IMPACTS OF PLANNING DECISIONS IN AN EARTHQUAKE VULNERABLE CITY:THE CASE OF ADAPAZARI

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

FİKRET BAYHAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
CITY PLANNING
IN
CITY AND REGIONAL PLANNING

JUNE 2010

Approval of the thesis:

IMPACTS OF PLANNING DECISIONS IN AN EARTHQUAKE VULNERABLE CITY:THE CASE OF ADAPAZARI

Submitted by **FİKRET BAYHAN** in partial fulfillment of the requirements for the degree of **Master of Science in City and Regional Planning Department**, **Middle East Technical University** by,

Prof. Dr. Canan ÖZGEN
Dean, Graduate School of **Natural Applied Sciences** _____

Prof. Dr. Melih ERSOY
Head of Department, **City and Regional Planning** _____

Prof. Dr. Melih ERSOY
Supervisor , **City and Regional Planning Dept. METU** _____

Examining Committee Members

Assoc. Prof. Dr. Çağatay Keskinok
City and Regional Planning Dept. METU _____

Prof. Dr. Melih Ersoy
City and Regional Planning Dept. METU _____

Prof. Dr. Murat Balamir
City and Regional Planning Dept. METU _____

Assoc. Prof. Dr. Özcan Altaban
City and Regional Planning Dept. METU _____

Assoc. Prof. Dr. Tarık Şengül
Political Science and Public Administration Dept. METU _____

Date: 07.06.2010

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: Fikret BAYHAN

Signature :

ABSTRACT

IMPACTS OF PLANNING DECISIONS IN AN EARTHQUAKE VULNERABLE CITY:THE CASE OF ADAPAZARI

Bayhan, Fikret

M.S., in City Planning, Department of City and Regional Planning

Supervisor: Prof. Dr. Melih Ersoy

June 2010, 214 pages

Much emphasis has been given to the damages and loss experienced in the 1999 earthquakes with little research however on the social and administrative causes, and in particular on the consequences of malpractice of planning previous to the natural hazard. Reviewing the case of Adapazarı, the three succesive periods of plan making and implementation are critically investigated here to establish the extent that planning decisions of the local authorities and their modes of enforcement have generated adverse results causing the loss of many Lifes.

The analysis required the combination of data sources on plan decisions and the consequences of the disaster, accommodated in the different authorities. Surveying the scope and decisions of 1957-70, 1970-85, and 1985-99 plan periods, and comparing these decisions in their spatial context with the loss and damage experienced, provides sufficent evidence of the causality. It is possible to identify that decisions of increased densities and building higher, changes to commercial uses in the CBD, siting of individual buildings, removal of open spaces all had their share in contributing the dramatic panaroma of losses.

Findings indicate strong correlations of loss of life with increased number of floors in buildings in the 27 districts of Adapazarı. It is particularly evident that greatest damages occured due to the 1985 plan decisions, when all powers of comprehensive plan-making were transferred to the local authorities, central authority control powers being removed.

So long as local interests can not be curbed in plan preparation avoiding control with reference to the criteria of 'public benefit', many other cities in Turkey are likely to have similar fate in the near future.

Keywords: Earthquake of 17 August 1999, Plan Decisions, Local Administration, Plan Management, Plan Revision

ÖZ

BİR DEPREM KENTİNDE VERİLEN PLAN KARARLARININ ŞEHİR ÜZERİNE ETKİLERİ: ADAPAZARI ÖRNEĞİ

Bayhan, Fikret
Yüksek Lisans, Şehir ve Bölge Planlama Bölümü
Tez Yöneticisi: Prof. Dr. Melih Ersoy

Haziran 2010, 214 sayfa

1999 depremlerinde yaşanan hasar ve kayıplar üzerinde daha çok durulurken, sosyal ve idari nedenler ve özellikle de doğal afet öncesindeki yanlış planlama uygulamalarının sonuçları üzerine çok az araştırma yapılmıştır. Adapazarı vakasını inceleyerek, yerel kurumların planlama kararları ve bu kararların uygulanma biçimlerinin pek çok kişinin hayatına mal olan olumsuz sonuçlara ne ölçüde yol açtığını belirlemek için, burada, birbirini izleyen üç plan yapım ve uygulama dönemi ciddi biçimde araştırılmıştır.

İnceleme, farklı kurumlarca düzenlenen, plan kararları ve felaketin sonuçları hakkındaki veri kaynaklarının birleştirilmesini gerektirmiştir.1957-70, 1970-85 ve 1985-99 plan dönemleri, kararlarının araştırılması ve bu kararların mekansal bağlamda yaşanan kayıp ve hasar ile karşılaştırılması, yeterli nedensellik kanıtı sağlamaktadır. Artan yoğunluk ve kat yükseltme kararlarının, Merkezi İş Alanlarında ticari kullanımlara dönüşmenin, müstakil binaların dönüşümünün, açık alanların kaldırılmasının, can ve fiziksel kayıpların dramatik panoramasına katkıda paya sahip olduğunu tespit etmek mümkündür.

Bulgular, Adapazarı'nın 27 mahallesindeki binalarda artan kat sayısı ile can kaybı arasında güçlü ilişkiler göstermektedir. En büyük hasarların, kapsamlı plan yapımına dair tüm yetkilerin yerel makamlara devredilerek merkezi otoritenin kontrol yetkilerinin kaldırıldığı 1985 plan kararları nedeniyle meydana geldiği de özellikle açıktır.

Yerel menfaatlerin, 'kamu çıkarı' kriterine ilişkin kontrolü önleyerek plan hazırlaması kısıtlanmadığı için, Türkiye'deki diğer pek çok şehrin de yakın gelecekte benzer kaderi paylaşması olasıdır.

Keywords: 17 Ağustos 1999 Depremi, Plan Kararları, Yerel Yönetim, Plan Yönetimi, Plan Tadilatı

to my mother

ACKNOWLEDGMENTS

I thank for the assistance and help of Prof. Dr. Melih ERSOY, Assoc. Prof. Dr. Özcan ALTABAN, Assoc. Prof. Dr. Çağatay KESKİNOK, Assoc. Prof. Dr. Tarık ŞENGÜL during this study. Moreover, I thank to all the members of tecnicians and engineers in the team who was in company with me while i was working at Adapazarı Metropolitan Municipality and Maltepe planning group. I also thank to Civil Engineer Serhat KAYA who is employee at Sakarya Metropolitan Municipality and Cartography Engineer Çağlar KOTAOĞLU for their supports.

I thank to Süheyla BAYHAN, my wife, Kerem BAYHAN, my son and Filiz BAYHAN my sister for their supports during my thesis study.

I thank to all instructors who are the source of my knowledge, starting from METU between the years of 1981-1986, who enable me to work for the city of Sakarya starting from 1996 and in the period of my experience of planning and disaster relation starting from 17 August 1999 Earthquake till 2010, and I especially thank to Prof. Dr. Murat BALAMİR - because of his patient support, assistance and contribution - from whom I got my undergraduate diploma, acquire planning conscious and ability in the university, and who enable me to use these knowledge in an earthquake zone.

I dedicate this thesis to Münevver BAYHAN, my mother, who was in intensive care during my thesis studies when i was tiding between hospital and computer for 4 months, and who lost her life in 1 May 2010, after her struggle with life.

I thank to God, who gave the chance to work in Sakarya Metropolitan Municipality after 17 August 1999 Earthquake.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF MAP

MAPS

LIST OF PICTURES

PICTURES

LIST OF ABBREVIATIONS

ADASU	Adapazari Water And Sewage Administration
ADPC	Asian Disaster Preparedness Center
CBD	Central Business District
DPT	T.R. Prime Minestry State Planning Organization
DİE	Turkish Statistical İnstitue
FAR	Floor Area Ratio
GAP	Southeastern Anatolia Project Regional Development Administration
GS	Governership of Sakarya
GIS	Geographical İnformation Systems
GNP	Gross National Product
ISDR	International Strategy for Disaster Reduction
ITU	Istanbul Technical University
JICA	Japan International Cooperation Agency
KAF	North Anatolian Fault Line
NGO	Non-governmental organization
MPWS	Ministry of Public Works and Settlement
METU	Middle East Technical University
MTA	General Directorate of Mineral Research and Exploration
OECD	The Organisation for Economic Co-operation and Development
SMM	Sakarya Metropolitan Municipality
SATSO	The Sakarya Chamber of Commerce and Industry
TDV	Turkish Earthquake Foundation
TUSIAD	Turkish Industrialists and Bussinnesmans Association
TÜBİTAK	The Scientific and Technological Research Council of Turkey
SE	District of Semerciler
CU	Cumhuriyet
TI	Tığcılar
PA	Papucçullar
YND	Yenidoğan

YNC	Yenicami
YNG	Yenigün
ÇU	Çukurahmediye
AK	Akıncılar
YA	Yahyalar
OR	Orta
KU	Kurtuluş
İS	İstiklal
KA	Karaosman
ŞE	Şeker
OZ	Ozanlar
SA	Sakarya
TE	Tekeler
TU	Tuzla
YAG	Yağcılar
TEP	Tepekum
MİT	Mithatpaşa
GÜ	Güllük
Şİ	Şirinevler
HI	Hızırtepe
MA	Maltepe
BE	Beşköprü

CHAPTER 1

INTRODUCTION

1.1. Purpose of Research

Adapazarı was the focal settlement where greatest damage and loss of life occured during the 1999 earthquakes. Most of the explanations of this grave result pointed to the nature of geological features where the city is located. The fact that the local substrata consisted of alluvial deposits subject to liquefaction even at low levels of disturbance was familiar to the authorities, and technical and political staff responsible in the administration of the city. Yet the particular knowledge did not give rise to the curbing of development in any manner, and the devising of development criteria and/or sufficiently prudent planning principles.

One after the other, preparation of development plans for the city, from 1957 to 1999 seem to have ignored the natural conditions and the threat in any serious capacity. The three sets of consequtive plans in their allocation of land uses, provision of densities, open spaces, distancing of buildings, and number of storeys for buildings seem not to have taken into consideration the bare fact of a potential earthquake. Following planning decisions, permissions given for the construction of buildings, which in the process, seldomly comply with the planning decisions and/or the constraints of the permission did not experience any technical supervision, although this was one of the basic functions and the legal responsibility of local authorities.

Safety in the city was not a concern in the preparation of plans, nor in their enforcement and supervision of construction. Changes in land uses and structural properties of the buildings has been common practice after the permissions for construction, to escape any form of planning control.

The analysis of the cumulative consequences of planning decisions and their mode of implementation could be surveyed so as to clarify the level such formal activity did decisively contribute to the calamity. Spatial decisions for initial boundaries of development, open spaces, building density designations, and the following relaxations of constraints on such decisions with following planning revisions must be scrutinized to explore what ensued as a result in 1999. A direct method of evaluating such contribution is therefore to follow the consequences of planning decisions to 1999, and correlate losses with planning decisions of all plans in sequence in the spatial context. A more ambitious form of analyses could have been the comparison of what has been lost in the earthquakes in value terms, with those of gains to various parties due to the inappropriate decisions of plans and their revisions.

Development plans in general are means not only physically to shape the cities, but they are also mechanisms by wich immense property values are generated and distributed. The earliest plan after its preparation and approval became effective in 1957. This plan experienced in its own 701 revisions until the preparation of the 1985 plan. Almost all of such revisions are related to reduction of open spaces, increases in densities and number of floors, mostly for buildings located in the central districts of the city.

Although much has been learned after the 1999 earthquakes, and many provisions were introduced both at the local and central levels concerning buildings, retrofitting of existing structures, communications systems, search and rescue operations, etc., it is significant that no measures took place related to the preparation of plans. This is an immense gap since any plan is to determine the fate of thousands of buildings and people with a single decision of land allocation and/or density designation. This is an immense gap again since most of the other measures taken to reduce risks since 1999 are undermined with the absence of a more prudent planning system. Problems particularly related to risks of disasters in the context of urban development plans are:

Absence of disaster mitigation plans at the national and local levels

- Absence of regional plans
- Deficiencies in the regulations concerning preparation of plans
- Deficiencies in the supervision of plan preparation in content and procedures
- Deficiencies in the supervision of plan enforcement
- Nonexistence of individual rights of control

It is a dissapointing observation that mistakes made prior to 1999 are obstinately prevailing in the current circumstances. Other than the renewed efforts of geological surveying and documentation, almost all concern and activities did focus on issues of building design, supervision of construction, retrofitting of individual buildings, and the introduction of an insurance system regarding buildings. Yet no action has been taken to upgrade the planning system in its content and procedures to maintain higher standards of safety in cities.

Despite the extensive research and numerous formal proposals and draftsto renew the planning law (3194) during the past decade, no action has taken place as if the planning system had nothing to contribute to the safety standards of settlements. The purpose here is therefore to provide evidence that the planning system did have significant impact on the disaster losses.

1.2. Method and Scope of Research

The purpose of identifying impacts of planning decisions in the 1999 earthquake losses required the compilation of considerable volumes of data, and the processing of related information for compatibility. This work covered the surveying of the archives of the Adapazarı Municipality, the local Governorate Public Works Department, as well as the Population Department, reciprocally for development plans, building damages and loss of life. Access to these sources has been possible for this research owing to the official status of the author as the Deputy Mayor.

On the one hand, city development plans for 1958 (comprising 61 sheets of formal maps) and 1985 (comprising 91 sheets of formal maps) have been scanned and transferred into the GIS environment, ready for use in vectoral form for various analyses. This covered 27 districts (mahalle) of Adapazarı and 2200 hectares of land area. Plan revisions for which documents were accessible have also been scanned and transformed into digital media. These covered 701 individual plan revision decisions out of a total of 950.

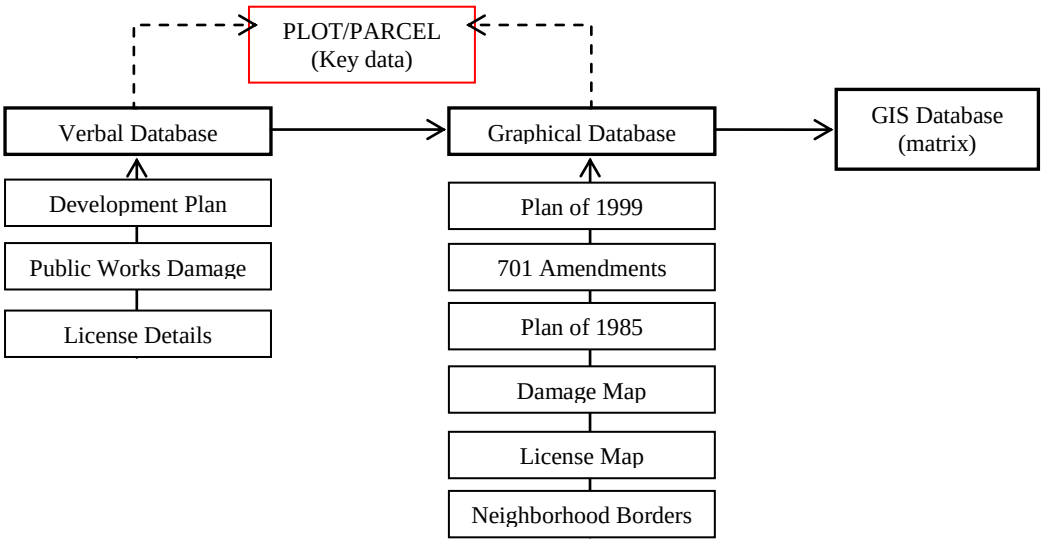


Figure 1.1 Data bases uses in the GIS (Geographical Information Systems)

On the other hand, information concerning damages and losses of life had to be obtained, made compatible, and recorded on the cadastral reference system for spatial analyses. This meant the editing of 12500 lines of reports leading to the synchronization of information for 3733 buildings with the GIS framework, coupling the postal addresses of buildings with the block-parcel references of the cadastral system. All of the information about losses, could then be related to the 701 plan revisions experienced. This is an ever first achievement of its kind in this country.

This procedure enabled the comparison of the 1958 and 1985 development plans and the cumulative 950 plan revisions describing the 1999 pre-earthquake state of the city with the damages and loss of life experienced post-earthquake in the spatial context. The digital base-map contained information to cover district (mahalle) boundaries, blocks-parcels identities, cadastral status, and street names.

The basic argument of the research could be stated as:
“In their formal status, the master plans of cities that determine where and according to what constraints the buildings are to be developed are only equal to laws and as such could be held liable for generating risks and for most of the damages and loss of life realized”.

This argument and the data obtained provide the basis upon which assessments of development plans could be carried out in terms of damaged buildings and loss of lives in a

spatial context for the first time. All previous assessments of similar nature were made on the basis of individual dwelling units rather than building units. The current research however, enable analyses of impacts of the natural hazard with reference to buildings in their immediate context, their locations and characteristics, and thereby provide a capacity to evaluate the dominant role that development plan decisions could have in the drama.

1.3. Purpose and Reason of the Study

After the earthquake of August 17th, 1999, the prevailing subject emphasized by the academic and governmental institutions have been in matters mostly concerning the construction sector like disaster risk management, building design, reinforcement of damaged structures, researches in earth sciences, foundation reinforcement, examination of construction earthquake regulations and etc. As if everybody has been waiting for the earthquake of August 17th, 1999 for making scientific research, lots of articles, books and statements were published, however, relation between the development plan decisions and the earthquake was expressed in narrower platforms than Building - Earthquake relation and although the development plan decisions were examined deeply, the voice couldn't be heard again.

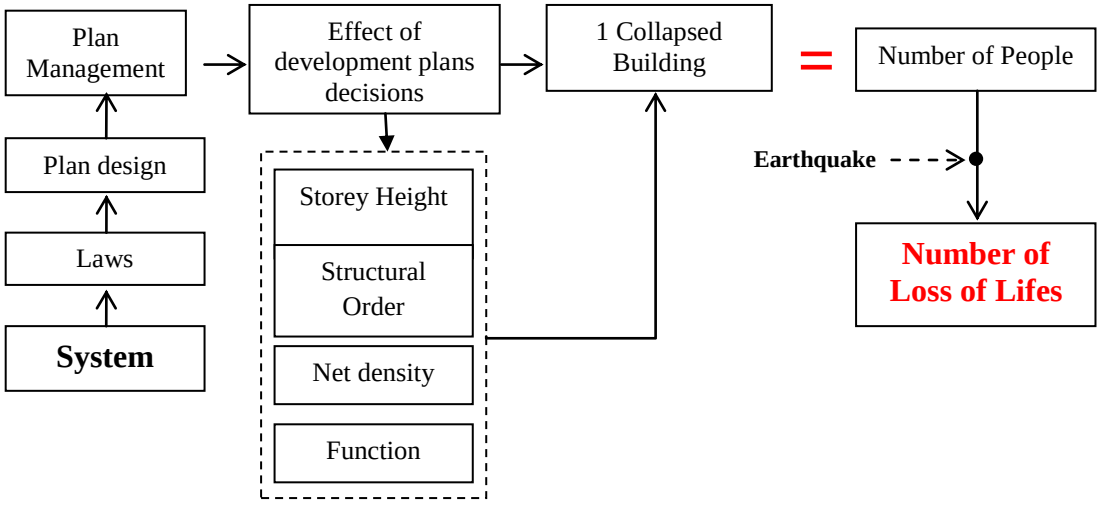


Figure 1.2 Testing Method Of The Planning Decisions

Whereas the earthquake building regulation, building auditing system relating to the structuring after the earthquake have been changes positively, no sufficient changes have

been made about the development plan which provides the formation of the building and decides about not only one building but thousands of structures and people.

And within this study, the importance of the development plan decisions increasing the damages given to city Adapazarı by the earthquake of August 17th, 1999 is emphasized. It will be mentioned that how the destruction and damage of high-rise buildings which are 4-5 storey formed as a consequence of plan decision before the earthquake of August 17th and the decrease in social reinforcement areas and especially green spaces although the urban density has increased through development plan and revisions again have increased the disaster damages in Adapazarı.

The most important purpose of this study is to emphasize that the primary reason of the effect of earthquake in August 17th, 1999 on the damage caused in Adapazarı is the development plan decisions and to provide digital data base - analyses that would prove this fact to be transferred to the future generations.

By analysing the plan changes made on development plan during the planning process and the plan management from 1957 to 1999, it is tried to determine the relation between the effects of the earthquake and the development plan decisions based on net digital details.

CHAPTER 2

NATURAL DISASTERS IN TURKEY

2.1. Earthquakes in Turkey

Turkey does not have sufficient and reliable records for most of its historical earthquakes. However, total losses of life in 6 destructive earthquakes that occurred between years 1168 and 1784 is approximately 82 000 (Kocyiğit, 1996).

Based on studies made about the earthquakes of Turkey, it is observed that at least one destructive earthquake occurs every year and 9-10 magnitude earthquakes occur quinquennially on average (Sengezer and Ozkahraman, 1996)

The countries such as Mexico, USA, China, Japan, Philippines, Indonesia, India, Pakistan, Iran, Greece and Italy have the same problem. However, studies carried out in USA, China, Japan and Italy among these countries have been successfully minimized the destructive effects of earthquakes. Considering their efforts in minimizing risks and restructuring their institutions, Turkey has major deficiencies in this respect. Generally, loss of life and degree of damage caused by the earthquakes depend on the following factors:

- Magnitude of earthquake
- Focal depth of earthquake
- Duration of earthquake
- Distance to epicenter
- Time of earthquake (night, daytime, holiday or working hours)
- Density of population
- Building technique, type and quality of the materials used
- Geology of earthquake areas

- Earthquake-awareness of the society in earthquake region
- Institutionalization and management in terms of earthquake (Sengezer and Ozkahraman, 1996)

Turkey is on the Mediterranean, Alp-Himalaya Seismic Belt, which is one of the most important seismic belts of the world. Due to its tectonic structure, the earthquakes causing loss of life and property occur frequently in our country (TDV, 1997). According to the statistics of the last two thousands years, Turkey is in the front rank of risk sequence in the world as a country where a destructive earthquake occur approximately 1,1 year. 96% of land surface of Turkey, and 95% of the population is threatened with the risk of earthquake. Our country was shaken with 54 destructive earthquakes between 1903 and 1990 (Saroglu, Emre and Kuscu, 1996).

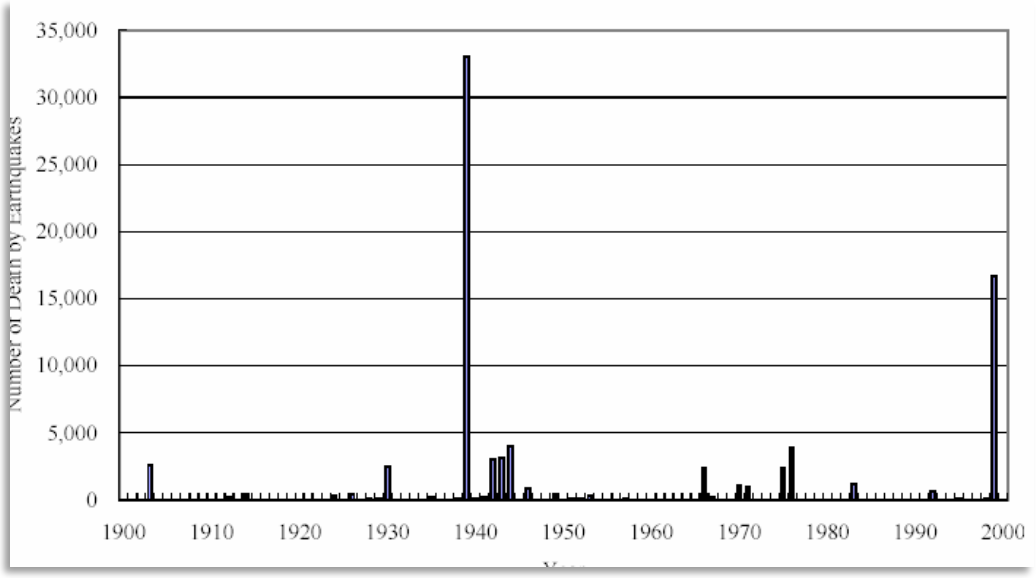


Figure 2.1 Number of death by earthquakes in last century in Turkey (IBB, 2003)

With respect to earthquake risks and possible level of destructions, most of the country is inevitably obliged to live with this natural hazard. It is observed that most of the earthquakes in Eastern Anatolia are destructive even though they occur less frequently (1939 Erzincan, 1966 Varto, 1971 Bingöl, 1976 Çaldıran, 1983 Narman-Horasan, 1992 Erzincan). Eastern Anatolia Region and its surroundings are within a belt surrounded by significant fault lines where very destructive earthquakes took place in the past, and where such activity is intensified today. The regions where segments of the Northern Anatolia Fault line are

contained (Eastern Marmara and Düzce Earthquakes 1999), Eastern Anatolia Fault and some other smaller scale faults are likely to generate further risks (Taymaz, 1996).
When rate of population changes in Turkey is examined, it is seen that the population in the regions under risk are increasing much rapidly. Population increase in Marmara and Aegean Regions is much greater than the other regions due to faster urbanization and industrialization. Losses of life and property caused by the earthquakes in these regions are gradually increasing every year (Ozmen, Nurlu and Guler, 1997). It can be said that more people become under the risks of earthquake with every day.

95% of Marmara and Aegean Region are in the 'First Degree Earthquake Area' and their densities of population are very high. Under the light of this data, it is seen that Marmara and Aegean Regions are the most risky regions in terms of earthquake. Eastern Anatolia Region has 1st and 2nd degree regions at most. However, as density of population in this region is very low, their risks become secondary. The region with lowest risk level is Southeastern Anatolia Region.

Table 2.1 Place, Survey and Population Density Of The Provinces Affected from Earthquake in The 'Map Of Earthquake Hazard Regions' (Ozmen, 2000).

Earthquake Areas (km)					Survey (km²)	Density of Population(km²)
Province	1. Degree	2. Degree	3. Degree	4. Degree		
Kocaeli	3 255	376	0	0	3 631	324
Sakarya	4 738	141	0	0	4 879	150
Yalova	828	0	0	0	828	198
Istanbul	965	2 193	1 630	565	5 353	1 718
Bolu	10 453	457	0	0	10 910	51
Bursa	8 011	2 884	0	0	10 895	180
Eskişehir	0	6 264	6 014	1 646	13 924	47
Zonguldak	1 876	1 428	0	0	3 304	185
Tekirdağ	1 171	1 723	2190	1 246	6 330	90
Total	31 297	15 466	9834	3 457	60 054	

When distribution of industrial facilities and hydro-electric dams within the earthquake regions in Turkey are considered, it is seen that 98,3% of the important industrial centers and 91,6% of the dams are resident in the first four earthquake areas (Celep, Kumbasar and 1193).

In the study of Turkey's Earthquake Areas executed by the Ministry of Public Works and Settlement in 1996 considering geological structure, tectonic situation and seismicity, Turkey is divided into 5 distinct areas in terms of seismic risk. Among these areas, 1., 2., 3. and 4. Degree Earthquake Regions are regarded as the most risky regions seismically. According to this study and the results of 1997 census, 96% of total survey of Turkey is in the risky region and 95% of the total population lives under the risk of earthquake. Most of the provinces having experienced losses of life and property in Eastern Marmara Earthquake of August 17, 1999 are within the 1st degree earthquake region as an earthquake and total 60 000 km.² area was affected from this earthquake (Ozmen, 2000) .

Table 2.2 Population, Numbers Of Dead And Injured People in The Provinces Affected from the 1999 Earthquake (MPWS, 2001)

Numbers of Dead and Injured People			
Province	Number of Dead People	Number of Injured People	Total
Kocaeli	9 476	19 447	28 923
Sakarya	3 890	7 284	11 174
Yalova	2 504	6 042	8 546
Istanbul	961	7 204	8 185
Bolu	271	1 165	1 436
Bursa	268	2 375	2 643
Eskişehir	86	375	461
Zonguldak	3	26	29
Tekirdağ		35	35
Total	17 479	43 953	61 432

2.2. Northern Anatolia Fault Line

Turkey experienced great earthquakes at every stage of its history which caused great losses and destructions. Due to its geographical and geological position, Turkey is located at the junction of major geological plates and therefore at a focal point of earthquakes. The shallow movements and structure of these plates inevitably generate seismic events of intensive nature and therefore, situations of increased destructiveness.

When the distribution on the world is examined, it is observed that 95% of the earthquakes are concentrated in two major belt systems. One of them is the Pacific Seismic Belt where 80% of the earthquakes occur, and the other is the Mediterranean-Alp-Himalaya Seismic Belt where 15% of the earthquakes occur.

Turkey takes place as a part of the Alp-Himalaya System extending from Mediterranean to Asia in the Mediterranean. Alp System is the result of compression forces owing to the movements of plates that tighten Europe and Asia and Himalaya System, and is the result of India-Asia collision (Hacettepe University, 1999).

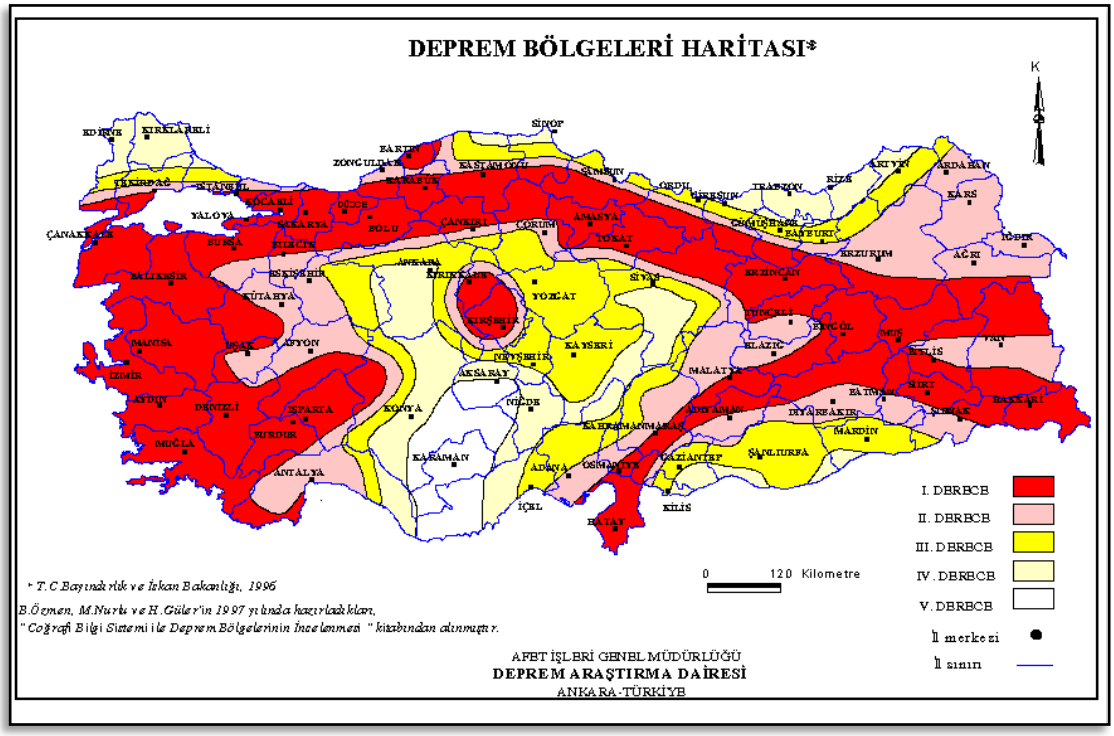
The earthquakes in Turkey within the Alp-Himalaya Seismic Belt are related to movement of the African-Arabian plates towards north-northeast, based on the spreading of Atlantic Ocean's middle part back towards two sides. Furthermore, due to the spreading of sea base continuing even today all along the long axis of Red Sea, the Arabian plate is pushed towards north and forced to dip into bottom at the periphery of the Eurasian plate. With this force, an intensified tightening effect occurs in Eastern Anatolia Region, remaining between the Arabian plate and the Eurasian plate. This tightening stimulates some major faults such as the Northern Anatolian Fault and the Eastern Anatolian Fault over millions of years. The main reason of the earthquakes experienced today is fundamentally due to this set of conditions.

The relative movement of the Arabian plate towards north, separate from the African plate caused shortening and contraction in the southern part of Eurasia plate and the development of the Eastern Anatolian plate. Shortening-contraction caused by this movement caused development of Anatolian plate by splitting off southern part of Eurasia plate all along the two big breaks which are the Northern Anatolian Fault Zone (KAFZ) and the Eastern

Anatolian Fault Zone (DAFZ). Anatolian plate has been continuing its movement towards southwest with a speed of 1-3 cm/year along KAFZ and DAFZ for approximately 4 million years (Map 2.1). Therefore, these two fault zones have played an important role up today as a seismic belt for many earthquakes that occurred in Turkey (Atabey, 2000).

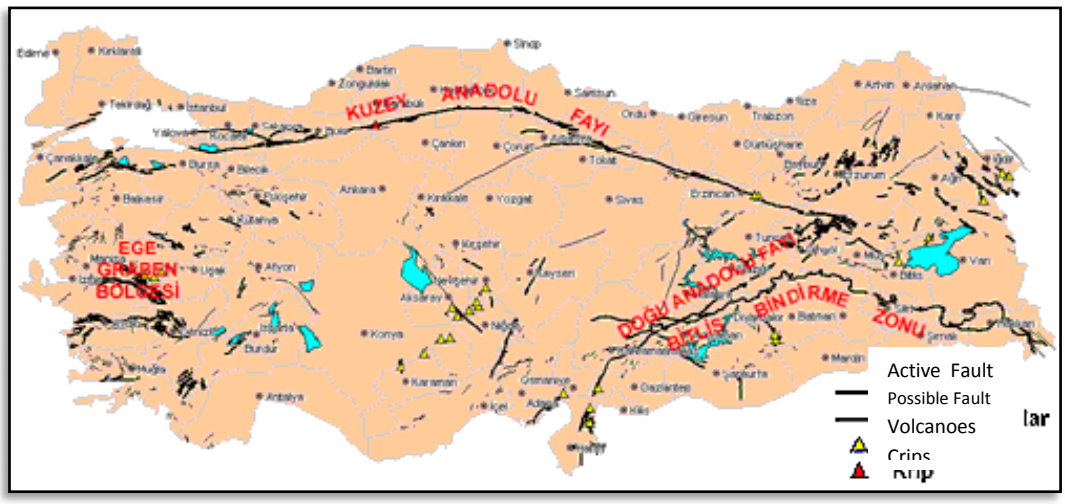
As Turkey is upon the Alpian-Himalayan Seismic Belt, which is one of the three big seismic belts of the world, and approximately 96% of the country is within the earthquake region, it is not surprising to observe that only during the last century, a total of 130 great (M > 5.0) earthquakes took place and approximately 100 000 people lost their lives. The material damage caused by these earthquakes is too great to state in figures.

Map 2.1 Mechanism Of Shift Of Anatolian Plate Towards West (Atabey, 2000)

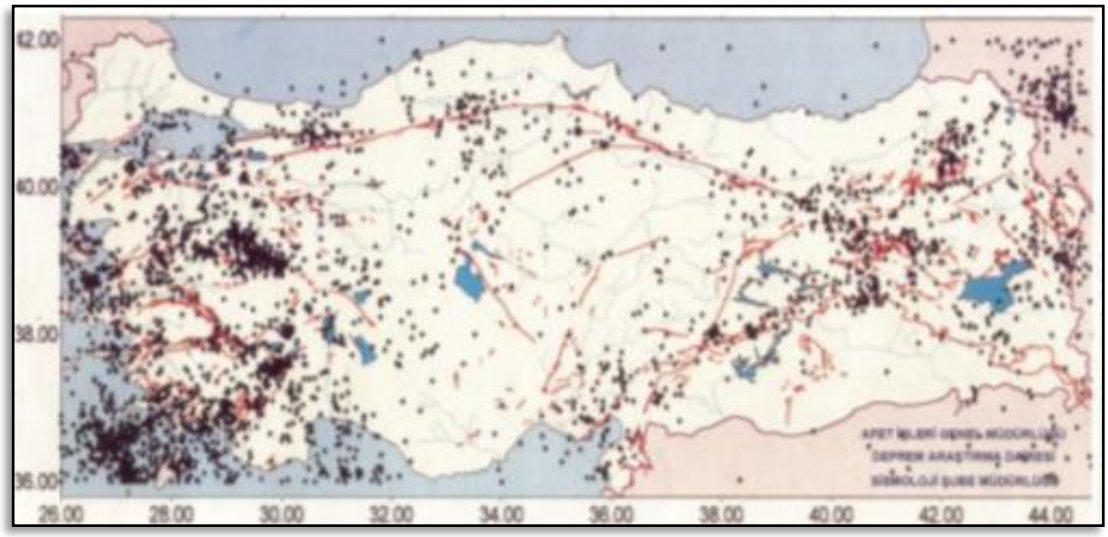


Map 2.2 Earthquake Hazard Regions of Turkey (Atabey, 2000)

Earthquakes occur in almost every part of Turkey. However, destructive earthquakes intensify in four notable regions. First of them is the Northern Anatolian Fault Zone where the biggest earthquakes happened in Turkey during the recent century. The second is the Eastern Anatolian Fault Zone which is as active as Northern Anatolian Fault Zone.



Map 2.3 Active Fault Lines of Turkey (MPWS, 2001)

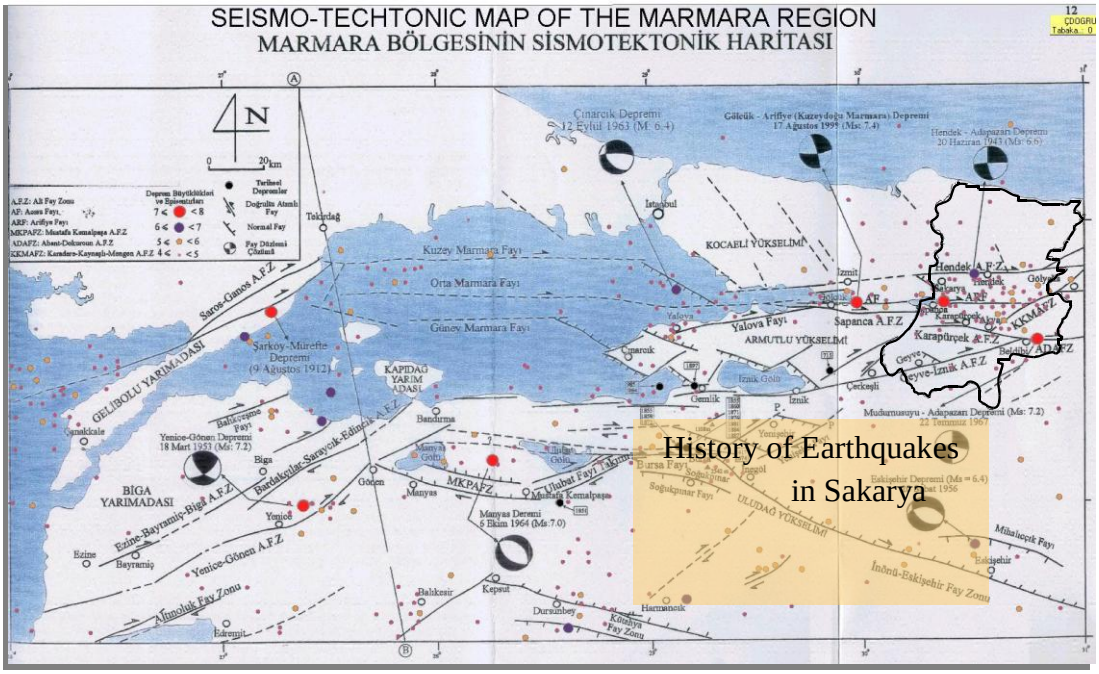


Map 2.4 Seismic Technical Map of Turkey (1900-1999 M≥4.0), (MPWS, 2001)

The third important earthquake area is the Western Anatolian (Aegean) Subsidence System and the fourth is the Hellenic-Cyprus Arch. Approximately 95% of the earthquakes in Turkey take place in these four regions (Map 2.3), (Hacettepe University, 1999).

Table 2.3 Population, Area and Power Central Distribution According to Earthquake Zoning Map (Kiper, 2002)

Earthquake zone	**Field (km^2)**	**%**	**Population in 1990**	**%**	**Number of power central**	**%**
1st degree earthquake zone	328.995	42	25.052.683	44	65	52
2nd degree earthquake zone	186.411	24	14.642.950	24	28	23
3rd degree earthquake zone	139.594	18	8.257.582	15	15	12
4th degree earthquake zone	97.894	12	7.534.083	13	14	11
5th degree earthquake zone	32.051	4	985.737	2	2	2
Total	784.985		56.473.035		124	



Map 2.5 Earthquakes in the Marmara Region (1900-1999 M≥4.0),
(MPWS, 2001).

Table 2.4 The biggest Earthquakes in last century in Turkey (Levy and Salvari, 2000)

Settlements	**Year**	**Magnitude**	**Causality**
Düzce	1999	7,2	860
İzmit	1999	7,4	18000
Adana-Ceyhan	1998	6,3	145
Erzincan	1992	6,3	486
Erzurum-Kars	1983	7,1	1300
Çaldıran	1976	7,9	4000
Lice	1975	6,8	2300
Bingöl	1971	6,8	755
Gediz	1970	7,4	1100
Adapazarı	1967	7,5	89
Pülümür	1967	6,0	97
Varto	1966	6,9	2500
Manyas	1964	6,6	23
Fethiye	1957	7,1	67
Abant	1957	7,1	25

Table 2.4 (cont)

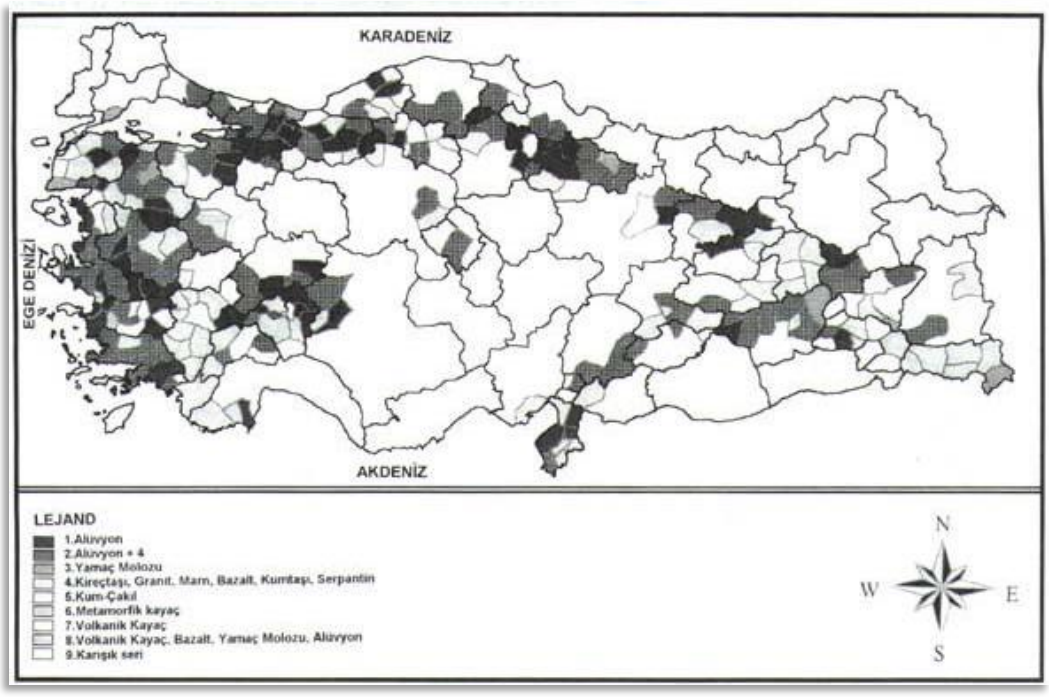
Gönen	1953	7,2	1200
Karlıova	1949	6,7	450
Varto	1946	6,0	839
Gerede	1944	7,4	3959
Niksar	1942	7,3	3000
Erzincan	1939	7,9	30000
Sivas	1929	6,5	64

There are many active fault lines in Turkey. There are also many inactive volcanoes within the same region (Map 2.4). The epicenters intensify especially on Northern Anatolia Fault Zone, Western Anatolia System and partially on Eastern Anatolia Fault Zone (Map 2.5, 2.6). Northern Anatolian Fault Line extends as a curve in the direction of east-west between Karlıova in east and Mudurnu Valley in west. Length of the Northern Anatolian Fault Zone among the most active and important fault lines of the world is approximately 1 200 km. And its width is between 100 m. and 10 km. (MPWS, 2001).

2.3. Damages Caused by Earthquakes in Turkey

Although Turkey is on a significant seismic belt and a big, destructive earthquake occurs once every 30 years, the necessary actions are still not taken. The mutual reasons of destruction and damages caused by the earthquakes in Turkey can be summarized as follows:

1. The common feature of the residential areas experiencing damages is that they are located on weak alluvial grounds where water tray is shallow. In such environments, earthquake waves are magnified by the ground and cast to the buildings in such locations. Furthermore, owing to the attributes of the ground negative impacts such as liquefaction, lateral spreading are developed. Therefore, one of the most important factors in causing damages is settlement to disregard geological features and ground conditions,



Map 2.6 Ground Types of Settlements at the First and Second Earthquake Zone (Sengezer, 1999)

2. Allowing building construction directly on or in the close vicinity of faults, or all along the belts including these faults without considering geological structure is another major disregard of hazards. In other words, ignoring facts concerning the positions of active faults, as the source of the earthquakes and refrain from necessary measures is a major factor that contribute to increases in destruction and damages caused by earthquakes,

3. The use of low quality and sub-standard building materials (sea sand, low quality cement) and inferior workmanship (as in the production of steel frames),

4. Disregard for the appropriate design of foundation types according to ground type and ground attributes in regions prone to earthquakes,

5. Non-conformity to the principles in the design of the structural system of buildings and non-compliance to building regulations,

6. Allowing the design of soft floors, or later in the use of buildings by removing some columns in to expand spaces used particularly on the ground floors of the buildings.

As is understood from these tendencies mentioned, in addition to the hazards like earthquakes or geological based disasters caused by the forces of nature, behavior without taking such forces into consideration increases the risks to greater levels (Atabey, 2000).

Since 1900, approximately 500 000 buildings have collapsed in the earthquakes in Turkey, the impacts of which extend to great impacts on economy of the country (Kesici, 2004).

The earthquake occurred on August 17, 1999 Kocaeli, Istanbul, Duzce, Yalova, Sakarya, Bolu, Eskisehir, and the most affected place was Adapazari, the center of the province of Sakarya. According to data from the Ministry of Public Works seven provinces affected by the earthquake were destroyed in the earthquake rubble of buildings that are set out half of Adapazari. In addition; the most important problem was not only destruction but also unavailable sewage system and infrastructure system. As known, infrastructure is lifeblood of a city. life at Adapazarı was effected very badly while the infrastructure was out of order. In the period of 5 years between 1999-2004 the construction of the city was go on other side at the same time life too. In that period social and economical development were affected negatively. the urban economy has come to a standstill as a result of Infrastructure work , urban health was also at risk.

As a result, according to DPT, the August 17 earthquake costed the total economic loss of 13-15 billion dollar in whole earthquake area. The damage in Adapazari 3 billion dollars respectively. In other word, %20 of total economic cost had experienced in Adapazarı. GNP per capita was $ 2,700 in Sakarya, $ 7,845 in Kocaeli , $ 4,966 in Yalova. So that victims of Sakarya earthquake have been affected more than the level of economic prosperity.

Adapazari earthquake has given the city center, next to the building demolition, the impact of earthquakes with a period of five years, the city's morale, the economy will affect thesize of the wounds was higher than in the other provinces.

CHAPTER 3

EARTHQUAKES IN ADAPAZARI AND EFFECTS OF THE EARTHQUAKE DATED AUGUST 17, 1999

Four major earthquakes caused great losses of life and property in recent decades in the city of Adapazarı. This was not surprising, as the city is located at the zone of highest probability of seismic hazards as indicated in the official map of hazard zones of Turkey.

Sakarya Province with Adapazarı as the provincial centre is within the 1st degree seismic belt in the map of Turkey's earthquake areas of the Ministry of Public Works and Settlement. It is known that the earthquakes in this area, between 39-41 degree north latitudes are particularly frequent and damaging. Approximately 200 earthquakes occurred in the magnitudes of 4 and more according to Richter scale between 1900 and 1999 (Eastern Marmara Earthquake dated August 17, 1999 and Düzce Earthquake dated November 12, 1999) excluding the shakings following the main quake.

Table 3.1. Great Earthquakes Affecting Adapazari in the Recent Century

	Earthquake	Magnitude	Distance to Earthquake Center (km)	Loss of life
1	1943 Hendek	Ms : 6.6	35	336
2	1957 Bolu – Abant	Ms : 7.1	70	52
3	1967 Adapazarı	Ms : 7.2	30	89
4	17 August 1999 Marmara	M_W : 7.4	40	17480
5	12 November 1999 Düzce	M_W: 7.2	55	763

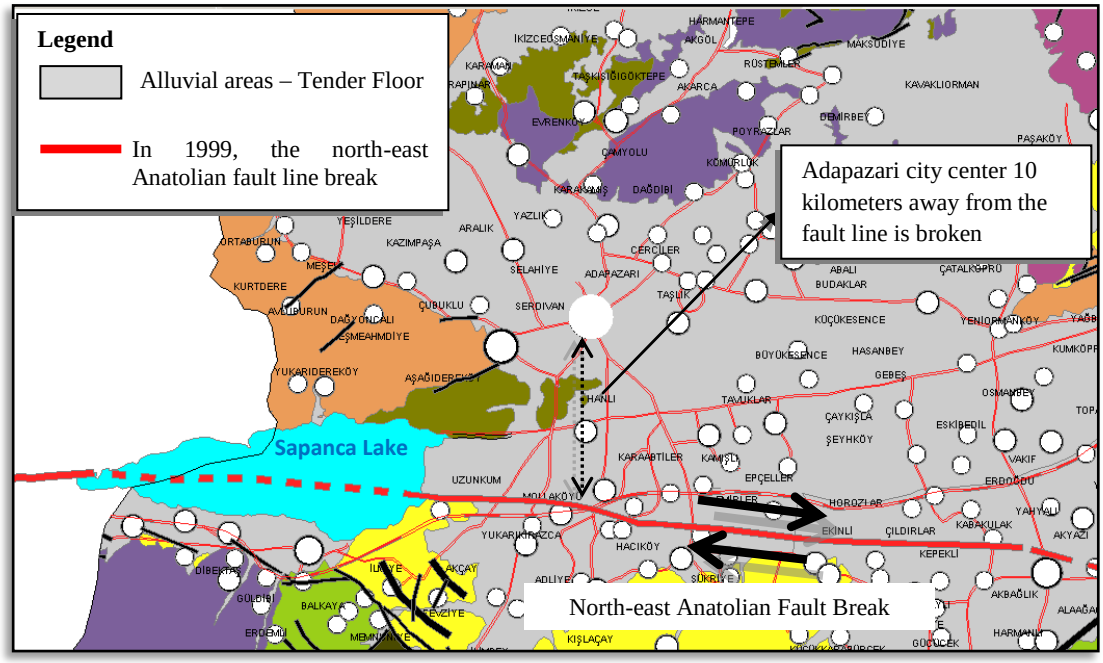
The city of Adapazarı, the most populated provincial center of Sakarya has experienced the greatest loss of life and property only next to the city of İzmit in Eastern Marmara Earthquake dated August 17, 1999.

Table 3.2. The Population of the that Earthquake-Affected Provinces,

Number of dead and wounded				Population (1997)			GDP per capita
City	Loss Of Lifes	The number of wounded	Total	Urban	Rural	Total	$
Kocaeli	9476	19447	28923	629333	548046	1177379	7845
Sakarya	3890	7284	11174	331431	400369	731800	2734
Yalova	2504	6042	8546	110106	53810	163916	4966
İstanbul	981	7204	8185	8506026	692783	9198809	4728
Bolu	271	1165	1436	265052	287970	553022	3104
Bursa	268	2375	2643	1484838	473691	1958529	3434
Total	**17479**	**43953**	**61432**	**12443493**	**3180923**	**15624416**	

This earthquake occurred on the northern arm of the Northern Anatolian Fault, and was caused by the breaking of part of this fault along its length of nearly 120 km between Gölyaka (Bolu) and Yalova Table 3.2. (Sunbul, Dagdeviren, Gunduz And Arman, 2004). Table 3.2.

When distribution of the damage caused by 17 August 1999 Marmara Earthquake within the center of Adapazarı is examined, it is seen that the damages in the region upon young alluvium is more than the damages in the higher or elevated parts of the city. When general ground features of the city center is considered, it is seen that 90% of the examined area is located on alluvial substrata. The sections where rocky grounds come out to the surface of the alluvium are the higher parts of the city, namely the districts of Beşköprü, Maltepe and Hızırtepe all located at the southwest part of the planned areas. As residential buildings take place upon the lower parts of the city on the young alluvial ground, damages and losses experienced here were more intense.



Map 3.1 Adapazarı Geology Map And Fault Line Breaking In August 17, 1999 (MTA, 2000)

3.1. Effects of the Earthquake of 17 August 1999 in Adapazarı

3.1.1. Effects on Building Stock

In 1999, Adapazari, a rapidly developing city in the Marmara region was in view. Toyota begun produce in Sakarya. Sakarya University with growing number of students won the city's economy dynamics. Developments in the economic sense and also, possibility of becoming Sakarya Metropolitan Municipality in the future period. All these positive view, August 17, 1999 hour 03:02 in a moment was lost. Thousands of buildings were destroyed in a moment of lost human lives. Every things in the city and life has changed in 45 seconds.

When the provinces exposed to damages are examined, of the total 244’383 building damages, 72’313 (29.6%) occurred in Kocaeli, and 57’661 (23.6%) in Sakarya (Table 3.2). When the damages in Sakarya Province are examined, it is observed that 65.8% of the residential buildings safely got through the earthquake without any damage and 34.2% were subject to damages in different degrees. Distribution of damaged houses and business premises according to the types of damage is given in Figure 3.3.

Table 3.3 Damages for Sakarya Province (Ozmen, 2000)

	Significant Damage	**Moderate Damage**	**Low Damage**	**Without Damage**	**Total**
House	19043	12200	18712	96262	146217
Business Place	4068	1963	1675	-	-
Total	**23111**	**14163**	**20387**	-	-

As it is the central city of the Sakarya Province, destructions in Adapazarı have a special significance. According to the values given on the basis of province, the most loss of life and property in percentage is observed in the districts connected to the city center. (Ozmen, 2000)

Findings of the survey and assessments of damages carried out for the Sakarya Province, and the 27 central districts within the boundaries of City of Greater Adapazarı, building damages can be expressed as given in Figure 5. 2. (GS,2000)

Picture 3.1 Building Stock is Before The Earthquake

Picture 3.2 Building Stock is Before The Earthquake

Picture 3.3 Building Stock in Sakarya and Adnan Menderes Streets Before the Earthquake

Picture 3.4 Building Stock in Milli Egemenlik And A.Yesevi Streets Before The Earthquake

3.1.2. Comparison Of Buildings Collapsed In 1999 Within The Total Building Stock (Adapazarı city center)

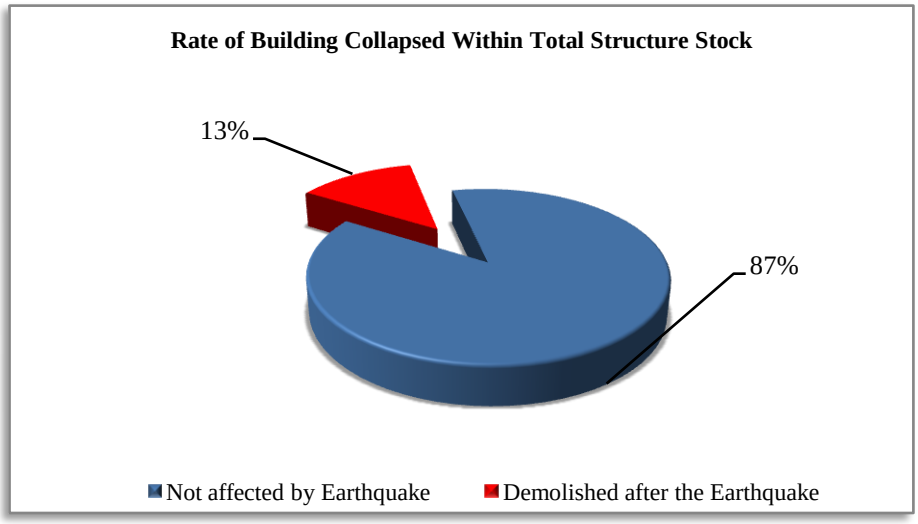
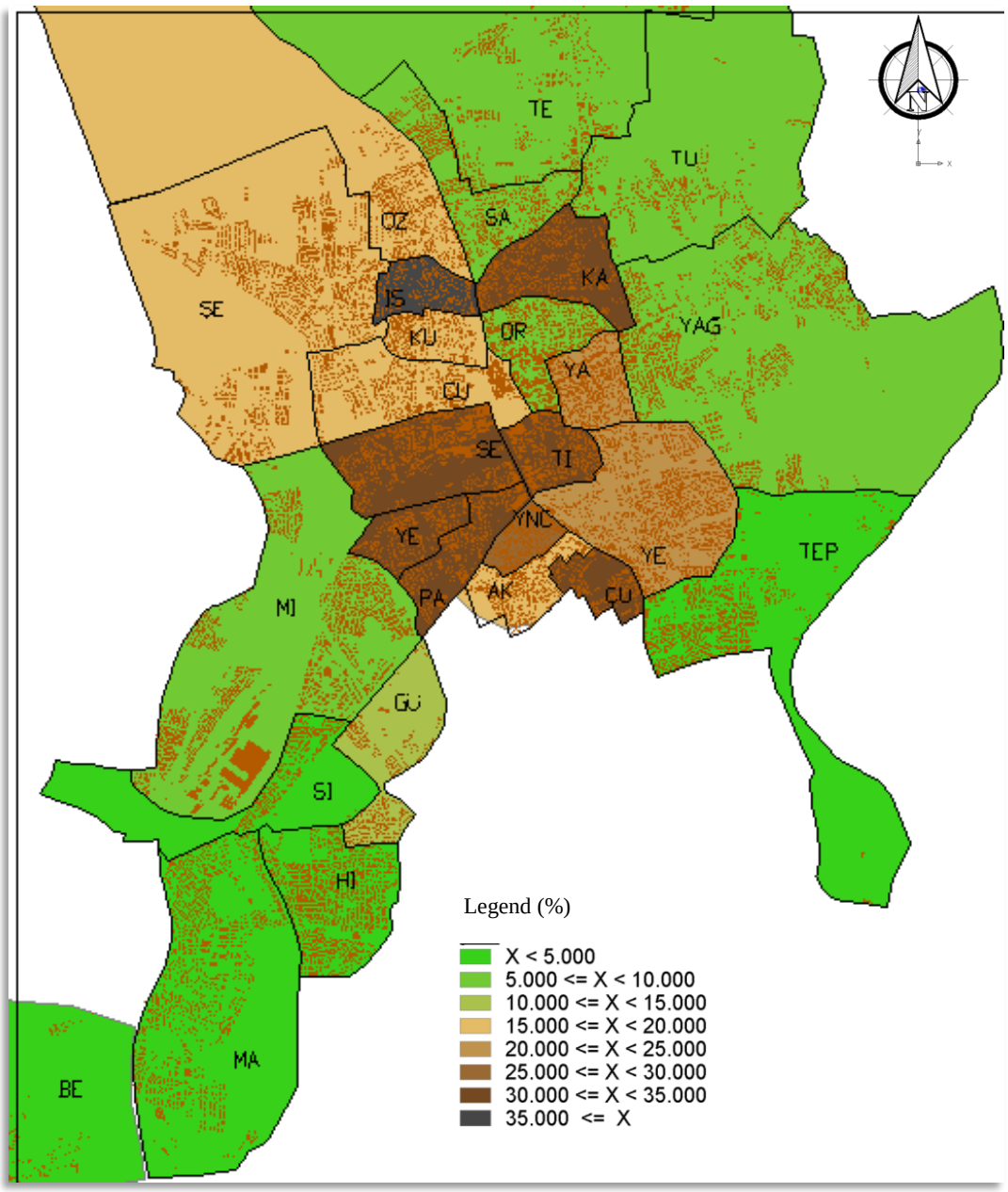


Figure 3.1 Rate of Building Collapsed Within Total Structure Stock

According to the results of research involving 27 districts of Adapazarı, it is observed that most of the housing stock collapsed is located at the center of Adapazarı (Figure 3.1). When the collapsed building stock is examined according to districts, it can be stated that the districts of Yenigun, Semerciler, Pabuccular, Tıgcılar as districts close to the urban center had the greatest rate of loss. Nevertheless, as it is observed that the loss of Lifes is high in these districts in a similar way, there is a significant decrease in the districts distant to the center like Tıgcılar and Yenicami. Furthermore, in the districts like Yagcılar and Mithatpasa, although the number of buildings collapsed is high, loss of lives is relatively lower than the districts at the urban center because of lower densities and due to buildings with lower number of storeys.



Map 3.2 Comparison of Building Stock Before and After The Earthquake

3.1.3. Comparison Of Total Independent Residential And Commercial Units Collapsed In The 1999 Adapazarı Earthquake

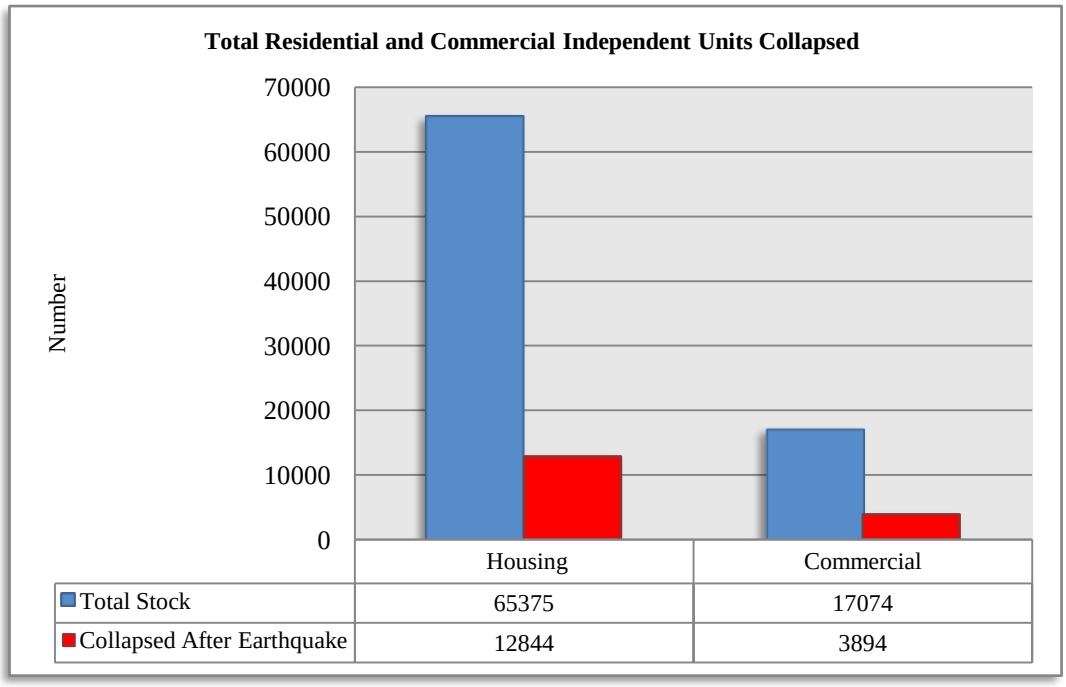


Figure 3.2 Total Residential and Commercial Independent Units Collapsed

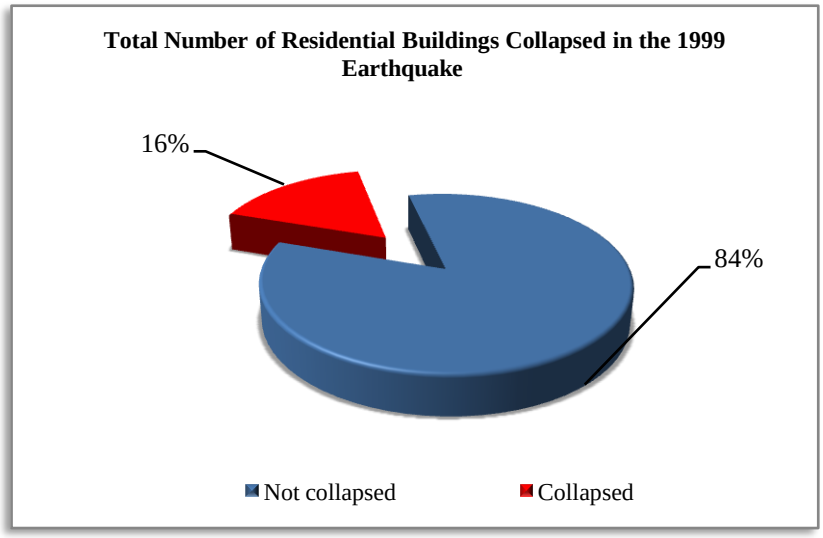


Figure 3.3 Total Number of Residential Buildings Collapsed in the 1999 Earthquake

Comparison of Figures 3.1. and 3.4. indicates that vulnerabilities in the housing stock is greater than the other buildings in the town.

