent Societies		Institute of Geophysics
		Dr. Hosseini	Deputy of Civil and Technical-Tehran Municipality		IRIB (Islamic Republic of Iran Broadcasting)		IIEES
			Police		Education Minisitry		BHRC
			Water and Sewerage Company				Metro Company
			Gas Company				Water and Sewerage Company
			Electricity Company				Gas Company
			Roads and Urban Development Ministry				Electricity Company
			Fire				
			International organization	Ms. Nazari	International organization		International organization

Minutes of Second Joint Coordinating Committee Meeting

on

The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran

Agreed upon between

The Tehran Disaster Mitigation and Management Organization (TDMMO)

and

Japan International Cooperation Agency (JICA)

7th December 2013, Tehran

Mr. Mohsen Nadi
Vice President
Tehran Disaster Mitigation and Management Organization

Mr. Yasuto Takeuchi
Chief Representative,
Japan International Cooperation Agency
Iran Office

Mr. Osamu Nishii
Deputy Chief Advisor / Disaster Risk Management
JICA Expert Team

In the Name of God

1. Introduction

The Tehran Disaster Mitigation and Management Organization (hereinafter referred to as 'TDMMO') and JICA Expert Team (hereinafter referred to as 'the Team') organized a meeting of the second Joint Coordinating Committee on 'The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran' (hereinafter referred to as 'the Project') on 7th December 2013 at the conference room in TDMMO. The attendance list is attached in Attachment A.

The following topics have been presented and discussed:

1) The progress of Output 1, Output 2 and Output 3 of the Project respectively,
2) Revision of Project Design Matrix (PDM) by establishing new verifiable indicators and
3) Project Implementation Scheme

The main points of the discussion are summarized below.

2. Acceptance of the progress of the Project

TDMMO reported the progress of the activities, problems, thier solutions and the plans from now. They also explained that the contents of the activities were well understood and the technology transfer was being sufficiently conducted.

The Iranian side acknowledged the receipt of the Progress Report (3) which describes the above discussed issues and confirmed that it was prepared in accordance with the Work Plan.

3. Revision of PDM

Both Iranian and Japanese sides discussed on the outstanding points of PDM which are 4 (four) items in the verifiable indicators. Both sides agreed on the new figures for the indicators. Revised PDM (PDM2) is attached in Attachment B.

4. Revision of Plan of Operation (PO)

In accordance with the discussion by both Iranian and Japanese side on the progress of the Project which is described in the Clause 2 of this Minutes of Meeting, the Plan of Operation (PO) of the Project has also been revised as Version 2 and attached in Attachment C.

5. Project Implementation Scheme

Since February 2013, the post of the Project Manager of TDMMO remains unfilled. Both sides discussed and agreed that in order to promote the mutual understanding about controversial issues on the Project and to attempt prompt solution, Project Director of TDMMO and the representative of the Team shall have weekly basis meeting in the remaining period of the Project.

Attachment A: List of Participants

Attachment B: Project Design Matrix Version 2: PDM2

Attachment C: Plan of Operation Version 2

Attachment B Project Design Matrix Version 2 (PDM2) December 7th, 2013

Project Name: Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
Project Duration: From April, 2012 to February, 2015 (35 months)
Implementing Agency: Tehran Disaster Mitigation and Management Organization (TDMMO)
Project Site: Tehran Municipality
Target Group: Counterpart, related organizations, communities

Modifications are underlined.

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
[Overall Goal]			
Integrated preparedness for response of Tehran Municipality against earthquake disaster is improved.	- Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area is revised based on the outputs of the project. - Priority actions following the master plan are implemented.	- Revised and latest version of Comprehensive Master Plan on Urban Seismic Disaster Prevention and Management for the Greater Tehran area - Implementation reports	-
[Project Purpose]			
In the three areas of road disaster management, community disaster management and early warning, preparedness for response against earthquake disaster of Tehran Municipality is improved.	1. Plans formulated in the project are shared with related organizations in the existing technical committees. 2. Short term action plans (from 2 to 3 years) in the improved master plan on public training and awareness for the earthquake disaster management are achieved. 3. Early warning to related organizations is functioned.	1. Result of activities conducted by counterparts by the time of the final evaluation of the Project 2. Project reports 3. Project reports, Operation records	- Disaster management institution and policy of Tehran Municipality are not fundamentally changed. - TDMMO and related organizations are properly budgeted and staffed. - Cooperation relationship with other partners is maintained for relief and rescue activities.
[Outputs]			
1. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to road management against earthquake disaster are improved.	1-1. The emergency road networks are updated. 1-2. A redundancy plan of emergency road networks is formulated. 1-3. A seismic resistant plan for emergency road networks is formulated. 1-4. An operation and maintenance plan for road networks is formulated. 1-5. A draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks is formulated. 1-6. Seminars and workshops on the plans related to emergency road networks are held for counterparts and related organizations more than 5 times. 1-7. Disaster Imagination Game (DIG) related to emergency road networks are held for counterparts and related organizations more than 3 times.	1-1. Project reports, The emergency road networks 1-2. Project reports, Redundancy plan 1-3. Project reports, Seismic resistant plan 1-4. Project reports, Operation and maintenance plan 1-5. Project reports, Instruction 1-6. Project reports 1-7. Project reports	- Most of trained staff continue working as counterparts. - Expected large earthquake does not occur during the project period.

