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The World Bank

Report No: ICR00003698

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-47840 and IBRD-80330)

ON A LOAN
IN THE AMOUNT OF EURO 310.0 MILLION (US$ 400.0 MILLION EQUIVALENT)

AND

AN ADDITIONAL FINANCING LOAN
IN THE AMOUNT OF EURO 109.8 MILLION (US$ 150 MILLION EQUIVALENT)

TO THE

REPUBLIC OF TURKEY

FOR AN

ISTANBUL SEISMIC RISK MITIGATION AND
EMERGENCY PREPAREDNESS PROJECT

June 25, 2016

Social, Urban, Rural and Resilience Global Practice
Turkey Country Management Unit
Europe and Central Asia Region

CURRENCY EQUIVALENTS
(Exchange Rate Effective as of December 31, 2015)

Currency Unit = Turkish Lira
TLR 1.00 = US$ [0.34]
US$ 1.00 = TNLR [2.91]
EURO 1.00 = US$ [1.09]
US$ 1.00 = EURO [0.92]

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AF	Additional Financing
CAS	Country Assistance Strategy
CH	Cultural Heritage
CPS	Country Partnership Strategy
DRM	Disaster Risk Management
EMP	Environmental Management Plan
FM	Financial Management
FY	Fiscal Year
GIS	Geographic Information System
GOT	Government of Turkey
IA	Implementing Agency
INSARAG	United Nations International Search and Rescue Advisory Group
IPCU	Istanbul Project Coordination Unit
IRR	Internal Rate of Return
ISARU	Istanbul Search and Rescue Unit
ISMEP	Istanbul Seismic Risk Mitigation and Emergency Preparedness Project
ISPA	Istanbul Special Provincial Administration
ISR	Implementation Status Report
JICA	Japan International Cooperation Agency
MEER	Marmara Earthquake Emergency Reconstruction
MIS	Management Information System
PAD	Project Appraisal Document
PDDEM	Provincial Directorate for Disaster and Emergency Management, Istanbul AFAD
PDO	Project Development Objective
PIU	Project Implementation Unit
TEMAD	Turkey Emergency Management General Directorate
VSL	Value of Statistical Life

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TURKEY
Seismic Risk Mitigation-TR

CONTENTS

Data Sheet
A. Basic Information
B. Key Dates
C. Ratings Summary
D. Sector and Theme Codes
E. Bank Staff
F. Results Framework Analysis
G. Ratings of Project Performance in ISRs
H. Restructuring
I. Disbursement Graph

1. Project Context, Development Objectives and Design 1
2. Key Factors Affecting Implementation and Outcomes 6
3. Assessment of Outcomes 13
4. Assessment of Risk to Development Outcome 28
5. Assessment of Bank and Borrower Performance 28
6. Lessons Learned 32
7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners 33
Annex 1. Project Costs and Financing 35
Annex 2. Outputs by Component 37
Annex 3. Economic and Financial Analysis 55
Annex 4. Bank Lending and Implementation Support/Supervision Processes 64
Annex 5. Summary of Borrower's ICR and/or Comments on Draft ICR 66
Annex 6. List of Supporting Documents 72
Annex 7. Pictures 73
MAP

A. Basic Information			
Country:	Turkey	Project Name:	Seismic Risk Mitigation Project
Project ID:	P078359	L/C/TF Number(s):	IBRD-47840,IBRD-80330
ICR Date:	06/14/2016	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	GOVERNMENT OF TURKEY
Original Total Commitment:	USD 400.00M	Disbursed Amount:	USD 563.12M
Revised Amount:	USD 544.11M		
Environmental Category: B			
Implementing Agencies: IPCU-ISTANBUL PROJECT COORDINATION UNIT OF GOVERNORSHIP OF ISTANBUL			
Cofinanciers and Other External Partners:			

B. Key Dates				
Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	08/07/2003	Effectiveness:	02/03/2006	02/03/2006
Appraisal:	03/01/2005	Restructuring(s):		04/14/2010 04/21/2011 12/11/2014
Approval:	05/26/2005	Mid-term Review:	05/30/2008	10/10/2008
		Closing:	09/30/2010	12/31/2015

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Highly Satisfactory
Risk to Development Outcome:	Low or Negligible
Bank Performance:	Satisfactory
Borrower Performance:	Highly Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	Ratings	Borrower	Ratings
Quality at Entry:	Satisfactory	Government:	Highly Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Highly Satisfactory
Overall Bank Performance:	Satisfactory	**Overall Borrower Performance:**	Highly Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	Indicators	QAG Assessments (if any)	Rating
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	Satisfactory
Problem Project at any time (Yes/No):	No	Quality of Supervision (QSA):	None
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes		
	Original	Actual
Sector Code (as % of total Bank financing)		
General education sector	20	20
Health	20	20
Other social services	20	20
Sub-national government administration	40	40
Theme Code (as % of total Bank financing)		
Natural disaster management	50	50
Participation and civic engagement	25	25
Urban planning and housing policy	25	25

E. Bank Staff		
Positions	At ICR	At Approval
Vice President:	Cyril E Muller	Shigeo Katsu
Country Director:	Johannes C.M. Zutt	Andrew N. Vorkink
Practice Manager/Manager:	David N. Sislen	Joseph R. Goldberg
Project Team Leader:	Elif Ayhan	Wael Zakout
ICR Team Leader:	Artessa Saldivar-Sali	
ICR Primary Author:	Artessa Saldivar-Sali	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document**)**
The specific objective of the project is to improve the city of Istanbul's preparedness for a potential earthquake 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 and land use plans.

Revised Project Development Objectives (as approved by original approving authority)

Through the Additional Financing (approved in April 2011) paper, the words "and land use plans", which were included in the original Project Appraisal Document's statement of the PDO, were deleted for the purpose of consistency with the Loan Agreement (Loan Number 4784 TU, dated October 18, 2005) of the original project.

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Key public facilities are retrofitted to resist a major earthquake			
Value quantitative or Qualitative)	None defined. Prioritization of key facilities during preparation identified 2,473 public buildings that required retrofitting. Prior to AF, this was refined to 1,576 based on vulnerability assessments conducted under the original loan.	Around 800 public buildings retrofitted	All targeted 763 public buildings retrofitted/reconstructed	806 public buildings retrofitted/reconstructed
Date achieved	02/03/2006	09/30/2010	12/31/2014	12/15/2015
Comments (incl. % achievement)	Exceeded by 6%. 2010 restructuring: target revised to 550 buildings. At AF, target increased to 763. At completion, both the original and revised targets were exceeded, with 806 vulnerable schools, hospitals and other buildings retrofitted/reconstructed			
Indicator 2 :	Skills and technical capacities of the relevant emergency response units are strengthened			
Value quantitative or Qualitative)	None defined	Capacity of the provincial and municipal public safety organizations in Istanbul to respond to major disasters is enhanced; coordination between regional	Emergency response units are adequately equipped and trained and emergency response plans tested	Technical capacity for emergency response was strengthened; Istanbul Search and Rescue teams were certified by UNINSARAG. Provincial Disaster and Emergency

		emergency response agencies, as well as between the Istanbul authorities and national govt improved		Response plans have been completed and a disaster and emergency management drill was carried out
Date achieved	02/03/2006	09/30/2010	12/31/2014	12/15/2015
Comments (incl. % achievement)	Exceeded. The target was revised at AF. Both the original and revised targets were exceeded, with the provincial emergency response units now internationally certified and with the capacity for emergency response demonstrated at the international level.			
Indicator 3 :	Building code enforcement and compliance with land use plans are improved			
Value quantitative or Qualitative)	None defined	Better enforcement of building codes and progress made in implementation of land use plans in selected municipalities	The process of building permitting is automated, transparent and allows for compliance monitoring	In two pilot cities: Document management system was established; building permit process optimized (automated, efficient and transparent); municipal call centers established
Date achieved	02/03/2006	09/30/2010	12/31/2013	12/15/2015
Comments (incl. % achievement)	Achieved. At AF, indicator was changed to "the transparency and efficiency of building permit issuance in two pilot municipalities are improved", making it more measurable (no additional activities or financing). Permitting is the means of enforcement.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	New communication system is installed and fully operational in emergency response facilities			
Value (quantitative or Qualitative)	None defined	Completed	The communicatio n system is fully operational in the main and back-up emergency management centers.	The new communication system is operational and in daily use

Date achieved	02/03/2006	12/31/2007	12/31/2014	12/15/2015
Comments (incl. % achievement)	Fully Achieved. From a baseline of 16 communications base stations, the Project had installed 80 new base stations by end-2010. This system is used in the emergency response units' daily operations.			
Indicator 2 :	Emergency management information and communication systems are installed and used in daily operations			
Value (quantitative or Qualitative)	None defined	Completed	Emergency management information and communication systems are installed and used in daily operation of the main and back-up emergency management centers	Main Hasdal Disaster Management Center was constructed and is fully operational, with management information and communication systems installed at both main and back-up DMC (Cagaloglu) and in daily use
Date achieved	02/03/2006	12/31/2007	12/31/2014	12/31/2012
Comments (incl. % achievement)	Fully Achieved. The target was made more specific at AF. The Command Control and Coordination Centers at the main and backup DMCs are fully equipped with the appropriately trained technical staff.			
Indicator 3 :	The Governorship Disaster Management Center (AYM) is strengthened.			
Value (quantitative or Qualitative)	None defined	None defined	The PDDEM is strengthened with better technical and coordination capacities	2 Disaster Management Centers (main and back-up) operational. All systems tested through a simulation exercise and emergency response drill with participation of all stakeholders.
Date achieved	02/03/2006	09/30/2010	12/31/2014	06/30/2015
Comments (incl. % achievement)	Fully Achieved. Indicator was modified at AF to "The Provincial Directorate for Disaster and Emergency Management (PDDEM) is strengthened with better technical and coordination capacities". PDDEM is the legal successor agency to AYM			
Indicator 4 :	The public safety units are provided with the adequate emergency response equipment.			
Value (quantitative or Qualitative)	None defined	Completed	The civil protection and emergency health units are provided	Emergency response units are adequately equipped and trained. Technical

			with adequate emergency response equipment	capacity for emergency response was strengthened, as certified by UN INSARAG.
Date achieved	02/03/2006	12/31/2007	12/31/2012	12/31/2014
Comments (incl. % achievement)	Exceeded. All public safety units have state-of-the-art emergency response equipment, and associated training. Search and Rescue Unit achieved UN INSARAG certification, validating 128 criteria on necessary equipment, preparedness, and capacity			
Indicator 5 :	The relevant agencies and volunteer groups are trained.			
Value (quantitative or Qualitative)	None defined	30 volunteer groups trained	Safe Life training and campaign carried out for 75,000 participants. Volunteer system under Governorship established.	1,045,339 volunteers trained; public awareness campaigns reached an estimated 2.5 million Istanbul residents
Date achieved	02/03/2006	12/31/2010	12/31/2013	06/30/2015
Comments (incl. % achievement)	Exceeded at 1394% of the targeted number of Safe Life participants. At Additional Financing, the indicator was modified to "The relevant agencies and volunteer groups are trained and public awareness campaigns reach out to Istanbul population".			
Indicator 6 :	Around 800 public buildings retrofitted/reconstructed.			
Value (quantitative or Qualitative)	0	800	763 public buildings are retrofitted/reconstructed	806 public buildings (784 retrofitted / 22 reconstructed)
Date achieved	02/03/2006	09/30/2010	12/31/2014	12/31/2015
Comments (incl. % achievement)	Target exceeded by 6%. During the 2010 restructuring, the target was revised to 550 buildings. At AF, the target was increased to 763 buildings. 817,000 occupants are directly benefitting from these safer buildings.			
Indicator 7 :	Vulnerability assessment of selected cultural heritage buildings completed			
Value (quantitative or Qualitative)	None defined	Completed		Designs for retrofitting 3 major CH buildings were completed, with 1 approved. Vulnerability assessments completed for 176 buildings in 26 complexes. Inventory of cultural heritage

				assets was completed in 2009.
Date achieved	02/03/2006	12/31/2009		12/31/2010
Comments (incl. % achievement)	Exceeded. The project went beyond vulnerability assessments to the development of innovative retrofit designs based on those assessments.			
Indicator 8 :	Feasibility assessments of lifelines and vital infrastructure completed			
Value (quantitative or Qualitative)	None defined	Completed		N/A
Date achieved	02/03/2006	12/31/2007		04/14/2010
Comments (incl. % achievement)	Dropped in the 2010 restructuring, as risk assessment of lifelines and vital infrastructure was carried out under the Bank-financed Istanbul Municipal Infrastructure Project.			
Indicator 9 :	Public awareness campaign			
Value (quantitative or Qualitative)	None defined	None defined		NA
Date achieved	02/03/2006	09/30/2010		04/21/2011
Comments (incl. % achievement)	Dropped at AF. However, 2.5 million Istanbul residents were reached by public awareness campaigns			
Indicator 10 :	Regulatory framework refined			
Value (quantitative or Qualitative)	None defined	Completed		NA
Date achieved	02/03/2006	12/31/2008		04/21/2011
Comments (incl. % achievement)	Dropped at AF. However, all of the planned activities were completed (studies and analyses to identify solutions and identify gaps in the regulations that would aim to enable the local authorities to better enforce the building code).			
Indicator 11 :	Improvement in compliance with building codes and land use plans in selected Istanbul municipalities			
Value (quantitative or Qualitative)	None defined	None defined	Document management system established; building permit process is optimized (automated, and document flow is more efficient and transparent). Municipal call centers established in	Document management system was established; building permit process optimized (automated, efficient and transparent); 2 municipal call centers established; Building permit issuance time decreased from 90 days to 10 days

			both municipalities	
Date achieved	02/03/2006	09/30/2010	12/31/2012	12/31/2012
Comments (incl. % achievement)	Achieved. At AF, this was revised to "Creation of a digital database of building stock and land use; established IT-based system for building permit issuance procedure which increases the process transparency, accountability, efficiency".			
Indicator 12 :	Voluntary accreditation and training of engineers has started			
Value (quantitative or Qualitative)	0	2000	Voluntary certified training provided to about 3,000 engineers	3,631 engineers trained
Date achieved	02/03/2006	09/30/2010	12/31/2013	12/31/2012
Comments (incl. % achievement)	Exceeded by 21%. At AF, the indicator was modified to "Voluntary certified training of about 3,000 engineers"			

G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	07/18/2005	Satisfactory	Satisfactory	0.00
2	11/09/2005	Satisfactory	Satisfactory	0.00
3	03/01/2006	Satisfactory	Satisfactory	1.19
4	07/11/2006	Satisfactory	Satisfactory	1.19
5	02/15/2007	Satisfactory	Satisfactory	2.57
6	07/03/2007	Satisfactory	Satisfactory	10.14
7	12/20/2007	Satisfactory	Satisfactory	62.36
8	05/28/2008	Satisfactory	Satisfactory	102.21
9	11/04/2008	Satisfactory	Satisfactory	162.04
10	05/09/2009	Satisfactory	Satisfactory	204.19
11	06/15/2009	Satisfactory	Satisfactory	204.19
12	11/17/2009	Satisfactory	Satisfactory	230.80
13	04/27/2010	Satisfactory	Satisfactory	266.41
14	06/09/2010	Satisfactory	Satisfactory	272.09
15	11/15/2010	Satisfactory	Satisfactory	303.15
16	06/26/2011	Satisfactory	Satisfactory	365.30
17	11/29/2011	Satisfactory	Satisfactory	383.31
18	08/05/2012	Satisfactory	Satisfactory	430.82
19	12/10/2012	Satisfactory	Satisfactory	436.26
20	02/03/2013	Satisfactory	Satisfactory	444.92
21	06/24/2013	Satisfactory	Satisfactory	451.17
22	12/24/2013	Satisfactory	Satisfactory	470.26
23	06/28/2014	Satisfactory	Satisfactory	491.61

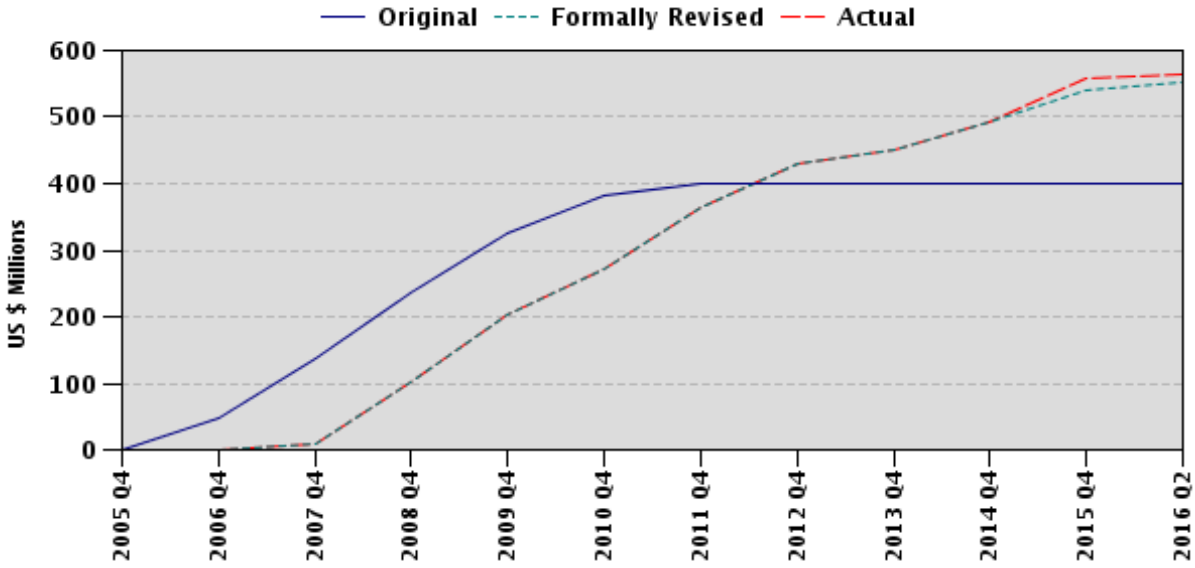
24	12/19/2014	Satisfactory	Satisfactory	513.20
25	06/16/2015	Satisfactory	Satisfactory	559.65
26	09/23/2015	Satisfactory	Satisfactory	559.65
27	12/23/2015	Satisfactory	Highly Satisfactory	563.12

H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
04/14/2010	N	S	S	266.41	The project was restructured to extend the closing date from September 30, 2010 to December 31, 2011, taking into account delays that had occurred during implementation due to difficulties experienced by contractors during the global financial crisis. In addition, the target value for the intermediate results indicator that measures the number of key selected public facilities to be retrofitted/reconstructed was adjusted from about 800 to 550 buildings to reflect increased construction unit costs and the higher-than-anticipated number of priority facilities requiring more expensive reconstruction rather than strengthening (due to their structural fragility).
04/21/2011		S	S	357.29	An additional loan in the amount of €109.8 million (US$150 million equivalent) was approved in April 2011 to help finance the costs associated with scaled-up activities to enhance the impact of the project. The closing date for the additional loan was December 31, 2014. The additional financing provided the opportunity to accelerate implementation of urgent and high priority seismic retrofitting

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
					of key public buildings. The following changes were also made: (i) a further extension of the closing date of the original loan by 12 months until December 31, 2012, to complete additional retrofitting contracts; (iii) amendment of the results framework; and (iv) revision of the procurement plan and national competitive bidding threshold for works.
12/11/2014	N	S	S	513.20	As requested by the Borrower on November 13, 2014, the following changes were made: (i) 12-month extension of the loan closing date to December 31, 2015, and (ii) change of the Project Implementing Agency from the ISPA to the Governorship of Istanbul.

I. Disbursement Profile



1. Project Context, Development Objectives and Design

1.1 Context at Appraisal

1. **Country and sector background.** Turkey is highly vulnerable to natural disasters, particularly earthquakes, with approximately 90,000 fatalities in 76 earthquakes since 1900, total affected population of 7 million, and direct losses of US$ 25 billion[1]. About half the deaths were due to two earthquakes on the North Anatolian Fault in 1939 and 1999. In the 1999 Marmara earthquake, the death toll was over 17,000 with a direct economic impact estimated at US$ 5 billion (2.5% of GNP). Modeling conducted after this earthquake showed a 35 to 70% probability of an earthquake in the Marmara Sea near Istanbul exceeding a moment magnitude (Mw) of 7.0 in the next 30 years[2]. This level of seismic hazard is shared by Tokyo and San Francisco; however, the fragility of the building stock constructed prior to the 2000 revision of the Turkish building code is much higher than that of California or Japan.

2. With 15 million inhabitants, Istanbul is not only the most populous province, but also the country's financial, cultural and industrial heartland, accounting for 28 % of national GDP, generating 38 % of the national industrial output and 44 % of its tax income. Istanbul faces high earthquake risk due to its location on the North Anatolian Fault, and the high level of exposure of its very dense population and commercial/industrial activity. Recent loss estimates indicate that an Mw7.25 earthquake on the North Anatolian Fault is expected to heavily damage or destroy 2 to 4% of buildings in İstanbul (Annex 3, Section C). Between 400,000 and 800,000 housing units would become uninhabitable, while 30,000 to 60,000 deaths and injuries are expected. Direct economic losses from building damage are estimated at US$ 11 billion, with total economic losses of US$ 40 billion.[3] With 188 of Turkey's 500 largest industrial companies located in Istanbul, and as the center of production, import and export, US$82.5 billion of Turkey's GDP is at risk from Istanbul's exposure to multiple hazards (primarily earthquakes).

