MINISTRY OF NATIONAL EDUCATION
REPUBLIC OF TURKEY

DATA COLLECTION SURVEY ON PROMOTION OF EARTHQUAKE RESILIENT BUILDING

FINAL REPORT

FEBRUARY 2020

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS GLOBAL CO., LTD.

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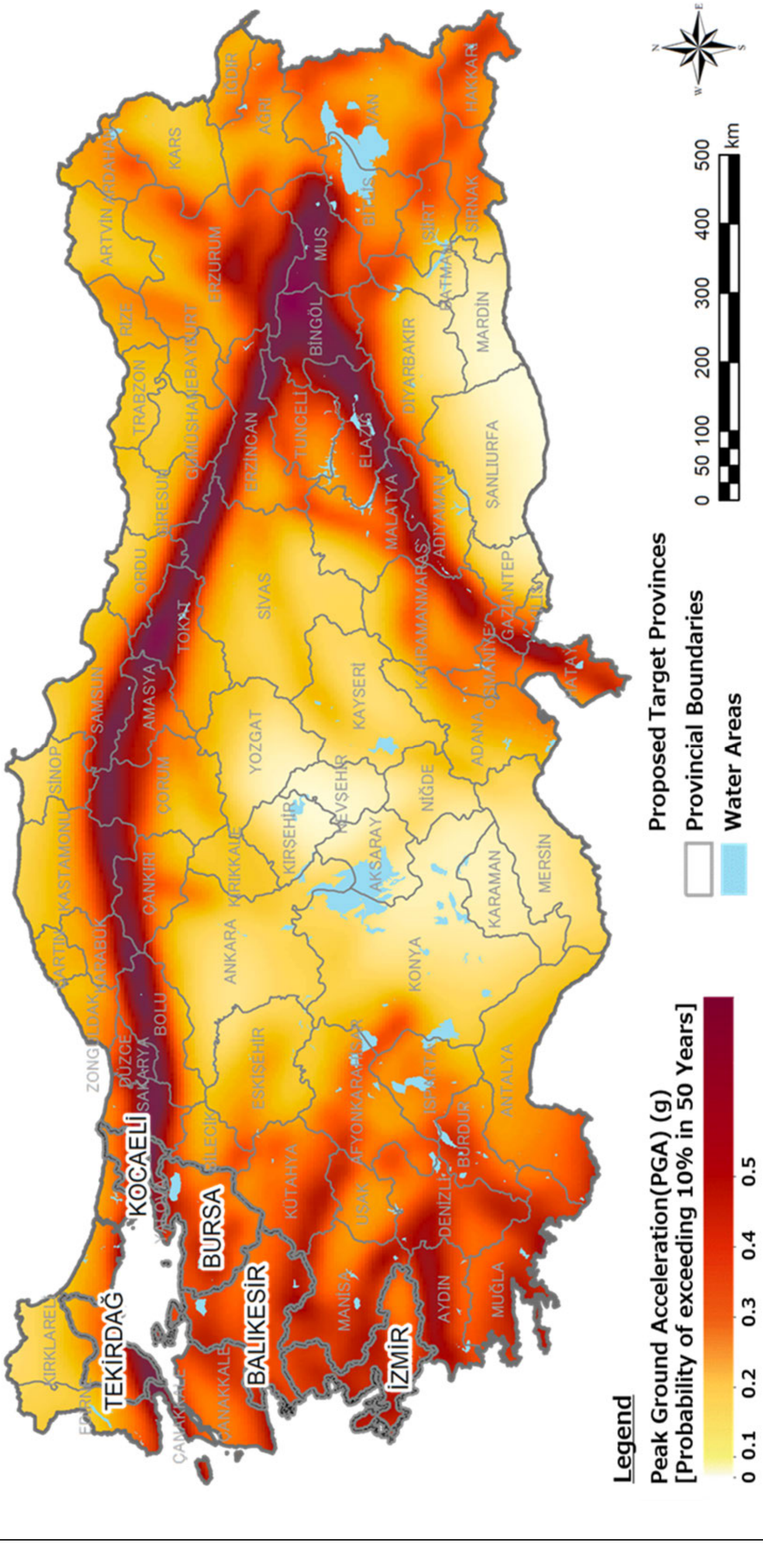
Proposed Target Area



Executive Summary

1. Background and Purpose

1.1. Background

Turkey is prone to earthquakes, being located in the Anatolian peninsula where the Eurasian Plate, African Plate and Arabic Plate meet. The Government of Turkey has been putting efforts into promoting earthquake-resilient buildings.

The continuous cooperation between Japan and Turkey for Disaster Risk Reduction was confirmed at the Japan-Turkey summit meeting in September 2018, and further endorsed by "The Japan-Turkey Memorandum on Disaster Risk Reduction Cooperation" signed on December 27, 2018.

Japan International Cooperation Agency (JICA) performed the "Data Collection Survey for Disaster-Resilient Urban Planning in Turkey" from September 2013 to May 2014, which proposes the concept of developing resilient cities in Turkey. The survey came with the conclusion that public buildings and facilities – such as hospitals and schools – which play important roles during emergency situations should have sufficient seismic capacity required for their purpose.

Following the previous survey, JICA started the Data Collection Survey on the Promotion of Earthquake-Resilient Buildings (hereinafter referred to as "the Survey").

1.2. Objective of the Survey

The objective of the Survey is to analyze the current situation and challenges in the promotion of earthquake-resilient buildings, especially public facilities such as schools and hospitals, in line with DRR-related policies and plans of the Government of Turkey. It also considers the direction of future cooperation including the validity, purpose and possible scenario of Japan's support for the promotion of earthquake-resilient buildings in Turkey.

1.3. Related Agencies of the Survey

Counterpart	: Ministry of National Education (MoNE)
Cooperating Agencies	: Ministry of Environment and Urbanization (MoEU), Ministry of Health (MoH), Disaster and Emergency Management Authority (AFAD), Housing Development Administration (TOKI) and local authorities

1.4. Scope of the Survey

The Survey covered the following items:

- Review the current socioeconomic conditions, records of earthquake damages, and local plans for disaster risk reduction in target provinces.

- Find out which public facilities require earthquake-resilient construction through discussions with relevant ministries.
- Confirm the feasibility of implementing earthquake-resilient construction methods to the above selected public facilities through on-site visits.
- Create the Project Package, or the list of public facilities with their applicability for construction confirmed, such as collapse risk, human and economic damage due to collapse, importance as a disaster management facility, and so on.
- Review the environmental and social impacts of promoting earthquake-resistant buildings on the area, people, and natural environment.
- Report the Survey method and results in details.

2. Earthquake Resilience Status of Public Facilities

2.1. Vulnerable Buildings Prior to 1998

The Seismic Design Code of Turkey has been evolving through the experience of major earthquake disasters in Turkey. The modern seismic code was established around 1998 with a notable increase in seismic design loads. Buildings designed according to any previous codes are therefore much more vulnerable than those designed based on the codes after 1998.

In the case of education facilities, it is assumed that out of 60,000 schools in total, there are about 30,000 schools that were constructed prior to 1998 and are thus vulnerable to earthquakes. MoH refers to the 2007 earthquake code for checking the seismic performance of medical facilities. More than 70% of the hospital buildings (rate based on floor areas) are constructed in compliance with the 2007 seismic code or have been upgraded to meet its requirements.

2.2. Policies, Strategies and Laws for Resilient Building

(1) 11th Development Plan

In the plan, the importance of enhancing the resilience of public buildings is also highlighted.

(2) National Earthquake Strategy and Action Plan 2012-2023

The Government of Turkey has been taking enormous efforts to make all important public buildings seismic-resistant within the next decade. In response to the significant damage and loss during the 1999 Kocaeri earthquake, the “National Earthquake Strategy and Action Plan 2012-2023” was formulated as the first step so that the society would be well-prepared and capable of coping well in the face of earthquakes, and that public facilities would become resilient through the implementation of risk reduction measures.

(3) Urban Transformation Law

The recent Law No. 6306, or the Law of Transformation of Areas under Disaster Risks, was enacted in 2012. The aim of this law is to determine the procedures and principles regarding the rehabilitation, clearance, and renovation of urban areas and buildings prone to disaster.

2.3. Status of Hospital Building

A total of 72% of hospital buildings in Turkey (ratio based on the floor areas) are earthquake-resilient as of December 2018 in compliance with the 2007 Turkish Seismic Code. Out of remaining 2,094 building structures that should become earthquake-resistant, 63% or 1,327 structures are to be reconstructed.

2.4. Status of School Building

MoNE has performed seismic assessments of 4,500 schools, and results showed that about 5% (250 schools) do not need any work, 20% (900 schools) require reconstruction and 75% (3,350 schools) need retrofitting. MoNE aims to improve the seismic performance of 18,000 vulnerable schools within the next decade.

2.5. Status of Provincial and Municipal Office Building

It was not possible to get any specific information from MoEU on this subject, and the current status could not be confirmed. It should be noted that improving the seismic performance of public buildings is also in the scope of the Urban Transformation Law.

2.6. Status of Apartment for Low and Middle Income Brackets

The low- and middle-income apartment buildings constructed by TOKI are private properties. Improving the seismic performance of vulnerable private buildings is within the scope of the Urban Transformation Law. According to TOKI, retrofit is not necessary for TOKI’s buildings, since all buildings were constructed in accordance with the seismic code and hazard map.

2.7. Other Donor’s Approach to School Buildings

(1) Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP)

The Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) is the World Bank-financed project with the objective to assist the Government of Turkey in improving the city of Istanbul’s preparedness for potential earthquake. This is done through enhancing the institutional and technical capacity for disaster management and emergency response, strengthening critical public facilities for earthquake resistance, and supporting measures for better enforcement of building codes.

As of December 2019, ISMEP has retrofitted and reconstructed 1,350 public buildings, including 1,150 school buildings (800 retrofitted and 350 reconstructed).

A total of 243 school buildings are left for retrofit or reconstruction and planned for completion within the next three years, with additional funding from IFIs.

(2) Disaster Risk Management in Schools Project

The World Bank concluded the loan agreement of USD 300 million for the Disaster Risk Management in Schools Project for Turkey on August 8, 2019. The objective of the project is to increase the safety of students, teachers, and staff in selected schools in high-risk seismic zones in Turkey. Procurement of individual consultants started in December 2019.

(3) The EU Facility for Refugees in Turkey (FRiT)

Turkey currently hosts over 4 million refugees, and the European Union (EU) is committed to assist Turkey in dealing with this challenge through "the EU Facility for Refugees in Turkey (FRiT)." FRiT manages EUR 6 billion, and its main focus areas are humanitarian assistance, education, health municipal infrastructure and socio-economic support.

According to CRED, EUR 575 million is allocated for school construction projects, among which EUR 150 million is managed by the World Bank and EUR 425 million is managed by KfW. Also EUR 40 million is planned to allocate for energy efficiency project in education sector. Procurement procedures of the World Bank and KfW are different: the World Bank applies for its own procurement procedure, and KfW applies for Turkish public procurement law.

(4) European Bank for Reconstruction and Development (EBRD)

The European Bank for Reconstruction and Development (EBRD) has introduced a new energy efficiency finance model for the public sector in Turkey. According to the Construction and Real Estate Department (CRED), EBRD is planning to implement the project for the retrofit and renovation of schools for energy efficiency, of which the detailed scope of works and target areas are not confirmed yet.

2.8. Level of Retrofit Technology in Turkey

The most widely used retrofit methods in Turkey are the conventional types such as adding RC shear walls and jacketing RC columns and beams. These methods are typically used in combination depending on the characteristics of the subjected building structures. The use of steel elements such as steel bracing is less popular in Turkey due to the higher cost compared to RC elements. The implementation of these conventional retrofit methods seems appropriate and effective.

The use of new or advanced retrofit technologies is limited, most likely due to cost competitiveness. There are only a few examples in which public buildings, such as hospital and airport buildings, were retrofitted using seismic isolation systems. There is also an industrial facility that was retrofitted using seismic damping devices.

2.9. Site Survey of Schools in Bursa and Izmir

The survey includes 17 schools in total:

- 9 schools in Bursa and 8 Schools in Izmir
- 4 elementary schools, 3 junior high schools, 9 high schools and 1 school for special education
- 5 retrofitted schools, 2 schools under construction, 9 schools where seismic assessment were completed and 1 historical school (building designated as national monument)

Major findings of the survey are summarized below:

- The primary and secondary education system of Turkey is "4-4-4," i.e. 4 years in elementary school, 4 years in junior high school and 4 years in high school.
- Some schools operate in double shifts due to lack of school capacity.
- Typical seismic retrofit methods used for the school buildings are conventional ones, such as adding RC shear walls, increasing the size of columns and beams, and strengthening of foundations.
- There is generally no preference between reconstruction and retrofit among the school staff.
- There were three major strategies that allowed the continuation of classes during the retrofit works performed in the past: 1) completing the works during the three-month summer vacation period; 2) avoiding interrupting classes by implementing the works block by block; and 3) moving the students to other schools during the works.
- Disaster education training was performed by a Master Teacher certified by MoNE.
- Disaster drills are typically performed twice a year. AFAD and fire department give lectures and demonstrations on such occasions.

Most schools are open to the idea of utilizing school buildings as temporary evacuation shelter.

3. Seismic Standard

3.1. Turkish Building Earthquake Code 2018

The new Turkish Building Earthquake Code, *Principles for Design of Buildings Under Earthquake Effect*, was published in 2018 and officially enacted on January 1, 2019. It is a comprehensive revision of the previous code in 2007. Alongside the revision, new contents on high-rise, seismically isolated, cold-formed steel and wooden buildings were added to the code.

The Turkish Building Earthquake Code 2018 consists of 17 chapters, stipulating the method for seismic load calculation and design approach for both new and existing buildings. The Table of Contents is outlined below:

Chapter 1	General Requirements
Chapter 2	Earthquake Ground Motion
Chapter 3	General Principles for the Design and Evaluation of Buildings Under Earthquake Effect
Chapter 4	Analysis Requirements for Force-Based Design of Buildings Under Earthquake Effect
Chapter 5	Analysis Requirements for Displacement Based Design of Buildings Under Earthquake Effect
Chapter 6	Design Principles of Non-Structural Building Elements Under Earthquake Effect
Chapter 7	Special Rules for the Design of Reinforced Concrete Building (Cast-in-Situ) Structural Systems Under Earthquake Effect
Chapter 8	Special Rules for the Design of Reinforced Concrete Building (Prefabricated) Structural Systems Under Earthquake Effect
Chapter 9	Special Rules for the Design of Structural Steel Building Structural Systems Under Earthquake Effect
Chapter 10	Special Rules for the Design of Cold-Formed Steel Building Structural Systems Under Earthquake Effect
Chapter 11	Special Rules for the Design of Masonry Building Structural Systems Under Earthquake Effect
Chapter 12	Special Rules for the Design of Wooden Building Structural Systems Under Earthquake Effect
Chapter 13	Special Rules for the Design of High-Rise Building Structural Systems Under Earthquake Effect
Chapter 14	Special Rules for the Design of Seismically Isolated Building Structural Systems Under Earthquake Effect
Chapter 15	Special Rules for Evaluating and Reinforcement Design of Existing Building Systems Under Earthquake Effect
Chapter 16	Special Rules for the Design of Foundation Under Earthquake Effect
Chapter 17	Simplified Seısmıc Desıgn Rules for Regular Low Rıse Cast-in-Sıtu Reınforced Concrete Buıldıngs.

3.2. Seismic Evaluation

In general, the seismic evaluation of existing building follows the same procedure as the seismic design of new buildings, but also considers the as-built drawings and actual concrete strength obtained during the site survey and material testing. The evaluation requires a 3-D structural analysis to check the capacity of each element (columns, beams and shear walls) of the structure in order to satisfy the required seismic performance level. There is no simplified method for seismic evaluation, such as the seismic capacity index of IS used in Japan.

3.3. Retrofit Design

Unlike in ordinary Japanese seismic evaluation and retrofit, the Turkish method of retrofit design follows the seismic code for new buildings against the seismic load similar to the one also stated in the code so that the safety of retrofitted buildings is considered conceptually identical. One exception is when the actual strength of materials are used instead of nominal values, which means that the safety margin against seismic load is not given based on the safety factor of the materials, but based on the actual section and / or arrangement of reinforcement.

3.4. Comparison with Other Countries' Standards

Through the comparison of response spectra used to determine seismic load, it is found that the seismic design standards of earthquake-prone countries except for Japan are similar to one another. The basic idea is to multiply functions related to soil condition, spectral shape, response reduction, building importance, and others to Peak Ground Acceleration (PGA) on site. In contrast, the Japanese standard does not employ the importance factor, since the concept is to give the minimum requirement to building owners and to engineers. One remarkable difference in the Japanese standard is that it employs the standard base shear coefficient instead of combine the PGA and spectral shape, since Japanese authorities decided to give relatively uniform ground motion intensity throughout Japan.

If the spectral shape of Turkey or of other countries is applied to the Japanese standard base shear coefficient, it can be seen that the Japanese building standard considers PGA of 0.4[G] implicitly, which corresponds to the maximum design PGA in other countries except for Colombia. Japanese retrofit methods aim to give the building of concern the strength compatible to current design standard, so that they can be applicable to the buildings in other countries which are required to withstand high seismic load.

4. Procurement and Construction Management System

In case of retrofit and construction projects implemented by MoNE, consultants are employed for detailed design and construction supervision works. A consultant is employed for both detailed design and construction supervision works, or two consultants are employed for each works. Unlike in JICA ODA Loan project, a number of consultants are employed for each package of consulting services.

A package of construction works consists of 5-10 schools, which is much smaller than the construction projects done by consulting services. The design consultant will prepare the bidding documents including drawings, technical specifications, bill of quantities, conditions of contract and contract format. MoNE will conduct all bidding procedures including the evaluation of bids, and the design consultant will support MoNE in case any technical clarification may be necessary.

Either a design / construction supervision consultant or a construction supervision consultant will be responsible for the construction management. The supervision consultant is employed based on the package of work or contract period.

5. School-Based Disaster Risk Management

5.1. Schools as Evacuation Shelters

When residential houses are destroyed or damaged during a disaster caused by earthquakes and other natural disasters, it is common for public spaces and buildings to be used as temporary evacuation shelters until people can safely return to their homes or stay in temporary houses. A temporary evacuation shelter is a critical requirement for survival and is necessary to protect security and health.

Schools are often deliberately designated by disaster management authorities to be used as temporary evacuation shelters.

In Turkey, the Emergency Response Plan in Turkey (TAMP) formulated by AFAD, stipulates that AFAD will carry out activities for the emergency shelter services of the victims with support from MoNE.

However, according to an interview with an AFAD representative, AFAD currently has no plans to utilize the building including schools as a temporary evacuation shelter.

5.2. School-Based Disaster Education

School-based disaster education in Turkey has been mainly implemented in a project supported by JICA. From 2010-2014, a technical cooperation project, titled School-Based Disaster Education Project implemented from 10 pilot provinces were targeted.. For the Phase II of the project, MoNE has changed the project-based education to a systematic education scheme targeting the teachers representing all 81 provinces in the country. MoNE, with the support of AFAD, has developed two kinds of training materials: online training material and face-to-face training material.

Through MoNE's education scheme, almost all cities now have at least one Master Teacher, and some of them have more than five Master Teachers. The dissemination of disaster education by Master Teachers is going on. It is the idea of MoNE that JICA can continuously support the scheme, especially for training in Japan, through technical cooperation project rather than loan project.

6. Situation of the Proposed Target Area

6.1. Socio-Economic Situation

This chapter presents the socio-economic situation of six provinces: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag, which are the proposed target provinces for possible Japanese ODA support as discussed in Chapter 8.

Table 1 Population in the Proposed Target Areas

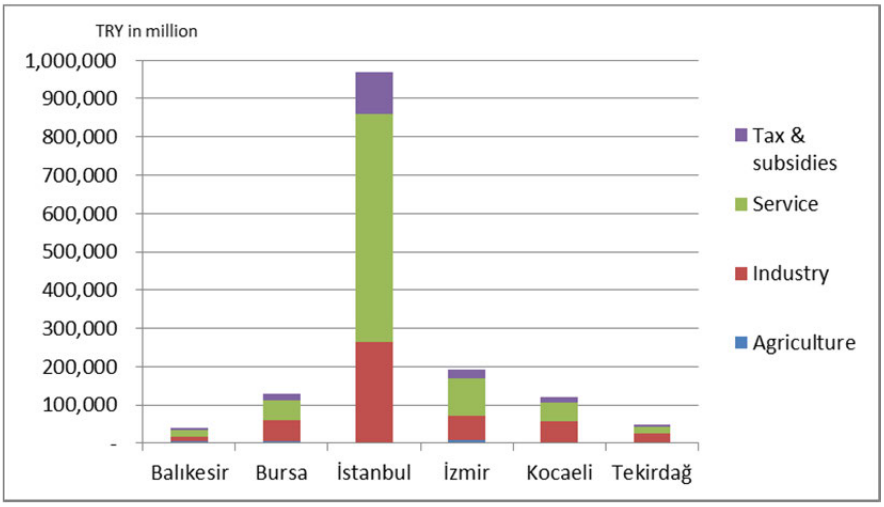
	Population					Average population growth (2014-2018)	Area (km²)	Population Density in 2018
	2014	2015	2016	2017	2018			
Turkey	77,695,904	78,741,053	79,814,871	80,810,525	82,003,882	1.4%	783,600	99
Balıkesir	1,189,057	1,186,688	1,196,176	1,204,824	1,226,575	0.8%	12,496	98
Bursa	2,787,539	2,842,547	2,901,396	2,936,803	2,994,521	1.8%	11,043	271
İstanbul	14,377,018	14,657,434	14,804,116	15,029,231	15,067,724	1.2%	5,170	2,914
İzmir	4,113,072	4,168,415	4,223,545	4,279,677	4,320,519	1.2%	11,973	361
Kocaeli	1,722,795	1,780,055	1,830,772	1,883,270	1,906,391	2.6%	3,626	526
Tekirdağ	906,732	937,910	972,875	1,005,463	1,029,927	3.2%	6,218	166

Source: Turkish statistical institute

Table 2 GRDP of the Proposed Target Areas

	Agriculture	Industry	Service	Tax & subsidies	GDP (current price) TRY in million	GDP per capita TRY
Turkey	6%	29%	53%	11%	3,106,537	37,883
Balıkesir	13%	27%	48%	11%	38,568	31,444
Bursa	4%	43%	42%	11%	127,584	42,606
İstanbul	0.1%	27%	61%	11%	970,189	64,389
İzmir	4%	33%	51%	11%	191,468	44,316
Kocaeli	1%	47%	41%	11%	120,074	62,985
Tekirdağ	4%	52%	32%	11%	46,964	45,600

Source: Turkish Statistical Institute



Source: Turkish Statistical Institute

Figure 1 GRDP by Sector

6.2. Seismic Disaster History

Damages caused by major historical earthquakes in Turkey are shown in the table below.

Table 3 Damages Caused by Major Historical Earthquakes in Turkey

Date	Location	Magnitude	Associated disaster	Total no. of deaths	Total no. of those affected	Amount of total damage ('000 US$)	Incurred losses ('000 US$)
04/29/1903	Malazgirt	6.3	--	3560	60000	0	0
08/09/1912	Murefte Sarkoy, Marmara Sea	7.8	tsunami / tidal wave	923	18195	0	0
10/04/1914	Burdur, Kilinc, Keciborlu, Isparta	7	--	4000	51700	0	0
09/13/1924	Erzurum	6.8	--	60	1140	0	0
05/01/1935	Kigi	6.1	--	540	0	0	0
04/19/1938	Kirsehir	6.6	--	149	800	0	0
12/27/1939	Erzincan (Anatolia)	7.8	tsunami / tidal wave	32962	0	20000	0
09/22/1939	Dikili	6.3	--	60	68	0	0
05/08/1940	Cis	6	--	16	0	0	0
09/11/1941	Van, Ercis	6	--	430	0	0	0
12/20/1942	Niksar, Erbaa	7	--	3000	0	0	0
11/15/1942		6.1	--	16	0	0	0
11/27/1943	Ladik, Samsun, Havza	7.5	--	4020	5000	40000	0
01/20/1943	Hendek	6.6	--	285	0	0	0
06/20/1943	Hundek, Adapazari	6.2	--	285	0	0	0
02/01/1944	Gerede (West Anatolia)	7.6	--	3959	0	0	0
10/06/1944	Ayvalik Edremit	6.8	--	27	0	0	0
06/25/1944	Usak	6	--	21	0	0	0
03/20/1945	Aelana, Veyhan, Adana	6	--	300	0	0	0
08/17/1949	Karliova (Anatolia)	6.8	--	320	355	0	0
08/13/1951	Kursunlu-Ilgaz	6.7	--	54	150	0	0
01/03/1952	Hasankale (Erzurum province)	6	--	103	250	0	0
03/18/1953	Canakkale, Balikesir, Yenice, Onon	7.3	--	1200	50000	3570	0
//1962	Pulumur	6.2	--	97	267	0	0
08/19/1966	Varto	6.9	--	2394	109500	20000	0
03/28/1970	Gediz	7.2	--	1086	83448	55600	0
05/22/1971	Bingol, Erzincan	6.8	--	878	88665	5000	0
09/06/1975	Lice	6.6	--	2385	53372	17000	0
11/24/1976	Muradiye	7.6	--	3840	216000	25000	0
10/30/1983	Khorasan, Pasinler, Narman (Erzurum province), Kars provinces	6.8	--	1346	834137	25000	0
03/13/1992	Erzican province	6.8	slide (land, mud, snow, rock)	653	348850	750000	10800
10/01/1995	Dinar, Evciler	6.1	--	94	160240	205800	0
06/28/1998	Adana, Ceyhan, Hatay	6.3	--	145	1589600	550000	0
08/17/1999	Izmit, Kocaeli, Yalova, Golcuk, Zonguldak, Sakarya, Tekirdag, Istanbul, Bursa, Eskisehir, Bolu	7.6	--	17127	1358953	20000000	2000000
11/12/1999	Duzce, Bolu, Kaynasli	7.2	slide (land, mud, snow, rock)	845	224948	1000000	0
02/03/2002	Bolvadin district (Afyon province)	6.5	--	42	252327	95000	0
01/27/2003	Pulumur district (Tunceli province)	6.1	--	1	2	0	0
05/01/2003	Bingol, Celtiksuyu, Sancak, Gokdere, Gozeler villages (Merkez district, Bingol province)	6.4	--	177	290520	135000	1000
03/08/2010	Basyurt village (Karakocan district, Elazig province), Demirci, Kovancilar, Okcular villages (Kovancilar district, Elazig province)	6.1	--	51	3600	0	0
10/23/2011	Van, Bitlis, Hakkari provinces	7.1	--	604	32938	1500000	90000
05/24/2014	Tekirdag, Canakkale provinces	6.9	--	0	324	0	0
07/21/2017	Bodrum	6.7	tsunami / tidal wave	0	360	0	0

Source: EM-DAT

6.3. Disaster Risk Management Plan

The draft of Preparation Guidelines for Provincial Disaster Risk Reduction Plan was formulated on the JICA Project on Capacity Development toward Effective Disaster Risk Management in 2014. This guideline aims to set the road map for understanding the current situation of the province and to support the formulation of Provincial Disaster Risk Reduction Plan in line with the status and regional characteristics of each province.

According to an interview with an AFAD representative, disaster risk management plans in the proposed target area have not been formulated yet. Currently, AFAD has been supporting to formulate the plan for Kahramanmaras, and it is almost in the final stage.

7. Environmental and Social Impacts

7.1. Natural Environment of the Proposed Target Area

This chapter presents the natural environment of six provinces: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag, which are the proposed target provinces for possible Japanese ODA support as discussed in Chapter 8.

(1) Balikesir Province

The territory of Balıkesir Province, which has a surface area of 14,299 km², is located in northwestern Anatolia adjacent to Bursa and Kütahya provinces in the east, Manisa and İzmir provinces in the south and Çanakkale province in the west.

Balıkesir Province has the characteristics of both the Mediterranean climate and the Black Sea climate, as it is located in the transition zone between these two regions.

Its major rivers include Susurluk, Gönen, Koca, Havran, Simav, Atnos, Üzümcü and Kille Creek. Its important lakes are Manyas Lake and Tabak Lake.

Forests cover 31% of the province's land, which corresponds to 45% of the provincial land. In general, there are larch, pine, beech, hornbeam, oak, willow, tamarisk, plane tree and olive trees in the forests.

(2) Bursa Province

Bursa Province is located in the northwestern part of Turkey and southeast of the Sea of Marmara. It is surrounded by Bilecik, Adapazarı in the east, İzmit, Yalova, İstanbul and Marmara Sea in the north, Eskişehir, Kütahya in the south and Balıkesir in the west. Bursa has a total area of 11,027 km² with 17 districts.

Bursa generally has a mild climate. However, it varies by climatic zones. Against the soft and warm climate of the Marmara Sea from the north, Bursa is confronted by the harsh climate of Uludag from the south.

Major rivers of the province are Nilufer Stream, Goksu Stream, Koca Creek, Kara Creek and Aksu Creek which are fed by many streams originating from the southern slopes of Uludag.

(3) Istanbul Province

The province is surrounded by the Black Sea in the north, the Kocaeli Mountain Range in the east, the Marmara Sea in the south, and the Ergene Basin in the west. The most important city in Turkey, Istanbul, is the only city that stands on two continents, Europe and Asia.

The climate of province resembles both the Mediterranean climate and the Black Sea climate. The former is hot and dry in summer, warm and rainy in winter. The latter is hot in summer and warm in winter but rainy in all seasons.

İstanbul has two major basins – the Marmara Sea Basin, and the Black Sea Basin which consists of many small river (creek) basins. There are no large capacity rivers, while the water system is composed of many streams that feed into the lakes and ponds or flow into the seas. Some low and irregular flow rates of the streams dry completely in summer, and some of them cause floods after heavy rains in spring.

There is no national park in İstanbul. However, there are 26 nature parks, a nature reserve area, three wildlife breeding areas, two wildlife improvement areas, wetlands, two hunting areas, archeological sites and 143 recreational areas.

(4) Izmir Province

Izmir Province is surrounded by Madra Mountains in the north, Kuşadası Bay in the south, the Aegean Sea in the west, and Manisa Province borders in the east. A typical town in the Aegean coast, Izmir is Turkey's third-largest city.

In terms of climate, summer is hot and dry in the province, and winter is mild and rainy.

Within the province of İzmir, the Gediz River, one of the important rivers of Aegean Region, shows flow with the Küçük Menderes River and the Bakırçay River.

A total of 40% of the İzmir province is covered with forests and there are 470,910 ha of forested area, which is above the average of 28.6% in Turkey. The forest areas consist of 45.9% of red pine, 4.1% of larch, 1.7% of peanut/pine, 10.8% of oak, and 37.7% of other trees and shrubs.

(5) Kocaeli Province

Kocaeli Province is located adjacent to İstanbul, Yalova, Bursa and Sakarya Provinces, and has an area of 3,505 km2. The geographical feature varies from the sea level up to 1,601 m altitude at the highest mountain of Kartepe.

Kocaeli climate constitutes a transition between Mediterranean climate and Black Sea climate. There are some differences between the climate of Kocaeli's Black Sea coast and the Izmit Bay's coast.

The province has coasts to the Marmara Sea and the Black Sea. Some of the waters originating from the lands of the province reach the Black Sea, and some of them reach the Sea of Marmara.

Generally, the upper parts of the mountains are covered with coniferous trees and the lower parts are covered with broad-leaved trees. Approaching the sea, the vegetation of the Mediterranean climate can be seen.

(6) Tekirdag Province

Tekirdağ is located in northwestern Turkey and is surrounded by Istanbul from the east, Kirklareli from the north, Edirne from the west, Canakkale from the south-west, and Marmara Sea from the south. It has a surface area of 6,313 km² and a coast of 2.5 km from the northeast to the Black Sea.

Climate of Tekirdağ is considered to be mildly humid, and it belongs to the semi-humid climate type.

Major rivers of the province are Ergene River, Çorlu River, Hayrabolu River, Beşiktepe River, Hoşköy River, Gazioğlu River, Kayı River, Koca River and Seymen River.

The forests in the northern part of the province are dominated by mostly coniferous trees, oak, and beech origin species. In the southern part of the province, there are deciduous trees of oak, hornbeam, linden, maple and others, and coniferous trees consisting of pine, larch and peanut trees.

7.2. Social Environment of Turkey

(1) Projected Population in 2019

The following table shows the population projection of the target provinces in 2019 by Turkish Statistical Institute.

Table 4 Projected Population in 2019 of Target Provinces

Year / Province	2017	2019*	Growth (17'-19')
Balıkesir	1,204,824	1,222,872	1.50%
Bursa	2,936,803	3,037,269	3.42%
İstanbul	15,029,231	15,468,919	2.93%
İzmir	4,279,677	4,381,976	2.39%
Kocaeli	1,883,270	1,991,665	5.76%
Tekirdağ	1,005,463	1,073,592	6.78%

Source: Turkish Statistical Institute

(2) Gross Domestic Product (GDP) per Capita

The following table shows the recent annual changes of GDP per capita of the target provinces in 2015 - 2017 (at current prices).

Table 5 Gross Domestic Product Per Capita of Target Provinces, 2015 - 2017 (At current prices)

Year / Province	2015	2016	Growth (15'-16')	2017	Growth (16'-17')
Bursa	33,501	36,780	9.79%	43,707	18.83%
Balıkesir	24,172	27,425	13.46%	32,127	17.14%
İzmir	34,261	37,817	10.38%	45,034	19.08%
Kocaeli	48,806	53,267	9.14%	64,659	21.39%
Tekirdağ	36,414	40,083	10.08%	47,479	18.45%
İstanbul	49,773	54,933	10.37%	65,041	18.40%

Note: Unit in TRY
Source: Turkish Statistical Institute

(3) Land Use

As shown in the following table, İstanbul was the most developed province followed by Kocaeli, which is bordered to the east of İstanbul.

Table 6 Land Use Structures of Target Provinces (2012)

Land Use / Province	Artificial Areas	Agricultural Areas	Forest and Semi-Natural Areas	Wetlands	Water Areas	Total
Bursa	3.38%	44.06%	47.84%	0.52%	4.19%	100.00%
Balıkesir	2.39%	47.26%	48.87%	0.17%	1.31%	100.00%
İzmir	5.33%	40.29%	53.46%	0.56%	0.36%	100.00%
Kocaeli	8.45%	45.84%	45.14%	0.06%	0.52%	100.00%
Tekirdağ	4.87%	77.08%	17.58%	0.02%	0.44%	100.00%
İstanbul	20.91%	29.44%	47.16%	0.05%	2.44%	100.00%

Source: Ministry of Forestry and Water Management

(4) Syrian Refugees

According to The Facility for Refugees in Turkey (FRiT) Monitoring Report: November 2019 of European Commission, 643,058 Syrian children were enrolled in education (public schools and Temporary Education Centers) in the 2018-2019 school year. Those who were enrolled corresponded to 61.4% of the Syrian children aged between 5 and 17 in the country. Therefore, there are schools accommodating the children of Syrian refugees according to interviews with schools in the target provinces.

(5) Cultural Heritages

Some school buildings are designated as cultural properties in Turkey. However, as the Project will not target at the school buildings designated as cultural properties for the seismic retrofitting works, no adverse impacts are expected.

7.3. Legal Framework

The basic law of the Environmental Impact Assessment (EIA) system in Turkey is the Environmental Law No. 2872, Law on Amendment of the Environment Law, August 1983, which was amended by Environmental Law No. 5491, April 2006. The EIA Regulation and Environmental Permit and Licensing Regulations were established based on this law.

7.4. Institutional Framework

MoEU is responsible for environmental administration, with main activities including environmental protection, pollution prevention and reduction. The ministry has jurisdiction over the planning and implementation of systems related to the environment, development and construction, monitoring and management of the implementation activities. Moreover, the ministry is responsible for the procedures of EIA approval.

7.5. Other Frameworks of Environmental and Social Considerations in Seismic Retrofit Projects

(1) Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP)

The World Bank has been supporting the disaster prevention sector and has been implementing ISMEP with Istanbul since 2006. The Environmental Management Plan is prepared based on Annex A O.P 4.01 for the ISMEP.

(2) Disaster Risk Management in Schools Project

NDRMP has also prepared an environmental and social management framework as well as the ISMEP.

(3) Urban Transformation Project

The UT project is implemented by MoEU based on the UT Act. However, the Act does not stipulate an environmental safeguard system or a framework for environmental and social considerations for the UT projects.

7.6. Environmental and Social Study

The proposed future loan project can be categorized into Category FI according to the JICA Guidelines, which stipulate that "the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment."

8. The Direction for Future Cooperation

8.1. Necessity of Future Cooperation

(1) Seismic Disaster Situation

Turkey is located on the Anatolian peninsula and is prone to earthquakes. Particularly, active faults are concentrated in the west near the Aegean Sea and the area is exposed to high risk in the event of a seismic disaster.

(2) Status of Public Facilities

The Government of Turkey has promoted earthquake-resilient buildings. MoEU promotes earthquake-resilient cities under the UT Law, while MoNE and MoH promote earthquake-resilient schools and hospitals.

Out of the existing 60,000 schools, 30,000 schools built prior to 1998 were assumed to be potentially vulnerable. MoNE has retrofitted or reconstructed about 3,500 schools which account for an estimated 12% of vulnerable schools. MoNE has also performed seismic assessments of 4,500 schools, and the results showed that about 5% (250 schools) of them do not need any work done, 20% (900 schools) require reconstruction, and 75% (3,350 schools) need retrofit. MoNE aims to improve the seismic performance of 20,000 vulnerable schools within the next decade.

(3) Ongoing Project

The World Bank concluded the loan agreement of USD 300 million for the Disaster Risk Management in Schools Project for Turkey on August 8, 2019. The objective of the project is to increase the safety of students, teachers, and staff in selected schools in high-risk seismic zones in Turkey, and 350 school buildings are estimated to be reconstructed and retrofitted.

(4) Possible Future Cooperation

Considering the current status of hospitals, government offices and apartments for low- and middle-income brackets explained in Chapter 2, these public facilities seem inappropriate for Japan's future support in seismic resilient buildings.

On the other hand, the need to improve the seismic performance of schools buildings remains huge and there is a room to introduce the Japanese experience in school-based disaster risk management. The succeeding section elaborates on the possible future cooperation with Japan in relation to schools in Turkey.

8.2. Loan Project

(1) Objective

The objective of the possible loan project is to increase the structural resilience of vulnerable school buildings by reconstruction and retrofit in order to support MoNE with its target to improve the seismic performance of 20,000 vulnerable schools within the next decade. The project includes the renovation of out-of-date facilities considering universal design, energy efficiency and gender equality in accordance with the "Minimum Design Standards Guidelines Applicable to Construction of Education Facilities" introduced by MoNE. In order to secure the safety of students during earthquakes, the project needs to include the enhancement of response management capacity complementary to the increase of structural resilience.

(2) Scope of Work

- Finalization of target schools to improve seismic performance
- Communication with stakeholders
- Review of seismic assessment and design
- Procurement of construction works
- Construction works
- Capacity-building of CRED
- Strengthening of response management capacity

(3) Target Provinces

Specific target provinces and schools could not be confirmed during the survey. The reason being is that once MoNE makes public a list of target schools, everyone – including students and teachers in the target school – have to be evacuated to other safe school.

The JICA Survey Team proposed six provinces as target provinces: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag. However, MoNE proposed the JICA Survey Team to exclude Istanbul because ISMEP has been successfully working on reconstruction/retrofit of school buildings and has access to financial resources. MoNE further requested the Team not to limit the number of target provinces to five, but to leave room to include schools from other provinces.

(4) Target School Selection Process

- MoNE identifies the schools to be retrofitted or reconstructed in each target provinces which will be covered by the JICA project. The target provinces under consideration include, but are not limited to: Balikesir, Bursa, Izmir, Kocaeli, and Tekirdag. The identified schools have not been made public by MoNE.
- JICA justifies the selection of schools based on the following criteria:
    - High seismic zone: PGA > 0.3g

    - Presence of seismic assessment report
    - Non-masonry
- MoNE identifies the schools to be retrofitted or reconstructed per each construction package in consultation with MoNE provincial directorates considering the transferring of students and teachers.
- MoNE announces the schools to be retrofitted or reconstructed and starts the selection of contractor per package.

(5) Executing Agency

MoNE will play the role of Executing Agency on behalf of the Government of Turkey, who will be responsible for the coordination, supervision and monitoring of the implementation of the Project to guarantee that the Project will be executed in accordance with its objective in a timely manner. MoNE will also be responsible for the budget administration of the project, including the administration of Japanese ODA Loan and budget from the Government of Turkey.

(6) Consulting Services

The Consultant will manage and monitor all project activities to complete the Project in an efficient and economical manner. An international consulting firm may be assigned as the leading firm of Project Management Services, with its scope of responsibility as follows:

- Overall project management (quality, cost and schedule)
- Disbursement management
- Coordination with stakeholders

International and national consulting firm may be involved and expected to play a leading role in providing the necessary services for detailed design and construction supervision as follows:

- Verification of seismic assessment
- Selection of target schools
- Detailed design (retrofit, seismic isolation, reconstruction)
- Preparation of bidding documents
- Procurement and contract management
- Construction management

Also International and national consulting firms may be involved with technical assistance for strengthening of response management capacity of MoNE with reference to seismic resilient measures for non-structural element and post-earthquake safety evaluation.

8.3. Technical Assistance Project

The Technical Assistance (TA) projects proposed hereinafter are complementary to the loan project on creating disaster-resilient schools described above. The TA projects cover two different areas: (1)

schools as community center for disaster risk management (including their function as temporary evacuation shelter), named "School-Centered Resilient Community"; and (2) disaster education.

(1) School-Centered Resilient Community

Public school facilities can be utilized not only for educational use, but also for establishing resilient communities by optimizing school facilities and their operations as community centers for disaster prevention and preparedness, and as temporary evacuation shelters during emergency situations.

The goal of this technical assistance project is to strengthen the capacities of MoNE, AFAD and local governments in preparing, coordinating, establishing and optimizing school facilities and their operations as temporary evacuation shelters as well as community centers for disaster prevention and preparedness. It will also enhance the capacities of concerned agencies in formulating or improving any relevant codes and guidelines. MoNE will establish a coordination mechanism with other government agencies in order to introduce the concept of school-centered resilient community.

Scopes of work include the following:

- Designation of schools to be used as temporary evacuation shelters
- Formulation of an initial evacuation plan
- Design and installation of infrastructures for temporary evacuation shelters
- Procurement of necessary relief items for stockpiling
- School DRR planning, including design and planning of emergency operation / evacuation drills for periodical implementation

(2) Disaster Education for a Safer Community

JICA is currently supporting MoNE for improving the training program for teachers on disaster education through the Country-Focused Training. In collaboration with JICA's program, MoNE has recently started the training of teachers to be in charge of disaster risk reduction and management, and the training of other teachers, called Master Teachers, through online and face-to-face training.

Selected Master Teachers have also been trained through their learning experience in Japan. Disaster education is one of the areas that Japan has been successful and has demonstrated that such program can save lives and minimize the impact of a disaster.

The existing training program for Master Teachers can be improved in two areas, namely: 1) inclusion of hands-on training or field training to understand the importance of disaster risk reduction and 2) inclusion of training on the operation of temporary evacuation shelters.

The efficiency can be significantly enhanced by training the teachers as Master Teachers in the schools that will be strengthened or reconstructed through the loan project and designated as temporary evacuation shelters through the other TA project, since there is a strong coherence and synergy between the activities to increase structural resilience and disaster preparedness for effective response; to establish a school-centered resilient community; and to raise disaster awareness in schools and community, which will lead to the establishment of a safer community.

8.4. Applicability of Advanced Technologies in Turkey's Building Structures

(1) Outer Frame

The outer-frame retrofit method strengthens a building structure by adding frames from outside of the building without performing any major retrofit works inside the building. It thus enables "INAGARASEKOU", which means "implementing retrofit works while staying (in the building)" in Japanese.

(2) Seismic Isolation Bearing

Bridgestone Corporation, a Japanese manufacturer and supplier of seismic isolation bearing, started a market research survey on the construction sector in Turkey in 2016 and started sales activity in 2017 through the Brisa Bridgestone Sabanci Tyre Manufacturing and Trading Inc. It provided seismic isolation bearing for the following two projects as of May 2019.

The high damping rubber bearing is suitable for retrofit of historical architecture such as old schools in Bursa and Izmir, museums and key government buildings for their preservation. This type of bearing is not suitable for general buildings, since the reconstruction cost is cheaper than the installation of the high damping rubber bearing.

(3) Seismic Resistance Design and Strengthening of Non-Structural Elements

The non-structural elements of the buildings and building equipment should also be seismically designed and installed in order to secure the safety and the continuity of building operations. Based on past experiences in which the vulnerable non-structural elements of school buildings were significantly damaged during earthquakes and the buildings could not be occupied right after the earthquakes, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) developed a "guideline for seismic resilient construction of non-structural elements of school facilities."

(4) Earthquake Early Warning System

The earthquake early warning system detects the P-wave, estimates the size and location of the earthquake, and alerts before the arrival of the S-wave or major ground shaking. There are typically a few to tens of seconds between the arrival of P-wave and S-wave depending on the distance from the earthquake epicenter. People can take appropriate action and position to be ready for the earthquake during this time and shut down the operation of any equipment that may be affected by the earthquake shaking.

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Abbreviations

Abbreviation	Name
AFAD	Disaster and Emergency Management Authority
AIIB	Asian Infrastructure Investment Bank
CEB	Council of Europe Development Bank
CRED	Construction and Real Estate Department
DoEU	Directorate of Environment and Urbanization
DRR	Disaster Risk Reduction
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
ES	Engineering Services
ESMP	Environmental and Social Management Plans
EU	European Union
FI	Financial Intermediary
FRiT	Facility for Refugees in Turkey
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
IFIs	International Financial Institutions
Ilbank	Iller Bank
ISMEP	Istanbul Seismic Risk Mitigation and Emergency Preparedness Project
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KfW	*Kreditanstalt für Wiederaufbau*
MEXT	Ministry of Education, Culture, Sports, Science and Technology of Japan
MoEU	Ministry of Environment and Urbanization
MoH	Ministry of Health
MoNE	Ministry of National Education
NDRMP	National Disaster Risk Management Project
ODA	Official Development Assistance
PGA	Peak ground acceleration
PGV	Peak ground velocity
PIU	Project Implementation Unit
PMS	Project Management Services
PPP	Public-Private Partnership
P-wave	Pressure wave

Abbreviation	Name
SA	Spectral acceleration
SDGs	Sustainable Development Goals
SI	Spectral intensity
SoP	Series of Projects
S-wave	Shear wave
TAMP	Emergency Response Plan in Turkey
TOKI	Housing Development Administration
UNDRR	UN Office for Disaster Rick Reduction
UNISDR	United Nations International Strategy for Disaster Risk Reduction
UT Act	Urban Transformation Act
WB	World Bank
WCDRR	World Conference on Disaster Risk Reduction
WISS	Worldwide Initiative for Safe Schools

Chapter 1 Introduction

1.1 Background of the Survey

Tukey is prone to earthquakes, being located in the Anatolia peninsula where the Eurasian Plate, African Plate and Arabic Plate meet. The seismic hazard map developed by the Disaster and Emergency Management Authority (AFAD) shows a particularly high risk in the areas with high industry and tourism concentration such as the Marmara area and the coastal areas along the Aegean Sea. Based on records, the recent major earthquakes in Turkey (greater than magnitude 7), such as the 1999 İzmit earthquake, 1999 Düzce earthquake and 2011 Van earthquake, have caused significant physical damage and economic loss, which were amplified by the emergent building constructions that were not compliant to the latest seismic codes due to the rapid economic growth in the past years. The United Nations Office for Disaster Risk Reduction (UNDRR, formerly UNISDR (United Nations International Strategy for Disaster Risk Reduction)) highlights that 65% of the deaths in the 1999 İzmit earthquake were caused by the collapsed buildings, and there are concerns that this may likely be repeated if a similar level of earthquake occurs in the future.

The Government of Turkey has been putting efforts into promoting earthquake-resilient buildings. The improvement of seismic performance of public buildings and critical infrastructure has been given high priority in the "11th Development Plan" as well as in the "National Earthquake Strategy and Action Plan 2012-2023" formulated by AFAD.

The Ministry of Environment and Urbanization (MoEU) promoted earthquake-resilient cities under the Urban Transformation Law. Also, both Ministry of National Education (MoNE) and Ministry of Health (MoH) have implemented seismic capacity evaluation and made plans for promoting earthquake-resilient public facilities including schools and hospitals.

As Japan and Turkey are both earthquake-prone countries, the Japan International Cooperation Agency (JICA) has been providing technical and financial assistance to Turkey for Disaster Risk Reduction (DRR). The continuous cooperation between Japan and Turkey for DRR was confirmed at the Japan-Turkey summit meeting in September 2018, and further endorsed by "The Japan-Turkey Memorandum on Disaster Risk Reduction Cooperation" signed on December 27, 2018.

