

10.1.9. Area Identification of Building and Urban Structure Issues

Based on the 6 vulnerability analyses of buildings and urban structures, vulnerabilities were assessed and compiled into 4 categories as follows:

- 1) **Mahalles with Building and Urban Structure Vulnerabilities:** 361 mahalles (56% of the Study Area).

This group of identified mahalles has both serious vulnerability issues of weak building structures and inappropriate urban structures. More than half of the mahalles in the districts along the Marmara Coast and inland areas of the European side belong to this category. In the 11 districts identified as most serious (Emmönü, Fatih, Beyoglu, Zeytinburnu, Güngören, Bağcılar, Küçükçekmece, Adalar, Maltepe, Pendik, and Tuzla), over 80% of the population or urbanized areas in each district reside in this category of mahalles.

A combination of drastic measures is required to strengthen both the vulnerabilities of buildings and urban structures for the identified 361 mahalles.

- 2) **Mahalles with Urban Structure Vulnerabilities:** 39 mahalles (6%).

400 mahalles found to have serious urban structure vulnerabilities are almost covered by the above category (1), “mahalles with building and structure vulnerabilities.” The remaining 39 mahalles without serious building structure issues are distributed over the central part of the Study Area.

- 3) **Mahalles with Building Structure Vulnerabilities:** 51 mahalles (8%).

412 serious mahalles with building structure vulnerabilities are almost covered by the above category (1), “mahalles with building and structure vulnerabilities.” The remaining 51 mahalles are widely distributed along the Marmara Coast of European and in Asian and European inland areas.

- 4) **Other Mahalles:** 191 mahalles (30%)

The 191 mahalles categorized as “other mahalles” do not have the above serious building and urban structure issues. However, these mahalles have the following issues and characteristics:

- Less than 10% of buildings in mahalle were estimated as having heavy or moderate building damages.

- Serious urban structure issues were not found in the mahalle, or the mahalle was not yet urbanized.
- Specific or detailed issues in the area should be considered in the development of the district urban disaster prevention plan.

Table 10.1.9 Identified Mahalle/Residents/Urbanized Area by Type of Building/Urban Structure Issues

Area	District		Issuable Mahalle on Building/Urban Structure				Issuable Mahalle on Urban Structure				Issuable Mahalle on Building Structure				Other Mahalles							
	Code	Name	Mahalle	Population (noaa)		Urbanized Area (ha)		Mahalle	Population (noaa)		Urbanized Area (ha)		Mahalle	Population (noaa)		Urbanized Area (ha)						
				(%)	(%)	(%)	(%)		(%)	(%)	(%)	(%)		(%)	(%)							
Old Town	12	EMİNÖNÜ	27	46	83	365	81	3	6	11	39	9	0	0	0	0	3	3	5	49	11	
	14	FATİH	67	393	100	966	98	0	0	0	0	0	2	1	0	16	2	0	0	0	0	
	7	BEYOĞLU	39	190	81	706	85	5	41	17	117	14	0	0	0	0	1	5	2	5	1	
	Sub-Total		133	628	92	2,036	90	8	47	7	156	7	2	1	0	16	1	4	7	1	54	2
Europe: Marmara Coast	32	ZEYTİNBURNU	10	200	83	701	75	0	0	0	0	0	3	40	17	238	25	0	0	0	0	0
	4	BAKIRKOY	9	68	33	537	33	0	0	0	0	0	6	139	67	1,076	67	0	0	0	0	0
	15	CÜNGÖREN	10	250	92	598	88	0	0	0	0	0	1	22	8	80	12	0	0	0	0	0
	3	BAHÇELİEVLER	8	352	75	676	47	0	0	0	0	0	3	118	25	754	53	0	0	0	0	0
	2	AVCILAR	6	174	75	1,069	70	0	0	0	0	0	2	44	19	297	19	1	14	6	165	11
Sub-Total		43	1,043	73	3,581	58	0	0	0	0	0	15	362	26	2,445	39	1	14	1	165	3	
Europe: Bosphoras	8	BESİKTAŞ	4	26	14	227	15	3	22	12	46	3	1	2	1	48	3	15	132	72	1,195	79
	19	KAĞITANE	6	100	29	279	23	2	33	10	98	8	2	43	12	362	30	9	167	49	483	40
	26	ŞİŞLİ	7	58	21	185	13	3	36	13	98	7	1	3	1	33	2	17	175	65	1,159	79
	23	SARIYER	0	0	0	0	0	1	5	2	56	3	0	0	0	0	0	22	208	98	2,040	97
	Sub-Total		17	0	0	691	11	9	96	12	299	5	4	47	6	444	7	63	683	83	4,878	77
Europe: Inland	13	EYÜP	7	90	39	652	43	6	64	28	304	20	2	8	4	174	11	5	70	30	391	26
	16	GAZİOSMANPAŞA	7	162	24	602	25	6	115	17	326	13	0	0	0	0	16	391	58	1,529	62	
	10	BAYRAMPAŞA	7	147	62	432	57	0	0	0	0	0	3	74	31	279	37	1	16	7	50	7
	902	ESENLER	12	284	73	523	51	0	0	0	0	0	1	3	1	18	2	5	101	26	482	47
	5	BAĞCILAR	21	517	93	1,831	94	0	0	0	0	0	0	0	0	0	0	1	40	7	108	6
	20	KÜÇÜKÇEKMECE	19	505	86	2,414	58	0	0	0	0	0	1	12	2	114	3	3	72	12	1,611	39
Sub-Total		73	1,705	64	6,455	55	12	179	7	631	5	7	98	4	585	5	31	690	26	4,171	35	
Total/Average of European Side		266	3,376	60	12,763	48	29	322	6	1,085	4	28	509	9	3,489	13	99	1,395	25	9,268	35	
Asian: Marmara Coast	1	ADALAR	6	18	100	356	100	0	0	0	0	0	0	0	0	0	5	0	0	0	0	
	17	KADIKOY	16	431	65	2,245	64	5	73	11	395	11	5	119	18	609	17	2	38	6	281	8
	21	MALTEPE	14	257	74	1,855	80	0	0	0	0	0	3	70	20	277	12	4	19	5	180	8
	18	KARTAL	14	242	73	1,995	76	0	0	0	0	0	5	76	23	480	18	1	14	4	144	6
	22	PENDİK	25	334	90	3,037	85	0	0	0	0	0	2	26	7	161	5	2	13	4	361	10
	28	TUZLA	8	82	81	1,622	82	0	0	0	0	0	2	19	19	337	17	1	0	0	21	1
Sub-Total		83	1,363	75	11,110	77	5	73	4	395	3	17	309	17	1,865	13	15	85	5	986	7	
Asian: Bosphoras	30	ÜSKÜDAR	7	28	6	144	4	5	37	7	115	4	2	40	8	183	6	40	392	79	2,805	86
	6	BEYKOZ	2	10	5	150	6	0	0	0	0	0	0	0	0	0	17	173	95	2,189	94	
	29	ÜMRANİYE	2	72	16	368	10	0	0	0	0	0	0	0	0	0	12	371	84	3,232	90	
	Sub-Total		11	110	10	662	7	5	37	3	115	1	2	40	4	183	2	69	936	83	8,226	90
Total/Average of Asian Side		94	1,473	50	11,772	50	10	109	4	510	2	19	349	12	2,048	9	84	1,021	35	9,212	39	
Outside IMM	9	BUYÜKÇEKMECE	1	0	NA	69	15	0	0	NA	0	0	4	0	NA	376	84	1	0	NA	2	0
	903	ÇATALCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	100	426	100	
	904	SİLİVRİ	0	0	0	0	0	0	0	0	0	0	0	0	0	5	44	100	841	100		
	Sub-Total		1	0	0	69	4	0	0	0	0	0	4	0	0	376	22	8	60	100	1,268	74
Total		361	4,849	56	24,603	47	39	431	5	1,595	3	51	858	10	5,913	11	191	2,476	29	19,748	38	

Source: The JICA Study Team

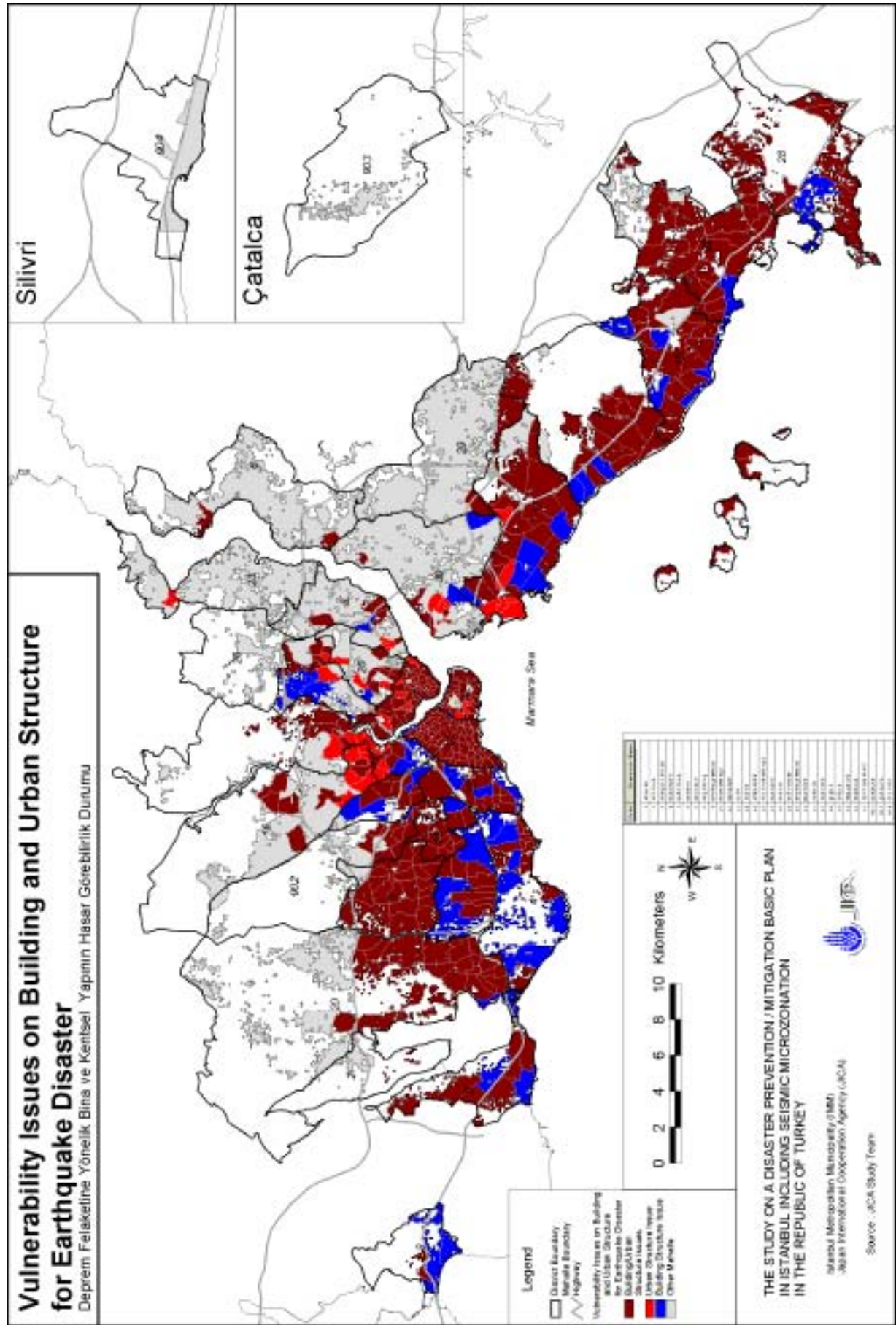


Figure 10.1.9 Building and Urban Structure Vulnerability Issues

10.2. Recommended Measures to Strengthen Vulnerable Buildings and Urban Structures

To address the assessed vulnerability issues, improvement measures for vulnerable buildings and urban structures are principally composed as follows:

1) Measures to Improve Vulnerable Building Structures

- Implementation of proper seismic-resistant diagnoses and formulation and implementation of building structure improvement plans for disaster management centres, emergency response centres, emergency goods related centres, and public facilities.
- Reinforcement of building structures of identified public and government facilities.
- Reconstruction of identified public and government facilities.
- The introduction, modification, and establishment of preliminary seismic resistance assessment systems for private housing.
- The implementation of preliminary seismic resistant assessments for private buildings.
- The acquisition of resources and establishment of a recyclable funding system for private sector building reinforcement and reconstruction (especially for weak building structures identified by the preliminary seismic resistant assessment).
- The implementation of building structure reinforcement or reconstruction projects for private housing/commercial buildings by groups of street blocks.
- All of the above required and improvement measures should be coordinated within the formulation of metropolitan and local (district) disaster prevention plans.