3. **Government strategy.** After the Marmara earthquake, the Government of Turkey (GOT) enhanced its efforts to develop and implement a comprehensive hazard risk management strategy for the country. With Bank support through the Marmara Earthquake Emergency Reconstruction (MEER) project, a decentralized emergency management system was initiated through the creation of the Turkey Emergency Management General Directorate (TEMAD). This agency later evolved into the current Prime Ministry Directorate for Disaster and Emergency Management (AFAD), which serves as the national disaster coordination agency.

4. At the local level in Istanbul, both the municipality and the governorship demonstrated commitment to seismic risk mitigation, and implemented risk assessment and planning activities leading to the Earthquake Master Plan for Istanbul, which has been internationally recognized as a strategic instrument for addressing seismic risk in a highly

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1 Erdik, M. (2013), Earthquake Risk in Turkey, ScienceMag, Vol. 341, Issue 6147, pp. 724-725, DOI: 10.1126/science.1238945

2 T. Parsons, J. Geophys. (2004) Res. 109, B05304

3 Demircioglu, M. B. (2011), Assessment of Earthquake Risk in Istanbul in Seismic Risk Management in Urban Areas, PEER Report 2011/07

vulnerable mega-city. In addition, the GOT invested in the revision and updating of the building code in 2000 and 2007 (adoption of the Earthquake Code).

5. **Rationale for Bank assistance.** The Bank, building on its original mandate for reconstruction, has financed post-disaster reconstruction globally. In the last 15 years, however, the Bank has led a shift to *ex ante* programs enhancing governments' capacities for disaster risk reduction and preparedness, including strengthening institutional frameworks, emergency management systems, and risk reduction investments. In Turkey, numerous efforts at the provincial and local levels to mitigate the impact of natural disasters had not been fully realized, due to the need for a comprehensive framework for integrated risk management. The Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP, or the Project) was seen as the vehicle to address this, with the Bank as the partner that could advise on state-of-the-art disaster risk management interventions.

6. The Bank has been instrumental in supporting the GOT's more proactive approach to disaster risk management (DRM). The lessons learned from successfully implemented projects[4] informed the inclusion of the objective "to increase disaster preparedness and minimize losses from natural disasters" in the Country Assistance Strategy (FY04-06).

7. **Higher-level objectives to which the Project contributes.** The project contributed to the objective in Section IV of the Millennium Development Goals (MDG) Declaration, "to intensify our collective efforts to reduce the number and effects of natural and man-made disasters". The Project was also aligned with the FY04-06 CAS program of poverty reduction, which aimed at "making the economy more resilient to crises (including natural disasters) that disproportionately affect the most vulnerable". Moreover, the project contributed to the governance agenda through more effective processes for building code enforcement, and supported activities that would increase the DRM capacities of the Istanbul region, province and metropolitan area.

1.2 Original Project Development Objectives (PDO) and Key Indicators

8. The objective of the Project, as stated in the Loan Agreement, was to assist the Borrower in improving the city of Istanbul's preparedness for a potential earthquake, 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. The original PDO in the PAD included the words "and land use plans"[5].

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[4] Erzincan Earthquake Rehabilitation and Reconstruction Project (Loan No. 3511), Emergency Flood and Earthquake Recovery Project (Loan No. 4388), Emergency Recovery Loan (Loan No. 4518), and MEER Project (Loan No. 4517).

[5] The PDO in Annex 3 (Results Framework and Monitoring) of the PAD is not the same formulation as the PDO in the PAD datasheet. The PDO in the datasheet (as in the Loan Agreement) is "to improve preparedness for a potential earthquake", while the PDO in the RF is "Istanbul (govt, people, facilities) is well prepared to a major earthquake". Furthermore, some indicators in the table on arrangements for results monitoring do not match the formulation in the RF.

9. The key indicators were:

- Key public facilities are retrofitted to resist a major earthquake;
- Skills and technical capacities of the relevant emergency response units are strengthened; and
- Building code enforcement and compliance with land use plans are improved.

1.3 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

10. There were no changes to the PDO, except that the words "and land use plans" were deleted for consistency with the Loan Agreement. In March 2010, a Level 2 project restructuring made the following changes to key indicators:

Indicator	Change
Key selected public facilities are retrofitted in order to ensure their operation in the aftermath of a disaster	Target was adjusted from 800 buildings retrofitted to 550 public buildings retrofitted/reconstructed, due to the higher-than-expected number of more expensive reconstructions required (which could only be determined through feasibility studies during implementation).
Feasibility assessments of lifelines and vital infrastructure completed	Dropped, as this was carried out under the Bank-financed Istanbul Municipal Infrastructure Project.

11. Through the Additional Financing (AF, approved in April 2011), the following changes were made to the key indicators:

Indicator	Change
Building code enforcement and compliance with land use plans are improved	Revised to "The transparency and efficiency of building permit issuance in two pilot municipalities are improved", as building permit issuance is the means by which building codes and land use plans are enforced (no additional financing or change in activities).
Key selected public facilities are retrofitted in order to ensure their operation in the aftermath of a disaster	Target was increased from 550 public buildings retrofitted/reconstructed to 763 public buildings retrofitted/reconstructed, due to increasing efficiencies over the implementation period
The Governorship Disaster Management Center (AYM) is strengthened	Revised to "The Provincial Directorate for Disaster and Emergency Management (PDDEM) is strengthened with better technical and coordination capacities", as the PDDEM was the legal successor agency to AYM.
The relevant agencies and volunteer groups are trained	Revised to "The relevant agencies and volunteer groups are trained and public awareness campaigns reach out to Istanbul population" to increase the Project's impact.
Improvement in compliance with building codes and land use plans in selected Istanbul municipalities	Revised to "Creation of a digital database of building stock and land use; established IT-based system for building permit issuance procedure which increases the process transparency, accountability, efficiency and will enable monitoring of compliance with building codes and land use plans in two pilot Istanbul municipalities" in order to increase measurability.
Voluntary accreditation and training of engineers has started	Revised to "Voluntary certified training of about 3,000 engineers" to increase the Project's impact.

1.4 Main Beneficiaries

12. Most earthquake-related fatalities are due to building collapse or damage. Therefore, the main beneficiaries are the 817,000 occupants of the public buildings (schools, administrative buildings and dormitory/social service buildings) and 32,406 beneficiaries served (daily) by the hospitals and polyclinics. In addition, 1,045,339 people were provided "Safe Life" training and other modules for disaster preparedness. Capacity was also strengthened for Istanbul's public safety and emergency response units, volunteer groups, Provincial Directorates of Education and Health, the Ministry of Culture and Tourism, pilot municipalities, 3,631 civil engineers trained, and 24 local design/consulting engineering firms and 95 local contractors whose capacity for seismic risk reduction was built through the project.

1.5 Original Components

13. **Component A: Enhancing Emergency Preparedness (US$73.46 million).** The objective of this component was to enhance the effectiveness and capacity of the provincial and municipal public safety organizations in Istanbul to prepare for, respond to and recover from significant emergencies, especially those arising from earthquakes. Specifically, the component supported:

A.1 Improvement of emergency communications systems (US$ 33.16 million);
A.2 Establishment of an emergency management information system (US$ 7.50 million);
A.3 Strengthening of institutional capacity of AYM - Istanbul Governorship Disaster Management Center (US$ 9.60 million);
A.4 Upgrading of emergency response capacity in Istanbul (US$ 15.20 million); and
A.5 Public awareness and training (US$ 8.00 million).

14. **Component B: Seismic Risk Mitigation for Public Facilities (US$309.55 million).** The objective of this component was to reduce the risk of future earthquake damage to critical facilities and lifelines in order to save lives and ensure their continued functioning in the event of an earthquake. The component consisted of the following key activities:

B.1 Retrofitting/reconstruction of priority public facilities (US$ 303.85 million);
B.2 Risk assessment of lifelines and vital infrastructure (US$ 2.45 million); and
B.3 Risk assessment of cultural heritage buildings (US$ 3.25 million).

15. **Component C: Enforcement of Building Codes (US$7 million).** The objective of this component was to support innovative approaches to better enforcement of building codes and compliance with land use plans. The component supported:

C.1 Public awareness campaigns (US$ 0.23 million);
C.2 Further development of regulatory framework for enforcement of building codes and enforcement of land use plans (US$ 0.56 million);
C.3 Volunteer accreditation/training of engineers (US$ 1.20 million); and
C.4 Streamlining of building permits issuance procedures and promoting transparency and accountability in selected district municipalities (US$ 5.01 million).

16. **Component D: Project Management (US$8.0 million).** The objective of this component was to support the Istanbul Special Provincial Administration (ISPA) to implement the project in efficient and transparent manner, and build the institutional capacity to sustain the implementation of the Seismic Risk Mitigation and Preparedness program beyond the life of the project. Specifically, the component comprised project management support, including support to monitoring and evaluation.

1.6 Revised Components

17. Sub-component B.2 was dropped in March 2010, as risk assessment of lifelines and vital infrastructure were carried out under the Bank-financed Istanbul Municipal Infrastructure Project.

18. The additional financing supported scaled-up activities to enhance the outcomes of the following components:

Component A (US$38.15 million): Additional activities financed were (i) updating of emergency response plans, (ii) establishing a training and exercise program for disaster response and provision of equipment, (iii) establishing a sustainable disaster risk management volunteer system and raising public awareness, (iv) further support to technical capacities of first responders, and (v) provision of adequate furnishing and equipment for the Disaster Management Centers on the European and Asian sides of Istanbul.

Component B (US$108.85 million): The AF supported (i) retrofitting of an additional 48 schools, hospitals and other public buildings, and the reconstruction of 1 hospital, and (ii) feasibility studies, designs and construction supervision for the additional works.

Component C: *No further financing was provided. No activities were added.*

Component D: (US$ 3 million).

1.7 Other significant changes

19. **2010 Project restructuring (Level 2).** The project was restructured to extend the closing date from September 30, 2010 to December 31, 2011, taking into account delays that had occurred due to difficulties experienced by contractors during the global financial crisis from 2007-2009. In addition, the target value for the intermediate results indicator that measures the number of key selected public facilities to be retrofitted/reconstructed was adjusted from about 800 to 550 buildings to reflect increased construction unit costs and the higher-than-anticipated number of priority facilities requiring more expensive reconstruction rather than strengthening (due to their structural fragility).

20. **Additional Financing (Level 1).** An additional loan in the amount of €109.8 million (US$150 million equivalent) was approved in April 2011 to help finance the costs associated with scaled-up activities to enhance the impact of the project. The closing date for the additional loan was December 31, 2014. The additional financing provided the opportunity to accelerate implementation of urgent and high priority seismic retrofitting of key public buildings. The following changes were also made: (i) a further extension of the

closing date of the original loan by 12 months until December 31, 2012, to complete additional retrofitting contracts[6]; (ii) amendment of the results framework to reflect scaled-up activities in Components A and B; (iii) increase in the national competitive bidding threshold for civil works based on a portfolio-wide country procurement assessment that recognized the increased capacity of local contractors; and (iv) corresponding revision of the procurement plan.

21. **2014 Project restructuring. (Level 2).** As requested by the Borrower on November 13, 2014, the following changes were made: (i) 12-month extension of the loan closing date to December 31, 2015, due to delays in provision of site access by the Umraniye Maternity and Obstetrics Hospital and the Zeynep Kamil Maternity and Pediatric Hospital administrations (paragraph 33), and (ii) change of the Project Implementing Agency from the ISPA to the Governorship of Istanbul (see paragraph 34).

22. **Fund cancellation.** The original loan was closed on December 31, 2012, with a cancellation of € 4.5 million, due to project cost savings. However, disbursements at closing of the original loan (US$ 426 million equivalent) exceeded the approved amount of US$ 400 million (equivalent) due to exchange rate fluctuations.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

23. **Soundness of the background analysis**. Project design was based on thorough analysis of the country's DRM priorities, which were high on the national agenda following the Marmara Earthquake. The background analysis of ISMEP benefitted from earlier Bank-financed disaster recovery projects, as well as extensive assessments of the institutional, technical and human capacities of the public safety organizations. The associated needs analyses directly informed the design of activities and outputs to be financed by ISMEP. While MEER focused on post-disaster recovery and institution building at the national level, ISMEP was correctly designed to operate at the sub-national level and reduce risk *ex ante* in Istanbul, which faces high disaster risk that could have significant social and economic impacts on the whole country. Background analysis also took into account international experience, which has shown that seismic risk is effectively managed by the complementary action of communities, capacities of local agencies, and the reduction of risk in the built environment. Hence, in addition to structural strengthening of key public buildings, the Project rightly strengthened institutional capacities in Istanbul.

24. **Assessment of the project design.** Project design was ambitious but still realistic given the strong capacity of the Borrower, and based on a sound analysis of Istanbul's DRM needs. The Marmara earthquake exposed: (i) the weaknesses of existing emergency management and disaster response systems, and (ii) the poor quality of building construction, arising from (iii) a lack of building code enforcement. ISMEP addressed these challenges directly (with a one-to-one correspondence with each Component) at the sub-national level, while ensuring that implementation capacity would be carried over by

[6] At Additional Financing, interventions on 595 public buildings had already been completed, exceeding the then-target of 550 buildings, and additional retrofitting contracts had commenced.

the assignment of experienced staff from the existing Project Implementation Unit (PIU) under the Prime Ministry, responsible for Bank-financed reconstruction projects.

25. During project design, it was assessed that the degree of institutional capacity and DRM needs varied considerably across provinces and, as such, a program focusing on one area would deliver the highest impact. Istanbul was correctly selected due to its high seismic risk, the provincial government's demonstrated ownership and commitment, and its vital economic and social importance to the country. ISMEP promoted a decentralized approach to reduce risk and strengthen local agencies, and all project components were aligned with the strategies adopted under the Earthquake Master Plan for Istanbul, particularly regarding engaging local communities, protection of cultural assets, and retrofitting or reconstructing vulnerable buildings.

26. Public buildings were prioritized for retrofitting/reconstruction during project preparation under the leadership of the Istanbul Governor's office. Officials from all relevant public agencies (and academia) developed a list of high priority public buildings through a transparent prioritization process, using importance in the Istanbul Emergency Management Plan, occupancy, population served, building-specific technical data, transport access data, distance from faults, and other relevant characteristics, depending on the type of facility. The process allocated project resources between sectors and among types of facilities, to ensure continuity of operations in the event of a major disaster.

27. A cap was set on project funds allocated for reconstruction (as opposed to retrofitting) of vulnerable buildings, and the selection of buildings for reconstruction required the Bank's No Objection. This design feature resulted in greater cost-effectiveness of the investments, allowed for the reduction of risk in a much larger number of facilities than would have otherwise been possible, and demonstrated that retrofitting is technically feasible across a large portfolio of buildings.

28. The physical impacts related to building construction were correctly identified and mitigated through the Environmental Management Plan (EMP, disclosed on February 23, 2005) that identified environmental duties and responsibilities of civil works contractors, consultants and the PIU. The EMP also included Physical Cultural Resource-related mitigation and monitoring measures to be applied to sub-projects (see Section 2.4).

29. **Adequacy of government's commitment.** GOT demonstrated commitment to the PDO by financing the development of the Earthquake Master Plan for Istanbul, temporary command centers for the coordination of post-disaster actions, and technical studies from their own sources. Responsible entities worked together efficiently, as demonstrated during the prioritization process for the public facilities to be selected for retrofitting (para. 26). The GOT also allocated the loan proceeds to İstanbul Province -- a preferential exception to Turkey's Public Finance and Debt Management Law -- and emphasized the selection of a highly qualified pool of professionals with deep experience in their respective fields (paragraph 35).

30. **Assessment of risks.** Overall risk was correctly rated Low. At appraisal, the key project risks were assessed as: (i) lack of institutional coordination, in view of the interventions on assets legally belonging to several public entities (*Modest*); and (ii) insufficient commitment of municipalities to strict enforcement of building codes and compliance with land use planning regulations (*Substantial*). These two main risks were

appropriate and realistic. The mitigation measures consisted of (i) vesting the PIU with responsibility and temporary ownership of assets until completion of the investment, and use of the emergency management component to strengthen coordination mechanisms between various institutions; and (ii) community involvement to increase public awareness, and emphasis on engineers' training. The first risk materialized to a limited extent, in terms of an initial difficulty in ensuring that retrofit and upgrade interventions for hospitals met modern health service needs, in addition to the seismic strengthening objective. This was, however, mitigated by close coordination by the PIU (the Istanbul Project Coordination Unit) with hospital administrators during the design process. The second risk was mitigated by the improvement of work flows for the key mechanism by which building codes and land use plans are enforced, i.e., the building permitting system.

31. The Bank's Quality Assessment Group (QAG) rated Quality at Entry satisfactory under QEA7 in September 2005 (see Section 5.1).

2.2 Implementation

32. As shown in table G in the datasheet, implementation was consistently rated Satisfactory and, at closing, Highly Satisfactory. Factors that affected implementation are described below.

33. *Factors outside project control*

- The global financial crisis of 2007-09, and the economic conditions that preceded it, imposed challenges on contractors. This led to implementation delays, resulting in the first extension of the Project closing date through the 2010 restructuring.

- The mid-term review concluded that a higher-than-anticipated number of priority facilities would require more expensive reconstruction, which costs 7-10 times more than retrofitting. This was due to the higher structural fragility found during building-specific feasibility studies (beyond a certain level of fragility, it is no longer effective to retrofit). This led to the reduction in the corresponding target from 800 to 550 buildings through the 2010 restructuring.

- Late provision of site access by the Umraniye Maternity and Obstetrics Hospital (reconstruction) and the Zeynep Kamil Maternity and Pediatric Hospital administrations led to initial delays in works on these facilities under the AF. This required extension of the AF closing date from December 31, 2014 to December 31, 2015, through the 2014 restructuring.

34. *Factors subject to government control*

- Government commitment to the PDO to improve Istanbul's disaster preparedness was demonstrated by vesting project implementation at the provincial level (first in ISPA, and then in the Governorship of Istanbul when ISPA was closed in late 2012 as part of changes to the metropolitan municipality regime in Turkey). For the purposes of ISMEP, the GOT also allocated the loan proceeds to İstanbul Province, which is a preferential exception to Turkey's Public Finance and Debt Management Law (under which foreign loans cannot be allocated to special, sub-national budget institutions such as Istanbul Province).

- The government also undertook a rigorous and transparent process of staff selection, which resulted in the appointment of a highly qualified pool of professionals with deep experience in their respective fields, as well as in the implementation of World Bank projects.

- In terms of relevant sector policies, in addition to the Earthquake Masterplan for Istanbul, the Government reaffirmed its support for the DRM agenda by amending the 1998 Building Code with the 2007 Turkish Earthquake Code, providing the regulatory basis and design standards for the investments under Component B.

- Institutional changes associated with the GOT's decentralization agenda led to closure of the special provincial administrations in metropolitan cities in 2014, including ISPA. As a result, the Implementing Agency was changed to the Governorship of Istanbul through the 2014 restructuring, with the same PIU reporting to the Deputy Governor for disaster risk management.

35. *Factors subject to implementing agency control*

- Despite early implementation delays (paragraph 33), the Implementing Agency's highly effective staff and the quality of management (particularly with regard to contracts) ensured that implementation was quickly brought back on track.

- Lump-sum contracting for civil works (in which a fixed price is agreed before the works begin) was utilized in a majority of contracts, with a minimal number of unit-price contracts (in which the final price of the works is dependent on the quantities of inputs needed to carry out the work). Such output-based lump sum contracts incentivized the contractors to rationally and precisely calculate the underlying costs and offer their bids accordingly. This resulted in significant time and cost savings, as lump-sum arrangements offer limited scope for cost increase and time extension (i.e., contract variations). Lump sum contracting was enabled by the PIU's ability to sufficiently define the scope and schedule of works.

- Effective use of technical assistance, resulting in a system of multiple-stage reviews of engineering designs. Designs submitted by consultants were reviewed by the PIU technical staff, who then forwarded selected designs for review by independent design review consultants. Institutionalization of this procedure resulted in continuous improvement in earthquake strengthening designs over the project life.

- Strong beneficiary participation, including consultations with 729 school communities to develop the transfer plans that ensured minimal disruption to students and their families during the retrofitting period. Consultations also included district and local directorates of health and education, hospital administrators, school principals, and parent associations.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

36. **M&E design.** A conventional M&E approach is not entirely appropriate for DRM projects. Conventional methods assess *what has taken place* as a result of an intervention, not *what has been prevented*. For ISMEP, the emphasis was placed on intermediate results, rather than outcomes, and baseline data was not available in some cases. However, it

should be noted that M&E design has evolved significantly since the time of project preparation, and the ISMEP Results Framework was found (in the 2009 World Bank-Turkey Joint Portfolio Performance Review) to be in accordance with good practice.

37. Furthermore, indicators selected to monitor progress toward achievement of the PDO correctly reflected defined areas of action and included a relevant mix of qualitative and quantitative targets (where appropriate). External evaluation and, in some cases, impact assessment for various components contributed to the M&E design. When assessed against current M&E guidelines, however, the original results framework would have benefitted from greater specificity.

38. **M&E implementation.** Data collection for the assessment of intermediate outcomes was carried out during implementation through a number of component-specific impact assessments performed by external consultants, while the internal M&E systems excelled particularly in financial monitoring and contract management. All physical outputs were regularly monitored through the PIU's management information system (MIS), reported to the Undersecretariat of Treasury and Ministry of Development twice a year, and regularly reported to the Bank. During the AF period, the MIS was enhanced and complemented with a document MIS that was integrated with a physical archive system for redundancy. An overall Project Evaluation Report covering the period 2009-2014 consolidated five impact assessments. An overall social impact assessment is underway, with completion expected in the first half of 2016.