JICA performed the "Data Collection Survey for Disaster-Resilient Urban Planning in Turkey" from September 2013 to May 2014, in order to understand the status of DRR policy and planning in Turkey including seismic risks, to understand the roles of relevant government organizations, and to study the challenges and potential solutions for enhancing resilience with the possible use of Japanese knowledge and technology, taking Bursa as an example. This report proposes a concept of developing resilient cities in Turkey, with the conclusion that public buildings and facilities – such as hospitals and schools – that play important roles in emergency situations should have sufficient seismic capacity for their purpose. The Turkish seismic design code as well as the status and challenges of seismic resilience construction in Turkey have also been studied through JICA's "Project for the Promotion and Dissemination of Seismic Retrofit Technology in Turkey" and "Study on the Promotion of Japanese Technologies for Seismic Retrofit in Turkey (2017, Ministry of Land, Infrastructure, Transport and Tourism)."

Following the previous survey, the Data Collection Survey on the Promotion of Earthquake-Resilient Buildings (hereinafter referred to as "the Survey") aims to understand the current conditions and approached of earthquake-resilient buildings in Turkey, and to consider how Japan can cooperate for this effort.

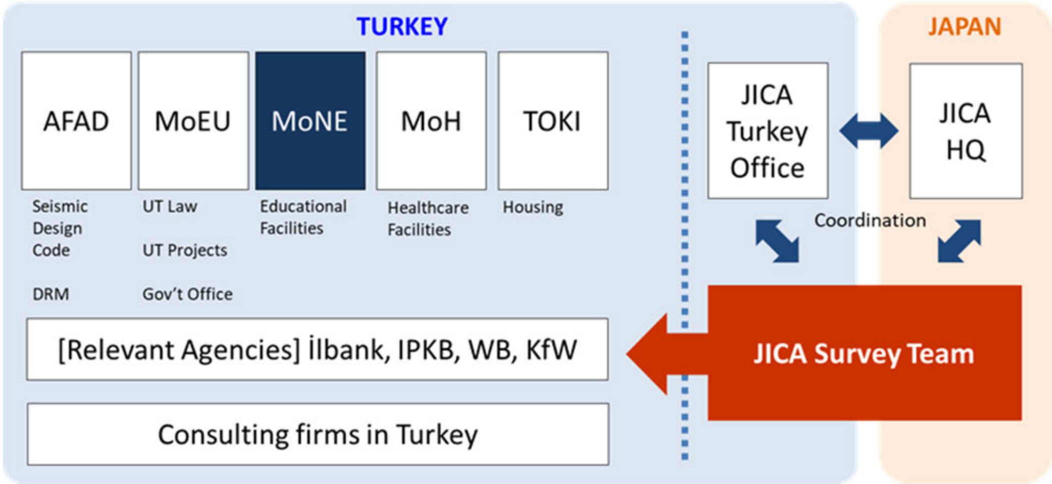
1.2 Objectives of the Survey

The objective of the Survey is to analyze the current situation and challenges in the promotion of earthquake-resilient buildings, especially public facilities such as schools and hospitals in line with DRR-related policies and plans of the Government of Turkey, and to consider the direction of future cooperation including validity, purpose and possible scenario of Japan's support for promotion of earthquake-resilient buildings in Turkey.

1.3 Related Agencies of the Survey

The counterpart agency and cooperating agencies of the Survey are shown below. In addition, the Survey was conducted on agencies related to the promotion of earthquake-resilient buildings such as İlbank, Istanbul Project Coordination Unit (IPKB), other donor agencies (World Bank (WB), Kreditanstalt für Wiederaufbau (KfW)) and relevant private companies including consulting firms in Turkey. Related agencies of the Survey are shown in Figure 1-1.

- Counterpart Agency : MoNE
- Cooperating Agencies : MoEU, MoH, AFAD, Housing Development Administration (TOKI)



Source: JICA Survey Team

Figure 1-1 Related Agencies of the Survey

1.4 Survey Area

The Survey was conducted in Ankara, Istanbul, Bursa and Izmir. Discussions and interviews with MoNE and relevant agencies were conducted mainly in Ankara, and the surveys related to Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) with IPKB were conducted in Istanbul. In addition, the site surveys of schools were conducted in Bursa and Izmir with permission from MoNE.

1.5 Scope of the Survey

The Survey covered the following items:

- Review the current socioeconomic conditions, records of earthquake damages, and local plans for disaster risk reduction in target provinces.
- Find out which public facilities require earthquake-resilient construction through discussions with relevant ministries.
- Confirm the feasibility of implementing earthquake-resilient construction methods to the above selected public facilities through on-site visits.
- Create the project package, or the list of public facilities with their applicability for construction confirmed, such as collapse risk, both human and economic damage from the collapse, importance as a disaster management facility, and so on.
- Review the environmental and social impacts of promoting earthquake-resistant buildings on the area, people, and natural environment.
- Report the Survey method and results in details.

1.6 Definition of Terms

The list of definition of terms in this Survey report is as follows:

- Seismic resilience : The improvement of seismic performance for buildings using the techniques and methods of seismic retrofit, seismic isolation, seismic control, and reconstruction.
- Seismic retrofit : Reinforcement of the main structure of the building to improve its strength to withstand earthquake shaking.
- Seismic isolation : Installation of the seismic isolation device between the building and the foundation to prevent the earthquake vibration from being transmitted directly to the building.
- Seismic control : Installation of damping materials inside the building to serve as structures that absorb the impact of earthquake shaking.
- Reconstruction : The construction of a new building after demolition and removal of the building.
- Public building : Schools, hospitals, local governmental buildings, and public housing units for low- and middle- income people.

1.7 Schedule of the Survey

The overall schedule of the Survey is shown in the Table below.

Table 1-1 Schedule of the Survey

Survey \ Year/Month	2019										2020	
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Preparation of the Survey in Japan	□											
Submission of the Inception Report (IC/R)		△										
1st Field Survey in Turkey		■										
Analysis of the 1st Field Survey and Preparation of the Interim Report (IT/R) In Japan			□	□								
2nd Field Survey in Turkey					■							
Analysis of the 2nd Field Survey and Preparation of the Interim Report (DF/R) In Japan						□	□					
Submission of the Interim Report (IT/R)						△						
On-Site Survey of Schools and Supplimental Suvey in Turkey								■				
Analysis of the On-Site Survey and Supplimental Suvey in Japan									□			
3rd Field Survey in Turkey										■		
Analysis of the 3rd Field Survey and Preparation of the Draft Final Report (DF/R) In Japan										□	□	
Submission of the Draft Final Report (DF/R)											△	
4ht Field Survey in Turkey											■	
Submission of the Final Report (F/R)												△

Legend ■ Field Survey in Turkey
□ Analysis in Japan
△ Submission of the Report

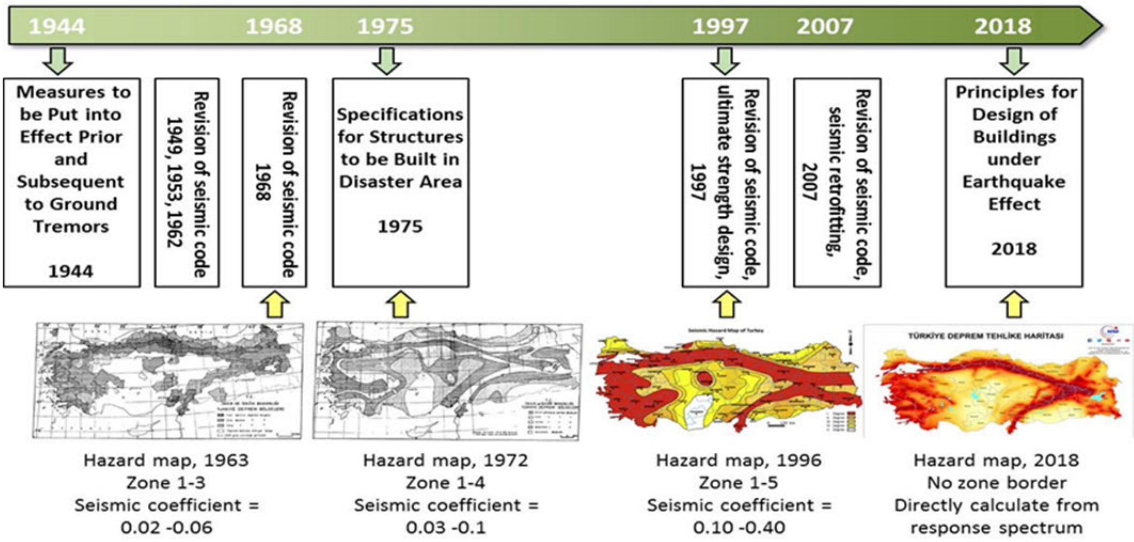
Source: JICA Survey Team

Chapter 2 Earthquake-Resilience Status of Public Facilities

This chapter summarizes the current status of earthquake resilience of public facilities in Turkey. Public facilities include buildings for public hospitals, public schools, provincial and municipal government offices, and public apartments for low- and mid- income persons.

2.1 Vulnerable Buildings Prior to 1998

The Seismic Design Code of Turkey has been evolving through the experience of major earthquake disasters in Turkey. The modern seismic code was established around 1998 with a notable increase in seismic design loads. Buildings designed according to any previous codes are therefore much more vulnerable than those designed based on the codes after 1998.



Source: JICA Survey Team

Figure 2-1 History of Seismic Design Code in Turkey

In the case of education facilities, it is assumed that out of a total of 60,000 schools, there are about 30,000 schools that were constructed prior to 1998 and are thus vulnerable to earthquakes. MoH refers to the 2007 earthquake code for checking the seismic performance of medical facilities. More than 70% of hospital buildings (rate based on floor areas) are constructed in compliance with the 2007 seismic code or upgraded to meet its requirements.

2.2 Policies, Strategies and Laws for Resilient Buildings

(1) 11th Development Plan

According to the 11th Development Plan of Turkey which covers 2019-2023, Turkey aims to increase gross domestic product to $1.08 trillion by 2023, the centenary of the Turkish Republic, with a per-capita income goal at $12,484, showing the principles and objectives in the fields of macro economy, finance, industry, agriculture, tourism, manufacturing, social, urban planning, justice and etc. In the plan, the importance of enhancing the resilience of public buildings is also highlighted. Table 2-1 summarizes the items related to educational buildings.

Table 2-1 11th Development Plan - Importance of Enhancing Resilience of Educational Buildings

548.3 While planning the construction of new classrooms, in the related area the efficient use of other educational buildings will be considered and the use of vacant educational buildings will be prioritized.
549.1 Educational structures will be designed in architecture that is safe, economical, aesthetic, accessible, with high standards and high quality in accordance with technology and environment.
552.3 The standards of physical infrastructure, curriculum and variety of materials, self-care abilities, integration applications and guiding services of learning environments will be improved.
725 In preparedness to disasters and post-disaster response, common use buildings such as hospitals, schools, dormitories and critical infrastructures such as energy, transportation, water, communication will be prioritized to be strengthened.

Source: Strategy and Budget Presidency

(2) National Earthquake Strategy and Action Plan 2012-2023

The Government of Turkey has been taking enormous efforts to make all important public buildings seismic-resistant within the next decade. In response to the significant damage and loss during the 1999 Kocaeri earthquake, the "National Earthquake Strategy and Action Plan 2012-2023" was formulated as the first stepso that the society would be well-prepared and capable of coping well in the face of earthquakes, and that they would become resilient through the implementation of risk reduction measures. The "National Earthquake Strategy and Action Plan 2012-2023" sets three major goals as follows:

- Goal A: Learning about earthquakes
- Goal B: Earthquake safe settlement and construction
- Goal C: Coping with the consequences of earthquakes

The Strategies B.1.2. and B.1.3. under Objective B.1 of the Goal B aim to give top priority toward improving the seismic performance of public facilities in Turkey, especially schools and hospitals.

Table 2-2 Objectives and Strategies under Goal B of the National Earthquake Strategy and Action Plan

Objective B.1.: The realization of earthquake safe settlements and earthquake-resistant construction
Strategy B.1.1. Procedures that emphasize hazard and risk in planning, environment and urban activities will be accorded priority and primacy.

Strategy B.1.2. The building inventory in Turkey led by schools and hospitals shall be extracted and all existing buildings shall be grouped on the basis of their damageability and risk.
Strategy B.1.3. Activities that cover earthquake-resistant building design, materials and standards shall be supported.
Strategy B.1.4. A coordinated system shall be set up for the purpose of ensuring that existing earthquake engineering laboratories provide more efficient and accessible service for the relevant community.
Strategy B.1.5. The current seismic design code shall be updated and revised in keeping with Eurocode 8.
Strategy B.1.6. Methods shall be developed, standardized and implemented for seismic safety assessment and building retrofit based on Turkish construction technology practices for bridges, viaducts and transportation networks as well as buried or surficial lifeline distribution systems (pipelines, natural gas lines, electric power networks and communication systems, etc.).
Strategy B.1.7. Professionals in service training shall be provided for the workforce in the construction industry.
Objective B.2: Protection of historic and cultural heritage from earthquakes
Strategy B.2.1. Technical information on the assessment of the earthquake safety of historic structures and their strengthening will be developed and disseminated.

Source: National Earthquake Strategy and Action Plan 2012-2023

The Strategy B.1.2. and B.1.3. further define the actions as follows:

Strategy B.1.2.

Action B.1.2.1. The number and typology of all buildings, particularly schools and hospitals, will be determined and a building identification system shall be developed.

Action B.1.2.2. With precedence placed on schools and hospitals, the vulnerability of existing buildings shall be determined and the relevant technology shall be put on a stable basis.

Action B.1.2.3. With priority placed on schools and hospitals seismic risk grouping for existing buildings shall be completed.

Action B.1.2.4. Priority shall be placed on retrofitting educational facilities, and ongoing work shall be accelerated.

Action B.1.2.5. Urban-scale damage prediction methods that take into account the construction practices of existing buildings shall be developed, and damageability models shall be refined on the basis of data collected following earthquakes.

Strategy B.1.3.

Action B.1.3.1. Priority areas for the design and construction of earthquake-resistant buildings shall be identified and relevant projects shall be encouraged and supported.

(3) Urban Transformation Law

1) Background of the Law

The concept of urban transformation / regeneration has been defined and mentioned legislation since 2004. Prior to this, there had been several urban transformation projects, particularly on lands where squatter settlements were located, without having any legislative changes. The historical background of property elations during the urbanization process of Turkey provides the basic idea about the urban development process and relations including such urban transformation processes. To sum up briefly, until 2000s, there had been several approaches on urban regeneration of inner-city areas. One of them is the transformation of a single building by contractors or landowners. This was realized through the demolition of existing buildings and reconstruction of new ones on the same land in accordance with the limits of right of development plan decisions on those lands. The other approach is the intervention on inner cities by central or local governmental units through the regeneration of urban fabric such as opening new boulevards, squares and inner-city roads. The major aim of such projects was for the beautification of cities. The third approach is urban transformation processes after the implication of renewal plans through the help of amnesty laws for squatter areas in order to create regular and healthy living environments for settlements. In accordance with the regulations and Law No. 2805 (1983) and No. 2981 (1984), respectively, squatter settlements have been transformed into apartment houses (high-rise development), such as four-story buildings, and legalized by several development rights. A maximum of 400 m^2 building lots were defined in the renewal plans. However, after the 1990s, larger areas including building blocks rather than single building lots were preferred for urban transformation processes.

After 2000, several laws have been in action until the Law 6306 in 2012 was enacted. The first legislation regarding urban regeneration and transformation was the Law 5104 for Northern Entrance of Ankara in 2004. In order to improve the physical structure, rehabilitation of environmental assets for livable settlements, a renewal plan that brings new sets of development rights was prepared for this specific area. Therefore, property owners and municipal government negotiated and reached a concession that, the properties were to be distributed based on mutual agreement. Following this, Law 5366 in 2005 was enacted for the regeneration or renewal of heritage sites and their associated protection zones. During the implementation process of regeneration projects, expropriation can be possible in some cases if there is public interest. With the help of Article 73 of Law 5393 enacted in the same year, the municipal law was changed, which allowed the municipal councils to determine the boundaries of such project areas at a minimum of 5 ha. However, the municipalities have no right to expropriate such areas. Therefore, there should be a total agreement within the parties concerned. Moreover, in 2010, another amendment on the Municipal Law no. 5998 was made, in which the size of the project area has been revised to a minimum of 5 and a maximum of 500 ha, while a total of minimum 5 ha could also constitute single and separated parts but related to each other. In this case, the responsible authority has been determined as the metropolitan government rather than the municipalities[1]. The recent Law 6306, or the Law of Transformation of Areas under the Disaster Risks, was enacted in 2012. It is necessary to explain some major terms that are

1 Urban and Regional Planning in Turkey, Ö. Burcu Özdemir Sarı (2019)

defined and used in transformation projects in accordance with this law. "The aim of this law is to determine the procedures and principles regarding the rehabilitation, clearance, and renovation of urban areas and buildings prone to disaster." Three major definitions and their designation procedures are critical. The three major definitions are explained as follows:

- Risky area that is determined according to the Law so that the redevelopment of that area is implemented based on the procedures defined by the Law;
- Risky building that is determined for rebuilding / reconstruction; and
- Reserve area that is determined to be used as new transitional and residential areas.

The relevant authorities of the Law are as follows:

- MoEU
- AFAD
- Special Provincial Administrations
- Metropolitan Municipalities, Municipalities
- TOKI
- Institutions and Organizations authorized by MoEU

2) Risky Area

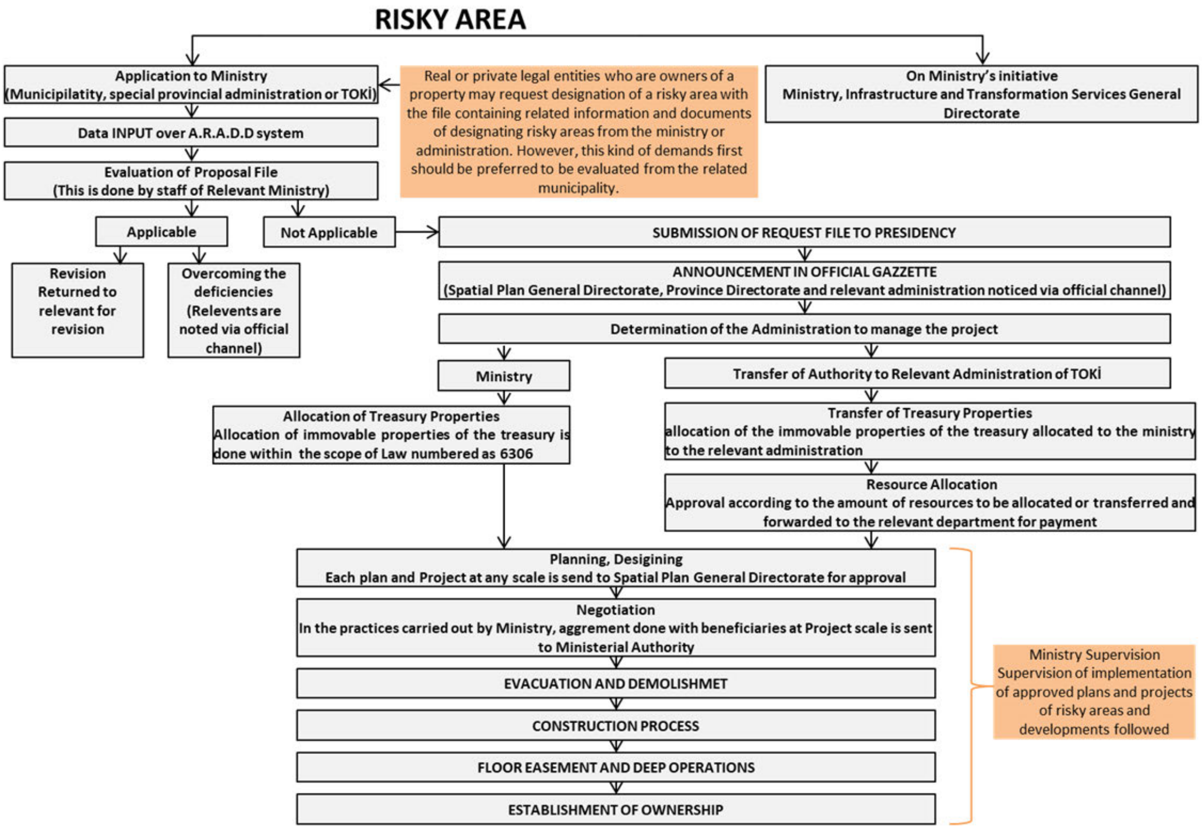
Risky area is designated based on at least one of three criteria shown below:

1. Areas that are determined by MoEU or local administration and decreed by Council of Ministers with the consent of AFAD upon the application of MoEU as posing risks on lives and properties due to the conditions of ground or structures.

2. Places where public order and safety are disturbed and affect daily routines; where there are inadequate infrastructural services; where the planning and structures are incompatible with development legislation; or where there are structures or infrastructures that are impaired.

3. Areas where 65% of the total number of buildings which are incompatible with development legislation are located; or areas where there are buildings that were constructed without construction permit or buildings, or which have construction and living permits after they have been constructed. These areas might be determined as risky areas by the Decision of Parliament after receiving the application from MoEU. This is done in order to promote healthy and safe living environments consistent with the norms and standards as well as to ensure the provision of regular public services like health, education and transportation.

Before the Amendment in 2016, a total of 163 areas across the country had been determined and declared in Official Gazette based on the definition of risky area under the first category. Following the enactment of the Amendment Law in April 2016, a second category was added to the definition of risky area. Following these categories, any place is determined whether or not it is located in risky area or not based on preset conditions. A third category has been added by a new regulation that describes the changes to the Regulation of Law 6306 in October 2016. When the Cabinet of Ministers identifies an area as a risky area, the buildings in that area will be demolished and redeveloped by the related institution, private sector or TOKI.

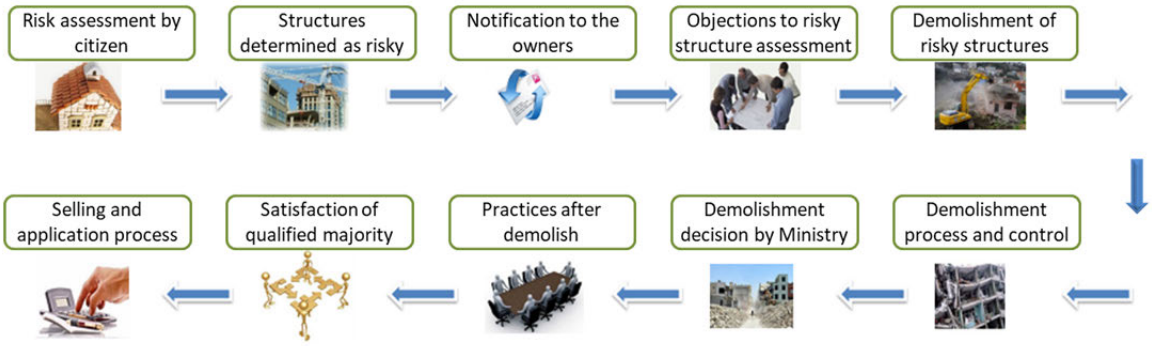


Source: MoEU, edited and translated by JICA Survey Team

Figure 2-2 Process of Determining Risky Areas

3) Risky Buildings

According to Article 2 of this Law, a risky building is any building found to be risky –either within or outside the risky area – based on scientific and technical data, which indicate that the building has completed its economic life, bears the risk of collapse, or suffers from heavy damage. This definition points out three types of risky buildings: (i) those that have completed their economic life, (ii) those that bear the risk of collapse and (iii) those that suffers from the risk of heavy damage. It is acceptable to have only one application from property / flat owners for launching the process of identification of risky buildings. That process can be made through consultation with licensed organizations and institutions.

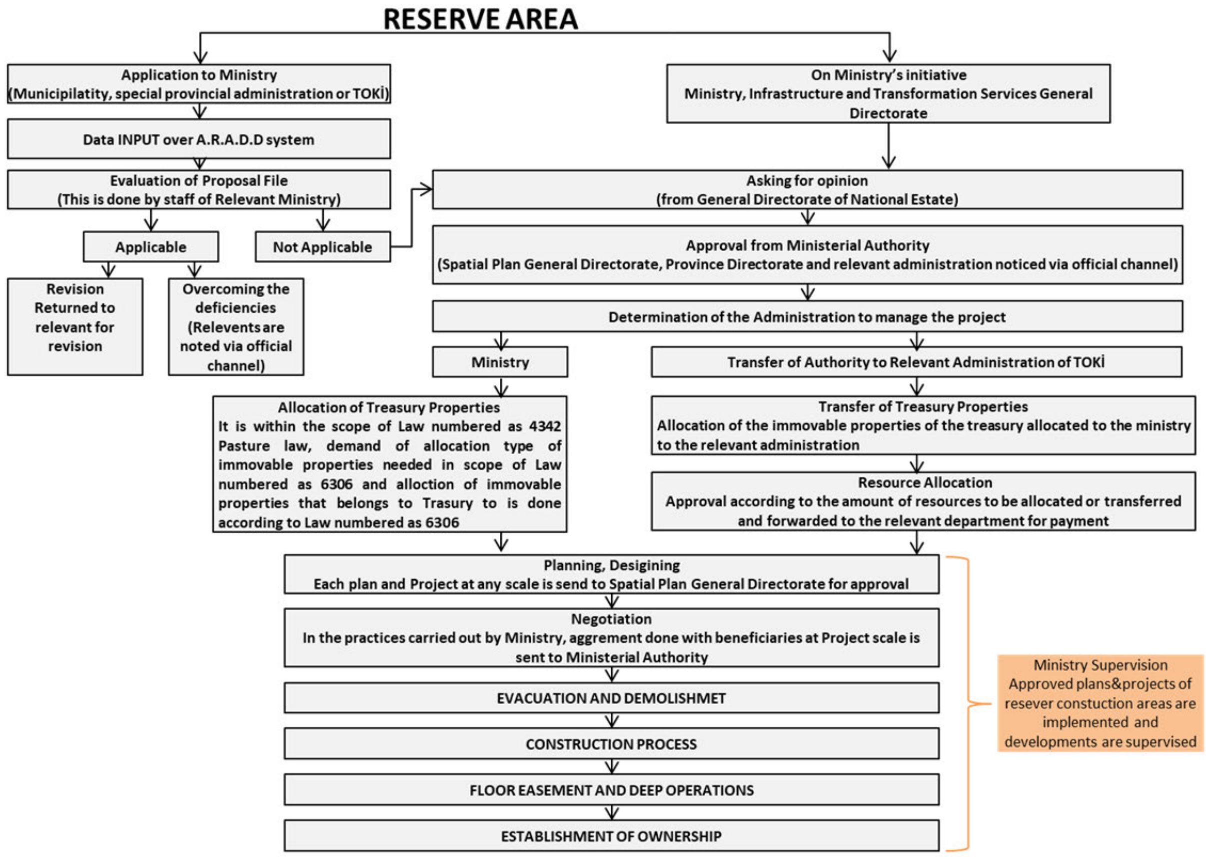


Source: MoEU, edited and translated by JICA Survey Team

Figure 2-3 Process of Demolition of Risky Buildings

4) Reserve Areas

The Cabinet of Ministers identifies reserve areas as areas for new developments. In order to eliminate disaster risk with the construction of new settlement areas, unpermitted, unauthorized and risky buildings will be cleared out. Although the definitions of risky buildings and risky areas have been explained in the constitution as written above, the determining parameters of such areas and buildings that can be done by either MoEU or certified institutions on behalf of property owners are not defined properly. As being the sole authorities, MoEU and the institutions have not shared the way of determination yet. It is also the same for the determination of reserve areas whose actual development rights are temporarily frozen whenever they are determined as reserve areas. If areas and/or immovable that belong to treasury are found as risky or determined as reserve areas for new development, their ownership has to be transferred to MoEU.



Source: MoEU, edited and translated by JICA Survey Team

Figure 2-4 Process of Determining Reserve Areas

5) Implementation Progress of Urban Transformation Projects

According to the information from MoEU as of December 23rd 2019, the implementation progress of risky buildings is shown in Table 2-2.

Table 2-3 Implementation Progress of Risky Buildings

Identification		Progress				
Building Basis						
Number of risky buildings identified		Number of risky buildings demolished		Number of retrofitted risky buildings		Progress ratio
195,932		164,001		34		83.7%
Unit Basis						
Number of housing units identified	Number of workplace unit identified	Number of housing units demolished	Number of workplace units demolished	Number of retrofitted housing units	Number of retrofitted workplace units	Progress ratio
548,222	80,119	453,032	58,461	203	243	81.5%
Total number of unitsidentified		Total number of units demolished		Total number of retrofitted units		
628,341		511,493		446		

Source: MoEU

A total of 195,932 buildings (628,341 housing units and workplace units) were identified as risky buildings. Regarding the breakdown of seismic retrofit and the implementation of the demolition of risky buildings as shown in Table 2-2, 99.98% of buildings designated as risky buildings has been demolished.

Moreover, a total of 241 risky areas with a size of approximately 12,450 ha were identified in 53 provinces, and areas of approximately 46,000 ha in 48 provinces were determined as reserve areas to be used as new settlement areas.

These transformation implementations are carried out by the delegated Municipalities and TOKİ presidency, with technical and financial support provided by MoEU.

2.3 Seismic Resilience Status

(1) Status of Hospital Building

According to MoH, 72% of the hospital buildings in Turkey (ratio based on the floor areas) are earthquake-resilient as of December 2018 in compliance with the 2007 Turkish seismic code.

Table 2-4 Seismic Resilience Status of Hospital Buildings as of December 2018

Turkey nationwide	Building	m^2	Ratio %
A) Earthquake-Resistant Structures as of December 2018	**3,493**	**13,043,831**	**72%**
A.1) Retrofitted structures after performing earthquake analysis	242	666,117	4%
A.2) Structures on which retrofitting is NOT necessary after performing earthquake analysis	55	226,352	1%
A.3) Structures constructed based on 2007 Earthquake Regulation, so earthquake analysis is not needed	3,196	12,151,362	67%
B) Structures that Should Become Earthquake-Resistant as of December 2018	**2,094**	**5,111,381**	**28%**
B.1) Structures with retrofitting that become qualified in compliance with the 2007 Earthquake Regulation	767	1,965,473	11%
B.2) Structures in which retrofitting is not appropriate and reconstruction is necessary	1,327	3,145,908	17%
Total	**5,587**	**18,155,212**	**100%**

Source: MoH

Out of remaining 2,094 building structures that should become earthquake-resistant, 63% or 1,327 structures are to be reconstructed. There are usually more buildings to be retrofitted than reconstructed. The reconstruction rate for hospital buildings are much higher due to the fact that, driven by the evolving health technology, it is easier for hospitals to comply with international functional standards to meet modern health service and infrastructure requirements. Some hospital buildings with outdated floor plans are reconstructed rather than retrofitted. In some cases, retrofitted hospital buildings no longer serve medical purposes and are only for office use.

MoH also aims to use advanced technology, i.e. seismic isolation, for hospitals that have more than 100 beds and are located in high seismic hazard zones, i.e. Zone 1 and Zone 2.

It should be noted that the construction and operation of hospitals is one of the most successful areas in attracting Public-Private Partnership (PPP) investment. Nearly 45-50% of the construction (40,000 beds out of total 80,000-90,000) has been covered by PPP projects since 2012 according to the MoH.

(2) Status of School Building

1) Overview of School in Turkey

According to the education statistics available on the website of the Turkish Statistical Institute[2], there are approximately 90,000 schools for formal education of Turkey in educational year 2017-2018 (see Table 2-5). Total number of schools excluding pre-primary education is about 60,000 schools.

Table 2-5 Statistics for Formal Education in Turkey (Educational Year 2017-2018)

		Number of Schools	Number of Students	Schooling Ratio (%)
Pre-primary education		31,246	1,501,088	38.5
Primary education	Primary school	24,967	5,104,599	91.5
	Junior High School	18,745	5,590,134	94.5
secondary education		11,783	5,689,427	83.6
Higher education		3,827	7,010,598	45.6
TOTAL		**90,568**		

Source: JICA Survey Team based on data from Turkish Statistical Institute

The current primary and secondary education system in Turkey consists of 4 years of first-level primary education, 4 years of second-level primary education and 4 years of secondary education (4+4+4). There is a constant lack of school capacity due to steep increase in younger population as well as reception of Syrian refugees. Therefore, a large number of schools are operating in double shifts in order to accommodate the needs. This often causes a problem when implementing the seismic strengthening work, since the school building to be retrofitted needs to be vacant during the work, and the students and teachers have to be relocated to another school that can accommodate them. There are areas in which the school's capacity is saturated and there is no room to accommodate additional students and teachers.

During the site visits of JICA Survey Team to the schools in Bursa and Izmir, some school heads expressed strong interest in advanced retrofit technology that enables retrofitting while continuing the use of class rooms, termed as "INAGARASEKOU", which means "implementing retrofit works while staying (in the building)" in Japanese.

2 Turkish Statistical Institute: http://www.turkstat.gov.tr/UstMenu.do?metod=kategorist

MoNE has performed seismic assessments of 4,500 schools, and results showed that about 5% (250 schools) do not need any work, 20% (900 schools) require reconstruction and 75% (3,350 schools) need retrofitting. MoNE aims to improve the seismic performance of 18,000 vulnerable schools within the next decade.

The World Bank is currently launching the "Disaster Risk Management in Schools Project" for complementing MoNE's investment cycle to reduce vulnerable schools in the country. A total of 700 schools are expected to be retrofitted or reconstructed using World Bank loan in two phases.

In the past, under the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP), 784 school buildings were retrofitted and 312 school buildings were reconstructed, as of 2018, out of total 1,352 public school buildings constructed in Istanbul prior to 1998. In this case, about 19% was judged safe without any need for upgrade work, 23% was reconstructed and 58% was retrofitted.

2) Strategy for Resilient School Building

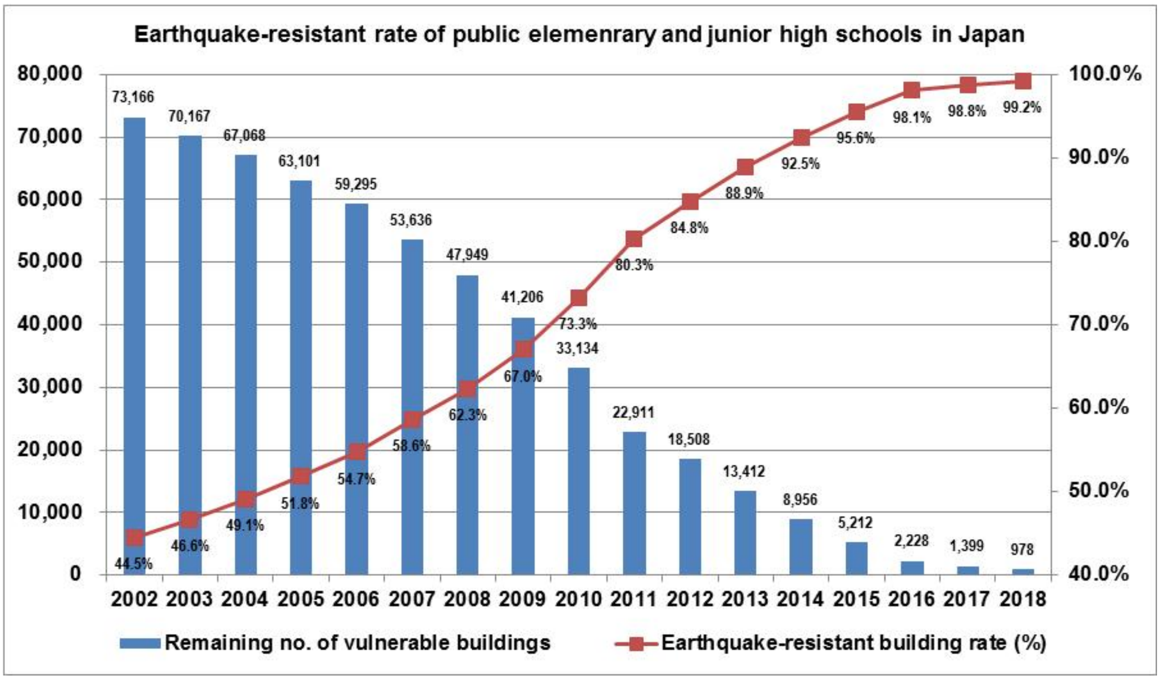
The "National Earthquake Strategy and Action Plan 2012-2023" gives top priority to the retrofitting of educational facilities in Turkey and to accelerate the retrofit works (see Table 2-6). Further, the country's Disaster and Emergency Management Director-General – speaking at the formal launch of the Worldwide Initiative for Safe Schools (WISS) during the World Conference on DRR in Sendai in 2015 – stated, "Turkey pledges that by 2018, all schools in Turkey will be safe learning facilities." (https://www.unisdr.org/archive/43110).

Table 2-6 Action for Retrofitting Educational Facilities
(National Earthquake Strategy and Action Plan)

Action B.1.2.4. Priority shall be placed on retrofitting educational facilities and ongoing work shall be accelerated. Educational facilities that are currently undergoing strengthening shall be preferentially completed. Work shall be started immediately for other educational facilities in the country that must be strengthened.		
Responsible Organization	**Associated Organization**	**Realization Period**
MoNE	YÖK, Relevant Governmental Institutions, Governorates, Universities, Private Sector, Municipalities	2012-2017

Source: National Earthquake Strategy and Action Plan 2012-2023

However, this appears to be extremely challenging in comparison to the track record in Japan. The improvement of seismic performance of vulnerable buildings designed and constructed based on the older seismic codes became an urgent issue after the 1995 Kobe Earthquake, where most of the victims' deaths were caused by collapsed buildings. The Government of Japan immediately formulated the "Act on Promotion of the Earthquake-Proof Retrofit of Buildings" and promoted the strengthening of the buildings, giving high priority to educational facilities. The rate of earthquake-resistant school buildings (public elementary and junior high school) exceeded 95% in 2015, 20 years after the formulation of the Act. During 2002 and 2015, 5,000 school buildings were reconstructed and retrofitted annually on average (i.e. 25,000 school buildings every 5 year).



Source: JICA Survey Team

Figure 2-5 Earthquake-Resistant Rate of Public Elementary and Junior High School Buildings in Japan

As described, MoNE aims to improve the seismic performance of 18,000 vulnerable schools within the next decade, which means 1,800 buildings have to be retrofitted or reconstructed annually.

MoNE, with support of Disaster Risk Management in Schools Project funded by World Bank is targeting to improve the seismic performance of 700 school buildings within the duration of 10 years. Additional financial support seems imminent in order to accelerate the achievement of 100% earthquake-resistant schools in Turkey in accordance with the National Earthquake Strategy and Action Plan.

(3) Status of Provincial and Municipal Office Buildings

It was not possible to get any specific information from MoEU on this subject and the current status could not be confirmed. It should be noted that improving seismic performance of public buildings is also within the scope of the Urban Transformation Law.

(4) Status of Apartments for Low- and Middle-Income Brackets

It is one of the major charges of TOKI, a government agency under MoEU (previously under the Prime Minister's Office), to provide mass housing for low- and middle-income individuals. TOKI also constructs public buildings such as school and hospital buildings under the request of relevant ministries. In both cases, TOKI constructs the buildings and hands them over to the owner.

The beneficiaries of the social type housing projects built on TOKI's own lands make their down payments at the beginning of the construction period and continue the monthly payments according to the single indexed and long-term repayment plans. For projects targeting low- and middle-income groups, the index is the public sector wage index. The repayment terms of TOKI are determined as 8 to 20 years depending on the financial means of the target groups. Implementations of projects for impoverished groups are executed under the coordination of TOKI and the Ministry of Family, Labor and Social Services, while TOKI only undertakes the construction of houses in those projects.[3]

The low- and middle-income apartment buildings constructed by TOKI are therefore private properties. Improving the seismic performance of vulnerable private buildings is within the scope of the Urban Transformation Law.

TOKI is reportedly responsible only for new construction and not for retrofit. According to TOKI, retrofit is not necessary for TOKI's buildings since all buildings were constructed in accordance with the seismic code and hazard map.

2.4 Approach of Other Donors to School Building

(1) Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP)

1) Outline

The Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) is the World Bank-financed project with the objective to assist the Government of Turkey in improving the city of Istanbul's preparedness for potential earthquake by enhancing the institutional and technical capacity for disaster management and emergency response, strengthening critical public facilities for earthquake resistance, and supporting measures for better enforcement of building codes. The project was started in February 2006 and is planned to be completed in 2021.

ISMEP is composed of the following components:

- Component A: Enhancing Emergency Preparedness
- Component B: Seismic Risk Mitigation for Public Facilities
- Component C: Enforcement of Building Codes
- Component D: Project Management

3 Source: https://www.toki.gov.tr/en/housing-programs.html

The World Bank initially provided USD 400 million for the project and increased the budget to USD 550 million later.

Table 2-7 World Bank Financing for ISMEP (USD million)

Component	Total Estimate	Actual Cost (2015)
A: Enhancing Emergency Preparedness	107.9	78.7
B: Seismic Risk Mitigation for Public Facilities	392.8	440.8
C: Enforcement of Building Codes	6.4	6.7
D: Project Management	10.9	9.3
Contingency	33.0	0.0
Total	550.0	535.5

Source: World Bank, Project Performance Assessment Report, 2018

Table 2-8 Retrofits and Reconstruction Works for ISMEP with World Bank Financing

Facility Type	Retrofit (Buildings)	Reconstruction (Buildings)	Total (Buildings)
Schools	626	13	639
Hospitals	38	1	39
Polyclinics & Health Centers	40	1	41
Administrative Buildings	39	1	40
Dormitories & Social Service Buildings	41	6	47
TOTAL	784	22	806

Source: World Bank, Project Performance Assessment Report, 2018

2) Contract Package

According to Procurement Plan (as of August 10, 2012), 79 packages of school retrofit work consisting of 505 buildings, and 7 packages of school reconstruction work consisting of 13 buildings were implemented. In case retrofit cost is less than 40% of reconstruction cost, the building will be retrofitted.

Table 2-9 Outline of Construction Contract Package

	Retrofit Work	Reconstruction Work
Package	79 packages	7 packages
Total Number of Buildings	505 buildings	13 buildings
Average Number of Building per Package	6.39 buildings	1.86 buildings
Total Contract Amount	EUR 159,083,797.16	EUR 27,608,663.99
Average Contract Amount per Package	EUR 2,013,718.95	EUR 3.944,094.86
Average Contract Amount per Building	EUR 315,017.42	EUR 2,123,743.38
Average Contract Period	206 days	280 days

Source: JICA Survey Team based on Procurement Plan, ISMEP

Moreover, there were 17 packages of consulting services for design and supervision works not only for schools, but also for other public facilities.

Table 2-10 Outline of Consultancy Services Contract Package

	Feasibility Study	Design	Construction Supervision	Design / Construction Supervision
Packages	3 packages	4 packages	4 packages	6 packages
Total Contract Amount	EUR 3,133,776.25	EUR 6,115,620.80	EUR 5,047,001.57	EUR 7,396,410.00
Average Contract Amount per Package	EUR 1,044,592.08	EUR 1,528,905.20	EUR 1,261,750.39	EUR 1,232,735.00
Average Contract Period	384 days	546 days	842 days	1,050 days

Source: JICA Survey Team based on Procurement Plan, ISMEP

3) Extension of Project

Strong project platform attracted substantial additional financing from other International Financial Institutions (IFIs), resulting to roughly 80% of program financing coming from other IFIs.

Table 2-11 Overall Financing for ISMEP (EUR million)

Financing Source	Committed Financing	Financing disbursed (January 2018)
World Bank	419.8	415.3
European Investment Bank	600.0	512.4
Council of Europe Development Bank (CEB)	500.0	406.6
Islamic Development Bank	247.9	146.1
Kreditanstalt für Wiederaufbau (KfW)	250.0	16.0
Total	2,017.7	1,496.5

Source: World Bank, Project Performance Assessment Report, 2018

Table 2-12 Overall Retrofits and Reconstruction Works for ISMEP (January 2018)

Type of Building	Work	ISMEP Total	
		Campus	Building
Schools	Retrofit	632	784
	Reconstruction	283	312
Hospitals	Retrofit	12	48
	Reconstruction	6	6
Polyclinic & Health Center	Retrofit	59	59
	Reconstruction	2	2
Dormitories	Retrofit	12	28
	Reconstruction	1	10
Social Service Buildings	Retrofit	8	16
	Reconstruction	2	6
Administrative Buildings	Retrofit	25	43
	Reconstruction	7	11
Total		1,049	1,325

Source: World Bank, Project Performance Assessment Report, 2018

As of December 2019, ISMEP has retrofitted and reconstructed 1,350 public buildings, including 1,150 school buildings (800 retrofitted and 350 reconstructed).

243 school buildings are left for retrofit or reconstruction and planned to be completed within the next three years with additional financing from IFIs.

(2) Disaster Risk Management in Schools Project

1) Outline

The World Bank concluded the loan agreement of USD 300 million for the Disaster Risk Management in Schools Project for Turkey on August 8, 2019. The objective of the project is to increase the safety of students, teachers, and staff in selected schools in high-risk seismic zones in Turkey. Procurement of individual consultants started in December 2019.

The project is comprised of the following three components:

- **Component 1: Improving seismic resilience of schools** will invest in:
    - o Preparation of a package of priority investments to support risk reduction in existing school buildings across the country's high-risk seismic zones through retrofitting and reconstruction;
    - o Civil works for retrofitting or reconstruction of priority education facilities;
    - o Conducting additional seismic risk assessments;
    - o Development of a national school retrofitting and reconstruction strategy which covers a forward-looking investment strategy and will be used in the next phases of the series; and
    - o Communications and awareness-raising activities.
- **Component 2: Enhancing institutional and technical capacity for safer schools** will enhance engineering and analytical capacity of the Construction and Real Estate Department (CRED) not only for smooth implementation of the first project in a of the series of projects (SoP). According to the World Bank, the detailed scope of work was not yet set in place, and the budget for the component 2 will be utilized as needed in a flexible manner.
- **Component 3: Project management** will focus on strengthening government's capacity in operations management and staff capacity. The following individual consultants will be employed under this component.
    - o Financial Management Expert
    - o Procurement Management Expert
    - o Monitoring and Evaluation Expert
    - o Environmental and Social Framework Expert
    - o Communication Expert

2) Project Cost Breakdown

Assumption for Cost Estimate

- Reconstruction Cost : TRY 2,400/m^2
- Retrofit Cost : TRY 900/m^2
- Reconstruction Area : 6,500 m^2 (primary school, 24 classrooms)
  6,500 m^2 (secondary school, 24 classrooms)
  4,000 m^2 (boarding facility, 100 beds)
- Retrofit Area : 2,500 m^2 (primary school, 24 classrooms)
  3,000 m^2 (secondary school, 24 classrooms)
  4,000 m^2 (boarding facility, 100 beds)
- Consulting Services Cost : 6% of Reconstruction / Retrofit Cost
- Furnishing and Equipment : TRY 700,000 / school (Reconstruction)
  TRY 700,000 / boarding facility (Reconstruction)
  TRY 250,000 / school (Retrofit)
  TRY 300,000 / boarding facility (Retrofit)

Table 2-13 Project Cost

USD 1.0 =TRY 5.68

No.	Item	Unit Cost		Q'ty	Total
		TRY	USD		USD
C1	**Improving Seismic Resilience of Schools**				
C1.1	Reconstruction				
C1.1.1	Primary Schools (24 Classrooms, 6,500m^2)				
	Construction Cost	15,000,000	2,640,845	25	66,021,127
	Bidding Docs, Design and SV	900,000	158,451	25	3,961,268
	Furnishing and Equipment	700,000	123,239	25	3,080,986
C1.1.2	Secondary School (24 Classrooms, 6,500m^2)				
	Construction Cost	15,000,000	2,640,845	20	52,816,901
	Bidding Docs, Design and SV	900,000	158,451	20	3,169,014
	Furnishing and Equipment	700,000	123,239	20	2,464,789
C1.1.3	Boarding House (100 beds, 4,000m^2)				
	Construction Cost	10,000,000	1,760,563	5	8,802,817
	Bidding Docs, Design and SV	600,000	105,634	5	528,169
	Furnishing and Equipment	700,000	123,239	5	616,197
	C.1.1 Total				141,461,268
C1.2	Retrofit				
C1.2.1	Primary School (2,500m^2)				
	Construction Cost	2,250,000	396,127	200	79,225,352
	Bidding Docs, Design and SV	112,500	19,806	200	3,961,268
	Furnishing and Equipment	250,000	44,014	200	8,802,817
C1.2.2	Secondary School (3,000m^2)				
	Construction Cost	2,700,000	475,352	90	42,781,690
	Bidding Docs, Design and SV	135,000	23,768	90	2,139,085
	Furnishing and Equipment	250,000	44,014	90	3,961,268
C1.2.3	Boarding House (100 beds, 4,000m^2)				
	Construction Cost	3,600,000	633,803	10	6,338,028
	Bidding Docs, Design and SV	180,000	31,690	10	316,901
	Furnishing and Equipment	300,000	52,817	10	528,169
	C1.2 Total				148,054,577

C1.3	Seismic Risk Evaluation				
C.1.3.1	Additional Seismic Evaluation and Design	45,000	7,923	100	792,254
	C1.3 Total				792,254
C1.4	Communication				
C1.4.1	Communication and Visibility Activities	-	-	-	1,441,901
	C1.4 Total				1,441,901
C1.5	Operation Cost				
	C1.5 Total				1,000,000
	C1 Total				**292,750,000**
C2	**Enhancing Institutional and Technical Capacity for Safer Schools**				
	C2 Total				**1,500,000**
C3	**Project Management**				
	C3 Total				**5,000,000**
	Component Total				**299,250,000**
	Pre-Commission Cost (0.25%)				750,000
	Grand Total				**300,000,000**

Total Cost of Consulting Services	:	USD 14,867,959
Total Cost of Individual Consultant	:	USD 5,000,000
Total Cost of Reconstruction / Retrofit	:	USD 255,985,915
Total Cost of Furnishing and Equipment	:	USD 19,454,225

Source: JICA Survey Team based on Cost-Benefit Analysis, World Bank

(3) The EU Facility for Refugees in Turkey (FRiT)

Turkey currently hosts over 4 million refugees, and the European Union (EU) is committed to assist Turkey in dealing with this challenge through “the EU Facility for Refugees in Turkey (FRiT).” FRiT manages EUR 6 billion and its main focus areas are humanitarian assistance, education, health municipal infrastructure and socio-economic support.