Project Design Matrix (PDM2)

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumption
2. Capabilities of TDMMO for formulation, operation, maintenance, and management of plans related to community-based disaster management against earthquake disaster are improved.	2-1. An exhibition plan of the disaster management museum is formulated. 2-2. Short term action plans (from 2 to 3 years) are formulated. 2-3. An operation and management plan of the disaster management museum is formulated. 2-4. Workshops on the community-based disaster management are held using training tools and materials developed in the project more than 12 times by more than 6 trained counterparts. 2-5. More than 12 of professional staff for the disaster management museum are educated and trained based on a public education plan and program formulated in the project.	2-1. Project reports, Exhibition plan 2-2. Project reports, Short term action plans 2-3. Project reports, Operation and management plan 2-4. Project reports, Training tools and materials 2-5. Project reports, Public education plan and program	
3. Capabilities of TDMMO for formulation of plans related to early warning and operation, maintenance and management of the system including the QD&LE system installed in the previous project are improved.	3-1. An installation plan of seismographs is formulated. 3-2. A pilot scale earthquake early warning system with seismographs is installed. 3-3. Backup communication line for the QD&LE system is established. 3-4. The QD&LE system incorporated more than 3 Items is functioned. 3-5. A plan to introduce a post-earthquake (secondary events) information and warning system is formulated. 3-6. A seismic intensity early warning system is demonstrated.	3-1. Project reports, Installation plan 3-2. Project reports 3-3. Project reports, Operation records 3-4. Project reports, Operation records 3-5. Project reports, Plan for the post-earthquake information and warning system 3-6. Project reports	

Project Design Matrix (PDM2)

Narrative Summary	Inputs		Important Assumption
[Activities]	[Inputs]		
1-1. To upgrade the emergency road networks introducing new methodology, in consideration of an expansion of Tehran, the location of relevant facilities for disaster emergency operations in/out of Tehran and others 1-2. To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways 1-3. To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and lines of water, gas, electricity and telecommunication, etc. and their interactions 1-4. To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels 1-5. To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future 1-6. To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan 1-7. To hold seminars and workshops on the plans related to the emergency road networks 1-8. To hold Simulation (Drill) utilizing disaster scenario based on the result of damage estimation and in consideration of the emergency road networks 2-1. To study current public awareness on the earthquake disaster 2-2. To study the contents and effectiveness of the disaster education for the public in the past 2-3. To review and improve the existing master plan on public training and awareness for the earthquake disaster management including short term (from 2 to 3 years) action plans. 2-4. To prepare public education training tools and materials 2-5. To prepare and finalize basic concept, display plan, circulation scenario, floor plan, spaces required, equipment plan for each space and drawing of each section for the disaster management museum 2-6. To prepare a public education plan and program conducted at the disaster management museum 2-7. To prepare an operation and management plan of the disaster management museum 2-8. To hold workshops on the community-based disaster management 2-9. To conduct emergency evacuation drill in designated Mahalle 3-1. To prepare an improvement plan on early warning including the QD&LE system 3-2. To prepare an improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS) 3-3. To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organization such as water, electricity, gas, fuel pipes, fire and safety service, and subways 3-4. To strengthen data communication system for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines 3-5. To increase items of the QD&LE system in addition to buildings and casualties 3-6. To install a seismic intensity early warning system for emergency response and public awareness 3-7. To improve the current multi-layered warning system for more effective emergency response activities 3-8. To prepare a plan to introduce a post-earthquake (secondary events) information and warning system	Iranian Side 1. Counterpart Personnel - Project director - Project manager - Traffic management - Bridge earthquake-resistant engineering - Building earthquake- resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Administrative Officials 2. Facility and Equipment - Project office - Necessary information and data - Backup communication system - Others as necessary 3. Project Implementation Budget - Disaster management museum and the exhibits - Education tools and materials - Mahalle scale disaster drills - Installation of backup communication system for the QD&LE system (e.g. Construction of antenna towers) - Installation of seismographs and data processing computers, power supply and data transmission system for EEWS - Software development for EEWS and the QD&LE system - Others as necessary 4. Others - Joint Coordinating Committee (JCC) - Necessary committees	Japanese Side 1. Expert - Chief advisor - Disaster risk management - Traffic management - Bridge earthquake-resistant engineering - Building earthquake-resistant engineering - Urban disaster management - Lifeline disaster management - Museum planning and operation - Museum exhibition and interior design - Community-based disaster management - Plan and program for disaster education and training - Seismograph network - Early warning - GIS and database management/Software Engineering - Communication system - Project coordinator 2. Equipment - 4 seismographs for EEWS - Others as necessary 3. Counterpart Training in Japan - As necessary 4. Others - Advisory committee -Supervision of software development	- Necessary information and data from counterparts and other organizations are obtained by the commencement of the project. - Relationship between TDMMO and related organizations is maintained through the exciting technical committees. [Pre-condition] - Full-time staff of TDMMO are assigned to the project based on formal administrative order.

