Evaluation of historic urban areas by using 3D GIS technologies – case study of old city Istanbul, Turkey

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by

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Abstract

Urban degradation and obsolescence is a problem affecting many old, historic areas of the cities. These areas are characterized by the existence of inharmonious buildings in traditional urban fabric in terms of their heights and construction materials, bad physical conditions and poor maintenance, social stress caused by the lack of accommodation and overcrowding and incompatible land uses that rely on industries causing noise and pollution. Revitalisation and conservation of historic urban areas includes both aspects, renewal of the physical fabric and maintenance as well as development of the economic structure and active economic use of buildings and land. All revitalisation strategies should be carefully developed by carrying out profound survey and analyses of the physical and functional characteristics of the historic urban fabric. The study demonstrates applicability of GIS technologies and 3D building database for the evaluation of historic urban area of the old city centre of Istanbul and proposing measures for sustainable revitalisation and conservation. A conservation framework was developed to evaluate characteristics of the study area and to analyze types and levels of its degradation. The framework is focused on assessing three types of degradation: architectural character, physical and functional. The variables used as main indicators of these types of degradation are building heights, construction materials, physical conditions, crowding and building functions. The 3D GIS database is especially beneficial in assessing harmony of buildings with the surrounding environment according to their height values and evaluating suitability of building functions by making use of vertical land use inventory.

The high number of buildings in the study area is classified for redevelopment due to the problems with disharmonious heights and construction materials. The other main problem in the area is the high amount of buildings with incompatible land uses that rely on manufacturing and wholesaling activities and call for functional restructuring. The main limitation in the study is the lack of socio economic data that would provide a complete insight into historic urban degradation and address the target group of renewal actions.

The study demonstrates that the developed framework and a 3D GIS database can be applicable and beneficial for the evaluation of the historic urban area for the purposes of conservation and revitalisation. The use of 3D GIS is effective for visualisation of disharmonious buildings and controlling of allowable building heights. It is also valuable for developing of land use proposals based on the vertical inventory of building functions. The main limitation of the framework is the lack of variables and a more detailed dataset that would considerably increase its quality and value.

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Chapter 1. Introduction

This chapter gives the general overview of the main topics and components presented in the research including research problem followed by research objectives and questions. The focus of the research is on the evaluation of built up areas within historic pattern by using 3D GIS technologies in order to determine the type and level of degradation and propose measures for sustainable revitalisation and conservation.

1.1. Introduction

Historic urban heritage is an important symbol of its city and evidence of the past society that gives the guidelines for the future development and prosperity. Historic urban areas, usually located in the centres of the cities, are valuable places abundant with old, historic buildings and structures with high artistic values that are worth to be preserved (Nijkamp and Riganti, 2008). However, many of these areas are being increasingly threatened and destroyed as a result of high urbanisation and population pressure everywhere in the world. In some places, economic growth and new developments seeking to increase the profitability and attractiveness of the area have a priority over preservation of the historic and cultural values (Oruc and Giritlioglu, 2008).

The relationships and tradeoffs between new developments and preserving cultural and historical aspects of the urban environment are of critical importance for optimal management practices in built up historic areas. The study will consider these relationships in order to attain a balanced outcome. It will provide a framework for conservation and revitalisation of historic urban areas in order to identify the decayed areas and propose measures for urban renewal. An integrated approach of urban conservation and development by urban revitalisation and transformation is the main aim and challenge that are historic areas facing today (UNESCO, 2008).

The process of urban conservation and planning for economic development can be supported and facilitated by making use of GIS technologies and spatial databases that can provide useful information for determining development directions and priorities (Petrescu, 2007).

1.2. Background and Significance

Preservation and sustainable management of cultural heritage is one of the key factors for economic progress and development of every country (Nijkamp and Riganti, 2008).

Turkey is a country rich with cultural heritage and Istanbul is certainly one of the most valuable historic resources. In Turkey cultural heritage is defined by the "Law on the Protection of Cultural and Natural Assets"(Gulersoy-Zeren et al., 2003).

According to this law, cultural assets are defined as "all over ground, underground and submarine movable and immovable assets related with science, culture, religion and fine arts or original in scientific and cultural manners, belonging to pre-historical and historical eras" (Gulersoy-Zeren et al., 2003). Protected sites are also defined by this law and they include archaeological sites, natural sites, urban sites and historical sites. Protected sites are urban settlements, sites or remains which reflect the social, economic and architectural values and structures of the original periods and civilisations in which they were created. Urban sites belong to protected sites and include structures that comprise not only high architectural and artistic importance but also display socio economic and cultural characteristics of the specific period and authentic life style.

The concept of urban conservation in Turkey has considerably changed over the years. The first attempts were focused on the protection of individual buildings and monuments which resulted in producing a museum phenomenon and limiting investments and development opportunities. Just recently, in the last few decades, the awareness of the importance of historic preservation has begun to increase and the efforts have turned towards developing of conservation plans and integration of cultural and historic sites with their functional and economic potential (Doratli et al., 2004). However, there are still many concerns regarding Turkish conservation systems that have to be addressed for the successful management of conservation and revitalisation processes through which destruction and degradation of the historic areas would be recognised and prevented (Gulersoy-Zeren et al., 2003).

1.3. Research problem

Urban cultural heritage is the living record of the past that has a huge potential and benefits in shaping the future of city and its inhabitants. Nevertheless, rapid globalisation and explosion of urban population have put a significant pressure on the historic urban areas leading to their destruction and degradation (UNESCO, 2008).

Turkey, as a developing country, is particularly facing problems of high urbanization and industrialisation and is experiencing problems of ineffective planning and

conservation of historic heritage. Uncontrolled population growth in the last few decades have caused exhaustion of natural and cultural resources and stressed the necessity to develop immediate and adequate strategies and regulations for preservation of the remaining values (Yaprak, 2008).

Despite all regulations, there are still many shortcomings concerning legal, planning, management and financial aspects of Turkish conservation system that hinder the success of implementation and have to be considered.

A major limitation is that conservation laws and regulations are not well integrated with the development plans to ensure sustainable conservation and economic revitalisation. Besides, there is the lack of cooperation between local and central governments for effective management and planning (Somuncu and Yiğit, 2010). There is also the lack of community participation and low public awareness and interest in necessity of urban conservation. Furthermore, there are insufficient tools and financial investments from the local and central governments and absence of private partnerships necessary for the conservation activities and revitalisation procedures (Gulersoy-Zeren et al., 2003)

Beside the general insufficiency of the existing conservation system, one of the main weaknesses is the lack of the strategic approach to increase the economic potential of the urban heritage and integrate urban conservation practices into urban development and planning processes (Gulersoy-Zeren et al., 2003). The definition of the strategic approach is the most important phase in formulating conservation polices and renewal plans for sustainable revitalisation and development (Doratli, 2000). Such approach should be based on a detail documentation and evaluation of historic areas which can be achieved by making use of GIS applications and incorporating spatial database into planning and conservation systems.

1.4. Research objectives

1.4.1. General objective

The main objective of the research is to demonstrate how GIS technologies and a 3D building database can be used to evaluate historic urban areas and contribute to urban conservation and management for the revitalisation and renewal of these areas.

1.4.2. Specific objective

For achieving the main objective the following specific objectives are defined.

1. To review different types of urban degradation and analyze urban conservation practices and organisational framework for the conservation of cultural heritage in Turkey

This sub objective will explain different types of urban degradation and provide insight into organizational structure and urban conservation practices and policies in Turkey.

2. To identify all necessary data for a constructive evaluation with regards to urban heritage conservation in order to produce a 3D building database and develop a conservation and revitalisation framework

   The first step in conservation practice should be identifying all necessary data and creating an urban heritage inventory with all relevant information. In this sub objective a simple 3D building database will be created and visualised in the level of detail 1 (LOD1) by incorporating building footprints data and height information data obtained from the elevation attribute of buildings. 3D building database will include information about location and height of buildings and other necessary information such as area, number of storeys, functional use of building, condition and type of construction. After the identification of all necessary data for constructive evaluation of historic areas, the conservation and revitalisation framework will be developed. The aim of this framework is to provide a model for the identification of decayed buildings and areas and to provide a support in formulating urban conservation and revitalisation strategies.

3. To apply the conservation framework to evaluate characteristics of the historic urban area and analyze types and levels of its degradation

   This sub objective is to apply developed conservation framework in order to analyze urban fabric of the historic area and to determine the degree of its degradation. First, physical characteristics of urban structure will be evaluated by looking at building height characteristics, building conditions and construction materials. Second, functional characteristics will be evaluated by looking at the functional use of buildings, incompatible uses and land use distribution.

4. To propose measures and strategies for sustainable revitalisation based on the present situation and assess usefulness of the conservation framework and GIS database for historic evaluation

   The evaluation of the present situation by using GIS spatial data will provide valuable information in formulating proposals and determining directions for sustainable revitalisation. Moreover, the usefulness of the developed framework

and GIS database will be critically assessed and suggestions for further improvements will be provided.

1.5. Research questions

Research questions were formulated in relation to research objectives.

- What is the historic urban degradation and what types of revitalisation strategies can be used?
- What is the current management practice in conservation and revitalisation of historic urban areas in Turkey and what is the organisational structure?
- What data is needed for constructive evaluation of the historic areas with regards to urban conservation and revitalisation?
- What is the degree of architectural character degradation in terms of buildings that are not in harmony with the traditional urban fabric?
- What is the degree of physical degradation of buildings in terms of their physical condition and quality?
- What is the degree of functional degradation in terms of functional uses of buildings and incompatible uses?
- What kind of recommendations for the urban revitalisation planning can be made from analyses and evaluation of the present situation by using 3D GIS technologies?
- What kind of data is missing and would be necessary to upgrade the framework and improve the analysis and evaluation?

1.6. Research approach

In order to fulfil research objectives and find answers to research questions, the research design was organized in to different phases (Figure 1).

Theoretical phase starts with the survey of relevant literature and formulation of the research proposal. Research proposal contains the definition of the research problem, objectives and questions. Preparations for the fieldwork follow with identifying the data requirements and sources of information and developing the fieldwork plan.

Practical phase includes data collection and preparation of the spatial database. Primary and secondary data were collected during the fieldwork in Istanbul. Primary data was collected by conducting interviews with experts and urban planners from IMP, Faculty of Architecture and Conservation Council. During these meetings, current planning and conservation practice in Istanbul and Turkey were analyzed and discussed. Legal context of urban planning system and legislation of urban conservation was critically evaluated. Secondary data collection included collection of spatial data in forms of digital maps of roads, administrative boundaries, building

footprints and other attributes. Field survey was carried out with the purpose of inspection and assessing accuracy of existing data and observation of the study area. After the data collection and preparation, analysis and measurements were performed in terms of 3D building database creation and development of conservation framework after which followed the evaluation of the present situation and formulating revitalisation proposal.

In the evaluation phase the discussion of the results of the data analysis and conclusions and recommendations were provided.

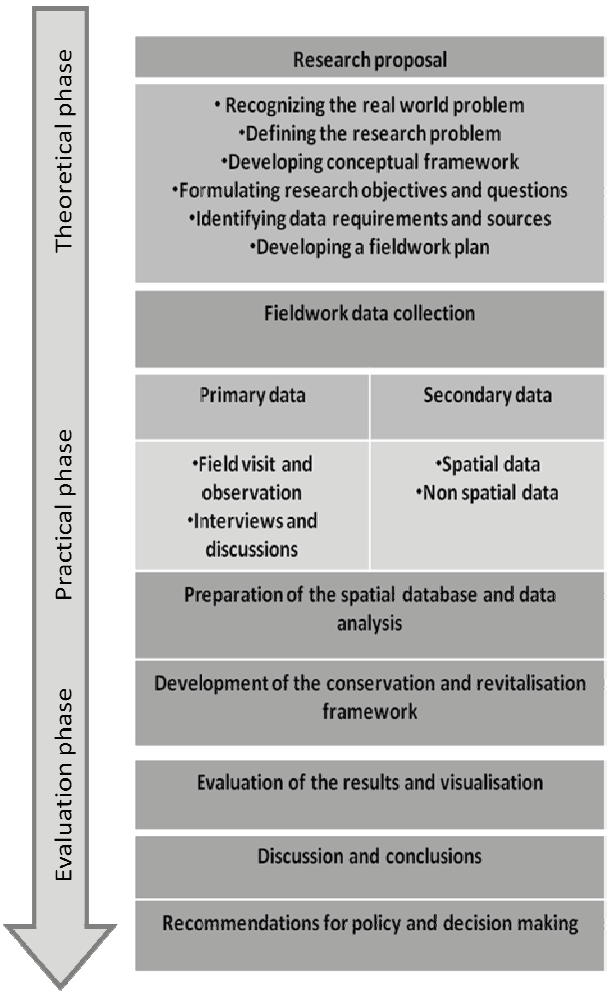

Figure 1 Flowchart of the research design

1.7. Research matrix

Research matrix in Table 1 is created to present the objectives, research questions, data required and sources for gathering data and methods for answering research questions.

No	Research objectives	Research questions	Data required	Data sources	Analysing methods
1.	To review different types of urban degradation and analyze urban conservation practices and organisational framework for the conservation of cultural heritage in Turkey	What is historic urban degradation and what types of revitalisation strategies can be used?	Relevant literature	Relevant literature	Literature review
		What is the current management practice in conservation of historic urban areas in Turkey and what is the organisational structure?	Relevant literature Knowledge from key respondents	Relevant literature Primary data	Literature review Interviews
2.	To identify all necessary data for constructive evaluation with regards to urban heritage conservation in order to produce a 3D building database and develop a conservation and revitalisation framework	What data is needed for the constructive evaluation of the historic areas with regard to urban conservation?	Relevant literature Knowledge from key respondents	Relevant literature Primary data	Literature review Interviews
3.	To apply the conservation framework to evaluate characteristics of the historic urban area and analyze types and levels of its degradation	What is the degree of architectural character degradation in terms of buildings that are not in harmony with the traditional urban fabric?	Building footprints Building attributes	Secondary data	GIS analysis
		What is the degree of physical degradation of buildings in terms of their physical condition and quality?	Building footprints Building attributes Listed buildings	Secondary data	GIS analysis
		What is the degree of functional degradation in terms of functional uses of buildings and incompatible uses?	Building footprints Building functions per floors	Secondary data	GIS analysis

4.	To propose measures and strategies for sustainable revitalisation based on the present situation and assess usefulness of the conservation framework and GIS database for historic evaluation	What kind of recommendations for the urban renewal planning can be made from analyses and evaluation of the present situation by using 3D GIS technologies?	Relevant literature Knowledge from key respondents Geo database	Relevant literature Primary data Secondary data	Literature review Interviews GIS analysis
		What kind of data is missing and would be necessary to upgrade the framework and improve the analysis and evaluation?	Relevant literature Knowledge from key respondents	Relevant literature Primary data Observation	Literature review Interviews

Table 1 Research matrix

1.8. List of chapters developed in the thesis

Chapter 1 provides an introduction to the research and background to the process of urban conservation and protection of historic urban areas. Research problem is presented and followed by research objectives and questions.

Chapter 2 provides main concepts of the historic urban areas, their major problems, types of degradation, methods and tools for their protection, revitalisation and sustainable development. It also reviews GIS applications in heritage conservation and urban renewal.

Chapter 3 provides introduction to the study area and explains process of data collection during the fieldwork conducted in Istanbul. It also explains the methodology applied in evaluation of historic case study district and development of the conservation framework. The used methods are analyzed with the main focus on achieving research objectives and addressing research questions.

Chapter 4 includes the results from the interviews conducted in Istanbul on issues related to urban conservation practices and organisational structure. It also presents the spatial data analyses and evaluation of the conservation framework applied on the study area.

Chapter 5 continues with the discussion on the results of the historic degradation and contributions of the 3D building database in urban conservation. It includes discussion on the conservation framework and its possible improvements.

Chapter 6 presents summary of the conclusions and remarks made during the research and gives recommendations for further studies.

Chapter 2. Literature review

This chapter is based on the literature survey and defines key terms and concepts of the research. In the first part, the focus is on the concepts of historic urban areas, their main problems, types of degradation and measures for their protection and conservation. In the second part, there is a review on the use of GIS technologies in the field of heritage conservation and urban renewal.

2.1. Historic urban areas

Historic urban areas are important parts of the cities. They are living records of the history and witness of the past societies. Their unique urban fabric and authentic character represents the reflection of the social, economic and political conditions of the time in which they were created (Doratli, 2000).

ICOMOS in their General Assembly in Washington, DC, 1987 state that the main features and elements of the historic areas include:

- urban design defined by the street pattern and building blocks
- the relationship between buildings and their surrounding landscape including open spaces
- physical characteristics of buildings, their appearances and styles, construction materials and conditions
- the relationship between urban neighbourhoods and their wider surroundings
- the functions of the historic areas that coexist and have developed through time (ICOMOS, 1987)

2.1.1. The main problems of historic areas

Historic urban areas are being increasingly threatened by the physical, functional and social degradation and obsolescence caused by the impacts of high urbanisation and industrialisation everywhere in the world. In the cities with high population growth and densities of urban structures, historic areas are in danger of destruction and demolition in ordered to make place for residential buildings and other constructions. The problems of historic areas caused by high urbanisation and building densities are numerous and have negative impacts on citizen's quality of life.

UNESCO in the "Historic districts", 2008 defines the main problems of the historic urban areas as follows:

- demographic pressure
- increase of poverty

- lack of infrastructure and public amenities
- environmental degradation caused by industrialization, traffic and atmospheric pollution
- vulnerability to natural disasters and hazardous events such as earthquakes or fires
- demolition of historic heritage
- decrease in local economy and lack of investments

Globalisation and socio economic changes have a direct impact on life standards and cultural heritage of city centres. Traditional values are often threatened by modern buildings that are not well adapted to the local environment. Perceptions of the inhabitants and their views regarding replacement of the traditional buildings with the modern multi storey structures are important factors that influence degradation or transformation processes. In the big cities of Latin America in 1950s, for example, urban heritage of the city centre was demolished in order to make place for high rise residential buildings and skyscrapers planned for the middle class residents that wanted to live near the city centre. The change in political structures and lack of legal concept can obstruct conservation and renewal processes and lead to increased devastation of cultural heritage. Overcrowding and demographic growth in many countries put extra pressure on historic districts. On the other hand, abandonment by wealthier residents and middle classes leads to their desertion. Industrial pollution, environmental degradation and increased vulnerability to hazardous events such as earthquakes and fires contribute to destruction of the whole cities and their historic quarters.

Even though many historic, rapidly growing and developing cities experience similar processes, each city is unique and has to find its own solutions to deal with these problems (UNESCO, 2008).

2.1.2. Degradation and obsolescence

The built environment reflects the general conditions of the particular period of time in which it was created. Over time, economic and political conditions of the area have changed as well as requirements and needs of people. These changes have brought mismatch of the existing urban fabric and contemporary needs of the area and raised the issue of historic degradation and obsolescence. Therefore, it is important to determine the type and level of degradation in order to develop strategies and approaches for a sustainable conservation and revitalisation (Doratli, 2000).

Different types of degradation require different types of actions and strategies. Physical degradation is caused by factors such as poor building conditions, inadequate maintenance, high number of old buildings and high rate of vacancy.

Degradation of the architectural character of the historic area is caused by new constructions that are not in harmony with the traditional urban fabric (Gulersoy-Zeren et al., 2003). Functional degradation, on the other hand is caused by incompatible uses and lack of infrastructure.

Strategic approach for protection of historic environment should consider physical revitalisation to improve the overall condition of the area as well as economic revitalisation to increase the attractiveness and profitability for long term sustainability. Tiesdell et al., 1996 argue that physical revitalisation can result in an attractive and well maintained urban fabric, but in long run it is not sufficient without economic revitalisation that implies active economic use of buildings and spaces. The value of strategic approach lies in its ability to identify what is valuable in the historic environment, the qualities that should be improved and protected, along with identifying of negative factors and determining how they can be mitigated and removed. Depending on their historical values and qualities, as well as socio economic and physical conditions, different approaches, in other words different strategies should be applied in the revitalisation processes of the historic urban areas (Doratli et al., 2004).