According to CRED, EUR 575 million is allocated for school construction projects, among which EUR 150 million is managed by the World Bank and EUR 425 million is managed by KfW. Also EUR 40 million is planned to allocate for energy efficiency project in education sector. Procurement procedures of the World Bank and KfW are different: the World Bank applies for its own procurement procedure, and KfW applies for Turkish public procurement law.

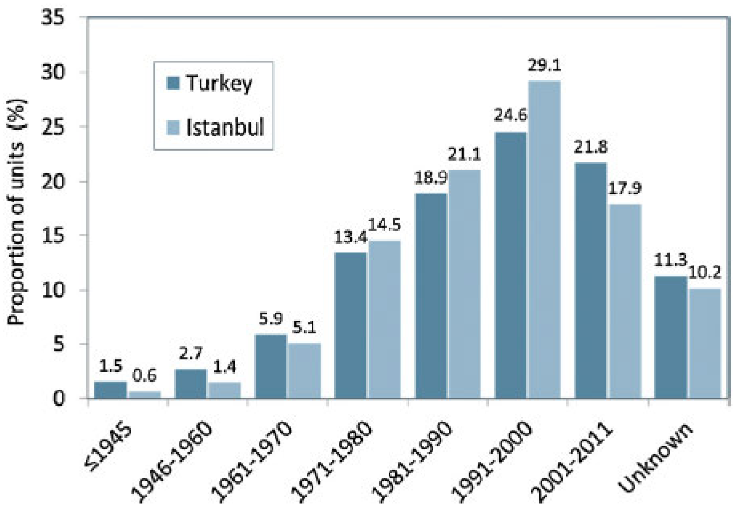
(4) European Bank for Reconstruction and Development (EBRD)

The European Bank for Reconstruction and Development (EBRD) has introduced a new energy efficiency finance model for the public sector in Turkey. According to CRED, EBRD is planning to implement the project for retrofit and renovation of schools for energy efficiency, of which detailed scope of works and target areas are not confirmed yet.

2.5 Level of Retrofit Technology in Turkey

(1) Characteristics and Challenges

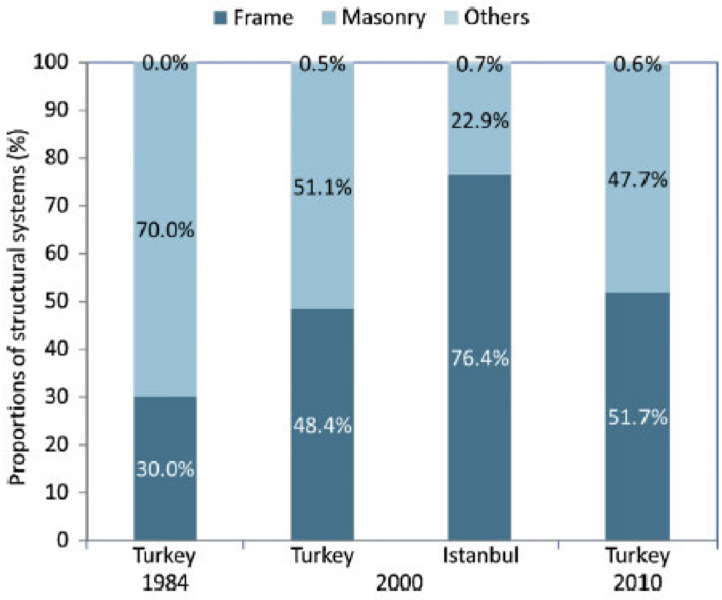
One of the major challenges in Turkey is the large number of building stocks that require seismic upgrade. The building stocks in Turkey are highly vulnerable, since most buildings were constructed before the major revision of the seismic code in 1998 (see Figure 2-6).



Source: Turkey's Grand Challenge: Disaster-Proof Building Inventory Within 20 Years, O. Gunes, 2015

Figure 2-6 Proportions of Occupancy Units by the Construction Year of Buildings in Istanbul and Turkey

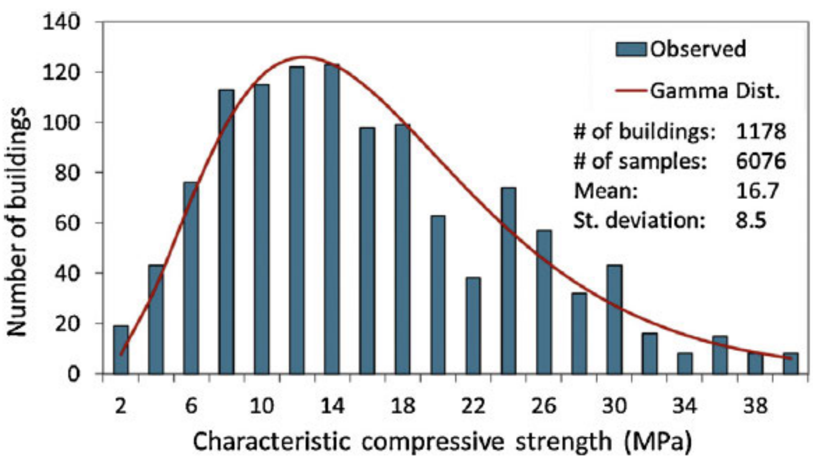
The buildings dominantly consist of RC frame and masonry structures (see Figure 2-7). Most public buildings appear to have RC structures, while a large number of residential buildings with typically a single floor, i.e. houses, flats etc., tend to be masonry structures. During our site survey of the school buildings, we saw some old buildings with masonry structures, which are normally not easy and cost-effective to retrofit and thus required to be reconstructed.



Source: Turkey's Grand Challenge: Disaster-Proof Building Inventory Within 20 years, O. Gunes, 2015

Figure 2-7 Distribution of Buildings in Istanbul and Turkey by Their Structural System

The older buildings tend to have very low concrete strength, in addition to the lower seismic capacity due to lower design seismic forces. The newer codes specify a minimum compressive strength of 20 MPa for concrete for buildings in seismic zones, while the concrete of older buildings often have less than 10MPa (see Figure 2-8). The low strength or quality may be due to the use of site-mixed concrete whose quality is much more difficult to control compared to ready-mixed concrete.



Source: Turkey's grand challenge: Disaster-proof building inventory within 20 years, O. Gunes, 2015

Figure 2-8 Distribution of Concrete Strength in Buildings Constructed Before 2000 (Mostly with Site-Mixed Concrete) in Istanbul and Surrounding Cities

The low strength concrete, together with the poor material characteristics and poor arrangement details of steel reinforcing, results in significant lack of seismic capacity for satisfying the requirements of the latest code. The seismic retrofit works are thus required in all and every part of the structure, especially when conventional retrofit methods are used.

(2) Conventional Retrofit Methods

The most widely used retrofit methods in Turkey are the conventional types such as adding RC shear walls and jacketing RC columns and beams. These methods are typically used in combination depending on the characteristics of the subjected building structures (please see Chapter 3 for further technical details of these methods). The use of steel elements such as steel bracing is less popular in Turkey due to the higher cost compared to RC elements. The implementation of these conventional retrofit methods seems appropriate and effective.

Table 2-14 Conventional Seismic Retrofit Methods Used in Turkey

Retrofit by Addition of RC Shear Walls

Retrofit by Jacketing of RC Column and Beam – RC Jacketing

Retrofit by Jacketing of RC Column and Beam – Steel Jacketing


Retrofit by Jacketing of RC Column and Beam – Fiber Sheet Jacketing

Source: Study on Promotion of Japanese Technologies for Seismic Retrofit in Turkey,

(3) New or Advanced Retrofit Technologies

The use of new or advanced retrofit technologies is limited, most likely due to cost competitiveness. There are only a few examples in which public buildings, such as hospitals and airport buildings, were retrofitted using seismic isolation systems. There is also an industrial facility that was retrofitted using seismic damping devices.

The structural designs of these advanced methods were performed based on international codes and standards, e.g. US Codes or Eurocodes, since the design processes for these methods have not been established in Turkey. The design requirements for seismic isolation system have been incorporated in the 2018 Seismic Code.

MoH intends to apply seismic isolation systems for the new construction or reconstruction of hospital buildings in high seismic hazard zones.

(4) Site Survey of Schools in Bursa and Izmir

The purpose of the survey was to get a general idea about the design and construction of the school buildings in Turkey, as well as general practices of seismic retrofit works. The survey also aimed to understand the implementation of disaster education at school, and the perception of the school staff and stakeholders toward seismic retrofit of the school building. The methodology of the site survey was as follows.

<Visual Check of School Building>

- To check plan and elevation configurations, structural type and characteristics of school buildings
- To check construction quality, maintenance conditions and implemented retrofit works

<Interview with the School Head>

- To understand views and perception of school staff on seismic retrofit and reconstruction
- To hear opinions about continuing the class during implementation of retrofit works
- To understand current status of disaster education

- To understand views and perception of school staff on utilizing school buildings as temporary evacuation shelter

MoNE selected the schools in Bursa and Izmir so that the JICA Survey Team could perform the site survey. The itinerary of the visit and the outline of the visited schools are summarized in Table 2-14.

Table 2-15 Outline of School Visits

Visit Date	Province	District	School Type	Status
10/7/2019	Bursa	Osmangazi	High School	Retrofitted
			Junior High School	Under construction
10/8/2019	Bursa	Osmangazi	High School	Seismic assessment performed
		Inegol	Primary School	Retrofitted
			High School	Seismic assessment performed
10/9/2019	Bursa	Yildirim	Primary School	Seismic assessment performed
			High School	Seismic assessment performed
		Nilufer	High School	Retrofitted
10/10/2019	Bursa	Osmangazi	Junior High School	Seismic assessment performed
	Izmir	Konak	High School	Historical School Building (National Monument)
10/11/2019	Izmir	Bornova	Special Education School	Retrofitted
			High School	Seismic assessment performed
			Technical & Vocational High School	Seismic assessment performed
			Primary School	Under construction
10/12/2019	Izmir	Bornova	Junior High School	Seismic assessment performed
			Primary School	Seismic assessment performed
		Konak	Vocational & Technical High School	Retrofitted

Source: JICA Survey Team

The survey includes 17 schools in total, and:

- 9 schools in Bursa and 8 Schools in Izmir
- 4 elementary schools, 3 junior high schools, 9 high schools and 1 school for special education
- 5 retrofitted schools, 2 schools under construction, 9 schools where seismic assessment were completed and 1 historical school (building designated as national monument)

Major findings of the survey are summarized below.

<Outline of School and Education System>

- The primary and secondary education system of Turkey is “4-4-4”, i.e. 4 years in elementary school, 4 years in junior high school and 4 years in high school.

- Some schools operate in double shifts due to lack of school capacity, e.g. first shift is from 7:30 to 13:30 and second shift is from 13:30 to 19:10.

< Retrofit or Reconstruction of School Building>

- Typical seismic retrofit methods used for the school buildings are conventional types, such as adding RC shear walls, increasing the size of columns and beams and strengthening of foundations. The addition of RC shear walls is done in a balanced manner in order to avoid introducing structural irregularity which may cause unfavorable concentration of seismic forces to a particular part of the structure. In some cases, strengthening of foundation system is implemented together with the strengthening of the upper structure. In general, the seismic retrofit works appear to be done in an adequate manner.

- There is generally no preference between reconstruction and retrofit among the school staff. Most school heads expressed their willingness to follow the decision that would be made by the central government.
- The school buildings appear well-maintained due to periodic maintenance and renovation works. Having said that, upgrade of building equipment and renovation for satisfying the current fire regulations are still necessary. Renovation and upgrade works are thus required when implementing seismic retrofit works.
- There were three major strategies that allowed the continuation of classes during retrofit works performed in the past: 1) completing the works during the three-month summer vacation period; 2) avoiding interrupting classes by implementing the works block by block; and 3) moving the students to other schools during the works.
    - The first option is limited to small size retrofit works with fewer places to be retrofitted, since the typical duration of seismic retrofit is about 8 to 10 months.
    - The second option is feasible only if there are enough rooms in the school building. Many schools in Turkey are operating in double shifts, and thus are not optimal for this option.
    - The third option is most commonly applied. Typically, students are moved to a nearby school operating in a single shift, and the classes continue as an additional shift. However, some schools are in such a situation that all surrounding schools are already operating in double shifts and the capacity of the area is saturated. For schools in which conventional retrofit methods are difficult to apply, school staff members have expressed strong interest in the retrofit methods that can be done without interrupting the classes, such as the "Outer-Frame Retrofit Method." This method strengthens the structure by adding frames from the outside of the building and does not require any works inside the building.
- In the past, a typical floor plan of a school building is composed of two rectangular floors which formed skipped floors connected to a staircase in the middle (see photo below). The rectangular parts have corridors in the middle and classrooms on both sides. This type of structure is optimal for applying the Outer-frame Retrofit Method. There is also enough space to implement the retrofit works outside the building.

Photo: High School in Bursa

<Disaster Education in School / School as Temporary Evacuation Shelter>

- On October 8th, a training on Disaster Education was performed at a high school in Inegol district in Bursa by a Master Teacher certified by MoNE. The Master Teacher received training from another school in the same district and, according to the Master Teacher, there are 5 Master Teachers in the district.
- We could not find or meet the Master Teachers from other schools. However, most teachers had received training or attended a lecture on disaster risk management conducted by a lecturer dispatched from MoNE or AFAD. Disaster Education and training programs exist in schools, but school heads consider them insufficient, or in some cases, they are not even aware of such training programs.
- Disaster drills are typically performed twice a year. AFAD and the fire department give lectures and demonstrations on these occasions.
- Most schools are open to the idea of utilizing school buildings as temporary evacuation shelters. School heads mentioned a story in which many people evacuated to schools during the 1999 Kocaeli earthquake. Some schools are difficult to be used as temporary evacuation shelters due to space limitation and lack of necessary equipment.
- Regarding the participation of teachers in the operation of temporary evacuation shelters, teachers remained at school and provided the utmost support beyond their responsibilities during the recent earthquake in Istanbul. Most school heads mentioned the necessity to train the teachers if the schools would be used as temporary evacuation shelters.

Chapter 3 Seismic Standard

3.1 Turkish Building Earthquake Code 2018

The new Turkish Building Earthquake Code, *Principles for Design of Buildings Under Earthquake Effect,* is a comprehensive revision of the previous code in 2007. This latest earthquake code was published in 2018 and was officially enacted on January 1, 2019. Alongside the revision, new contents on high-rise, seismically isolated, cold-formed steel and wooden buildings were added to the code.

(1) Development History of Seismic Design Code in Turkey

The first building seismic design code was published in 1944 based on experience from the 1939 Erzincan earthquake (M7.9), in which more than 30,000 people died and more than 116,000 buildings were damaged. Other destructive earthquakes – such as Varto earthquake (M6.9, 1996); Gediz earthquake (M7.2 1970); Lice earthquake (M6.9, 1975); Caldiran earthquake (M7.2, 1976); Kocaeli earthquake (M7.4, 1999); Duzce earthquake (M7.2, 1999) and Van earthquake (M7.2, 2011) – had led to the revisions of the code in 1949, 1953, 1962, 1968, 1975, 1998, 2007 and 2018, respectively, for enhancing building safety against earthquake. The 1968 revision introduced the response spectrum for seismic design; the 1998 revision adopted the new seismic hazard map based on seismic hazard analysis; and the 2007 revision introduced a new chapter for seismic assessment and rehabilitation of existing buildings. The 2018 revision uses the updated seismic hazard map and enhances the performance-based design. The history of seismic design code development is illustrated in Figure 2-1 and the seismic hazard map and seismic load (base shear) in different versions of seismic design code is shown in Table 3-1.

Table 3-1 Seismic Hazard Map and Seismic Load in Different Versions of Seismic Design Code

Year	Seismic Hazard Map	Base Shear Calculation
1944	NA	First seismic design code. The base shear is calculated by: V = C*W V: Base shear C: seismic coefficient (= 0.1 for whole country) W: weight of building
1945	First official seismic zonation map based on earthquake damage Zone 1: high seismic hazard Zone 2: less seismic hazard Zone 3: no seismic hazard	
1949		Revision of seismic coefficient C = 0.02 - 0.04 for Zone 1 C = 0.01 - 0.03 for Zone 2
1963	Revision of seismic hazard map using MSK intensity scale Zone 1: MSK >= VIII Zone 2: MSK VII – VIII Zone 3: MSK V – VII Zone 4: no seismic hazard	
1968		Response spectrum and importance factor were introduced for seismic design. $C = C_0*α*β*γ$ C_0: zone coefficient, = 0.06, 0.04 and 0.02 for Zone 1, 2 and 3 α: factor for soil condition, = 0.8 - 1.2 β: importance factor, = 1.0 and 1.5 γ: spectral shape
1972	Revision of seismic hazard map Zone 1: MSK >= IX Zone 2: MSK VIII Zone 3: MSK VII Zone 4: MSK <= VI Zone 5: no seismic hazard	
1975		Zone coefficient was increased and structure factor was introduced. $C = C_0*K*I*S$ C_0: zone coefficient, = 0.1, 0.08, 0.06 and 0.03 for Zone 1, 2, 3 and 4 K: factor for structure type, = 0.6 - 1.5 I: importance factor, = 1.0 and 1.5 S: combined coefficient for spectral shape and site condition, $= 1 / \|0.8+T-T_0\|$ T and T_0: the fundamental period of building and soil, respectively
1996	Seismic hazard map was created based on probabilistic seismic hazard analysis for PGA with a 475-year return period. Zone 1: PGA = 0.4 Zone 2: PGA = 0.3 Zone 3: PGA = 0.2 Zone 4: PGA = 0.1 Zone 5: no seismic hazard	

Year	Seismic Hazard Map	Base Shear Calculation
1997		Ultimate strength design was introduced. The latest concept for seismic design was included. $C = A_0*I*S(T) / R_a(T)$ A_0: zone coefficient, = 0.4, 0.3, 0.2 and 0.1 for Zone 1, 2, 3 and 4 I: importance factor, = 1.0 to 1.5 S(T): spectral shape, $S(T)_{max} = 2.5$ $R_a(T)$: response modification coefficient for different structure type
2007		Seismic assessment and rehabilitation of existing buildings were added.
2018	Revision of seismic hazard map by probabilistic seismic hazard analysis for PGA, acceleration response at 0.2 and 1.0 seconds for 43-year, 72-year, 475-year and 2475-year return periods.	
2018		Site specific response spectrum was calculated with acceleration response at 0.2 and 1.0 seconds. $C = S(T)*I / R_a(T)$ S(T): spectral acceleration I: importance factor, = 1.0 and 1.5 $R_a(T)$: response modification coefficient for different structure type

Source: JICA Survey Team

(2) Outline of Turkish Building Earthquake Code 2018

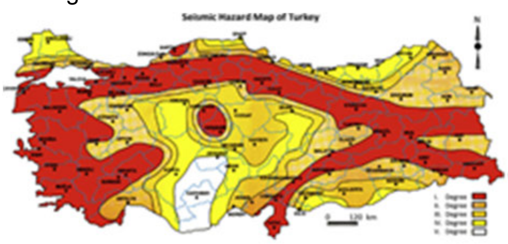
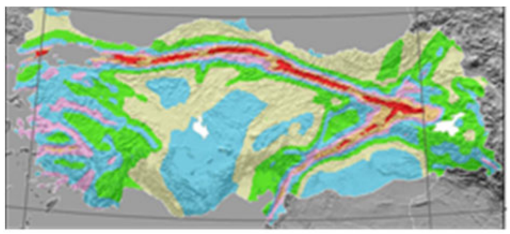
Turkish Building Earthquake Code 2018 consists of 17 chapters, stipulating the method for seismic load calculation and design approach for both new and existing buildings. The table of contents are:

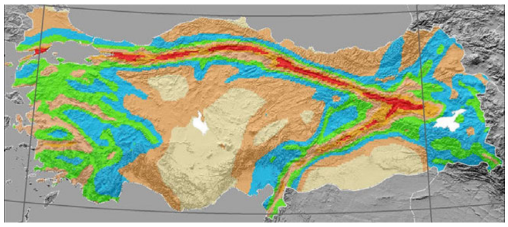
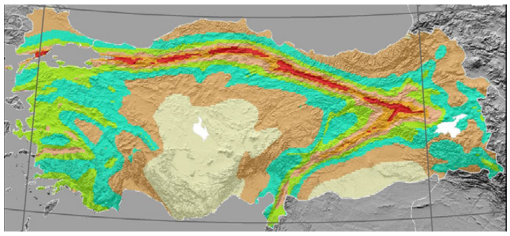
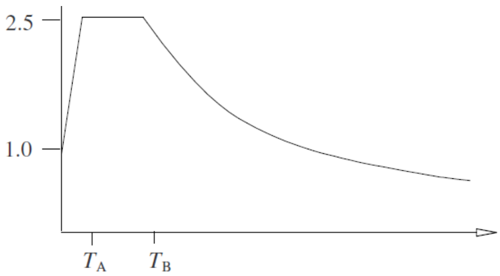
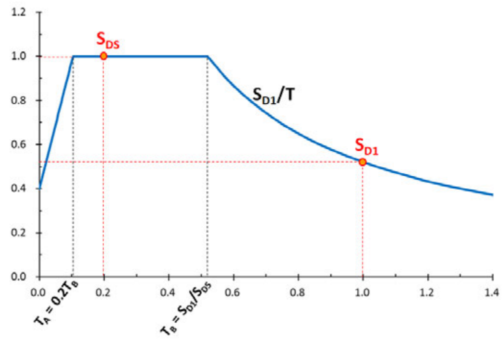
Chapter 1 General Requirements
Chapter 2 Earthquake Ground Motion
Chapter 3 General Principles for the Design and Evaluation of Buildings Under Earthquake Effect
Chapter 4 Analysis Requirements for Force-Based Design of Buildings Under Earthquake Effect
Chapter 5 Analysis Requirements for Displacement-Based Design of Buildings Under Earthquake Effect
Chapter 6 Design Principles of Non-Structural Building Elements Under Earthquake Effect
Chapter 7 Special Rules for the Design of Reinforced Concrete Building (Cast-in-Situ) Structural Systems Under Earthquake Effect
Chapter 8 Special Rules for the Design of Reinforced Concrete Building (Prefabricated) Structural Systems Under Earthquake Effect
Chapter 9 Special Rules for the Design of Structural Steel Building Structural Systems Under Earthquake Effect
Chapter 10 Special Rules for the Design of Cold-Formed Steel Building Structural Systems Under Earthquake Effect

Chapter 11	Special Rules for the Design of Masonry Building Structural Systems Under Earthquake Effect
Chapter 12	Special Rules for the Design of Wooden Building Structural Systems Under Earthquake Effect
Chapter 13	Special Rules for the Design of High-Rise Building Structural Systems Under Earthquake Effect
Chapter 14	Special Rules for the Design of Seismically-Isolated Building Structural Systems Under Earthquake Effect
Chapter 15	Special Rules for Evaluating and Reinforcement Design of Existing Building Systems under Earthquake Effect
Chapter 16	Special Rules for the Design of Foundation under Earthquake Effect
Chapter 17	Simplified Seısmıc Desıgn Rules For Regular Low Rıse Cast-in-Sıtu Reınforced Concrete Buıldıngs.

The main features of the 2018 Code are the introduction of the new seismic hazard map and the enhancement of performance-based design. The new code no longer uses seismic zones, but calculates site specific response spectrum directly from seismic hazard map. The earthquake ground motion level is given for the return period of 43, 72, 475 and 2475 years for different demand performance. The seismic load calculation and required performance levels are summarized in Table 3-2, with comparison to the 2007 Code.

Table 3-2 Comparison of Seismic Load Calculation and Required Performance Levels of Codes 2007 and 2018

Item	2007 Code	2018 Code
Hazard map	Seismic hazard is divided into 4 zones. The PGA is assigned for each zone 	Seismic hazard is given continuously, not in zones 

Item	2007 Code	2018 Code
Ground motion indicator	Only PGA is mapped	PGA, PGV and the spectral acceleration at 0.2 and 1.0 seconds are mapped  Hazard map of spectral acceleration at 0.2 seconds  Hazard map of spectral acceleration at 1.0 seconds Map source: S. Akkar, etc., 2018
Ground motion intensity level	Hazard map for 475-year return period only. The value of PGA for 2475-year return period is estimated using the formula: PGA|2475 = 1.5 * PGA|475	Hazard map is created for 43-year, 72-year, 475-year and 2475-year return periods, respectively.
Response spectrum	Spectral shape is specified for different site classification. Design response spectrum is calculated using the formula: Spectral acceleration = PGA * spectrum shape  where T_A and T_B are given for different site classification	Spectral acceleration at 0.2 (S_{DS}) and 1.0 (S_{D1}) seconds are used to determine the design response spectrum. 
Seismic performance required	Two performance levels: Immediate occupancy (IO) Life safety (LS)	Four performance levels: Uninterrupted Use (KK) Limited Damage (SH) Controlled Damage (KH) Collapse Prevention (GO)

Source: JICA Survey Team

The performance-based design is enhanced by introducing Building Usage Categories, Earthquake Design Classes Categories and Building Height Categories, which are shown in Table 3-3, Table 3-4 and Table 3-5, respectively.

Table 3-3 Building Usage Classes and Building Importance Factors

Building Usage Class	Intended Use of Building	Building Importance Factor (I)
BKS=1	**Buildings to be utilized after the earthquake and buildings, buildings for intensive use and long-term occupation, buildings for preserving valuable goods, buildings containing hazardous materials** a) Buildings required to be utilized immediately after the earthquake (i.e. hospitals; dispensaries; health wards; firefighting buildings and facilities; PTT (General Directorate of Post and Telegraph Organization) and other telecommunication facilities; transportation stations and terminals; power generation and distribution facilities; governorate, county and municipality administration buildings; first aid and emergency planning stations) b) Schools; other educational buildings and facilities; dormitories and hostels; military barracks; prisons; etc. c) Museums d) Buildings containing or storing toxic substances; explosive and flammable materials; etc.	1.5
BKS=2	**Buildings for intensive use but short-term occupation** Malls; sport facilities; cinemas; theater and concert halls; prayer buildings; etc.	1.2
BKS=3	**Other buildings** Buildings other than the above-defined buildings (i.e. residential and office buildings; hotels; building-like industrial structures; etc.)	1.0

Source: Turkish Building Earthquake Code 2018

Table 3-4 Earthquake Design Classes (DTS)

Design Spectral Acceleration Factor at Short Period for DD-2 Earthquake Ground Motion Level (S_{DS})	Building Usage Class (BKS)	
	BKS=1	BKS=2, 3
$S_{DS} \le 0.33$	DTS=4a	DTS=4
$0.33 < S_{DS} < 0.50$	DTS=3a	DTS=3
$0.50 < S_{DS} < 0.75$	DTS=2a	DTS=2
$S_{DS} \le 0.75$	DTS=1a	DTS=1

Source: Turkish Building Earthquake Code 2018

Table 3-5 Building Height Classes and Building Height Ranges

Building Height Class	Building Height Classes and Building Height Ranges Defined According to Earthquake Design Classes [m]		
	DTS=1,1a,2,2a	DTS=3,3a	DTS=4,4a
BYS = 1	$H_N > 70$	$H_N > 91$	$H_N > 105$
BYS = 2	$56 < H_N \le 70$	$70 < H_N \le 91$	$91 < H_N \le 105$
BYS = 3	$42 < H_N \le 56$	$56 < H_N \le 70$	$70 < H_N \le 91$
BYS = 4	$28 < H_N \le 42$	$42 < H_N \le 56$	
BYS = 5	$17.5 < H_N \le 28$	$28 < H_N \le 42$	
BYS = 6	$10.5 < H_N \le 17.5$	$17.5 < H_N \le 28$	
BYS = 7	$7 < H_N \le 10.5$	$10.5 < H_N \le 17.5$	
BYS = 8	$H_N \le 7$	$H_N \le 10.5$	

Source: Turkish Building Earthquake Code 2018

For each earthquake design category and ground motion level, the performance target and evaluation approach are defined as shown in Table 3-6.

Table 3-6 Performance Targets and Evaluation / Design Approaches

(a) New Cast-in-Place Concrete RC, Precast RC and Steel Buildings (Except High-Rise Buildings - BYS≥2)

Earthquake Ground Motion Level	DTS=1, 1a ,2 ,2a ,3 ,3a ,4 ,4a		DTS=1a, 2a	
	Normal Performance Target	Evaluation/Design Performance Approach	Advanced Performance Target	Evaluation/Design Performance Approach
DD-3	---	---	SH	ŞGDT
DD-2	KH	DGT (5)	KH	DGT (3,4)
DD-1	---	---	KH	ŞGDT

(b) New Buildings or Existing High-Rise Buildings (BYS = 1)

Earthquake Ground Motion Level	DTS=1, 2, 3, 3a, 4, 4a		DTS=1a, 2a	
	Normal Performance Target	Evaluation/Design Performance Approach	Advanced Performance Target	Evaluation/Design Performance Approach
DD-4	KK	DGT	---	---
DD-3	---	---	SH	ŞGDT
DD-2	KH	DGT (3)	KH	DGT (3,4)
DD-1	GÖ	ŞGDT	KH	ŞGDT

(c) Existing Cast-in-Place Concrete RC, Precast RC and Steel Buildings (Except High-Rise Buildings - BYS≥2)

Earthquake Ground Motion Level	DTS=1, 2, 3, 3a, 4, 4a		DTS=1a, 2a	
	Normal Performance Target	Evaluation/Design Performance Approach	Advanced Performance Target	Evaluation/Design Performance Approach
DD-3	---	---	SH	ŞGDT
DD-2	KH	ŞGDT	---	---
DD-1	---	---	KH	ŞGDT

Note: DGT: Strength-based calculation method; SGDT: Deformation-based calculation method

Source: Turkish Building Earthquake Code 2018

3.2 Seismic Evaluation

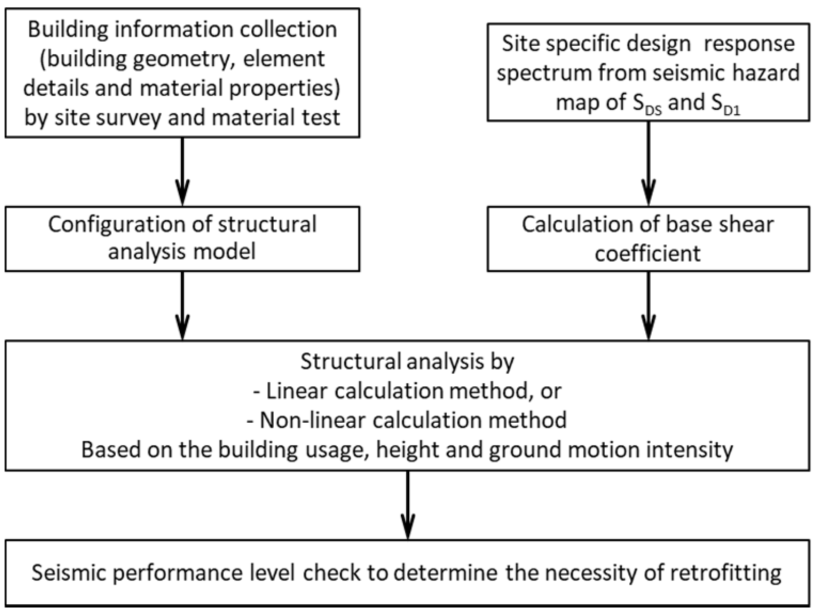
After the 1999 Kocaeli earthquake, which caused more than 17,000 deaths and more than 200,000 buildings severely damaged or collapsed, it has become widely recognized in Turkey that many of the existing buildings are vulnerable to earthquakes and are not strong enough to resist possible future earthquakes. Vulnerable buildings are mainly considered as either the buildings constructed before 1997 or those with poor construction quality. In this circumstance, a new chapter of Seismic Assessment and Rehabilitation of Existing Buildings was added to the 2007 version of the Building

Code. As a consequence, a project called ISMED – financed by the World Bank and other donors – was conducted for retrofitting of public buildings, mainly school buildings, in Istanbul. Moreover, MoH is promoting hospital safety with emphasis on reconstruction, and MoNE is preparing for school retrofitting. The Building Earthquake Code 2018 enhanced the contents of seismic evaluation and retrofitting.

In general, the seismic evaluation of existing building employs the same procedure as the seismic design of new buildings, but applies as-built drawings and actual concrete strength obtained through site survey and materials test. The evaluation requires 3-D structural analysis to check the capacity of each element (columns, beams and shear walls) of the structure in order to satisfy the required seismic performance level. There is no simplified method for seismic evaluation, such as the seismic capacity index of I_S used in Japan.

(1) Code 2018

The method for seismic evaluation is stipulated in *Chapter 15: Special Rules for Evaluating and Reinforcement Design of Existing Building Systems under Earthquake Effect* of the Code 2018. The general procedure for seismic evaluation is illustrated in Figure 3-1.



Source: JICA Survey Team

Figure 3-1 General Procedure for Seismic Evaluation

The major contents of seismic evaluation are shown below:

15.1 Scope

Define the general calculation rules for seismic evaluation and basic principles for retrofitting the design of existing buildings.

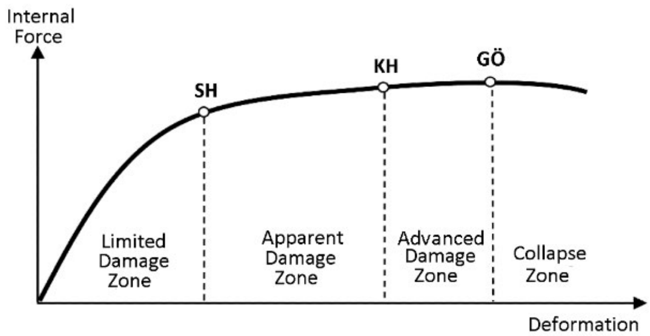
15.2 Data Collection from Existing Buildings

The information on structural geometry, element details, material properties, foundation system, soil properties, existing damages as well as previous modifications and repairs (if any) should be collected through site survey and sample test.

The data collection is categorized as Limited Information Level and Comprehensive Information Level according to the data sufficiency. The seismic capacity calculated with Comprehensive Information Level data is calculated, while the capacity with Limited Information Level data shall be reduced to 75%.

15.3 Damage Limits and Damage Zones at Structure Elements

The cross-section damage zone of an element is defined in Figure 3-2 according to its deformation.



Source: Turkish Building Earthquake Code 2018

Figure 3-2 Definition of Damage Zone of Cross-Section and Elements

15.4 General Principles and Rules Regarding Seismic Calculation

In general, the calculation of seismic performance of existing building follows the same procedure as that for seismic design of a new building, such as combining both horizontal and vertical seismic load and calculating for two directions individually. However, the actual material strength should be used.

15.5 Seismic Calculation with Linear Calculation Method

Linear Calculation Method (Equivalent Seismic Load Method) is used for strength-based seismic performance assessment.

15.6 Seismic Calculation with Non-Linear Calculation Method

Non-Linear Calculation Method (pushover method or analysis in time domain) is required for deformation-based seismic performance assessment.

15.7 Deformation Limits

The deformation (strain) limits for all structural members are defined.

15.8 Determination of Seismic Performance of Existing Buildings

The target of seismic performance and evaluation approach is defined (see Table 3-6 (c)).

15.9 Methods of Retrofitting of Buildings

The method of retrofitting includes the activities such as elimination of structure defect, installation of new elements, reduction of mass, improvement of seismic behavior of existing elements, ensuring continuity of load transfer, etc.

15.10 Methods of Retrofitting for RC Buildings

The frequently used techniques for retrofitting of RC buildings are:

- Jacketing of columns (RC jacketing, steel jacketing and fiber reinforced polymer jacketing)
- Increasing bending capacity of columns by increasing section dimensions
- Jacketing of beams (adding external stirrups, wrapping with fiber reinforced polymer)
- Retrofitting of partition walls
- Retrofitting of RC structure system with cast-in-place shear walls (adding RC shear walls in frame plane or adding RC shear walls adjacent to frame plane)
- Installation of new frames or RC system
- Reduction of mass of RC system

(2) ISMEP

ISMEP has retrofitted and reconstructed 1,350 public building, including 1,150 school buildings (800 retrofitted and 350 reconstructed). Seismic evaluation is required to decide if a building needs retrofit or not. The evaluation was carried out based on the *Turkish Earthquake Code: Specifications for Structures to be Built in Earthquake Areas 2007*, and the *Guidelines for Retrofitting of School and Hospital Buildings in Istanbul* prepared by the Technical Committee and international experts of ISMEP. The main procedure of seismic evaluation are as follows:

- Site survey on architectural, structural and foundation for the information of structural analysis;
- Take core samples and carry out materials testing based on the requirements of the Turkish earthquake code;
- Conduct geotechnical survey by borehole and soil tests;
- Identify significant faults around the site and estimate the ground acceleration for seismic evaluation;
- Review all available construction documents, including the original structural and architectural drawings and specifications and any significant modifications or upgrades;
- Identify structural defects, apparent detailing problems and structural configurations that cause unacceptable performance;
- Prepare a 3-D computer model
- Perform structural analysis following the method required by the Turkish earthquake code and create an acceptable 3-D (three dimensional) structural analysis program;
- Compare structure capacity with respect to seismic demand to decide the necessity of retrofit;

- Develop an inventory of critical non-structural components, including building utility equipment (power supply, HVAC systems), ceilings, elevators and fire protection systems; and
- Assess mechanical and electrical systems on operational deficiencies for renovation.

(3) MoNE

MoNE has performed the seismic evaluation for school buildings in high seismic-hazard area. The companies which conducted the evaluation for ISMEP also did the evaluation for MoNE. Also, since both evaluations were based on the Turkish Earthquake Code 2007, the evaluation method of MoNE is basically the same as that used in ISMEP.

3.3 Retrofit Design

Unlike in ordinary Japanese seismic evaluation and retrofit, the Turkish way of retrofit design follows the seismic code for new buildings against the seismic load similar to the one also stated in the code, so that the safety of retrofitted buildings is considered conceptually identical. One exception is that the actual strength of materials is used instead of nominal values, namely safety margin against seismic load is not given based on the safety factor of material, but based on the actual section and/or arrangement of reinforcement.

The detailed design procedure for retrofitting is described in the previous section. This section focuses mainly on the retrofit measures and the situations of ongoing projects in Turkey.

(1) Code 2018

The Earthquake Code 2018 provides one chapter for seismic evaluation and retrofit design for existing building systems under seismic effect. It is noted that for the building system, the code concretely describes the retrofit method, with some examples such as RC building construction, though there other types of buildings which include steel building, masonry building and others exist in Turkey. The reason for using RC buildings as an example is because majority of seismically-risky buildings are RC buildings due to having low quality construction materials.

This code is applicable to buildings damaged by earthquakes. For retrofitting of damaged buildings, the civil engineer in charge of the project decides on what extent the strength and stiffness of existing elements should be considered.

1) Outline of Retrofit

The concept of retrofit is categorized as follows:

- Elimination of faults that may cause seismic damage;

- Installation of new elements regarding seismic safety;
- Reduction of mass;
- Improvement of seismic behavior of existing elements; and
- Ensuring continuity of load transfer.

These concepts are similar to those employed in Japanese seismic retrofit design. Therefore, it can be presumed that the retrofit measures are adequate from the viewpoint of Japanese experience in retrofit, and some aspects of Japanese technology are also applicable if they are mentioned in the code.

a) Ensuring the safety of retrofitted building

It is required to check the seismic safety of retrofitted buildings, including newly installed elements such as shear walls, additional frames and so on. Though the safety of new elements are checked according to seismic evaluation procedure in Japan, the new elements shall be counterchecked in Turkey based on its procedure corresponding to new designs. The Turkish method of assessing the safety of retrofitted buildings is also adequate.

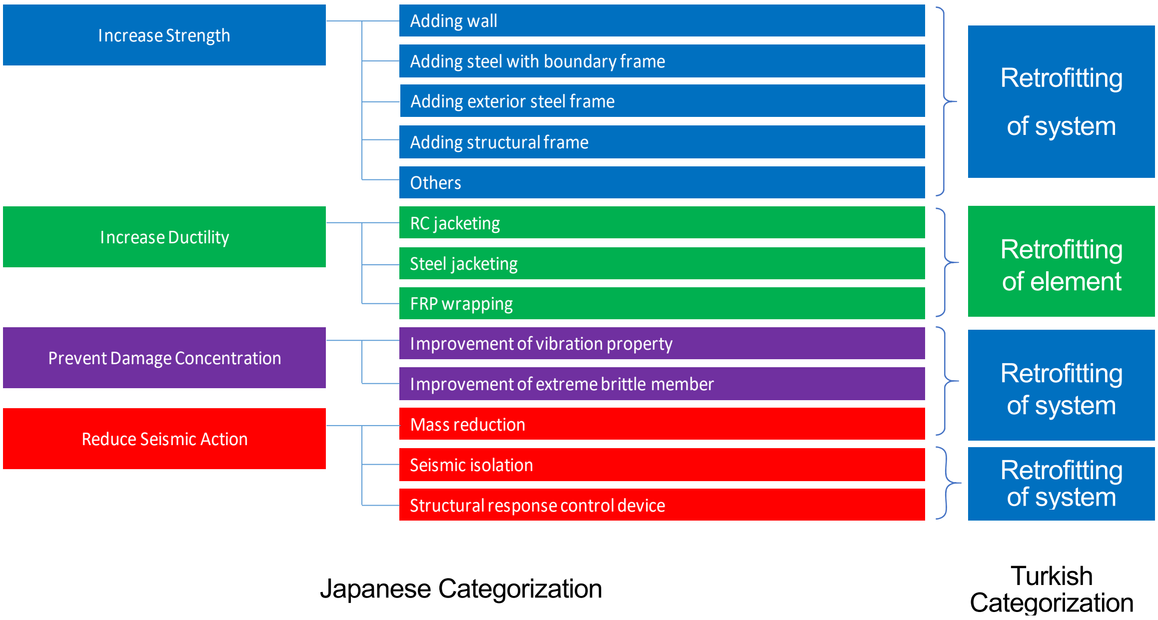
b) Types of retrofitting

In the code, retrofit work is categorized into two types as follows:

- Retrofit of elements, and
- Retrofit of system.

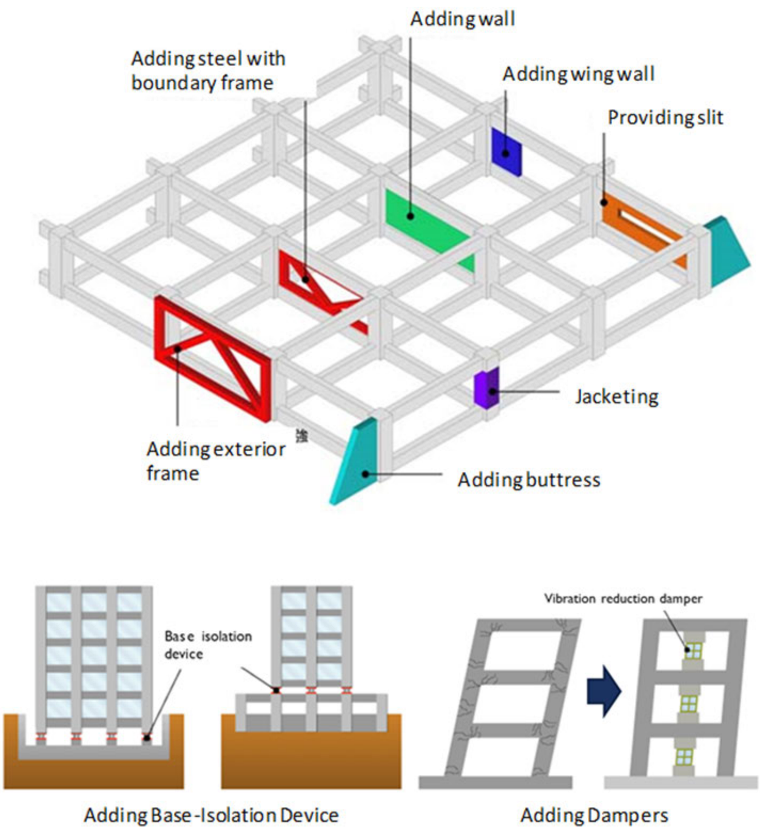
The former is improving the elements by means of adding reinforcement and / or jacketing so that the strength and deformation capacity will be increased, and the latter is improving the vibrating characteristics of buildings by means of adding new elements, reducing building mass, and so on. Though the terminologies used are different, the concept of categorization of retrofit work in Turkey corresponds to the Japanese categorization as shown in Figure 3-3.

For reference, typical retrofit works are illustrated in Figure 3-4, in which some of works are not conducted in Turkey due to the cost, quality of concrete and capacity of engineers. Particularly, the supposed advanced technologies, such as base isolation or vibration control including adding dampers, are not popular compared to Japan.



Source: JICA Survey Team

Figure 3-3 Categorization of Retrofit



Source: JICA Survey Team

Figure 3-4 Overview of Seismic Retrofit Work

2) Retrofit Method for RC Building

Code 2018 is focusing on the seismic retrofit of existing RC buildings, since the majority of buildings in Turkey is made of reinforced concrete and the requirement for retrofit is due to the low quality of materials used. In case of retrofit of buildings of other structural type or of employing other retrofit methods not described in this code, a review committee will assess if the retrofit is adequate or not. Therefore, it can be concluded there is a room to employ Japanese retrofit methods in the future if they are technically and economically acceptable.

Some concrete retrofit methods mentioned in the code are briefly explained below.

a) Jacketing of columns

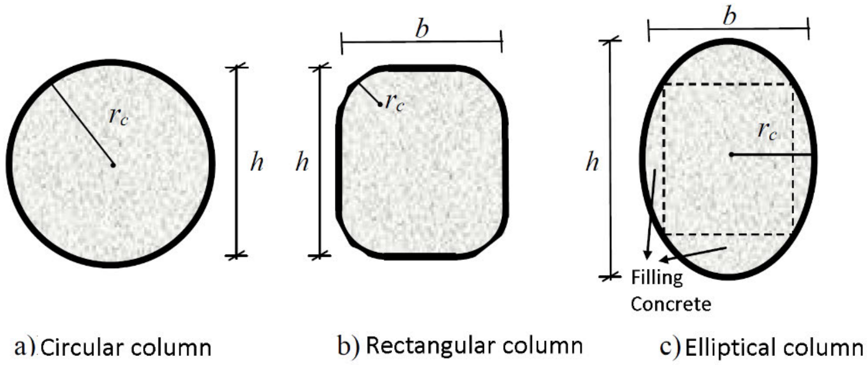
Jacketing of columns is a very popular method in Turkey as method of retrofit elements. Three materials to jacket existing columns – concrete, steel plate, and fiber reinforced polymer – are mentioned in the code. It is noted these three materials are also used in retrofit in Japan.

Jacketing with concrete can increase the shear and vertical bearing capacity with relatively low cost, and this method is often used in Turkey. However, this may reduce the floor area. It is noted the concrete jacketing does not increase the bending capacity of columns if the reinforcement is not adequately connected to the reinforcement of upper or lower floors by drilling the existing floor.

