METU JFA 2015/1
(32:1) *261-298*

DOI: 10.4305/METU.JFA.2015.1.13

REDUCING LOCAL VULNERABILITIES AND RISKS BY PLANNING DECISIONS: THE CASE OF FATİH DISTRICT IN İSTANBUL

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Received: 12.02.2013; **Final Text:** 12.05.2015

Keywords: Risk reduction; mitigation planning; risk identification; risk assessment; local capacity; urban planning; local seismic attributes; vulnerability.

INTRODUCTION

In this section, the guiding international framework, recent attempts at multi-hazard analysis and the motivation of the study are given consecutively by multi-scale case experiences, distinct methods of multi-hazard analyses and a preliminary view for the analytical study.

The Guiding International Framework and Cases for Risk Reduction

Last decade claimed the failure of post-disaster approach including disaster management methods as response, relief and emergency management repeatedly. For the period 2000 to 2009, total number of disaster victims are registered as 227.5 million and 8.5 million victims are exposed to geophysical disasters. It is indicated that 95% of victims died and injured during geophysical disasters are from developing countries in this period. The general occurrence of geophysical disasters increased by 147.4% in 2010, 217.3 million victims are registered and 7.3 million of people are only affected in geophysical disasters (3.4 of total victims) (CRED, 2011).

Increasing loss records show the lack of risk reduction strategy in developing countries which have been facing the tragic consequences. International framework provides guidance but hardly can be internalized by organizational capacities of vulnerable countries. By the declaration of the International Decade for Natural Disaster Reduction (IDNDR, 1990-2000), international efforts put risk reduction to the central area of concern. Changing objectives from post-disaster to pre-disaster risk management determined the requirement of a broader strategy. The International Strategy for Disaster Reduction (ISDR 2005-2015) has been formed as a supportive UN-led initiative for implementing the goals and objectives of the Hyogo Framework for Action (2005).

In scope of the IDNDR, the Yokohoma Strategy (1994) reframes initial establishments in disaster prevention, mitigation, preparedness and relief for better risk reduction and sustainable development. Furthermore, the

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basic requirement of plans and programs for risk reduction at national, sub-regional and sectoral levels, the relevance of participatory methods, the need for risk assessment as a primary step to disaster reduction policies and measures, the adoption of disaster prevention and preparedness as an integral part of development policies to reduce the need for relief and providing mitigation as the top priority at all levels are indicated precisely. Land use planning and other technical measures are also mentioned as a fundamental part of risk assessment, environmental management and development.

As the output of the Kobe Conference held in 2005, the Hyogo Framework for Action (2005-2015) aims to implement a holistic approach for risk reduction. Disaster risk is defined as an emergence formed when hazards interact with physical, social and ecologic vulnerabilities (UNISDR, 2005). Developing advanced techniques of collaboration at all levels is established to reduce risks at key sectors and improve risk information on hazards and vulnerabilities through monitoring, mapping, analyzing and sharing activities.

Yokohoma Strategy (1994) and Hyogo Framework for Action (2005-2015) emphasize the common means of providing disaster preparedness for national and sectoral levels through developing political and legislative frameworks for risk reduction. In these frameworks, there are strong recommendations on supportive plans, programs and funds at all levels, promoting multi-sectoral and multi-scale participation. Other common goals are; providing the diversification of risk definitions, employing risk assessment, early warning systems, learning programs and information sharing facilities with public access, adopting new methods for risk reduction and concentrating on the vulnerable urban parts and the urban poor.

MITIGATION MEASURES AND RISK REDUCTION IN THE USA

The international adjustment of risk reduction objectives affected the USA to adopt mitigation as a national priority. The Disaster Mitigation Act (2000), mitigation planning is integrated in to governmental plans and programs regarding the identification of natural hazards, risks and vulnerabilities. Mitigation plans are financed by the National Mitigation Fund that supports 75% of the total cost of mitigation plans and actions of states and local governments while 90% of the total cost of Small Impoverished Communities (lesser than 3000 people) is supplied by the Federal Share. The goals of mitigation plan are to reduce injuries, loss of lives, damages and destruction of properties, damages to critical services, facilities and provide public and private partnerships. (UNISDR, 2005)

The development and implementation of mitigation plans refers to Pre-disaster Hazard Mitigation Program defined at state and local levels under national act and coordinated by Interagency Task Force-IATF. Federal Emergency Management Agency-FEMA manages the implementation of the program and the coordination between national, federal and local levels involving members of relevant federal agencies, states, local governments and American Red Cross.

Hazard identification and risk assessment are defined under the set of actions of mitigation "to reduce the probability of occurrence of damages and to remove or reduce their intensity" (Gülkan, 2009, 7). In scope of Hazard Mitigation Measures, Multi-hazard Mapping Initiative-MMI under

FEMA is specialized to identify natural disaster types and develop Multi-Hazard Advisory Maps corresponding to each type. Multi-hazard Maps are developed by states, local governments and federal agencies for mitigation and reduction of the impacts of natural disasters such as flooding, hurricanes and seismic events. In fact they are advisory maps and do not directly refer to any policy of sanctions. In order to exchange real time risk data, raise risk consciousness and support hazard mitigation measures, FEMA manages Multi-hazard Identification and Risk Analysis-MHIRA at regional scale and continuously updates, and passes risk information to local authorities as it is ensured by the national act.

MHIRA is an assisting apparatus to facilitate the institutionalization of risk information in the USA employed in hazard identification, risk assessment processes and also by mitigation specialists to clarify the origins and the impacts of hazards on people and built environment. Hazard identification is institutionally underlined as "defining and describing a hazard with its physical attributes, magnitude and severity, frequency and probability, causative factors, locations/areas affected" (FEMA, 1997, 25). Moreover, the process has been digitalized through HAZUS-MH methodology utilizing Geographic Information Systems (GIS) models for mitigation planning or estimating potential losses, physical, economic and social impacts of earthquake; hurricane, floods, and their spatial relationships with population and geographic resources.

Even though hazard identification and risk assessment processes are the primary steps to mitigation, their integration to urban planning by devising appropriate legal and financial tools is still a legitimate issue. The recovery plan for New Orleans developed after the Hurricane Katrina (2005) introduces operational incompatibilities while seeking alternative socio-technical tools for conceiving and implementing the mitigation measures in disaster prone areas. After the disaster, 80% of the city became flooded and 1.836.000 people lost their lives in the actual floods by the failure of the levee system (APA, 2007). The most devastating effects were doubled by the delayed emergency evacuation and response that turned in to a major authority conflict in between national and federal state organizations. (Seidman, 2013)

Major impacts of the flood created a waste land in the lower areas and the requirement of redevelopment of the entire site became obvious. The recovery of New Orleans was a five month planning process established by the Mayor, City Council and City Planning Commission, based on three stages including recovery assessment, scenario development and physical planning. The Unified New Orleans Plan-UNOP was constituted of individual district and neighborhood plans, and developed for community planning.

As a citizen-led recovery plan given to private planning firms, UNOP was approved by local authorities and supported by other private organizations. The basic plan includes mitigation measures to reduce vulnerability for natural disasters and to ensure the main recovery process of the whole state. Community congresses in between planning firms and neighborhood residents were organized at 13 planning districts in four rounds. The strongest part of the plan was the redevelopment of the lower areas through providing a compact development of clustering critical services around the city center, assigning schools as community centers, and locating health care and social services on to school site. The New Orleans School Facilities Master Plan also referred to minimize economic vulnerability and maximize public access to critical services. For this purpose, the primary to middle school facilities were distributed throughout the city mostly at a distance of 1.6 km to each other by which dependency to automobile transportation was reduced gradually. The coordination of education facilities with transportation planning was another recommendation of the plan that increases accessibility and mobility of the dwellers. The absence of functional integration of community assets with parks, libraries, health care and adult education, was eliminated by locating community facilities at the center of civil society.

Mitigation measures stated through the plan aspire to prepare the local community for an effective response and emergency management, reduce losses and become organized for risk reduction activities. The implementation of the plan was stuck in to FEMA's Financial Assistance. Besides, other drawbacks were the lack of concomitant policies and financial instruments matching to local government scale and the incompatibilities in between neighborhood rebuilding facilities and the citywide rebuilding system (Seidman, 2013).

DISASTER RISK MANAGEMENT IN JAPAN

Being familiar with major earthquakes as well as volcanic activity, and typhoons through the history, Japan developed disaster risk management measures and plans systemized at national, prefectural and municipal levels. Disaster Countermeasures Basic Act (1961) is the main regulation requiring the coordination of disaster mitigation policies, disaster risk mitigation plans at central and multi-sectoral levels likewise emergency plans at all levels. The multi-level coordination is ensured by the participation of the Prime Minister, the Bank of Japan, local communities, private sector, public bodies, and legal bodies charged in public business and volunteer activities. The Basic Act includes Disaster Reduction Measures and Disaster Countermeasures for large scale disasters and earthquakes, refer to the designation of administrative units for risk reduction at emergency and the implementation of post-disaster techniques such as response, recovery and reconstruction that are tailored for each type of disaster. Disaster management activities are supported by state budget and risk reduction activities are covered by 5% of total general budget. (UNISDR, 2005)

Under the act, the Basic Plan for Disaster Management had drafted in 1963 by Central Disaster Management Council. After the Kobe Earthquake (1995), entire plan was revised through expanding long-term plans for disaster risk reduction, comprehensive disaster management planning system was established and sub-plans were incorporated in to the national disaster management measures at all levels of administrative units. At national level, Central Disaster Management Council is responsible for preparing the main instruments of disaster management, directed by the Prime Minister. At prefectural and municipal levels, Disaster Management Operation Plan and Local Disaster Management Plan are prepared for the same purpose of giving a detailed implementation plan of emergency management for the designated administrative organizations and public corporations, and defining local priorities for metropolitan and municipal disaster management councils. Despite the sub-plans specific to individual natural disasters, Comprehensive National Plan defined under Comprehensive National Development Act (1998), indicates

TOKYO KYOJIMA DISTRICT COMMUNITY DEVELOPMENT PROJECT		
Road Network Planning For Service Areas	**Rehabilitation and Development of Residential Units**	**Land Use Planning For Public**
Testing the existing traffic network for efficiency Determination of new routes Determination of primary routes to be utilized during or after disaster Development of service roads and main service roads located at a distance of max 100m to each other Development of specific routes for fire vehicles Development of pedestrian and cycle routes	Demolition of aged and wooden buildings Rehabilitation of storages and commercial uses Construction of buildings resilient to disasters and fires Supporting reconstruction process through unification and planning multi-unit buildings Clarification of roles and responsibilities of local communities and local governments Providing financial support to owners during the reconstruction process Providing temporary housing that are under the ownership of central and local governments or renting available public properties and generate revenue for urban transformation	Planning public centered land use Designing a new public structure through including the existing conference halls Planning pocket parks and open space network to work as evacuation corridors and rally points during or after disaster Determination of pocket parks and water tank locations for distant residential units in case of emergency

Table.1 Kyojima District Community Planning Objectives and Actions

improving safety and prevention from large-scale earthquakes and other natural disasters by mainstreaming pre-disaster risk management. Other objectives of the plan are, to increase technical capacity for providing disaster-resilient transport, communications and infrastructure, to introduce public works design standards and to promote assurance of earthquake resistance capacity in buildings. (UNISDR, 2005)

Japan’s articulated system of disaster risk management embodies legislations and plans that are specific to risk sectors and facilitating the efficacy of implementation for all levels. As an earthquake prone site, Kyojima District located at the city of Sumida, had been integrated to the community development project that aims to rehabilitate urban deprived areas and increasing the resilience of the city. (Kalkan, 2004). All costs under community development were sustained by public sector. (50% central government, 25% metropolitan government, 25% local government) The implementation of the project was directed by the metropolitan government and the Ministry of Land, Infrastructure and Transportation. The basic problems in residential areas were; soft ground conditions prone to seismicity; hazardous building features as attached, multi-unit and aged buildings, unplanned construction led to narrow streets and cul de sacs, infills and irrigation canals positioned parallel to narrow streets. According to the risk report; 74.7% of 3365 residential units were deprived and 56% of streets were inaccessible. Total population had decreased by 40% after the major earthquakes along with small business and manufacturing industries which contributed the socio-economic stagnation of the site. On the other hand, joint ownership with small lots impeded the development of a holistic solution for re-arranging building lots and reconstruction. The purposes of the three stage project were, to develop pedestrian and mixed-use centered residential areas, to provide high standards of safety and resilience, and to produce a permanent and living urban space (**Table 1**).

At the beginning stage of the project, an executive committee had been established by sub-groups of local civil initiatives and a series of conferences had started in 1981 to provide a transparent and participatory decision making process. The second stage of the plan had begun in 1983 and 43% of total buildings were determined as vulnerable. Through urgent expropriation, new residential units and residential areas were transferred to right owners for minimizing risk and vulnerability. The finalization of the project has been continued for more than 25 years and often interrupted by revisions but finally succeed by total public support (Kalkan, 2004).

Recent Attempts at Multi-Hazard Analysis

Changing from re-active to pro-active perspective on disaster risk management; mitigation planning, including the prerequisite steps of hazard identification, spatial risk assessment and socio-economic planning, becomes an efficacious apparatus for risk reduction. (Balamir, 2009). In mitigation planning; hazards, being one of many local seismic attributes regarding active faults, liquefaction,...etc. are identified by earth scientists and then planners transform local and national data sets in to development plans to determine the types and levels of risks in underdeveloped and developed lands in order to decide the conditions for new development areas (Balamir, 2009). Although the general relation between hazard identification, risk assessment and mitigation planning is clear, variations on distinct analysis techniques, perspectives and methodological constraints may conclude to different approaches in hazard analysis which predefines the methods of risk reduction.

Multi-Hazard Risk Assessment (MHRA) is a method of analysis that aims to cope with the limitations of single hazard assessment. While building on single hazard analyses, hazard interaction is considered to develop a complete view of risk by assessing and mapping the relative danger or expected losses due to the occurrence of multiple natural hazards in an area (Liu et al., 2014, 6).

MHRA consists of a technique called "risk index" which analyzes and monitors key factors generating disasters. Considering that "Risk = Hazards x Exposure x Vulnerability" (cited in Liu et al., 2014, 7), hazards, exposed factors and vulnerabilities are defined as risk parameters. In fact, hazard is "the presence of potentially damaging physical events in an area." On contrary, exposure includes "total attributes of receptors exposed to specific hazard" and vulnerability refers to "intrinsic characteristics of those receptors that make them more or less responsive to adverse impacts" (Liu et al., 2014, 7). The relative significance of those factors and their interactions are analyzed in scope of the methodology. The technique relies on the determination of primary indicators of hazard, vulnerability and exposure for each hazard type and then the sum of multi-hazard risk index is figured out. Or it is possible to define risk index for each hazard for a given area; later weights are assigned to each and the process is completed by the summation to derive multi-hazard risk index. As the approach focuses on origins of disasters and their interaction, it is criticized for missing the probability factor for potential future disasters (Liu et al., 2014).