2.2. Protection of historic areas

The importance of historic protection has been recognized from early civilizations. The first attempts of historic preservation were mainly focused on individual buildings and those with high national and religious significance. However, building based preservation has not appeared sufficient for urban conservation. As a result, the focus of historic protection has moved from individual buildings to the whole areas. The efforts were focused to enhance the economic conditions in the area and provide funds for the sustainable conservation. This can be achieved by good management and revitalisation (Tiesdell et al., 1996).

2.2.1. Urban conservation

Process of urban conservation aims to retain the identity of urban areas and preserve values of the past. There can be made a clear difference between preservation and conservation of urban areas. Preservation is concerned with the protection of individual buildings and it allows only limited changes, whereas conservation considers the whole conservation areas and deals with the management of the changes. It aims to balance economic development and the quality of urban environment.

The most common measures for the protection of cultural heritage in Turkey and many other European countries include listing of buildings, declaration of conservation areas and conservation plans. Listing of buildings is an operational

method used for the preservation of individual buildings regardless of their economic viability. Listed buildings are protected from destruction through the legislative measures and their owners have to obey certain rules stated by the authorities. Declaration of the conservation areas is another operational method that defines the area that is worth to be protected, whereas conservation plans include strategic approaches with the legislative and administrative measures for the sustainable revitalisation (Doratli, 2000).

2.2.2. Sustainable revitalization

The revitalisation of historic areas can be defined as a process that aims to achieve a balance between economic growth, inhabitant's needs and aspirations, sustainable preservation of the historic values and improvement of the overall state of the neighbourhoods and the city. It attracts new inhabitants, new investments and enables economic viability of the area.

Tissdel et al, 1996 define two different types of revitalisation of the historic quarters: physical and economic. Physical revitalisation implies adaptation of the physical fabric to the contemporary needs by applying different means of restoration. Some of the methods of the physical revitalisation include: renovation of buildings and physical fabric, restoration or reconstruction and demolition and redevelopment (Hajjar, 2008, Doratli, 2000, Doratli, 2005, Tiesdell et al., 1996).

Physical revitalisation contributes to the better physical condition, maintenance and attractiveness of the area. However, pure physical renewal cannot be sustainable in the long term without enhancing the economic values that can provide investments and resources for the long run sustainability (Hajjar, 2008). Economic values can be increased by means of functional restructuring and diversification. This implies introducing new functions and uses in the area and optimization of the efficiency and productivity of the old ones. These two types of revitalisation, physical and economic cannot be segregated from each other, but complementary to achieve the main objective of the area, to protect historic heritage and increase their economic values (Doratli, 2000, Oktay et al., 2003).

2.2.2.1. Means of physical revitalisation

Physical revitalisation can be considered as a short term strategy of revitalisation which aims to increase the attractiveness and physical quality of the area by the means of physical interventions. Some of the possible intervention methods for physical revitalisation include:

- Maintenance

Maintenance is the process of applying regular measures to preserve the existing integrity and stop the further decay of the structure. It includes slight repairs such as painting or replacement of decayed parts.

- Restoration

Restoration is the process of depicting the character of the structure as it was in its original state in the specific period of history. It refers to removing additions from other periods or adding new elements and authentic features without introduction of new materials.

- Reconstruction

Reconstruction is the process of returning the structure to its original state and imitating its appearance in the specific period of time by using replicating design or materials.

- Redevelopment

Redevelopment is the process of total or partial demolition of the structure with the purpose of new construction that is in accordance with the traditional environment (Abdelhamid, 2009).

2.2.2.2. Means of economic revitalisation

Only physical revitalisation may not be sufficient for the long term sustainability unless it is followed by the enhancement of the local economy and profitability of the area. The complete revitalisation of the historic area includes both aspects, the renewal of the physical fabric of the area and making use of economic potential of buildings and land. Therefore, the economic revitalisation can be thought of as a long term strategy and management tool for the historic areas development. The three main approaches to economic revitalisation according to Tiessdel et al., 1996 are:

- Functional regeneration

Functional regeneration is the process of preserving of the existing functions but increasing their potential and making them operate more successfully.

- Functional diversification

Functional diversification is the process of keeping the existing functions to some extent and introducing the new functions to support their economic uses.

- Functional restructuring

Functional restructuring is the process of changing of the existing functions and replacing them with more suitable and profitable ones (Doratli, 2000, Tiesdell et al., 1996).

2.2.3. An integrated approach of conservation and revitalization

An integrated approach of conservation emphasizes the importance of strategic approach in urban conservation through sustainable revitalisation. On one hand, it aims to protect cultural heritage and identity of the historic areas and on the other to integrate it into the context of modern life and contemporary requirements (Ercan, 2010).

All planning and development projects for the modernization and upgrading of the city need to be coherent with the goals of the historic preservation. Conservation of cultural heritage and historic neighbourhoods is equally important as new development and modernization of cities and it is an essential part of the sustainable development. Historic neighbourhoods are symbols of the city's image and very important places for the development of local and regional economy. Preservation of cultural traditions and protection of areas of architectural and natural beauties have many benefits to its residents. Yet, solely preservation would create a "museum" effect and put constraints on important financial and development opportunities. Therefore, residents of the city and its authorities are facing a dual challenge, on one hand they have to preserve unique urban fabric and authentic look of the city and on the other to improve standard of living and stabilize economic viability.

The integrated approach includes both, preservation and development. Preservation maintains and improves attractiveness of the city and its original characteristics, while development tends to boost the economy and create employment opportunities and sources of income for its inhabitants (UNESCO, 2008).

2.3. Use of GIS in heritage conservation and urban revitalisation

There is a wide range of applications of Geographical Information Systems in the field of heritage conservation and urban revitalisation. Advances in new technologies and GIS tools have brought many benefits to urban planners, architects, conservationist, managers and other experts involved in the process of cultural heritage management. Local authorities and central governments responsible for managing and protection of cultural heritage increasingly rely on information systems and start to implement GIS technologies for managing and exchange of spatial data (Petrescu, 2007).

Accurate spatial information and detail documentation is needed for the development of restoration programs and management of historic areas. A detail and precise documentation is the first and the most important phase in preservation and conservation programs that require realistic representation of the condition and location of historical objects. Technical documentation and evaluation of the present

situation enables to develop plans and strategies for protection and future sustainable development (Korumaz et al., 2009) .

There are three main purposes in creating documentation of historic areas. First, to have a record or back up of historical buildings in the case of their destruction or demolition, second, to prepare conservation plans and management programs for future development and third, for monitoring and detecting changes that occur with time or because of external forces (Mohsen Miri and Varshosaz, 2005).

2.3.1. Experience from other countries

Based on the literature search, experiences and practices of many countries regarding the application of GIS in cultural heritage conservation and urban renewal show the positive contributions of these technologies.

Li and Song, 2009 are using GIS database in urban renewal and heritage conservation of the historic neighbourhoods in Wuhan, China. They developed a GIS based conceptual model for the evaluation of historical district renewal. The model is then applied to historic districts to decide on different means of renewal. According to the model buildings are classified to three possible renewal classes: maintenance or improvement, restoration or reconstruction and redevelopment. First, buildings were classified to historic, old and new buildings and then their attributes were used to decide on the type of renewal action. The data considered in analysis includes building age, physical condition, artistic value, facility condition, crowding state and height limit. Height control zones were generated according to their distance from the protective elements to identify new buildings that exceed the height limit and should be classified for redevelopment. Based on the conceptual model, they made the plan for the historic urban renewal (Li and Song, 2009).

A GIS database has also been applied in the work of Li and He, 2009 for urban neighbourhood renewal of the Huangjiadun neighbourhood in Wuhan, China. The database includes general characteristics of the area such as building attributes, land use, infrastructure, roads and environment. First, the neighbourhood was divided to smaller sub areas. Second, specific criteria for evaluating of physical condition of the area were defined such as quality of buildings, sufficiency of infrastructure, compatible land uses. Third, all variables were combined to obtain different levels of physical problems in defined sub areas and formulate actions for urban renewal (Li and He, 2009).

Similarly, Xi, 2004 developed a GIS conceptual model for urban visual management to identify areas which should be preserved and which should be redeveloped in historical conservation of Hankou, China. Her GIS database includes elements such as historical buildings which were classified according to their architectural style, decoration, historic values and functions as well as urban spaces such as pedestrian

streets, roads, riversides and squares. The model was applied to generate the height control map using buffer areas according to the distances from the protected elements and considering the ideal height to width proportions of buildings and streets. Finally, the areas which need preservation and redefinition were identified and presented on the map for urban heritage conservation (Xi, 2004).

Arteaga, 2000, is also making use of GIS database for defining areas for urban renewal of historic centre of Trujillo, Peru. In his model for urban renewal he is using two main indices to identify potential treatment areas. One is social stress which refers only to residential buildings and is caused by overcrowding and multiple occupations and another is building quality which is composed of building condition, age and infrastructure quality. Both indices were combined to classify building parcels into potential renewal classes such as conservation or maintenance, improvement, high degree of renewal and redevelopment. After the potential renewal areas were identified, variables such as monumental status of buildings, physical characteristics and economic values were evaluated to decide on their renewal feasibility (Arteaga, 2000).

GIS technologies have also been applied in the study of impacts of modern urbanisation on the heritage buildings in the historic centre of Ibrid, Jordan. The paper investigates compatibility of new structures with the historic environment and degradation of the visual balance caused by modern multi storey buildings built near the heritage sites. Spatial GIS analyses and 3D visualisation is applied to identify degraded areas and evaluate the current situation. The authors emphasize the importance of creating GIS based documentation for all historic buildings in the area which would facilitate the process of heritage monitoring and enable identifying areas for revitalisation and conservation. Where necessary, buffer zones would be created to protect historic buildings from increasing urbanisation. The database would typically include data on building geographical location, construction material, age, number of storeys and function (Al-kheder et al., 2009).

2.3.2. Experience from Turkey

There are also many projects in Turkey that use GIS as a tool for heritage protection, mostly on the local and regional scale.

Surul et al., 2003 in their study are focused on the development of the digital inventory of historic buildings and cultural sites in the city of Trabzon, Turkey. They are creating an electronic database of the historic sites and use web based system for sharing such database with other users. The database is organized as a “Heritage Building Inventory” with all important information on the historic buildings and digital maps. The information on the buildings is collected from the field survey and the local office for the heritage preservation. Each building has a unique ID number

which is linked to digital map, video images and architectural drawings. Users can easily asses the web site and exchange information (Surul et al., 2003).

Toz and Duran, 2003 are using digital photogrammetry to make a documentation of the cultural heritage and GIS tools to store, use and represent the data. After the sample buildings were recorded by using close range photogrammetry and geodetic measurements, they were modelled in Auto Cad and Studio MAX. Graphical data is linked to the attribute database which contains other non spatial information such as building functionality, total floor area, condition and building name. The information system provides a better insight in the existing state and development processes of the urban environment (Duran et al., 2003).

3D Studio Max together with GIS vector data was also employed in producing a 3D city model for land use planning and visualisation of different scenarios in the project of Haydarpasa port and surrounding area in Istanbul. This area has a great historical importance due to the Haydarpasa train station which is registered as an old national monument. All development proposals and designs of new buildings in the Haydarpasa area have to be planned very carefully because they can affect silhouette of Bosporus and view to the Historic Peninsula which is just on the opposite side. Therefore, the 3D model in the project was used to determine the heights of new designed buildings and evaluate their impact on the Bosporus silhouette (Buhur et al., 2009).

Koramaz and Gulersoy, 2009 are making use of 3D urban model and VR application for the spatial evaluation in Zeyrek conservation site in Istanbul. In their study they are using questionnaires to examine advantages of visualisation techniques in urban conservation and effectiveness of the 3D model. The respondents, one group of professionals and one group of students, were asked to evaluate the model and assess to what extent they perceive the location, size and topography of the site in the model. They were also asked to evaluate how they perceive site characteristics such as height of buildings, material, structural condition, harmony and architectural quality. The results showed positive contribution of the 3D model with VR application in providing more information for the perception of the historic sites (Koramaz and Gulersoy, 2009).

Chapter 3. Study area and methodology

This chapter provides description of the study area and data collection, followed by the development of the conservation framework for evaluating historic urban degradation and determining revitalisation strategies. It explains the methodology and criteria applied in the study.

3.1. Study area

3.1.1. Selection of the study area

Even though this kind of research can be done in many different densely populated and historic urban areas, the Historic Peninsula of Istanbul has been chosen as a study area for three main reasons. The first reason is due to its great historical and cultural importance. This is the area with a large number of important archaeological sites and historical buildings and it falls under the strict UNESCO protection zone since being listed as a world heritage site in 1985. Second, there has been carried out a detailed documentation of all buildings in the Historic Peninsula as many parts of this area are designated as potential renewal areas. The documentation provides useful input for further calculations and analysis. Finally, there has been a Memorandum of Understanding concluded between ITC and IMP in 2009 which supports research work in Istanbul and provides data for ITC students.

3.1.2. General description and location

Selected study area for this research is located in the Eminonu district, Historic Peninsula of old Istanbul (Figure 2). Historic Peninsula is one of the touristicaly most attractive destinations in Istanbul and Turkey. It is surrounded by Golden Horn on the north, the Sea of Marmara on the south and the Bosporus on the east. Golden Horn is dividing the old city from the northern, younger parts of the European side.
For its historical importance and value, the old city of Istanbul was listed as a UNESCO world heritage site in 1985. It is famous as a historic and cultural centre of the city with a number of archaeological and protected areas. This location has an area of approximately 1500 ha and contains about 48,000 buildings (Baz et al., 2008). The majority of buildings are historic residential buildings and the most important historic sites and museums. Other land use activities in this area include commercial activities, modern shopping centres, business management centres and hotels (Alpay, 2005). The Historic Peninsula today is the place with dense population, narrow streets and mixture of residential and commercial functions, sometimes found in the same buildings (Gerçek and Demir, 2008).

It comprises the districts of Eminonu and Fatih. The Eminonu is a central district of old Istanbul and it is situated south of the Golden Horn. The area is known for its cultural and historical values and for many functions important for the city and region that are located here. The main activities of this area include transportation, shopping and religious. There are many different kinds of transportation such as cars, buses, boats and rails that connect here. This was the trade centre of old Istanbul and still today it is an important shopping and commerce centre. Furthermore, it is also an important religious centre of the city as the most popular mosques such as Hagia Sophia and the Blue Mosque are located here (Lenferink et al., 2006).

3.1.3. Historical and cultural values

In the 1985 Historic Peninsula was inscribed in the UNESCO World Heritage list. There are 4 different zones in the Historic Peninsula that are included into UNESCO World Heritage List:

- Sultanahmet Archaeological Park
- Süleymaniye Mosque and surrounding conservation area
- Zeyrek Church-mosque and surrounding conservation area
- Istanbul City Walls (Kocabas, 2006)

Figure 2 Historic Peninsula, Istanbul

3.1.4. Population growth and urbanization

Istanbul has been facing a high population growth and rapid urbanisation starting from 1950s with the beginning of immigration of people from rural to urban areas. The pressure of high population growth and limited land resources have caused an increase in informal settlements on the outskirts of the city as well as deterioration of historic sites and traditional buildings in the historic core of the city.

In the period between 1950 and 1955, for example, the growth rate of Istanbul was 31.5% which is as twice as the growth rate for the entire Turkey in that period.

Today only about 37% of Istanbul population was born in Istanbul while other 63% of people were born in other places (Gulersoy-Zeren et al., 2003).
According to the last census from 2009, Istanbul population is estimated to 12.9 million, which is one fifth of the total Turkish population. Mitigation is still an important factor in population growth and expansion of the city.

3.2. Fieldwork and data collection

In order to fulfil research objectives and address research questions, primary and secondary data were collected during the fieldwork in Istanbul (Figure 3). The main activities during the fieldwork phase were:

- Semi structured interviews with the experts
- Field visit and observation
- Collection of data from secondary sources

The list of data required for this research was defined before the fieldwork stage after the theoretical and literature study and consultation with research supervisors.
The most of the data required is collected from the Istanbul Greater Municipality – Metropolitan Planning and Urban Design Centre (IMP).

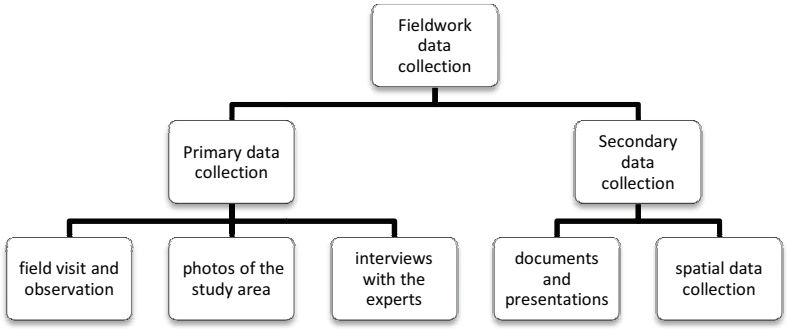

Figure 3 Field work data collection phase

3.2.1. Primary data collection

Primary data were collected in the forms of total seven semi formal interviews conducted with urban planners from Istanbul Metropolitan Planning and Design Centre (IMP), academic staff from the Faculty of Architecture, Department of City and Regional planning (ITU) and surveying engineer from the conservation council no. 4 of Historic Peninsula (Dört). The main objective of these meetings was to obtain qualitative information relative to the study. The main issues discussed were related to the existing conservation system in Istanbul and Turkey, organisational

framework and responsibilities of institutions involved in the process of heritage management, the main threats to the historic urban areas and urban conservation and renewal programs together with the data requirements (Appendix II). The interviews were useful to get an idea of the processes involved in collecting data and making documentation of the historic heritage as well as to understand issues of urban conservation and management of historic areas and problems related to the existing conservation system.

List with the interviewed professionals, their position and organization together with the key points drawn from the notes taken during the interviews are shown in the table and summarized below.

Position of interviewed	**Institution**	**Key points discussed**	**Number of people interviewed**
Urban Planner	IMP, City and Regional Planning Department	• The role of IMP in urban heritage management • The main development projects and their impacts on the heritage • Designation of renewal areas and transformation projects	4
Surveying engineer	Higher monument Conservation Council no. 4	• The main responsibilities of the council regarding urban conservation • Buildings that have a priority in the conservation process • General concerns in making conservation plans and data requirements	1
Academic staff	ITU, Faculty of Architecture, Department of City and Regional Planning	• The main threats to the historic heritage and methods for the effective protection • Existing state of the conservation system in Turkey and major problems • Strategies and expectations for the future of the conservation process	2
Total			**7**

Table 2 A list of interviewed people and the key points discussed

Beside the interviews with the experts, the primary data was collected in the forms of field visit and observation. The field visit was the best way to familiarise with the study area and get a picture of the authentic look and traditional character of the area (Figure 4). During these visits, digital photos were taken to upgrade the database and provide better insight in the real situation on the field (Appendix I).

Figure 4 Traditional urban fabric of the Historic Peninsula

3.2.2. Problems with primary data collection

Interviews were chosen as a main method for collecting primary data on issues relevant for the research. Even though many useful information and data were collected with this method, there were also some problematic issues related. First, it was quite difficult to find people and arrange meetings. People from IMP and faculty were generally too busy and it was difficult to make an appointment. As a result, some of the interviews conducted were very short and not very informative. People from the municipality were also planned to be interviewed, but they were not responding to student mails. Second, even though interviews were planned to be semi structured with the specific set of questions prepared, some of them were more informal conversations where respondents had tendency to talk about their own projects and things that they were currently working on. Although it was interesting to listen about their work and experience, this has caused occasionally digressions from the topic and waste of time. Third, some of the respondents were not very good in English and they could not express themselves in the best way. Also some of the planned non English speaking respondents could not be interviewed because of the absence of translators. Regarding collection of primary data on the field, it was very inconvenient to go to the field with large, printed maps and digital equipment, because of very big crowd in those areas and strange looks and questions from the local people.