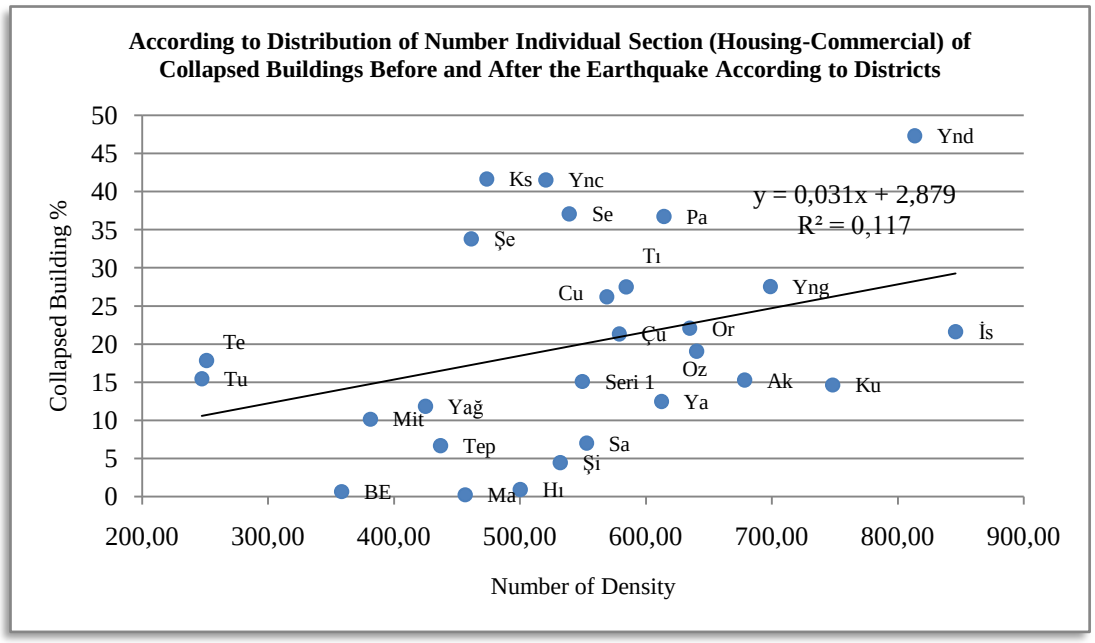


Figure 3.4 According to Distribution of Number Individual Section (Housing-Commercial) of Collapsed Buildings Before and After the Earthquake According to Districts

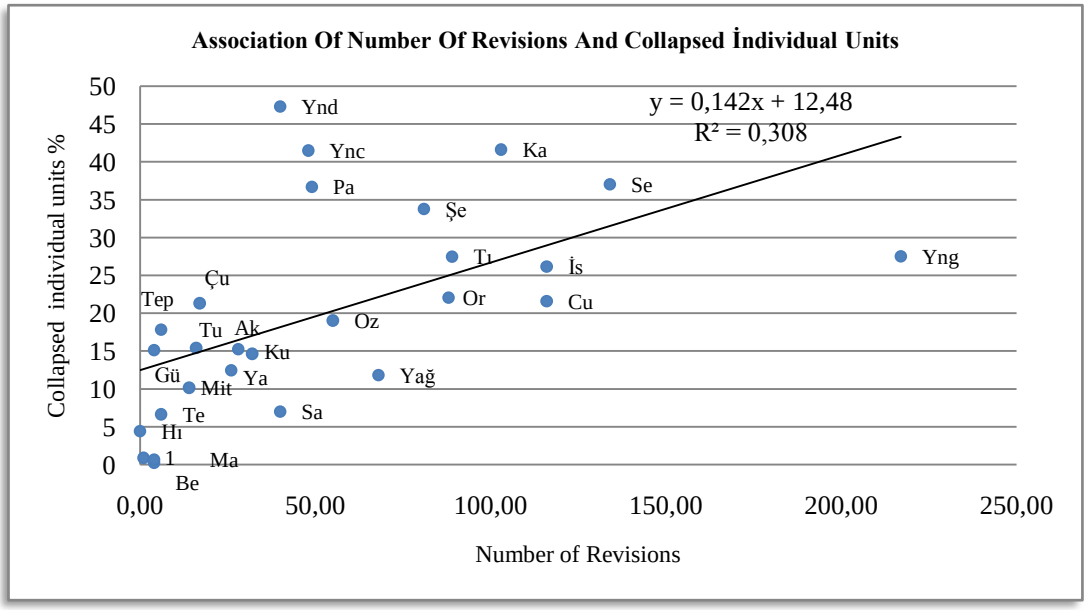
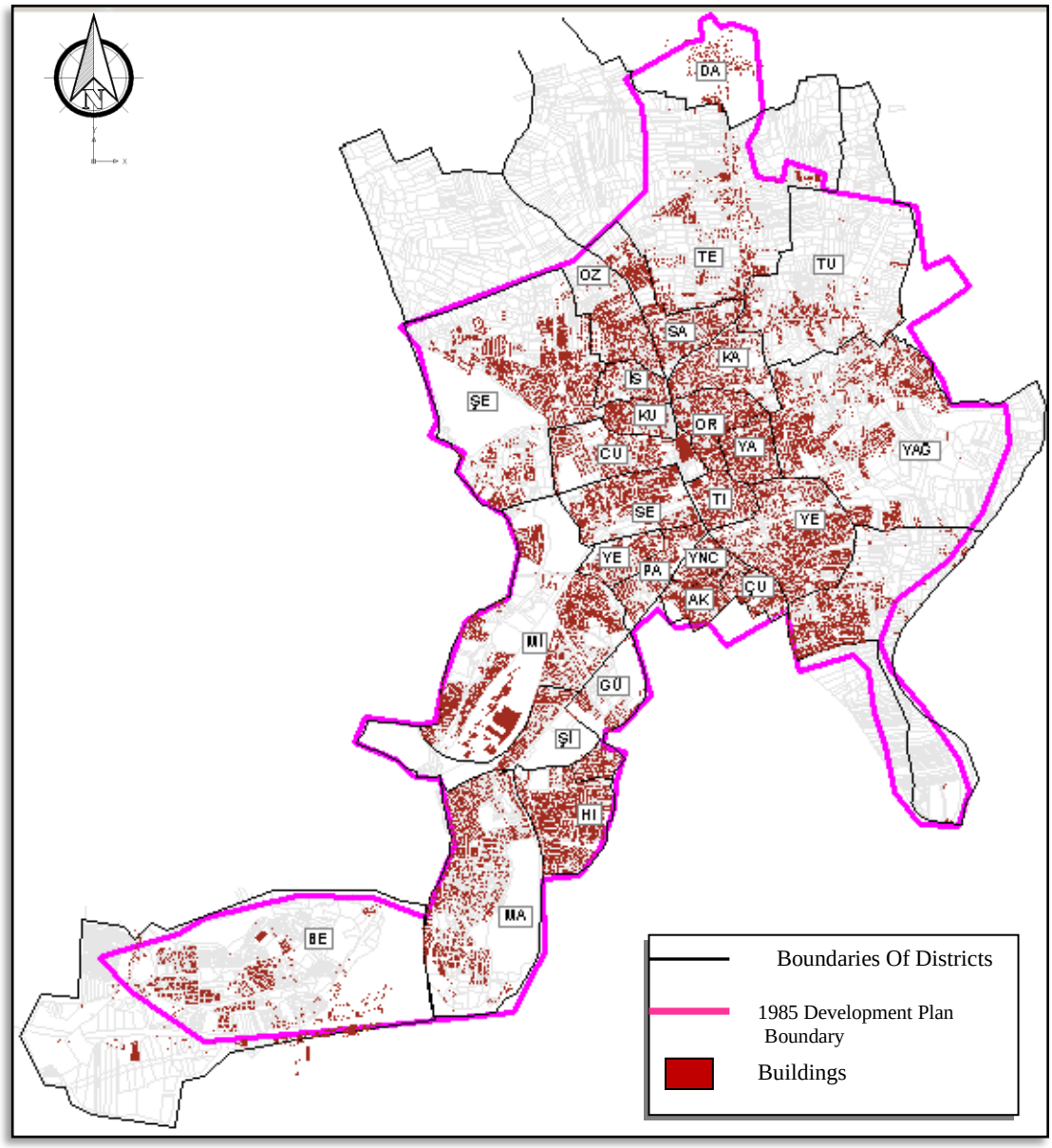


Figure 3.5 Association Of Number Of Revisions And Collapsed Individual Units

In Yenigun and Seker districts where housing sections in the collapsed buildings are the most, more destruction has happened compared to other districts. Figure 3.4



Map 3.3. Boundaries of Districts And Urban Texture of The Center of Adapazari

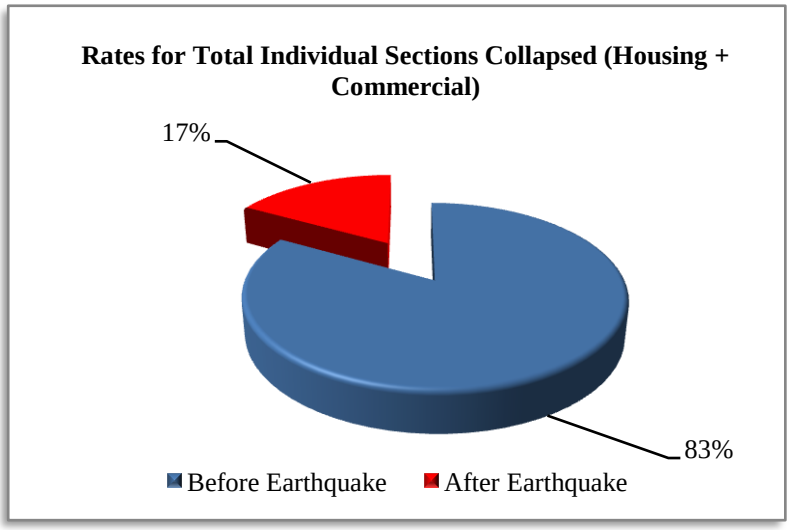


Figure 3.6 Commercial Independent Units Collapsed in Adapazarı at the 1999 earthquake

Along with the physical losses and damages, 50 thousand persons became homeless, and 40 thousand persons were affected adversely from the loss of employment in commercial activities.

3.1.4. Post-Disaster Problems of Housing Deficit: Effects of Collapsed Buildings Under Flat-Ownership and Properties

Before the earthquake, residential buildings under flat-ownership occupied most of the central districts of Adapazarı. These were buildings of 5 storeys many of which collapsed with the earthquake. Owners were left only with the shared ownership of the common land after the clearance of the site and removal of debris. After the earthquake however, densities were reduced to 2 storeys only with the decisions of the local and central governments. Thus the greater number of occupiers in the previously existing property was ousted. For this reason, the situation caused legal problems and the deterioration of human and district relations. This caused many plots in central areas to be left vacant, causing empty plots on one hand, and housing shortages on the other (Bayhan, 2001).

Almost 60% of the houses in Adapazarı were damaged, as some of the buildings were moderately and others slightly damaged, in addition to the significant loss of in the building stock. Even after three years following 1999, people preferred not to leave the prefabricated buildings allocated to them by the government, due to their fears, housing shortages and

increased housing prices in the market. Households almost became obliged to live in these houses.

Greater part of the population was settled in the central city of Adapazarı as a result of the decisions of plans and their all too frequent revisions. This meant that most of the population resided in alluvial areas which were not convenient for settlement. Licenses allowed in such areas buildings up to 5 floors, greatest risk scenarios were determined. Although two floors above basement was the decision, these were changed with partial revision plans and many other buildings ignored the constraint and had built unauthorized extra floors. Even if some of the building stock in the central districts remained intact after the earthquake, these buildings are structurally subject to fatigue which could not survive another shaking. When the studies for determining damages are evaluated objectively, the multiple storey buildings in the Center of Adapazari will be the most risky buildings in the next earthquake.

3.2. Impacts on the Infrastructure System

The other result of the earthquake was that 90% of the city infrastructure fell completely into disuse. Within the scope of sewage system operations, 1478 km of the sewage network was reconstructed, with a total cost of $ 584 millions. The potable water system was renewed with its total length of 2356 km. costing $ 93 millions. In the case of drainage constructions, 131 km rain water canals were renewed at a cost of $ 29 millions. Total loss of infrastructural systems of Adapazarı amounted to $ 706 millions (ADASU, 2009).


Altyapı çalışmaları nedeniyle şehir şantiyeye döndü. Trafiğin de içine ettiler...

Adapazarı ölü şehir mi?

Adapazarı'nda sanki kimse yaşamıyormuş gibi, plansız-programsız alternatif yollar tespit edilmeden yapılan altyapı çalışmaları, Adapazarlılar'ı çileden çıkartıyor.

Bu halka çok yazık!

Bir trafik yetkilisi

Müteahhitlerin 24 saat çalışması gerekiyor

İtfaiyeciler bile şikayetçi

Picture 3.5 Infrastructure Works Caused the Destruction Of 1000 Km Of Asphalt Surfaced Roads And Pavement Surfaces

3.3. Temporary Accommodation Areas and Tent Towns and Extended periods of Unhealthy Accommodation

After the earthquake, 42 745 tents have been distributed until today, and around 120 000 citizens were accommodated with these tents (GS, 2000) Number of the tent villages and towns is 53 as officially recorded since 21/10/1999. Here, 8058 tents were put up and 33 770 persons were accommodated (SATSO, 2000).

Picture 3.6 Emirdağ Tent Town and Local Newspaper After Earthquake

3.4. Debris of Collapsed Buildings

As a result of thousands of collapsed buildings, life in the town became difficult and damaged buildings were a major threat to safety of life and property of people living in the city. At the end of debris removing operations, **2,5 millions m^3 of 5 millions m^3** debris collected from 5 different earthquake areas were taken out of the Sakarya province (Bayhan, 2001).

Picture 3.7 Çark and Adnan Menderes Streets

3.5. Falling into Disuse of Superstructure Streets and Avenues

As a result of infrastructure renewal operations, surfacing of streets and avenues in a length of 1100 km within the city became completely wasted for long periods of time. This has been especially been uncoordinated as each infrastructural operations such as electricity, water, waste water, telephone lines and drainage systems were performed one after the other, the same road being excavated as many as 5 times, totally blocking circulation in the city for long periods. This had a great adverse impact on travel and transportation in the city center and on commercial and civil life, which were on the verge of stopping due to loss of pedestrian lanes in trade areas (Bayhan, Kotaoğlu and Tokuc, 2001).

Picture 3.8 Destroyed Roads of Atatürk Boulevard And Çark Street Before The Earthquake (SMM, Arcive)

Picture 3.9 Destroyed Roads of Atatürk Boulevard and Çark Street (SMM, Arcive)

Picture 3.10 Ankara street and Atatürk Boulevard (SMM, Archive)

3.6. Loss of Green Areas and Children's Playgrounds

80 children's playgrounds in city center were used as space for temporarily accommodating the survivors after the earthquake and therefore, the damaged parks and playgrounds fell completely into disuse and whenever they were to return to their original use it proved expensive (Bayhan, 2001).

3.7. Economic Impacts of the 17 August Earthquake on Adapazarı

3.7.1. Effects of Earthquake on Region's Economy

The study made by the Organization for Economic Cooperation and Development (OECD) concerning 1999 Earthquake reveals the effects of the earthquakes on the economy, in terms of direct costs, indirect costs and effects of earthquake in production and income losses and emergency aid expenses. The secondary effects, on the other hand, reflect the effects of earthquake on the general economy in the short and long terms, that is on the indicators such as financial policies and payments balance, inflation and unemployment (OECD, 2000).

In Table 3.4, the macroeconomic costs of 1999 Earthquake according to studies made by the Turkish Industrialists and Businessmen's Association (TUSIAD), State Planning Agency DPT, and the World Bank are shown. In these estimates, direct costs have the highest share. In Table 3.3, total cost is 17 billions dollars according to TUSIAD, 15-19 billions dollars according to DPT and 12-17 billions dollars according to the World Bank.

Accordingly, the earthquake caused a loss of 9 percent of the 1999 Gross Domestic Product according to TUSIAD, 8-10 percent according to DPT and 6,3-9 percent according to the World Bank (Kotil, Konur and Ozgur 2007).

Table 3.4 Macro Economic Costs of the 1999 Earthquake (Billion Dollars)

	TUSIAD	**DPT**	**World Bank**
Direct costs	**10**	**6.6-10.6**	**3.1-6.5**
Houses	4	3.5-5	1.1-3
Companies	4.5	2.5-4.5	1.1-2.6
Infrastructure	1.5	0.5-1	0.9
Indirect Costs	**2.8**	**2-2.5**	**1.8-2.6**
Loss of value added	2	2-2.5	1.2-2
Emergency aid expenses	0.8		0.6
Total damage loss	**13**	**9-13**	**5-9**
Secondary Effects			
General Value loss	2		3
Financial Costs	2	5.9	3.6-4.6

3.7.2. Impact of Earthquake on the Economy of Adapazarı,

The impacts of the 17 August earthquake on the economy of Turkey is not simply the loss of life and physical assets, but the effects emerge also as loss of factory buildings, machinery, stock and labor force in manufacturing and industrial business premises, the effects in the form of production loss and decreases in exportation of goods, resulting from the facilities that suspended production. Economic loss experienced by Adapazarı in the earthquake is approximately $ 3 billions according to the assessments made by the World Bank, Adapazarı Chamber of Industry and DPT. Table 3.5

Table 3.5 Effects of Earthquake on Adapazari Economy, City of Greater Sakarya

(Bayhan, F, Kotaoglu and Dikmen, 2009)

Total Loss Resulting from Earthquake	**Costs ($ millions)**
Houses	1,290
Companies	489
Infrastructure	706
Loss of Added Value	330
Emergency aid expenses	152
Total Damage Loss	**2,967**

It is not easy to have a full estimate of the economic impacts of the 1999 earthquakes in Adapazarı, as primary (as loss of life and property and infrastructure), secondary (education, trade, investments halfway), and tertiary costs such as loss of time, energy and wasted periods of individual times, and obstructed potential growth which are almost impossible to track. The argument here is to draw attention to the immense volume of values lost, opportunities escaped, intentions and processes delayed, if it was not for planning decisions that served to immediate interests of a few, rather than the public good. It is for this reason that the following chapter intends to investigate how city plans were made and identify the nature of revisions followed by these plans.

CHAPTER 4

PLANNING DECISIONS IN ADAPAZARI

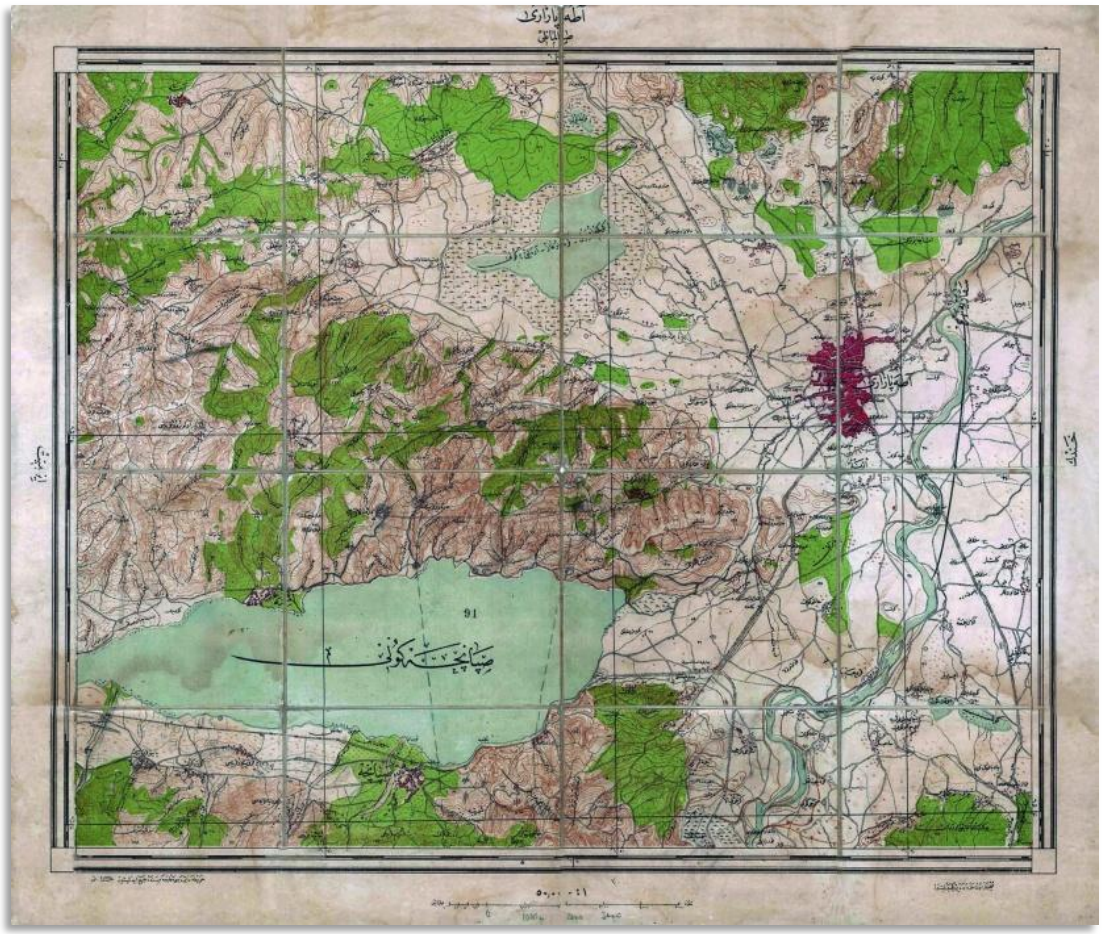
4.1. Urban Development Of Adapazarı

Towards the end of 13th century, today's Adapazarı River Basin was conquered under the Command of Ghazi Osman. Nomadic Turkish clans firstly coming from Western Turkistan and Azerbaijan settled down in villages and cities here. Adapazarı was settled on the piece of land formed between two branches of River Sakarya. During the reign of Mahmut II (1837), Adapazarı became a district. Towards the end of 19th century, it became the district of the Kocaeli province. It became an independent province in pursuance to Act No 419 on 22 June 1954 and took the name of Sakarya.

Due to the topographic structure in Sakarya, urban development is generally on the flat regions close to city center. In addition, settlement is also very commonly observed in Hızırtepe, Maltepe and Serdivan which are central districts of Adapazarı. The city is generally developed on the rich Sakarya plains of the Pprovince. Moreover, River Sakarya which flows through the east of Sakarya is a natural barrier which limits the development of the province in that direction. On the north of Sakarya is Black Sea and on the west is Kocaeli and on the east is Bolu and on the south is Bilecik.

Owing to the fact that Sakarya is a plain city, there are no other natural limitations for the growth and spread of the city. Particularly, in the recent years, industrial establishments which have developed intensively in cities such as İstanbul and Kocaeli tend to prefer Sakarya as a new settlement location. With the development of the industry, Adapazarı has become a city which continuously receives immigrants and whose population gradually increases. Four development plans have been made in the province of Sakarya starting from

1957 up to 2009 due to this strong tendency of growth. This trend is not independent from major investments in the city.



Map 4.1 Map of Central Settlement 1922 (SMM Archive)

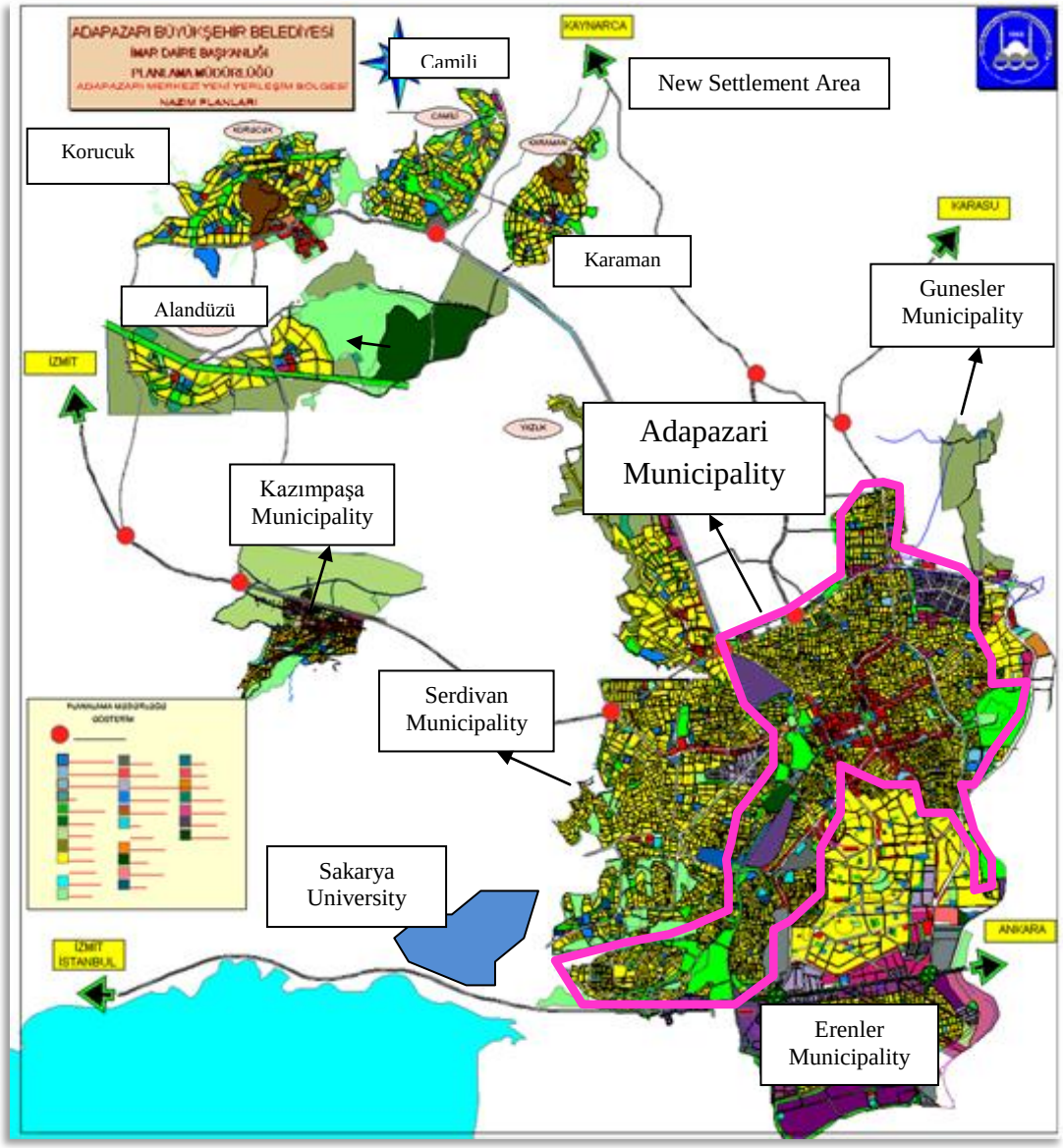
In 1957, the city was settled in the current central area, and tended towards the west where the sugar factory is located. On the other hand, the railway carriage production plant caused the city to grow towards the south. In 1970, the highway of Ankara – Istanbul assigned to pass through the center of the city was changed and the existing E-5 Highway was realized (Picture 4.1).

Picture 4.1 E-5 Highway 1975 and 2005 (SMM, Archive)

With the arrival of E-5 highway, the city completely tended towards the south. Although some spin-offs are observed in the rapidly growing city, River Sakarya has always constituted a boundary for the city. Upon the arrival of Sakarya University, the city started to develop in the direction of south-west where Serdivan is located. (Map 4.2)

In 2000, in the development plan made after the earthquake, it was understood that the settlement of Adapazarı was on the area which cannot be entirely safely settled. As a result of the geological investigations, development plans were made to occupy areas which can be settled in the north-west. These are Korucuk, Camili, Karaman and Alandüzü districts. As the population increased, the demand for the houses also expanded and the houses constructed cannot meet the demand. This led to unauthorized urbanization.

Picture 4.2 New Settlement Area (SMM, Archive)



Map 4.2. Central Adapazarı (27 Districts), Serdivan, Erenler, Güneşler Municipalities and the New Settlement Areas

4.2. Population Changes 1955 - 2000

Sakarya Province had a population of 731.800 in 1997. This has increased by %3 after the 1999 earthquakes to 756.168 in year 2000 according to the General Census (Table 4.1 – Figure 4.1).

Table 4.1 Population in Turkey, Sakarya and Neighboring Provinces (1955-2000) (DİE, 2000)

	Turkey	Sakarya	Kocaeli	Bilecik	Bolu	Bursa	Düzce
1955	24.065.000	297.108	253.174	139.233	318.219	598.898	-
1960	27.755.000	361.992	297.463	145.699	353.004	693.894	-
1965	31.395.000	404.078	335.518	139.041	383.939	755.504	-
1970	35.605.000	459052	385.408	138.856	403.766	847.884	-
1975	40.348.000	495.649	477.736	137.120	428.704	901.639	-
1980	44.737.000	548.747	596.899	147.001	471.751	1.148.492	-
1985	50.664.000	610.500	742.245	160.909	504.778	1.324.015	-
1990	56.473.000	683.061	936.163	175.526	536.869	1.603.137	273.679
1995	-	-	-	-	-	-	-
1997	62.866.000	731.800	-	-	-	-	-
2000	67.853.000	756.168	1.206.085	194.326	270.654	2.125.140	314.266

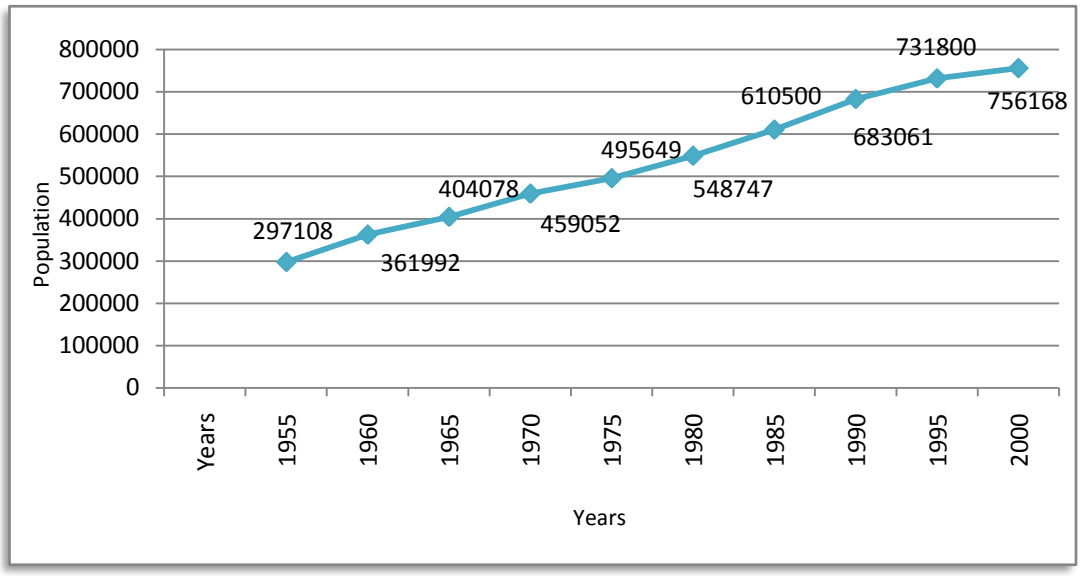


Figure 4.1 Sakarya Province Population Increase (1955 – 2000) (DİE, 2000)

The Table 4.2 and Figure 4.2 indicate that the province of Sakarya with its provincial center and towns havegrown by %2-%22 except the town of Taraklı. Taraklı sub-province

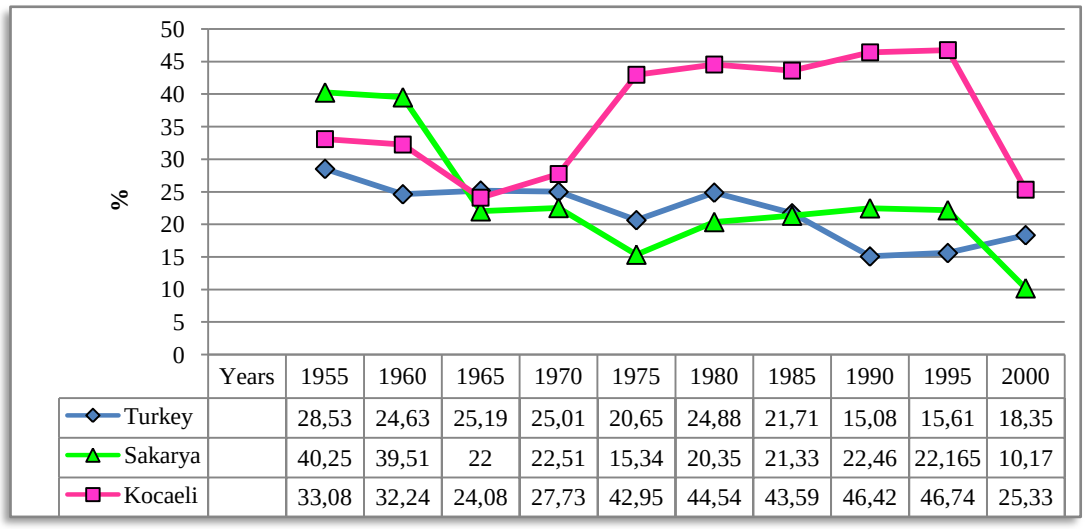
population has migrated mostly to İstanbul and Kocaeli metropolitan areas. Greatest population increase takes place in Sapanca (%22), Ferizli (%21) and Karasu (%18) sub-provinces. Karasu ve Ferizli, is north of Adapazarı, on safer grounds in terms of the earthquake hazard. This trend may be considered as a rational decision-making as a consequence of the experience in 1999

Rate of birth in the Sakarya Province in 2000 is almost one fourth of what it was in 1950's. This is lower than the average for Turkey.

Table 4.2 Population Increases in Turkey, Sakarya and Kocaeli Provinces (1955 –2000) (DİE, 2000)

Years	Turkey	Sakarya	Kocaeli
1955	28,53	40,25	33,08
1960	24,63	39,51	32,24
1965	25,19	22	24,08
1970	25,01	22,51	27,73
1975	20,65	15,34	42,95
1980	24,88	20,35	44,54
1985	21,71	21,33	43,59
1990	15,08	22,46	46,42
1995	15,61	22,165	46,74
2000	18,35	10,17	25,33

As rate of population growth increased in Turkey after 1990, decreases occurred in Sakarya and Kocaeli provinces after the 1999 earthquakes (Figure 4.2).



Years	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
Turkey	28,53	24,63	25,19	25,01	20,65	24,88	21,71	15,08	15,61	18,35
Sakarya	40,25	39,51	22	22,51	15,34	20,35	21,33	22,46	22,165	10,17
Kocaeli	33,08	32,24	24,08	27,73	42,95	44,54	43,59	46,42	46,74	25,33

Figure 4.2 Population growth Rate in Turkey, Sakarya and Kocaeli Provinces (1955 –2000) (DİE, 2000)

4.3. Economy of Province

The Sakarya province is in the most developed region of Turkey in economic terms. Large scale private industrial firms are concentrated in the region. Shares of population and employement of the Sakarya Povince relative to Turkey are given in Figure 4.3.

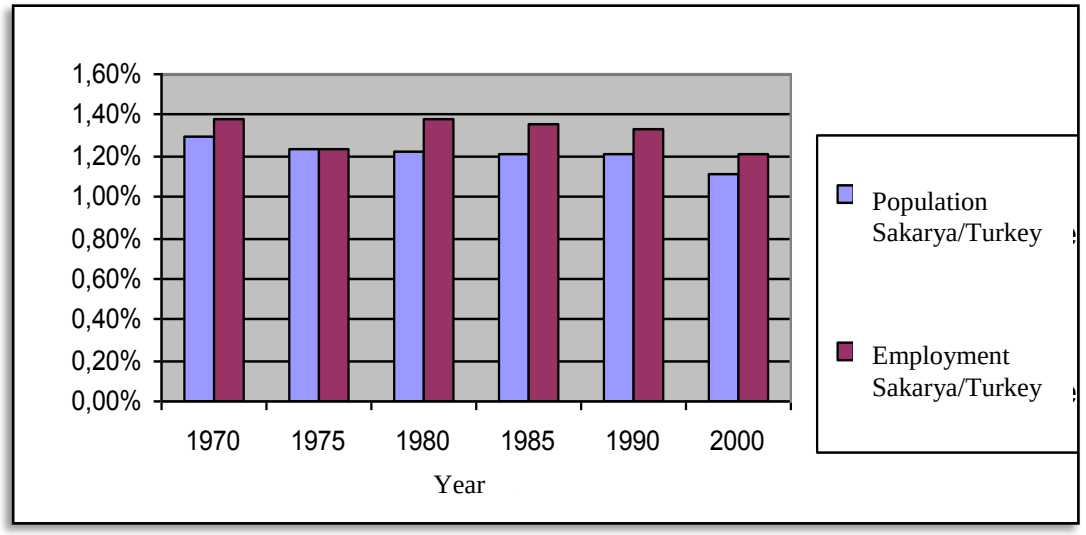


Figure 4.3 Population and Employment in the Sakarya Province relative to Turkey (DIE, 2000)

Although absolute figures of employment in the province increased since 1990's, the share relative to the region tend to fall or remain stagnant. Fundamental reason is the lower capacity of the province to compete with Istanbul, Bursa, and Kocaeli in the region.

Employment ratio relative to population in Sakarya (% 41.6) is in general above national averages (% 38.3). This is largely because agriculture represents a major sector of activities employing greater population. However, as a concomitant of urbanization, employment in industrial and tertiary services sectors is also in the increase. AS GDP in the Sakarya province is in the increase, its relative share in the region is falling.

Tablo 4.3 Gross Domestic Production (DPT, 2002)

	Turkey	Marmara	Sakarya	Marmara/Turkey	Sakarya/Marmara
1990	393060176	143466689	856483	36,50	0,60
1991	630116965	230965493	862164	36,65	0,37
1992	1093368048	395507302	924336	36,17	0,23
1993	1981867097	713815037	952086	36,02	0,13
1994	3868429190	1378860035	943518	35,64	0,07
1995	7762456076	2860126564	1099101	36,85	0,04
1996	14772110196	5411678292	1197979	36,63	0,02
1997	28835883136	10942220761	1253782	37,95	0,01
1998	52224945129	19262951140	1314815	36,88	0,01
1999	77415272307	28238555867	1218022	36,48	0,004
2000	1,24583E+11	46145179150	1343891	37,04	0,003

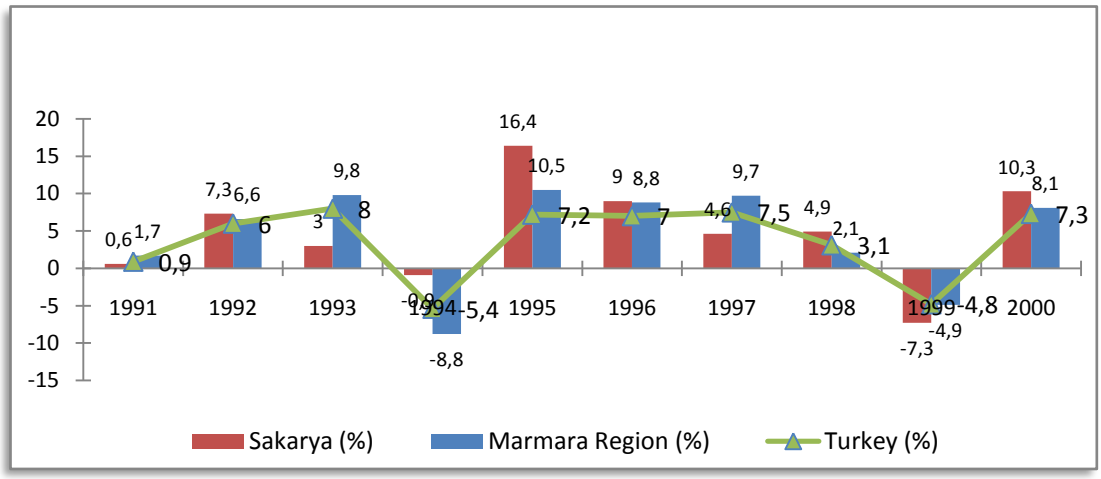


Figure 4.4 Rates of Increase (%) in GDP in Sakarya, Marmara , Turkey (DPT, 2002)

4.3.1. Sectoral Employement

Tablo 4.4 Sectoral Distribution of Labour 1990 and 2000 (DİE, 2003)

1990	**Agriculture**	**Industry**	**Services**
Turkey	48,3	13,3	38,4
Marmara	46,1	13,1	40,8
Sakarya	63,1	11,3	25,6
2000	Agriculture	Industry	Services
Turkey	15	31	54
Marmara	5	39	56
Sakarya	21	32	47

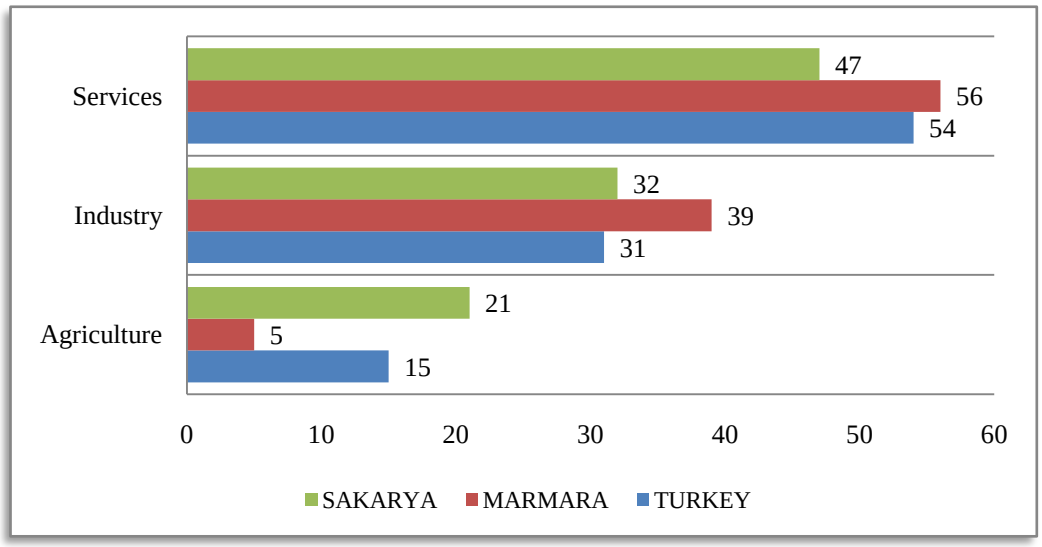
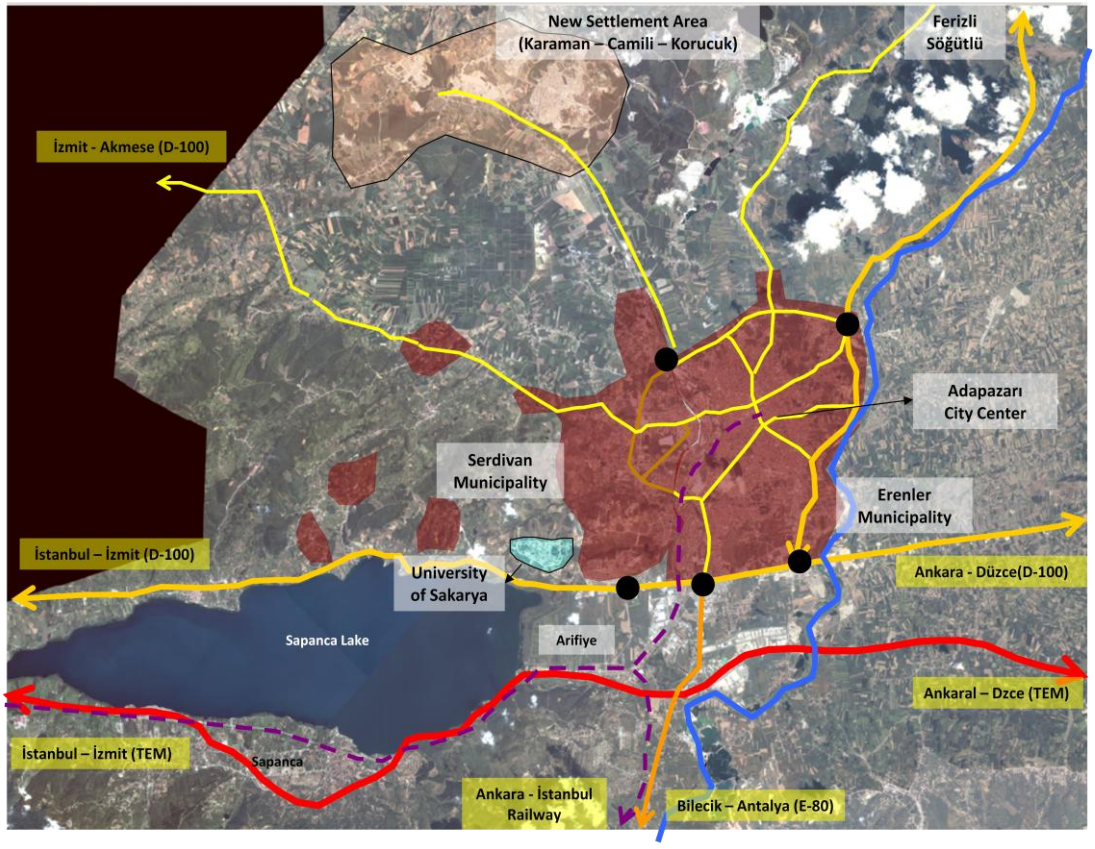


Figure 4.5 Sectoral Distribution of Labour 1990 and 2000 (DİE, 2003)



Map 4.3 Adapazarı as the Provincial Center and Major Routes

Sakarya Province is located on the main rail and auto transportation routes between Istanbul-Anatolia to east and gateway to south in the direction of Eskişehir-Antalya. The

decision for the Trans-Europe Motorway has intensified the strategic location, attracting major invetments as TOYOTA and OTOKAR factories.

4.4. Housing Development

The most important factor that determined population and housing growth is developments in Sakarya of the agricultural and industrial potentials. Until 1960s, no significant development in industry and housing sectors was observed in the province. Yet soon after, major developments in the industrial and housing sectors took place due to its proximity to İstanbul and as a result of the regional plans made. The industrial potential in the province has displayed great improvements since regional plans were made and highways constructed. This development in the industrial sector after 1960s has led to some deficiencies in the housing stocks in the face of rapid population increase. Developments in the industrial sector also affected the growth of the housing stock and the available house dwellings in Adapazarı increased rapidly after 1960s. Developments in the industrial sector mostly affected central districts of Adapazarı because industrial investments have been made particularly in the central districts of Adapazarı.

Picture 4.3 Çark street 1935 and Adapazarı city center 1935 (SMM Archive)

Industrial developments and therefore housing and population growth in central Adapazarı took place despite the fact that the North Anatolian Fault lay only 8-10 km south of the city center.

The entire Province of Sakarya and the city of Adapazarı were in the 1st degree seismic belt in the official hazard map of Turkey. Sakarya has experienced many earthquakes. The most

important of these earthquakes has been that of 1999 which affected great damages at the entire Eastern Marmara region. This earthquake gave rise to a different scenario in the development of housing.

Picture 4.4 Adapazarı Earthquake “long bazaar” and 1967 Adapazarı Earthquake (SMM Archive)

Picture 4.5 1930 1930 İzmit Center Adapazarı and 1998 İzmit Center (SMM Archive)

Before the earthquake, public production of housing did not exist in Adapazarı. The relationship of the state in the provision of housing had been confined only to a partial meeting the needs of members of the public institutions before the earthquake of 1999. Uuntil 1980s, production of detached housing was the common building form. In these years, production of block of flats was only about one third of the existing detached houses. However, by 1990s, annual construction of blocks of flats increased and even exceeded the production of detached houses.

Picture 4.6 17 Augustus 1999 Adnan Menderes (İzmit) Street
(SMM Archive)

Although conventional construction still exists in many of the districts of Adapazarı, the central districts are densely made by blocks of flats. In settlements where tourism activities are concentrated such as Sapanca, Kırkpınar, Karasu and Kocaali, second houses are generally in the form of local complexes with two storey houses. The production of houses is realized by the commercial activities of private developer firms and entities.

The issue of earthquake has been taken into account in most of the development plans in Adapazarı and Sakarya. however, at the phase of implementation, the earthquake threat has always been ignored. The first development plan of Adapazarı was first approved in 1960. A new plan was made in 1974. The latest plan made for the city before the earthquake of 1999 has been approved in 1985. An 'environmental arrangement' plan at the scale of 1/25000 for Adapazarı was made in 1998 and in this plan it was indicated that the settlement of Adapazarı was entirely on the geologically dangerous area. As a result of this fact, it was foreseen that Adapazarı development may take place in the local settlements of Korucuk, Alandüzü, Karaman and Resuldivan, 8 km of north west of its settlement. However, this plan was not approved (Bayhan 1998). Map 4.11

Environment Arrangement Plan made after the earthquake was in the form of revising the previous Environmental Arrangement Plan made in 1998 but not approved.

In Adapazarı, there were high-income houses in the center, and houses which may be regarded as luxury in the districts surrounding the center though not as high as the ones in the center in terms of market values. Buildings are generally constructed with cheaper and inferior materials as one goes further away from the center. The earthquake experienced in 1999 indicated that the destruction was not only observable in the block of flats in the farther quarters which were constructed at lower costs. Luxury blocks of flats erected above ground floor commercial premises in the centre of the city.

4.5. Planning Process in Adapazarı Before the Earthquake of 17 August

Figure 4.6 indicates in a time horizon plans of various scales prepared and approved, together with the major earthquakes that took place and had serious impacts in the city of Adapazarı.

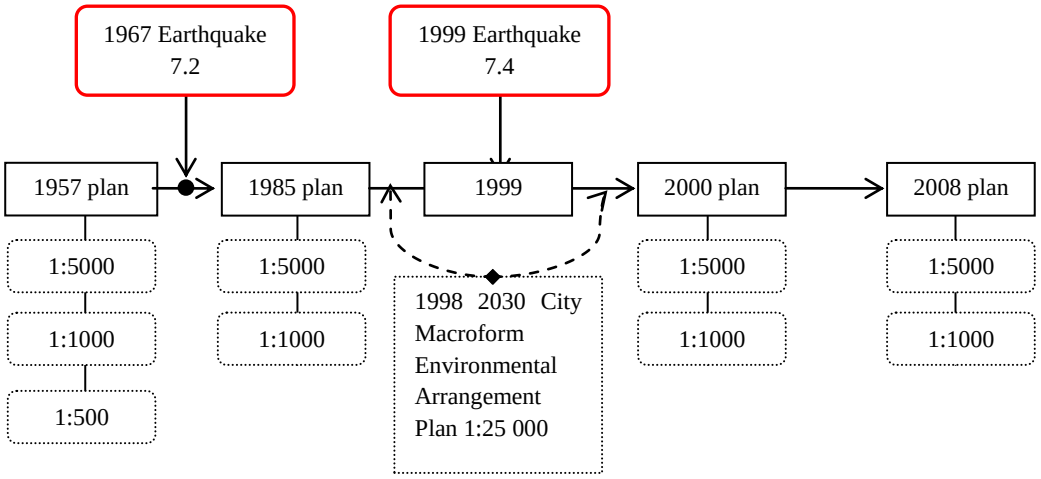
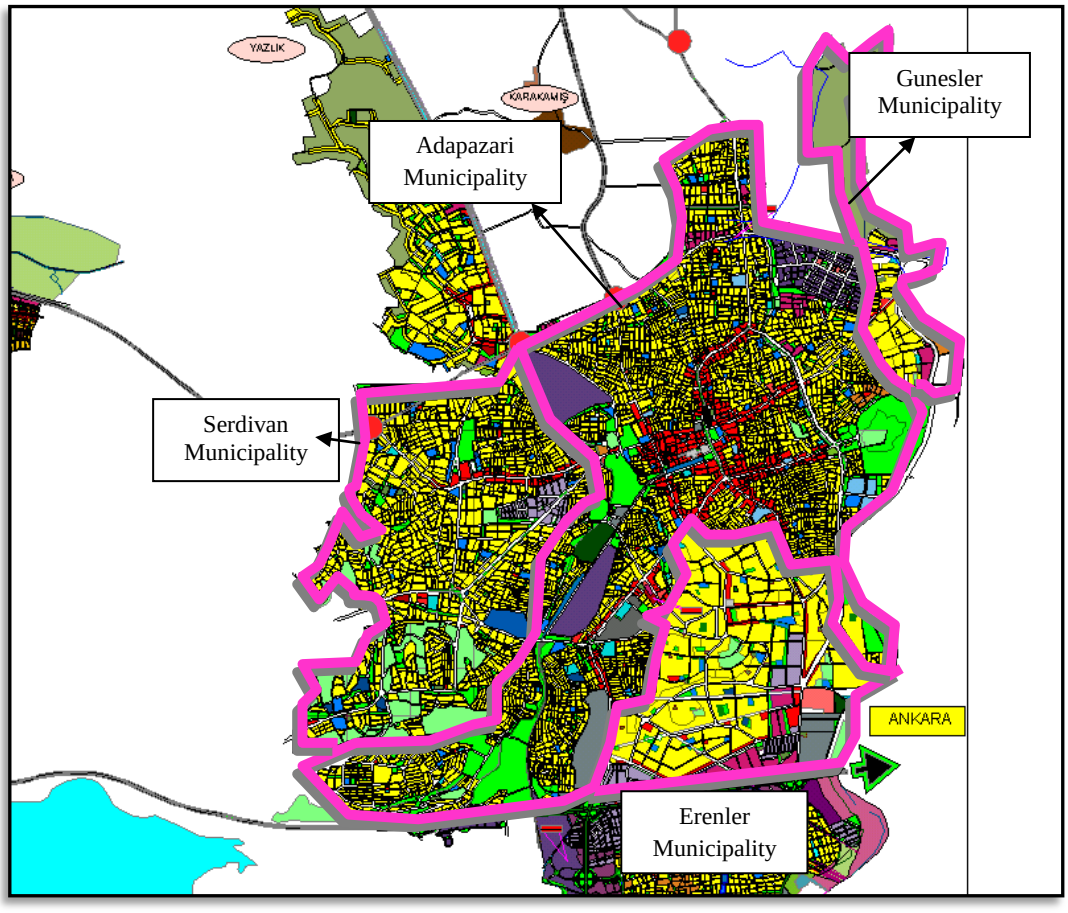


Figure 4.6 Development Plans of Adapazarı and Major Earthquakes

4.5.1. Planning Activities for Adapazarı and Its Surrounding Area

Although the different municipalities of Sakarya are very close to one another, development plans of Adapazarı, Serdivan and Erenler Municipalities (1974) have been made and revised at different times. The first development plan of Adapazarı was prepared by means of a Commision Report in 1957, and was directly approved in 1960. (Map 4.4)

The latest plan of the city before the earthquake of 1999 was made in 1985. The first development plans for Serdivan were made in 1964, 1969 and 1976 respectively and revised. An additional development plan was made in 1975. The plan of Erenler was approved in 1971. (Map 4.4)



Map 4.4 Adapazarı City Center (Adapazarı, Serdivan, Erenler, Güneşler Municipalities Development plans)

4.5.2. Planning Activities Prior to the Development Plan of 1957

The planning activities for the city of Adapazarı started in 1924. In the maps at the scale of 1/500 which used to indicate the current state at those times is the signature of 'Topographer Mehmed Seyyid'. In pursuance to Code No 2290 passed in 1933, the negotiations were made with Prof. H. Jansen who was the author of the development plan of Ankara. The efforts to hire him make development plans for the first time produced no results. Development plans were started in 1939 based on an agreement with Van den Berg who was an Architect from Holland. The agreement was terminated however, due to disagreements on the railway route. Subsequently, although the Ministry of Constructional Affairs undertook the work, no results were obtained until the earthquake in 1943.

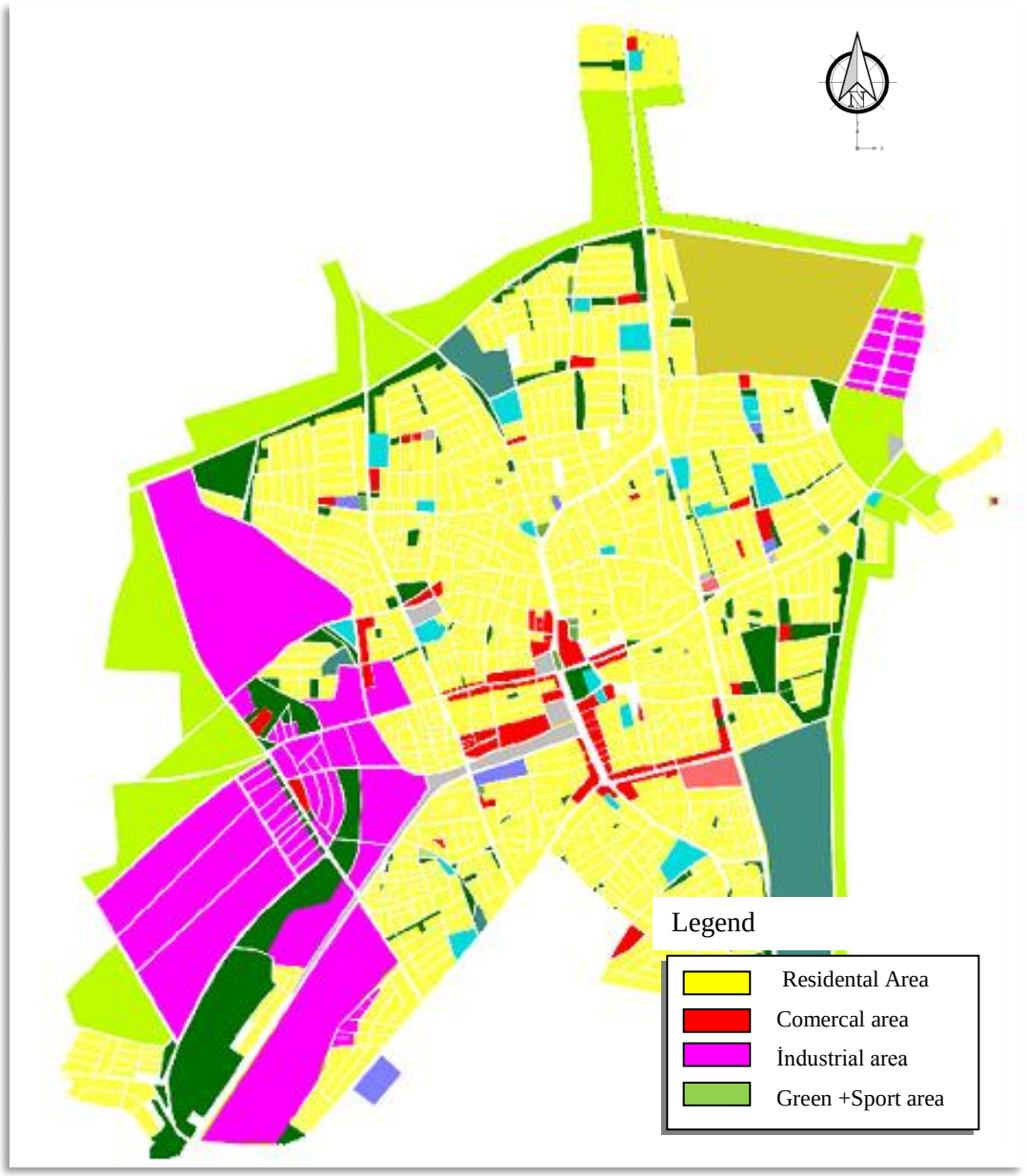
The plans of 12 sheets (400 ha) were made by Architect Ferit Örs at the scale of 1/1000 under the supervision of Prof. Oelsner who was the consultant architect of the Ministry of Constructional Affairs after the earthquake in 1943. The plans envisaged the short-term development of Adapazarı and was based on the estimation of a population target of 45 000.

4.5.3. Development Plan in 1957

This was obtained as a result of the competition opened by the Bank of Provinces (İller Bankası) in 1957. The development plan approved did remain effective until 1985, though with several revisions in due course. The plan was co-authored by High Engineer-Architects M. Ali Topaloğulları, Melahat Topaloğulları, and Bülent Berksan who won the competition. It was estimated that the population of this city would be 120 -150 000 in 20 years. In the 'Report of Adapazarı City Construction Commission' related with this plan, and in the 'Supplementary Report' issued by Dr. A. Lahn 'Constructional Representative Construction and I.I. Presidency Geologist', the attention was drawn to the geological attributes of the city and the issue of the earthquake..

"....Adapazarı is within the seismic zone of North Anatolia and located on the river basin which includes techno collapse. As happens in all land within the seismic zone, much destruction from earthquakes have occurred in river basin of Adapazarı in previous years… During the last earthquake on 10 / June / 1943, very heavy events occurred in almost the entire city. The quarters which are affected at maximum level are on the northern part of the

city… Location of the entire city on a very young and non-settled aggregate of the river and that the underground water level is very close to the surface are very dangerous in terms of earthquake... The old hills and slopes on the south (Erenler Hills) and on the southwest around the railway carriage industrial plant) of the city are less hazardous in terms of earthquake…". Following these explanations, suggestions are made about how the settlements should develop in the same report.



Map 4.5 Plan of 1957

Firstly, it is suggested that the city be expanded towards locations where the underground water level is deeper. Secondly, there is the suggestion for constructing a sewage system at a very deep level in order to lower the level of underground water.

“It doesn’t matter how much it costs to allocate such sewage network. Lowering the level of underground water will be very crucial in terms of earthquake, even if, this is the only precaution that could be taken seismically”.

Lastly, the number of the floors should be decreased when considering the nature of ground in Adapazarı.

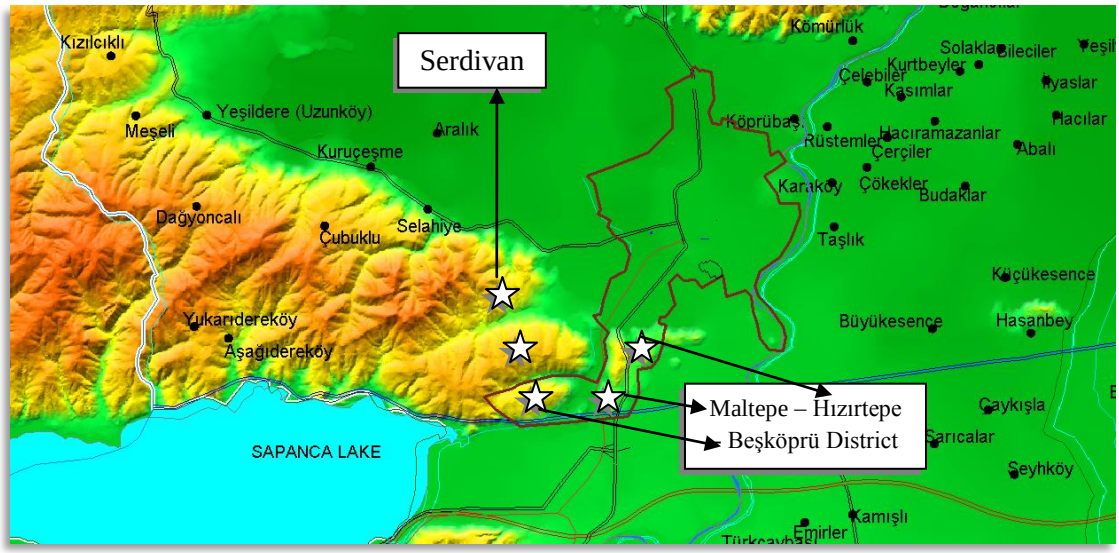
Picture 4.7 Adapazarı city center 1963 (SMM, Archive)

The Structure of Adapazarı City is proposed to be prepared in accordance with Articles 4 and 9 of Code on Structural Roads. Under the title of the order, the provisions are also given about the number of building floors and their heights, areas designated for ‘block’ / ‘group’ / ‘twin’ / ‘individual’ structures, construction types and building styles, lot widths, and the depths of building and land provide certain conditions pertaining to the principles of physical structuring at those times. In the plan, the maximum number of floors is determined to be 3.

To sum up, suggestions have been made that the land-mass on which Adapazarı is located was taken over from rice-farmers in a very old periods. The level of underground water is only 1,5-2,00 meters during the summer, which increases the potential hazard for earthquake. The hills and slopes on the south and southwest of the city are therefore less hazardous regions in terms of earthquake.

The suggestion is that if it is possible, the city should be expanded in the western direction, the level of underground water should be lowered through a deep sewage network allocation and therefore the danger of earthquake is reduced and the number of floors should be limited when considering the state of the ground.

Only districts of Hızırtepe, Maltepe, Beşköprü are located on higher elevations of non-alluvial grounds (300 ha). Serdivan district was partly geologically hazardous. All this indicate to the difficulty of transferring all development in central Adapazarı to such limited landscapes (Map 4.6).