2) Measures to Improve Vulnerable Urban Structures

- Widening of narrow road (2 to 6 m in width) to the appropriate for evacuation and emergency operations.
- Widening of designated emergency road networks to function in an emergency case (without the need for debris removal).
- Widening and safety measures of designated evacuation routes (they should be set in the local/district disaster prevention plan).
- Standardized parks and open space development to provide safety evacuation areas and recreational spaces for citizens.

- Reducing excessive land/building use conditions (especially, high building coverage, which can negatively impact efforts of safety evacuation).

The assessed and identified vulnerability issues are grouped into 4 categories as follows:

- Issue 1: Urban/Building Structure Vulnerability
- Issue 2: Urban Structure Vulnerability
- Issue 3: Building Structure Vulnerability
- Issue 4: Particular Building Structure Vulnerability

The recommended principal measures to solve the issues of building and urban structure vulnerability should be well coordinated and combined to meet with the present characteristics of issues and their combinations.

Strategic Measures for Issue 1: two strategic measures will be required to solve the complex issues of building and urban structure vulnerability.

- Combined/coordinated measures to strengthen identified vulnerabilities of building structures and urban structures.
- Urban reconstruction measures to address the lack of available land for urban structure improvement projects.

Strategic Measures for Issue 2: the following strategic measures will also be required to solve issues of urban structure vulnerability.

- Intensive measures to strengthen urban structure vulnerability.
- Urban reconstruction measures to address the lack of available land for urban structure improvement projects.
- Supplemental measures for individual building structure improvements are also required to strengthen estimated building damages (10% to 30% of heavy and moderate).

Strategic Measures for Issue 3: the identified and recommended measures to improve building structures are fully required to be implemented on buildings of estimated high building damage (more than 30% of heavy and moderate). Also, some urban improvement measures will be required as supplements for non-serious urban structure issues, which should be also examined in detail during the formulation of the local disaster prevention plan.

Strategic Measures for Issue 4: some of the identified and recommended measures to improve building structures will be required to improve the individually estimated building damages (less than 10% of heavy and moderately damaged). Some urban improvement measures will be required as supplements for non-serious urban structure issues, which should be also examined in detail during the formulation of the local disaster prevention plan.

10.2.1. Specialized Improvement Measures for Designated Conservation Areas

Presently, identified archeological heritage, historical, and traditional urban fabrics, and natural environmental resources are grouped into one of four categories of area conservation systems as follows:

- **Area Conservation 1:** Archeological Area (eastern top of the Istanbul Peninsula)

All archeological heritage sites at ground level and underground within the designated areas are strictly protected and all activities of development or redevelopment are completely controlled by the boards of conservation.
- **Area Conservation 2:** Historical Urban Area (inside the Walled City, Beyoğlu, and Eyüp, and towns in Adalar islands, etc.)

Designated historical buildings and their surrounding buildings and traditional alleyways are the main objects of conservation.
- **Area Conservation 3:** Historical Scenery Conservation Areas (along the Bosphorus Strait, includes districts of European and Asian Bosphorus areas)

Facade control for waterfront buildings and height and scenery control for the hinterland within visible areas from the Bosphorus Strait sea level.
- **Area Conservation 4:** Natural Environmental Resources (hinterland of Area Conservation 3: Bosphorus, Adalar Islands, etc.)
- Mixed area conservation of the above

In addition, the Istanbul Peninsula and the Chronological Walled City of Constantinople/Istanbul, including the districts of Eninönü and Fatih, were registered as World Heritage sites by UNESCO in 1992.

Some recommended measures to improve the identified vulnerability issues of building and urban structures contradict the regulations of some area conservation systems (especially those of the Historical Urban Conservation Areas). Thus, specialized or modified improvement measures for identified vulnerabilities are required.

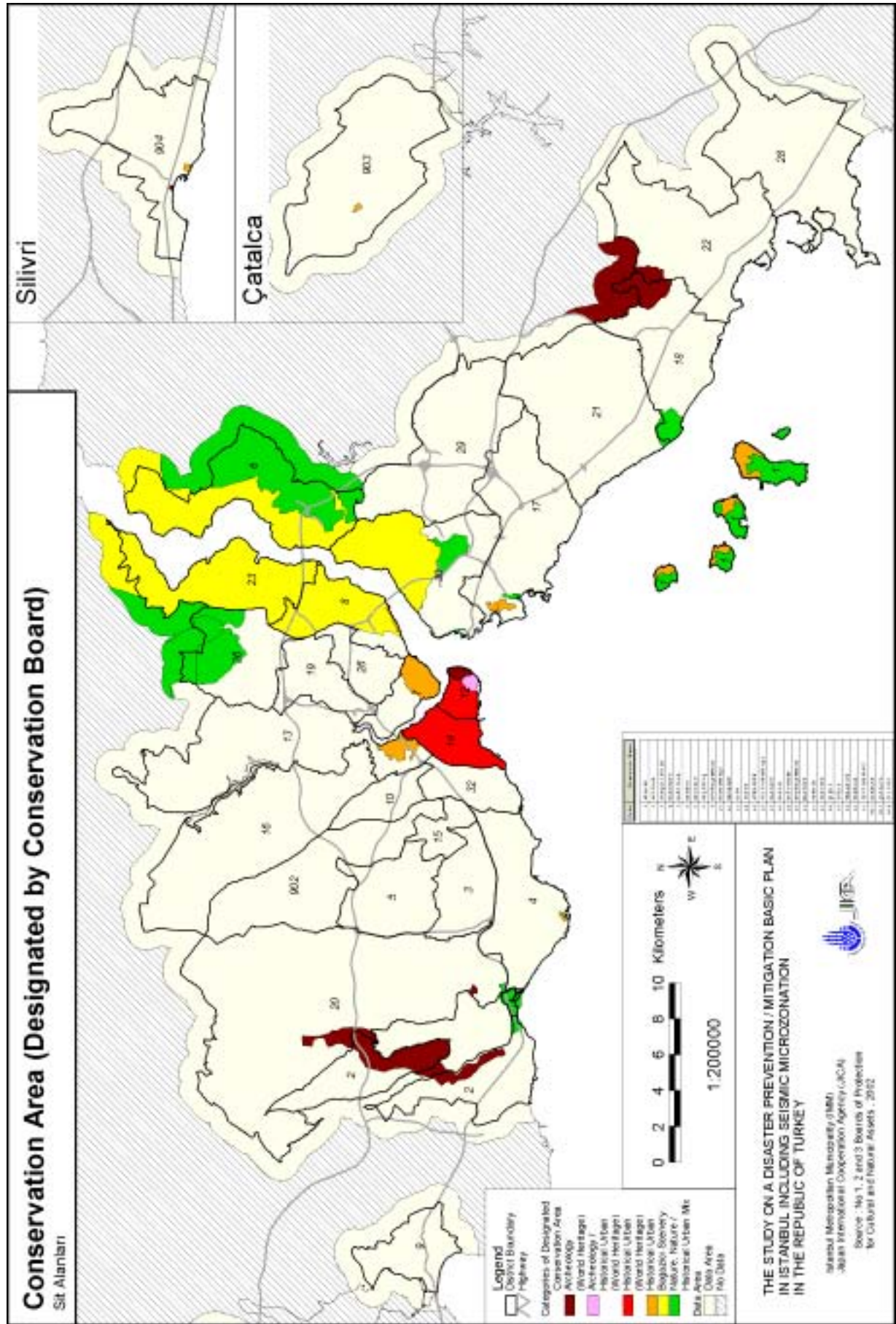


Figure 10.2.1 Conservation Areas (Designated by the Conservation Board)

(1) Archeological Area Conservation

Existing Condition: In the Study Area, 7 small and major archeological areas, in which all private and public development and improvements are strictly controlled by the Boards of Conservation, the IMM, and local governments, were identified.

The most serious contradiction between conservation and improvement measures identified concern the Tarihi Yarymada Archeological Conservation Area (Topkapi and its surroundings) and the Mixed Archeological/Historical Urban Conservation Area (Ayasofiya/Sultanahmet, Camii, and surroundings) at the top of the Istanbul Peninsula, which also includes areas registered as world heritage sites. Both designated areas are assessed as having mahalles with serious building and urban structure vulnerabilities.

Measures to improve the safety of the environment for residents (population of approximately 12,500) would be required of responsible agencies and of the IMM as follows:

- Reinforcement, restoration or reconstruction of assessed weak structures/buildings (public and private) by the authority.
- Modification of parks and gardens to serve as potential evacuation areas.
- Improvement of existing road/alleyway network to serve as evacuation routes and emergency vehicle access roads.
- The above required safety measures should be incorporated into the Archeological Conservation Plan and Programme for both areas (as part of a specialized disaster prevention plan for strictly controlled areas).

In addition, the following incentive measures to revitalize socioeconomic activities and to compensate for the strict control measures in the area are also recommended to the government authorities:

- Right to purchase properties by the authority.
- Subsidy for conservation/beautification activities.
- Exemption of real estate tax in the area, etc.

In the Avcilar district, huge areas on the west-coast of the lake are designated as Archeological Conservation areas, which are also planned and designated as tent village areas for homeless victims and as helipads within the Provincial Disaster Management Plan. Some infrastructure development (water pipes/tanks, sewage treatment facilities, and

helipads) can negatively impact buried archeological heritages. The permanent and heavy weight facility development within a disaster management plan will be required to coordinate with the archeological conservation plan.

(2) Historical Urban Conservation

Designated Historical Urban Conservation areas are assessed and categorized as areas having serious building and urban structure vulnerabilities. In order to minimize and mitigate the estimated damage, improvement measures to strengthen the identified vulnerabilities are critical and describes as follows:

Vulnerability Issues	Required Improvement Measures	Regulation for Conservation
Old/weak structures/buildings: high building damage and human casualties ratio	Seismic resistance assessment, reconstruction/ reinforcement	Conserve registered historical building or selected building group
Narrow alleyways: cannot be used as safety evacuation routes or for emergency vehicle access	Road widening or additional (new) road development	Conserve selected alleyway streetscapes and no widening of roads or construction of new roads

The recommended improvement measures for buildings and urban structures are unacceptable according to the present and strict Historical Urban Conservation regulation. Based on this situation, modification of the recommended improvement measures and, also, some modification of zoning regulations for the conservation areas would be required to harmonize conservation and disaster prevention as follows:

a. Existing Condition

Almost all of the designated historical urban conservation areas are assessed as having mahalles with the most serious building and urban structure vulnerabilities. The identified vulnerability issues contradict the objectives of the conservation of Istanbul's traditional Historic District as follows:

- Non building set-back or alley overhang to create shaded alleyway
- Specialized arch-type with patio to create inner sphere
- Chaotic alley network reflecting an old society (before the 20 century)

All of these recommended earthquake disaster preparedness measures, which would contribute to the safety of residents in the 21st century, contradict conservation objectives. In addition, some of the nation's capital functions are located in and overlap on the designated conservation areas, and these areas will be considered as having national risk in the event of an earthquake disaster.

Based on the above condition, specialized improvement measures for designated Historical Urban Conservation areas are recommended as follows:

b. Istanbul Peninsula within City Wall (Eminonu and Fatih):

The designated areas, also registered as World Heritage sites were part of the chronological walled capital from times of the Byzantine to Ottoman Empires. Istanbul citizens and Turkish people regard this area as the heart of Istanbul or Old Town. On the other hand, almost all of the mahalles in the area are assessed as having mahalles with serious building and urban structure vulnerabilities in the previous analysis. Under this condition, the IMM is formulating a conservation plan for the area under the regulation of the Conservation Board.

It is recommended that the following aspects be incorporated into the conservation plan:

Regulation: The current designated area is too large (15.5km², half million population, including some functions of a capital city) to be covered and managed by a single area conservation system. The following prioritized conservation zoning system, broken out by conservation areas, roadways, and specific locations, is recommended:

Prioritized Area Conservation: Two or three levels of archeological/historical conservation zoning systems are recommended. The Primary Zone, or the centrally important Istanbul Historic District, could be identified as the designated Tarihi Yaryamada Archeological/Historical Urban Conservation Area. The Secondary Zone of conservation could be 14 areas, which have been identified by the authority and IMM Study Team, as shown in the following figure. Lastly, the Tertiary Zone could be the other areas within the City Walls and would include regulations for building height, floor area ratio, and façade material/color control that would ensure a harmony with the historical urban surroundings.

Line Conservation: It is recommended that a traditional alley-scape conservation system be applied for prioritized and selected alley networks, which could be main radial alleys to the gates and some main north-south connection alleys. Conservation of all alleyways in the Historical Peninsula is a very important factor. However, it should only be applied selectively and not be applied to all alley networks. Otherwise it may generate serious impediments for the entire Historic District in the 21st Century.

Spot Conservation: Historical monuments, buildings, and memorial places are registered and listed by the authority.