3.2.3. Secondary data collection

Secondary data include spatial and non spatial data collected from the Istanbul Metropolitan Planning and Design Centre (IMP). The spatial data consists of geographical database that was collected with the purpose of making documentation of all buildings in the study area. Objects in the database are in the forms of ESRI shape files defined by assigning attribute values to the geometrical spatial data with defined topology. The database includes information about buildings such as their physical condition, construction material, number of storeys, number of dwellings and functions per floors. The database also includes shape file with registered

historic buildings and their listed status. Other shape files include administrative boundaries of district and neighbourhoods, building parcels, building blocks and road network. Regarding raster files, digital elevation model with the resolution of 5 m and orthophoto from 2009 were also provided by the company.

All data before analysis were converted to the same coordinate system and projection. Geographical coordinate system used for the shape files was ED 1950 based on Transverse Mercator projection. The DEM raster data was defined in ITRF1996 and had to be transformed to ED 1950 before using.

The non spatial data collected from IMP include pdf files of the Conservation management plan from 2005 with defined conservation areas and Istanbul Master Plan summary report from 2007 with the information on planning objectives and strategies. The list of secondary data collected from IMP during the fieldwork is given in the Table 3.

Data description	**Format**	**Attributes**	**Scale**
Boundaries of districts and neighbourhoods	Polygon shape file	Name of district and neighbourhood	Istanbul metropolitan area
Building footprints with elevation data	Polygon shape file	Elevation of building footprints	Eminonu district
Building footprints with functions per floors	Polygon shape file	Functions of buildings per floors	Eminonu district
Building footprints with attribute data	Polygon shape file	Condition, type of construction, number of storeys, number of dwellings, number of rooms per dwelling	Historic peninsula
Building parcels with listed buildings	Polygon shape file	Listed buildings that have historic values	Historic peninsula
Road network	Polyline Shape file	Length	Historic peninsula
Block of buildings	Polygon shape file	Block id, neighbourhood name	Historic peninsula
Parcels	Polygon shape file	Neighbourhood name, ownership	Historic peninsula
Digital elevation model (DEM)	Raster (5m)	Ground elevations	Istanbul metropolitan area
Orthophoto 2009	Raster		Istanbul metropolitan area
Istanbul Master plan summary report, 2007	pdf		
Conservation management plan, 2005	pdf		

Table 3 A list of the collected secondary data (Source IMP)

3.2.4. Spatial data quality

The secondary data collected was derived from different sources, formats and different time periods. This has caused an inevitable problem of data quality and limitations.

The building data was collected from more than one database containing different attributes. The database containing building elevation data was available only for one district of the Historic Peninsula, which has limited the area of the research. At the same time this database was the most current data available. The other building shape files that include other building attributes were created in previous years and did not match completely the current situation. Some of the buildings were demolished and some new buildings were built that can be noticed when compared to new orthophoto image. The data on listed historic buildings was obtained as a separate shape file and it had to be spatially joined to the shape file containing other building attributes. The data on building functions per floors was provided only in forms of AutoCad maps for each floor separately. In order to make use of it, all maps had to be converted to GIS shape files first and then spatially joined to obtain building functions per floors in the same shape file. The digitizing errors can also be observed when looking closely to the building dataset which has created a number of small polygons and decreased the data quality. This was excluded from the graphical analysis because it just increases processing time without any greater significance. The conservation master plan with land use zoning regulations was also required, but given only as a pdf file and in net cad file format that can only be used in Turkey. When transformed to CAD or GIS format the most important information such as colours for each land use is being lost. Despite all problematic issues the dataset collected is sufficient to conduct the most important analysis.

3.3. Development of the conservation framework for determining historic areas revitalisation strategies

The conservation framework is developed with the purpose of identifying types and levels of degradation of the historic urban areas and to propose measures for physical and economic revitalisation and renewal. It is based on the conservation principles defined in the conservation master plan of the study area and it is planned to provide a support in making urban renewal projects and conservation programs. It includes different phases from the review of existing policies and plans to analysis and implementation. The focus here will be on the analysis of the existing situation of the built up historic environment and proposing actions for the renewal and revitalisation projects based on the data available. The phases of the framework can be described as following:

1. Phase: Preview of existing plans and policies

The first phase, before starting the analysis, is to make a preview of existing plans and reports to get an insight into relevant issues and policies that need to be considered for effective urban conservation and development planning. The basic principles defined in the previous conservation master plan of the area include guidelines for efficient re functioning of the area and building restrictions on new constructions built in the proximity of listed historic buildings.

2. Phase: Identification of cultural and historic values

The next phase is to do the identification of historic and cultural heritage in the study area and define their contribution to the historic pattern. This can be done by looking at the individual buildings that can be:

- Listed as a historic monumental buildings
- Listed as a historic civil architecture buildings
- Non listed buildings

Listed historic buildings are considered to be in harmony with the traditional character of the area and contribute to the historic pattern.

Non listed buildings, however, can be neutral or incompatible with the historic pattern according to their physical characteristics.

3. Phase: Analysis of the existing state and identification of type and level of degradation

The next phase, after the identification of the historical and cultural values of the area, is the analysis of the existing state and identification of type and level of degradation. There are three different types of degradation that can be evaluated: architectural character, physical and functional degradation.

- Architectural character degradation

The evaluation of the architectural character degradation is applied to non listed buildings to determine to which extent they fit into the traditional pattern and historic image of the area. Non listed buildings can cause degradation of the architectural character of the area by disharmonious construction materials and heights that exceed the height limit.

Building height indicator

Building height indicator is used to determine the harmony of buildings according to their heights. According to the conservation principles of the study area, the heights

of non listed buildings cannot exceed the heights of the listed adjacent structures (Gulersoy-Zeren et al., 2003). Based on this criterion, all non listed buildings in the study area can be classified into harmonious and disharmonious according to their height characteristics (Table 4).

Number	Buildings height harmony class	Characteristics of buildings
1.	Harmonious	Non listed buildings on plots next to listed buildings that do not exceed the height of listed buildings
2.	Disharmonious	Non listed buildings on plots next to listed buildings that exceed the height of listed buildings

Table 4 Criteria for classification of non listed buildings according to their heights

Building construction material indicator

Another indicator of building harmony with the architectural character of the area is the construction material. Similarly, buildings can be classified to harmonious and disharmonious according to their construction material (Table 5). Harmonious materials for this area include masonry and timber whereas disharmonious materials are concrete and steel (Gulersoy-Zeren et al., 2003).

Number	Buildings construction material harmony	Characteristics of buildings
1.	Harmonious	Masonry and timber buildings
2.	Disharmonious	Concrete and steel buildings

Table 5 Criteria for classification of non listed buildings according to their construction materials

Combination of building height and construction material indicators

The two indicators are combined to obtain architectural character degradation classes. In the case where buildings are assessed as harmonious according to the both indicators there is no degradation whereas if the building is disharmonious according to both of the indicators then there is a high level of architectural character degradation (Table 6).

Number	Architectural character degradation class	Buildings height harmony class	Buildings construction material harmony class
1.	No	Harmonious	Harmonious
2.	Low	Disharmonious	Harmonious
3.	Medium	Harmonious	Disharmonious
4.	High	Disharmonious	Disharmonious

Table 6 Criteria for classification of non listed buildings in architectural character degradation classes

- Physical degradation

Physical degradation of the historic area is caused by buildings that are in bad conditions and poor state of maintenance. This type of evaluation is mostly applied on listed historic buildings that have the priority in the conservation process due to their historical and cultural values. The factors that will be used to assess the physical degradation of the area are building physical conditions and crowding condition in residential buildings. These indicators will be combined in order to classify buildings according to their state and quality and to determine the level of their physical degradation. According to this level, the type of revitalisation strategy will be proposed.

Building physical condition indicator

Building physical condition indicator is used to express the quality of buildings and their state of maintenance. According to their physical state buildings can be in a good, moderate, bad or ruined state (Table 7).

Number	Building physical condition	Characteristics of buildings
1.	Good	Buildings in a good state of maintenance and quality
2.	Average	Buildings in a moderate state of maintenance and quality
3.	Bad	Buildings in a bad state of maintenance and quality
4.	Abandoned and ruined	Buildings in a very bad state of maintenance and quality

Table 7 Criteria for classification of buildings according to their physical condition

Building crowding condition indicator

For the residential buildings, the important factor to consider is also crowding state which indicates the bad social conditions and results in reducing the building quality. This can be done by looking at number of persons per bedroom in residential dwellings according to which buildings can be in a crowding or not crowding state (Table 8). Residential buildings with more than 2 people per bedroom are generally considered to be in a crowding state (Arteaga, 2000).

Number	Building crowding condition	Characteristics of buildings
1.	Crowding	Residential buildings with more than 2 people per bedroom
2.	Not crowding	Residential buildings with 2 or less people per bedroom

Table 8 Criteria for classification of residential buildings according to their crowding condition

Combination of building physical condition and crowding condition indicators

The two indicators of building physical quality and state were integrated to gain different levels of physical degradation, from no degradation to high physical degradation (Table 9).

Number	Physical degradation class	Characteristics of buildings
1.	No	Listed monumental buildings in good condition Listed civil architecture buildings in good condition, not crowded
2.	Low	Listed civil architecture buildings in good condition, crowded Listed civil architecture buildings in moderate condition, not crowded Listed monumental buildings in moderate condition
3.	Medium	Listed civil architecture buildings in moderate condition, crowded Listed monumental buildings in bad condition or abandoned Listed civil architecture buildings in bad condition, not crowded
4.	High	Listed civil architecture buildings in bad condition, crowded Listed civil architecture buildings in abandoned and ruined condition

Table 9 Criteria for classification of listed buildings into physical degradation classes

- Functional degradation

Functional degradation is evaluated on all buildings in the study area regardless of their physical characteristics. The indicator of this type of degradation is building function. Some of the original functions may have disappeared and replaced by incompatible functions and some parts may have lost their historical identity. Therefore, an inventory of existing functions will give an insight into functional degradation.

Building function indicator

From their functional perspective buildings in the study area can be classified to harmonious, disharmonious or neutral functions (Table 10). This type of classification is based on the principles from conservation master plan which gives the guidelines for effective re functioning of the study area. Buildings with disharmonious functions are causing high level of functional degradation while buildings with harmonious functions cause no functional degradation. According to the level of functional degradation, proposed actions for economic revitalisation will be formulated.

Number	Functional harmony of buildings	Building function
1.	Harmonious	culture, religious, tourism, recreation, education
2.	Neutral	commercial, residential, health, social, administrative
3.	Disharmonious	warehouse, wholesale, small industries

Table 10 Criteria for classification of buildings according to their functional characteristics

After the buildings with disharmonious functions are identified, the land use allocation rules from the master plan will be applied to propose new functions.

Land use allocation rules

To support land use planning and re functioning of the area, land use prioritizing guidelines are defined as following:

- Tourist + Cultural
  - in the first degree archaeological site area
  - in the area surrounding the monumental buildings
- Commercial
  - in the proximity of the main streets
  - ground floors of the housing units on the main streets
- Tourist + Commercial
  - in the area surrounding the monumental buildings
  - on the main streets
- Residential
  - further away from the main streets
  - in the third degree conservation area
  - residential buildings with manufacturing ground floor activities (Gulersoy-Zeren et al., 2003)

After the buildings which need re functioning were defined, the level of functional degradation can be determined (Table 11).

Number	Functional degradation class	Characteristics of buildings
1.	No	Buildings with harmonious or neutral functions that should keep the existing functions
2.	Low	Buildings with mixed harmonious or neutral and disharmonious functions that should be changed Buildings with neutral functions that should introduce new uses
3.	High	Buildings with disharmonious functions that should be completely changed

Table 11 Criteria for classification of buildings into functional degradation classes

4. Phase: Proposal of conservation and revitalisation strategies

From the data analysis and identification of the types and levels of degradation in the previous phase, proposals for the conservation and revitalisation of the historic urban area can be made. Different types of degradation require different types of actions
The proposals must indicate actions that need to be taken in order to:

- Improve the living conditions of the considered historic areas
- Retain the traditional character and visual integrity of the area
- Renew the existing decayed buildings and infrastructure
- Enhance the economic potential of the area by re functioning of existing buildings and land uses (Dun, 2009)

Therefore, the proposed actions for each building will include the physical revitalisation strategy in terms of improving physical condition and attractiveness of the area and economic revitalisation strategy in order to increase economic potential and attract possible inventions.
The physical revitalisation strategies are in forms of maintenance, restoration, reconstructions and redevelopment, while possible interventions for economic revitalisation include functional regeneration, diversification or restructuring (Figure 5).

5. Phase: Master plan

On behalf of the analysis and proposal, the plan should be developed and presented to all relevant stakeholders for the formal approval. The plan should include a renewal plan to increase the physical attractiveness and condition of the area as well as revitalisation design to improve the economic prospective and create investment opportunities. This can be done, for example, by introducing the small shops in unused floors of the houses or abounded buildings or by encouraging cultural and tourist facilities. The plan should also include a multiyear implementation program which indicates the renewal of the existing buildings and historic values (Dun, 2009). It should be clear for which period of time the plan is provided, for example 6 years. The financial aspects have to be specified in the plan as well. After the plan is approved, it can be implemented. This part is not a subject of this research.

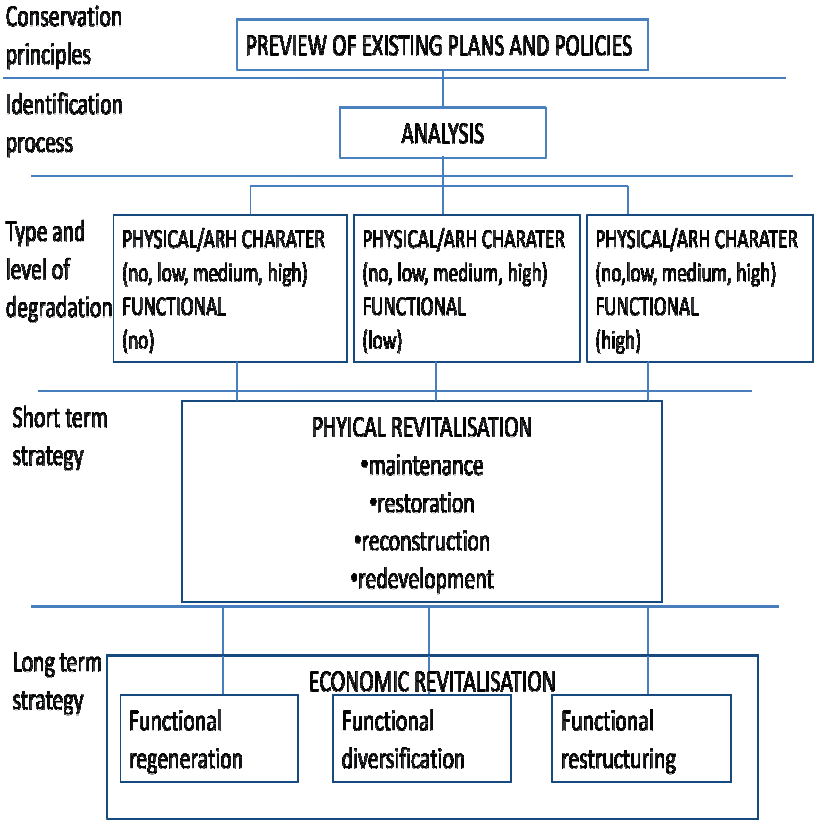

Figure 5 Flowchart of the conservation framework for determining strategies for physical and economic revitalisation

Chapter 4. Results

The first part of this chapter presents results from the interviews conducted in Istanbul on issues related to policies and practices with respect to conservation and revitalisation of the historic areas. The second part provides the analyses on the collected spatial data based on the application of the conservation framework presented in the previous chapter.

4.1. Policies for conservation and revitalisation of historic areas

The interviews in Istanbul were carried out to better understand the conservation system in Turkey and the organisational structure as well as to understand conservation and revitalisation polices and data requirements in practice. They also contributed to identifying problems and gaps in the existing situation and understanding strategies for future. The key findings from interviews are summarized below.

4.1.1. The existing conservation system in Istanbul and Turkey

The current urban conservation system in Turkey is similar to many other European countries. It includes listing of buildings, declaration of conservation areas and making conservation and renewal plans. All legal actions and procedures are regulated by the Law no. 2863 which stresses the importance of development control and conservation measures for protection of cultural and natural values.

Despite all legal protection and regulations there are still many problems in the existing conservation system in Turkey. One of the main problems is that conservation plans are not well integrated into urban planning and development plans and there is a lack of cooperation between municipalities and Conservation Councils. There is also lack of financial resources provided by the local authorities and lack of policies promoting the importance of the heritage in economic development. Furthermore, there is a low public awareness regarding the importance of heritage conservation and lack of community participation. To improve the existing situation in conservation and renewal planning, it is very important to integrate the conservation plans with development programs as much as possible. They should not clash with each other but be complementary to achieve the main objective: balance between the development and preservation of the historic values. Conservation plans should be prepared after the detail study that takes into account each building block and each single building and all information and decisions should be shared with public using mass media to increase public participation.

4.1.2. The organisational framework and responsibilities of institutions

The institutions involved in the heritage management include Ministry of Culture as the main responsible for the heritage conservation, Regional Boards for the protection or Conservation Councils, municipalities and related private organizations. IMP (Centre for Istanbul Metropolitan Planning and Urban Design) is making a precise documentation of the cultural heritage of the Historic Peninsula by using terrestrial laser scanning technologies. Moreover, the conservation department of IMP is involved in the preparation of the site management plan for the places listed on the UNESCO World Heritage list together with their buffer zones. After being prepared by the municipality, the conservation management plan has to be approved by the Conservation Council and the commission where they make a report on conservation areas and buildings that need to be preserved. The Conservation Council decides which building should be listed, which part should be an archaeological site or urban site or monumental building. If the plan development decisions are equivalent with the conservation policies, the plan is accepted and then it can be implemented and the restoration process can begin.

4.1.3. The main threats to the historic urban areas

According to the local experts the main threats to the historic areas are related to the process of uncontrolled urban growth and expansion of the city. The major development projects have negative impacts in terms of demolishing historic buildings and replacing them with multi storey modern constructions. New transportation projects have negative impacts caused by increase in traffic and pollution near the heritage sites. UNESCO is concerned about two major transportation projects: the new metro bridge from Galata side to the Historical Peninsula that is proposed by the municipality and the car tunnel under the Bosporus. The bridge will have too high columns that will damage the silhouette of the Historical Peninsula and the car tunnel will bring more traffic and pollution.

4.1.4. Deciding on urban conservation and renewal programs and data requirements

Conservation and renewal programs are planned to protect historic values and renovate dilapidated neighbourhoods. There are some common considerations that need to be taken into account when making renewal plans. This refers to physical condition of buildings and types of restoration methods. Financial issues are also very important. Generally speaking, monumental buildings have priority in the conservation process and they are more privileged than others. The data for renewal projects is usually collected from the field and households surveys. A good example of such a renewal project is Sulukule neighbourhood where poor, gypsy people

lived. The municipality designated to be a renewal area and the residents were obligated to leave their homes and move about 35 km away from the neighbourhood. They demolished existing houses and built completely new houses for higher income people. This process is known as gentrification. Another renewal project is taking place in Suleymaniye area. The plan is to demolish old historic buildings and replace it with the similar new buildings. In order to achieve this, it is important to have a precise documentation on each historic building. GIS tools and especially 3D modelling using laser scanning technologies can be very beneficial in the process of renovation and reconstruction of the neighbourhood.

