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Risk Management and Microzonation in Urban Planning: An Analysis for Istanbul

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Abstract Urban planning that can be defined as designing the cities according to the foresights for the future has undergone major changes with exposure of urban areas to major disasters for last 50 years. It is agreed that the most important factor of making disaster resilient city is taking precautions and damage reduction with planning process. In Turkey, disaster sensitive planning approach which started quite late and after the great losses has largely taken place right after the major earthquake occurring in 1999. Thus, the transition from period of transferring disaster hazards to the planning through the synthesis of thresholds to period that geological, geotechnical and microzonation reports are compulsory has been experienced. Making geological surveys in various forms in order to be basis for planning activities in every scale has been obliged by the laws. The outputs of these different analyzes filled reports providing inputs for planning are the site suitability maps which classify settlements in four categories: appropriate areas for settlement, areas for preventive actions, areas require detailed geotechnical survey and inappropriate areas for settlement. Empirical studies show that although microzonation studies have been currently undertaken, plan decisions based on residential areas are quite poor due to the challenges of restricting the development rights, regulating and discharging of those areas. This study aims to examine conformity of planning decisions and existing urban patterns with the site suitability maps produced by microzonation studies in the İstanbul, megacity of Turkey.

***Index Terms*—Microzonation, urban planning, disaster sensitive planning, risk management, suitability maps for settlement, İstanbul**

I. Introduction

Planning is generally described as designing the physical space according to projections which are made with the assumption of certain features of societies will be similar in the future. However, due to the dialectic relationship between them, every planning decision taken for physical space significantly affects natural, economical and social structures. Especially in developing countries, development and rapid growth goals have brought economic structure into the fore in this relationship. In addition to this, with the impact of political goals, planning has began to evolve into a form that cares natural and social structures fewer. Planning decisions which ignore these structures against economic development and the unplanned areas/settlements where emerged as a result of rapid growth are the most obvious examples of this situation. However, this mentality that is presented as a short term solution gives occasion for more material, spiritual and ecological losses in long term. Because avoiding doing investigations for urban areas caused natural disasters that cause heavy loses and both not determining the conveying capacities for urban areas and not taking protective and preventive precautions caused man-made disasters. More than 95% of all losses suffered in disasters occurred in developing countries [1].

Both disasters occurred across worldwide and in Turkey and losses aftermath of these disasters have revealed the need of improve planning activities in a form of sustainable and environmentally-conscious and making disaster resilient cities.

The progress of disaster sensitive planning approach varies depending on the level of development in each country. In Turkey, this approach mainly was accelerated after the earthquake occurred in 1999. Previously, geological data were analyzed under the subheading of geomorphological, topographical and geological thresholds associated with the heading of natural restrictives. It has

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began to be investigated by geological-geotechnical reports and microzonation studies with legal regulations.

Microzonation is determining the areas that have the different potential of seismic hazard and serving it to the service of urban planning and land use management. The main aim of this paper is to highlight the importance of the relationship between microzonation maps and urban planning and to examine the status of implementation of risk management activities. In this context, following the elaborating of disaster sensitive planning approach discussions on microzonation in the literature is mentioned in this study. After providing the theoretical background, the legislation on disaster sensitive planning in Turkey and via İstanbul case the relationship between urban planning and microzoning maps in practice will be examine.

II. DISASTER SENSITIVE PLANNING APPROACH

Even if they are used interchangeably, disaster and natural event are different notions. To qualify a natural event as "disaster", it must cause economical and/or social losses and disrupt daily life and human activities [2]. Natural events that have potential to cause harms as earthquake, flood and landslide are denominated as *hazard. Risk* is the sum of the negative consequences which will occur in case of hazard. While risk increases with the rise of hazard and vulnerability, it decreases with the increase of manageability.

$$\textbf{RISK} = \frac{\textbf{Hazard} * \textbf{Vulnerability}}{\textbf{Manageabiliy}} \qquad [1]$$

As can be understood from all these definitions, it is possible to reduce the disaster risk with the measures that are produced as a result of the determination of the disaster hazards in practices.