Risk mitigation for reducing the aggregated impacts of disasters reveals another category regarding the macro assessment of losses. As an approach concerning pre-disaster risk management of seismic risks, expert decision-making is required for engineering tactics at building level or simulation methods at system level (Balamir, 2009). The engineering studies employed in the analysis of risks in building structures assume that city-level risks could be identified through the equated sums of risks of the urban building stock. The general concern of the analysis is to investigate the robustness of specific systems such as buildings and lifelines in the city rather than whole urban system (Balamir, 2009). In both cases of assessing multi hazards and risks at building or system level, it applies the statistical technique which is also employed by FEMA in HAZUS-MH. Despite that equation "Risk = Probability x Consequence" (cited in Liu et al., 2014, 9), disaster risk combines "an outcome of the probability of an occurrence of a hazardous event and the consequences of that event for receptors including the magnitude of impact resulted by the hazard" (Liu et al., 2014, 9). As a part of the approach, a parametric or nonparametric technique is used according to the availability of the historical data sets of hazards (Liu et al., 2014). This approach has been questioned for neglecting the key parameters (hazards, vulnerabilities, exposure) forming disasters and also for estimating probabilistic loss relying on historical data.

As a non-quantifiable method, Morphological Analysis is a distinct technique of initializing judgmental processes rather than causality in multi-hazard identification and risk assessment (Ritchey, 2006). It is favorable for complex socio-technical problems such as comparing different hazards in terms of risk reduction strategies and mitigation measures. Primarily, the most significant parameters of the problem complex are determined (1-types of hazards, 2-principle risk reduction strategies, 3-primary causes of vulnerability…etc.) and then assigned by a range of relevant values or conditions (1-earthquakes, 2-risk assessment, 3-weak infrastructure …etc.)(Ritchey, 2006). A morphological field is constructed by positioning the parameters against each other in an n-dimensional configuration space which refers to a matrix. If the particular sub set of configurations satisfy the criteria of internal consistency then the solution space or a more refined matrix is formed. This criteria is tested by assessing all parameters through Cross Consistency Assessment which uses pair-wise consistency relationships between conditions to eliminate internally inconsistent configurations and determine the extent of co-existing pairs (two conditions can co-exist, cannot co-exit, can co-exist but insignificant) (Ritchey, 2006). Graduate elimination of inconsistent parameters and extracting the correlated ones define the solution space and the residual morphological field becomes a flexible model including inputs and outputs decided for further analyses (Ritchey, 2006). Differing from structural methods, Morphological Analysis has many advantages in holistic approach, group work, finding new relations and testing limits and extremes of distinct parameters. Also the method is required to be facilitated as poor parameters become evident when they are assessed for internal consistency (Ritchey, 2006).

Whether there are blind spots in MHIRA, morphological analysis and single-track methods of engineering; there is a challenging field for scientific research to determine the most efficient parameters both for getting an overall risk view and rediscovering the relation in between multi-hazard analysis, urban planning and mitigation. The Earthquake Master Plan of Istanbul (EMPI, 2003) was both a comprehensive and a strategic study in the matter of interpreting and converting the technical output in to a meaningful input data for testing mitigation planning measures on local seismic risk factors of the urban system. The statistical methods including the hazard probability distribution in the region and microzonation maps were developed during the joint study of the Metropolitan Municipality of Istanbul-MMI and Japan International Cooperation Agency-JICA after the Great Marmara Earthquake (1999) to diagnose the seismic risk profile, possible impacts and loss scenarios of the potential future earthquake. The Metropolitan Municipality of İstanbul-MMI made a tender in late 2002 and assigned all four of the participant universities. The METU-ITU approach was based on the analysis of the hazard risk distribution according to urban risk sectors concluding to the mitigation plan. The Earthquake Master Plan of Istanbul (2003) developed in eight months through considering natural and human origin hazards, micro-zonation, and determination of thirteen risk sectors, prioritization of risks, defining procedures and methods for risk mitigation (Balamir, 2009). Through adopting a multi-sectoral and a participatory view, the plan simply aimed to gather stakeholders under matching risk sectors including macro-form, urban texture, urban productive capacity, land-use, hazardous uses, building stock, lifelines, emergency facilities, and special areas in connection with conservation, open spaces, risk management, social structure and externalities related to accidental events, emergences or terrorism (Balamir, 2009). Merely, the absence of concomitant policies to maintain planning powers and tools for the total transformation of high risk areas and comprehensive rehabilitation and the lack of supplementary financing and management methods weakened the concern of the metropolitan administration for the holistic implementation of the plan.

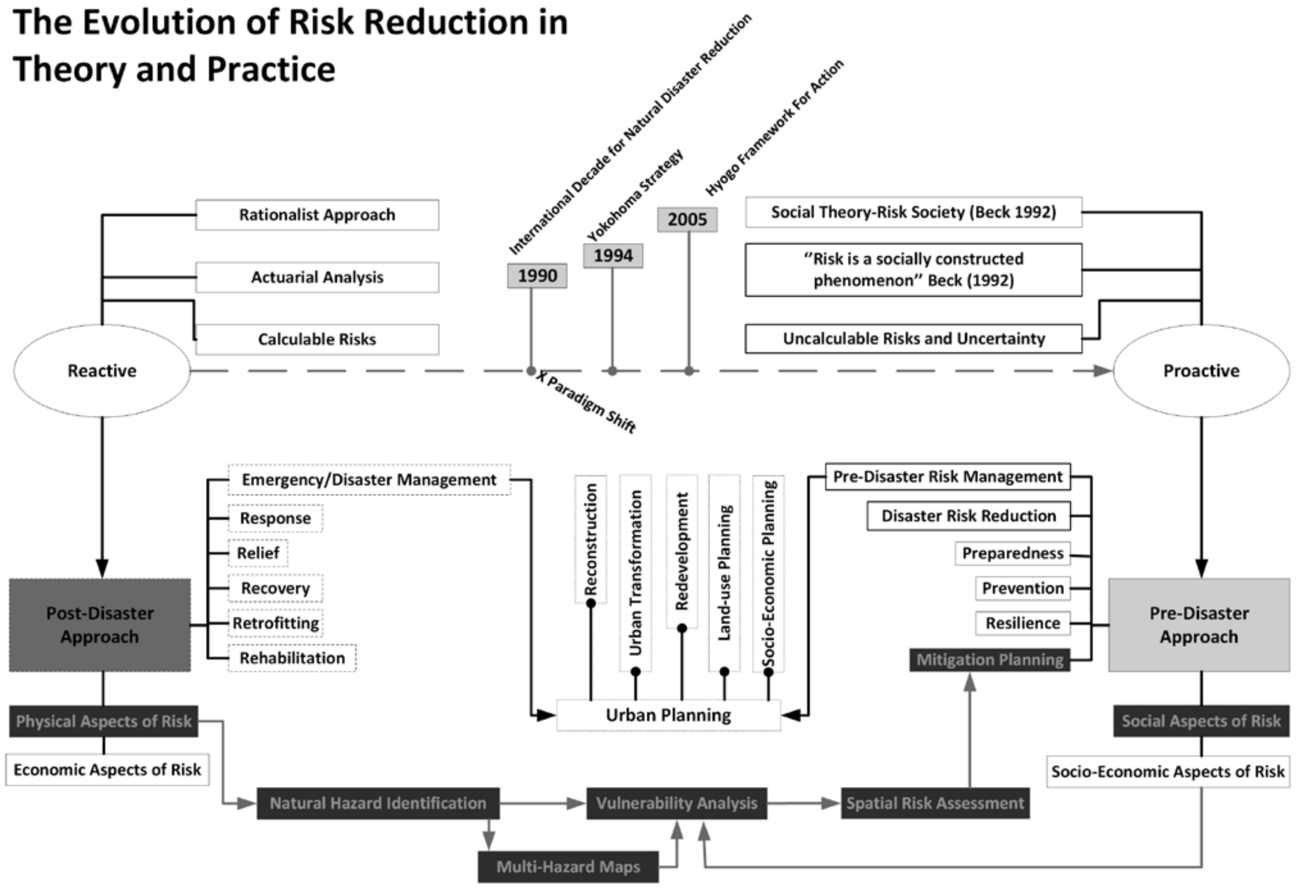


Figure 1. Author's Conceptualization, Evolution of Risk Reduction in Theory and Practice (Adam & Van Loon, 2000, 1-31; Balamir, 2009, 69-109; Beck 1992a, 22-38; 2000b, 211-227)

Motivation of the Study

Recent attempts on multi-hazard analysis clarified the requirement of redefining the relation between multi-hazard analysis, urban planning and mitigation. Whether multi-hazard risks are analyzed through statistical methods, non-structural techniques assessing correlation or as a part of the strategic methods adopting urban planning approaches for mitigation, configuring it as a dynamic analysis including multi-aspects of hazards as origins, impacts and vulnerabilities in urban system is rather critical to reduce the overall impacts of hazards. Therefore, single hazard analyses formed of rigid engineering studies fail to grab the overall impacts of hazards and delay in relating the statistical output to contextual input which refers to the direct impacts on urban system in identifying local seismic attributes, and prioritized risks and zones for mitigation.

Not a technical apparatus as it is imposed by administrators; but as a comprehensive set of activities, mitigation planning seeks to identify all types of hazards, risks and reduce likely losses from hazards (Balamir, 2009). Furthermore, it is based on "the identification and analysis of risks, estimation of the impact magnitude and the costs of the likely disaster;" and "demands intensive collaboration of disciplines and orchestrated preferably by planners in the urban context" (Balamir, 2004, 341). By adopting a proactive role and a pre-disaster approach, mitigation differs from the former concerns in theory and practice of post-disaster paradigm targeting to control and manage the impacts of disaster after it happened (**Figure 1**). Though, technical content, scope and method of implementation are still to be discovered at all levels.

Recent efforts concentrating on Istanbul has depended on individual risk analyses and risk reduction techniques for the determination of hazardous ground conditions and the assessment of the building codes for safety. After the development of the Earthquake Master Plan of Istanbul (2003) demanded by MMI, specific neighborhoods considered as high risk zones has been subjected to detailed risk analyses and mitigation plans in terms of geological and geophysical studies. In fact, the engineering tactics related to sampling methods focus on individual building risks rather than determination of city-level risks (Balamir, 2009). It is hard not to mention the gap in multi-hazard analysis to identify city-level hazards becoming risks, interpret risk data as a legible and accessible scientific knowledge, and facilitate the integration of a planning vision structured by the mitigation plan. That a small but critical contribution for developing a holistic approach, it could also help the implementation of the complementary objectives of mitigation planning by leading it to multi-sectoral and multi-disciplinary organization of socio-technical capacities.

By the same reason of filling the gap of developing an approach for risk reduction within the holistic objectives of planning; METU graduate city planning studio team (2007-2009) gathered under the mentorship of Prof. Dr. Murat Balamir for İŞAT Fatih Project (2009). Istanbul Fatih District, as the first degree seismic risk zone, holds challenging factors as seismic attributes, historical and cultural assets included in scope of Istanbul Historical Peninsula Conservation Plan Decisions 1:5000 (2005). The main objective of analysis is to develop an independent approach including the identification of multi-hazard risks and the determination of the necessity and the priority ranks as well as objectives, projects, standards and operation units for implementation at neighborhood level. (Balamir, 2009) As the secondary purpose, the identification of multi-hazard risk and vulnerabilities through planning-led evaluations are tested for their consistency with the results of engineering surveys. Therefore the strongest point of this study expresses an alternative for analyzing multi-hazards and urban risks by the critical perspective of planning which is devised and integrated as a mitigation approach.

In scope of the article the main contribution is introducing a set of analysis to evaluate multi-aspects of natural hazards, vulnerabilities and unfolding the layers of the compound risk profile of the district in order to determine the priority risk zones and develop mitigation strategies. In the first step, Identifying Local Seismic Attributes, the research criteria depends on the available natural hazard data achieved from BİMTAŞ project group. Natural hazards are examined through their relations to natural disaster resources located in the neighborhood. Natural hazard maps developed by using ARCGIS 9.0 program and entitled as Terrain Hazards, Local Geological Attributes and Hydrologic Hazards. In this scope, they are categorized in accordance with natural hazard types and hazard intensity potentials referring to their distribution patterns in the neighborhood.

Multi-Hazard Map shows the clustering relations of natural hazards in terms of hazard type and location. By this way, quantitative and qualitative attributes of hazards become available for further analyses of risk sectors. Multi-Hazard Map also works as a base map for other analyses through combining slope and elevation features, ground structure, location and coastal hazard potential. In the first level of prioritization, 24 hazard zones are determined out of 36 and evaluated by 5 criteria with reference to the research criteria defined in line with GIS data obtained from BİMTAŞ project group;

- Priority Hazard Zones: A high overlapping intensity of local seismic attributes and hazardous ground conditions are likely to generate major disaster impacts.
- Built-up Area Density at Hazard Zones: Hazard areas with dense building patterns imply for high sensitivity to urban risks.
- Land-use at Hazard Zones: In residential disaster-prone areas, more dwellers are exposed to seismic urban risks.
- Density of Historical Registered Buildings per Hazard Zone: Historical registered building density per hazard area is evaluated to define conservation priorities.
- Conservation Plan Decisions: Through considering the previous criteria, hazard areas located in conservation areas are evaluated to define potential levels of physical intervention permitted according to historical priorities.

Both quantitative and qualitative aspects are regarded for prioritization and describing the priority zones. Prioritization is rather a judgmental process in which the destructive combinations of natural hazards, vulnerabilities bearing secondary and tertiary disasters, high loss estimations, and weak infrastructure for emergency are under consideration.

In Vulnerability Analysis, 24 priority hazard zones are categorized by the vulnerability criteria consists of; socio-economic structure, building stock, hazardous land use attributes, open space network, infrastructure and emergency transportation. Considering calculable and economic aspects of risk parameters and vulnerabilities, Spatial Risk Assessment is the last step focusing on economic impacts of the vulnerabilities. Property values per hazard zone are calculated by the real estate data derived from BİMTAŞ project group. Residential and commercial real estate values are calculated for each hazard zone to find total asset value and estimate the potential economic losses. The buildings at risk which are determined from the engineering survey of BİMTAŞ, are compared to the findings of the vulnerability analysis relevant to building stock. Through defining a new research criteria based on the building codes for disaster-prone areas (2006); spatial distributions and qualities of the building stock are also explored.