4.1.5. Organisation for the protection of cultural and historic assets

The conservation of cultural and natural assets in Turkey is defined by the Law on the Protection of Cultural and Natural Assets and related regulations. The institution directly responsible for cultural conservation, according to this law is the Ministry of Culture and Tourism. On behalf of this Ministry, there are two main boards that are attached to Directorate of Preservation of Cultural and Natural Assets. They are: Supreme Board for the Protection of Cultural and Natural Assets and Regional Boards for the Protection of Cultural and Natural Assets. They have the authority to decide on what kind of conservation work needs to be done in particular area and approve the conservation implementation. The main role of the Supreme Board is to establish the principles that need to be applied in the protection and restoration of the cultural heritage, to coordinate the work of the boards of protection and support the Ministry in dealing with problems encountered in practice. The Regional Boards for the protection were established by the Ministry for specific regions and they work in accordance with the principles established by the Supreme Board. Their main responsibilities regarding heritage conservation are to register cultural and historic assets that need to be protected, to determine the temporary building regulations in the transit period after the registration, to establish the protection areas and make decisions regarding their protection. The Ministry is also responsible for making the final decisions and approval of the conservation plans. Finally, the municipality in cooperation with the Regional Boards carries out the conservation work and implementation of the plan. Their main responsibility is to execute the decisions taken by the Boards and give the permissions for the implementation of proposed projects (Gulersoy-Zeren et al., 2003, Bakacak, 2007). The conflicts between these two institutions can arise when municipalities have to implement the decisions taken by the Boards which they do not support and consider against development. The issue here is that municipalities usually take decisions on a political basis, without technical and scientific concerns. Besides, there is a lack of technical experts and conservation professionals like architects, urban planners and civil engineers among

the municipality personnel which reduces the awareness of the importance of urban conservation (Basagac et al., 2003).

4.1.6. Legal framework

The legal framework for the conservation process in Turkey is defined by the laws and regulations mostly developed during the past two centuries. The current law is Law No.2863 for the Conservation of Cultural and Natural Assets which defines protection sites and stresses the importance of introducing development control measures. Beside this general legislation defined by the conservation law No. 2863, there are also two separate laws defined for the regions of Bosporus and Gelibolu. The aim of these laws was to protect these unique regions from increased development and densities. Even though the laws are well defined and sufficient in their contents, there are still many problems regarding the responsible institutions and authorities that exist in practice (Unsal, 2009).

For better functioning of the conservation system it is important that the responsibilities and duties are equally shared between the municipalities and ministries and it is also necessary that municipalities employ more conservation professionals and give them a constant and adequate education. The resources provided to municipalities for the development and new construction should be more used for the renewal and protection of existing structures and historic houses and the law on the housing should be revised and adapted more in favour of preservation of historic buildings and registered properties (Basagac et al., 2003).

4.1.7. Conservation approach and procedures

The first step in the conservation practice of Turkey is registering and listing of cultural and historic buildings and sites that are considered worth to be protected by the Regional Board of Protection. After the field survey has been done and the registration of the object is approved, the Ministry should inform all related institutions, local authorities, municipalities and owners about the decision for listing. The characteristics of the assets that should be considered for listing are defined by the Law No. 2863 and they include immovable assets built before the end of 19^{th} century, other immovable assets built after that period but with important historic characteristics defined by the Ministry, assets located within the protective zones and those where the important historic events have taken place.

After the area has been designated as conservation site by the Board, all the development plans for the area should be terminated and the conservation plan should be prepared. Urban planners are the main experts involved in this process. In the transit period, within three months after the registration of buildings, the temporary building conditions need to be declared by the Regional Board. All

planning decisions regarding new construction and restoration of historic buildings need to be examined and approved by the Board during this period. The conservation plan should be prepared by the municipality within two years and submitted to the related Board for the approval. After being accepted by the Board for protection and related municipal institutions it can be implemented. If the Board assess that there should be some changes in the proposed plan, it informs local authorities and related bodies which then decide about the proposed changes (Gulersoy-Zeren et al., 2003). The flowchart of the conservation procedures is given in the Appendix III.

4.1.8. Strategies and expectations for the future of urban conservation in Turkey

Despite all laws and regulations, there are still many problems and gaps regarding conservation system in Turkey that need to be tackled for the successful future planning and implementation of conservation programs. First of all, before any actions for the implementation of conservation master plans are taken into account, the legal and organisational issues should be resolved. The process of restructuring of Ministry of Culture and local authorities should be the first logical step as well as sharing responsibilities in implementation of conservation projects between these two institutions (Basagac et al., 2003). It is difficult to implement conservation plans within the existing structure of municipalities that are encouraging new development projects in the conservation zones.

Conservation plans should be integrated into development plans and conservation policies should not clash with the urban planning and development policies of the area to be preserved. This especially refers to heights and densities of newly planned objects and constructions (Gulersoy-Zeren et al., 2003). Moreover, the study for the conservation plan should not be based only on physical plans, but it should also consider social, economic and cultural aspects of the planning area. Before making any decisions, the study on the current situation should be carried out, with the detail description of the natural and built environment in the planning area. The study should provide examination of each building block plot by plot to determine relevant strategies for rehabilitation. The conservation plan, based on these strategies should be prepared by the technical specialist and experts in the field of urban planning and conservation. The municipalities should provide financial resources for carrying out such study or if they have trained personnel they can produce some of the projects on their own. The resources provided to municipalities for creating new housing should be equally used for protecting historical houses. The conservation of historical houses should be supported by continuous monitoring and maintenance carried out by the municipalities with the control of Conservation Councils.

4.2. Application of the conservation framework to determine historic areas revitalisation strategies

Three types of degradation are used to assess the current state of the historic district and identify possible areas for urban renewal. After the type and level of degradation have been identified, possible strategies for physical and economic revitalisation were determined. Each of the degradation type is described with the variables that are the most important indicators of that type of degradation. The indicators were combined according to the conservation principles of the area to classify the buildings in different categories and levels of degradation which in the end leads to different proposed revitalisation strategies.

4.2.1. Identification of cultural and historic values

Building listed status

The first step, before doing the analyses of types and levels of degradation and proposing revitalisation strategies is to identify historic and cultural values within the study area.

According to their historical values and importance all buildings within the study area are classified into:

- Non listed buildings
- Listed monumental buildings
- Listed civil architecture buildings

Listed status of building is important factor to consider when making plans for historic areas renewal. It is usually used to analyze the feasibility of physical renewal actions and degrees of changes. There are certain restrictions on listed buildings that need to be considered. If some building is designated as a monumental listed site, it can be only restored or reconstructed with little changes and it is strictly protected from demolishing. Buildings that have a status of listed civil architecture building have fewer restrictions regarding physical changes and in some cases when their physical condition is very bad or ruined they can be designated for redevelopment. Buildings that are not listed, on the other hand, have the least restrictions and they are more suitable for physical changes and renewal.

In the whole study area there are 4 268 listed and 11 911 non listed buildings. Out of the total number of listed structures 1 992 are monumental buildings and 2 276 are classified as civil architecture listed buildings (Table 12).

Building listed status class	Number of buildings	%
Non listed	11 911	73.62
Listed monumental	1 992	12.31
Listed civil architecture	2 276	14.06

Table 12 Number and percentage of buildings per building listed status class

Buildings with non listed status have the highest frequency of 73% whereas monumental buildings are present with 12% of the total buildings. The most of the examples of monumental buildings can be found on the northern and eastern part of the study area. On the other hand, civil architecture examples occupy north western and southern residential areas (Figure 6).

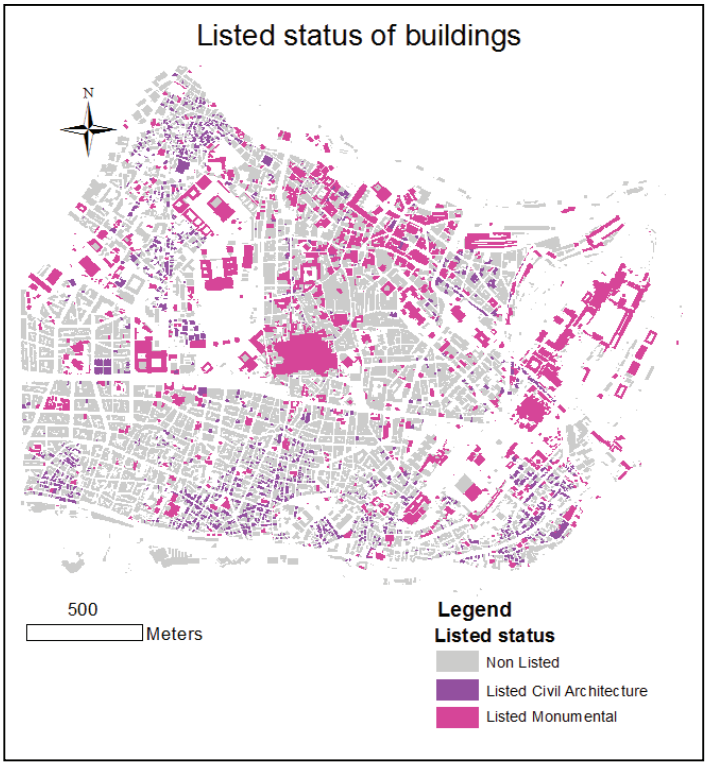

Figure 6 Map showing the distribution of building listed status

4.2.2. Identification of type and level of degradation and proposing revitalisation strategies

In the first step, historic area is analyzed in terms of two types of degradation: architectural character and physical degradation. The identification of cultural and historic values gave the insight into the listed status of buildings. Non listed buildings are selected for the evaluation of the architectural character degradation

since they can negatively impact the traditional character of the area. Listed buildings, on the other hand, are analyzed in terms of their physical degradation. Finally, the analyses of all buildings are combined to obtain physical revitalisation strategies.

4.2.2.1. Architectural character degradation

The architectural character degradation is related to 11 911 of buildings classified as non listed buildings. This is an indicator of building characteristics in relation to their harmony with the traditional urban fabric of the area. The two most important indicators that are used to assess the harmony of buildings and level of degradation are building heights and construction materials. By combining these two indicators, all buildings in the area can be classified into buildings that are in harmony and buildings in disharmony with the architectural character of the area. According to this classification it is possible to decide on level of degradation and propose treatment actions.

Building height indicator

The height value of buildings is an important factor to assess their consistency with the architectural character of the area. In order to estimate harmony of buildings with respect to their heights, all non listed buildings in the area were classified into harmonious and disharmonious buildings according to their distance from listed protected sites. All listed buildings are considered to be in harmony with the architectural character of the area and their heights are taken as referring values to estimate the harmony of their adjacent non listed buildings. First, only directly adjacent buildings were taken into account to decide their harmony. According to the conservation principles and polices their height values are not allowed to exceed the values of the adjacent listed buildings. Buildings that are higher than the adjacent listed buildings are classified as disharmonious whereas buildings that have the same or lower height values are considered to be harmonious buildings. Second, the buffer function was used to estimate the harmony of buildings that are not directly adjacent to listed buildings but still in a very close distance from the protective elements. Therefore, buildings that are within 20 meter buffer from listed sites and have equal or less heights than listed structures are also classified as harmonious, whereas all others are classified as disharmonious buildings. Third, the next buffer of 40 meters was applied to all harmonious buildings according to their height values to decide on the harmony of the remaining buildings that are further away from the protective sites. Generally speaking, buildings that are further away from the protective sites have less influence on the visual integrity and character of the area.

Building harmony according to their height characteristics was evaluated in 3D Analyst (Arc Scene) by using 3D building model obtained from vector polygon data and height attributes of buildings (Appendix IV). The model is used to compare the existing heights of buildings with the allowable heights based on the conservation principles. The buildings were placed using the DEM as a base height layer and extruded above the surface using their height values. In this way, the elevation of the terrain is also considered in assessing harmony of buildings according to their heights. Thus, the absolute elevations of buildings above the sea level are used in calculations. The buffer zones were generated around the listed buildings and extruded to their height values. They represent the height control zones in a 3D view and can be used to compare the existing heights of the buildings with the allowable heights. In this way it is possible to compute the difference between allowable and actual heights of buildings and identify disharmonious buildings (Figure 7). This application can be used to control maximum allowable height of buildings in the blocks (Murata, 2004).

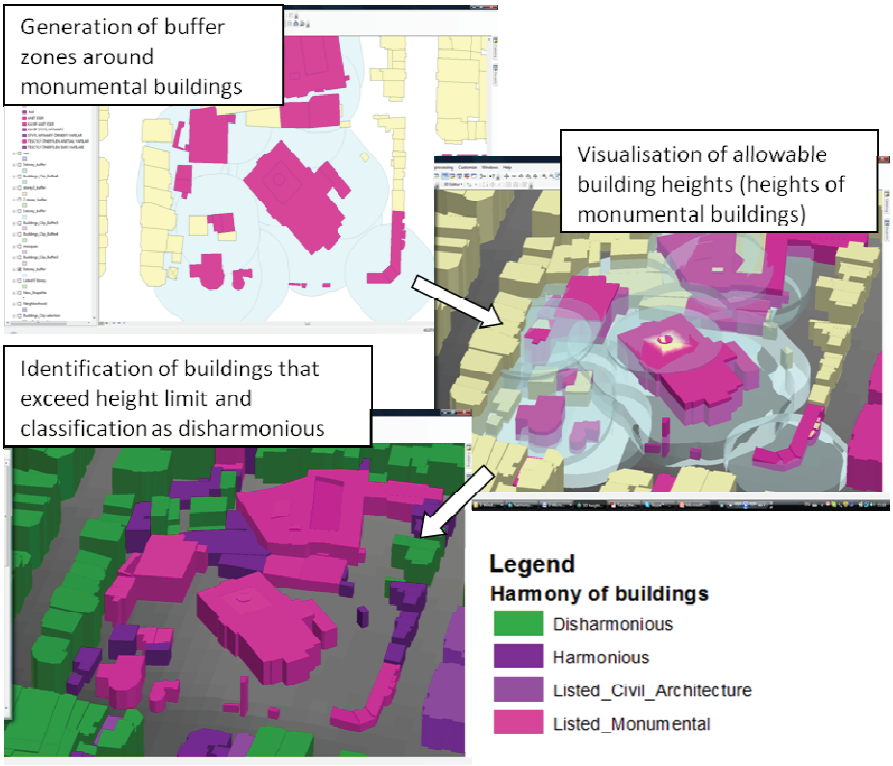

Figure 7 3D view of the difference between the existing building heights and maximum allowable heights in the block

The harmony of buildings according to their height characteristics can be best observed from ground view perspective (Figure 8). Depending on the point of view of the observer, buildings can have different impacts on the visual integrity of the area. Some of the disharmonious buildings cannot be seen from the certain view points if they are obstructed by other buildings and therefore they can have less negative impact on the architectural character of the area.

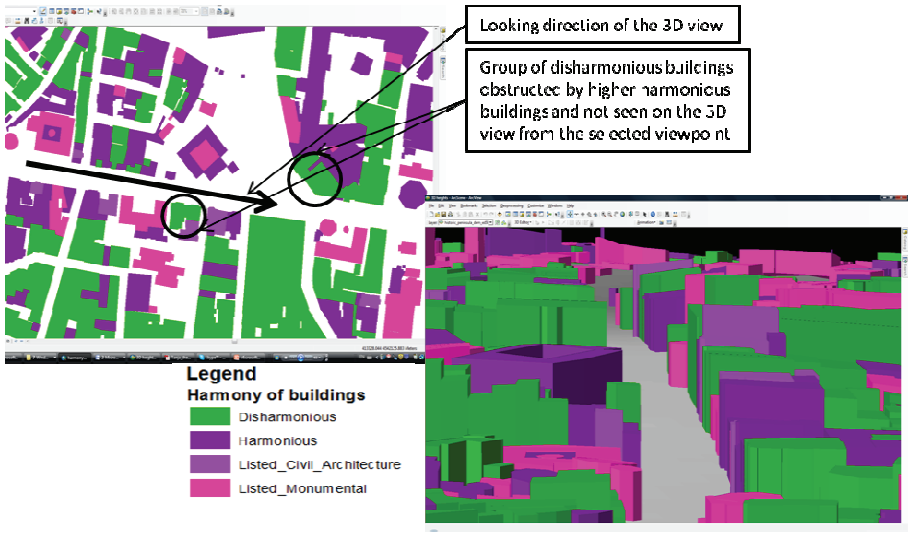

Figure 8 Ground view perspective of the 3D building model

The Table 13 shows number and percentage of buildings classified as harmonious or disharmonious according to their height characteristics.

Buildings height harmony	Number of buildings	%
Harmonious	10 684	65.48
Disharmonious	5 631	34.52

Table 13 Number and percentage of buildings and their harmony with the architectural character of the area according to their heights

According to the table, the most of the buildings 65% are classified as harmonious buildings. The reason for this is very high percentage of listed structures in the study area. Other 35% is classified as disharmonious which means that their heights exceed the heights of the neighbouring listed structures and they are not in accordance with the regulations from the conservation master plan.
The spatial distribution is presented on the map (Figure 9).

The buildings classified as disharmonious according to their height characteristics are located in the scattered manner in the south west and central parts of the study area. Harmonious buildings, on the other hand, are scattered in the whole study area with the higher degree of clustering in the eastern part of the district.

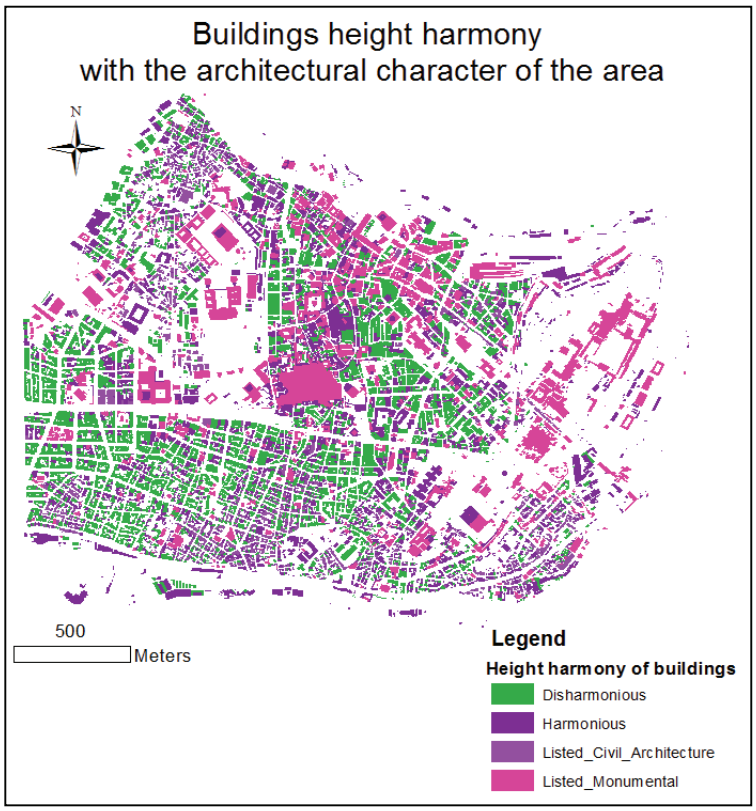

Figure 9 Map of harmonious and disharmonious buildings according to their height characteristics

Building construction material indicator

Construction material of buildings is another indicator important for assessing harmony with the architectural character of the area. The main construction materials that can be found in the area include timber, masonry, concrete and steel. Traditional construction materials of the area are timber and masonry which are considered to be in harmony with the traditional character of the area. Buildings built of concrete and steel are considered not to be in harmony with the architectural character of the area and they were mainly built after demolishing the traditional timber structures. The main reasons for demolishing the traditional timber houses

and their replacement with new, modern structures results from problems related to their ageing and difficult maintenance as well as the contemporary requirements for more comfort and convenience.

The distribution and number of buildings and their harmony regarding their construction materials are given in the Table 14 and presented on the map (Figure 10). The number of harmonious and disharmonious buildings according to this indicator is almost equal in both categories. This indicates that the traditional urban pattern and original timber structures are gradually disappearing and being replaced with modern concrete structures.