Map 4.6 Hızırtepe, Maltepe, Beşköprü Districts Were More Reliable Geological Grounds To The South-West of Existing Adapazarı

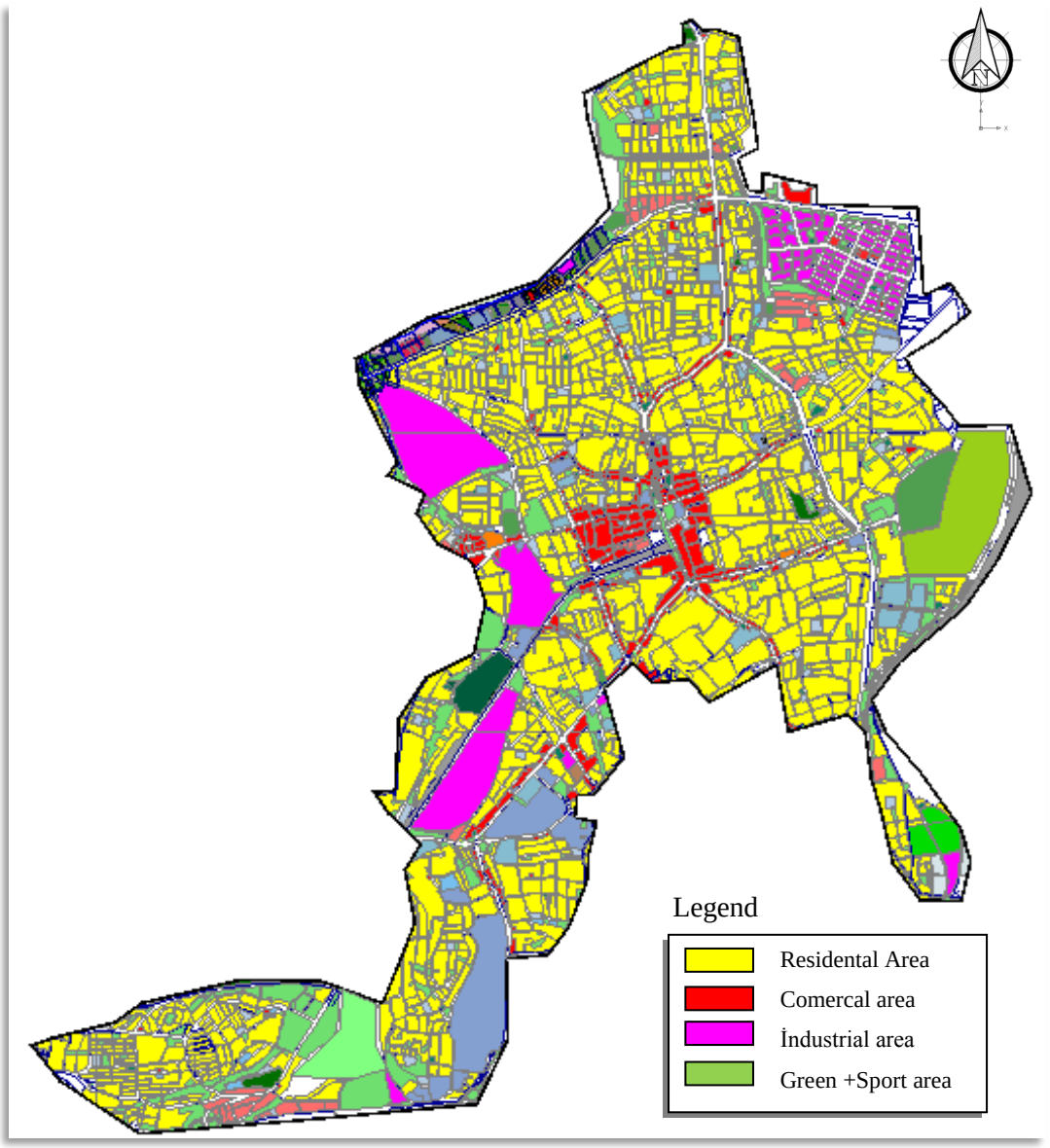
Picture 4.8 Adapazarı city center 1960 (SMM Archive)

4.5.4. Development Plan of 1985

Considering that the development in Adapazarı, Erenler and Serdivan settlements may occur simultaneously, development plan of 1985 was approved at the scale of 1 / 25 000 to include settlement parts of Sakarya and the surroundings of the Sapanca Lake. In accordance with this plan, Urban Development plan at the scale of 1/5000 and Implementation Development Plan at the scale of 1 /1000 were prepared. Therefore, the planning area of 1722 ha in the previous planning term increased up to 4387 ha with the addition of 2665 ha in this plan.

A geological survey was prepared by 1st Regional Directorate of the Bank of Provinces on 18/3/1982 for Adapazarı-Serdivan- Erenler- Hanlıköy. This report is an important document since it describes the latest conditions before the earthquake of 1999. The report describes the likely earthquakes in Adapazarı and in its surrounding areas:

“Adapazarı and its surrounding areas are on the fault of North Anatolia and within the 1st degree seismic belt”.



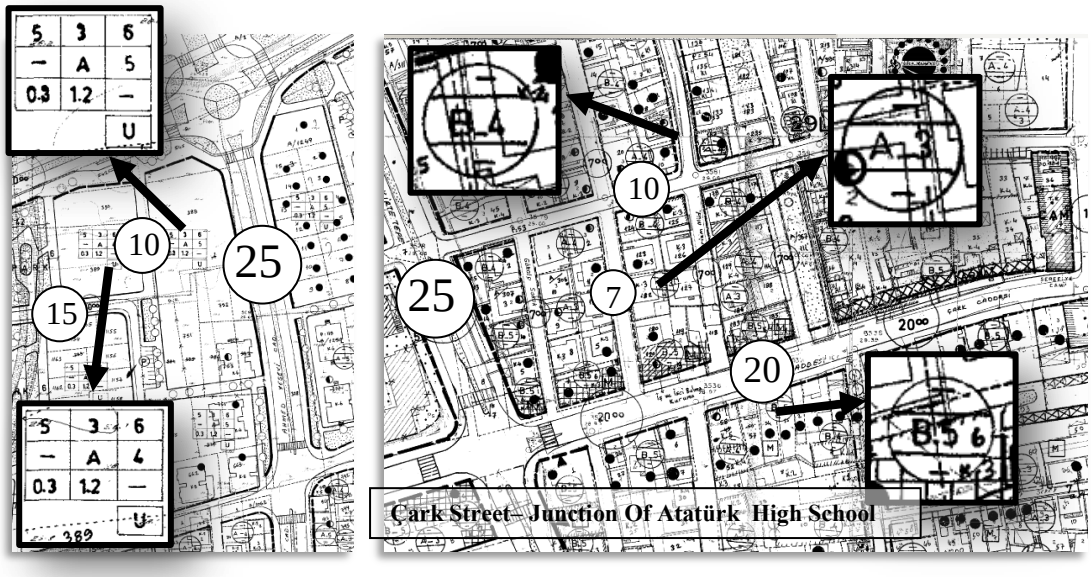
Map 4.7 Plan of 1985

Lastly, it is determined that the city was subject to great damages and the majority of the destructions were to be observed on structures located on the alluvial grounds as realized in the earthquake of 1967. “Because the very high level of underground water may increase the velocity of the earthquake, this issue should be taken into consideration for the structures in such a territory”.

Under the light of the information given, the locations which are considered appropriate for the settlement in the same report are suggested to be the areas around slightly sloppy hills and regions around Serdivan. The report, in relation to the alluvial grounds is the expression:

"Very high level of underground water almost at the level of surface in alluvial formations is highly hazardous for a region within the earthquake zone. As for the buildings, all the conditions required in the building regulation should be strictly complied with in the region of earthquakes".

Although there are no specifications made about the number of floors for the planning area in the Explanation Report of Urban Development plan of Sakarya City Entirety of 1985, building up to 5 floors in almost all of the area depending on the width of the roads were allowed in the 1/1000 implementation plans. The table which indicates building heights according to the number of floors, in the allowances for the constructing in the house areas up to 5 floors, subbasement up to 2,00 was added separately to the height. In this table, the part up to 8 floors added in parallel to the relevant legislation was lined with a thick line and excluded from the implementation area.



Map 4.8 Building Heights as Indicated in the 1985 Plan

Apart from the tolerance provided by the local code, some buildings were constructed to have more than 5 floors where only 5 floors were allowed. Projects and implementation were carried out in some buildings in violence of the fact of earthquake, development plans were

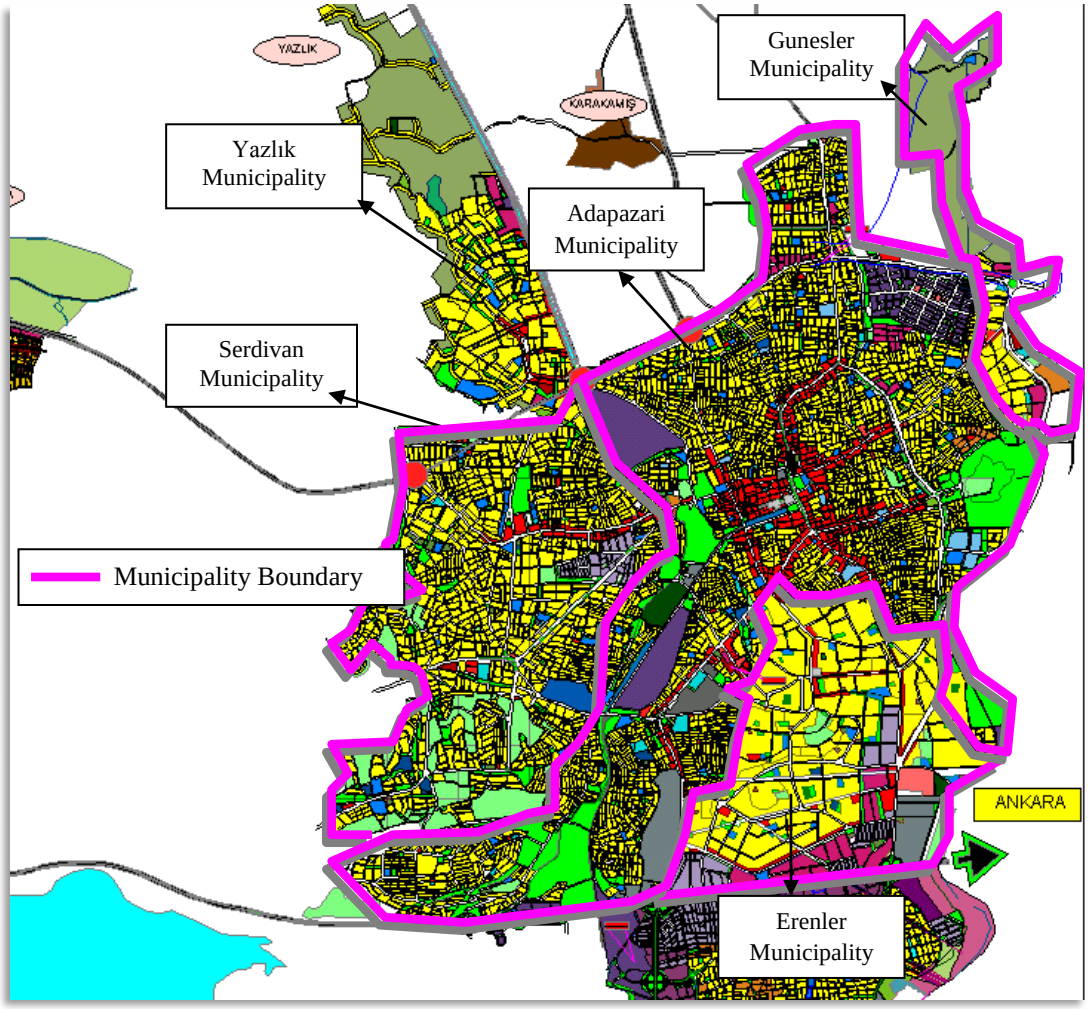
made by neglecting the maximum number of floors which the ground of Adapazarı Plain can carry (building load). With the transfer of all rights and discretion of plan preparation and approval functions to the local authorities and municipalities in 1985, such powers have been myopically exercised by almost all municipalities in Turkey.

Adapazarı Municipality was not an exception. Plan revisions which is an exceptional tool for flexibilities in planning followed one after the after, immediately after 1985, and became the routine. Most of these served to increase number of floors in many districts, reductions in open spaces, changes in uses, and changes in the building block design. These amounted to 950 partial plans which changed the development decisions in a total area as large as 50% of the the 1985 plan (Map 4.12). This obviously altered the main decisions of the original plan and as it will be discussed in Chapter 5, immensely aggravated the vulnerabilities in the city.

4.5.5. The State of Development in the Earthquake of 17 August

Adapazarı Municipality is on location having Sakarya River– Güneşler Municipality on the east, Erenler Municipality on the south, and Serdivan and Yazlık Municipality on the west (Map 4.9) . The existing macro-form of Adapazarı expanded to an area of 2200 ha covering 27 quarters. When we look into the boundaries of the Municipalities, it is seen that 75% of the macro-form is built. The average green space per capita is 2,2 m². Maximum number of floors given as the situation of the development plan in the city has been determined to be 5.

While attached building form has been planned and realized in the center where the city is particularly dense (600 per/ha), the characteristics of detached and block urban structure are observed in the areas of housing settlements around the center. The districts where the structuring is generally not so dense are Tekeler district on the north of the city and the territory of Dağdibi. Other districts also tend to make investments of similar densities. Structuring pattern and transportation network of the city give the appearance of an organic form, apart from areas which have been recently planned (SMM, 2000).

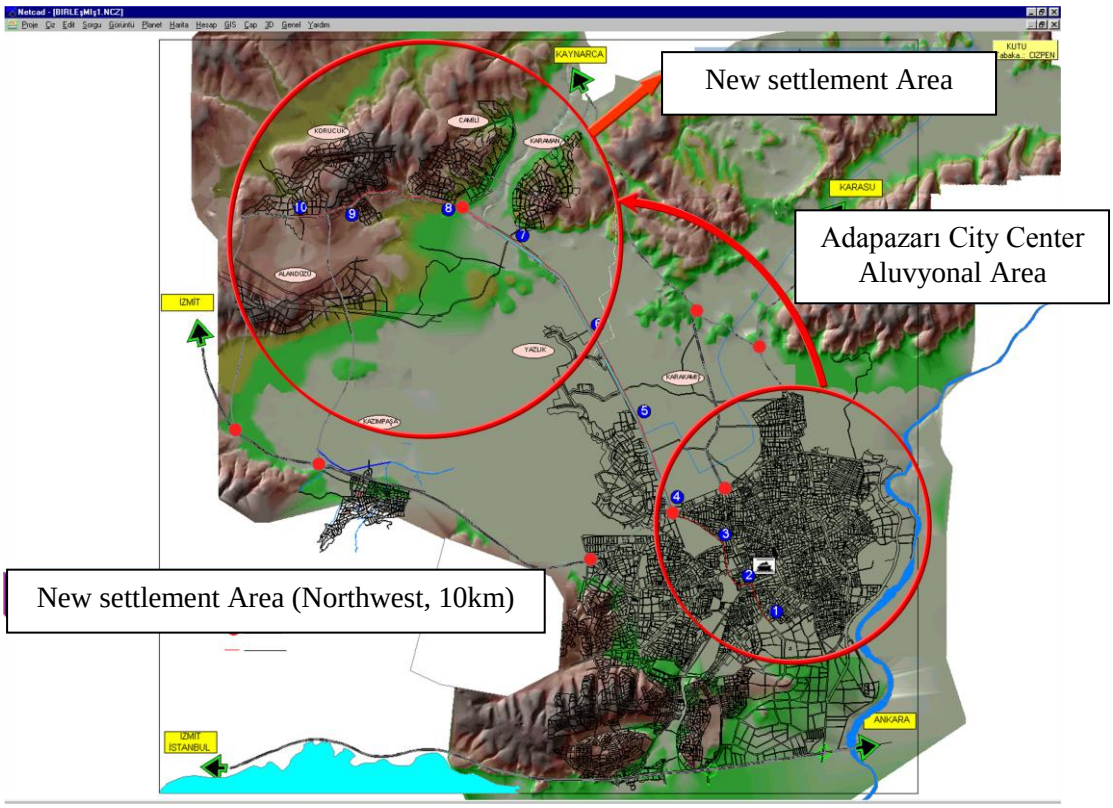


Map 4.9 Adapazarı City Center (Adapazarı, Serdivan, Erenler, Güneşler Municipalities Development plans)

4.5.6. Adapazarı City Macroform of 1996 at the scale of 1:25000, and the Environmental Arrangement Plan

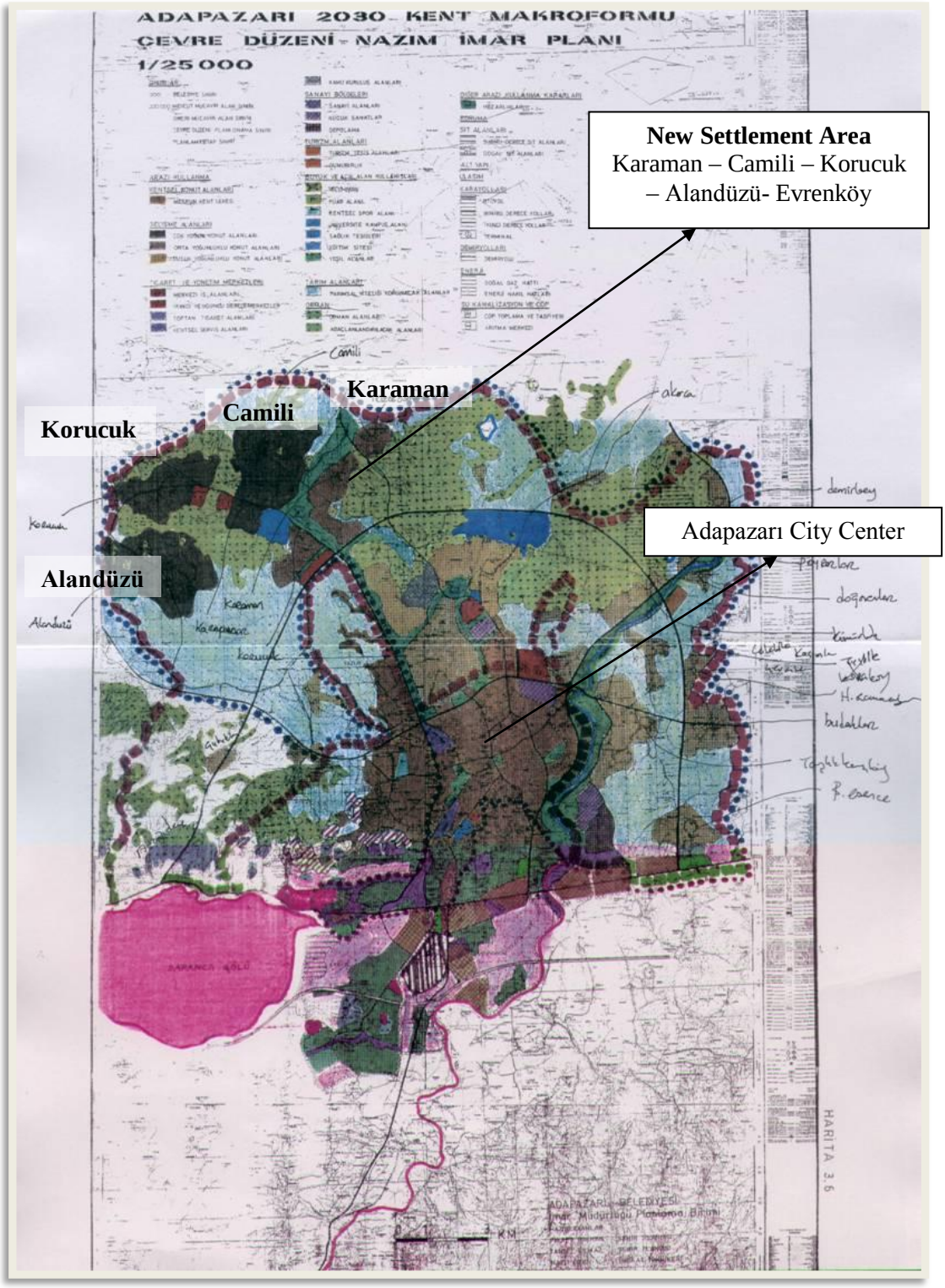
Adapazarı City Macro Form and Environmental Arrangement Plan of 2030 prepared by Fikret Bayhan, the City Planner of Adapazarı in 1996, considering the earthquake hazard which was approved by the municipality council in 1998 and sent to the Governorship of Sakarya. In this environmental arrangement plan valid until 2030, it is suggested that Adapazarı should develop toward the settlements of Karaman, Karaman, Camili, Korucuk, Alandüzü and Evrenköy districts located 10 km from the city on the northwest and that are resistant to the earthquakes with no risk of liquefaction. The aim was to reduce the risks of

earthquake in the city center as determined according to geological and geotechnical surveys. Although this plan was sent to the Governorship of Sakarya, it was not sent to the relevant ministry and kept pending due several reasons.



Map 4.10 Adapazarı city center and new settlement area

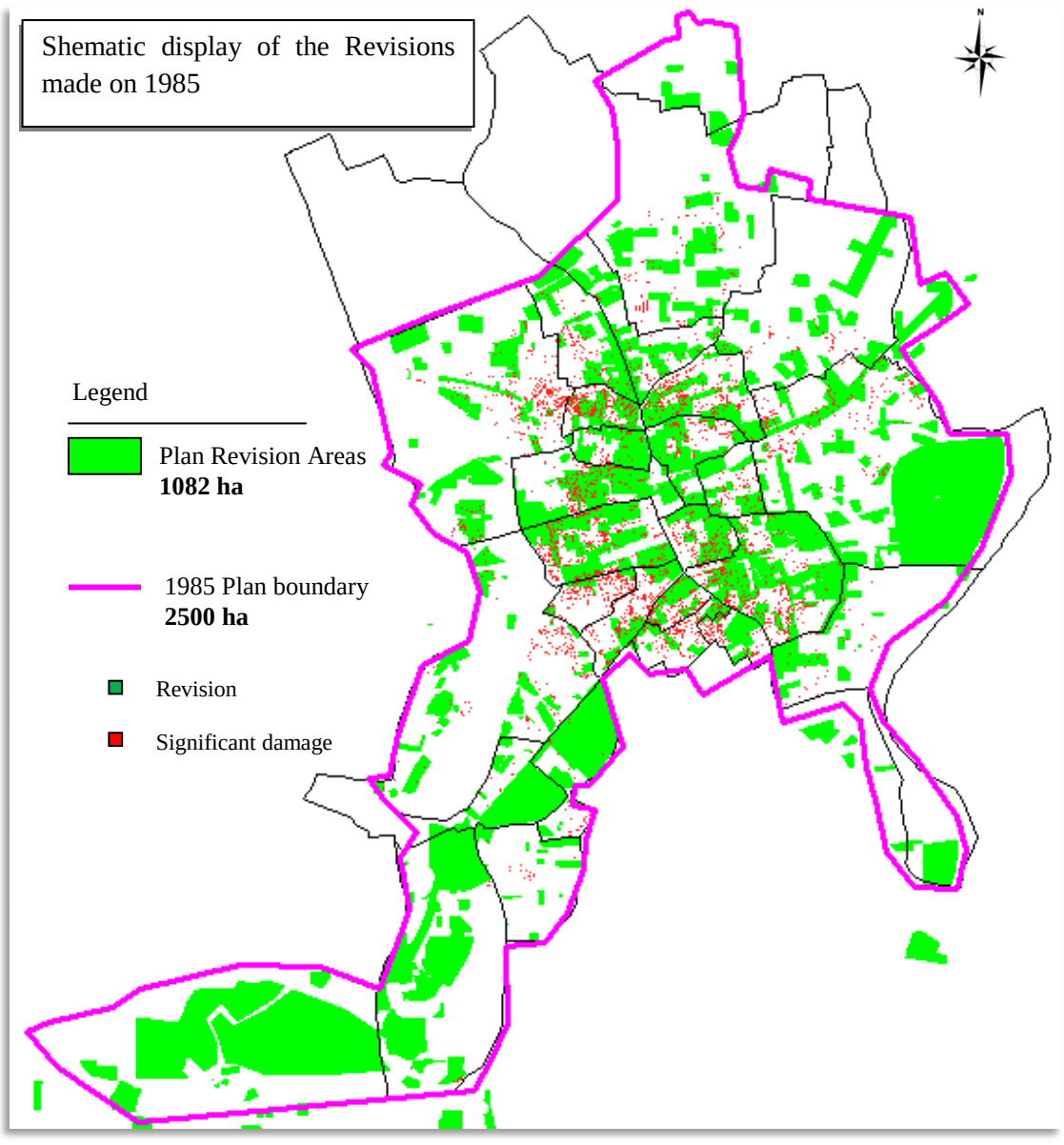
The plan at the scale of 1: 25’000 of the region indicates the villages of Karaman – Camili – Korucuk and Alandüzü as new settlements which was imitated by the plan prepared immediately after the earthquake of 17 August 1999 and approved by the Ministry of Public Works. It was according to this plan that 8500 disaster houses were constructed in the region and the plan at the scale of 1:25000 prepared in 1996 was taken finally into effect by being approved with the section of New Settlements (Map 4.10 – Map 4.11).



Map 4.11 2030 City Macro Form Environmental Arrangement Plan at the Scale of 1:25 000 of 1996 (Bayhan, 1998)

4.5.6.1. Analyses Regarding Plan Revisions Made Between 1985-1999

The informed estimation is that about 950 separate pieces of plan revisions have been made between 1985 and 1999. However, only 701 pieces of these could be accessed (Map.12).



Map 4.12 The 701 Revisions Made Within The Boundaries Of The 1985 Development Plan

If considered in terms of development blocks, the revisions made to the 1985 plan seems to have affected %30 of the total.

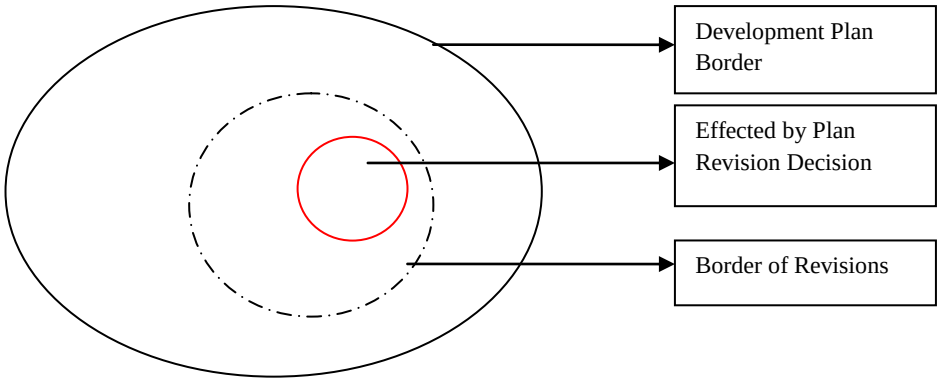


Figure 4.7 Areas Affected by the Plan Revisions

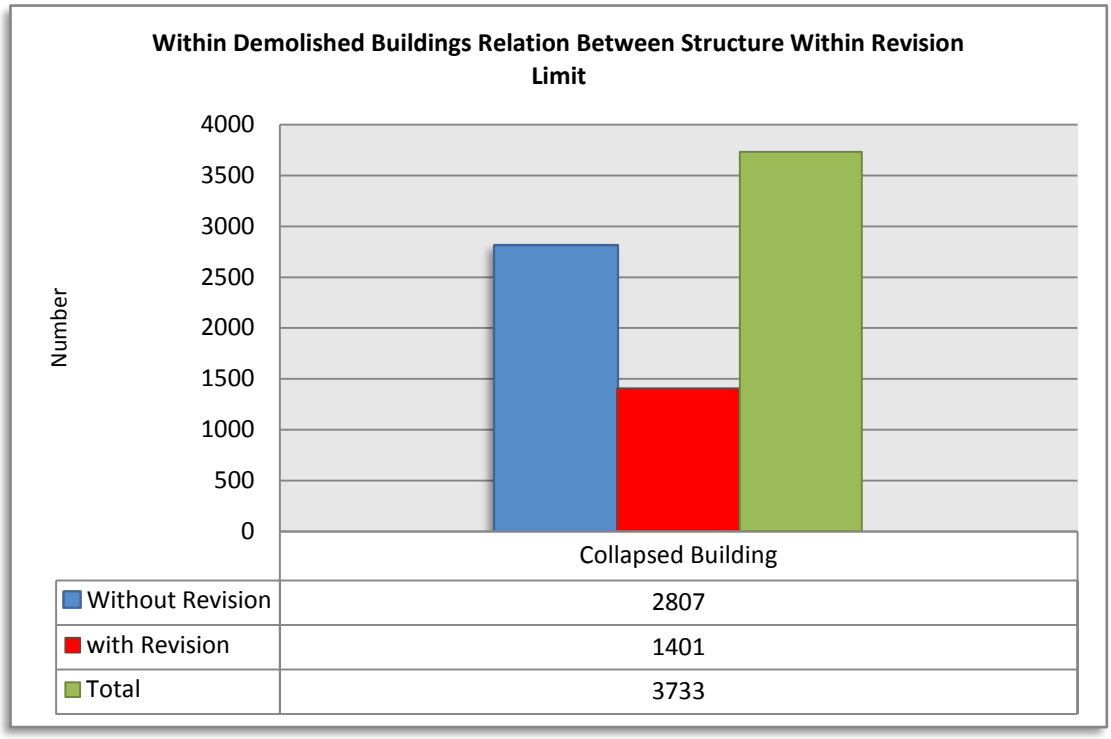


Figure 4.8 Within Demolished Buildings Relation Between Structure Within Revision Limit

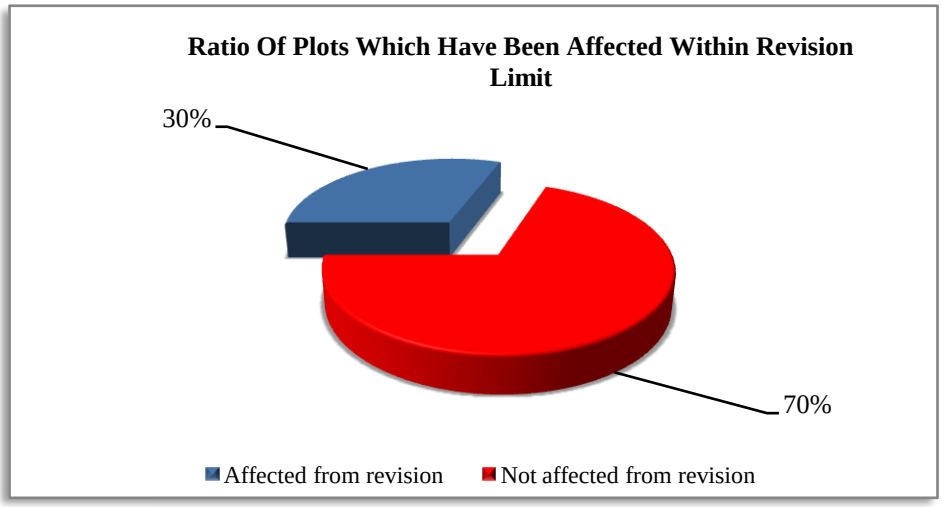


Figure 4.9 Ratio Of Plots Which Have Been Affected Within Revision Limit

4.5.7. 1957-1985 Application Development Plans and Last Situation before 1999 Earthquake

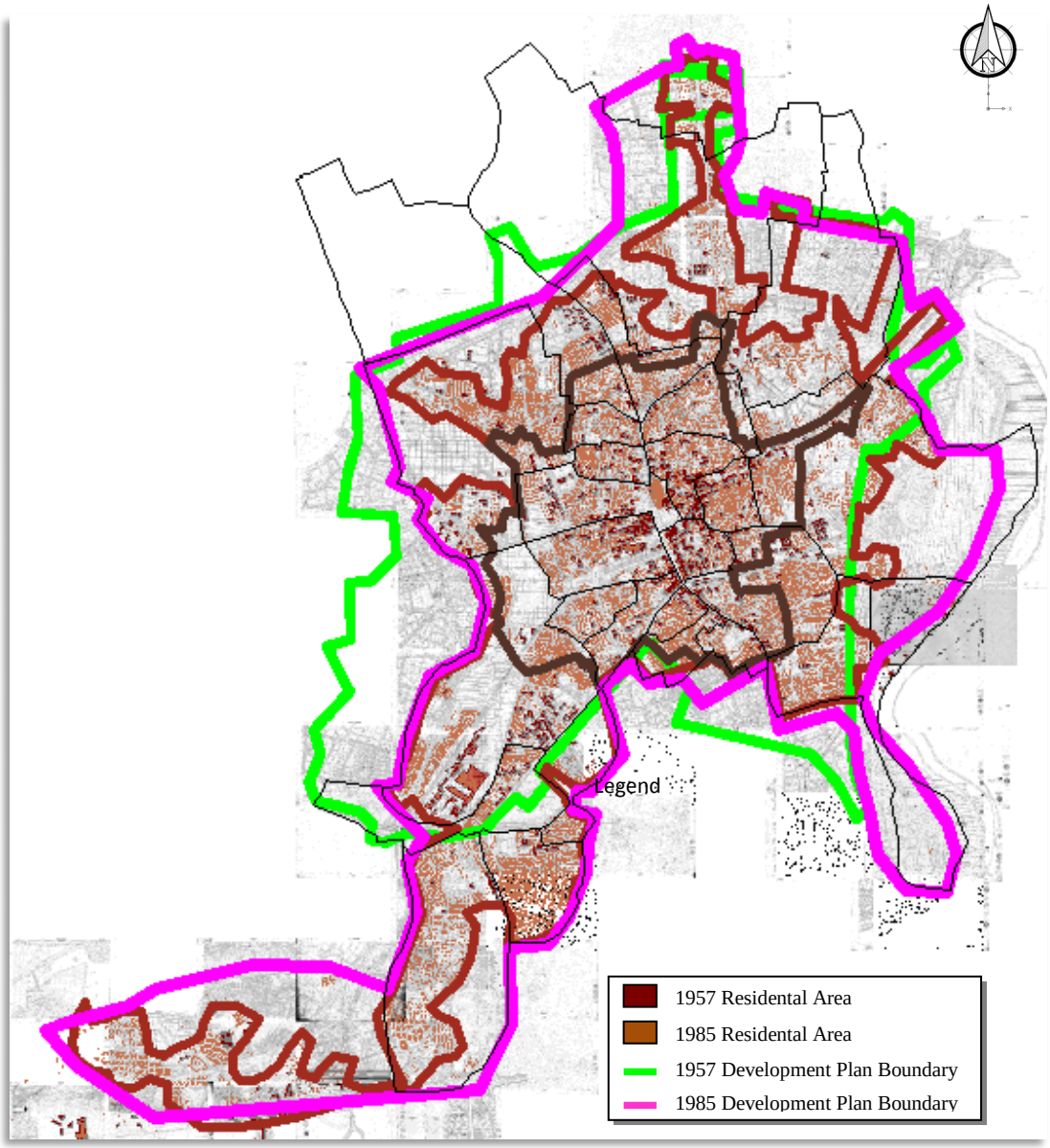
Planning area which was 1921ha at 1957 plan has been increased to 2200 ha with 1985 plan, with addition development plans made after 1985 plan it has been increased to 2466 ha. Table 4.5 - Map 4.13

Within period from 1957 to 1999 in planning area, there has been a growth with including of Beskopru quarter and Yagcılar quarter which locates at the east of centrum close to Sakarya river, Dagdibi tekeler quarter which locates at the north of centrum and Hızırtepe and Malteoe quarters which have been located at the south of centrum.

Adapazarı is indicated in the Earthquake Hazard Map of Turkey as located in the first degree zone. Despite the fact however, the 1985 development plan ignored a relation between ground properties in geologic terms, and number of floors of buildings and assigned 4-5 floors in the central city, densely accommodating the population. The same plan has reduced open spaces in the city. Whatever was designated as green areas in this plan has been removed later with 950 plan revisions, futher reducing the available open spaces.

Table 4.5 1957-1985 Plans And Function Changes Happened In Plan Actions Before The Earthquake In 1999

	Adapazarı Development Plan					
	Original Plan	Plan 1985	Revisions	Ratio of Revision **(%)**		
	1957 (1)	1985 (2)	1999 (3)	1-2	1-3	2-3
Planned Area (ha)	1921	2200	2466	%13	%28	%11
Planning Population	250 000	600 000	1.000.000	%140	%300	%67
Density	130	300	405	%130	%211	%35
Housing	739	820	973	%11	%32	%19
Trade	43	85	104	%98	%142	%22
Industry	265	100	109	-62%	-59%	9%
Green+ Sport Area	250	310	260	24%	4%	-16%
Green Area Per People	**10**	**5**	**2.6**	**-48%**	**-74%**	**-50%**
Administrative	13	93	103	615%	692%	11%
Education	27	46	54	70%	100%	17%
Number of the Floors	2-3	3-4-5	3-4-5			
Structure Arrangement	Detached	Detached	Attached			



Map 4.13 Development Plans and Designated Residential Zones

Projection population of 1985 development plan made after the 1957 plan has been considerably increased. But a development plan was made that can comfortably accommodate 3 times more population than the projected population. The most important decision was that of building floor intensities which increased number of floors to 3-4-5 floored structures. This rise in density took place in the districts located on the alluvial

formations of Adapazarı, despite the earthquake experiences of 1943 and 1967 (Figure 4.10|).

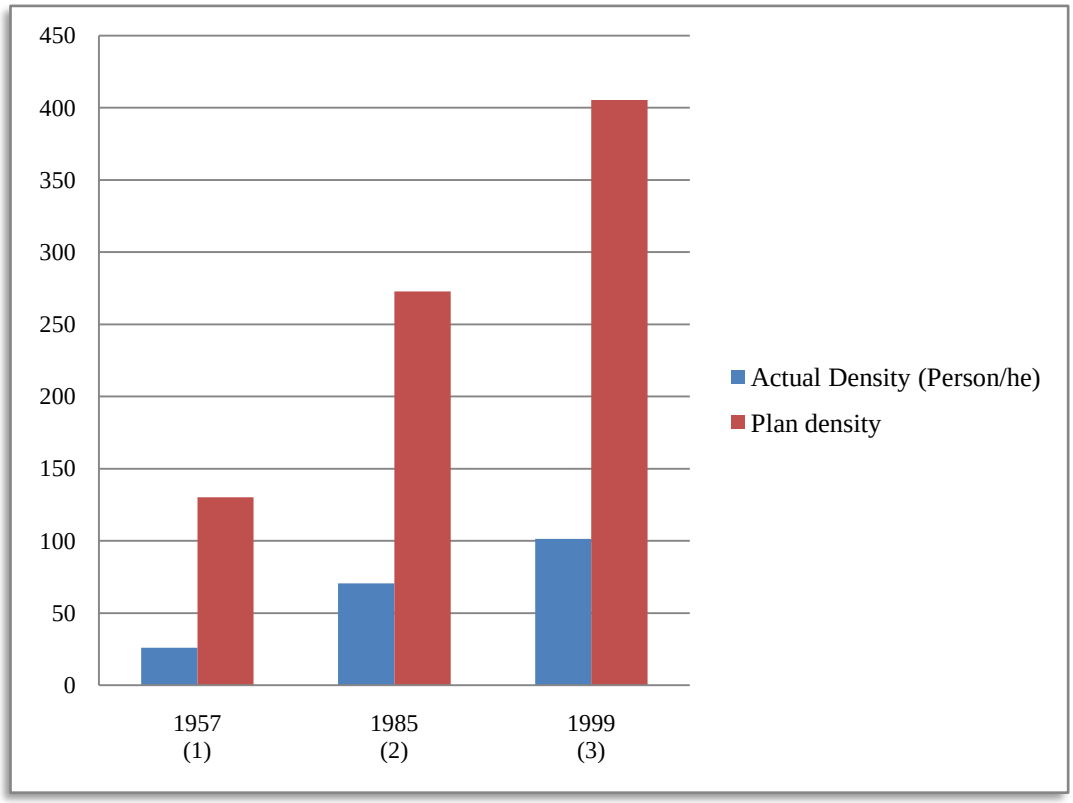
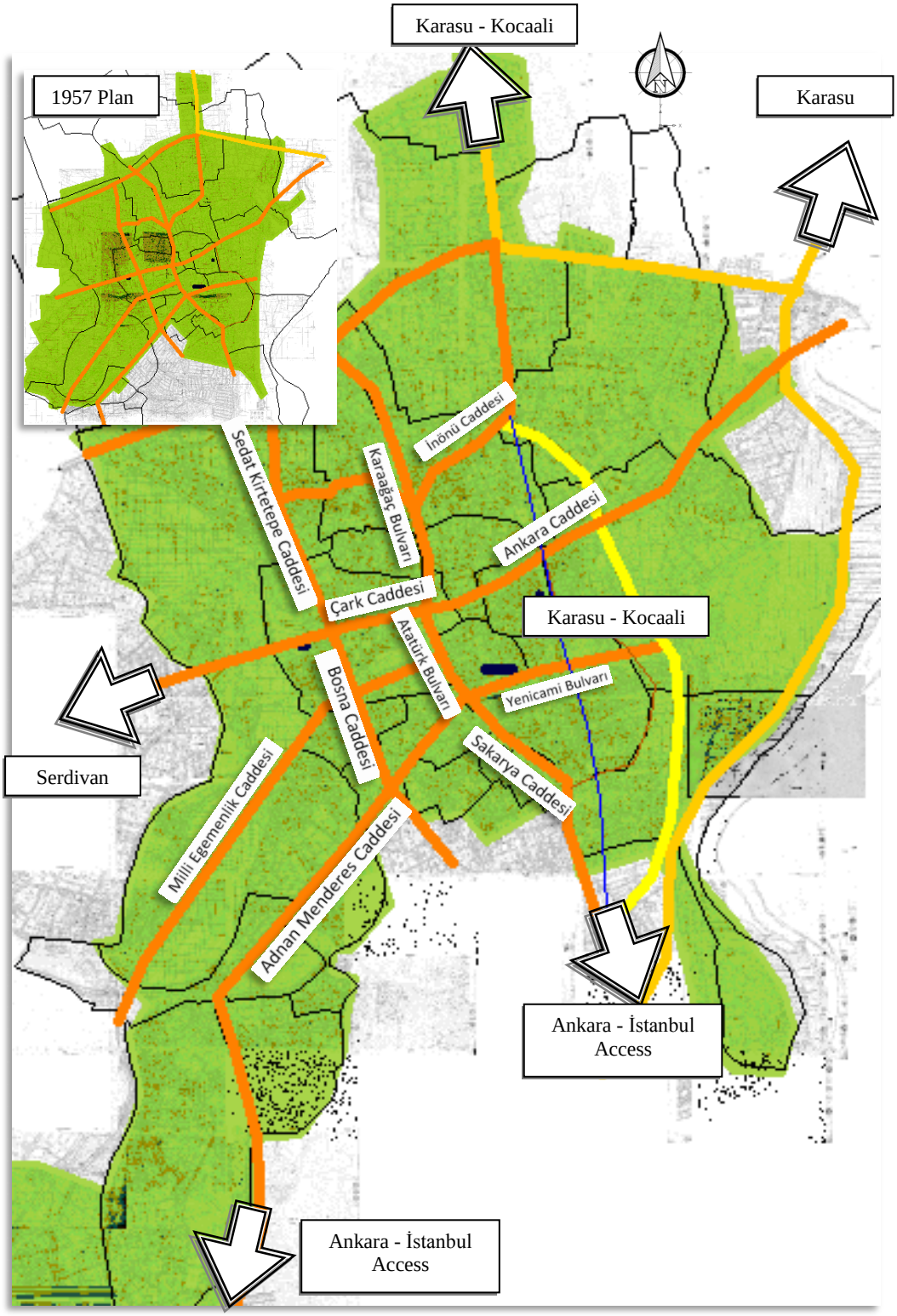


Figure 4.10 Densities designated by Plan and Actual (persons/he)

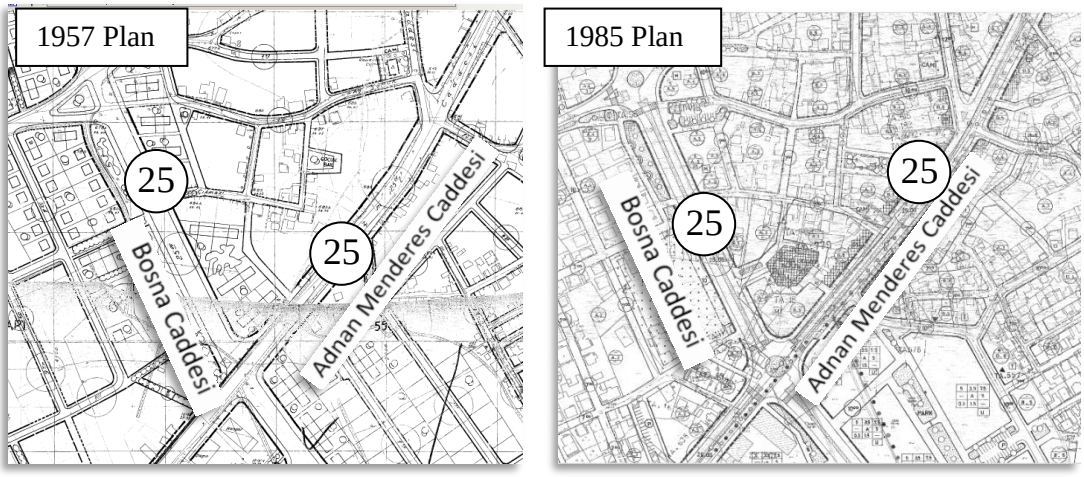
Transportation system: While the densities were increased in the 1985 development plan, no changes have been achieved in the infrastructure and the road widths, especially in those streets of Adnan Menderes (Izmit Street), Bosna, Sakarya, Sedat Kirtepet, Ankara, Orhangazi, milli egemenlik, which are the main arterial roads of city that were designated in the 1957 plan, to meet demands of that period. No new transportation network was either offered as a new system to meet current demands which had vitally adverse effects in the earthquake. (Map 4.14)



Map 4.14 Major Roads in Central Adapazarı

The road widths and sizes determined by the 1957 plan have not been changed by the 1985 Plan despite the nature of 30 years of urban growth. No other measure was taken to serve the

movement needs of population and reduces crowding on the roads. The major roads in particular were under severe pressure due to the decisions of the 1985 plan allowing ground floor commercial uses im buildings of 4 and 5 storeys. The road system remained as a constant from 1950 to 1999. When buildings on these major roads collapsed in 1999 the total movement in the city came to a halt. The clearing of blocked roads took weeks after the disaster.



Map 4.15 Roads in the 1957 ve 1985 Plans

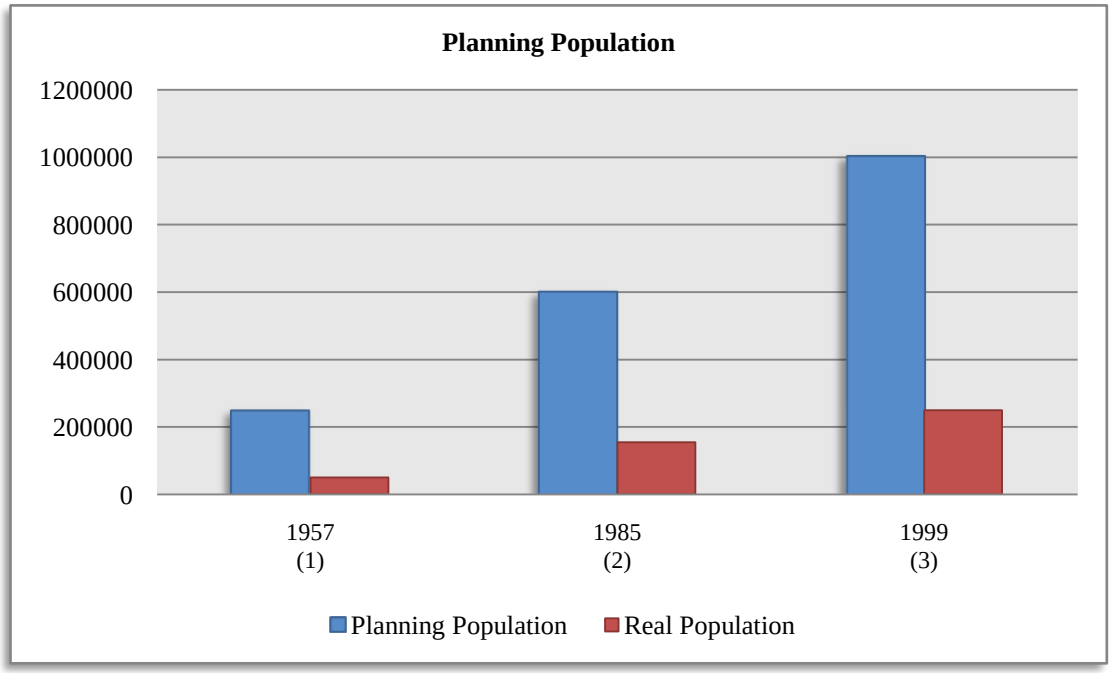


Figure 4.11 Population Envisaged by the Plans and the Actual Increase

Green areas designated in the 1957 plan provided 10 sqm. per person. This was been decreased to 5 sqm. with the 1985 plan. Decreases in green areas despite the apparent need and low standards were one of the most significant changes. Besides, the 1957 development plan that allowed load-bearing buildings of two floors in 6 districts in the city center was permitted development by the 1985 plan also in areas which were previously designated as vineyards and orchards. The 1985 development plan and revisions allowed mostly building in the adjacent order, and with 4-5 floors at major streets, 3 floors at minor streets (Figure 4.11).

Green area standard which was 5 sqm. in the 1985 development plan has been further decreased with plan revisions up to year 1999. This was mostly realized with the conversion of green areas to residential uses by means of individual plan revisions after 1985. In these areas, green area standard has been decreased down to 2sqm. in the development plan of year 1999 (Figure 4.12).

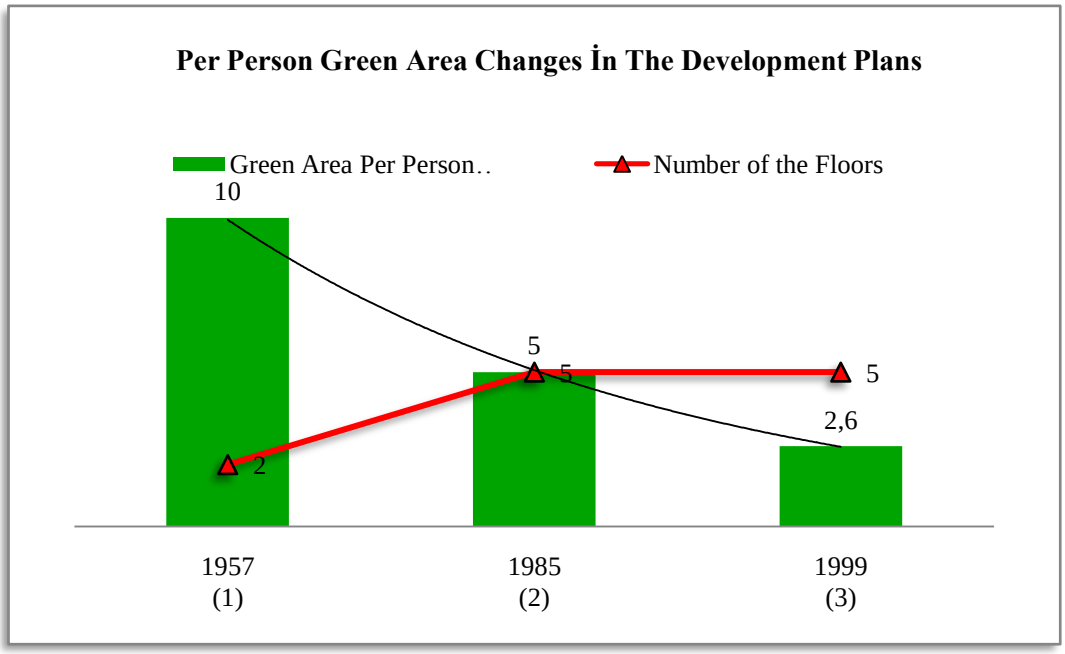
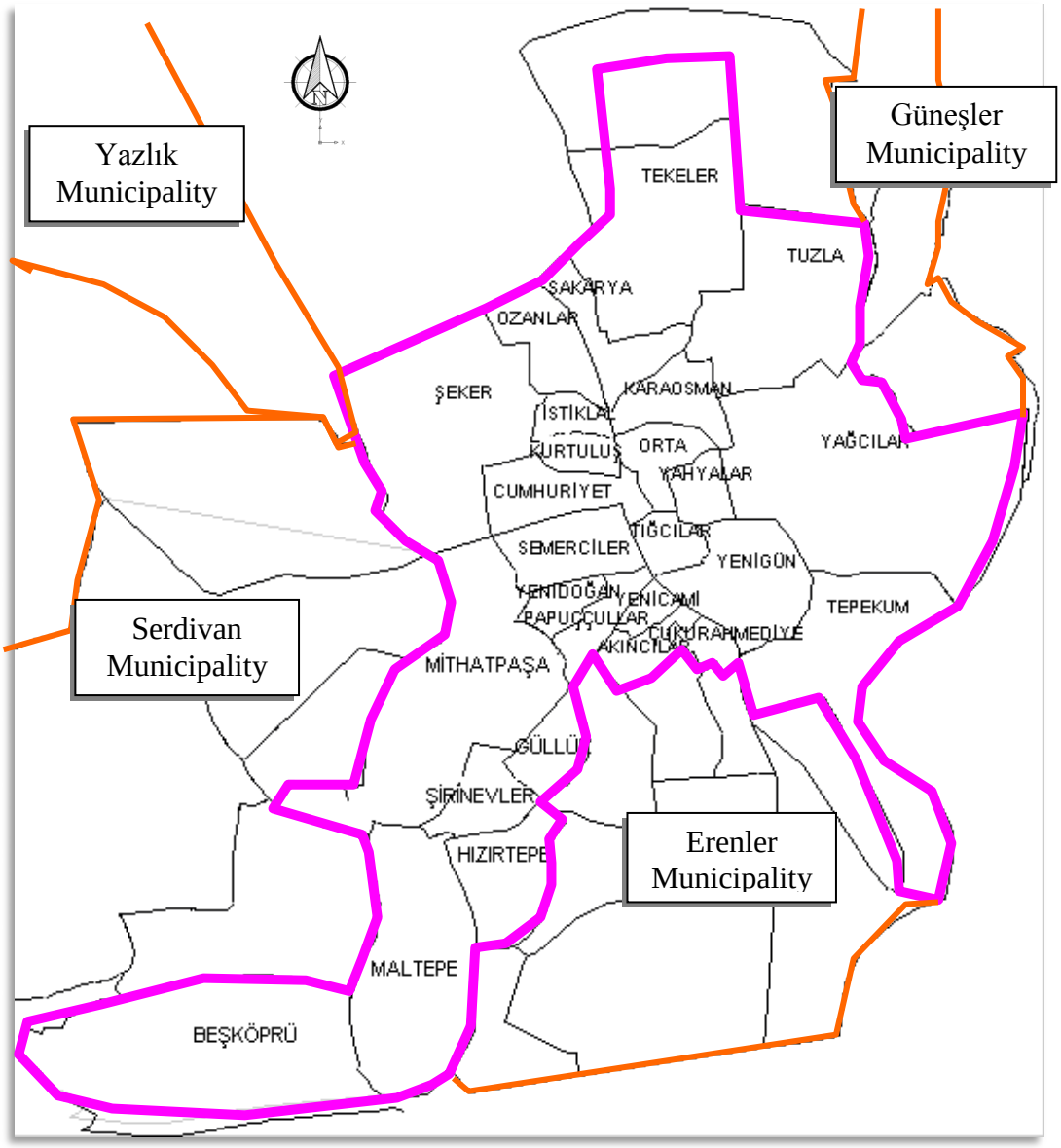


Figure 4.12 Green Area per Person in 1957-1985 and 1999 Development Plans

Changes in building order is a second major condition that has adversely affected safety conditions in the city. The legends which clarify building order in the 1985 development plan was indefinite in districts with high urban density, and form and size of buildings have been given according to current plot size and shape. According to this, even detached

separate ordering has been transformed into adjacent structures. Reason of this was that in districts such as Tigcilar, Cumhuriyet, Semerciler, Yenicami, Akincilar, Yenidogan, Papuccular, Orta, Kurtulus, Istiklal, Karaosman buildings have been built for years in this manner due to the size of plots which were 150-250 sqm. in the average. At such conditions the 1985 development plan allowed a floor area ratio (FAR) of %60. Other districts like Ozanlar, Sakarya, Tuzla, Tekeler, etc. also acquired this tolerant condition one after the other by means of revisions in the plan. (Map 4.16)



Map 4.16 Central Adapazarı Districts and Neighboring Municipalities

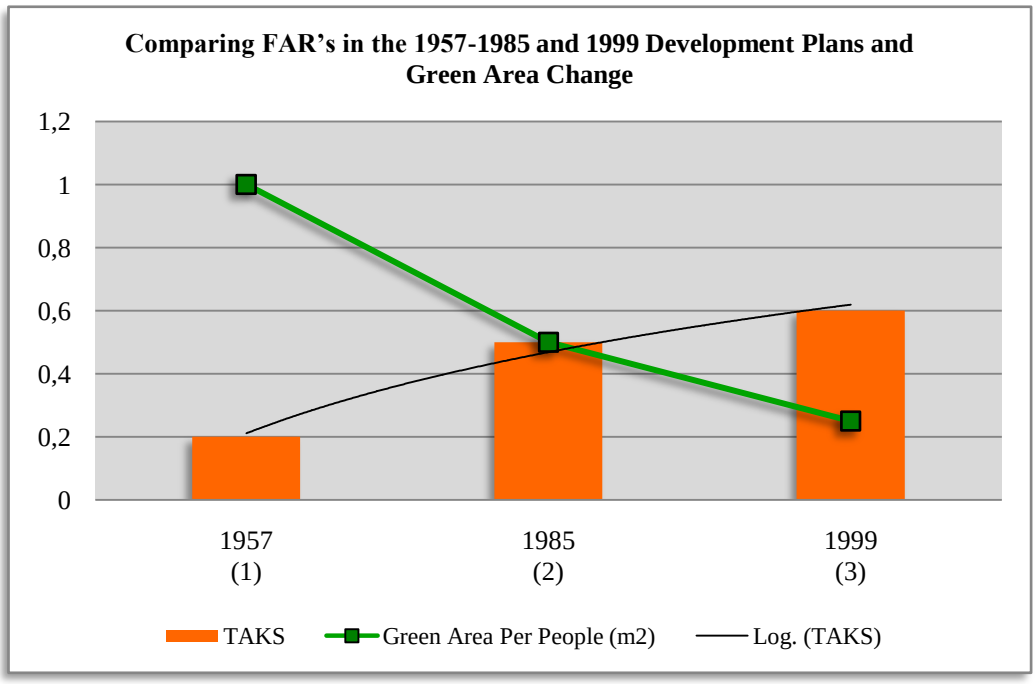
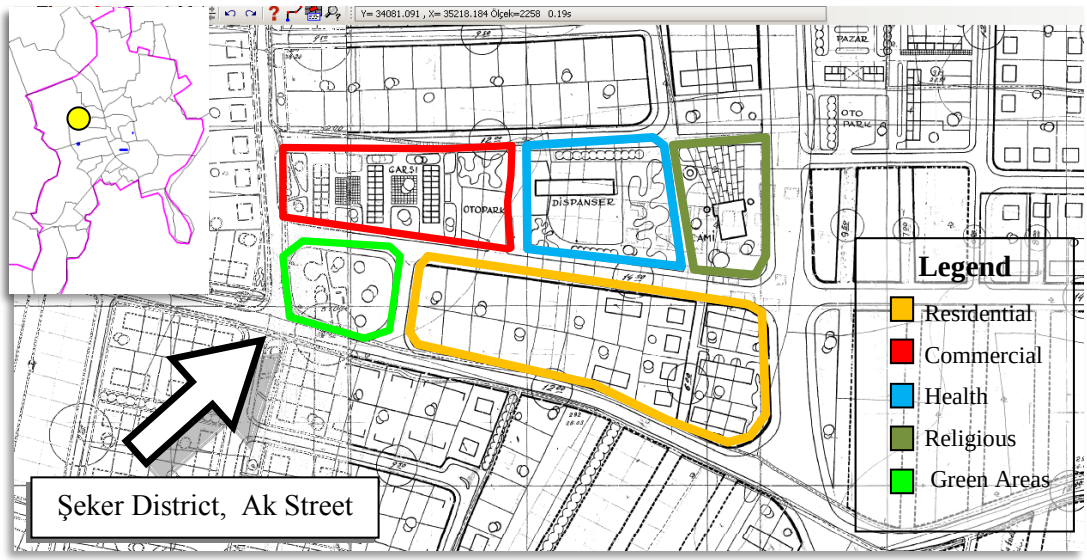


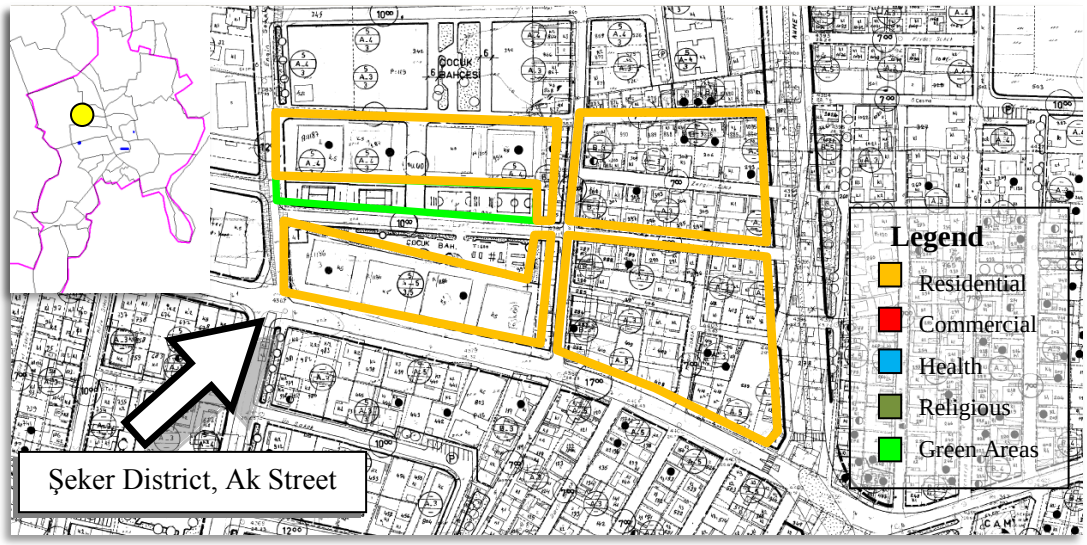
Figure 4.13 Comparing FAR's in the 1957-1985 and 1999 Development Plans and Green Area Change

Function and form changes between the 1957 and 1985 Application Development Plans and the effects of the commercial / business functions is another major factor to explain the trends in the city and the political-social impositions in the process of planning. In the 1957 plan commercial functions have been planned together with health, sports and green areas so as to constitute mixed local small centers (Map 4.17). Yet in the 1985 development plan, most of such combined mixed-use areas were transformed into high density residential use (Map 4.18).

Also an urban tissue which overtook all main streets has been formed by converting existing residential units into trade and commercial uses with large windows, removing the walls at the ground floor level.