As the last stage, risk zones are prioritized in terms of emergency scenario and emergency measures stated by the administrative authorities. Building stock attributes, engineering survey data achieved from BİMTAŞ, Conservation Plan Decisions, and infrastructure are considered while developing an emergency scenario. Damage/loss estimations are developed with respect to AFAD's damage report of the Great Marmara Earthquake (1999), and according to the earthquake scenario model of JICA with a magnitude 7.5 (JICA, 2002). Emergency measures and emergency facilities (ADG) defined by the disaster manual of the governorship and MMI-AKOM data base are re-evaluated in terms of accessibility, capacity and proximity to emergency service areas. Emergency routes for evacuation, vulnerable road networks that would be closed during earthquake, rallying points and alternative emergency routes are determined in the scenario.

ANALYSIS

Natural hazards inherited from terrain morphology are unalterable indicators of risk parameters. Technical aspects of natural hazards and their relations to the building stock have been commonly explored by other disciplines but their impacts on urban system is the primary research field of the planning discipline.

Istanbul Fatih District as an Urban Risk Pool

As an urban risk pool, Fatih District located at the Historical Peninsula, includes the entire area of Haliç, Beyoglu and the Bosphorus at the east, the Marmara Sea and three other districts on the west (Zeytinburnu, Eyüp, Bayrampaşa)(**Figure 2**). Through the history; settlements of Greek, Roman civilizations and the Ottoman Empire claim the significance of the district preserving today as a center of tourism, culture, and business while small industry and wholesales functions endanger historical assets here. Fatih District is a contextual priority with various challenges for planners and a prototype for carrying all the general problems and constraints that Istanbul is withstanding.

Figure 2. Fatih District and the Historical Peninsula

The Historical Peninsula is defined under the first Degree Earthquake Zone and Fatih District is evaluated with in the first ten settlement areas exposed to high seismic risk. (AFAD, 1996)

Developing an Approach to Analyze Local Seismic Attributes

Through evaluating the natural hazards that Fatih district is exposed to, it is aimed to determine relevant spatial zones and conditions. Natural hazards grounded on the natural attributes of the district are the primary factors increasing the vulnerability of assets, communities and investments at the district. These factors are examined and entitled (**Figure 3**), as Terrain Hazards, Geological Attributes, and Hydrologic Hazards, depending on

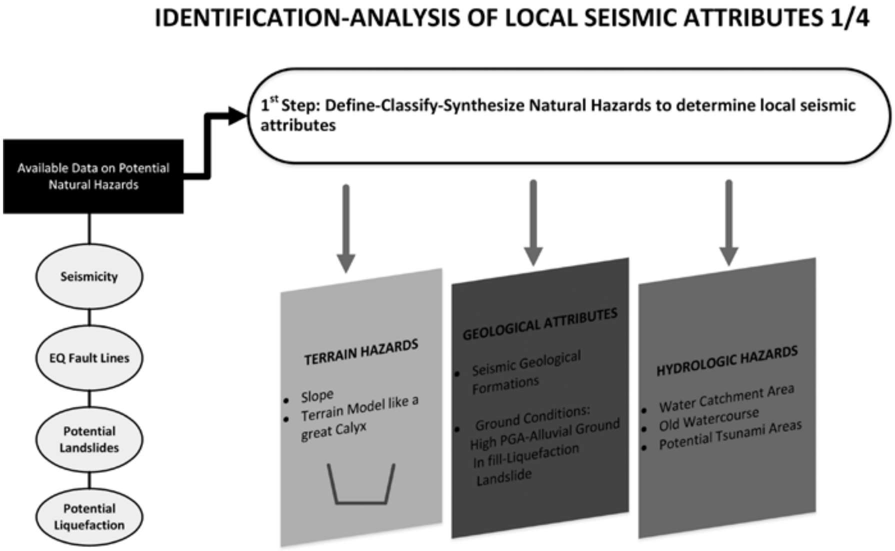


Figure 3. Hazard Identification

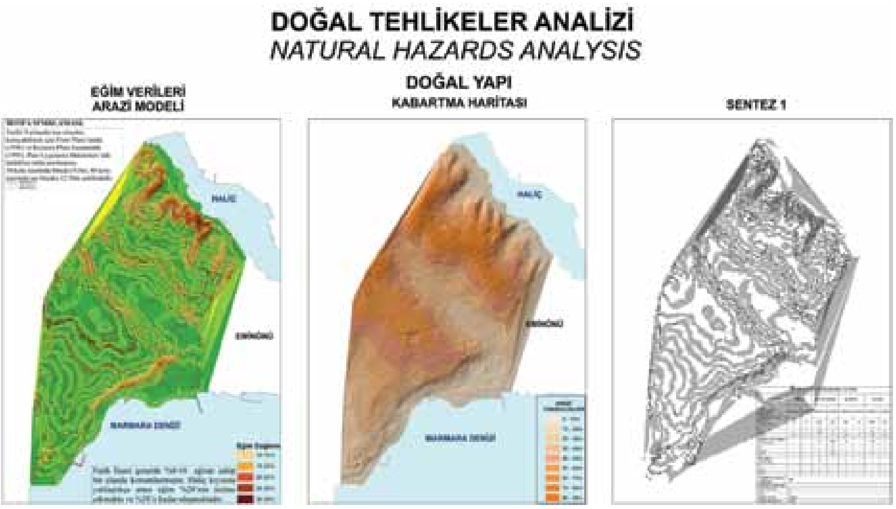


Figure 4. Terrain Hazards: Slope Analysis and Terrain Model (İŞAT Fatih Project, 2009).

JICA report (2002) and hazard digital maps derived from BİMTAŞ project group in scope of İŞAT Fatih Project (2009).

In first step of the analysis; hazard data is defined, classified, represented in maps and synthesized in terms of types and groups of hazards reflecting the physical relations that trigger seismicity. In Terrain Hazards; slope data and terrain model are mapped and analyzed (**Figure 4**). Local Geological Attributes include the available data on formations and ground conditions (**Figure 5**). Also water catchment area, old water course and potential tsunami impact areas are examined under Hydrological Attributes. Under all three titles, synthesis maps show the aggregation zones of natural hazards according to each defined category, giving individual analysis of the natural hazard impact areas and also the preliminary phases of the Multi-Hazard Map which would be the next step.

Slope is the primary indicator to point out the terrain character and specific zones exposed to natural hazards. This map is developed by utilizing contour lines showing the altitude changes between 90m to 10m. Land

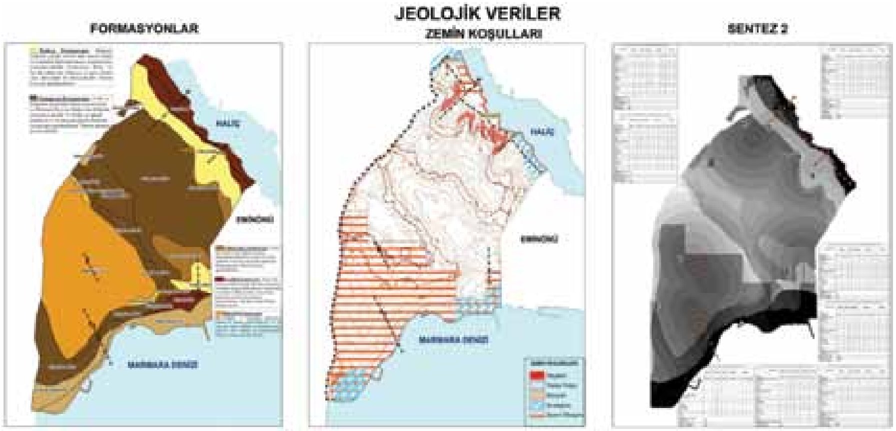


Figure 5. Local Geological Attributes: Geologic Formations and Geologic Data Analysis (İŞAT Fatih Project, 2009).

shapes; hillsides, heights and lower parts that form the water catchment area simply define the existing terrain character.

In terrain model, developed according to the slope data, slope values changing in 10% to 35%, are shown with contour lines. Slope values higher than 20% indicates for landslide hazard (EMPI, 2003), therefore slope potential zones are identified separately and also included by the Multi-hazard Map. Hillsides located at the coastal areas of Haliç in Fatih district, Güngören and Trakya formations, areas with terrain slope changing in 20% to 38% contains landslide potential (İŞAT Fatih Project, 2009). With a calyx-like terrain morphology, it generates a water catchment area in the mid part of the district in which slope values change in 10-15% at the water catchment periphery and 10-20% at Marmara coastal areas (İŞAT Fatih Project, 2009). Despite the landslide potential of the district, the destruction of Haliç and Marmara coast line and artificial infills increase the exposure to earthquakes and subsequent tsunamis.

Local Geological Attributes refer to seismic potential of the district are composed of specific ground conditions, hazardous grounds, natural hazards as landslide and liquefaction and earthquake faults. Geological formations are classified with respect to the hazard rating specified in the geological report for settlement convenience derived from BİMTAŞ (EMPI, 2003). It is indicated that fine grained texture is a better transmitter for ground shakes when it is compared to coarse grained texture and rocks with a minimum transmittance of seismic ground shakes (EMPI, 2003). In parallel with the settlement convenience criteria, formations ranging from the most hazardous to safe are shown in dark to light brown areas in the first map in **Figure 5**.

The key factors increasing the seismic potential of the geologic structures are summarized as follows:

Ground Conditions specify natural formations, earthquake fault lines, and landslide and liquefaction hazards.

Fault lines increasing the level of seismicity are examined with 50m impact areas in multi-hazard analyses.

Red landslide zones shown in North direction in the second map in Figure 5 are clustered proximately to Haliç coast and positioned on hazardous Güngören and safe Trakya formations. Potential landslide areas are observed in hillsides with slope values greater than 20% and are also

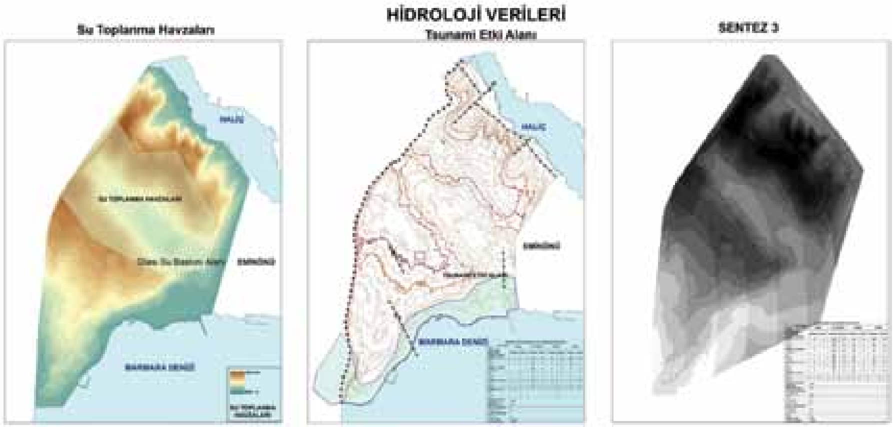


Figure 6. Hydrological Attributes: Tsunami Impact Area, Water Catchment Model (İŞAT Fatih Project, 2009).

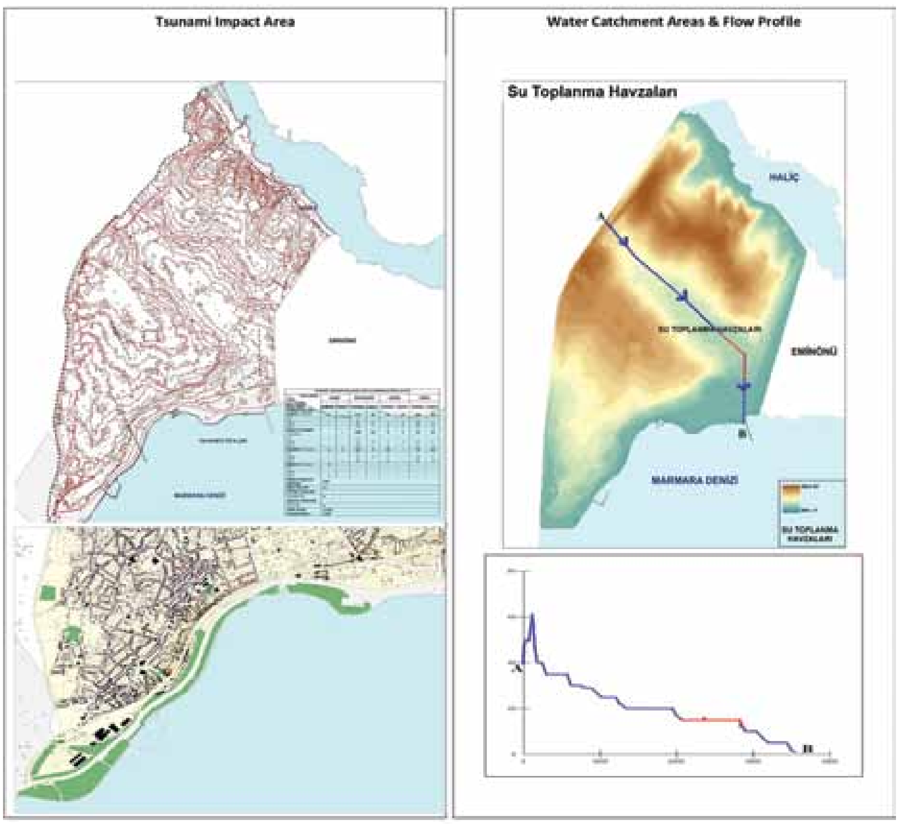


Figure 7. Details on Hydrological Attributes: Tsunami Impact Areas and Flow Profile (İŞAT Fatih Project, 2009).

exposed to water catchment area which may trigger secondary disasters such as floods during the earthquake.

Liquefaction areas, located at both Haliç and Marmara coasts in North-Northwest and South-Southwest directions, are shown in blue hatches in the second map in **Figure 5**. Artificial infills, the most hazardous Kuşdili formation, and the areas with high conductivity in transmitting earthquake shaking and potential liquefaction areas increase the overall hazard potential of the district seriously.

Hazardous grounds include artificial infills, high PGA areas and alluvial grounds (JICA, 2002).

Considering with the most hazardous formations Kuşdili and Güngören, generating landslide potential and artificial infills are structured at Marmara coast and imply for a high level of hazard during the earthquake.

Alluvial grounds are located along the Haliç coast and increasing the district's vulnerability by intersecting with the most hazardous Kuşdili formation, liquefaction areas and high PGA areas.

Areas with High Peak Ground Acceleration-HPGA, are separated in to three zones, shown by the red hatched areas in the second map in **Figure 5**. First zone is located at the Marmara coast and active to transmit seismic shakes as safe Bakırköy formation covers 401 hectares of the hazardous Güngören formation, including historical registered buildings, hospitals and wooden constructions. Other two zones cover 14.5 hectares at the Marmara coast and geographically intersects with liquefaction areas, and 1 hectare in city walls area (İŞAT Fatih Project, 2009).