Jacketing with steel plate can increase the shear capacity, and will increase the bending capacity if the steel plate is duly connected to the slab and can transmit bending moment to upper / lower floors through the columns. It is noted that the vertical load-carrying capacity will not increase largely compared to concrete jacketing, since the sectional area of columns will not be largely increased. This method is not mainly used in Turkey because of its high cost.

Jacketing with fiber can increase shear, vertical bearing and ductility capacity. In order to prevent breaking the fiber, the section of columns may preferably be circular, elliptical or rectangular having rounding corners with 30mm radius at the smallest as illustrated in Figure 3-5.

In actual retrofit in Turkey, jacketing is often combined with adding shear walls, since the amount of building capacity to be increased is too large to be ensured by jacketing only.



Source: Turkish Building Earthquake Code 2018

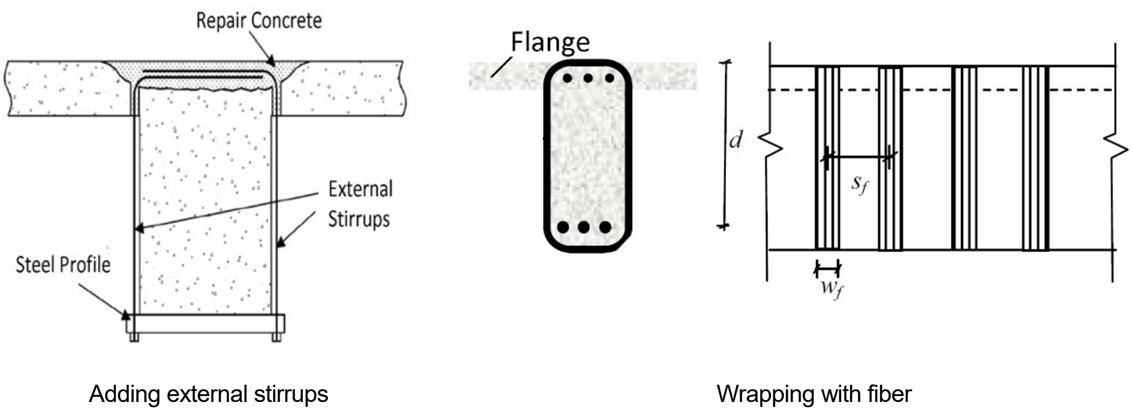
Figure 3-5 Shapes of Columns for Fiber Jacketing

b) Jacketing of beams

Jacketing of beams is done by means of two methods: by adding external stirrups and by wrapping with fiber as shown in Figure 3-6.

Adding external stirrups increases the shear capacity of beam, and wrapping with fiber increased both shear capacity and ductility. Similar to jacketing column with fiber, the beam shall have rounding corners with 30mm radius at the smallest.

In both methods, it is required to make holes or slits in which the stirrups and fiber can be inserted. Therefore, the risk of reducing the bending capacity may arise if the slab and beam cannot act as T-section.



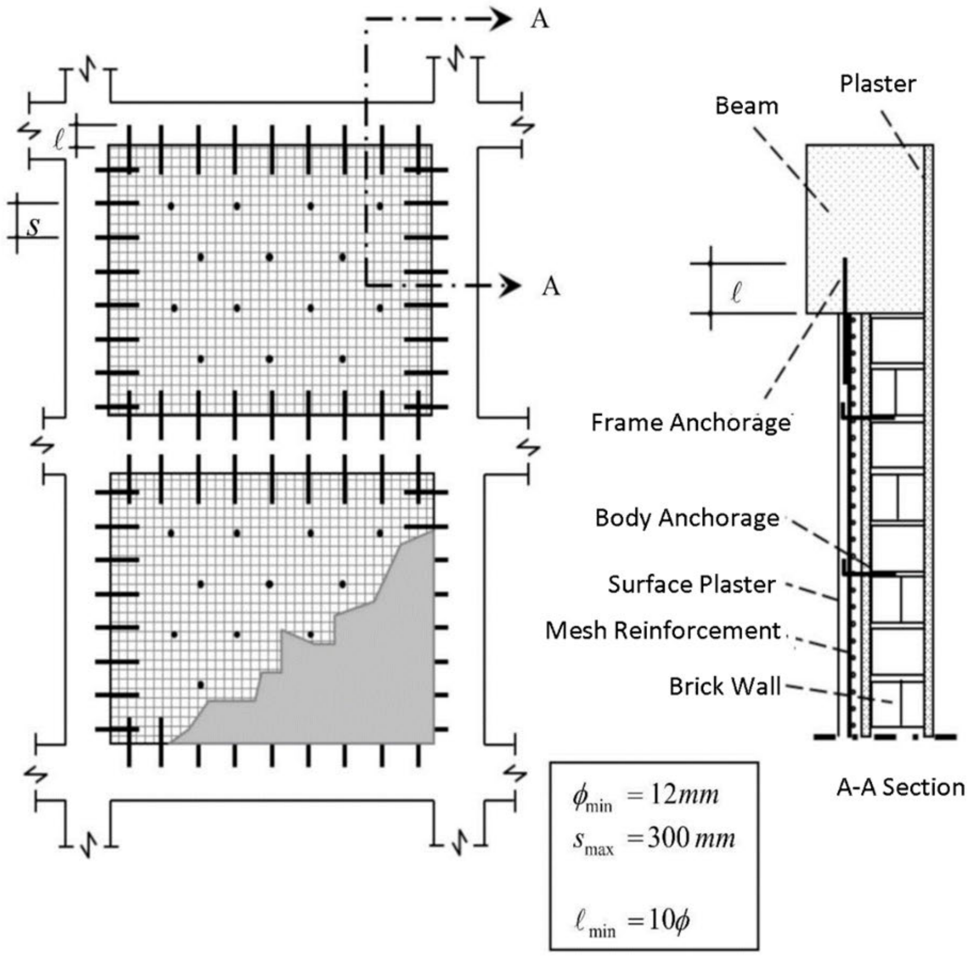
Source: Turkish Building Earthquake Code 2018

Figure 3-6 Method of Jacketing Beams

c) Retrofitting of partition walls

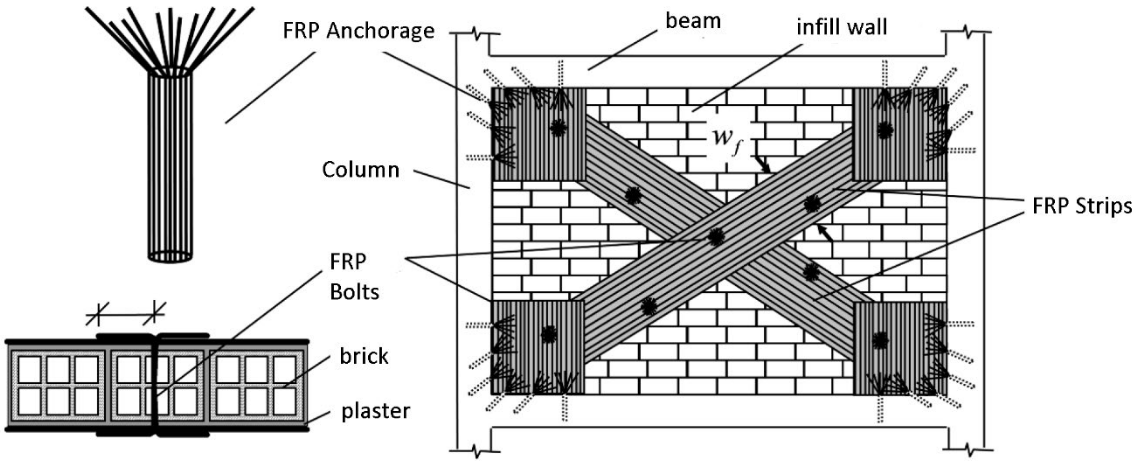
Though infill walls are non-structural elements, shear strength may be increased through the following methods: by retrofitting of infill walls by special plaster with reinforcement mesh, and with fiber-reinforced polymers. The former is illustrated in Figure 3-7 and the latter in Figure 3-8, respectively. Since the retrofit of masonry building is very limited in Japan, and the practical method is by adding shear walls or by adding steel frames as observed in the case of rehabilitation of masonry building damaged by 2011 off the Pacific coast of Tohoku earthquake, it is difficult to judge if the Turkish method is adequate or not from the viewpoint of Japanese practice.

It must be noted that this method is applicable for three-story (excluding basement floor) buildings at most, if retrofit of buildings is done mainly by this method.



Source: Turkish Building Earthquake Code 2018

Figure 3-7 Retrofit of Infill Wall by Special Plaster with Reinforcement Mesh



Source: Turkish Building Earthquake Code 2018

Figure 3-8 Retrofit of Infill Wall with Fiber-Reinforced Polymers

d) Retrofit of RC structural system with cast-in place shear walls

RC structural systems with insufficient lateral stiffness and strength may be retrofitted with cast-in-place shear walls. RC shear walls may be arranged in an existing frame system plane or adjacent to a frame plane.

Adding RC shear walls in a frame plane is one of the most popular retrofit measures as observed in Japan and other countries, since the cost of retrofit is relatively low. Concrete specifications for retrofit work are duly described in the code with some notes. Similar to Japanese seismic evaluation or design, it is noted that RC shear walls are categorized into one with columns and one without columns, since their shear strength is controlled by ultimate bending moment in the walls. Adding RC shear walls adjacent to a frame plane is also the effective method of retrofit if load transfer between an existing frame and newly installed shear walls is adequate.

For buildings with insufficient concrete strength, this retrofit method is considered practical from the viewpoint of cost and strengthening effectiveness, which is why many retrofitted buildings in this Survey employed this method.

e) Installation of new frame or RC system

The outer frame methodology can be categorized into this system. It is noted that the new frame shall be attached to the slabs of existing buildings to ensure load transfer. One of the remarkable pros of this method is that retrofit work will not require space for the work to be done, which enables the continuation of building operations during the work.

On the other hand, it is required that the concrete strength of an existing building should be high enough to make sufficient load transfer possible. This is of particular concern for school buildings in Turkey, many of which have considerably low concrete strength. It is also needed to check if the load-deflection characteristics of the new frame is appropriate for the retrofitted building to effectively withstand the seismic load.

f) Reduction of mass of RC system

This methods involves the removal of top floor/s, replacement of an existing roof with a lighter roof, replacement of equipment such as reservoir at the roof (by moving them to the basement), replacement of heavy elements such as balconies, parapets, partition walls, side-coating with lighter ones. This may be the most effective method if the performance of building is maintained after the retrofit work.

(2) ISMEP

The outline of ISMEP – including the seismic evaluation method – was explained in the previous section. This section focuses on the concrete procedure of retrofit design based on the report prepared by the engineering consultants involved in ISMEP.

1) Objective of retrofit work

The objective of retrofit work includes not only the structure itself, but also the architectural, mechanical and electrical designs, since finishing, non-structural elements and/or equipment inside are also considered deteriorated. This means that retrofitting the structure itself and the designs simultaneously is both cost and time effective.

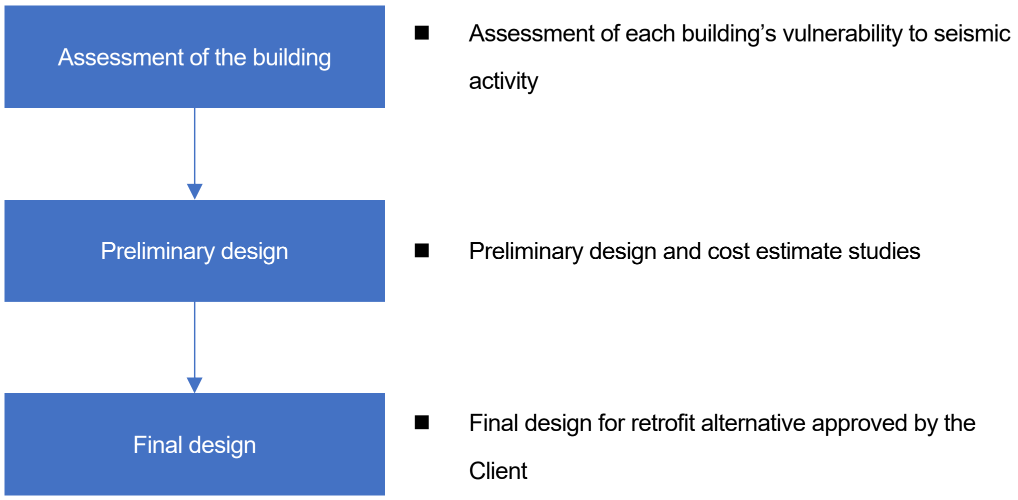
2) Guidelines to be referred

The following guidelines are referred to:

- *"Guidelines for Retrofitting of School and Hospital Building in Istanbul"* prepared by the Technical Committee and international experts of ISMEP for Concrete and Masonry Structures and Rehabilitation of Non-Structural Components as the minimum standard; and,
- New specification for structures to be built in an earthquake area published in the Official Gazette on June 3, 2007.

3) Scope of work

Retrofitting requires three steps as shown in Figure 3-9.



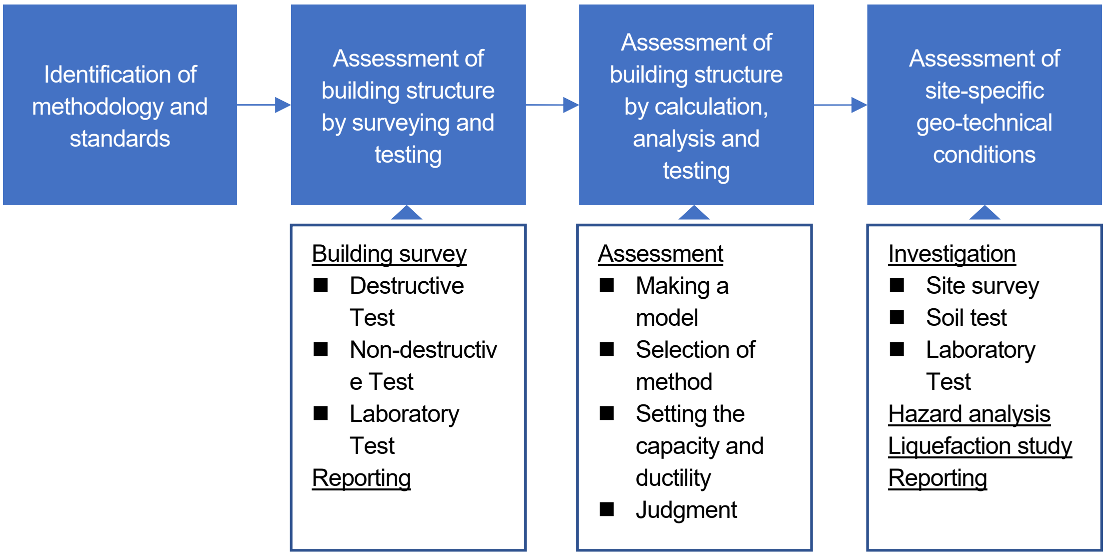
Source: JICA Survey Team

Figure 3-9 Steps taken in ISMEP Retrofit

a) Assessment of buildings

Assessment of buildings includes four steps shown in Figure 3-10, in which a detailed explanation on seismic evaluation is given in the previous section. Based on these studies, the buildings are classified into the following categories:

- Those that require structural retrofit with the performance level of :
  - Immediate Occupancy
  - Life Safety
  - Collapse Prevention
- Those that require no structural retrofit



Source: JICA Survey Team

Figure 3-10 Process of Building Assessment

b) Preliminary design

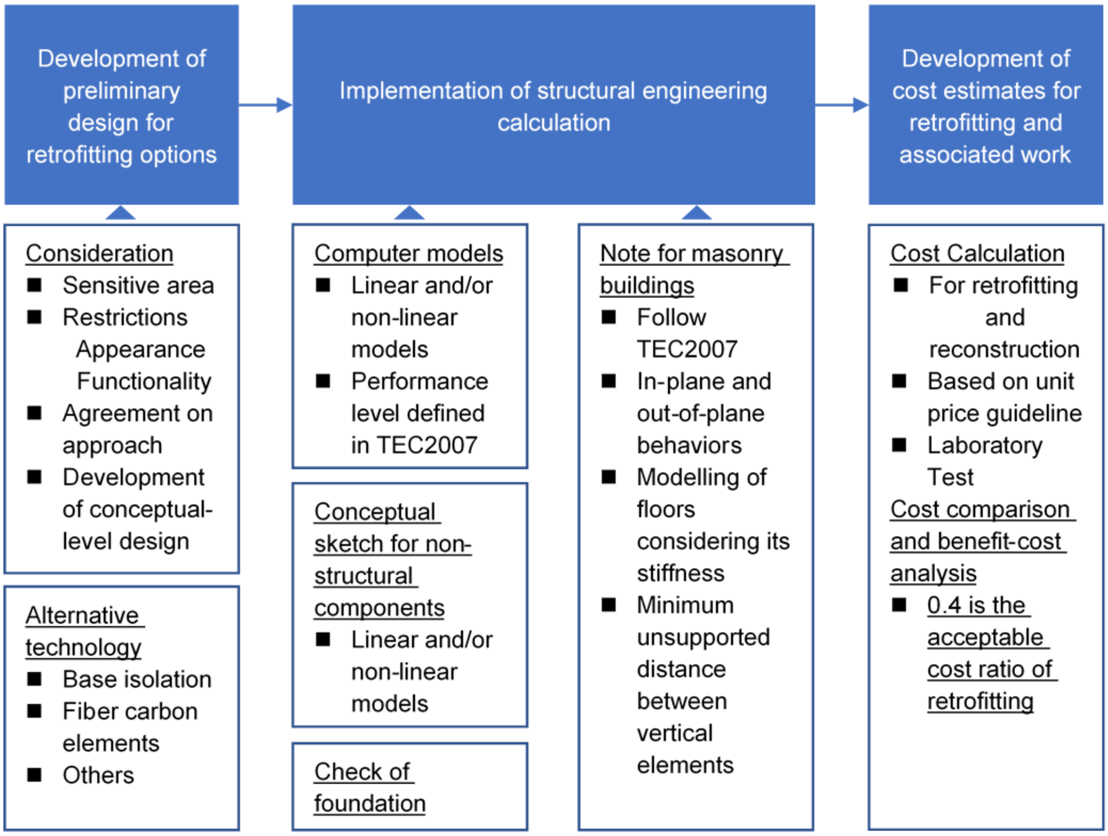
Preliminary design with cost estimation is conducted to identify the retrofit option for the final design, including the items in Figure 3-11.

As the result of "Development of preliminary design for retrofitting options", the conceptual-level upgrade designs for each retrofitting alternative are developed by taking the Turkish Earthquake Code 2007 into consideration, and the design criteria is identified by using performance-based engineering. It is noted that the advanced technologies such as base isolation and carbon fiber jacketing are considered as retrofitting method in ISMEP.

Under "Implementation of structural engineering calculation", non-structural elements and architectural and mechanical components are also examined as well as the structural element / system. Special attention is given to masonry buildings, in which out-of-plane strength is considered dominant as observed in the past disasters in developing countries and is also employed in the Japanese retrofit guideline for masonry buildings in Hokkaido.

The item "Development of cost estimates for retrofitting and associated work" gives the important information for discussion to determine retrofitting options including reconstruction. It is noted that the value of 0.4, which is the ratio of retrofit work to reconstruction, is mentioned in the project as an acceptable value.

After conducting the items mentioned above, the reporting of preliminary design is required, including the scope of the study, findings related to building deficiency and performance, and the recommendations for alternative levels of upgrade as well as other recommendations for additional investigation to be conducted as part of the final design.

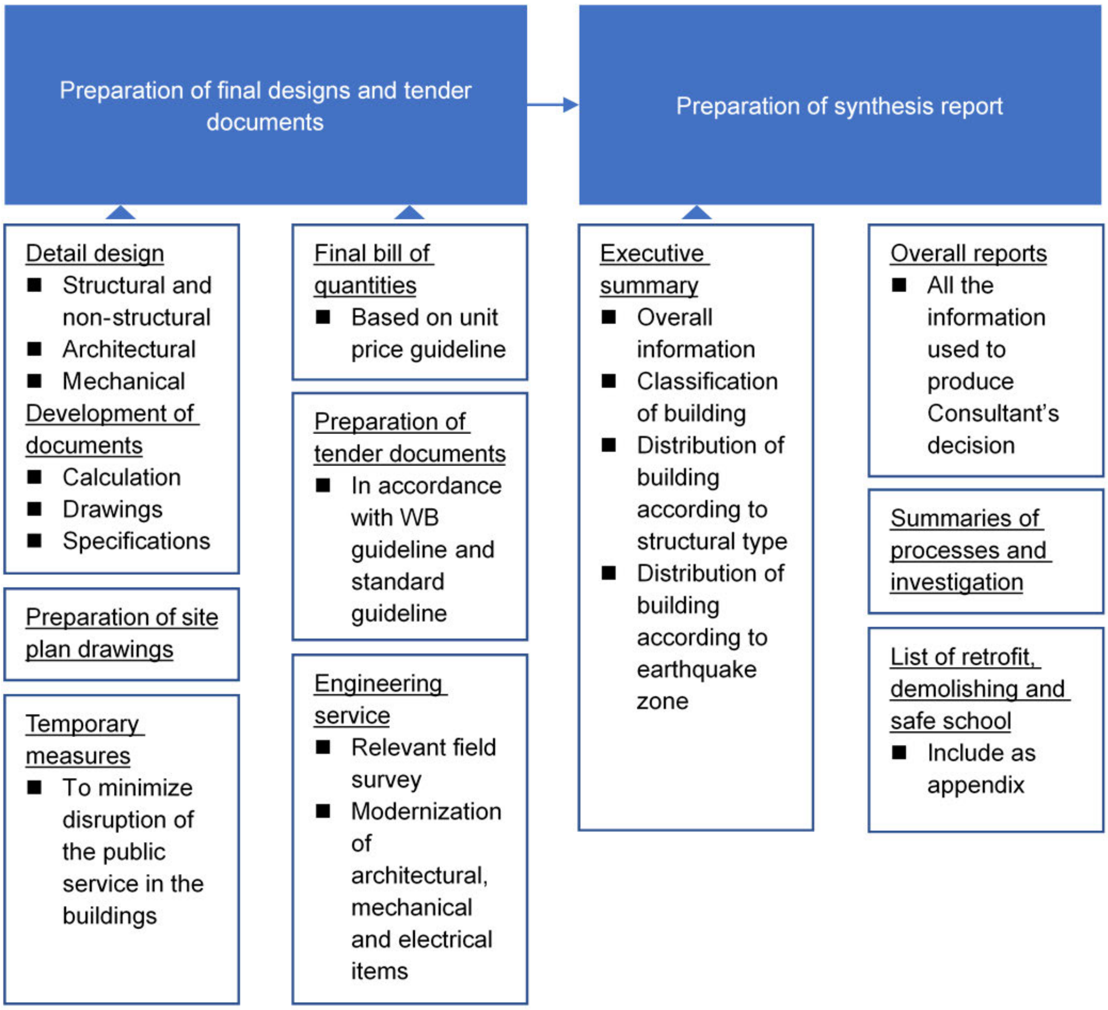


Source: JICA Survey Team

Figure 3-11 Process of Preliminary Design

c) Final design

In the final design stage, the final design and tender documents are prepared, and the items shown in Figure 3-12 shall be conducted.



Source: JICA Survey Team

Figure 3-12 Process of Final Design

4) Schedule and Reporting Requirements

a) Schedule

"Assessment of building" shall be completed within 120 calendar days after the effective date of the contract and approved by the client within 15days after the assessment phase.

"Preliminary design" shall be completed within 180 calendar days after the effective date of the contract.

"Final design" shall be completed within 240 calendar days after the effective date of the contract and approved by the client within 15 days after the completion of final design phase.

b) Reporting requirements

The reports shown in Table 3-7 shall be prepared.

Table 3-7 Reports to be Prepared

Report	Contents
Material Test Report	■ Soil investigation ■ Geotechnical and geophysical study ■ Surveying ■ Concrete core sampling and exposure of the steel ■ Ferro-scan reading along with all the architectural, structural, mechanical and electrical findings ■ Information gathered through foundation openings
Assessment Report	■ Assessment findings methodologies ■ Approval documents regarding the performed tests and their demand
Preliminary Design Report	■ Structural and non-structural analyses, calculation and design for different retrofit alternatives and recommendations including structural, architectural, mechanical, and electrical findings and deficiency submitted in the Assessment Report ■ Cost and cost comparison estimates
Final Design Reports and Drawings	■ Detailed structural retrofit designs ■ Detailed non-structural retrofit designs ■ Detailed architectural, mechanical, and electrical design ■ Final cost and cost comparison for alternatives ■ Synthesis Report
Tender Documents	■ Conditions of contract, form of bid technical specifications ■ Bill of quantities, pricing preambles, final designs, etc.

Source: JICA Survey Team

(3) MoNE

MoNE has performed the seismic evaluation for 4,500 school buildings in high seismic hazard area as mentioned in the previous section. Since the consultants involved in ISMEP also work for MoNE, the retrofit method and procedure can be considered identical.

3.4 Comparison with Other Countries' Standards

Since the seismic design standards are determined considering not only seismic risk but also the countries' economics, the direct comparison may be meaningless in some cases. However, the comparison is done here to analyze the required seismic performance of buildings in Turkey so that it becomes possible to determine if the current retrofit technologies developed in Japan are applicable in Turkey.

(1) Method of Comparison

1) Policy of Comparison

In seismic risk analysis, various ground motion intensities – such as peak ground acceleration (PGA), peak ground velocity (PGV), spectral intensity (SI) and spectral acceleration (SA) – are used. PGA and PGV are ground motion-related, and SI and SA include the characteristics of both ground motion and response of structure.

The seismic performance of buildings is controlled by design ground motion, limit state, design method, construction quality and others, among which the design ground motion is considered the dominant factor.

Therefore, it is considered convenient to arrange the design ground motion based on the format of SA, since SA is compatible with design intensity and is related to PGA. PGV can be related to PGA relatively easily.

2) Items to be Compared

Seismic design load is determined considering some factors listed in Table 3-8, though all of them need not to be considered depending on the seismic design practice.

Table 3-8 Items to be Compared

Items related to design ground motion	Concrete items
Usage of building	■ Importance factor
Ground motion intensity at site	■ Seismic hazard ■ Amplification by surface soil
Building response	■ Evaluation of natural period ■ Effect of non-linear behavior of structure ■ Damping ■ Shape of spectral acceleration

Source: JICA Survey Team

(2) Standards Investigated for Comparison

Table 3-9 shows the standards for investigation. Eurocode and ISO 3010 were selected, since they are considered to give a general policy on seismic design followed in many countries. Other standards were selected from the viewpoint of application in earthquake-prone countries including Japan.

Table 3-9 Standards Investigated for Comparison

Country	Name of Standard	Issuing Office	Year of issuance
Eurocode	1999 Eurocode 8, Design provisions for earthquake resistance of structures		
ISO3010	Basis for design of structures Seismic actions on structures		
Chile	Earthquake-Resistant Design of Buildings	National Institute of Normalization	
Colombia	Colombian Code for Earthquake-Resistant Constructions Decree-Law 1400 of 1984		

Country	Name of Standard	Issuing Office	Year of issuance
Italy	Technical Rules For Constructions in Seismic Zone	Public Works Ministry	
Japan	Building Standard Law of Japan	Ministry of Land, Infrastructure, Transport and Tourism	
Spain	Norma de Construccion Sismorresistente, Parte General y Edification, NCS-92	Comishion Permanente de Normas Sismorresistentes, Institute Geografico Nacional	
Turkey	Specification for Structures to be built in Disaster Areas	Ministry of Public Works and Settlement	
United States	ASCE-7 Minimum Design Loads for Buildings and Other Structures	American Society of Civil Engineers	

Source: JICA Survey Team

(3) Comparison of Standards Focusing on the Items Related to Design Load

The features of each standard are summarized in relation to each item listed in Table 3-8. It is noted that detailed explanation of each standard is not described in this section.

1) Usage of Building

Not only the "importance factor", but also other factors are employed to adjust the design of seismic load according to building usage, though they are called "importance factor" in this chapter. The importance factor employed in each standard is summarized in Table 3-10.

From the table, it can be seen that importance factor takes on different values, including the value less than unity, in accordance with various descriptions of building usage. The Japanese standard does not mention the importance factor since the standard is considered as minimum requirement and there is a room for engineers to increase the design load.

Table 3-10 Importance Factor Used in Standards

Country	Name of Factor	Value	Explanation	Note
Eurocode	Importance Factor	1.4 1.2 1.0 0.8	Essential for life safe Collapse prevention Others Not important for life safe	Factor can be less than unity.
ISO3010	Degree of Importance	1.5-2.0 1.0 0.4-0.8	High Normal Low	Factor can be less than unity.
Chile	-	1.2 1.0 0.6	Public building Building containing expensive item Building containing many people Private building and others Isolated or temporary building	Factor can be less than unity.
Colombia	Importance Coefficient	1.3 1.2 1.1 1.0	Extremely important building Public building Building for specific usage Building for normal usage	

Country	Name of Factor	Value and Explanation		Note
Italy	Seismic Protection Coefficient	1.4 1.2 1.0	Most important buildings Building with specific risk Others	
Japan	-	-	-	Not mentioned
Spain	Coeficiente de Riesgo	1.3 1.0	Important (Service period: t <= 100) Important (Service period: t <= 50)	Factor = (t/50)0.37
Turkey	Building Importance Facto	1.5 1.4 1.2 1.0	Building used after earthquake Building containing hazardous material Building containing many people and used long time Building containing expensive item Building containing many people but used short time Others	
United States	Occupancy Category	1.5 1.25 1.0	Essential facilities Building containing extremely hazardous material Building related to life-safe Others	

Source: JICA Survey Team

2) Ground motion intensity at site

a) Seismic hazard

Seismic hazard can be considered as the value which regulates the standard ground motion intensity, with details for each country summarized in Table 3-11.

Table 3-11 Standard Ground Motion Intensity

Country	Name of Factor	Value and Explanation		Note
Eurocode	Design Ground Acceleration	a_g	PGA at ground of soil type A, including importance factor	No concrete value mentioned
ISO3010		k_E=0.40 k_E=0.08 k_Z	For ultimate limit For serviceability limit Zone faction	k_Z is unknown.
Chile	Effective Acceleration	A_0=0.40 A_0=0.30 A_0=0.20	Regulated by PGA in [G]	Refer to Figure 3-13
Colombia		A_a=0.45 A_a=0.40 A_a=0.35 A_a=0.30 A_a=0.25 A_a=0.20 A_a=0.15 A_a=0.10 A_a=0.075 A_a=0.05	Regulated by PGA in [G]	Refer to Figure 3-14
Italy	Seismicity Degree	S=12 S=9 S=6	Standard shear coefficient is given as (S-2)/100, namely, 0.1, 0.07, and 0.04, respectively	

Country	Name of Factor	Value and Explanation		Note
Japan	Standard base shear coefficient	C_0=0.2 C_0=1.0 Z	For serviceability limit For ultimate limit Zone factor (0.7-1.0)	Refer to Figure 3-15
Spain	Coeficiente de Contribucion	K	The concrete value is determined by hazard map (1.0-1.5).	Refer to Figure 3-16
Turkey	Building Importance Factor	A_0=0.40 A_0=0.30 A_0=0.20 A_0=0.10	Regulated by PGA in [G]	
United States	Occupancy Category	S_s S_1	Spectral acceleration for the period on 0.2 sec. Spectral acceleration for the period on 1 sec.	By seismic hazard map

Source: JICA Survey Team

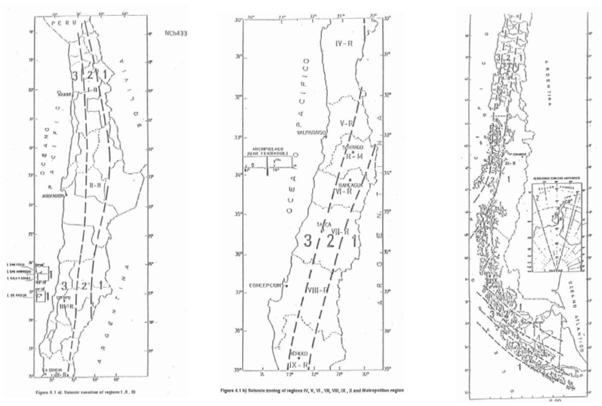


Figure 3-13 Seismic Hazard Map of Chile

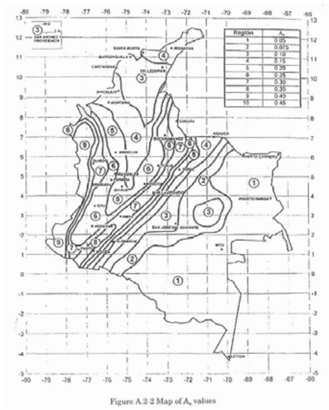


Figure 3-14 Seismic Hazard Map of Colombia

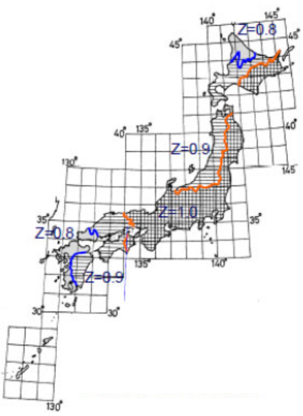


Figure 3-15 Zone Factor Map of Japan

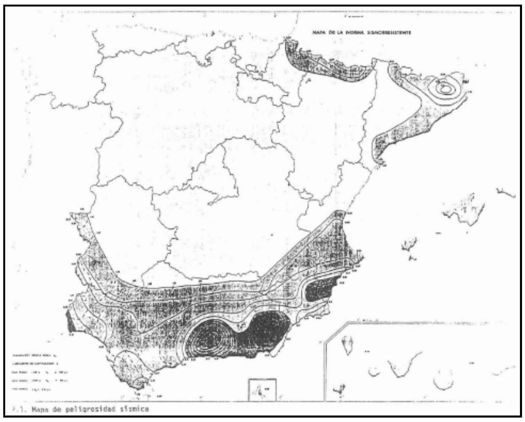


Figure 3-16 Seismic Hazard Map of Spain

b) Amplification by surface soil

Amplification of ground motion by surface soil is often considered as amplification factor, with details summarized in Table 3-12.

Table 3-12 Amplification Factor of Surface Soil

Country	Name of Factor	Value	Explanation	Note
Eurocode	Soil Factor	1.00/1.00 1.25/1.35 1.25/1.50 1.35/1.80 1.40/1.60	The factor is reflected not to ground motion intensity but to response spectral shape.	
ISO3010	-	-	Categorized into 3 types The factor is reflected not to ground motion intensity but to response spectral shape.	
Chile		0.90 1.00 1.20 1.30	For soil type I For soil type II For soil type III For soil type IV The factor is reflected to response spectral shape. The values are used to give upper bound.	
Colombia		1.0 1.2 1.5 2.0	For soil type S_1 For soil type S_2 For soil type S_3 For soil type S_4 The factor is reflected to response spectral shape.	
Italy	Foundation Coefficient	1.0 1.3	For normal case In case there is alluvium layer of 5-20m thick	
Japan	Vibration characteristic factor	Rt	Vibration characteristic factor corresponding to natural period of a building is applied based on three soil types; Type-I, -II, and -III soil.	
Spain	Coeficiente de Suero	1.0 1.4 1.8	Soil type-I: 750m/s < Vs Soil type-II: 400m/s < Vs <= 750m/s Soil type-III: Vs <= 400m The factor is reflected to response spectral shape.	
Turkey	Local Site Factor		Categorized into 4 classes The factor is reflected to response spectral shape.	
United States	Site Coefficient	F_A/F_V	Categorized into 6 classes The factor is a function of S_s and S_1, and is reflected to response spectral shape.	

Source: JICA Survey Team

3) Response of Building Structure

a) Evaluation of natural period

The natural period of a building needs to be evaluated to obtain design seismic load from spectral acceleration. The natural period of a building can be evaluated by theoretical method as well as by empirical method, with details summarized in Table 3-13.

Table 3-13 Evaluation of Natural Period of Building

Country	Method	Note
Eurocode	$T_1 = C_t h_n^{3/4}$ C_t = 0.085 for Steel moment frame building C_t = 0.075 for RC moment frame building and Steel braced frame building C_t = 0.050 for others	
ISO3010		Not mentioned
Chile		Not mentioned
Colombia	$T_a = C_t h_n^{3/4}$ C_t = 0.08 for RC moment frame building and Steel braced frame building C_t = 0.09 for Steel moment frame building C_t = 0.050 for others	
Italy	$T_0 = 0.1\ H / B^{1/2}$	
Japan	$T_0 = 0.02\ (1+0.5\alpha)\ H$ α : proportion of height of steel portion to total building height	
Spain	Concrete block structure : $0.06H[H/(2L+h)]^{1/2}/L^{1/2}$ RC moment frame : $0.09n$ RC moment frame with shear wall: $0.07n[H/(B+H)]^{1/2}$ Steel moment frame : $0.11n$ Steel moment frame with bracing : $0.085n[H/(B+H)]^{1/2}$	
Turkey	$T_1 = C_t H_n^{3/4}$ C_t = 0.07 for RC moment frame building and Steel braced frame building C_t = 0.08 for Steel moment frame building C_t = 0.050 for others	
United States	$T_a = C_t H_n^{x}$ C_t = 0.068, x = 0.8 for Steel moment frame building C_t = 0.044, x = 0.9 for RC moment frame building C_t = 0.070, x = 0.75 for Steel moment frame building with bracing C_t = 0.055, x = 0.75 for others	

Source: JICA Survey Team

b) Effects of nonlinear response of building structures

In order to express the effects of nonlinear response of building structures, such as an increment of natural period and / or damping, the seismic load on building is reduced to a certain level. The details on the reduction factor are summarized in Table 3-14.

Table 3-14 Load Reduction Factor for Nonlinear Response of Building Structure

Country	Name of Factor	Value	Explanation	Note
Eurocode	Behaviour factor	*q*	Used to reduce design response spectra. Divided into two categories, high ductile buildings and normal buildings. Values are given in Table for each structural type.	
ISO3010	Structural factor	1/5-1/3 1/3-1/2 1/2-1/1	Ductility: High Ductility: Middle Ductility: Low Design response spectra are multiplied by these values.	
Chile	Structural response modification factor	R R_0	For static analysis; Design seismic intensity is divided by the factor. For modal analysis; Design response spectra are divided by factor R' obtained from R_0.	
Colombia	Coefficient of energy dissipation	R_0	Energy dissipation is evaluated by multiplying the effects of building torsion and irregularity in hight to R_0.	This factor is not applied to load, but to capacity.
Italy	-	-	-	Not mentioned
Japan	Structural characteristic factor	0.3-0.55 0.25-0.5	For RC bulging For Steel building These values are multiplied to design base shear coefficient	
Spain	-	1/4 1/3 1/2 1/1	Ductility: Extremely high Ductility: High Ductility: Low Ductility: No (Brittle)	
Turkey	Seismic load reduction factor	$R_a(T)$	$R_a(T) = 1.5+(R-1.5)T/T_A$ The value R is determined based on ductility and structural type.	
United States	Response modification factor	R	Design response spectra are divided by this factor. Concrete values are given in the Table.	

Source: JICA Survey Team

c) Effects of damping factor of buildings

In general, 5% damped response spectra is used as the design response spectra. Therefore, it becomes necessary to adjust the design response spectra in case the building of concern possesses a different damping factor, such as steel structure or structure with damping devices. The methods for adjustment are summarized in Table 3-15.

Table 3-15 Method to Adjust Design Load by Damping Factor

Country	Method	Note
Eurocode	$\eta = [10/(5+\xi)]^{1/2} >= 0.55$ η : Adjustment factor, multiplied to response spectra ξ : Damping factor in [%]	
ISO3010	-	Not mentioned
Chile	-	Not mentioned
Colombia	-	Not mentioned
Italy	-	Not mentioned
Japan	-	Not mentioned
Spain	$v = [5/\Omega]^{3/4}$ $(T>=T_0)$ v : Adjustment factor, multiplied to response spectra Ω : Damping factor in [%] In case $T<T_0$, adjustment factor is calculated by linear interpolation assuming that $v=1$ when $T=0$.	
Turkey	-	Not mentioned
United States	-	Not mentioned

Source: JICA Survey Team

d) Spectral shape

Design seismic load is determined by design response spectra, which is given as a product of a standard ground motion intensity and spectral shape in many cases. From the viewpoint of comparison, it may be preferable to compare the spectral shape itself. However, the effect of amplification by surface soil is not given as a multiplying factor. The methods of estimating the response spectra with other factors mentioned are summarized in Table 3-16.

Table 3-16 Method Used to Estimate Response Spectra

Country	Method	Note
Eurocode	$S_D(T) = \gamma_1 * a_{oR} * S * [(2/3)+(T/T_B)*(2.5/q-2/3)]$ $(0<=T<T_B)$ $S_D(T) = \gamma_1 * a_{oR} * S * (2.5/q)$ $(T_B <= T < T_C)$ $S_D(T) = \gamma_1 * a_{oR} * S * (2.5/q)*(T_C/T)$ $(T_C <= T < T_D)$ $S_D(T) = \gamma_1 * a_{oR} * S * (2.5/q)*(T_C * T_D/T^2)$ $(T_D <= T)$ γ_1 : Importance factor, a_{oR} : PGA at Type A soil S : Amplification factor of soil, q : Response reduction factor T_B, T_C, T_D : Reference period	Lower limit is given.
ISO3010	$S_D(T) = \gamma_E * k_Z * k_E * k_D * k_R$ γ_E : Importance factor, k_Z : Zone factor k_E : PGA, k_D : Structural factor, k_R : Spectral shape $K_R = 1+(T/T'_C)(K_{R0}-1)$ $(0<T<T'_C)$ $K_R = K_{R0}$ $(T'_C<=T<=T_C)$ $K_R = K_{R0}(T_C/T)^\eta$ $(T_C<T)$	Lower limit is given.
Chile	$Q_0 = 2.75A_0/(gR)\ (T'/T^*)*I*P$ for static analysis $S_D(T) = I*A_0*\alpha*R^*$ for modal analysis A_0 : PGA, g : gravity, I : Importance factor, P : building weight, T^* : Natural period corresponding to the maximum effective mass R, R^* : Response reduction factor	Upper and lower limits are given.

Country	Method	Note
Colombia	$S_D(T) = A_a*I*(1+5T)$ ($T < 0.3$) $S_D(T) = 2.5A_a*I$ ($0.3 <= T <= 0.48S$) $S_D(T) = 1.2A_a*S*I/T$ ($0.48S < T <= 2.4S$) $S_D(T) = A_a*I/2$ ($2.4S < T$) A_a : PGA, I : Importance factor, S : Factor determined by soil type	
Italy	$F_h = C*R*I*W$ for static analysis $S_D(T) = C*R*I$ for modal analysis $C = (S\text{-}2)/100$ I : Standard base shear $R = 0.862/T_0^{2/3}$ ($0.8<T_0$) $R = 1.0$ ($T_0<=0.8$) I : Importance factor, W : Building weight	
Japan	$Q = C_0*Z*R_t*Ds*F_{ES}*W$ Q : Base shear , C_0=1.0 : Standard base shear coefficient Z : Zone factor, R_t : Vibration characteristic factor Ds: Structural characteristic factor, F_{ES} : Shape factor W : Building weight	For life safe
Spain	$S_D(T) = \rho*a_b*v/\mu*\alpha(T)$ ρ : Importance factor, a_b : Standard base shear v : Damping modification factor, μ : Response reduction factor $\alpha(T)$: Spectral shape $\alpha(T) = 1+[\alpha(T_0)-1]*T/T_0$ ($T < T_0$) $\alpha(T) = \alpha(T_0)$ ($T_0 <= T < T_1$) $\alpha(T) =\alpha(T_0)*T_1/T$ ($T_1 < T$) $\alpha(T_0)=(3C-3.8)(K-1.25)+2.3$ $T_0=1.25C+0.2K-0.175$, $T_1=0.125(5C-1)/\alpha(T_0)$	
Turkey	$S_D(T) = A_0*I/R_a(T)*S(T)$ A_0 : PGA, I: Importance factor $R_a(T)$: Response reduction factor $S(T)$: Spectral shape $\alpha(T) = 1+1.5*T/T_A$ ($T < T_A$) $\alpha(T) = 2.5$ ($T_A <= T <=T_B$) $\alpha(T) =2.5(T_B/T)^{0.8}$ ($T_B < T$)	Lower limit is given.
United States	$S_D(T) = S_{DS}[0.4+0.6(T/T_0)] *I* (1/R)$ ($T < T_0$) $S_D(T) = S_{DS} *I* (1/R)$ ($T_0<= T<= T_s$) $S_D(T) = S_{D1} / T *I* (1/R)$ ($T_s < T$) S_{DS} : Spectral acceleration for short period S_{D1} : Spectral acceleration for period of 1 sec. $T_0 = 0.2\ S_{D1} / S_{DS}$, $T_s = S_{D1} / S_{DS}$ I : Importance factor R : Response reduction factor	Lower limit is given.

Source: JICA Survey Team

(4) Conclusion

Though the comparison of response spectra used to determine seismic load, it is found that seismic design standards of earthquake-prone countries except for Japan are similar to one another. The basic idea is to multiply functions related to soil condition, spectral shape, response reduction, building importance and others to PGA on site. In contrast, the Japanese standard does not employ the importance factor, since its concept is to give the minimum requirement to building owners and to engineers. Also, employing the standard base shear coefficient instead of combining PGA and spectral shape is the remarkable difference, since Japanese authorities decided to give relatively uniform ground motion intensity throughout Japan.

If the spectral shape of Turkey or of other countries is applied to Japanese standard base shear coefficient, it can be seen that Japanese building standard considers PGA of 0.4[G] implicitly, which corresponds to the maximum design PGA of other countries except for Colombia. Japanese retrofit methods aim to give the building of concern the strength compatible to current design standard, so that they can be applicable to the buildings in other countries which are required to withstand high seismic load.

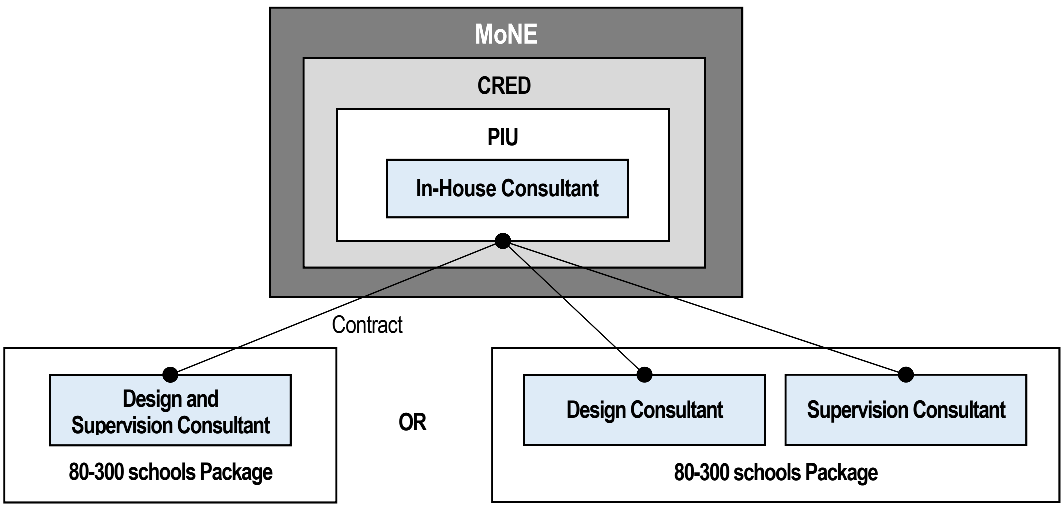
Chapter 4 Procurement and Construction Management System

This chapter explains the procurement and construction management system of the Government of Turkey using MoNE's case as an example.

4.1 Employment of Consultant

In the case of retrofit and construction projects implemented by MoNE, consultants are employed for detailed design and construction supervision works. A consultant is employed for both detailed design and construction supervision works, or two consultants are employed for each works. Unlike in JICA ODA Loan project, a number of consultants are employed for each package of consulting services. A package of consulting services is intended for schools with total floor area of 400,000 ~ 600,000 m^2.

Depending on the type of projects, MoNE's own staff or in-house consultant prepares the necessary documents for the selection of consultant. In the case of government-funded projects, the necessary documents such as request for proposal shall be prepared in accordance with the Public Procurement Law. For International Financial Institution or bilateral donor-funded projects, procurement procedure shall be in accordance with its own procurement guidelines.