39. **M&E utilization.** In general, the findings of M&E were used to inform decision-making, resource allocation and to modify project implementation. Based on the findings of the Impact Assessment of Retrofitting and Repair Works at Schools (2009, 2010), in which concerns were expressed by parents and school administrators regarding the need to temporarily relocate students during the retrofitting works, additional resources were allocated for innovative social guidance and training programs and to implement capacity building activities that were specifically tailored to parents, students, school administrators and other members of the community. This effectively utilized emerging challenges in the implementation of the physical risk reduction investments as an entry-point for communicating the benefits generated by structural strengthening to the general community and enhancing public support. The impact assessment also led to broader dissemination of public awareness ('Safe Life' training) programs. Similarly, on the basis of beneficiary feedback, implementation was modified during the AF to launch tenders only once a year and undertake retrofitting works during the summer break (where possible) to minimize disruption of educational continuity.

2.4 Safeguard and Fiduciary Compliance

40. **Safeguard Compliance.** The Project was rightly classified as Category B, and triggered two policies: Environmental Assessment (OP/BP 4.01) and Physical Cultural Resources (OP/BP 4.11). The physical impacts related to building construction, and included: emissions of particulate matter/dust to the air, domestic wastewater generated during construction works, disposal of excavated material, noise pollution, disposal of hazardous material (e.g., old pipes containing asbestos, paint used during construction).

These impacts were mitigated accordingly. Regular supervision of safeguards found no major negative social or environmental impacts as a result of project activities.

41. *Environmental Safeguards.* Throughout implementation, the Project complied with environmental safeguard policies and promoted positive impacts in a number of aspects. A framework Environmental Management Plan was prepared and continuously implemented, clearly identifying environmental duties and responsibilities of civil works contractors, consultants and the PIU, while the Bank provided implementation support in assessing the operation's compliance with environmental regulations. The subproject EMPs individually developed for each construction site were also fully aligned with the Project EMP. The PIU had a designated environmental specialist to (i) monitor contractors' compliance with EMPs, and (ii) liaise with the Bank on emerging environmental issues, which is good practice. Close supervision and monitoring of safeguard policies were also instrumental in increasing the quality of environmental construction practices, such as timely and proper disposal of debris (including hazardous materials such as asbestos and epoxy), compliance with workers' health and safety regulations and prevention of grievances among the PIU, consultants, contractors and the project beneficiaries.

42. In addition to seismic retrofitting, functional upgrades and energy efficiency features introduced in reconstructed/retrofitted public buildings helped generate additional environmental co-benefits. Finally, the dissemination and implementation of the framework EMP and site-specific EMPs by a significant number of consultants and contractors in the construction supervision and contracting market led to increased awareness and broader compliance with environmental regulations.

43. *Physical Cultural Resources*. The safeguard policy on Physical Cultural Resources (PCR) was triggered in the original project and the AF due to potential civil works on structures classified as cultural heritage (CH) buildings, or on buildings located in proximity to such assets. The framework EMP included national legislation on cultural heritage and a comparative analysis against the Bank's OP 4.11, which showed that Turkey's national system of conserving cultural heritage is aligned with the Bank's requirements. The EMP also included PCR-related mitigation and monitoring measures to be applied to sub-projects, which were satisfactorily implemented, including appropriate references in bidding documents and contracts.

44. *Social Safeguards.* Compliance with social safeguards was satisfactory. The implementing agency's procedures, regulations, and institutional capacity were adequate to implement the Bank's social safeguard policies. OP 4.12 was not triggered as land acquisition did not take place, with reconstruction and retrofitting works carried out in situ. No civil works resulted in involuntary resettlement. In terms of the necessity of transferring students to alternate schools, the Project organized social guidance meetings targeting representatives of provincial, district, and local directorates of education, school principals, students and parent associations to explain and build consensus around the benefits derived from structural strengthening, the process and the timeline (meetings were conducted in 729 schools, with 284,680 beneficiaries). With regard to health facilities, the PIU coordinated with provincial health authorities and hospital administrators to develop less disruptive patient transfer options. In cases where health facilities needed to remain operational during construction, innovative external retrofit solutions were employed.

45. **Fiduciary Compliance.** No major fiduciary issues emerged during implementation. The main findings are detailed below.

46. *Procurement.* The PIU complied satisfactorily with the procurement procedures in the Loan Agreement and Procurement Plan, and no waivers were sought. The quality of the bidding documents was satisfactory in terms of both commercial requirements and technical specifications. There were seven revisions to the Procurement Plan under the original Loan and four under the AF. Throughout the Project, procurement documentation was in order and no deviation was reported. In addition to Bank funding, the PIU successfully managed multiple parallel procurement processes originating from loans from different IFIs. Nevertheless, given the volume and number of contracts, the PIU could have benefitted from engaging additional procurement specialists for even more timely procurement of goods and civil works, for hospital construction in particular.

47. *Financial Management (FM).* High-quality financial and contract management systems were maintained throughout the Project and FM was rated Highly Satisfactory at closing. The Project was in compliance with loan covenants at all times: interim financial reports were submitted on time with the agreed format and content, transactions accounted for and documented adequately, audit reports submitted on a timely basis with unqualified opinions. The Project established an FM team that ensured successful disbursements and close financial supervision. Additionally, the Project's MIS ensured timely and efficient monitoring of all sub-projects. The MIS held the entire finance and procurement-related database, as well as real-time progress and disbursement status of contracts issued.

2.5 Post-completion Operation/Next Phase

48. Istanbul has become an international showcase in DRM and physical risk reduction. This experience is being leveraged in the design of the proposed Turkey National Disaster Risk Management Project (FY18), which will focus on strengthening planning and implementation mechanisms for long-term risk reduction throughout the country, and be supported by a program of technical assistance on Building Resilience in Turkey. The National DRM Project is envisioned to be the first of a series, will serve as a platform for coordinating and funding risk reduction investments, and will support further enhancement of overall disaster risk management capacity, risk reduction in selected sectors (education) and areas, and developing administrative and budgetary mechanisms for screening, preparing, implementing and monitoring multi-sector risk reduction programs.

49. Initially supported with a € 415.26 million (US$550 million) IBRD loan and AF, ISMEP has leveraged another € 1.36 billion from the European Investment Bank, Council of Europe Development Bank and Islamic Development Bank, which will continue financing risk reduction for critical public facilities until 2020 under the ISMEP implementing arrangements.

50. Improvement of the existing M&E systems and implementation capacity beyond the IBRD operation is ongoing. The PIU is building up a dedicated M&E team and specifying clearer units of measurement for each indicator (such as number of people trained, number of beneficiaries in safer schools, decrease in building permit issuance

time), baselines, annual and final targets for each indicator as well as the roles and responsibilities for collecting, reporting, and analyzing data on those indicators.

51. Both Bagcilar and Pendik pilot municipalities (Sub-component C.4) have continued funding the operation and maintenance of the automated building permitting systems, using internal budget allocations. They have also secured ISO 27001 certification, which is a standard for information security management systems, subject to inspection and review every three years of all disaster recovery and business continuity systems.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

52. **Relevance of Objectives is rated High.** The PDO was highly relevant to the country's development priorities and Bank strategies at appraisal (see Section 1.1), throughout implementation (the same PDO was used for the AF), and at closing. Turkey's 10th National Development Plan (2014-2018) has a section specific to DRM, in the GOT's recognition that Turkey is highly exposed to natural hazards (particularly earthquakes). The Project's results are now informing the design of programs to replicate the experience of Istanbul in other high-risk areas in Turkey. Disaster risk reduction (including climate change adaptation and establishing implementation and financing mechanisms) and urban transformation remain a focus of Turkey's urban development agenda.

53. The PDO also remained consistent with the World Bank Group CPS (FY12-15), which recognizes that natural disaster risk can be mitigated by Bank-supported programs. Under Strategic Theme 3, the FY12-15 CPS (*Deepened Sustainable Development*), Outcome 10 (*Improved Sustainability of Turkish Cities*) has a target of "At least a total of 750 public buildings in the Istanbul Metropolitan Area retrofitted/reconstructed to resist a major earthquake" (exceeded).

54. The PDO is consistent with the Earthquake Master Plan for Istanbul, developed in 2003 by the Metropolitan Municipality of Istanbul (and the current plan in force for seismic risk reduction). The Master Plan is based on the following principles, with which ISMEP's PDO is directly aligned: (i) ensuring the continuity of vital urban functions (such as healthcare and education) in case of a disaster, (ii) reducing losses at metropolitan scale through coordination between local and central governments, (iii) designated agencies must be empowered to carry out their mandates, (iv) the impact of earthquakes on the safety of life and property should be reduced, (v) a critical assessment of the administrative and technical resources at disposal of the local government must be made, and appropriate capacities built; and (vi) a public training and awareness program must be implemented.

55. **Relevance of Design and Implementation are rated High.** The PDO was clear, with intermediate outcomes that comprise earthquake "preparedness" – terminology that has itself evolved (since the project was designed) into the broader concept of disaster risk management, or "resilience". Commonly-used working definitions (e.g., developed by the United Nations and the Global Facility for Disaster Reduction and Recovery) are used in this discussion to provide more practical, measurable definitions or proxies against which to evaluate the project design and outcomes.

56. As discussed in Section 2.1, ISMEP's components responded to challenges faced by the GOT after the 1999 Marmara earthquake. The Project activities were realistic, well focused, and directly aligned with the UN definition of "preparedness", i.e., "The knowledge and capacities developed by governments, professional response and recovery organizations (Sub-components A.3 *Strengthening of institutional capacity of AYM - Istanbul Governorship Disaster Management Center*, and A.4 *Upgrading of emergency response capacity in Istanbul*), communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions"[7] (Sub-component C.3 *Volunteer accreditation/training of engineers*). This is complemented by contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination (Sub-components A.1 *Improvement of emergency communications systems* and A.2 *Establishment of an emergency management information system*), public information, and associated training and field exercises (Sub-component A.5 *Public awareness and training*).

57. Project design was also relevant to the current internationally accepted framework for DRM[8], which emphasizes pillars of risk identification and risk reduction, in addition to preparedness. Risk identification involves systematic efforts to analyze the causal factors of disasters (Sub-component B.3 *Risk assessment of cultural heritage buildings*), while risk reduction focuses on decreasing exposure to hazards (Sub-component C.2 *Further development of regulatory framework for enforcement of building codes and enforcement of land use plans*), and lessened vulnerability of people and property (Sub-components B.1 *Retrofitting/reconstruction of priority public facilities*, C.1 *Public awareness campaigns,* and C.4 *Streamlining of building permits issuance procedures and promoting transparency and accountability in selected district municipalities*).

58. Retrofitting of private housing (and provision of a financing mechanism) was considered as an option, but correctly dropped because: (i) the Government did not approve providing a subsidy (with associated foreign exchange risk) to incentivize private banks; and (ii) households' willingness to pay for retrofitting was low given the costs and lack of information on the benefits of retrofitting. Instead, the Project's support of public awareness and building code enforcement (through the improvement of the permitting process) were indispensable measures to reduce seismic risk in the private building stock.

59. Implementation arrangements remained relevant, responding to the changes in the institutional framework for local administration in Turkey, with the change in implementing agency from ISPA to the Governorship of Istanbul (see paragraph 34). The inputs of project funds, technical assistance and capacity building supported outputs including (i) trained staff of the relevant disaster management and emergency response units as well as a state-of-the-art disaster management center, technological systems and equipment; (ii) seismic retrofitting of key public facilities; and (iii) improved building code enforcement processes, systems and training for municipalities. Paragraph 38 describes

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[7] http://www.unisdr.org/we/inform/terminology#letter-p

[8] GFDRR (2012), The Sendai Report, https://www.gfdrr.org/sites/gfdrr/files/publication/Sendai_Report_051012_0.pdf

the use of M&E findings to inform and modify project implementation, when appropriate. QAG rated "Strategic Relevance and Approach" as Highly Satisfactory in its QAE7.

3.2 Achievement of Project Development Objectives

60. The PDO was to assist the Borrower in improving the city of Istanbul's preparedness for a potential earthquake. Although the level of GOT commitment and action by provincial authorities prior to the Project were significant (e.g., development of the Istanbul Earthquake Master Plan), the level of risk was so severe that important needs (see Section 2.1) remained unmet. While the Earthquake Master Plan did not specify outcomes or targets, ISMEP contributed to the range of strategies the Plan adopted. Like all DRM projects, ISMEP's results can be measured through models that show reduced human and economic losses as a result of the investments, and through qualitative benchmarking of important institutional capacities. In addition to the indicators specified in the Results Framework, the following summarize the Project's efficacy:

Outcome Areas	Results
Enhancing institutional and technical capacity for disaster management and emergency response	Public awareness campaigns reached 2.5 million people (18% of Istanbul's population); Disaster preparedness training and volunteer programs reached over 1 million people
	Istanbul AFAD was certified by the UN International Search and Rescue Advisory Group (INSARAG), meeting 128 criteria and capacity checks for international emergency response (equipment, preparedness, mobilization, and operations)
	Deployment of Istanbul AFAD, Search and Rescue Unit and Medical Rescue Team after the Tohoku (2011), Van (2011), and Nepal (2015) earthquakes demonstrates capacity for international disaster management
	Large-scale simulation (106 military, public and non-public institutions and 400 participants) tested the Istanbul Disaster Response Plan, which informed the subsequent development of the Turkey Disaster Response Plan
	State-of-the-art Disaster Management Centers fully operational, in daily use
Strengthening critical public facilities for earthquake resistance	Life Safety: 817,000 direct occupants of 806 retrofitted/reconstructed buildings, and capacity to provide safe emergency shelter for an additional 450,000 people
	Avoided Direct Damage to Key Public Facilities: US$ 728 million
Supporting measures for better enforcement of building codes	Under the automated, transparent building permitting systems, 1,400 new apartment building permits are issued annually, resulting in 67,000 people/year living in code-compliant housing
	Training and capacity building provided for 3,631 engineers on "Regulation on Buildings to be constructed in Earthquake Zones"

Outcome 1: Enhancing institutional and technical capacity for disaster management and emergency response

Rating: **High**

61. Prior to the Project, budgetary constraints had delayed full operational status for the temporary provincial disaster management center in Cagaloglu, Istanbul. Studies conducted during preparation showed that personnel levels and equipment for the first responder agencies were well below those of comparably large, high risk metropolitan areas in other countries. Communication links between the fire, security, emergency medical services and crisis centers/hospitals lacked interoperability and were marginally adequate for day-to-day operations, but would have been immediately overwhelmed in the aftermath of a significant earthquake. Finally, limited coordination systems were in place for national, provincial and municipal agencies, or for tracking resource requests and needs during an emergency. These issues were directly addressed by the Project.

62. Communication is the foundation of an effective disaster management system. ISMEP therefore provided new, fully operational, interoperable emergency communication systems in emergency response facilities (the ISMEP-financed disaster management center (DMC) at Hasdal and the back-up DMCs at Akfirat and Cagaloglu). As a result, provincial and municipal public safety agencies[9] have effective daily communications at the tactical, operational and strategic levels, and with national agencies in Ankara. The Project also supported training on operation and maintenance for system users and administrators. The coverage area of analogue systems is now 95% of the province (with all equipment installed on earthquake-resistant telecommunication pylons), providing redundancy and improving the signal quality of the communication networks.

63. Emergency management (resource planning, deployment and reduction of response times) was enhanced through investments in information systems and enhanced IT infrastructure, which is in daily use by the DMCs in Istanbul, at the national level in Ankara, and by the public safety agencies. The Project financed 100 seismic sensors to enhance the Kandilli Observatory Earthquake Monitoring System, resulting in faster and more accurate seismic analysis. Annex 2 contains a list of Project outputs by component.

64. ISMEP technical assistance supported the Istanbul Emergency and Disaster Response Plan (ADMIP), which preceded and informed the development of the Turkey Disaster Response Plan. Under the ISMEP AF, the ADMIP was further updated to fully align with the Turkey Disaster Response Plan's principal service areas (Response and Operations, Information and Planning, Logistics and Maintenance, Finance and Management Services) and 26 sub-service groups. ISMEP activities directly enhanced the capacity of 18 of the 26 sub-service groups.

65. Istanbul AFAD (PDDEM) carried out a large-scale training and simulation exercise (with 106 military, public and non-public institutions and 400 participants) together with a

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[9] These investments enhanced the operational capabilities of the Istanbul public safety units: Provincial Directorate for Disaster and Emergency Management (PDDEM, or AFAD), Istanbul Search and Rescue Unit (ISARU), İstanbul Health Directorate, Istanbul Police Department, Istanbul Gendarmerie Commandership, and the Turkish Red Crescent.

search-and rescue drill (150 participants) in June 2015 to test the Disaster Response Plan, after which an action plan was developed for continuous improvement, including the integration of volunteer groups trained under the (AF) Project-supported "Volunteer System and Management Model". The Volunteer system and model is under review by the Prime Ministry Directorate for Disaster and Emergency Management, to establish an accreditation process, operational procedures, training, and guidelines for volunteers.

66. Through the improvements in organizational structure, construction and equipping of a fully staffed, state-of-the-art DMC with a Command Control and Coordination Center (Annex 7, Picture A) in Hasdal, ISMEP enhanced Istanbul AFAD's (PDDEM) capacity to coordinate provincial-scale disaster response. Designed to remain fully operational in the scenario earthquake, the DMC ensures inter-agency coordination during a disaster. Capacity has exceeded the level for provincial disaster management, as demonstrated by the deployment of Istanbul AFAD, Search and Rescue Unit (ISARU) and UMKE (Medical Rescue Team) after the Tohoku (2011), Van (2011), and Nepal (2015) earthquakes[10].

67. The Project interventions, particularly training, have enabled the certification of the AFAD Search and Rescue Unit as a "Heavy Rescue Unit" by the UN International Search and Rescue Advisory Group (INSARAG), meeting 128 criteria[11] after a rigorous two-year examination process. This certification validates that Istanbul AFAD's capacity to provide international assistance in emergency response has exceeded the targeted provincial level.

68. Public awareness and training activities were integral to all the Project components, with multi-media training materials and modules implemented for the general public, technical staff of beneficiary agencies and municipalities, and decision makers. Local Disaster Volunteer training provided the general public with the capacity for neighborhood-level disaster response. This program will continue after project closing through agreements between the Governor's Office, NGOs and other organizations. ISMEP also supported school-based training in collaboration with the Provincial Directorate for National Education, disseminating modules to 37,195 people (25,214 students, 3,667 teachers and 8,314 parents). In total, 1,045,339 people (against the target of 75,000) were directly trained under the Project, through various modules of "Safe Life" training, social guidance and other programs (see Annex 2), while public awareness campaigns reached about 2.5 million people (18% of Istanbul's population).

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[10] This capacity for international emergency response was also demonstrated in the Afghanistan Earthquake (2015), Pakistan Earthquake (2015), Albania floods (2015), and in support to the Somalia Humanitarian Aid Project.

[11] Heavy Urban Search and Rescue (USAR) Teams are certified according to their operational capabilities for difficult and complex technical search and rescue operations. The certification takes into account 128 criteria on necessary equipment, preparedness, mobilization, operations, demobilization, capacity checks, mock drills and exercises identified in INSARAG guidelines. (http://www.insarag.org/en/iec/iec-leftmenu.html)

Outcome 2: Strengthening critical public facilities for earthquake resistance

Rating: **High**

69. The 1999 Marmara earthquake demonstrated the high seismic vulnerability of the building stock in Istanbul. During preparation of the original loan 2,473 public buildings were deemed to require retrofitting, which was refined to 1,576 prior to the AF, based on vulnerability assessments conducted during implementation. The Project retrofitted/reconstructed a total of 806 key public facilities (51% of the total identified need), directly benefitting 817,000 occupants (school buildings) and 32,406 people served daily (hospitals, polyclinics and health centers). Building selection was based on strategic importance in the Emergency Management Plan, general population served, accessibility, vulnerability of the building, distance to fault lines, and bed capacity (hospitals) or number of students (schools). All of the original and revised targets were exceeded.

70. The Project supported: (i) retrofitting/reconstruction of priority public facilities (Table 1), and (ii) structural risk assessment of cultural heritage (CH) buildings and development of retrofit designs. Out of the 3,300 public schools in Istanbul, the Turkey Disaster Response Plan identifies 900 schools to be deployed as emergency shelters. Of these 900, 639 are ISMEP retrofitted/reconstructed school buildings that can each provide emergency shelter for 700 people, or 450,000 more people than the regular occupants.

Table 1. Facilities retrofitted/reconstructed, by type

Facility Type	Retrofitted	Reconstructed	Total
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 (Original and AF)**

71. Seismic retrofitting increases strength such that a building can reach a minimum level of structural performance[12] at the expected earthquake intensity level. This results in three distinct but related benefit streams: (i) avoided fatalities (life safety), (ii) avoided direct structural damage, and (iii) service continuity for the public facilities.

72. The criteria for (demolishing and) reconstructing existing vulnerable buildings included minimal remaining economic life and estimated retrofitting costs higher than 40% of the cost of a new building of the same size. This is in alignment with the United States Federal Emergency Management Agency's guidelines on whether to repair or replace a

[12] The Turkish Earthquake Code (TEC) defines the minimum targeted structural performance levels to be used in strengthening designs for existing buildings. The performance levels specified for strengthening both hospitals and schools are: Immediate Occupancy (or 'Ready for Use') after earthquakes with 10% probability of exceedance in 50 years, and Life Safety after earthquakes with 2% probability of exceedance in 50 years (the highest earthquake intensity level specified in the TEC). At the lower intensity level of the Istanbul "scenario earthquake" (50% probability of exceedance in 50 years), strengthened buildings are designed to sustain negligible damage.
(http://www.staticad-yigma.com/download/2007_Turkish_Earthquake_Code.pdf).

building damaged in an earthquake, under which replacement is chosen if the necessary repair costs exceed 40% of the building's replacement cost. Annex 7, Picture B shows a school that was reconstructed under ISMEP.