In scope of Hydrological Attributes, water catchment model is developed by considering terrain slope and water courses located in the Fatih district. Terrain morphology structured like a great calyx, is laid from west to the center, dividing the district in north-south direction by a valley. Slope values increasing up to 30% in the Haliç coast and decreasing to the coastline which is destructed by artificial infills, and infrastructure problems are the favorable conditions for floods (İŞAT Fatih Project, 2009). In order to determine the potential flood impact area; slope, long-term precipitation statistics, past flood data and water flow direction are required (İŞAT Fatih Project, 2009). Even though there has not been experienced a serious flooding in last five years, flood potential of the district is critical when vulnerabilities are considered. In **Figure 6-7**, water catchment model is formed by slope data and water flow data based on its direction after rainfall, is shown in dark green. The precipitation water is catched through the valley dividing the district in north-south direction and crosses Vatan Street which is the main artery including dense settlements. The rainwater flows in southeast direction and accumulates in the joint of Millet Street and Atatürk Boulevard as shown in red line in **Figure 6** and **Figure 7**. Catchment areas are located on the Haliç coast and on the Marmara coast where the artificial infills are also included. The determination of the potential flood areas is the main process in taking risk reduction precautions for the basement and ground floor uses. It is found that more than half of the buildings located at water catchment area include commercial basement uses. (İŞAT Fatih Project, 2009)

According to JICA's earthquake scenario with 7.5 magnitude, tsunami would be observed in the Marmara coast. Tsunami impact area includes; artificial infills, liquefaction areas, areas with high PGA, and the most hazardous Kuşdili formation which increase the vulnerability of the district. Mostly, residential uses and masonry buildings are observed in the tsunami impact area.

In conclusion of examining Natural Structure including Terrain Hazards, Geological Attributes and Hydrological Attributes, multi-hazard zones formed of the superimposition of natural hazards are determined in ARCGIS 9.0 program and Multi-hazard Map is developed. Without prioritizing any hazard groups composing the hazard combinations, it is aimed to identify and map quantitative relations of hazards. Also hazard combinations included by multi-hazard zones are examined precisely.

MULTI-HAZARD ZONES	
2 Hazard Combinations HGF +Landslide HGF+ W. Catch. HGF + HPGA	**3 Hazard Combinations** HGF +Landslide + W. Catch. HGF +Infill +HPGA HGF+ Tsunami + W. Catch. HPGA + Tsunami + W. Catch.
4 Hazard Combinations HGF +Landslide + W. Catch. + HPGA HGF+ Tsunami+ W. Catch. HGF + Alluvial Ground + Fault + W. Catch. HGF + Alluvial Ground + Liquefaction + W. Catch. HGF + HPGA +Fault + W. Catch. HGF + Fault + Landslide + W. Catch. HGF + Fault + Liquefaction + W. Catch. HGF + HPGA + Alluvial Ground + W. Catch. HGF + HPGA + Liquefaction + W. Catch. Tsunami + Infill + HPGA + W. Catch.	**5 Hazard Combinations** HGF +HPGA + Fault + Tsunami + W. Catch. HGF + HPGA + Liquefaction + Tsunami + W. Catch. HGF + HPGA + Alluvial Ground + Fault + W. Catch. Infill + HPGA + Liquefaction + Tsunami + W. Catch.
HPGA-High Peak Ground Acceleration **HGF-Hazardous Geologic Formation** **W. Catch-Water Catchment Area**	

Table 2. Multi-Hazard Zones

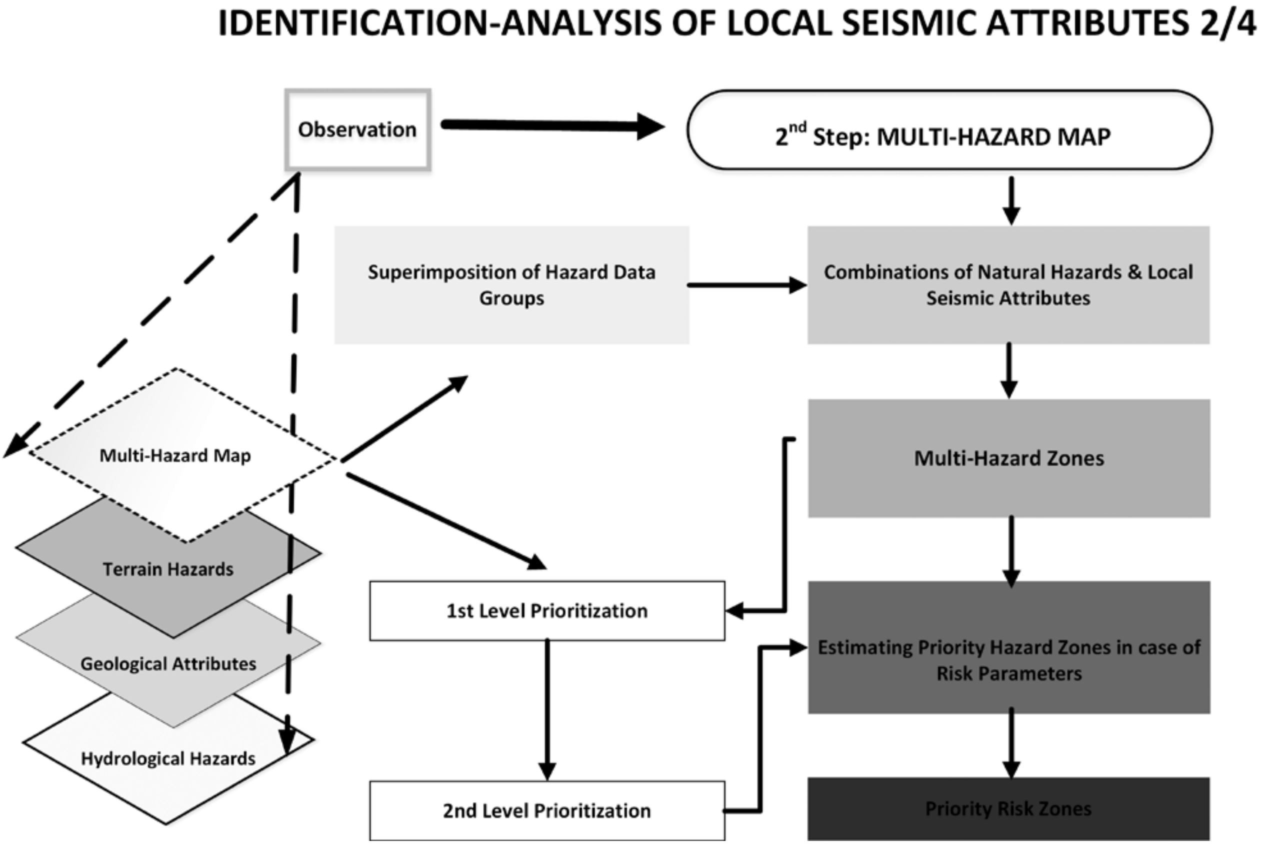


Figure 8. Multi-Hazard Map Author's Conceptualization

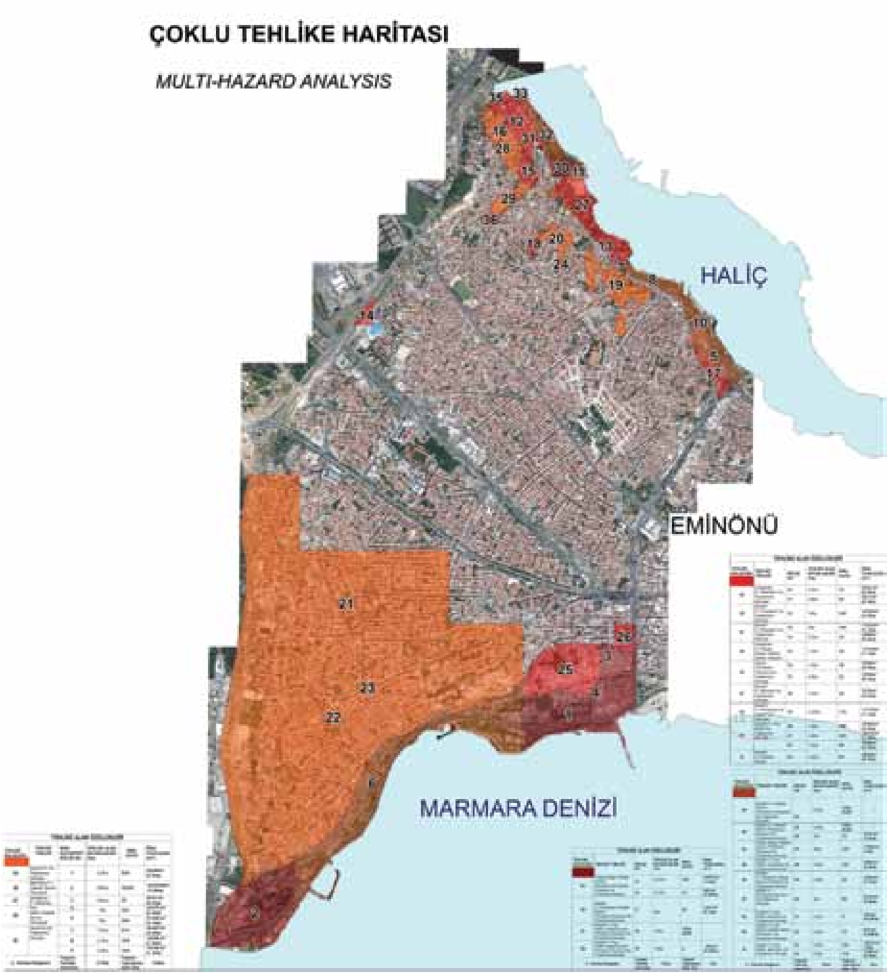


Figure 9. Multi-Hazard Map (İŞAT Fatih Project, 2009).

Hazard data achieved from BİMTAŞ project group is utilized in the identification of 36 multi-hazard zones in scope of the Multi-hazard Map. 36 multi-hazard zones with 24 distinct attributes are determined from the variants of the clustering hazards of two to five (**Table 2**). In the identification of multi-hazard zones, high levels of vulnerability and high risk potential in terms of quantitative and qualitative seismic attributes are evaluated primarily. Multi-hazard zones are assessed in equal significance under the quantitative perspective and utilized as a base map for further analysis. Other circumstances created by vulnerabilities or urban risks disturbing the level of equality are determined through the qualitative perspective and prioritized to monitor integrated effects of hazards and disaster risks (**Figure 8**).

36 multi-hazard zones formed of the combinations of distinct natural hazards as landslide, fault lines, liquefaction, tsunami, alluvial ground, artificial infills are positioned proximate to Marmara and Haliç coasts. Multi-Hazard Map, showing multi-hazard zones ranging 5 to 2 hazard combinations are shown in dark to light red (**Figure 9**).

The prioritization criteria is selected by pre-assessing local seismic attributes and building stock to find the most vulnerable multi-hazard zones. Hazard combinations included by multi-hazard zones are re-evaluated as to the frequency of overlapping ground conditions and

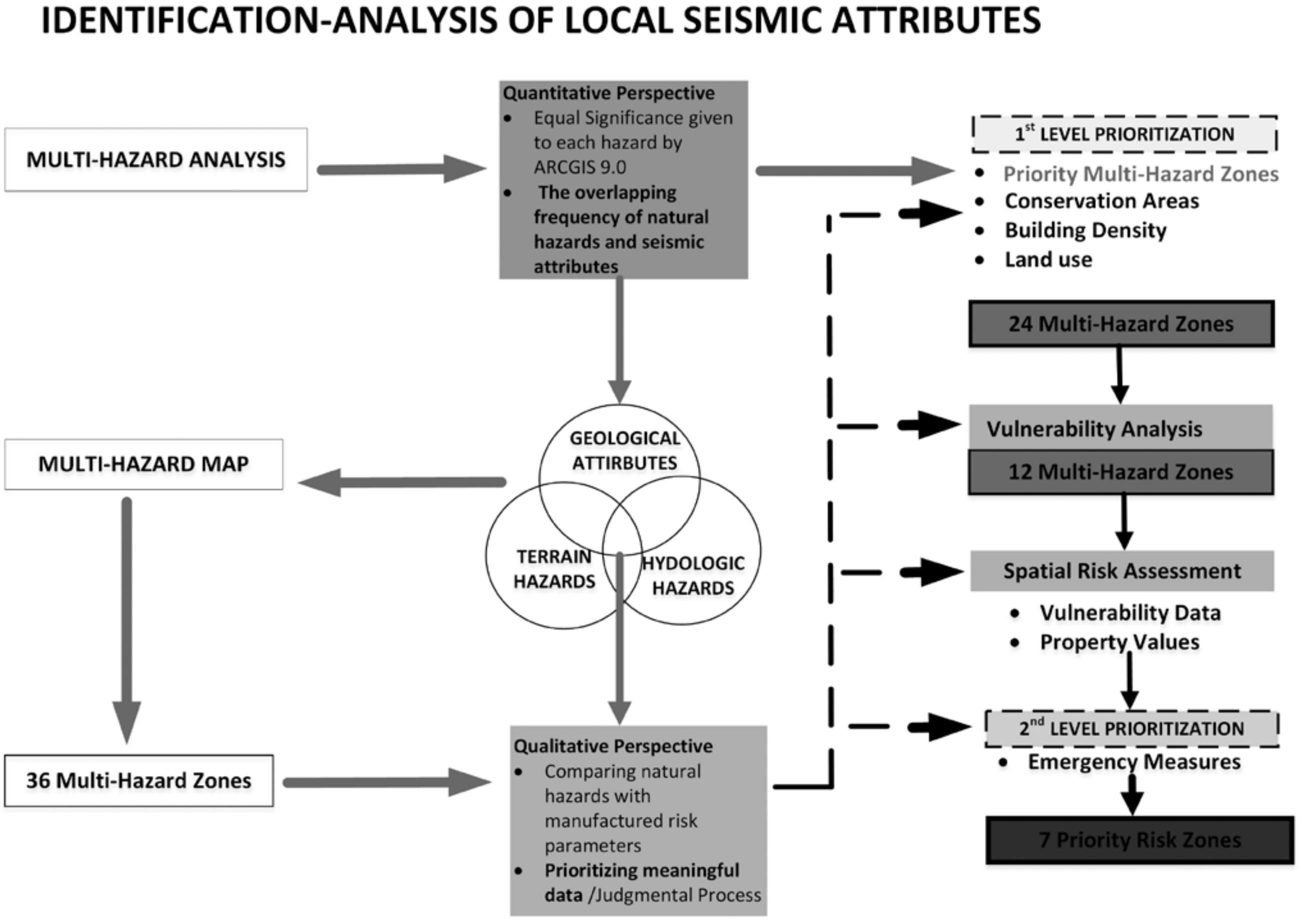


Figure 10. The Prioritization of Multi Hazard Zones Author's Conceptualization

seismic attributes. The assumption is made to prioritize highly vulnerable combinations of hazards holding together ground conditions of liquefaction, landslide, alluvial ground, formations unsafe for settlements and seismic attributes such as fault lines and high PGA areas referring to active seismicity.