Buildings construction material harmony	**Number of buildings**	*%*
Harmonious	8 219	50.68
Disharmonious	7 998	49.31

Table 14 Number and percentage of buildings and their harmony with the architectural character of the area according to their construction material

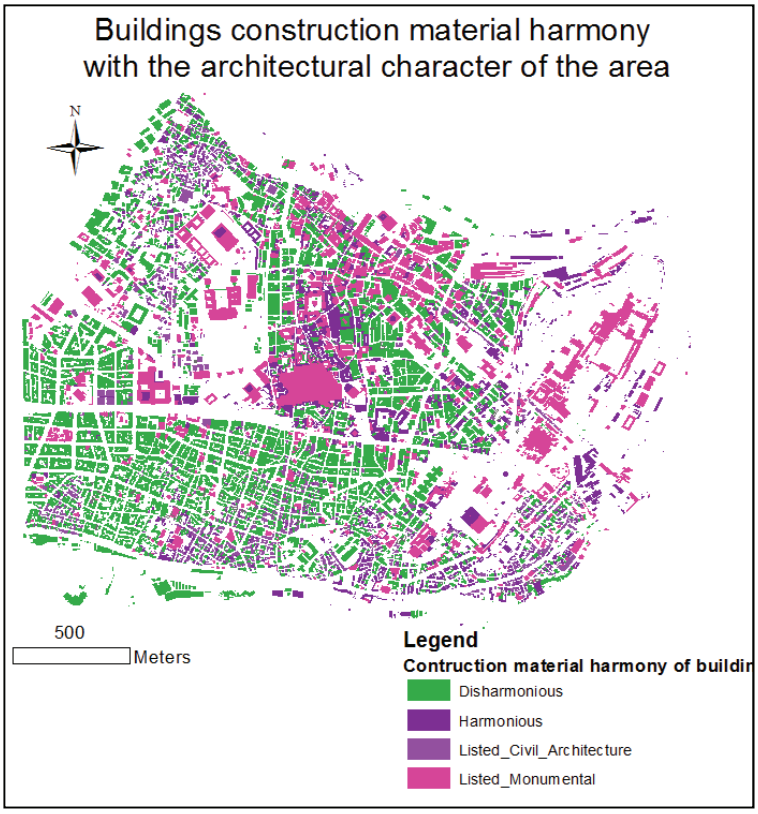

Figure 10 Map of harmonious and disharmonious buildings according to their construction material

Combination of building height and construction material indicators

Building height and building construction material indicators are combined in order to obtain the overall harmony of buildings with the traditional architectural character of the area. According to those criteria, buildings can be classified to buildings in harmony and buildings in low, moderate or high disharmony with the architectural character of the area. This finally results in no degradation or low, medium or high level of degradation respectively. According to these levels of degradation proposed actions for physical renewal of buildings are determined.

To sum up, first all buildings were classified to "harmonious" and "disharmonious" according to their height harmony with the traditional architectural character of the area. The same was done for their harmony with respect to the construction material. Second, the two indicators were integrated to obtain the overall harmony class and finally different levels of architectural character degradation (Table 15).

Architectural character degradation class	Buildings height harmony class	Buildings construction material harmony class	Number of buildings	%
No	Harmonious	Harmonious	7 262	45.38
Low	Disharmonious	Harmonious	917	5.73
Medium	Harmonious	Disharmonious	3 207	20.04
High	Disharmonious	Disharmonious	4 615	28.84

Table 15 Number and percentage of buildings per architectural character degradation class

Out of all buildings in the area, the highest number (45%) is classified to be in harmony with the architectural character of the area. The reason for this is very high number of protected listed sites in the area which make around 26% of all buildings. This also indicates that there are still a lot of non listed buildings that wait to be listed. 917 buildings were classified to be in low disharmony with the architectural character of the area which means that their construction materials are in accordance with the traditional urban fabric, but their heights exceed the allowed height limit. This mainly refers to buildings that have additions or have been upgraded for one or more floors. The proposed action for removing of additional parts or upgraded floors on the building is restoration liberation. Around 20% of buildings are classified to be in moderate disharmony because of their construction materials which are not harmonious. These are mostly concrete buildings that were built to replace the original timber houses. The smaller number of structures was built out of steel which is considered as a highly disharmonious material. There are almost one third of all buildings in the area that are classified as a highly disharmonious because of both, their height characteristics that exceed the limit and incompatible construction

material. These buildings are designated for redevelopment and replacement with more harmonious lower buildings.

Regarding their location it can be observed that the most of the buildings classified in high disharmony with the traditional character of the area is located at southwest part of the study area. This part contains mainly modern multi-storey buildings that degrade the visual integrity of the area. The rest of disharmonious buildings are also noticed in the middle part of the district, east of Gran Baazar. The buildings that are in low or moderate disharmony are mainly equally scattered all over the district, from northwest to southeast part of the area, while the harmonious buildings mainly occupy the northern and eastern part of the district where the highest concentration of protected listed sites and monuments is (Figure 11).

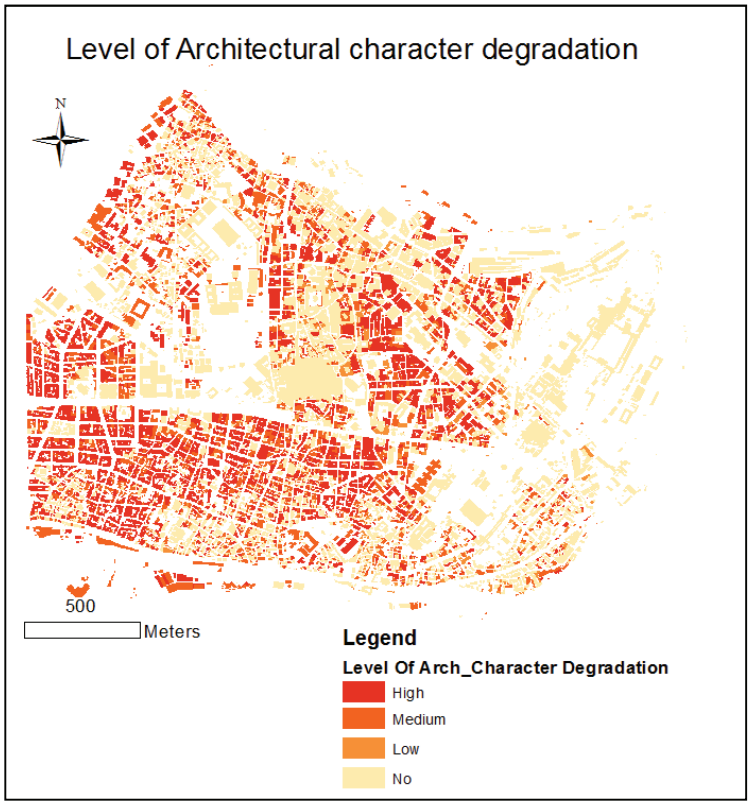

Figure 11 Map showing different levels of architectural character degradation

4.2.2.2. Physical degradation

Physical degradation is an important factor to assess the quality of life and improve living conditions in the historic urban areas. Physical conditions of all buildings in the study area need to be assessed in order to protect them from dilapidation and obsolescence. A high level of physical degradation means poor living conditions, bad maintenance and insufficient living space. On the other hand, a good quality of physical environment and sufficient space indicates better quality of life and standard of living for its residents.

Physical degradation of the historic area will be assessed by looking at the indicators such as physical condition of buildings and crowding state for residential buildings with consideration of their listed status.

Building physical condition indicator

The physical condition of buildings is an important indicator of the level of their preservation and maintenance. This indicator refers only to external elements of buildings and their state of maintenance, excluding the internal elements and facilities condition such as electricity, sewage and water, which are also important factors for overall building quality assessment.

Building physical condition indicator is classified to four classes which include good, average, bad and abandoned and ruined conditions (Table 16) Out of the total buildings in the area, 36% of them are in a good physical condition which takes about 46% of built up land. 39% of buildings are in average condition built on 36% of land, 23% are in bad condition built upon 16% of land and approximately 1% are abandoned and ruined.

Building physical condition class	Number of buildings	%	Ha	%
Good	5 814	36.02	91.02	46.30
Average	6 275	38.88	72.07	36.66
Bad	3 817	23.65	31.92	16.24
Abandoned and ruined	233	1.44	1.57	0.80

Table 16 Number and percentage of buildings per building physical condition class

The map below (Figure 12) shows the spatial distribution of building physical condition classes within the study area. It can be observed that buildings with good physical conditions are mostly located in the southwestern and eastern part of the study area in the surrounding of Topkapi palace. Buildings with the bad and ruined physical conditions are distributed in two parts of the study area. One part is located in the south, near the shores of the Marmara sea, and the second one is in the northwest. These areas are mostly residential areas and it can be concluded that the

most of the buildings in bad and ruined conditions can be found among the residential land use class. Regarding the class average building conditions, which is the most dominant class, it can be found in the whole study area without any special distribution pattern.

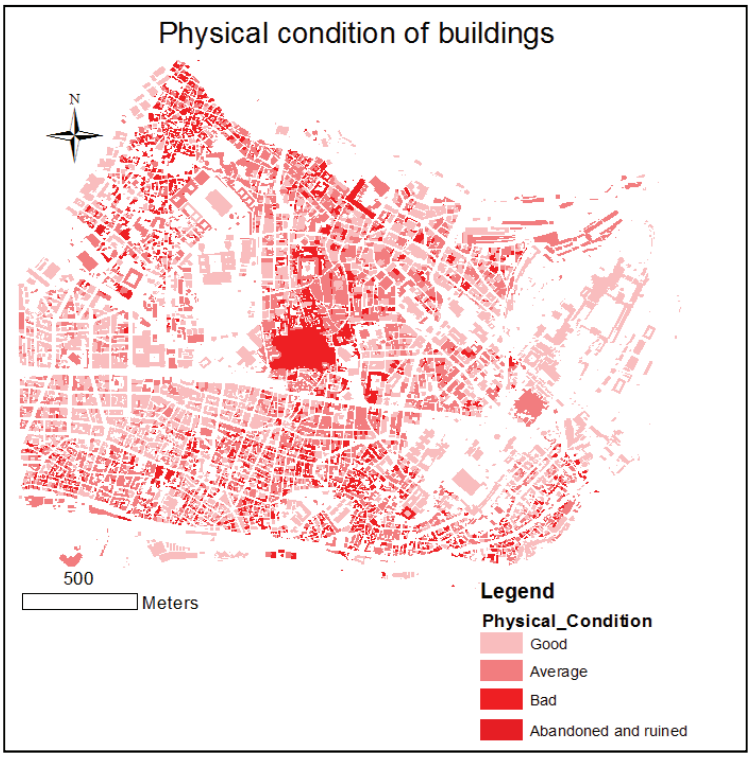

Figure 12 Map showing the distribution of building physical conditions

Building crowding condition indicator

Crowding condition of buildings measures the spatial pressure inside the building. It is important factor to consider when assessing physical degradation as inadequate space and overcrowding living conditions decrease the building quality. This indicator is applied only to residential buildings with known number of inhabitants and bedrooms per dwelling. The crowding condition is measured as a number of inhabitants per number of bedrooms in the house. The reason for crowded condition can be insufficient number of rooms in the house or mismatch between the number of rooms and number of inhabitants. The crowding condition indicator is calculated for each residential building and classified into crowding condition or no crowding condition. If the calculated value is less or equal 2 then there is no crowding condition. If the value is more than 2 then there is a crowding condition. The

threshold value of 2 is taken because it is considered that the standard is 2 people per one room for a sufficient living space and privacy (Arteaga, 2000).

Building crowding condition class	Number of buildings	%
Crowding (>2)	128	8
No crowding (<=2)	1479	92

Table 17 Number and percentage of residential buildings per building crowding condition class

In the study area there are 128 residential buildings with crowding conditions and 1479 buildings with not crowding conditions (Table 17). The both crowding classes are equally scattered on the surface and there is no specific spatial pattern (Figure 13).

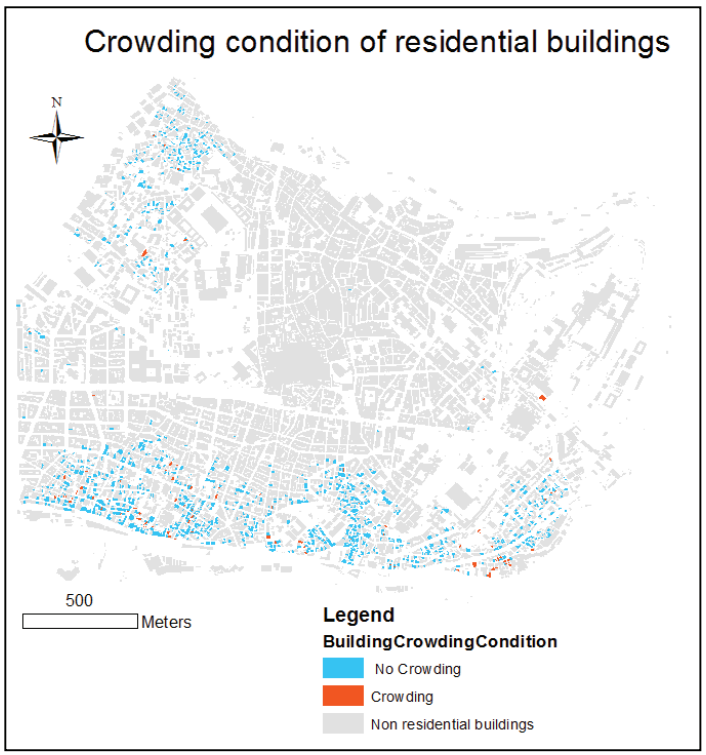

Figure 13 Map showing the distribution of residential buildings per building physical condition class

Combination of building physical condition and crowding condition indicators

The two indicators mentioned above are combined to obtain the final map showing the level of physical degradation. All buildings in the area were classified to four

classes depending on their physical quality and condition. Integration of both indicators is explained in the table below (Table 18).

Physical degradation class	Building physical condition	Building crowding condition	Building listed status	Number of buildings	%
No	Good	Not crowded	Listed civil architecture	5 805	36.0
	Good		Listed monumental Non listed		
Low	Good	Crowded	Listed civil architecture	6 243	38.7
	Average	Not crowded	Listed civil architecture		
	Average		Listed monumental Non listed		
Medium	Average	Crowded	Listed civil architecture	3 825	23.7
	Bad	Not crowded	Listed civil architecture		
	Bad		Listed monumental Non listed		
	Abandoned and ruined		Listed monumental		
High	Bad	Crowded	Listed civil architecture	249	1.5
	Abandoned and ruined		Listed civil architecture		

Table 18 Number and percentage of buildings per physical degradation class

The table shows the final outcome of the combination of indicators resulting in different levels of physical degradation. The highest number of buildings are in bad or average condition 62% and they are candidates for the restoration or reconstruction. 36% of buildings are in good condition and quality and they only need regular maintenance. A small number of buildings 1.5% is in ruined condition and abondened and they are considered for redevelopment.

The map (Figure 14) presents the spatial distribution of the physical degradation classes with the following characteristics. Buildings of good physical state and meintenace are located in the southwestern part of the study area in the blocks with the highest amount of new structures. The other pattern of good maintened structures is located on the north eastern part in the sourrounding of the protected sites. Buildings in a bad and ruined physical state are clusterd in nort western and southern part of the district where the residential buildings are dominant.

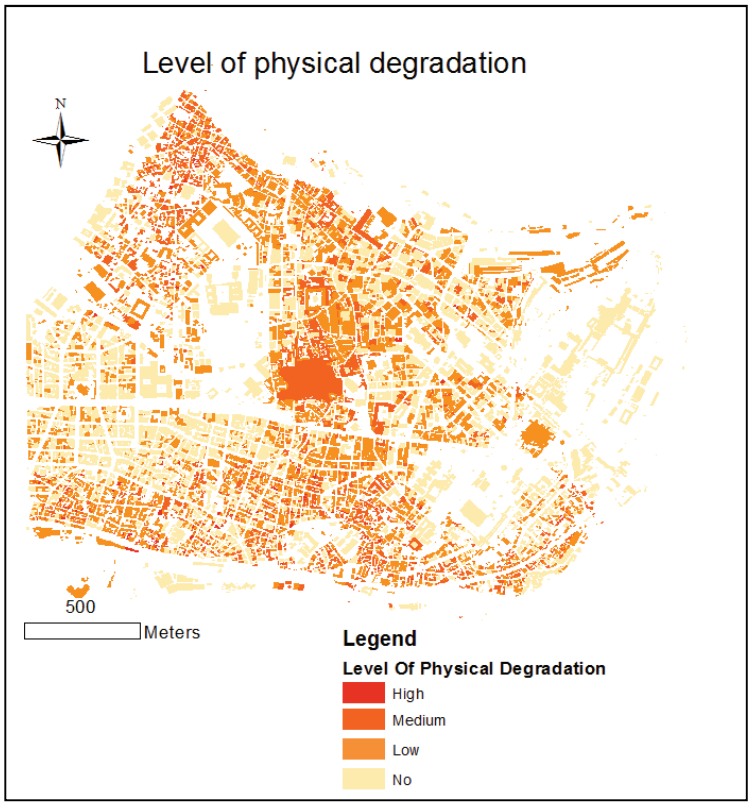

Figure 14 Map showing the spatial distribution of different levels of physical degradation

4.2.2.3. Physical revitalisation strategies for the potential renewal areas, integration of architectural character and physical degradation

The next stage, after the identification of type and level of degradation is to decide on actions and strategies for physical revitalisation (Table 19 and Table 20).

Proposed physical revitalisation strateies for non listed buildings:

Architectural character degradation class	Proposed physical revitalisation strategies
No	Maintenance
Low	Restoration liberation
Medium	Reconstruction
High	Redevelopment

Table 19 Architectural character degradation classes and proposed physical revitalisation strategies for non listed buildings

Non listed buildings were evaluated in in terms of their heights and construction materials to decide on their harmony with the architectural character of the area and level of degradation. If the building is classified as no degradation, the proposed renewal action is maintenace. Only exception from this rule is if its physical condition is average or bad. Then it is classified to restoration or reconstruction rather than maintenance. If there is a low level of degradation, the building is classified for restoration liberation. Proposed actions for medium or high level of architectural character degradation are reconstruction or redevelopment respectively.
Proposed physical revitalisation strategies for listed buildings:

Physical degradation class	Proposed physical revitalisation strategy
No	Maintenance
Low	Restoration or reconstruction
Medium	Restoration or reconstruction
High	Redevelopment

Table 20 Physical degradation classes and proposed physical revitalisation strategies for listed buildings

Listed buildings were evaluated only in terms of their physical degradation as they are considered to contribute to the traditional character of the area and cause no architectural character degradation. Buildings with no physical degradation are classified for maintenace, buildings with low or medium physical degradation are candidates for restoration or reconstruction, whereas buildings with high level of physical degradation are considered for redevelopment.
According to the clasification from the tables above 5 revitalisation classess for all buildings are combined and presented:

Proposed physical revitalisation strategies	Number of buildings	%
Maintenance	2 336	14.46
Restoration liberation	917	5.67
Restoration or reconstruction	4 779	29.58
Reconstruction	3 375	20.89
Redevelopment	4 746	29.38

Table 21 Number and percentage of buildings per physical revitalisation class

The Table 21 shows the classification of all buildings into five renewal classes for the physical revitalisation and their frequency distribution. All buildings in the area were evaluated according to their characteristics to propose strategies for the physical renewal and revitalisation. The interventions are proposed to maintain the visual integrity and traditional character of the area and to protect it from dilapidation and decay.