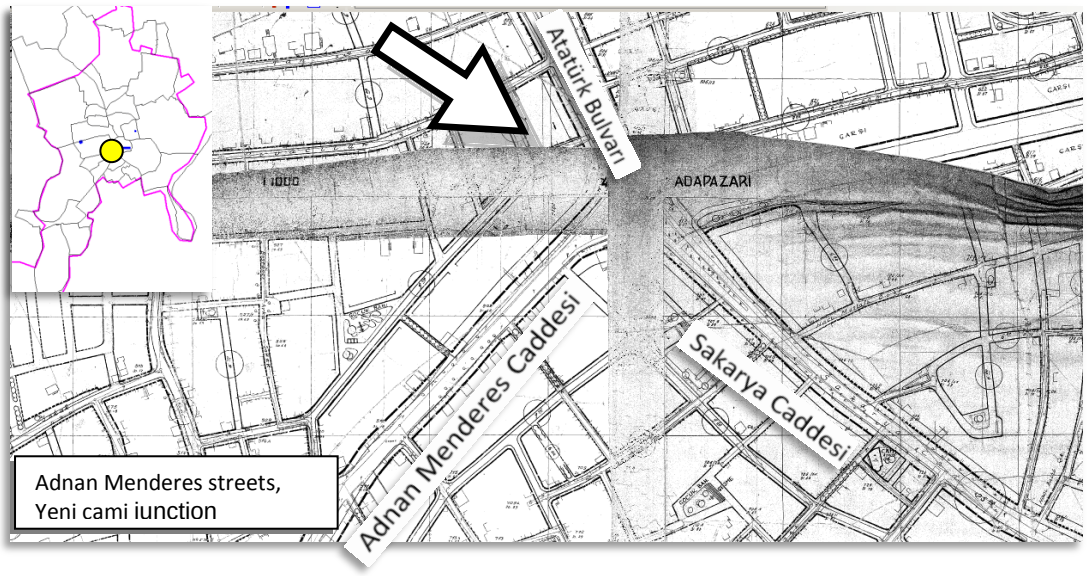


Map 4.17 1957 Development Plan

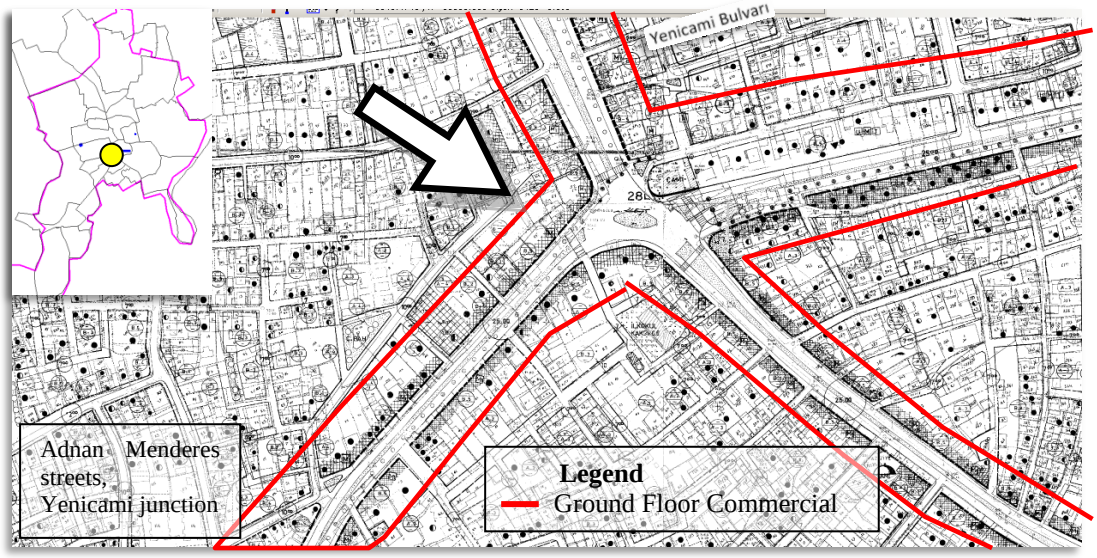


Map 4.18 Converted Land-Use with the 1999 Development Plan

Apart from the conversion of building coverage (FAR) in plots with the 1985 plan, the expansion of commercial and business uses along the main roads that was designated only for residential uses in the 1957 plan is the decision that changed the urban identity and reduced safety in the city. It was not surprising to observe that most of the damage that occurred in the 1999 earthquake took place along such major central roads (Map 4.19 and Map 4.20).



Map 4.19 The 1957 Development Plan, Adnan Menderes Street

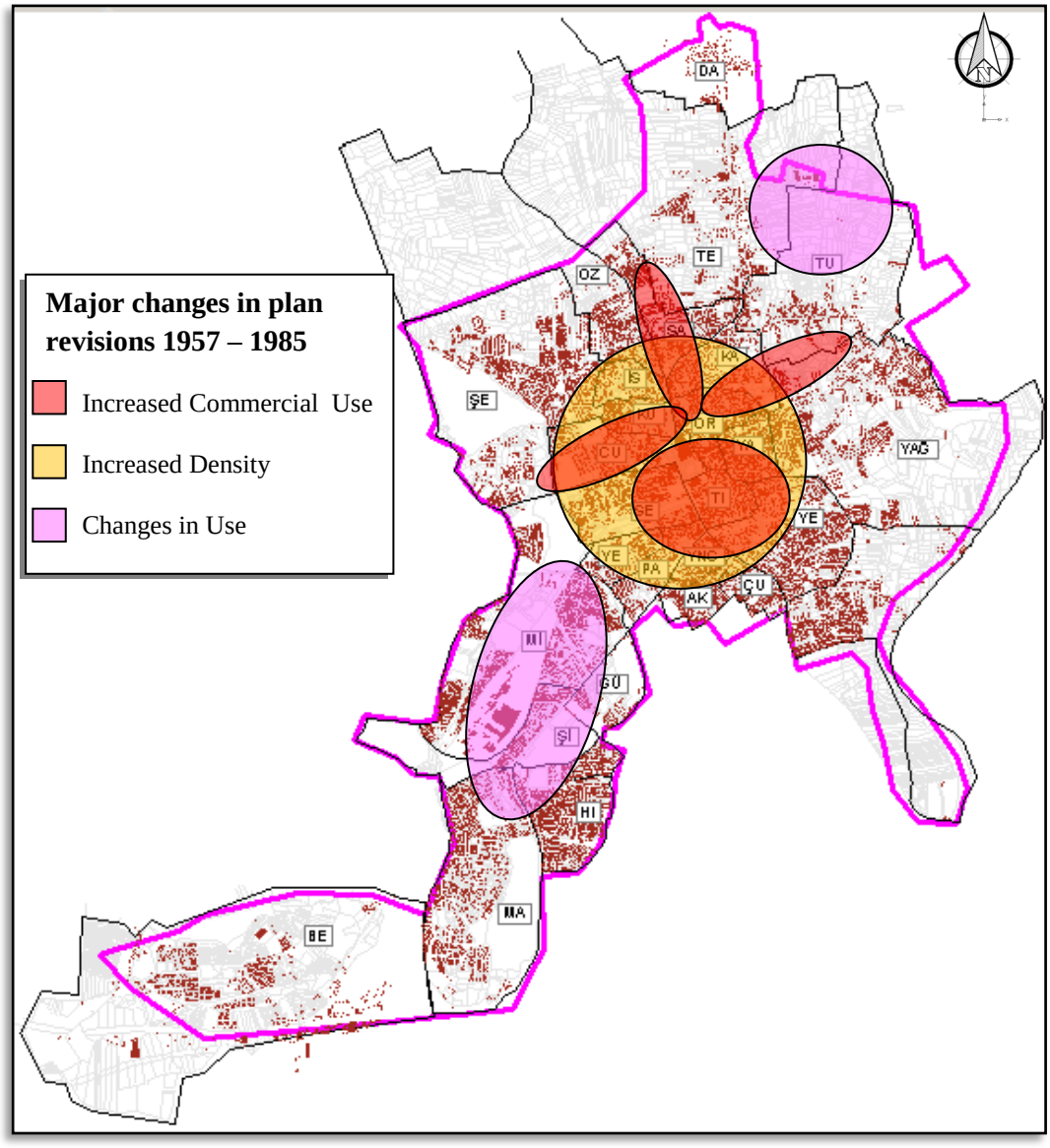


Map 4.20 The 1985 Development Plan: Adnan Menderes Street Ground Floor Commercial Uses Allowed

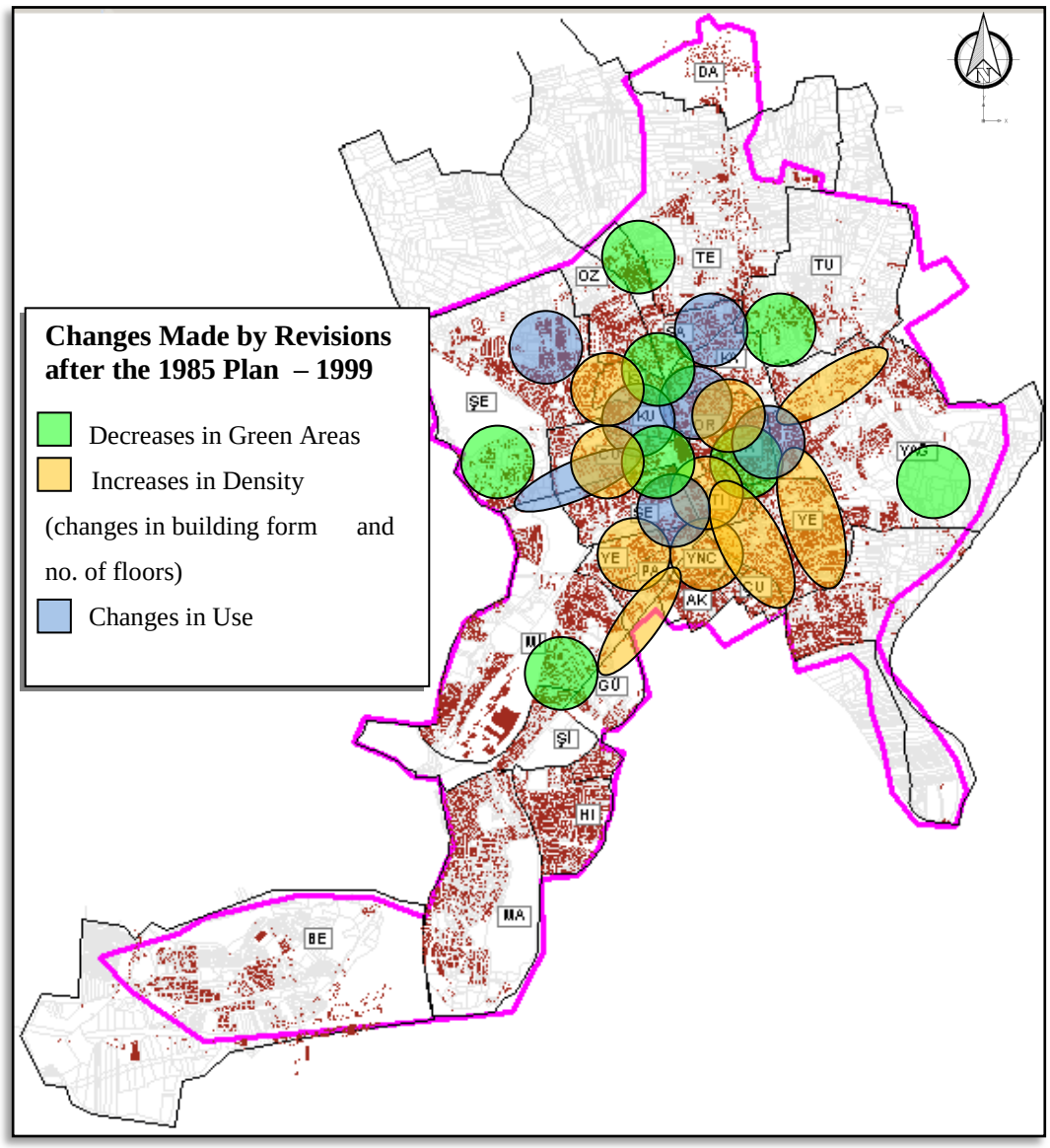
In Figure 4.14; 4.15; 4.16; and 4.17, the 1957-1985 and 1999 development plans are compared in terms of a number of basic indicators. These cover total population and planned land surface, densities, land-uses such as residential, commercial, and industrial, open and green spaces, public infrastructure. Changes in these indicators reveal that standards have fallen down to increase the potential risks in the city. Green areas have turned into residential

areas increasing the densities in the central districts, and reducing public facilities land-use, despite the fact that a major industrial plant has been removed from the central city. Map 4.21

As mentioned before, 17 august earthquake has been realized with green area turning into residence area and insufficient equipage area at density rising centrum. If enough equipage area had been placed in plans, effects of demolishment would be decreased even one step. As seen in Figure 4.14; 4.15; 4.16; density have been rised between 1985 and last 1999 development plan occurred with revision but equipage areas have been decreased.



Map 4.21 Changes in Plans by means of Revisions 1957 – 1985



Map 4.22 Changes Made by Revisions Since the 1985 Plan – 1999

Revisions changes, which increased the risk of earthquake compared to the 1985 plan and 1999 plan before earthquake (namely; annihilating green areas, increase in density, addition of new commercial uses) are mounded around Cumhuriyet, Yenicami, Papucçular, Akıncılar, Semerciler, Yahyalar, Orta, İstiklal, Kurtuluş Districts. On the other hand, revisions based on function changes are located generally in Şeker, Yağcılar, Mithatpaşa, Karaosman, Sakarya, Tepekum, Tekeler, Tuzla districts. All these districts stands on alluvial ground.(Map 4.22)

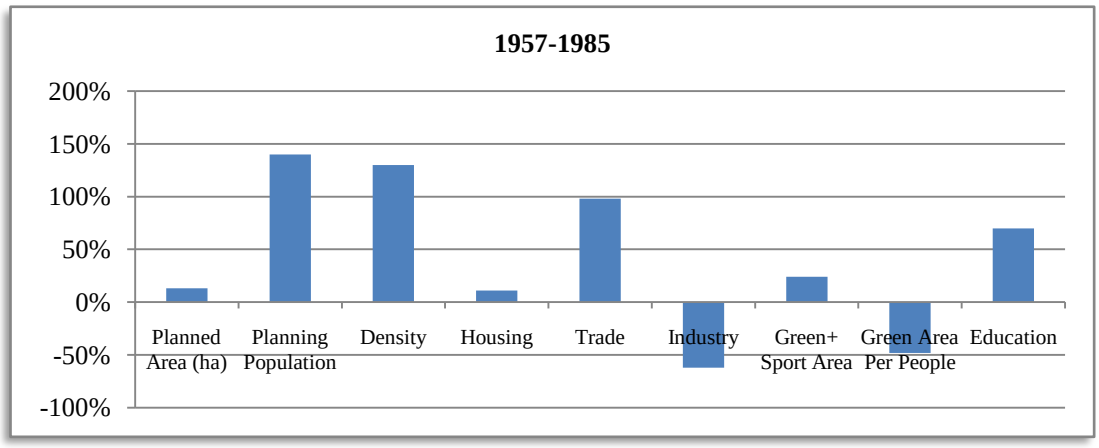


Figure 4.14 Comparison of the 1957-1985 Development Plans

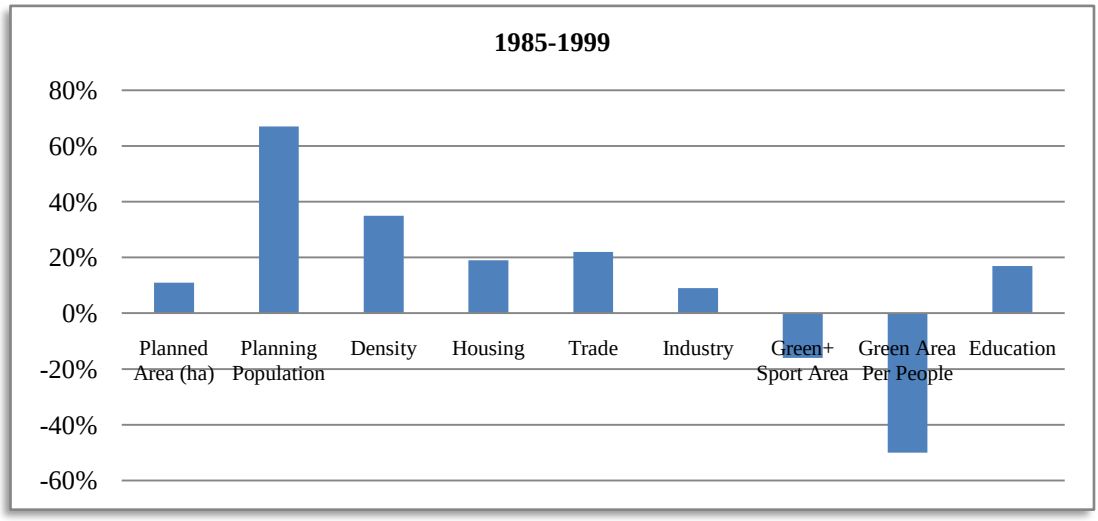


Figure 4.15 Comparison of the 1985-1999 Development Plans

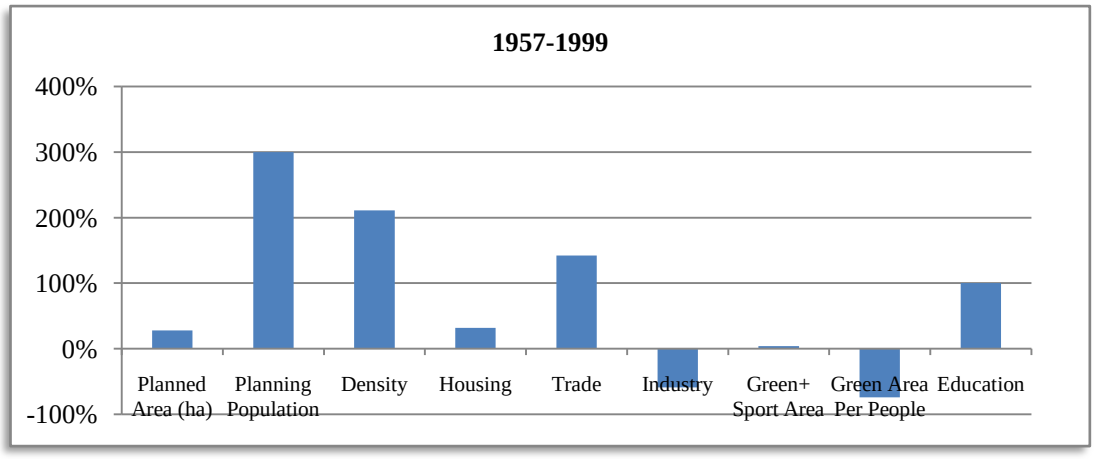


Figure 4.16 Comparison of the 1957-1999 Development Plans

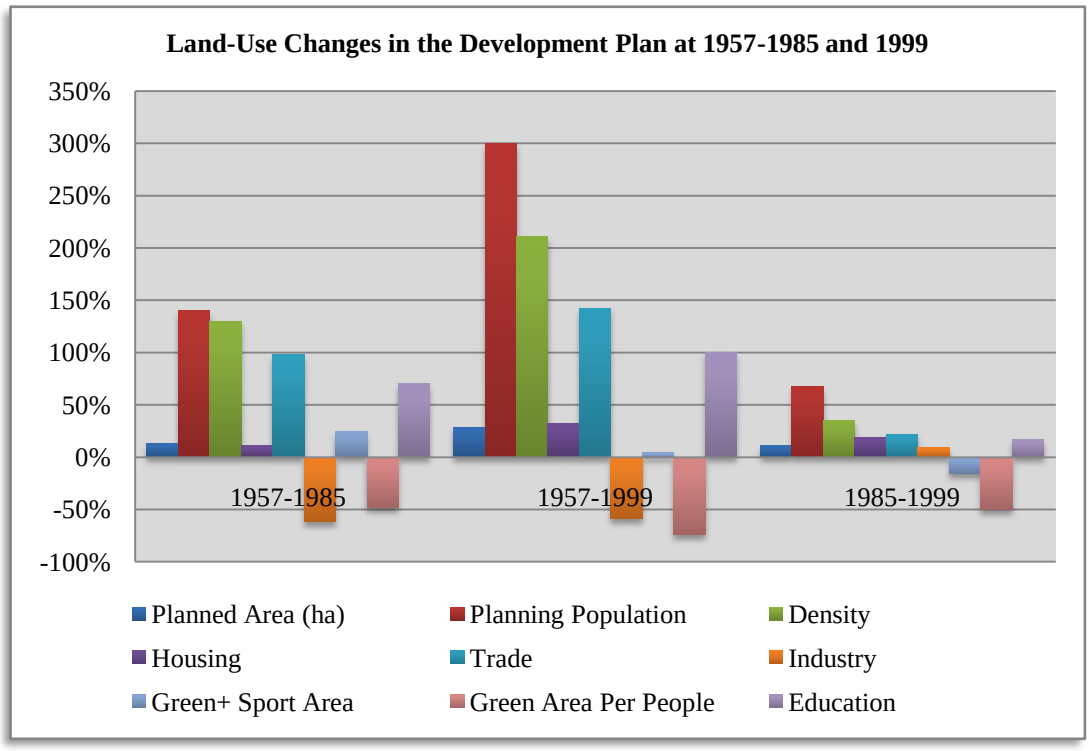


Figure 4.17 Land-Use Changes in the Development Plan at 1957-1985 and 1999

The whole history of planning in Adapazarı seems therefore to represent steps that gave rise to the immense devastation the city experienced in the 1999 earthquakes. Given the planning decisions and their allocations in space, it is now possible to examine the how effective these decisions were in losses experienced in 1999. The next chapter will evaluate the possible associations of the spatial distribution of losses of life and property with the planning decisions in space.

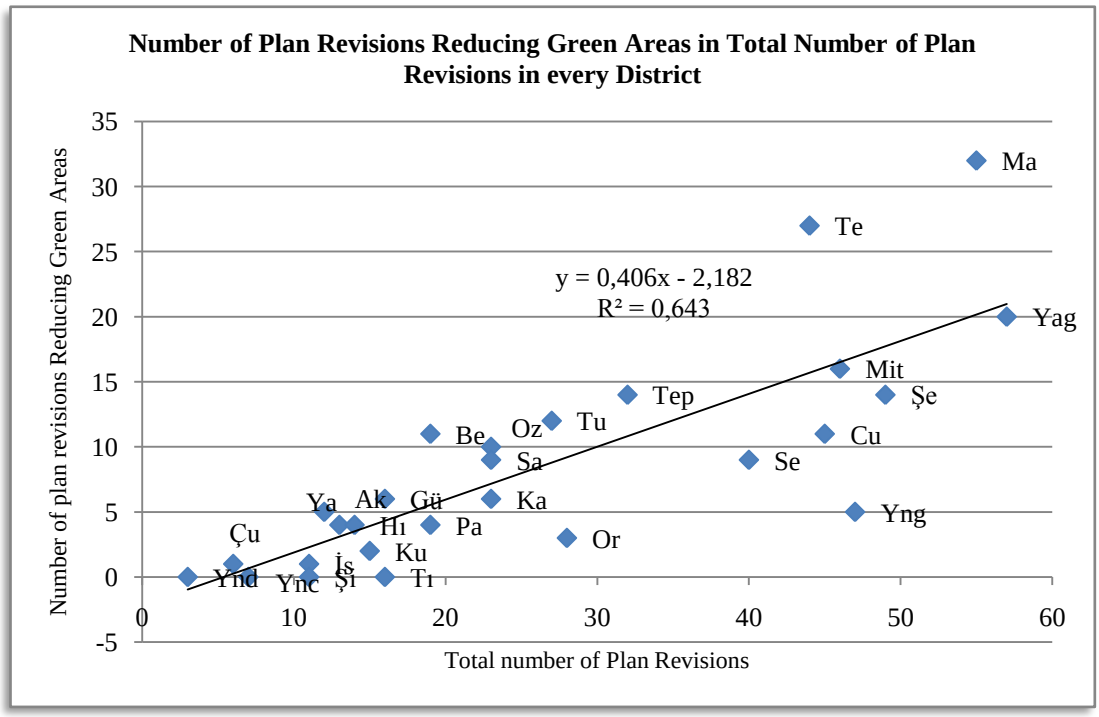


Figure 4.18 Number of Plan Revisions Reducing Green Areas in Total Number of Plan Revisions in every District

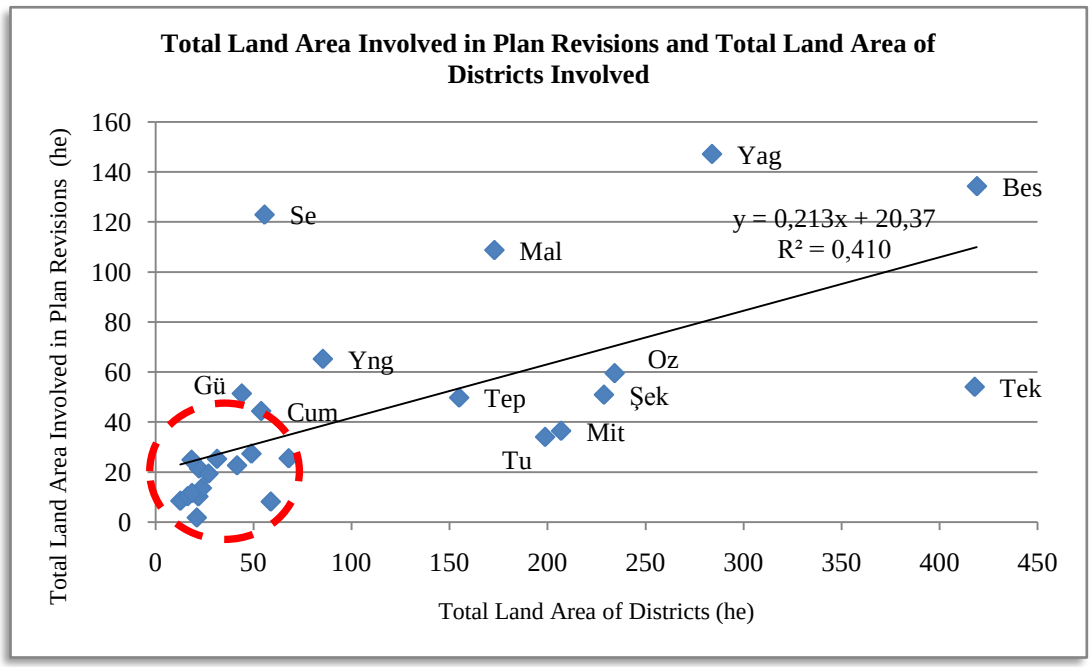


Figure 4.19 Total Land Area Involved in Plan Revisions and Total Land Area of Districts Involved

Three distinct groups can be delineated in this distribution of revisions to districts. Agglomeration indicated by the red circle represents a sample of more central districts with smaller total area, and revisions therefore involving smaller areas. Districts above the line on the other hand, represent larger districts and those further away from the city center. In most of such cases, open areas reserved for urban green in the 1985 plan have been converted by revision plans to residential complexes by means of housing cooperatives. Though number of revision in such cases are relatively small, they imply large tracks of land. Those below the straight line are districts in proximity to the center represent larger districts with smaller number and areas of revisions made. Figure 4.19

Semerciler (Se) district is a unique case which is centrally located, with a smaller area. Yet the multiple number of revisions and the total area this set of revisions entails in 'Se' is larger than the total district area itself. Cumhuriyet (Cu) district again has a similar condition.

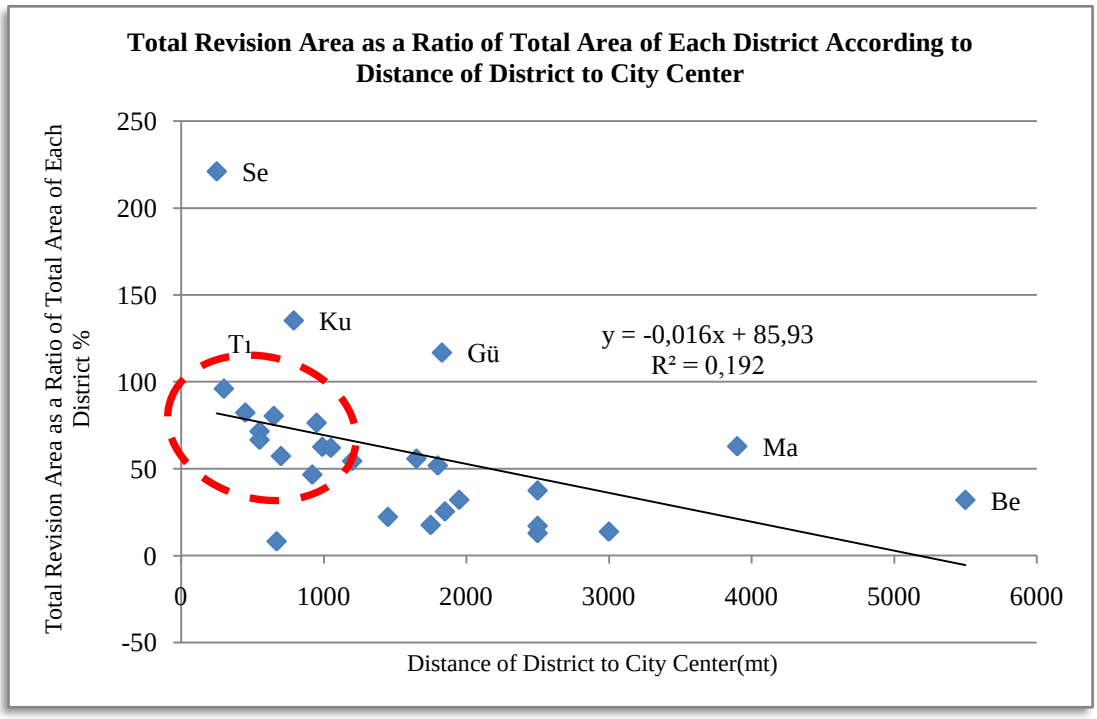


Figure 4.20 Total Revision Area as a Ratio of Total Area of Each District According to Distance of District to City Center

As observed in the distribution of ratio of revision areas according to distance to center, the districts with higher rates agglomerate in the city center (as in the red circle in Figure xx). The rate of revision areas fall with distance except a few of the cases (Güllük, Maltepe, Beşköprü) where large tracks of land received a few special designations of land-use in larger tracks of land available in the peripheral districts. Figure 4.20

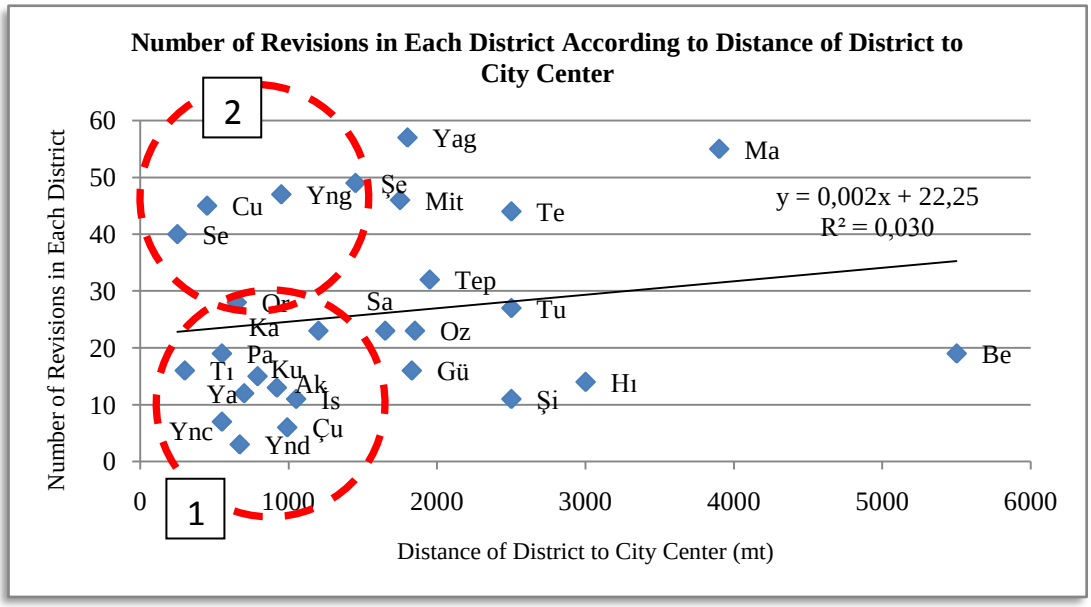


Figure 4.21 Number of Revisions in Each District According to Distance of District to City Center

Districts grouped in the red circle (1) are smaller and centrally located districts with relatively smaller number of revisions in plans. This can be explained by lower availability of space for development in these districts. The group falling into the red circle (2) are however, though central and small as well are those which experienced multiple revisions often in the very same areas, and which enjoy higher demand and property values, and therefore higher rent transfers in development decisions.

In the rest of the Figure, districts that fall above the straight (regression) line are larger districts yet with greater number of revisions. Those below the line are districts more distant to the center that enjoyed smaller number of revisions. The Beşköprü (Be) district is a special case on the other hand, with a large area but also experienced revisions for large areas to including mass-housing projects. Figure 4.21

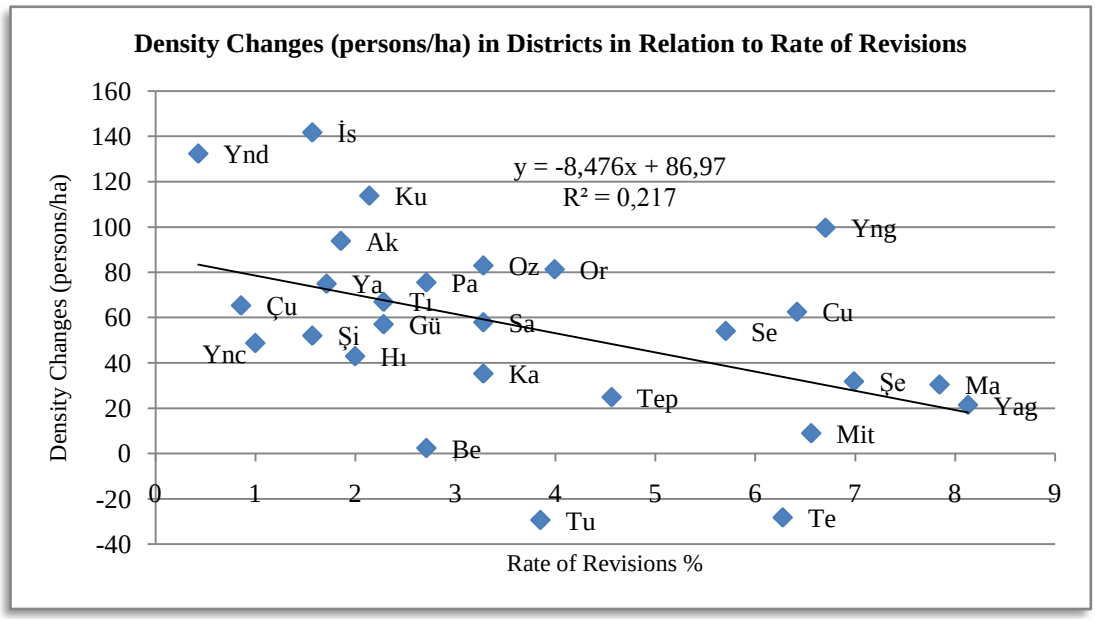


Figure 4.22 Density Changes (persons/ha) in Districts in Relation to Rate of Revisions

Net density is determined by multiplying the ground floor area with the number of floors of each building in any district.

Population Density of Districts According to Distance of District to City Center.

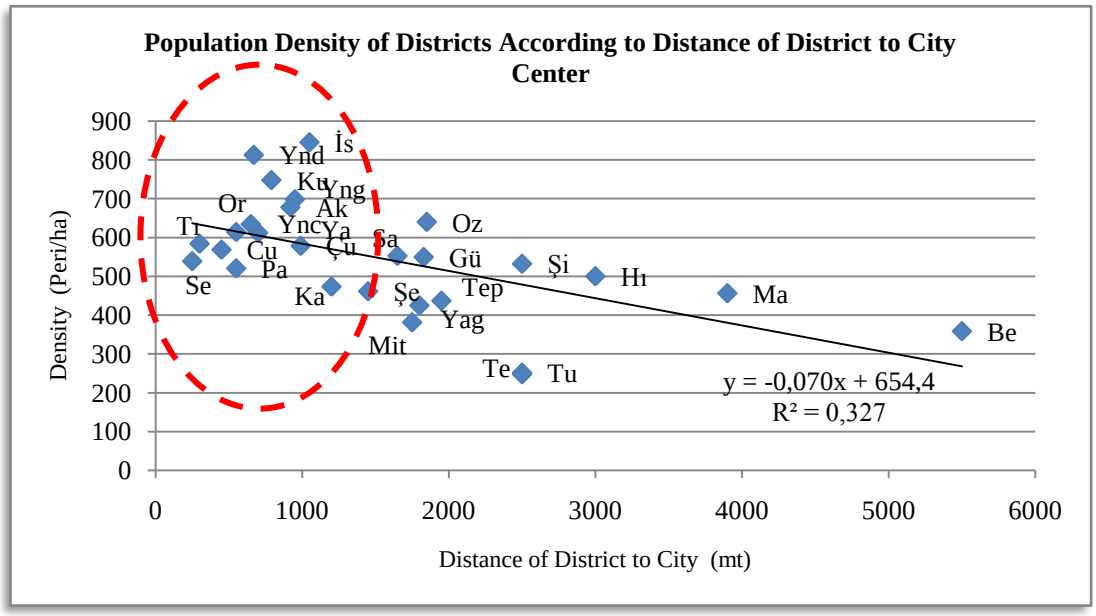


Figure 4.23 Population Density of Districts According to Distance of District to City Center

There is a clear indication that high density districts are the more central districts of the city.

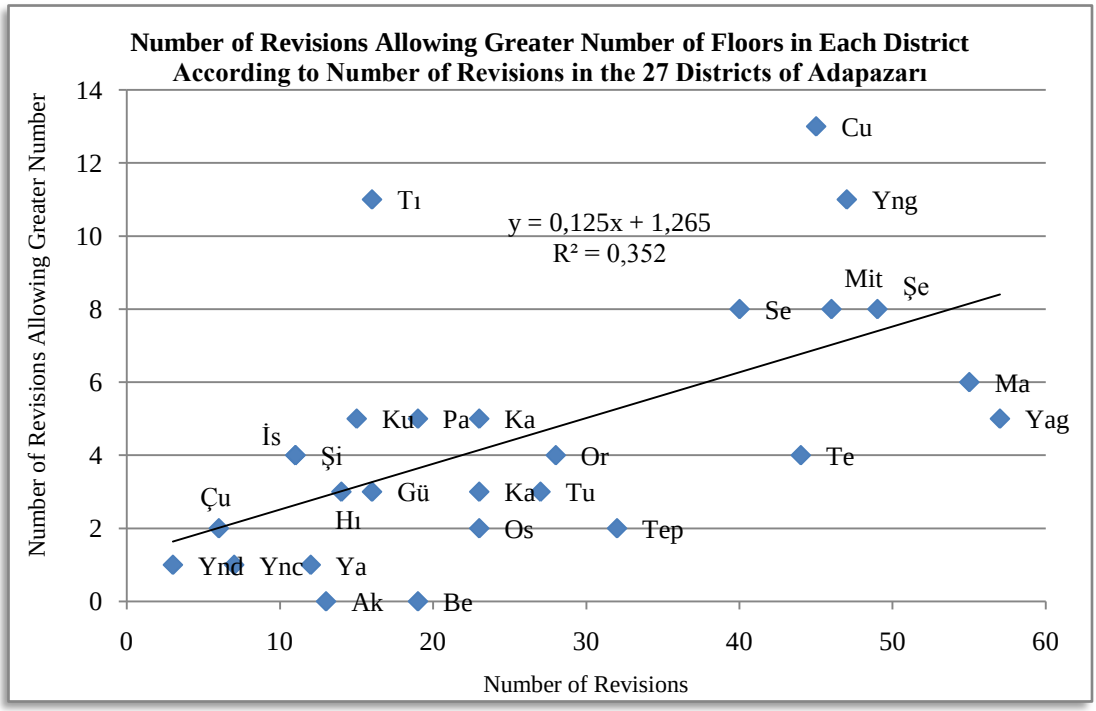


Figure 4.24 Number of Revisions Allowing Greater Number of Floors in Each District According to Number of Revisions in the 27 Districts of Adapazarı

The relatively central districts seem to have greater proportion of revisions to increase the number of floors in buildings

4.6. General Evaluation of Plannig Decisions

As the beginning of Adapazarı planning process, 1957 plan, proposes generally 2-3 storey buildings. The plan comprises Semerciler, Cumhuriyet, Tığcılar, Orta, Yenicami, Karaosman, Yahyalar, Akıncılar, Çukurahmediye and Şeker Districts and the main arterials (Adnan Menderes, Sakarya, Atatürk Boulevard, Orhangazi Avenue, Karaağaç Boulevard, İnönü Avenue, Çark Avenue, Sedat Kirtetepe etc.), that are still in use, have firstly seen in 1957 plan. The following plan which was made in 1985 has been improved around these arterials. Today, the main supporter spine of the city is still formed from these roads. If 1957,

1985 and the last situation before the 1999 earthquake are compared as plan arguments; it is seen that 1921ha planning area in 1957 increased to 2200ha in 1985 plan and 2466ha before the 1999 earthquake. Population projection increased from 250 000 people to 600 000 and lastly reached to 1 000 000 people. The density of the area increased to 300person/ha in 1985 from 130person/ha which is in 1957 and lastly in 1999 it is increased to 400person/ha. There is an escalation of 32% in residential areas between 1957 and 1999. However, in the commercial areas, it is recommended an increase of 93%. An important change in 1957 plan structuring decision according to 1985 plan and after that was the transition from detached buildings to attached buildings.

While in 1957 plan the green area ratio was 10sqm./person, it is reduced to 5sqm./person (decrease of 48%) in 1985 plan. In 1999, the rate decreased to 2.6sqm./person (decrease of 50%) after the plan revisions. Although, revisions that are aimed to annihilate the green areas and increase floor area ratio in center and around the center are not so much in spatial terms, they are high in numeric terms. There have also been major transformations in order to develop social housing in the surrounding districts but the revisions are not so much.

Although the new plan does not show ocular differences spatially compared to 1957 plan; the population projection of the city was planned as 4 times over the real population, by the density change decisions of 1985 plan. 950 plan revisions, that comprise 1082 ha area, were made in the area of 2500ha in 1985 plan. It shows that approximately 50% of the 1985 plan has partially changed in 14 years.

Briefly, the city of Adapazarı, realized its urban development on cadastral pattern, became a mono-centric disordered city; because of the density increases after 1985 plan decisions, plan revision that increase floor area ratio (shifts from 2 storey to 5 storey), ground floor commercial use decision in the city center, annihilating green areas, function changes done till 1999.

Table 4.6 The Analysis Of Plan Revisions Made Between in 19885-1999

	Dist.	Other					Function					Floor Increase					Floor+Structure Straigh					Sturucture Straigh					RemainGreen				
		total Num.	total area	84 89	89 94	94 99	total Num.	total area	84 89	89 94	94 99	total Num.	total area	84 89	89 94	94 99	total Num.	total area	84 89	89 94	94 99	total Num.	total area	84 89	89 94	94 99	total Num.	total area	84 89	89 94	94 99
1	Se	17	161231	6	8	3	5	84134	2	1	2	1	9547	0	1	0	7	131509	0	6	1	0	0	0	0	0	9	840401	2	5	2
2	CU	10	61988	6	3	1	7	173050	3	2	2	6	28025	1	2	3	7	63413	1	4	2	0	0	0	0	0	11	69393	7	4	0
3	Tı	4	71309	1	2	1	1	8482	1	0	0	9	99757	5	3	1	2	33840	1	1	0	0	0	0	0	0	0	0	0	0	0
4	PA	6	64172	3	3	0	4	18849	0	4	0	2	17209	1	1	0	3	17085	0	2	1	0	0	0	0	0	4	75889	3	1	0
5	Ynd	2	11914	2	0	0	0	0	0	0	0	1	5403	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Ync	5	38323	3	1	1	0	0	0	0	0	0	0	0	0	0	1	5667	0	1	0	1	40387	1	0	0	0	0	0	0	0
7	Yng	20	269307	13	5	2	4	53200	1	1	2	8	97103	4	0	4	3	119887	1	0	2	1	4266	0	1	0	5	59959	3	1	1
8	Çu	2	12719	1	0	1	1	35643	1	0	0	1	2573	0	1	0	1	35943	0	1	0	0	0	0	0	0	1	15407	1	0	0
9	Ak	7	64129	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12321	1	0	0	4	19062	1	3	0
10	Ya	3	26183	2	1	0	2	42263	2	0	0	1	6706	0	1	0	0	0	0	0	0	1	11647	1	0	0	5	48590	1	4	0
11	Or	15	137583	5	6	4	3	27597	1	0	2	1	3917	0	0	1	3	31532	1	2	0	2	28572	1	1	0	3	15672	0	1	2
12	Ku	5	37911	3	2	0	0	0	0	0	0	3	27873	0	2	1	2	19258	0	2	0	1	9039	1	0	0	2	142777	1	1	0
13	İs	5	35407	1	2	2	0	0	0	0	0	2	28025	0	2	0	2	45083	1	1	0	1	4632	0	1	0	1	2317	0	1	0
14	Ka	11	96176	6	3	2	1	7675	0	1	0	1	7685	0	0	1	2	28182	1	1	0	0	0	0	0	0	6	44796	2	4	0
15	Şe	11	164416	4	4	3	13	116930	3	7	3	7	72634	2	4	1	1	4689	1	0	0	1	7134	1	0	0	14	104627	4	6	4
16	Oz	10	350154	5	5	0	0	0	0	0	0	1	18499	1	0	0	1	21178	0	1	0	0	0	0	0	0	10	173922	5	5	0
17	Sa	8	67942	4	3	1	1	7076	0	1	0	3	45586	1	1	1	2	34982	0	2	0	0	0	0	0	0	9	117514	6	2	1
18	Te	9	125786	1	7	1	4	40463	1	2	1	3	56659	0	1	2	1	12157	0	0	1	0	0	0	0	0	27	305535	14	7	6
19	Tu	7	68230	1	5	1	2	21464	2	0	0	2	20475	0	1	1	1	18185	0	0	1	1	6984	0	1	0	12	187599	4	6	2
20	Yag	20	227497	8	9	3	7	120126	2	3	2	2	34454	0	1	1	3	172849	1	1	1	0	0	0	0	0	20	874955	6	10	4
21	Tep	8	81781	2	2	4	4	21368	1	1	2	2	21703	0	1	1	0	0	0	0	0	0	0	0	0	0	14	335983	7	5	2
22	Mit	14	109956	10	2	2	3	14808	0	2	1	6	40790	2	3	1	2	13865	1	1	0	0	0	0	0	0	16	155160	8	7	1
23	Gü	3	13133	2	0	1	4	42001	1	3	0	3	15795	0	2	1	0	0	0	0	0	0	0	0	0	0	6	443029	3	2	1
24	Şi	5	15090	2	1	2	2	208170	0	0	2	3	21467	0	2	1	1	9757	1	0	0	0	0	0	0	0	0	0	0	0	0
25	Hı	5	21103	2	1	2	1	23946	1	0	0	3	3918	0	1	2	0	0	0	0	0	0	0	0	0	0	4	26669	1	3	0
26	Ma	6	35643	3	0	3	9	192031	4	2	3	3	121095	1	0	2	3	96932	2	0	1	2	110173	1	1	0	32	532145	13	13	6
27	Be	2	57036	0	2	0	6	700757	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0		0	0	11	585982	0	4	7

Table 4.6 (cont.)

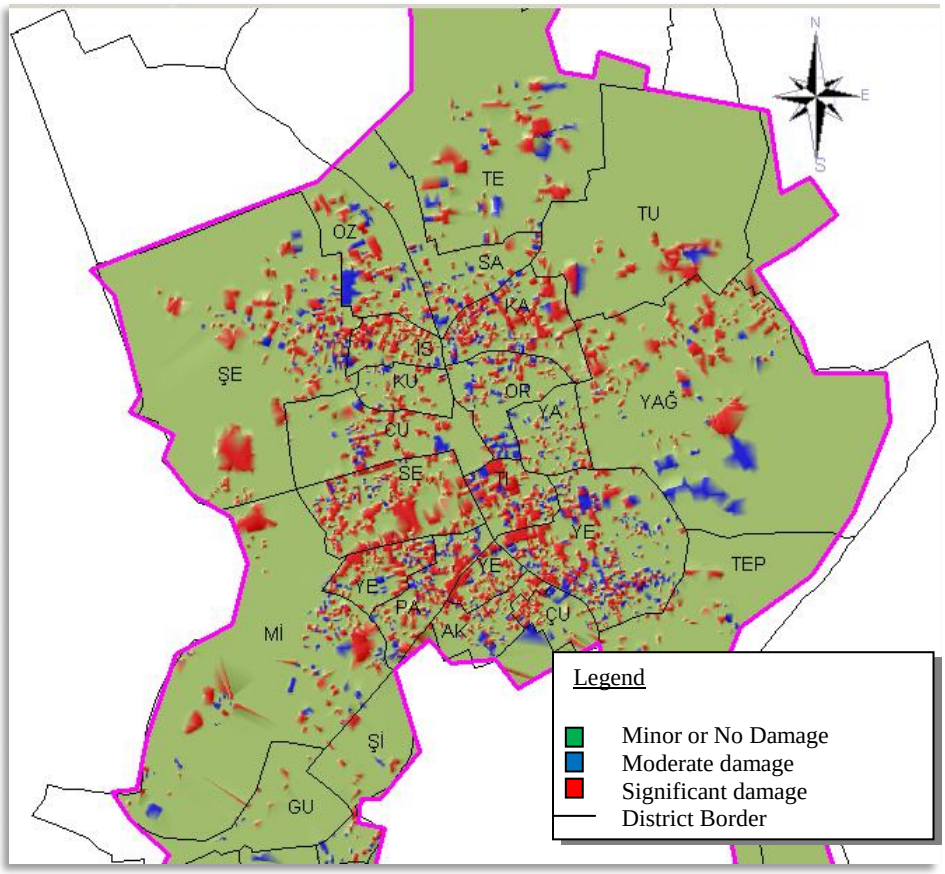
	Dist.	Removing Green+ Floor İncrease					Total Revision					FAR			District Area	Density
		total Num.	total area	84 89	89 94	94 99	total Num.	Area	84 89	89 94	94 99	1957	1985	1999 (after 701 revision)	ha	Per/ha
1	Se	1	2945	0	1	0	40	1E+06	10	22	8	0.20-0.40	0.60-0.80	0.80-1.00	56	539
2	CU	4	47773	4	0	0	45	443642	22	15	8	0.20-0.40	0.60-0.80	0.80-1.00	54	569
3	Tı	0	0	0	0	0	16	213388	8	6	2	0.20-0.40	0.60-0.80	0.80-1.00	22	584
4	PA	0	0	0	0	0	19	193204	7	11	1	0.20-0.40	0.60-0.80	0.80-1.00	27	614
5	Ynd	0	0	0	0	0	3	17317	3	0	0	0.20-0.40	0.60-0.80	0.80-1.00	21	813
6	Ync	0	0	0	0	0	7	84377	4	2	1	0.20-0.40	0.60-0.80	0.80-1.00	13	521
7	Yng	6	48713	2	2	2	47	652435	24	10	13	0.20-0.40	0.60-0.80	0.80-1.00	85	699
8	Çu	0	0	0	0	0	6	102285	3	2	1	0.20-0.40	0.60-0.80	0.80-1.00	16	579
9	Ak	1	6430	0	1	0	13	101942	3	10	0	0.20-0.40	0.60-0.80	0.80-1.00	22	678
10	Ya	0	0	0	0	0	12	135389	6	6	0	0.20-0.40	0.60-0.80	0.60-0.80	24	612
11	Or	1	7243	0	1	0	28	252116	8	11	9	0.20-0.40	0.60-0.80	0.60-0.80	31	635
12	Ku	2	11739	1	1	0	15	248597	6	8	1	0.20-0.40	0.60-0.80	0.80-1.00	18	748
13	İs	0	0	0	0	0	11	115464	2	7	2	0.20-0.40	0.60-0.80	0.80-1.00	19	846
14	Ka	2	41749	2	0	0	23	226263	11	9	3	0.20-0.40	0.60-0.80	0.80-1.00	42	473
15	Şe	2	38644	2	0	0	49	509074	17	21	11	0.20-0.40	0.60-0.80	0.80-1.00	229	461
16	Oz	1	31465	1	0	0	23	595218	12	11	0	0.20-0.40	0.40-0.60	0.60-0.80	234	640
17	Sa	0	0	0	0	0	23	273100	11	9	3	0.20-0.40	0.40-0.60	0.60-0.80	49	553
18	Te	0	0	0	0	0	44	540600	16	17	11	0.20-0.40	0.40-0.60	0.40-0.60	418	251
19	Tu	2	17124	0	1	1	27	340061	7	14	6	0.20-0.40	0.40-0.60	0.40-0.60	199	247
20	Yag	5	42736	2	0	3	57	1E+06	19	24	14	0.20-0.40	0.40-0.60	0.80-1.00	284	425
21	Tep	4	36560	0	1	3	32	497395	10	10	12	0.20-0.40	0.40-0.60	0.40-0.60	155	437
22	Mit	5	29865	3	0	2	46	364444	24	15	7	0.20-0.40	0.40-0.60	0.60-0.80	207	381
23	Gü	0	0	0	0	0	16	513958	6	7	3	-	0.40-0.60	0.60-0.80	44	550
24	Şi	0	0	0	0	0	11	254484	3	3	5	-	0.60-0.80	0.60-0.80	68	532
25	Hı	1	5587	1	0	0	14	81223	5	5	4	-	0.60-0.80	0.60-0.80	59	500
26	Ma	0	0	0	0	0	55	1E+06	24	16	15	-	0.60-0.80	0.60-0.80	173	456
27	Be						19	1E+06	0	6	13	-	0.60-0.80	0.80-1.00	419	358

CHAPTER 5

IMPACTS OF PLANNING DECISIONS AND CONDUCT IN LOSSES OF THE 1999 EARTHQUAKE

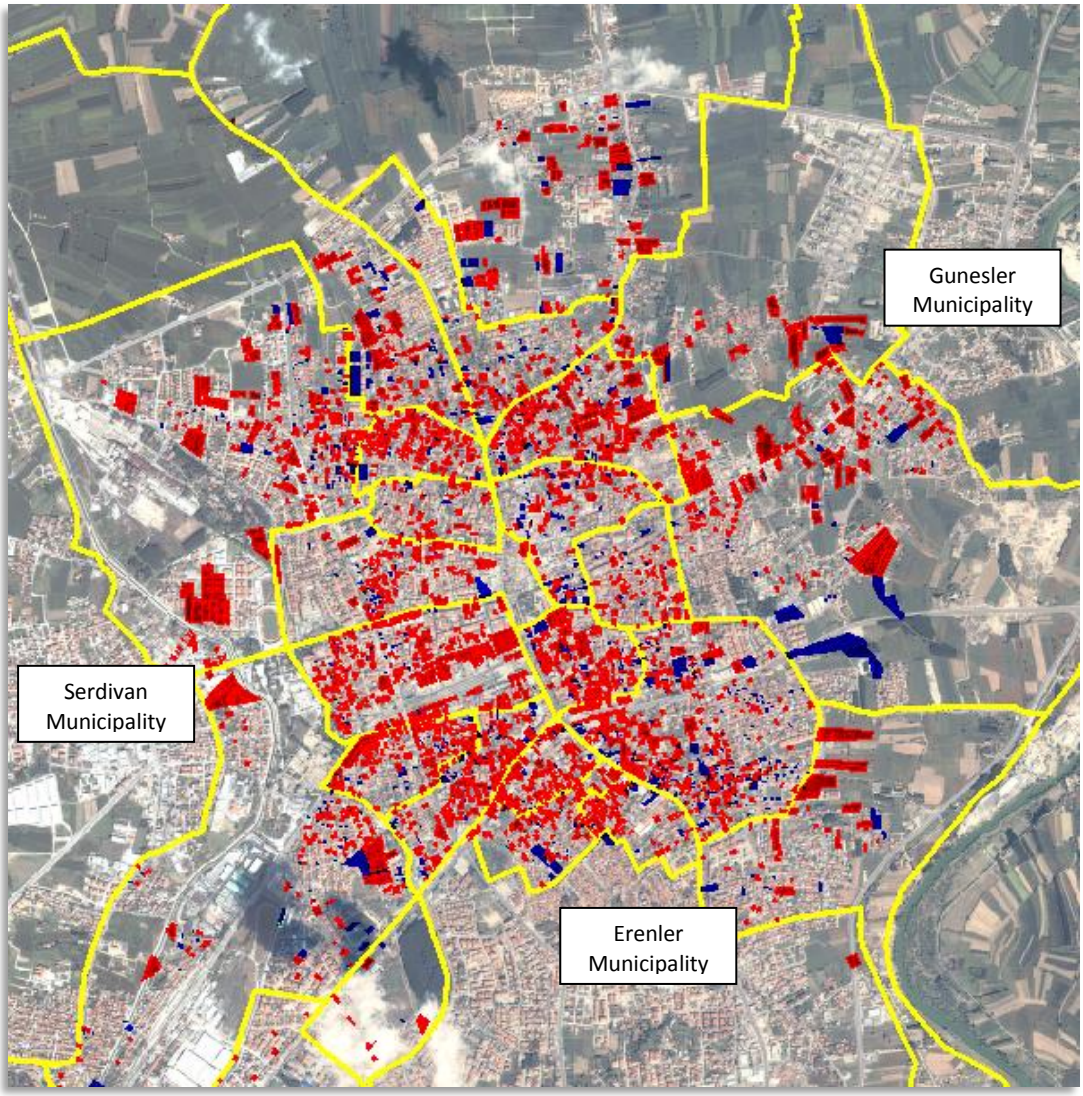
5.1. Effects of the Existing Plan Decisions

The reason why great devastation and destruction occurred in Adapazarı in the earthquake of 17 Augustus 1999 is often considered solely in relation to destruction in the building stock. In this context, the role of the development plan decisions is often ignored.

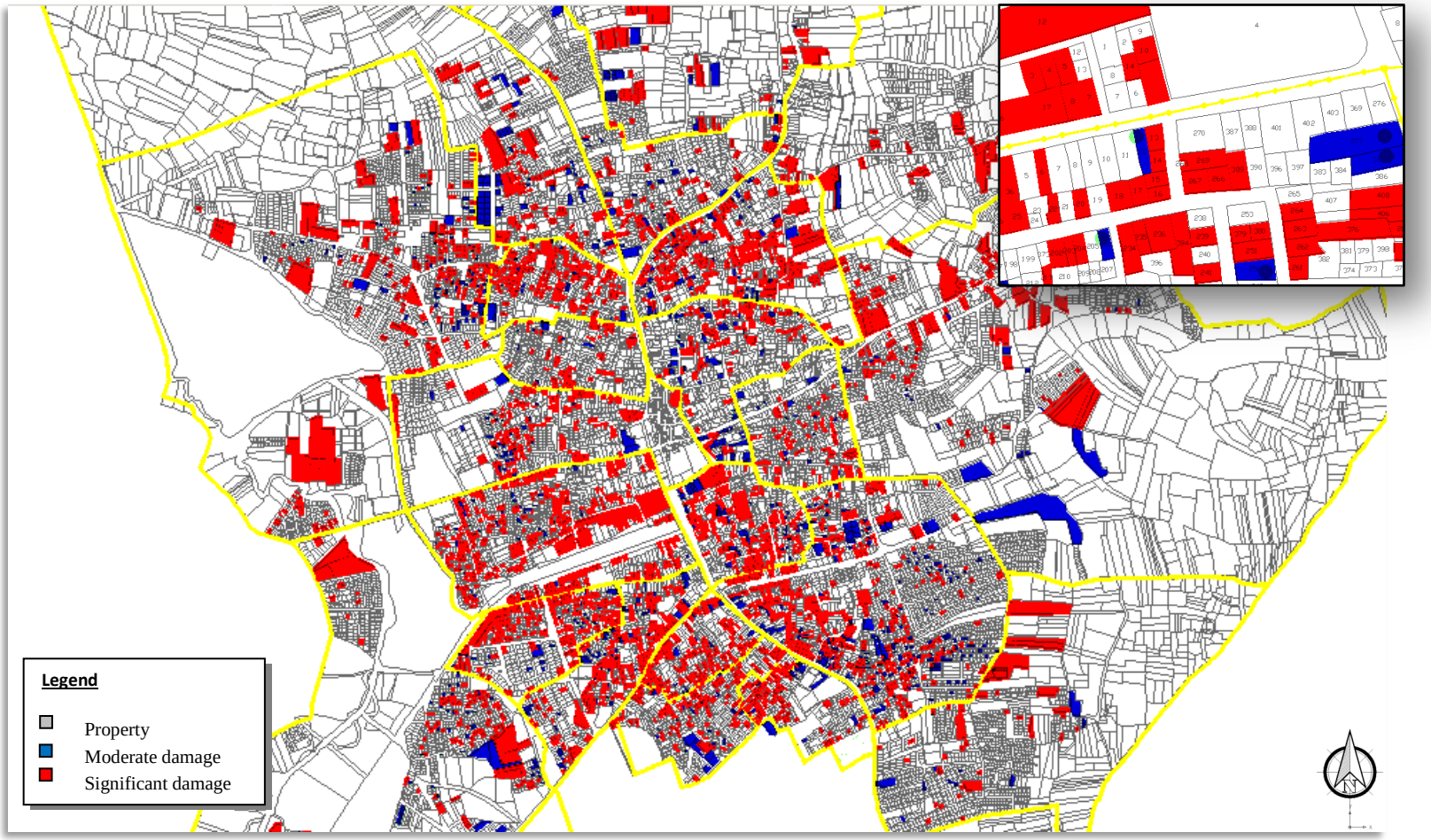


Map 5.1 Damage Map of Adapazari City Center

The distribution of damage as visualized in maps is extensive compared to many other cases of similar urban disasters. Almost whole districts have been destroyed in the 1999 earthquake, with buildings collapsed, cars destroyed, roads blocked, people crushed under debris, many injured. Those survived were in panic to save and comfort their relatives, to protect their valuable posessions, and out of all their daily facilities.

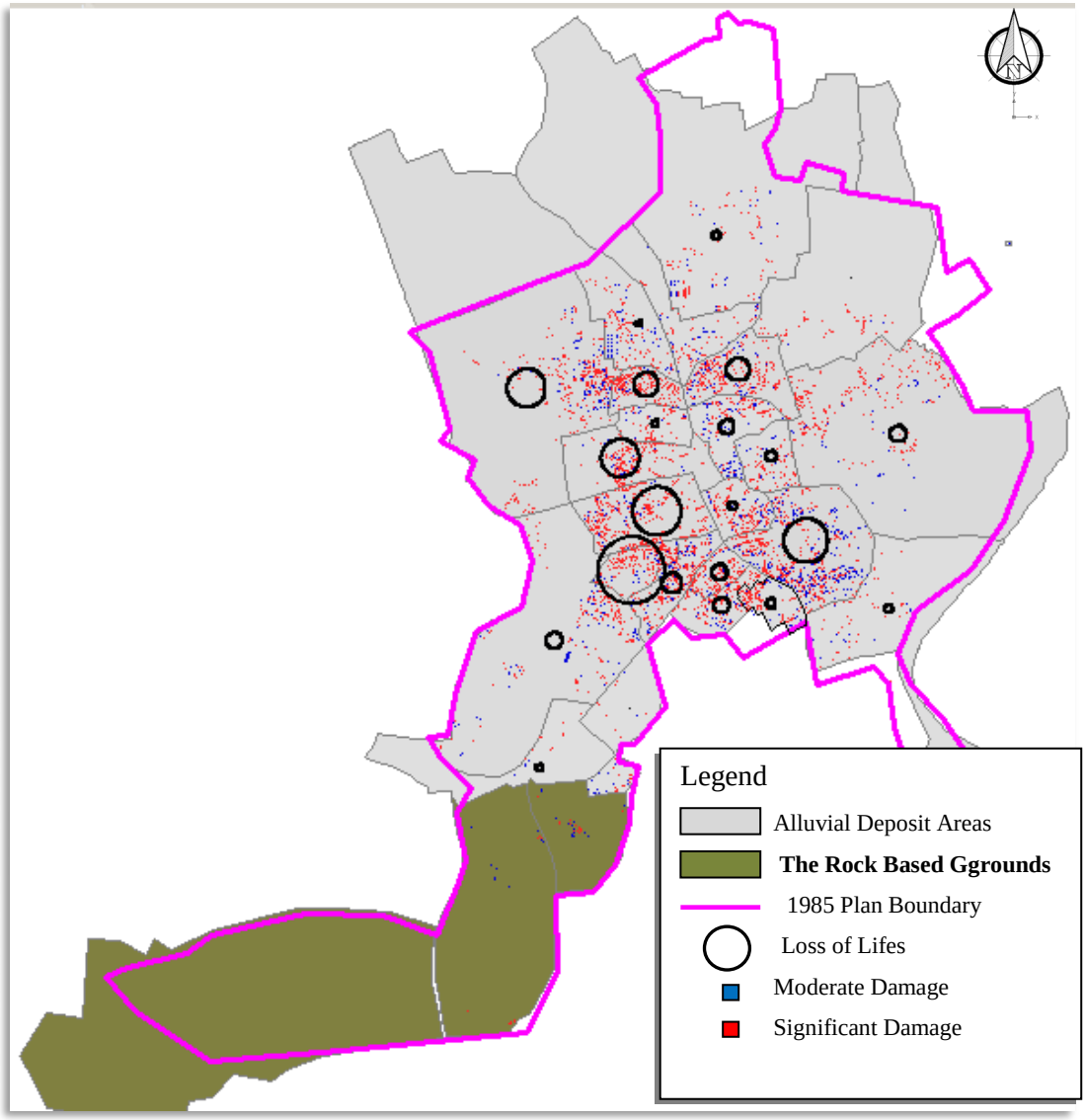


Map 5.2 Damage Distribution in Adapazari on the satellite image of City
(Bayhan, Kotaoglu, Suna, Celikel, 2001)



Map 5.3 Damage Distribution in Adapazari on the Cadastral Map of City

(Bayhan, Kotaoglu, Suna, Celikel, 2001)



Map 5.4 Distribution of Building Damage in Districts of Central Adapazarı and Loss of Life

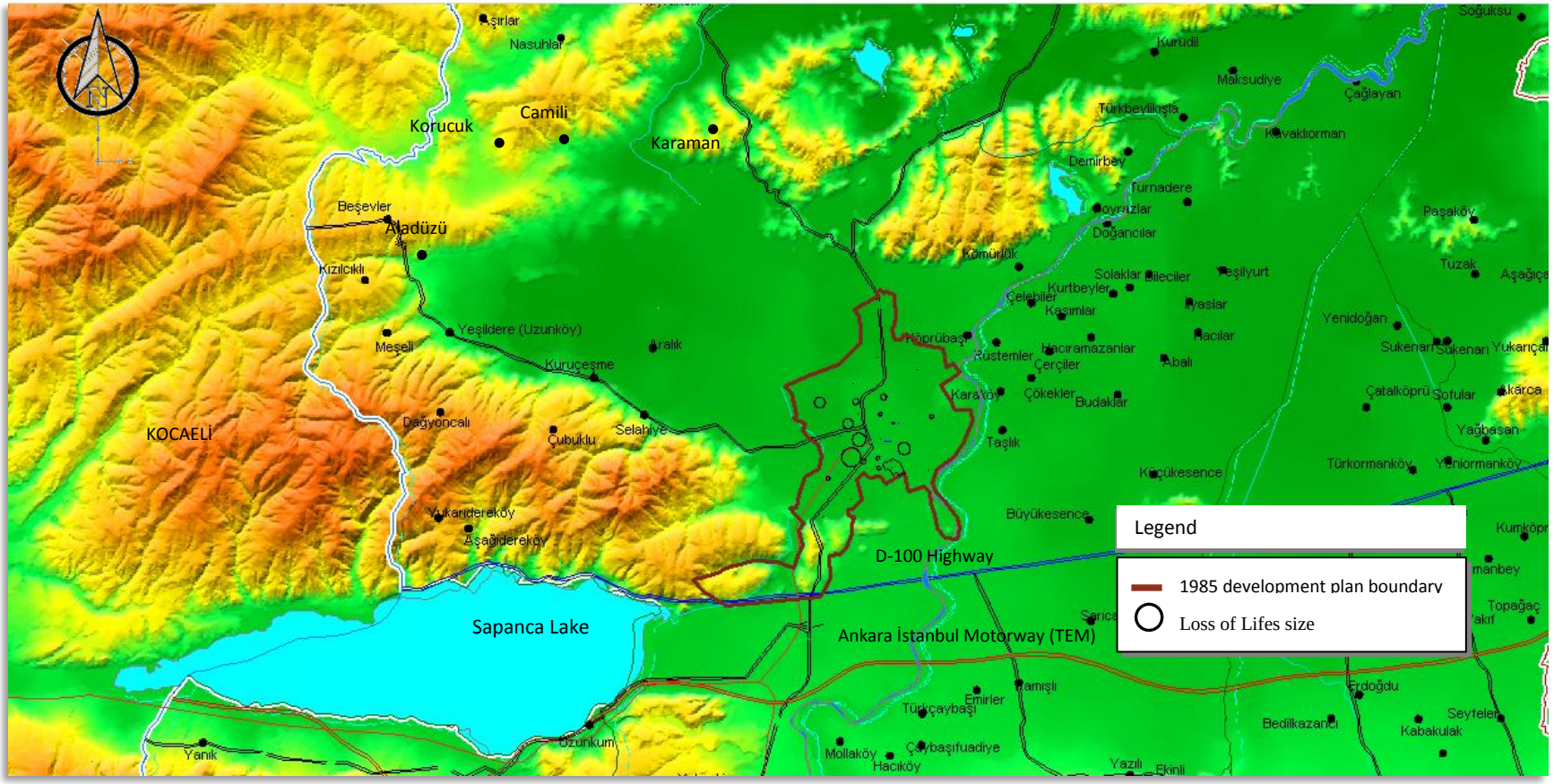
The most important aspect of development plans made from 1957 to 1999 in Adapazarı is the determination of spatial distribution of density and its timing. It is fundamentally this set of decisions from 1957 to August 17th, 1999 that has reached to a certain population and suffered from the earthquake of August 17th, 1999. In this context, the most important effect of the plan decisions on earthquake damages has been with increasing the density towards an unknown direction which was wrong and having no scientific background.