- **Measure to Enhance/Support Improvement Activities of Vulnerable Building Stock:** At present, the process has been started in part of the designated historical urban conservation area. Enhancement and/or supporting measures to reconstruct the remaining weakened buildings and non-seismic resistant buildings in the area (almost all estimated as heavily/moderately damaged buildings) are an indispensable requirement to mitigate disaster damages and to stop the growth of slums and ghost towns.

- **Measure to Revitalize Istanbul's Historic District and to Provide Safety Network:** The implementation of physical measures, such as road and infrastructure improvements are an indispensable necessity to revitalize socio-economic activities in the area.

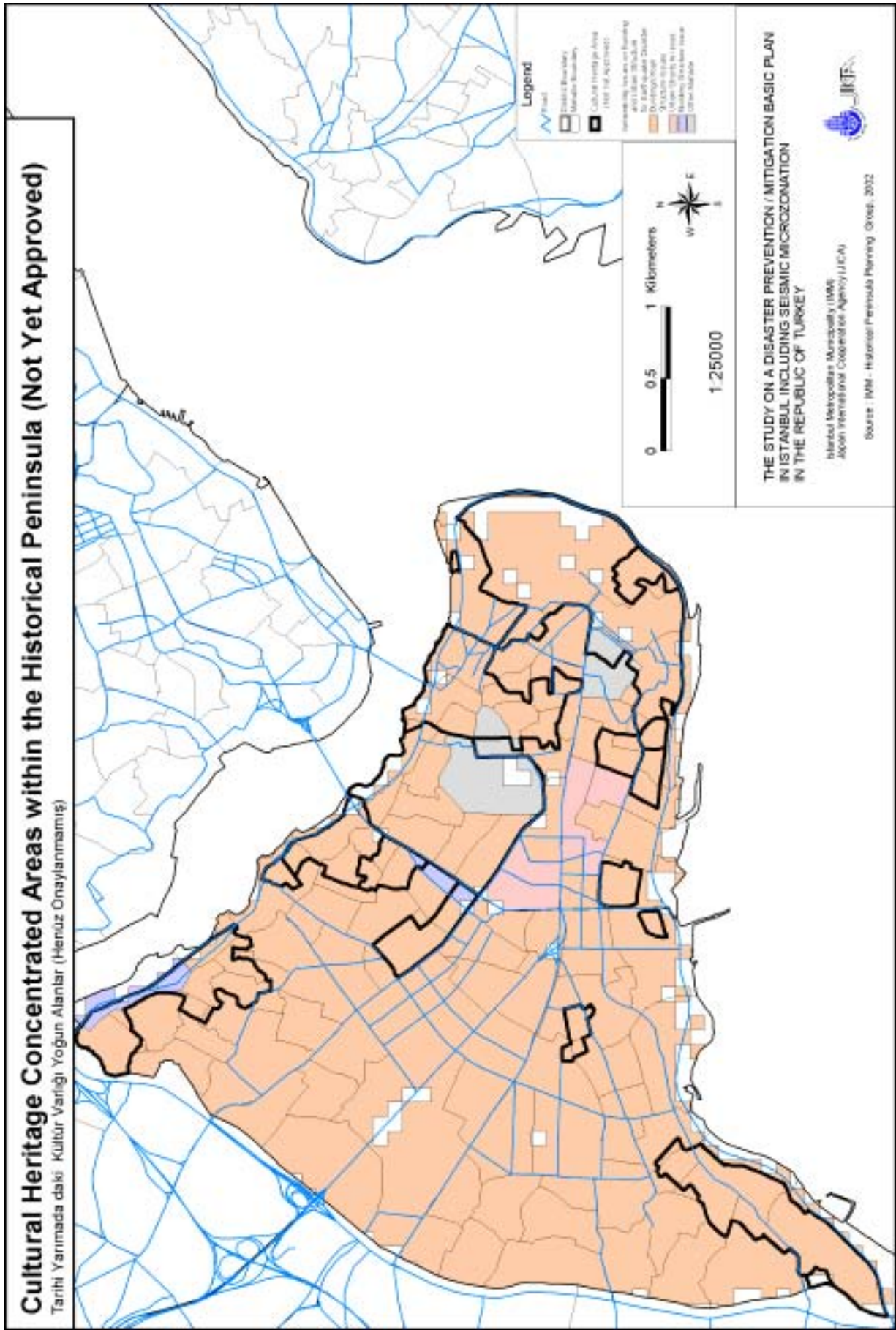


Figure 10.2.2 Cultural Heritage Concentrated Area within the Historical Peninsula

c. Deteriorated Urban/Building Structure in Beyoğlu:

Existing Condition: The designated area is also too large (approximately 3.6 km², population of 77,000 and including some socio-economic capital functions), to be covered and managed by a single method of area conservation system. Almost all of the mahalles in the area are assessed as having serious building and urban structure vulnerabilities. Only the areas along main streets have been reconstructed and revitalized by new arterial road development after 1900. However, in the other areas, building renewal has been overly delayed. The remaining weak buildings create slum and ghost town conditions, with some building collapses occurring on an ongoing basis. A conservation plan has not yet been formulated for this area.

The following measures are recommended to improve safety conditions for residents. The measures should be incorporated with the formulation of the conservation plan for the area in the near future.

- **Regulation:** The same area, line and spot based zoning regulation systems are recommended as with the historical peninsula. recommended
- **Measures to Enhance/Support Improvement Activities of Vulnerable Building Stock:** Currently, the growth of slums and ghost towns has clearly occurred in a part of the designated historical urban conservation area. Enhancements or supporting measures to reconstruct the remaining old building stock in the area (estimated as heavily/moderately damaged buildings) are required indispensable measures to mitigate disaster damage and to stop the growth of slums and ghost towns.
- **Measures to Revitalize the Historic District and to Provide a Safety Network:** The implementation of physical measures, such as road and infrastructure improvements, are an indispensable necessity to revitalize socio-economic activities in the area.

d. Eyüp

It is also inappropriate to use a single conservation system for the designated area of Eyüp (1.8km² with 30,000 residents). It is adjacent to the northern part of the historical peninsula area along Golden Horn Bay. The designated area is assessed into three categories of vulnerable mahalles: building/urban structure, urban structure, and building structure. The authority is restoring the traditional wooden building reconstruction in part of the designated area.

The same zoning regulation systems and improvement measures recommended for the historical peninsula are also recommended for this area.

e. Old Kadıköy

This designated area is not as large an area as the front of the bay. However, road and land use conditions are especially hazardous for the area, and have been assessed as having mahalles with the most serious vulnerability to earthquake disaster. In particular, narrow streets impair safety evacuations and emergency vehicle operation, especially when the debris of collapsed and damage buildings is piled on the streets. For this situation, measures to improve the identified issues may be select from the following possible solutions:

Solution 1: Reconstruct or reinforce all weak building structures in the area. This includes structures with seismic resistance sufficient to withstand the estimated earthquake motions, able to avoid building damage, and able to not disrupt road functions.

Solution 2: A moderate mix of Solution 1 and Solution 3.

Solution 3: The widening of narrow roads and the development of new parks to facilitate evacuation through the use of structural improvements or redevelopment measures. Additionally, building structure improvement measures to strengthen the estimated 10 to 20% of heavily and moderately damaged buildings identified through the preliminary structural assessment.

f. Adalar Islands

The Adalar islands are designated as nature conservation areas (mountainous areas) or historical urban conservation areas (settlement areas), and were almost all developed in the 19th century. Nonetheless, the assessed vulnerability of building and urban structures in this historical urban conservation areas is very serious. The following is an overview of some of the vulnerability:

- Estimated earthquake motion and building damages are worst in the Study Area. Damages are based on the location closest to the active fault.
- More than 80% of the existing roads in the islands are narrow.
- The port facilities are not strong enough structures to withstand the estimated seismic motion and liquefaction potential, Thus, there exists the potential for the islands to be isolated.

The same zoning regulation systems and improvement measures recommended above are also recommended for this area.

(3) Bosphorus Historical Scenery Conservation

The designated areas of the Bosphorus Historical Scenery Conservation include large tracts on both sides of the European and Asian continents. However, the objects of conservation and regulation for this category do not conflict with the recommended measures to improve the most serious building and urban structure vulnerabilities.

(4) Natural Environmental Resources Conservation

The designated nature conservation areas are typically natural forests or nature oriented land use areas. Issues of building and urban structure vulnerabilities are not identified in the designated nature conservation areas.

10.2.2. Land Availability for Urban Structure Improvements

The availability of land and current land/building use in each mahalle are key factors in selecting strategic measures of urban structure improvements and urban reconstruction. In this study, the analysis is composed of two fields: Built-up Area (urbanized area) Ratio and Building Coverage Ratio.

The Built-up Area Ratio will show the proportion between vacant land and the use of land without buildings in the mahalle. This may become a part of the formula for urban structure improvements, especially for parks and open spaces.

The Building Coverage Area Ratio will show the average frontage setback condition in the mahalle, which may also determine if a mahalle is a candidate for the widening of narrow roads, emergency road network and evacuation routes. The statistical analysis used alone is limited in its ability to identify the required land available for road widening. Instead, it should be studied and examined along with a detail base map as part of the formulation of metropolitan and local disaster prevention plans.

(1) Built-up Area Ratio

The built-up area is estimated based on the building database of the IMM GIS Base Map Information collected by the JICA Study Team. Results of the analysis are assessed and compiled into 5 categories as follows:

- **100% Developed:** 174 mahalles (27% of the Study Area) with 50 km² of urbanized areas are fully developed. In these mahalles, the required extra land for urban improvements is not available.

- **95-99% Developed:** 130 mahalles (13% of the Study Area) with 91 km² of urbanized area are almost fully developed. In these mahalles, the land availability condition is almost the same as that of the above category.
- **90-94% Limited Remaining Land:** in the 84 mahalles (13% of the Study Area) with 74 km² of urbanized area, 5 to 10% of undeveloped lands in these mahalles may be candidates for urban improvements.
- **80-89% Available Land:** in the 95 mahalles (15% of the Study Area) with 94 km² of urbanized area, 10 to 20% of undeveloped lands in these mahalles may be candidates for urban improvements.
- **Less 80%:** 154 mahalles (24% of the Study Area) with 210 km² of urbanized areas are understood to be in an underdeveloped stage. The identified urban structure issues may be solved in future development stages.