The proposed actions are defined as follows:

- Maintenance- regular care, small repairs, painting and replacement of decayed parts
- Restoration liberation- removal of the additional or upgraded parts
- Restoration- depicting the features from the original period, removal of some elements or adding new without introducing new material
- Reconstruction- rebuilding to the original state by introducing new material into the fabric
- Redevelopment- proposing new structure in harmony with the environment

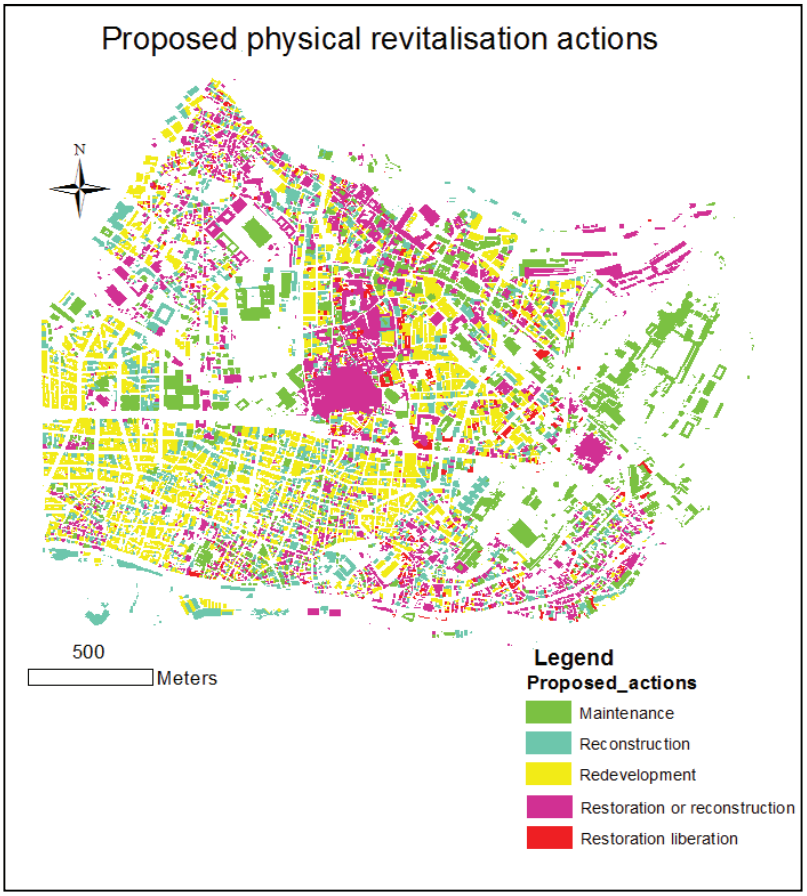

Figure 15 Map showing proposed actions for physical revitalisation

The frequency distribution of renewal classes shows that there is a high percentage 29% of buildings that need to be redeveloped and replaced with more harmonious

structures. The highest percentage of these buildings are located on the south-western part of the study area with abundance of concrete multi storey constructions. There is also a considerable amount of buildings that need a restoration or reconstruction due to their bad physical condition. These are generally listed civil architecture buildings distributed in two sections of the study area, one at the north west part and one at the south east (Figure 15). 20% of buildings need reconstruction due to their incompatible construction material and only about 14% of buildings need maintenence and slight repairs.

3D representation of proposed actions for physical revitalisation is shown on the smaller scale example (Figure 16).

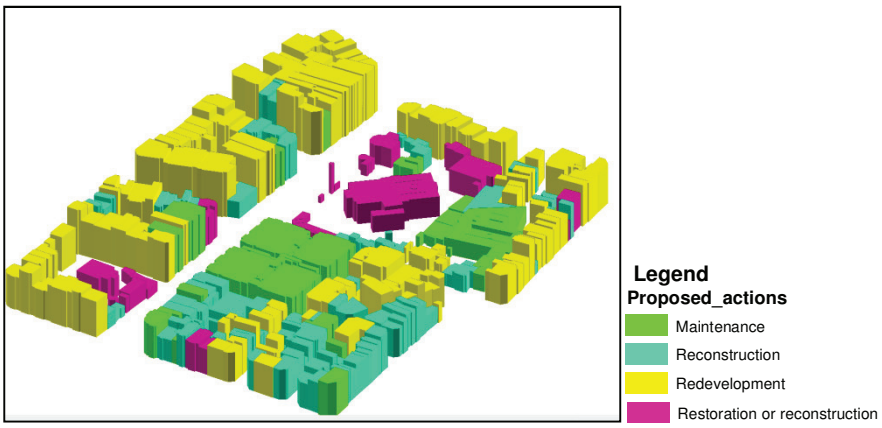

Figure 16 3 D model of proposed actions on the smaller scale example

Figure 17 shows an example of proposed new construction to replace disharmonious buildings in the block with monumental listed buildings. Disharmonious buildings that exceed allowable height limit are identified first (up figure) and then proposed to be replaced with more harmonious lower structures (down figure).

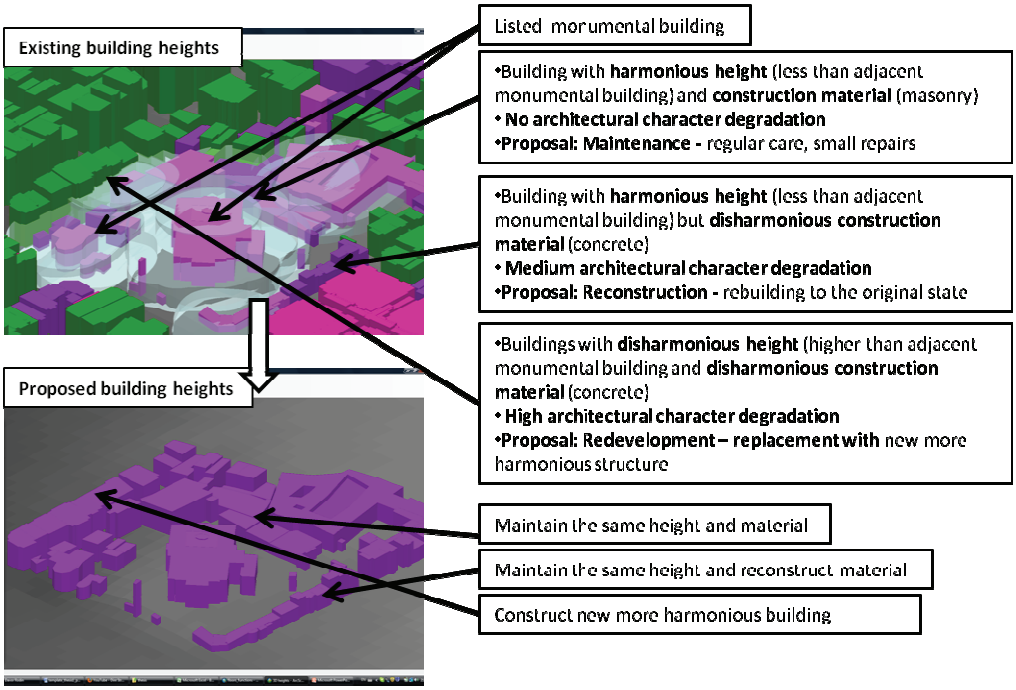

Figure 17 An example of 3D building model before and after proposed actions for architectural character degradation

4.2.2.4. Functional degradation

Functional degradation is related to functional characteristics of buildings and land uses that are not in accordance with the traditional character of the area. Revitalisation strategy dealing with functional degradation is defined as economic revitalisation (Oktay et al., 2003, Doratli, 2000, Doratli et al., 2004, Tiesdell et al., 1996). The main aim of this type of revitalisation is to increase economic value and potential of the area by encouraging functions that are compatible with the traditional character of the area and eliminating disharmonious functions. In order to suggest strategies for economic revitalisation, study area will be analyzed in terms of its functional degradation. The main indicator of this type of degradation is building functional use.

Building function indicator

From the functional point of view, buildings in the study area can be classified into buildings with harmonious functions, buildings with neutral functions and buildings with disharmonious functions. According to the conservation principles of the study area culture, religious, education and tourism functions are considered to be

harmonious and should be encouraged and more developed (Gulersoy-Zeren et al., 2003). Housing and commercial activities, for example, are neutral functions, but also recommended to increase the economic potential of the area. On the other hand, disharmonious functions that should be eliminated and replaced with more compatible functions include warehousing, wholesaling and manufacturing land uses. The distribution of buildings according to their functional harmony is shown in the Table 22 and presented on the map (Figure 18). All mix used buildings that have at least one disharmonious function are marked dark green on the map.

Functional harmony of buildings	Building function	Number of buildings	%
Harmonious	culture, religious, tourism, recreation, education	379	2.76
Neutral	commercial, residential, health, social, administrative	8520	61.97
Disharmonious	warehouse, wholesale, small industries	4831	35.25

Table 22 Number and percentage of buildings with harmonious, disharmonious or neutral functions

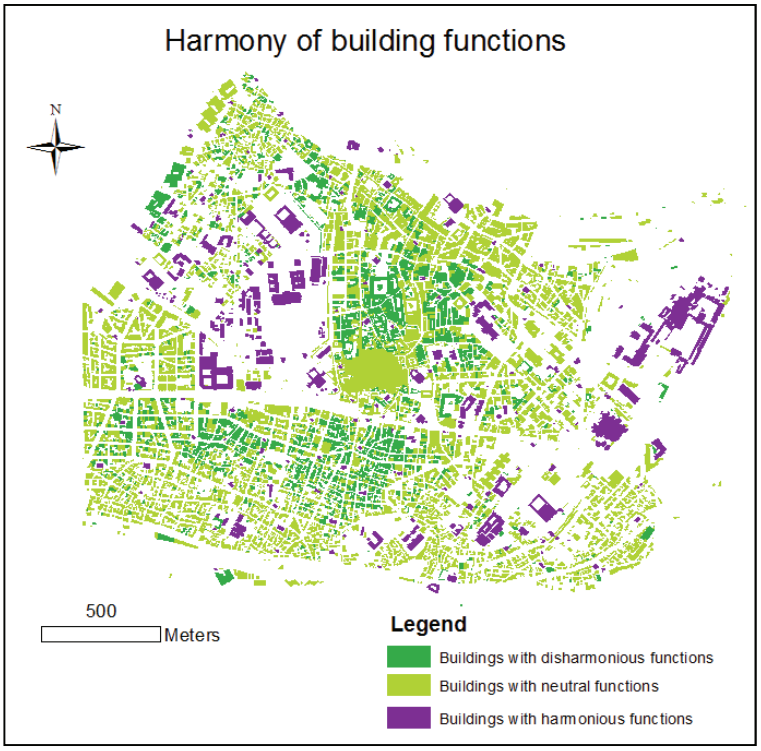

Figure 18 Map showing distribution of harmony of building functions

There is a considerable amount of buildings 35% in the area with at least one disharmonious function. These are manufacturing and wholesaling activities located in the central and south western part of the area. Only 2.7% of buildings are classified as harmonious with functions such as religious, culture and education. They are generally listed monumental buildings. The rest of the buildings with the highest percentage of 61% belong to residential, commercial or administrative land uses.

Land use allocation rules

In order to estimate level of functional degradation and decide on economic revitalisation strategies, land use allocation rules will be applied on the study area to decide on the most suitable land uses according to the conservation principles (Gulersoy-Zeren et al., 2003). Land use allocation guidelines are expressed as following:

- Culture and tourism facilities such as cafes, restaurants, galleries, libraries and museums are recommended in the 1st degree archaeological site area, in the near proximity of monumental listed buildings within 20 m buffer.
- Commercial services and facilities are proposed along the main roads within 20 m buffer
- Housing areas are recommended inside the 3rd degree archaeological site areas which are further away from the main street and instead of the manufacturing activities on the ground floors of residential buildings.
- Mixed use tourist + commercial functions are proposed in the proximity of both, main streets and monumental buildings. Tourist activities are suitable to be developed on the ground floors whereas commercial facilities can be located on the upper floors.
- Mixed use commercial + residential functions are suitable to be introduced in residential buildings located on the main streets.

The 3D building model together with the data on building functions per each floor was used to determine the land use suitability and to make a proposal for land use restructuring. 2D map has shown its limitations in presenting and analyzing land use in multi storey and multi functional buildings since it can only display predominant or ground floor uses. Space use in dense urban areas is typically in 3D and the conventional map is not sufficient for land use decisions in such complex and diverse urban environment. The reason for this is that a 2D map usually represents only one function per building which is not enough because many buildings have more than one function and they use space in the vertical direction. In order to make decisions and proposals for re functioning of the area, all building functions need to

be considered. The 3D building model enables visualisation of all building functions by each floor separately and allows 3D spatial analyses. In this way it is possible to select buildings with manufacturing upper floor activities, or empty floors of buildings and assign them more suitable uses.

An example shows the value of 3D spatial analysis based on the model built from 2D vector data and building height characteristics and coloured according to its land use attribute per each building floor. The spatial analysis was performed to select all buildings on the main streets and near monumental buildings with disharmonious functions on the second and third floor. These functions according to the conservation guidelines should be replaced with more harmonious functions that rely on commercial and tourist activities. The 3D model of buildings was generated by modelling of each building storey separately using assumption for the average floor height of 3 m. Thus, each storey in a building becomes an individual object in the dataset and can be assigned with corresponding land use value (colour coded classification). Afterwards, the data can be queried by attributes and spatial locations to identify functionally disharmonious building floors and assign them more suitable uses (Figure 19).

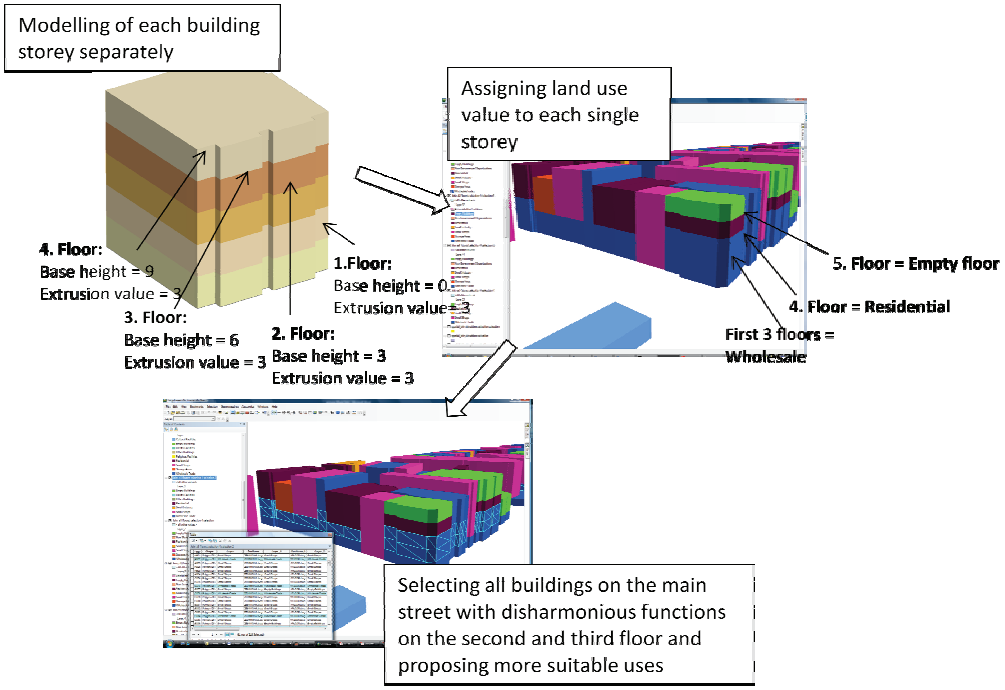

Figure 19 A 3D spatial analyses to select disharmonious building functions on the upper floors

Existing building functions in the study area are presented on the smaller scale example using the 3D building model. Each building in the model is split to individual floors which are then coloured according to their functions (Figure 20). It is obvious that the study area is a mixed used environment with a great diversity of functions.

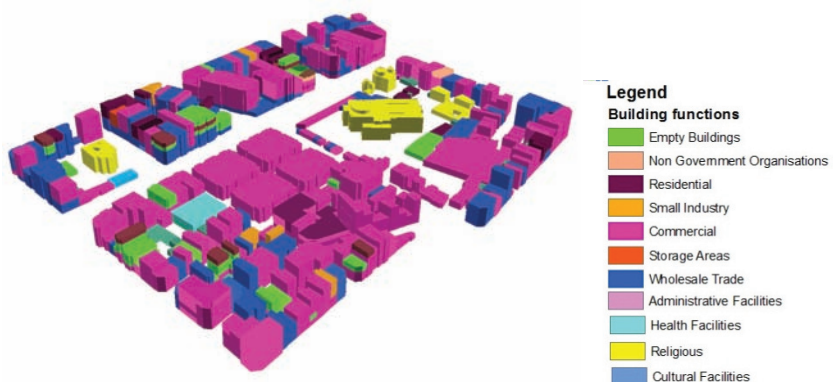

Figure 20 A 3D model of existing building functions in the selected area

After identifying disharmonious buildings and building floors according to their functions and having in mind land use allocation guidelines, a proposal for more suitable land uses to replace disharmonious function can be made. The proposal for harmonious functions is evaluated and presented on the smaller scale 3D building model (Figure 21).

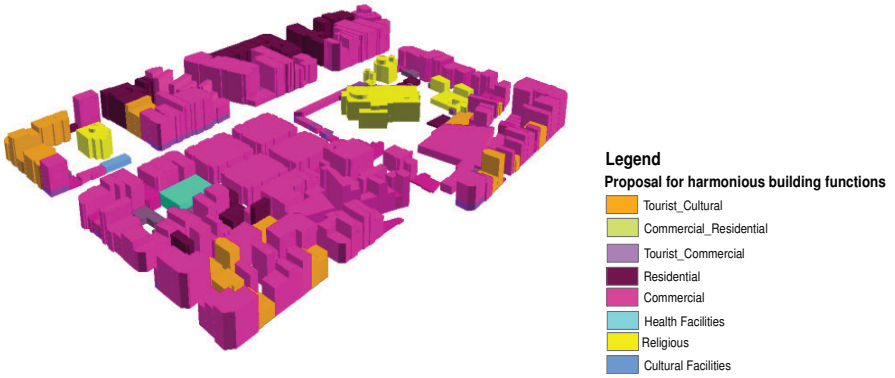

Figure 21 A 3D model of proposed harmonious functions in the selected area

Due to the very large extent of the study area, the decisions related to proposed suitable land uses and building functions for the whole area are presented on the 2D map (Figure 22).

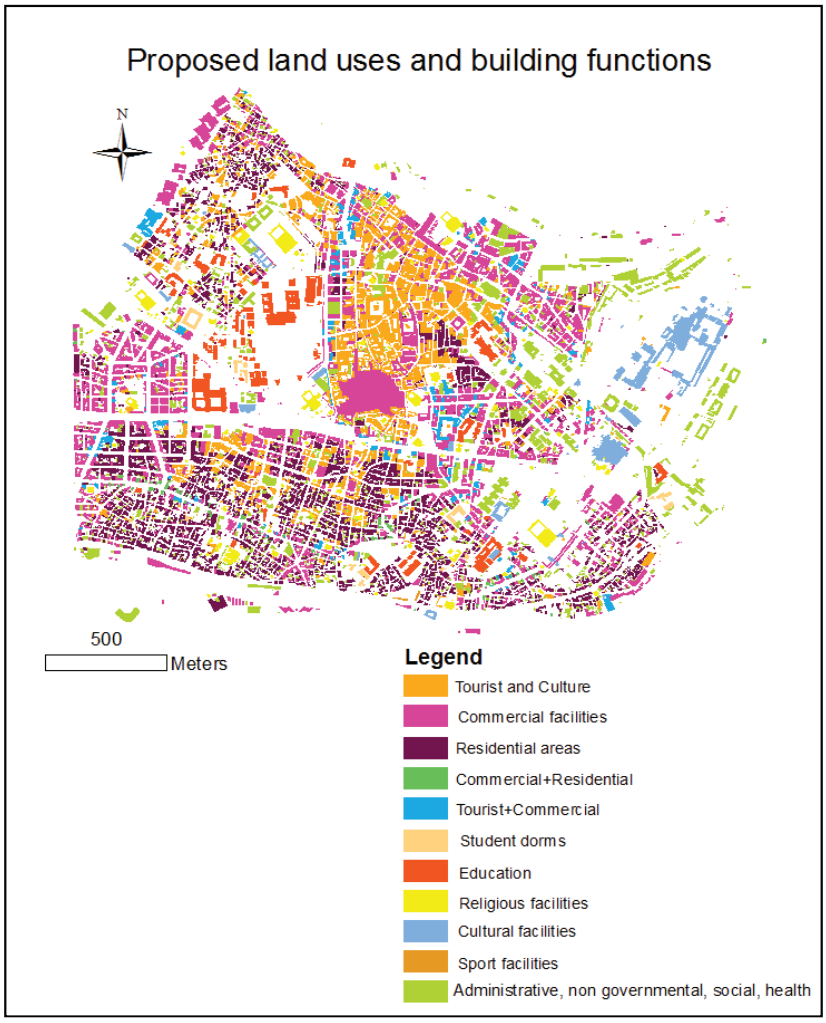

Figure 22 Map showing proposed land uses

Level of functional degradation is based on the harmony of building functions with the original historic character of the area. Buildings that have harmonious or neutral functions that need to be preserved have no impact on the functional degradation of the area and they should be encouraged to operate more efficiently. Buildings which have mix of harmonious and disharmonious functions result in low functional degradation and they should keep the existing harmonious function but replace the disharmonious ones with more suitable functions. Additionally, some buildings with residential or commercial functions located near the main streets or monumental buildings should also consider introducing of new uses. However, buildings with

completely disharmonious functions cause high functional degradation and should be replaced with more harmonious functions (Figure 23).