Another critical factor is the priority of historical values and assets included by multi-hazard areas that are exposed to natural hazards and risks. It is required to eliminate these hazards by defining the scale and the limit of spatial interventions which are determined in scope of the Conservation Decisions (İstanbul Historical Peninsula Conservation Plan 1:5000, 2005) (**Table 5**). Thus, Conservation Areas are examined in respect of the multi-hazard combinations, the level of spatial interventions and density attributes of the existing building stock.

The correlation between multi-hazard areas and total built up area is shown in **Figure 11**. The ratio of total building surface area to multi-hazard area gives the built up area density (İŞAT Fatih Project, 2009). Fortunately, it is observed that natural hazard combinations decrease as total built up area (ha) increases. In order to identify problems, potentials and priorities according to the mitigation plan, building type, quality, use, historical buildings and green areas are inventoried.

The number of existing buildings, construction permits and permits for building alterations are also examined through the parallel assessment

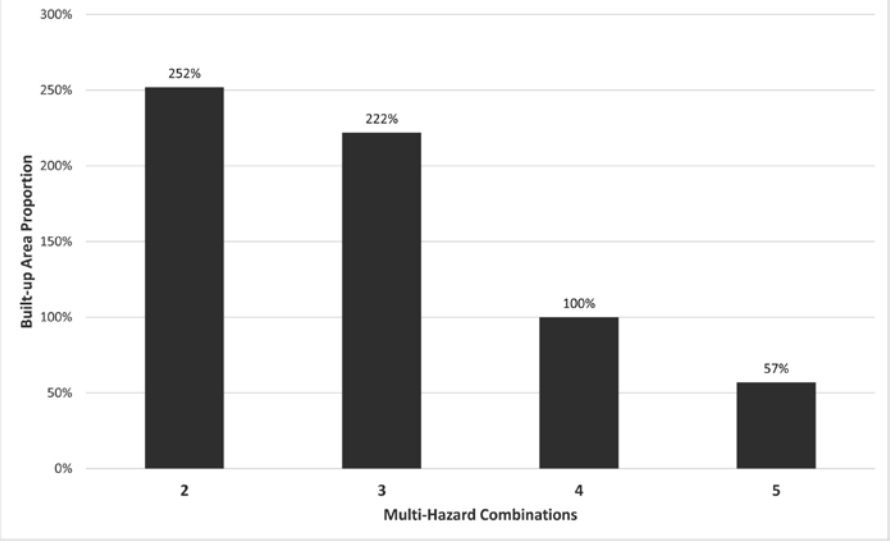


Figure 11. Built Up Area Density (İŞAT Fatih Project, 2009)

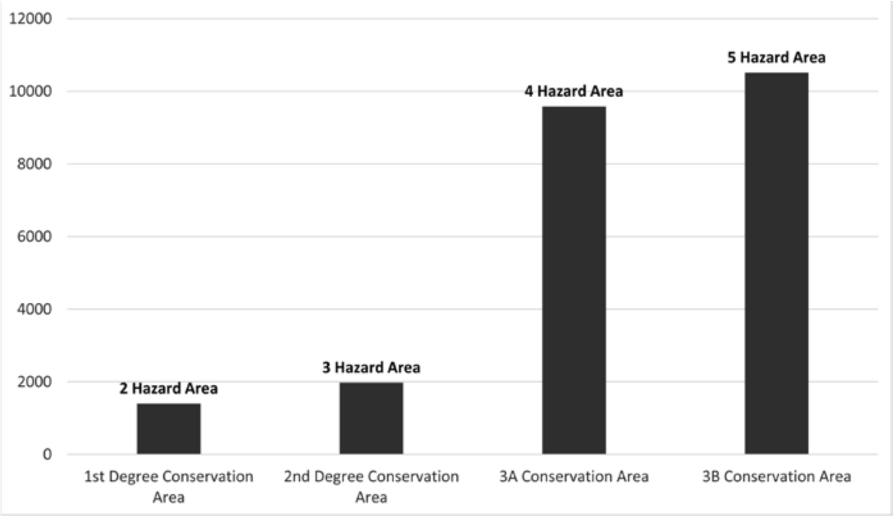


Figure 12. The Distribution of Buildings According to Multi-Hazard Zones & Conservation Areas (İŞAT Fatih Project, 2009)

of the Multi-Hazard Map and the Conservation Plan. It is concluded that while decisions related to conservation areas are relaxed, hazard combinations and number of buildings increase (**Figure 12**). In other words there is a greater scope for the implementation of mitigation measures since areas at greater hazard are strictly less constrained by conservation decisions. Accordingly 16.000 buildings and 29.5% of total built up area are found to be under 3rd degree Conservation Area, which allows retrofitting and regeneration, including areas with 4 or 5 hazard combinations (İŞAT Fatih Project, 2009).

In third step of the Analysis, vulnerability criteria is defined for the district through exploring physical and social structure. Built-up Area Density is explored through reviewing multi-hazard zones in which natural hazard impacts are likely to be increased by the vulnerabilities in dense building patterns. Land use in multi-hazard zones is examined and residential area are prioritized as dwellers exposed to natural hazards continuously (İŞAT Fatih Project, 2009). Average Building Age is critical to rise the sensitivity of the district to natural hazards and potential damage as the most multi-

<table>
<tr><td colspan="2">**VULNERABILITY ANALYSIS**</td></tr>
<tr><td colspan="2">**PHYSICAL STRUCTURE**</td></tr>
<tr><td>Building Material
Wooden 1%
Concrete-Masonry 5%
Masonry 31%
Concrete 63%</td><td>Buildings in Conservation Areas
1st Degree Conservation Area 8%
2nd Degree Conservation Area 11%
3A Conservation Area 41%
3B Conservation Area 40%</td></tr>
<tr><td>Land Use
Residential 65%
Residential-Commercial 27%
Commercial 7%
Small Manufacturing Industry 1%</td><td>Public Use in Conservation Areas
1st Degree Conservation Area 40%
2nd Degree Conservation Area 20%
3A Conservation Area 10%
Conservation Area Periphery 30%</td></tr>
<tr><td>Age
0-15 Years 13%
16-35 Years 43%
36-45 Years 20%
46-65 Years 19%
66-98 Years 5%</td><td>Registered Buildings in Multi-Hazard Zones
5 Hazard Zone 7%
4 Hazard Zone 21%
3 Hazard Zone 12%
2 Hazard Zone 60%</td></tr>
<tr><td>No. of Storey
1-3 Storey 10%
4 Storey 16%
5 Storey 28%
6 Storey 19%
7 Storey 5%</td><td>Infrastructure in Fault Line Impact Area (50m)
Gas Line Network 19%
Electric Network 57%
Water Line Network None
Sewage Network 55%
Infrastructure in Multi-Hazard Zones
Lifelines are mostly located at 2 Hazard Areas
Vulnerable Road Network
2-8m roads will be closed with a possibility>50%
8-15m roads will be closed with a possibility=50%</td></tr>
<tr><td colspan="2">**SOCIAL STRUCTURE**
POPULATION CHARACTERISTICS
• Participation to Local Meetings **85%**
• Neighbor Relations **Do not Feel Bounded to Neighborhood 59%**
• Opinion on Local Safety **Unsafe 66.7%**
• House Ownership **45%Owner, 61% Tenant**
• Vehicle Ownership and Transportation **Do not have any vehicle 78%**
Use Bus for Transportation 79%
Do not travel 90%
• The Level of Contentment in the Locality **Discontentment 73%**</td></tr>
</table>

Table 3. Vulnerability Analysis

hazard zones include buildings over 50 years. Historical Registered Buildings indicating the historical priority and potential economic vulnerability, increase the overall vulnerability of the district and requires for extra mitigation precautions.

Infrastructure and building stock as an alternative to infeasible engineering surveys are examined by singular and comparative matrices depending on the available data derived from BİMTAŞ including age, material, quality, land use, number of storey and number of registered historical buildings. Social dimensions of vulnerabilities are determined through social survey on quality of life, carried out by BİMTAŞ in 2008 (İŞAT Fatih Project, 2009).

SPATIAL RISK ASSESSMENT	
VULNERABILITY DATA • Comparative Matrices on o Building Stock Attributes o Land Use o Conservation Areas o Historical Buildings o Infrastructure-Lifelines	**BUILDING STOCK** o Aged and High Buildings (Over 45 Years & 5-7 Storey) o Wooden Building Stock o Commercial Use
***Comparison With The Engineering Survey Data**	**PROPERTY VALUES** Residential and Commercial RE Values Based on Average Market Price Per Unit

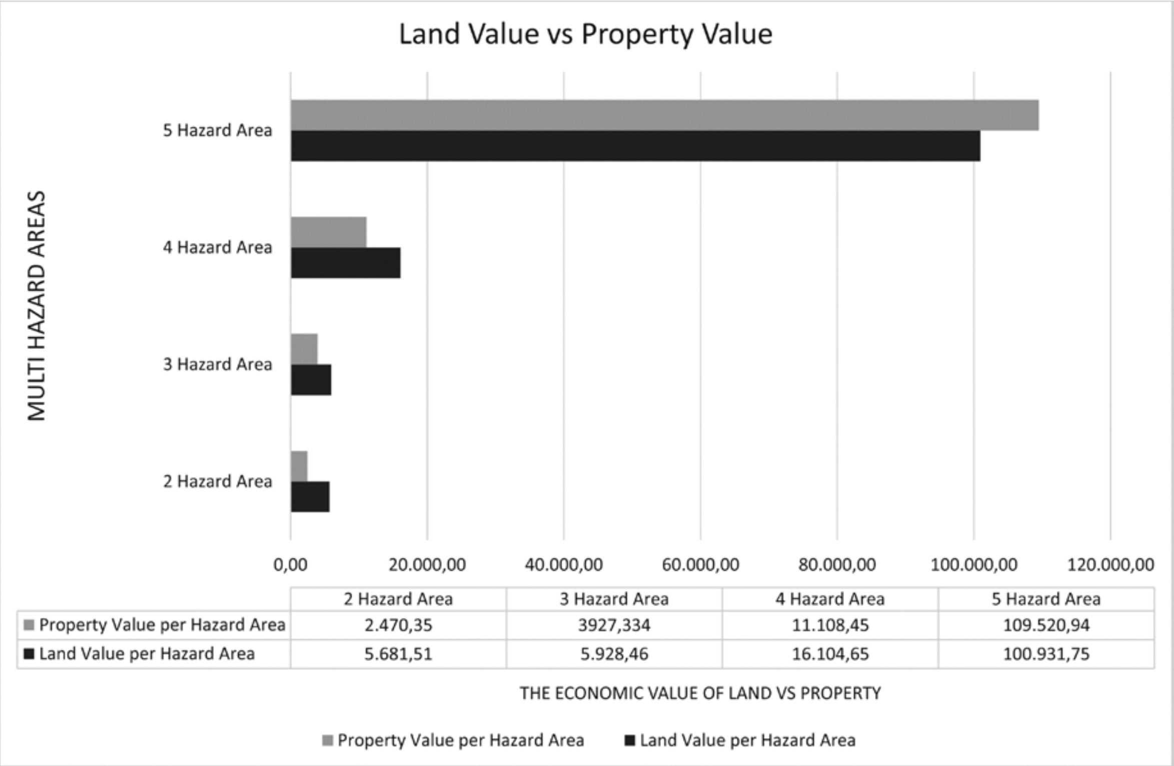
Table 4. Spatial Risk Assessment

Figure 13. Property Value Vs Land Value

Social survey relevant to risk reduction including accessibility, sense of attachment, safety, sociability, and socio-economic statue are taken in to consideration (**Table 3**).

Fourth step spatial risk assessment, theoretically refers to physical dimensions of vulnerabilities regarding the expected harm and loss analysis according to the worst earthquake scenario (JICA, 2002). Property values including residential and commercial real estate values based on average market price per unit of property are examined through integrating to the previous research findings on vulnerabilities (**Table 4**).

While analyzing the building stock, it is required for an additional emphasis on wooden buildings that constitute the minor part of the stock but are hazardous to generate secondary disasters as fires which were rather common in district's history. Infrastructure as a vulnerable resource to generate secondary disasters such as explosions in gas lines is evaluated in the analysis. As a common vector, socio-economic vulnerabilities that have direct impacts on physical vulnerabilities are explored according to district-based quality of life survey achieved from BİMTAŞ (İŞAT Fatih Project, 2009).



	2 Hazard Area	3 Hazard Area	4 Hazard Area	5 Hazard Area
■ Property Value per Hazard Area	2.470,35	3927,334	11.108,45	109.520,94
■ Land Value per Hazard Area	5.681,51	5.928,46	16.104,65	100.931,75

Figure 14. Land Value Vs Property Value

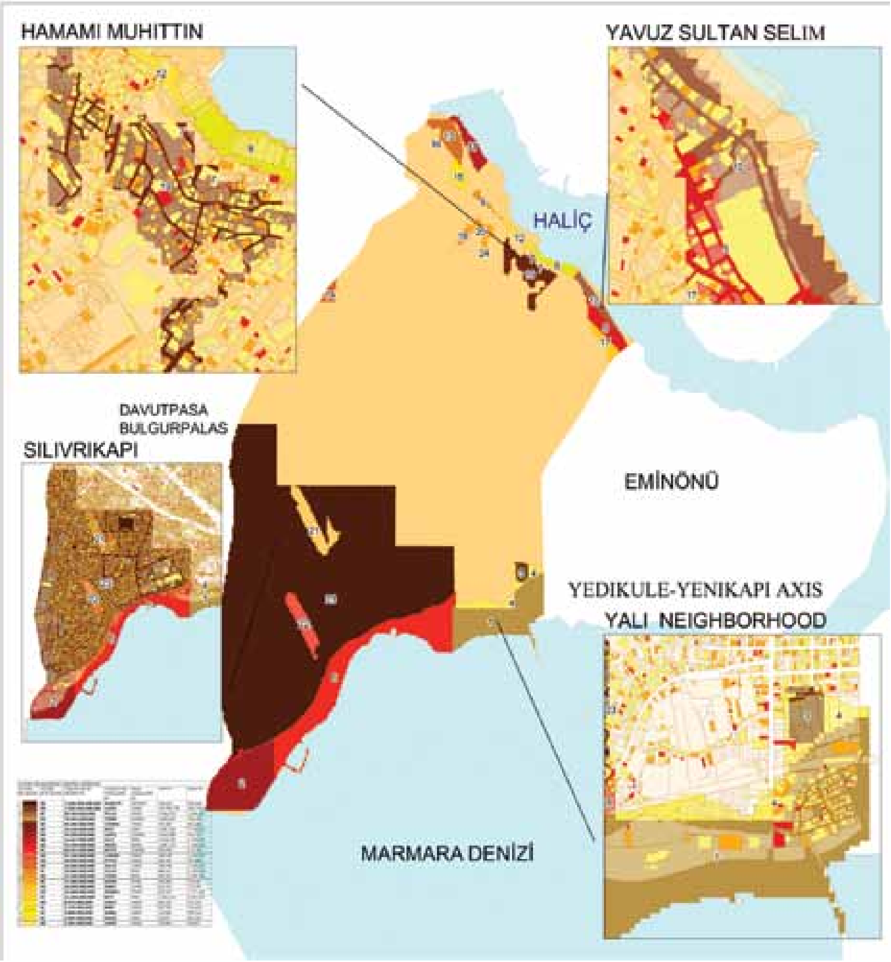


Figure 15. Prioritized Risk Areas-I (Ertan, 2009)

The poor quality building stock and built environment minimize property value which is 44% of the land value in 2 hazard areas while land value is higher in most of the multi-hazard areas (İŞAT Fatih Project, 2009) (**Figure 13**).