Attachment C Plan of Operation Version 2

Revised on 20131207

Project Name: Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran
Project Duration: From April 2012 to February 2015 (35 months)

Activities	2012									2013										2014										2015		
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
(1) Capabilities of TDMMO in regard to road management against earthquake disaster are improved.																																				
1-1 To upgrade the emergency road networks introducing new methodology, in consideration of an expansion of Tehran, the location of relevant facilities for disaster emergency operations in/out of Tehran and others																																				
1-2 To prepare multiple and alternative plans of the main emergency road network in conjunction with other transportation systems such as air transportation, railways and subways																																				
1-3 To assess vulnerability of the emergency road networks based on the aspects including lifeline facilities such as stations and lines of water, gas, electricity and telecommunication, etc. and their interactions																																				
1-4 To prepare a seismic resistant plan for the vulnerability of the emergency road networks including bridges and tunnels																																				
1-5 To prepare an operation and maintenance plan of the emergency road networks including methodology of clearing the roads after an earthquake, and methodology of revising and expanding the emergency road networks in the future																																				
1-6 To prepare a draft instruction for design and construction of structures, lifelines and buildings adjacent to the emergency road networks, to be included in the urban development plan																																				
1-7 To hold seminars and workshops on the plans related to the emergency road networks																																				
1-8 To hold Simulation (Drill) utilizing disaster scenario based on the result of damage estimation and in consideration of the emergency road networks																																				
(2) Capabilities of TDMMO in regard to the community-based disaster management against earthquake disaster are improved.																																				
2-1 To study and current public awareness on the earthquake disaster																																				
2-2 To study the contents and effectiveness of the past disaster education for the public in the past																																				
2-3 To review and improve the existing master plan on public training and awareness for the earthquake disaster management																																				
2-4 To prepare public education training tools and materials																																				
2-5 To prepare and finalize basic concept, museum display plan, circulation scenario, floor plan, spaces required, equipment plan for each space and drawing of each section																																				
2-6 To prepare a public education plan and program conducted at the disaster management museum																																				
2-7 To prepare an operation and management plan of the disaster management museum																																				
2-8 To hold workshops on the community-based disaster management																																				
2-9 To conduct emergency evacuation drill in designated Mahalle																																				
(3) Capabilities of TDMMO in regard to early warning including the QD&LE system installed in the previous project are improved.																																				
3-1 To prepare an improvement plan on early warning including the QD&LE system.																																				
3-2 To prepare an plan improvement plan of the existing seismograph network in and around Tehran considering future implementation of the earthquake early warning system (EEWS)																																				
3-3 To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system including necessary measures to be taken by related organization such as water, electricity, gas, fuel pipes, fire and safety service, and subways																																				
3-4 To strengthen data communication system for the QD&LE system based on investigation of communication systems, recommendation of suitable systems and development of backup lines.																																				
3-5 To increase items of the QD&LE system in addition to buildings and casualties																																				
3-6 To install a seismic intensity early warning system for emergency response and public awareness.																																				
3-7 To improve the current multi-layered warning system for more effective emergency response activities.																																				
3-8 To prepare a plan to introduce a post-earthquake (secondary events) information and warning system.																																				
Joint Coordinating Committee																																				
Evaluation																																				
Training in Japan																																				
Output 1																																				
Output 2																																				
Output 3																																				