Table 10.2.1 Built-up (Urbanized) Area Ratio by Mahalle

Area	District		5. 100%			4. 95-99%			3. 90-94%			2. 80-89%			1. less 80%			Unknown	Total Urbanized Area
	Code	Name	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)		
Old Town	12	EMİNÖNÜ	13	112	25	7	84	19	3	52	12	6	98	22	4	105	23	0	452
	14	FATİH	43	561	57	9	155	16	5	107	11	7	74	8	5	84	9	0	982
	7	BEYOĞLU	25	326	39	6	132	16	6	135	16	6	142	17	2	93	11	0	828
	Sub-Total		81	1,000	44	22	371	16	14	294	13	19	315	14	11	282	12	0	2,262
Europe: Marmara Coast	32	ZEYTİNBURNU	5	159	17	2	102	11	1	36	4	2	371	39	3	271	29	0	939
	4	BAKIRKÖY	0	0	0	5	260	16	0	0	0	1	258	16	9	1,095	68	0	1,613
	15	CÜNGÖREN	4	127	19	5	390	58	1	67	10	0	0	0	1	93	14	0	677
	3	BAHÇELİEVLER	2	189	13	4	279	20	3	391	27	1	285	20	1	286	20	0	1,430
	2	AVCILAR	0	0	0	2	176	11	0	0	0	3	392	26	4	963	63	0	1,531
	Sub-Total		11	476	8	18	1,208	20	5	494	8	7	1,305	21	18	2,709	44	0	6,191
Europe: Bosphoras	8	BESİKTAŞ	3	84	6	5	256	17	4	307	20	7	495	33	4	375	25	0	1,517
	19	KAĞITANE	7	219	18	6	348	28	1	99	8	2	147	12	3	408	33	0	1,221
	26	ŞİŞLİ	11	243	16	4	151	10	4	161	11	2	129	9	7	792	54	0	1,476
	23	SARIYER	0	0	0	4	268	13	3	181	9	5	578	28	11	1,069	51	0	2,096
	Sub-Total		21	546	9	19	1,023	16	12	749	12	16	1,350	21	25	2,643	42	0	6,311
Europe: Inland	13	EYÜP	3	113	7	4	315	21	3	171	11	2	160	11	8	762	50	0	1,522
	16	GAZİOSMANPAŞA	8	464	19	8	672	27	4	235	10	2	244	10	7	843	34	0	2,458
	10	BAYRAMPAŞA	3	188	25	2	126	17	0	0	0	3	170	22	3	277	36	0	761
	902	ESENLER	6	231	23	3	167	16	2	111	11	1	58	6	6	455	45	0	1,022
	5	BAĞCILAR	7	371	19	6	457	24	4	330	17	3	350	18	2	431	22	0	1,939
	20	KÜÇÜKÇEKMECE	3	138	3	8	579	14	4	532	13	1	313	8	7	2,577	62	0	4,139
	Sub-Total		30	1,505	13	31	2,316	20	17	1,380	12	12	1,296	11	33	5,344	45	0	11,841
Total/Average of European Side		143	3,526	13	90	4,918	18	48	2,916	11	54	4,265	16	87	10,979	41	0	26,605	
Asian: Marmara Coast	1	ADALAR	5	346	97	0	0	0	0	0	0	0	0	0	1	9	3	5	356
	17	KADIKÖY	2	237	7	10	1,046	30	6	965	27	9	975	28	1	306	9	0	3,530
	21	MALTEPE	0	0	0	7	705	30	4	400	17	3	498	22	7	709	31	0	2,312
	18	KARTAL	2	85	3	6	710	27	4	550	21	2	330	13	6	944	36	0	2,619
	22	PENDİK	4	235	7	4	430	12	5	718	20	6	719	20	10	1,457	41	0	3,559
	28	TUZLA	0	0	0	0	0	0	0	0	0	3	284	14	8	1,696	86	0	1,980
	Sub-Total		13	904	6	27	2,891	20	19	2,634	18	23	2,806	20	33	5,121	36	5	14,356
Asian: Bosphoras	30	ÜSKÜDAR	17	432	13	9	516	16	10	812	25	8	746	23	10	742	23	0	3,247
	6	BEYKOZ	0	0	0	1	87	4	4	454	19	4	366	16	10	1,433	61	0	2,340
	29	ÜMRANİYE	1	124	3	2	249	7	3	618	17	3	1,024	28	5	1,585	44	0	3,600
	Sub-Total		18	556	6	12	852	9	17	1,883	21	15	2,136	23	25	3,759	41	0	9,186
Total/Average of Asian Side		31	1,460	6	39	3,743	16	36	4,517	19	38	4,942	21	58	8,880	38	5	23,542	
Outside IMM	9	BÜYÜKÇEKMECE	0	0	0	0	0	0	0	0	2	145	32	4	302	68	0	446	
	903	ÇATALCA	0	0	0	0	0	0	0	0	0	0	0	2	426	100	0	426	
	904	SİLİVRİ	0	0	0	1	433	52	0	0	0	1	11	1	397	47	0	841	
	Sub-Total		0	0	0	1	433	25	0	0	0	3	156	9	9	1,124	66	0	1,713
Total		174	4,986	10	130	9,094	18	84	7,434	14	95	9,363	18	154	20,983	40	5	51,860	

Source: JICA Study Team

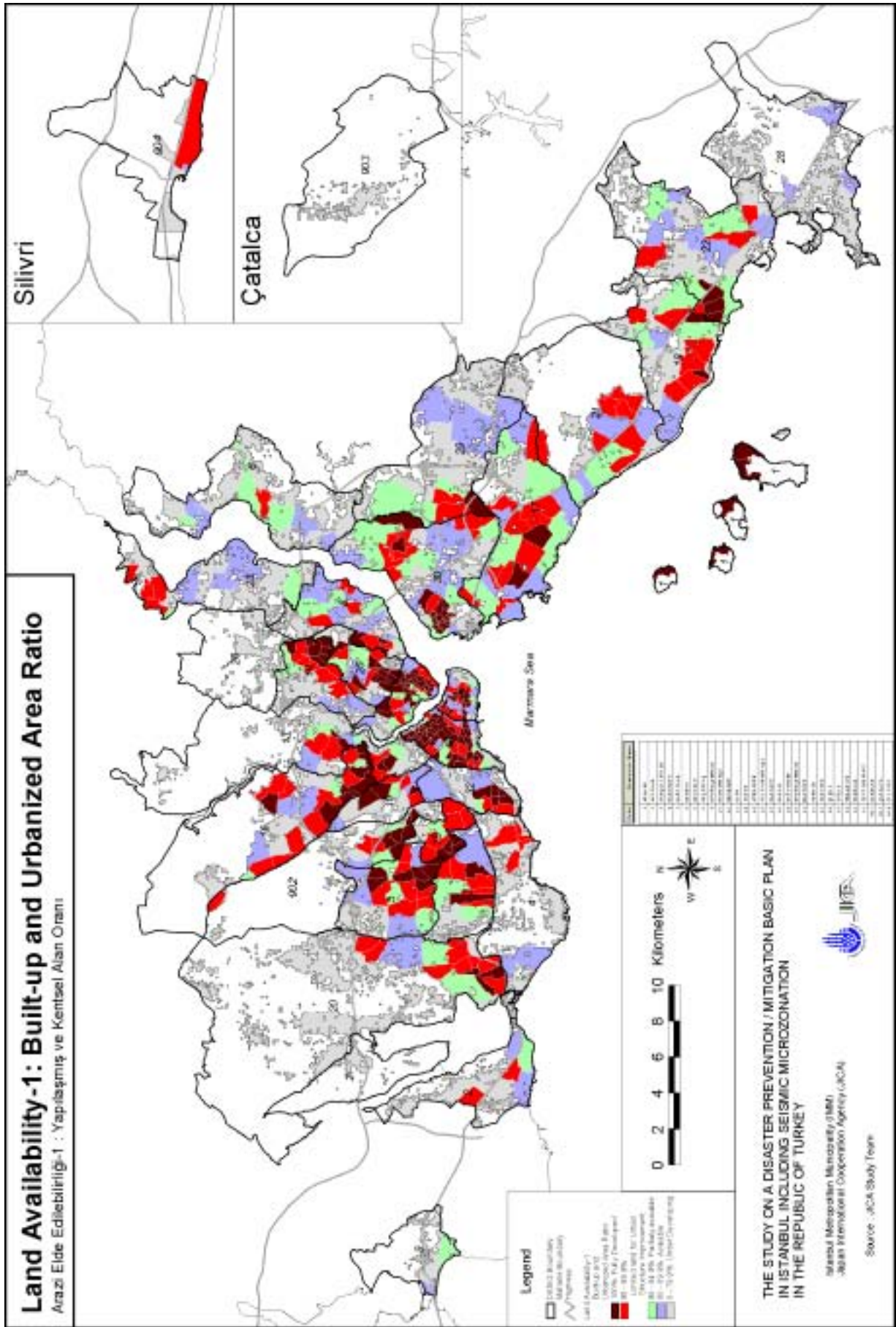


Figure 10.2.3 Built-up (Urbanized) Area Ratio

(2) Building Coverage Ratio

The average building coverage ratio of the mahalle is estimated by the JICA Study Team based on the plot area and building coverage area obtained from the 2000 Building Census. Results of the analysis executed to assess the land availability for urban structure improvements are compiled into the following five categories:

- **Over 90% - Full Coverage:-** In 40 mahalles (6% of the Study Area) with 6 km² of urbanized area, almost all of the plots are covered fully by buildings. In these mahalles, the required spare land for urban improvements is not available.
- **80-89% - High Coverage-1:-** In 72 mahalles (11% of the Study Area) with 15 km² of urbanized area, again, almost all of the plots are fully covered by buildings. In these mahalles, land availability conditions are the same as that of the above category.
- **70-79% - High Coverage-2:-** In 90 mahalles (14% of the Study Area) with 34 km² of urbanized area, some areas may be candidates for road widening projects. However, these areas will not be enough to meet the demand.
- **60-69% - Moderate Coverage:-** In 119 mahalles (19% of the Study Area) with 68 km² of urbanized area, 10 to 20% of the areas may be candidates for urban structure improvement.
- **Less than 60% - Moderate to Low Coverage: -**In 316 mahalles (49% of the Study Area) with 397 km² of urbanized area, the required available land for urban structure improvements may be identified in the setback areas. The availability of this land should be checked and planned in detail as part of the formulation of the local disaster prevention plan.

The mahalles with the highest building coverage ratio are almost all located on the European side of Istanbul, especially in the Historical Districts.

Table 10.2.2 Building Coverage Ratio by Mahalle

Area	District		5. Over 90%			4. 80-89%			3. 70-79%			2. 60-69%			1. Less 60%			Unknown	Total Urbanized Area (ha)
	Code	Name	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)		
Old Town	12	EMİNÖNÜ	14	118	26	8	120	26	7	145	32	1	10	2	3	59	13	0	452
	14	FATİH	5	48	5	28	433	44	17	217	22	14	198	20	5	87	9	0	982
	7	BEYOĞLU	10	88	11	14	230	28	10	242	29	8	202	24	3	67	8	0	828
	Sub-Total		29	254	11	50	782	35	34	604	27	23	409	18	11	213	9	0	2,262
Europe: Marmara Coast	32	ZEYTİNBURNU	0	0	0	2	50	5	4	271	29	4	380	40	3	238	25	0	939
	4	BAKIRKÖY	1	19	1	0	0	0	3	132	8	2	179	11	9	1,284	80	0	1,613
	15	CÜNGÖREN	0	0	0	1	95	14	0	0	0	4	163	24	6	419	62	0	677
	3	BAHÇELİEVLER	0	0	0	0	0	0	2	164	11	4	330	23	5	936	65	0	1,430
	2	AVCILAR	0	0	0	0	0	0	0	0	0	0	0	0	9	1,531	100	0	1,531
	Sub-Total		1	19	0	3	145	2	9	567	9	14	1,052	17	32	4,409	71	0	6,191
Europe: Bosphoras	8	BESİKTAŞ	0	0	0	3	48	3	1	22	1	3	121	8	16	1,326	87	0	1,517
	19	KAĞITANE	3	156	13	8	314	26	3	175	14	3	213	17	2	362	30	0	1,221
	26	ŞİŞLİ	3	142	10	4	74	5	8	259	18	5	232	16	8	770	52	0	1,476
	23	SARIYER	0	0	0	0	0	0	2	28	1	6	503	24	15	1,565	75	0	2,096
	Sub-Total		6	298	5	15	436	7	14	485	8	17	1,070	17	41	4,022	64	0	6,311
Europe: Inland	13	EYÜP	0	0	0	1	24	2	6	367	24	9	651	43	4	480	32	0	1,522
	16	GAZİOSMANPAŞA	0	0	0	0	0	0	1	86	3	17	1,265	51	11	1,107	45	0	2,458
	10	BAYRAMPAŞA	0	0	0	1	49	6	4	233	31	3	237	31	3	242	32	0	761
	902	ESENLER	0	0	0	0	0	0	10	541	53	4	157	15	4	324	32	0	1,022
	5	BAĞCILAR	0	0	0	0	0	0	3	141	7	11	748	39	8	1,051	54	0	1,939
	20	KÜÇÜKÇEKMECE	0	0	0	0	0	0	1	98	2	6	417	10	16	3,624	88	0	4,139
	Sub-Total		0	0	0	2	73	1	25	1,466	12	50	3,475	29	46	6,827	58	0	11,841
Total/Average of European Side		36	571	2	70	1,435	5	82	3,121	12	104	6,006	23	130	15,471	58	0	26,605	
Asian: Marmara Coast	1	ADALAR	0	0	0	0	0	0	0	0	0	0	0	6	356	100	5	356	
	17	KADIKÖY	0	0	0	0	0	0	2	102	3	2	147	4	24	3,281	93	0	3,530
	21	MALTEPE	0	0	0	0	0	0	0	0	0	1	84	4	20	2,228	96	0	2,312
	18	KARTAL	0	0	0	0	0	0	0	0	0	0	0	20	2,619	100	0	2,619	
	22	PENDİK	0	0	0	0	0	0	0	0	0	0	0	29	3,559	100	0	3,559	
	28	TUZLA	0	0	0	0	0	0	0	0	0	0	0	11	1,980	100	0	1,980	
	Sub-Total		0	0	0	0	0	0	2	102	1	3	231	2	110	14,022	98	5	14,356
Asian: Bosphoras	30	ÜSKÜDAR	4	29	1	2	21	1	5	98	3	6	76	2	37	3,024	93	0	3,247
	6	BEYKOZ	0	0	0	0	0	0	1	72	3	1	125	5	17	2,142	92	0	2,340
	29	ÜMRANİYE	0	0	0	0	0	0	0	0	0	0	0	14	3,600	100	0	3,600	
	Sub-Total		4	29	0	2	21	0	6	170	2	7	201	2	68	8,766	95	0	9,186
Total/Average of Asian Side		4	29	0	2	21	0	8	273	1	10	431	2	178	22,788	97	5	23,542	
Outside IMM	9	BÜYÜKÇEKMECE	0	0	0	0	0	0	0	0	3	273	61	3	174	39	0	446	
	903	ÇATALCA	0	0	0	0	0	0	0	0	0	0	0	2	426	100	0	426	
	904	SİLİVRİ	0	0	0	0	0	0	0	0	2	50	6	3	791	94	0	841	
	Sub-Total		0	0	0	0	0	0	0	0	0	5	323	19	8	1,390	81	0	1,713
Total		40	600	1	72	1,456	3	90	3,394	7	119	6,761	13	316	39,650	76	5	51,860	