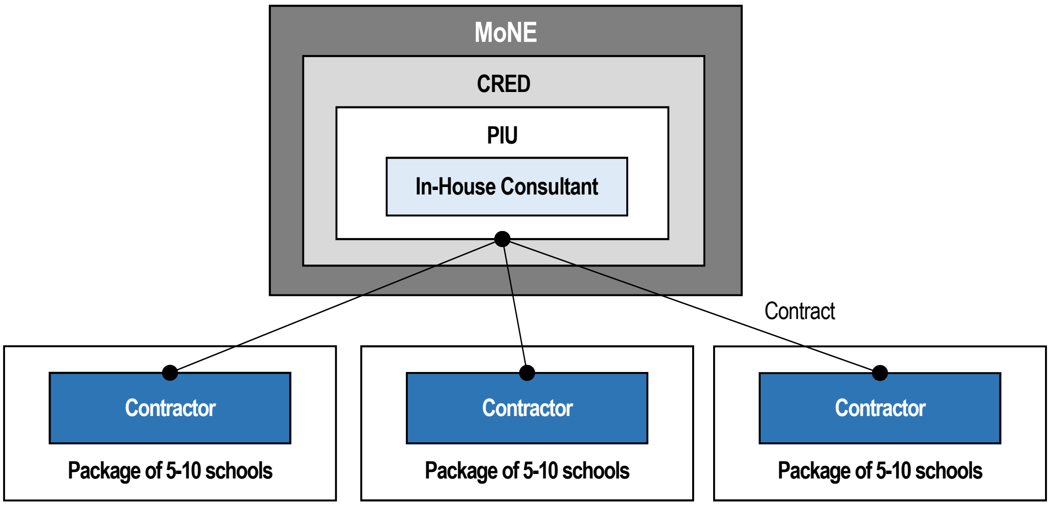


Source: JICA Survey Team

Figure 4-1 Employment of Consultant

4.2 Procurement of Works

A package of construction works consists of 5-10 schools, which is much smaller than the one of consulting services. The design consultant will prepare the bidding documents including drawings, technical specifications, bill of quantities, conditions of contract and contract format. MoNE will conduct all bidding procedure including the evaluation of bids, and the design consultant will support MoNE in case any technical clarification may be necessary. Procurement period will be 6-10 months depending on the availability of human resources in MoNE who conduct the evaluation of bids.

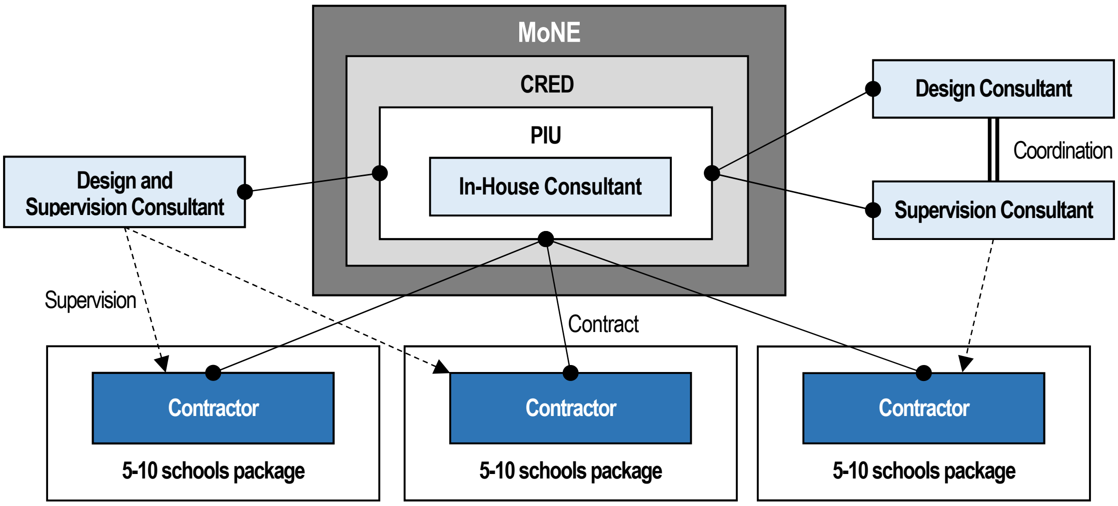


Source: JICA Survey Team

Figure 4-2 Procurement of Works

4.3 Construction Management

Either a design / construction supervision consultant or a construction supervision consultant will be responsible for the construction management. The supervision consultant is employed based on the package of work or contract period. In the former case, the supervision consultant is responsible for the construction of all buildings in the package. In the latter case, the supervision consultant works for a fixed period and payment will be made according to the work volume.



Source: JICA Survey Team

Figure 4-3 Construction Management

4.4 Other Considerations

(1) Building Permit Application

Contractors are responsible for building permit. Contractors will prepare an application with signatures from designer, construction supervisor and contractor and submit it to relevant municipality. In case the work includes new construction technology, the municipality will require the designer to clarify it. Basically the procedure are similar among municipalities

(2) Transfer of Students during Retrofit Work

Once a school is identified as the school for retrofit or reconstruction, students, teachers and school-related workers have to be evacuated to other safe school, and the school building has to be kept empty. The school to which students are transferred is determined by MoNE provincial directorate or district directorate by taking into account whether the school is able to accept students with enough room or if this can be done by operating in double shifts.

One of the conditions to determine the number of schools which can be retrofitted or reconstructed in the area is the availability of safe schools and the capacity of MoNE Provincial and District Directorates.

(3) Decision-Making Process

MoNE will make a decision whether a school building is to be retrofitted or reconstructed based on the seismic assessment report prepared by national consultants. Generally, reconstruction is more preferable than retrofit because retrofit is not well-understood even if safety has been established. It is therefore assumed that stakeholders will be against the decision if their school was identified for retrofit. Actually there had been cases in ISMEP in which the retrofit work was suspended and turned into reconstruction work during the implementation period due to political intervention.

However, based on interviews with MoNE provincial directorates and school representatives, they will not make an objection against the decision made by MoNE.

Chapter 5 School-Based Disaster Risk Management

5.1 Schools as Evacuation Shelters

When residential houses are destroyed or damaged during a calamity caused by earthquakes and other natural disasters, it is common for public spaces and buildings to be used as temporary evacuation shelters until people can safely return to their homes or stay in temporary houses. A temporary evacuation shelter is a critical requirement for survival and is necessary to protect security and health.

Schools are often deliberately designated by disaster management authorities to be used as temporary evacuation shelters.

(1) Japanese Experience

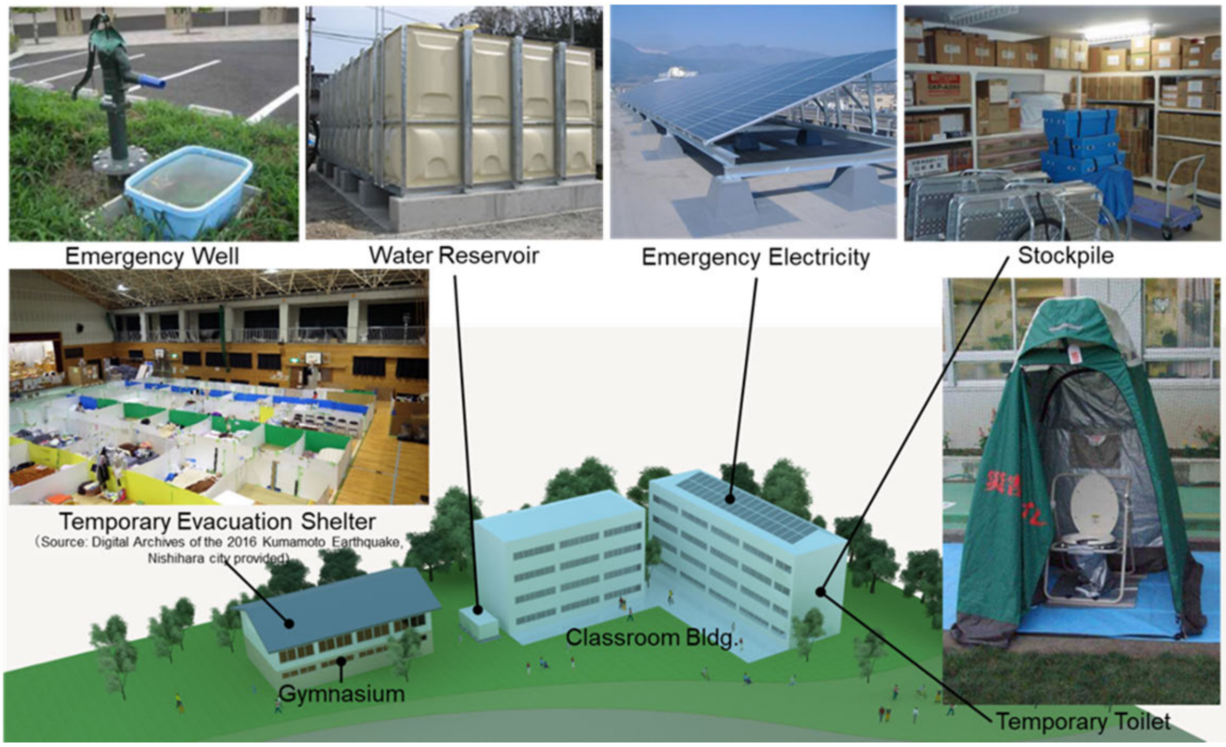
Schools are often deliberately designated by disaster management authorities to be used as temporary evacuation shelters. In Japan, people are well aware of the location of schools and the fact that schools are designated temporary evacuation shelter. Hence, people can evacuate to the school without wondering where to go in the event of any disaster. For primary educational schools in Japan, 95% of schools are designated temporary evacuation shelters as follows:

Table 5-1 Number of Schools Designated as Temporary Evacuation Shelters in Japan (2017)

		Number of Schools	Number of Designated Temporary Evacuation Shelters	Ratio (%)
Primary education	Primary Schools and Junior High Schools	29,006	27,768	95.7
High schools		3,586	2,764	77.1
Special support schools for the disabled		1,046	462	44.2
TOTAL		**33,638**	**30,994**	**92.1**

Source: Ministry of Education, Culture, ports, Science and Technology Japan

Figure 5-1 shows a typical configuration of a temporary evacuation shelter in Japan.



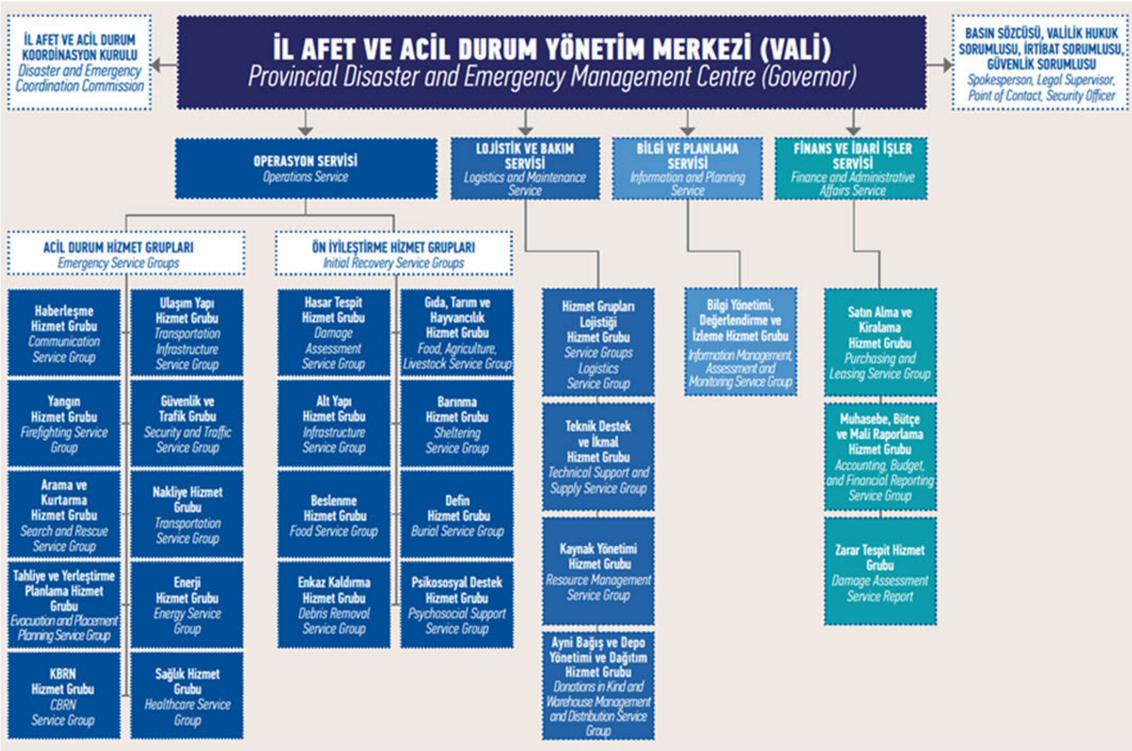
Source: JICA Survey Team

Figure 5-1 Infrastructures for Temporary Evacuation Shelters

(2) Current Situation of Schools as Evacuation Shelters in Turkey

In Turkey, the Emergency Response Plan in Turkey (TAMP) formulated by AFAD stipulates that AFAD will carry out the activities for providing emergency shelter services for the victims with support from the Ministry of National Education (MoNE).

The TAMP includes ministries, agencies and departments, private organizations, non-governmental organizations and ordinary citizens who can respond to any kind of disasters and emergency situations of any scale that may occur in Turkey. With an integrated planning approach and modular structure, the TAMP system comprises 28 service groups that focus on minimizing operational risks during disasters.



Source: AFAD

Figure 5-2 Organizational Chart of the Local Response Plan

One of the service groups is "Sheltering Service Group." The organizations responsible and the duties and responsibilities of the service group are shown as follows. MoNE is included as one of the supporting solution partner.

Table 5-2 Outline of Sheltering Service Group in TAMP

Main Solution Partner	Supporting Solution Partners	Duties and Responsibilities of the Service Group
AFAD - Responsible for the coordination of emergency and temporary shelter services for victims in the disaster area.	Turkish Armed Force General Staff; MoUE; Ministry of Interior, Ministry of Youth and Sport; Ministry of Family and Social Policies; MoNE; TOKİ; Red Crescent; Non-Governmental Organizations; Private Sector	· Carry out activities for the emergency shelter services for the victims · Provide the necessary facilities for emergency shelter, cleaning, health and social needs of the victims · Provide infrastructure for temporary shelter and maintenance units · Manage and keep records of emergency accommodation centers such as Tent city, container city, etc. in a coordinated manner · Determine the capacity of social facilities of public institutions and organizations, · Set the standards for emergency sheltering areas.

Source: TAMP, AFAD

However, according to an interview with an AFAD representative, AFAD currently has no plans to utilize the building including schools as temporary evacuation shelters.

5.2 School-Based Disaster Education

School-based disaster education in Turkey has been mainly implemented in a project supported by JICA. During 2010-2014, a technical cooperation project, titled *"School-Based Disaster Education Project",* targeted 10 pilot provinces. For phase II of the project, MoNE has changed the project-based education to a systematic education scheme targeting the teachers covering all 81 provinces in the country. MoNE, with support from AFAD, has developed two kinds of training materials: online training material and face-to-face training material. The new training scheme has the following steps as shown below:

- Online training of volunteer teachers
- Face-to-face training of volunteer teachers who have finished the online training course
- Teachers who have successfully completed both the online and face-to-face training courses qualify as Master Teachers
- Disaster education dissemination to other teachers by the Master Teacher through face-to-face training

The JICA projects related to school education is summarized in Table 4-3 and the progress of MoNE's ongoing school education scheme is shown in Table 4-4.

Table 5-3 JICA Projects Related to School Education

	Activities	Target (or Pilot) Provinces	Achievement
1.	School-Based Disaster Education Project, Technical Cooperation Project, 2010-2014		
	1. Institutionalization of DRR education 2. Development of handbooks 3. Manual for school DRR plan	Istanbul, Bursa, Kocaeli, Balıkesir, Tekirdağ, Sakarya, Çanakkale, Düzce, Bolu, Yalova	Four kinds of handbook for general disaster, education material, disaster management plan and evacuation were developed. About 260 teachers from 80 schools of 10 pilot provinces were trained to become Master Teachers who will disseminate the program across the country.
2.	Knowledge Co-Creation Program, School-Based Disaster Education Phase II, Country-Focused Training Program, 2017-2020		
	For the phase II of above project, the aim is to provide DRR education training for Master Teachers of elementary schools, junior high schools and high schools, and administrative officers	Whole country	The target province had been extended from 10 provinces to the 81 provinces of the whole country. A total of 767 Master Teachers had been trained since June 2019.
3.	Project on Earthquake and Tsunami Disaster Mitigation in the Marmara Region and Disaster Education in Turkey, SATREPS, 2013-2018		
	1. Construct probable scenarios of destructive earthquakes based on multidisciplinary researches 2. Conduct damage assessment of buildings 3. Develop disaster education materials	Istanbul, Bursa, Kocaeli, Balıkesir, Tekirdağ, Sakarya, Çanakkale, Yalova	• Earthquake source model. • Tsunami simulation • Seismic characterization and damage assessment. • Disaster education materials

	Activities	Target (or Pilot) Provinces	Achievement
4.	Joint DRR Programs with Turkish Japanese Foundation (TJV), ongoing		
	4. DRR Training Invitation Program. Training in Ankara, Eskisehir and Bursa (in Bursa at AFAD Disaster Training Center, and a pilot school of the School-Based Disaster Education Project) 5. Regional DRR Training. Disaster Friendship Caravan" in Mus, Bingol, Elazıg and Van provinces 6. Disability-Inclusive DRR. DRR training for PWDs, teachers and supporting personnel 7. Material Development	Ankara, Eskisehir and Bursa, Mus, Bingol, Elazıg and Van	Referring to the results of project 1, education materials for students were developed in the form of puzzle and question. The idea of materials mainly came from the Master Teachers.
5.	DRR Training Program for Teachers and Parents of PwDs		
	1. Special Lecture on DRR DRR and Teachers' Roles Special Education Disaster Psychology 2. Practical Training		In the first training held in 5 provinces, about 150 special education teachers successfully completed the online training, and about 100 of them received theoretical and practical training.
6.	DRR Training Program for Pre-service Teachers		
	1. Lecture on DRR Two credit compulsory elective lecture at METU 2. Practical Training in Bursa AFAD Disaster Training Center		A total of 32 pre-service teachers and 2 academicians from METU received about 4 hours of practical DRR training in Bursa Disaster Training Center. In addition, JICA ex-participant delivered a lecture at METU

Source: JICA Survey Team

Table 5-4 MoNE's Ongoing Teacher Training Program

No	Activities	Achievement
1	In-Service Training: Basics: Apply for e-learning program Criteria: All volunteer teachers Period of Training: within one week	A total of 16,830 teachers have completed the In-Service Training: Basics. (11,254 teachers from May-June, 2019; 5,576 teachers from Sept.- Nov. 2019)
2	In-Service Training: Mastery Criteria: Successful completion of online learning; <15 years of teaching experience; volunteers Priority: High disaster risk regions Period of Training: 2 days	A total of 767 teachers have completed the In-service Training: Mastery. (567 teachers in June, 2019; 200 teachers in Nov., 2019)
3	Teacher Trainers' Program Completing both e-learning and face-to-face learning program successfully	A total of 756 teachers have completed the Teacher Trainers Program.
4	Training of other teachers (One day face-to-face + online course)	A total of 55,517 teachers have received the training from Master Teachers during Sept., to Nov., 2019.

Source: JICA Survey Team

Through MoNE's education scheme, almost all cities now have at least one Master Teacher and some of them have more than five Master Teachers. The dissemination of disaster education by Master

Teachers is ongoing. It is the idea of MoNE that JICA can continuously support the scheme, especially for training in Japan, through technical cooperation project rather than loan project.

In Japan, the school gymnasiums are often used as evacuation center in case of emergency. In Turkey, school gymnasiums are not used in emergency cases. According to AFAD, open space is used for the purpose of evacuation, which has two definitions: Assembly Area, which refers to the area where the community gathers to escape from danger zones immediately after an earthquake in order to prevent panic and maintain a reliable information flow until temporary sheltering areas are prepared. Sheltering Areas, which are used to form tent cities / container cities for the sheltering needs of disaster victims.

For strengthening school disaster management capacity, MoNE is planning to create a regulation on school-based emergency plan by combining the several existing regulations, such as civil defense plan, disaster and emergency response plan and occupational health and safety plan. The new regulation will require schools to conduct stockpiling for emergency use for school purpose only (i.e. students, teachers and other staff). The general stockpiling for disaster is under the mandate of AFAD.

Chapter 6 Situation of the Proposed Target Area

6.1 Socio-Economic Situation

(1) Population

Turkey is composed of 81 provinces, which are divided into seven geographical regions. This chapter presents the socio-economic situation of six provinces: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag proposed as target provinces for possible Japanese ODA support as discussed in Chapter 8.

Out of six provinces in the target area, Balikesir, Bursa, Istanbul, Kocaeli, and Tekirdag belong to Marmara region, and Izmir to Aegean region.

There is a relatively high concentration of population in the target area. Istanbul is the most populous province in Turkey with 15 million inhabitants, since Istanbul is the country's economic, cultural and historic center. Next, Izmir is the third populated province of Turkey with 4.3 million inhabitants, which is the largest population in the Aegean region in 2018, followed by Bursa as the fourth populated province with 2.9 million inhabitants, and Kocaeli as the tenth populated province with 1.9 million inhabitants. The population in Balikesir is 1.2 million, and Tekirdag's is 1.0 million.

Table 6-1 Population in the Target Area

	Population					Average population growth (2014-2018)	Area (km²)	Population Density in 2018
	2014	2015	2016	2017	2018			
Turkey	77,695,904	78,741,053	79,814,871	80,810,525	82,003,882	1.4%	783,600	99
Balıkesir	1,189,057	1,186,688	1,196,176	1,204,824	1,226,575	0.8%	12,496	98
Bursa	2,787,539	2,842,547	2,901,396	2,936,803	2,994,521	1.8%	11,043	271
İstanbul	14,377,018	14,657,434	14,804,116	15,029,231	15,067,724	1.2%	5,170	2,914
İzmir	4,113,072	4,168,415	4,223,545	4,279,677	4,320,519	1.2%	11,973	361
Kocaeli	1,722,795	1,780,055	1,830,772	1,883,270	1,906,391	2.6%	3,626	526
Tekirdağ	906,732	937,910	972,875	1,005,463	1,029,927	3.2%	6,218	166

Source: Turkish statistical institute

(2) Gross Regional Domestic Product (GRDP)

The total gross regional domestic product (GRDP) of the target area was TRY 1.5 trillion in 2017, corresponding to 48% of the total GDP of Turkey. Istanbul has the largest GRDP in the target area at TRY 970.2 billion, in which the service sector accounts for 61% of GRDP. Izmir has the second-largest GRDP in the target area at TRY 191.5 billion, in which the service sector accounts for 51 % of GRDP due to the province's rich tourism resources. The third-largest GRDP is Bursa at TRY

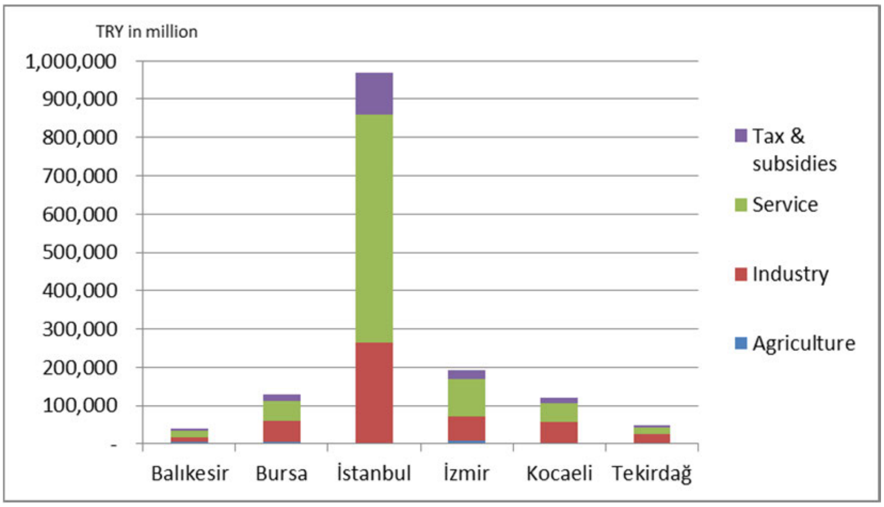
127.6 billion, in which the industrial sector accounts for 43% of GRDP since Bursa is the center of the Turkish automotive industry. In addition, the GRDP of Kocaeli, called the industrial capital of Turkey, is TRY 120.1 billion in which the industrial sector accounts for 47% of GRDP; Tekirdag's is TRY 47 billion in which the industrial sector accounts for 52% of GRDP; and Balikesir's is TRY 38 billion in which the service sector accounts for 48% of GRDP.

On the other hand, the GRDP of the target area for the agricultural sector, with the exception of Balikesir, is relatively low at less than 4%.

Table 6-2 GRDP in the Target Area

	Agriculture	Industry	Service	Tax & subsidies	GDP (current price) TRY in million	GDP per capita TRY
Turkey	6%	29%	53%	11%	3,106,537	37,883
Balıkesir	13%	27%	48%	11%	38,568	31,444
Bursa	4%	43%	42%	11%	127,584	42,606
İstanbul	0.1%	27%	61%	11%	970,189	64,389
İzmir	4%	33%	51%	11%	191,468	44,316
Kocaeli	1%	47%	41%	11%	120,074	62,985
Tekirdağ	4%	52%	32%	11%	46,964	45,600

Source: Turkish Statistical Institute

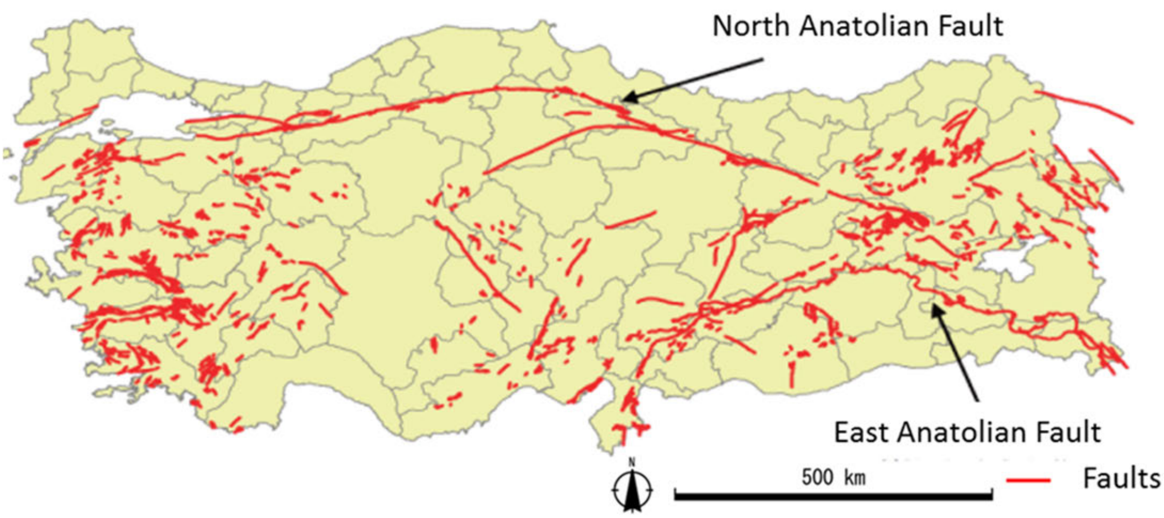


Source: Turkish statistical institute

Figure 6-1 GRDP by Sector

6.2 Seismic Disaster History

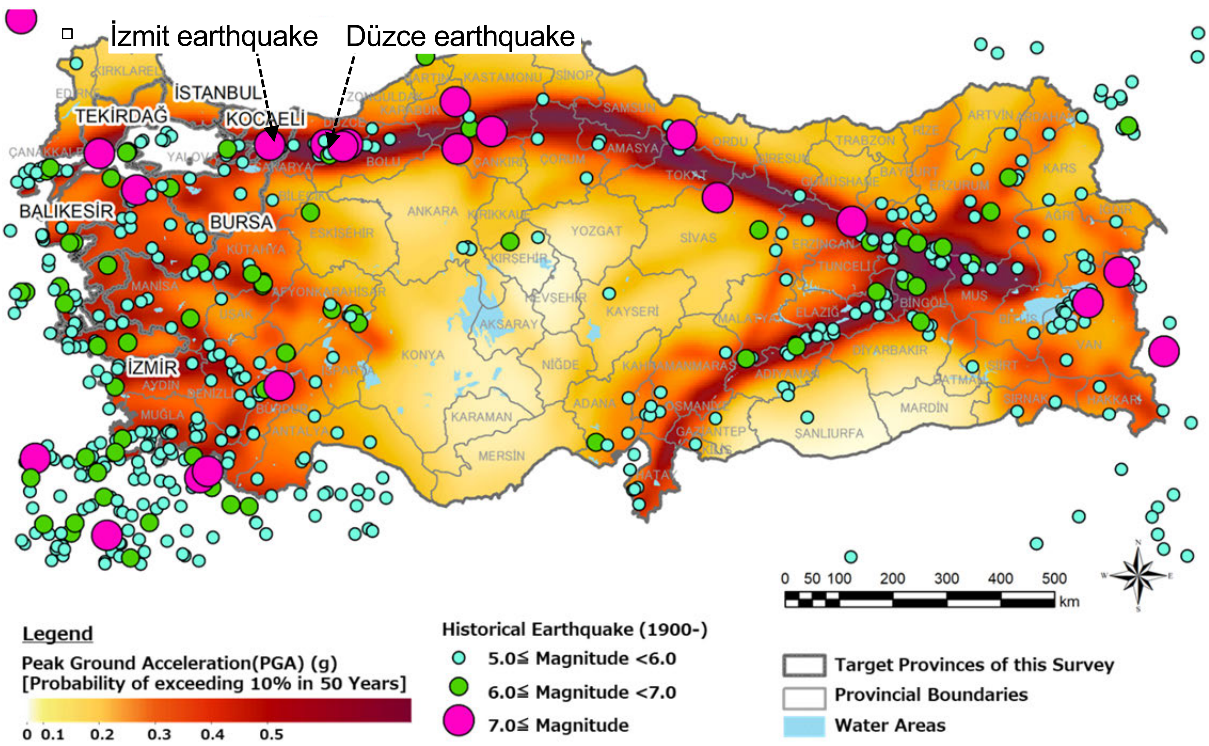
Tukey is prone to earthquakes, being located in the Anatolia peninsula where the Eurasian Plate, African Plate and Arabic Plate meet. Among the many active faults in Turkey, the East Anatolian Fault and the North Anatolian are most notable for their length. In addition, active faults are concentrated on the west near the Aegean Sea in the target area as shown in Figure 6-2.



Source: A survey on overseas earthquake insurance system (Turkey 2006), edited by JICA Survey Team

Figure 6-2 Active Faults in Turkey

In fact, the recent major earthquakes in Turkey (greater than magnitude 7.0), such as the two earthquakes – İzmit earthquake and Düzce earthquake – that happened in 1999 near the survey area had caused significant physical damage and economic loss. Figure 6-3 shows the historical earthquakes (greater than magnitude 5.0) in Turkey from 1900, and many large earthquakes had occurred in the survey area as shown in the figure below.



Source: [PGA] JICA Survey Team calculated interpolation based on earthquake hazard data received from AFAD, [Earthquake] USGS

Figure 6-3 Historical Earthquakes in Turkey

Damages caused by major historical earthquakes in Turkey are shown in Table 6-3.

Table 6-3 Damages Caused by Major Historical Earthquakes in Turkey

Date	Location	Magnitude	Associated disaster	Total no. of deaths	Total no. of affected	Amount of total damage ('000 US$)	Incurred losses ('000 US$)
04/29/1903	Malazgirt	6.3	--	3560	60000	0	0
08/09/1912	Murefte Sarkoy, Marmara Sea	7.8	Tsunami/Tidal wave	923	18195	0	0
10/04/1914	Burdur, Kilinc, Keciborlu, Isparta	7	--	4000	51700	0	0
09/13/1924	Erzurum	6.8	--	60	1140	0	0
05/01/1935	Kigi	6.1	--	540	0	0	0
04/19/1938	Kirsehir	6.6	--	149	800	0	0
12/27/1939	Erzincan (Anatolia)	7.8	Tsunami/Tidal wave	32962	0	20000	0
09/22/1939	Dikili	6.3	--	60	68	0	0
05/08/1940	Cis	6	--	16	0	0	0
09/11/1941	Van, Ercis	6	--	430	0	0	0
12/20/1942	Niksar, Erbaa	7	--	3000	0	0	0
11/15/1942		6.1	--	16	0	0	0
11/27/1943	Ladik, Samsun, Havza	7.5	--	4020	5000	40000	0
01/20/1943	Hendek	6.6	--	285	0	0	0
06/20/1943	Hundek, Adapazari	6.2	--	285	0	0	0
02/01/1944	Gerede (West Anatolia)	7.6	--	3959	0	0	0
10/06/1944	Ayvalik Edremit	6.8	--	27	0	0	0
06/25/1944	Usak	6	--	21	0	0	0
03/20/1945	Aelana, Veyhan, Adana	6	--	300	0	0	0
08/17/1949	Karliova (Anatolia)	6.8	--	320	355	0	0
08/13/1951	Kursunlu-Ilgaz	6.7	--	54	150	0	0
01/03/1952	Hasankale (Erzurum province)	6	--	103	250	0	0
03/18/1953	Canakkale, Balikesir, Yenice, Onon	7.3	--	1200	50000	3570	0
//1962	Pulumur	6.2	--	97	267	0	0
08/19/1966	Varto	6.9	--	2394	109500	20000	0
03/28/1970	Gediz	7.2	--	1086	83448	55600	0
05/22/1971	Bingol, Erzincan	6.8	--	878	88665	5000	0
09/06/1975	Lice	6.6	--	2385	53372	17000	0
11/24/1976	Muradiye	7.6	--	3840	216000	25000	0
10/30/1983	Khorasan, Pasinler, Narman (Erzurum province), Kars provinces	6.8	--	1346	834137	25000	0
03/13/1992	Erzican province	6.8	Slide (land, mud, snow, rock)	653	348850	750000	10800
10/01/1995	Dinar, Evciler	6.1	--	94	160240	205800	0
06/28/1998	Adana, Ceyhan, Hatay	6.3	--	145	1589600	550000	0
08/17/1999	Izmit, Kocaeli, Yalova, Golcuk, Zonguldak, Sakarya, Tekirdag, Istanbul, Bursa, Eskisehir, Bolu	7.6	--	17127	1358953	20000000	2000000
11/12/1999	Duzce, Bolu, Kaynasli	7.2	Slide (land, mud, snow, rock)	845	224948	1000000	0
02/03/2002	Bolvadin district (Afyon province)	6.5	--	42	252327	95000	0
01/27/2003	Pulumur district (Tunceli province)	6.1	--	1	2	0	0
05/01/2003	Bingol, Celtiksuyu, Sancak, Gokdere, Gozeler villages (Merkez district, Bingol province)	6.4	--	177	290520	135000	1000
03/08/2010	Basyurt village (Karakocan district, Elazig province), Demirci, Kovancilar, Okcular villages (Kovancilar district, Elazig province)	6.1	--	51	3600	0	0
10/23/2011	Van, Bitlis, Hakkari provinces	7.1	--	604	32938	1500000	90000
05/24/2014	Tekirdag, Canakkale provinces	6.9	--	0	324	0	0
07/21/2017	Bodrum	6.7	Tsunami/Tidal wave	0	360	0	0

Source: EM-DAT

6.3 Disaster Risk Management Plan

(1) Guideline for Provincial Disaster Risk Reduction Plan

The draft of Preparation Guidelines for Provincial Disaster Risk Reduction Plan was formulated under the JICA Project on Capacity Development Toward Effective Disaster Risk Management in 2014. The disaster risk reduction plan sets the road map for being resilient against disaster risks before the disasters occur. The basic approach is to determine and implement all countermeasures collectively and increase the society's resiliency. This guideline aims to set the road map to understand the current situation of the provinces and to support the formulation of Provincial Disaster Risk Reduction Plan in line with the status and regional characteristics of each province. The overall contents of the guideline are shown in Figure 6-4.


Provincial Disaster Risk Reduction Plan
Preparation Guidelines

(Earthquake, Tsunami, Landslide and Man Made Disasters)

June 2014

AFAD
Planning and Mitigation Department

Guideline		DRRP
1.Introduction		1. Introduction to Plan
Aim of 'Provincial disaster risk reduction plan' and main planning principles		
2.Features of the plan and formulation method and technic		
Plan formulation method, relevant institutions and organisations, formulation layout, target planning year and improvement of the plan		
3. Contents of Objectives According to Levels		
Module 1	General overview to the province	Ⅱ. General overview to the province
Module 2	Integration of risk evaluation to plans	Ⅲ. General overview to the risks in the province
Module 3	PDRRP current situation analysis	Ⅳ. Problems in the province
Module 4	Determination of the objectives of the plan	Ⅴ. Purpose of the plans
Module 5	Plan short term targets, planning activities, strategies and indicators, determinations of budgets	Ⅵ. Risk reduction plan
4. Monitoring and Evaluation of the Plan		Ⅶ. Monitoring and evaluation of the plan

Source: JICA Project on Capacity Development toward Effective Disaster Risk Management

Figure 6-4 Overall Contents of the Draft of Preparation Guidelines for Provincial Disaster Risk Reduction Plan

In the guideline, the sample measures to be implemented for disaster risk reduction in the provincial level are listed and divided into four components: 1) Risk Assessment; 2) Spatial Planning; 3) Structural Measures; and 4) Non-Structural Measures. Table 6-4 shows the sample structural measures listed under the guideline "Strengthening of existing buildings," which is the one of the measures for disaster risk reduction.

Table 6-4 Sample Structural Measures Listed in the Draft of Preparation Guidelines for Provincial Disaster Risk Reduction Plan

3. STRUCTURAL MEASURES	
3.1 Improving urban development (considering disaster hazards and risks in regional development)	1. Urban development for highly vulnerable places 2. Urban transformation
3.2 Relocation of communities (assets) under risk	1. Implementing community-level relocation programs 2. Assets under risk, humans and settlements
3.3 Strengthening / repair / construction and reconstruction	**1. Seismic assessment of public buildings and other structures** **2. Strengthening of existing buildings** **3. Constructing new buildings according to Earthquake Regulation, promoting building code in the construction sector**
3.4 Measures against hazards (preventative structures)	1. Sustaining walls 2. Rock stabilizations 3. Avalanche prevention structures 4. Stream improvements 5. Measures against ground failure and/or liquefaction 6. Other physical prevention structures for various disaster types. 7. Strengthening, maintenance, repair etc. of current prevention structures.
3.5 Making infrastructures disaster – resilient	1. Managing infrastructure systems 2. Electrical power systems 3. Water network and system 4. Communication network 5. Multipurpose underground canals 6. Gas network and system 7. Sewerage system 8. Rainwater collection systems, etc.
3.6 Landslide Countermeasures	1. Restricting settlements in landslide prone areas. 2. Setting excavation, terracing and construction rules. 3. Determining slope improvement and preservation methods 4. Installing monitoring and early warning systems
3.7 Hazard Measures for Hazardous Materials	1. Implementing disaster countermeasures at hazardous material facilities. 2. Implementing disaster measure legislation at hazardous material facilities. 3. Implementing disaster countermeasures at the periphery of hazardous material facilities 4. Hazardous material facility managers determining disaster countermeasures

Source: JICA Project on Capacity Development toward Effective Disaster Risk Management

(2) Current Status for the Formulation of Disaster Risk Management Plan

According to an interview with an AFAD representative, disaster risk management plans in the proposed target area have not been formulated yet. Currently, AFAD has been supporting to formulate the plan for Kahramanmaras, and it is almost in the final stage.

Chapter 7 Environmental and Social Impact

7.1 Outline of the Proposed Project

This Survey is a data collection survey for the promotion of earthquake-resilient buildings, particularly school buildings, in Turkey. No feasibility study of any specific project was included in the scope of the Survey, and target sub-projects have not been decided in this stage. MoNE will propose approximately 400 target schools to be retrofitted or reconstructed prior to the request for Japanese ODA Loan. Consequently, the project sites (provinces) and scales were still not clear. However, the seismic retrofit and reconstruction works will be conducted within the premises of the existing schools.

Also, MoNE will propose methods for retrofit and reconstruction works for the project prior to JICA appraisal. The following methods are expected for the Project, and further details of are explained in Section 3.3.

- Seismic retrofitting methods
  - Advanced technology: outer frame
  - Conventional works: adding shear walls, jacketing columns, etc.
- Reconstruction works: RC structure, steel structure or prefabricated structure, and others

To support MoNE in the selection of target areas in order of priority considering population, earthquake hazard and JICA's support in past projects, the JICA Survey Team suggested six target provinces in Chapter 8: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag.

7.2 Outline of Proposed Target Areas

In the matters of environmental and social considerations, JICA Survey Team was unable to visit the target local governments in this survey as well as related organizations in the target provinces due to limited cooperation of MoNE counterparts and time constraints.

Currently, Balıkesir, Bursa, İzmir, Kocaeli, and Tekirdağ provinces have been expected by MoNE as the target municipalities for the seismic retrofitting works of schools. In addition, JICA proposed to include Istanbul, but MoNE did not agree. The JICA Survey Team visited several candidate schools in Bursa and Izmir provinces for seismic retrofitting works as recommended by MoNE. In this section, the outline of target municipalities as project sites is explained based on the present conditions in both natural and social environments. The socio-economic conditions are described in 6.1.

(1) Natural Environment

1) Balıkesir Province

a) Geographical Features

The territory of Balıkesir Province, which has a surface area of 14,299 km², is located in north-western Anatolia adjacent to Bursa and Kütahya provinces in the east, Manisa and İzmir provinces in the south, and Çanakkale province in the west. A large part of the province's territory is in the Marmara Region and the rest is in the Aegean Region. The province has 290.5 km coastline that is 115.5 km on the Aegean Sea and 175 km on the Sea of Marmara.

The main plains are Gönen, Manyas, Balıkesir and Körfez Plains. The province has mountainous areas as well as flat areas. The highest point of the province is the Akdağ Hill at 2,089 meters above sea level.

b) Climate

Balıkesir Province has the characteristic features of both the Mediterranean climate and the Black Sea climate, as it is located in the transition zone between these two regions. When the province is under the influence of the Mediterranean climate, summer is hot and dry, while winter is mild and rainy. It becomes cold and rainy during the winter months when it is affected by the Black Sea climate. The areas located on the Aegean coasts are generally affected by the hot and dry summers, and the winters are characterized by mild and rainy Mediterranean climate. The Marmara coasts are relatively cool in summer and colder in winter due to the Black Sea climate.

c) Water System

Major rivers include Susurluk, Gönen, Koca, Havran, Simav, Atnos, Üzümcü and Kille Creek. The important lakes are Manyas and Tabak Lakes.

d) Forests with Natural Vegetation and Protected Areas

Forests cover 31% of the province's land, which corresponds to 45% of the provincial land. In general, there are various trees in the forest which include larch, pine, beech, hornbeam, oak, willow, tamarisk, plane and olive tree species. Among them, oak is the most widespread tree species with a rate of 30%, although it generally establishes degraded forests. The province also has the second-highest distribution of larch species in the country and also has the most optimal spread in the region, especially in the Dursunbey Alaçam Mountains.

There are two National Parks in the province: Kazdağı Natural Park and Bird Paradise Natural Park. The other protected areas are Kazdağı Fir Nature Reserve Forest (174.8 ha), Ayvalık Islands Nature Park (869 ha), Darıdere Nature Park (10.5 ha), Değirmen Boğazı Nature Park (24.9 ha) and Sarımsaklı Nature Park (1.1 ha).

2) Bursa Province

a) Geographical Features

Bursa Province is located in the northwestern part of Turkey and in the southeast of the Sea of Marmara. It is surrounded by Bilecik and Adapazarı in the east, İzmit, Yalova, İstanbul and Marmara Sea in the north, Eskişehir and Kütahya in the south and Balıkesir in the west. Bursa has total area of 11,027 km² with 17 districts. The coastal length from the Sea of Marmara in the north is 135 kilometers.

Land of Bursa consists of 35% of mountainous and plateau, 48% of plateaus, 17% of plains with a 155 meters elevation from the sea level. The land has a volcanic structure. Bursa has plains such as Karacabey, Orhangazi, Iznik, Inegol, Bursa, Yenisehir plateaus. The Bursa Plain is composed of alluvial plains. The highest mountain is Mount Uludağ at 2,543 m in height.

b) Climate

Bursa generally has a mild climate. However, it varies by climatic zones. Against the soft and warm climate of the Marmara Sea from the north, Bursa is confronted by the harsh climate of Uludag from the south. The hottest months of the province are June through September, while the coldest months are February through March. Based on 52 years of observation period, the average amount of annual rainfall in the province is 706 mm, while relative humidity is around 69%.

c) Water System

Major rivers of the province are the Nilufer and Goksu Streams, Koca, Kara and Aksu Creeks, which are fed by many streams originating from the southern slopes of Uludag. The most important river, Nilüfer River, has a catchment area of 680 km^2 and flows into the Marmara Sea around Karacabey Strait.

Bursa's major lakes are Uluabat (1,134 m²) and Iznik (298 m²) Lakes, which are within the territory of the province.

- Uluabat Lake: It is a shallow lake with a maximum depth of 6m and a eutrophic freshwater lake to the south of the Marmara Sea. The lake is roughly triangular in shape in the east-west direction with a length of 24 km and a width of 12 km. The lake area varies according to year and season. The average depth of the lake is 2.5 m.
- Iznik Lake: it is a tectonic natural freshwater lake with a maximum depth of 80 meters.

d) Protected Areas

There is one National Park, two Nature Parks and one Wildlife Development Area within the borders of Bursa Province. A total of 8.6% of the total area of Bursa is protected area.

- Uludağ National Park: The highest point of Uludağ National Park is 2,543 m with its area of 12,762 ha, which consists of 71% forest areas, 28% pasture and rocky areas, 0.4% open areas, 0.1% water-covered areas, and 0.5% residential areas.
- Sadağı Canyon: It is located within the borders of Bursa, Orhaneli district. The total area of nature park is 436 ha.
- Suuçtu Nature Park: It is located within the borders of Bursa, Mustafakemalpaşa district. The total area of the nature park is 10 ha. and has been declared as a 1st degree natural protected area.
- Karacabey Karadağ Ovakorusu Wildlife Development Area: It is located within the borders of Bursa Karacabey district and Mudanya district. The area is 28,611 ha.

3) Istanbul Province

a) Geographical Features

The province is surrounded by the Black Sea in the north, Kocaeli Mountain Range in the east, Marmara Sea in the south, and Ergene Basin in the west. Istanbul – the most important city in Turkey – is the only city that stands on two continents: Europe and Asia. The Bosphorus, about 35 km long, connects the Black Sea to the Marmara Sea, separates the Asian continent from the European continent, and divides the city of Istanbul into two parts.

The geographical structure of İstanbul has generally low elevation and is characterized by plateaus. The Asian side is higher than the European side, and even Istanbul's hills are not very high. Aydos Mountain, with the height of 537 m, is the highest point in Asian side.

b) Climate

The climate of the province resembles both the Mediterranean climate and the Black Sea climate. The former is hot and dry in summer, warm and rainy in winter. The latter is hot in summer and warm in winter, but rainy in all seasons. The southern parts of the province, where the population is dense, have characteristic features closer to the Mediterranean climate, whereas the climate evolves toward the Black Sea climate in the northern parts. The average temperature rises from around 6 °C in January to 23 °C in July. İstanbul is a province with high rainfall variability in the north-south direction. While the total annual precipitation in the south is around 650 mm, it increases above 1,000 mm in the central parts of İstanbul.

c) Water System

İstanbul has two major basins – Marmara Sea Basin and Black Sea Basin, which consists of many small river (creek) basins. There are no large capacity rivers, while the water system is composed of many streams that feed into the lakes and ponds or flow into the seas. Some low and irregular flow rates of the streams dry completely in summer, and some of them cause floods after heavy rains in spring.

Moreover, there are three small lakes in European side of İstanbul. The Terkos Lake (25 km^2) separated from the sea is freshwater, which provides the water of the city. On the other hand, the waters of the Küçükçekmece (11 km^2) and Büyükçekmece (16 km^2) Lakes on the shores of Marmara Sea are salty due to contact with the seawater.

d) Forests and Protected Areas

There is no national park in İstanbul. However, there are 26 nature parks, a nature reserve area, three wildlife breeding areas, two wildlife improvement areas, wetlands, two hunting areas, archeological sites and 143 recreational areas. The wildlife breeding areas are for breeding pheasant, partridge, deer, roe, and deer. The most important wetlands are Büyükçekmece, Küçükçekmece, Terkos, Büyükokmuşgöl and Küçükokmuşgöl Lakes in the European side, and Kamil Abduş Lake in the Asian side.

The forest area in İstanbul is 238,710 ha, which account for 44% of the province. A total of 58% of the forest area is located in the European side, while 42% is in the Asian side.

