CREATING A SUSTAINABLE SETTLEMENT IN THE EARTHQUAKE RISKY AREA: THE CASE OF ESKISEHIR-TURKEY

1. INTRODUCTION

Political shifts in national planning systems and urban agenda all around the world, have created new forms of planning tools and mechanisms for creating a healthy and safe living environment, efforts of which have also been experienced in Turkey.

"Eskisehir Risky Area, Urban Development Project[1]" is realized under one of such planning tools, titled the "Law of Transformation of Areas under the Disaster Risks" (Law No. 6306) entered into force in the year 2012 (Official Gazette of 31.5.2012, no.28309); and the "Regulation on the Implementation of Law of Transformation of Areas under the Disaster Risks" (Official Gazette of 15.12.2012, no. 28498) in Turkey. The scope of the law and regulation are to determine the procedures and principles regarding the rehabilitation, clearance, and redevelopment of areas and buildings at disaster risks by relevant standards.

"Eskisehir Risky Area, Urban Development Project" is prepared by an interdisciplinary group from Istanbul Technical University in collaboration with the Greater Eskisehir Municipality for a 56.4 ha-sized site, located along the Porsuk River, in Eskisehir Central Business District, where there are risks of liquefaction in any possible earthquake.

Eskisehir province, with its attractive, culturally vibrant city centre and prominence on university education, is ranked at 7th among 81 provinces in Turkey, in socio-economic development index (Figure 1, Figure 2).

Figure 1 Location of Eskişehir in Turkey

Figure 2 Location of Eskişehir Risky Area

(1) Eskisehir Risky Area, Urban Development Project, (2014-2017) Nuran Zeren GÜLERSOY (Project Director); Turgay Kerem KORAMAZ (vice-director); Ahmet SAĞLAMER, (consultant); Ahsen ÖZSOY; Haluk GERÇEK; Okan TÜYSÜZ; Necla ULUĞTEKİN; Ayçim TÜRER BAŞKAYA, Greater Eskişehir Municipality, İTÜ Faculty of Architecture Revolving Found.

2. THE AIM OF THE ESKISEHIR URBAN DEVELOPMENT PROJECT

Eskisehir Urban Development Project in Earthquake Risky Area, advocates the ecological and social sustainability principles, in the re-shaping city centre with evident earthquake risks, and “redevelopment in-situ with locals” approach.

The aim of the project is, “to produce urban development plans and projects which enrich the dynamics of functional potentials to create a safe human settlement with adequate technical and social infrastructure, to provide sustainability while eliminating the risks of geological structure and built environment and to implement in a short-term period” (Report 1, 2015).

3. WORKING STEPS OF ESKISEHIR URBAN DEVELOPMENT PROJECT

The work and operations of the Eskişehir Urban Development Project in Earthquake Risky Area are composed of the following working steps (Report 1):

- Analysis of Existing Situation
- Vision, Principles and Strategic Objectives of the Development Plan
- Plan Decisions, Development Plan and Urban Design Project Alternatives
- Feasibility Studies and Implementation Model
- Negotiation Process with the Property Owners

3.1.ANALYSES OF EXISTING SITUATION

Located within the boundaries of Tepebaşı District and Odunpazarı District, Eskişehir Earthquake Risky Area contains 6837 immovables in 1348 parcels, belonging to 8940 property owners (Figure 3, Figure 4).

The essential characteristics of the Eskişehir Earthquake Risky Area, its immediate surroundings and the whole city have been defined based on the data obtained from the public and private institutions. The location of the planning area within the Eskişehir and the transportation and infrastructure links, administrative structure, investment programs, and the plans that have been implemented in the past and present have been inspected and evaluated. Also, Eskişehir Earthquake Risky Area Analyses have been carried out in line with the information and data obtained from the field survey by the project team, within the scope of the current situation assessment (Report 1, 2015).

Figure 3: Eskişehir Earthquake Risky Area Working Model (Report 1, 2015)

Figure 4: Eskişehir Earthquake Risky Area Aerial Photograph (Report 1, 2015)

The analyses of the existing situation were prepared under the headings of:

- The natural environment and risk analyses: Slope analysis, geologic and geotechnical analysis, the risk of liquefaction, earthquake risk, and total disaster risk, settlement suitability analysis;
- Physical environment: Building and land use, transportation and mobility, infrastructure, listed historic and natural values, building heights, building conditions, urban pattern;
- Ownership, building and land values assessment;
- Socio-economic environment: Social structure of population living in the area, sectoral structure of the working population, demands and expectations of the user groups (Report 1, 2015).