Minutes of The Third Joint Coordinating Committee Meeting

on

The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran

Agreed upon between

The Tehran Disaster Mitigation and Management Organization (TDMMO)

and

Japan International Cooperation Agency (JICA)

October 1, 2014 Tehran

Mr. Mohsen Nadi
Vice President
Tehran Disaster Mitigation and Management Organization

Mr. Ichiro Kobayashi
Chief Advisor / Disaster Risk Management
JICA Expert Team

As witness
米林 優人
JICA H.Q.
Director

In the Name of God

1. Introduction

The Tehran Disaster Mitigation and Management Organization (hereinafter referred to as "TDMMO") and JICA Expert Team (hereinafter referred to as "the Team") organized a meeting of the third Joint Coordinating Committee (hereinafter referred to as "JCC")on 'The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran (hereinafter referred to as "the Project") on 1st October 2014 at the conference room in TDMMO in the occasion of Terminal Evaluation of the Project. The attendance list is attached in Attachment A.

In the 3rd JCC, following topics have been presented and discussed:

1) The progress of Output 1, Output 2 and Output 3 of the Project respectively,
2) Result of Terminal Evaluation, and
3) Confirmation on the Schedule of final seminar and 4th JCC meeting.

The main points of the discussion are summarized below.

2. Acceptance of the progress of the Project

TDMMO reported the progress of the activities, issues, their solutions and the future plans for activities and also explained that the contents of the activities and outputs of the project.
The Iranian side acknowledged the receipt of the Progress Report (5) which describes the above discussed issues and confirmed that it was prepared in accordance with the Work Plan.

3. Result of Terminal Evaluation

The Evaluation Team, headed by Mr. Norihito Yonebayashi, Director of Disaster Management Team 2, Global Environment Department, JICA HQ, and Evaluation Consultant, Mr. Kaneyasu Ida made explanations on the Terminal Evaluation Report, and both side agreed on the contents, and expressed the appreciation of great efforts by both Iranian, and Japanese side for successful progress of the project. However, it has been underlined that due to delay of procurement of equipment for EEWS in line with Output 3, Activity 3-3 "To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system", planned evaluation of the established EEWS will not be able to complete within the original duration of the project, therefore, in order to complete the project effectively, possibility of extension for the time for evaluation will be considered in accordance with conditions set in the M/M for the Terminal Evaluation.

4. Project Implementation Scheme

TDMMO and JICA Expert Team agreed that the next JCC, conclusion of the project except for Output 3, Activity 3-3, will be held on 17 or 18 February, 2015. A final seminar of the project also schedule to be held during February 2015.

Attachment A: List of Participants

Minutes of The Fourth Joint Coordinating Committee Meeting

on

The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran

Agreed upon between

The Tehran Disaster Mitigation and Management Organization (TDMMO)

and

Japan International Cooperation Agency (JICA)

February 18, 2015 Tehran

Mr. Mohsen Nadi
Vice President
Tehran Disaster Mitigation and Management Organization

Mr. Ichiro Kobayashi
Chief Advisor / Disaster Risk Management
JICA Expert Team

Witness:

Mr. Yasuto Takeuchi
Chief Representative
Iran Office
Japan International Cooperation Agency

In the Name of God

1. Introduction

The Tehran Disaster Mitigation and Management Organization (hereinafter referred to as "TDMMO") and JICA Expert Team (hereinafter referred to as "the Team") organized a meeting of the fourth Joint Coordinating Committee (hereinafter referred to as "JCC") on 'The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran (hereinafter referred to as "the Project"), chaired by Mr. Mohsen Nadi, Vice President of TDMMO, on 18th February 2015 at the conference room in TDMMO in the occasion of completion of the Project except Output 3 Activity 3-3 "To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system", due to unavoidable reasons.

An attendant list of participants is attached.