A more detailed version of property average value changing in between 3600.000 TL to 110.000 TL and range of land value in between 8.000 TL to 101.000 TL for 24 multi-hazard zones are summed to show the potential economic vulnerability of the district (İŞAT Fatih Project, 2009) (**Figure 14**).

The second level of prioritization includes risk zones that are critical for emergency management. Particularly, emergency measures indicated by disaster coordination center of local municipality (AKOM) are questioned for adequacy and operationality (İŞAT Fatih Project, 2009). For developing a mitigation approach; both long-term socio-physical impacts and short term physical disaster impacts; pre-disaster and post disaster objectives are considered from a holistic perspective. Emergency management, as the last criteria of prioritization, concentrates on vulnerabilities in road network, availability and accessibility to designated emergency facilities, temporary accommodation availabilities, emergency storage requirements, hospital capacities and schools in proximity. Finally 7 micro zones are identified as indicated below (**Figure 15**).

Emergency measures defined by the metropolitan municipality and JICA are compared to find out inconveniencies. The basic research criteria tested

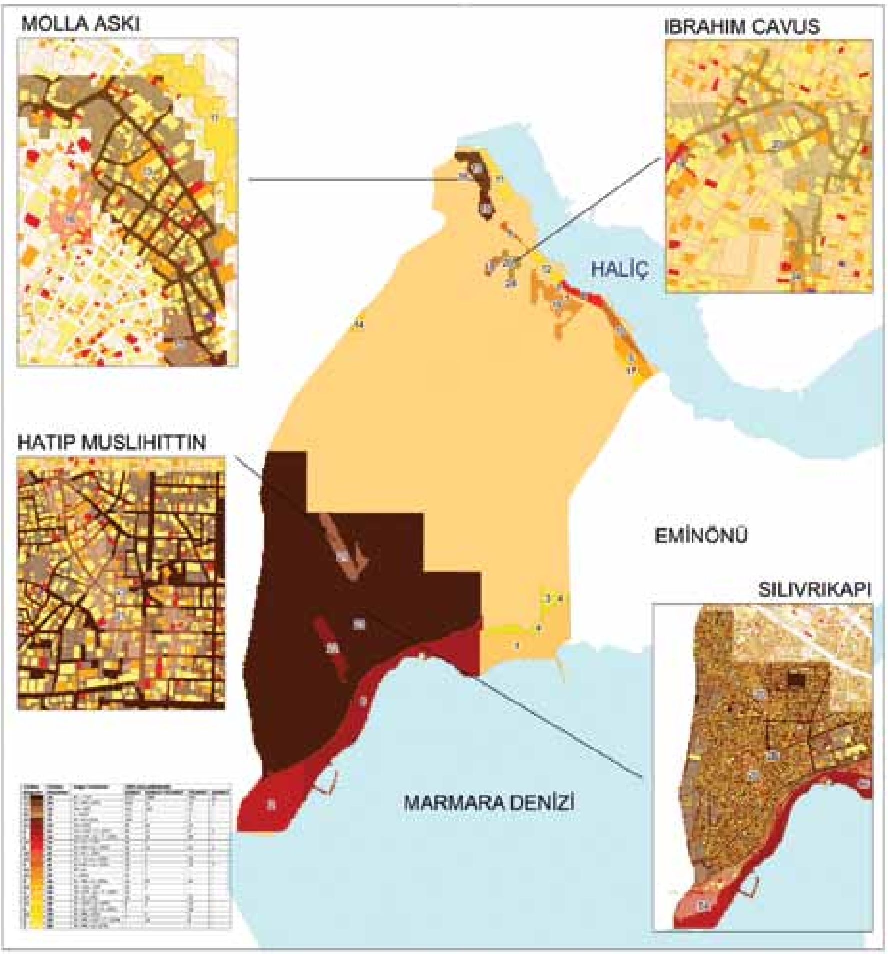


Figure 16. Prioritized Risk Areas-II (Ertan, 2009)

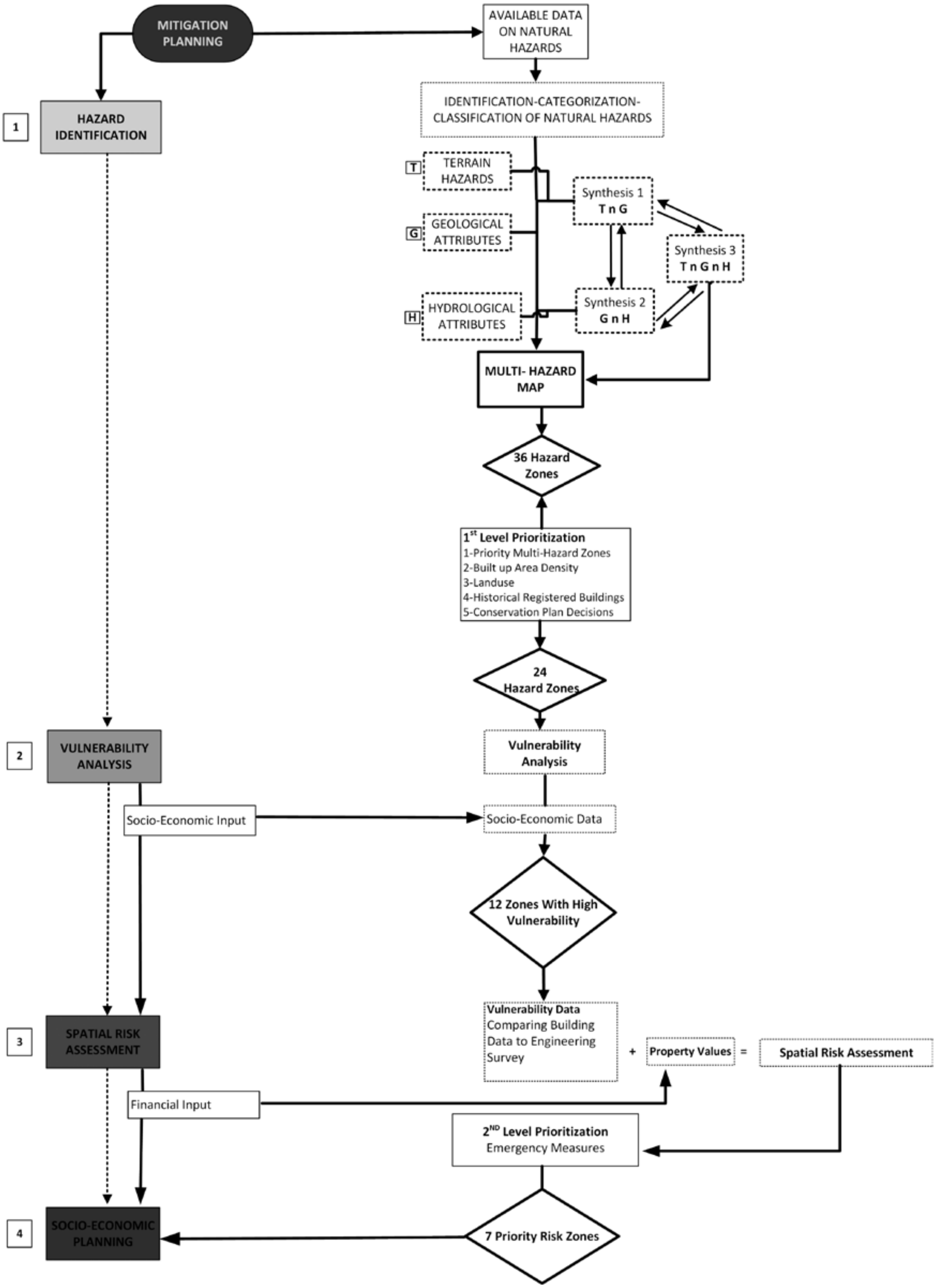


Figure 17. An Approach for the Identification of Local Seismic Attributes

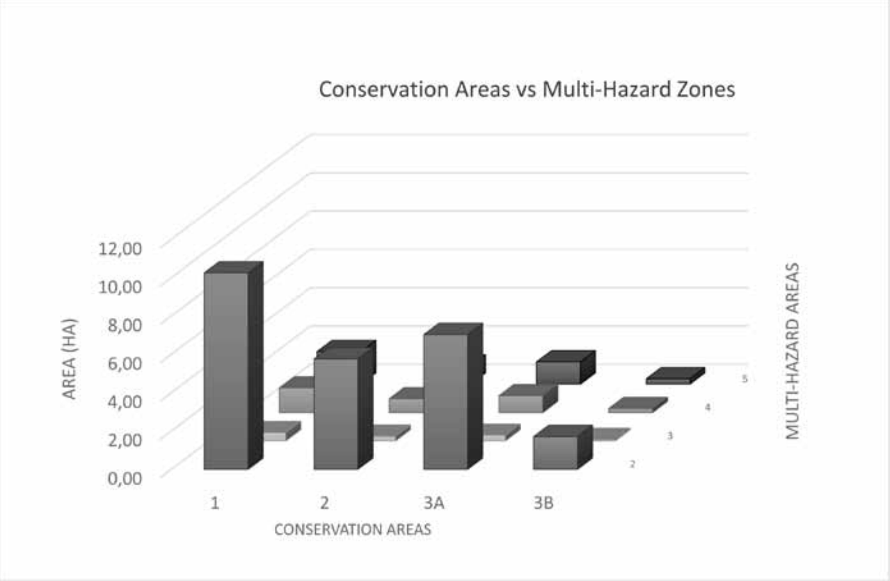


Figure 18. Conservation Areas vs Multi-Hazard Zones

spatially is taken from JICA including the adequacy for hospital capacities and emergency centers, temporary accommodation for evacuated communities, road networks for evacuation, school-hospital proximity and earthquake faults-hospitals proximity (**Figure 16**).

IMPLICATIONS OF FINDINGS FOR A MITIGATION PLAN

According to the research findings, Fatih District is exposed to a variety of natural hazards and vulnerable assets. The district is also likely to generate secondary disasters and contagious risks that differ in various risk sectors specific to the district.

The multi-hazard analysis; combining the evaluation, classification, synthesizing, representation and interpretation of the field data of Local Seismic Attributes, mainstreams a mitigation planning approach. The whole process evolved as a meso level between the first step of multi-hazard identification, including the comparison of origins and impacts of multi-hazards and the last step of developing a mitigation plan, which focuses on spatial and non-spatial mitigation measures to reduce urban risks (**Figure 17**).

Plan Considerations for the Historical Urban Texture

In 16th and 18th centuries, 4 destructive earthquakes had been experienced in Fatih district. Although the level and type of the damage is unclear in historical listed building stock, the scope and economic aspect of the potential damage are required to be explored. (İŞAT Fatih Project, 2009)

According to the analysis of multi-hazard areas with respect to conservation areas and conservation plan decisions, it is concluded that the lower the degree of conservation areas are, the degree of multi-hazard areas increase (**Figure 18**).

Though it appears as a positive finding, it does not make us underestimate the quality of hazards included by 1st Degree Conservation Areas (**Table 5**). By combining several physical constraints such as 50 m impact area of seismic faults, historical listed buildings and mixed uses with

ISTANBUL HISTORICAL PENINSULA CONSERVATION PLAN (1:5000)		
Degree	**Scope**	**Decisions**
1st Degree Conservation Areas	o Topkapi Palace and periphery o Archeological Areas o The preserved Historical Urban Areas, Squares and Main Routes o Khans o Cisterns o Historical Citadel Yards o City Walls o Halic and Marmara coastal fronts and areas greater than +40m	• In streets including monumental heritages and civil architecture clusters, original road codes shall be provided as it is possible. • Pedestrian routes shall be planned to connect the conservation areas. • Floor height increase for the building blocks including the registered civil architecture clusters shall not be allowed • Physical interventions and implementations related to technical infrastructure destroying social-cultural-traditional attributes of the site shall not be allowed. • Unification and allotment operations not for the purpose of gaining and increasing construction right but for the purpose of increasing social and physical quality of the site according to the decisions of the Historical Peninsula Culture and Historical Assets Conservation Assembly shall be allowed.
2nd Degree Conservation Areas	o The preserved Historical Urban Areas and Routes o The preserved historical citadel yard located at City Walls Inner Conservation Area o Monumental Heritages and periphery o Historical Squares o 1st Degree Conservation Areas and Periphery	• Road widths shall be changed only in obligatory circumstances. • In historical squares, pedestrian-based transportation solutions shall be applied. • In streets including monumental heritages and civil architecture clusters, original road codes shall be provided as it is possible. • For the lots not having a historical value but located beside monumental heritages, the given altitude is H-max 12.50m without exceeding the original valance height. • Floor height increase for the building blocks including the registered civil architecture clusters shall not be allowed.
3rd Degree Conservation Areas	o Historical areas that include small number of civil architecture samples and monumental heritages o The areas that lost its natural value but located in City Walls Inner Conservation Area and could be preserved with an arrangement o The areas located in between 1st Degree and 2nd Degree Conservation Areas and affecting the Historical Peninsula silhouette negatively o Halic and Marmara coastal fronts and areas greater than +50m	• 3A Conservation Areas shall be defined as Short-term Regeneration Areas. • 3B Conservation Areas shall be defined as Long-term Regeneration Areas. • For the lots not having a historical value but located beside monumental heritages, the given altitude is H-max 12.50m without exceeding the original valance height. (despite 50m) • The preservation of green areas and vitalizing the existing traditional architectural, cultural and natural texture of the city shall be basis for the urban regeneration in historical districts.