3.1.1.NATURAL ENVIRONMENT: RISK ANALYSES, GEOLOGICAL AND GEOTECHNICAL SURVEYS

Eskişehir Earthquake Risky Area is located within the 2nd Degree Earthquake Zone of Turkey. The main characteristic of the area that causes the earthquake risk is the risk of liquefaction within the first 10 meters of groundwater level. The existence of low-quality structures that have remained unused and damaged in the area, especially in the Porsuk River Coast and its immediate vicinity, is expected to increase the disaster risk regarding the loss of life and property after a possible earthquake. On the other hand, Eskişehir Earthquake Risky Area has rich hot/thermal underground water resources

whose temperatures vary between 26 - 44.5°C and has significant thermal, tourism potentials (Report 1, 2015).

3.1.2.ASSESSMENT OF BUILT ENVIRONMENT

In the planning area, in the field survey, assessment of the built environment, such as urban pattern characteristics, land use, transportation and accessibility, infrastructure, listed buildings, building heights, building conditions and building materials have been done (Report 1, 2015).

According to the survey, the sum of residential, commercial-residential, and commercial-tourism-residential areas was calculated as 19,33 hectares. In mixed-use areas and other areas; uses that would create risk at the event of any disaster, such as warehouses, manufacturing shops, industrial material ateliers, etc. were determined (Figure 5).

3.1.3.ASSESSMENT OF OWNERSHIP AND REAL ESTATE APPRAISAL

Within the context of collecting the data for assessment of ownership and real estate value appraisal, the earthquake risky area was examined with the features such as administrative boundaries, size and number of parcels, urban pattern characteristics, transportation and accessibility relations within the scope of the regional analysis. Then, the precedent research was done, and the precedent analysis map was drawn, and the appraisal reports were prepared (Report 1). With the assessment of ownership and real estate appraisal in the field studies, 5077 residential units were determined in the Eskişehir Earthquake Risky Area (Figure 6).

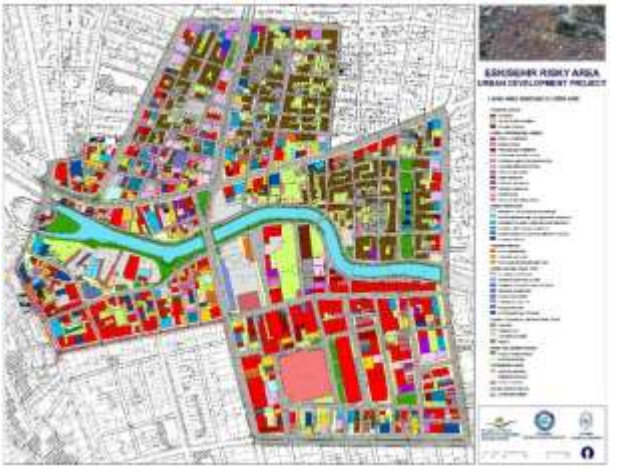

Figure 5: Eskişehir Earthquake Risky Area Area Land and Ground Floor Use (Report 1,2015)

Figure 6 Eskişehir Earthquake Risky Area Real Estate Appraisal (Report 1, 2015)

3.1.4.SOCIO-ECONOMIC ENVIRONMENT

According to one of the project's principles related to the development of transparent and participatory redevelopment process, within the social environment research, the survey has been conducted with the households and trade owners firstly, to understand the thoughts and requests of the users and to inform them about the project (Report 1, 2015).

The completed studies and surveys to determine planning and design decisions were shared with relevant institutions and organisations through participation meetings, and opinions and recommendations were collected.

The average household size of the eight neighbourhoods is 2,92 people, and approximately 15.000 people live in the area, and the average gross density is determined as 1000 p/ha (Report 1, 2015).

3.1.5. EVALUATION OF THE EXISTING SITUATION

With the results of the research and examinations, analyses and evaluations made with the help of participation meetings in the scope of the Project, Strengths-Weaknesses and Opportunities-Threats were determined by applying a SWOT analysis that created a response to user requests and directs the determined strategies for the future (Report 1).

Under the heading of evaluation and synthesis of examinations and researches, sub-regions with similar characteristics were identified. Moreover, the specialised and clustered core uses that were in the central business district; uses that have not fit the character of the area; distribution of urban social facility areas and their service domains, and unused but potentially promising areas were assessed accordingly (Figure 7, Figure 8).