All of the activities related disaster were in a form of intervention and recovery after disaster in Turkey. But the huge losses that were experienced led to take measures before the disasters by experts. In this way, perception of crisis management has evolved into disaster management.

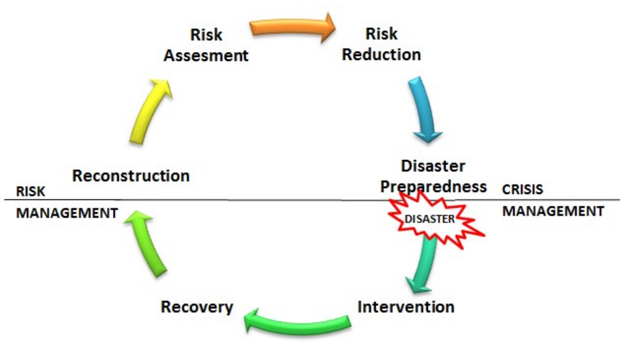

Fig. 1. Phases of disaster management (improved from[1]).

Disaster management is the activities that determining and mitigating type and level of risk in country, region, city and local scales and it gives a direction to the planning activities as a guide [3]. In that sense, planning is one of the most crucial factors regarding the successful administration of disaster management due to its capability of both building the physical, economical and social environment that suffer losses due to disasters and determining the risk level.

Especially for the countries located in sensitive regions in terms of disaster hazard, it is accepted that the most rationalist and effective method to prevent disaster hazards and to reduce the risk in urban areas is making planning activities disaster sensitive and also wide enough include the risk management. Disaster sensitive planning can be ensured by production of geological data to determine all kind of disaster hazard and risk in every scale and by production of healthy planning decisions in accordance with geological surveys. These planning decisions should vary according to the scale. For example, while determining the areas that can be opened for settlement and zoning for land using are done in macro scales, giving decisions about land use, development directions and magnitudes of settlements, population and settlement densities are the parts of lower scale plans. Finally, building scale includes giving decision of the most suitable building techniques in accordance with the ground conditions and material types to reduce or prevent the risk.

In other words, mainly three different professional groups need geological data for three different purpose in urbanization process. Geological data are needed as geological and geotechnical surveys to be based for urban plans to determine suitable areas for settlement, general using formats of land parts, building blocks and their formations by urban planners, as geological and geotechnical investigations to determine suitable construction techniques and material types by architects and to determine soil bearing capacity by civil engineers.

Differently from other professional groups due to being binding for lower-scale plans and executions, ensuring both private property and public order and deciding for larger areas planning decisions are more serious. Therefore, it is possible to reduce the disaster risk via disaster sensitive planning decisions as well as increase the risk via mistaken decisions (Table I). The fact that any fault can be done in any scale affects entire region or city makes a necessity for preparing all the plans as a disaster sensitive plan.

Technological improvements in last decades have started to build the idea that all kinds of buildings can be constructed on all kind of soil by various engineering solutions. The reinforcements made according to soil structure and new construction technologies and materials constitute significant progress for making buildings more secure. On the other hand, fighting natural disasters with technology has begun to cause the repetition of old mistakes in the process of making cities disaster sensitive. It has led to the mentality that ignores both the geological structure and the planning process and has ensured the executions that plunder the cities by an annuity based approach to development.

TABLE I
PLANNING DECISIONS THAT CONSIDER DISASTER RISK (improved from [4])

Land Use	Transportation - Infrastructure	Building Block Formations	Structural - Building
-Appropriate location selection -Appropriate population density -Avoidance of an intensive urban texture -Sufficient open space -Plans in accordance with conveying capacity -Keeping dangerous using formats(lpg, petrol station etc.) away from residential areas -Taking the all necessary precautions to build major energy investments -Taking precautions for hazardous settled urban areas -Avoidance of opening hazardous areas, coastal districts and landfills to construction	-Alternative road networks -Avoidance of narrow and dead-end streets -Avoidance of intersections of road route and fault lines -Designing infrastructure network appropriate to soil composition -Preventing development of hazardous areas with avoidance of providing infrastructure service	-Appropriate building block formations -Sufficient side,front and rear garden distances -Building heights proportional to the width of the road	-Prevention of illegal structures -Controlling and prevention of non-projected structural changes -Prevention of structural changes -Material choices appropriate to soil composition -Controlling and prohibition of leak floors -Beam-column continuity -Doing maintenance and renovation of buildings on time