Source: JICA Study Team

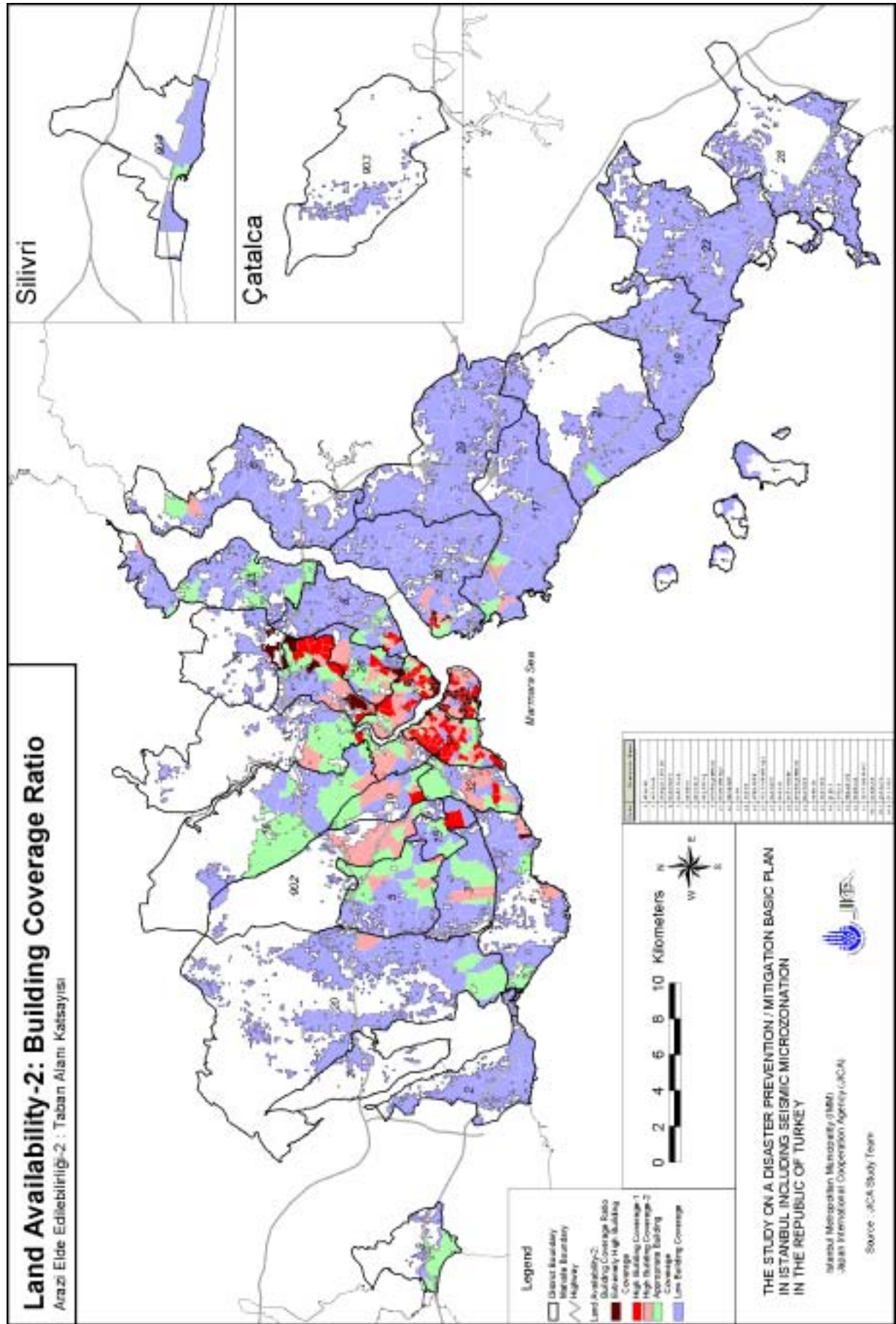


Figure 10.2.4 Building Coverage Ratio

(3) Land Availability for Urban Structure Improvement

Based on the two building coverage ratio and built-up area ratio analyses, the land availability in each mahalle can be represented by taking the average score of the two analyses. The resulting land availability analysis can be assessed as one of the following five categories:

- **Category –5 - Not Available:** In 77 identified mahalles (12% of the Study Area) with 11 km² of urbanized area (2% of the Study Area), both vacant land and frontage setback areas are not completely available for urban structure improvements, as most of the land is already fully developed. These identified mahalles are concentrated in the Historic District, the Marmara Coast, the Bosphorus on the European side, and in the Uskudar District.
- **Category –4 - Highly Not Available:** In the 119 identified mahalles (19% of the Study Area) with 37km² of urbanized areas (7% of the Study Area), land for urban structure improvements are also not available. There are, however, some vacant land or frontage setback areas available to fill part of the demand. These mahalles are also concentrated entirely in the districts on the European side and the Uskudar and Kadikoy districts on the Asian side.
- **Category –3 - Slightly Available:** There are 169 identified mahalles (26% of the Study Area) with 119 km² of urbanized area (23% of the Study Area) where vacant land for park developments or frontage setback areas for road widening are available. These mahalles are widely spread out over almost all districts except Tuzla in the IMM.
- **Category –2 - Available –1:** There are 157 mahalles (24% of the Study Area) with 167 km² of urbanized area (32% of the Study Area) where urban development has not matured yet. Building coverage in these mahalles is not very high, and the required land for urban improvement could be identified within each mahalle.
- **Category –1 - Available 2:** There are 115 mahalles (18% of the Study Area) with 185 km² of urbanized area (36% of the Study Area) that may not have land availability issues for urban structure improvements.

Areas with serious issues of land availability are identified as follows:

- **The Historic District Area:** In this area, categories 5 and 4 together share 60% of the urbanized areas. Category 3 shares 19% of the urbanized areas. This, in turn, demonstrates that approximately 80% of the urbanized area may have to face issues of land availability with the required urban structure improvements.

- **European Marmara Coast:** Categories 5 and 4 together share 9% of the urbanized area. Category 3 follows with a share of 23%. Land availability constraints will be found in the Zeytinburnu and Güngören districts.
- **European Bosphorus:** In this area, Categories 5 and 4 together share 16% of the urbanized areas. Category 3 has a share of 19% .Areas with land use constraints amount to 35% of the land. Kağıthane and Şişli will face the most serious constraints in making land available for improvements.
- **European Inland:** In this area, Category 4 has a 13% share of the urbanized areas and Category 3 has a 27% share. Together they amount to 40% of the urbanized area. . The total share between Categories 4 and 3 ranges from 47 to 55% of the urbanized areas in each district except Küçükçekmece.
- **Asian Side:** Limited land availability issues may exist in the districts of Kadıköy and Üsküdar.

Table 10.2.3 Land Availability for Urban Structure Improvement Measures

Area	District		5. Not Available				4. Almost Not				3. Slightly Available				2. Available-1			1. Available-2			Others	Total Urbanized Area
	Code	Name	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)	Mahalle	Urbanized Area (ha)	share (%)		
Old Town	12	EMİNÖNÜ	12	100	22	10	115	25	7	118	26	4	119	26	0	0	0	0	0	0	452	
	14	FATİH	24	307	31	27	386	39	9	159	16	9	130	13	0	0	0	0	0	0	982	
	7	BEYOĞLU	20	250	30	11	200	24	7	154	19	7	224	27	0	0	0	0	0	0	828	
	Sub-Total		56	657	29	48	701	31	23	431	19	20	473	21	0	0	0	0	0	0	2,262	
Europe: Marmara Coast	32	ZEYTİNBURNU	2	50	5	2	51	5	5	304	32	2	353	38	2	180	19	0	0	0	939	
	4	BAKIRKÖY	1	19	1	1	22	1	3	219	14	5	547	34	5	807	50	0	0	0	1,613	
	15	GÜNGÖREN	0	0	0	4	191	28	6	393	58	0	0	0	1	93	14	0	0	0	677	
	3	BAHÇELİEVLER	0	0	0	3	245	17	4	314	22	3	585	41	1	286	20	0	0	0	1,430	
	2	AVCILAR	0	0	0	0	0	0	2	176	11	3	392	26	4	963	63	0	0	0	1,531	
	Sub-Total		3	69	1	10	510	8	20	1,408	23	13	1,876	30	13	2,329	38	0	0	0	6,191	
Europe: Bosphoras	8	BESİKTAŞ	1	9	1	4	112	7	5	257	17	9	764	50	4	375	25	0	0	0	1,517	
	19	KAĞITANE	7	220	18	5	321	26	5	318	26	0	0	0	2	362	30	0	0	0	1,221	
	26	ŞİŞLİ	5	87	6	9	254	17	5	263	18	4	235	16	5	638	43	0	0	0	1,476	
	23	SARIYER	0	0	0	0	0	0	6	387	18	10	841	40	7	868	41	0	0	0	2,096	
	Sub-Total		13	316	5	18	688	11	21	1,225	19	23	1,840	29	18	2,243	36	0	0	0	6,311	
Europe: Inland	13	EYÜP	0	0	0	6	240	16	5	481	32	5	321	21	4	480	32	0	0	0	1,522	
	16	GAZİOSMANPAŞA	0	0	0	6	322	13	12	896	36	8	872	35	3	368	15	0	0	0	2,458	
	10	BAYRAMPAŞA	0	0	0	4	236	31	2	123	16	3	237	31	2	164	22	0	0	0	761	
	902	ESENLER	0	0	0	8	340	33	4	227	22	3	189	18	3	266	26	0	0	0	1,022	
	5	BAĞCILAR	0	0	0	6	308	16	9	652	34	6	657	34	1	322	17	0	0	0	1,939	
	20	KÜÇÜKÇEKMECE	0	0	0	2	113	3	11	824	20	3	625	15	7	2,577	62	0	0	0	4,139	
	Sub-Total		0	0	0	32	1,559	13	43	3,204	27	28	2,900	24	20	4,177	35	0	0	0	11,841	
Total/Average of European Side			72	1,042	4	108	3,457	13	107	6,267	24	84	7,090	27	51	8,749	33	0	0	0	26,605	
Asian: Marmara Coast	1	ADALAR	0	0	0	0	0	0	5	346	97	0	0	0	1	9	3	5	0	0	356	
	17	KADIKÖY	0	0	0	2	102	3	11	1,260	36	14	1,861	53	1	306	9	0	0	0	3,530	
	21	MALTEPE	0	0	0	0	0	0	8	789	34	6	814	35	7	709	31	0	0	0	2,312	
	18	KARTAL	0	0	0	0	0	0	8	795	30	6	880	34	6	944	36	0	0	0	2,619	
	22	PENDİK	0	0	0	0	0	0	8	665	19	11	1,437	40	10	1,457	41	0	0	0	3,559	
	28	TUZLA	0	0	0	0	0	0	0	0	0	3	284	14	8	1,696	86	0	0	0	1,980	
	Sub-Total		0	0	0	2	102	1	40	3,856	27	40	5,276	37	33	5,121	36	5	0	0	0	14,356
Asian: Bosphoras	30	ÜSKÜDAR	5	36	1	9	149	5	16	813	25	14	1,507	46	10	742	23	0	0	0	3,247	
	6	BEYKOZ	0	0	0	0	0	0	2	159	7	8	872	37	9	1,308	56	0	0	0	2,340	
	29	ÜMRANIYE	0	0	0	0	0	0	3	373	10	6	1,642	46	5	1,585	44	0	0	0	3,600	
	Sub-Total		5	36	0	9	149	2	21	1,345	15	28	4,021	44	24	3,634	40	0	0	0	9,186	
Total/Average of Asian Side			5	36	0	11	251	1	61	5,201	22	68	9,298	39	57	8,755	37	5	0	0	23,542	
Outside IMM	9	BÜYÜKÇEKMECE	0	0	0	0	0	0	0	0	0	3	273	61	3	174	39	0	0	0	446	
	903	ÇATALCA	0	0	0	0	0	0	0	0	0	0	0	2	426	100	0	0	0	0	426	
	904	SİLİVRİ	0	0	0	0	0	0	1	433	52	2	50	6	2	357	42	0	0	0	841	
	Sub-Total		0	0	0	0	0	0	0	1	433	25	5	323	19	7	957	56	0	0	0	1,713
Total			77	1,078	2	119	3,708	7	169	11,901	23	157	16,711	32	115	18,461	36	5	0	0	51,860	