Figure 7: Existing Urban Pattern (Report 1, 2015)

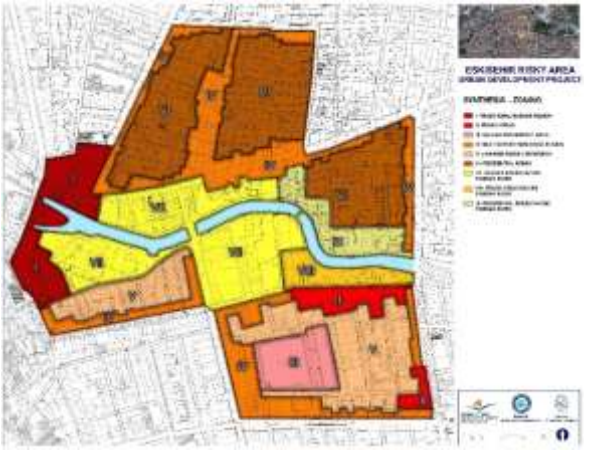

Figure 8: Evaluation of Existing Situation (Report 1, 2015)

3.2.DETERMINATION OF VISION, PRINCIPLES, STRATEGIC OBJECTIVES OF THE DEVELOPMENT PLAN

Within the framework of the field survey, research and evaluation, preferences and development priorities of relevant public institutions, and SWOT analysis provided by the current situation research, including the factors specified in the aim of the project, the vision of the project were defined:

“To create a modern urban environment with high living standards, which is resistant to disaster risk, has functional and spatial qualities compatible with its social and economic structure, and can transfer its cultural and natural heritage to the future while hosting its locals again”.

To reach the vision of the project, the principles of:

- In-situ urban development (locals remaining in their current vicinity);
- Safe spaces resistant to disaster risk;
- Healthy, reliable and high-quality places;
- Accessible, vivid city centre;
- Ecological, social and economic sustainability;
- Green Porsuk River corridor with an ecological system and public uses;
- Efficient use of geothermal resources;
- The transparent and participatory planning process

were taken into consideration, and strategic objectives were developed.

The strategic objectives of the project were formed in three main headings, which were about the (Figure 9), (Report 2, 2016):

- Physical environment;
- The natural environment and ecological planning;
- Socio-economic environment.

The strategies have been developed under the sub-headings of land use, physical space, transportation and infrastructure; sustainability, reduction of disaster risk, socio-cultural, economic and administration, to guide planning and design decisions (Report 2, 2016).

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	STRATEGIES FOR PHYSICAL ENVIRONMENT	
A	Land Use	Ensuring Functional Sufficiency
B	Physical Space	Developing Urban Spatial Quality
C	Transportation and Infrastructure	Providing Effective Communication and Optimum Accessibility
	STRATEGIES FOR NATURAL ENVIRONMENT AND ECOLOGICAL PLANNING	
D	Sustainability	Ensuring Functionality and Sustainability of Urban Ecosystems
		Reducing the Ecological Impacts of Physical Environment
E	Reduction of Disaster Risk	Enhancing Resistance against Natural Risks
		Raising Public Awareness about Urban Ecosystems and Natural Risks
	STRATEGIES FOR SOCIO-ECONOMIC ENVIRONMENT	
F	Socio-cultural	Protecting the Social and Cultural Integration
G	Economic	Creating Economic Dynamics
H	Administrative and Organizational	Developing a Transparent and Participatory Redevelopment and Regeneration Process

Figure 9: Eskişehir Earthquake Risky Area Planning (Report 2, 2016)

3.3. PLANNING DECISIONS, PREPARATION OF DEVELOPMENT PLAN AND URBAN DESIGN PROJECT ALTERNATIVES

Through the suggested planning strategies, Eskisehir Urban Development Plan and Urban Design Project proposed a sustainable urban development example, which tried to establish a responsive social and economic environment in ecological planning approaches, and a unique model in Turkish planning and legislative system (Report 2, 2016).

3.3.1. PLANNING DECISIONS RELATED TO PHYSICAL ENVIRONMENT: LAND USE, TRANSPORTATION AND INFRASTRUCTURE

The project offers a unique redevelopment approach which strives to establish a healthy, vibrant and safe city centre. With the aim of ensuring the relation of functional areas with the ecological system and the rational use of the built-up areas, planning decisions have been developed to support the city's compact, natural risk-tolerant, and mixed-use development (Report 2, 2016).

A new redevelopment scheme has been proposed which will enable the residents to remain free from the disaster risks of the area as possible and to continue their life in the same location with modern living standards and necessary social facilities.

Within the strategy of “Developing Urban Spatial Quality”, "Planning High-Quality Residential Areas" and "Reorganizing Existing Urban Blocks in a way to Provide Efficient Urban Density and Regularity” strategies have been developed and larger urban blocks that were integrated with courtyards and open spaces have been created instead of dense and very small housing units (Figure 10, Figure 11) (Report 2, 2016) (Report 3, 2017).