Table 5. Istanbul Historical Peninsula Conservation Plan Decisions (1:5000)

Table 6. Multi-Hazard Combinations vs Conservation Plan Decisions (İŞAT Fatih Project, 2009)

				Conservation Areas			
Multi-Hazard Areas							
No. of Combinations	**Area Code**	**Total Amount of Area (ha)**	**Hazard Combination Labels**	**1st Degree:** Physical Intervention Not Allowed	**2nd Degree:** Only Road Widening Allowed Excluding Buildings	**3rd Degree (3A):** Short-Term Urban Regeneration Area	**3rd Degree (3B):** Long-Term Urban Regeneration Area
2	2c	0,4	(Gungoren) Geological Formation+Landslide	0,3	-	-	-
	2e	2,3	Landslide + Water Catchment	1,2	1,1	-	0,01
	2d	5	Fault+High PGA	0,3	0,01	1,3	2,3
	2b	287	(Bakırkoy) Geological Formation+High PGA	22,3	32	2,5	168
	2e	7,5	Landslide + Water Catchment	2,2	2,4	2,6	0,3
	2d	7	Fault+High PGA	0,1	-	0,7	6,2
3	3g	2,17	(Kusdili) Geological Formation + Liquefaction+Water Catchment	0,1	1,7	-	-
	3h	5	(Kusdili) Geological Formation + Fault+Water Catchment	1,3	3,4	0,2	-
	3c	2	(Kusdili) Geological Formation + Landslide+Water Catchment	0,01	1,7	0,5	-
	3c	0,3	(Kusdili) Geological Formation + Landslide+Water Catchment	0,05	0,00047	0,3	-
	3h	1,6	(Kusdili) Geological Formation + Fault+Water Catchment	0,6	-	0,9	-
	3d	1,3	(Gungoren) Geological Formation + Artificial Infill+High PGA	0,3	-	0,9	-
	3a	0,8	(Gungoren) Geological Formation +Landslide+Water Catchment	-	0,2	-	0,6
4	4ı	2,6	(Kusdili) Geological Formation + Fault+Alluvial Ground+Water Catchment	0,2	0,1	2	-
	4b	0,9	(Kusdili) Geological Formation + High PGA+Alluvial Ground+Water Catchment	0,4	0,07	3	-
	4ı	0,3	(Kusdili) Geological Formation + Fault+Alluvial Ground+Water Catchment	0,7	0,00046	0,03	-
	4c	35	Artifical Infill+High PGA+Tsunami+Water Catchment	0,04	4	9	0,2
5	5a	22,2	Artifical Infill+High PGA+Liquefaction+Tsunami+Water Catchment	0,04	7	0,5	3
	5d	1,5	(Kusdili) Geological Formation + Fault+High PGA+Tsunami+Water Catchment	-	-	1,5	-
	5b	5	(Kusdili) Geological Formation + High PGA+Liquefaction+Tsunami+Water Catchment	-	-	4	-
	5a	22,5	Artifical Infill+High PGA+Liquefaction+Tsunami+Water Catchment	-	-	14	0,05

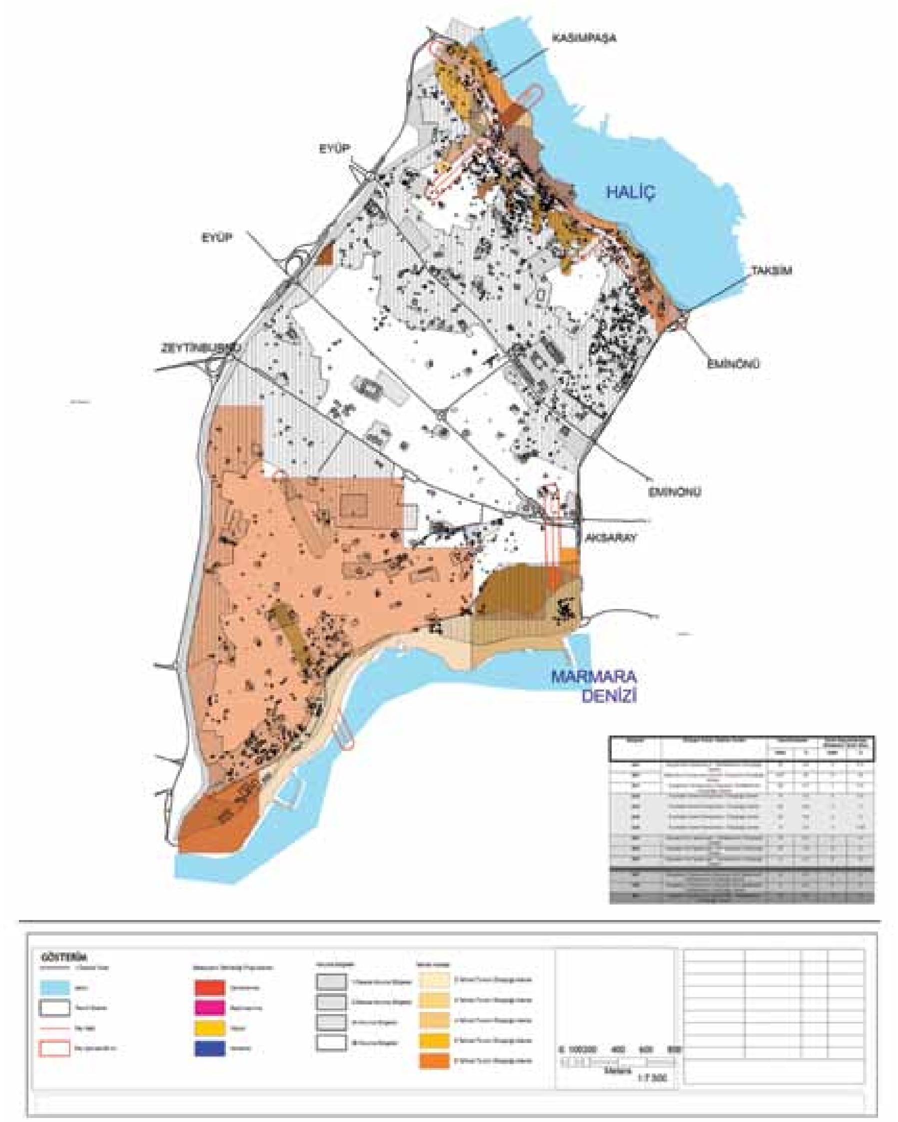


Figure 19. Natural Hazards Positioned at Conservation Areas (İŞAT Fatih Project, 2009)

Plan Considerations for the Historical Urban Texture
1st Degree Conservation Areas contain; • 50 m impact area of seismic faults • Historical listed buildings • High percentage of public use (health and education facilities), auto parks • Mixed Use (Commercial use, small manufacturing industry)
Wooden Buildings • Above 45 Years/3-5 Storey, • Industrial and Commercial Uses • Hazardous Uses at Periphery such as Gas Lines • Vulnerable Road Network in 2-3m width
Recommendations ▪ Special Act on Restoration and Rehabilitation of Historical Buildings and Cultural Assets for the Purpose of Mitigation in Disaster Prone Areas ▪ National Mitigation Fund for Historical Assets

Table 7. Historical Urban Texture

high percentage of health services, education facilities, auto parks, commercial use, small manufacturing industries, and public use; 1st Degree Conservation Areas are critical to convey the hazardous combinations located at historical urban texture, and required for a complementary legislative mitigation approach permitting to restricted physical intervention (**Table 6**) (**Figure19**).

Second parameter concentrates on building risks which are examined through comparative matrix of land use, number of storey, material and age (**Table 7**). Wooden buildings above 45 years and with 3-5 storeys, industrial and commercial uses, hazardous uses at periphery such as proximate gas lines are monitored as risk factors that could cause secondary disasters like fires and explosions during earthquakes. Besides, the inadequate road network in the historical urban texture with a width of 2-3 m neglects accessibility in emergencies.

In order to overcome physical constraints for risk reduction in historical districts, permits for retrofitting and reconstruction are rather essential but also exposed to exploitation of historical and cultural assets. Thus, new construction and alterations ensured by a special Act on Restoration and Rehabilitation of Historical Buildings and Cultural Assets for the Purpose of Mitigation in Disaster Prone Areas, innovative ways to build public-private partnerships for the compensation of retrofitting and reconstruction projects and a sustainable national mitigation fund for historical assets to

Mitigation Plan Decisions in View of Geological Macroform Risks	
Coastal Areas	
• Building Stock & Green Areas on Infill • Landslide Areas • Liquefaction areas • Hazardous Geologic Formations	Public Use & Recreational Facilities
Recommendations ▪ In the short run; Development Restriction/Height Restriction/Floor Reductions ▪ In the long run; Urban Regeneration	

Table 8. Geological Macroform Risks

develop permanent and institutional mitigation measures are precisely required.

Mitigation Plan Decisions in View of Geological Macro-form Risks

Geological formations with high range of sensitivity to transmit earthquake shakes in destructive magnitudes cause secondary disasters as landslides and provide hazardous ground attributes for settlement convenience. The components of geological macroform risks, diagnosed as vulnerable building stock, infill areas which are found to be green areas mostly, landslide areas, liquefaction areas and geological formations with high PGA values, are frequently concentrated on coastal fronts with public use, recreational facilities and residential use at the periphery (**Table 8**).

For reducing local seismic attributes; spatial regulations such as development restriction, height restriction and floor reduction are demanded in the short run to diminish potential vulnerability and prevent

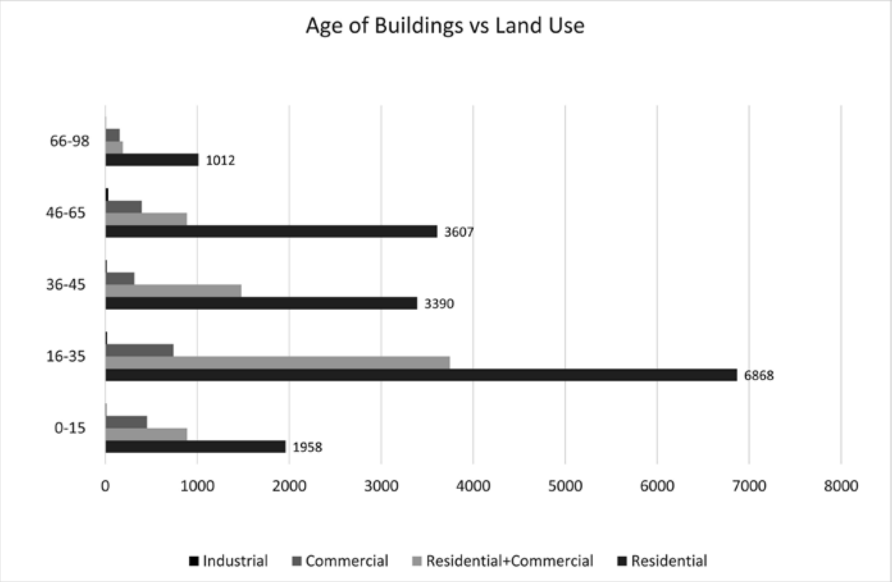


Figure 20. Age of Buildings vs Land Use

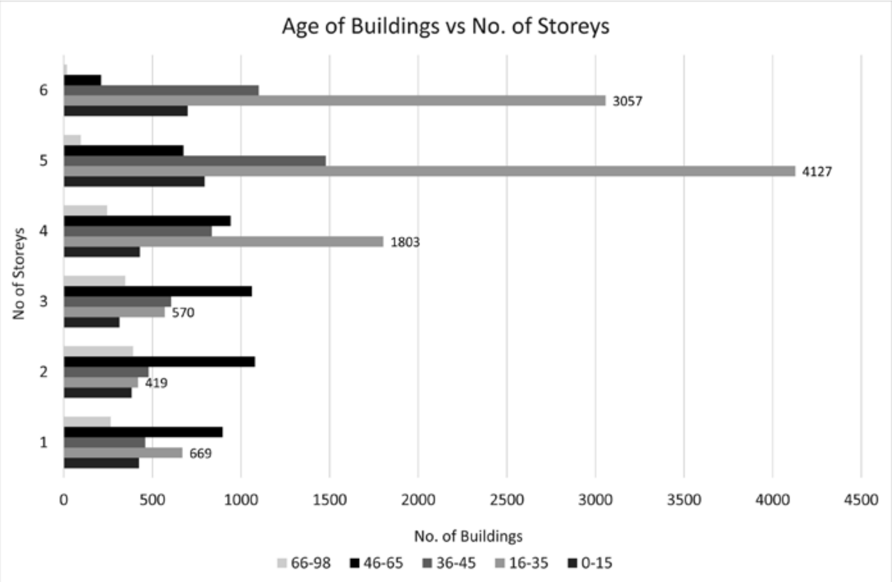


Figure 21. Age of Buildings vs No. of Storeys

destructive impacts of multi-hazards. In the long run, urban regeneration is compulsory for reconsidering land use and density. In fact urban regeneration for the purpose of mitigation is called for low/medium density settlements with open space network which could also function as evacuation corridors and rallying points during an emergency.

Decisions Concerning the Building Stock in the Mitigation Plan

When the engineering data is compared to the vulnerable buildings stock data, it is found that 40 % of total building stock is vulnerable to seismicity other than wooden buildings that are aged and high storey buildings densely clustered in 3rd Degree Conservation Areas (İŞAT Fatih Project, 2009). 37% of total building stock is formed of 5 and 6 storey buildings with residential and residential-commercial uses which are required to be re-evaluated considering floor area ratio (**Figure 20**). As significant risk patterns, 4% of the building stock is 5-7 storey (**Figure 21**) and over 45 years while 37% of total stock are adjacent at corner increasing the vulnerability of the area during seismic shocks (**Table 9**).

Overall it is clarified that seismic attributes depend on density, land use and physical characteristics as material, age and quality of buildings, geological macro-form risks and socio-economic disadvantages. In 3rd Degree Conservation Areas, urban regeneration is rather critical to be implemented by gradual development and pilot projects, and prioritizing public interest for the purpose of mitigation. Through reconsidering

Table 9. Building Stock Risks (İŞAT Fatih Project, 2009).