Analyses of plans and revisions in the previous chapter indicated that the variables that were all too often revised are increases in densities, changes in the formation of buildings,

increases in the number storeys in buildings, changes in the use of buildings, loss of green areas in the localities, permission dates or age of buildings, unauthorized buildings, and the like.

The purpose of this chapter is to establish to what specific consequences such changes gave rise to in the 1999 earthquakes. The analysis will therefore rely on the analysis of functional distributions between loss of life and collapse of buildings in relation to such changes. In this manner, not only the relevance of planning decisions in risk mitigation could be established, but also the likely differences between these variables in their adverse impacts of the consequences of the earthquake could be identified.

The method followed here is therefore the analysis of each of these variables and the observation of the associations with damages caused. Within the scope of the thesis, data about the plan revisions after 1985 were accessed in the archives of the Municipality of Adapazarı, plan revisions were scanned and converted into numerical form. On the other hand, loss of life was obtained from the population directory of the provincial government. These data bases were than matched to relate plan decisions to the consequences of the earthquake.



Map 5.5 Dispersion Of Damage And Loss Of Life In Adapazari City Center On The Topographic Map

5.2. Effects of the 1985 Development Plan and Revisions

The breaking point which caused the damages in the earthquake of 17 August starts from the decision of development plan of 1985. The number of floors indicated in the development plan of 1957 were increased in the development plan in 1985 from 2-3 to 4-5 floors without observing the risks of earthquakes.

The spatial designation of the number of floors in the plan of 1985 was not established on a net plan legend, and was given only in the plan notes. It was stated that maximum 5 floors may be allowed according to the width of the roads following the standards identified in the Development Law 3194. Binding the number of the floors in the development plan to the act on construction and escaping from political pressures and referring the construction work and leaving these powers at the discretion of the local administration have become the starting point of a tragic error.

The construction permissions given with indefinite number of floors according to demand, and neglecting the attributes of the ground factor have given way to the structuring with 4-5 floors in Adapazarı, in which greatest loss of property and life occurred in the earthquake of 17 August 1999.

While the number of floors was increased in the implementation development plan of 1985, no revisions were made in the standards of public facilities and transportation system. The most important decision from the revision on the development plan in 1985 was the increase in the number of the floors, and the risk of the city of Adapazarı to be affected from the earthquakes was increased without regard that the location of Adapazarı's subject to earthquakes on the alluvial ground and with a level of ground water of 1-2 meters to amplify the effects of the tremor.Map 5.4

5.2.1. Association of Earthquake Losses with Increases in the Number of Floors of Buildings

Increasing the number of floors in development areas without considering ground conditions and methods of construction relying on the 3rd section 29th article of the building regulation has probably had a direct effect on increased loss of life and property.

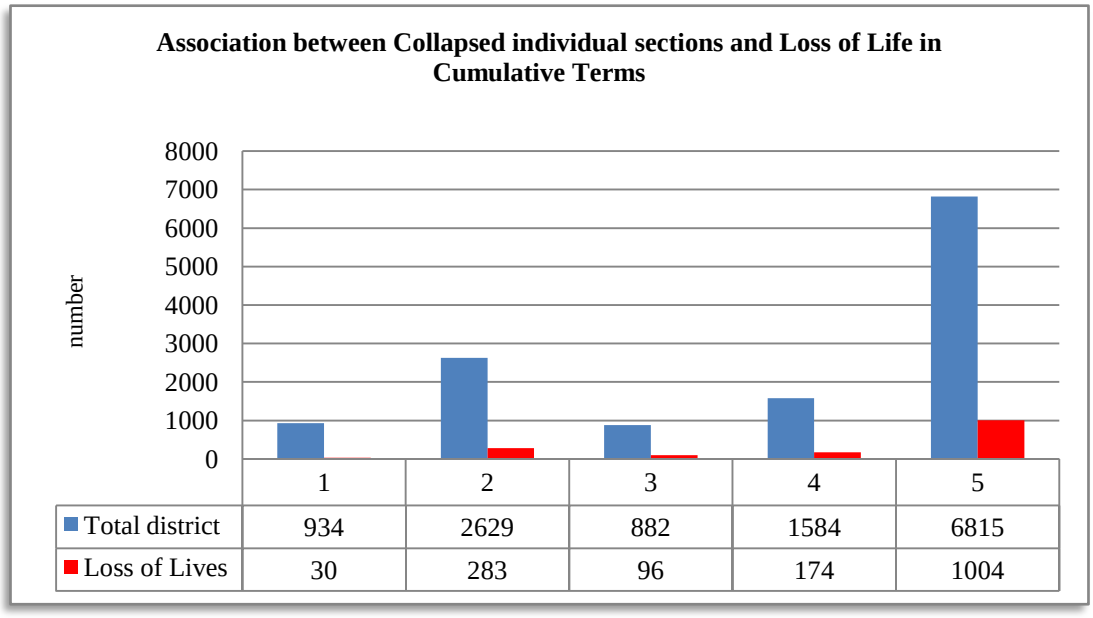


Figure 5.1 Association between Collapsed Buildings and Loss of Life in Cumulative Terms

Picture 5.1 Damages in Central Adapazarı, Yenicami Street (SMM, Archive)

Increases in the in number of the floors in buildings by means of plan revisions have destroyed the compatibility of the Plan in its original decisions. In this process, population

densities were increased, deficiencies in public services occurred, arteries and circulation areas were reduced in standards, city aesthetics and quality of life were adversely affected.

Picture 5.2 Damages in High-Rise Structures of Çark Street, Central Adapazarı (SMM, Archive)

Picture 5.3 Damages in High-Rise Structures of Adnan Menderes Street, Central Adapazarı (SMM, Archive)

As decisions for increases in the number of floors were given, the geological surveys of the area were disregarded, and no measures were taken especially in the construction of foundations of buildings. This gave rise to extensive damages in the face of liquefaction effecs of the earthquake in the basements of high-rise buildings.

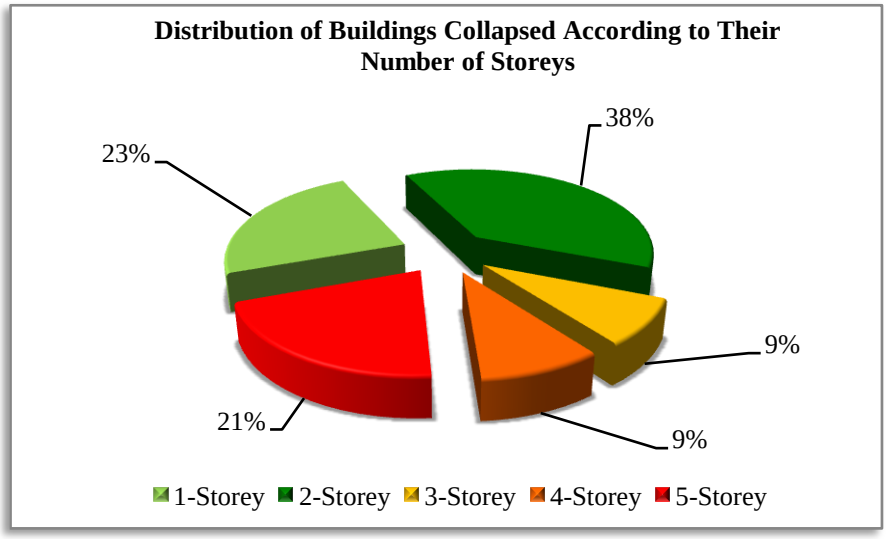


Figure 5.2 Distribution of Buildings Collapsed According to Their Number of Storeys

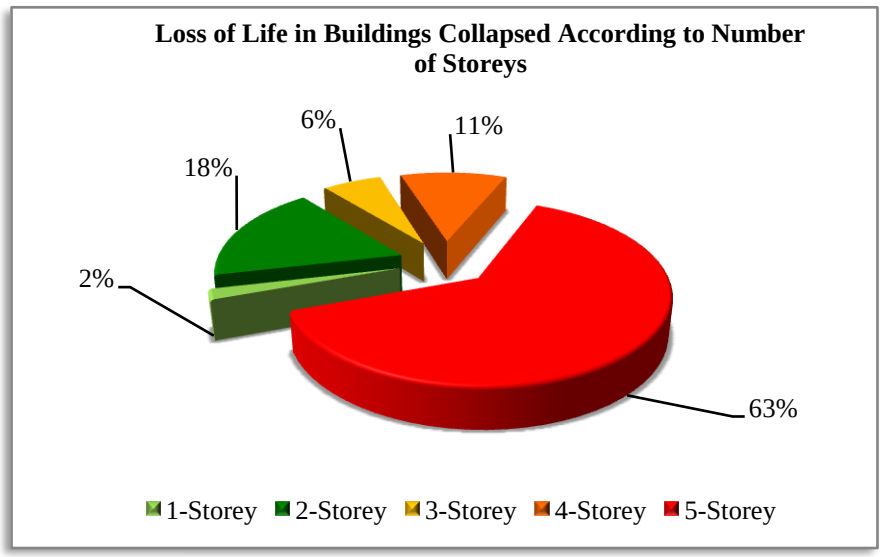


Figure 5.3 Loss of Life in Buildings Collapsed According to Number of Storeys

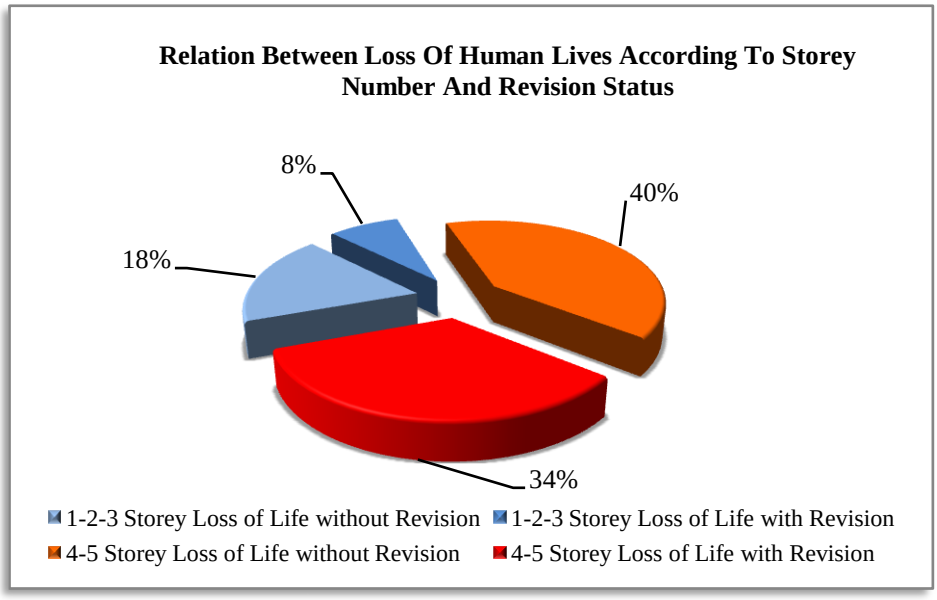
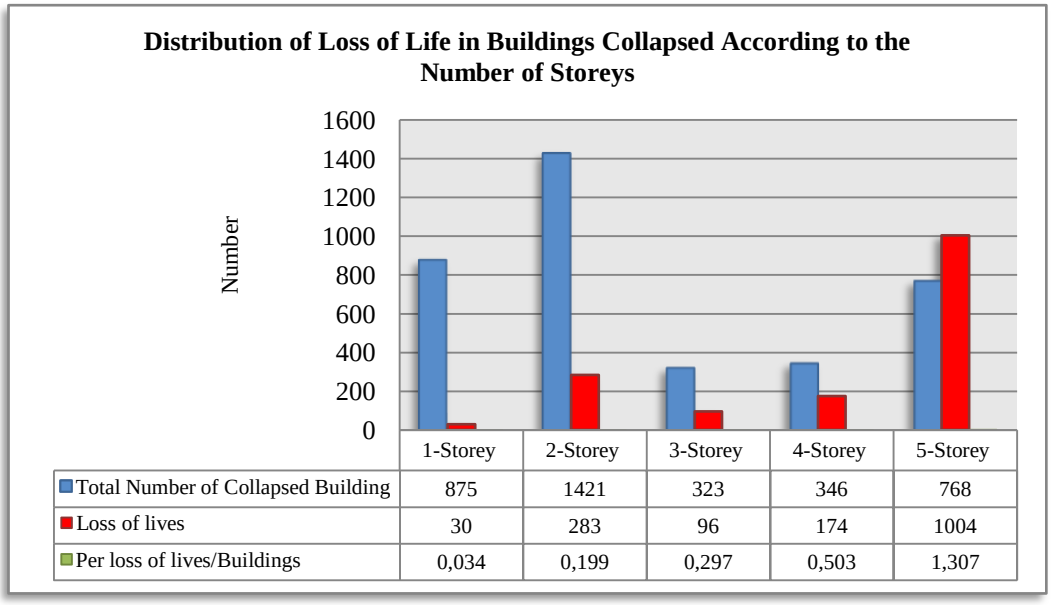


Figure 5.4 Relation Between Loss Of Human Lives According To Storey Number And Revision Status

Not only %34 of loss of lives in 4-5 storey building but also %8 of loss of lives in 1-2-3 storey housing had been occurred in revision areas.



	1-Storey	2-Storey	3-Storey	4-Storey	5-Storey
Total Number of Collapsed Building	875	1421	323	346	768
Loss of lives	30	283	96	174	1004
Per loss of lives/Buildings	0,034	0,199	0,297	0,503	1,307

Figure 5.5 Distribution of Loss of Life in Buildings Collapsed According to the Number of Storeys

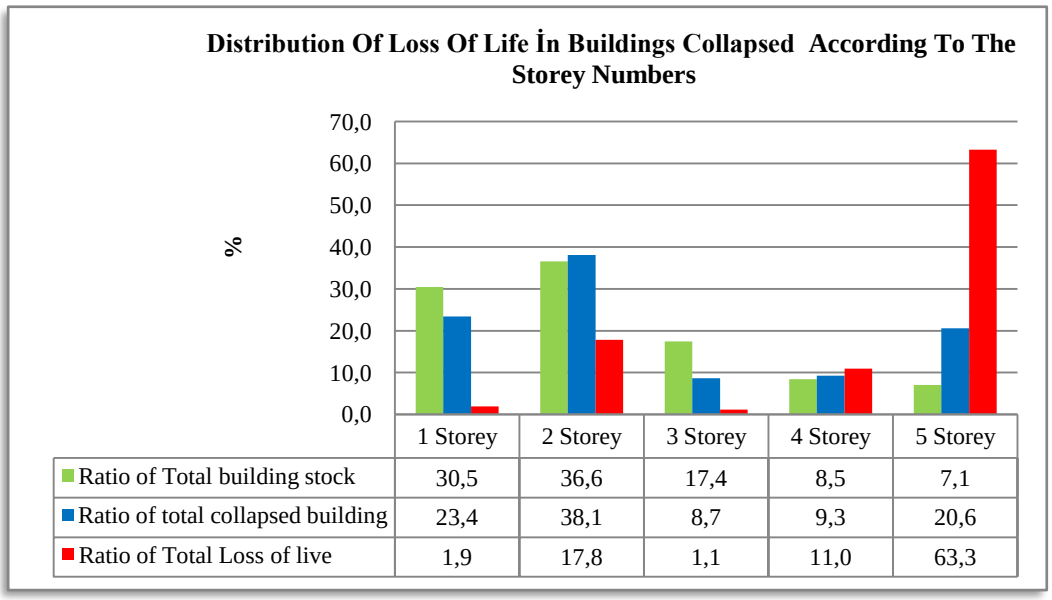


Figure 5.6 Distribution of Loss of Life in Buildings Collapsed According to the Storey Numbers

1 storey buildings were %30.3 of the total building stock, which were also %23.4 of total amount of collapsed buildings. Althougth the ratio of collapsed buildings is big, only %1.9 of the total amout of loss of human lives occurred in 1 storey buildings. On the other hand, 2 storey buildings were %36.6 of the total building stock and they composed %38.1 of total amount of collapsed buildings. Loss of human life ratio for 2 storey buildings over total amount of loss was %17.8. Lastly, 5 storey buildings were %7.1 of the total building stock, which were also %20.6 of total amount of collapsed buildings. However, %63.3 of loss of lives took place in 5 storey buildings. (Figure 5.6)

There are areas which are increased from 2-3 floors and from 3-4 floors to 5 floors after the plan of 1985. The increase in the number of the floors before the earthquake of 17 August has the following adverse effects on the development of the city.

While constructing new buildings in the construction lot, the arrangements of construction block in the former development plan foresaw a certain size of lot and therefore the density in the construction lot occurred due to the increase in the number of the floors. Reductions in distances of set back from borders and increase in the umber of floors altered the urban appearance, spatial quality, and architectural aesthetics. With increases in number of floors, the need to improve the construction technique for a building was ignored, especially in the

case of foundations where no precautions were taken against the likely liquefaction of ground. Thus with the increase in the number of floors, the risks of the building increased, exposed to the earthquakes.

Picture 5.4 Damages in Central Adapazarı; Turan Street (SMM, Archive)

We can examine the effects of the development plan on the lots with building on it into two groups, namely, licensed structures with the supervision of the Municipality, and structures without a license and unsupervised. In the case of structures with licenses:

A building which was constructed to have 3 floors in the existing plan was increased to the 4-5 floors in pursuance to plan revisions on the construction lot. According to the new development plan, the owner of property demanded an additional 2 floors on the building with 3 floors in the existing plan by means of a revision plan. The revision license obtained, on the building with 3 floors upon the request, additional floors are made with new rights of construction. The building thus developed is not only on an area which is alluvial geologically and there is risk of liquefaction and without the technical precautions necessary, but also extra demands are created on the infrastructure and public services.

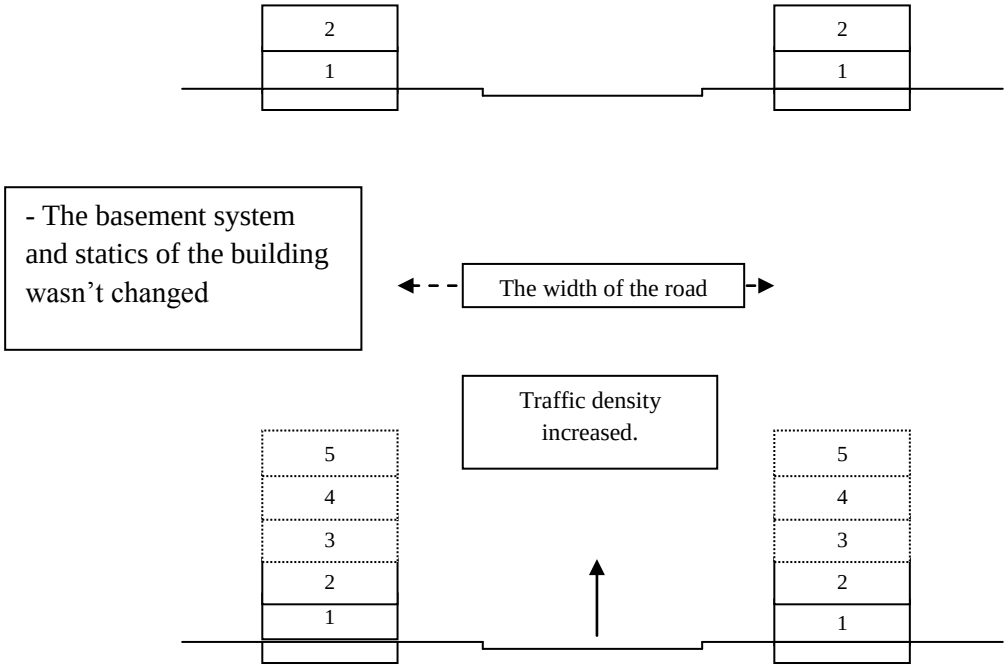


Figure 5.7 The effects of the increase in the floors on the lots with buildings on it

Since 53% of Adapazarı building stock did not have license (SMM, 2001), as a result of the rights of construction obtained due to revisions in the center of Adapazarı developing without effective construction supervision, addition of floors were made on top of the existing floors without any license. These buildings did not receive any engineering services when additional floors were made. Areas which constitute the most risky zones of Adapazarı were thus built with such kinds of structures when the earthquake struck.

Although most of the buildings damaged at the earthquake of August 17th, 1999 are one and two storey structures constituting %61 of the total in numbers (Figure 5.2), these buildings did not experience total collapse according to the data obtained from the Provincial Directorate of Public Works. Since majority (%92) of one and two storey buildings are timber and masonry load-bearing structures, these buildings did not collapse completely on to its residents. In consequence, in the damage assessment work performed, these structures were reported as 'heavily damaged' and were required to be demolished after the earthquake.

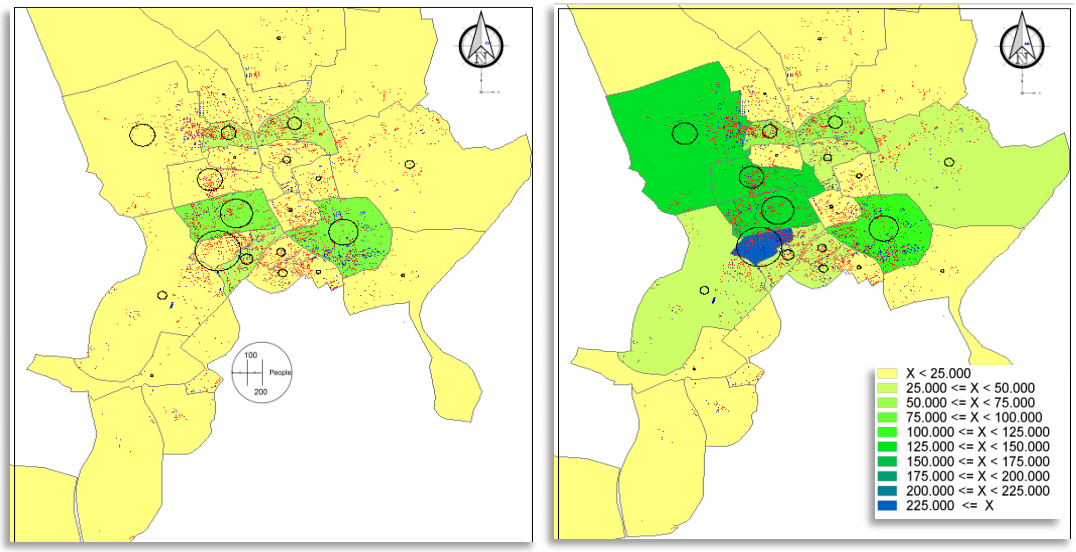
The fact that 1- and 2-storey buildings have a majority can be explained the experience of the 1967 earthquake. This is verified by the fact that these buildings are mostly older in terms of construction dates. Yet loss of life 1- and 2-storey structures was less than 3-4-5-storey structures as is also seen in Figure 5.6. Loss of life in consequence of the destruction of 4-5-storey buildings is %74 of all loss. When we analyse the number of storeys according to districts, we see that destruction and loss of lives is more in the central districts where 4- and 5-storey structures have greater shares in the building stock Figure 5.3. Despite the fact that these represent a minority of buildings, rate of destruction and life loss is comparatively much greater.

Especially in districts Semerciler, Cumhuriyet, Yenigun, Pabuccular, Yenidogan, Yenigun and Seker, greater numbers of 4-5-storey structures collapsed and accordingly greater loss of life took place in these districts. Map 5.6 – 5.7 – 5.8

Picture 5.5 Damages in Central Adapazarı, New Bosna Street (SMM, Archive)

Loss of Lifes in 1-2-3-Storey Buildings

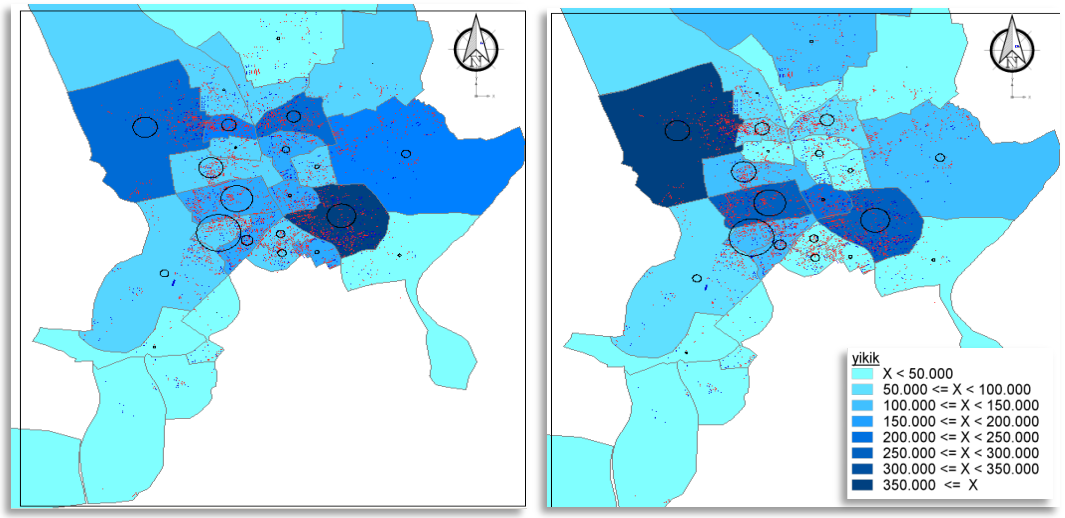
Loss of Lifes in 4-5-Storey Buildings



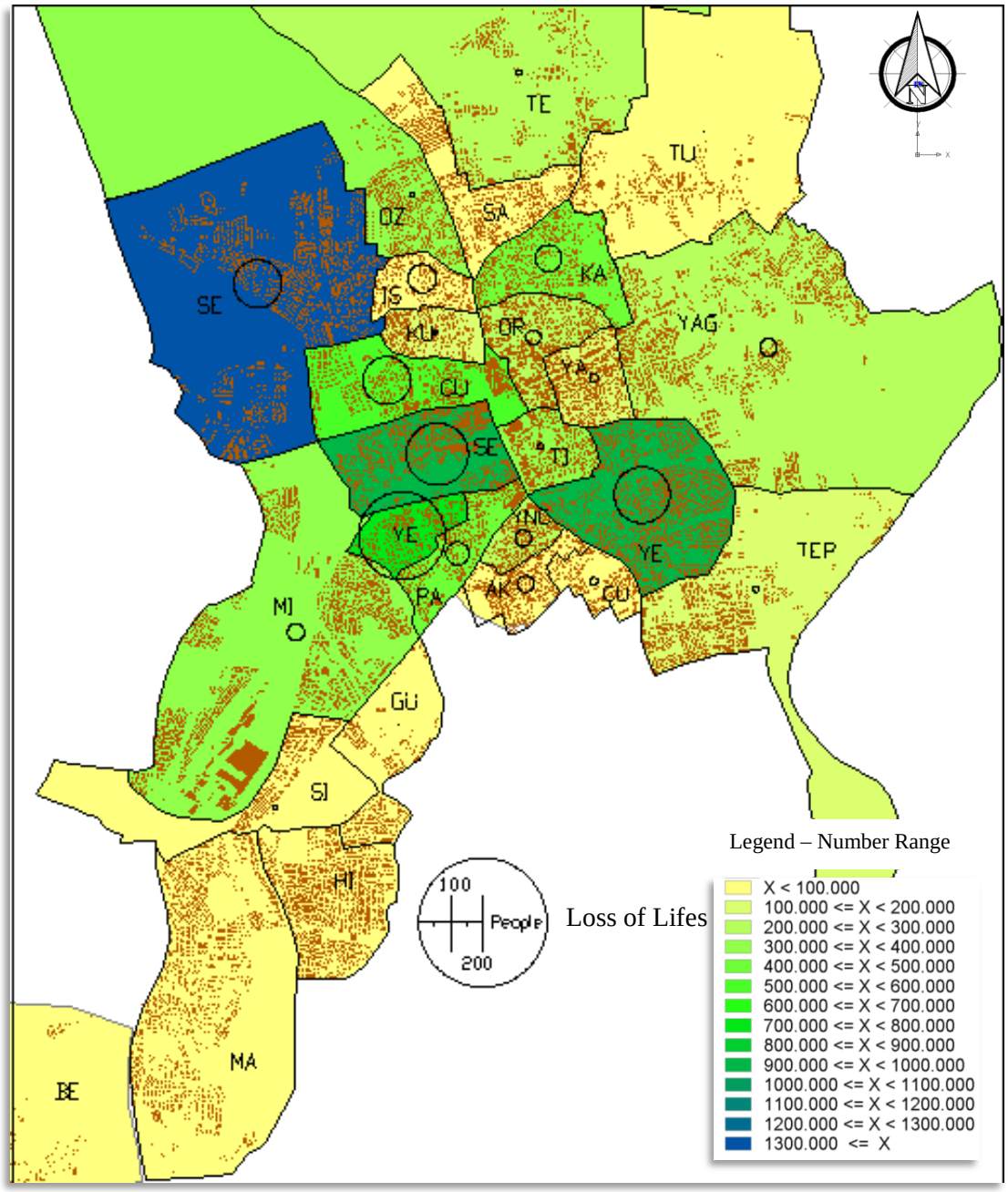
Map 5.6 Distribution of Loss of Life according to Number of Storeys of Buildings Collapsed

Distribution of 1-2-3-Storey Buildings Collapsed

Distribution of 4-5-Storey Buildings Collapsed



Map 5.7 Distribution of Buildings Collapsed According to Number Storeys



Map 5.8 Distribution of 4-5-Storey Buildings Collapsed According to Number of Dwellings and Loss of Life

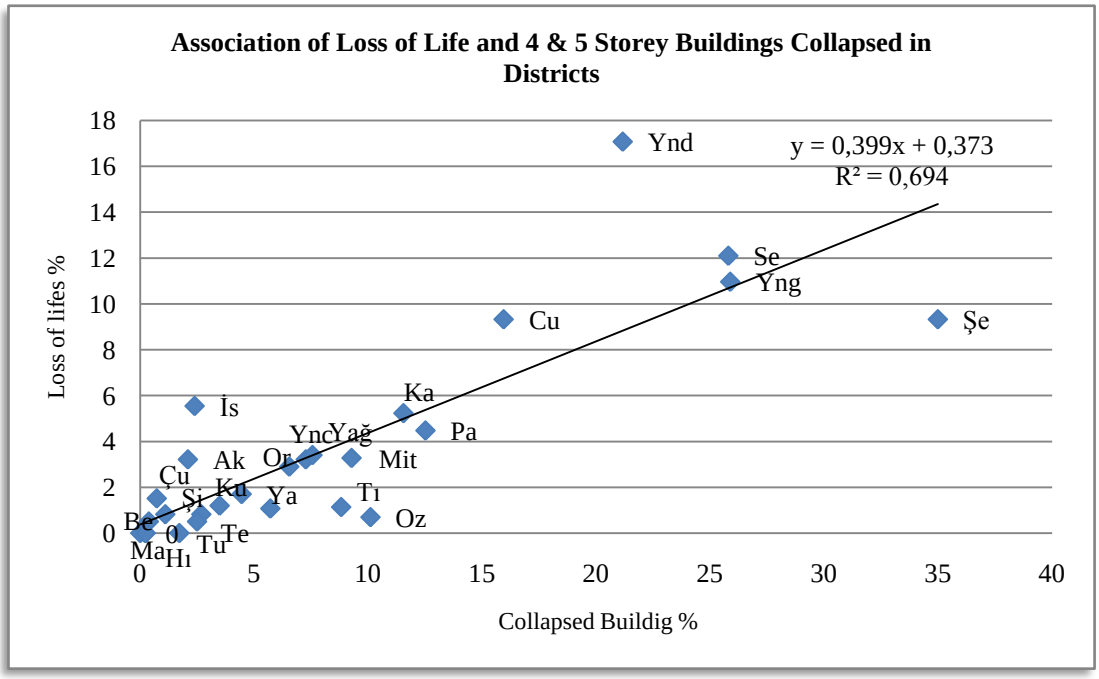


Figure 5.8 Association of Loss of Life and 4 & 5 Storey Buildings Collapsed in Districts

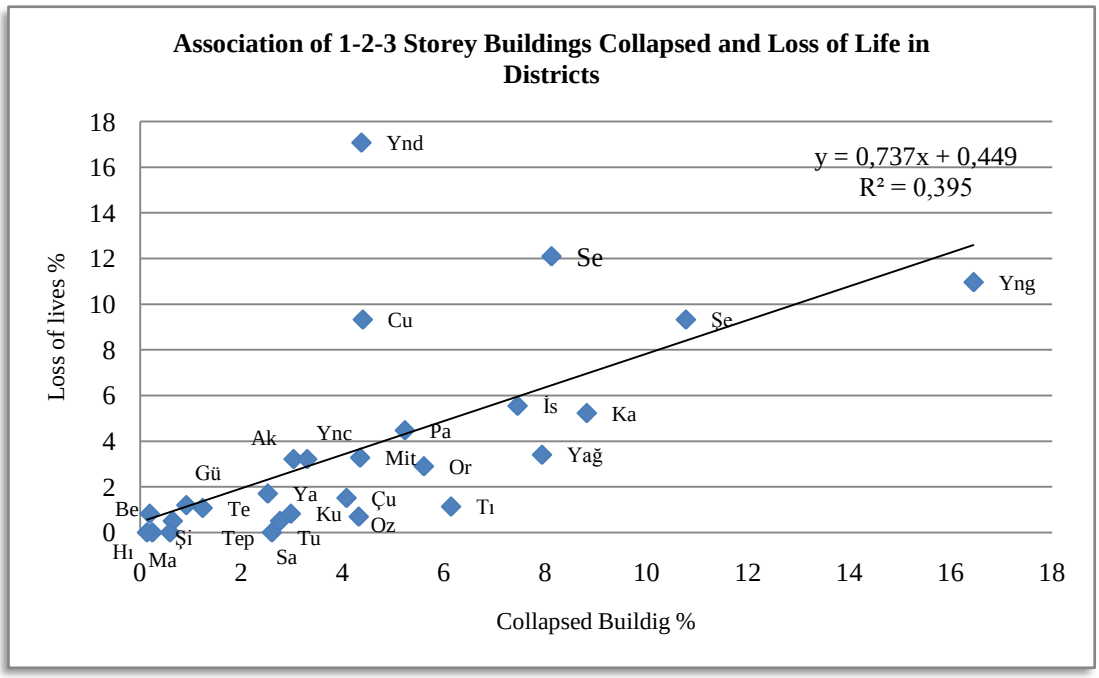


Figure 5.9 Association of 1-2-3 Storey Buildings Collapsed and Loss of Life in Districts

The districts observed well above the regression line (like Semerciler, Cumhuriyet, Şeker) are districts with high densities established at earlier dates. Buildings of 1-2-3 storeys here date back to 1960s.

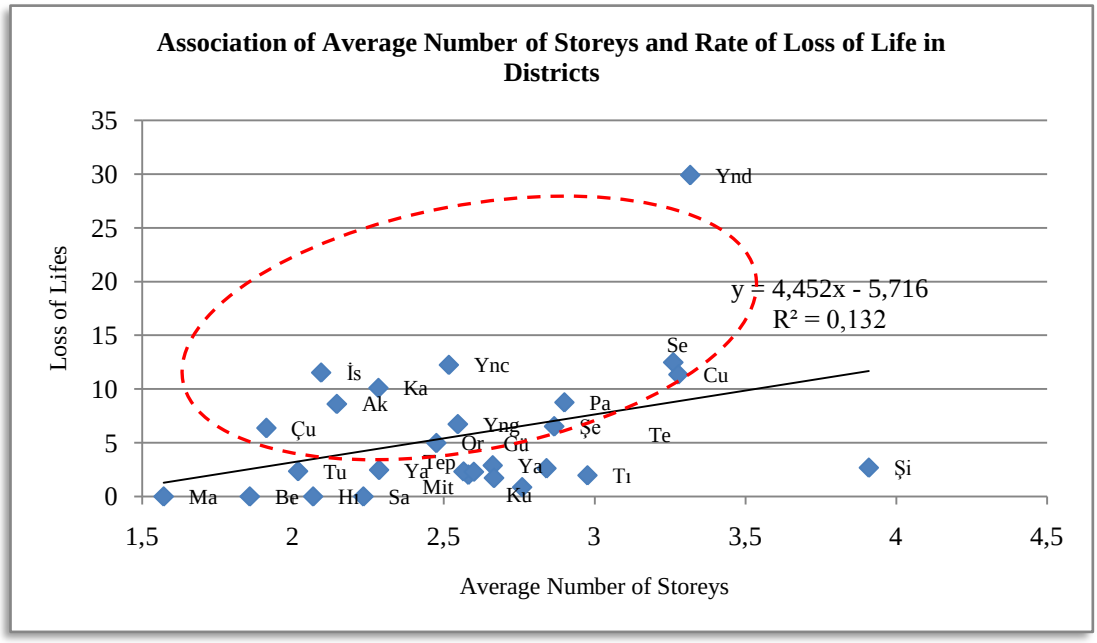
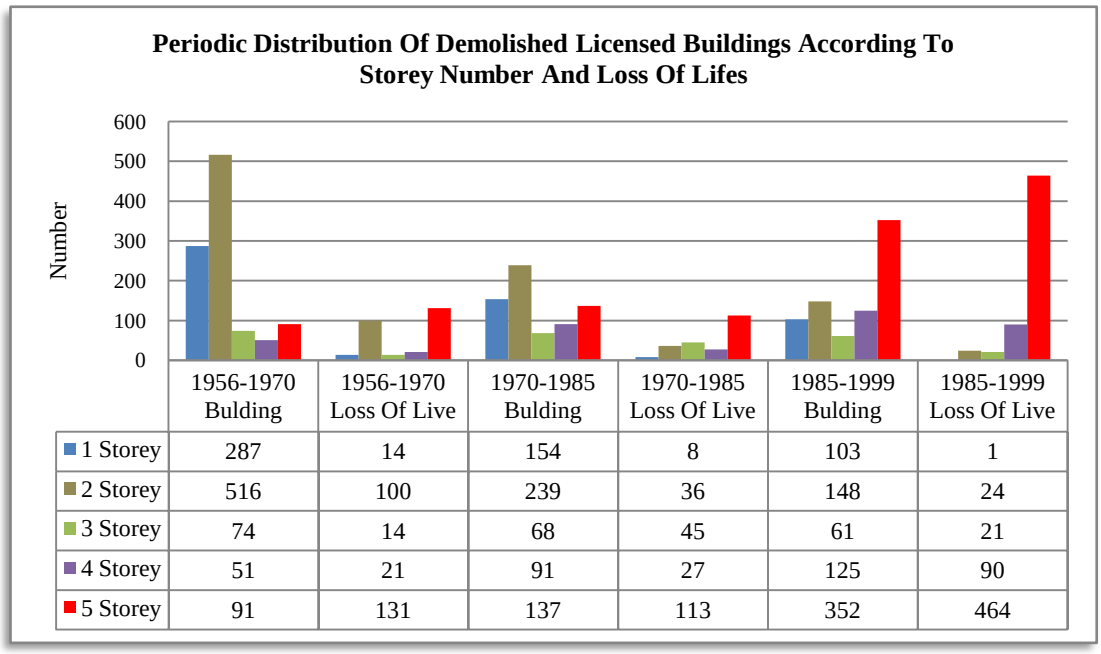


Figure 5.10 Association of Average Number of Storeys and Rate of Loss of Life in Districts

The group observed in the figure reveals the association between number of storeys and loss of life in districts. This result indicates the basic misconception that compliance with building regulation is not sufficient for safety, particularly in the case of 4-5 floors buildings collapsed which were constructed in full compliance with the regulations. Although there is significant scientific difference in design and implementation performance between the licensed and un-authorized structures, the earthquake of 1999 revealed that no difference exists between these categories in terms of vulnerabilities. Figure 5.11



	1956-1970 Bulding	1956-1970 Loss Of Live	1970-1985 Bulding	1970-1985 Loss Of Live	1985-1999 Bulding	1985-1999 Loss Of Live
1 Storey	287	14	154	8	103	1
2 Storey	516	100	239	36	148	24
3 Storey	74	14	68	45	61	21
4 Storey	51	21	91	27	125	90
5 Storey	91	131	137	113	352	464

Figure 5.11 Periodic Distribution Of Demolished Licensed Buildings According To Storey Number And Loss Of Lifes

Association of Net Population Density and Loss of Lifes

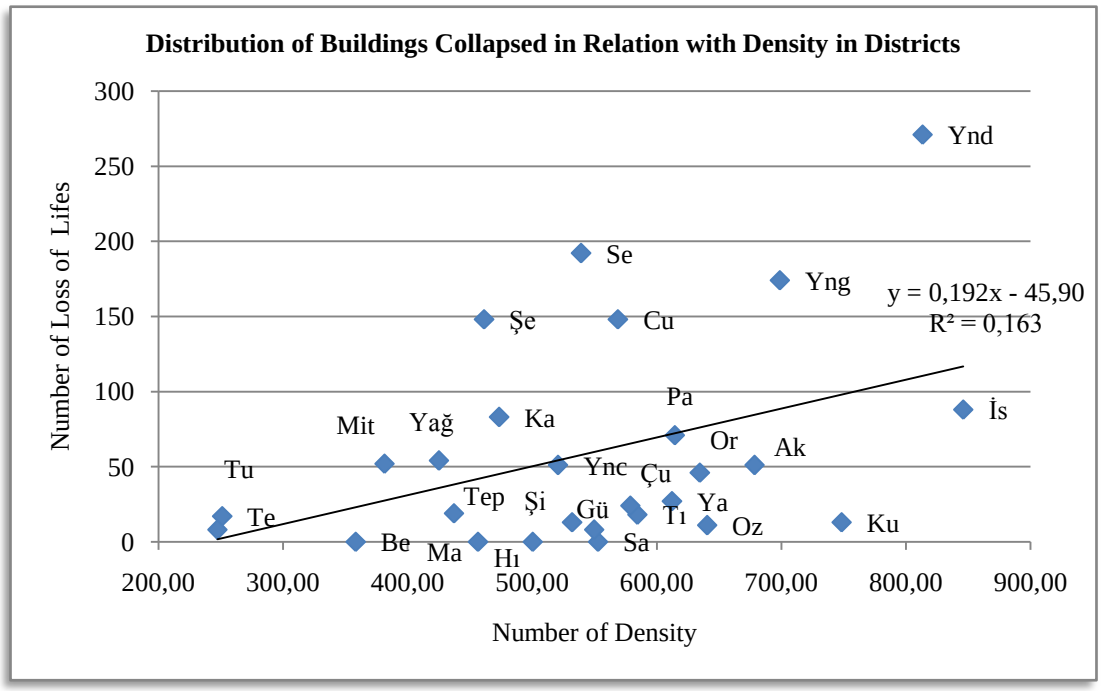


Figure 5.12 Distribution of Buildings Collapsed in Relation with Density in Districts

The density of districts are generally 400-700 person/ha. Between this GAP, The districts, that are above the line, are high rise districts. Low dense districts which are composed of low storey buildings stand out below the line. Figure 5.12 and Map 5.9

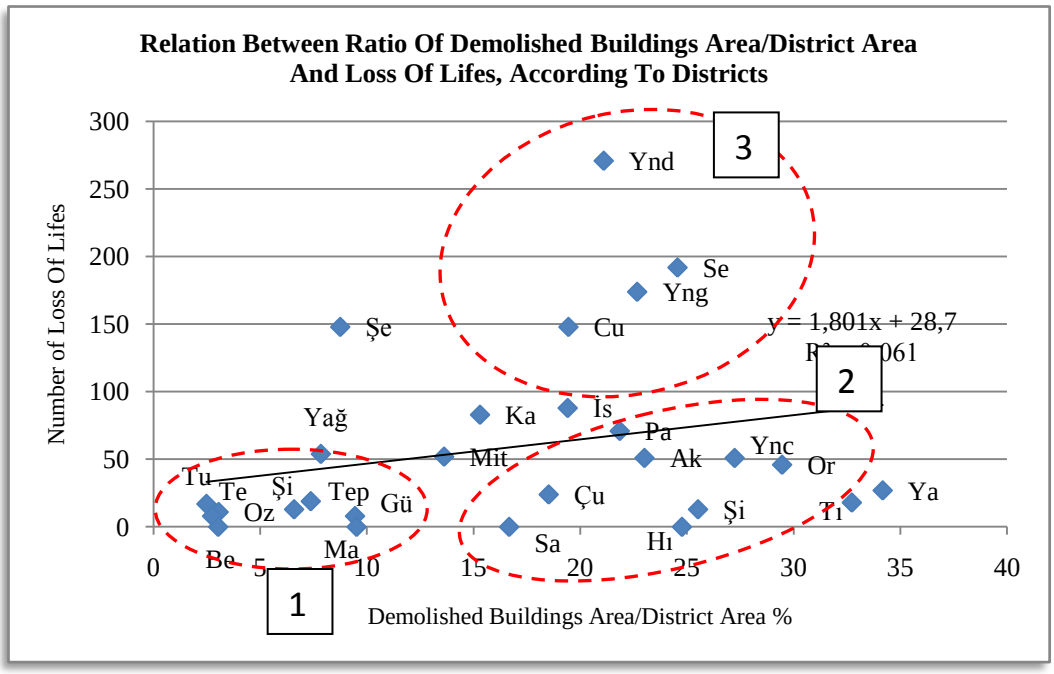


Figure 5.13 Relation Between Ratio Of Demolished Buildings Area/District Area And Loss Of Lifes, According To Districts

Loss of life ratio is low in districts - shown as number 1- which are out of center and have large area. Ratio of demolished buildings area is high, on the other hand, district area is high in districts - shown as number 2 - which are located around the center (akıncılar, yenicami, etc.).Loss of life is low in these districts; because, buildings are generally not high rise buildings. The ratio of building area and district are is approximately %20 in central districts – shown as number 3 – and these are high rise districts. Loss of life rate is very high in these districts. Figure 5.13

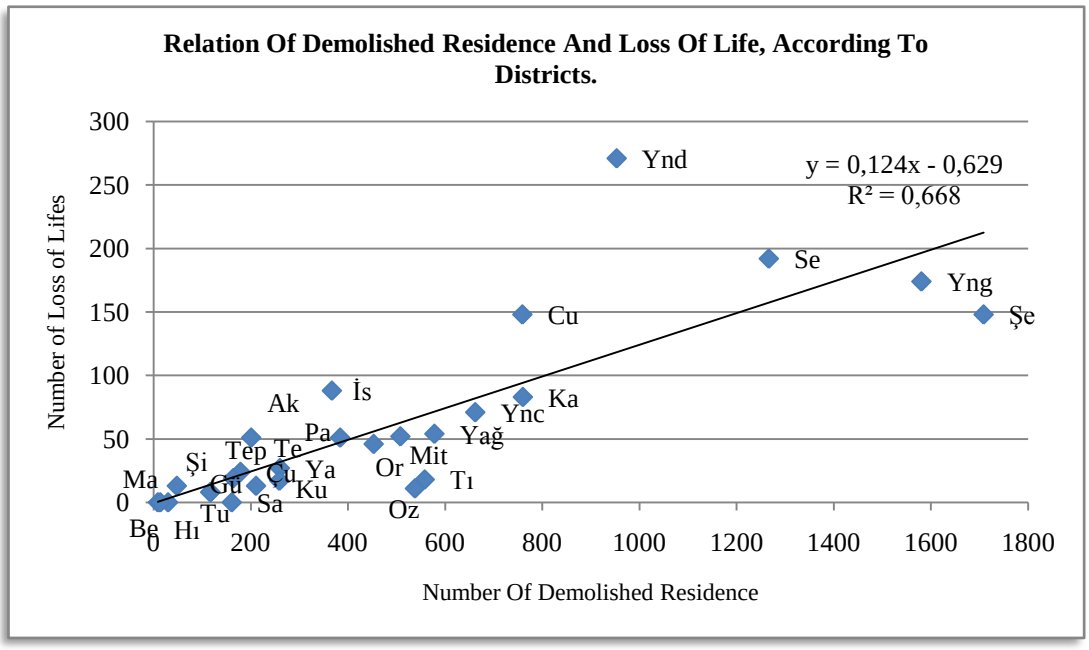


Figure 5.14 Relation Of Demolished Residence And Loss Of Life, According To Districts.

Amount of the residences and loss of life is high in central districts (i.e. Yenidoğan, Semerciler Cumhuriyet, Yenigün and Şeker districts). Because there are a lot of high rise buildings in that district. Figure 5.14

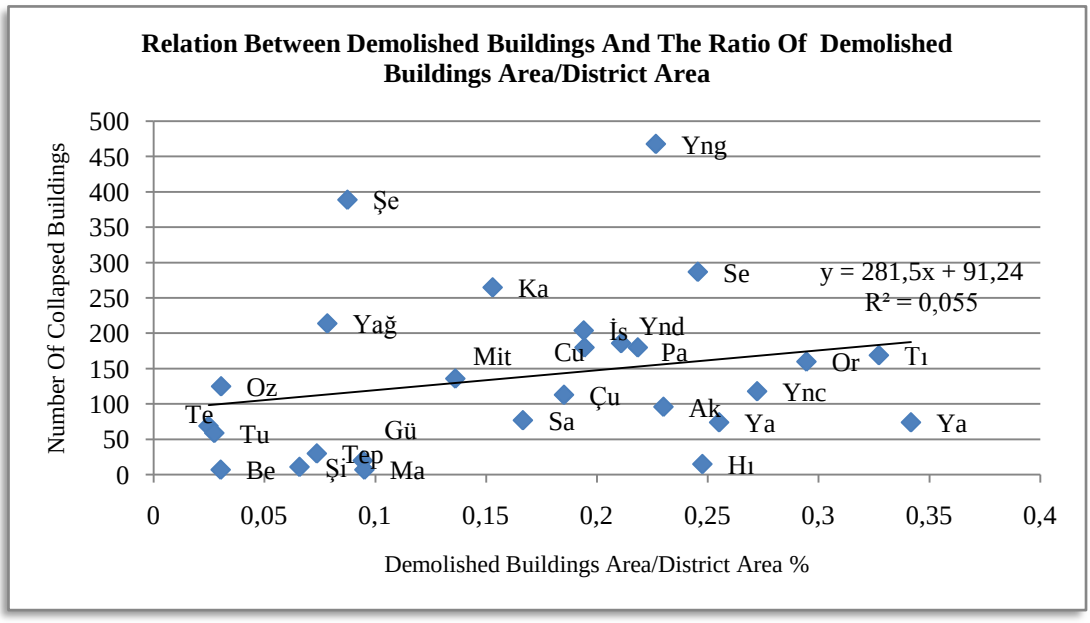


Figure 5.15 Relation Between Demolished Buildings And The Ratio Of Demolished Buildings Area/District Area

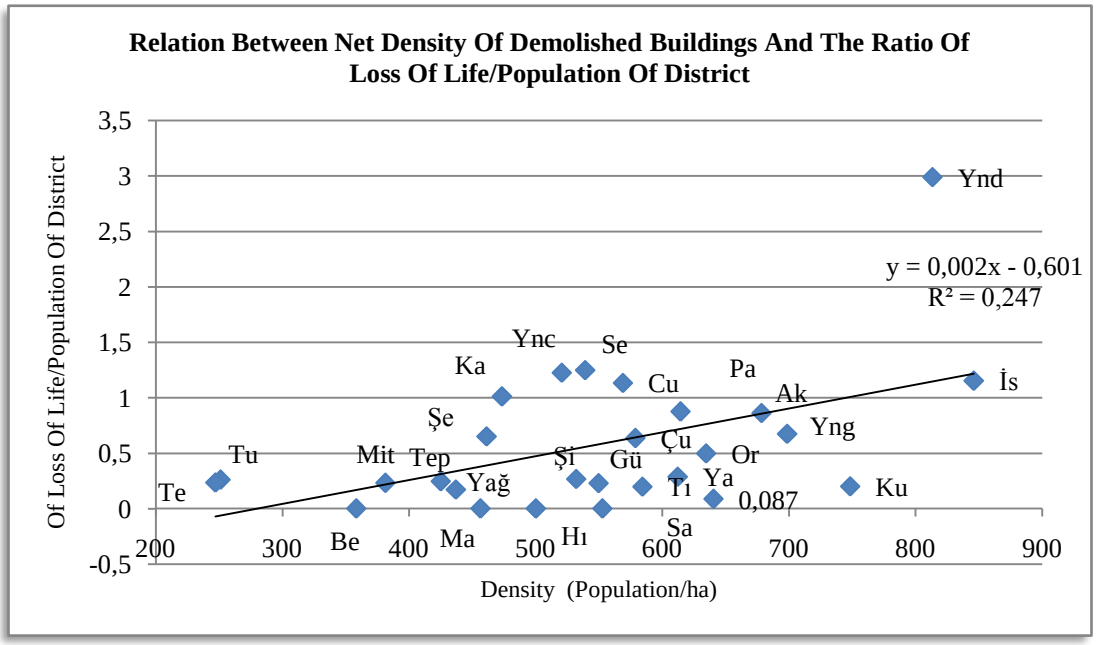


Figure 5.16 Relation Between Net Density Of Demolished Buildings And The Ratio Of Loss Of Life/Population Of District

In Figure 5.1**6**, it can bee seen that districts which have the density between 400 and 700 person/ha were mounded.Loss of life/ population of district ratio increase in the districts where the density is higher, near 700 person/ha. Furthermore, it can be again defined that districts - figured above the line - are high rise district and districts - figured below the line - are not high but dense districts.

Picture 5.6 Damages in Central Adapazarı, Yenicami Street (SMM, Archive)

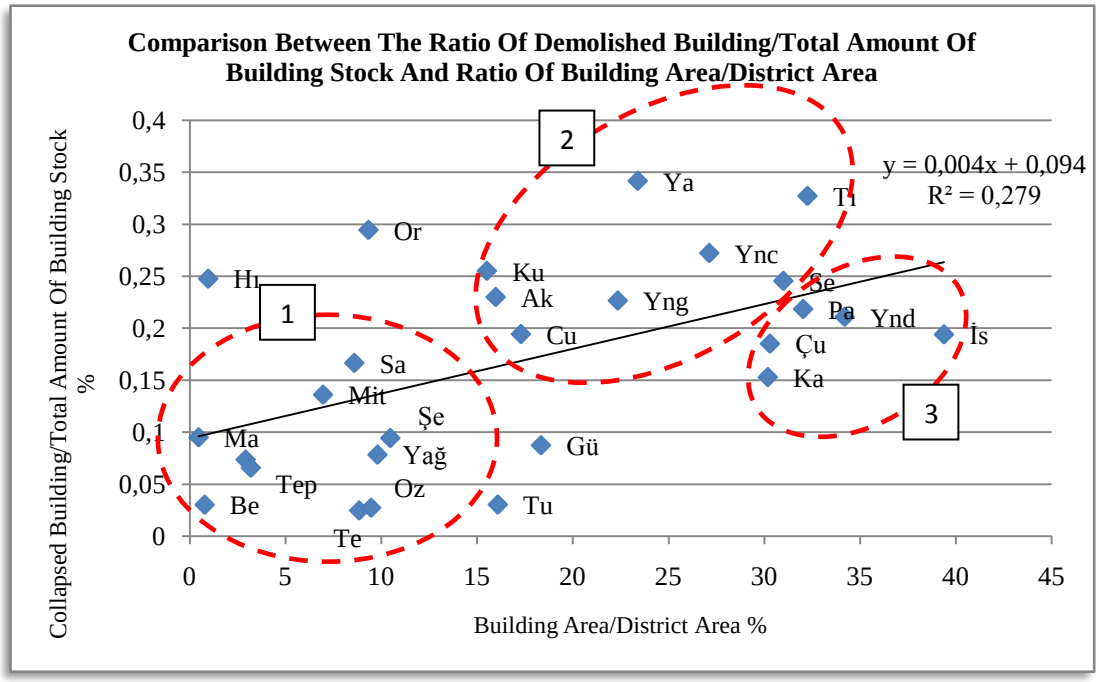
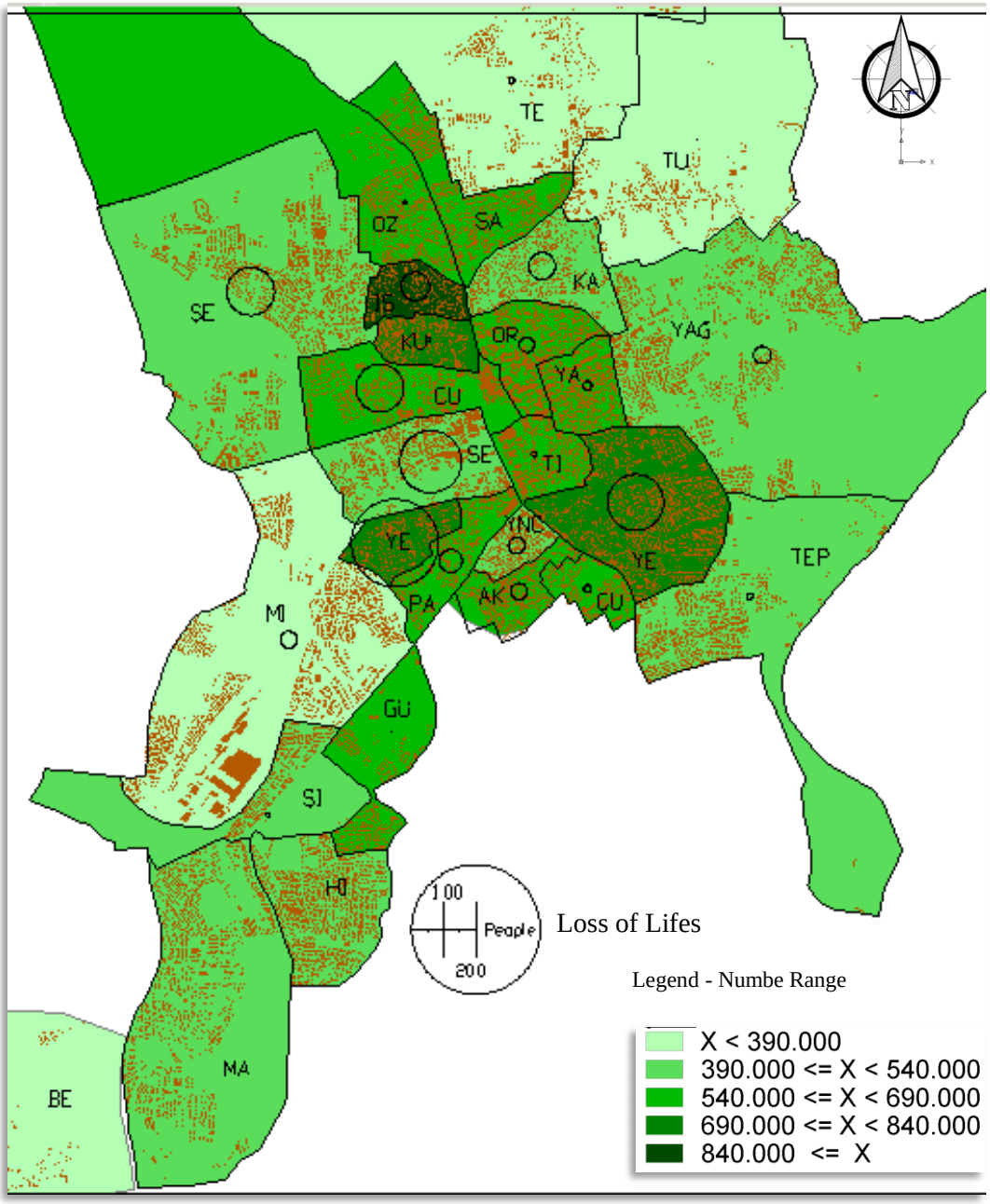


Figure 5.17 Comparison Between The Ratio Of Collapsed Building/Total Amount Of Building Stock And Ratio Of Building Area/District Area

Building density is low in districts shown as number 1; because, these districts have large area. Demolished buildings/total buildings stock ratio is low in these districts. Districts shown as number 2 have high building density but have small district area. Therefore, demolished buildings/total buildings stock ratio is high. Districts shown as number 3, which are located around center, are high dense residential districts. Figure 5.17

When the distribution of buildings collapsed is compared to loss of life on the basis of districts, it is observed that losses are dominant in the high-rise stock. In terms of destruction, districts Yenigun, Seker and Semerciler districts come to the forefront. In terms of loss of life, districts Yenidogan, Semerciler, Yenigun and Seker are more prominent.