III. RISK MANAGEMENT AND INTEGRATED DISASTER MANAGEMENT IN TURKEY

Geological surveys to be base for urban plans attributable to the Law No.4623 (1944) on “Law for Precautions before and after Earthquakes”. For a long time from this period, there has been no information on how the geological surveys should be done and how they should integrated into planning in the urban development laws that establish rules for planning activities. Urban development laws both Law No.6785 (1956) and Law No.3194 (1985) do not comprehensively mention to geological surveys [5]. During this process, the relationship between disasters and urban planning conducted by the General Directorate of Provincial Bank via observatory geologic surveys to be base for urban plans and by the General Directorate of Natural Disasters via the investigation of unsuitable areas for settlement.

The legal basis of disaster management system in Turkey is constituted by the Law No.7269 (1959) on “Precautions to be taken for the Disasters which effect Public Life and Relevant Aids to be made”. However, the law is not sufficiently including risk mitigation and disaster preparedness concepts.

“Buildings to be constructed in disaster zones” by-law(1975) stipulated expressly that new buildings and dwellings can not be built and also existing ones can not be repaired in both unsuitable areas for settlement and areas that experienced disaster before and designated as the disaster area by decree. This by-law can be termed as the beginning of the studies of taking measures before disasters.

In Turkey where a devastating earthquake occurs every nine months in addition to approximately 25 major floods and 50 landslides for per year, legal and structural alterations related to disaster management began to develop after the huge losses that were experienced with earthquake occurred in 1999 [6]. Disaster management efforts had been made compulsory by legal arrangements in this period as well as content of the survey reports and professional groups that are responsible for these studies were clearly defined. For example, 34th article of by-law on “Amending Typical Urban Development By-laws in the Municipalities which are beyond the scope of Code No 3030” (1999) stipulate soil investigation report and geological survey report that is prepared by geological engineers and geophysics engineers in addition to static project to get construction permit. This is one of these important alterations.

During these years, the relationship between planning and disaster management is provided mainly via threshold synthesis. Threshold synthesis consist of two main phases. In the first phase of threshold synthesis, features and hazards associated with the topographical and geological structure such as legal and natural reserves, water supplies and their protection zones, groundwater, seismicity, soil texture and structure, soil classification, soil properties, landslides, rock falls, floods are analyzed. Then, all of the data that collected in analysis phase are evaluated together to produce synthesis. In this phase, geological data which used for determining the risk of disaster is used as a threshold that restricts the development of settlements and directs it. These thresholds can be manageable with a specific cost as well as they can limit the development exactly. Threshold synthesis that is produced by determining and classifying all the thresholds that limit development, provide a base for planning activities to understand potential development areas and characteristics of them. Unfortunately, there is no legal framework about what kind of data should be taken as threshold in planning activities and how they should be classified. All of these decisions are determined depending on the goals, principles and policies of the plan and the needs, the extent and the distribution of the development area. Thus, the threshold synthesis that are made by different institutions can be differ from one another.

When Turkey’s planning system is analyzed, even though macro scale studies such as thresholds synthesis are possible, it is seen that disaster-oriented studies are often provided by geological surveys made in lower scale. As a result of “Earthquake Council” held in 2004

TABLE II
SURVEY FORMATS MUST BE PREPARED ACCORDING TO PLANNING SCALES [7]