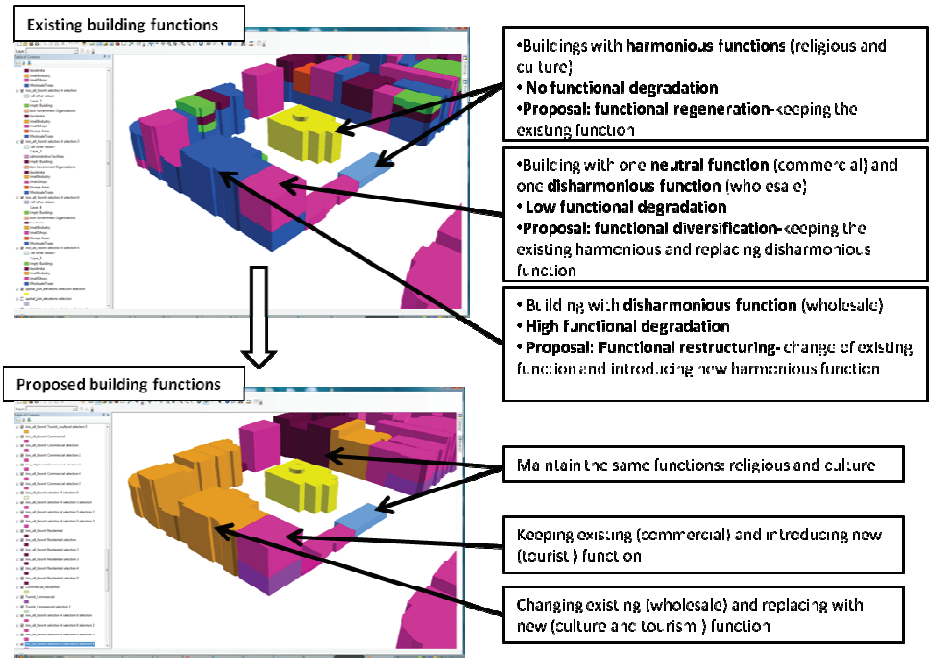

Figure 23 An example of 3D building model before and after proposed actions for functional degradation

Table 23 shows the number and percentage of buildings per functional degradation class. The highest percentage of buildings causes no functional degradation as their functions are described as harmonious or neutral and should be maintained as they are. However, there are also a very high number of buildings with disharmonious functions that result in high functional degradation. Only 4% of buildings are classified as low degradation and should consider introducing of new uses.

Functional degradation class	Building function	Number of buildings	%
No	Buildings with harmonious or neutral functions that should be maintained as they are	7 635	55.72
Low	Buildings with mixed harmonious or neutral and disharmonious functions that should be changed Buildings with neutral functions that should introduce new uses	662	4.83
High	Buildings with disharmonious functions that should be completely changed	5 405	39.44

Table 23 Number and percentage of buildings per functional degradation class

Economic revitalisation strategies

Economic revitalisation strategies are developed to deal with the functional degradation and to increase the economic potential and preserve the original character of the area. There are three types of economic revitalisation strategies: functional regeneration, diversification and restructuring. Functional regeneration refers to functions which should remain and operate more efficiently. Functional diversification is applied to buildings which keep the existing functions, but also introduce some new uses, for example small commercial activities on the ground floor of residential houses. Functional restructuring refers to buildings with disharmonious functions which should be completely eliminated and replaced with more suitable uses.

Proposed actions for the economic revitalisation are shown in the Table 24 and presented on the map below (Figure 24). There is a very high percentage of buildings in the study area that need restructuring and change of disharmonious functions. The most of them are located in the central part of the study area where the industry facilities are dominant. Another reason is a very high number of empty buildings in a bad condition, 1129 of them. Buildings that are proposed for diversification are generally located along the main streets or in the archaeological areas near the monumental buildings. These are usually residential or commercial buildings with the manufacturing ground floor activities. Buildings that are classified to keep the existing functions are generally buildings with harmonious functions that should be encouraged and more developed.

Functional degradation class	Proposed action for the economic revitalisation	Characteristics of buildings
No	Functional Regeneration	Buildings that keep the existing functions
Low	Functional Diversification	Buildings that keep the existing functions and introduce new uses
High	Functional Restructuring	Buildings that completely change the existing function with new more suitable uses

Table 24 Number and percentage of buildings per economic revitalisation class

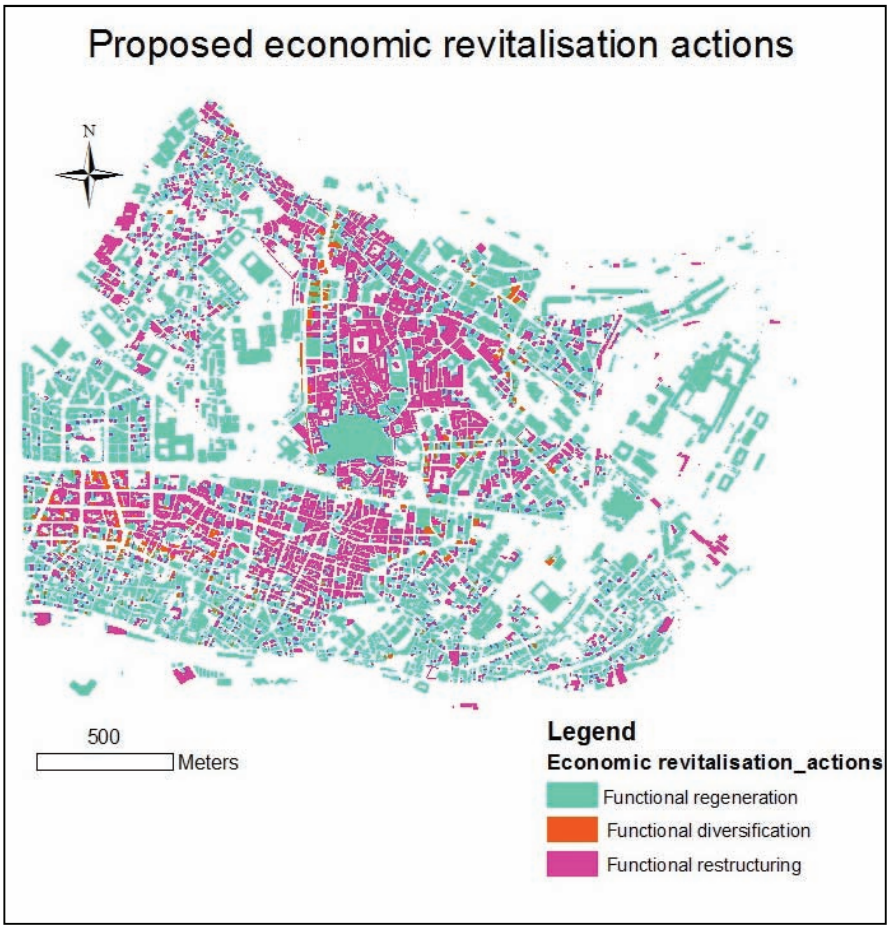

Figure 24 Map showing the distribution of the economic revitalisation actions

Chapter 5. Discussion

This chapter is devoted to the discussion on the results of the study and contributions of the 3D building database in urban conservation and renewal planning. Furthermore, it critically evaluates the conservation framework and reflects its possible improvements.

5.1. On the results of the historic area degradation

Three types of the historic area degradation were identified and evaluated in the study. Architectural character degradation of the study area was evaluated by looking at two parameters, height of the buildings and construction materials. These parameters were selected as the most important characteristics for assessing harmony of new structures with the historic urban fabric. Importance of identifying buildings which cause degradation of the historic urban fabric and visual balance of the area has been recognized in many similar conservation studies (Al-kheder et al., 2009, Gulersoy-Zeren et al., 2003, Li and Song, 2009, Xi, 2004). Al-kheder et al., for example, are investigating negative effects of the multi storey buildings built in the proximity of the heritage sites of Irbid, Jordan. They argue that the master plan of the area should focus on reorganizing construction of those buildings in a way that preserves the heritage sites and visual integrity of the area (Al-kheder et al., 2009). According to the results of the study, architectural character degradation was observed in the south and south western part of the study area. The results correspond to the expected spatial pattern of distribution of non listed buildings described as disharmonious with the architectural character of the area. Most of the disharmonious buildings located in the south western part of the study area belong to the commercial land use class. These are predominantly new, multi storey, concrete constructions. Disharmonious buildings present in the southern residential part of the study area are generally concrete buildings built after demolishing of traditional timber houses. Possible reasons for replacement of timber houses with modern, concrete structures are difficult maintenance and lack of comfort. The high percentage of disharmonious buildings due to their height characteristics or construction materials were also observed in the similar conservation studies for neighbourhoods Suleymaniye, Zeyrek and Yenikapi (Gulersoy-Zeren et al., 2003).

Physical degradation of the area was estimated using parameters physical condition of buildings and crowding state for residential buildings. These parameters were selected based on the related studies for urban conservation and renewal planning (Arteaga, 2000, Doratli, 2000, Gulersoy-Zeren et al., 2003, Li and Song, 2009). However, there are two other important parameters usually considered in

conservation studies that were not included due to the lack of data. These refer to the age of building or year of construction and facility condition. The parameter crowding condition of building, used in the study, is slightly underestimated. The reason for this is that the number of rooms in a dwellings includes all rooms, even if the ground floor is non residential and should be excluded from calculations. The results show that physical degradation is generally present in the residential neighbourhoods located in the north western and southern parts of the study area. The reason for this is a high percentage of listed civil architecture buildings in bad or ruined condition. The majority of them are timber structures which are more difficult to conserve. Not surprisingly, recently constructed concrete structures in the western parts of the study area are in better state of maintenance and indicate lower level of physical degradation.

Regarding functional degradation of the area, it is mostly expressed in the central part of the district where there is a dominance of industrial buildings and manufacturing activities. These areas should have a priority in the process of functional restructuring to preserve original values and protect buildings from dilapidation. The same results were obtained in the case study of the heritage site in Han neighbourhood also in the central part of Eminonu district. There are several proposals under discussion by the authorities and local governments about re functioning of these neighbourhoods. The main purpose is to remove functions such as metal works, manufacturing, textile trading and warehouses and replace them with other activities which rely on culture industries and tourism. The plan from 2004 emphasizes the importance of introducing functions that would be sustainable and historically harmonious with the cultural and historical identity of the district. According to the survey from 2004 based on the households and commercial occupants of the Historic Peninsula, there is a high demand for development of cultural and tourism activities in the area and the existing potential and benefit of tourism industry is not sufficient (Gokturk et al., 2010). The plan also stresses the importance of increasing the density of cultural-tourist services together with the commercial facilities in order to create new job opportunities and to provide economic revitalisation by creating a dynamic historic environment. The development of housing units over the shops in the commercial zones on the main streets is recommended to prevent the decay of the historic listed structures (Gulersoy-Zeren et al., 2003). According to the literature, culture and tourism regeneration polices have been approved as a strategic approach for economic revitalisation of many historic centres in Turkey in the recent years (Ciftci et al., 2010, Bagbanci and Bagbanci, 2010, Bimptas, 2007). Therefore, Ciftci et al., 2010 argue that “culture-related investments and policies are used to diversify economic activities in the cities and increase the quality of urban life and the image of the city

from the end of 1980's to the early 1990's. Therefore, it is understood that in order to revitalize the economical and physical structure of the cities, culture-led strategies and projects have gained importance in the revitalization policies."

5.2. On the benefits of use of 3D building database in the conservation framework

The conservation framework is based on the analyses and evaluation of physical and functional characteristics of the historic environment. The analyses and evaluation of characteristics of urban landscape are supported by making use of 3D building database and 3D representation techniques. 3D building model is used to provide more information and increase user's perception of physical characteristics of urban landscape for conservation and revitalisation purposes. Moreover, the model shows that urban renewal and conservation planning can be achieved not only by using conventional mapping techniques but also with the support of 3D GIS technologies. The GIS analyses in the research were generated in order to evaluate characteristics of urban structures and their relationships, to assess their mutual harmony and visual integrity and to formulate proposals for urban conservation and renewal. Each analysis was generated and presented in the form of 2D map with addition of 3D model on the smaller scale example to improve the representation of the most important urban characteristics and present results of proposed revitalisation actions. The 3D visualisation of building database has especially shown as an effective method to examine height characteristics of buildings and their consistency with the architectural character of the area. 3D GIS model is used to visualise the existing building heights and compare them with the allowable heights according to the conservation principles. This capability of 3D visualisation enables identification of buildings that are causing architectural character degradation and can be used to control allowable building heights in a block (Murata, 2004). Therefore, height control regulations can be easily understood and buildings that display disharmony due to their height characteristics can be better determined by using 3D model in comparison with 2D mapping technique. The similar method is used by Al- Kheder et al., 2009 for identifying disharmonious buildings based on their heights in the historic centre of Ibrid, Jordan. Kirimura et al., 2009 are also using 3D GIS to formulate view preservation polices in historic city Kyoto, Japan. In this way, 3D GIS model can be effectively used in determining height restriction policies because it provides representation of their results (Kirimura et al., 2009). Moreover, it can be used to simulate proposed renewal actions and visualise shapes of proposed new buildings.

Apart from the capability of 3D GIS to compare the existing building heights with the regulations and simulate the shapes of proposed new constructions, another

important contribution is its ability to visualise land use data in 3D per each building floor separately and to make a vertical land use inventory. Historic urban areas are generally mixed use environments with a great diversity of functions that can be often found in the same buildings. 3D GIS technique enables assigning values to each building floor individually and facilitates decision making for functional restructuring of the area. The similar technique was used in two studies: one for building a 3D land use model of Portland central city for land use development purposes (Martin, 2009) and one for cadastral applications in Jordan (Al-Hanbali et al., 2006).

The contributions of 3D urban model in determining characteristics of urban environment and deciding priorities in conservation planning were also examined in the study of Zeyrek historic site in Istanbul (Koramaz and Gulersoy, 2009). The authors made a survey among two groups; professionals and non professionals to compare the results of analyses generated with 2D mapping and analyses obtained by using 3D urban model. The results from the study confirmed the responses from the conservation and planning professionals about the three main benefits of 3D models in urban conservation: better justification of the conservation plans and visual quality, better representation of transformations in the area and better perception of the historic urban landscape (Koramaz and Gülersoy, 2010).

5.1. On the conservation framework and how it can be improved

The conservation framework was developed with the main purpose of identification of types and levels of degradation and definition of buildings and potential areas for urban renewal and revitalisation programs in the historic centre of Istanbul. To identify buildings and areas which require different revitalisation actions, it was necessary to follow logical principles for selecting buildings with specific characteristics. In the case of the conservation framework, the first step was previewing existing conservation polices and principles which then serve as guidelines for the entire process of determining degraded areas and formulating revitalisation actions. Before starting to evaluate the degradation of the area, it was necessary to identify cultural and historical values. All buildings were classified according to their listed status to monumental, civil architecture or non listed buildings. After the identification phase, building characteristics were examined to determine the level of degradation and classify them to different revitalisation classes.

The efficiency of the applied framework for urban conservation and revitalisation purposes depends on the availability and quality of input data. If the input data set is incomplete or insufficient, the results will be less accurate or different from reality.

In the case of developed framework, the obtained results would be better if the input dataset included more variables and building attributes.

In the process of determining the architectural character degradation of the area and identifying buildings which are not consistent with the traditional urban fabric, the main indicators included in the framework were building heights and construction materials. However, there are some other variables that could be considered to increase the accuracy of the results. Important characteristics of buildings that should also be evaluated in estimation of the architectural character degradation of the area include architectural style of buildings, characteristics of windows, doors, facade characteristics and roof materials. According to these elements buildings can also show their disharmony with the character of the area. Stapp, 2009, for example, in his study of the historic area of Philadelphia is combining three parameters: construction materials, architectural styles and facade characteristics of buildings to determine architectural and character compatibility of buildings in the historic urban environment (Stapp, 2009). In the conservation study of Gulersoy et al, 2003, characteristics of windows and doors were combined with the building heights and construction materials to identify buildings that are not in accordance with the character of the area. Each building was evaluated individually to determine how it fits with the surrounding environment. In the similar studies of urban renewal building heights were also recognized as an important variable to indicate disharmonious, new buildings that are not consistent with the traditional style and should be redeveloped (Li and Song, 2009, Al-kheder et al., 2009, Xi, 2004)

When determining physical degradation of buildings, considered indicators were building physical condition and crowding state for residential buildings. This analysis can also be improved by adding more variables into the framework. The important variable to consider when assessing physical quality of buildings is an internal infrastructure and condition of facilities such as electricity, water and sewerage. Good condition and provision of these facilities indicates good quality of buildings and lower level of physical degradation. This factor is considered in similar studies for defining areas for urban renewal projects (Arteaga, 2000, Li and Song, 2009, Doratli, 2000, Nayci et al., 2003). Another characteristic of buildings that was omitted but it is important for the evaluation of physical degradation is the age of building. If there is a dominance of old buildings in the area, the physical degradation will be higher. In that case, interventions related to conservation or restoration will be necessary in order to improve their condition and make them more attractive and modern. This will consequently imply higher costs of maintenance and repair. Older buildings can also display characteristics of functional degradation as a result of their age. On the other hand, if there is a predominance of new buildings in the area, there is no need for restoration or

upgrading activities, but they can be considered for reintegration in the historic environment or change of functions. The indicator crowding condition used in the framework could be added to the indicator of multi occupancy which is measured by number of households per dwelling. It is in a close relation with the lack of facilities, shortage of living space and poor physical conditions which all lead to physical degradation (Arteaga, 2000, Li and Song, 2009). Additionally, the framework could be more developed by taking into account some other variables that are not directly related to the physical or functional characteristics of buildings, but also important for determining revitalisation strategies and feasibility of urban renewal. For example, land ownership and occupancy of buildings can be used for determining social characteristics of the area and address the target group of revitalisation programs. It is easier to implement revitalisation actions in the areas that are dominantly owner occupied and in private ownership then with dominant tenant type occupancy. In other cases it is necessary to formulate public private or other partnerships. Moreover, the level of physical degradation may be higher in the tenant occupied buildings. The reason for this can be unwillingness of tenants to maintain and invest in buildings that are not in their ownership. Land and building values are other important parameters to decide on areas which are more convenient for development from the economic point of view. Generally, higher values of land and buildings will imply higher economical costs and will be less suitable for urban renewal actions. On the other hand, if there is a less expensive building in terms of cheaper construction materials, smaller size or older period of construction, it will be more convenient for renewal changes or total demolition because it will naturally imply lower expenses (Arteaga, 2000).

Determination of relevant revitalisation strategies should also consider analysis of the social and economic aspects of the inhabitants in the planning area. People give meaning to the historic places and should not be excluded from the renewal planning. Their expectations and opinions to urban conservation and revitalisation are important for the success of renewal efforts (Gulersoy-Zeren et al., 2003). Evaluation of degradation of an area together with analysis of social structure would facilitate decision making processes. Revitalisation decisions can have a big impact on the inhabitants of the area. For example, if there is a need for functional restructuring of the place, it will inevitably imply replacement of the residents, except in the case of vacant buildings. Even if there is a need for physical renewal actions that improve building conditions and increase attractiveness of the area, that would entail an increase in building values and rents that would finally result in replacement of the lower income residents by the higher income (Doratli, 2000). Therefore, before implementation of any revitalisation actions, it is important to examine structure of inhabitants and their approach to conservation. Social structure

and demographic features of inhabitants together with their opinions about urban conservation and renewal have been examined in many studies for urban revitalisation planning (Li, 2003, Nayci et al., 2003, Doratli, 2000, Gulersoy-Zeren et al., 2003, Ciftci et al., 2010). This include variables such as nationality, education, employment, income, size of the households, ownership of buildings, period of residence, preferences for the future, preferences for the types of interventions or improvement, satisfaction with the environment and opinion regarding replacement of old buildings with modern structures. These parameters, if available, could provide valuable inputs for upgrading of the framework with the social aspect of urban degradation.