Source: The JICA Study Team

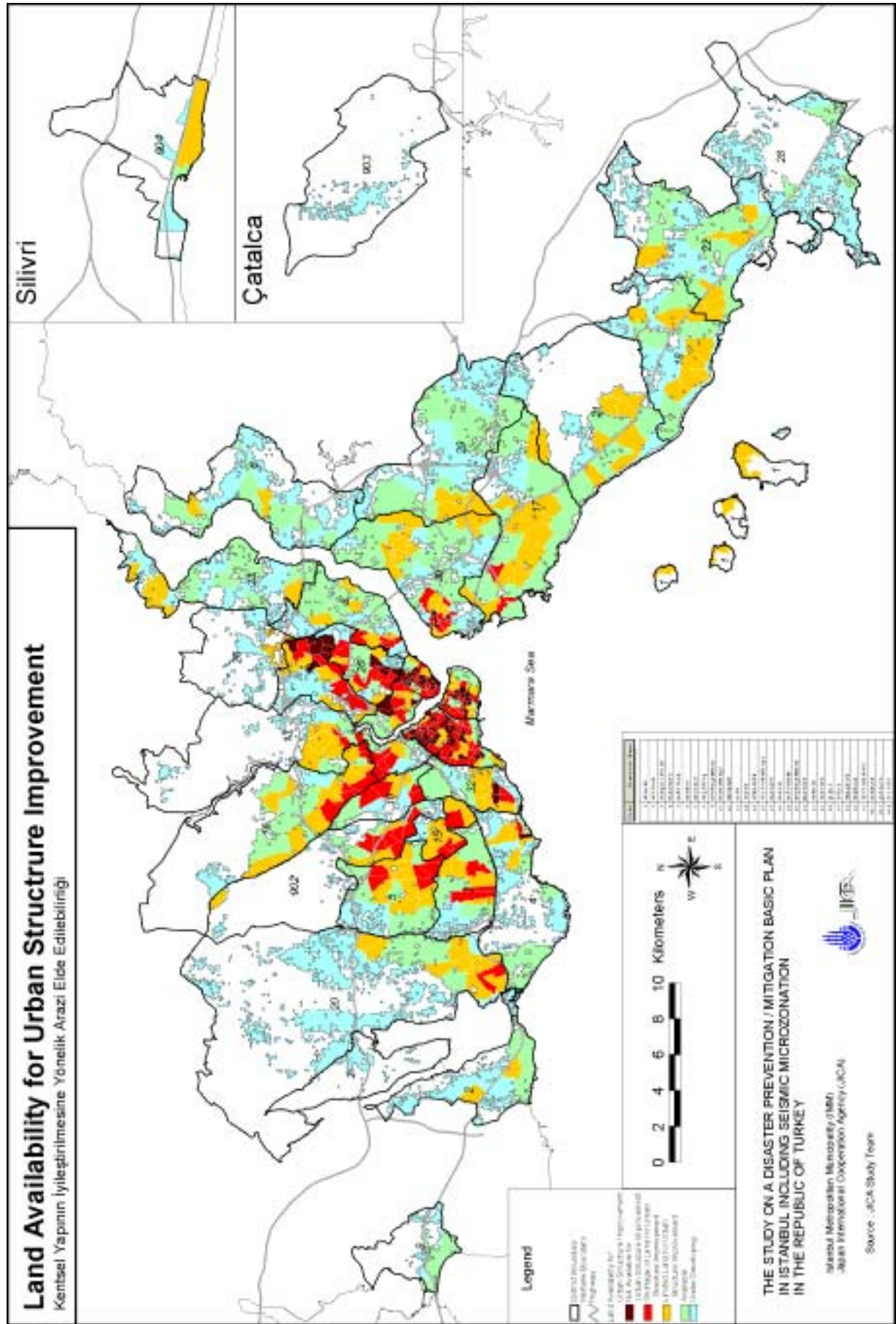


Figure 10.2.5 Land Availability for Urban Structure Improvement Issues

10.2.3. Recommended Strategic Improvement Areas for Mahalles With Serious Building and Urban Structure Vulnerabilities

The mahalles with serious Building and Urban Structure vulnerabilities are identified as follows:

- **Mahalles with Building/Urban Structure Vulnerabilities:** 361 mahalles (56% of the Study Area) with 246 km² urbanized area (47% of the Study Area) and 4.8 millions residents (56% of the population).
- **Mahalles with Urban Structure Vulnerabilities:** 39 mahalles (6% of the Study Area) with 16 km² urbanized area (3% of the Study Area) and 0.4 millions residents (5% of the population).

These two categories are included in the strategic measures for improvement or reconstruction based on the previous land availability analysis. The identified strategic improvement areas, where spare land is available for projects to improve building and urban structure vulnerability are identified below:

- **Combined Strategic Improvement Measures for Building/Urban Structure Issues:** 214 mahalles (60% of all the identified mahalles with serious issues) with 213 km² urbanized area (87% of the identified mahalles) and 3.6 million residents (75% of the identified mahalles).
- **Strategic Improvement Measure for Urban Structure Issues:** 19 mahalles (49% of all the identified mahalles with serious issues) with 11 km² urbanized area (66% of the identified mahalles) and 0.23 million residents (58% of the identified mahalles).

(1) Combined Strategic Improvement Measure for Issues of Building Urban Structure

The identified 214 mahalles with 213 km² urbanized area and 3.6 million residents combine into 33% of the mahalles, 42% of all urbanized area and 42% of the population, which is the biggest share in the identified five strategic measures.

The mahalles identified for the five strategic measures share over 50% of urbanized area in 11 districts, which are located on both the Asian and European sides of the Marmara Coast, and Bağcılar and Küçükçekmece on the European Inland.

The recommended principal measure to strengthen building structures and urban structures must be applied under the formulated metropolitan and local district disaster prevention master plans. Also, all of the implementation measures and projects should be carefully prioritized and coordinated with each other and with the above plan formulation procedures.

The specialized and modified measures applied in designated Historical Urban Conservation Areas should be coordinated with the agencies responsible for conservation.

(2) Strategic Improvement Measure for Issues of Urban Structure

The 19 mahalles with 11 km² of urbanized areas and 0.24 million residents represent only 2 to 3% of mahalles, with the same percentages for urbanized areas and population in the Study Area. The identified 19 mahalles are spread out over 8 districts.

The recommended principal measures to strengthen urban structure issues must be applied intensely in the identified 19 mahalles. Supplemental measures for building structure issues are also required to strengthen the estimated number of damaged buildings (10% to 30% with heavy and moderate damage), in addition to the recommended preliminary seismic resistant assessments.

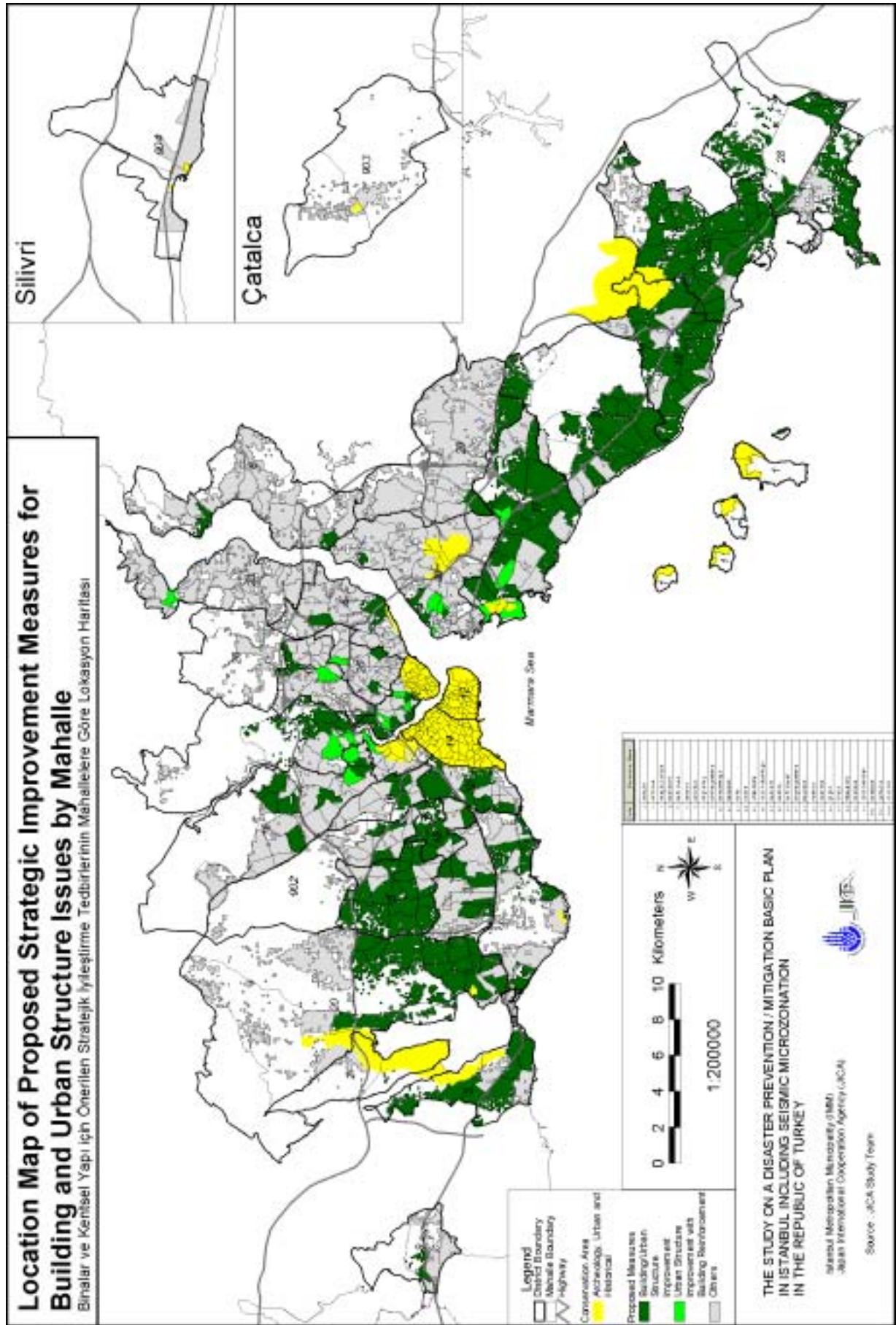


Figure 10.2.6 Location Map of Recommended Strategic Improvement Measures for Building and Urban Structure Issues by Mahalle

Table 10.2.4 Recommended Strategic Improvement Measures for Building and Urban Structure Issues by Mahalle

Area	District		Improvement Building/Urban Structure				Improvement Urban Structure			
	Code	Name	No. of mahalle	Urbanized Area In Mahalle (ha)	Area share (%)	Population in mahalle (000p)	No. of mahalle	Urbanized Area In Mahalle (ha)	Area share (%)	Population in mahalle (000p)
Old Town: historic urban	12	EMİNÖNÜ	9	197	44	26	0	0	0	0
	14	FATİH	16	273	28	89	0	0	0	0
	7	BEYOĞLU	10	271	33	52	4	107	13	35
	Sub-Total		35	741	33	167	4	107	5	35
Europe: Marmara Coast	32	ZEYTİNBURNU	6	600	64	134	0	0	0	0
	4	BAKIRKÖY	7	497	31	55	0	0	0	0
	15	CÜNGÖREN	6	407	60	167	0	0	0	0
	3	BAHÇELİEVLER	5	431	30	192	0	0	0	0
	2	AVCILAR	6	1,069	70	174	0	0	0	0
	Sub-Total		30	3,003	49	722	0	0	0	0
Europe: Bosphoras	8	BESİKTAŞ	3	212	14	23	0	0	0	0
	19	KAĞITANE	2	145	12	26	1	78	6	20
	26	ŞİŞLİ	2	84	6	24	1	40	3	16
	23	SARIYER	0	0	0	0	1	56	3	5
	Sub-Total		7	441	7	74	3	174	3	41
Europe: Inland	13	EYÜP	4	510	33	51	3	207	14	36
	16	GAZİOSMANPAŞA	7	602	25	162	2	133	5	43
	10	BAYRAMPAŞA	3	196	26	52	0	0	0	0
	902	ESENLER	5	235	23	100	0	0	0	0
	5	BAĞCILAR	15	1,523	79	364	0	0	0	0
	20	KÜÇÜKÇEKMECE	17	2,301	56	463	0	0	0	0
	Sub-Total		51	5,367	45	1,193	5	340	3	79
Total/Average of European Side			123	9,552	36	2,156	12	620	2	154
Asian: Marmara Coast	1	ADALAR	6	356	100	18	0	0	0	0
	17	KADIKÖY	15	2,192	62	411	4	345	10	66
	21	MALTEPE	14	1,855	80	257	0	0	0	0
	18	KARTAL	14	1,995	76	242	0	0	0	0
	22	PENDİK	25	3,037	85	334	0	0	0	0
	28	TUZLA	8	1,622	82	82	0	0	0	0
	Sub-Total		82	11,057	77	1,343	4	345	2	66
Asian: Bosphoras	30	ÜSKÜDAR	4	120	4	19	3	95	3	29
	6	BEYKOZ	2	150	6	10	0	0	0	0
	29	ÜMRANİYE	2	368	10	72	0	0	0	0
	Sub-Total		8	638	7	101	3	95	1	29
Total/Average of Asian Side			90	11,695	50	1,444	7	440	2	95
Outside IMM	9	BÜYÜKÇEKMECE	1	69	15	0	0	0	0	0
	903	ÇATALCA	0	0	0	0	0	0	0	0
	904	SİLİVRİ	0	0	0	0	0	0	0	0
	Sub-Total		1	69	4	0	0	0	0	0
Total			214	21,316	41	3,600	19	1,060	2	249

Source: The JICA Study Team

Note: The designated Archeological and Historical Urban Conservation Areas are also included

10.2.4. Recommended Strategic Urban Redevelopment Measures and Specialized Measures for Historical Urban Conservation Areas

The strategic urban redevelopment measures are recommended in order to be applied to those specific mahalles that are fully developed and lack the spare land needed for the improvement of vulnerable urban structures. The identified 167 mahalles with 38.2 km² urbanized area and 1.6 millions residents represent 26% of mahalles, 7.5% of the urbanized area, and 18.8% of population in the Study Area. These identified areas are composed from the following three areas of strategic measures: 1) Strategic Urban Redevelopment Measures for Building/Urban Structure Issues, 2) Strategic Urban Redevelopment Measures for Urban Structure Issues, and 3) Specialized Improvement Measures for Historical Urban Conservation Area.