<table>
<tr><th colspan="2">Planning Hierarchies and Scales</th><th colspan="4">Survey Types and Format to be used in Surveys</th></tr>
<tr><th>Name of Plan</th><th>Scale</th><th>1^{st}, 2^{nd} and 3^{rd} Degree Earthquake Zones + Settlements have population ≥ 30,000 (A)</th><th>Format to be Used (A)</th><th>Other Areas (4^{th} and 5^{th} Degree Earthquake Zones + Settlements have population <30.000 (B)</th><th>Format to be Used (B)</th></tr>
<tr><td colspan="6">MACRO SCALE PLANS</td></tr>
<tr><td>REGIONAL DEVELOPMENT PLAN</td><td>1/250.000 - 1/100.000</td><td rowspan="5">Geological Surveys to be Base for Land Use</td><td rowspan="5">Format-1</td><td rowspan="5">Geological Surveys to be Base for Land Use</td><td rowspan="5">Format-1</td></tr>
<tr><td>METROPOLİTAN PLAN</td><td>1/50.000- 1/100.000</td></tr>
<tr><td>CITY ENVIRONMENTAL PLAN</td><td>1/100.000</td></tr>
<tr><td>ENVIRONMENTAL PLAN (includes multiple basins)</td><td>1/100.000</td></tr>
<tr><td>ENVIRONMENTAL PLAN</td><td>1/25.000 -</td></tr>
<tr><td colspan="6">URBAN PLANS</td></tr>
<tr><td>URBAN(DEVELOPMENT) PLAN (is prepared by metropolitan municipalities)</td><td>1/25.000</td><td>Microzonation Study</td><td>Format-4</td><td>Geological Surveys to be Base for Land Use</td><td>Format -1</td></tr>
<tr><td rowspan="2">URBAN(DEVELOPMENT) PLAN</td><td rowspan="2">1/5.000</td><td rowspan="2">Microzonation Study</td><td rowspan="2">Format -4</td><td>Geological- Geotechnical Survey</td><td>Format -3</td></tr>
<tr><td>Microzonation Study</td><td>Format -4</td></tr>
<tr><td rowspan="2">IMPLEMENTATION URBAN PLAN</td><td rowspan="2">1/1.000</td><td rowspan="2">Microzonation Study</td><td rowspan="2">Format -4</td><td>Geological- Geotechnical Survey</td><td>Format -3</td></tr>
<tr><td>Microzonation Study</td><td>Format-4</td></tr>
<tr><td rowspan="2">PARTIAL URBAN PLAN</td><td rowspan="2">1/5.000
1/1.000</td><td>Microzonation Study (for 1/5000)</td><td>Format -4</td><td>Geological Survey</td><td>Format -2</td></tr>
<tr><td>Geological- Geotechnical Survey</td><td>Format -3</td><td>Geological- Geotechnical Survey</td><td>Format -3</td></tr>
<tr><td rowspan="2">RURAL SETTLEMENT PLAN</td><td rowspan="2">1/5.000
1/1.000</td><td rowspan="2">Geological- Geotechnical Survey (Notwithstanding the population)</td><td rowspan="2">Format -3</td><td>Geological Survey</td><td>Format -2</td></tr>
<tr><td>Geological- Geotechnical Survey</td><td>Format -3</td></tr>
</table>

this approach was discouraged by the idea of survey reports that provide a base for planning activities must be updated. These surveys in micro scale make significant progress toward holistic geological, geological-geotechnical surveys and microzonation studies that are made compulsory to produce planning decisions in every scale. Manual of "Integration of Earth Scientific Data to Spatial Planning" is prepared by General Directorate of Disaster Affairs after the "Earthquake Council". This manual created a draft plan about geological data that provide a base for planning in every scale. It also gives information about how these surveys should be handled and integrated into planning.

Circular dated 19/08/2008 and numbered as 10337 designated basis, formats and appendix of these reports in detail to improve them all [7]. This circular tackled planning hierarchy more detailed than the manual prepared before but also reduced population amount which is an important factor in determining the formats of reports to 30.000 from 50.000. Even more importantly the circular stipulated bringing all the studies done earlier in compliance with the format of circular (Table II).

According to the relationship between planning hierarchy and geological survey, for the settlements have population more than 30.000 and in the 1st, 2nd and 3rd degree of earthquake zones, from 1/25.000 scaled master plans to 1/1.000 scaled implementation urban plans survey format which provides base for urban plans is microzonation. For the settlements in the 4th and 5th degree of earthquake zones and have population less than 30.000 geological-geotechnical surveys or microzonation studies must be done in these scales.