In the 4th JCC, following topics have been discussed, and confirmed:

1) Confirmation of Completion of the Project except for Output 3 Activity 3-3: ,
2) Confirmation of Extension of the Project and Planned Schedule and Activities, and
3) Confirmation of Schedule of 5th JCC

The main points of the discussion are summarized below.

2. Confirmation of Completion of the Project except for Output 3 Activity 3-3:

JICA Expert Team explained overall results of the Project followed by detail explanation of the result of each output by leaders from TDMMO. After the presentations, both TDMMO and the Team confirmed the completion of all of the activities and formulated planned outcomes except for Output 3, Activity 3-3, which are realized necessity of extension by both Iranian and Japanese side at the Terminal Evaluation carried out from 10 September to 1 October 2014.

Furthermore, Iranian side acknowledged the receipt and confirmation of the Progress Report (6) which describes the completion of the activities for each Output.

3. Confirmation of Extension of the Project and Planned Schedule and Activities

In line with the result of Terminal Evaluation, both side realized the necessity of extension of the Project in relation to Output 3, Activity 3-3 "To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system", and set up conditions to be persuaded, and confirmed if these conditions are satisfied, project duration would be extended in accordance with conditions set in the M/M for the Terminal Evaluation signed on 1 October, 2014. Both side confirmed that according to the Memorandum of Understanding signed by the Team and TDMMO on 18 December 2014, JICA confirmed persuade the conditions set and proceed for extension of the project duration to complete Activity 3-3. As of 18 February 2015, recent status of set conditions are confirmed by both side as described in the Attachment B, and fully persuaded the conditions.

Both side confirmed dispatch schedule of Mr. Imamura, Expert on Earthquake Early Warning System, who is responsible for Activity 3-3 and scheduled to dispatch three (3) times until October 2015 based on the progress of activities (Tentatively, scheduled to be dispatched in May, August, October 2015) , and discussed and confirmed on necessary measures to be taken by both parties. The Team requested TDMMO to report regularly by e-mail on the condition and progress in order to dispatch the expert at appropriate timing.

4. Confirmation of Schedule of 5th JCC

TDMMO and the Team agreed that the next JCC, of which the subject shall be the completion of Output 3, Activity 3-3 and the completion of the Project will be held in October 2015.

Attachment A: List of Participants

Attachment B: Confirmation of Progress of Conditions for Extension of Project in relation to Output 3 Activity 3-3

End of Document

Attachment B: Confirmation of Progress of Conditions for Extension of Project

Confirmation of Progress of Conditions for Extension of Project in relation to Output 3 Activity 3-3

TDMMO and JICA Expert Team confirmed current progress of the five conditions to extend the project duration, and summarized below;

Condition I. : Donated 4 seismometers (AC73) and controllers (GMSPlus) are installed and working as planed.

Two sets are installed and working. The other two sets were installed once, and removed for the purpose to update station side software in TDMMO.

Condition II. : Data communication system among stations, repeaters, and TDMMO is established.

All equipment are installed and configured. The network is now on the tuning stage for stable communication because of some packet loss.

Condition III. : Station side software is developed and installed to each controller at the station and they are all working.

Station side software has been developed and installed to all controllers. A bug found while test run from October to December, and updated version has been installed and is running.

Condition IV. : Server side software is developed, installed to server computer at TDMMO and they are all working.

Final beta version of the server side software has developed, installed, and it is running at a server computer in TDMMO. A detailed technical testing using real earthquake waveform recorded at similar geometry of Japanese seismic network is now on the process.

Condition V. : Relationship among the seismometer supplier, the software developer, the communication company, the land owner of all stations, and TDMMO is well maintained and shall not affect for the follow up assistance.

All are well maintained.

Based on above progress, TDMMO and JICA Expert Team confirmed fulfillment of the conditions set in the M/M at Terminal Evaluation signed on 1 October 2014, and all of the parts for the pilot Earthquake Early Warning System (EEWS) have been developed ready to operate.