Decisions Concerning the Building Stock in the Mitigation Plan
• **40% of total building stock is risky;** o Aged Buildings (Older than 45 years) o High Storey Buildings (5-7 storey) o Weak Quality Buildings (Concrete/concrete-masonry/masonry) o Residential, Residential+Commercial
• **37% of total stock** are attached and adjacent at corner.
Recommendations ▪ Urban Regeneration Opportunities and Options ▪ Gradual development by pilot projects ▪ Participatory Process

Table 10. Social Inaccessibility

Avoiding Social Inaccessibility
o **Introverted and weak socio-economic infrastructure** o 59% discard neighborhood relations, o 73% discontent with the environment, o 66,7% afraid to go after dark o Illiteracy o Low income rents 200-400 TL and Real Estate Prices 1000-3000 TL (per unit price)
Recommendations ▪ Community Building / Public Awareness / Emergency Preparedness ▪ Socio-cultural and Education Programs to build local sense of belonging ▪ Training Programs for Public Officials and Community ▪ Safe Economic Development of the District (Social Development Projects for Unemployed and Women)

Table 11. Emergency Measures

Evaluating Emergency Measures
The lack of open space >Total Open Space in Fatih is 25% lower than the demanded open space for primary evacuation areas referring to JICA report (min $500m^2$ for 2000 m^2) >Total Open Space could be increased by 11.42%, in order to cover 25% additional regulations are required for Conservation Areas
Inadequate distribution and capacity of Emergency Centers **Capacity** **Health Facilities (2%)** No. of Person 0-41(27%) 42-163(23%) 164-450 (13%) 164-1010(20%) 1011-3000(13%) **Education Facilities (8%)** No. of Person 0-41(30%) 42-163(22%) 164-450 (22%) 164-1010(17%) 1011-3000(9%) **Proximity** Education Facilities at 200m distance to hospitals are designated as First Aid Center and Health Facility. Others are determined as temporary accommodation, storage and aid distribution center
Vulnerable Road Network >2-8m roads will be closed with a probability>50% >8-15m roads will be closed with a probability = 50%
Vulnerable Infrastructure **Gas Line** >11.54% of the main valves-6% of the distribution line-6.20% of the connection line are located seismic impact zone >High secondary risk potential in 2 hazard areas including 6 main valves-47 wooden buildings-2209 vulnerable buildings **Electric Line** 33.33% of the transformers-6.5% of electric lines-7% of the telecommunication lines are located at seismic impact zone **Water Line** 8% of the main water line is located in 2 hazard areas including clustering wooden buildings- vulnerable buildings **Sewage Line** 7.8% of the main connector line-5.7% of the connection line are located at seismic impact zone
Recommendations --Designating Emergency Centers through the site analysis by reevaluating their capacities and proximities to critical services and schools --Considering Health Services and Relief Activities integrated with open space network --Increasing options for Temporary Accommodations --Providing the continuity of Accessibilities through transportation nodes

the historical and commercial bonds, tourism potential of the district is significant to revitalize local economy and provide a functional continuity in the Historical Peninsula. In fact, the determination of urban regeneration options for urban land which is a challenging arena both for reducing disaster risk and urban conservation, is required for additional legal regulations. Through increasing the types and scope of Conservation Areas in disaster risk zones and defining a more detailed and specific levelling of conservation degrees; obligatory activities as retrofitting and reconstruction become more applicable as well as urban regeneration. Unless developing specific regulations, urban regeneration gets a conflicting role with urban conservation.

Avoiding Social Inaccessibility

Referring to the socio-economic survey derived from BİMTAŞ; 59% of the local community discard neighborhood relations, 73% discontent with the environment, 66.7% feel insecure and most of the individuals are illiterate (İŞAT Fatih Project, 2009)(**Table 10**). Fatih District is preferred by users for low income rents 200-400 TL and real estate values 1000-3000 TL (per unit price). In parallel with urban regeneration, tourism potential of the district is significant to provide safe economic development including social development projects and revenue generating activities especially for unemployed individuals and women to participate in social organization. Further; socio-cultural programs are required to increase the sense of belonging in the neighborhood. In order to raise public awareness and develop prevention culture, education and training programs for public officials, trainers and local communities imply necessity.

Emergency Plan Recommendations

Emergency Plan is evaluated as a prerequisite step based on the spatial analysis of the emergency measures determined by AKOM and JICA and recommendations on new measures that are specific to district (İŞAT Fatih Project, 2009) (**Table 11**). Referring to the earthquake scenario in JICA Report with 7.5 magnitude, pre-defined emergency measures are found as inadequate and unplanned. Emergency Centers designated by AKOM are insufficient in terms of capacity and need to be reconsidered as to proximity to health facilities and proximity to each other. Vulnerable road network and the lack of open space are key factors to increase the vulnerability of the district. Specific emergency and relief activities including health centers, evacuation routes, rallying points, convenient tenting areas or other options for temporary accommodation are required for a detailed plan depending on the re-evaluation of the designated emergency centers in respect of accessibility and capacity.

CONCLUSIONS

For many years; hazard identification and risk analyses have stuck with actuarial methods, statistical analyses and high-tech innovations in civil engineering supported by global and local economic programs. Hazard and risk impacts have been evaluated through harm and loss analyses which led to elimination of relations and causality in hazard identification and oversimplification of the natural facts. Engineering and statistical methods only focusing on the building texture often dismiss the overall impacts of natural hazards and risks on whole urban system. The nature of contemporary risk is much complicated and multi-faceted to manage with single-referential methods and approaches. A proactive perspective to recognize today’s risks as avoidable and reducible attributes has been required to provide a radical change in the existing disaster risk management theory and practice.

1990s, a breaking point at theoretical foundations of risk literature also altered the implementation methods in disaster risk management. Trending away from actuarial methods and introducing social aspects of risk determined a new level of risk consciousness. Risk, “a peculiar and intermediary state between security and destruction" (Beck, 2000, 213), described as calculable through the estimation of the maximum potential loss; was inherited from insurance trade. By turning to actuarial methods within the rationalist approach, statistical probability analyses and expertise in disaster risk management became popular and an illusion of controlling risks by minimizing the maximum potential loss was created by accepting the minimum possible loss. On the other hand, confronting with the failure in recent events and recognition of uncertainty and incalculable risks brought in the necessity of redefining risk. Risks had been explored in terms of "factual statements" or "value statements", and "manufactured risks" as products of industrialization but describing risk as a "socially constructed phenomenon" (**1**) emphasized society as a strategic medium to produce quasi risks or inclining to its political connotations in risk society.

Although the complex nature of risk creates different orientations in risk literature, the strong emphasis on social and worldwide effects of global disasters activate international organizations to shift priorities from post-disaster to pre-disaster approach. Through adopting a proactive perspective, risk reduction has been declared as a multi-disciplinary multi-scale task, available for social organization and participation referring to a shared responsibility and accountability at all levels. As a matter of governance, managing contemporary risks through a multi-disciplinary and multi-scale perspective called for new scientific approaches and concomitant policies that also demand a new task from planning.

Coping with city-level risks requires for the reconsideration of relations between the methods of multi-hazard analysis, mitigation and urban planning. Since urban mitigation planning is not a technique but an articulated field of study, it is precisely opened to exploration and re-definition of interrelations between hazards, risks, vulnerabilities likewise consequences, probabilities which make urban planning with a non-opportunistic nature (Balamir, 2009). Determination of local seismic attributes of locations in urban system and utilizing methods to assess vulnerabilities and losses are prerequisites of urban mitigation planning (Balamir, 2004). In that case planner's role is prior to contribute and symphonize the multi-tasks of hazard analysis, hazard identification, vulnerability and risk assessment, developing mitigation policies, plans and actions as well as stimulating community participation both for decision making and implementation processes under mitigation.

Multi-hazard identification and risk assessment is an effectuate approach for giving overall risk view. Recent attempts shown that as a common approach employed in mitigation planning, multi-hazard analysis and risk assessment includes distinct methods of analyzing hazards, exposure and vulnerability as risk factors, statistical analyses of probability, judgmental processes seeking for correlation between predefined parameters. With concomitant urban mitigation plans at all levels, the USA employs MHIRA while Japan adopts a deeper analysis of individual hazards and risks completed with hazard-specific mitigation plans and policies. Re-defining mitigation planning at all levels is even harder when it comes to Turkey as it reveals the absence of any inclusive legislative framework or permanent institutions. The existing institutional and governmental structure does not provide possible strategic mediums for reducing disaster risks and vulnerabilities but promoting post-disaster strategies. The so called Disasters Law (Law no. 7269,1959) primarily focuses on post-disaster risk management process including relief and emergency management while

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1. These concepts are borrowed from Beck (2000).

the Development Law (law no. 3194, 1985) do not contain the necessary concern for safety in land use planning and both has no aspiration to devise appropriate tools for mitigation. Urban planner who could mainstream a holistic approach under urban mitigation planning is hardly apparent in legislation.

A proactive emphasis on disaster risk management included by the guiding international framework is most likely to be dismissed by recent implementations in Turkey. After the Great Marmara Earthquake (1999) retrofitting practice became highly achievable. The scope and the quality of risk data focusing on Istanbul is developed by the efforts in hazard and risk identification as JICA (2002) and EMPI (2003). Though EMPI (2003) was an innovative work to determine risks specific to localities and priority zones under seismic risk and recommending mitigation measures such as density control and urban transformation in convenient seismic risk zones which led to the promotion of urban transformation by the authorities (Balamir, 2004). Later, the enactment of Urban Transformation Law on Disaster-prone Areas (Law no. 6306, 2012) became a triggering device that imposed urban transformation as only possible approach for disaster risk reduction. Urban transformation in disaster-prone areas neither involves precise analyses for the determination of risk areas or buildings at risk nor legitimate circumstances for participation of local communities. Without referring to an accurate method for hazard identification and risk assessment and neglecting to develop mitigation planning measures; “the determination of high risk zones, buildings at risk and reserve areas for constructing extra building stock” are quick fixes to relocate urban risks rather than avoiding them.

In order to develop a holistic approach; Istanbul as an urban risk pool, demands multi-disciplinary perspectives in identifying natural hazards, evaluating seismic risks and developing an integrated mitigation plan focusing on localities as well as the whole urban system. This study structures a meso level in between hazard identification and mitigation plan via utilizing a scientific evaluation of local seismic attributes as an alternative way to rigid engineering surveys and projecting the socio-technical pillars of mitigation approach through planning recommendations. For the purpose of rebuilding a relation in between multi-hazard analysis, planning and mitigation; planner’s contribution is to evaluate local seismic attributes for defining urban priorities referring to spatial and categorical data both by the critical perspective of planning and the concern of developing legible and accessible conclusions. The common characteristics of priority areas in Fatih District, indicate that local seismic attributes are not solely constituted of building stock but also historical urban texture, geological macroform risks, social inaccessibility, and vulnerable infrastructure and transportation network evaluated in emergency measures which have key roles in shaping the local risk pattern and increasing the potential vulnerability of the district. Whether multi-hazard analysis gives the overall risk review, the absence of legal and planning devices may neglect the development of an effective strategy for risk reduction at institutional level.

Risk reduction and mitigation as controversial topics in both urban planning and public policy issues provide a new research area for a multi-disciplinary framework. The implementation of the recent techniques and approaches concomitant with urban planning for developing a mitigation approach to reduce urban risks that are specific to localities;

and the institutionalization of mitigation with internalizing international frameworks on risk reduction but also developing a socio-technical infrastructure for identifying, monitoring, and reducing risks are still legitimate issues for Turkey. By facing these controversies utterly, urban planning for risk reduction becomes a non-bargainable task and then becomes mitigation planning, a strong apparatus; regarding a permanent institutionalization with more precise dependency to scientific objectivity in lieu party politics.

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SYMBOLS AND ABBREVIATIONS

AFAD: Republic of Turkey Prime Ministry Disaster and Emergency Management Center

AKOM Disaster coordination center of Istanbul Metropolitan Municipality

BIMTAŞ Istanbul Engineering and Consultancy Services Cooperation established under Istanbul Metropolitan Municipality

EMPI Earthquake Master Plan of Istanbul

CRED Centre for Research on the Epidemiology of Disasters-Belgium

HPGA: High Peak Ground Acceleration

HGF: Hazardous Geologic Formation

MHIRA: Multi-hazard Identification and Risk Assessment

IDNDR: International Decade for National Disaster Reduction

MMI Metropolitan Municipality of Istanbul

UN: United Nations

UNISDR United Nations International Strategy for Disaster Reduction

W. Catch: Water Catchment Area

Alındı: 12.02.2013; **Son Metin:** 12.05.2015

Anahtar Sözcükler: Risk azaltımı; sakınım planlaması; risk belirleme; risk değerlendirmesi; yerel kapasite; kent planlaması; yerel sismik özellikler; korunmasızlık.

YEREL KORUNMASIZLIKLARI VE RİSKLERİ PLANLAMA KARARLARIYLA AZALTMADA ISTANBUL FATİH MAHALLESİ ÖRNEĞİ

Son on yıl içerisinde, küresel ölçekte afet riski yönetimi için gereken araç ve kavramsal çerçeveler bu konudaki öncelikleri acil durum yönetiminden afet öncesi risk yönetimine kaydırarak kent planlamasından yeni görevler talep etmiştir. Yerel, ulusal ve küresel düzeylerde güvenlik ve dirençlilik kapasiteleri; planlama disiplinine yerel sismik kayıpları azaltmada ve yerel bir sakınım stratejisi tanımlamada öncü rol vermektedir. Diğer taraftan uluslararası kavramsal çerçevenin afet öncesi yaklaşım kapsamında geliştirdiği öngörülü stratejiler, Türkiye'de kolaylıkla içselleştirilememektedir.

Yerel bağlamda, Afetler Yasası (no. 7269), İmar Yasası (no. 3194) ve Afet Riski Altındaki Alanların Dönüştürülmesi Hakkında Yasa (no. 6306) kent planlamasında güvenlik için gerekli sorumlulukları ve araçları sağlamamakla birlikte sakınım için uygun araçların kullanılmasını da hedeflememektedir. Karar verme süreçlerinde toplum katılımını kolaylaştıracak ve bütüncül bir yaklaşım geliştirecek plancının rolü, yasal çerçevede zorlukla görülebilmektedir. Kentsel sakınım planlaması metodolojisi kapsamındaki sınırlamalar ve olanaklar planlama açısından yeni bir ilerleme alanı tanımlamaktadır. Bu alanda; planlama için yeni hedefler ve roller mevcutken, plancı da yerel, ulusal ve küresel kapasiteleri kullanmada hesap veren bir aktördür. Planlama metodunun meşruiyeti birincil olarak yerel sismik özellikleri kapsayan bir risk tanımlaması ve risk belirlemesine dayanmaktadır.

Bu yazıda; doğal tehlikeleri, bunların risklere evrilmelerini ve olası etkilerini tanımlamak, belirlemek ve bu konuda bir sakınım stratejisi geliştirmek için İstanbul Fatih Mahallesi örneği üzerinden bir yöntem geliştirme araştırması yapılmıştır. Risk azaltımı için yerel kapasite, yereldeki korunmasızlıklar ve risk sektörleri belirlenirken aynı zamanda; şu anki politik yapıya, uluslararası çerçeveye eklemlenmeyi ve sakınım için gerekli düzenleyici ölçütleri geliştirmeyi sağlayacak önerilere yer vererek, mekansal ve mekansal olmayan risk azaltımı konularında küresel çerçeveyle bağlantı kurulmuştur.

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