IV. MICROZONATION SURVEYS

Microzonation is a technique that aims planned land use to reduce potential disaster hazard for a region. To provide planned and healthy land using via planning, microzonation is used to create economically, socially and politically compatible and useable zones by researching geological, geophysical and geotechnical conditions against earthquake hazard [8].

Microzonation is one of the most accepted tolls in seismic hazard assessment and risk evaluation and it is defined as the zonation with respect to ground motion characteristics taking into account source and site conditions. Topics such as ground amplification, ground motion level, liquefaction, slope stability, water floods and surface faulting are examined during seismic microzonation studies.

Microzonation studies have generally made in three phases [9]:

First Phase – General Zoning: This phase includes compilation of fundamentals obtain from historical sources, formerly prepared reports and various databases and interpreting them all. In this phase zoning studies are done between the scales of 1/1.000.000 to 1/50.000.

Second Phase – Detailed Zoning: In this phase satellite imageries, field studies, geotechnical investigations are added to the first phase of the study and a detailed zoning is made. In this phase zoning studies are done between the scales of 1/100.000 to 1/10.000.

Third Phase – More Detailed Zoning: If potential risk is too high more detailed studies should be done to provide a high detailed zoning. These are the zoning studies that require more detailed, field-basic, specific and their costs are high. In this phase zoning studies are done between the scales of 1/25.000 to 1/5.000.

Damages of earthquake basically depends on three groups of factors: earthquake source and path characteristics, local geological and geotechnical site conditions, structural design, construction features and building materials. The most important factor for reduction of disaster risk is developing a planning approach that considers all of these conditions. As an applied research seismic microzonation frequently needs to be revised. Seismic microzonation is the first step of disaster risk reduction and needs an interdisciplinary approach that includes geology, seismology and geotechnical engineering.

The main point for seismic microzonation that aims to minimize the loss in man-made environment is the transition of selected microzonation parameters for land use and planning. Therefore both selected microzonation parameters and maps can be understood and interpreted by planners and public officers as well as geologists. Various zones should be separated as a guide to determine population density, building density and structural features for urban planners. Transitions between these zones are not so clear.

Microzonation studies are interdisciplinary studies that provide a base for planning activities with determining the disaster risk in both settlement areas and developing areas. In addition, they are used for giving suitable decisions for land using and zoning, determining strategic goals, aims and priorities for urban renewal and mitigation planning.

These studies can be defined as the studies that determine the disaster hazard and disaster risk in local scales [10]. The role of geological and geotechnical survey in microzonation is crucial to describe, control and obviate the hazards for planning urban infrastructure and hazardous energy fields. Especially educational buildings, hospitals, public buildings and infrastructure facilities such as substations, communication centers and gas pipelines network must be planned in consideration of the suitability analysis for settlement area which is made as a result of microzonation studies.

A. Settlement Suitability Analysis

Suitability analysis for settlement area are the final maps which are created after the evaluating all of the raw data maps (geology, slope, underground water maps, etc.), semi-product maps (local soil classes, etc.) and final hazard maps (soil enlargement, liquefaction) prepared by the studies. Beside this engineering comments are added to these maps [10].

With settlement suitability analysis area is divided into four groups: Suitable Areas(UA), Precautionary Areas(ÖA), Areas Requiring Detailed Geotechnical Surveys (AJE) and Unsuitable Areas(UOA):

Suitable Areas(UA): Areas that have no potential for natural disaster hazard except earthquake hazard, no engineering problems that can affect suitability to settlement. In other words, the areas where are ready for settlement without taking any precautions within the study area.

Precautionary Areas(ÖA); Areas within the study area that have been specified as hazardous area in terms of earthquake, mass movement and high slope, water flood, avalanche, engineering problems and other hazards. These areas should be divided into sub-sections according to the type of problems and their precautions.