End of Document

Minutes of the Fifth (Final) Joint Coordinating Committee Meeting

on

The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran

Agreed upon between

The Tehran Disaster Mitigation and Management Organization (TDMMO)

and

Japan International Cooperation Agency (JICA)

October 13, 2015 Tehran

Fatemeh Saleh

Ms. Fatemeh Saleh
Head of Mitigation and Risk Reduction
Deputy
Tehran Disaster Mitigation and Management
Organization

Mr. Ichiro Kobayashi
Chief Advisor / Disaster Risk Management
JICA Expert Team

Witness:

Mr. Kohei Sato
Chief Representative
Iran Office
Japan International Cooperation Agency

1. Termination of the Project

On the occasion of the completion of the Project activities, the Tehran Disaster Mitigation and Management Organization (hereinafter referred to as "TDMMO") and JICA Expert Team (hereinafter referred to as "the Team") organized a meeting of the fifth (final) Joint Coordinating Committee (hereinafter referred to as "JCC") on 'The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran (hereinafter referred to as "the Project"), chaired by Ms. Fatemeh Saleh, Head of Mitigation and Risk Reduction Deputy of TDMMO, on 12th October 2015 at the conference room in TDMMO to confirm the completion of the Project.

An attendant list of participants is attached.

In the 5th JCC, following topics have been discussed, and confirmed:

1) Confirmation of the Completion of Output 3 Activity3-3 extended in the 4th JCC,
2) Handover of the Equipment, and
3) Handover of the Technical Cooperation Materials

The main points of the discussion are confirmed below.

2. Confirmation of the Completion of Output 3 Activity3-3 extended in the 4th JCC

In line with the result of Terminal Evaluation, both side realized the necessity of extension of the Project in relation to Output 3, Activity 3-3 "To develop a pilot scale earthquake early warning system and prepare an action plan for further development of the system", and set up conditions, and confirmed if these conditions are satisfied, the Project duration would be extended in accordance with conditions set in the M/M for the Terminal Evaluation signed on 1 October, 2014. In the 4th JCC on 18th February 2015, status of set conditions was confirmed by both side and fully fulfilled the conditions. Based on this condition, JICA extended the Project duration to complete Activity 3-3.

According to the agreement of the 4th JCC, Mr. Imamura, Expert on Earthquake Early Warning System, who is responsible for Activity 3-3, was dispatched three (3) times (May, August and October 2015) additionally and supported necessary measures with TDMMO.

TDMMO and the Team explained the result of Activity 3-3 and both TDMMO and the Team confirmed the completion of the Project including Activity 3-3 and formulated planned outcomes.

3. Handover of the Equipment

The Team handed over a GIS software, including spatial analyst and network analyst, one A3 color printer, one multi-function printer and two computers to TDMMO and TDMMO surely received the above-mentioned equipment and confirmed to utilize the equipment for sustaining outcomes of the Project.

4. Handover of the Technical Cooperation Materials

The Team handed over the Technical Cooperation Materials prepared by the Project activities. TDMMO surely received and confirmed to utilize the materials.

1) Emergency road network including multiple and alternative routes
2) Seismic-resistant plan for the emergency road network including multiple and alternative routes
3) O&M plan for the emergency road network including multiple and alternative routes
4) Draft instruction for the design, construction, and reinforcement of lifelines and buildings
5) Report on the survey on public awareness of earthquake disasters
6) Master plan on public education for disaster management including an action plan
7) Public education training tools and materials
8) Exhibition plan of the disaster management museum including the interior design
9) Public education plan and program to be conducted in the disaster management museum
10) Improvement plan for the early warning system including the QD&LE system
11) Specification of the pilot scale EEWS
12) Action plan for the practical use of the pilot scale EEWS
13) Materials of the seminars and workshops
14) Materials of the counterpart training in Japan

5. Utilization of the Earthquake Warning System (EWS)

The information from the EWS should be utilized by relevant organization for appropriate emergency response. Iranian side explained that disaster management organization to utilize the information has formulated, and members of the organization started the preparation of response manual for the EWS.

Attachment A: List of Participants
Attachment B: Certificate of Handover

End of Document

The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran
Project Office: C/O The Tehran Disaster Mitigation and Management Organization
Address: West End of Jalale – Ale – Ahmad Highway, Tehran, IRAN
Ph: +98(21)44244040 Fax: +98(21)44243100

CERTIFICATE OF HANDOVER

Attn.: Chief Representative
JICA IRAN OFFICE
6TH Floor, Kajabadi Street, Afriqa Street, Tehran

PROJECT TITLE: The Project for Capacity Building for Earthquake Risk Reduction and Disaster Management in Tehran in the Islamic Republic of Iran

This is to certify that the equipment that have been used since the project, which requested in the attached Form has been handed over properly as of October 13, 2015 to TDMMO.