Another limitation of the developed conservation framework is that it is focused only on buildings and built up structures in the study area. However, there are other features in the historic urban environment beside the buildings that need to be considered in effective urban conservation and renewal planning. This refers to pattern of streets and open spaces around buildings. Decisions related to transportation and road network should be developed in such way to distribute the traffic away from the heritage sites and make a proposal for creating pedestrian zones and open spaces near the historical and cultural values. This can be achieved by transforming streets near the monumental buildings into pedestrian routes and introducing open spaces or green areas in the backyards of the building blocks and near the important religious and monumental buildings (Al-Hanbali et al., 2006, Gulersoy-Zeren et al., 2003).

Chapter 6. Conclusions and recommendations

This chapter presents the main conclusions of the research based on the research objectives and questions from introduction and gives recommendations for further studies.

6.1. Conclusions

The study demonstrated that there is a considerable potential in using GIS technologies and 3D building database for the evaluation of historic urban areas for the purposes of identifying degraded areas and formulating proposals for conservation and revitalisation planning. Conclusions can be made with respect to the research questions posed in the introduction.

- What is historic urban degradation and what types of revitalisation strategies can be used?

Historic urban degradation can be described as a process of decay and dilapidation of historic urban areas as a result of deterioration of physical, functional or socio economic conditions in the area. Physical degradation can be addressed by the means of physical revitalisation which include renovation of buildings and adaptation to contemporary needs and requirements. Possible physical revitalisation strategies include maintenance, restoration, reconstruction and redevelopment. Economic revitalisation, on the other hand, deals with the functional aspects of the area. It aims to increase the local economy by introducing suitable land uses and creating development opportunities. Methods for economic revitalisation include functional regeneration, diversification or restructuring.

- What is the current management practice in conservation and revitalisation of historic urban areas in Turkey and what is the organisational structure?

In Turkey, urban conservation and revitalisation programs have been implemented only recently, as a part of a systematic policy for rehabilitation and renewal of the historic areas. The current management practice consists of registering buildings that are considered worth to be preserved and designation of the conservation and renewal areas. After the area has been designated as a conservation site, conservation master plans are being prepared by the municipalities or private institutions and approved by the Conservation Councils. The Ministry of Culture and Tourism is the institution directly responsible for the heritage conservation and making final decisions. Finally the municipality carries out the implementation of

the plans. However, despite all regulations and legal preservation, there are still many problems regarding the Turkish conservation system that hinder the implementation and success of the conservation and revitalisation projects. First, the conservation plans are not well integrated into development plans and planning decisions often clash with the conservation principles. Second, there is a lack of cooperation between municipalities and Conservation Councils and lack of trained professionals among the municipality personnel. Third, there is a low awareness of the public regarding importance of heritage conservation and insufficient resources provided by the authorities for the economic development and renewal of the historic areas.

- What data is needed for the constructive evaluation of the historic areas with regards to urban conservation and revitalisation?

For the constructive evaluation of the historic urban areas with regards to urban conservation and revitalisation the detail data set that covers physical, functional, social and economic aspects of the area would be needed. The physical data is necessary to measure the level of physical degradation of buildings and their harmony with the historic environment. This should include variables such as building age, physical condition, quality of infrastructure, construction materials, heights of buildings and architectural styles. Land use and building functions should be used for the evaluation of functional degradation of the area. Social and economic data is necessary for identification of bad social conditions and determining profiles of inhabitants. It includes information on demographic structure of people, education, income, households and attitude of people towards conservation and renewal.

- What is the degree of architectural character degradation in terms of buildings that are not in harmony with the traditional urban fabric?

The degree of architectural character degradation in the area is relatively high and it is caused by buildings that are disharmonious with the traditional urban pattern according to their heights and construction materials. 35% of buildings are disharmonious according to their heights that exceed allowable height limits whereas 49% of buildings are disharmonious according to the construction material. In total 45% of buildings are classified in no degradation class, 5% in low, 20% in medium and 29% in high degradation class. High degree of architectural character degradation can be best observed in the south western parts of the study area, in the commercial zone with a number of high rises, concrete structures.

- What is the degree of physical degradation of buildings in terms of their physical condition and quality?

The degree of physical degradation was evaluated in terms of physical condition of buildings and crowding condition in residential buildings. 36% of buildings are in good physical condition, 39% average, 23% bad and approximately 1% in abandoned and ruined condition. Residential buildings were additionally analyzed to decide on their crowding condition. 128 of residential buildings were estimated to be in a crowding condition. These parameters were combined to determine the level of physical degradation. Finally, 36% of buildings are in good quality and show no physical degradation, 38% show low, 24% medium and 1% high level of physical degradation. The highest degree of physical degradation is present in the north western and southern parts of the study area where there is a predominance of listed civil architecture residential buildings in bad or ruined condition.

- What is the degree of functional degradation in terms of functional uses of buildings and incompatible uses?

The degree of functional degradation in the area is generally very high, since about 40% of buildings have at least one disharmonious function and need functional restructuring. These are mainly buildings with manufacturing, warehousing and wholesaling activities located in the central part of the study area. The problem with these uses is that they cause disturbance in terms of pollution and noise and should be displaced from the historic area. Buildings with lower level of functional degradation include residential or commercial buildings with manufacturing ground floor activities located near the monumental buildings or on the main streets.

- What kind of recommendations for urban renewal planning can be made from analyses and evaluation of the present situation by using 3D GIS technologies?

Based on the conservation framework developed in the study and applied on the study area, recommendations for economic and physical revitalisation can be made. The recommendations propose different types of interventions to prevent the degradation of buildings and decay of the area. Non listed buildings that are in harmony with architectural character of the area and in good physical condition should be maintained as they are. Non listed buildings with disharmonious construction materials should be reconstructed, whereas those which exceed the allowable height limits should be restored liberated. Buildings which are disharmonious according to both, their heights and construction materials are

candidates for redevelopment and replacement with more harmonious structures. Listed buildings in good conditions and not crowded should be regularly maintained. Buildings that are classified to low or medium physical degradation should be restored or reconstructed while those with high level of physical degradation, in a bad and ruined conditions and crowded should be considered for redevelopment. Regarding functional use of buildings, it is recommended that residential or commercial buildings in the proximity of monumental listed structures either keep their original functions or change to culture and tourism activities. Manufacturing buildings should be eliminated from those areas completely and replaced with more harmonious functions. It is also recommended that buildings on the main street introduce commercial activities on the ground floors and that housing units with ground floor manufacturing functions change to their original uses.

- What kind of data is missing and would be necessary to upgrade the framework and improve the analyses and evaluation?

There are several shortcomings regarding collected data in the study. In order to obtain better results, the data in reality should be more detailed and complicated. It should include more specific description of building physical characteristics such as building age and facility condition. These data in combination with building physical condition and crowding state would provide better interpretation of the physical degradation of buildings. To measure architectural character degradation, the variables missing in the framework that can identify disharmonious buildings together with height of buildings and construction materials include architectural styles and characteristics of windows and doors. Additionally, the data might include information on social and economic aspects of the area. This refers to data on demographic and social structure of inhabitants such as nationality, employment, income, education and their opinions and attitudes about urban conservation. This data can be used to address the target group of revitalisation programs and determine feasibility of planned interventions. From the economic point of view, the data missing in the framework that can improve analyses include value of buildings, parcels and land. The list of data necessary for urban conservation and revitalisation projects is given in the Appendix V.

6.2. Recommendations

Recommendations for policy and decision making:

- Physical condition and quality of the area should be improved by maintaining, restoring or reconstructing historically and architecturally important buildings and protecting them from decay and degradation.

- Non listed buildings that have negative effects on the traditional architectural character of the historic area should be harmonised in terms of building heights, facade characteristics and construction materials.
- Buildings that have lost their original functions, abandoned buildings or buildings used for manufacturing and industry purposes should be functionally transformed to more harmonious uses which are preferably oriented to culture and tourism.
- The proposal for creating of new economic functions should be developed to increase the profitability of the area, create new job opportunities and increase the economic level of the inhabitants.
- Local people, residents, commercial users and other stakeholders should be involved and actively participate in the conservation and revitalisation processes.

Recommendations for further studies:

- To apply the conservation framework on the smaller scale, not larger than one neighbourhood or several blocks of buildings. It is very difficult to collect detailed data for urban conservation and renewal projects for the entire district. Thorough renewal and conservation studies should be focused on the smaller area.
- To incorporate more data into the framework. The additional data should include building age, infrastructure quality, architectural style, building and land values, ownership, type of occupancy. The data should be collected from the field survey and each building should be evaluated individually, so that proposed actions can be prepared in detail for each single building.
- To make a survey and collect demographic and socio economic data within the planning neighbourhood. The understanding of socio economic conditions in the area is essential for the complete planning. This can be done by making questionnaires and interviews with local inhabitants.
- To include the data about other features of urban environment such as pattern of streets and spaces between the buildings.
- To formulate more renewal classes that should be based on more detailed data.
- To make a plan for creating pedestrian routes, open spaces and green areas around the buildings and inside the building blocks.
- To evaluate the landscape using more detailed 3D model developed in other modelling software.

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Appendices

Appendix I

Photos of authentic buildings in the study area (taken during the fieldwork in October 2010)

Figure 25 Listed civil architecture buildings (timber and masonry)

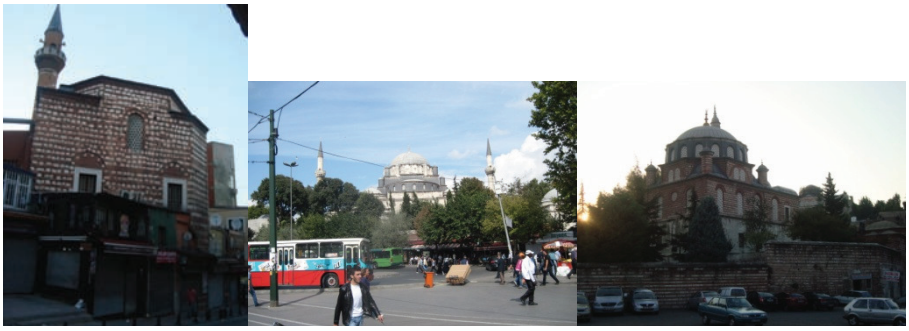


Figure 26 Listed monumental buildings

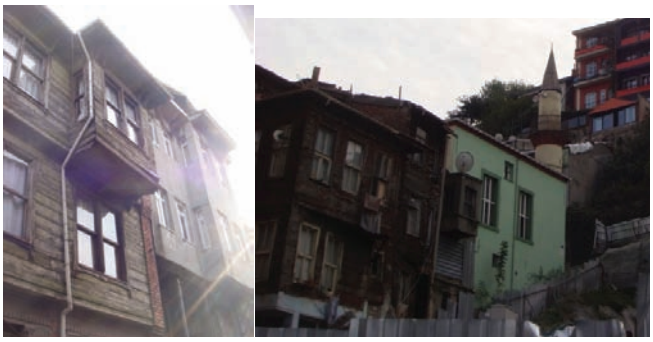


Figure 27 Disharmonious buildings

Figure 28 Listed timber buildings in a good condition

Figure 29 Listed timber buildings in a ruined and abandoned condition

Figure 30 Disharmonious building uses: small industry and warehouse

Appendix II Questions from interviews conducted in Istanbul

1. About the existing conservation system in Istanbul and Turkey

- What is the current management practice in conservation of historic urban areas in Istanbul?
- What are the main gaps in the existing state of the conservation system in Turkey?
- What can be improved in the current conservation process and what should be policy for the future?

2. About responsibilities of institutions involved in the process of heritage management

- What is the role of IMP in the field of urban heritage management?
- What are the main responsibilities of Conservation Councils regarding heritage conservation?
- What other institutions are involved in urban conservation and renewal planning?

3. About the main threats to the historic urban areas and methods for their protection

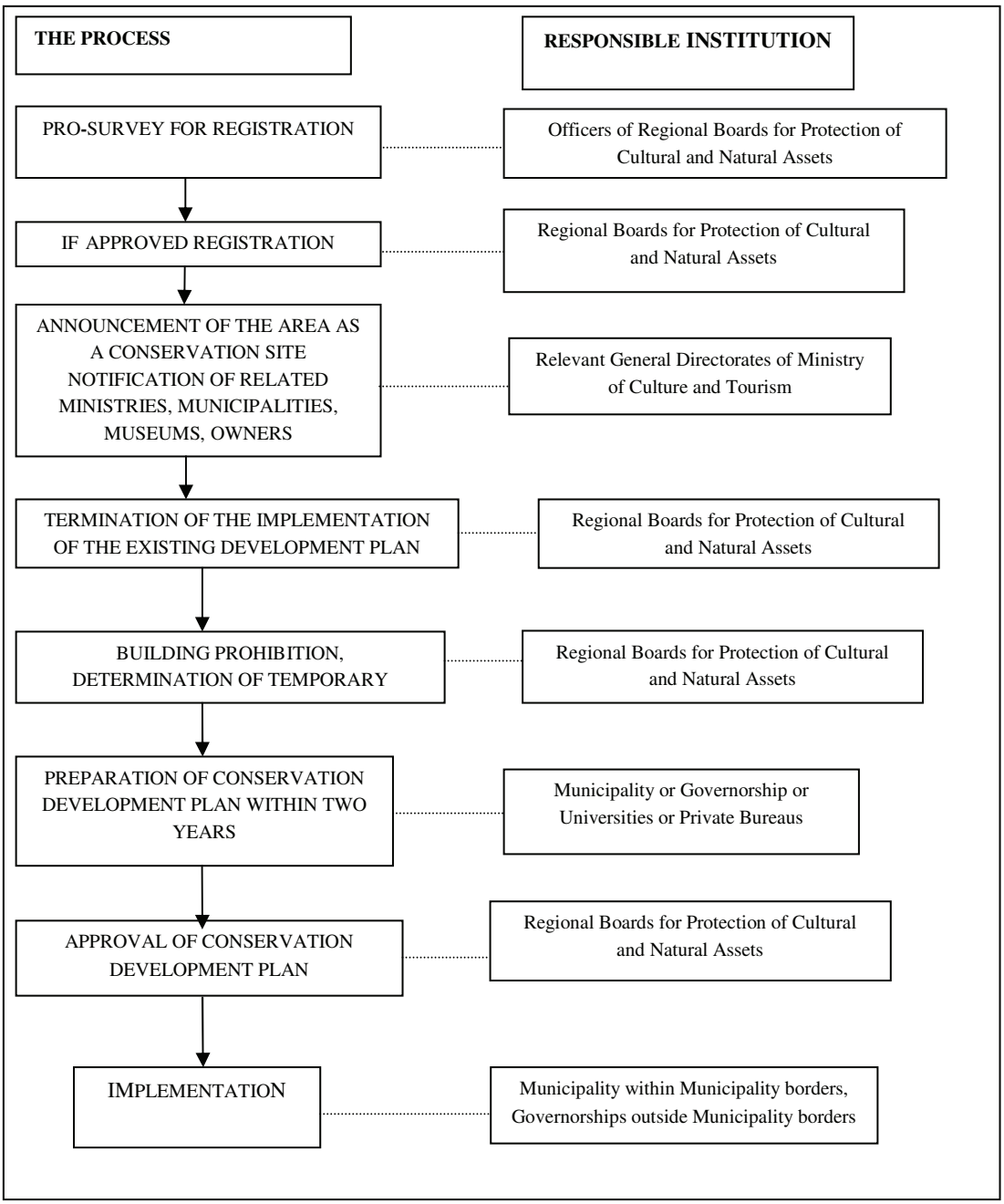
- What are the main threats to the historic areas and what would you recommend for the effective protection?
- Why is UNESCO concerned and wants to put Istanbul heritage on the list of heritage in danger?
- What are the major development projects that threaten the urban heritage and what is the attitude of Conservation Councils?

4. About deciding on urban conservation and renewal programs and data requirements

- What are the main issues that need to be considered when making decisions for conservation and renewal of historic buildings?
- Which buildings are considered the most valuable to be preserved? Are there some buildings that are privileged and have priority in the conservation process?
- Are there some renewal areas designated in the Historic Peninsula?
- What data should usually be collected when making conservation plans and renewal programs?
- What are the usual methods for collecting data?
- What about the use of GIS and 3D modelling to manage the data?

Appendix III

Conservation procedures in Turkey (Gulersoy-Zeren et al., 2003)



Appendix IV

A 3D building database

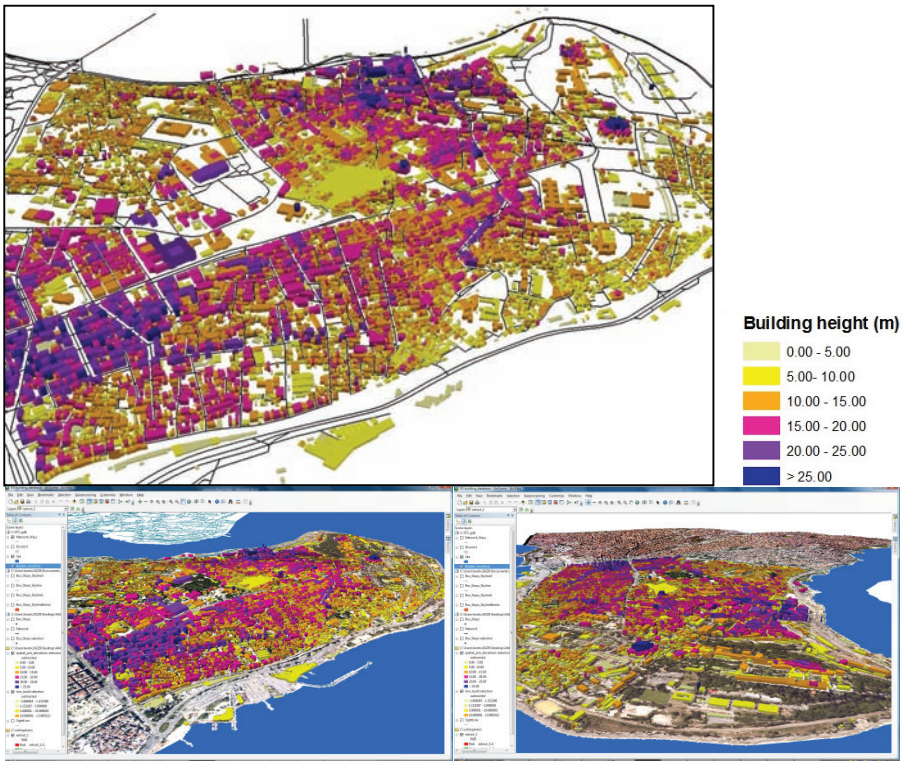


Figure 31 A 3D building database

Appendix V

Type of data relevant for urban conservation and revitalisation

Type of data	Variables	Used in the study
Physical	Location of buildings	X
	Area of ground	X
	Construction area	X
	Height of building	X
	Elevation above the sea level	X
	Listed status/level of protection	X
	Time of construction/ age of building	
	Number of households	
	Number of rooms in a dwelling	X
	Number of inhabitants per dwelling	X
	Number of floors	X
	Construction material	X
	Physical condition	X
	Facility condition	
	Architectural style	
	Characteristics of windows, doors	
Functional	Building functions per floors	X
Social	Nationality	
	Education	
	Employment	
	Income	
	Size of the household	
	Ownership	
	Occupancy	
	Period of residence	
	Preferences of people for the future	
	Opinions of people about urban conservation	
Economic	Value of land	
	Value of parcel	
	Value of building	