The areas specified as precautionary area does not refer to the area forbidden to be used for construction purposes. However, it implies that certain measures must be taken before and/or during building construction.

Areas Requiring Detailed Geotechnical Surveys (AJE); These are the areas where the detailed geotechnical investigations (drilling, laboratory experiments, hazard analysis, etc.) are required in terms of providing more efficient statements for determining the suitability of the areas for settlements.

The issues that should be studied in the geotechnical investigations to be conducted afterwards must be highlighted in reports.

Unsuitable Areas(UOA); Areas where should not to be opened to settlement because of taking measures have not been considered suitable because of natural disaster hazards in project area, geological problems and related laws.

Suitability analysis for settlement area are made to provide a base for planning activities. Therefore the determined area groups and necessary preventive actions which are determined under the guidance of microzonation studies should be noted on plans and in planning.

V. THE EVALUATION OF ISTANBUL MICROZONATION MAPS

In Istanbul, urban geology studies that run together with city master planning essentially began in 1994. But as time passed by, it was understood that geological studies are not sufficient by itself for reduction of disaster risk in urban areas. Thus, to identify both man-made and natural disaster hazards, to determine urban risk, to produce plan decisions that eliminate these risks and to create a roadmap to reduce the risk microzonation studies that are more comprehensive have began to be conducted. In this context, “Istanbul Microzonation Projects” which include southern parts of both Asian and European sides of Istanbul was prepared for 700km2 survey area. The first phase of İstanbul Microzonation Studies, European side microzonation survey, were finished in 2007. The project was completed with finishing the Asian side microzonation survey in 2009.

Ground shaking, liquefaction hazard, landslide hazard, flooding and inundation hazard, earthquake hazard and various engineering problems were analyzed in scope of the study. Finally, with evaluating all analysis together, they were summarized as 1/2.000 scaled “Land Suitability Map” for each side to provide a basis for development plans [11],[12].

Each land suitability map that was produced as an outcome examines the work area in terms of the parameters that are determined at the beginning of the study and divides the survey area into three groups: Suitable Areas(UA), Precautionary Areas(ÖA) and Unsuitable Areas(UOA). Also the areas designated as precautionary area were examined in groups that were divided for each parameter.

TABLE III
SUITABILITY DISTRIBUTIONS OF ISTANBUL MICROZONATION FIELD
(compiled from [11] and [12])

% Distribution	European Side	Asian Side
Suitable Areas(UA)	39.64	39.14
Precautionary Areas (ÖA)	58.94	60.30
Unsuitable Areas(UOA)	1.42	0.56

Measures must be taken for each risk area are also mentioned in reports via this microzonation surveys. However, despite the detailed survey, when the relationship between the microzonation survey and urban planning activities is examined some significant problems are seen in practice. When the microzonation maps completed in 2009 are superposed with the existing land use map it is seen that some of the areas identified as unsuitable area with microzonation survey are being used as residential, educational and industrial area. Whereas, mistaken location selections in particular for industrial areas will lead to the destruction of investments in the event of a disaster as in the case of Sakarya for earthquake occurred in 1999.

Similarly, almost all of the areas determined as precautionary area by the land suitability maps produced are built-up area in current situation. As stated previously, precautionary areas are not the areas that can not ever be built, they are the areas where need more detailed surveys to determine the measures should be taken to build. However, when it taken into account microzonation studies completed in 2009 and geological surveys became compulsory in 1999 to get a construction permit, it can be possible to say that a great majority of precautionary areas that built prior to 1999 are in danger (Fig. 2.)

As stated before microzonation studies are made to be base for planning activities. Site selection especially for public buildings that crowds of people swarm and vital infrastructure facilities have great importance. Therefore, usages like that should be positioned depending on the suitability maps that are produced within microzonation studies.

"Making Cities More Resilient: My City is Getting Ready!" campaign that launched by UNISDR (The United Nations Office for Disaster Risk Reduction) pays special attention to this subject. 5th article of "The Ten Essentials for Making Cities Resilient Checklist" which is prepared by campaign is mention to the subject as:

"Assess the safety of all schools and health facilities and upgrade these as necessary." [13].