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Figure 10: Existing Housing Use
5028 Units – 528.791 m^2 (Report 2, 2016)

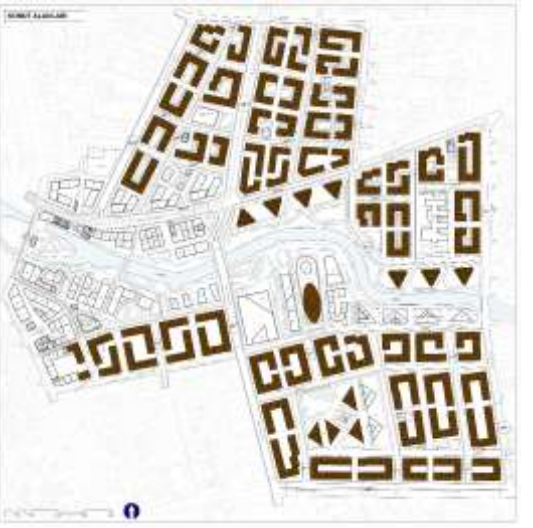

Figure 11: Proposed Housing Use
6880 Units – 938.063 m^2 (Report 2, 2016)

In mixed-use areas; uses that would create risk at the event of any disaster, and other facilities such as warehouses, manufacturing shops, industrial material ateliers, etc. were removed from the risky area (Figure 12, Figure 13).

In the Traditional Bazaar and Hot Waters Region, traditional land use features of the area were taken into consideration. Hot Waters Region has been planned with thermal tourism facilities and retail trade functions on the ground floors to serve these facilities.

In the Porsuk River Coastal Region, only cultural and touristic trade areas, accommodation facilities, food-beverage tourism facilities, residence housing + mixed commercial use and cultural facilities would be located. The open spaces in the Kurtuluş Area have been planned as the most significant "disaster gathering place" in the event of an earthquake, flood, etc. in pedestrian ways, parks and recreation (Report 2, 2016) (Report 3, 2017).

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Figure 12: Existing Commercial Use 221.790 m^2 (Report 3, 2016)

Figure 13: Proposed Commercial Use 359.742 m^2 (Report 3, 2016)

The original uses of the “Listed Buildings” have been taken into account, and the buildings were freed from the structural additions and use such as wholesale trade and small manufacturing, that have not compatible with their character. Eskisehir People’s House is planned to be reconstructed and is returned to its original use as a cultural centre (Report 2, 2016).

The tram line and tram stations passing over Sivrihisar 1 and Hasan Polatkan Streets were preserved for the continuity of the transportation system around the area. On Sivrihisar 1 Street, between Gazi Yakup Satar and Hasan Polatkan Streets, a new additional lane has been proposed to facilitate vehicle traffic (Figure 14; Figure 15). Taking existing urban blocks into consideration, some regulations made on the lower level transportation routes to ensure the relationship with the current urban pattern (Report 2, 2016, (Report 2, 2016) (Report 3, 2017).

Roadside parking, which creates traffic problems regarding traffic safety and is not pedestrian-friendly in the use of public space has been proposed only on lower level roads so as not to affect traffic flow. For the whole project area, underground parking spaces were planned underneath almost all urban blocks to provide at least one car parking space for each dwelling unit to solve the parking problem (Report 2, 2016) (Report 3, 2017).

To ensure the efficient use and continuity of bicycle routes and to integrate them with the immediate vicinity; physical arrangements have been proposed that would support the use of bicycles and make it safer. While bicycle routes

are placed in separate lanes in the main arteries, in the lower level roads, they are only on one side of the road (Figure 16) (Report 2, 2016) (Report 3, 2017).

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Figure 14: Existing Transportation Routes (Report 3, 2016)

Figure 15: Proposed Transportation Routes (Report 3, 2016)

Porsuk Coast has been planned as the backbone of the green pedestrian road system which will ensure the sustainability of the biological diversity that the river has throughout the water line. The pedestrian ways are designed on the east-west and north-south directions to feed all functions throughout the project area. Another vital component of the green system is the use of green spaces in the inner courtyards of the urban blocks (Figure 17) (Report 2, 2016)

Figure 16: Proposed Bicycle Route (Report 3, 2016)

Figure 17 Proposed Pedestrian Route (Report 3, 2016)

While a pedestrian-oriented transportation system is designed in the planning area, disabled-pedestrian and vehicle directions are considered, and for recreational purposes, access has been provided to every point by ramps (Report 3, 2017).