Map 5.9 Association of Densities and Collapsed Buildings (and Loss of Life) in Districts

5.2.1.1. Association of Type of Structure with Losses

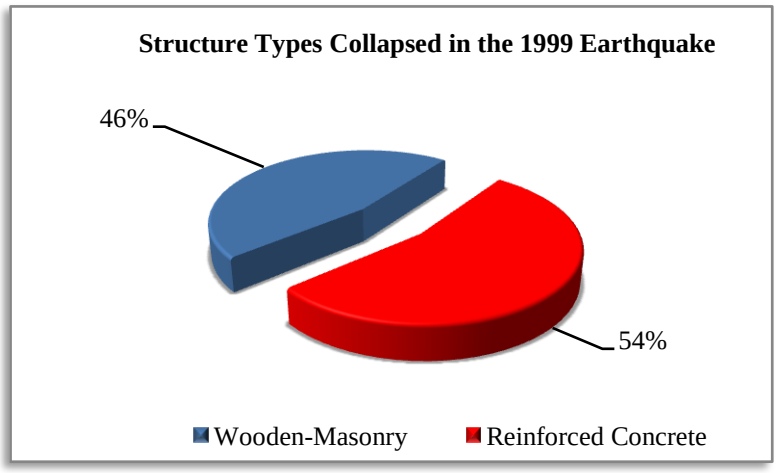


Figure 5.18 Structure Types Collapsed in the 1999 Earthquake

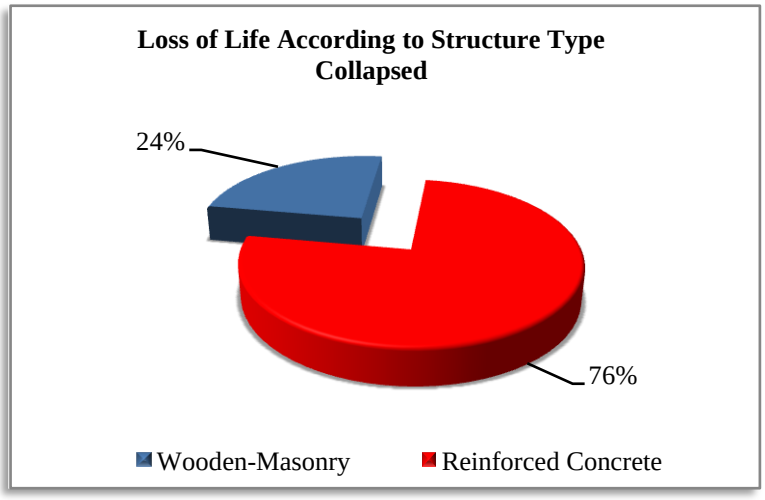
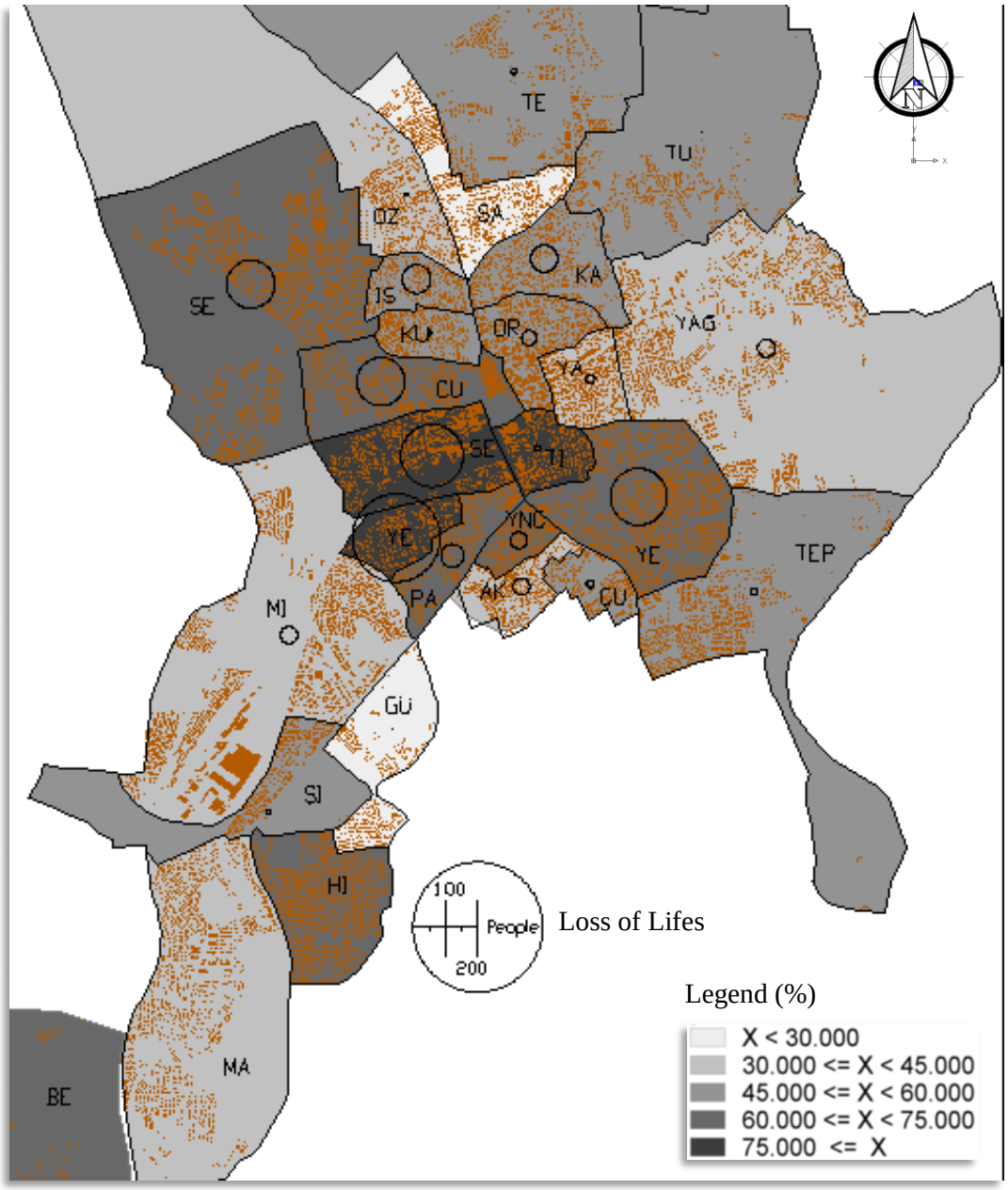


Figure 5.19 Loss of Life According to Structure Type Collapsed

When we examine the buildings collapsed, it is seen that the part of %54 is reinforced concrete and %46 is wooden-masonry buildings (Figure 5.18). And when we examine wooden-masonry structures in terms of loss of life however, we see that loss of life in wooden and masonry structures is % 24 of total population loss, and % 74 in reinforced concrete structures (Figure 5.19). This is verified again when the collapsed structures

according to types in 27 Districts are investigated, it is observed that loss of life is higher in the districts where reinforced concrete structures are dominant. Map 5.10



Map 5.10 Buildings Collapsed in Districts and Loss of Life

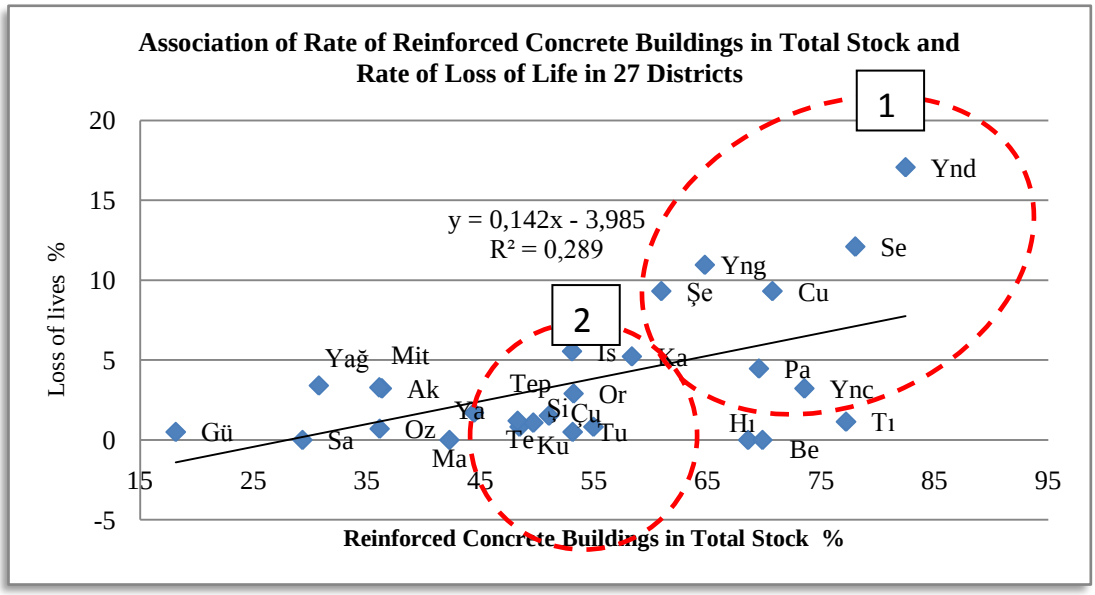


Figure 5.20 Association of Rate of Reinforced Concrete Buildings in Total Stock and Rate of Loss of Life in 27 Districts

Picture 5.7 Damages in Central Adapazarı, Milli Egemenlik Street (SMM, Archive)

Loss of lifes ratio is high in Semerciler, Cumhuriyet, Şeker, Yeni Doğan Districts where reinforced concrete building amount is high (marked as 1). There are no loss of life in Hızırtepe, Beşköprü, Maltepe Districts where the urban development arise after 1985 and the ground is strong enough for construction (area under the line). As in these areas, ratio of the loss of human lives is very low in Tığcılar, Yenicami and other central districts and amount of reinforced concrete buildings is high. Number of reinforced concrete buildings in districts, which are above the line, like Akıncılar, Yağcılar, Güllük is low. Districts, which are marked as 2, are located just outside the center and these are settlements which generally has rural pattern. Figure 5.20

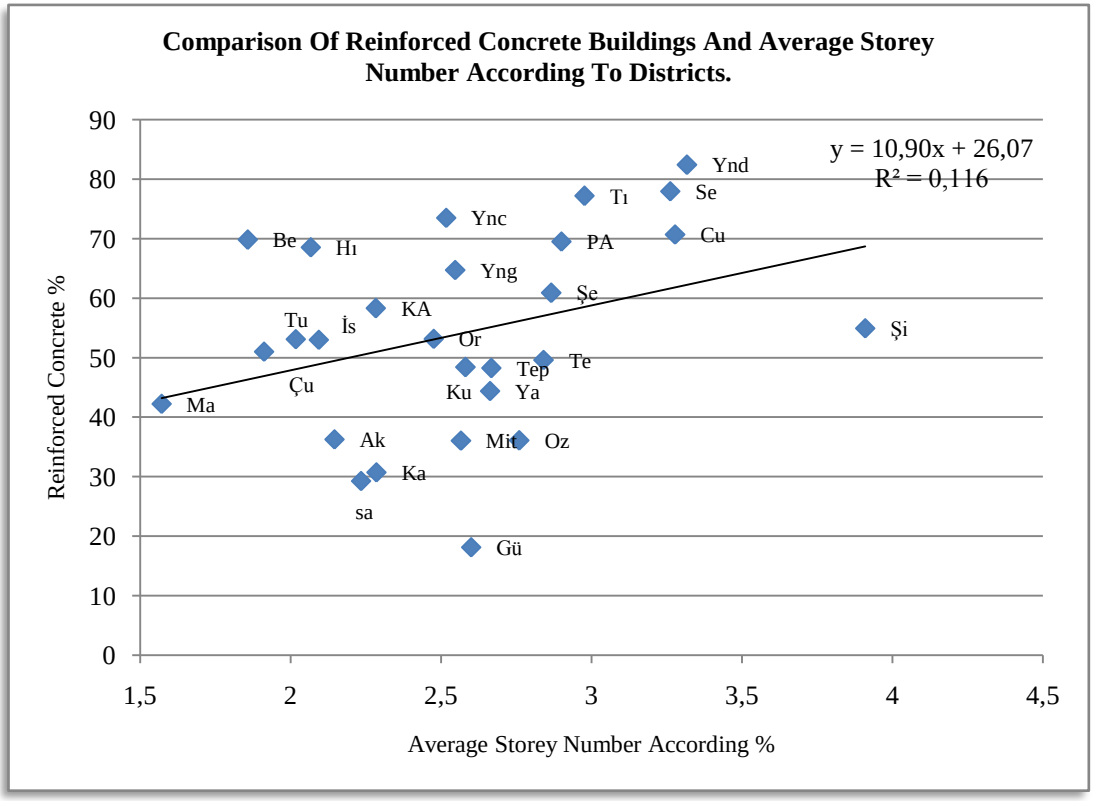


Figure 5.21 Comparison Of Reinforced Concrete Buildings And Average Storey Number According To Districts.

Ratio of collapsed reinforced concrete buildings is increasing as the storey level of the buildings increase. According to this, loss of human live is high in cetral districts like Semerciler, Yenidoğan, and Cumhuriyet. Figure 5.21

5.2.1.2. Type of Use of Buildings Allowed

Greatest part of the buildings collapsed at the earthquake (%57) is multi-unit blocks of flats (Figure 5.22). In terms of loss of life, these buildings represent a much higher ratio (%87) of the total loss of life (Figure 5.23). With the development plan of 1985, 4-5-storey buildings have been allowed. In addition to this, ground floor uses of such high-rise structures were allowed for commercial activities. Accordingly, the development plan of 1985 introducing higher urban densities, also increased the earthquake risk.

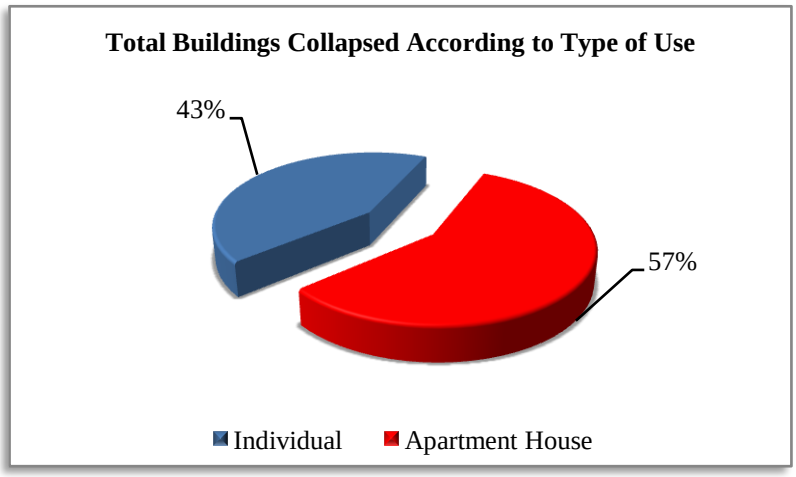


Figure 5.22 Total Buildings Collapsed According to Type of Use

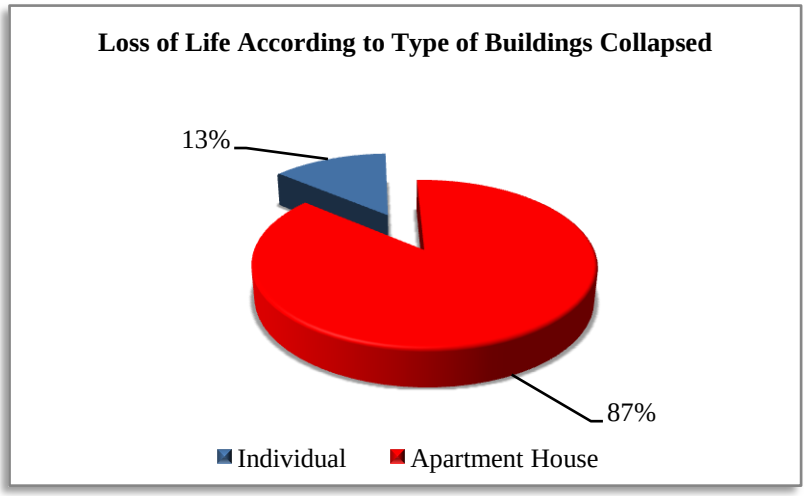


Figure 5.23 Loss of Life According to Type of Buildings Collapsed

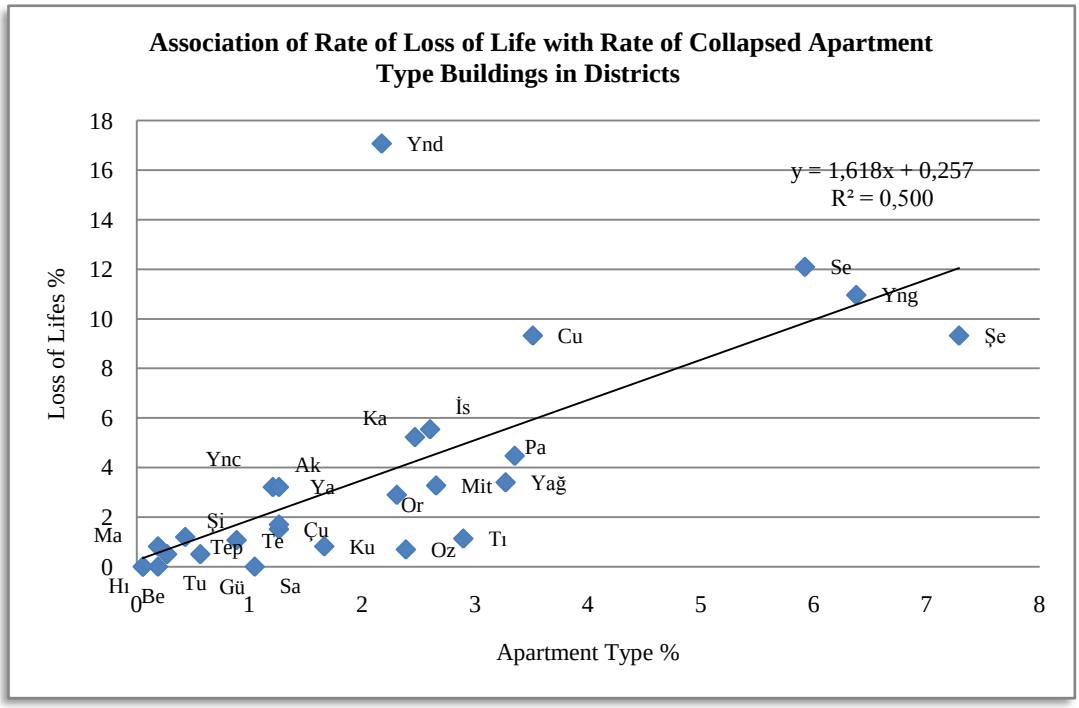
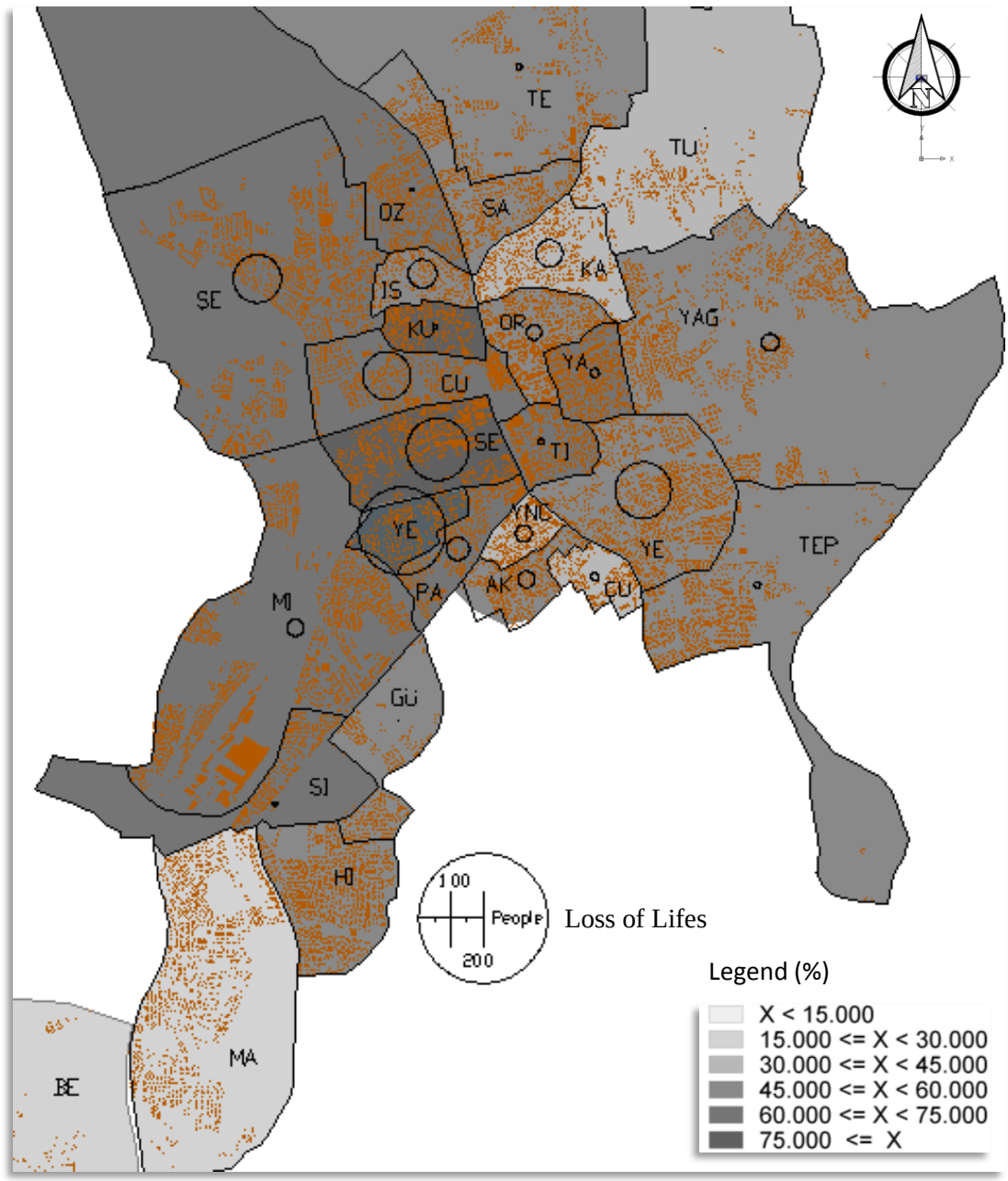


Figure 5.24 Association of Rate of Loss of Life with Rate of Collapsed Apartment Type Buildings in Districts

It is evident that loss of life is strongly related with the collapse of multi-unit blocks of flats. These are specifically concentrated after the 1985 plan which marks the changes in the procedures of planning throughout the country, empowering local authorities in the preparation and approval of local plans avoiding supervision of central government. Table 5.1, Figure 5.24 and Map 5.11

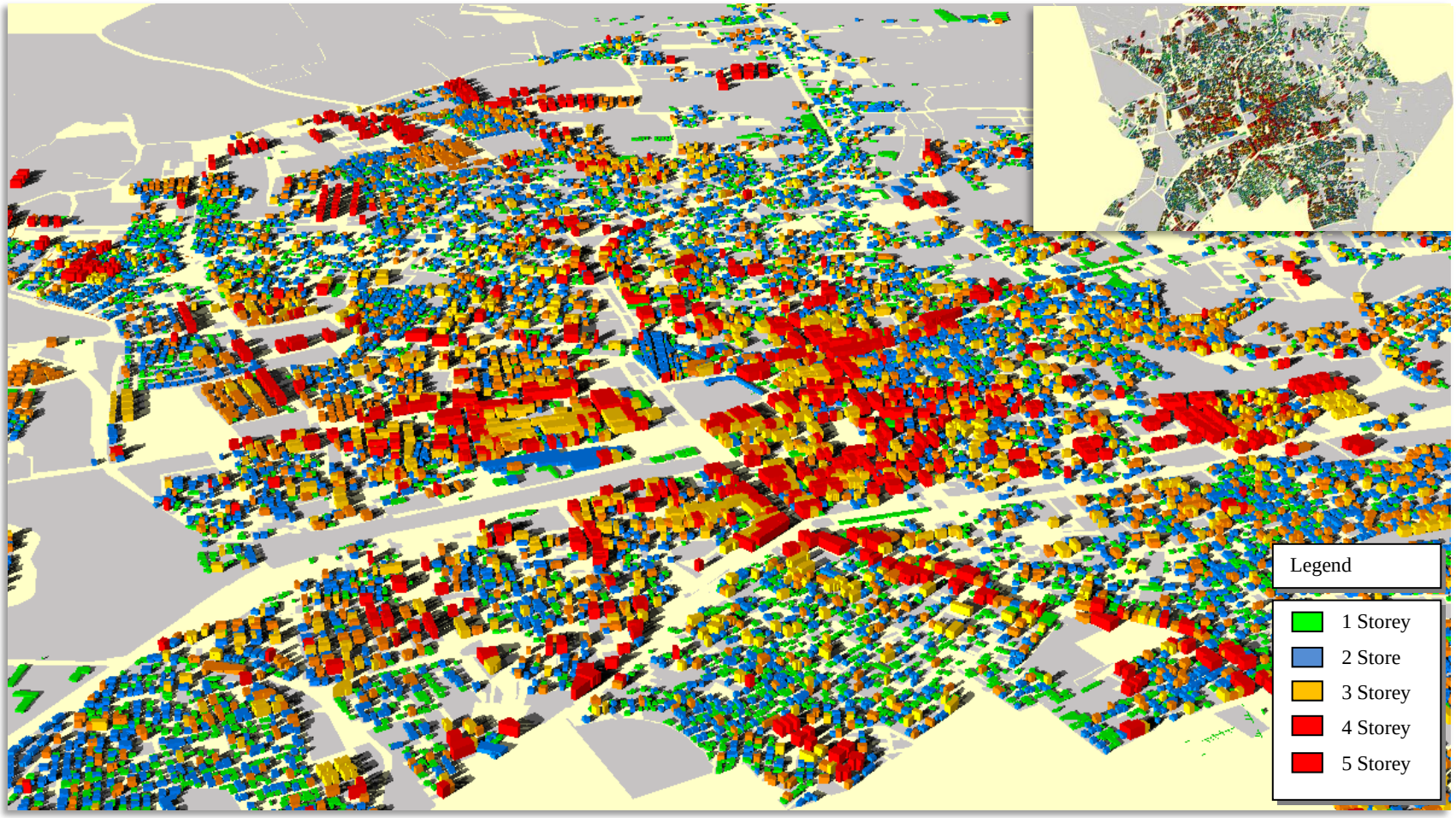
Table 5.1 Seasonal Ratio Of Function Of Buildings and Loss Of Lifes

	1955 - 1970		1970 -1985		1985 - 1999	
	Collapsed Building	Loss of Lifes	Collapsed Building	Loss of Lifes	Collapsed Building	Loss of Lifes
Apartment	449	217	407	189	522	513
Other	479	63	282	40	265	45

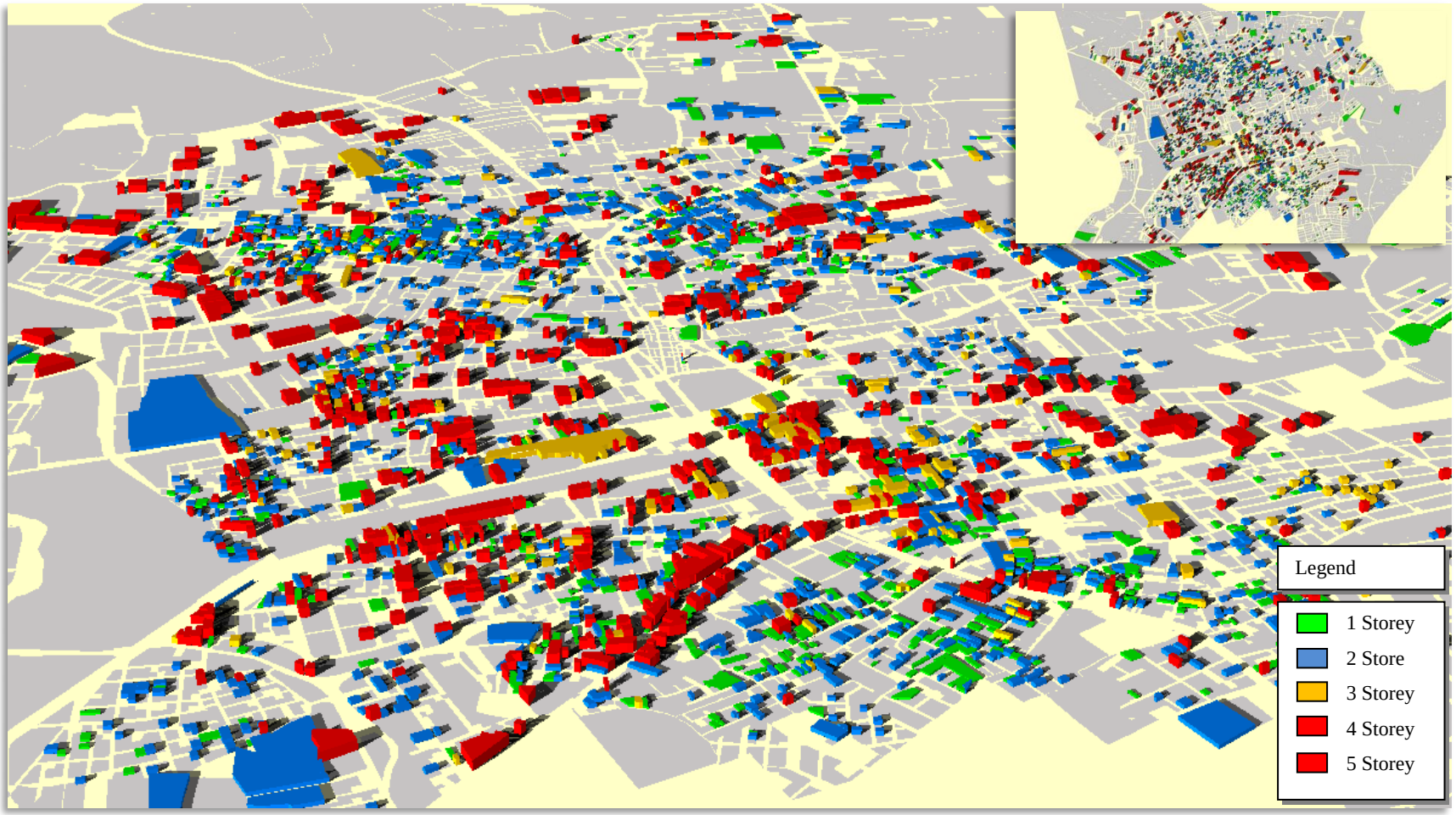


Map 5.11 Association of Apartment Type Buildings Collapsed and Loss of Life

Map 5.12 Solid Model Of Building Inventory To Number Of Floors Before 17th August 1999 Earthquake In Adapazari



Map 5.13 Solid Model of Adapazarı Building Inventory Indicating Number of Floors 17th August 1999 Earthquake



Map 5.14 Distribution of Collapsed Buildings According to Number of Floors in the 17th August 1999 Earthquake.

5.2.2. Effects of Building Formation

Many of the revisions implemented in the centre of Adapazarı represent transfers from detached forms of buildings to attached buildings, and from attached buildings to block buildings with multiple units particularly in the commercial areas of the city. Attached building formation particularly on alluvial deposits in Adapazarı poses a major risk in terms of the earthquake. This fact has been particularly ignored by plan revisions on the main arteries, and in due course this system has spread, being applied in the other locations of the city.

Earthquake risks have particularly increased in the regions where there are 4-5 storey buildings in attached formation (Map 5.16). As a result of increased number of storeys and changes in the formation of buildings with plan revisions, adjacent buildings have been joined without any spacing in between. Technically this requires expansion and movement spacing and joint detailing which were not implemented. Due to variations in the column and beam levels between adjacent buildings, and differences in the height of storeys, many buildings have been destroyed hammering each other and caused immense damages in the earthquake (Figure 5.25).

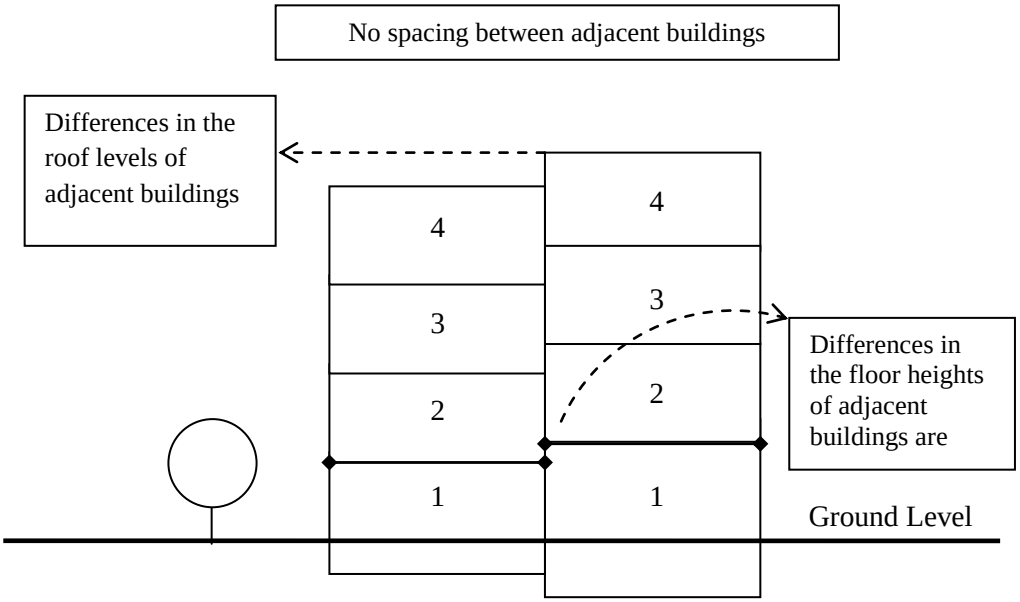


Figure 5.25 Hammering Impacts of Adjacent Buildings in the Earthquake

Picture 5.8 Damages in Attached Structures with Different Floor Heights

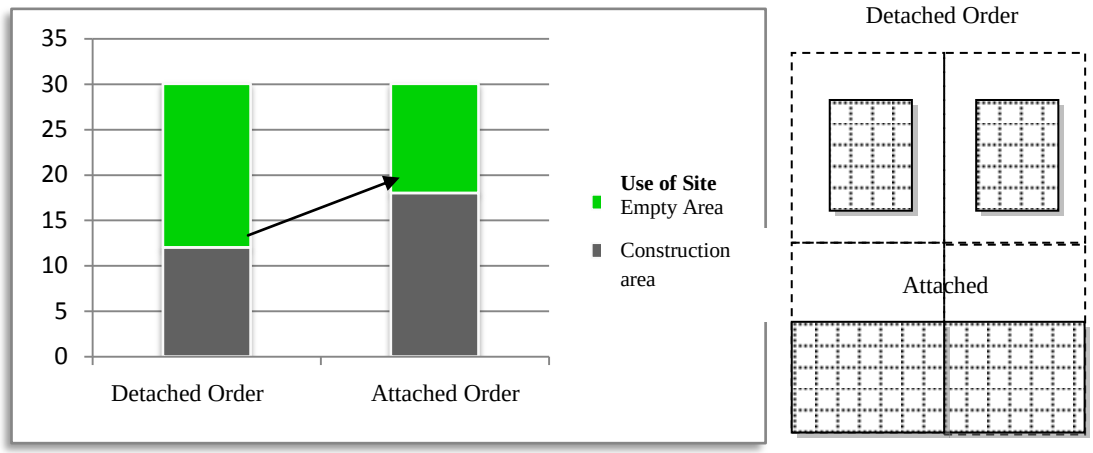
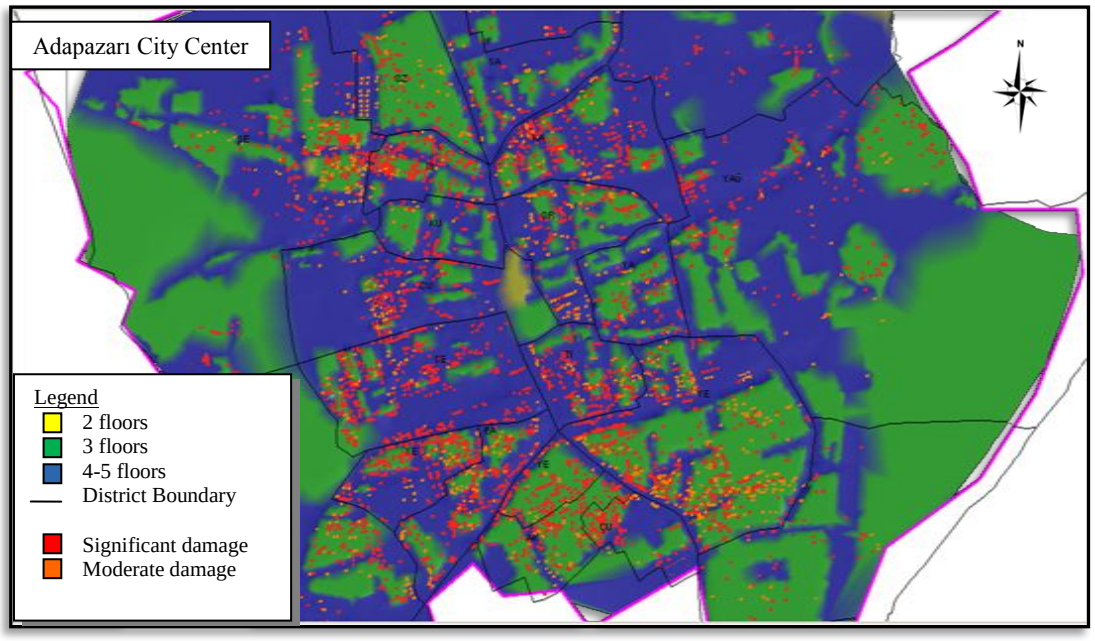
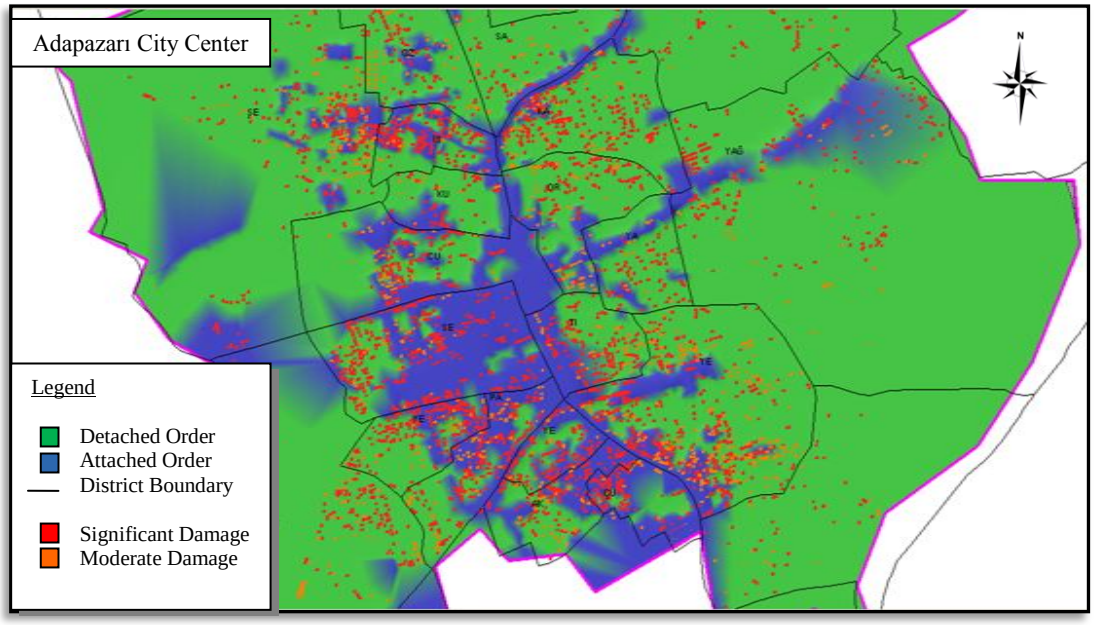


Figure 5.26 Transformationof Detached Order to Attached Order

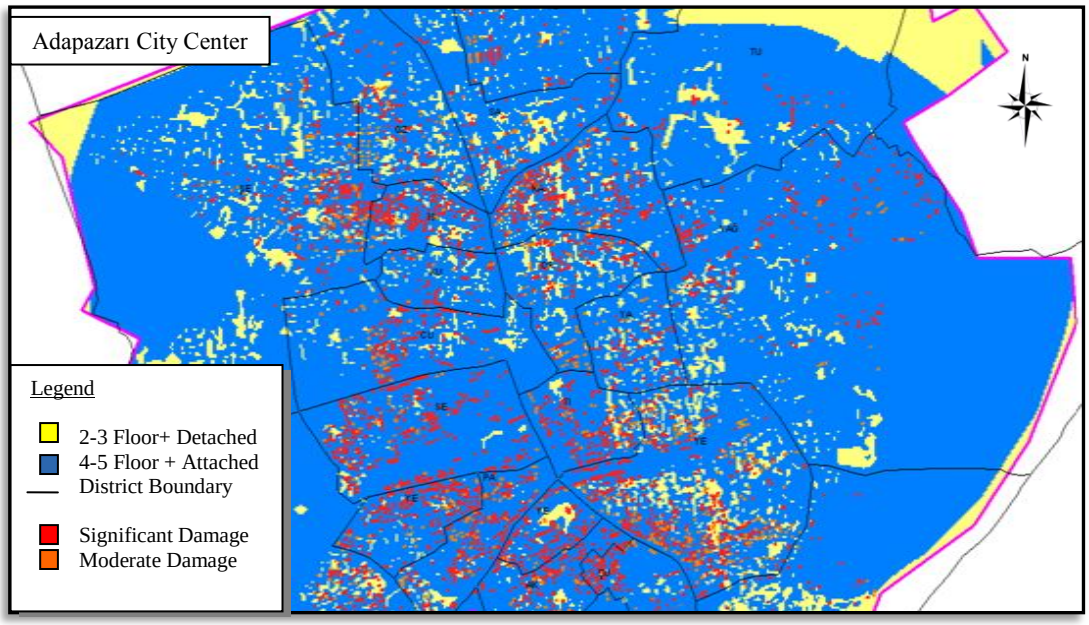
The heavily damaged main arteries like Adnan Menders and Bosna Streets, Yeni Cami Boulevard, Çark Street, Milli Egemenlik Street, Atatürk Boulevard of the Adapazarı city center have been converted into commercial areas, with multi-unit blocks of flats of 4-5 storeys in this manner. Buildings in such arteries have collapsed in the 1999 earthquake giving rise to great loss of life.



Map 5.15 Association of Number of Floors and Buildings Collapsed in Central Adapazarı

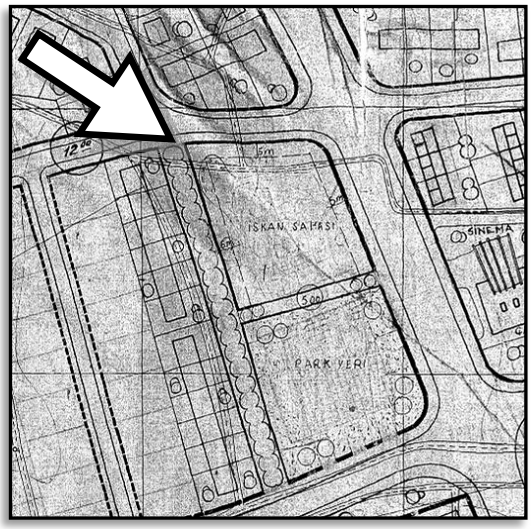


Map 5.16 Association of Building Formation and Buildings Collapsed in Central Adapazarı

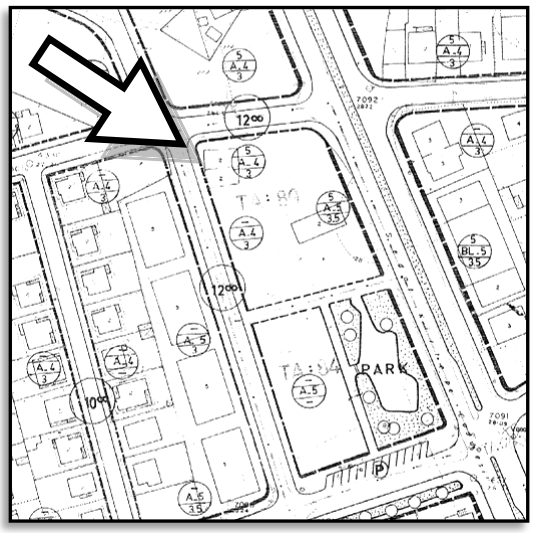


Map 5.17 Asociation of Number of Floors and Building Formation According to Damages in Central Adapazarı

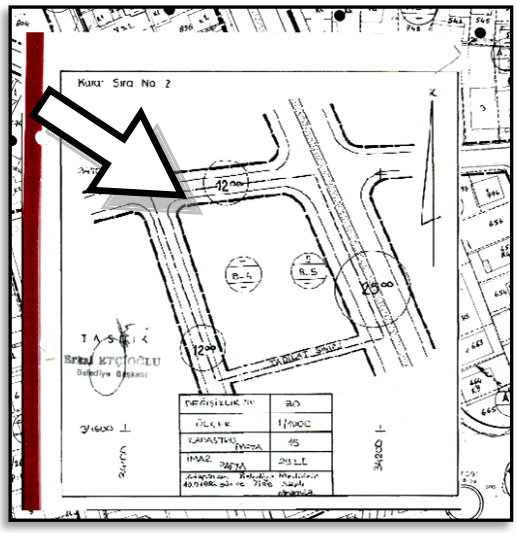
Cases of transformation in building forms between 1957 and 1985 as well as revision plans provide information of the general tendencies (Map 5.16).



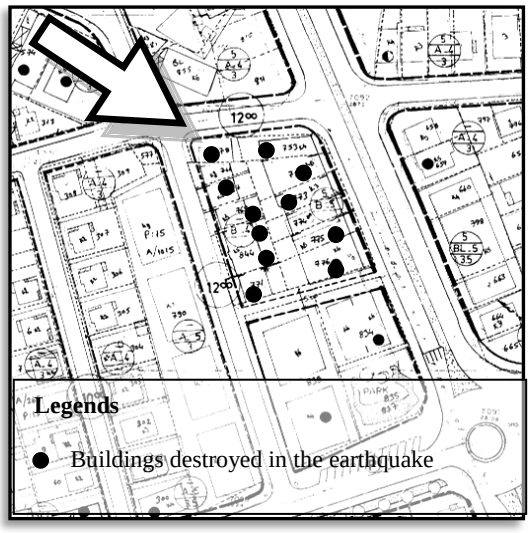
Map 5.18 Partial Application Plan of 1957 indicate 3 buildings and 5 m of set-back



Map 5.19 Partial Application Plan of 1985 indicate detached formation with 4-5 floors



Map 5.20 Revisions Made in the Same Location after 1985 indicate 4-5 floors



Map 5.21 All of the Buildings in the Revision Area have Collapsed in the Earthquake

Picture 5.9 One Of The Collapsed Buildings In The Zone Which Is Shown In Map5.15 (Sedat Kirtetepe Street) (SMM Archive)

As in the example, 1985 plan and plan revisions made after 1957 gave rise to the disaster in the Sedat Kirtetepe Street in Adapazarı (Map 5.20-5.21). In the first development plan, the development area indicated as ‘detached order’ was converted into ‘attached order’ with the plan revisions not for any reason of public benefit or technical urban planning considerations, but solely for the increase in rents and private benefits. As a result of

increasing ground coverage of buildings by including gardens of attached order into area of construction, building densities were increased. Such changes not only distorted the physical structure of the city but also gave way to a socially unacceptable distribution of rents in the city.

5.2.2.1. Association of Collapsed Buildings and Their Formation

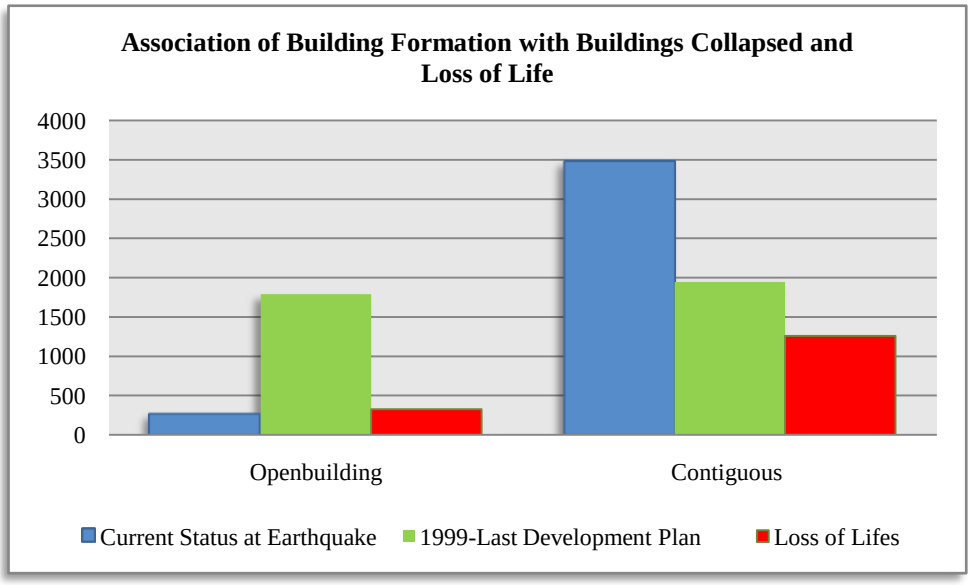


Figure 5.27 Association of Building Formation with Buildings Collapsed and Loss of Life

Picture 5.10 Damages in Central Adapazarı, Ak Street (SMM, Archive)

The state of the building formation for the area in 1999 just before the earthquake was very different from that described in the 1985 Application Development Plan (Figure 5.27). Destruction in buildings where building order was contiguous has been at the rate of %93 (Figure 5.28). Furthermore, the loss of life in attached or contiguous buildings has been 3 times greater than in the detached buildings (Figure 5.29).

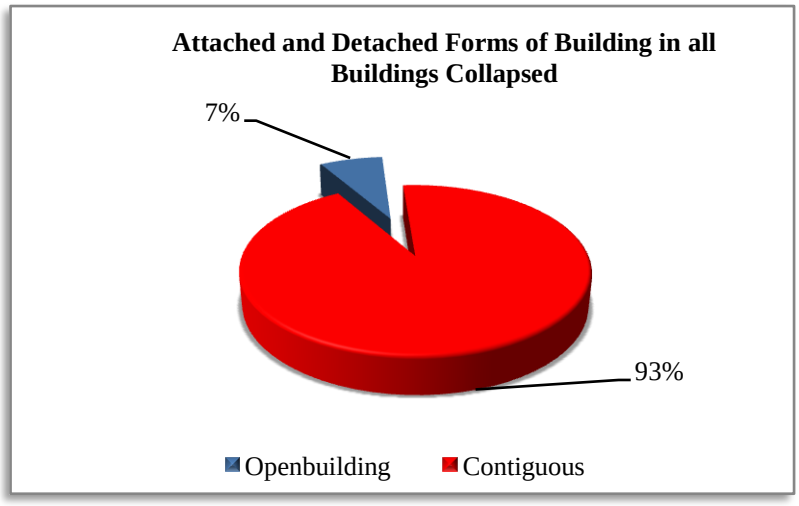


Figure 5.28 Attached and Detached Forms of Building in all Buildings Collapsed

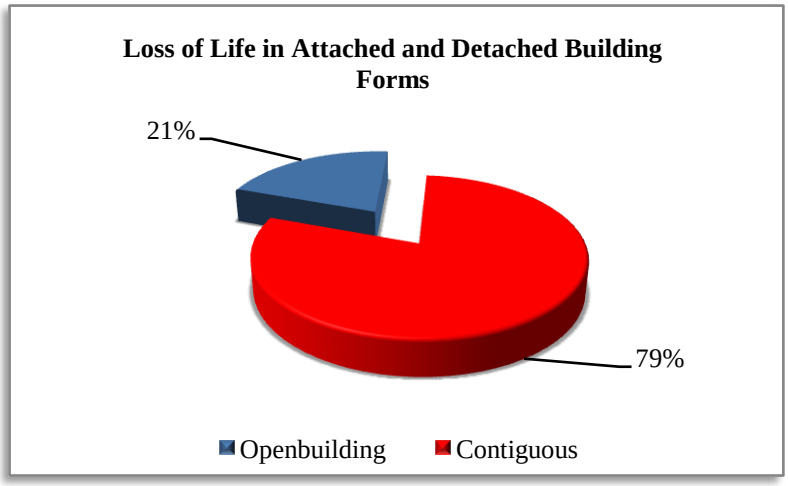
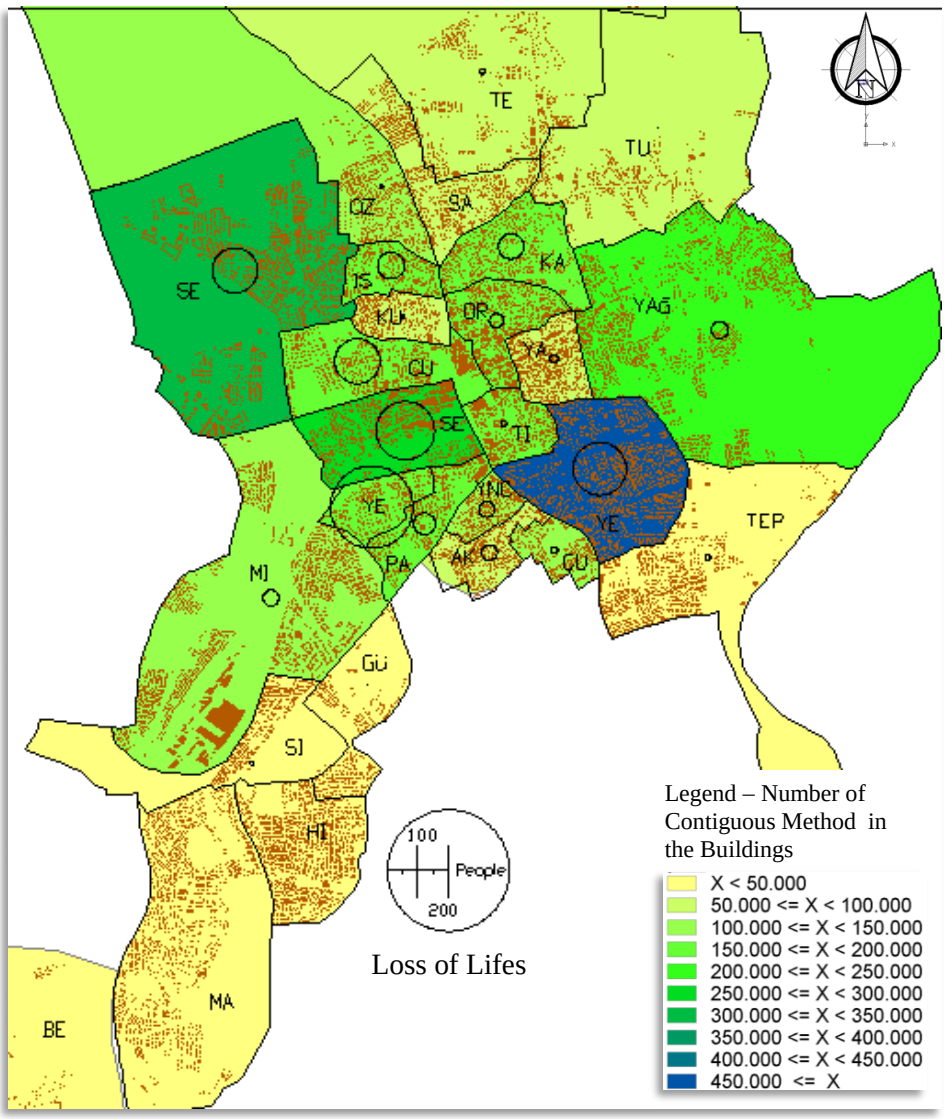
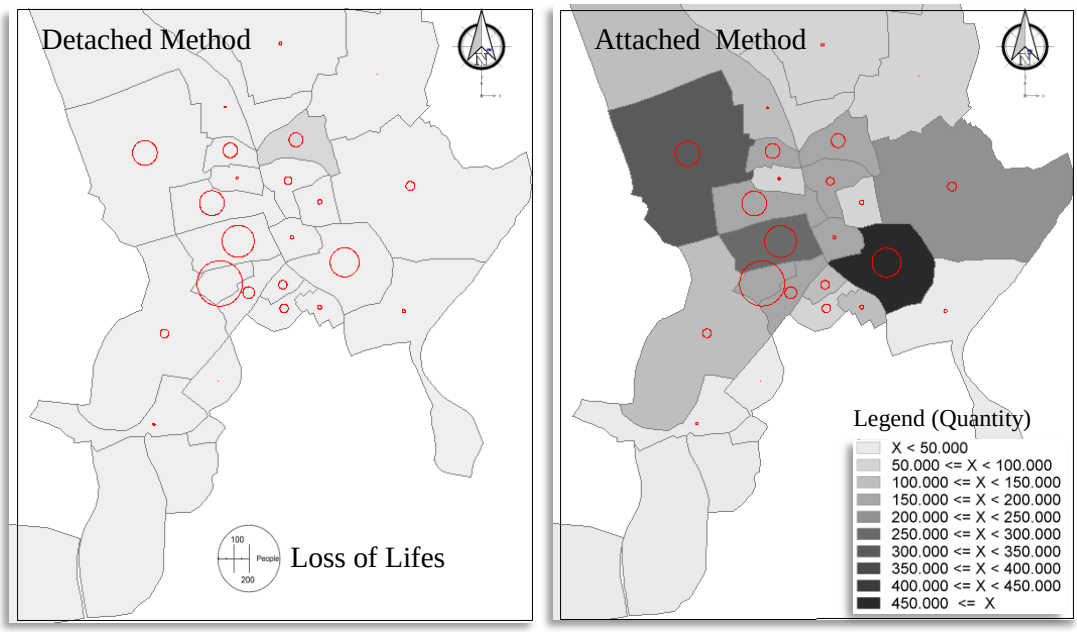


Figure 5.29 Loss of Life in Attached and Detached Building Forms



Map 5.22 Contiguous Method In The Buildings Collapsed At The Earthquake



Map 5.23 Detached and Attached Buildings Collapsed

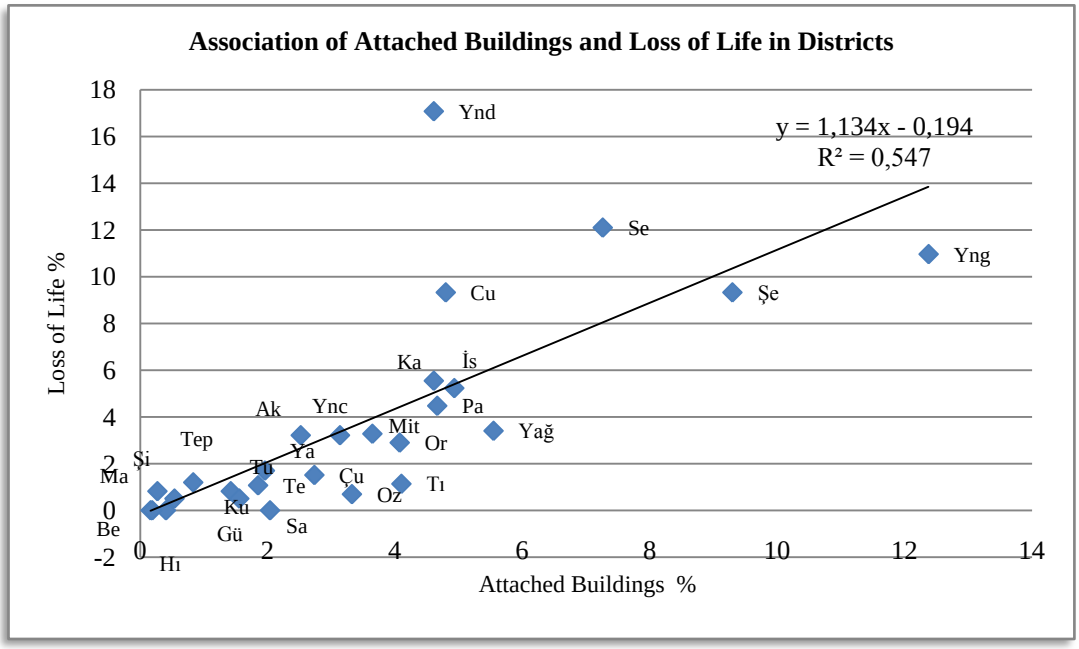
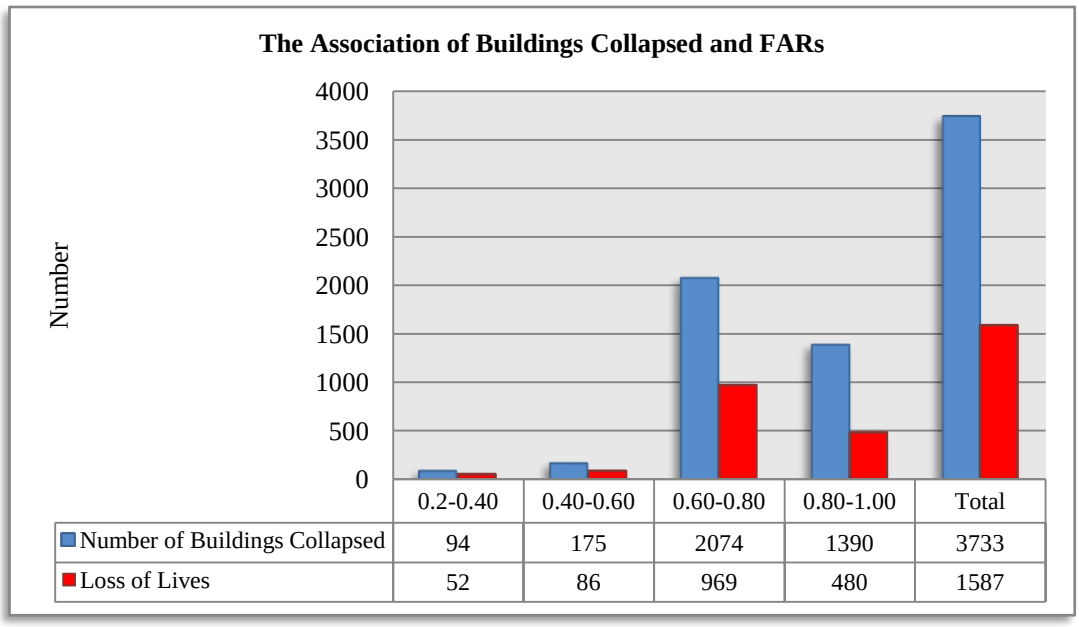


Figure 5.30 Association of Attached Buildings and Loss of Life in Districts

5.2.2.2. Effects of Variations in Building Density or by 'Floor Area Ratio' (FAR)



	0.2-0.40	0.40-0.60	0.60-0.80	0.80-1.00	Total
Number of Buildings Collapsed	94	175	2074	1390	3733
Loss of Lives	52	86	969	480	1587

Figure 5.31 The Association of Buildings Collapsed and FARs

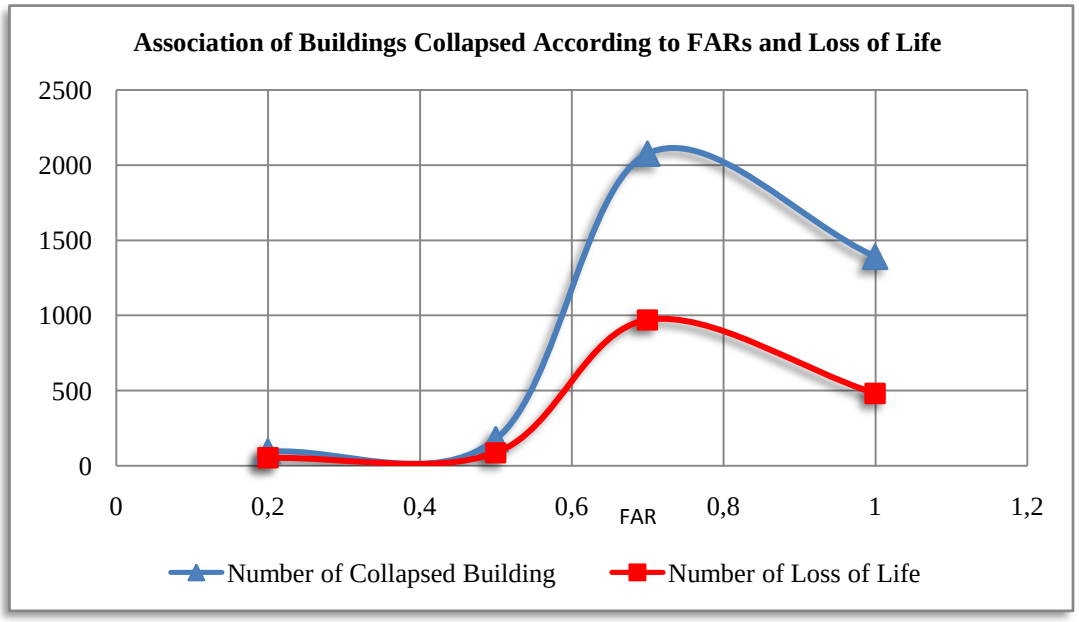


Figure 5.32 Association of Buildings Collapsed According to FARs and Loss of Life

When we compare the FARS of buildings collapsed, Figure 5.31-Figure it is seen that the part of %96 is between the values of 0.60-0.80 and 0.80-1.00 and the loss of life within this

ratio increases up to %91 (Figure 5.33). Since the property pattern at Adapazarı center consists of small parcels, as observed in the Development Plan of 1999, no standard or objectives are stated related to FAR, apart from descriptions of attached and detached forms of building.