Despite being one of the participations of this campaign multitude of educational and health facilities in the unsuitable and precautionary areas clearly demonstrate that the chaos will occur in case of a possible disaster in İstanbul (Fig. 3.). When the practices of foreign countries are examined, it is seen that public buildings such as schools and hospitals and vital infrastructure facilities are positioned on the areas where haven't any risks as much as possible. Although it is late for such an approach due to construction rate of Istanbul there is a requirement for maintenance or rebuilding of public buildings and infrastructure facilities were built before the regulations.

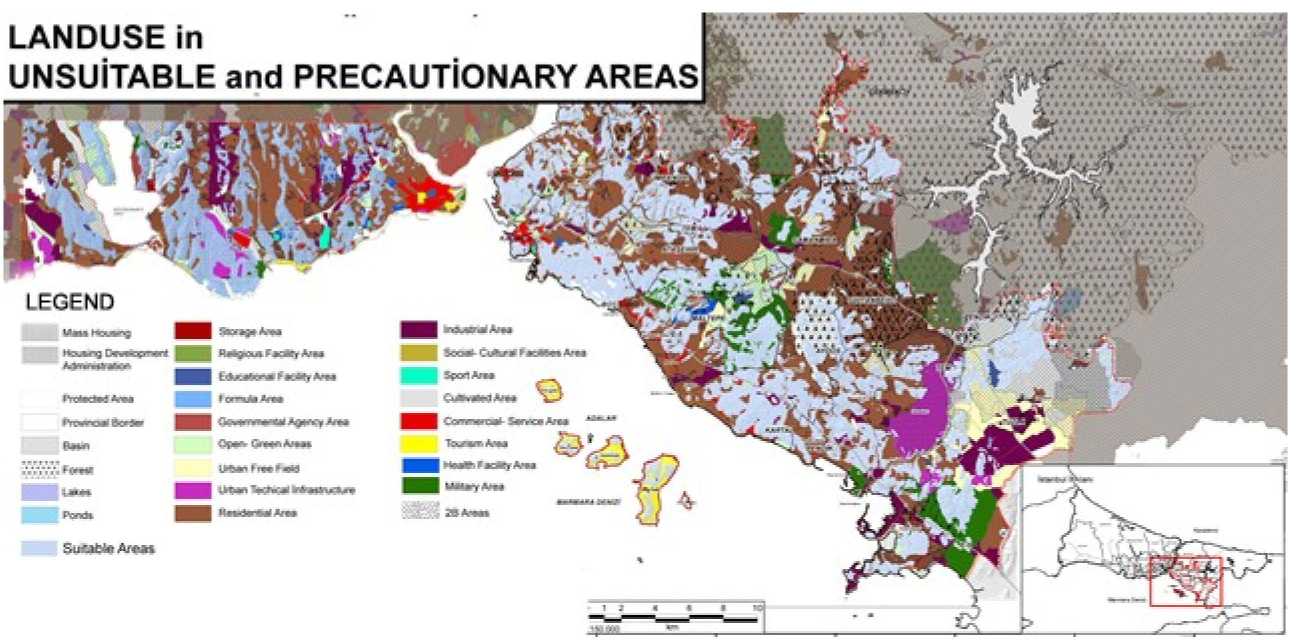

Fig. 2. Landuse in unsuitable and precautionary areas (Authors' analysis based on data of [11] and [12])