73. The typical retrofit interventions for school buildings were interior reinforced concrete shear walls inside the existing beam-column frame and exterior reinforced concrete shear walls outside of the existing structural frame (Annex 7, Pictures C and D). In order to ensure operational continuity for the hospitals during and after an earthquake, state-of-the art retrofitting methods (Annex 7, Picture E) were employed to minimize vibrations that damage critical equipment and non-structural components. Hospitals' emergency units were also made larger to increase service capacity during a disaster.

74. Building-specific assessments conducted for ISMEP schools estimated the damage and casualties that would be expected[13], had these not been retrofitted/reconstructed to achieve the targeted level of structural performance. This assessment took the Mw7.25 scenario event[14] that is expected to take place on the Marmara Fault to the south of Istanbul, and estimated that (in the absence of the risk reduction interventions), approximately 415 school buildings would sustain medium damage, heavy damage or total collapse (resulting in 300,000 students needing alternate school facilities). In addition, the expected ratio of damage to the buildings would be reduced from 40% without the project to 5% with the project (equivalent to US$ 728 million in avoided damage). Figure 1 shows the locations of the retrofitted/reconstructed schools against the site-specific earthquake intensity[15] distribution in Istanbul, predominantly concentrated in the highest-intensity areas.

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[13] Based on (i) the site-specific exposure of each building to earthquake ground motion, and (ii) the vulnerability of the original structures.

[14] Updating Estimations of the Probable Earthquake in Istanbul: Final Report, Istanbul Metropolitan Municipality, Directorate of Earthquake and Ground Analysis, Nov. 2009.

[15] The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the Modified Mercalli (MM) Intensity Scale is composed of increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. It is a ranking based on observed effects. The Modified Mercalli Intensity value assigned to a specific site has a more meaningful measure of severity than earthquake magnitude because intensity refers to the effects actually experienced at that site. (http://earthquake.usgs.gov/learn/topics/mercalli.php)

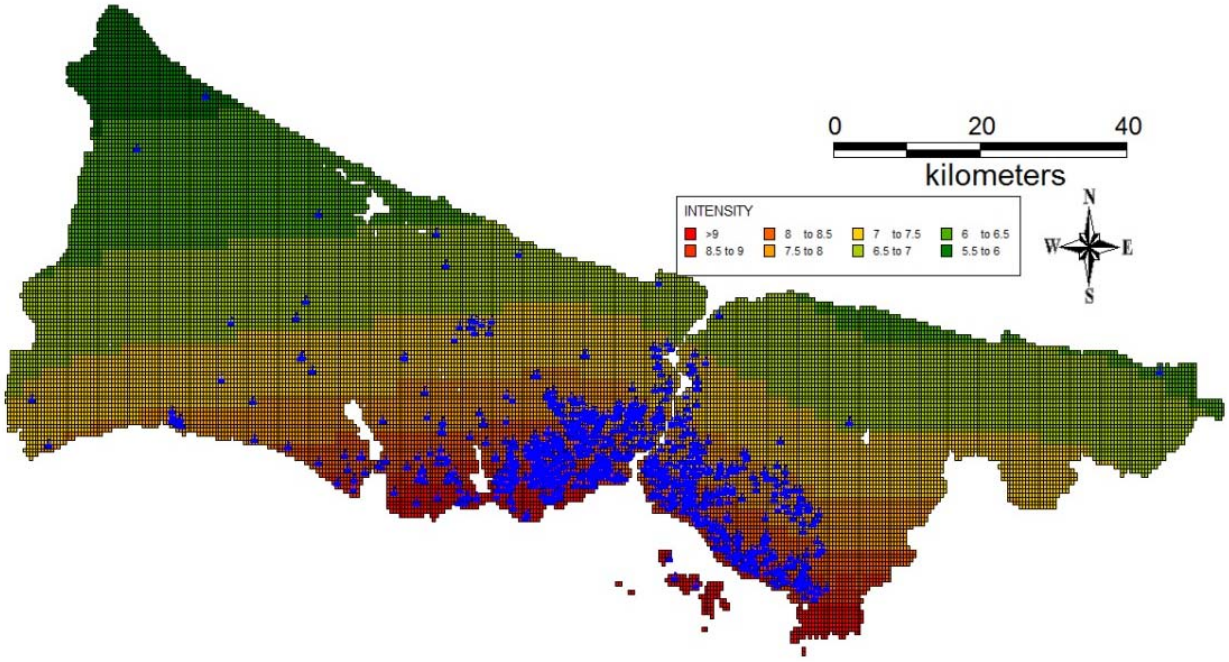

Figure 1. Site specific intensity (Modified Mercalli) distribution and location of ISMEP school buildings

75. The estimated number of avoided fatalities due to ISMEP interventions in the 806 buildings alone is 1,750 (taking into consideration the average occupancy rate of schools, with reduced occupancy during weekends, school holidays and outside class hours) for the Mw7.25 scenario earthquake. If an earthquake were to occur during school hours (full occupancy), the expected fatalities in the 'without project' scenario could be as high as 5,000. In scenario-based analyses such as the foregoing, estimated fatalities are median values, and could thus be far higher in a major earthquake.

76. Finally, ISMEP supported the vulnerability assessments of 176 historical public buildings that remain in daily use in 26 heritage sites, digitization of archive data and drawings, and development of a geospatial database inventory for CH buildings under the jurisdiction of the Ministry of Culture and Tourism. The Project also supported the development of retrofit designs for three highly vulnerable CH buildings in Istanbul, including the Archeological Museum, the Mecidiye Kiosk and the Aya Irini (a UNESCO World Heritage Byzantine church), all in the high-occupancy Topkapi Palace complex. Being the first of their kind in Turkey, the designs underwent an extensive review and approval process by the Istanbul Preservation Board for Cultural Heritage and Monuments. Approved strengthening and preservation works (financed by the Ministry of the Culture and Tourism) for the Archeological Museum are ongoing.

Outcome 3: Supporting measures for better enforcement of building codes

Rating: **Substantial**

77. Unplanned spatial development and municipalities' lack of capacity to monitor compliance and transparently enforce building regulations resulted in the concentration of

disaster risk in Istanbul. The following specific shortcomings in the enforcement of building codes were identified: (i) gaps in the legal and regulatory framework; (ii) lack of certification of engineers, (iii) lengthy processes of building permit approvals; and (iv) lack of public understanding of the importance of compliance with building code and land use plans to minimize disaster risk.

78. To increase the capacity of civil engineers, the Project financed training sessions throughout Turkey (from 2008 – 2012) under a protocol with the Ministry of Environment and Urbanization. A total of 3,631 civil engineers (against a target of 3,000) from metropolitan and district municipalities and provincial directorates were provided with 3-day training on the application of the "Regulation on Buildings to be constructed in Earthquake Zones" (i.e., the 2007 Retrofitting Code). Trainees were evaluated and provided with completion certificates (recognized by the Chamber of Civil Engineers).

79. ISMEP also provided technical assistance (as planned in the PAD) for the further development of the regulatory framework for enforcement of building codes and land use plans through the publication and dissemination of the following analytical work: Identification of Main Principles of Land Rearrangement Activities (2006), Identification of Rural Planning Processes and Principles in Rural Development Definition and Settlements (2006), Preparation of Periodic Development Report Formats for Urban Settlements (2006), Design of Preliminary Study and Identification Stage in the Project of Improving Planning Processes (2006). These studies address the fact that non-compliant construction typically took place on state-owned land that was occupied due to the insufficient availability of private land. Furthermore, the June 2016 revision of the Turkish Earthquake Code was directly informed by the technical innovations and standards successfully implemented under ISMEP.

80. Through the "Safe City, Safe Life Training" sessions, these studies were disseminated as part of capacity building for urban planning, building safe settlements, identifying urban risks, potential disaster impacts and risk reduction measures (delivered to 744 decision-makers and technical staff from Istanbul municipalities).

81. The Project established a digital database of building stock, land registers, and land use archives in Bagcilar and Pendik municipalities, selected as pilots based on a number of criteria[16]. Their total combined population is over 1.35 million, or about 10% of Istanbul's population. In both municipalities, the Project financed work flow analysis and process optimization for building permit issuance, on the basis of which automated (IT-based) permitting and document management systems were established, together with the associated training for the municipal staff. ISMEP also established call centers, introduced transparent business standards, and systems integration of processes to manage applications, requests and complaints from citizens. Through the integration of all available spatial data and natural hazard information in the databases, building design and construction are informed by the prevalent seismic and other site-specific hazards.

[16] Bagcilar and Pendik were selected based on criteria such as exposure to seismic hazard and proximity to faults, high population density, industrial and commercial activity, and growth potential.

82. The more transparent building permitting system provides an automated means of building code enforcement, by ensuring that all code-specified construction inspections are conducted prior to issuance of an occupancy permit for new structures. For example, before the Project, addition of extra floors to existing buildings without obtaining the required permit led to structurally unsound building configurations. With some 1,400 new apartment building permits issued annually in the two municipalities, there are around 67,000 people each year living in safer, code-compliant housing due to this Project activity.

83. At Project closing, knowledge exchange on how the automated permitting system enables building code enforcement had been conducted between the ISMEP pilot municipalities and the remaining 37 municipalities of Istanbul (and 14 from other provinces). The systems have been replicated (with internal funding) by six municipalities, with two additional municipalities at the procurement stage as of December 2015.

84. In addition to improving building code enforcement through rigorous and transparent building permit issuance, the interventions also increased efficiency. Surveys conducted under the Project in 2012 show the following improvements:

	Before ISMEP, 2006	**After ISMEP, 2012**
Documents needed for building permit application, #	81	52
Steps needed for building permit issuance, #	25	18
Approval time for building permit (days)	90	10
Construction inspections for Building Code compliance	Could not be monitored/tracked	- Fully integrated with relevant permitting work flows - Increased transparency, with accessible field reports and documentation of construction stages, penalties and compliance with all building code requirements for construction permits

3.3 Efficiency

Rating: **High**

85. Risk reduction interventions differ from infrastructure projects in that they do not have conventional benefit streams, and these will not be fully realized until a disaster occurs. A recent World Bank Policy Paper[17] identified the key variables in a cost-benefit analysis of risk reduction (i.e., retrofitting and reconstruction) for critical public facilities: (i) strengthening/retrofit costs, (ii) building replacement costs, (iii) the risk of a natural disaster (and of the scale of that disaster), (iv) the risk of damage if a natural disaster does occur, (v) the cost of that damage in both financial and human terms (i.e., life losses, structural damage and service interruption for public facilities), and (vi) the discount rate. Table 2 shows the assumptions and parameters that correspond to this approach.

[17] Charles Kenny, *Why Do People Die in Earthquakes?* , The World Bank (WSP 4823)

86. The estimate of the IRR at appraisal for the original project was 11% for the conservative case and 19% for the most likely case (base case). During AF, these were re-estimated, yielding an IRR of 12% for the conservative case and 23% for the base case. This ICR analysis has re-estimated the conservative case IRR at 10%. The difference is due to modifications in the underlying methodology, which is more attributable (but less optimistic) than the macro-economic approach used during the appraisal of the original project and AF. In addition, since analytical models have not yet been developed to estimate the costs of closure for schools or healthcare facilities, the calculated IRR does not take into account the project benefits from avoided service interruption that, in the case of schools, can be in the order of 145 days[18] (or 1 semester).

87. The approach described below further departs from the methodology used during preparation of the original project and at AF, in that it utilizes the concept of the value of statistical life (VSL) to capture the benefits associated with life safety, which is arguably the strongest rationale for risk reduction investments. VSL estimates are derived from willingness-to-pay surveys and reflect the intrinsic value of life to a greater degree than approaches that depend on estimates of foregone income (that is, what the victims could have earned on the labor market if they had survived). The use of VSL mitigates, to a certain extent, the concerns around trivializing the value associated with human life (which has been an obstacle to attributing such values in economic analysis). In addition, although it embodies the individual respondents' utility preferences, the average VSL (as used here) is a neutral measure that is applicable regardless of income earning potential.

88. As of this writing, the state-of-the-art methodology for attributing value to human life in cost benefit analyses in use by the United States Environmental Protection Agency[19] (and other institutions such as the World Health Organization, Organization for Economic Cooperation and Development and the World Bank[20]) is to arrive at VSL by estimating how much people are willing to pay for reductions in their risks of dying from (for instance) adverse health conditions that may be caused by environmental pollution. As such, institutions that utilize these analyses do not (themselves) place a dollar value on individual lives. The method of VSL estimation rests on the notion of stated preference of the people. Annex 3 provides a detailed discussion.

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[18] http://ac.els-cdn.com/S2212567114010247/1-s2.0-S2212567114010247-main.pdf?_tid=d514aba8-332e-11e6-8201-00000aacb35d&acdnat=1466018871_0cb8d00cb865693a3246b268af6059d4

[19] First used in the Benefits and Costs of the Clean Air Act: 1970-1990 (USEPA 1997). It was subsequently codified in the EPA's Guidelines for Preparing Economic Analyses (USEPA 2000) and was retained in the revised Guidelines released in 2010 (USEPA 2010a). After adjusting for inflation and real income growth over time (using an income elasticity of 0.4), the VSL estimate now stands at $9.7 million (latest figure from 2013). The EPA Guidelines recommend that this value be applied to all mortality risk reductions in EPA regulations no matter the source of the risk and to all affected populations regardless of their characteristics.

[20] http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-5421 and Charles Kenny, Why Do People Die in Earthquakes, https://openknowledge.worldbank.org/bitstream/handle/10986/4042/WPS4823.pdf

Table 2. Parameters used for ISMEP Cost-Benefit Analysis at ICR

Description	Units	Levels	
		W/out Project	With Project
Earthquake Hazard, magnitude	Mw	7.25	
Project Investment (IBRD only)	US$ Million	0	535 (*)
Share of Civil Works in investment cost	percent	0	85%
Cost of Civil Works	US$ Million	0	455
Value of Buildings & Structures	US$ Million	227	910
Avoided fatalities (all Components)	person	0	3,000
Value of a Statistical Life (VSL)	US$	820,000	
Annual Exceedance Probability - EQ	percent	2%	2%
Ratio of Damage to Buildings	percent	40%	5%
Ratio of Asset Value (Undamaged)	percent	60%	95%
Asset Value (Undamaged)	US$ Million	136	864
Avoided Direct Damage	US$ Million	0	728
Ratio of Avoided Direct Damage to Cost of Civil works	US$ Million	N/A	1.6
Planning Horizon	years	N/A	30
Discount Rate	percent	N/A	6

(*) Exclusive of price contingencies and tax

89. This analysis covers the IBRD-funded investments, corresponding to some 24% of the total IFI funding[21] leveraged for the ISMEP program (a total of US$ 2.25 billion). The re-estimated base case IRR = 10%, vis-a-vis the Bank-recommended discount rate of 6%. When the physical assets, i.e., buildings and equipment housed in the buildings, are excluded in the analysis, the IRR declines to 9%, demonstrating a relative insensitivity to the dollar value of structures and avoided physical damage. However, when the statistical value attributed to human life (VSL) is eliminated from the analysis, the IRR drops to -14%. This shows that the VSL estimate (US$ 820,000 per person) and the number of lives potentially saved by the project (some 3,000 persons) are key drivers in the analysis. The break-even (or switching value) VSL is US$ 561,000 which yields a 6% IRR, and corresponds to NPV = 0. The break-even number of lives saved is 2,050 persons, which similarly returns an IRR = 6%. An implicit assumption of the analysis is that economic and financial values converge, and hence a separate financial analysis was not developed.

90. The probability of occurrence of the scenario earthquake has a significant impact on the project's economic performance: when the annual probability is doubled from 2%

[21] Funding from other IFIs was secured by the GOT after a strong track record of IBRD implementation. The ICR analysis is limited to the IBRD financing because: (i) other sources financed separate facilities and were never defined as "co-financing", (ii) investments by other financiers fundamentally differed in nature, with no cap on the civil works budget for reconstructions, which led to other IFIs financing primarily reconstructions (with a focus on hospitals, rather than schools), with little or no financing for other activities. Therefore, the basis for an unbiased comparison (and hence aggregation) of the IBRD and other financing that was subsequently leveraged would not be appropriate.

to 4% (a plausible alternative scenario supported by the scientific community), the IRR improves to 23%. If the EQ probability in increased to 5% per annum, IRR would be 30%.

91. An alternative to the probabilistic economic analysis that annualizes the benefits (i.e., total avoided losses) is to assign a year to the occurrence of the scenario earthquake and analyze the consequences. The table below shows the variation in IRR depending on the year of earthquake occurrence. In this approach, the cost is still incurred in the investment year, while the full value of benefits is assigned to the year in which the earthquake occurs. This alternative analysis highlights that the largest economic return on a DRM investment would be realized if a disaster occurs immediately after completion of the investment.

Year of EQ occurrence (after investment year)	IRR
2nd Year	368%
5th Year	47%
10th Year	19%
15th Year	12%
20th Year	8%
25th Year	7%
30th Year	5%

92. **Cost effectiveness.** The majority of the project resources were allocated to civil works (some 85%), which either financed reconstructions (high cost option) or retrofits (low cost option). ISMEP favored investment in retrofits as opposed to reconstruction, using a well-defined criterion: if the cost to seismically strengthen (structural elements only) a facility would exceed 40% of the cost of reconstructing a building of the same size, then reconstruction would be implemented. Otherwise, the facility would be retrofitted (in a limited number of cases, additional functional upgrades later resulted in total cost in excess of 40% of reconstruction cost). Overall, approximately 30% of the funds allocated for civil works were utilized on reconstructions, while retrofits accounted for the remaining 70%, in accordance with the project design.

93. ISMEP provided not only for seismic strengthening, but also added value and service life to those buildings that were retrofitted, in the order of some US$ 227 million, due to extended building life and enhanced functional and service features. Furthermore, the difference between the undamaged asset value 'with' and 'without' the project shows avoided direct damages in the amount of US$ 728 million.

94. The Project also adopted efficient contracts management practices, emphasizing contract bundling and lump sum contracting (paragraph 35) to the extent possible, both of which contributed to greater cost-effectiveness. Approximately 85% of the contracts awarded for reconstruction and retrofitting works incorporated some degree of bundling, with buildings located in close proximity combined in the same contract packages. This enabled more competitive tenders and contracting, whereby the selected contractor(s) were able to efficiently allocate resources and staff to the program of works. Further discussions of the administrative and institutional efficiency (for example, related to procurement and financial management) are in Section 5.2(b), *Implementing Agency Performance*.

3.4 Justification of Overall Outcome Rating

95. The Project's overall outcome rating is **Highly Satisfactory**. Table 3 presents a summary of detailed ratings in order to arrive at an overall outcome rating. Relevance, efficacy, and efficiency are all rated High.

Table 3. Summary of detailed ratings

	Rating
Relevance	**High**
Objectives	High
Design and Implementation	High
Efficacy	**High**
Outcome 1: *Enhancing institutional and technical capacity for disaster management and emergency response*	High
Outcome 2: *Strengthening critical public facilities for earthquake resistance*	High
Outcome 3: *Supporting measures for better enforcement of building codes*	Substantial
Efficiency	**High**
OVERALL RATING	**Highly Satisfactory**

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

96. While disasters affect whole societies, the poor and vulnerable (especially women and children) are disproportionally affected. Disasters can induce and exacerbate poverty through the loss of lives, destruction of assets, disruption of economic activities and trade, and indirect impacts on health, mobility, gender equality, and access to education.[22] By improving disaster resilience in public facilities (i.e. hospitals, schools and dormitories), the Project had a direct impact on the safety, quality and continuity of services provided to the public. ISMEP applied modern accessibility standards for reconstructed and retrofitted public facilities, to ensure usability by individuals with disabilities. The Project also retrofitted/reconstructed two maternity, obstetrics and pediatric hospitals to ensure operational continuity during and after disasters, with 1,022 staff, serving 6,708 beneficiaries daily. In addition, according to the social impact assessment conducted in 2012, 65% of parents involved in the public awareness activities conducted were women. Similarly, 60% and 52% of volunteers who successfully completed the Safe Life Training 1 and Safe Life Training 2, respectively, are women.

97. In addition to seismic retrofitting or reconstruction to save lives and reduce the risk of future earthquake damage, the Project also incorporated functional and energy efficiency upgrades to improve the quality of the learning environment in the schools, and health service delivery in the hospitals. This was vital to the success of the Project as it served to build support among beneficiaries and stakeholders for the primary risk reduction intervention as well. The Project also conducted extensive stakeholder consultations in the target hospitals and schools, as well as the schools that temporarily hosted students while

[22] World Bank. 2010-2012. *Guidance Note 1: Making Women's Voices Count - Addressing Gender Issues in Disaster Risk Management in East Asia and the Pacific*. World Bank: Washington DC.

civil works were ongoing. In addition to providing information on the benefits of structural strengthening, the social guidance activities addressed parents' concerns regarding any interruptions resulting from the transfer to alternative education facilities. The Project, under the leadership of the Istanbul Provincial General Directorate of Education, organized and financially supported transport expenses and transfer of students to host schools.

(b) Institutional Change/Strengthening

98. The ability to manage disaster risks and emergencies, particularly in complex settings like in Istanbul, requires knowledge, skills and adequate planning and response capacities. Building on the regulatory framework established by the GOT, through enhancing the institutional and technical capacity for disaster management and emergency response in Istanbul, the Project directly contributed to longer-term capacity building in Istanbul AFAD and beneficiary public agencies[23]. Furthermore, the Istanbul Emergency and Disaster Response Plan, which was enhanced and extensively tested under the Project, directly informed the development of the Turkey Disaster Response Plan.