4) İzmir Province

a) Geographical Features

Izmir Province is surrounded by Madra Mountains in the north, Kuşadası Bay in the south, Aegean Sea in the west, and Manisa Province borders in the east. A typical town in the Aegean coast. Izmir is Turkey's third- largest city.

The recessed and protruding shoreline naturally results in the formation of numerous beautiful bays and beaches. On the other hand, the same natural structure has led to the creation of many fishing shelters or yacht berthing places. Given these characteristics, İzmir is considered a natural tourism and port city.

b) Climate

In terms of climate, summer is hot and dry in the province, and winter is mild and rainy. July and August are the hottest months and January to February are the coldest months. There is almost no snowfall. In the hot summer months, the regionally specific wind called "*imbat getir*," which is composed of the difference of heating and cooling between land and sea and day and night, brings coolness.

c) Water System

Within the province of İzmir, the Gediz River, one of the important rivers of Aegean Region, shows flow with the Küçük Menderes and the Bakırçay Rivers. The Küçük Menderes River originating in İzmir pours into the sea, and the whole basin is located within the borders of the province.

d) Forests with Natural Vegetation and Protected Areas

A total of 40% of İzmir province is covered with forests and there are 470,910 ha of forested area, which is above the average of 28.6% in Turkey. The forest areas consist of 45.9% of red pine, 4.1% of larch, 1.7% of peanut / pine, 10.8% of oak and 37.7% of other trees and shrubs.

Although no national parks are located within the provincial borders, there are eight Nature Parks under the responsibility of İzmir Regional Directorate. These Nature Parks are the Karagöl, Çiçekli, Yamanlar Mountain, Meryemana, Efeoğlu, Tanay, Ekmeksiz Beach, and Gümüldür Nature Parks.

5) Kocaeli Province

a) Geographical Features

Kocaeli Province is located adjacent to İstanbul, Yalova, Bursa and Sakarya Provinces, and has an area of 3,505 km^2. Its geographical features vary from the sea level up to 1,601 m altitude at the highest mountain of Kartepe. The Samanlı Mountains, located in the south of the province, are characterized by mountain ranges and are approximately 130 km long and 30 km wide. In general, the geographical structure of the province – which consists of agriculture, industrial and residential areas – is a flat and slightly hilly land..

b) Climate

Kocaeli climate constitutes a transition between Mediterranean climate and Black Sea climate. There are some differences between the climates of Kocaeli's Black Sea coast and the Izmit Bay's coast. The gulf coast is sometimes cooler as compared to the sweltering heat on the Black Sea coast. At the center, summer is hot and less rainy, and the area is also occasionally rainy, snowy and cold.

c) Water System

The province has coasts to the Marmara Sea and the Black Sea. Some of the waters originating from the provincial lands reach the Black Sea, and some of them reach the Sea of Marmara. Within the province, there are wetlands including a part of Sapanca Lake.

d) Forests with Natural Vegetation and Protected Areas

Generally, the upper parts of the mountains are covered with coniferous trees and the lower parts are covered with broad-leaved trees. Approaching the sea, the vegetation of the Mediterranean climate can be seen. There are eight nature parks in Kocaeli Province: Ballıkayalar, Beşkayalar, Eriklitepe, Kuzuyayla, Suadiye, Uzuntarla, Gazilerdağı and Uzunkum Nature Parks. In addition, the Kandıra Seyrek Wildlife Development Area, Izmit Bay Wetland and some part of Sapanca Lake Wetland are located within the boundaries of the province.

6) Tekirdağ Province

a) Geographical Features

Tekirdağ is located in the north-western Turkey and is surrounded by Istanbul from the east, Kirklareli from the north, Edirne from the west, Canakkale from the southwest, and the Marmara Sea from the south. Tekirdağ has a surface area of 6,313 km^2 and a coast of 2.5 km from the northeast to the Black Sea.

b) Climate

Climate of Tekirdağ is considered to be mildly humid, and it belongs to the semi-humid climate type. On the coastline of Tekirdağ, which has the effects of the Mediterranean climate, summer is usually dry and hot, and winter is warm. The inland, which includes the Ergene basin, has a more continental climate, with semi-terrestrial climate characteristics in the drier summer and colder in winter.

c) Water System

The major rivers of the province are Ergene, Çorlu, Hayrabolu, Beşiktepe, Hoşköy, Gazioğlu, Kayı, Koca and Seymen Rivers.

d) Forests and Protected Areas

The forests in the northern part of the province are dominated by mostly coniferous trees, oak, and beech origin species. In the southern part of the province, there are deciduous trees of oak, hornbeam, linden, maple and others, and coniferous trees consisting of pine, larch and peanut trees. Besides these, there are two natural parks which are Çamlıkoy Natural Park and Kartaltepe Natural Parks.

(2) Social Environment

1) Projected Population in 2019

Table 7-1 shows the population projection of the target provinces in 2019 by Turkish Statistical Institute. Tekirdağ was the most population growing province at 6.78% from 2017, followed by Kocaeli about 5.76% and Bursa at 3.42%, although Tekirdağ had the least population in the target provinces. These population growing provinces of Tekirdağ and Kocaeli are located bordering on İstanbul.

Table 7-1 Projected Population in 2019 of Target Provinces

Year / Province	2017	2019*	Growth (17'-19')
Balıkesir	1,204,824	1,222,872	1.50%
Bursa	2,936,803	3,037,269	3.42%
İstanbul	15,029,231	15,468,919	2.93%
İzmir	4,279,677	4,381,976	2.39%
Kocaeli	1,883,270	1,991,665	5.76%
Tekirdağ	1,005,463	1,073,592	6.78%

Source: Turkish Statistical Institute

2) Gross Domestic Product (GDP) per Capita

Table 7-2 shows the recent annual changes in the GDP per capita of the target provinces in 2015-2017 (at current prices). All provinces had estimated annual growths of 20% in 2016-2017. Following Istanbul with a GDP per capita of TRY 65,041 is Kocaeli – bordered to the east of İstanbul – which had the second-largest GDP per capita at TRY 64,659. Moreover, Kocaeli province registered the highest GDP growth per capita in 2016 - 2017 at 21.39%.

Table 7-2 Gross Domestic Product Per Capita of Target Provinces, 2015 - 2017 (At current prices)

Year / Province	2015	2016	Growth (15'-16')	2017	Growth (16'-17')
Bursa	33,501	36,780	9.79%	43,707	18.83%
Balıkesir	24,172	27,425	13.46%	32,127	17.14%
İzmir	34,261	37,817	10.38%	45,034	19.08%
Kocaeli	48,806	53,267	9.14%	64,659	21.39%
Tekirdağ	36,414	40,083	10.08%	47,479	18.45%
İstanbul	49,773	54,933	10.37%	65,041	18.40%

Note: Unit in TRY
Source: Turkish Statistical Institute

3) Land Use

As shown in Table 7-3, İstanbul was the most developed province followed by Kocaeli, which is bordered to the east of İstanbul. On the other hand, Tekirdağ, which is bordered to the west of İstanbul, consisted mostly of agricultural areas comprising about 77% of the entire land. The other three provinces had similar compositions in terms of land use.

Table 7-3 Land Use Structures of Target Provinces (2012)

Land Use / Province	Artificial Areas	Agricultural Areas	Forest and Semi-Natural Areas	Wetlands	Water Areas	Total
Bursa	3.38%	44.06%	47.84%	0.52%	4.19%	100.00%
Balıkesir	2.39%	47.26%	48.87%	0.17%	1.31%	100.00%
İzmir	5.33%	40.29%	53.46%	0.56%	0.36%	100.00%
Kocaeli	8.45%	45.84%	45.14%	0.06%	0.52%	100.00%
Tekirdağ	4.87%	77.08%	17.58%	0.02%	0.44%	100.00%
İstanbul	20.91%	29.44%	47.16%	0.05%	2.44%	100.00%

Source: Ministry of Forestry and Water Management

4) Syrian Refugees

Turkey has been absorbing the Syrian refugees. The provinces temporally protect them as Table 7-4 shows registered number of refugees in the target provinces in January 2020. Although the provinces bordering Syria has mostly absorbed the refugees, İstanbul has the most refugees accounting for 13.42% of the country followed by Bursa at 4.94% and İzmir at 4.12%, which are the seventh and eighth largest refugees in the country.

On the other hand, according to The Facility for Refugees in Turkey Monitoring Report: November 2019 of European Commission, 643,058 Syrian children were enrolled in education (public schools and Temporary Education Centers) in the 2018-2019 school year. Those who were enrolled corresponded to 61.4% of the Syrian children aged between 5 and 17 in the country. Therefore, there are schools accommodating the children of Syrian refugees according to interviews with schools in the target provinces.

Table 7-4 Distribution of Syrian Refugees of Target Provinces in January 2020

Province \ Year	2020	(%)
Bursa	176,743	4.94%
Balıkesir	4,710	0.13%
İzmir	147,503	4.12%
Kocaeli	55,519	1.55%
Tekirdağ	12,850	0.36%
İstanbul	480,077	13.42%
Whole country	3,576,659	100.00%

Source: Turkish Statistical Institute

5) Cultural Heritages

Some school buildings are designated as cultural properties in Turkey. However, as the Project will not target at the school buildings designated as cultural properties for the seismic retrofitting works, no adverse impacts are expected.

7.3 Legal and Institutional Frameworks of Environmental and Social Considerations

(1) Legal Frameworks

1) Environmental Legislations

The basic law of the Environmental Impact Assessment (EIA) system in Turkey is the Environmental Law No. 2872, Law on Amendment of the Environment Law, August 1983, which was amended by Environmental Law No. 5491, April 2006. The EIA Regulation and Environmental Permit and Licensing Regulations were established based on this law. The works related to the procedures of EIA approval are under the jurisdiction of MoEU.

Article 7 of the Environmental Law requires EIA to be implemented for projects that can have impacts on the environment. The EIA regulation stipulates the projects which are subject to EIA, and the methods of EIA implementation for all projects implemented in the country. The list of project activities subject to EIA is shown in Annex I of the EIA Regulation. The Annex II of the EIA Regulation shows the project activities to be determined by whether each project is subject to EIA.

- Law on Amendment of the Environment Law, August 1983 (amended by Environmental Law No. 5491, April 26, 2006)
- EIA Regulation, November 2014, No. 29186 (amendment of the EIA Regulation 1983)
- Environmental Permit and Licensing Regulations, September 2014, No. 29115 (amendment of the Regulation 2010)

Aside from the basic laws, the implementation of the following legislation is expected for the Project.

Waste management:

- Regulation on Control of Solid Wastes, Official Gazette No. 29314, 02.04.2015
- Regulation of the Control of Excavation Soil and Construction and Demolition Waste, Official Gazette No. 25406, 18.03.2004
- Regulation on Hazardous Waste Control, Official Gazette No: 25755, 14.03.2005 (amended by the regulation issued in the OG dated 30.10.2010; No: 27744)

Air quality:

- Regulation on the Assessment and Management of Air Quality, Official Gazette No. 26898, 06.06.2008

Water pollution:

- Water Pollution Control Regulation, Official Gazette No. 25687, 31.12.2004 (amended by the regulation issued in the OG dated 30.03.2010; No: 27537)
- Surface Water Quality Management Regulation, Forestry and Water Affairs Ministry, Official Gazette No. 28483, 30.11.2012

Noise:

- Regulation on the Assessment and Management of Environmental Noise, Official Gazette No. 26809, 07.03.2008

Soil Pollution:

- Regulation on Soil Pollution Control and Point Source Polluted Areas Official Gazette No. 27605, 08.06.2010

Labor, Occupational Health and Safety:

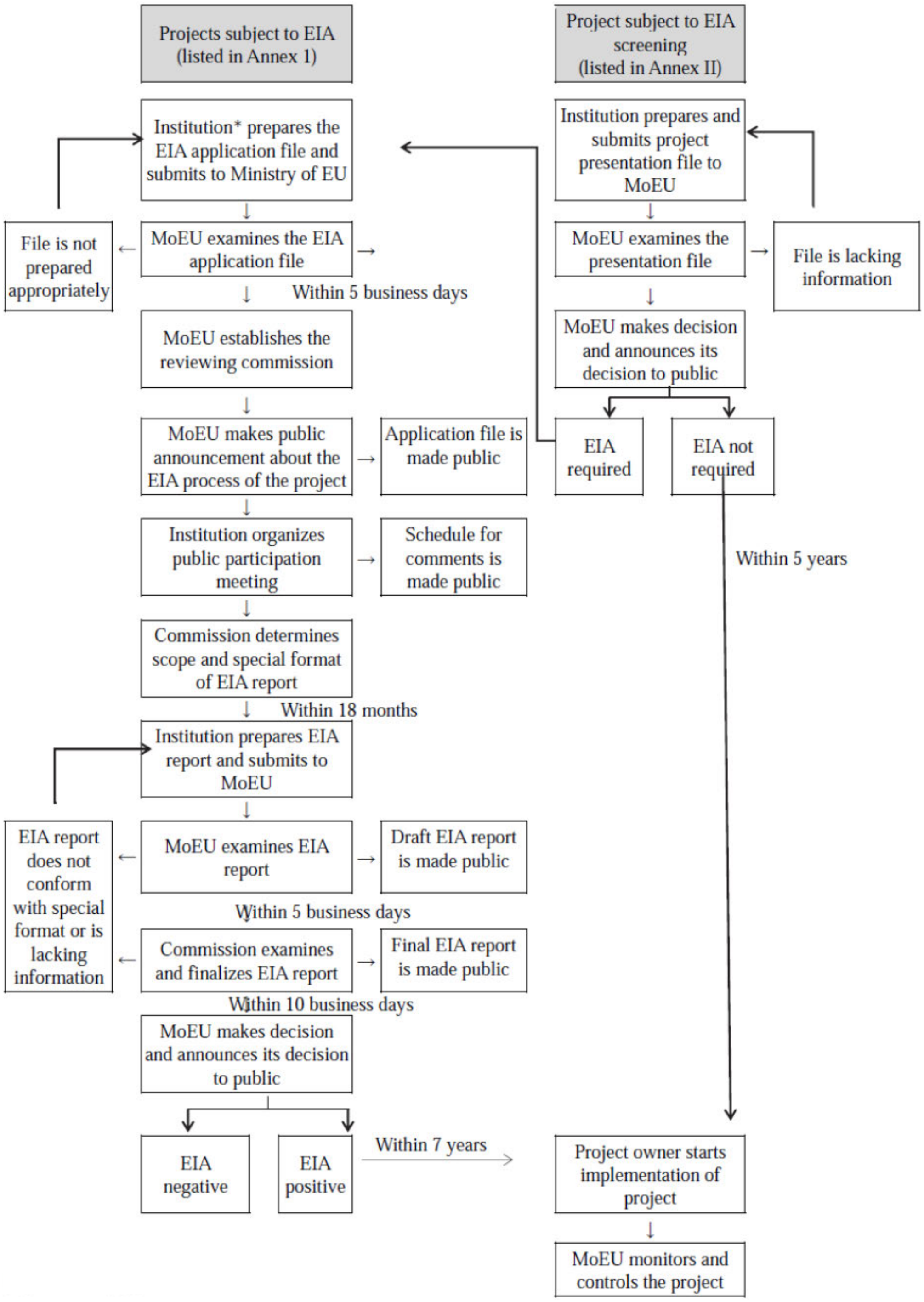
- Labor Law No. 4857, 22.05.2003 (Official Gazette 10.06.2003)
- Occupational Health and Safety Law No. 6331, 20.06.2012 (Official Gazette No. 28339, 30.06.2012)
- Construction Supervision Law No. 4708
- Regulation on Health and Safety Measures Concerning the Work with Asbestos, Official Gazette No. 28539, 25.01.2013

Conservation of Cultural and Natural Assets:

- Law on the Conservation of Cultural and Natural Property Law No. 2863, July 1983 (amended by Law No. 5226, 2004)

2) EIA System

The EIA procedures in Turkey are stipulated in the EIA regulation. The outline is shown in Figure 6-1.



Source: EIA Regulations, JICA Data Collection Survey on Waste Sector 2015

Figure 7-1 EIA Procedures in Turkey

3) Screening for EIA

In the EIA Regulations, Annex I shows the list of "EIA-Required" projects. Meanwhile, projects that are not included in Annex I but require EIA are indicated in Annex II of the EIA Regulations. Such regulations are defined according to the project sector by assessing the project's environmental impact and scale.

(2) Institutional Frameworks

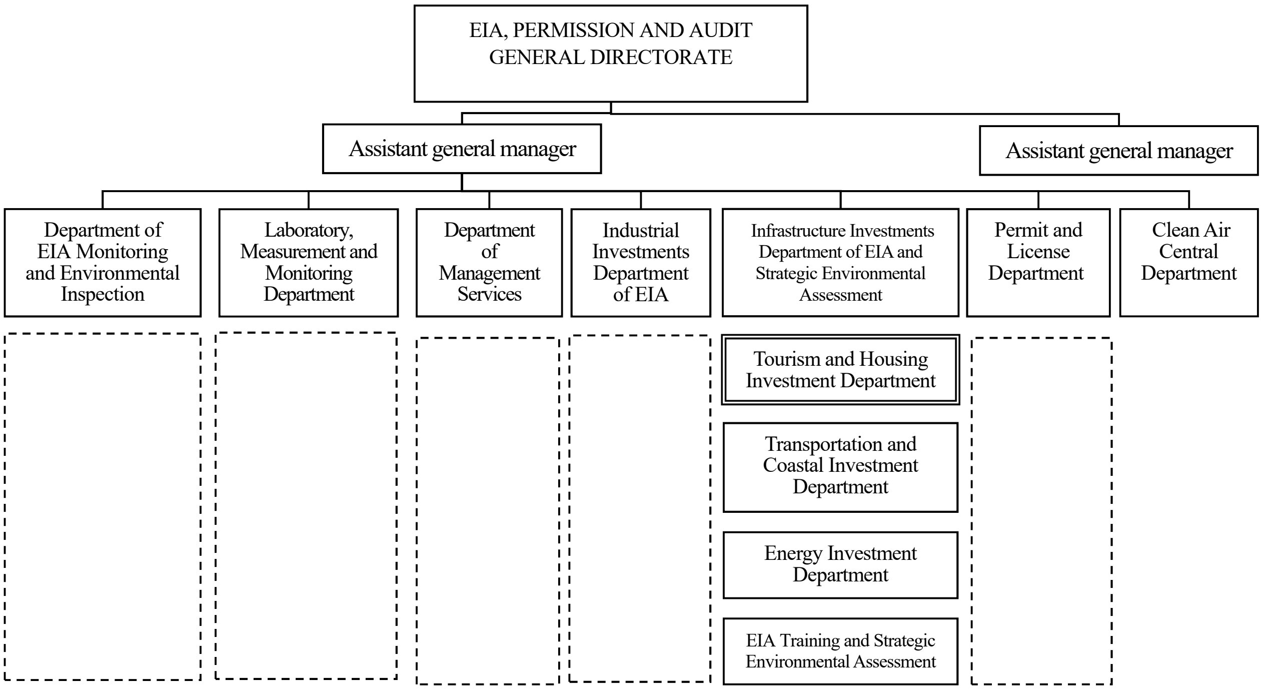
1) MoEU

In Turkey, MoEU is responsible for environmental administration, whose main activities are environmental protection, pollution prevention and reduction. The ministry has jurisdiction over the planning and implementation of systems related to the environment, development and construction, monitoring and management of the activities of implementation. Moreover, the ministry is also responsible for the procedures of EIA approval.

The duties of the ministry are stated as follows: "protect the natural environment and create sustainable cities and settlements; perform planning, transformation, safe construction, and management of real estate and the housing sector; and provide environmental services based on low-rise structural perspective in order to revive the identity of the cities, with a regulatory and supervisory approach".

2) Tourism and Housing Investment Department

The works related to the EIA approval procedures for building constructions is carried out by the Tourism and Housing Investment Department under the Permission and Audit General Directorate of MoEU EIA shown in Figure 6-2. According to a department representative, school facilities of more than 50,000 square meters were previously subject under EIA. At present, schools are currently exempt from EIA requirement.



Source: Excerpt from MoEU

Figure 7-2 Institutional Structure of EIA Section in MoEU

3) Directorate of Environment and Urbanization (DoEU)

DoEU is located in each province under the MoEU. DoEU is responsible for environmental administration in the province.

In order to create cities and settlements with high quality of life compatible with sustainable environment, the DoEU conducts business and operations related to planning, construction, transformation and environmental management with a regulatory, supervisory, participatory and solution-oriented approach.

4) Municipality Environmental Protection and Control Department

In a particular province, the Municipality Environmental Protection and Control Department works for the protection and development of natural resources and public health, ensures the implementation and sustainability of projects, identifies elements which generate environmental pollution, and takes the necessary measures in line with the framework of relevant laws and regulations within the boundaries of municipality.

The department consists of Waste Management Department and Environmental Control Department. Waste Management Department works for the services to evaluate solid wastes (domestic, non-hazardous industrial wastes, special wastes, etc.), transport and disposal, and establishes and operates facilities. It also conducts collection, transportation and disposal of medical wastes.

The Environmental Control Department works performs services related to identifying the elements which generate environmental pollution, conducts evaluations and studies in coordination with related institutions and organizations, and deal with complaints. In particular, this department identifies pollutant sectors and their environmental impacts, and those with high environmental pollution impacts and adversely affect the environment and public health. It also prepares environmental inventory and environmental status reports and updates them periodically. Moreover, it performs services related to evaluation, storage and disposal of excavation soil and construction / demolition wastes. The department establishes and operates the facilities for this purpose. It also prepares the certificates for vehicles carrying the excavation soil and construction / demolition wastes and supervises their activities.

(3) Gap Analysis on EIA

The basic legislation of EIA system in Turkey are the Law on Amendment of the Environment Law No. 5491, EIA Regulation No. 29186 and Environmental Permit and Licensing Regulations No. 29115. Table 6-1 summarizes the differences between the legislation of EIA system in Turkey and JICA guidelines. As shown in the table, there are gaps on the bases between the JICA Guidelines and the legislation of Turkey. However, the Project is exempt from the EIA process according to the legislation of EIA system in Turkey.

Table 7-5 Gaps Analysis between JICA Guidelines and Legislation in Turkey

No.	JICA Guidelines (GL)	EIA System of Turkey	Gaps between JICA GL and Laws in Turkey	Policy to fill the gaps
Underlying Principles	Environmental impacts that may be caused by projects must be assessed and examined at the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan. (JICA Guidelines Appendix1, 1.)		Laws of Turkey do not stipulate that environmental impacts must be assessed and examined at the earliest possible planning stage, although laws stipulate alternative analysis and mitigation measures.	
Examination of Measures	Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, the avoidance of environmental impacts shall be given priority; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided through any of the aforementioned measures. (JICA Guidelines Appendix1, 2.)			

No.	JICA Guidelines (GL)	EIA System of Turkey	Gaps between JICA GL and Laws in Turkey	Policy to fill the gaps
Scope of Impacts to Be Assessed	The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety as well as on the natural environment, such as impacts transmitted through air, water and soil; waste; accidents; water usage; climate change; ecosystems; and fauna and flora, including trans-boundary or global-scale impacts. Social impacts must also be assessed, which include migration of population and involuntary resettlement; local economy such as employment and livelihood; utilization of land and local resources; social institutions such as social capital and local decision-making institutions; existing social infrastructures and services; vulnerable social groups such as poor and indigenous peoples; equality of benefits and losses and equality in the development process; gender; children's rights; cultural heritage; local conflicts of interest; infectious diseases such as HIV/AIDS; and working conditions including occupational safety. (JICA Guidelines, Appendix 1, 3.)			
Social Acceptability	Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. (JICA Guidelines, Appendix 1, 5.)			
Ecosystem and Biodiversity	Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. (JICA Guidelines, Appendix 1, 6.)			
Involuntary Resettlement	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected. (JICA Guidelines, Appendix 1, 7.)			
Indigenous Peoples	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses. (JICA Guidelines, Appendix 1, 8.)			

Source: JICA Survey Team

7.4 Other Frameworks of Environmental and Social Considerations in Seismic Retrofit Projects in Turkey

(1) ISMEP

In Turkey, the World Bank has been supporting the disaster prevention sector and has been implementing ISMEP with Istanbul since 2006. ISMEP provides the support mechanisms consisting of three components: i) rebuilding and seismic retrofitting for public facilities; ii) development of systems for disaster prevention and earthquake resistance; and iii) capacity development for disaster prevention education and awareness-raising. ISMEP targets the seismic retrofitting of critical public facilities for higher earthquake resistance, which include schools and hospitals.

Environmental Management Plan is prepared based on Annex A O.P 4.01 for ISMEP. The plan is composed of the following outline:

- 1. Introduction
- 2. Background
- 3. Environmental Management Plan
- 3.1 Definition
    - 3.2 Potential Environmental Impacts
    - 3.3 Environmental Legislation
    - 3.4 Environmental Mitigation Plan
    - 3.5 Mitigating Measures For Operation Phase
- 4. Cultural Heritage Issue
    - 4.1 National Institutional & Legal Framework
    - 4.2 Local Procedures
    - 4.3 World Bank Cultural Heritage Policy
    - 4.4 International Framework
    - 4.5. Comparison
- 5. Institutional Strengthening
- 6. Local Consultations
- 7. Findings & Recommendations
- 8. Annexes

In addition, in regard to the procurement of construction contractors, the ISMEP requires environmental management as a part of the technical specifications in order to minimize the impact on the environment and social conditions during construction works. It requires the contractors to comply with Turkish environmental regulations, to follow the World Bank guidelines (OP), and to undertake mitigation measures for the environmental impacts.

(2) Disaster Risk Management in Schools Project

MoNE has started "Disaster Risk Management in Schools Project" (originally called "National Disaster and Risk Management Project"). Its main component is the retrofitting or reconstruction of prioritized schools with the World Bank, and the background excerpt is shown below.

> Background Excerpt from NATIONAL DISASTER RISK MANAGEMENT PROJECT, ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK
>
> National Disaster and Risk Management Project (NDRMP) will be implemented by CRED of MoNE. The Project Implementation Unit (PIU) established under CRED, which is currently responsible for management of the "Education Infrastructure for Resilience Project (EIRP)" (P162004), will also be responsible for the overall implementation, management and coordination of the proposed Project.
>
> The overall objective is to increase the safety of students, teachers and staff who benefit from / serve in schools which are located in high-risk seismic zones: The NDRM Project will enable the retrofitting and reconstruction of approximately 400 schools, reaching out to more than 320,000 students and staff per annum.
>
> The proposed Project will be implemented through three components: (i) improving seismic resilience of schools; (ii) enhancing institutional and technical capacity for safer schools; and (iii) project management.

Similar to ISMEP, NDRMP also prepared an environmental and social management framework which consists of:

- 1. Introduction
- 2. Compliance with World Bank Safeguards Policies
- 3. Guidelines for the Preparation of the Environmental and Social Management Plans (ESMP)
- 4. Site Alternatives
- 5. Environmental and Social Monitoring and Grievance Redress Mechanism
- 6. Institutional Implementation and Responsibilities
- 7. Schedule
- 8. Public Consultation
- Annexes

(3) Urban Transformation Project

In 2012, the Urban Transformation Act (hereinafter referred to as the "UT Act") was enacted in order to improve the appropriate living environment in areas with disaster risks and dangerous buildings. Under the UT Act, the hazardous areas subject to redevelopment, dangerous buildings subject to demolition, and reserve areas subject to resettlement and redevelopment are identified. Upon assessment of identified buildings, redevelopment, rebuilding of dangerous buildings or seismic retrofitting works have been implemented.

The UT project is implemented by MoEU based on the UT Act. However, the Act does not stipulate an environmental safeguard system or a framework for environmental and social considerations for the

UT projects. Also, in an interview with MoEU's UT Division representative, no response was obtained regarding the framework for environmental and social considerations.

7.5 Study of Alternatives

Regarding project implementation, MoNE proposes the target areas of the project and the target schools to be retrofitted or reconstructed. The target schools are the existing facilities and the project is implemented in those sites. Even in the case of rebuilding, the conditions generally do not change. Therefore, respective alternatives were neither considered nor compared. In order to confirm its validity, the project was compared to a case where it was not implemented (zero option).

Table 6-2 shows the results of the comparison of alternatives. A result of the study shows that in the case where the project is not implemented, the school facilities remain not retrofitted, no project cost is required, and there is no risk of pollution. However, since the school buildings are not retrofitted, their seismic performance remains vulnerable, and the buildings and facilities can be damaged or collapse in the event of an earthquake.

Therefore, it is difficult to ensure the safety of students, teachers, and school officials. Also, a huge volume of debris will be generated, which should be transported and disposed of. The disposal of construction debris and the repair and rebuilding of the facilities for the damages caused by the disaster take more time and cost. During this time, the school activities cannot resume immediately.

On the other hand, in the case where the project is implemented, there is a risk of pollution occurring during the seismic retrofitting works. However, this is only temporary and not cumulative, and the sphere of its impact is limited within the vicinity of the construction site. Therefore, the impact is not significant. The mitigation measures can be planned and taken systematically without difficulty by anticipating the occurrence of the impact.

The seismic retrofitting of buildings of school facilities will ensure the safety of building operations and their use even in the event of a disaster, which will help save the lives of students and teachers. Also, schools can be used as a temporary shelters in emergency situations and contribute to disaster education. In this way, the project can contribute toward ensuring the safety of students and school officials, and the prompt resumption of school activities. Therefore, it has been evaluated that the implementation of the project is appropriate.

Table 7-6 Comparison of Alternatives

Items	With Project Implementation	Without Project Implementation
Technical Aspect	School facilities are seismically retrofitted and will secure safety in the event of an earthquake. They can be operated as temporary evacuation shelter in case of emergency. Also, disaster awareness can be promoted through disaster education in schools.	The school facilities are not retrofitted and are currently operating under structurally vulnerable conditions.
Cost	B	C
	Costs are required for seismic retrofitting works or rebuilding of schools. However, higher effective retrofitting methods will be considered according to the costs. The retrofitting methods are expected to include advanced technology such as outer frame, as well as the conventional work such as adding shear walls, jacketing columns, etc. The reconstruction work methods include RC structure, steel structure or pre-fabricated structure, etc. In the event of a disaster, only a little damage is expected to take place in retrofitted or rebuilt buildings, and this consequently reduces repair costs.	No costs for seismic retrofitting works are required. However, there are potential risks that the school buildings will be severely damaged or collapse in the event of an earthquake. As a consequence, a huge volume of debris will be generated, which should be transported and disposed of. The disposal of construction debris and rehabilitation of the facilities take more time and cost.
Pollution	B	C
	During the seismic retrofitting or rebuilding works of school buildings, some pollutants are expected to affect particularly the air and water quality, and there will be noise and vibration impacts mainly due to the operation of construction vehicles and machinery and demolition works. In addition, the demolition works will generate demolition wastes. However, as the period is limited at the time of construction and the scope of impact remains within the site of the existing school facilities, the adverse impacts are limited in scope and no significant impact is expected.	No pollution is expected as there are no project works. However, there are potential risks that the school buildings will be severely damaged or collapse in the event of an earthquake. As a consequence, a huge volume of debris will be generated which should be transported and disposed of.
Natural Environment	B	A
	As the project sites are within the premises of existing school sites and the surrounding areas are residential areas or farmland, there are no specific impacts on flora and fauna and the natural environment.	No impacts are expected.
Social Environment	A	C
	Positive impacts: The project will seismically retrofit the school buildings and help save the lives of students and teachers in the event of an earthquake. The retrofitted buildings can be used as temporary evacuation shelters in case of emergency. The school can continue performing school activities immediately after the earthquake. Apart from this, the project can contribute to heighten disaster awareness by promoting disaster education in schools. Adverse impacts: The seismic retrofitting and reconstruction works can cause temporary impacts, noise, vibration and dust which can distract classes and nearby schools.	As the school buildings and facilities can be damaged or collapse in the event of an earthquake, it will take time to restore the facilities and resume classes.

Items	With Project Implementation	Without Project Implementation
Evaluation	**Recommended**	Not recommended
	Although there is a risk of pollution during the seismic retrofitting or reconstruction works upon implementation of the project, the impacts are only temporary and not cumulative, and the scope of impacts is limited to the area around the construction site. Therefore, the adverse impacts are not significant, and mitigation measures can be promoted systematically assuming the occurrence of impacts. On the other hand, the retrofitted school facilities can be used safely in the event of a disaster as well as help save the lives and ensure the safety of students and teachers. Also, facilities can be used as a temporary shelters in emergency situations and contribute to disaster education. In this way, the project can contribute to ensuring the safety of students and school officials, and the prompt resumption of school activities.	The school facilities remain not retrofitted, no project cost is required, and there is no risk of pollution. However, since the school buildings are not retrofitted, the seismic performance remains vulnerable, and the buildings and facilities can be damaged or collapse in the event of an earthquake. Therefore, it is difficult to ensure the safety of students, teachers, and school officials. Also, a huge volume of debris will be generated, which should be transported and disposed of. The disposal of construction debris and repair and rebuilding of facilities damaged by the disaster take more time and cost. During this period, school activities cannot resume immediately.

Note: Note: A: No adverse impact or has positive impact, more preferable; B: Has more negative impact than A but only limited and not significant, C: Has negative impact or no positive impact, less preferable
Source: JICA Survey Team

7.6 Environmental and Social Study

(1) Screening of the Project

In EIA system in Turkey, the Project on "Seismic retrofitting work" and "Seismic retrofitting rebuilding (including dismantling work)" of school facilities are not included in Annex I and Annex II of the Environment Impact Assessment (EIA) Regulation, which are the lists of projects required to conduct EIA. Therefore, the project is not subject to EIA in Turkey, and EIA procedures are not required to implement the project.

On the other hand, the study has proposed a long list of projects, and the target projects will be decided in the project implementation phase. For projects consisting of "Seismic retrofitting work" and / or "Seismic retrofitting rebuilding (including dismantling work)" of existing buildings, the scope of impact is limited within the duration and the sphere. Consequently, the impact is not significant, although the target projects have not been decided yet. The potential adverse impacts are site-specific; few, if any, are irreversible. In most cases, normal mitigation measures can be designed more readily.

Therefore, the proposed loan project can be categorized into Category FI according to the JICA Guidelines, which is defined as "the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment."

(2) Scoping

The scoping was done based on the expected seismic retrofitting methods for school buildings with the environmental and social conditions of the projects sites as shown in Table 6-3.

Table 7-7 Scoping

	No.	Likely Impacts	Rating: Preconstruction/ Construction Phase	Rating: Operation Phase	Reasons of Rating
Pollution	1	Air Pollution	B-	D	[Construction Phase] Exhaust gas and dust caused by operation of construction vehicles and equipment, and dust from demolition works can temporally deteriorate air quality around the construction sites. [Operation Phase] No new facility is operated, which generates exhaust gas or dust and deteriorates air quality.
	2	Water Pollution	B-	D	[Construction Phase] As the construction work will not involve any major alteration of the topography or civil engineering work, water pollution is not expected, although turbid water can be generated by the demolition and rebuilding works. [Operation Phase] No new facility is operated, which deteriorates water quality.
	3	Noise and Vibration	B-	D	[Construction Phase] The operation of construction vehicles and equipment, demolition works can temporally increase levels of noise and vibration in areas near the construction sites. [Operation Phase] No new facility is operated, which generates noise and vibration.
	4	Soil Contamination	D	D	[Construction Phase] As the seismic retrofitting and reconstruction works are conducted for existing facilities, no construction waste soil will be generated; therefore, no soil contamination is expected. [Operation Phase] No new facility is operated, which generates soil contamination.
	5	Waste	B-	D	[Construction Phase] Waste will be generated from demolished buildings, domestic wastes and night soil from construction site offices.
	6	Ground Subsidence	D	D	As the seismic retrofitting and reconstruction works do not involve the use of large-scale groundwater, no serious adverse impacts are expected on the ground subsidence.
	7	Offensive Odor	D	D	[Construction Phase] The seismic retrofitting, demolition and rebuilding works do not generate significant offensive odor. [Operation Phase] No new facility is operated, which generates offensive odor.
	8	Bottom Sediment	D	D	The projects are the seismic retrofitting, demolition and rebuilding of the existing school facilities. This item is, therefore, not affected specifically.

	No.	Likely Impacts	Rating		Reasons of Rating
			Preconstruction/ Construction Phase	Operation Phase	
Natural Environment	9	Protected Areas	D	D	As the possible project sites are not located in and around the protected areas, no impacts on protected areas are expected.
	10	Flora, Fauna and Biodiversity	D	D	As the project site is located in residential or agricultural land, no negative impacts on local biodiversity are anticipated.
	11	Hydrological Situation	D	D	As the construction works do not involve the use of large-scale groundwater, no serious adverse impacts on the hydrological situation are expected.
	12	Topography and Geographical features	D	D	As the seismic retrofitting, demolition and rebuilding works do not involve any major alteration of the topography or geology, no serious adverse impacts on those features are expected.
Social Environment	13	Involuntary Resettlement	D	D	As the projects are implemented on the existing sites of school facilities, there are no residential areas and private properties surrounding the sites. Therefore, neither land acquisition nor involuntary resettlement will occur.
	14	People in Poverty	D	D	As the projects are implemented on the existing sites of school facilities, no people in poverty reside on the sites.
	15	Indigenous and Ethnic Peoples	D	D	As the projects are implemented on the existing sites of school facilities, no indigenous and ethnic peoples reside on the sites.
	16	Local Economy such as Employment, Livelihood, etc.	B+	D	[Construction Phase] The construction activities can result in demand for workers (especially for unskilled and demolition works), and provide a temporary boost to local employment. The local service sector can provide the accommodation for construction workers, as well as food and drinks. The project can facilitate business opportunities for the local service sector. [Operation Phase] No new facility is operated, which worsens the local economy.
	17	Land Use and Utilization of Local Resources	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of existing school facilities, it does not change the present land use.
	18	Water Usage or Water Rights and Rights of Common	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of existing school facilities, the items in mention are not specifically affected.
	19	Existing Social Infrastructures and Services	B-	A+	[Construction Phase] For project works, the seismic retrofitting, demolition and rebuilding of existing school facilities, including the operation of construction vehicles and equipment, can hinder regular conduction of school activities and access to school, and generate nuisance to classes if the students and teachers should be temporally transferred. [Operation Phase] In terms of disaster, the seismic retrofitted school facilities will help secure the lives of students and teachers. It can also work as temporary shelters and can contribute to ensuring people's safety.
	20	Social Institutions such as Social Infrastructure and Local Decision-Making Institutions	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of the existing school facilities, the items in mention are not specifically affected.
	21	Misdistribution of Benefit and Damage	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of the existing school facilities, the items in mention are not specifically affected.

	No.	Likely Impacts	Rating		Reasons of Rating
			Preconstruction/ Construction Phase	Operation Phase	
	22	Local Conflict of Interests	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of existing school facilities, the item in mention is not specifically affected.
	23	Cultural Heritage	D	D	As school buildings designated as cultural heritages are not targeted for the Project, no impacts on cultural heritages are expected.
	24	Landscape	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of the existing school facilities, the project does not seriously change or detract the surrounding landscape.
	25	Gender	D	D	As project activities involve seismic retrofitting, demolition and rebuilding of the existing school facilities, the item in mention is not specifically affected.
	26	Children's Rights	B-	A+	[Construction Phase] In the existing schools, project works which include seismic retrofitting, demolition and rebuilding of the existing school facilities can generate nuisance to tuitions. Especially during rebuilding, alternative classrooms should be prepared, where teachers and students can be temporally transferred so the classes can continue. [Operation Phase] In the event of disaster, the seismic retrofitted school facilities will secure the lives of students and teachers. It can also work as temporary shelters, and can contribute to ensuring the safety of them.
	27	Hazards (Risk), Infectious Diseases such as HIV/AIDS	B-	D	[Construction Phase] Although a considerable influx of workers is unexpected, the risk of contracting infectious diseases such as HIV/AIDS is of concern if the workers lack control and education. [Operation Phase] No operations of facilities or equipment where infectious diseases can generate from are expected.
	28	Working Conditions	B-	D	[Construction Phase] There is a possibility of accidents involving workers caused by operation of construction vehicles and equipment. These accidents can temporally disturb people's health and security. Traffic accidents can also occur around construction sites. [Operation Phase] No operations of facilities or equipment that will endanger workers' safety and health are expected.
Others	29	Accidents	B-	D	[Construction Phase] There is a possibility of accidents involving workers and the local people caused by operation of construction vehicles and equipment. These accidents can temporally disturb people's health and security. [Operation Phase] No new facility or equipment where accidents may happen is being operated.
Others	30	Transboundary Issues, Global Warming	D	D	Although exhaust gas and dust are generated by operation of construction vehicles and equipment, no adverse impacts are expected on transboundary issues and global warming meteorology, as the project sites and construction periods are limited in scope.

Rating:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown (Examination is needed. Impacts may become clear as the study progresses.)
D: No impact is expected
Source: JICA Survey Team

(3) TOR of Environmental and Social Considerations Study

Based on scoping results, a TOR of Environmental and Social Study to evaluate the impacts is summarized in Table 6-4. In terms of availability, the target municipalities and schools were unclear, and the Survey activities and relevant data were limited. Thus, the study methods were mainly literature survey composed of collection of relevant legislations and information, hearings for relevant organizations and local consultants for similar projects.

Table 7-8 TOR of Environmental and Social Considerations Study

	No.	Likely Impacts	Phase/ Rating	Study Item	Study Method
Pollution	1	Air pollution	Const. B-	• Existing situation of air pollution at construction sites • Seismic retrofitting methods and demolition methods	• Hearings for organizations relevant to the seismic retrofit and reconstruction works for schools • Site reconnaissance for similar project sites
Pollution	2	Water Pollution	Const. B-	• Existing situation of wastewater treatment at construction sites • Seismic retrofitting methods and demolition methods	• Hearings for organizations relevant to the seismic retrofit and reconstruction works for schools • Site reconnaissance for similar project sites
Pollution	3	Noise and Vibration	Const. B-	• Existing situation of noise/ vibration at construction sites • Seismic retrofitting methods and demolition methods	• Hearings for organizations relevant to the seismic retrofit and reconstruction works for schools • Site reconnaissance for similar project sites
Pollution	5	Waste	Const. B-	• Waste disposal system at construction sites • Seismic retrofitting methods and demolition methods	• Hearings for organizations relevant to the seismic retrofit and reconstruction works for schools • Site reconnaissance for similar project sites
Social Environment	16	Local Economy such as Employment and Livelihood, etc.	Const. B+ Operation B+	• Possibility of hiring local workers	• Hearings for organizations relevant to retrofit and reconstruction works for schools
Social Environment	19	Existing Social Infrastructures and Services	Const. B- Operation A+	• Conditions of school facilities • Plans for using schools as community centers for disaster prevention and preparedness	• Site reconnaissance for the target schools • Hearings for target schools
Social Environment	26	Children's Rights	Const. B- Operation A+	• Policy for children's rights • Implementation of classes • Seismic retrofitting and demolition methods	• Study on existing information (literature survey) • Hearings for organizations relevant to retrofit and reconstruction works for schools
Social Environment	27	Hazards (Risk), Infectious Diseases such as HIV / AIDS	Const. B-	• Existing situation of sanitation at construction sites • Outbreak situation of infectious diseases including HIV / AIDS around the project sites	• Study on existing information (literature survey) • Hearings for organizations relevant to retrofit and reconstruction works for schools • Site reconnaissance for similar project sites

	No.	Likely Impacts	Phase/ Rating	Study Item	Study Method
	28	Working conditions	Const. B-	• Policy and measures on work security • Occurrence of traffic accident	• Study on existing relevant legislations (literature survey) • Hearings for organizations relevant to retrofit and reconstruction works for schools • Site reconnaissance for similar project sites
	29	Accidents	Const. B-	• Policy and measures on work security • Accident occurrence at construction sites	• Hearings for organizations relevant to retrofit and reconstruction works for schools • Site reconnaissance for similar project sites • Collection of relevant legislations (literature survey)

Source: JICA Survey Team

(4) Results of the Environmental and Social Considerations Study

The results of the environmental and social study based on the TOR are explained in Table 6-5.

Table 7-9 Results of the Environmental and Social Considerations Study

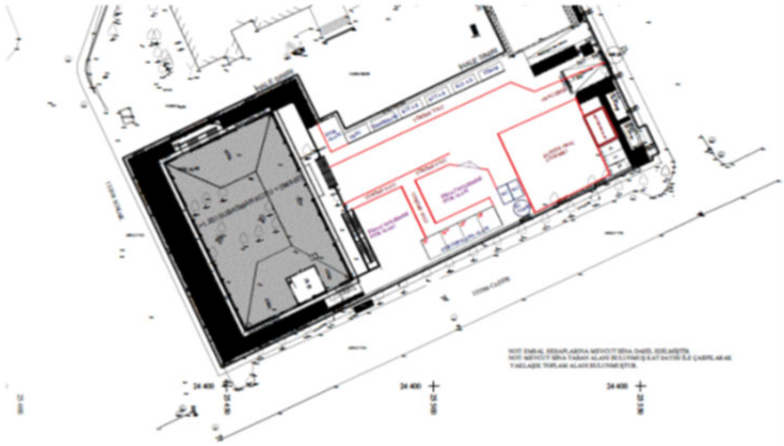
	No.	Likely Impacts	Study Results
Pollution	1	Air Pollution	[Study Results] According to the results of interviews with local consultants who have experience in school construction supervision, the problem of air pollution was not serious in Turkey because the scale of school construction work was not large. Also, there was a similar result in an interview with an environmental safeguard staff of IPCU-ISMEP, a seismic retrofitting project for public facilities in Istanbul. As Istanbul is urbanized, the problem of air pollution caused by school construction works was not serious. At the construction site of ISMEP, staff monitors the air conditions due to the dust and exhaust gas generated by vehicle traffic and the operation of construction equipment. Regarding the dust emission during excavation, construction, repair, renovation and demolition works, it is required to meet the air quality standards specified in Regulation on the Assessment and Management of Air Quality, which is defined in the Regulation of the Control of Excavation Soil and Construction and Demolition Waste. The exterior of the buildings to be renovated or demolished should be protected with a tear-resistant / retaining net or similar material to minimize dust emissions and to ensure visual acuity and safety in the sites. [Impact Prediction] As results of the study, although the impact is not significant, dust and exhaust gas are generated during construction due to the operation of construction vehicles and machinery, or dust is generated during demolition works. These factors can slightly temporarily deteriorate air quality at the construction sites and surrounding areas.