3.3.2. DECISIONS RELATED TO NATURAL ENVIRONMENT AND ECOLOGICAL PLANNING: SUSTAINABILITY, REDUCTION OF DISASTER RISKS

At the top of the project's sustainable urban development and ecological planning principles; there has been the rehabilitation of the natural environment and redevelopment of the existing areas. Possible natural hazard risks (flood, earthquake, liquefaction, proximity to groundwater, etc.) have been identified and taken into account in the planning decisions. In the case of public uses requiring extensive use of space, the rate of ground coverage has been limited to protect water and carbon cycle and soil.

One of the leading environmental planning strategies is to provide optimum land use along the Porsuk River and to enhance functional continuity in the entire eco-system. In the meantime, reserving a hot spring water preservation increases the significance of geothermal resource management, while providing the public welfare with these resources. Alongside the river, "green corridor" applications have been proposed to prevent spreading of flood hazard to broad areas due to the flat topography, by restricting the non-permeable ground materials in the urban blocks near Porsuk River. In the green system, it was aimed to reduce the effects of built-up surface and the urban heat island effect and to control the rainwater (Report 3, 2017).

3.3.3. DECISIONS RELATED TO SOCIO-ECONOMIC ENVIRONMENT

Within the scope of the principle for the project ‘’Securing the rights of the residents to remain in their current vicinity”, it is aimed to determine the population size and the carrying capacity by an applicable development model. The future population projection of the Eskişehir Earthquake Risky Area was accepted as 20,000 people after the completion of the project. In Eskişehir Risky Area Project, education, health, administrative and social facilities are proposed as urban facilities (Report 2, 016) (Report 3, 2017).

By the plan decisions; a new restructuring scheme has been proposed which will enable the residents living here to remain as free from the disaster risks of the area as possible and to continue their lives in the same location with modern living standards and necessary social facilities. The proposed new settlement scheme was provided with alternative housing sizes suitable for

different household structures (Figure 18, Figure 19, Figure 20 Figure 21) (Report 3, 2017).

Figure 18: Eskişehir Earthquake Risky Area Urban Design Project (Report 3, 2017)

Figure 19: Eskişehir Earthquake Risky Area Urban Design Project Computer-Aided 3D Model (Report 3, 2017)

Figure 20: Sections and an example of Architectural Design of a Block in Urban Design Project 1/1000 (Report 3, 2017).

Figure 21: Existing views of Eskişehir Risky Area (Report 3, 2017)

Figure 22: Proposed views of Urban Design Project (Report 3, 2017)

4. FEASIBILITY STUDIES AND IMPLEMENTATION STAGE

Eskişehir Risky Area, Urban Development Project, is a mandatory project due to earthquake risk and the risk of liquefaction within the first 10 meters of groundwater level. For this reason, instead of the classic "profit and return of investment" approach in the feasibility study, the question "how much citizen contribution can be realised by at least" is sought. In order to be used in feasibility studies, the total of construction costs, project consulting costs, destruction and transportation costs of existing buildings, landscaping costs, infrastructure costs and social facilities costs have been calculated by Urban Design project data. It has been accepted that the new residential and commercial real estate would be sold at the current market price (Report 4, 2017).

As a result of the feasibility analysis, it has been found that the feasibility of the project is provided when the distribution is made as much as the size of the immovable that the owners have rights. Except for the distribution of the existing entitlement, the real estate sales income to be obtained from the residential area, which is supposed to support the project financially (Report 4, 2017).

5.NEGOTIATION PROCESS WITH THE PROPERTY OWNERS

For the implementation of the project, the planning group proposed to the municipality to establish a non-profit company under the public-private partnership. The municipality's company has to simultaneously provide consultancy services to both the developer and the owner and carry out the negotiation process with them (Report 4, 2017).

6. RESULTS AND DISCUSSION

Urban redevelopment projects in Turkey, to be held under the “Law of Transformation of Areas under the Disaster Risks” have been criticised with housing programs in new development sites (reserve settlement area), which may force to evict the local communities and cause resource depletion, loss of urban identity and neighbourhood characteristics in the social structure and gentrification. The case in this paper, advocates the ecological and social sustainability principles, in the re-shaping city centre with evident earthquake risks, and “development, keeping residents in-situ” approach.

Eskişehir Earthquake, Risky Area Urban Development Project, achieves to produce urban development plans and projects which enrich the dynamics of functional potentials; to create a safe and healthy human settlement with adequate technical and social infrastructure and to provide sustainability while eliminating the risks of geological structure and the built environment.

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