Mr. Ichiro Kobayashi
Chief Advisor / Disaster Risk Management
JICA Expert Team

Ms. Fatemeh Saleh
Head of Mitigation and Risk Reduction Deputy
Tehran Disaster Mitigation and Management Organization

October 13, 2015
Tehran

(Attachment)

List of Equipment

No	Equipment	Specification	Quantity	Total Price	Place of Use	Date of Handover
1	GIS Software	Arc View 10.0	1	JPY 1,150,000	TDMMO	Oct.13, 2015
2	GIS Software	Spatial Analyst	1		TDMMO	Oct.13, 2015
3	GIS Software	Network Analyst	1		TDMMO	Oct.13, 2015
4	A3 Color Printer	Epson Stylus Photo 1410	1	USD 517	TDMMO	Oct.13, 2015
5	Multi-function printer	Sharp AR-5520D	1	USD 1,936	TDMMO	Oct.13, 2015
6	Computer	GIGABYTE H61MS2-B3 + SAMSUNG 22inch LCD	2	IRR 39,500,000	TDMMO	Oct.13, 2015
7	GPS receiver	GeoSIG RS-232	4	IRR 3,938,810,618	TDMMO	Oct.13, 2015
8	Triaxial Force balance Accerometer	GeoSIG AC73	4		TDMMO	Oct 13, 2015
9	GMSplus Measuring System	GeoSIG with software	4		TDNNO	Oct 13, 2015

Appendix 8
List of Collected Documents/Data

List of Collected Documents/Data

No.	Title	Year	Publisher	Type of Data	Original/ Copy	Language
General						
G-1	Population	Not written	TDMMO	CD	Original	English
G-2	MATLAB Guide to Finite Elements (An interactive Approach)	2007	Author: Peter Issa Kattan . Translated to Farsi by: Touraj Zakizadeh Koohenour Publications	Book with CD	Original	Farsi
G-4	Code for Complying the Operation Plan for Tehran Municipality (2011-2013)	2011	Tehran municipality; Deputy of planning and urban development	Booklet	Original	Farsi
G-5	The Guide/tourist Map of Tehran 2012	2012	Tehran Province Cultural Heritage, Handicrafts and Tourism Organization	Map	Original	Farsi & English
G-7	Iran Tourism Road Map	Not written	Rahnama Information disseminators tehran Institue	Map	Original	Farsi & English
G-8	Map of Islamic Republic of Iran	Not written	Gitashenasi Geographic & Cartographic Institute	Map	Original	English
G-9	New map of Tehran	Not written	Gitashenasi Geographic & Cartographic Institute	Map	Original	English
G-10	General map of Tehran	Not written	Gitashenasi Geographic & Cartographic Institute	Map	Original	English
Output1						
1-1	HAZUS-MH MR4 Technical Manual: Chapter 15; Direct economic losses	Not written	Not known	Copied paper	Copy; only chapter 15 was printed	English
1-2	HAZUS-MH MR4 Technical Manual: Chapter 8; Direct damage to lifelines-utility systems	Not written	Not known	Copied paper	Copy; only chapter 8 was printed	English
1-3	HAZUS-MH MR4 Technical Manual: Chapter 7; Direct damage to lifelines-utility systems	Not written	Not known	Copied paper	Copy; only chapter 7 was printed	English
1-4	Road & Railway Bridges Seismic Resistant Code of Practice	2008	Iranian National Standardization Organization	Copied paper	Copy	Farsi & English
1-5	Iranian Code of Practice for Seismic Resistant Design of Buildings (Second edition)	2003	BHRC Publications	Copied paper	Copy	English
1-6	Iranian Code of Practice for Seismic Resistant Design of Buildings (Third edition)	Not written	BHRC Publications	Copied paper	Copy	English
1-7	Seismic Resistant Design of Buildings -Code of Practice (Third revision)	Not written	Institute of Standards &Industrial Research of Iran	Copied paper	Copy	Farsi
Output2						
2-1	Earthquake happened, the house was shaken…	2011	Tehran Publications. Author/Poet: Mustafa Rahmandoust	Children's poetry book about earthquake	Original	Farsi
2-2	Dona and Dana in earthquake	2008	Taher Publications. Author: Zeynab Tabatabayi Owned & ordered by: TDMMO	Children's story book about earthquake	Original	Farsi
2-3	Preparedness against earthquake	2005	Publisher: TDMMO. Prepared by: Islamic City Council of Tehran	Booklet	Original	Farsi
2-4	Guideline for forming disaster management team in residential buildings (Amaken)	2002	TDMMO.	Book	Original	Farsi