(1) Strategic Urban Redevelopment Measures for Building/Urban Structure Issues

The listed Redevelopment for Building/Urban Structure includes the designated archeological and historical urban conservation areas. These areas include approximately 85 mahalles (13% of Study Area) with 12km² urbanized areas (2% of the Study Area) and a population of 440,000 in the districts of Eyüp, Adalar, the Historic District, and Kadıköy.

The net area for Strategic Urban Redevelopment Measures is identified as approximately 82 mahalles (13% of the Study Area) with 26.2km² urbanized area (5% of the Study Area) and a population of 1.2 million (14% of the population). All of the recommended measures in the detailed study the District Disaster Prevention Plan formulation to improve urban structures should be carefully rechecked and project areas should be redefined in detail on the base map/aerophoto with the same vulnerability analysis that follows.

- Emergency Road Network Plan with road widening/improvement projects
- Evacuation Plan with the development of new parks and the improvement existing parks for community and regional evacuation places, which should be linked by safe evacuation route
- Widening and improvement of narrow roads
- Seismic Resistant Diagnosis for crisis management centres, emergency response centres and public facilities
- Reinforcement/Reconstruction Plans and Programmes for the above centres
- Preliminary Seismic Resistant Assessment with cadastral data for housing and private commercial buildings (the estimated building damage is over 30% of all buildings in mahalle)

- Building Demarcation for the required reconstruction, reinforcement, and structural resistance
- Checking in detail of public and private land availability for road and public emergency response resources in order to designate urban redevelopment areas and urban structure improvement areas
- Action plans and implementation programmes for the above mentioned comprehensive projects

(2) Strategic Urban Redevelopment Measures for Urban Structure Issues

The listed redevelopment for vulnerable urban structures also includes the designated archeological and historical urban conservation areas. These areas are composed of about 5 mahalles, 0.8 km² urbanized area and a population of 15,000 in the Historic District and the district of Kadıköy.

The net target area for strategic urban redevelopment measures is approximately 15 mahalles (2% of the Study Area) with 4.6 km² of urbanized area (1% of the Study Area) and 170,000 population (2% of the population). All of the recommended measures to improve urban structures in the study of the district disaster prevention plan formulation should be carefully rechecked and project areas should be redefined in detail on the base map/aerophotomap through the vulnerability analysis that follows:

- Emergency road network plan with road widening/improvement projects
- Evacuation plan with the development of new parks and the improvement of existing parks for community and regional evacuation places, which should be linked by safe evacuation route
- Widening and improvement of narrow roads
- Seismic resistance diagnosis for crisis management centres, emergency response centres, emergency supply centres, and public facilities
- Reinforcement/reconstruction plans and programmes for the above centres
- Preliminary seismic resistant assessment with cadastral data for housing and private commercial buildings (the estimated building damage is 10 to 29% of all buildings)
- Building designation for the required reconstruction, reinforcement, and structural resistance
Checking in detail of public and private land availability for road and public facilities in order to designate urban redevelopment areas and urban structure improvement areas

- Action plans and implementation programmes for the above mentioned comprehensive projects

(3) Specialized Improvement Measures for Historical Urban Conservation Area

The designated historical urban conservation areas in the assessed strategic urban reconstruction area may have difficulties in creating safer environments and urban structures for residents due to the following serious situations:

- Required land for urban structure improvement projects cannot be easily found under the old, rigid and mosaic land-use conditions.
- The existing alleyway network cannot only support the needed vehicle traffic demand for daily socio-economic activities in the area. Additionally, the existing alleyway network cannot support the traffic demands for the reconstruction/reinforcement activities of structurally weak buildings in the area.
- Under the strict regulations of the conservation system (conservation of all traditional alleyways, etc.), it is difficult to implement necessary changes.

Modified and specialized improvement measures, and modified zoning regulation systems as mentioned in 10.2.1, are recommended in order to improve, establish, and provide safer environments for residents.

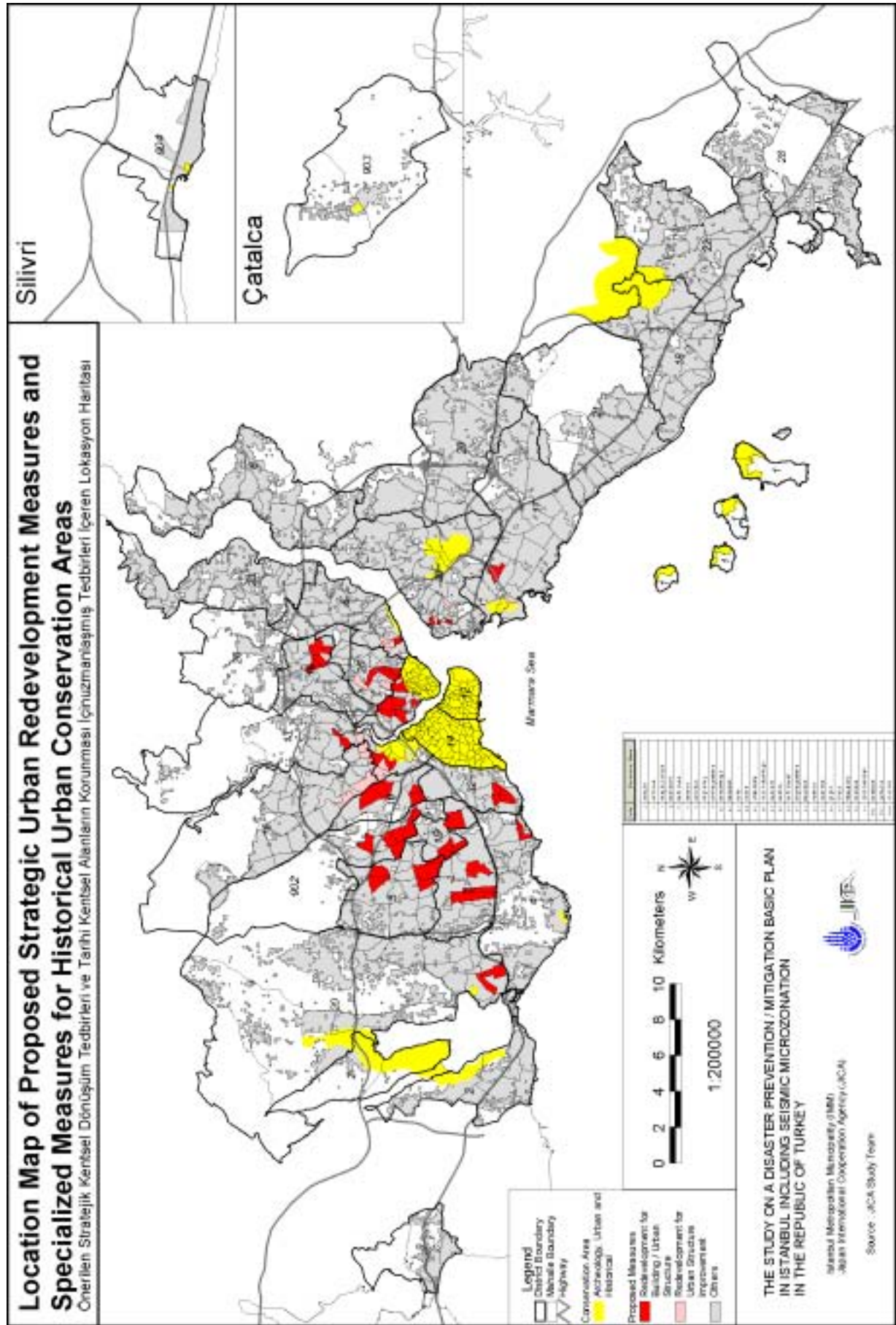


Figure 10.2.7 Location Map of Recommended Strategic Urban Redevelopment Measures and Specialized Measures for Historical Urban Conservation Areas

Table 10.2.5 Recommended Strategic Urban Redevelopment Measures and Specialized Measures for Historical Urban Conservation Area

Area	District		Building/Urban Structure Redevelopment				Urban Structure Redevelopment			
	Code	Name	No. of Mahalle	Urbanized Area In Mahalle (ha)	Area share (%)	Population in Mahalle (000p)	No. of Mahalle	Urbanized Area In Mahalle (ha)	Area share (%)	Population in Mahalle (000p)
Old Town: historic urban	12	EMİNÖNÜ	18	168	37	20	3	39	9	6
	14	FATİH	51	693	71	304	0	0	0	0
	7	BEYOĞLU	29	434	52	138	1	11	1	6
	Sub-Total		98	1,295	57	461	4	49	2	12
Europe: Marmara Coast	32	ZEYTİNBURNU	4	101	11	66	0	0	0	0
	4	BAKIRKÖY	2	41	3	13	0	0	0	0
	15	CÜNGÖREN	4	191	28	83	0	0	0	0
	3	BAHÇELİEVLER	3	245	17	160	0	0	0	0
	2	AVCILAR	0	0	0	0	0	0	0	0
	Sub-Total		13	578	9	321	0	0	0	0
Europe: Bosphoras	8	BESİKTAŞ	1	15	1	2	3	46	3	22
	19	KAĞITANE	4	134	11	73	1	20	2	13
	26	ŞİŞLİ	5	101	7	34	2	59	4	20
	23	SARIYER	0	0	0	0	0	0	0	0
	Sub-Total		10	250	4	110	6	125	2	55
Europe: Inland	13	EYÜP	3	143	9	38	3	97	6	28
	16	GAZİOSMANPAŞA	0	0	0	0	4	194	8	73
	10	BAYRAMPAŞA	4	236	31	95	0	0	0	0
	902	ESENLER	7	288	28	184	0	0	0	0
	5	BAĞCILAR	6	308	16	153	0	0	0	0
	20	KÜÇÜKÇEKMECE	2	113	3	42	0	0	0	0
	Sub-Total		22	1,088	9	512	7	291	2	101
Total/Average of European Side			143	3,211	12	1,404	17	465	2	168
Asian: Marmara Coast	1	ADALAR	0	0	0	0	0	0	0	0
	17	KADIKÖY	1	53	1	20	1	50	1	6
	21	MALTEPE	0	0	0	0	0	0	0	0
	18	KARTAL	0	0	0	0	0	0	0	0
	22	PENDİK	0	0	0	0	0	0	0	0
	28	TUZLA	0	0	0	0	0	0	0	0
Sub-Total		1	53	0	20	1	50	0	6	
Asian: Bosphoras	30	ÜSKÜDAR	3	24	1	9	2	20	1	8
	6	BEYKOZ	0	0	0	0	0	0	0	0
	29	ÜMRANİYE	0	0	0	0	0	0	0	0
	Sub-Total		3	24	0	9	2	20	0	8
Total/Average of Asian Side			4	77	0	29	3	70	0	14
Outside IMM	9	BÜYÜKÇEKMECE	0	0	0	0	0	0	0	0
	903	ÇATALCA	0	0	0	0	0	0	0	0
	904	SİLİVRİ	0	0	0	0	0	0	0	0
	Sub-Total		0	0	0	0	0	0	0	0
Total			147	3,288	6	1,433	20	535	1	182

Source: The JICA Study Team

Note: The designated Archeological and Historical Urban Conservation Areas are also included

10.2.5. Recommended Strategic Building Structure Improvement Measures

Strategic building structure improvement measures are recommended for specific mahalles when the following conditions are met:

- The share of the estimated heavy and moderately damaged buildings equals more than 30% of the mahalle's total building stock, and
- The mahalle is not assessed as having serious urban structure vulnerability issues.