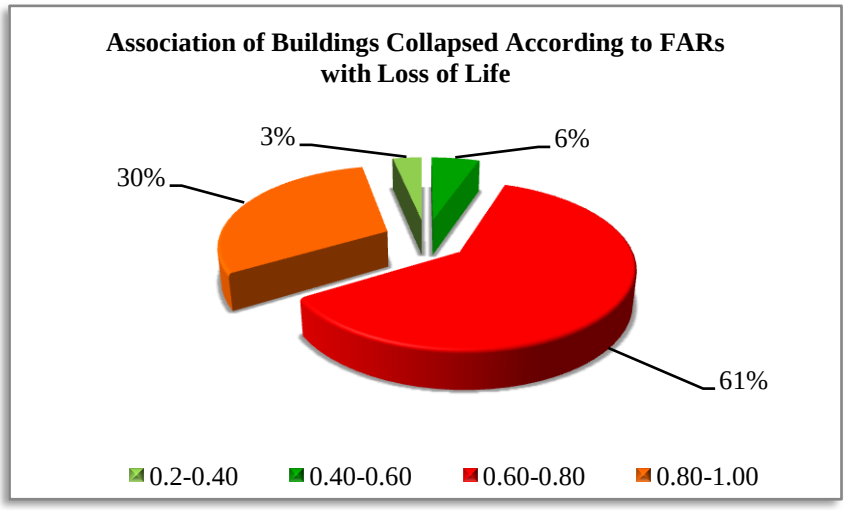
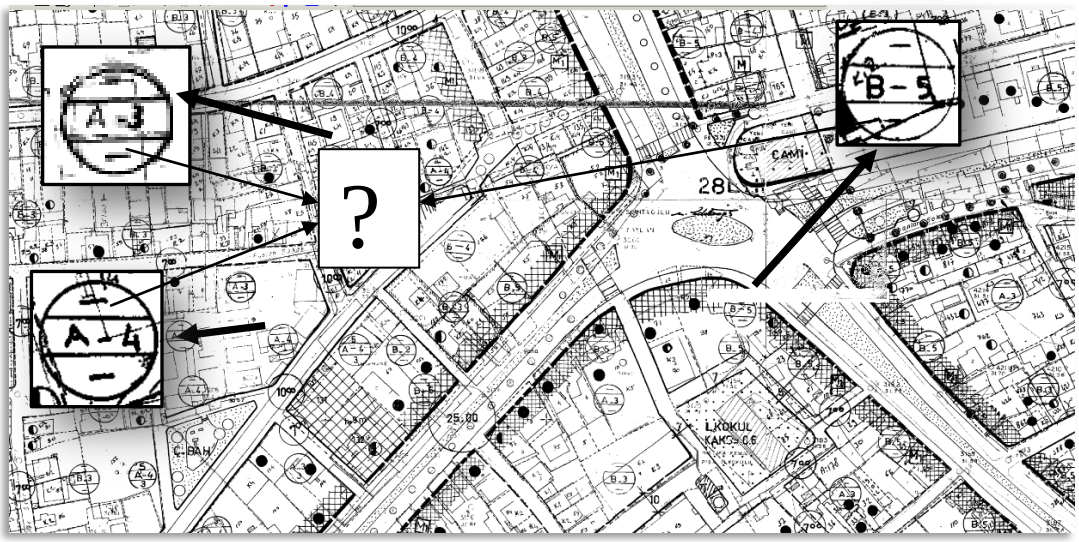


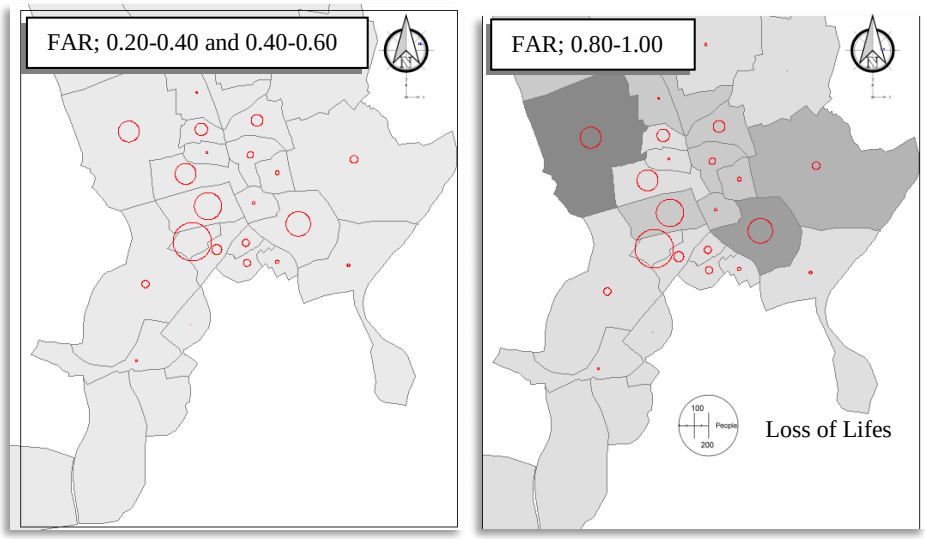
Figure 5.33 Association of Buildings Collapsed According to FARs with Loss of Life

The descriptions for building formation in the Application Development Plan were either indefinite or given in a very flexible manner. As is seen in Map 5.24, building forms are given as detached building of 4-storeys. However, front and rear boundary and the lateral set-backs were not specified on the plans.



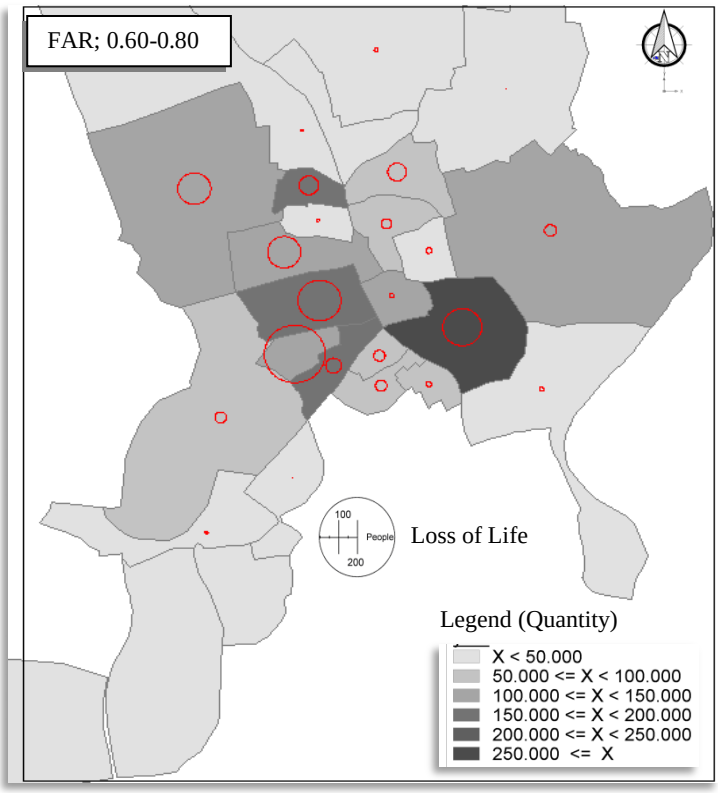
Map 5.24 A Sample from the Development Implementation Plan of 1985

This application performed was due to the fact that parcels at central Adapazarı very small (100 sqm.-200 sqm.). Although such problems could be solved relying on the application of Article 18 of Development Law 3194 (1985), transfers to public roads were practiced largely on the basis of individual parcels. This situation is mostly the result of Municipality's incapacity to stand against the development demands of individuals and impose principles for the collective good.



Map 5.25 FAR Categories of Buildings Collapsed in Districts

Picture 5.11 Damages in Central Adapazarı, Yenidoğan District (SMM, Archive)



Map 5.26 FAR Categories of Buildings Collapsed in Districts

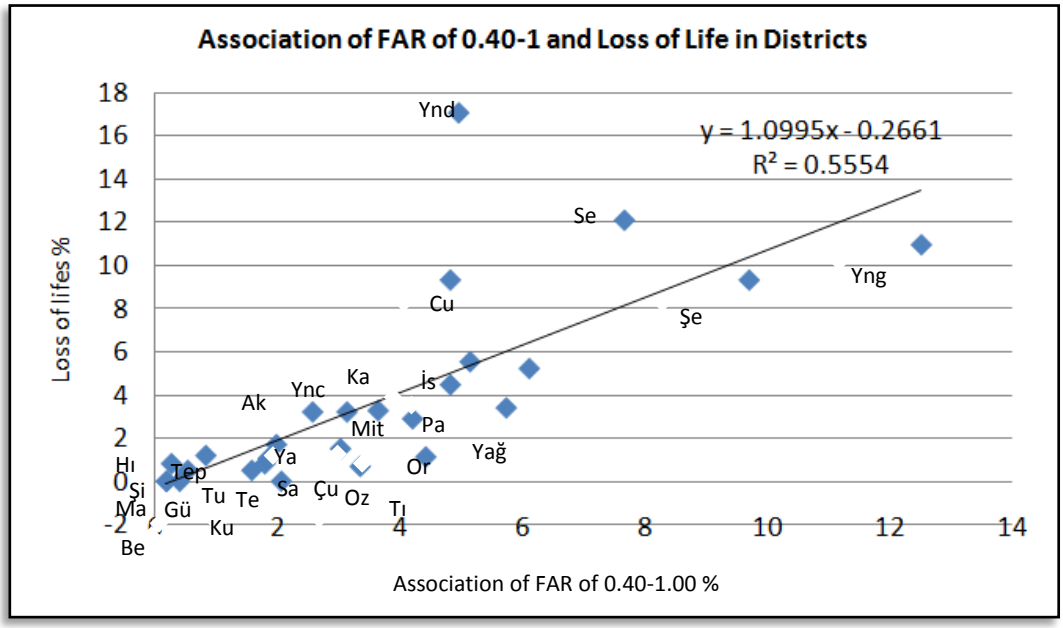


Figure 5.34 Association of FAR of 0.40-1.00 and Loss of Life in Districts

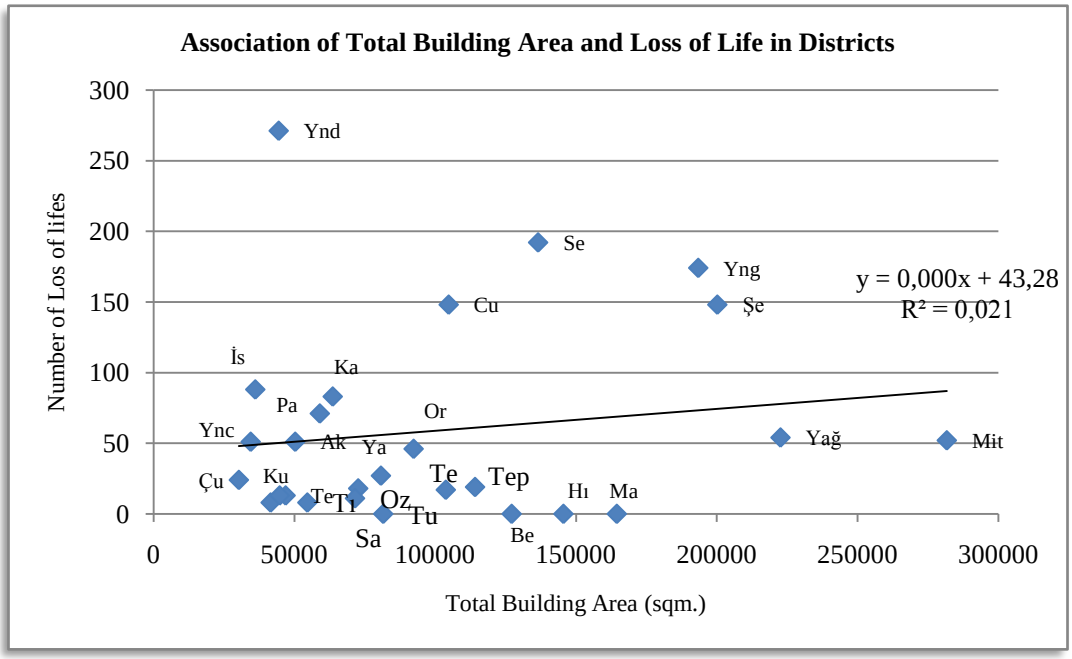
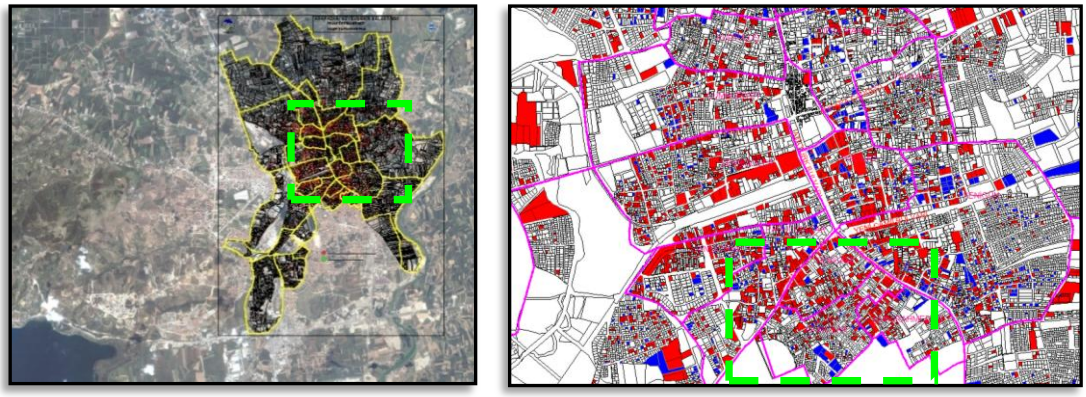


Figure 5.35 Association of Total Building Area and Loss of Life in Districts

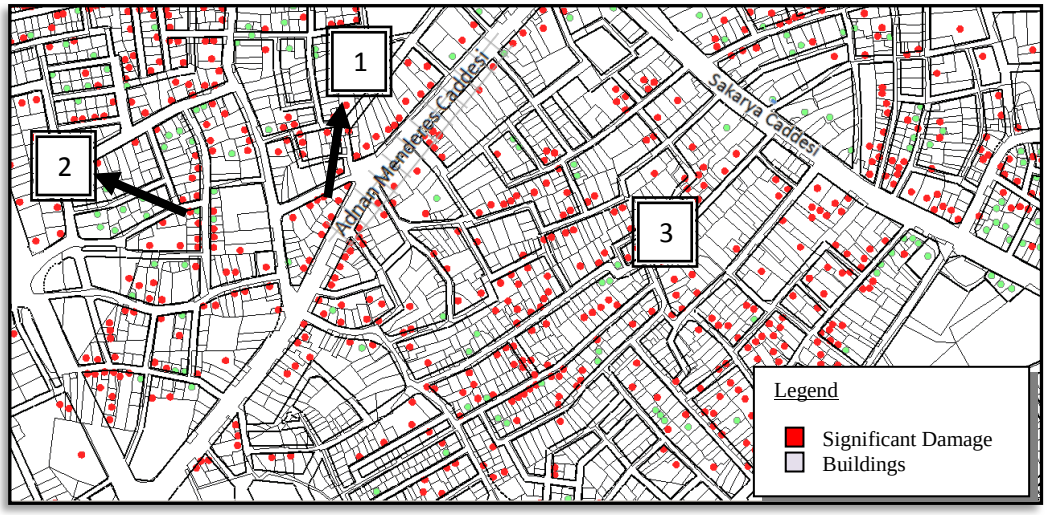
Loss of life increases relative to total building area in the districts. This is again another indicator of losses in the central Adapazarı. Figure 5.35

5.2.2.3. The effect of Property design – Construction Implementations

Pressures for intensive development of property in central Adapazarı increased together with population increases and increases in property values. Map 5.27



Map 5.27 Central Adapazarı Property Damages



Map 5.28 Damage in Yenidoğan,Yeni Cami, Akıncılar , Çukurahmediye Districts

Yenidoğan,Yeni Cami, Akıncılar and Çukurahmediye Quarters were the areas which were affected most by the earthquake. The developments on Adnan Menderes Caddesi according to 1985 plan in Map 5.28 was largely attached in building formation with 5 floors. The lot sizes in the sections 1 and 2, construction lots on which buildings of 5 floors are located vary between 150-250 sqm. . Moreover, since the lots were small while development was allowed, full use of ,lots had to be tolerated, giving rise to increased the risks of earthquake in architectural and static design terms.

The inner districta on the other hand, being far from the main streets (Map 5.28), development in section numbered 3 are detached or even if attached, only have 3-4 floors in the 1985 plan. In this region, most of the buildings are unlicenced and many buildings with narrow streets or blind streets close the path of arteries. Average lot sizes vary between 100 sqm. and 200 sqm. and many buildings are built in attached form on the same lot.

Although in the report of the 1985 development plan provisions of executing Article 18 were given, this was only applied on Dağdibi, Hızırtepe and Maltepe districts. Since the design of properties in Semerciler, Tığcılar Cumhuriyet, Orta Mahalle, Akıncılar, Yenidoğan, Yenicami, Kurtuluş, İstiklal and Yahyalar districts were made as the commercial centers of Sakarya existing property pattern was employed which gave rise to an urban pattern which is in disharmony and unorganized development resulted. Map 5.29

Map 5.29 Buildings Collapsed in the İstiklal District

Map 5.30 Comparison of Subdivisions and Damage in Yahyalar and Yağcılar Districts

Since the section 1 in Map 5.30 was planned on the existing property pattern in the plan of 1957, it is observed that the arrangement of the development is in conflict and disorganized. In addition to this, the area 1 in 1957 is better organized than the area 2 and the building lots are formed better . As a result, in areas where the plan and property design of Adapazarı has been accomplished according to planning principles, less damage has taken place.

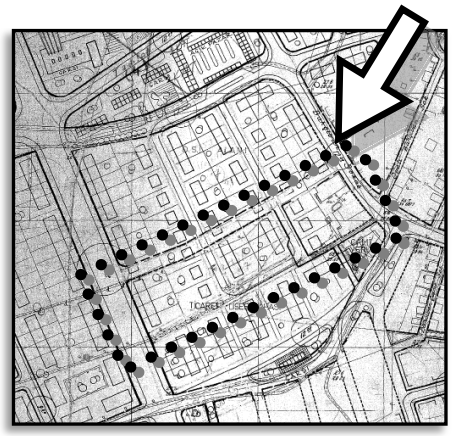
The effect of property form on the status of Construction, structure architectural form and static;

Land lots which were not in compliance with the subdivision regulations were given development licences like residual plots from the road alignments, green spaces or the designation of other public areas. These remainder pieces of land were irregular, small, and deformed. This caused building forms which adversely affected architectural form of buildings far from aesthetic criteria. Moreover, construction of asymmetric buildings on such pieces of land also gave rise to difficulties in the structural engineering design. All such factors contributed to risky development in Adapazarı.

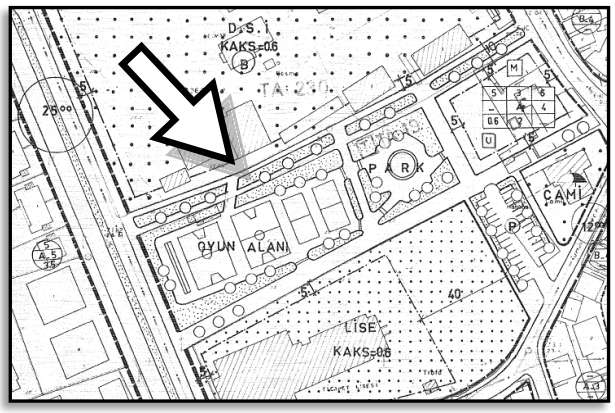
5.2.3. Effects of Changes in Land Use

Urban areas in Adapazarı such as green spaces in particular, recreation fields and car parks have been converted into residential use areas since the authority of carrying out the preparation of plans have been given to municipalities in 1985. Due to such plan revisions, functional integrity of development plans has been lost and population prescribed in the plan increased and standards of urban functions prescribed in the development plan failed to meet the needs.

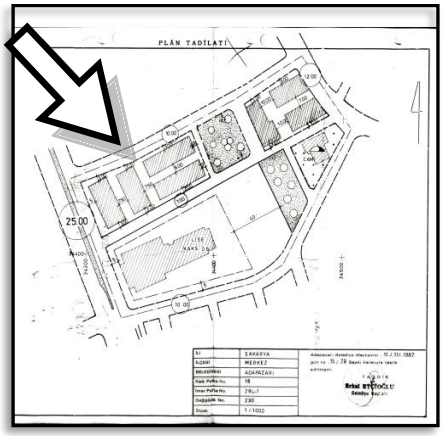
After the 17 August earthquake, since there was no sufficient open spaces left, people had to live on pavements, school gardens and among ruins by setting up tents. Such conditions gave rise to great psychological effects after the earthquake, impossible to eliminate.



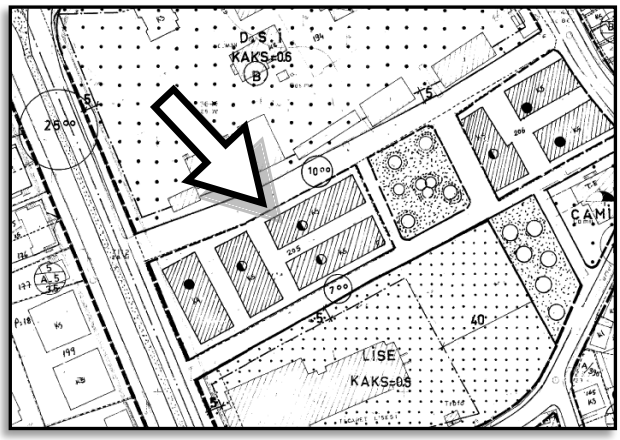
Map 5.31 Commercial Area in the 1957 Plan



Map 5.32 Area was Converted into a Green Area of 7500 sqm. in the 1985 Plan

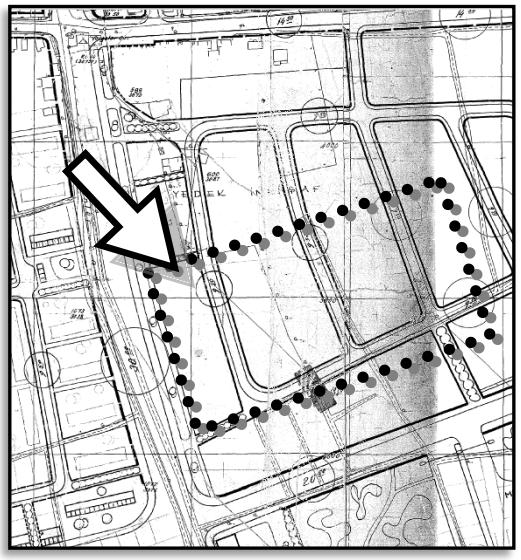


Map 5.33 A Revision Plan (1987) Converted the Green Area into Residential Use with 4-5 Floors



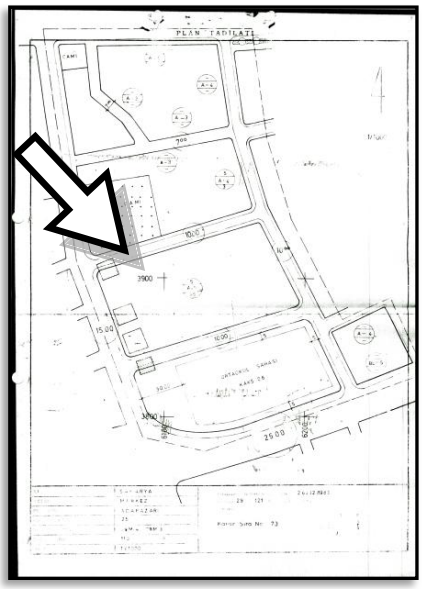
Map 5.34 Three out of 7 Residential Blocks Collapsed in 1999; The Other Four were Damaged

Areas designated as green spaces in the plan as in the above example, were not substituted by other open spaces, and the development law was violated.



Map 5.35 Residential Use Designated in the 1957 Plan

Map 5.36 the 1985 Plan the Area was Designated as a Green Area and trade area



Map 5.37 The 1987 Revision Plan Converted the Site into a housing Area

Map 5.38 Three Blocks out of 4 Collapsed in 1999 as the Revision Plan Converted the Green into Residential Use;

The revisions made in the development plan at central Adapazarı which removed green spaces prove that development plans are very effective tools in risk mitigation. As shown in Map 5.37, if these green spaces were not removed, the extent of losses would have been much lower. Map 5.38

5.2.3.1. Effect of the Ground Floor Commercial Uses Allowed on Building Failures and Loss of Lifes

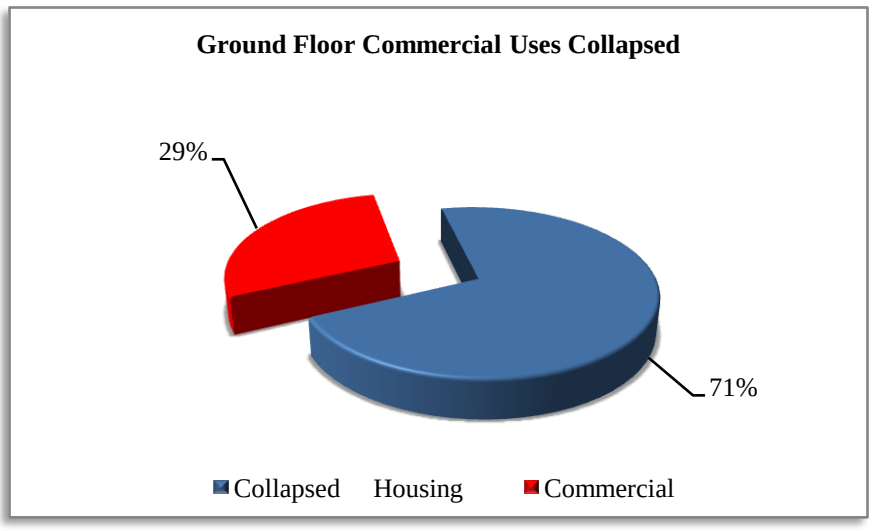


Figure 5.36 Ground Floor Commercial Uses Collapsed

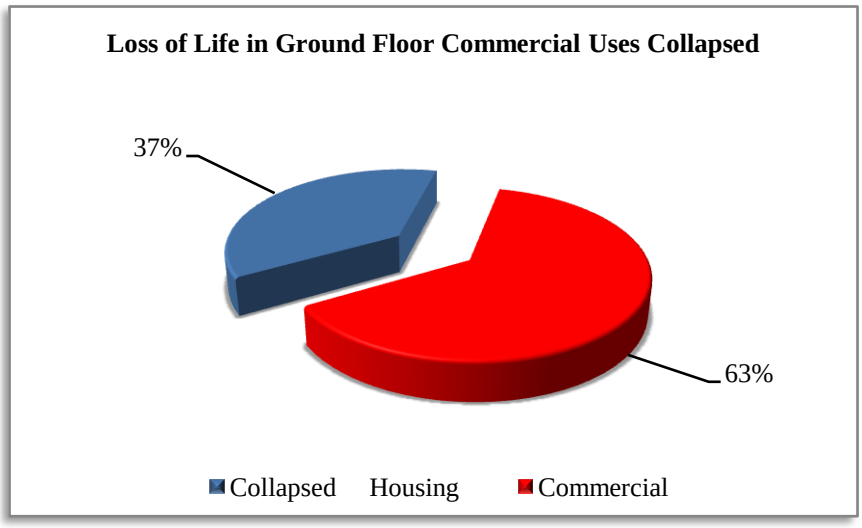


Figure 5.37 Loss of Life in Ground Floor Commercial Uses Collapsed

In the 1957 plan, commercial areas were planned mostly in the system of bazaars, separate from housing, which was altered in the plan of 1985. The decisions that allowed ground-floor commercial use of the residential buildings took place particularly on the main streets. As 4 and 5-storey structures have been allowed on the main-streets, commercial functions have become denser in major arteries in the centre like in Çark Street, Atatürk Boulevard, Sakarya Street, Adnan Menderes Street and Yenicami Boulevard, in the districts of Semerciler, Cumhuriyet, Pabuccular, Yenigun, Tıgcılar at the city center. The regions damaged most by the earthquake have been these buildings on the main streets. In buildings where there are commercial activities on the ground floor, generally the height of ground floor has been given as 5.75 m. This plan decision taken without considering the factor for ground conditions has immensely increased destruction and loss of life (Figure 5.37; 5.38).

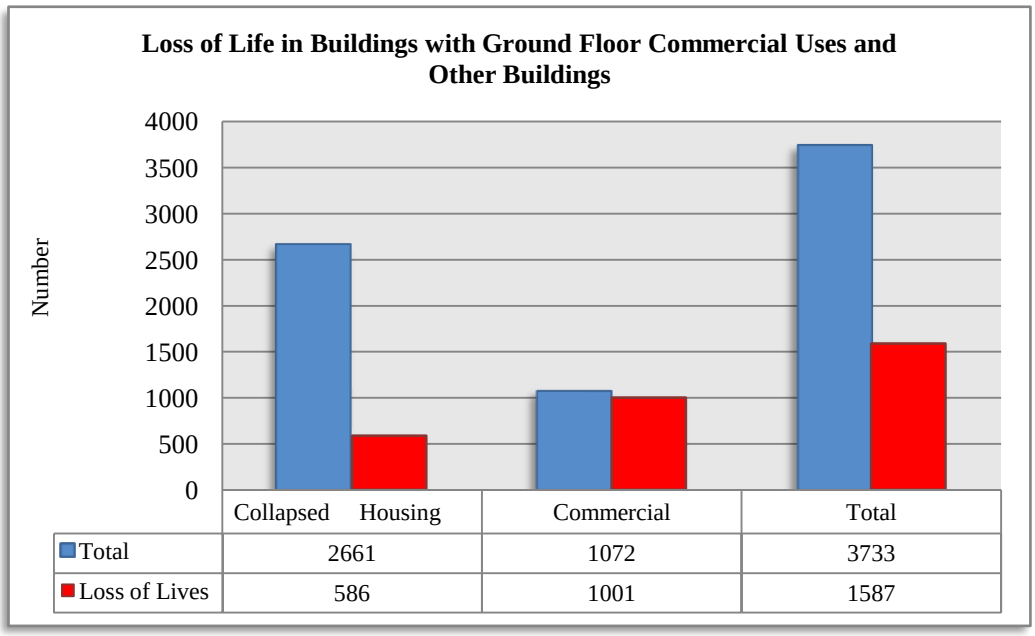
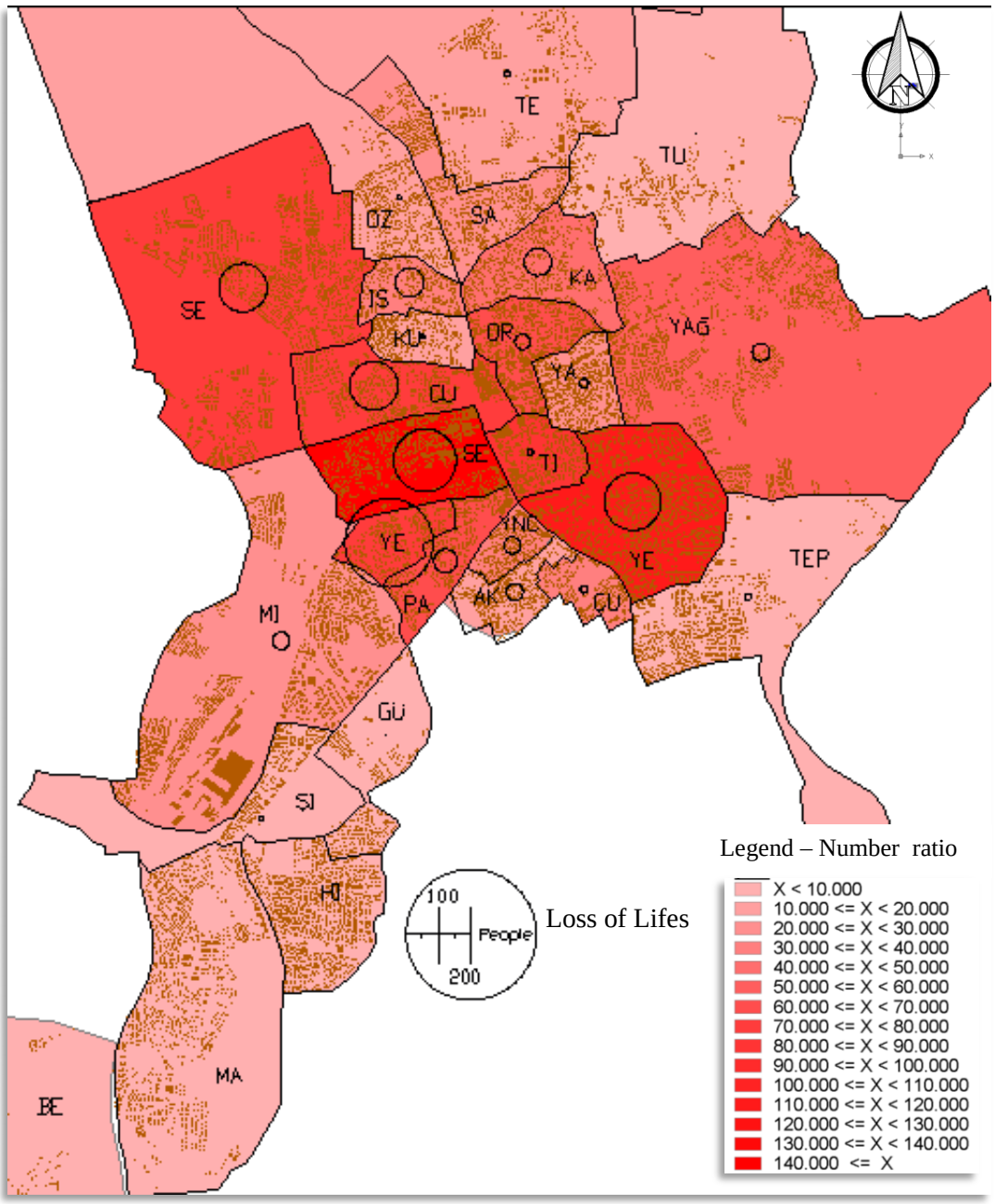


Figure 5.38 Loss of Life in Buildings with Ground Floor Commercial Uses and Other Buildings

The development plan of 1985 designated commercial functions on the main arteries, and wherever high-rise housing and commercial units were concentrated there was greater destruction and loss of life in these central arteries in the earthquake of August 17th (Map 5.39)



Map 5.39 Distribution of Ground Floor Commercial Uses Collapsed

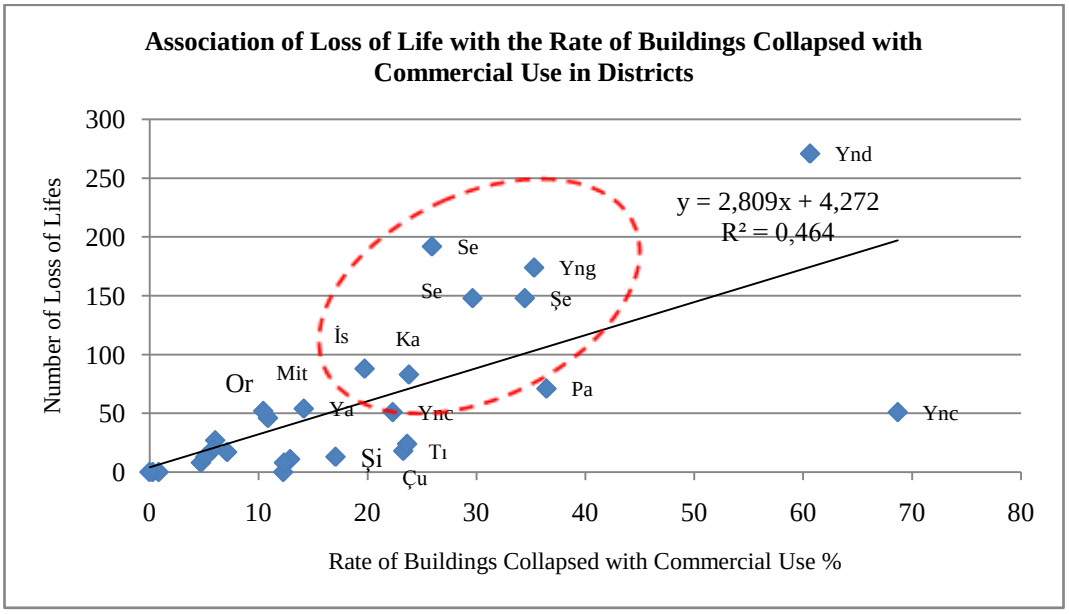


Figure 5.39 Association of Loss of Life with the Rate of Buildings Collapsed with Commercial Use in Districts

As rate of commercial uses increase, the number of building collapse and loss of life do increase. The group indicated in red denote central districts of the city. Figure 5.39

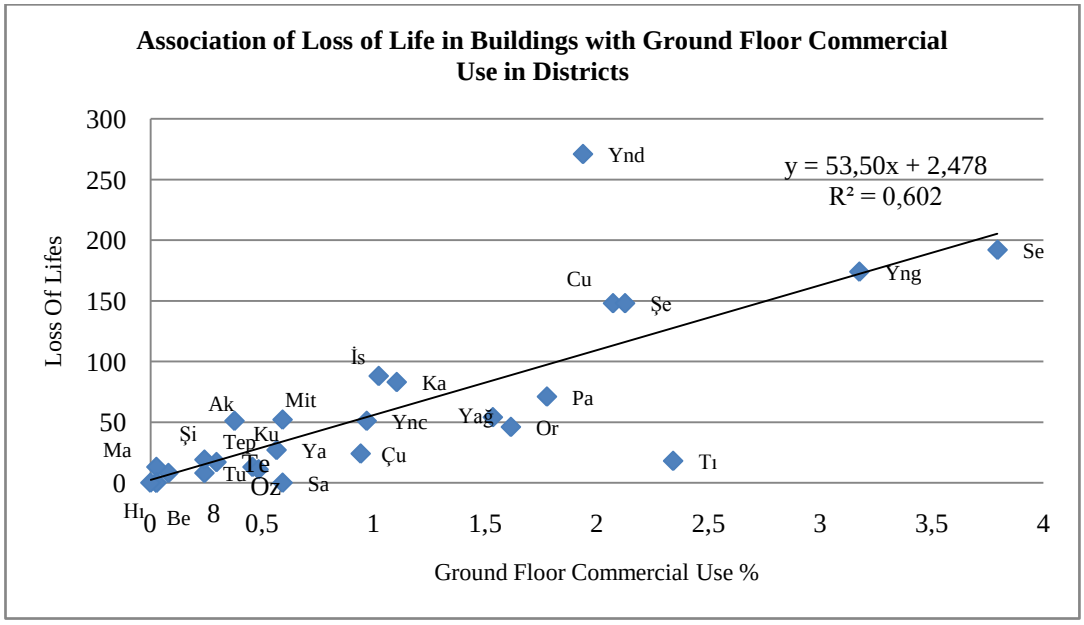


Figure 5.40 Association of Loss of Life in Buildings with Ground Floor Commercial Use in Districts

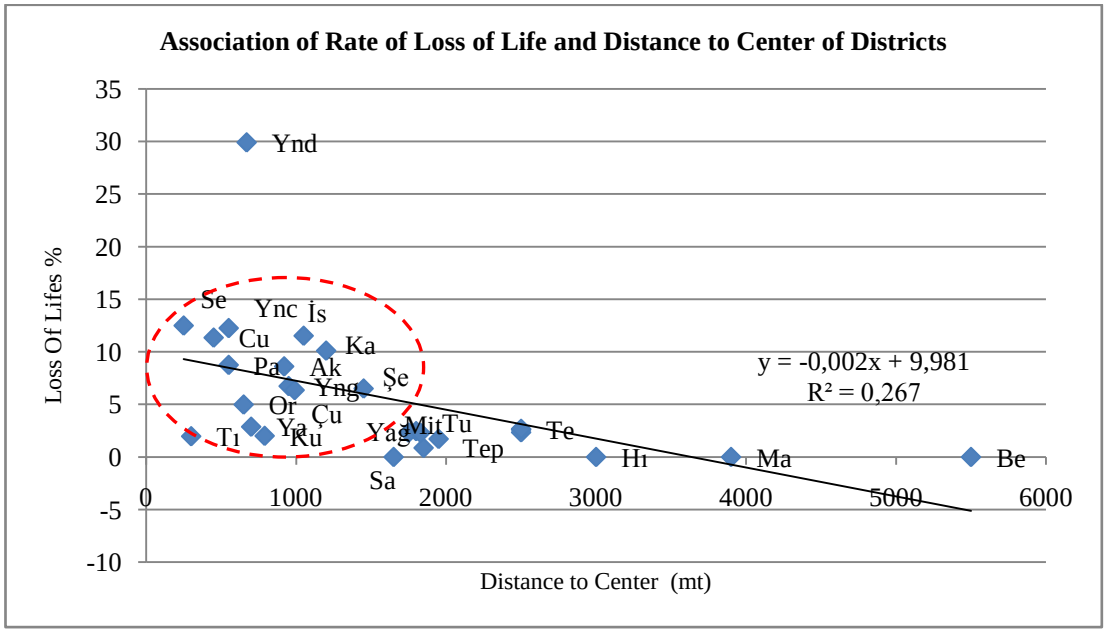


Figure 5.41 Association of Rate of Loss of Life and Distance to Center of Districts

The group in red indicate central districts. As moved out from the cntral city the loss of life also falls. Figure 5.41

Picture 5.12 Damages in Central Adapazarı Atatürk Boulevard (SMM, Archive)

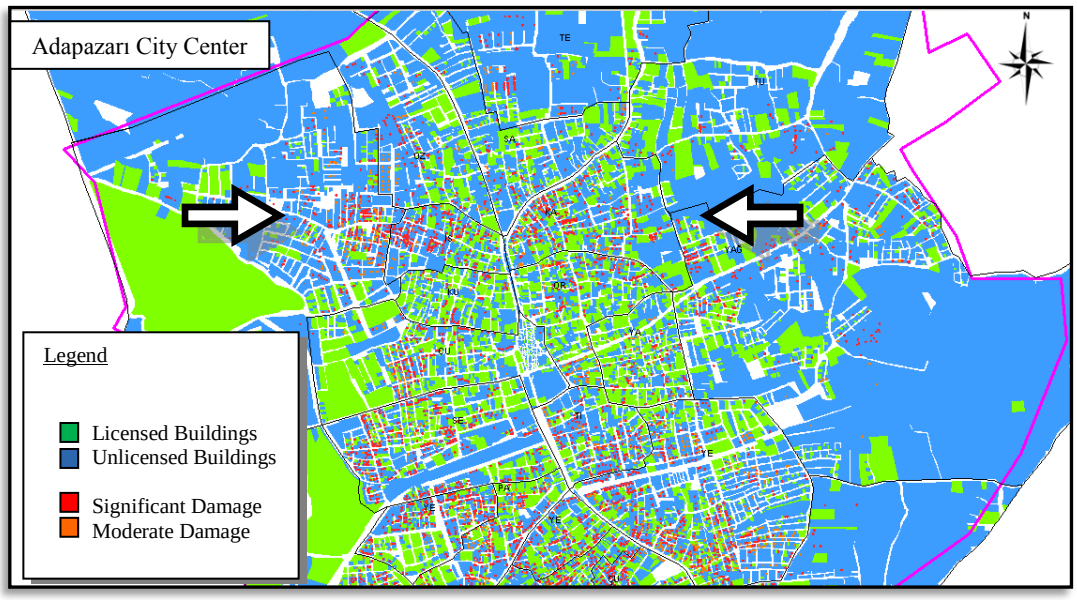
5.2.3.2. Effects Of Licances

It is observed that the ratio of permitted buildings after the plan of 1957 is far more than ratio of permitted buildings after 1980 in Adapazarı. There are no shanty occupied regions in the centre of Adapazarı, and unauthorized buildings have been constructed only on their own plots.

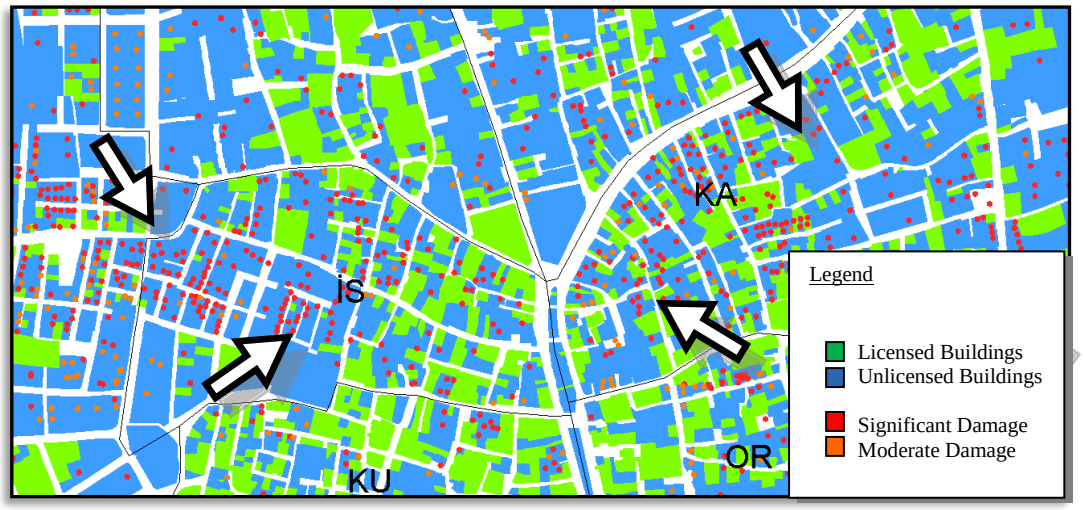
In particular, after the 'development amnesty' in 1983, the housing stock without licenses has been legalized. Unplanned urbanization has arisen in Adapazarı due to buildings constructed as unauthorized, without construction engineering, planning discipline and development implementation plans.

Buildings which have not been constructed within the development confines, multiple building within the same plot, buildings violating the roads and culs-de sac blind streets have created an unaesthetic urban development and a chaotic urban landscape. After the earthquake this distorted structure caused failures and barriers in the removal of debris and relief efforts.

Istiklal, Kurtuluş, Orta Mahalle, Yenicami and Çukurahmediye are districts in the centre of the city where distorted structure is at the very apparent (Map 5.40)



Map 5.40 Spatial Association of Licensed and Unlicensed Buildings in Central Adapazarı



Map 5.41 Spatial Distribution of Unlicensed and Licensed Buildings Damaged in the İstiklal and Karaosman District.

It can be seen in details that generally unlicensed buildings demolished around the city center and its periphery, in Istiklal, Karaosman ve kurtuluş districts. Map 5.41

Demolished buildings are generally licenced buildings in central buildings such as Cumhuriyet , Semerciler, Tığcılar, Yenidoğan, Papucçular.

5.2.3.3. Licences of Buildings Collapsed in the Earthquake

As research within thesis indicates, all of demolished buildings that do not have licenses are %53 of the total (Figure 5.42). Since these two rates are almost equal, it can be stated that building license is a secondary condition in the collapse of buildings than that of the planning decisions. Factors like geology and floor height relations which were the bases in planning decisions, have increased the risk of damages even of licensed buildings.

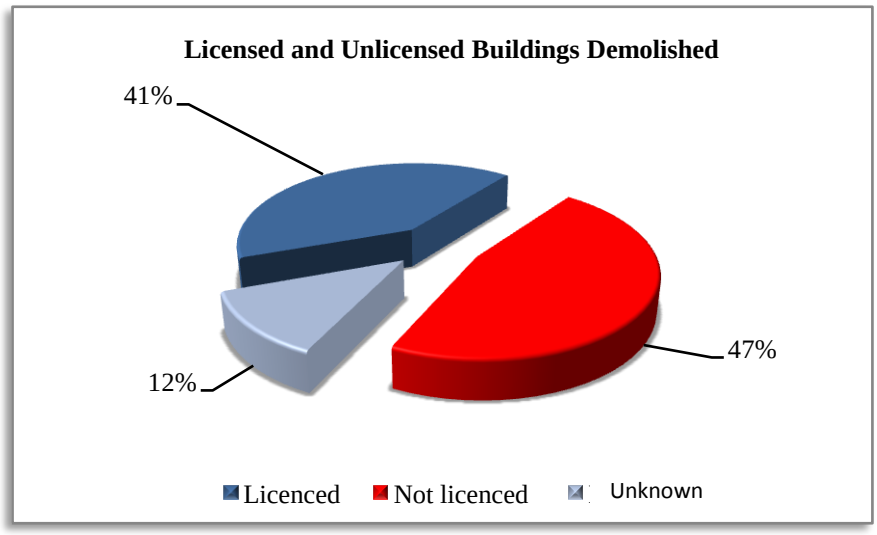


Figure 5.42 Licensed and Unlicensed Buildings Demolished

It is observed that loss of life in licensed buildings occur at a greater rate of %60 (Figure 5.45). This is because collapsed buildings have a rate of %81 which are of 4-5 floors. As this is an application directly emanating from the plan decisions, effects of the earthquake largely can be interpreted once again the consequence of the deregulated planning practices, rather than any other reason.

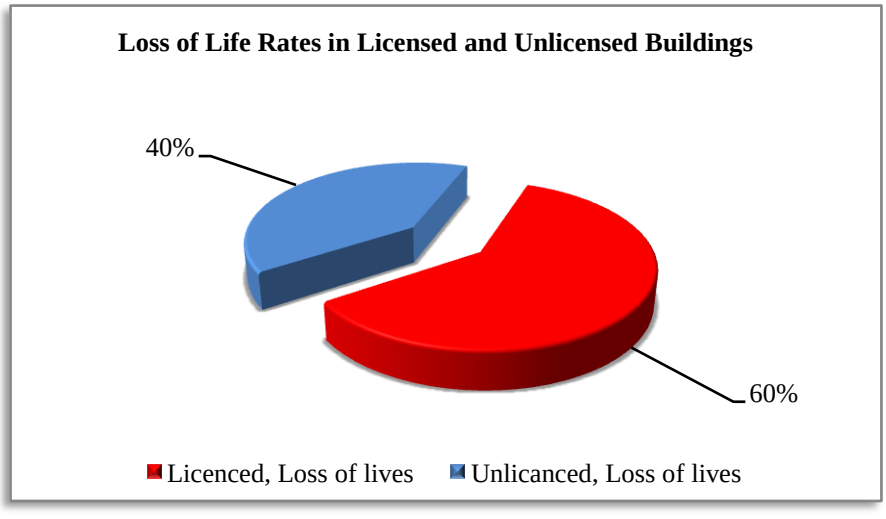


Figure 5.43 Loss of Life Rates in Licensed and Unlicensed Buildings

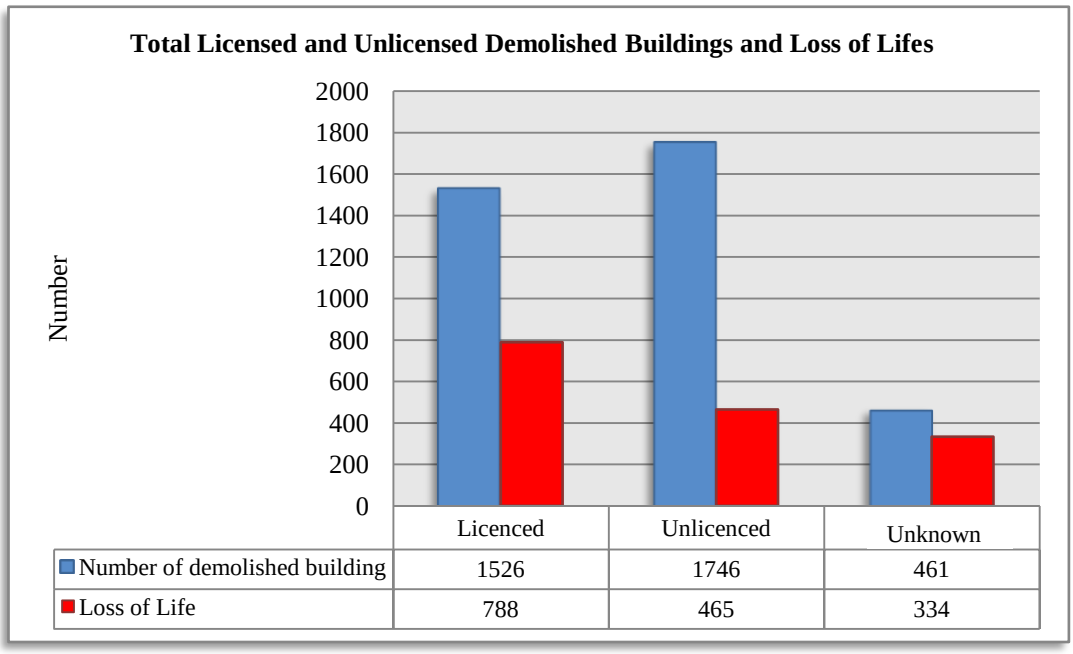


Figure 5.44 Total Licensed and Unlicensed Demolished Buildings and Loss of Life

When we analyze all licensed and unlicensed buildings according to loss of life, it is understood that loss of life is %60 greater in licensed buildings (Figure 5.43-5.44).

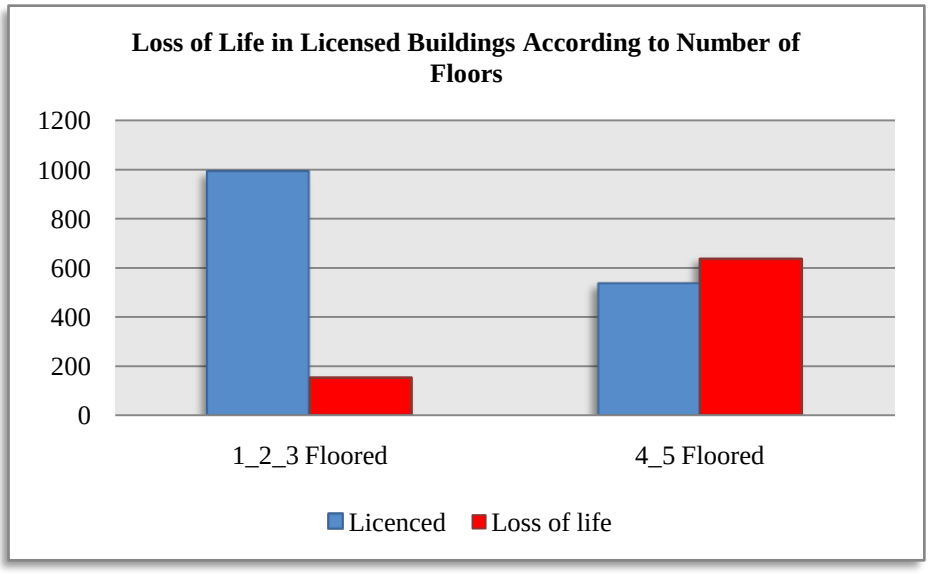


Figure 5.45 Loss of Life in Licensed Buildings According to Number of Floors

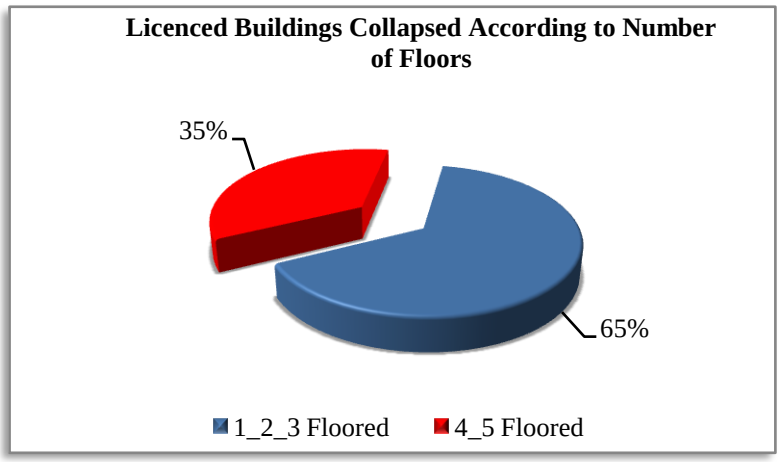


Figure 5.46 Licenced Buildings Collapsed According to Number of Floors

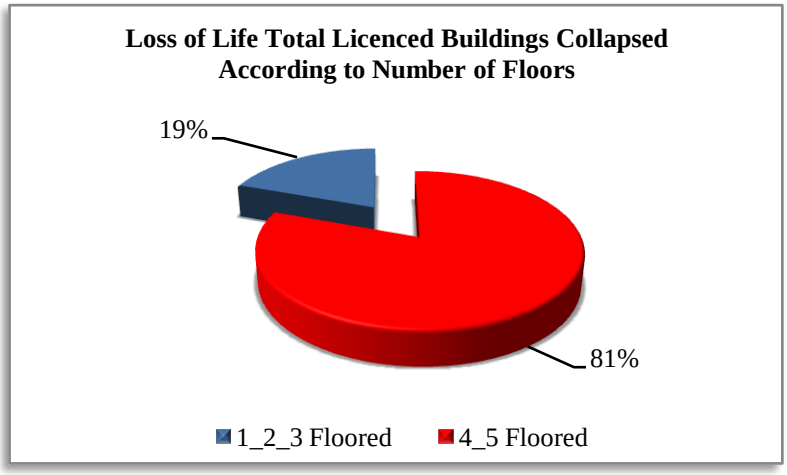


Figure 5.47 Loss of Life Total Licenced Buildings Collapsed According to Number of Floors

The analysis according to floor height points out that demolishment and loss of life is more in 4-5 storey buildings (with the rate of %81) than 1-2-3 storey buildings (with the rate of %65) (Figure 5.47). In Table 5. 2 shows loss of life in all licenced and unlicenced collapsed buildings.

Reasons of High rate of Two Storey Buildings Demolishment

Analysis according to storey (Figure 5.48) shows determines that 1-2 storey buildings are mostly unlicenced buildings and %92 of them are wooden-masonary structures. The reason

of low rate of loss of human lives in -2 storey buildings is residents did not effected too much from the destruction compared to high rise buildings. Therefore, it can be said that 1-2 storey buildings are safer than 4-5 storey buildings

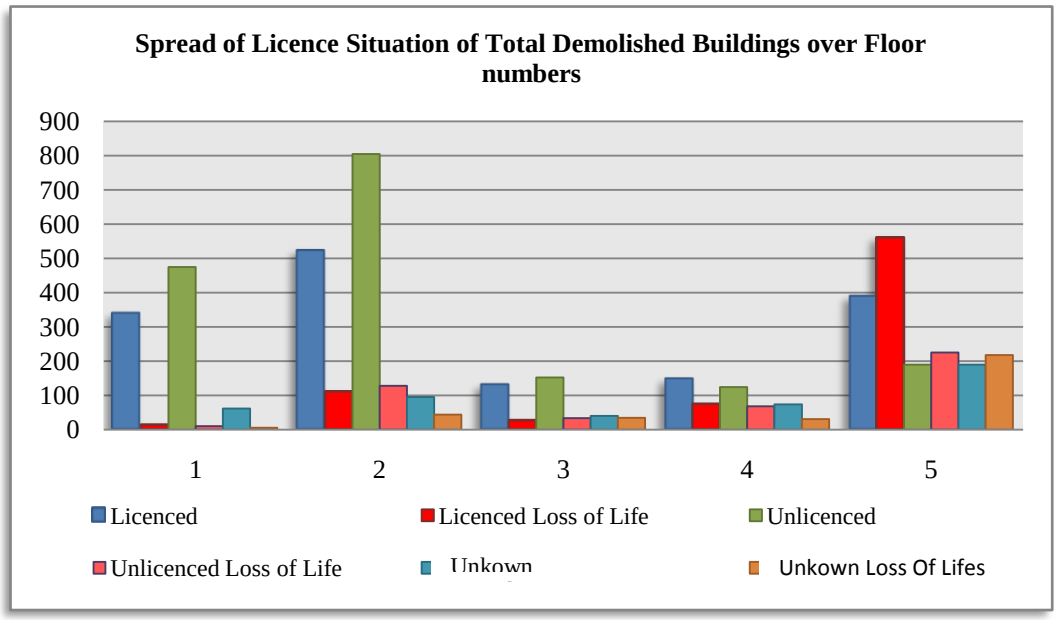


Figure 5.48 Spread of Licence Situation of Total Demolished Buildings over Floor numbers

Picture 5.13 Damages in Central Adapazarı Yenigün District (SMM, Archive)

Table 5.2. Association of Loss of Life with Licensed Buildings Collapsed in Districts

	Licenced		Unlicenced	
	Collapsed Building	Loss of Life	Collapsed Building	Loss of Life
Se	140	106	91	68
CU	128	106	43	15
Tı	89	1	55	0
PA	106	41	61	26
Ynd	85	111	65	66
Ync	72	44	32	0
Yng	185	95	226	37
Çu	41	5	40	1
Ak	43	36	72	6
Ya	35	20	32	3
Or	88	28	65	13
Ku	35	10	34	3
İs	66	60	128	24
Ka	41	17	213	60
Şe	114	41	215	50
Oz	44	5	70	6
Sa	31	0	41	0
Te	26	5	26	3
Tu	15	0	39	7
Ya	67	17	115	29
Tep	11	9	16	0
Mit	53	26	67	24
Gü	4	1	12	7
Şi	5	4	6	9
Hı	1	0	8	0
Ma	1	0	3	0
Be	0	0	0	0

Analyze of Structuring Rates of Licenced Structures within All Collapsed Structures Between 1957-1985-1999

Rates of collapsed buildings in 17 August Earthquake according to year periods have been given in Figure 5.49. Firstly, the figure shows that buildings constructed between 1985 and 1999 have mostly been collapsed. Secondly, Building stock constructed between 1956 and 1970 are generally 1-2 storey buildings and had experienced 1967 earthquake. The

demolishment rate of these buildings is %38. Lastly, buildings erected between 1970 and 1985 have a demolishment rate of %33.

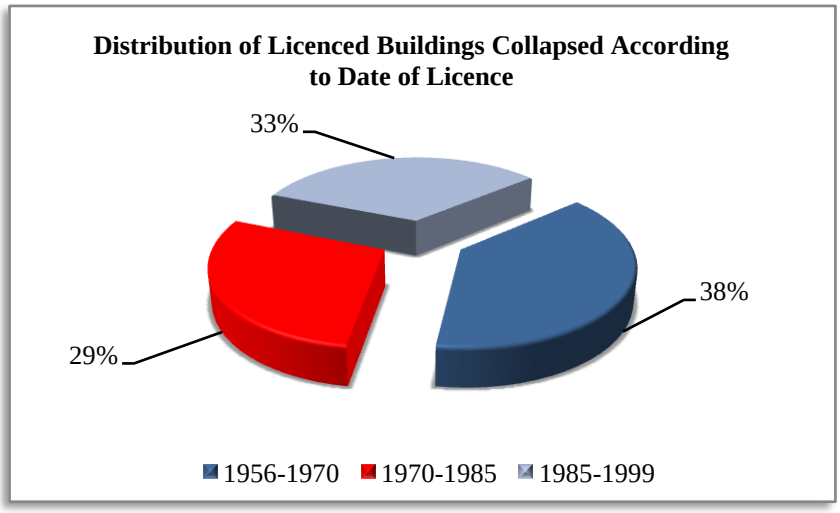


Figure 5.49 Distribution of Licenced Buildings Collapsed According to Date of Licence

The analysis of loss of human lives occurred in demolished buildings according to their construction period, %62 of looses took place in the buildings that were constructed between 1985 and 1999, after the law 3194 passed.

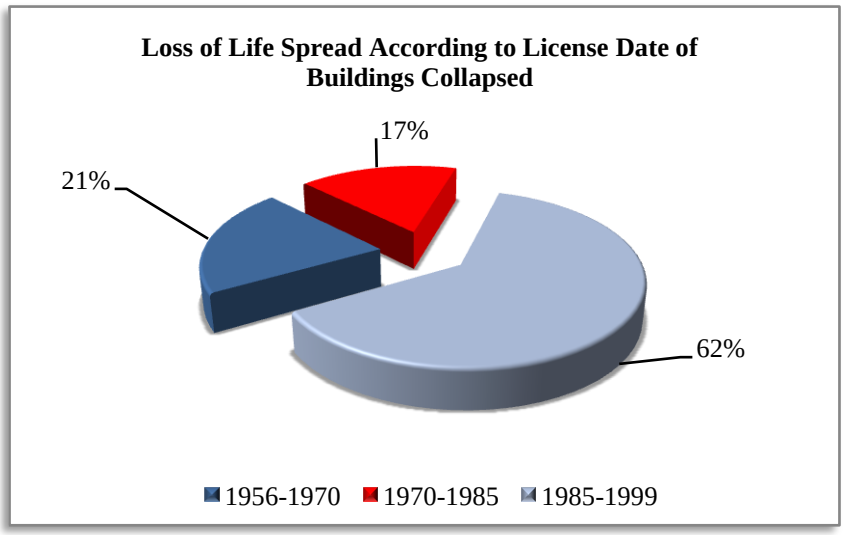


Figure 5.50 Loss of Life Spread According to License Date of Buildings Collapsed

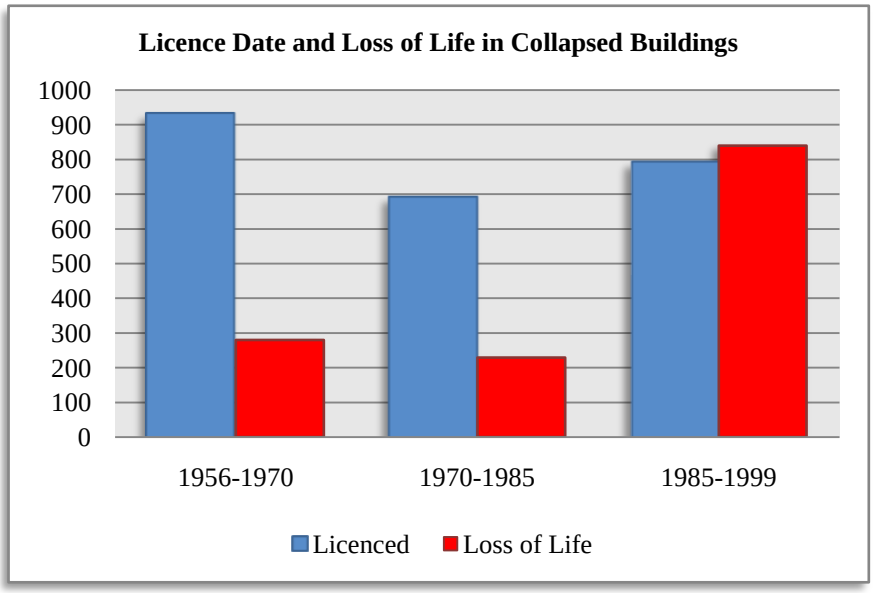


Figure 5.51 Licence Date and Loss of Life in Collapsed Buildings

While underlying the effects of plan decisions on 4-5 storey buildings, on the other hand, 1-2 storey buildings have bigger ratio than them; this is the weakest link of the thesis. As it is shown in Figure 5.52, %56 of these buildings, however, constructed between 1956 and 1970. Therefore, they experienced 1967 earthquake and are 30 years old wooden masonary buildings. From this perspective, deolishment reason of 1-2 storey buildings is related with its construction characteristics and also their old damages coming from 1967 earthquake.