(c) Other Unintended Outcomes and Impacts (positive or negative)

99. ISMEP has been a showcase of capacity building for emergency management and DRM as well as physical risk reduction. Twenty-eight delegations from all around the world have visited the project observing what has been done both at the institutional and technical level. The IPCU team has participated in 62 international conferences and workshops presenting the project and sharing knowledge and experience. Within the Bank, ISMEP has informed the preparation and implementation of several operations.

100. The design guidelines developed by ISMEP for the strengthening of school and hospital buildings were incorporated in all procurement packages. The implementation of these guidelines resulted in long-term capacity building in the engineering profession. Due to the implementing agency's effective use of technical assistance (in the form of third-party design review panels), the quality of design and construction for seismic retrofitting progressively increased during project implementation, setting standards for future earthquake strengthening and risk reduction in the country.

101. The project completed the inventory of some of the most prominent heritage buildings in Istanbul under the authority of the Ministry of Culture and Tourism, which is the first such effort carried out for Turkish historical buildings. The GIS-based inventory includes probabilistic analysis of the vulnerability of almost 180 historical buildings in Istanbul. This unique database is available not only to the Ministry of Culture and other public agencies, but also to academia and online to the public. This effort has been recognized as good practice by UNESCO.

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[23] Hasdal, Akfirat and Cagaloglu Disaster Management Centers, Istanbul Health Directorate-National Medical Rescue Team, Istanbul AFAD Search and Rescue Unit, Istanbul Police Department, Kandilli Observatory, Istanbul Gendarmerie

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

Not applicable

4. Assessment of Risk to Development Outcome

Rating: **Low**

102. In addition to the € 415.26 million IBRD financing, the project has leveraged an additional €1.36 billion from other international financing institutions such as European Investment Bank, Islamic Development Bank, Council of Europe Development Bank. The most recent IFI loan provided to ISMEP guarantees financing for the program until 2020.

103. The main capacity building measures at the provincial level in Istanbul were realistic, given the strong political backing for reducing underlying disaster risk and improving preparedness. Improving capacity to enforce building codes will depend on increasing the number of accredited engineers as well as sustained political leadership at both provincial and central levels for compliance with seismic construction standards. Paragraph 51 describes the sustainability measures being undertaken by pilot as well as other municipalities in Istanbul, including internal allocations from municipal budgets.

104. Following the Third UN World Conference on Disaster Risk Reduction (March 2015) in Sendai, Turkey endorsed the Worldwide Initiative for Safe Schools. This initiative promotes the application of the Comprehensive School Safety framework, consisting of three pillars: (1) safer school facilities, (2) school-based DRM, and (3) disaster risk reduction and resilience education. Advancement of this initiative will build on the scale-up of retrofitting and reconstruction activities to reduce the vulnerability of the existing school building stock, advancing emergency response and contingency planning across the country, and continuing integration of DRM into formal and informal education. These have been successfully implemented under ISMEP, and are the core components of the Turkey National DRM Project (FY18).

105. The long-term sustainability of the emergency communication and information system, as well as the response equipment, will require continuing budgetary support from the municipal and provincial governments. In view of the fact that the equipment is used on a day-to-day basis, the risk that the project initiatives will not be maintained is low.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

106. The Bank's Quality Assessment Group undertook a Quality at Entry assessment in September 2005. The QAG rated QAE as "Satisfactory", with which this assessment agrees. Strong features were the decentralization of the project in view of the local nature of disasters, utilization of the Bank's in-country and regional experience in disaster reconstruction, and support of building code enforcement to address earthquake risk. Areas needing improvement were the lack of socioeconomic criteria in the selection of buildings

for retrofitting (although strategic importance of the facility in the Emergency Management Plan and accessibility during disasters were considered, which ensured that selected facilities covered the most vulnerable areas of Istanbul), and lack of consideration to overall country and political risk.

107. QAG also commended the Bank's "focus on disaster prevention measures" and the dialogue that led to agreement with the GOT on an "approach to leverage effectively building code enforcement for private sector construction". Support from both country and sector management was strong and influential throughout preparation of the project, "particularly in the final 6 months of project processing when interventions with central government officials in particular were critical to keeping the project on track".

108. Project design was based on lessons learned from similar Bank operations in the region, and project preparation effectively moved the dialogue with the GOT to design the first project in Turkey whose entire funding was allocated to *ex ante* risk reduction and preparedness. The Bank provided leading international expertise on seismic engineering, DRM, emergency management, social and environmental safeguards, procurement, financial management, which led to smooth project implementation. Given the challenge of implementing and monitoring risk reduction activities, the strong collaboration formed between the Bank, the Treasury and the PIU during preparation was crucial.

109. The QAG made no comment on the fact that baselines were not available for all indicators, particularly those which were qualitative. This is likely due to the recognition of the difficulty of quantifying institutional change.

(b) Quality of Supervision
Rating: **Satisfactory**

110. Implementation support missions were regular, timely and solution-oriented. The Bank conducted a total of 17 supervision missions, which were instrumental in the resolution of emerging issues that may have otherwise adversely affected project implementation. Reporting was of high quality, and demonstrated the appropriate level of candor. The Bank rightly identified that Additional Financing was required to meet urgent retrofitting needs, in view of other financiers' focus on reconstruction.

111. The Task Team, consisting of highly experienced structural/earthquake engineers, disaster risk managers, social scientists, procurement experts, financial and environmental specialists, provided global experience in innovative seismic retrofitting, emergency management, and other areas pertinent to achieving the PDO. Fiduciary aspects such as procurement and financial management were also well supervised. Supervision inputs were responsive and flexible, with regard to both tendering and disbursement processes. Tender documents were thoroughly reviewed by the Task Team, whose recommendations were reflected in Project implementation. Supervision of safeguards was satisfactory, and no negative social or environmental impacts were identified as a result of project activities.

112. The Bank team made a significant effort to ensure stability of the Project's institutional, fiduciary, and technical capacity. For example, implementation could have suffered from the institutional change in Turkey's local administrative structure (abolition of the Special Provincial Administrations in 2012). This challenge, which could not have

been anticipated during project design, was mitigated by the strong cooperation and mutual trust built between the Bank and the Government.

113. Quality of supervision is rated satisfactory in recognition that: (i) the three project restructurings (including one AF) could have been utilized to establish more specific targets for the PDO-level result indicators and the intermediate outcome indicators; and (ii) PDO and intermediate outcome indicators were not reflected exactly in the ISRs, but were combined during reporting.

(c) Justification of Rating for Overall Bank Performance

Rating: **Satisfactory**

114. In view of the Satisfactory rating of Bank performance on both dimensions of Quality at Entry and Quality of Supervision, overall Bank performance is rated Satisfactory.

5.2 Borrower Performance

(a) Government Performance

Rating: **Highly Satisfactory**

115. Government ownership was demonstrated by the early establishment of a Project Steering Committee to provide strategic guidance and oversight during implementation. The Steering Committee had high-level leadership, chaired by the Governor of Istanbul, and included the Undersecretariat of Treasury, and Directors of the provincial departments of the relevant stakeholder ministries. By having the TEMAD -- the secretariat of the national disaster management system -- represented on the project Steering Committee, the right balance was struck between the national and local authorities. As discussed in Section 2.2, GOT's commitment to the PDO was demonstrated by vesting project implementation at the provincial level, given the local nature of disaster risk management, and Istanbul's unique position as the country's economic and population center.

116. Even prior to Loan signing, implementation was already underway with the launching of three consultancy contracts using residual funding from ongoing operations. The procurement plan for the project was also ready. Capacity for implementation was ensured through a rigorous and transparent process of staff selection, which resulted in the appointment of highly qualified professionals with deep experience in implementing World Bank projects. In terms of relevant sector policies, the Government prepared and adopted the Earthquake Master Plan for Istanbul, as well as the 2007 Turkish Earthquake Code (which provided the regulatory basis and design standards for the structural investments).

117. Coordination with other donors was highly satisfactory, as evidenced by the quadrupling of the total financing for the ISMEP program, after the successes demonstrated under IBRD financing. Implementation arrangements (for example, for M&E) are being further strengthened in view of the continuation of the program under financing from other IFIs. Project investments in pilot municipalities have received budget allocations for operation and maintenance from the relevant local governments. The Project was awarded the World Bank Europe and Central Asia Region Team Award, in recognition of

outstanding achievement of results, development impact, innovation, and cooperation mechanisms.

(b) Implementing Agency Performance

Rating: **Highly Satisfactory**

118. Project management was Highly Satisfactory at closing, with FM consistently rated Highly Satisfactory and procurement rated Satisfactory throughout implementation. Issues were resolved in a timely fashion (despite a number of factors that were outside project control, see Section 2.2), due to the exceptionally high managerial and technical capacity of the Implementing Agency (IA).

119. Full coordination among the relevant stakeholders was ensured through the signing of Implementation Coordination Protocols with key beneficiary agencies. In its commitment to the PDO of improving Istanbul's preparedness for an earthquake, the IA prioritized training activities that built the capacity of the general public, in addition to the public safety agencies. The IA also developed and fostered strong relationships and sustained coordination with partners/stakeholders, making use of extensive social guidance activities, particularly in the context of the civil works that required the temporary transfer of students and patients to alternate facilities during retrofitting/reconstruction (Section 2.4, Social Safeguards).

120. Timely intervention from the IA expedited project activities through, for example, facilitation of power connections to the AFAD DMCs, expediting land management issues and accelerating the permitting process for public buildings.

121. Procurement correctly emphasized contract bundling and lump-sum contracting to the extent possible, both of which contributed to cost-effectiveness. Approximately 85% of the contracts awarded for reconstruction and retrofitting works incorporated some degree of bundling. Buildings located in close proximity to one another were combined in the same contract packages, enabling more competitive tenders and more efficient allocation of plant, labor and other resources by contractors.

122. Financial management was supported with a periodically updated spreadsheet in which cash-flows and disbursement projections were listed based on a number of scenarios (fluctuations in exchange rate, delays in execution of contracts etc.). Through this practical and highly effective modeling system, the Project developed appropriate financial risk mitigation measures. Such financial and contract management systems established by the IA are exemplary for similar, contract-intensive lending operations. These systems are examples of good practice and contributed to the highly satisfactory rating of the financial management systems.

123. The independent construction supervision system used by the PIU is a positive model for strengthening of the existing construction system in Turkey. The PIU improved upon the typical building supervision system, which does not utilize construction supervision consulting firms. The PIU rightly engaged design-cum-construction supervision consultants, allowing for: (i) independent quality assurance of the designs prepared by a different firm, and (ii) assurance that the construction works were implemented in strict adherence to the designs.

(c) Justification of Rating for Overall Borrower Performance

Rating: Highly Satisfactory

124. Overall Borrower Performance is rated Highly Satisfactory based on the ratings for the dimensions of government performance and implementing agency performance.

6. Lessons Learned

125. **Risk reduction investments, whose outcomes (minimization of losses and fatalities) will become visible only in the event of a major disaster, require a long-term policy dialogue with public authorities facing competing demands on resources.** The Bank anchored the dialogue with the GOT on: (i) decades of support for post-disaster reconstruction, and (ii) a window of favorable political will, spurred by the earthquake in Marmara in 1999 (and fueled also by more recent disasters in other parts of the world). This, combined with a highly motivated local Istanbul authority and a central government persuaded of the need to mitigate risk made ISMEP the first project in Turkey to allocate 100 percent of proceeds to *ex ante* disaster risk management.

126. **There are specific reasons that this Project, over a 10-year implementation period, was rated Satisfactory or higher throughout.** These include: (i) commitment from the Government at a very high level, given the urgency and importance of disaster risk management in Istanbul, (ii) the autonomous structure of the PIU, and (iii) the Bank's strong capacity for design and implementation, based on highly qualified sector, procurement, fiduciary, and safeguards experts.

127. **Subnational implementation and the autonomous structure of the PIU has advantages and disadvantages.** The project was financed through an exception to Turkish domestic legislation (Debt Law 4749), which allowed the Undersecretariat of Treasury to allocate funds on a grant basis to the Istanbul provincial government. This allowed the PIU to report only to the Istanbul Special Provincial Administration, and later to the provincial Governor, which enabled efficient decision-making that was not subject to bureaucratic pressure. The model was so successful that it attracted almost all active IFIs in Turkey and ISMEP leveraged an additional € 1.36 billion. On the other hand, criticisms have been raised that this exception is not replicable to other at-risk provinces, as ISMEP capitalized on a window of favorable political will after the1999 Marmara Earthquake, along with a highly motivated and capable local administration in Istanbul. Future mechanisms to ensure that the Government can continue to balance localized implementation with national sectoral programs and policies deserve careful consideration.

128. **Inclusion of functional upgrades (to modern service provision standards) makes disaster risk reduction investments for public facilities and assets more effective and sustainable.** The Project supported extensive coordination with the Provincial Directorates of Health and Education, as well as administrators of individual facilities, to ensure that the design and retrofitting plans (and the associated budget allocations) took into account service quality and required functionalities. This generated strong support for the primary investment in risk reduction, even though the works caused unavoidable disruption to the operation of the facilities.

129. **Early involvement of project beneficiaries and multiple stakeholders in the planning and execution of the retrofitting/reconstruction was crucial to successful project implementation.** School principals, teachers and parents were initially very apprehensive about vacating schools selected for retrofitting, which caused early delays. However, the transparency of the processes and engagement with the beneficiaries contributed to the positive results, through consultation with school principals and hospital directors throughout the facility selection, design and tendering processes. This allowed for arrangements to be in place well before the relocation of the students to host schools.

130. **Integrating well-designed public awareness and disaster preparedness programs with physical investments builds buy-in for risk reduction, the benefits of which may only be demonstrated in the event of a disaster.** The Project combined infrastructure investments to reduce the vulnerability of critical public facilities with tailored public risk awareness campaigns. Significant resources were invested in developing innovative and engaging training modules on disaster preparedness for different age groups and sectors (including volunteers), in order to deliver a DRM approach that also had a positive impact on the behavior of the users of facilities, families and communities.

131. **For contract-intensive lending operations with long implementation periods, financial risk management measures are crucial to deliver project outcomes.** Financial risk management was based on scenario-based cash-flows and disbursement projections that accounted for factors such as fluctuations in exchange rate and delays in execution of contracts. This type of modeling allowed for an efficient use of project funds and timely implementation of a large and complex program of geographically dispersed physical works.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

132. The Borrower commented that the majority of the Project's detailed ratings were High, and further highlighted ISMEP's receipt of the World Bank Europe and Central Asia Vice Presidential Award for outstanding achievement of results, development impact, innovation, and cooperation mechanisms. The Borrower highlighted that it is appropriate for the overall outcome rating to be Highly Satisfactory.

133. As the operation's major relevant objectives were achieved efficiently (and in a number of cases, significantly exceeded), the Project is rated Highly Satisfactory.

(b) Cofinanciers

(c) Other partners and stakeholders

(e.g. NGOs/private sector/civil society)

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent) – Original Loan

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
A. Enhancing Emergency Preparedness	68.74	49.25	72%
B. Seismic Risk Mitigation for Public Facilities	283.90	331.62	117%
C. Enforcement of Building Codes	6.40	6.72	105%
D. Project Management	7.92	6.45	81%
Total Baseline Cost	366.98	394.04	107%
Physical Contingencies	19.56		
Price Contingencies	13.48		
Total Project Costs	400.00	394.04	99%
Front-end fee PPF	0.00		
Front-end fee IBRD (paid by GOT)	2.00	2.00	
Total Financing Required	402.00	396.04	99%

(a) Project Cost by Component (in USD Million equivalent) – Additional Financing

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
A. Enhancing Emergency Preparedness	38.15	29.49	77%
B. Seismic Risk Mitigation for Public Facilities	108.85	109.19	100%
C. Enforcement of Building Codes	0.00	0.00	
D. Project Management	3.00	2.82	94%
Total Baseline Cost	150.00	141.50	94%
Physical Contingencies	0.00	0.00	
Price Contingencies	0.00	0.00	
Total Project Costs	150.00	141.50	94%
Front-end fee PPF	0.00	0.00	
Front-end fee IBRD	0.00	0.00	
Total Financing Required	150.00	141.50	94%

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		0.00	0.00	.00
Local Communities		0.00	0.00	.00
International Bank for Reconstruction and Development – Original Loan		400.00	426.16	1.07
International Bank for Reconstruction and Development – Additional Financing		150.00	136.96	0.91

Annex 2. Outputs by Component

The Project Development Objective is to assist the Borrower in improving the city of Istanbul's preparedness for a potential earthquake, 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.

The Project contributed to increasing Istanbul's earthquake preparedness through the retrofitting and reconstruction of public facilities, technical and institutional capacity building in provincial and local institutions responsible for disaster management and emergency response, awareness raising and skills building among the population, and better enforcement of building codes through the establishment of transparent e-permitting systems. Planned and actual activities financed by the Project are shown in Table 2.1.

Table 2.1 Planned and Actual activities			
Planned sub-components and activities (from PAD – Original Loan)	**Revision /Cancellation**	**Activities financed by additional financing**	**Key Outputs**
Component A: Enhancing Emergency Preparedness			
A.1 Improvement of emergency communications systems: Support was planned for the establishment, upgrade and installation of an integrated communications system so that all public safety agencies such as police, fire brigades, civil defense, health care providers and ambulances, at the provincial and municipal levels communicate effectively at the tactical (field) level using both voice and data. The system would also enable the communications to the relevant crisis centers and key facilities including national offices in Ankara. The system would have several layers of backup so that it would continue to be operational in the event of a catastrophic event. The activity would also support training of system users, training of system maintenance and operations.		N/A	For all outputs below, the Project supported the corresponding training of system users, training for system maintenance and operations. 73 Base Stations, 9 Central Control Units, 2 Microwave Links, 2 Mobile Relays, 30 meter in length. Antenna Mast and 8 Mux-Demux Devices were procured to enhance the analog radio infrastructure. Analog Radio Network infrastructure consisting of 16 wide-area relays and 2 central units operating in VHF and UHF frequencies were installed for Istanbul AFAD. The analog radio system covers 95% of Istanbul province after the Project. Analog radio communication infrastructure was installed on seismically resistant telecommunication pylons of the Istanbul Metropolitan Municipality, improving the signal quality and operational continuity of the radio networks. Internet-protocol (IP) Based Communication Switch - IP Interoperability and Collaboration System (IPICS) was established, which is compatible with up-to-date IP connection technologies such as 2G/3G/4G, PSTN, IP Phones, Satellite, VHF Radio, UHF Radio, HF/SSB Radio. These investments ensure effective and uninterrupted communication

			among public agencies on a daily basis, and during/after a disaster. Five state-of-the-art mobile communication vehicles, including three off-road vehicles with backup communication systems, were provided to ensure communication and coordination of all disaster-related units in Istanbul. Fiber Optic Cables and IP Network Devices were installed to enable the Directorate for Disaster and Emergency Management to retrieve 1000+ video streams of urban cameras from Istanbul Metropolitan Municipality and the Istanbul Police Department. Peripheral hardware investments were made to ensure effective communication among the public agencies such as Istanbul AFAD, Istanbul Health Directorate, Istanbul Search and Rescue Unit, and Istanbul Police Department.
A.2 Establishment of an emergency management information system: Support was planned for the establishment of an Emergency Management Information System that can collect, aggregate and display information related to a crisis, in real time, for use by the operations crises centers that would be established both in the Istanbul metropolitan region and at the national level in Ankara. This system would also support daily operations of the public safety organizations such as civil defense, fire brigades, police, traffic control and municipal governments. The component would also support data			For all outputs below, the Project supported the corresponding training of system users, training for system maintenance and operations. Disaster Management Information System software was developed for Istanbul AFAD to ensure coordinated and timely communication across relevant organizations during disasters and emergencies. The investment enables, through a designated 'Common Operational Picture' platform, communication of provincial agencies with national organizations in Ankara. Through IT Hardware (servers, storage, client terminals, peripheral output devices, structural cabling, video walls, and audio-visual equipment) and

conversion, training in system operations and system maintenance.			software (operating systems, office packages, IT management software, virtualization, and other client software systems) the Project set up IT infrastructure for the use of Istanbul AFAD and other public safety organizations. 100 seismic sensors were established and integrated in Kandilli Observatory's Earthquake Monitoring System, enabling the Observatory to undertake faster and more efficient seismic analysis.
A.3 Strengthening of institutional capacity of AYM - Istanbul Governorship Disaster Management Center: Support was planned for technical assistance to the provincial government to enable the facility to become operational including computers, visual displays, and other equipment. In addition, the project would provide technical assistance to the provincial government to develop the organizational structure and operational procedures to strengthen its capacity to carry out the roles assigned to it.	**A3. The Provincial Directorate for Disaster and Emergency Management (PDDEM) is strengthened with better technical and coordination capacities (revised during AF)**. The PDDEM is the legal successor to the AYM, also known as Istanbul AFAD.	Updating of emergency response plans. Provision of adequate furnishing and equipment for the Disaster Management Centers on the European and Asian sides of Istanbul.	The existing disaster management center assigned for the use of Istanbul AFAD (inside the Governorship campus at Cagaloglu) was expanded and fully equipped and furnished. The main Istanbul AFAD Disaster Management Center (DMC) – construction of which was financed under the Project -- on the European side (located in Hasdal) was equipped to function as a Provincial Crisis Center in emergencies. The Akfirat DMC on the Asian side was equipped and furnished accordingly. Capacity building, technical assistance and equipment upgrading elevated the DMC to Provincial Command Control and Coordination Center (C4) status. The PDDEM DMC in Hasdal, with a construction area of 7,500 sq. m., was equipped with road- and freight-access facilities. The DMC, equipped with communication and information technologies allowing 550 persons' simultaneous collaboration during emergencies, is now fully staffed (by trained technical specialists) and operational.