<table>
<tr><th></th><th>No.</th><th>Likely Impacts</th><th>Study Results</th></tr>
<tr><td></td><td>2</td><td>Water Pollution</td><td>
[Study Results]
According to the results of interviews with local consultants who have experience in construction management of school construction, the problem of water pollution was not serious in Turkey because the scale of school construction work was not large.
The drainage water from the construction sites was discharged into drains provided by local governments. The oil that has leaked or spilled from the vehicles and construction equipment was adsorbed by filters.
According to an interview with the environmental safeguard staff of IPCU-ISMEP, the problem of water pollution caused by school construction works was not serious. At the construction site of ISMEP, the staff monitors the conditions of wastewater.
On the other hand, water pollution during excavation, construction, repair, renovation and demolition works is not specified in the Regulation of the Control of Excavation Soil and Construction and Demolition Waste. However, the works should meet the environmental water quality standards of the Surface Water Quality Management Regulation.
[Impact Prediction]
Based on the results of the study, although the impact is not significant, drainage water can be discharged from the construction sites during construction, which include washing water for construction vehicles and machinery, topsoil runoff from the construction sites during rainfall, drainage from work offices, and night soil from toilets. Although it is considered that wastewater treatments can be dealt with through usual measures, the water quality of the surrounding rivers can deteriorate.
</td></tr>
<tr><td></td><td>3</td><td>Noise and Vibration</td><td>
[Study Results]
According to the results of interviews with the local consultants who have experience in school construction supervision, the problems brought by noise and vibration were not serious in Turkey because the scale of school construction work was not large. Also, there was a similar result in an interview with the environmental safeguard staff of IPCU-ISMEP. As Istanbul is urbanized and noise and vibrations occur on a daily basis, those caused by school construction works were not regarded as serious. At the construction site of ISMEP, staff monitors the noise generated by vehicle traffic and the operation of construction equipment.
On the other hand, there are environmental noise standards at construction sites and indoor noise standards at educational facilities in Turkey as follows.
Table 7-10 Environmental Noise Limit Values for Construction Site
<table>
<tr><th>Type of activity (construction, demolition and repair)</th><th>daytime (dBA)</th></tr>
<tr><td>Building</td><td>70</td></tr>
<tr><td>Way</td><td>75</td></tr>
<tr><td>Other sources of noise</td><td>70</td></tr>
</table>
Source: Regulation on assessment and management of environmental noise (Official Gazette No. 27601, 4 June 2010)
Table 7-11 Indoor Noise Level Limit Values for Educational Facilities
<table>
<tr><th>Area of Use
Educational Facilities Areas</th><th>Closed Window
Leq (dBA)</th><th>Open Window
Leq (dBA)</th></tr>
<tr><td>Classrooms in schools, special education facilities, kindergartens, laboratories and so on</td><td>35</td><td>45</td></tr>
<tr><td>Gym</td><td>55</td><td>65</td></tr>
<tr><td>Dining hall</td><td>45</td><td>55</td></tr>
<tr><td>Bedrooms in kindergartens</td><td>30</td><td>40</td></tr>
</table>
Source: Regulation on assessment and management of environmental noise (Official Gazette No. 27601, 4 June 2010)
[Impact Prediction]
Based on the results of the study, although the impact is not significant, noise and vibration will be temporarily generated during construction due to the operation of construction vehicles and machinery, or due to construction and demolition works. Unless the seismic retrofitting works for schools are implemented during the school summer vacations in Turkey, it is necessary to secure other classrooms and move the students so that classes could continue. If there are enough vacant rooms within the same school facilities, noise and vibrations generated intermittently can still disturb the classes during works done at daytime.. If the environmental noise standards for construction sites and indoor noise level limit for educational facilities are not complied with, the risk of impacts will increase.
</td></tr>
</table>

	No.	Likely Impacts	Study Results
	5	Waste	[Study Results] According to the results of interviews with the local consultants who have experience in school construction supervision, waste materials from demolished structures were firstly segregated into disposable waste, recycled materials and hazardous waste, and these were temporarily stored at the sites. For example, reinforced concrete structures (pillars, beams, etc.) were cut and shredded, and the rebar inside was abstracted, sorted and recycled. These wastes were be transported by a licensed contractor to disposal sites or recycling facility designated by the municipality. Moreover, the contractors and supervisory consultants filled up a waste transport form with the types, amount of wastes, transport destinations, recycled materials, etc. They also submitted it to the competent authority to report the status of waste disposal.   Abstracted rebar from demolition structures Waste transportation by licensed vehicle
			[Study Results] On the other hand, construction and demolition waste including hazardous waste are defined in the waste list of EK-4 in the Regulation on Control of Solid Wastes No. 29314. In particular, hazardous waste materials are coal tar and tar products, oil, insulation materials and construction materials containing asbestos; construction and demolition waste containing mercury; construction and demolition wastes containing PCB (e.g. sealants containing PCB, PCB-based and resin-based flooring materials, PCB-coated glazing units, and capacitors containing PCB). A license is required for vehicles that transport these wastes. Producers of waste are required to prepare waste management plan to reduce the volume, collect waste separately and store them temporarily with proper packaging and labeling. They also regularly keep a record of accumulated waste. The duties and responsibilities of municipalities include the following: establish and operate waste treatment facilities; obtain environmental licenses for related facilities; carry out or contribute to raising awareness; provide periodic training of personnel in charge of waste management; health control; prevent of occupational risks; implement measures including provision of training and information, necessary tools and equipment; and implement health and safety measures. Regulation of the Control of Excavation Soil and Construction and Demolition Waste No. 25406 stipulates that the recyclable materials inside the structures to be demolished are firstly separated and recycled. Construction materials such as doors, windows, cabinets, floor and wall coverings, flooring and insulation materials and hazardous waste are separated from the structures to be demolished and collected separately. Waste loaded containers are collected and transported to recycle or storage facilities by the municipal authority or by companies authorized to collect and transport waste materials. During the demolition procedures, measures shall be taken in relation to noise and dust pollution. During the demolition, repair and renovation of buildings where materials containing asbestos are used, the principles are complied with in order to protect the health and safety of employees in line with the Regulation on Health and Safety Measures Concerning the Work with Asbestos prepared by the Ministry of Labor and Social Security. During excavation, construction, repair, renovation and demolition works, the principles of noise control regulation shall be applied for noise emissions at the sites. Regarding dust emissions, the air quality standards specified in the Regulation on Air Quality Assessment and Management shall be met. Besides, the exterior of the buildings to be renovated or demolished must be protected with tear-resistant / retaining net or similar material to minimize dust emissions, and to ensure visual acuity and safety on the sites.

	No.	Likely Impacts	Study Results
			[Impact Prediction] Based on the results of the study, in the case of rebuilding, it is necessary to demolish the existing buildings, recycle and dispose of the demolished materials. The demolition wastes can include hazardous waste. In addition, construction waste will be generated from the construction works, and domestic waste will be generated from the construction officesThe dismantled waste, construction waste and hazardous waste will be separated according to Turkish regulations and temporarily stored separately on the sites. Then, they will be collected by licensed companies and transported to disposal sites. The domestic waste will be collected and disposed of by local governments or licensed contractors. However, these wastes can cause contamination if they are not properly separated, sorted or disposed of on the sites, or not transported and disposed of in accordance with the Turkey regulations.
Social Environment	16	Local Economy such as Employment and Livelihood, etc.	[Study Results] Based on interviews with construction supervisory consultants, a contractor can hire local workers for school construction works. [Impact Prediction] The contractor can hire local workers for school construction works. This can increase opportunities for local people to secure temporary employment.
	19	Existing Social Infrastructures and Services	[Study Results] According to the results of interviews with representatives of schools in which seismic retrofitting works were carried out, seismic retrofitting works were conducted for about 10 months up to one year in the long term, or three months during the summer vacation from mid-June to mid-September. In the case of schools where long-term construction was performed, the works were divided into blocks so that classes could continue in other existing facilities on the premises by doing double shifts during seismic retrofitting works. Therefore, there was no need to move the students to another school, and lessons were carried out in the same school even during the construction period. In addition, the works were intensively carried out at nighttime, and major construction works were conducted during the summer vacation. There were no objections against the implementation of the retrofitting works. On the other hand, the following opinions were raised during interviews with representatives of schools targeted for seismic retrofitting works: • If the seismic retrofitting works are required, students should be moved to a nearby school that has sufficient capacity, and the host school will respond to the increase in the number of classes by changing from single shift to double shift system. • If MoNE gives instructions for the seismic retrofitting works or rebuilding, school personnel will follow the instructions and make a plan to move students in cooperation with the provincial division of education in preparation for the works. • The provincial division of education will decide the school that the students will be moved to. • It is desirable if the seismic retrofitting works can be implemented during the three-month summer vacation from mid-June to mid-September. • The adoption of the outer frame method, which allows construction while occupants stay in place, can eliminate concerns about making students move, and the schools recognize that it is an ideal and effective method. • It is conceivable to carry out renovation and other construction works inside the buildings during the three-month summer vacation, and then reinforce the buildings with the outer frame from the outside.

	No.	Likely Impacts	Study Results
			When the capacity of the nearby schools was not enough, the following opinions were raised: • Due to the difficulty of moving students to nearby schools, there is no choice but to carry out seismic retrofitting works during the three months of summer vacation. • Alternatively, in case the seismic retrofitting works are not completed during the three months of the summer vacation, if the outer frame method can be carried out from outside of the buildings while occupants stay inside, it is an effective method because the students will not need to move to a nearby school. It was also raised that the first priority was to ensure the safety of students during seismic retrofitting works. According to the results of interviews with local consultants who have experience in school construction supervision, the people in Turkey are concerned about earthquakes. They think that schools should be resistant to earthquakes. They complain even about small cracks due to small earthquakes as they think the buildings will collapse. [Impact Prediction] Based on the results of the study, unless the seismic retrofitting works for schools are implemented during the school summer vacation in Turkey, it is necessary to secure other classrooms and move the students to continue classes. It is desirable if there are enough vacant rooms within the same school facilities. However, moving to a nearby school and conducting double shift classes will affect both schools. In the case of the outer frame method in which the works are performed outside the buildings while the occupants stay inside, the impact can be reduced because the students do not need to move to the nearby school. On the other hand, retrofitted school facilities can suffer the least damage and collapse and can be used safely in the event of a disaster as well as help save the lives and safety of students and teachers. Also, they can be used as temporary shelters in emergency situations, and school activities can resume immediately after the earthquake. Furthermore, promoting disaster education in schools can contribute to raising disaster prevention awareness.
	26	Children's Rights	[Study Results] Under the constitution, all citizens are entitled to education. Primary education is compulsory for all citizens of both sexes and is free of charge in state schools. Also, all children are protected. Turkey has also ratified the Convention on the Rights of the Child signed on September 14, 1990 and approved under Law No. 4058 on September 12, 1994. [Impact Prediction] Based on the results of the study, unless the seismic retrofitting works for schools are implemented during the school summer vacation in Turkey, it is necessary to secure other classrooms and move the students to be able to continue classes. It is desirable if there are enough vacant rooms inside the same school facilities. However, moving to a nearby school and doing double shift classes will be nuisance on both school students. In the case of the outer frame method in which the works are performed outside the buildings while occupants can stay inside, the impact can be reduced because the students do not need to move to the nearby school. On the other hand, as the retrofitted school facilities can suffer the least damage and collapse and can be used safely in the event of a disaster as well as help save lives and ensure safety of students and teachers. Also, they can be used as temporary shelters in emergency situations and the school activities can resume immediately after the earthquake. In this way, retrofitted school facilities can help save children's lives and their rights to education.

	No.	Likely Impacts	Study Results
	27	Hazards (Risk), Infectious Diseases such as HIV/AIDS	[Study Results] According to the results of interviews with the local consultants who have experience in school construction supervision and the environmental safeguard staff of IPCU-ISMEP, both interviewees did not point out any problems related to infectious diseases. On the other hand, the labor law and occupational safety and health law related to the working environment is stipulated as follows: Under the labor law, employers provide employees with the necessary training on occupational health and safety. In addition, the Occupational Safety and Health Law stipulates that employers should provide the assignment of doctors and occupational safety managers, recording and reporting of accidents and illnesses, inspection of health of workers, training of workers, and consultation of workers. [Impact Prediction] Based on the results of the study, if the sanitary environment especially drainage and waste disposal at the construction site is not properly maintained during construction works, waterborne or insect-borne infectious diseases can occur. Also, if the workers are not properly instructed, the risk of sexually transmitted diseases, including HIV / AIDS, may increase.
	28	Working Conditions	[Study Results] According to the results of interviews with the local consultants who have experience in school construction supervision, accidents of workers (e.g. falling accidents) or inadequate payment of workers' wages may occur at the construction sites. The most common occupational safety issues include improper installation of scaffolds; lack of safety equipment / gears and not wearing them; and improper sorting, storage and disposal of wastes and recycled materials. For this reason, the consultants supervise and improve deficiencies and accidents by using construction site inspection forms, rules violation reports and improvement result reports at construction sites. In order to prevent traffic accidents and labor accidents, traffic management plans and construction site layout plans are created and implemented. In addition, along with the contractor's safety officer, a certified independent organization commissioned by the contractor's authorities monitors the labor accidents and the working environment, inspects scaffolds and construction equipment  Source: Local supervisory consultant **Figure 7-3 Example of a Layout Plan at a Construction Site**
			On the other hand, the Labor Law and the Occupational Health and Safety Law are stipulated as follows. The Labor Law stipulates working conditions, work-related rights and obligations for employers and employees working under an employment contract. In this context, as an obligation to ensure occupational health and safety for employers and employees, the employer should provide and maintain all the necessary means and tools, and employees should comply with these measures taken in the context of occupational health and safety. Employers should inform employees regarding occupational risks and the measures that they must take, as well as their legal rights and obligations. Then, employers provide employees with the necessary training on occupational health and safety.

	No.	Likely Impacts	Study Results
			The Occupational Safety and Health Law also regulates the duties, authority, responsibility, rights and obligations of employers and employees to ensure occupational safety and health at workplaces and to improve existing health and safety conditions. Employers should provide the assignment of doctors and occupational safety managers, recording and reporting of accidents and illnesses, inspection of health of workers, training of workers, and consultation of workers. [Impact Prediction] Based on the results of the study, occupational accidents may occur due to the operation of construction vehicles and machinery during construction works and / or building demolition works, particularly at high places.
	29	Accidents	[Study Results] The accident of workers at construction sites are described above. In particular, traffic management plans and construction site layout plans are important for preventing traffic accidents not only in the construction sites, but also in the surrounding residential areas. [Impact Prediction] Based on the results of the study, accidents involving workers may occur during construction works. Further, in addition to regular vehicle traffic, the traffic volume will increase due to construction vehicles running, and a risk of traffic accidents may increase.

Source: JICA Survey Team

(5) Evaluation of Anticipated Environmental and Social Impacts

The anticipated environmental and social impacts were evaluated and summarized as shown in Table 6-8. As a result, no significant negative impact is expected in the project.

As the project consists of "Seismic retrofitting work" and/or "Seismic retrofitting rebuilding (including dismantling work)" of the existing buildings, the scope of impact is limited in duration and sphere. Consequently, the potential adverse impacts can be minimized and in most cases, normal mitigation measures can be designed readily.

Table 7-12 Evaluation of Anticipated Environmental and Social Impacts

	No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
			Preconstruction / Construction	Operation	Preconstruction/ Construction	Operation	
Pollution	1	Air Pollution	B-	D	B-	N/A	[Construction Phase] Dust and exhaust gas are generated due to the operation of construction vehicles and machinery, or dust is generated during demolition works. These can slightly deteriorate air quality temporarily at the construction sites and the surrounding areas.
	2	Water Pollution	B-	D	B-	N/A	[Construction Phase] Drainage water can be discharged from the construction sites during construction, which include washing water for construction vehicles and machinery, topsoil runoff from the construction sites during rainfall, drainage from work offices, and night soil from toilets. Although it is considered that these wastewater treatments can be dealt with by usual measures, the water quality of the surrounding rivers can deteriorate.

	No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
			Preconstruction / Construction	Operation	Preconstruction/ Construction	Operation	
	3	Noise and Vibration	B-	D	B-	N/A	[Construction Phase] Noise and vibration pollution will be temporarily generated during construction works due to the operation of construction vehicles and machinery, or due to construction and demolition works. Unless seismic retrofitting works for schools are implemented during the school summer vacation in Turkey, it is necessary to secure other classrooms and move the students to be able to continue classes. If there are enough vacant rooms within the same school facilities, noise and vibrations generated intermittently can disturb the classes during works done at daytime. If the environmental noise standards for construction sites and indoor noise level limit for educational facilities are not complied with, the risk of impacts will increase.
	4	Soil Contamination	D	D	N/A	N/A	
	5	Waste	B-	D	B-	N/A	[Construction Phase] In the case of rebuilding, it is necessary to demolish the existing buildings, recycle and dispose of the demolished materials. The demolition wastes can include hazardous waste. In addition, the construction waste will be generated from the construction works, and domestic waste will be generated from the construction offices. The dismantled wastes, construction waste and hazardous waste will be separated according to Turkish regulations and temporarily stored separately on the sites. Then, they will be collected by licensed companies and transported to disposal sites. The domestic waste will be collected and disposed of by local governments or licensed contractors. However, these wastes can cause contamination if they are not properly separated, sorted or disposed of on the sites, or not transported and disposed of in accordance with the Turkey regulations.
	6	Ground Subsidence	D	D	N/A	N/A	
	7	Offensive Odor	D	D	N/A	N/A	
	8	Bottom Sediment	D	D	N/A	N/A	
Natural Environment	9	Protected Areas	D	D	N/A	N/A	
	10	Flora, Fauna and Biodiversity	D	D	N/A	N/A	
	11	Hydrological Situation	D	D	N/A	N/A	
	12	Topography and Geographical features	D	D	N/A	N/A	
Social Environment	13	Involuntary Resettlement	D	D	N/A	N/A	
	14	People in poverty	D	D	N/A	N/A	
	15	Indigenous and Ethnic Peoples	D	D	N/A	N/A	

	No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
			Preconstruction / Construction	Operation	Preconstruction/ Construction	Operation	
	16	Local Economy such as Employment and Livelihood, etc.	B+	D	B+	N/A	[Construction Phase] The contractor can hire local workers for school construction works. This can increase opportunities for local people to secure temporary employment.
	17	Land Use and Utilization of Local Resources	D	D	N/A	N/A	
	18	Water Usage or Water Rights and Rights of Common	D	D	N/A	N/A	
	19	Existing Social Institutions such as Social Infrastructure and Local Decision -Making Institutions	D	D	N/A	N/A	
	20	Existing social Infrastructures and Services	B-	A+	B-	A+	[Construction Phase] Unless the seismic retrofitting works for schools are implemented during the school summer vacation in Turkey, it is necessary to secure other classrooms and move the students to be able to continue classes. It is desirable if there are enough vacant rooms in the same school facilities. However, moving to a nearby school and doing double shift classes will affect both schools. On the other hand, in the case of the outer frame method in which the works are performed outside the buildings while occupants can stay inside, the impact can be reduced because the students do not need to move to the nearby school. [Operation Phase] On the other hand, as the retrofitted school facilities can suffer the least damage and collapse and can be used safely in the event of a disaster as well as help save lives and ensure safety of students and teachers. Also, they can be used as temporary shelters in emergency situations and the school activities can resume immediately after the earthquake. Furthermore, promoting disaster education in schools can contribute to raising disaster prevention awareness.
	21	Misdistribution of Benefit and Damage	D	D	N/A	N/A	
	22	Local Conflict of Interests	D	D	N/A	N/A	
	23	Cultural Heritage	D	D	N/A	N/A	
	24	Landscape	D	D	N/A	N/A	
	25	Gender	D	D	N/A	N/A	

No.	Likely Impacts	Rating by Scoping		Rating by Study Results		Reasons of Rating
		Preconstruction / Construction	Operation	Preconstruction/ Construction	Operation	
26	Children's Rights	B-	A+	B-	A+	[Construction Phase] Unless the seismic retrofitting works for schools are implemented during the school summer vacation in Turkey, it is necessary to secure other classrooms and move the students to be able to continue classes. It is desirable if there are enough vacant rooms within the same school facilities. However, moving to a nearby school and doing double shift classes will be a nuisance for both school students. On the other hand, in the case of the outer frame method in which the works are performed outside the buildings while occupants can stay inside, the impact can be reduced because the students do not need to move to the nearby school. [Operation Phase] On the other hand, as the retrofitted school facilities can suffer the least damage and collapse and can be used safely in the event of a disaster as well as help save lives and ensure safety of students and teachers. Also, they can be used as temporary shelters in emergency situations and the school activities can resume immediately after the earthquake. In this way, retrofitted school facilities can help save children's lives and their rights to education.
27	Hazards (Risk), Infectious Diseases such as HIV/AIDS	C-	D	B-	N/A	[Construction Phase] During construction works, if the sanitary environment, particularly the drainage and waste disposal at the construction site, is not properly maintained, waterborne or insect-borne infectious diseases can occur. Also, if the workers are not properly instructed, the risk of sexually transmitted diseases including HIV/AIDS may increase.
28	Working Conditions	B-	D	B-	N/A	[Construction Phase] During construction works, occupational accidents may occur due to the operation of construction vehicles and machinery, or construction works and building demolition works particularly at high places.
29	Accidents	B-	D	B-	N/A	[Construction Phase] The accidents of workers may occur during construction works. Further, in addition to ordinary vehicle traffic, traffic volume will increase due to the construction vehicles running, and the risk of traffic accidents may increase.

Source: JICA Survey Team

(6) Mitigation Measures

Table 6-9 s summarizes the proposed mitigation measures for the adverse impacts in the project. Pollutions in the construction phase are expected as the most adverse impacts. The mitigation measures are incorporated into the Environmental Safeguards in the Standard Specifications to provide environmental countermeasures and actions to perform any civil works under a contract required by the consultant and the CRED of MoNE.

In addition, regarding securing the cost for implementing mitigation measures, those at construction sites including the working conditions will be secured mainly by contractors, those related to the target schools will be secured by MoEU or DoNE, and those for waste disposal will be secured by contractors and municipalities. However, it will be determined depending on the project details in the design works or in the supervisory consultant and contractor procurement process.

Table 7-13 Proposed Environmental Mitigation Measures

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
Preconstruction and Construction Phases					
1	Air Pollution	Deterioration of air quality due to dust	• Contractor will regularly spray water on working areas, roads and demolition debris to minimize dust generation especially in dry season • Construction vehicles and machineries will be regularly washed and cleaned by high pressure water spray • Back of hauling equipment will be covered by sheet during their operations • Open burning of domestic waste, construction material and demolition debris at the construction site	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality
		Deterioration of air quality due to gas emissions	• Contractor will use modern equipment and regularly maintain the construction vehicles and machineries to minimize exhaust gas emission • Develop a traffic management plan so that construction vehicles are not congested around the construction site • Install an outer wall around the construction site • Drivers of vehicles are instructed not to make excessive idling and revving of construction vehicles on sites		
2	Water Pollution	Turbid water due to eroded soil from the construction site	• A silt fence is installed to prevent soil eroded from the construction site and siltation in nearby drainages, streams and rivers	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality
		Deterioration of river water due to wastewater from the construction site	• Install toilets at the construction site to appropriately treat and dispose of human waste • Washing water for construction equipment and vehicles, and wastewater from site offices are treated to meet the water quality and environmental standards of the surrounding rivers, and discharged into drainage channels		
3	Noise and Vibration	Nuisance on residents or structures due to noise and vibration generated by equipment and vehicles	• Contractor will use modern construction vehicles and machineries that generate low noise and vibration, and regularly maintain them • Contractor will effectively schedule working hours in restricted times considering nuisance on nearby communities • Develop a traffic management plan so that construction vehicles are not congested around the construction site • Install an outer wall around the construction site • Drivers of vehicles are instructed not to make excessive idling and revving of construction vehicles at sites	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
Preconstruction and Construction Phases					
4	Soil Contamination	Deterioration of soil due to spilled fuel and oil from equipment	• Contractor will regularly maintain the construction vehicles and machineries to avoid spillage • Any hazardous liquid such as fuel, hydraulic or lubricating oils dropped or spilled will be cleaned and collected • Washing of vehicles and equipment will be permitted in designated and equipped areas	Supervising Consultant, Contractor	MONE
5	Waste	Domestic waste from construction site	• All garbage will be put in trash can and regularly disposed of to assigned place where feasible under coordination with municipality	Consultant, Contractor, Licensed collectors	CLPIU (CRED/ MoNE), Municipality
		Demolition and construction waste disposal	• Demolition and construction wastes are sorted, separated and stored by type, domestic waste, solid waste, liquid waste and chemical wastes on site. • Demolition waste is first separated as much as possible, individually disassembled and stored whenever possible • Demolition waste is collected by a contractor, and processed in a recycling facility authorized by local government • Demolition and construction waste are appropriately collected, transported and disposed of by licensed collectors		
		Hazardous waste	• Hazardous wastes are temporarily stored in leak-proof containers in a separate safe place on site • Hazardous waste is collected and transported on specified route by licensed collectors, and disposed of in a designated facility authorized by local government		
6	Existing Social Infrastructures and Services	Disruption of classes	• In order to continue the classes, construction works are done during a long school holiday, or temporary transfer of students is coordinated with other schools • In order to minimize the temporary transfer of students during construction work, “doing installation while occupants stay inside” is adopted.	DoNE, Consultant, Contractor	CLPIU (CRED/ MoNE)
7	Hazards (Risk), Infectious diseases such as HIV/AIDS	Expansion of infectious diseases	• Maintain the hygienic environment around the site offices and also sanitation in order to avoid the occurrence of infectious diseases caused by water and insects. • Contractor will instruct and sensitize the construction workers to prevent the spread of sexually transmitted diseases	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality
8	Children’s Rights	Disruption of classes	• In order to continue the classes, construction works are done during a long school holiday or temporary transfer of students is coordinated with other schools • In order to minimize the temporary transfer of students during construction work, “doing installation while occupants stay inside” is adopted	DoNE, Consultant, Contractor	CLPIU (CRED/ MoNE)
9	Working Conditions	Occupational safety, hygiene and health of workers	• The contractors take responsibility to ensure occupational safety, hygiene and health of workers in accordance with the legislation related to construction work and general occupational safety and health • The consultant supervises and monitors the construction activities of contractors, and improve the working environment as necessary	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality

No.	Item	Possible Adverse Impacts	Proposed Environmental Mitigation Measures	Implementing Organization	Responsible Organization
Preconstruction and Construction Phases					
10	Accidents	Accidents of teachers, students and nearby residents	• Develop a traffic management plan including individual routes so that construction vehicles are not congested, and secure safe access of vehicles and passengers without traffic interference around the construction site • In particular, the concentration of vehicles during heavy traffic hours of commuting times for school and business are avoided, and instruct the worker the safe driving • Safety equipment are installed, which include traffic signs, traffic mirrors, lighting, signposts, warning signs, and barriers for traffic segregation • Install an outer wall or fence around the construction site to separate it	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality

Source: JICA Survey Team

(7) Monitoring Plan

1) Monitoring Plan

A monitoring plan is proposed as shown in Table 6-10. Important monitoring items are mostly for pollutions and accidents that may occur during construction period. These items will be monitored according to the legislation of Turkey and under the supervision of concerned municipality where the project is located. The proposed monitoring items will be reviewed depending on project details in the design works or the supervisory consultant and contractor procurement process.

The CLPIU of CRED will hire the consultant, including environmental safeguard specialists who will also conduct the monitoring in cooperation with the consultant. The consultant will prepare a monthly monitoring report and submit it to CLPIU and CRED.

Table 7-14 Proposed Monitoring Plan (Draft)

Environmental Item	Monitoring Item	Location	Frequency	Implementing Organization	Responsible Organization	Cost
Construction Phase						
Air Pollution	TSP, PM10, CO, NOx, SOx	Construction sites	Once a month	Contractor	CLPIU (CRED/ MoNE), Municipality	Included in the construction costs
Water Pollution	Water quality standards	Discharging point to drainage, river, stream	Once a month	Contractor	CLPIU (CRED/ MoNE), Municipality	Included in the construction costs
Noise	Noise, Leq (dBA)	Around the construction site, within the school vicinity, in the classroom	Once a week	Contractor	CLPIU (CRED/ MoNE), Municipality	Included in the construction costs

Environmental Item	Monitoring Item	Location	Frequency	Implementing Organization	Responsible Organization	Cost
Construction Phase						
Waste	Domestic construction waste /Demolition waste Hazardous waste	Construction site	Every collection period	Contractor, Licensed Collectors, Municipality	CLPIU (CRED/ MoNE), Municipality, DoEU	Included in the construction costs
Existing Social Infrastructures and Services, Children's Rights	Class interruption status	Within the school vicinity	Once a month	Consultant, DoNE	CLPIU (CRED/ MoNE), DoNE	
	Noise, Leq (dBA)		Once a week	Contractor		
Hazards (Risk), Infectious diseases such as HIV/AIDS, Working Conditions, Accidents	Infectious diseases, occupational accidents, traffic accidents	Construction site, around construction site	Everyday	Contractor	CLPIU (CRED/ MoNE), Municipality	Included in the construction costs
Grievance Redress	Process of grievance redress	Construction site, around the construction site	Once a week	Consultant, Contractor	CLPIU (CRED/ MoNE), Municipality	Included in the construction costs

Source: JICA Survey Team

2) Monitoring Form

Monitoring forms were drafted based on the draft monitoring plan as follows. The draft monitoring forms will be reviewed depending on the finalized monitoring plans and the environmental safeguards in the standard specifications under a contract required by the consultant and the CRED of MoNE.

Table 7-15 Monitoring Form (Draft)

Monitoring Item 1: Air Quality
Frequency: Once a month

No.	1		2		3	
Date						
Location						
Time						
Item	Measured Value	Standard Value	Measured Value	Standard Value	Measured Value	Standard Value
PM10 (mg/m^3)						
NO_2 (ppm)						
SO_2 (ppm)						
Dust/Visibility						

Monitoring Item 2: Water Quality
Frequency: Once a week

No.	1		2		3	
Date						
Location						
Time						
Item	Measured Value	Standard Value	Measured Value	Standard Value	Measured Value	Standard Value
General Terms						
Temperature (°C)						
pH						
Electrical conductivity (µS/cm)						
Chroma icity						
(A) Oxygenation parameters						
Dissolved oxygen (mg O2/L)						
Oxygen saturation (%)						
COD (mg/L)						
BOD (mg/L)						
(B) Nutrients (Nutrient) parameters						
Ammonia Nitrogen (mg $NH4^+$-N/L)						
Nitrite Nitrogen (mg NO_2^--N/L)						
Nitrate Nitrogen (mg NO_3^--N/L)						
Total Kjeldahl Nitrogen (mg/L)						
Total Phosphorus (mg P/L)						
(C) Trace elements (metals)						
Mercury (µg Hg/L)						
Cadmium (µg Cd/L)						
Lead (µg Pb/L)						
Copper (µg Cu/L)						
Nickel (µg Ni/L)						
Zinc (µg Zn/L)						
(D) Bacteriologic parameters (MPN/100 ml)						
Fecal coliform (EMS/100mL)						
Total coliform (EMS/100 mL)						

Monitoring Item 3: Ambient noise level in dB(A)
Frequency: Once a week

No.	Date	Location	Dayti e	Nighttime	Measured Value Leq dB(A)	Standard Value Leq dB(A)	Special Instruction
1							
2							
3							

Monitoring Item 4: Waste
Frequency: Every collection period

No.	Date	Location	Type of waste	Contents	Volume	Stock condition	Collector	Special Instruction
1			Domestic waste					
			Demolition waste					
			Recycle waste					
			Hazardous waste					
2								
3								

Monitoring Item 5: Status of class interruptions
Frequency: Everyday

No.	Date	Location	Frequency of interruption	Duration	Cause	Measure	Improvement	Special Instruction
1								
2								
3								

Monitoring Item 6: Infectious diseases, occupational accidents, traffic accidents
Frequency: Everyday

No.	Date	Location	Type	Description	Cause	Measure	Improvement	Special Instruction
1			Infectious diseases					
			Occupational accidents					
			Traffic accidents					
2								
3								

Monitoring Item: 7. Process of grievance redress
Frequency: Once a week

No.	Date	Location	Number of petitioners	Grievance	Measure	Improvement	Special Instruction
1							
2							
3							

Source: JICA Survey Team

Chapter 8 The Direction for Future Cooperation

8.1 Necessity of Future Cooperation

Through the Survey, the following situation was confirmed which shows the necessity of future cooperation with Japan.

(1) Seismic Disaster Situation

Turkey is located on the Anatolian Peninsula and is prone to earthquakes. Particularly, active faults are concentrated in the west near the Aegean Sea, and the area is exposed to high risk during seismic disasters. The recent major earthquakes in Turkey such as the 1999 Izmit earthquake and 1999 Duzce earthquake caused significant physical damage and economic losses.

(2) Status of Public Facilities

The Government of Turkey promotes earthquake-resilient buildings: MoEU promotes earthquake-resilient cities under the UT Law, while MoNE and MoH promote earthquake-resilient schools and hospitals.

The modern seismic code was established around 1998, with a notable increase in seismic design loads. Building facilities designed before 1998 are assumed to be more vulnerable than those designed after 1998. The latest Turkish Building Earthquake Code, a comprehensive revision of the previous code, was published in 2018.

MoNE has performed seismic assessments of 4,500 schools, and results showed that about 5% (250 schools) do not need any work, 20% (900 schools) require reconstruction and 75% (3,350 schools) need retrofitting. MoNE aims to improve the seismic performance of 18,000 vulnerable schools within the next decade.

(3) Ongoing Project

The World Bank concluded the loan agreement of USD 300 million for the Disaster Risk Management in Schools Project for Turkey on August 8, 2019. The objective of the project is to increase the safety of students, teachers, and staff in selected schools in high-risk seismic zones in Turkey, and 350 school buildings are estimated to be reconstructed and retrofitted.

(4) Possible Future Cooperation

Considering the current status of hospitals, government offices and apartments for low- and middle-income brackets as explained in Chapter 2, these public facilities are deemed not appropriate for Japan's future support in establishing seismic-resilient buildings.

On the other hand, the need to improve the seismic performance of school buildings remains huge, and there is a room to introduce the Japanese experience in school-based disaster risk management. The following section outlines the possible future cooperation with Japan in relation to schools in Turkey.

8.2 Loan Project

(1) Objective

The objective of the possible loan project is to increase the structural resilience of vulnerable school buildings by reconstruction and retrofit in order to support MoNE with its target to improve seismic performance of 18,000 vulnerable schools within the next decade. The project includes the renovation of out-of-date facilities considering universal design, energy efficiency and gender equality in accordance with the "Minimum Design Standards Guidelines applicable to Construction of Education Facilities" introduced by MoNE. In order to secure the safety of students during earthquakes, the project needs to include the enhancement of response management capacity complementary to the increase of structural resilience.

The project will contribute to the achievement of the Sendai Framework for DRR 2015–2030, which was adopted at the Third UN World Conference on Disaster Risk Reduction (WCDRR) under the leadership of the Japanese Government. Through reconstruction and retrofit of vulnerable schools, the project will meet the need for priority 3, "Investing in DRR for resilience" of the framework.

The project is able to adopt Japan's knowledge and technology in retrofit works which was introduced in the Sendai Cooperation Initiative for DRR.

From the perspective of the Sustainable Development Goals (SDGs), the reconstruction and retrofit of vulnerable school buildings will contribute to Goal 9, "Build resilient infrastructure, promote sustainable industrialization and foster innovation" and Goal 11, "Make cities inclusive, safe, resilient and sustainable". The renovation of facilities includes creating gender-friendly spaces, safe bathroom and sanitary facilities which will support Goal 5, "Achieve gender equality and empower all women and girls". In consideration of energy efficiency, the renovation will result in saving of electricity, gas and water consumptions and reducing CO2 emission, which indirectly contribute to Goal 7, "Ensure access to affordable, reliable, sustainable and modern energy" and Goal 13, "Take urgent action to combat climate change and its impacts".

Table 8-1 Contribution to Development Goals

Component	Contribution
Reconstruction and retrofit of vulnerable school buildings	Sendai Framework Priority: Action 3, "Investing in DRR for resilience" of the framework"
	Sendai Cooperation Initiative for DRR: Japan's knowledge and technology
	SDGs: Goal 9, "Build resilient infrastructure, promote sustainable industrialization and foster innovation"
	SDGs: Goal 11, "Make cities inclusive, safe, resilient and sustainable"
Renovation (Gender-friendly space)	SDGs: Goal 5, "Achieve gender equality and empower all women and girls"
Renovation (Energy Efficiency)	SDGs: Goal 7, "Ensure access to affordable, reliable, sustainable and modern energy"
	SDGs: Goal 13, "Take urgent action to combat climate change and its impacts"
Response management capacity	Sendai Framework Priority: Action 4, "Disaster preparedness for effective response"
	SDGs: Goal 11, "Make cities inclusive, safe, resilient and sustainable"

Source: JICA Survey Team

(2) Scope of Work

1) Finalization of target schools to improve seismic performance

The project will review and finalize the schools to be reconstructed or retrofitted considering the logistics and capacity of the provincial directorate of MoNE with regard to the transfer of students to other school during construction period.

2) Communication with stakeholders

Necessary communication activities will take place after the finalization of schools which includes information-sharing meetings with stakeholders such as teachers, parents and students regarding work procedure, transfer of students, and construction schedule.

3) Review of seismic assessment and design

The project will take advantage of the existing seismic assessment report and design report prepared by national consulting firms and presumably kept at CRED. These reports will be reviewed in accordance with the update seismic code, if needed.

The standard design of schools buildings prepared by MoNE will be used for the reconstruction with necessary adjustments so as to fit into the construction site.

In addition to improvement of seismic performance, functional improvements will also be considered in accordance with the "Minimum Design Standards Guidelines applicable to Construction of Education Facilities".

4) Procurement of construction works

The project will prepare the bidding documents for procurement of construction works including drawings and technical specifications.

5) Construction works

Selected contractors will undertake reconstruction or retrofit works and MoNE, through the consultant, will supervise the work.

6) Capacity -building of CRED through works indicated in nos. 1 to 5

The project will strengthen the engineering capacity of CRED as a technical transfer from the consultant through works indicated in nos. 1 to 5.

7) Strengthening of response management capacity

This task will enhance MoNE's capacity in emergency management and strengthen disaster response capacity of target schools. Details are as follows.

a) Improvement of seismic resilient measures for non-structural elements (mitigation of potential damage and loss)

- develop reference manual
- utilize the manual for the design of the target schools to be reconstructed
- identify safe evacuation route to facilitate effective evacuation drills

b) Improvement of post-earthquake safety evaluation of school buildings (enhancement of preparedness for effective response)

- optimize CRED’s response organization and procedure
- improve existing post-earthquake safety evaluation manual
- conduct training of CRED’s staff according to the improved procedure and the manual at target schools to be retrofitted

(3) Target Provinces

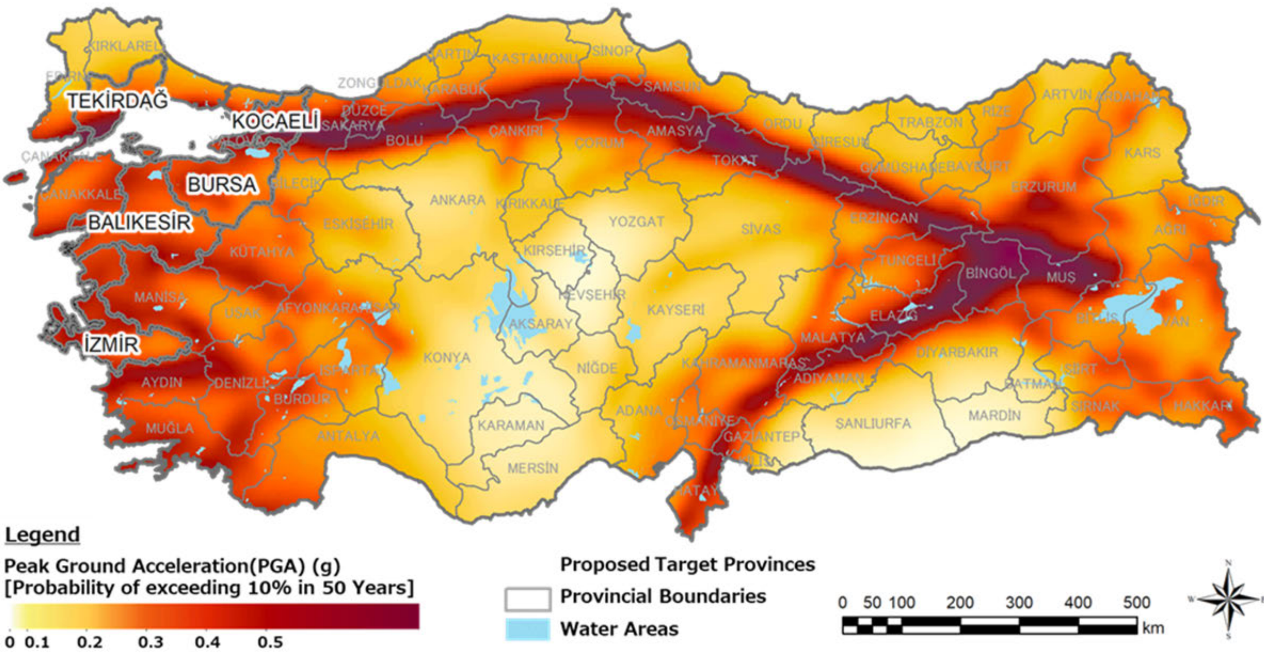
Specific target provinces and schools could not be confirmed during the survey. The reason being is that once MoNE makes the list of target schools public, everyone – including the students and teachers in the target schools – would have to be evacuated to other safe schools.

The JICA Survey Team has proposed six provinces as target provinces: Balikesir, Bursa, Istanbul, Izmir, Kocaeli and Tekirdag based on the criteria listed below. Istanbul was included even it does not meet the third criteria on the average of province because the hazard level in its city center is considered high.

- Relevance and Sustainability: Target provinces of JICA’s Technical Assistance related to disaster education

- Efficiency: Population is over 1,000,000
- Effectiveness and Impact: PGA for probability of exceeding 10% in 50 years is more than 0.3g (average of province)

However, MoNE has proposed to the JICA Survey Team to exclude Istanbul because ISMEP has been successfully working on the reconstruction / retrofit of school buildings and has access to financial resources. MoNE further requested the JICA Survey Team not to limit the target provinces to five provinces and to leave room to include schools from other provinces.



Source: AFAD modified by the JICA Survey Team

Figure 8-1 Proposed Target Provinces after Considering MoNE's Comments

(4) Target School Selection Process

1) Possible Target Schools

As mentioned in Section 2.3, MoNE has implemented the seismic assessment for 4,500 schools in high seismic hazard zones. The results indicated that 250 (5%) schools were assessed as safe, 900 (20%) schools needed reconstruction and 3,350 (75%) schools required retrofit. The target schools for retrofit and reconstruction under this project will be selected from the 4,250 (900+3,350) schools which need seismic strengthening.

2) Prioritization Criteria of the World Bank Project

In order to select the schools for seismic strengthening, MoNE and WB have worked out a draft prioritization criteria for the Disaster Management in Schools Project, shown in the table below, aiming at a total of 350 schools. The prioritization criteria for possible Japanese ODA loan project should not differ substantially from the WB project. However, it should be noted that the target provinces for the WB project have not been decided and the selection process has not yet started.

Table 8-2 Prioritization Criteria of the World Bank Project

PRIORITIZATION CRITERIA				
NO	**PARAMETERS**	**SEISMIC PERFORMANCE IDENTIFICATION**	**SEISMIC PERFORMANCE MAXIMIZATION/ RETROFITTING**	**RECONSTRUCTION**
1. HAZARD LEVEL				
1.1. Seismic Hazard Level				
1.1.1	MYI (PGA)>= 0,60g		28	N/A
1.1.2	MYI (PGA)= 0,40g - 0,59g		21	N/A
1.1.3	MYI (PGA)= 0,21g - 0,39g		14	N/A
1.1.4	MYI (PGA)<= 0,20g		7	N/A
1.2. Non-Seismic Hazard Level				
1.2.1.	Significant		2	N/A
1.2.2	Moderate		1	N/A
1.2.3	Low		0.5	N/A
2. TECHNICAL SPECIFICATIONS OF SCHOOLS				
2.1. Year of Construction				
2.1.1	Prior to 1975		3	N/A
2.1.2	1976 - 1984		5	N/A
2.1.3	1985 - 1997		4	N/A
2.1.4	1998 - 2006		2	N/A
2.1.5	2007 and onwards		1	N/A
2.2. Number of Stories / Construction Typology				
2.2.1	Single story and reinforced concrete		5	N/A
2.2.2	Single story and masonry		5	N/A
2.2.3	2 stories and reinforced concrete		6	N/A
2.2.4	2 stories and masonry		7	N/A
2.2.5	3 stories and reinforced concrete		7	N/A
2.2.6	4 stories and reinforced concrete		8	N/A
2.2.7	3+ stories and masonry		10	N/A
2.2.8	5+ stories and reinforced concrete		10	N/A
2.3. Total Construction Area				
2.3.1	1000 m² and below		1	N/A
2.3.2	1001 m² - 2999 m²		2	N/A
2.3.3	3000 m² - 4999 m²		3	N/A
2.3.4	5000 m² - 6999 m²		4	N/A
2.3.5	7000 m² and above		5	N/A
2.4. Concrete Strength				
2.4.1	< 8 MPa	N/A	10	N/A
2.4.2	9 MPa - 14 MPa	N/A	8	N/A
2.4.3	15 MPa - 19 MPa	N/A	5	N/A
2.4.4	> 20 Mpa	N/A	3	N/A
2.5. Relative Story Displacement / Dimax Control				
2.5.1	Dimax / Story height (h) <=1	N/A	3	N/A
2.5.2	Dimax / Story height (h) >1	N/A	5	N/A

PRIORITIZATION CRITERIA				
NO	**PARAMETERS**	**SEISMIC PERFORMANCE IDENTIFICATION**	**SEISMIC PERFORMANCE MAXIMIZATION/ RETROFITTING**	**RECONSTRUCTION**
3. OCCUPATION TYPE OF SCHOOLS AND NUMBER OF STUDENTS				
3.1. Occupation Type / Duration				
3.1.1	Single shift		5	10
3.1.2	Double shift		7	15
3.1.3	Boarding school		10	20
3.2. Number of Students				
3.2.1	250 students and below		2	8
3.2.2	250 - 500 students		4	16
3.2.3	500 - 750 students		6	24
3.2.4	750 – 1,000 students		8	31
3.2.5	1,000 students and above		10	40
3.3. Number of Students per Classroom				
3.3.1	>40		5	20
3.3.2	35 - 39		4	16
3.3.3	30 - 34		3	12
3.3.4	25 - 29		2	8
3.3.5	<24		1	4
4. EMERGENCY MANAGEMENT, POPULATION DENSITY, TITLE DEEDS AND ADMINISTRATIVE CONSIDERATIONS				
4.1	Is the given school significant based on local emergency management plans?		Yes=3 No=0	Yes=5 No=0
4.2	Is the school located in a district with high population density?		Yes=3 No=0	Yes=5 No=0
4.3	Is the school classified as a cultural heritage? If so, is there a need for cultural heritage preservation board approval?		Yes=2 No=0	Yes=0 No=5
4.4	Is the school located in a district / province of high increase rates as per the population of school-aged children?		Yes=2 No=0	Yes=5 No=0
TOTAL SCORE				

3) Selection Process

<u>During project formulation:</u>

a) MoNE identifies the schools to be retrofitted or reconstructed in each target provinces which will be covered by the JICA project. The target provinces under consideration are, but not limited to: Balikesir, Bursa, Izmir, Kocaeli, and Tekirdag. MoNE has not made public the identified schools.

b) It is recommended to identify the schools to be considered based on the following criteria:

- High seismic zone: PGA > 0.3g
- Presence of seismic assessment report
- Non-masonry

<u>During project implementation:</u>

c) MoNE identifies the schools to be retrofitted or reconstructed per each construction package in consultation with MoNE provincial directorates considering the transfer of students and teachers.

d) MoNE announces the schools to be retrofitted or reconstructed and starts the selection of contractor per package.

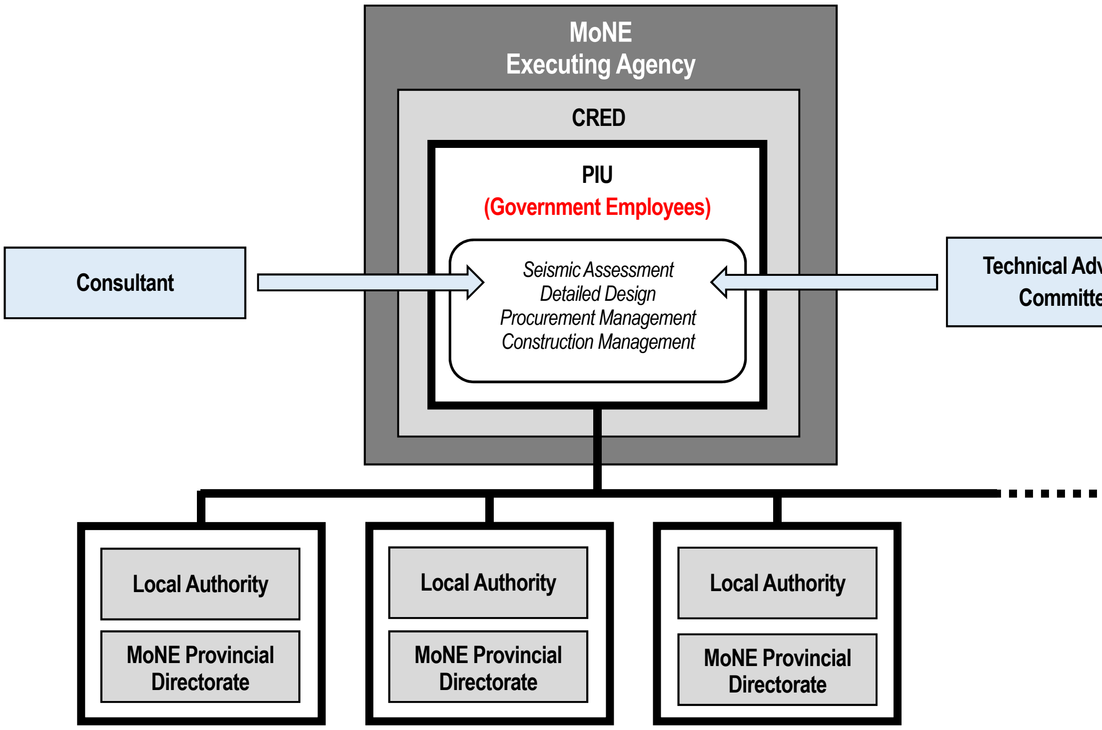
(5) Executing Agency

MoNE will play the role of Executing Agency on behalf of the Government of Turkey, which will be responsible for coordination, supervision and monitoring of the implementation of the Project to guarantee that the Project will be executed in accordance with its objective in a timely manner. MoNE will also be responsible for budget administration of the project, including administration of Japanese ODA Loan and budget by the Government of Turkey.