51 mahalles (8% of the Study Area) with 59.1 km² of urbanized area (12% of the Study Area) and 0.9 millions residents (10% of the population) are identified for the strategic building structure improvement area.

For the identified area, the recommended strategic measures to improve weak building structure are mentioned in 10.2 and should be intensively applied to the areas.

The areas without strategic improvement measure (191 mahalles with 197.5 km² of urbanized area and 2.5 millions residents) are assessed and identified without any of the five categories for strategic improvement measures. However, not one of 642 mahalles could avoid building damage from the estimated earthquake motion in the Study Area. The estimated building damage ratios in the identified mahalles range from the minimum case (4% of partially damaged buildings in the mahalle) to the maximum case (58% of heavily/moderately/partially damaged buildings in the mahalle). For the estimated building damage, supplemental building structure improvement measures are recommended for each mahalle through the preliminary seismic resistant assessment for the existing building stock. Additionally, in the identified mahalles, serious urban structure vulnerability issues are not obviously assessed and identified; however, some specific urban structure improvement projects, such as road widening and park developments, will be required to upgrade the safety of residents' environments.

Supplemental or specific improvement measures for building and urban structure vulnerabilities are recommended for the categorized mahalles in order to be examined with the detailed plan formulation studies of district disaster prevention plan.

Table 10.2.6 Recommended Building Structure Improvement by Mahalle

Area	District		Building Structure Improvement Measures				Other Measure			
	Code	Name	No. of Mahalle	Urbanized Area In Mahalle (ha)	Area Share (%)	Population in Mahalle (000p)	No. of Mahalle	Urbanized Area In Mahalle (ha)	Area Share (%)	Population in Mahalle (000p)
Historic District:	12	EMINÖNÜ	0	0	0	0	3	49	11	3
	14	FATİH	2	16	2	1	0	0	0	0
	7	BEYOĞLU	0	0	0	0	1	5	1	5
	Subtotal		2	16	1	1	4	54	2	7
Europe: Marmara Coast	32	ZEYTİNBURNU	3	238	25	40	0	0	0	0
	4	BAKIRKÖY	6	1,076	67	139	0	0	0	0
	15	CÜNGÖREN	1	80	12	22	0	0	0	0
	3	BAHÇELİEVLER	3	754	53	118	0	0	0	0
	2	AVCILAR	2	297	19	44	1	165	11	14
	Subtotal		15	2,445	39	362	1	165	3	14
Europe: Bosphorus	8	BESİKTAŞ	1	48	3	2	15	1,195	79	132
	19	KAĞITANE	2	362	30	43	9	483	40	167
	26	ŞİŞLİ	1	33	2	3	17	1,159	79	175
	23	SARIYER	0	0	0	0	22	2,040	97	208
	Subtotal		4	444	7	47	63	4,878	77	683
Europe: Inland	13	EYÜP	2	174	11	8	5	391	26	70
	16	GAZİOSMANPAŞA	0	0	0	0	16	1,529	62	391
	10	BAYRAMPAŞA	3	279	37	74	1	50	7	16
	902	ESENLER	1	18	2	3	5	482	47	101
	5	BAĞCILAR	0	0	0	0	1	108	6	40
	20	KÜÇÜKÇEKMECE	1	114	3	12	3	1,611	39	72
	Subtotal		7	585	5	98	31	4,171	35	690
Total/Average of European Side			28	3,489	13	509	99	9,268	35	1,395
Asian: Marmara Coast	1	ADALAR	0	0	0	0	5	0	0	0
	17	KADIKÖY	5	609	17	119	2	281	8	38
	21	MALTEPE	3	277	12	70	4	180	8	19
	18	KARTAL	5	480	18	76	1	144	6	14
	22	PENDİK	2	161	5	26	2	361	10	13
	28	TUZLA	2	337	17	19	1	21	1	0
	Subtotal		17	1,865	13	309	15	986	7	85
Asian: Bosphorus	30	ÜSKÜDAR	2	183	6	40	40	2,805	86	392
	6	BEYKOZ	0	0	0	0	17	2,189	94	173
	29	ÜMRANİYE	0	0	0	0	12	3,232	90	371
	Subtotal		2	183	2	40	69	8,226	90	936
Total/Average of Asian Side			19	2,048	9	349	84	9,212	39	1,021
Outside IMM	9	BÜYÜKÇEKMECE	4	376	84	0	1	2	0	0
	903	ÇATALCA	0	0	0	0	2	426	100	16
	904	SİLVİRİ	0	0	0	0	5	841	100	44
	Subtotal		4	376	22	0	8	1,268	74	60
Total			51	5,913	11	858	191	19,748	38	2,476

Source: The JICA Study Team

Note: The designated Archeological and Historical Urban Conservation Areas are included

10.3. Recommendations for Land-Use Plan and Zoning

10.3.1. Recommended Land-Use Zoning Measures for Natural Hazard Areas

(1) Identified Risks of Natural Hazard

For the unstable ground conditions identified in Chapter 6, all superstructures and infrastructures in the area have the following high natural hazard risks:

- Unstable steep slopes
- Liquefaction potential areas along the coast and rivers

(2) Recommended Land-Use Zoning System

In order to mitigate and minimize foreseeable disaster damage in the area, a land-use zoning system with specialized building codes for natural hazards is an indispensable measure to guide and establish proper and suitable land-use in identified areas of natural hazard risks.

A land-use category of park and open space is principally recommended to avoid human casualties and economic loss in the identified hazardous areas of the present urbanized areas and its surroundings.

Additional zoning system for natural hazards is recommended with design codes and regulations for foundation and building structures. This will enable buildings to resist the estimated natural hazards. It will also have the added function of avoiding inappropriate building construction and development in the designated areas.

(3) Required Supporting Measures to Achieve Proper Land Use

Parts of the identified unstable slope areas have been illegally or irregularly developed into residential areas. Similarly, parts of liquefaction potential areas have also been developed into residential areas, ports, and related facilities. Supporting measures to achieve proper land-use in these natural hazard areas are required and recommended. The suggested category areas are listed as follows:

Residential Relocation/Park Development: It is proposed that the existing residential areas in the identified natural hazard risk areas be relocated to safer areas. Parks and open spaces may be developed in the remaining natural hazard areas after the relocation of residential areas by the metropolitan government.

Port/Related Facilities: In order to ensure emergency functions, special reinforcement and improvement measures are recommended for the facilities in the identified liquefaction potential areas that are selected and assigned as strategic major transportation nodes and/or emergency goods circulation centres.

Bridge/Road Facilities: Bridges, traffic signals, street light poles and other road facilities in the identified liquefaction potential areas, as well as steep slope shoulders in the identified unstable slope should be reinforced and improved before a disastrous event occurs.

Infrastructure: The reinforcement and improvement of main water pipelines, natural gas and sewage lines, and main cable networks of electricity and telecommunication located in identified liquefaction potential areas is also recommended in order to maintain essential services and avoid secondary disasters under earthquake disaster conditions.

10.3.2. Recommended Land-Use Zoning and Related Measures for Hazardous Facilities

In the last century, almost developed and accumulated manufacturing industries moved out from the metropolitan area. Some industries maintain only headquarter facilities; however there are some hazardous industries remaining in the metropolitan area.

Hazardous facilities are divided into two categories for the purpose of permission and registration with the Licensing Directorate of the IMM and each district's municipality. Major hazardous facilities, composed from the following five (5) categories of large-scale hazardous facilities and negative environmental impacts, are currently permitted and registered by the Licensing Directorate of the IMM:

- Big LPG Storage (163 facilities)
- Paint and polish material factories (91 facilities)
- Chemical product warehouses (404 facilities)
- LPG filling stations (123 facilities)
- Liquid fuel filling stations (33 facilities)

The 814 registered hazardous facilities are widely distributed in 331 mahalles (52% of mahalles). Nonetheless, more than five (5) registered hazardous facilities are concentrated in 40 urbanized mahalles, mainly located in Bahçelievler (2 mahalles), Bağcılar (4 mahalles), Gaziosmanpasa (4 mahalles), Kadıköy (2 mahalles), Kartal (3

mahalles), Kagıthane (2 mahalles), Küçükçekmece (3 mahalles), Pendik (5 mahalles), Ümraniye (5 mahalles), and Zeytinburunu (4 mahalles).

The estimated number of fire outbreaks from the 814 hazardous facilities identified are 14 when considering earthquake scenario A and 16 when considering earthquake scenario C. The potential for fire to spread from those facilities is low (based on the limited data source). The estimated earthquake damages of hazardous facilities also appears to be moderate to low. However, land-use issues regarding hazardous facilities should be properly managed by the recommended land-use zoning system as follows:

- Careful review and revision of the designated existing industrial land-use within urbanized areas in order to maintain safer environments for surrounding communities.
- New designation and development of industrial areas for the relocation of unsuitable hazardous facilities out of urbanized areas (if necessary).
- Carefull review and revision of the existing land use regulations for hazardous facilities in and out of the designated industrial land use areas.
- The proper systemization and demarcation of the present system for approval, registration, monitoring, taxation, and execution of regulations for hazardous facilities by the appropriately responsible agencies, e.g., Licensing Directorate, Flammable/Explosive Directorate, Fire Brigade Department, and the Civil Defence.

Table 10.3.1 Registered Hazardous Facilities and Estimated Fire Outbreak Points

Area	District		Number of Registered Establishments by Hazardous Material						Estimated Points of Fire Outbreak	
	Code	Name	Total	Big LPG Storage	Factory of Paint/ Polish Products	Warehouse of Chemical Products	LPG Filling Station	Liquid Fuel Filling St.	Case-A	Case-C
Historic District	12	EMİNÖNÜ	7	4	0	3	0	0	0.3	0.3
	14	FATİH	29	13	0	12	4	0	1.8	2.0
	7	BEYOĞLU	22	4	1	14	1	2	0.3	0.3
	Subtotal		58	21	1	29	5	2	2.4	2.6
Europe: Marmara Coast	32	ZEYTİNBURNU	35	6	3	19	6	1	1.2	1.4
	4	BAKIRKÖY	19	0	0	17	2	0	0.4	0.4
	15	CÜNGÖREN	18	4	1	8	4	1	0.6	0.7
	3	BAHÇELİEVLER	36	7	0	11	16	2	1.6	1.9
	2	AVCILAR	17	3	0	10	4	0	0.6	0.7
	Subtotal		125	20	4	65	32	4	4.3	5.1
Europe: Bosphorus	8	BESİKTAŞ	18	7	0	10	1	0	0.1	0.2
	19	KAĞITANE	44	15	7	10	7	5	0.6	0.7
	26	ŞİŞLİ	33	9	2	18	3	1	0.2	0.2
	23	SARIYER	20	6	0	11	3	0	0.1	0.1
	Subtotal		115	37	9	49	14	6	1.0	1.1
Europe: Inland	13	EYÜP	29	6	7	10	4	2	0.6	0.6
	16	GAZİOSMANPAŞA	59	14	12	30	1	2	0.3	0.4
	10	BAYRAMPAŞA	21	2	1	8	5	5	0.5	0.6
	902	ESENLER	12	0	0	10	2	0	0.1	0.1
	5	BAĞCILAR	61	17	0	28	16	0	1.4	1.8
	20	KÜÇÜKÇEKMECE	43	9	10	16	6	2	0.6	0.7
	Subtotal		225	48	30	102	34	11	3.6	4.2
Total/Average of European Side			523	126	44	245	85	23	11.2	13.1
Asian: Marmara	1	ADALAR	NA	NA	NA	NA	NA	NA	NA	NA
	17	KADIKÖY	46	6	0	35	5	0	0.4	0.5
	21	MALTEPE	26	6	3	12	4	1	0.4	0.5
	18	KARTAL	46	9	9	22	5	1	0.7	0.8
	22	PENDİK	67	5	29	25	3	5	0.5	0.5
	28	TUZLA	6	1	0	5	0	0	0.1	0.1
	Subtotal		191	27	41	99	17	7	2.1	2.3
Asian: Bosphorus	30	ÜSKÜDAR	33	2	0	20	11	0	0.1	0.2
	6	BEYKOZ	13	0	0	11	2	0	0.0	0.0
	29	ÜMRANİYE	54	8	6	29	8	3	0.2	0.3
	Subtotal		100	10	6	60	21	3	0.4	0.5
Total/Average of Asian Side			291	37	47	159	38	10	2.4	2.8
Total			814	163	91	404	123	33	13.7	15.9

Source of hazardous facility: registered hazardous facility 2000 and 2001 from Licensing Directorate

Source of fire out-break point: JICA Study Team