			Mobile decontamination systems equipped with state-of-the-art technology were provided for the Istanbul Search and Rescue Unit, for use during chemical, biological, radioactive and nuclear (CBRN) contamination. The Disaster and Emergency Prevention, Response and Recovery Plan for Istanbul was developed, and designed to coordinate risk reduction activities, response plans, monitoring, rapid post-disaster needs assessment, and recovery. Under the plan, a total of 26 sub-service groups were identified within the organizational structure and main service areas of Response and Operations, Information and Planning, Logistics and Maintenance, Finance and Management Services.
A.4 Upgrading of emergency response capacity in Istanbul: Provision of equipment for first responder agencies in Istanbul was planned, as well as training and on-going maintenance costs, e.g. response vehicles, upgrades of emergency medical support teams, rescue equipment, command vehicles, and personal protective gear.		Establishing a training and exercise program for disaster response and provision of equipment. Further support to technical capacities of first responders.	Istanbul AFAD and the Governorship carried out a large-scale tabletop simulation (400 participants) together with a search-and rescue drill (150 participants) in June 2015 to test Istanbul Disaster/Emergency Response plan developed under sub-component A3. A total of 106 military, public and non-government first responder agencies participated. For the Istanbul Health Directorate: Isolated Containers (125 items),Various Medical equipment, Vehicles (Electrical and diesel forklifts, 4x4 health rescue vehicles, emergency health service vehicles, heavy duty health service trucks, trailers, refrigerated vehicles), Mobile Lighting Towers, Cold Air Depot, Mobile Water Treatment Systems, and Stretchers. For the Istanbul Provincial Directorate for Disaster and Emergency Management: Vehicles (Mobile

			communication, mobile broadcast, and survey, transport, and operation vehicles), Various Communication Devices (Radio handsets, car radios, communication switches, antennas and antenna near products, etc.). For the Istanbul Search and Rescue Unit: 10 Vehicles (Off-road Search and Rescue, Water Rescue, K-9 Rescue, CBRN Decontamination System Truck, NBC Rescue, Mobile communication, Survey and operation vehicles). For the Istanbul Police Department and the Gendarmerie Command: Fully Equipped Water Rescue Vehicles. For the Turkish Red Crescent: 660 temporary shelters and mobile generators. For local emergency response agencies: Various communication devices (Satellite communication devices, Radio handsets, car radios, HF/SSB radios, etc.), search & rescue equipment, diving equipment, IT equipment (PCs, laptops, cameras, video cameras, printers, etc.). The corresponding training and capacity building activities were supported by the Project.

A.5 Public Awareness and Training: Support was planned for public information campaigns aimed at increasing public awareness of seismic risks, and training to school children, community groups, and the business community in preparedness and mitigation measures. This component would disseminate educational and other materials already available but not yet widely distributed as well as develop materials for radio and television.		Establishing a sustainable disaster risk management volunteer system and raising public awareness.	Public awareness and training activities were integral to all the Project components, with multi-media training materials and modules implemented for the general public, technical staff of beneficiary agencies and municipalities, and decision makers. Disaster awareness training programs were developed and implemented for different target groups. Fifteen training modules and materials including instructor's booklets, posters, brochures, information cards, and multi-media presentations were prepared both in Turkish and English and used for the topics shown in Table 2.2 of this Annex. Local Disaster Volunteer training built the general public's capacity to participate in neighborhood-level disaster response. This program will continue after project closing through agreements between the Governor's Office, NGOs and other organizations. ISMEP also supported school-based training in collaboration with the Provincial Directorate for National Education, disseminating modules to 37,195 people (25,214 students, 3,667 teachers and 8,314 parents). In total, 1,045,339 people (against the target of 75,000) were directly trained under the Project, through various modules of "Safe Life" training, social guidance and other programs (see Table 2.3), while public awareness campaigns reached about 2.5 million people (18% of Istanbul's population). Istanbul AFAD has developed a "Volunteer System and Management Model", including the institutional structure, operational issues, strategy and action plans. This proposal is under review by the Prime Ministry Directorate for Disaster and Emergency Management to establish an accreditation process for

			volunteers with minimum qualification criteria, operational procedures, training standards, and guidelines. At the municipal level, "Safe City, Safe Life Training" sessions led to improved capacity for urban planning, building safe settlements, identifying urban risks and potential disaster impacts as well as risk reduction measures (delivered to 744 decision-makers and technical staff from the two pilot municipalities of Pendik and Bagcilar).
Component B: Seismic Risk Mitigation for Public Facilities			
B.1 Retrofitting/reconstruction of priority public facilities: Structural retrofitting measures to reduce the risk of future earthquake damage to essential facilities, in order to ensure their continuing function and to reduce casualties in the event of an earthquake. In the case of especially critical medical facilities where retrofitting is deemed to be unfeasible, some reconstruction may be included.		Retrofitting of an additional 48 schools, hospitals and other public buildings, and the reconstruction of 1 hospital. Feasibility studies, designs and construction supervision for the additional works.	Retrofitting or reconstruction of around 800 buildings was planned under the original loan. The costs associated with the higher-than-anticipated number of priority facilities requiring reconstruction rather than strengthening due to structural weakness (reconstruction costs 7 to 10 times more than retrofitting) led to revision of the target to 550 buildings (through project restructuring in 2010). The target was again revised to 763 at Additional Financing. At Project closing, 806 buildings were retrofitted/reconstructed (734 under the original loan and 72 under AF, exceeding both the original and revised targets (Table 2.4). The first round of prioritization of public buildings in Istanbul was conducted during project preparation under the leadership of Istanbul Governor's office. Officials from relevant public agencies reviewed a comprehensive inventory of critical facilities, developing a preliminary list of high priority public buildings through a transparent prioritization process. Prioritization criteria included building-specific

			technical data, transport access data (hospitals and schools), proximity to faults, importance in the Istanbul Emergency Management Plan, population on-site and general population served and other relevant characteristics depending on the type of facility, taking account criteria for each sector as indicated in agreed weighting formulas[24]. The Project then conducted seismic vulnerability assessments of 1,382 campuses in order to inform the final selection of facilities to be strengthened. The Project conducted social guidance meetings in 729 schools (284,590 stakeholders), including both the schools to be structurally strengthened as well as the host schools. The meetings targeted school administrations, parents, students, teachers and representatives from the Provincial Directorate of Education (Table 2.5). In addition to providing guidance on the retrofitting process, timeline and associated transfer needs during construction, stakeholder awareness was built regarding the benefits of structural strengthening (retrofitting/reconstruction). The School-based Disaster and Emergency Management Plans Pilot Project, targeting 39 districts and 39 schools, was initiated in 2014. By the end of the activity, teachers, students and parents were equipped with skills and capacity for earthquake preparedness. School-based disaster plans, including

[24] See Annex 4 of the Project Appraisal Document for further details pertaining to the prioritization criteria

			a to-do-list prior to, during and after disasters were developed with together with school administrations. The Istanbul Seismic Risk Mitigation Conference, organized by the Turkish Republic Prime Ministry Disaster and Emergency Management Presidency and the Governorship of Istanbul, was held in 2009. There were 1,017 participants from 26 different countries, representing ministries, universities, financial institutions, urban and regional planning committees, earthquake research institutes, and from Turkish institutions, such as provincial governorships, provincial directorates for disaster and emergency management from 81 provinces, İstanbul local administrations, NGO representatives and universities. Energy efficiency and functional upgrades that were combined with the structural strengthening works have resulted in estimated average savings of 35% in gas consumption, 40% in electricity consumption and 25% in water consumption in the retrofitted or reconstructed public buildings. The Commentary Guideline for the Seismic Retrofit Design for School and Hospital Facilities in Istanbul, developed under ISMEP, has informed retrofitting works in Turkey by providing the technical details to support better implementation of the earthquake code.
B.2 Risk assessment of lifelines and vital infrastructure: Risk Assessment was planned for vital infrastructure (lifelines) to identify remaining gaps, and recommend an action plan to implement needed mitigation measures.	Dropped in the 2010 restructuring, as risk assessment of lifelines and vital infrastructure was carried out under the Bank-financed	N/A	N/A

	Istanbul Municipal Infrastructure Project.		
B.3 Risk assessment of cultural heritage buildings: A small technical assistance program was planned to address the vulnerability of cultural assets, which are important to Istanbul's economy, and which in many cases have global cultural heritage value.		N/A	The Project developed a GIS-based inventory of cultural heritage buildings under the jurisdiction of Ministry of Culture and Tourism. The database includes digitized archive data, sketches and probabilistic vulnerability assessments of 176 historical buildings located in 26 historical complexes in Istanbul. In addition, ISMEP developed retrofitting designs for three critical cultural heritage buildings in Istanbul (Aya Irini, Archaeology Museum, and Mecidiye Kiosk), based on state-of-the-art seismic vulnerability assessments and 3D modelling of these buildings' potential performance in a major earthquake. The retrofit designs for the Museum of Archaeology and Mecidiye Kiosk were reviewed and approved by the Istanbul Preservation Board for Cultural Heritage and Monuments, and retrofitting is ongoing using funding from other sources. Proposed retrofitting designs for the Aya Irini Monument are awaiting approval from the Istanbul Protection Board. In November 2012, the Provincial Directorate of Culture and Tourism, together with the PIU organized a conference in Istanbul on the global experience and challenges of seismic strengthening and preservation of historical assets.
Component C: Enforcement of Building Codes			
C.1 Public awareness campaigns: Support was planned for a public awareness campaign to the wider community in regard to the		N/A	This subcomponent was implemented jointly with subcomponent A5 as they both entailed public awareness and training activities. Training on urban

importance for public safety of compliance with building codes and land use plans.			planning and construction for disaster risk reduction and preparedness were conducted. The training program provided participants with enhanced understanding of disaster preparedness, structural and urban risks related to land use and measures to be taken in order to enable safer settlements, and roles and responsibilities of the municipalities and the community. Three target groups were trained at the municipal level: decision makers, technical staff and community representatives. Following the design and development of training modules and materials, training activities were conducted at Bagcilar and Pendik pilot municipalities (Table 2.6).
C.2 Further development of regulatory framework for enforcement of building codes and enforcement of land use plans: Support was planned to build on the work undertaken as part of MEER project, and further support the Ministry of Public Works and Settlements in further studies and analyses in order to identify solutions and identify gaps in the regulations that would aim to enable the local authorities to better enforce the building code and increase the compliance with land use plans. The component would also support public consultation with stakeholder groups, and drafting of the relevant regulations.		N/A	In 2007, the Project collaborated with the former Ministry of Public Works and Settlements (now the Ministry of Environment and Urbanization) on the preparation of National Disaster Data Archives and Disaster Information Systems. The corresponding training programs were provided for technical staff of the Ministry's General Directorate of Disaster Affairs. Four analytical reports were published and disseminated to public institutions, including universities and provincial directorates of the Ministry: • Identification of Main Principles of Land Rearrangement Activities (2006)

			• Identification of Rural Planning Processes and Principles in Rural Development Definition and Settlements (2006) • Preparation of Periodic Development Report Formats for Urban Settlements (2006) • Design of Preliminary Study and Identification Stage in the Project of Improving Planning Processes (2006).
C.3 Volunteer accreditation/training of engineers: Support was planned for the accreditation of engineers on a voluntary basis, starting with civil engineers who expressed interest in the scheme. The accreditation would follow the standards used in the EU member countries.		N/A	Training of civil engineers on "Regulation on Buildings to be Constructed in Earthquake Zones" in order to increase the capacity for implementation of the regulation was conducted. Some fifty trainers were trained by project's technical teams to conduct training sessions in the field. Under the protocol signed between the Ministry of Environment and Urbanization and the PIU, 3,631 civil engineers were trained during 30 separate training sessions across the country between 2008 and 2012. Training sessions were implemented in provinces with high seismic risk, primarily targeting metropolitan cities. At the end of each 3-day training program, an examination was conducted on a voluntary basis. The Ministry issued either participation or completion certificates to participants. This certification is officially recognized by Chambers of Civil Engineers, enabling their respective member engineers' secure additional technical points for their professional liability and engineering practice.

C.4 Streamlining of building permits issuance procedures and promoting transparency and accountability in selected district municipalities: Support was planned for: (i) re-engineering of building permit issuance, including training, capacity building activities, and installation of computer systems, including hardware, software and data conversion; (ii) hiring of an independent private firm to inspect the compliance with building permits and to identify any illegal construction. The component would also support the establishment of hotline, to be operated by an independent private entity, to receive customer complaints.	At AF, the Intermediate Outcome Indicator "Improvement in compliance with building codes and land use plans in selected Istanbul municipalities" was made more specific and measurable by the revision to "Improved efficiency and transparency of building permit issuance process in two pilot municipalities", as building permit issuance is the means by which municipalities ensure compliance with building codes and land use plans.	N/A	For the purposes of streamlining building permit issuance, planning and land use development procedures Bagcilar and Pendik Municipalities were identified as pilots based on several criteria such as proximity to faults, high population density, industrial and commercial activity, growth potentials and commitment by the top management of the municipality. In both municipalities, work flow analysis, compliance inspection, and process optimization was carried out for land use planning and building permit issuance. Automated document management systems were established, and e-permitting systems were financed by the Project. As a result, the total number of steps to issue building permits decreased from 106 to 70. Application time significantly reduced from 90 days to 10 days. Both municipalities established call centers for citizen service and introduced business standards to increase efficiency. The Project supported full systems integration for managing applications, requests and complaints from citizens and internal technical and administrative clients. Geospatial data and hazard information were integrated in land use planning and permit issuance systems.

Table 2.2 Training modules

1. First 72 Hours for Disabled People in an Earthquake
2. First 72 Hours for the Individual and Family in an Earthquake
3. Compulsory Earthquake Insurance Awareness
4. Survival under Extraordinary Conditions
5. Psychological First Aid in Disasters
6. Non-structural Risk Mitigation against Earthquake
7. Structural Risk Mitigation against Earthquake
8. Structural Retrofitting Against Earthquake
9. Disaster Emergency Aid Planning for Educational Institutions
10. Disaster Emergency Aid Planning for Healthcare Organizations
11. Disaster Emergency Aid Planning for Industries and Working Places
12. Disaster Preparedness for Local Disaster Volunteers
13. Urban Planning and Construction for Disaster Mitigation for Local Decision Makers
14. Urban Planning and Construction for Disaster Mitigation for Technical Staff
15. Urban Planning and Construction for Disaster Mitigation for Community Representatives

Table 2.3 Beneficiary training

Year	2009	2010	2011	2012	2013	2014	2015	Total
Safe Life 1	2,746	24,299	20,753	8,095	27,379	122,857	27,135	**233,264**
Safe Life 2	25	668	1.988	3,073	1,029	18,668	4,632	**30,083**
Local Disaster Volunteer				760			1,026	**1,786**
Social Guidance, Informing and Awareness Raising Study Required in the Retrofitting Schools	85,495	88,315	30,841	14,340	8,728	34,312	22,649	**284,680**
Safe Life Training For High Schools And Universities							162,711	**162,711**
Kids Trainings		37,195	11,694	121,721	4,042		970	**175,622**
Theatre		6,560	52,043	51,019	39,664			**149,286**
Yıldız Technical University - Safe Life 1 by volunteers			1.357					**1,357**
Republic Of Turkey Ministry Of Environment And Urbanization - Civil Engineer Trainings					3,631			**3,631**
Urban Planning and Construction for Disaster Mitigation Trainings	744							**744**
Preparation of Disaster and Emergency Plan of Pilot Schools							2.175	**2,175**
Total	**89,010**	**157,037**	**118,676**	**199,008**	**84,473**	**175,837**	**221,298**	**1,045,339**

Table 2.4 Retrofitted/Reconstructed Public Buildings

Building Types	Retrofitting			Reconstruction		
	Campus	Buildings	Occupants	Campus	Buildings	Occupants
Schools	500	626	738,063	13	13	25,550
Hospital	11	38	18,339	1	1	7,793
Policlinics& Health Care Centers	40	40	9,006	1	1	1,183
Administrative Building	21	39	11,261	1	1	250
Dormitories & Social Service Buildings	18	41	5,262	2	6	200
TOTAL	**590**	**784**	**781,931**	**18**	**22**	**34,976**

Table 2.5 Participants in social guidance meetings

	Retrofitted and Host Schools			
Year	**Schools**	**Teachers***	**Students**	**Parents**
2009	175	5,692	64,640	15,703
2010	216	7,114	64,922	16,279
2011	110	3,445	23,150	4,246
2012	35	1,319	10,858	2,163
2013	60	1,695	5,934	1,099
2014	91	2,321	29,275	2,716
2015	42	1,110	18,289	3,250
Total	**729**	**22,696**	**217,068**	**44,826**
*Teachers and School Administrations		**Total**		**284,590**

Table 2.6 Training in pilot municipalities

	Number of Sessions	Dates	Number of participants
BAĞCILAR MUNICIPALITY	11(Community Representatives)	June-July 2009	320
	2 (Decision Makers)	June 2009	56
	1 (Technical Staff)	May 2009	21
PENDİK MUNICIPALITY	12(Community Representatives)	November 2009	262
	2 (Decision Makers)	Sept-Dec 2009	65
	1 (Technical Staff)	November 2009	20
		TOTAL	**744**

Annex 3: Economic and Financial Analysis

a. Economic and Financial Analyses at Preparation and Additional Financing

A cost-benefit analysis was undertaken during project preparation in 2005. At appraisal of the original loan, the estimated ERR (economic rate of return), NPV (net present value) and cost-benefit ratios were calculated using a simple macro-economic model based on potential losses to provincial GDP, the avoidance of which was attributed to the project's interventions over a planning horizon of 30 years. Loss calculations were based on an Mw7.25 scenario earthquake (EQ) expected to hit Istanbul at an annual probability of 2%. The original economic analysis assumed that the impacts of the scenario EQ in Istanbul would be similar to that of the 1999 Marmara EQ, except that the level of impact of an Istanbul EQ on the provincial economy would be much larger. Valuation of human life was not part of the analysis, and the concept of Value of a Statistical Life (VSL) was not employed. This appraisal-stage analysis was updated in 2010 for the Additional Financing, using the relevant macro-economic estimates at the time.

b. ICR Approach and Methodology

The methodology applied for this ICR differs from the analyses of 2005 and 2010, in that it attempts to more directly quantify the (expected) avoided earthquake losses to arrive at a more attributable stream of project benefits.

A recent World Bank Policy Paper[25] identifies the key variables in a cost-benefit analysis of risk reduction (i.e., retrofitting and reconstructing) for critical social infrastructure: (i) strengthening/retrofit costs, (ii) building replacement costs, (iii) the risk of a natural disaster (and of the scale of that disaster), (iv) the risk of damage if a natural disaster does occur, (v) the cost of that damage in both financial and human terms, and (vi) the discount rate. Table 3.1 shows the assumptions and parameters that correspond to this approach.

[25] Charles Kenny, *Why Do People Die in Earthquakes?* , The World Bank (WSP 4823)

Table 3.1 Data and Parameters – Cost-Benefit Analysis

Description	Units	Levels	
		W/out Project	With Project
Earthquake Hazard, magnitude	Mw	7.25	
Project Investment (IBRD only)	US$ Million	0	535 (*)
Share of Civil Works in investment cost	percent	0	85%
Cost of Civil Works	US$ Million	0	455
Value of Buildings & Structures	US$ Million	227	910
Avoided fatalities (all Components)	person	0	3,000
Value of a Statistical Life (VSL)	US$	820,000	
Annual Exceedance Probability - EQ	percent	2%	2%
Ratio of Damage to Buildings	percent	40%	5%
Ratio of Asset Value (Undamaged)	percent	60%	95%
Asset Value (Undamaged)	US$ Million	136	864
Avoided Direct Damage	US$ Million	0	728
Ratio of Avoided Direct Damage to Cost of Civil works	US$ Million	N/A	1.6
Planning Horizon	years	N/A	30
Discount Rate	percent	N/A	6

(**) Exclusive of price contingencies and tax

It should be noted that this economic analysis takes into account only the key categories of avoided losses (i.e., direct benefits), and does not consider the other "triple dividend" benefits from disaster risk reduction (i.e., (i) unlocked development potential arising from stimulated innovation and bolstered economic activity in a context of reduced disaster-related background risk for investment, and (ii) enhanced synergies of the social, environment and economic co-benefits of disaster risk management investments, even if a disaster does not take place for many years). This ICR accounts solely for avoided losses, which are expected to constitute the major portion of the benefits stream accruing directly from project interventions.

This analysis covers the IBRD-funded investments, corresponding to some 24% of the total IFI funding[26] leveraged for the ISMEP program (a total of US$ 2.25 billion). The re-estimated base case IRR = 10%, vis-a-vis the Bank-recommended discount rate of 6%. When the physical assets, i.e., buildings and equipment housed in the buildings, are excluded in the analysis, the IRR declines to 9%, demonstrating a relative insensitivity to the dollar value of structures and avoided physical damage. However, when the statistical

[26] Funding from other IFIs was secured by the GOT after a strong track record of IBRD implementation. The ICR analysis is limited to the IBRD financing because: (i) other sources financed separate facilities and were never defined as "co-financing", (ii) investments by other financiers fundamentally differed in nature, with no cap on the civil works budget for reconstructions, which led to other IFIs financing primarily reconstructions (with a focus on hospitals, rather than schools), with little or no financing for other activities. Therefore, the basis for an unbiased comparison (and hence aggregation) of the IBRD and other financing that was subsequently leveraged would not be appropriate.

value attributed to human life (VSL) is eliminated from the analysis, the IRR drops to -14%. This shows that the VSL estimate (US$ 820,000 per person) and the number of lives potentially saved by the project (some 3,000 persons) are key drivers in the analysis. The break-even (or switching value) VSL is US$ 561,000 which yields a 6% IRR, and corresponds to NPV = 0. The break-even number of lives saved is 2,050 persons, which similarly returns an IRR = 6%. An implicit assumption of the analysis is that economic and financial values converge, and hence a separate financial analysis was not developed.