The PIU will be established in CRED of MoNE, which will be responsible for all aspects of project implementation at the national level and take all the necessary measures in coordination with local authorities and MoNE provincial directorates. CLPIU members are composed of government employees in CRED. CLPIU has already been established for the following donor projects, and the same CLPIU can implement the proposed project financed by JICA.

- Disaster Risk Management in Schools Project by the World Bank
- School Construction Project under EU FRiT implemented by the World Bank
- School Construction Project under EU FRiT implemented by KfW

A Technical Advisory Committee will be formulated as an external body to advice and support PIU from time to time on specific technical issues such as seismic assessment, detailed retrofit design, bidding, construction supervision, etc., based on necessity. Members of Technical Advisory Committee will be composed of CRED Director who will act as the Chairman, and representatives from various universities.



Source: JICA Survey Team

Figure 8-2 Proposed Organizational Structure

(6) Consulting Services

1) Project Management Services (PMS)

The Consultant will manage and monitor all project activities to complete the Project in an efficient and economical manner. An international consulting firm may be selected as the leading firm of PMS, with scope of work as follows:

- Overall project management (quality, cost and schedule)
- Disbursement management
- Coordination with stakeholders

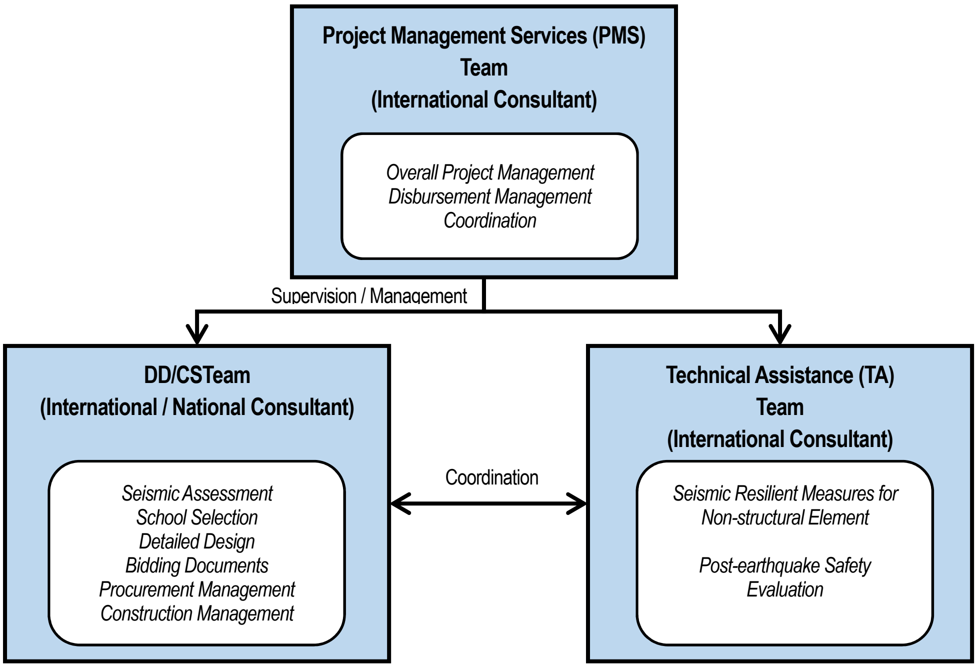
2) Detailed Design and Construction Supervision (DD/CS)

International and national consulting firms may be involved and expected to play leading roles in providing the necessary services for DD/CS as follows:

- Verification of seismic assessment
- Selection of target schools
- Detailed design (retrofit, seismic isolation, reconstruction)
- Preparation of bidding documents
- Procurement and contract management
- Construction management

3) Technical Assistance

International and national consulting firms may be involved with technical assistance for strengthening of response management capacity of MoNE with reference to seismic resilient measures for non-structural element and post-earthquake safety evaluation.



Source: JICA Survey Team

Figure 8-3 Proposed Consultant Organization Structure

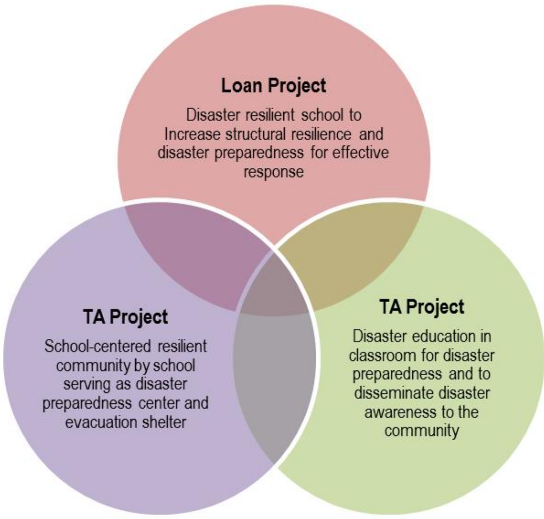
8.3 Technical Assistance Projects

The Technical Assistance (TA) projects proposed hereinafter are complementary to the loan project on creating disaster-resilient schools described above. The TA projects cover two different areas: (1) schools as community centers for disaster-risk management (including their function as temporary evacuation shelters), or "School-Centered Resilient Community", and (2) disaster education.

The purpose of the loan project is to increase the structural resilience and disaster preparedness within the schools for an effective response. The aim of the TA project on "School-Centered Resilient Community" is to expand the use of schools not only for educational purpose, but also for protecting the students as well as the community. Taking advantage of the enhanced seismic performance of school buildings, they will serve as temporary evacuation shelters for the community in earthquake events. As vulnerable buildings cannot be used as temporary evacuation shelters, the loan project has a potential to enhance the resilience of the community if this TA project is implemented.

The other TA project for disaster education can also benefit from the loan project and the TA for School-Centered Resilient Community. Under the scope of disaster education, the training of teachers to assist in the operation of temporary evacuation centers can be included. Another is to equip teachers to understand the importance of implementing mitigation actions or DRR investment such as retrofit and reconstruction of vulnerable school buildings.

The two TA projects proposed herein will have a strong synergy with the loan project if the three projects are implemented simultaneously. The three projects including the loan project contribute to building a safer community in Turkey.



Source: JICA Survey Team

Figure 8-4 Coherence and Synergy Between the Proposed Projects

(1) School-Centered Resilient Community

1) Background and Objectives

Public school facilities can be utilized not only for educational use, but also for establishing resilient communities by optimizing school facilities and operations as community centers for disaster prevention and preparedness, and as temporary evacuation shelter in emergency situations.

The goal of this technical assistant project is to strengthen the capacities of MoNE, AFAD and local governments in preparing, coordinating, establishing and optimizing school facilities and their operations as temporary evacuation shelters as well as community centers for disaster prevention and preparedness. It will also enhance the capacities of concerned agencies in formulating or improving any relevant codes and guidelines. MoNE will establish a coordination mechanism with other government agencies in order to introduce the concept of school-centered resilient community.

2) Scope of Work

The scope of the project will include the following: a) designation of schools to be used as temporary evacuation shelters; b) formulation of an initial evacuation plan; c) design and installation of infrastructures for temporary evacuation shelters; d) procurement of necessary items for stockpiling; and e) school DRR planning, including design and planning of emergency operation / evacuation drills for periodical implementation.

JICA provided technical assistance to AFAD for implementing the project for Capacity Development Toward Effective Disaster Risk Management (2013-2017) to develop a guideline for disaster risk management. The proposed scope can take advantage of the outcomes of the above mentioned project as well as the Emergency Response Plan in Turkey (TAMP) formulated by AFAD.

a) Designation of schools to be used as temporary evacuation shelters

When the residential houses are destroyed or damaged during a disaster caused by earthquakes and other natural disasters, it is common for public spaces and buildings to be used as temporary evacuation shelters until people can safely return to their homes or stay in temporary houses. A temporary evacuation shelter is a critical requirement for survival and is necessary to protect security and health.

The Emergency Response Plan in Turkey (TAMP) formulated by AFAD stipulates that AFAD carries out activities for the emergency shelter services of the victims with support from MoNE. Thus the project will contribute to the current policies and activities in Turkey and the schools, where seismic performance is improved through the loan project on creating disaster-resilient school, may be used as temporary evacuation shelters.

For the first activity, schools to be used as temporary evacuation shelters will be designated. In general, school gymnasiums will be used as space areas of temporary evacuation shelters. Based on the consideration of criteria in determining schools to be used as temporary evacuation shelters such as size of schools and size of gymnasiums, etc., and information collected from schools selected by the loan project for disaster-resilient school, schools will be designated as temporary shelters by MoNE provincial directorate in coordination with AFAD provincial directorate, such as the selection of 10 schools as the pilot activity as an example.

b) Formulation of an initial evacuation plan

As an initial evacuation plan, the number of evacuees for each school (10) will be estimated in order to design the infrastructures for the utilization of temporary evacuation shelters and calculate the quantities of necessary items for stockpiling.

c) Design and installation of infrastructures for temporary evacuation shelters

The necessary infrastructures for temporary evacuation shelters will be designed and installed in the pilot schools. Several infrastructures for temporary evacuation shelters, such as the temporary toilets, wells, water reservoirs, portable generators, photovoltaic power cells and radio communication devices, are also important (see Figure 5-1).

If a school is to be utilized as a temporary evacuation shelter for an extended period, spaces for administration and operation, health care, cooking, relief supply and communication must be planned. Changing rooms in consideration of women's privacy and universal design for elderly and physically disabled people shall be considered. By the time school activities have resumed, clear zoning for educational areas and evacuation areas is important.

d) Procurement of necessary relief items for stockpiling

A safe space in schools to be used as temporary evacuation shelters needs to be secured for storage for supplies during a disaster, since food, water, blankets and equipment for withstanding the cold is essential before relief supplies arrive. The necessary items for the temporary shelter will be considered and procured.

[Food]	[Daily necessities]	[Rescue equipment]
Hardtack	Feeding bottle	Water filter
Pregelatinized rice	Blanket	Assembled Water Tank
Modified milk powder	Carpet	Battery Floodlight
Mineral water	Plastic container	Cord reel
Canned rice porridge	Paper cup	Generator
Canned bread	Disposable diaper	Rice cooker
	Portable radio	Tent
[Medical equipment]	Med kit	Temporary toilet
Disaster medical kit	Sanitary goods	STRETCHER
	Underwear	Cot
[Fuel]	Blue plastic sheet	Trolley
Gasoline	Wet Towel (Wet Tissue)	Carpenter's tool
Kerosene		Rescue kit
		Partition panel

Source: JICA Survey Team

Figure 8-5 Examples of Necessary Relief Items for Stockpiling

e) School DRR planning, including design and planning of emergency operation / evacuation drills for periodical implementation

In order to effectively use schools as temporary shelters in the event of actual earthquakes, practical and periodical training / drills are required.

First of all, it is necessary for the community to recognize that schools are temporary evacuation shelters. It is important to conduct periodical training regarding the operation of evacuation shelters and share the manuals of operation among school organizations. Following the plan formulation, trainings / drills will be conducted and the facilitators will be the teachers trained by MoNE.

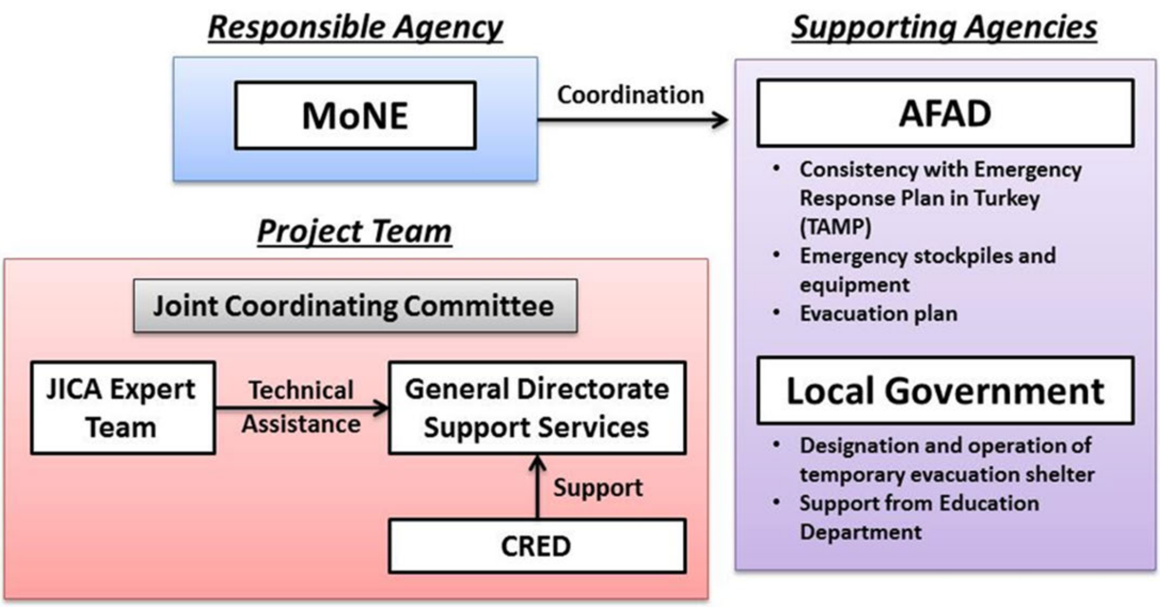
The plan formulation includes the following:

- Formulation of an evacuation plan in the community and conducting evacuation drill
- Formulation of an operation plan for activation and living in temporary shelter and conducting drill
- Formulation of an instruction manual to be used for installing infrastructures and stockpiling, and conducting training on how to use the manual

3) Implementation Structure

MoNE will play the role of Responsible Agency which will be responsible for implementing and monitoring the project in accordance with its objective in a timely manner. AFAD and local governments will be the Supporting Agencies in coordination with MoNE. AFAD is expected to support the project to maintain its consistency with the emergency response planning in Turkey both at national and local levels. The local governments are expected to support the project in terms of designating and operating schools as temporary evacuation shelters and also provide support though their education departments.

A project team will be formed in MoNE. The General Directorate Support Service will be the implementing organization with the support of CRED and JICA Expert Team. A Joint Coordinating Committee will be established for monitoring the implementation of the project.



Source: JICA Survey Team

Figure 8-6 Proposed Implementation Structure

(2) Disaster Education for a Safer Community

Schools can offer excellent opportunities for the communities to learn about disasters through providing disaster education to students, who will later become adults and are expected to act immediately as "agents" to convey the message to their families and neighbors. This model has been working as a fundamental instrument for disaster management at the community level in Japan, and proven to be effective in major disaster events such as the 2011 Tohoku earthquake and tsunami.

JICA is currently supporting MoNE for improving the training program for teachers on disaster education through the Country-Focused Training. In collaboration with JICA's program, MoNE has recently started the training of teachers – called Master Teachers – who will be in charge of disaster risk reduction and management and of training other teachers – through online training and face-to-face training. Approximately 20,000 teachers have participated in the online training, and 500-600 teachers have participated in the face-to-face training and became Mater Teachers. As a result, 135,000 teachers received training on school-based disaster education.

Selected Master Teachers have also received training through their learning experience in Japan. Disaster education is one of the areas in which Japan has been successful, and it has demonstrated that it can help save lives and minimize the impact of a disaster.

The existing training program for Master Teachers can be improved in two areas, namely: 1) inclusion of hands-on training or field training to understand the importance of disaster risk reduction, and 2) inclusion of training for the operation of temporary evacuation shelters.

Firstly, in order to ensure the continuity of disaster education in Turkey and the training of Master Teachers, it is crucial that the Master Teachers understand the importance of disaster risk reduction and the role of disaster education for raising awareness. They should acquire hands-on experiences by visiting places where they can relive a disaster or see actual examples of disaster risk reduction, as some Master Teachers did in Japan. Turkey has many places that preserve the memories of disasters. It also has several museums and facilities where the teacher trainees can experience what disasters may ensue. Moreover, the retrofitted or reconstructed schools under the loan project can be excellent examples of disaster risk reduction.

Secondly, in case schools are utilized as temporary evacuation shelters, the teachers – who are being trained by MoNE or by Master Teachers and thus are supposed to be in charge of disaster risk reduction and management – may be involved not only in the evacuation activities, but also in the operation of temporary evacuation shelters. They may also be responsible for formulating school safety or DRR plans and conducting drills. The Master Teachers should ideally acquire such knowledge through the training program.

The efficiency can be significantly enhanced by training the teachers as Master Teachers in the schools that will be strengthened or reconstructed through the loan project and designated as temporary evacuation shelters through the other TA project, since there is a strong coherence and synergy between the activities to increase structural resilience and disaster preparedness for effective response; to establish a school-centered resilient community; and to raise disaster awareness in schools and the community, which will lead to the establishment of a safer community.

8.4 Applicability of Advanced Technologies in Turkey's Building Structures

This section of the report focuses on the advanced technologies which have not yet been commonly used in Turkey, though they may have advantages compared to the conventional ones and serve to enhance the resilience of public buildings in Turkey. We have selected the technologies and practices which have already been verified or under the process of verification in Turkey, or could be applied immediately without any formal technical verification or certification.

(1) Outer Frame

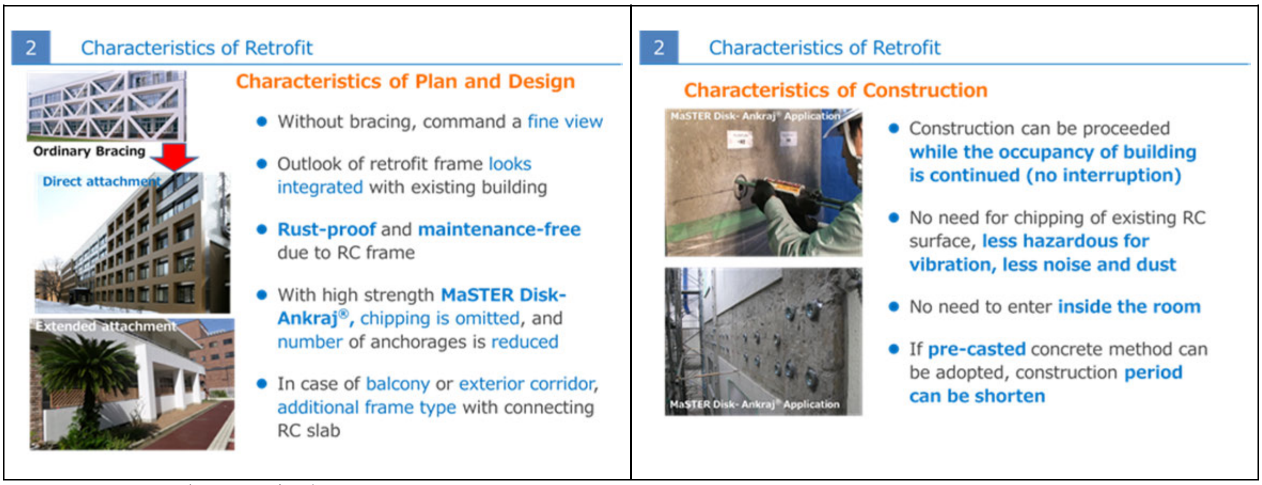
The outer-frame retrofit method strengthens a building structure by adding frames from outside of the building without performing any major retrofit works inside the building. It thus enables "INAGARASEKOU", which means "implementing retrofit works while staying (in the building)" in Japanese.

The MaSTER FRAME is one of the outer frame retrofit methods developed by Maeda Corporation, Toyo Construction and Sanko Techno using RC outer frame and "Disk Anchor". "Disk Anchor" is a post-installed anchorage having a disk-shaped part which significantly increases the shear capacity. The "Disk Anchor" is currently being applied to National Technical Assessment Certificate in Turkey.

The MaSTER FRAME is licensed in Turkey under GKMC Construction and Consulting Inc., which is a joint stock company with the participation of Garanti Koza, Turkey and Maeda Corporation, Japan with equal shares. The license and know-how of the design and construction of MaSTER FRAME will be provided to Turkish design and construction companies.

<u>Type of structures optimal for MaSTER FRAME</u>

- RC structure
- Moment frame, i.e. not a wall structure
- Less than 6 stories
- Minimum limit of concrete strength is 8 MPa (12MPa is currently recommended)



Source: Maeda Corporation / GKMC

Figure 8-7 Outline of MaSTRE FRAME Retrofit

The MaSTER FRAME has been applied to many public buildings including school buildings in Japan. It does not cover the windows, and thus does not obscure the view and can maintain the natural light and air ventilation, which can avoid degrading the environment of the classrooms.

Thanks to the characteristics of "Disk Anchor", the MaSTER FRAME produces less noise and dust during construction works. It does not cause discomfort or annoyance to the students or interrupt classes even during construction. The construction period using MaSTER FRAME is typically shorter than the conventional retrofit methods, since it requires less number of anchors due to the high shear capacities of "Disk Anchors" and does not require construction works inside the building.

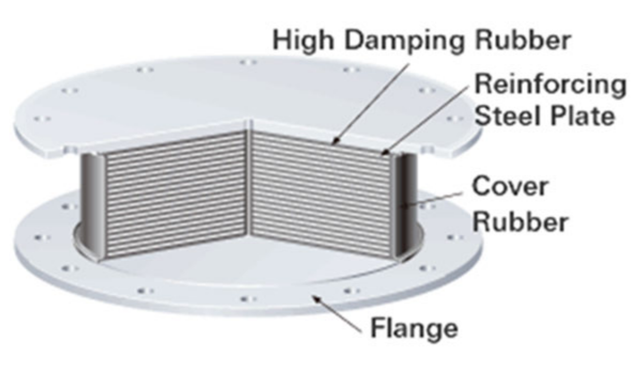
(2) Seismic Isolation Bearing

1) Japanese Supplier

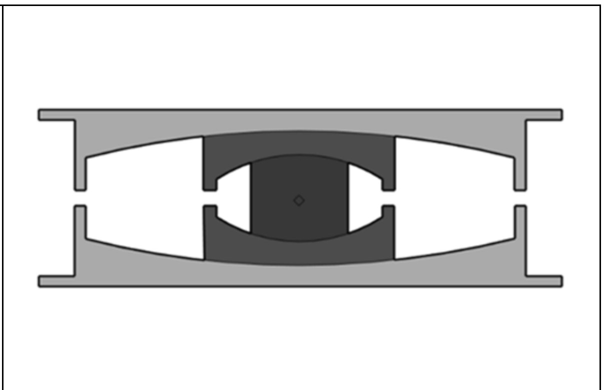
Bridgestone Corporation, a Japanese manufacturer and supplier of seismic isolation bearing, started a market research survey on construction sector in Turkey in 2016 and started sales activity in 2017 through the Brisa Bridgestone Sabanci Tyre Manufacturing and Trading Inc. It provided seismic isolation bearing for the following two projects as of May 2019.

- A data center in Kocaeli province : Completed
- Tupras Izmir Oil Refinery : Pending due to recession

Bridgestone introduced the high damping rubber bearing in Turkey which is suitable for retrofit works but more expensive than others. Meanwhile, the friction pendulum is more popular which accounts for 60% of seismic isolation bearing in Turkey.



High Damping Bearing



Friction Pendulum

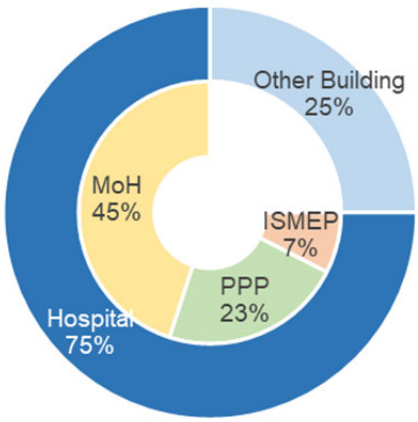
Source: Bridgestone Corporation, JICA Survey Team

Figure 8-8 Seismic Isolation Bearing

2) Situation

Though the market for seismic isolation bearing is small, there are several manufacturers for this type of technology.

According to Bridgestone, 75% of seismic isolation bearing installed in Turkey is for hospitals with more than 100 beds. Among which, 45% is for the projects implemented by MoH, 23% is for PPP projects and 7% is for ISMEP.



Source: Brisa Bridgestone Sabanci Tyre Manufacturing and Trading Inc.

Figure 8-9 Proportion of Seismic Isolation Bearing in Turkey

The seismic isolation bearing system designed by MoH is likely to be the friction pendulum, and Turkish contractors also tend to select the friction pendulum because of its price advantage. The cost of the Bridgestone's high damping rubber bearing is 1.3-1.4 times higher than the seismic isolation bearing by local supplier. The period for procurement of Bridgestone's high damping rubber bearing is more than five months since it will be imported from Japan and that of friction pendulum takes only about three months.

The Japan Bank for International Cooperation (JBIC) made a loan agreement with Istanbul PPP Saglik Yatirim A.S., in which Japanese company Sojitz Corporation has stakes in part, for the Istanbul Ikitelli Integarated Health Campus PPP project. The loan is co-financed with other Japanese banks and amounting up to JPY 163 billion. The said hospital will be one of the largest hospital complexes in Turkey with 2,682 beds in total equipped with seismic isolation bearing. However, Bridgestone's high damping rubber bearing was not selected because of higher cost, and Earthquake Protection Systems (EPS), an American company, was selected to supply the seismic isolation bearing instead.

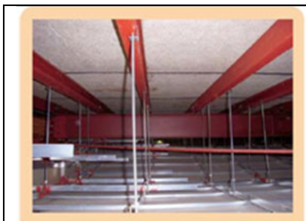
3) Possibility

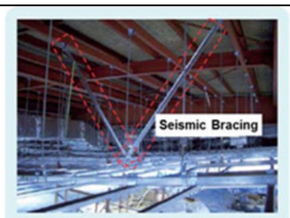
Generally, national suppliers are not interested in supplying seismic isolation bearing to smaller buildings such as schools. However, Bridgestone is able to supply the high damping rubber bearing to such smaller buildings. The high damping rubber bearing is suitable for retrofit of historical architectures such as old schools in Bursa and Izmir, museums, and key government buildings for their preservation. It is not suitable for general buildings since reconstruction cost is cheaper than installation of the high damping rubber bearing. In order to apply seismic isolation bearing for retrofit works, the existing building has to be lifted up, and there are three construction companies which are able to do this work.

(3) Seismic Resistance Design and Strengthening of Non-Structural Elements

The non-structural elements of the buildings and building equipment should also be seismically designed and installed in order to secure the safety and the continuity of building operations. Based on past experiences in which vulnerable non-structural elements of school buildings were significantly damaged during earthquakes and the buildings could not be occupied right after the earthquakes, the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) developed a "guideline for seismic resilient construction of non-structural elements of school facilities" (see examples in Table 8-3). The guideline as well as the Japanese experiences and knowledge could be customized and applied in Turkey.

Table 8-3 Best Practices for Seismic Strengthening of Non-Structural Elements


Vulnerable Celling - Before retrofit



Celling with bracing - After retrofit


Vulnerable Pendulum Lights


Seismically Designed Lights

Source: Examples of Seismic Resilient Measures for Non-Structural Elements of School Facilities (MEXT)

(4) Earthquake Early Warning System

The concept of earthquake early warning system is based on the characteristics of seismic wave. The seismic wave is composed of several different types of waves. Among them, the Primary wave (P-wave) arrives at the very beginning, followed by the Secondary wave (S-wave) which causes major shaking during an earthquake. The earthquake early warning system detects the P-wave, estimates the size and location of the earthquake and alarm before the arrival of the S-wave or major ground shaking. There are typically a few to tens of seconds between the arrival of P-wave and S-wave depending on the distance from the earthquake epicenter. People can take appropriate action and position to be ready for the earthquake during this time and shut down the operation of any equipment that may be affected by the earthquake shaking.

EQGuard-III (EQG-III), developed by Challenge Co., Ltd., is one of the earthquake early warning systems. It is a small sensor device equipped with alarm. After detecting the P-wave, the specialized software installed in the device estimates the level of ground shaking and triggers the alarm according to the predefined criteria. It can work as a standalone using a server and also possible to construct a regional early warning system easily by networking (see Table 8-4)

The evacuation drills at schools using alarms of EQGuards have been very effective, and many countries including Turkey are currently working on implementing them. EQGuards are very useful because evacuation drills can be performed simply by pressing the test button.

Table 8-4 Outline of EQG-III

<u>Outline of Equipment</u>

Built-in accelerometer detects P wave and issues earthquake alarm before the arrival of strong shaking by S wave.EQG-III has specialized software to distinguish between the earthquake and the living noise generated near EQG-III, which prevents it from issuing erroneous alarms.

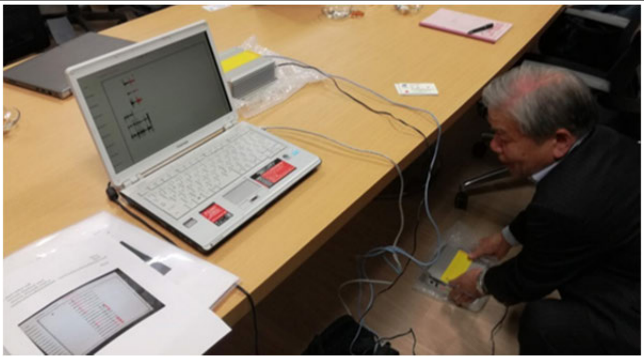
<u>Multi-Language Announcement</u>

EQG-III issues the alarm with 11 language selection options: Japanese, English, Chinese, Korean, Indonesian, Persian, Turkish, Spanish, Portuguese, Russian and Arabic.

<u>Control Signal Output</u>

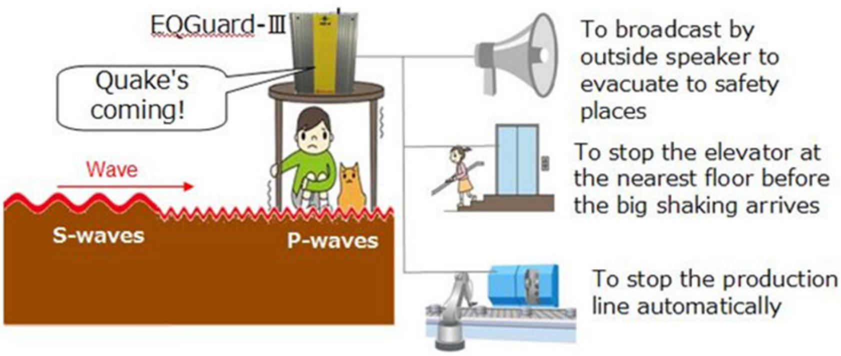
EQG-III can send the signals to control the connected equipment such as broadcasting facility, elevator, production facility, etc., in accordance with the estimated seismic intensity level of the earthquake.

EQG-III Device



Demonstration of EQG-III at JICA Turkey Office

Evacuation drill using EQGuard



Concept and Function of EQG-III

Source: JICA Survey Team based on information from Challenge Co., Ltd.

Appendix A: List of Collected Information

List of Collected Information

No.	Title	Language	Year	Size	Number of pages	Original or Hard/Soft copy	File format	Source	Contents
1	Turkish Seismic Code 2007	Turkish	2007	A4	159	Soft copy	pdf	Ministry of public works and settlement (Changed to MoEU) (official gazzette web site)	Seismic Code
2	Turkish Seismic Code 2007	English	2007	A4	161	Soft copy	pdf	StatiCAD analysis and design software website	Seismic Code (Translation)
3	Turkish Seismic Code 2018	Turkish	2018	A4	416	Soft copy	pdf	AFAD	Seismic Code
4	TS 500 REQUIREMENTS FOR DESIGN AND CONSTRUCTION OF REINFORCED CONCRETE STRUCTURES	English	2000	A4	82	Soft copy	pdf	Anonymous translator	Translation of Turkish Standart
5	2019 detailed analysis of construction unit prices	Turkish	2019	A4	1209	Soft copy	pdf	MoEU (from website)	Construction unit prices
6	2019 construction and intallation unit prices	Turkish	2019	A4	753	Soft copy	pdf	MoEU (from website)	Construction unit prices
7	Notification on 2019 Construction Approximate Unit Costs to be used in the arch. and eng. services	Turkish	2019	A4	4	Soft copy	pdf	MoEU (official gazzette web site)	Construction unit prices
8	Earthquake Hazard Map	Turkish	2019	Map	1	Soft copy	tiff	AFAD	Earthquake Hazard Map
9	Parameter of Earthquake Hazard Map	Turkish	2019	Excel Sheet	–	Soft copy	xlsx	AFAD	Parameter of Earthquake Hazard Map
10	Emergency Response Plan in Turkey (TAMP)	Turkish	2013	A4	44	Soft copy	pdf	AFAD	Emergency Response Plan
11	Urban Transformation Law	Turkish	2012 (Updated in 2019)	A4	17	Soft copy	pdf	MoEU (from website)	Urban Transformation Law
12	Principles for determination of risky buildings	Turkish	2019	A4	55	Soft copy	pdf	MoEU	Principles for determination of risky buildings
13	Number of identified risky structures in Turkey	English	2019	Excel Sheet	–	Soft copy	xlsx	MoEU	Number of identified risky structures in Turkey
14	Number of risky areas and reserve areas	English	2019	Word	1	Soft copy	docx	MoEU	Number of risky areas and reserve areas
15	Innovative Approaches in Turkey's Urban Transformation Based on Disaster Risk Reduction	English	2019	Powerpoint	22	Soft copy	pptx	MoEU	Presentation material for Asian Conference on Disaster Reduction 2019
16	ISMEP Publications	Turkish	Various Years	A4	23 books	Soft copy	pdf	IPKB	Various information on earthquake
17	Terms of Reference, Turkey Istanbul Seismic Risk Mitigation and Emergency Preparedness (ISMEP) Project Cosultancy Services for Retrofitting Design of Selected Public Buildings in Istanbul	English	–	A4	14	Soft copy	pdf	IPKB	Terms of Reference for seismic design (Ulker) on ISMEP project
18	Terms of Reference, Turkey Istanbul Seismic Risk Mitigation and Emergency Preparedness (ISMEP) Project Cosultancy Services for Construction Supervision of Strengthening of Public Buildings in Istanbul	English	–	A4	12	Soft copy	pdf	IPKB	Terms of Reference for seismic design (Ulker) on ISMEP project
19	Environment Management Plan for Schools	Turkish	2019	A4	24	Soft copy	pdf	IPKB	Environment Management Plan for Schools
20	Monthly Environmental Report for Göztepe Training and Research Hospital	Turkish /English	2019	A4	87	Soft copy	pdf	IPKB	Monthly Environmental Report
21	Environmental Management Issues to be Inserted into Contractor's Contract –"Technical Specifications – A. Contract Documents" Section ENVIRONMENTAL ASPECTS	English	2019	A4	14	Soft copy	doc	IPKB	Environmental Management Issues
22	Statistics information	Turkish /English	2019	Excel Sheet	–	Soft copy	xls	Turkish Statistics Institute	Statistics regarding education
23	Health Statistics Yearbook 2017	English	2018	A4	286	Soft copy	pdf	MoH	Health Statistics
24	TOKI Housing Production Report	English	2019	A4	2	Hard copy	pdf (scan)	TOKI	Housing Production Report
25	PROMER Brochure for General	English	2018	A4	19	Soft copy	pdf	PROMER	Company Profile
26	PROMER Brochure for Seismic Engineering	English	–	A4	47	Soft copy	pdf	PROMER	Projects Profile of PROMER
27	TUMAS Company Profile	English	2019	A4	19	Soft copy	pdf	TUMAS	Company Profile
28	TUMAS Major Superstructure Projects	English	2019	A4	46	Soft copy	pdf	TUMAS	Projects Profile of TUMAS
29	TUMAS Retrofitting and Renovation Projects	English	2019	A4	27	Soft copy	pdf	TUMAS	Projects Profile of TUMAS

Appendix B: Detailed Survey Schedule

Data Collection Survey on Promotion of Earthquake Resilient Buildings in Turkey
Detailed Survey Schedule (1st Field Survey)

No	Date	Day	Place	Miyano	Kojika	Kato	Task
				Team Leader	Earthquake-resilient Design (Structure)	DRM Planning	
1	Apr-15	Mon	Tokyo	TK53 Narita (21:40) - Istanbul (03:40+1)			
2	Apr-16	Tue	Istanbul	9:00 Ulker 13:00 Promer 16:30 GKMC			Information Collection
3	Apr-17	Wed	Istanbul	9:00 Brisa 11:30 IPKB 14:00 ISMEP Site Visit TK2166 Istanbul (17:00) - Ankara (18:20)			Information Collection
4	Apr-18	Thu	Ankara	10:00 World Bank 15:30 MoNE			Confirmation of Principle Selection of Target Area
5	Apr-19	Fri	Ankara	9:30 MoNE 15:00 Workshop JICA MoNE Iller Bank 17:00 Promer			Information Collection Explanation and Discussion on Inception Report
6	Apr-20	Sat	Ankara	Paper work			Information Collection
7	Apr-21	Sun	Ankara	Paper work			Information Collection
8	Apr-22	Mon	Ankara	11:30 TOKI			Information Collection
9	Apr-23	Tue	Ankara	Paper work			Information Collection
10	Apr-24	Wed	Ankara	9:00 TUMAS 13:30 PROTA 16:00 MoH			Information Collection
11	Apr-25	Thu	Ankara	9:30 Iller Bank 11:00 AFAD			Information Collection
12	Apr-26	Fri	Ankara	11:30 MoNE TK2163 Ankara (18:15) - Istanbul (19:35)			Report on Survey Result
13	Apr-27	Sat	Istanbul	TK52 Istanbul (01:40) - Narita (19:10)			

Data Collection Survey on Promotion of Earthquake Resilient Buildings in Turkey

Detailed Survey Schedule (2nd Field Survey)

No	Date	Day	Place	Miyano	Fukushima	Kojika	Gonai	Kato	Task
				Team Leader	Earthquake-resilient Design (Design)	Earthquake-resilient Design (Structure)	Economic and Financial Analysis	DRM Planning	
1	Jul-22	Mon	Kathmandu, Tokyo	TK027 Kathmandu (07:40) – Istanbul (12:55) TK2158 Istanbul (15:00) – Ankara (16:20)	TK53 Narita (21:40) – Istanbul (03:40+1)				
2	Jul-23	Tue	Ankara		TK2116 Istanbul (06:00) – Ankara (07:25)				
				10:00 JICA Turkey Office 14:30 MoNE: Mr. Umut GUR, DG, Construction and Real Estate Department, MoNE					Explanation on Project Proposal
3	Jul-24	Wed	Ankara	10:00 World Bank Ms. Ayse ERKAN, Disaste Risk Management Specialist 11:30 JICA Turkey Office, Dr. Emin 15:00 KfW, Ms. Julide OGUZ					Information Collection
4	Jul-25	Thu	Ankara	10:00 MoNE 14:30 AFAD, Dr. Murat NURLU, Earthquake Department Head 16:00 MoNE, Dr. Tuba					Information Collection
5	Jul-26	Fri	Ankara	Revision of Project Proposal JICA Turkey Office					Revision of Project Proposal
6	Jul-27	Sat	Ankara	Paper work					Information Collection
7	Jul-28	Sun	Ankara	Paper work					Information Collection
8	Jul-29	Mon	Ankara	15:00 AFAD		15:00 AFAD		15:00 AFAD	Information Collection
				Revision of Project Proposal					Revision of Project Proposal
9	Jul-30	Tue	Ankara	JICA Turkey Office					Explanation and Submission on Revised Project Proposal Report on Survey Result
				TK2159 Ankara (17:15) – Istanbul (18:40) TK0726 Istanbul (20:35) – Kathmandu (06:25+1)	TK2159 Ankara (17:15) – Istanbul (18:40)				
10	Jul-31	Wed	Kathmandu, Tokyo		TK0052 Istanbul (01:40) – Narita (19:10)				

Data Collection Survey on Promotion of Earthquake Resilient Buildings in Turkey

Detailed Survey Schedule (On-Site Survey and Supplimental Survey)

No	Date	Day	Place	Mr. Okada	Mr. Miyano	Mr. Kobayashi	Mr. Kojika	Mr. Fukushima	Task
				JICA Officer	Team Leader	Earthquake-resilient Design (Design)	Earthquake-resilient Design (Structure)	Earthquake-resilient Design (Design)	
1	Oct-2	Wed	Kathmandu, Tokyo	TK53 Narita (21:40) – Istanbul (03:40+1)	TK727 Kathmandu (07:40) – Istanbul (12:55) TK2158 Istanbul (15:00) – Ankara (16:20)	TK53 Narita (21:40) – Istanbul (03:40+1)			
2	Oct-3	Thu	Ankara	TK2116 Istanbul (06:00) – Ankara (07:25)		TK2116 Istanbul (06:00) – Ankara (07:25)			
				9:30 JICA Turkey Office 11:00 Tumas 14:30 MoNE, Mr. Fatih and colleagues, DG, CRED, MoNE					Status update Consulting Service Outline
3	Oct-4	Fri	Ankara	10:00 MoNE, Dr. Tuba 14:00 World Bank 16:00 Promer					Disaster Education Status update Consulting Service
4	Oct-5	Sat	Ankara, Tokyo	Data compiling				TK53 Narita (21:40) – Istanbul (03:40+1)	
5	Oct-6	Sun	Ankara					TK2116 Istanbul (06:00) – Ankara (07:25)	
			Ankara, Bursa	TK7164 Ankara(11:50) – 12:45 Bursa (12:45)					
6	Oct-7	Mon	Bursa	On-Site Survey					Status update School conditions
7	Oct-8	Tue	Bursa	On-Site Survey					School conditions
8	Oct-9	Wed	Bursa	On-Site Survey					School conditions
9	Oct-10	Thu	Bursa	On-Site Survey					School conditions
			Bursa, Izmir	Bursa-İzmir (3h by Car)					
10	Oct-11	Fri	Izmir	On-Site Survey					Status update School conditions
11	Oct-12	Sat	Izmir	On-Site Survey					School conditions
12	Oct-13	Sun	Izmir, Istanbul	TK2307 Izmir (06:40) – Istanbul (07:50)					
			Istanbul		TK726 Istanbul (20:45) – Kathmandu (06:35+1)				
13	Oct-14	Mon	Kathmandu, Tokyo	TK0052 Istanbul (01:40) – Narita (19:10)		TK0052 Istanbul (01:40) – Narita (19:10)			

Data Collection Survey on Promotion of Earthquake Resilient Buildings in Turkey

Detailed Survey Schedule (3rd Field Survey)

No	Date	Day	Place	Ms. Takebayashi	Mr. Okada	Mr. Miyano	Mr. Kobayashi	Mr. Fukushima	Mr. Kojika	Mr. Omura	Mr. Kato
				JICA Officer	JICA Officer	Team Leader	Earthquake-resilient Design (Design)	Earthquake-resilient Design (Design)	Earthquake-resilient Design (Structure)	Environment and Social Consideration	DRM Planning
	Nov-25	Mon	Ankara			TK727 Kathmandu (12:25) – Istanbul (18:20) TK2178 Istanbul (19:45) – Ankara (21:10)					
1	Nov-30	Sat	Ankara			Other Assignment	TK1832 Paris (12:50) – Ankara (18:35)	TK53 Narita (23:00) – Istanbul (05:45+1)			
2	Dec-1	Sun	Ankara			Preparation for the survey	Preparation for the survey	TK2122 Istanbul (07:00) – Ankara (08:20) Preparation for the survey			
3	Dec-2	Mon	Ankara			10:00 JICA Turkey Office 14:00: MoNE (CRED)					
4	Dec-3	Tue	Ankara			10:30: Promer 14:00: TUMAS	10:30: Promer 14:00: TUMAS	10:30: Promer 14:00: TUMAS		10:30: Promer 14:00: TUMAS	
5	Dec-4	Wed	Ankara			11:00 MoEU (GD of EIA, Permission and Auditing) EIA Monitoring and Env. Audit Department, Mr. Barıs Ecevit AKGUN Dept. Head	14:00 MoEU (UT) with experts			11:00 MoEU (GD of EIA, Permission and Auditing) EIA Monitoring and Env. Audit Department, Mr. Barıs Ecevit AKGUN Dept. Head 14:00 MoEU (UT) with experts	14:00 MoEU (UT) with experts
6	Dec-5	Thu	Ankara			AM: JICA Turkey Office PM: JICA Turkey Office (Dr. Emin)					
7	Dec-6	Fri	Ankara			Preparation DFR (1st Draft)					
8	Dec-7	Sat	Ankara			Preparation DFR (1st Draft)					
9	Dec-8	Sun	Ankara			Preparation DFR (1st Draft)					
10	Dec-9	Mon	Ankara	TK53 Narita (23:00) – Istanbul (05:45+1)		11:00 World Bank	15:00 AFAD	Preparation DFR (1st Draft)	15:00 AFAD	11:00 World Bank	15:00 AFAD
11	Dec-10	Tue	Ankara	10:00 IPKB 14:00 Ulker TK2976 Istanbul (18:10) – Ankara (19:15)		TK2105 Ankara (05:50) – Istanbul (07:10) 10:00 IPKB 14:00 Ulker TK2980 Istanbul (19:45) – Ankara (20:45)					Preparation DFR (1st Draft)
12	Dec-11	Wed	Ankara	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED)	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED) 17:00 Challenge	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED) 17:00 Challenge	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED) 17:00 Challenge	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED) 17:00 Challenge	10:00 MoNE (Dr. Tuba) 14:00 MoNE (CRED) 17:00 Challenge	14:00 MoNE (CRED)	14:00 MoNE (CRED) 17:00 Challenge
13	Dec-12	Thu	Ankara	AM: JICA Turkey Office PM: MoNE (CRED) TK2175 Ankara (22:00) – Istanbul (23:30)	AM: JICA Turkey Office TK2159 Ankara (17:20) – Istanbul (18:50) TK874 Istanbul (21:10) – Tehran (00:50)	AM: JICA Turkey Office PM: MoNE (CRED)	AM: JICA Turkey Office PM: MoNE (CRED)	JICA Turkey Office TK2169 Ankara (19:45) – Istanbul (21:10)	JICA Turkey Office	JICA Turkey Office TK2169 Ankara (19:45) – Istanbul (21:10)	JICA Turkey Office
14	Dec-13	Fri	Ankara	TK0052 Istanbul (01:40) – Narita (19:10)		Preparation DFR (1st Draft) TK2169 Ankara (19:45) – Istanbul (21:10)	Preparation DFR (1st Draft)	TK0052 Istanbul (01:40) – Narita (19:10)	Preparation DFR (1st Draft) TK2169 Ankara (19:45) – Istanbul (21:10)	TK0052 Istanbul (01:40) – Narita (19:10)	Preparation DFR (1st Draft) TK2169 Ankara (19:45) – Istanbul (21:10)
15	Dec-14	Sat	Ankara			TK726 Istanbul (01:30) – Kathmandu (11:10)	TK1831 Ankara (09:40) – Paris (11:50) AF272 Paris (16:05) – Haneda (12:05+1)		TK0052 Istanbul (01:40) – Narita (19:10)		TK0052 Istanbul (01:40) – Narita (19:10)
16	Dec-15	Sun									

Data Collection Survey on Promotion of Earthquake Resilient Buildings in Turkey

Detailed Survey Schedule (4th Field Survey)

No	Date	Day	Place	Ms. Takebayashi	Mr. Okada	Mr. Miyano	Mr. Kobayashi
				JICA Officer	JICA Officer	Team Leader	Earthquake-resilient Design (Design)
1	Jan-12	Sun	Ankara			TK53 Narita (23:00) - Istanbul (05:45+1)	
2	Jan-13	Mon	Ankara			TK2122 Istanbul (07:00) - Ankara (08:20) **16:00: JICA**	
3	Jan-14	Tue	Ankara			**10:00: Yuksel Project International** **15:00: World Bank** **16:00: JICA**	
4	Jan-15	Wed	Ankara			**11:00: MoNE CRED**	
5	Jan-16	Thu	Ankara			**10:00: MoNE CRED**	
6	Jan-17	Fri	Ankara			**9:00: JICA** (TV Conference)	
7	Jan-18	Sat	Ankara			Preparation of Final Report	
8	Jan-19	Sun	Ankara	TK53 Narita (23:00) - Istanbul (05:45+1)	TK53 Narita (23:00) - Istanbul (05:45+1)	Preparation of Final Report	
9	Jan-20	Mon	Ankara	TK2122 Istanbul (07:00) - Ankara (08:20) **11:00 MoNE CRED**	TK2122 Istanbul (07:00) - Ankara (08:20) **11:00 MoNE CRED**	**11:00 MoNE CRED**	
10	Jan-21	Tue	Ankara	**14:30 MoNE CRED**			
11	Jan-22	Wed	Ankara	**10:00 MoNE CRED**			
12	Jan-23	Thu	Ankara	**16:00 MoNE CRED**			
13	Jan-24	Fri	Ankara	**10:00: MoNE CRED** TK2175 Ankara (22:00) - Istanbul (23:30)			
14	Jan-25	Sat	Ankara	TK0052 Istanbul (01:55) - Narita (19:40)			