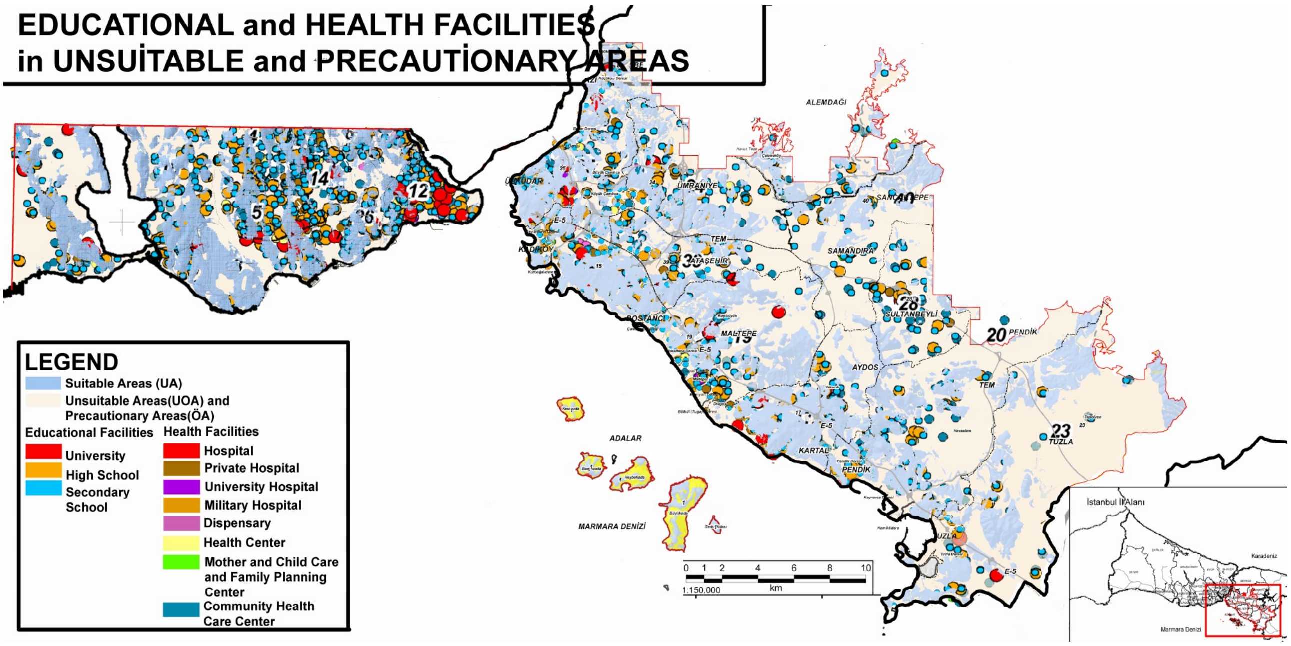

Fig. 3. Educational and health facilities in unsuitable and precautionary areas (Authors' analysis based on data of [11] and [12])

VI. EVALUATIONS AND FUTURE DIRECTIONS

Microzonation is a powerful tool in guiding the design of disaster sensitive planning. Most effective method in reducing disaster risk is making correct site selection with taking measures from macro scales to micro scales. Therefore, microzonation is not primarily concerned about building design but land use and urban planning. However, it is difficult to say that microzonation studies which began to develop especially after the earthquake occurred in 1999 has established a successful relationship with urban planning in practice in Turkey.

Land suitability maps are prepared with an approach that ignores earthquake hazard in Turkey where 92% of total areas are located on seismic zone. Ignoring the greatest potential risk make the cities opened to the risk. This legislation problem should be corrected as soon as possible.

The survey format that is recommended in microzonation studies for each planning scale is determined by the population factor. This conduce to excluding major developments such as industrial zones from the boundaries of microzonation survey area. Whereas when the number of industrial facilities damaged in earthquake occurred in 1999 and the financial losses are considered it is obvious that site selection of such land functions have great importance. Due to bordering the survey area by southern parts of both sides many residential, commercial and industrial areas remained outside the boundaries of microzonation study in İstanbul. However, planning is an activity that makes holistic decisions and is carried out in whole of the administrative boundary. Thus, to make all the decisions healthy, whole planning area should be investigated by microzonation studies.

Microzonation studies made across Turkey is mainly for new residential areas. However, as seen in Istanbul example, hazardous areas have a great building stock that built before the microzonation surveys, especially in big cities. To make cities disaster resilient it is necessary to develop strategies that contain entire city. Therefore, planning should make serious decisions like collapsing, transporting or regeneration of hazardous areas as well as repairing and structure strengthening. Also regeneration areas that under disaster risk should be determined according to these risks before the age of the buildings.

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