The probability of occurrence of the scenario earthquake has a significant impact on the project's economic performance: when the annual probability is doubled from 2% to 4% (a plausible alternative scenario supported by the scientific community), the IRR improves to 23%. If the EQ probability in increased to 5% per annum, IRR would be 30%.

An alternative to the probabilistic economic analysis that annualizes the benefits (i.e., total avoided losses) is to assign a year to the occurrence of the scenario earthquake and analyze the consequences. The table below shows the variation in IRR depending on the year of earthquake occurrence. In this approach, the cost is still incurred in the investment year, while the full value of benefits is assigned to the year in which the earthquake occurs. This alternative analysis highlights that the largest economic return on a DRM investment would be realized if a disaster occurs immediately after completion of the investment.

Year of EQ occurrence (after investment year)	IRR
2nd Year	368%
5th Year	47%
10th Year	19%
15th Year	12%
20th Year	8%
25th Year	7%
30th Year	5%

ISMEP provided not only for seismic strengthening, but also added value and service life to those buildings that were retrofitted, in the order of some US$ 227 million, due to extended building life and enhanced functional and service features. Furthermore, the difference between the undamaged asset value 'with' and 'without' the project shows avoided direct damages in the amount of US$ 728 million.

c. Discussion of Key Data and Parameters

Earthquake hazard and annual exceedance probability. The economic analysis presented in this ICR makes use of a deterministic "scenario earthquake" of Mw = 7.25 with a 50% probability of exceedance in 50 years. This scenario earthquake is expected to occur on the unbroken segments of the Marmara Fault. While a full probabilistic risk assessment would increase the robustness of this analysis, it was necessary to utilize available deterministic seismic hazard assessments due to the prohibitive technical and financial cost of undertaking a probabilistic assessment for the purposes of this ICR.

IBRD Project investment. Since both the original loan and the AF were denominated in Euros and disbursed in Turkish Liras, the US$ 535 million (equivalent) parameter reflects actual disbursements (exclusive of price contingencies and tax).

Asset Valuation. Due to lack of data on property asset values (including equipment), this analysis used 50% of the cost of the civil works (without the project), equal to US$ 227 million. For the 'with project' case, 200% of the cost of civil works was used, which amounted to US$ 910 million. This resulted in incremental surplus value of US$ 228 million, which can be directly attributed to the project interventions, owing to extended building life and enhanced amenities over and above the cost of the construction. Meanwhile, value of land was excluded in the calculations, as per standard insurance business practice.

About 30% of the project's civil works budget was spent on reconstructions (accounting for 8% of the serviceable floor area), while 70% of the civil works budget was utilized for retrofits (92% of the floor area).

Discount Rate. World Bank guidelines recommend that state-of-the-art economic analysis should link social discount rates to long-term growth prospects of the country where the project takes place[27]. Given reasonable parameters for the other variables in the standard Ramsey formula, this yields a **discount rate of 6%**.

Value of Lives Saved. Cost-benefit analysis is particularly useful in the comparison of alternatives. In order to enable decision making in the context of life-saving investments, some numerical estimate must be attached to the value of life[28]. The relevant concept is the so-called **Value of a Statistical Life (VSL)**. VSL estimates are derived from willingness to pay surveys and reflect the intrinsic value of life to a greater degree than approaches that depend on estimates of foregone income (that is, what the victims could have earned on the labor market if they had survived). The use of VSL mitigates, to a certain extent, the concerns around trivializing the value associated with human life (which has been an obstacle to attributing such values in economic analysis). In addition, although it embodies the individual respondents' utility preferences, the average VSL (as used here) is a neutral measure that is applicable regardless of income earning potential.

Due to the paucity of contextualized and reliable VSL estimates applicable for the ISMEP case[29], the "benefits transfer" method was used to value the lives potentially saved by the project[30]. The "benefits transfer" calculation involves selecting a relevant reference country (in this case, the United States) and utilizing the most recent VSL estimate (US$ 9.7 million[31] from the Environmental Protection Agency). The second step requires adjustment

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[27] Where no country-specific growth projections are available, 3% serves as a reasonable estimate for expected long-term growth rate in these countries.

[28] Natural Hazards Unnatural Disasters, https://www.gfdrr.org/sites/gfdrr/files/publication/NHUD-Report_Full.pdf

[29] In Turkey, the concept of VSL has been applied in a restricted sense for some well-defined health risks, such as cancer, which are not appropriate for this ICR.

[30] Cropper and Sahin, The World Bank (Mortality and Morbidity in the Context of Disaster Risk, http://elibrary.worldbank.org/doi/abs/10.1596/1813-9450-4832

[31] The EPA conducts benefit-cost analysis of new environmental policies by estimating how much people are willing to pay for small reductions in their risks of dying from adverse health conditions that may be caused by environmental pollution. As such, the EPA itself does not place a dollar value on individual lives.

of the United States' VSL estimate by the ratio of Turkey's GDP per capita to US GDP per capita, resulting in an estimate of US$ 1.87 million for the VSL in Turkey. To address known issues of overestimation in the resulting VSL estimates derived from the transfer of benefits from high income to lower income countries, an income elasticity of 1.5 was used to calibrate the VSL. This yielded a VSL estimate of US$ 820,000 for Turkey. Table 3.2 summarizes these calculations.

Table 3.2. VSL Calculation for Turkey

Parameter Description	Designation or Formula	Units	Values
EPA VSL for the United States	VSL_{USA}	US$ M	9.7
Turkey GDP/capita 2014[32]	Y_{Tur}	US$	10,515
USA GDP/capita 2014	Y_{USA}	US$	54,630
Income Elasticity of VSL	E	none	1.5
VSL Estimate - Uncalibrated	$VSL_a = VSL_{USA} * (Y_{Tur}/Y_{USA})$	US$ M	1.87
VSL Estimate – Calibrated	$VSL_b = VSL_{USA} * \{ (Y_{Tur}/Y_{USA})\}^{E}$	US$ M	0.82

Estimation of avoided fatalities under Component B. Seismic strengthening – either retrofitting or reconstruction - serves the purpose of saving lives and avoiding asset damage in case of an earthquake. Table 3.3 summarizes the methodology for estimating lives saved under Component B (which accounted for 85% of the project resources). It is estimated that some 817,000 people will be occupying and using these buildings which have either been strengthened (retrofitted) or reconstructed under ISMEP.

Bogazici University Department of Earthquake Engineering Prof. Emeritus Dr. Mustafa Erdik, technical adviser to the ISMEP program, has estimated (using the ELER risk assessment[33]) that the expected fatalities from the Mw7.25 scenario earthquake range from 0.2% to 0.4% of the approximately 15 million population of Istanbul.

Crowding rates of buildings, occupancy rates and resulting mortality (fatalities due to building collapse) are interrelated. In most events, deaths are caused largely by the collapse or partial collapse of buildings. Occupancy rates vary by type of building and the time of the day when the earthquake strikes, with more fatalities in buildings with higher occupancy. Therefore, 0.2% to 0.4% fatality rate was calibrated in this analysis by the crowding and occupancy rates. With 0.41 persons/m^2, schools are the most crowded buildings, and a mortality rate of 0.6% was assigned, while the other buildings were assigned a mortality rate of 0.4%. On the other hand, the occupancy rate of schools is lowest at 35%, due to weekends, school holidays, and part-time use during the day. Table

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The method rests on the notion of **stated preference** of the people, as opposed to revealed preference, which is yet another method for the pursuit of the same estimate.

[32] GDP estimates both for Turkey and the USA come from the World Bank web site provided below: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD/countries?display=default

[33] Demircioglu, M. B., Erdik, M., Hancilar, U., Sesetyan, K., Tuzun, C., Yenidogan, Zulfikar, A.C., (2009), Technical Manual - Earthquake Loss Estimation Routine. ELERv1.0, Bogazici University, Department of Earthquake Engineering, Istanbul, March 2009.

3.3 summarizes these calculations. Overall, ISMEP investments are estimated to **save 1,750 lives**, up to some **5,000 at full occupancy** during school hours.

Table 3.3. 'With Project' Mortality Calculations: Component B (Reconstruction and Retrofitting)

Descriptions	Units	Schools	Hospitals, Clinics	Admin Bldgs	Dorms, Social Service Bldgs	Total
Campuses (bldg. agglomerates)	number	513	53	22	20	608
Individual Buildings	number	639	80	40	47	806
Floor Areas Retrofitted and Reconstructed						
Retrofitted	m^2	1,765,547	131,289	167,964	78,774	2,143,574
Reconstructed	m^2	76,768	101,910	8,000	6,400	193,078
Total Floor Areas	m^2	1,842,315	233,199	175,964	85,174	2,336,652
Statistics						
Users	person	763,613	36,321	11,511	5,462	816,907
Crowding Intensity	person/m^2	0.41	0.16	0.07	0.06	0.35
Crowding Index	percent	119%	45%	19%	18%	100%
Mortality Rate	percent	0.60%	0.40%	0.40%	0.40%	0.40%
Occupancy Ratio in Time	percent	35%	80%	50%	50%	
Lives Saved	person	1,604	116	23	11	1,754

Estimation of avoided fatalities under Components A and C. Using unpublished data from the Istanbul Metropolitan Municipality (IMM), the number of people expected to be trapped in the buildings in the Mw7.25 scenario earthquake is in the order of 100,000. Some 90% of these people will be saved by their own means or with help from neighbors. The remaining 10,000 people will need some assistance from search and rescue teams, for which ISMEP has provided significant technical assistance (via emergency response plans), training and equipment under Component A. Enhanced emergency communications funded by ISMEP are another essential facet of emergency management. In view of the strengthened skills, technical capacities and rescue equipment provided under the Project, the contribution is estimated to be **at least 1,000 lives saved** due to Component A (10% of the people needing rescue from public safety units).

Under Component C, better enforcement of building codes and more stringent construction inspections contribute to better structural performance and avoided building collapses in an earthquake. Quantifiable benefits will mainly result from new buildings constructed in full compliance with the building codes. Over the useful life of the ISMEP investments, some 1 million people will be living in safer accommodations who would have otherwise been housed in non-code compliant buildings. Assuming a 'without project' mortality rate of 0.30%, 3,000 fatalities would be avoided as a result of the new code-compliant buildings. It was estimated that the share attributable to Component C is 8%, or **at least 250 saved lives** due to project investments. These calculations are summarized in Table 3.4.

Table 3.4. Component C – Avoided fatalities

Description	Units	Quantity
Number of Participating Municipalities in Component C	number	2
Number of new code-compliant building permits issued annually	number /year	700
Total number of new buildings constructed according to code annually	building/years	1400
Useful life of ISMEP Investment	year	15
Total number of buildings constructed according to code over project life	building	21000
Number of apartments per building	apartment	12
Number of occupants per apartment	person	4
Number of occupants per building	person	48
Total number of people living in safer buildings	person	1,008,000
Mortality due to scenario EQ (Mw 7.25) – without project	percent	0.30%
Number of lives saved	person	3024
Share attributable to Component C investments (as incremental value)	percent	8%
Number of lives saved as result of Component C investments	person	250

d. Results and Discussion

Cost Effectiveness. The decision of whether to retrofit or to reconstruct a building under the project was based on a two-stage analysis: (i) buildings exhibiting the highest seismic vulnerability were inventoried and prioritized, after which detailed designs for full reconstruction were developed and tested under a simulation model for seismic resistance; and (ii) retrofitting was selected if the associated cost would not exceed 40% of the cost of reconstructing a building with comparable characteristics. The use of this threshold allowed for a majority of buildings to be retrofitted, leading to greater cost effectiveness.

The average age of the 806 buildings retrofitted/reconstructed under the Project was 27 years, with a total expected life of some 50 years. The functional upgrades incorporated in the retrofits have rendered the buildings more useful, increased the asset values, and added at least 10 years of extra service life.

The total estimate of avoided fatalities attributable to the Project, against the total investment cost (exclusive of price contingencies and tax) of US$ 535 million, yields a cost of US$ 178,000 per life saved.

Interpretation of ISMEP Efficiency Parameters. Tables 3.5 and 3.6 show the calculations yielding the standard project efficiency parameters for the base case scenarios and others. The base case scenario yielded IRR = 10%, NPV = 187 million, B/C = 1.37, and payback period of 10.68 years. This represents an acceptable investment, despite the fact that the economic analysis did not try to capture all of the related benefits. This base case may be taken as the lower bound for the project's efficiency.

Table 3.5 Results of Economic Analysis

Discount Rate = 6%	Parameters						Estimates from Calculations			
Scenarios Reviewed	**VSL**	**Lives Saved**	**OCC**	**EQ Probability**	**Horizon**		**IRR**	**NPV**	**B/C Ratio**	**Payback Period**
	US$	**person**	**percent**	**percent**	**years**		**percent**	**US$ M**	**N/A**	**years**
Base Case	820,000	3000	6	2	30		10%	185	1.37	10.7
Without Buildings	820,000	3000	6	2	30		9%	173	1.34	10.9
W/O Lives Saved	820,000	0	6	2	30		-14%	-492	0.02	588.2
Breakeven (BE) VSL	561,000	3000	6	2	30		6%	0	1.00	14.6
BE Lives Saved	820,000	2053	6	2	30		6%	0	1.00	14.6
25 Year Horizon	820,000	3000	6	4	25		23%	776	2.54	5.3
20 Year Horizon	820,000	3000	6	5	20		30%	932	2.85	4.3
Discount Rate = 4%										
Scenarios Reviewed	**VSL**	**Lives Saved**	**OCC**	**EQ Probability**	**Horizon**		**IRR**	**NPV**	**B/C Ratio**	**Payback Period**
	US$	**person**	**percent**	**percent**	**years**		**percent**	**US$ M**	**N/A**	**years**
Base Case	820,000	3000	4	2	30		10%	352	1.68	10.7
Without Buildings	820,000	3000	4	2	30		9%	336	1.65	10.9
W/O Lives Saved	820,000	0	4	2	30		-14%	-499	0.03	588.2
Breakeven (BE) VSL	446,000	3000	4	2	30		4%	0	1.00	18.0
BE Lives Saved	820,000	1632	4	2	30		4%	0	1.00	18.0
25 Year Horizon	820,000	3000	4	4	25		23%	1051	3.04	5.3
20 Year Horizon	820,000	3000	4	5	20		30%	1188	3.31	4.3
Discount Rate = 8%										
Scenarios Reviewed	**VSL**	**Lives Saved**	**OCC**	**EQ Probability**	**Horizon**		**IRR**	**NPV**	**B/C Ratio**	**Payback Period**
	US$	**person**	**percent**	**percent**	**years**		**percent**	**US$ M**	**N/A**	**years**
Base Case	820,000	3000	8	2	30		10%	69	1.14	10.7
Without Buildings	820,000	3000	8	2	30		9%	59	1.12	10.9
W/O Lives Saved	820,000	0	8	2	30		-14%	-485	0.02	588.2
Breakeven (BE) VSL	683,500	3000	8	2	30		8%	0	1.00	12.2
BE Lives Saved	820,000	2500	8	2	30		8%	0	1.00	12.2
25 Year Horizon	820,000	3000	8	4	25		23%	574	2.16	5.3
20 Year Horizon	820,000	3000	8	5	20		30%	735	2.48	4.3

Table 3.6 Worksheet for Cost Benefit Calculations

Base Case Scenario in Istanbul

Years	Without Project							With Project							Incremental Costs and Benefits				
	Building Values	Number of Casualties	SVL	Total Value of Life	Damage Ratio to Buildings	Damage to Buildings	Expected Losses to People and Structures	Building Values	Number of Casualties	SVL	Total Value of Life	Damage Ratio to Buildings	Damage to Buildings	Expected Losses to People and Structures	Total Benefits - Avoided Losses of Life and Structures	Probability of EQ Occurrence	Annualized Project Benefits	Project Costs	Cash Flow
	US$ M	person	US$	US$ M	percent	US$ M	US$ M	US$ M	person	US$	US$ M	percent	US$ M	US$ M	US$ M	percent	US$ M	US$ M	US$ M
1	227	3,000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50	535	(485)
2	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
3	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
4	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
5	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
6	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
7	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
8	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
9	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
10	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
11	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
12	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
13	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
14	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
15	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
16	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
17	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
18	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
19	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
20	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
21	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
22	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
23	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
24	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
25	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
26	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
27	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
28	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
29	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
30	227	3000	820,000	2,460	40%	91	2,551	910	0	820,000	-	5%	45	45	2,505	2%	50		50
															Payback Per.	10.68		IRR	10%
															NPV (Benefits)	689.75		NPV (US$ M)	185
															NPV(Costs)	504.72		B/C	1.37

When buildings (assets) were disregarded in the analysis, the IRR was reduced to 9%, while other parameters varied slightly, suggesting that the asset values had a marginal impact on the overall economic performance of the project. However, when the lives saved were eliminated from the analysis, the resulting IRR declined to - 14%. Hence, if only assets values are considered, the project would not meet efficiency criteria.

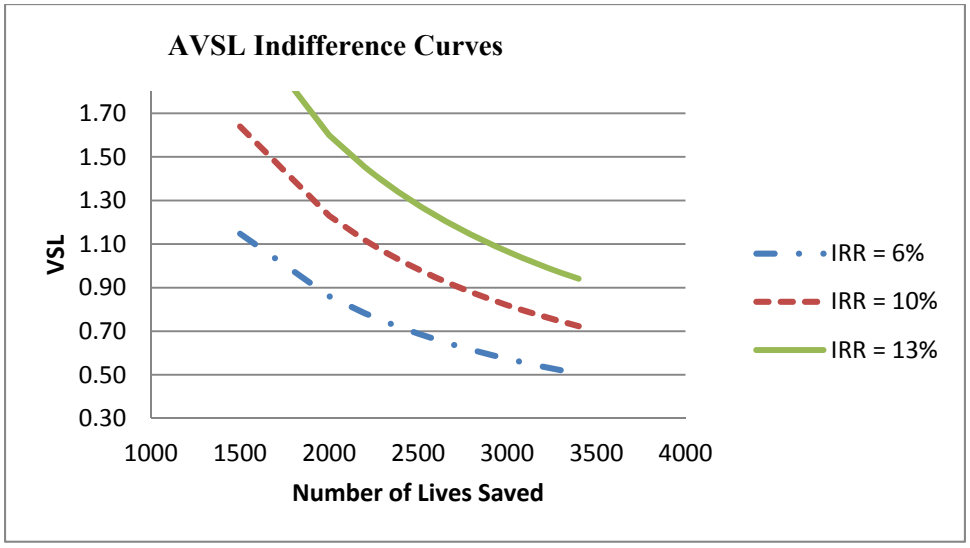
The probability of occurrence of the scenario earthquake has a significant impact on the project's economic performance: when the annual probability is doubled from 2% to 4% (a plausible alternative scenario), the IRR improves to 23%. If the EQ probability in increased to 5% per annum, IRR would be 30%.

Sensitivity of efficiency parameters to changes in the Aggregate VSL. A sensitivity analysis was performed solely on the AVSL (principal benefit stream) because variations in the investment cost would be irrelevant for an *ex post* analysis of a completed project. An increase of 30% in the aggregate VSL would result in an IRR of 13%, while a 30% reduction in the same would approximately correspond to the switching value, at which the IRR = Discount Rate = 6%. Variations in AVSL generate a significant sensitivity in the efficiency parameters: for every 300 additional lives saved (10% of the estimated project total), the IRR improves by 1 percentage point (Table 3.7), the payback period is reduced by approximately one year, and the NPV and B/C ratios improve non-linearly.

Table 3.7 Sensitivity Analysis Based on Parametric Variations of Aggregate VSL

Parameter	Units	Down by 30%	Down by 20%	Down by 10%	Base Case	Up by 10%	Up by 20%	Up by 30%
IRR	percent	6%	7%	8%	10%	11%	12%	13%
NPV	US$ M	-18	50	117	185	253	320	388
C/B Ratio	N/A	0.96	1.10	1.23	1.37	1.50	1.63	1.77
Payback	years	15.13	13.29	11.84	10.68	9.72	8.92	8.25

In theory, there is an infinite number of VSL and number of lives saved pairs that would result in the same aggregate VSL magnitude. The figure below shows three levels of IRR: 6% (break-even or switching value), 10% (base case) and 13% (higher efficiency level).



Switching Values. Using the *ceteris paribus* approach, the number of lives saved or the VSL was varied and other parameters kept constant in order to generate the switching values that yield an IRR = 6%. At 3,000 lives saved, the switching VSL is US$ 561,000. Alternatively, at a VSL of US$ 820,000, the necessary number of lives saved to yield a 6% return on the investment is 2,053. These pairs of observations represent distinct points on the blue curve in Figure 3. The IRR remains invariant to all changes in the discount rate, because IRR and discount rates are independent of one another.

Impact of variation in the discount rate. This analysis found that a 2% increase in the discount rate would require an additional 500 lives saved for break-even conditions to be fulfilled. Likewise, a 2% decrease in the discount rate would enable the project to break-even with 400 fewer lives saved.