No.	Title	Year	Publisher	Type of Data	Original/ Copy	Language
2-5	1-Knowing about earthquake 2-Psychological support 3-Are you prepared? 4-Rescue bag 5-Retrofitting non-structural elements 6-Shelter-seeking and emergency evacuation	Not written	TDMMO.	Set of brochures for public education on preparedness against earthquake	Original	Farsi
2-6	Earthquake Damage Reduction of Building Non-structural Elements	2008	TDMMO.	Book	Original	Farsi
2-7	Disaster Management	2008	TDMMO.	Book	Original	Farsi
2-8	Safe and secure mountain: Guideline for safe hiking/mountain climbing in North Tehran	2012	TDMMO.	Book	Original	Farsi
2-9	1-Fundamentals of mountain climbing 2-Survival in mountains 3-Safe routes in North Tehran mountain 4-Hypothermia & Frostbites 5-Weather forecasting& Lightening 6- Hyperthermia	Not written	TDMMO.	Set of brochures for public education on safety while mountain climbing	Original	Farsi
2-10	Exhibition & Museum of history/culture of childhood	2013	Research Institute of history/culture of childhood	Brochure to give information on forthcoming exhibition	Original	Farsi
2-11	Preparedness against earthquake	Not written	TDMMO.	CD for educating student at schools	Original	Farsi
2-12	The Price of Smile of Children of Bam	2005	TA publications. Author: Ahmad Khalili	Book : a Documentary on Bam earthquake and children during the disaster	Original	Farsi, English, Japanese
2-13	Master Plan for Training disaster management	2009	TDMMO	Mater Plan Draft Document printed out	Copy	Farsi
2-14	Scientific Journal of Architecture & Urbanism	1994/95	Not known; Author: a team of 20 people	Journal	Original	Farsi & English
2-15	5th Exhibition for children and youth: games, entertainment and education	2013	City of Tehran municipality; Cultural & Social affairs Deputy	Booklet	Original	Farsi
2-16	Training how to get prepared against earthquake	Not written	TDMMO	Brochure	Original	Farsi
2-17	Let's live safe and secure: Plan for formation of disaster management team of residential buildings (Amaken)	Not written	TDMMO	Brochure	Original	Farsi
2-18	Preparedness against earthquake series: 1-Shelter seeking 2-Tehran condition in terms of seismic activity	Not written	TDMMO	Brochure series: Preparedness against earthquake	Original	Farsi
2-19	Research Institute of History of Children's Literature	Not written	Research Institute of History of Children's Literature	Brochure for introduction of the institute	Original	Farsi

No.	Title	Year	Publisher	Type of Data	Original/ Copy	Language
2-20	Iran National Museum , Ancient Iran Museum	Not written	Iran National Museum	Brochure on information regarding Ancient Iran Museum	Original	Farsi
Output3						
3-1	Patsa Industry	Not written	Patsa Industry	Company Booklet/brochure	Original	Farsi
3-2	Telemetry -SCADA training course	Not written	Patsa Industry	Brochure for Telemetry -SCADA training course that Patsa Company offers	Original	Farsi
3-3	Journal of Earth and Space Physics	2011	Tehran University	Journal (Book format)	Original	Farsi
3-4	Cities of the World	2011	Dr Mohsen Ebrahimi Mojarad	Journal	Original	Farsi
3-5	Vijeo Citect (SCADA software) Vijeo Historian (reporting software)	Not written	Patsa Industry	Brochure for introducing technical specifications of the software	Original	English
3-6	How much city of Tehran is prone to earthquake and manner of its speed	2009	TDMMO	Book	Original	Farsi
3-7	"Anar" Early Warning & Seismic Network Management System	2013	Mashhad University	Booklet which contains brochures of EEWS which are developed and sold by Mashhad University	Original	Farsi
3-8	Introduction to activities of National Geology & Mineral Research Organization - Geological Survey of Iran	2011	National Geology & Mineral Research Organization	Booklet	Original	Farsi
3-9	Geology and mine	2011	National Geology & Mineral Research Organization	Journal	Original	Farsi
3-10	Development of an Earthquake Early Warning System & its benefits	2011	Journal : Quality Review, No. 38	An Article/paper in a journal	Copy	English
3-11	Software products of Oil Industry Research Center	Not written	Oil Industry Research Center	Brochure	Original	Farsi