Difference between estimates of IRR at Appraisal and ICR. The appraisal-stage IRR estimate was 11% (lower bound) and 19% for the base case. At AF, the lower bound was estimated at 12%, with a 23% IRR for the base case. This ICR has re-estimated the base case IRR at 10%, due to the use of a more attributable (but less optimistic) methodology than the macro-economic approach.

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Deniz Baharoglu	Manager	CRKI3	Social Development
Bernard Baratz	Consultant	GEEDR	Infrastructure Development
Dilek Barlas	Executive Secretary	IPN	Legal Counsel
Eugene N. Gurenko	Lead Financial Sector Specialist	GFMDR	Catastrophe Insurance
Betty Hanan	Consultant	GSP06	Health Sector Specialist
Jolanta Kryspin-Watson	Lead Disaster Risk Management Specialist	GSURR	Disaster Risk Management
Dara Lengkong	Consultant	GFM02	Trust Fund Operations
Beatrice Koshie Michel	Senior Executive Assistant	GENDR	
Norval Stanley Peabody	Consultant	GEEDR	
Eric L. Peterson	Sr. Architect	GSDFO-HIS	
Christoph Pusch	Lead Disaster Risk Management Specialist	GSU19	TTL-Lending
Ibrahim Sirer	Consultant	GSU03	
Wael Zakout	Lead Land Administration Specialist	GSULN	TTL - Lending
Supervision/ICR			
Ibrahim Akcayoglu	Operations Officer	ECSHD – HIS	
Richard Andrews	HQ Consultant ST	SACIN	Emergency Management
Esra Arıkan	Sr Environmental Specialist	GEN03	Environmental Safeguards
Ayse Seda Aroymak	Sr Financial Management Specia	GGODR	FM
Elif Ayhan	Senior Disaster Risk Managemen	GSURR	TTL-Supervision
Dilek Barlas	Executive Secretary	IPN	Legal Counsel
Zeynep Darendeliler	Social Development Specialist	OPSPF	Social Safeguards
Sergio Dell'Anna	Disaster Risk Management Specialist	GSU10	
Ruxandra Maria Floroiu	Lead Environmental Specialist	GENDR	Environmental Safeguards
Salih Kemal Kalyoncu	Sr Procurement Specialist	GGO03	Procurement
Ulker Karamullaoglu	Program Assistant	ECCU6	
Jolanta Kryspin-Watson	Lead Disaster Risk Management Specialist	GSURR	TTL-Supervision

Zeynep Lalik	Sr Financial Management Specia	GGODR	FM
Beatrice Koshie Michel	Senior Executive Assistant	GENDR	
Norval Stanley Peabody	Consultant	GEEDR	
Eric N. Peterson	Consultant	ECSPE – HIS	
Ibrahim Sirer	Consultant	GSU03	
Joaquin Toro	Sr Disaster Risk Management Specialist	GSU09	
Natasa Vetma	Sr Environmental Specialist	GEN03	
Peter I. Yanev	HQ Consultant ST	GSU08	Earthquake Risk Management
Artessa Saldivar-Sali	Municipal Engineer	GSURR	ICR TTL
Suha Satana	Consultant	GWADR	Sr. Economist
Pinar Arikan	Consultant	GSURR	DRM Analyst
Alp Aydin	Consultant	GSURR	Seismic Engineer

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY03	12.65	92.20
FY04	23.58	191.11
FY05	39.7	292.205
Total:	75.93	616.21
Supervision/ICR		
FY05	0.96	8.12
FY06	29.67	145.271
FY07	36.03	150.716
FY08	20.5	116.32
FY09	39.05	151.78
FY10	33.08	148.14
FY11	25.77	87.44
FY12	20.89	213.64
FY13	24.6	117.84
FY14	16.73	104.61
FY15	14.97	129.15
FY16	3	74.15
Total:	265.25	1447.18

Annex 5. Summary of Borrower's ICR and/or Comments on Draft ICR

a. Executive Summary (extracted from Borrower's ICR)

The World Bank funding for the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP), became effective in 2006 and closed at the end of 2015. European Investment Bank, Council of Europe Development Bank, Islamic Development Bank funding for ISMEP continue to 2020. It was designed by a national and international team of specialists as one of the largest and most comprehensive disaster preparedness project in the world while the 1999 Marmara Earthquake Emergency Reconstruction Project (MEER) was being implemented under Turkish Prime Ministry.

Owing to the paradigm shift by the Turkish Government towards being proactive, special legislative changes have been made in the Parliament and matching by laws and bureaucratic procedures have been put into effect to ensure smooth, timely, efficient and cost effective operations of the Project.

In this way, the project management was decentralized by establishing the Istanbul Project Coordination Unit (IPCU) under Istanbul Special Provincial Administration of the Governorship. Yet, adopting a matrix type organizational structure, it was steered by a committee of representatives from all the provincial and central government stakeholders ensuring active participation not only during decision making and prioritization but also during implementation. Without appropriate legislation all the planning, decision making and prioritization functions would have to be executed by central government departments and Ministries located in Ankara.

The IPCU model (as a unique and first of a kind in Turkish administration) contributed positively to successes and achievements during project implementation. The level of ownership and professional contributions of the stakeholders created further synergies and the original project funding increased by more than six times with new commitments from other IFI's after World Bank.

This report is formally called the Borrower's Completion Report and has been prepared by the designated IPCU team during the first quarter of 2016 under the ISMEP Project Director's supervision, in fulfillment of the Government and World Bank requirements for externally funded projects implemented and duly closed.

ISMEP's Project Development Objective (PDO) was to improve the city of Istanbul's preparedness for a potential earthquake 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 and land use plans.

Under the Istanbul Governorships oversight and actual management of the IPCU, ISMEP made steady progress towards achievement of the PDO and has received high ratings from the World Bank since the project launch in 2006.

The project is comprised of three technical components plus a fourth one providing the management service and function for the project. These components were:

Component A: Enhancing Emergency Preparedness

The component enhanced the effectiveness and capacity of the provincial public institutions and organizations in Istanbul to prepare for, respond to and recover from significant emergencies and disasters, especially those arising from earthquakes by improving emergency communications systems, establishing an emergency management information system, enhancing the institutional capacity of Istanbul AFAD, upgrading the emergency response capacity of first responder public agencies and raising public awareness and conducting disaster preparedness trainings.

Component B: Seismic Risk Mitigation for Public Facilities

The component aimed to support a well-designed risk reduction program to minimize human and physical losses that would be suffered in the event of an earthquake by targeting critical public facilities in order to save lives and ensure their continued functioning by retrofitting or reconstruction of priority public facilities such as hospitals, clinics, schools, administrative buildings, dormitories and social service buildings where residential buildings were kept outside ISMEP's scope and undertaking risk assessments for cultural heritage buildings. In connection with the latter risk assessments activity, an inventory of cultural heritage buildings was planned to be developed under the jurisdiction of Ministry of Culture and Tourism together with retrofitting designs.

Component C: Enforcement of Building Codes

The component supported innovative measures on a pilot basis for monitoring and improvement of building codes and land use plans enforcement through data collection on land use and building inventory; enhancement of the technical and institutional capacity of the pilot municipalities, data digitization and computer equipment to help district municipalities render the process of issuing building permits more efficient and transparent and training/awareness raising for municipal authorities and local communities on seismic risks and the need to take this into account in land use planning and construction and voluntary training of engineers in new legislation involving retrofitting of buildings.

Component D: Project Management

This component supported the Istanbul Governorship to implement the project efficiently and transparently, and build institutional capacity to sustain the seismic risk mitigation program beyond project life. The project was implemented within the Istanbul provincial boundaries.

Implementation Record

Following the EUR 415.26 million funding from the Bank, the project has been funded with another 1.36 billion Euro from other international financing institutions[34] such as EIB,

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[34] The Republic of Turkey signed loan agreements with the European Investment Bank on March 12, 2008 for €300 Million and on October 29, 2013 for €300 Million as additional finance, with the Council of Europe Development Bank (abbreviated as CEB or COE Bank) on September 16, 2010 for €250 million and on March

CEB and IDB. The disbursement schedule for the most recent loan provided to ISMEP implies that ISMEP will continue its existence well into 2020, although the World Bank funding effectively ceased at the end of 2015.

During the last decade, ISMEP has helped improving capacity for disaster and emergency management public agencies at the provincial level through building new command, control and coordination centers, providing equipment and vehicles for first responder public agencies and Istanbul AFAD emergency communication and information management systems, training search and rescue units and enabling Istanbul to be the first in Turkey receiving INSARAG '"Heavy Search and Rescue" certificate showing that they could operate under UN framework in case of a disaster globally. A new Emergency Response Plan was prepared by Istanbul AFAD in consultation and close collaboration with all stakeholders and the entire disaster risk management system was tested by a well-attended table-top exercise and a search and rescue drill in July 2015. ISMEP has reduced vulnerability of public buildings in Istanbul to earthquakes through retrofitting or reconstructing 806 schools, hospitals, dormitories, and other high priority public buildings. Four major hospitals equipped with base isolators for the continuity of operations during an earthquake are under construction. In total, with the entire budget available, ISMEP has strengthened 1258 buildings in Istanbul to be safer which serves for about 1.5 million direct beneficiaries. Based on the engineering experience, the project has developed guidelines for better implementation of the Earthquake Code. The project also supported developing a GIS based inventory of cultural heritage buildings and prepared retrofitting and renovation designs for three major cultural heritage assets. Working with two pilot municipalities of Pendik and Bagcilar; ISMEP has demonstrated better enforcement of building codes through improving efficiency and transparency in land use planning and building permit issuance processes, establishing help desks and hot lines.

The project has carried out a proactive training and awareness raising strategy through developing training modules which then informed national programs as well as children friendly materials, board games, computer games and even a theatre play. ISMEP has provided regular information and social guidance to project beneficiaries, especially to those who occupy or use buildings to be retrofitted or reconstructed. Engineers have received hands on training on the current Earthquake Code nationwide.

Overall, ISMEP has been an exemplary showcase of capacity building for emergency and disaster risk management as well as physical risk reduction. Some 28 delegations from all around the world has visited the project to observe and investigate what has been done both at the institutional and technical level. Various IPCU teams participated in 62 international conferences and workshops presenting the project and sharing knowledge and experience.

12, 2015 for €250 million as additional funding, with the World Bank again on August 04, 2011 for €109.80 million as additional funding and with the Islamic Development Bank on April 04, 2012 for € 259 million, for the incremental funding needs of ISMEP. Consequently, the ISMEP budget reached to € 1.78 billion. According to disbursement profiles of the incremental financing provided to ISMEP to support its current mandate as designed in 2006 by the World Bank, the project is now expected to continue well into 2020.

Lessons Learned

Many important lessons were learned as a result of implementing ISMEP, which has been a pioneering effort in large scale seismic interventions and enhancement of preparedness.

Legislative Base: Special law and by laws for the establishment of IPCU in Istanbul created managerial efficiency and speeded up procedures. Existence of retrofitting technical guidelines avoided interventions.

Decentralized Management/Local Administration: The first implemented seismic mitigation project under a local administration through a specialized a project coordination unit (IPCU).

Steering Commitee: The DRM Sector has multi-sectoral dimensions with cross-cutting characteristics and necessitates active involvement of central and provincial government departments. Without appropriate measures, project implementation is prone to serious problems. Establishment of the **Steering Commitee** consisting of representatives from local and central stakeholder institutions enabled IPCU to establish joint ownership and enhanced collective decision making and effective implementation.

Experienced Technical Cadre: Employment of key personnel who had experience in DRM related international projects facilitated prudent technical management from the start of the Project, which enabled transfer of knowledge and timely and efficient implementation.

Decision making Methodology :

- **Prioritization:** IPCU Management established the necessary criteria and worked with individual provincial Directorates of Ministries represented in the Steering Commmitee to prepare the priority list of public buildings to be assessed for vulnerabilty to seismic risks.
- **Retrofitting vs. Reconstruction Decision:** A concise and coherent decision methodology was needed to decide whether to strengthen or reconstruct the buildings exposed to risk, and this decision rule had to be administered firmly and consistently. Adoption of such a methodology by ISMEP, which involves but not just limited to what we briefly refer to as the 40% threshold, has greatly helped reduce disputes and controversies.

Mitigating Social Impacts: Evacuation of schools and diverting students to interim facilities needed considerable care and attention. Negligence of such social impacts could have jeopardized the program if they were not well managed.

Capacity Building in the Construction Industry: When ISMEP started its activities in 2006, the construction industry in Istanbul was not fully prepared to take an immediate role involving building retrofitting on a mass scale and in an expedient manner. Other follow-on projects should be explicitly cognizant of this capacity creation process while trying to further develop new capacity.

Biased opinions of the general public including high level decision makers about the reliability of retrofitting created big obstacles during project design and early years of ISMEP implementation. Trust and confidence gradually built in ISMEP activities, made

possible only owing to strict obedience to high standard technical designs and meticulous supervision made by IPCU professionals during selection and application of appropriate materials and techniques for retrofitting. The results achieved in this respect changed people's negative prejudices to highly positive levels.

Stakeholder Approach: IPCU consulted closely and worked in close collaboration with all the stakeholders (public and private, NGOs, academia, scientific and research institutions, etc) and endusers. Ultimately, the community (including men, women, children, youth, disabled, elderly, etc) is considered as the most important stakeholder for IPCU and through this **participatory approach**, the beneficiary satisfaction and appreciation have increased. Impact assessment studies were made after successive stages of the Project and the feedback from the beneficiaries were taken into consideration. In this way, more people-centred preventive approach were integrated to the designs and implementation to achieve better quality and higher satisfaction.

Education and Training: IPCU's awareness raising activities, trainings, use of knowledge, innovation and education (i.e; e-training modules) has always been a catalyst to build a culture of safety and resilience at all levels.

International Cooperation: IPCU has always engaged with the international organizations, platforms and International mechanisms for strategic advice, coordination and partnership development for disaster risk reduction which is crucial to enhance the mutual learning and exchange of know-how, technology, innovations and skills.

Contributing to Other Governmental Policies and Programs - Side Benefits: While retrofitting or reconstructing schools/hospitals, energy efficiency and practical green building measures were also accommodated. In this way their carbon footprints were minimized and energy and water costs were also decreased. Also the compliance levels of the buildings regarding fire regulation, lifts, safety precautions and sanitary issues were raised to higher levels.

Moreover, ISMEP improved tailor-made designs with architectural esthetics and increased the service capacity of the public institutions; such as increased classrooms in reconstructed schools, number of beds in the hospitals, more modernized buildings in line with the current technical and service requirements, etc.

Achievements and Awards

ISMEP project has been deemed worthy of World Bank ECA Region (Europe and Central Asia) Team Award as it was considered to be one of the 16 projects which showed outstanding achievements in terms of results and attainments obtained, developmental effect, innovation and cooperation mechanisms created.

Reconstructing 44 schools across Istanbul, IPCU was honoured as the winner of Public Category in the scope of the Arkitera Employer Awards on December, 2015. The award, the winners of which are determined according to public responsibilities of the architect and the employer, has been given for honouring the enterprises that perform qualified architectural works in public and private sectors.

ISMEP project was received a rating of 4/4 according to Council of Europe Development Bank in June 2013 and was shown as a model for design and implementation of other projects in the field of disaster management in other parts of Turkey and in the world. Istanbul Provincial Directorate of National Education and VİKO (a private company in electricity equipments production sector) co-organised 'Energy Efficiency in Schools for a Brighter Future' Project Awards Ceremony in 2013. Kağıthane Primary School reconstructed under ISMEP Project, was awarded as the winner on energy efficiency.

In scope of ISMEP Project, Bağcılar and Pendik Municipalities have received ISO 27001 certificates proving that their systems comply with international standards for information management and data security. Bağcılar Municipality with its İSO 27001 Security Certificate Project was awarded with the first prize within the scope of the Golden Ant Municipality Awards in 2012.

'Take Action' Campaign was honoured as the winner of Public Communication Category in the scope of Golden Compass Awards, carried out by the Public Relations Society of Turkey (TÜHİD), in 2012. The campaign executed with the objective of training and raising awareness among residents in Istanbul about earthquakes, and to raise the number of 'Safe Living Volunteers' invited people to 'Safe Living Training Programs' through informative and educative films, posters and booths, using the mottos 'Take Action and Receive Training, Take Action and Volunteer, Take Action and Take Measure'.

ISMEP is mentioned as a good practice in EU Peer review of Turkey Report and quoted as 'ISMEP: Local initiative on seismic risk mitigation. An excellent example of integrating various domains and connecting multi-stakeholders'.

Future Prospects

Based on the implementation experiences and achievements of ISMEP, it is highly recommended to further consider the following sets of projects to be implemented in Turkey.

1- Broadening the scope of retrofitting/reconstruction to include:
   - Residential buildings,
   - Industrial estates,
   - Industries,
   - Commercial centers, hotels,
   - Lifelines and other critical infrastructure.
2- Integrating seismic resilience projects of public buildings with urban transformation projects.
3- Scaling up relevant features of ISMEP Project to other earthquake prone provinces of Turkey.
4- Dissemination of the experience gained in two municipalities of Istanbul to other municipalities.
5- Establishing an international Center of Excellence for Disaster Risk Management:
   -to further continue and expand research, testing and training,
   -to improve designs, methods and technologies,
   -to exchange fellows and experiences with similar centers worldwide.

Annex 6. List of Supporting Documents

1. Loan Agreement, Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, 2005, Loan Number 4784 TU
2. Loan Agreement for Additional Financing, Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, 2011, Loan Number 8033-TR
3. Project Appraisal Document, Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, 2005, Report No: 32173 – TR
4. Project Paper on Additional Loan, Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, 2011, Report No: 58792-TR
5. Restructuring Paper, Istanbul Seismic Risk Mitigation and Emergency Preparedness Project, 2014, Report No: RES17153
6. Sinan ERER; Tan, Aylin; Gonenc, Ethem. 2005. Environmental management plan for retrofitting of selected high priority public buildings in Istanbul Vol. 1 of Turkey - Istanbul Seismic Risk Mitigation and Emergency Preparedness Project: environmental assessment. Washington, DC: World Bank.
7. Sinan ERER; Tan, Aylin; Gonenc, Ethem. 2005. Environmental management plan for retrofitting of selected high priority public buildings in Istanbul Vol. 2 of Turkey - Istanbul Seismic Risk Mitigation and Emergency Preparedness Project: environmental assessment. Washington, DC: World Bank.
8. Sinan ERER. 2010. Additional Financing for the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project: environmental management plan. Washington, DC: World Bank
9. Istanbul Seismic Risk Mitigation and Emergency Preparedness Project Evaluation Report, 2014, Deloitte
10. Impact Assessment Reports of Retrofit and Renovation Work of Schools, 2008, 2009, Akadametre
11. Social Impact Assessment of Safe Life Trainings, 2012, Akadametre
12. Impact Assessment of Better Enforcement of Building Permit Procedures in Pilot Municipalities, 2012, Akadametre
13. Environmental Management Plan prepared by IPCU
14. Law No. 6360 on the Abolishment of Special Provincial Administrations
15. Law No. 6525 on Public Financing and Debt Management enabling the Governorship of Istanbul to continue to disburse loans originally allocated to ISPA

Annex 7. Pictures

Picture A. Command Control and Coordination Center (Disaster Management Center, Hasdal, Istanbul)

Picture B. School reconstructed under ISMEP

Picture C. Internal reinforced concrete shear walls (school retrofit)

Picture D. External reinforced concrete shear walls (school retrofit)

Picture E. Reconstructed hospital

MAP


TURKEY
PROVINCE CAPITALS*
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
PROVINCE BOUNDARIES*
INTERNATIONAL BOUNDARIES
*Province names are the same as their capitals.
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
TURKEY
BULGARIA
RUSSIAN FEDERATION
GEORGIA
AZER-BAIJAN
ARMENIA
ISLAMIC REP. OF IRAN
IRAQ
SYRIAN ARAB REPUBLIC
GREECE
Black Sea
Mediterranean Sea
Sea of Marmara
Gulf of Antalya
Lake Van
Kuzey Anadolu Daglari
Toros Daglari
ANKARA
Istanbul
Izmir
Edirne
Kirklareli
Tekirdag
Canakkale
Balikesir
Bursa
Bilecik
Eskisehir
Kutahya
Manisa
Uscak
Aydin
Denizli
Mugla
Burdur
Isparta
Afyon
Konya
Antalya
Karaman
Mersin
Adana
Hatay (Antakya)
Osmaniye
Kahramanmaras
Gaziantep
Sanliurfa
Kilis
Adiyaman
Malatya
Elazig
Tunceli
Bingol
Mus
Bitlis
Van
Siirt
Batman
Diyarbakir
Mardin
Sirnak
Hakkari
Erzincan
Erzurum
Agri
Igdir
Kars
Ardahan
Artvin
Agri Dagi (5,166 m)
Trabzon
Rize
Giresun
Ordu
Samsun
Sinop
Bartin
Zonguldak
Karabük
Kastamonu
Cankiri
Corum
Amasya
Tokat
Gumüshane
Bayburt
Sivas
Yozgat
Kirikkale
Kirsehir
Nevsehir
Kayseri
Aksaray
Nigde
Karaman
Düzce
Bolu
Sakarya (Adapazari)
Yalova
Kocaeli (Izmit)
Tekirdag
Kirklareli
Edirne
Istanbul Strait (Bosphorus)
Canakkale Strait (Dardanelles)
Black Sea
Mediterranean Sea
Sea of Marmara
Gulf of Antalya
Lake Van
Kuzey Anadolu Daglari
Toros Daglari
0 50 100 150 200 Kilometers
0 50 100 150 Miles
26°E
28°E
30°E
32°E
34°E
36°E
38°E
42°E
44°E
42°N
40°N
38°N
36°N
JULY 2008
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