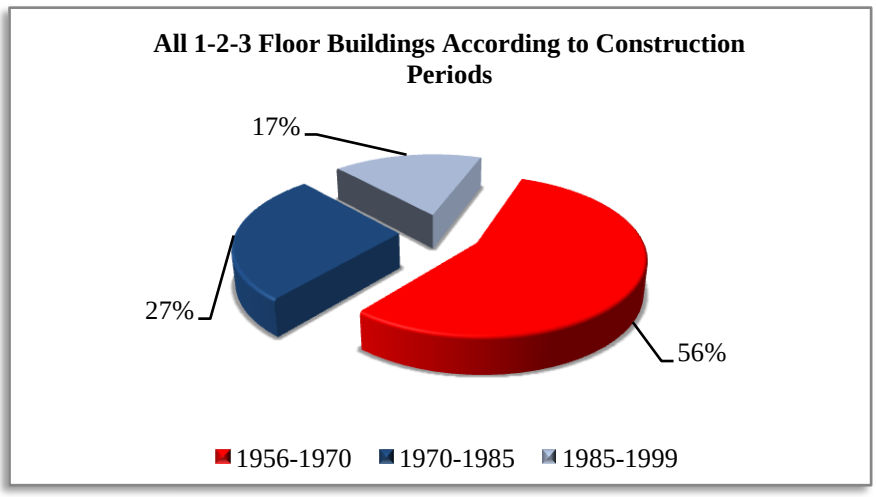


Figure 5.52 All 1-2-3 Floor Buildings According to Construction Periods

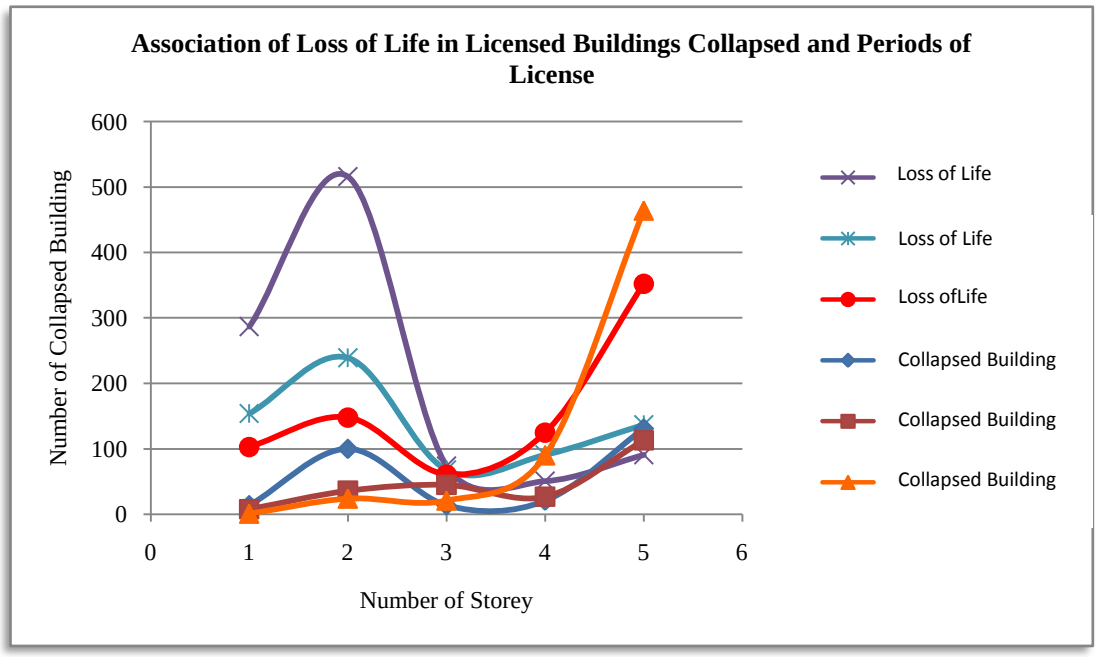
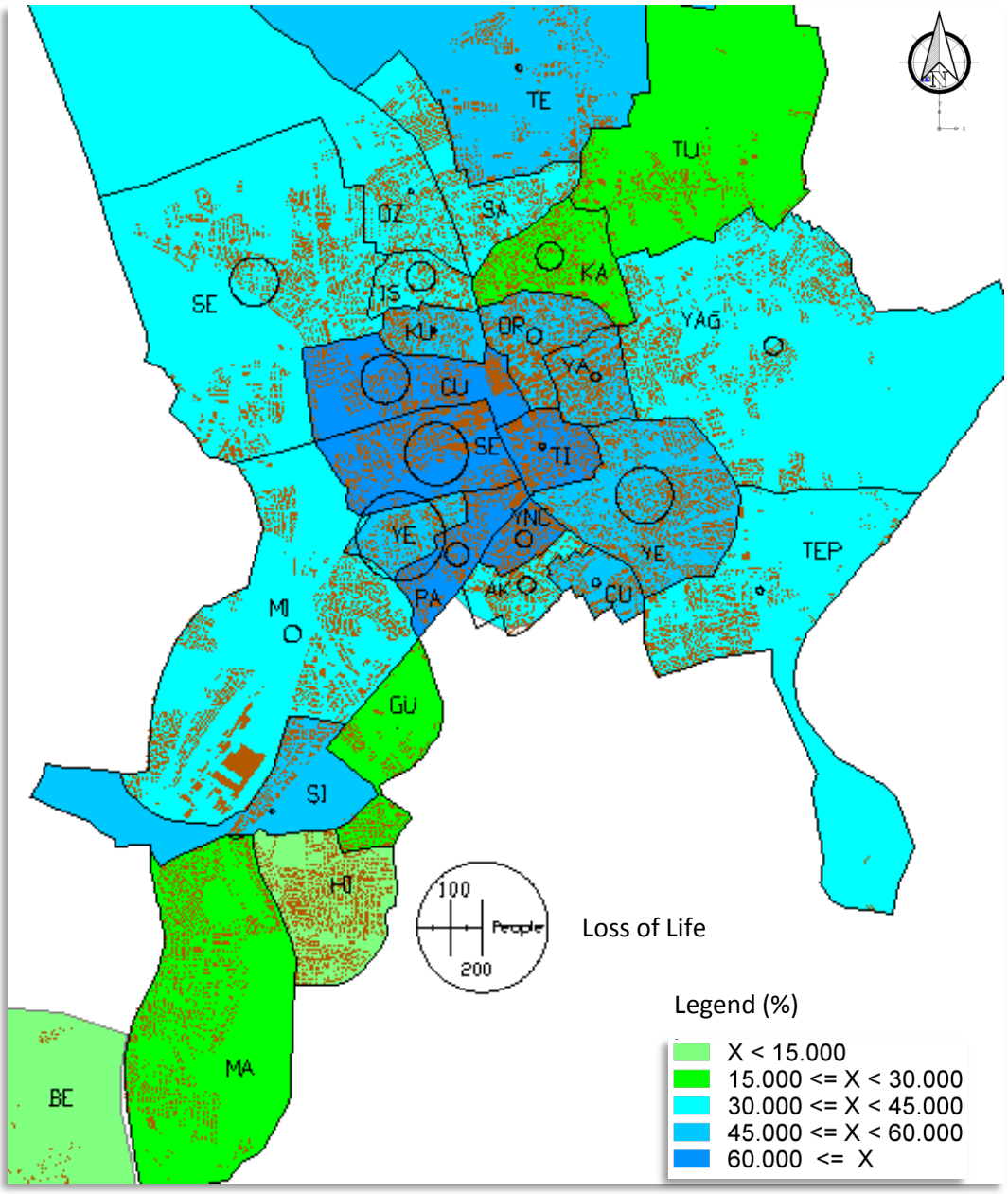


Figure 5.53 Association of Loss of Life in Licensed Buildings Collapsed and Periods of License

Demolish and loss of life amount is high according to other year periods in the 5 storey buildings contructed between 1985 and 1999. On the other hand, this ratio is decreasing in 1-2-3 storey buildings. For the beginning period 1956-1970, loss of life and demolishment level of 1-2 storey building is high. Figure 5.53

Picture 5.14 Damages in Central Adapazarı Papucçullar District (SMM, Archive)

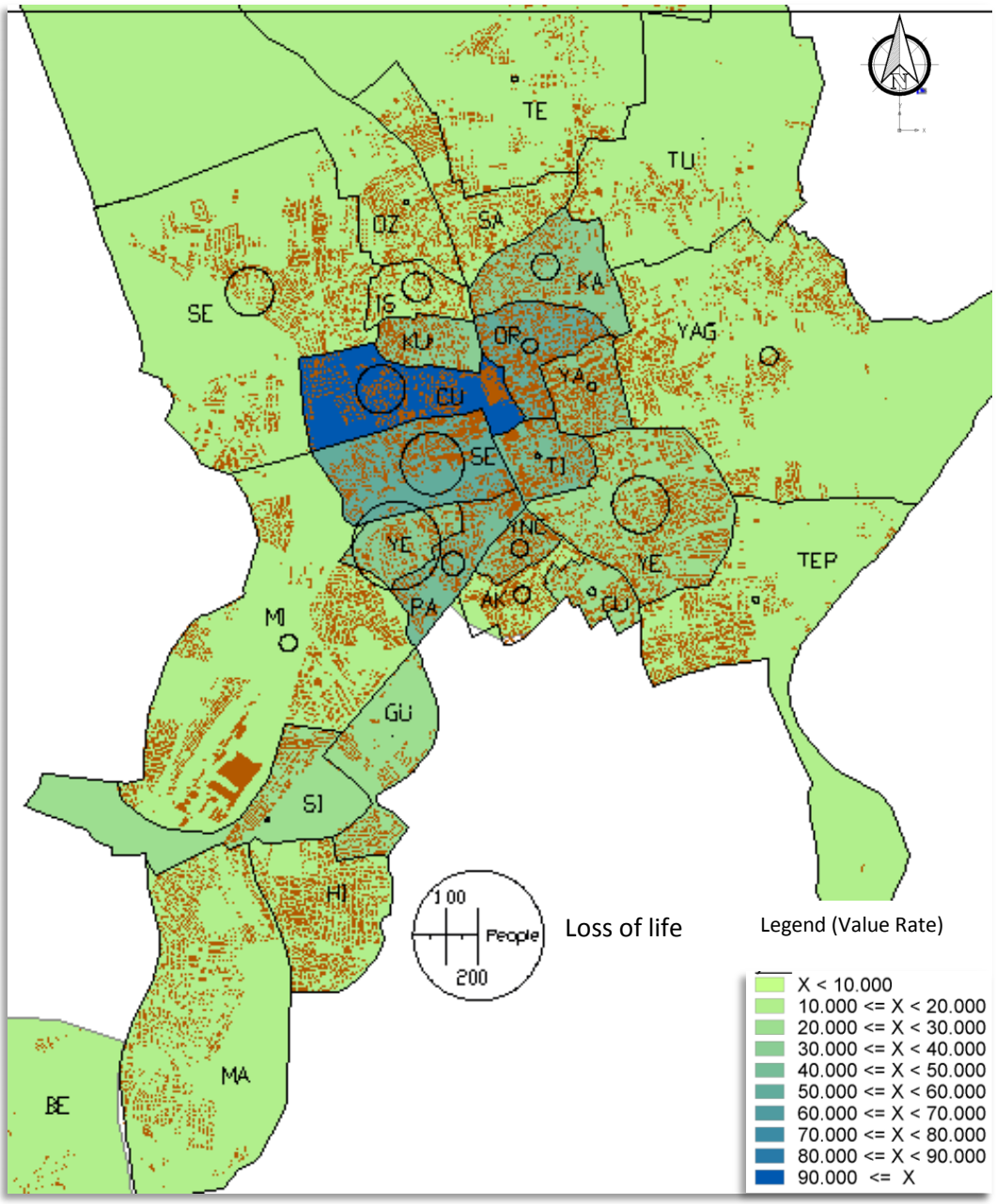


Map 5.42 Spatial Distribution of Rates of Licenced Buildings on Unlicenced Buildings in Districts

Land value of collapsed buildings and loss of life relation

As it can be seen in Map 5.43, loss of life is more in the centeral districts which have more land value than other districts. Redevelopted commercial activities – especially

mix-use ground floor commercial zones - with the revisions and 1985 development plan increased the land value.



Map 5.43 Spatial Relation of Land Values of Property Collapsed and Loss of Life

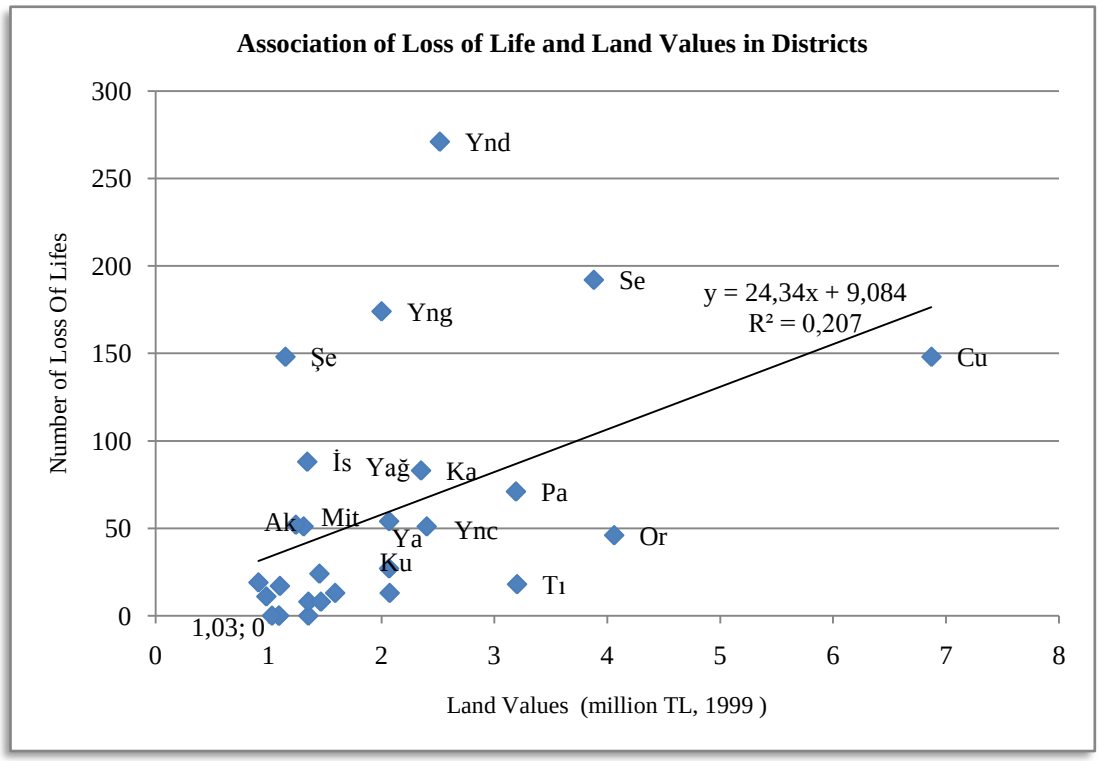


Figure 5.54 Association of Loss of Life and Land Values in Districts

Briefly, loss of life rate is increasing in districts where the urban rant is high. Figure 5.54

5.3. Effects of the Plan Revisions

According to planning chronology of the city of adapazarı, the city which took up the biggest wounds in 17 Agust 1999 earthquake, there had done development plans in 1957 and 1985 before the earthquake.

After the plan of 1957, which was proposed by İller Bankası offices, there did not proposed too much revisions on the plan. After the transfer of authority and power of preparation and approvement of development plans to the local municipalities in 1985, however, political oppression on development plans increased.

5.3.1. Analyze of Plan Revisions Made between 1985-1999 According to their Kind

Plan revisions done in the center of Adapazarı between 1985 and 1999, was decoupled and and their effects on loss of human lives was examined.Figure 5.56

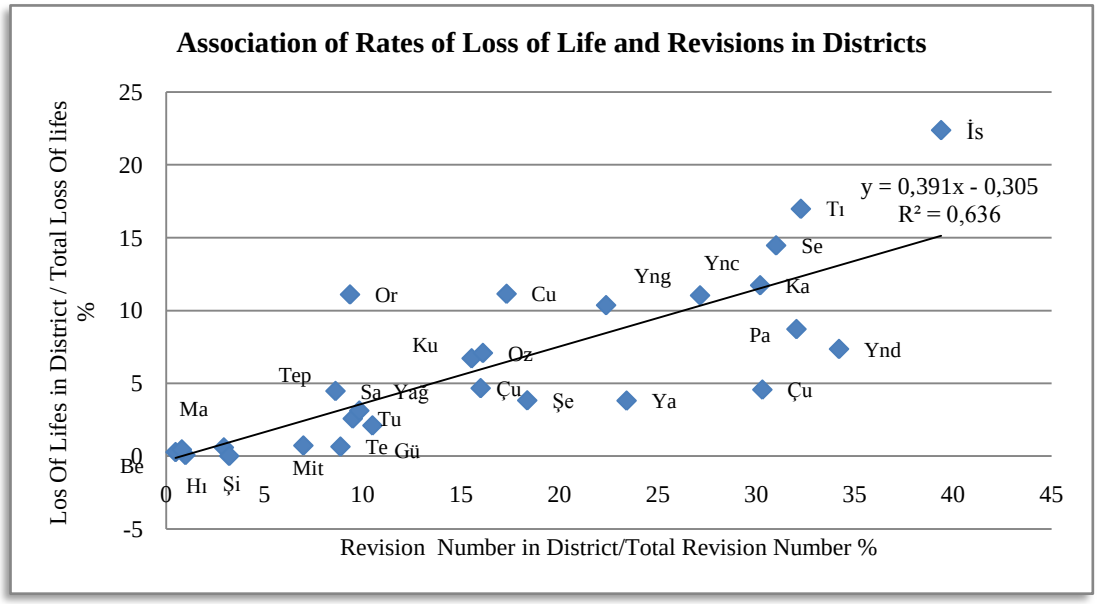


Figure 5.55 Association of Rates of Loss of Life and Revisions in Districts

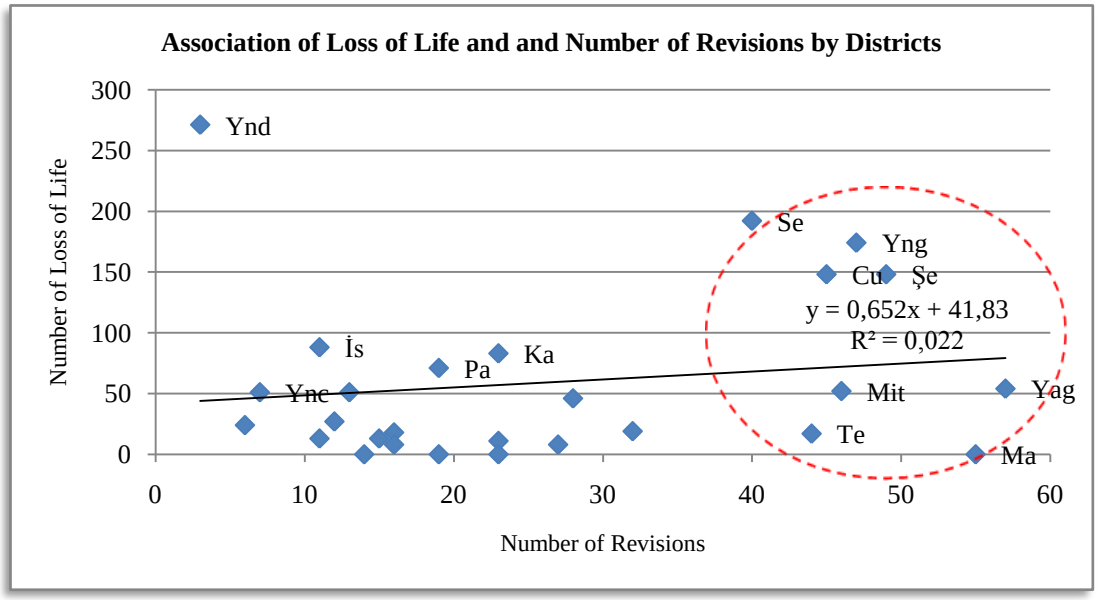


Figure 5.56 Association of Loss of Life and and Number of Revisions by Districts

Districts that has the highest level of loss of life are districts where had done numerous revisions on development plans.

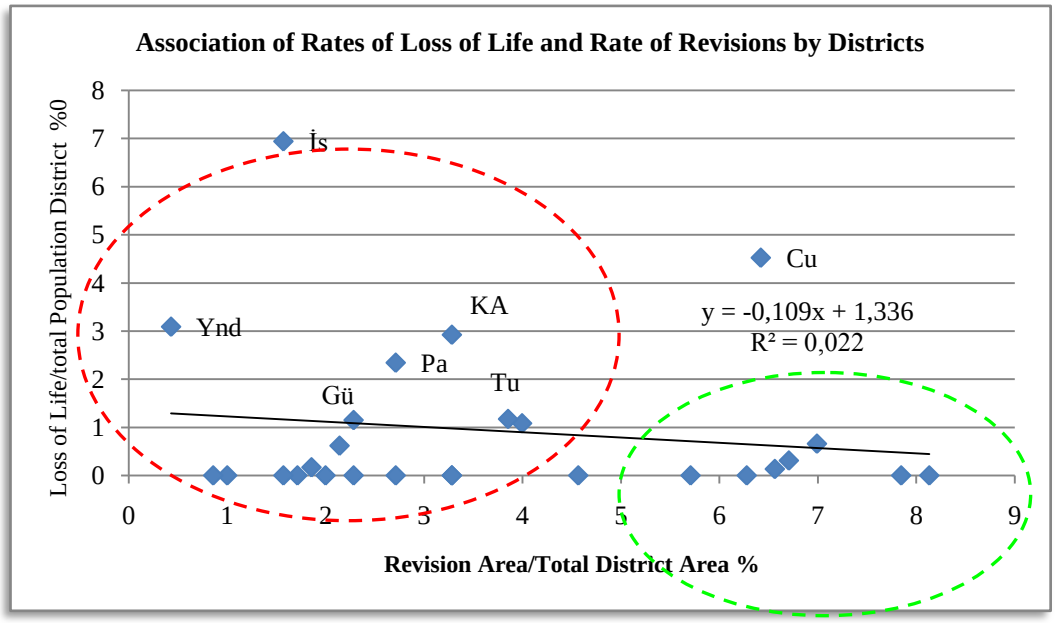


Figure 5.57 Association of Rates of Loss of Life and Rate of Revisions by Districts

Loss of life is partially high in central districts where had done several plan revisions. Other districts, in which the amount of revisions is high and loss of life is low, has functional change in revisions rather that floor area ratio change and these revisions are not comprehensive, based on plots.Figure 5.56; 5.57

Between years of 1985 and1999, 1000 ha part of development plan that was a current implementation, has been changed with plan revisions (Picture 5.15.). %90 of city councils agenda was composed of plan revisions and development decisions. There is 950 plan revisions on 1/1000 development plans, that can fit A4 paper and prepared individually rather than comprehensively. Although most of these revisions rejected because of public pressure, the ones that could pass from the council had changed the development plan partially and independently from the whole development plan, especially in the city center. (Map 5.44)

After 1985, when the authority and power of preparation and approvement of development plans was transfered to the local municipalities, city councils started to approve revision which were prepared with unexperience technical background, between 1985 and 1999. Within this period Adapazarı Development Plan decisions was partially changed.

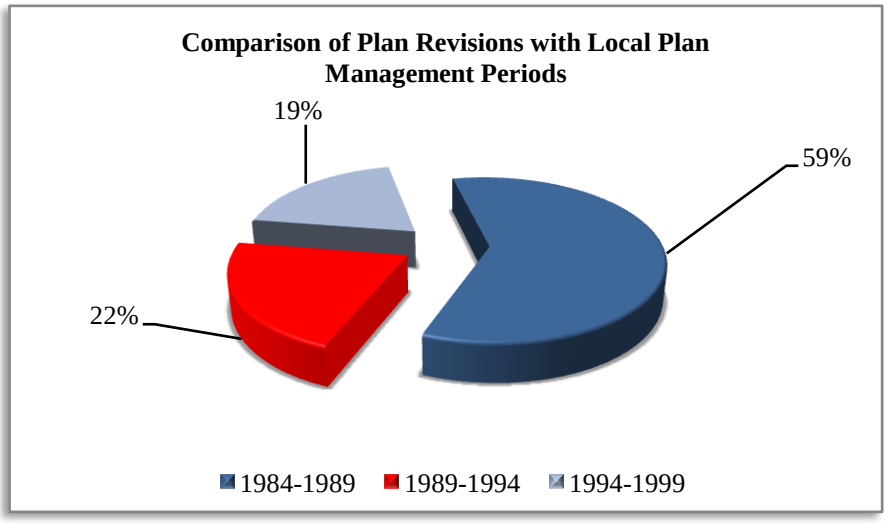


Figure 5.58 Comparison of Plan Revisions with Local Plan Management Periods

Plan revisions - made between 1984 and 1999 - were realized within three different local management periods, from political point of view: 1984-1989, 1989-1994 and 1994-1999. When plan revisions have been examined in the city council, plan revisions have densely been realized with a ratio of %59, between 1984 and 1989 (Figure 5.58).

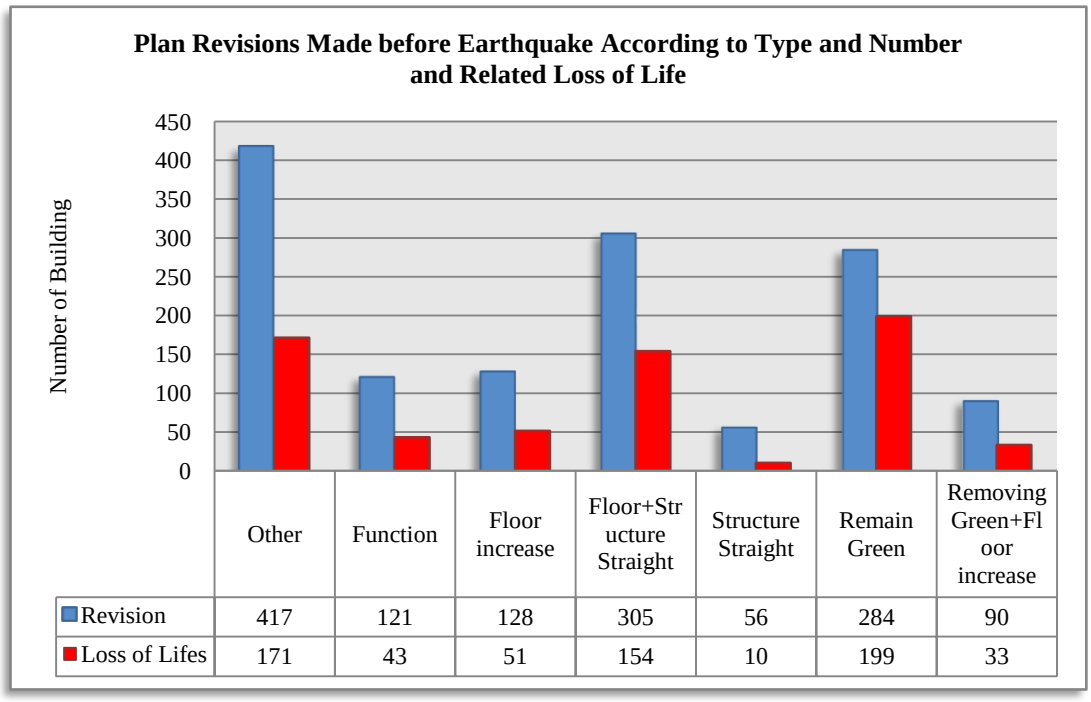
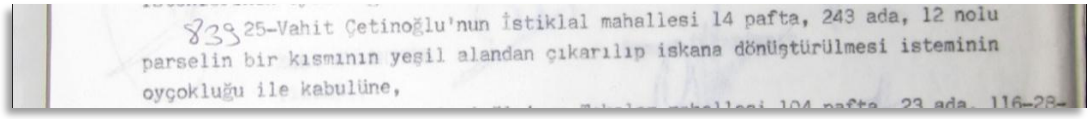


Figure 5.59 Plan Revisions Made before Earthquake According to Type and Number and Related Loss of Life



Picture 5.15 Examples of Council decisions (1)

It should inevitably be underlined that removal of green area has been realized with a ratio of %20 between 1985 and 1999 (Figure 5.59; 5.60). As a result of this decision change, there occurred urban development on these lands and 199 people died in demolished buildings which were erected on ex-green areas. Moreover, this is the biggest ratio (%30) for loss of human lives in amended buildings (Figure 5.61). This data point out an ironic result; planning authorities have to argue about about planning and plan management system in the country again.

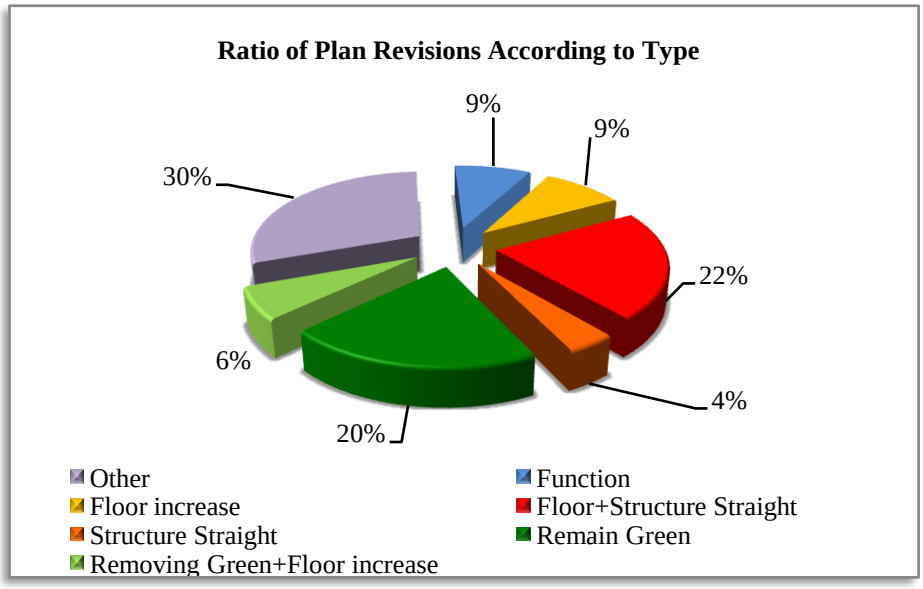


Figure 5.60 Ratio of Plan Revisions According to Type

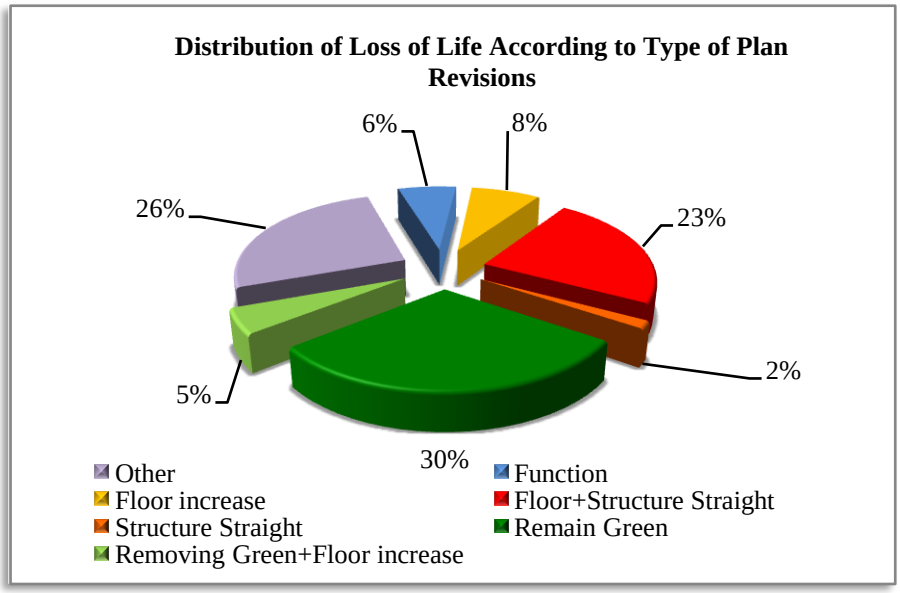
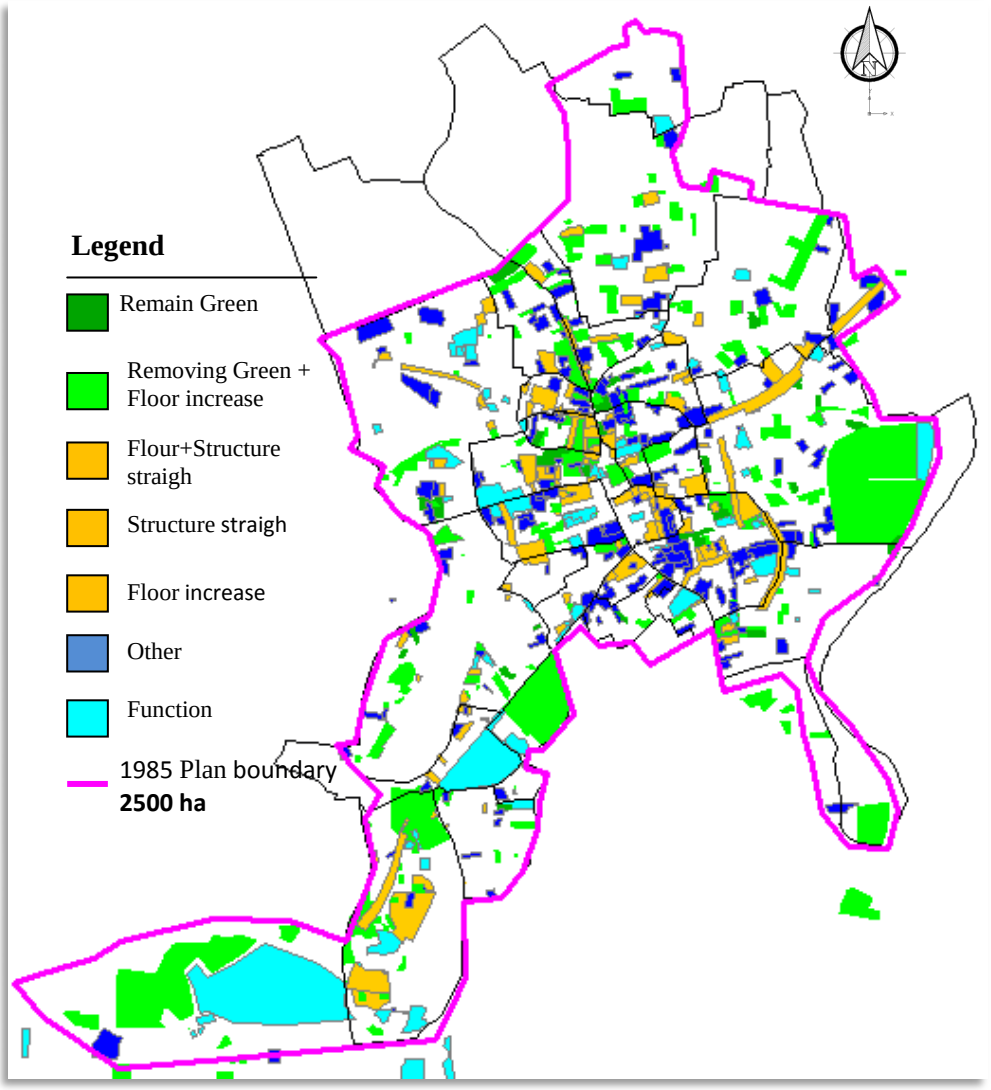


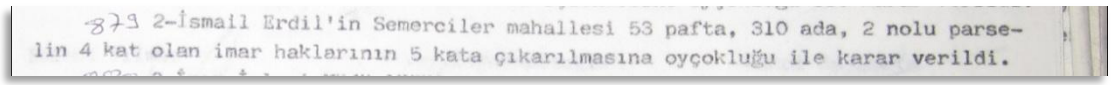
Figure 5.61 Distribution of Loss of Life According to Type of Plan Revisions



Map 5.44 Spatial Distribution of Plan Revisions Made before Earthquake

Table 5. 3 Within Demolished Buildings Relation Between Structure Within Revision Limit And Life Loss

	Collapsed Building	**Loss of Life**
Without Revision	2807	926
with Revision	1401	661
Total	3733	1587



Picture 5.16 Examples of Council decisions (2)

Furthermore, the other milestones of plan revisions are increasing floor area ratio and changing the structural order of detached buildings. Especially, plan revisions that enable the development of urban blocks on main streets increased the density of cetral areas which was produced before 1999; therefore, many people exposed to the risk of earthquake. Moreover, urban development in surroundings of central area - out of 1 km radius of main center - realized slower than city center. Both in center and surroundings, there appeared a new dense urban pattern, which is composed of 4-5 storey attached buildings, especially on the main streets.

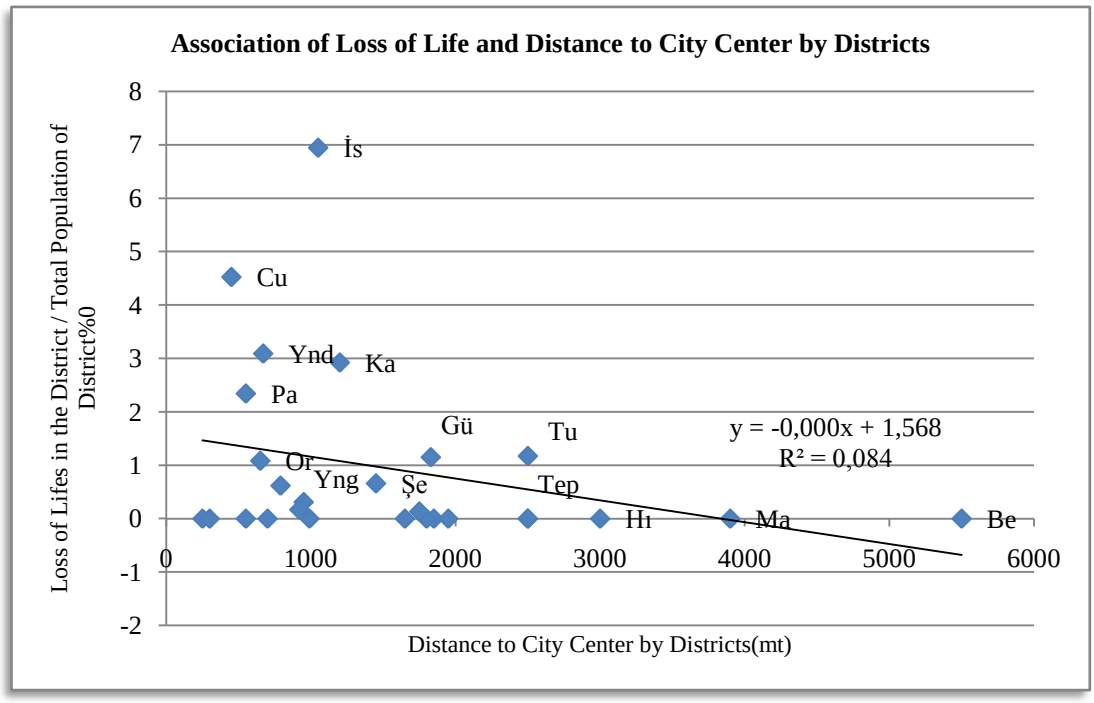
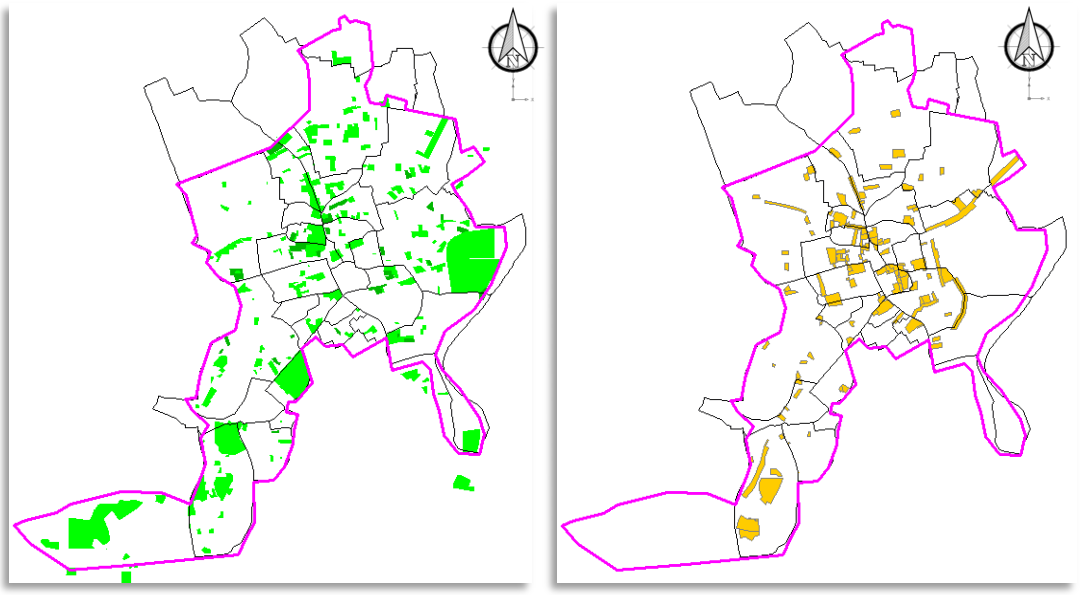
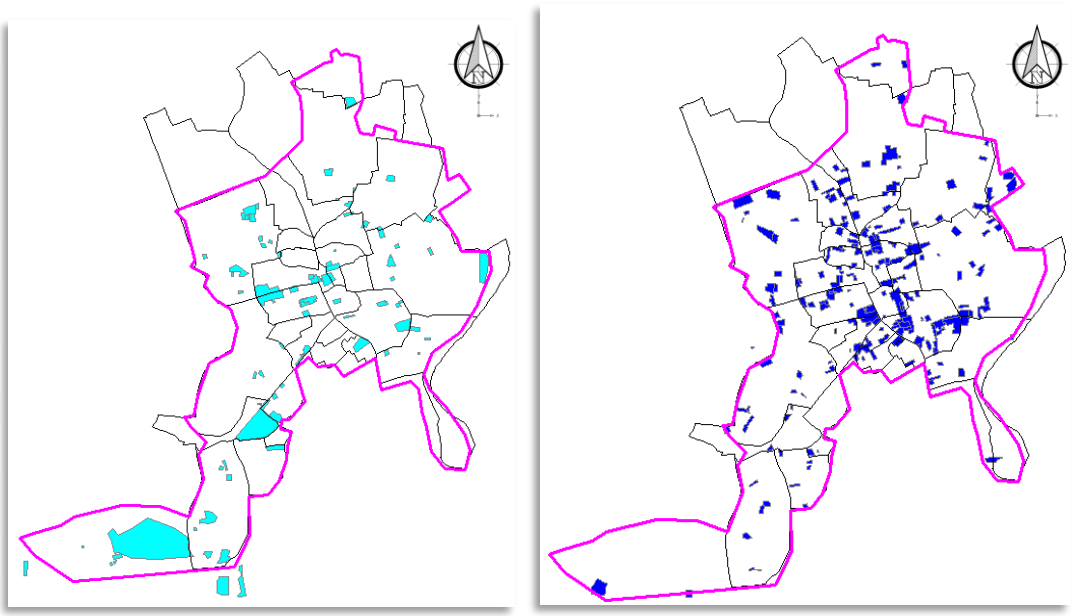


Figure 5.62 Association of Loss of Life and Distance to City Center by Districts

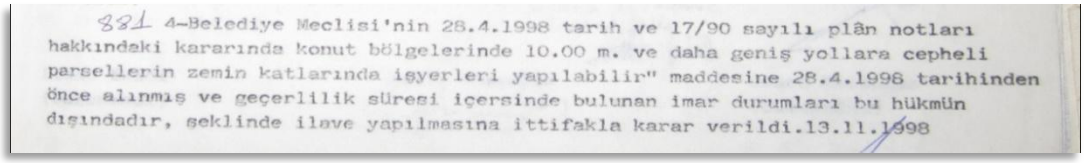
In outer districts where had done revisions; loss of life is decreasing where had done some revisions Figure 5.62



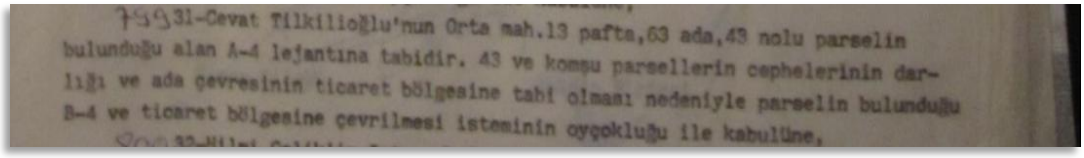
Map 5.45 Revisions that Increased Number of Floors and Removed Green Areas



Map 5.46 Other Revision Plans such as Land-Use Change and Change of Road Width



Picture 5.17 Examples of Council decisions (3)



Picture 5.18 Examples of Council decisions (4)

Figure 5.59 shows the plan revisions which were grouped as "other revisions"; road removals, roads route change, correcting lines of city block development. Under the function change topic, there are generally decision changes like; shift from public area to residential use, shift from residential use to public area, locating transformer station, shift from residential use to religious building, from residential use to commercial use, etc. or at plan notes changes and plan legend changes. The ratio of thse revisions is %26, and these caused 176 loss of persons life (Figure 5.61)

Analysis of plan revisions according to districts (where the revisions had done) shows that demolishing ratio is high, if the floor area ratio was changed and green areas removed (Figure 5.63; 5.65)

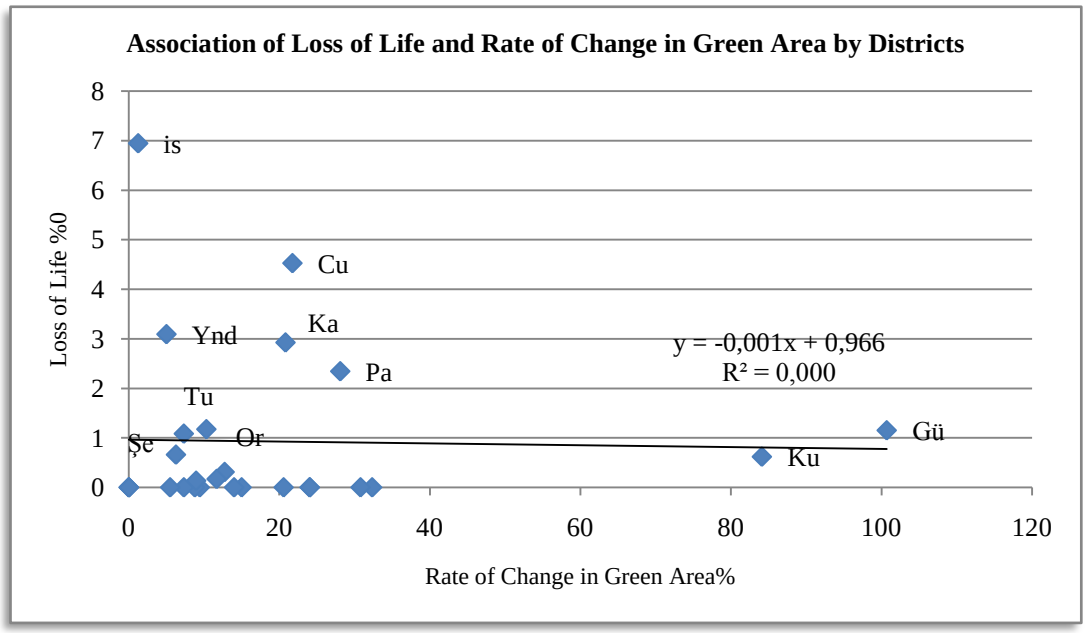


Figure 5.63 Association of Loss of Life and Rate of Change in Green Area by Districts

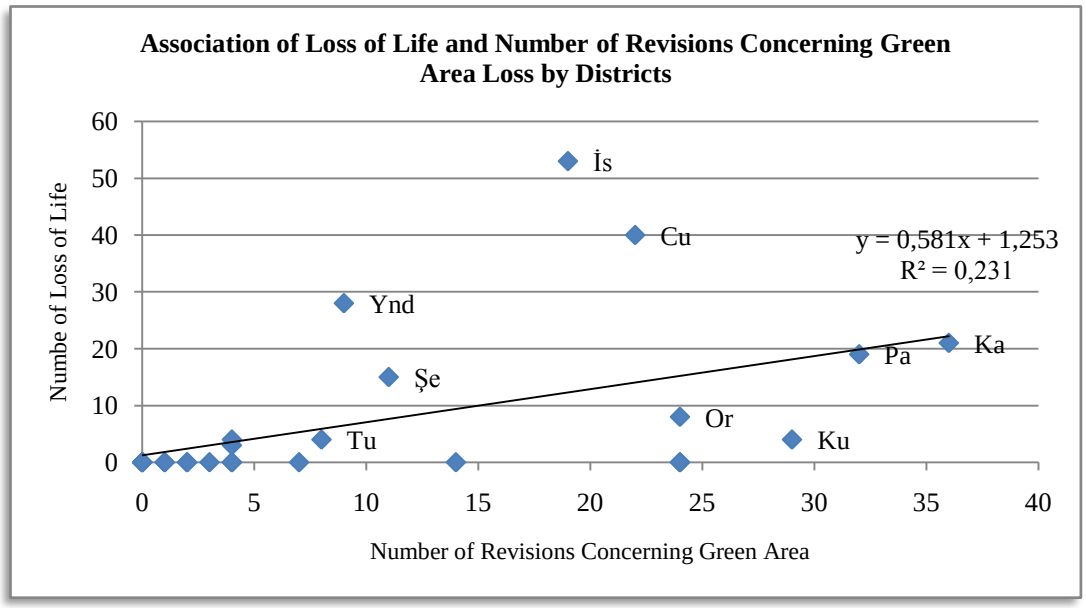


Figure 5.64 Association of Loss of Life and Number of Revisions Concerning Green Area Loss by Districts

As the number of revisions increase in İstiklal, Yenidoğan, Şeker and Cumhuriyet Districts, the loss of life rate also increase. Loss of life ratio is high in Cumhuriyet, Karaosman Districts because of surface area is high, nearly %40 of total surface. Figure 5.64

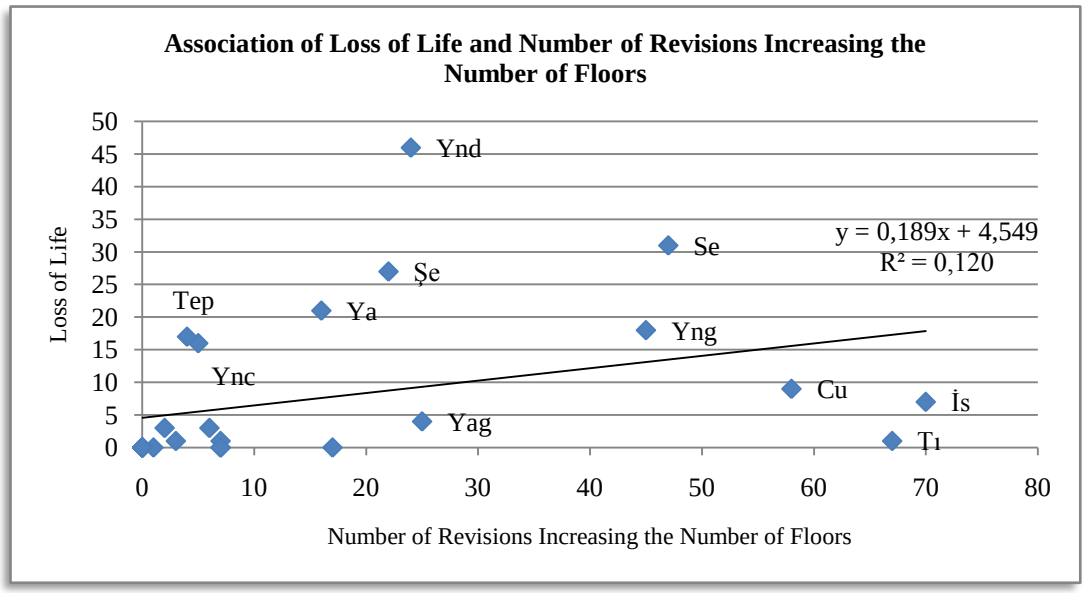


Figure 5.65 Association of Loss of Life and Number of Revisions Increasing the Number of Floors

Loss of life is increasing in central districts if the revisions changed the floor area ratio. Moreover, there is increase in loss of life in outer districts like Tepekum, Yağcılar which result from revisions in floor area ratio; because of the pressure cooperative housing. Figure 5.65

Table 5.4 Comperison of Invidual Housing Units and Buildings Collapsed in the 1999 Adapazarı Earthquake and Loss of Life According to the Districts

Districts	Number of Collapsed Buildings	Number of Housing Individual Section	Number of Commercial Individual Section	Loss of Life
Se	287	1266	833	192
CU	180	759	1079	148
Tı	169	558	358	18
PA	180	662	188	71
Ynd	186	953	174	271
Ync	118	384	171	51

Table 5.4 (cont.)

Yng	468	1580	275	174
Çu	113	179	61	24
Ak	96	201	25	51
Ya	160	260	38	27
Or	74	453	128	46
Ku	74	211	35	13
İs	204	367	61	88
Ka	265	760	65	83
Şe	389	1708	124	148
Oz	125	538	20	11
Sa	77	161	27	0
Te	69	259	23	17
Tu	59	117	10	8
Ya	214	578	114	54
Tep	30	164	19	19
Mit	136	508	45	52
Gü	20	117	10	8
Şi	11	48	8	13
Hı	15	30	1	0
Ma	7	9	2	0
Be	7	14	0	0
Total	**3733**	**12844**	**3894**	**1587**

5.4. Findings Related to the Destructive Consequences of Planning Decisions

In the 17 August 1999 Earthquake, the city of Adapazarı lost %13 of its existing building stock. This was accompanied by loss of life and 3 bilion $ of economic loss for the city. The most intensive collapse of the stock took place in the central and surrounding neighourhoods (Semerciler, Cumhuriyet, Yenidoğan, Papucçullar, Yenigün, Orta, Şeker, İstiklal, Karaosman, Kurtuluş, etc.) .

The 1957 development plan foresaw 2-3 storey detached buildings at low densities. The commercial and residential uses are separated strictly. However, the 1985 development plan introduced 4-5 storey buildings in attached formation, together with mix-use especially in the central city. The city shifted to a denser pattern with this plan in all districts. Yet the transportation system was not changed into the necessary form.

After 1985 rights of preparation and ratification of development plans were transferred to the municipalities. This has been the most decisive milestone in the process of loosing prudence. Earthquake risk was totally ignored in the plan and following revisions between 1985 and 1999. The rationality of a balanced spatial development dissapeared in the central and sourrounding districts of Adapazarı.

In the 1985 development plan floor area ratios (FAR) were increased without necessarily changes in the social infrastructure and transportation systems to meet new demands. It also ignored the requirements of the geological and geomorphological chacteristics of the region (i.e. alluvial floor ground water level) where earthquake hazard probability is very high.

In the 1999 earthquake, %20.6 of all 5- storey buildings, constructed between 1985 and 1999 collapsed. These buildings are the %7.1 of total building stock. Besides, in buildings constituting %30 of all demolished have been the stage in which %74 of loss of life occurred, taking place in 4-5 storey building areas (Cumhuriyet, Yenidoğan, Yenigün, Tığcılar, Şeker, Papucçular Districts). On the other hand, although %70 of buildings collapsed were of 1-2-3 storeys, loss of life in these buildings were about %26 of all losses. The latter group of buildings had been constructed before the 1967 earthquake, and were already nearly subject to fatigue. This might be the explanation of relatively high level of destruction in this group.

Wooden and masonry buildings were turned into reinforced concrete frame structures after the changes in the floor area ratios by means of plan revisions. Most of the collapsed buildings (%54 of total) were of reinforced concrete, and % 46 were wooden-masonry buildings. Nonetheless, %24 of loss of life occurred in the wooden-masonry, and %76 in reinforced concrete buildings.

More of the collapsed buildings are apartments (%57) and %43 are detached houses. These blocks of flats are located in the city center or at the vicinity. Greater part of loss of life occurred (%87) in apartments and %13 in detached houses.

After the 1985 development plan and with the following set of revisions, a shift from detached building form to attached buildings took place. With this shift, central areas and main arteries were rapidly developed with high structures, including Çark, Sedat Kirtetepe,

Adnan Menderes, Bosna, Yeni Cami Boulevard, Sakarya Avenue, Milli Egemenlik Avenue. However, %93 of collapsed buildings was in attached buildings, %7 was detached buildings. Furthermore, %79 of loss of life occurred in attached buildings.

In the 1985 development plan setback distances were not defined, because existing ownership pattern then was generally composed of small plots (average 100-200 sqm.). As a result of this uncertainty attached high rise buildings with 0.60-1.00 floor area ratio emerged. In terms of building densities, it is observed that % 93 of buildings detroyed took place in 0.60-1.00 FAR ranges. Loss of life has been most dominant in these buildings (%91).

Commercial areas that had been designated with the 1957 plan were turned into mixed-use commercial zones in the 1985 plan. With this change the height of commercial spaces of buildings were increased to 5.75 m. The observations are that %71 of destroyed buildings and % 63 of loss of life occurred in these buildings.

Greater number of the stock (%47) consisted of unlicensed buildings. Major part of loss of life (%60) occurred in licensed buildings. Most of (%65) collapsed licensed buildings were 4-5 storeys. where %81 of loss of life took place.

The 1956 development plan, 1967 Earthquake, 1985 second development plan and 17 Agust 1999 Earthquake are the milestones of urban development process in Adapazarı. From this point of view urbanization process of Adapazarı is analysed in 3 periods. According to these periods, collapsed buildings constitute %38 of licensed buildings built between 1956-1970, %29 of licensed buildings built between 1970-1985, and %33 of licensed buildings built between 1985-1990.

According to this distribution, % 62 of loss of life occurred in licensed buildings between 1985 and 1999. Secondly, %21 of loss of life occurred in buildings of the 1956-1970 period. Lastly, loss of life in licensed buildings is %17, in the period of 1970-1985.

After effects of these planning decisions, between 1985 and 1999, revisions – increase in floor rarea ratio, shift from detacthed buildings to attached buildings, function changes, decreases in green areas – increased the vulnerabilities in the city. In terms of local

administration periods, %59 of revisions had been accomplished between 1984 and 1989, % 22 of revisions between 1989 and 1994, %19 of revisions between 1994-1999.

A significant part of the loss of life (%42) of occurred in the plan revision areas. Of all revisions, %20 were related to the removal of green areas, % 35 increases in floor area ratio and shifts from detached buildings to attached buildings. In the revision areas, %30 of loss of life was related to the removals from green areas, %33 were in areas where floor area ratios were increased or related to shifts from detached buildings to attached buildings.

Although Adapazarı had a typical Bazaar city pattern of 50's, planning decisions implemented after 1985 did not consider this urban character. The city experienced a metamorphosis via revisions, promoting high-rise development on the very same old structure, introducing shifts from detached to attached buildings, creating more compact commercial zones, annihilating green areas and weakening the social infrastructure. This structure was damaged with the 1999 earthquake and the reasons of this destruction resulted from type and quality of plan decisions. Analysis introduced in this thesis substantiate that both reason and result of the problems were focused on planning decisions.

CHAPTER 6

CONCLUSION AND SUGGESTIONS

Despite findings of the previous chapters, the sole reason of all losses in 17 August 1999 earthquake in Adapazarı is not the city plans. Rather it is the national level performance related to plan preparations, the tolerant attitude towards un-authorized developments, system of laws and regulations regarding development planning that gave rise to the destruction of the city. Development amnesty laws have paved the way that %53 of Adapazarı city center was un-authorized. Preparation of development plans ignoring all scientific evidence related to natural attributes of location, disregard of projections of likely developments,

The total surrender of preparation of urban plans to the local municipalities, irrespective of their capacities after 1985 aggravated the exploitation of urban land for local private interests rather than public benefit. The fact that 70% of all municipal council decisions are related to changes in plans is a abundant evidence for the instant and biased pressures of private interests. The observation is that even an external event as the earthquake in adapazarı has not been sufficient to alter the structure of this kind of interests in the local set of relations.

The most effective decision that aggravated earthquake losses seems to be the increase in number of floors of buildings which was 2-3 storeys in the 1958 plan and designated as 4-5 storeys in the 1985 plan. This decision was given without any commensurate change in the structure and capacities of the system of accessibility in the city. As number of floors were increased, there was no compensating measures in land subdivisions and distancing of buildings. The 1999 earthquakes proved that highest losses occurred in relation to 4-5 storey buildings. Although they represent 30% of all destruction, they involve 74% of all loss of life.

This loss is not related to any deficiency in the engineering design and implementation of individual buildings, but the negligences in planning and the decision-making procedures in the increases in number of floors without consultation to earth-sciences, geo-mechanics, and engineering criteria.

The other adverse impact is the set of revisions made to the 1985 plan which changed 50% of central Adapazarı. Removal of green areas constituted 20% of all plan revisions. Another 26% have altered building formation and shape, and still a further 9% represent changes in number of floors in buildings. Thus, at least one third of the demolished areas have been subject to one of these types of plan changes.

In the procedures of plan preparation and implementation, the legal course of action was ignored especially in the practice of the article 18 of Development Law which specifies the method of land assembly and re-subdivision. This has generated awkward geometries in the shaping of individual parcels of land which in turn gave rise to building development of buildings with odd shapes up to 5 storeys, generating structural weaknesses in buildings and high vulnerabilities.

Furthermore, the original vision and decisions of the development plans have been overturned by piecemeal revisions in due course, densities have been increased, commercial and business enterprises have been allowed on the main arteries, and these premises having occupied ground floors of many residential blocks have caused structural weaknesses once again in the buildings. It was not surprising to to observe that 29% of all building failures and 63% of all loss of life took place in such physical conditions.

Partial plan revisions reducing open spaces and increasing built densities have thus contributed to losses to a significant extent in the city. Under the circumstances, planning practice has been far more effective in the determination of disaster losses than the control of robustness of buildings.

This finding begs to pose critical questions therefore for the current urban policy environment in Turkey. Despite standards and regulations are available in Turkey for the safe construction of buildings in cities, and despite the fact that these have been scrutinized more strictly and improved after 1999, no similar measure exists in the regulatory system of

planning. Yet the planning system is the basic facilitator of the realization of thousands of buildings shaping the architecture of the city and standards of life.

Weaknesses in the regulations and procedures of supervision in the planning system is the main cause of the current state of vulnerabilities. In this set of conditions, losses in Adapazarı have been successfully 'planned'. The locally 'planned destruction' of the city maintained, failures of the centrally 'planned' aftermath of the disaster could not take measures to avoid the repetition of further losses, in the face of the inevitable repetition of the natural event.

Although the new settlement areas north of the city are relatively safer in geological terms, and are likely to face lower levels of losses in the next cycle of similar events, the remaining central city of Adapazarı resting on alluvial deposits still maintains its high risks. This will obviously tend to increase in due course as greater investment are to agglomerate and population densities are to increase by means of prospective plans, revisions, or unauthorized development.

It is definite that this condition is not specific to Adapazarı but a general consequence of rapid urbanization in Turkey. Urban areas in Turkey are perhaps the most vulnerable geographic units in the world for a number of reasons. Natural conditions are the primary given in this setting. Towns have been settled and grown in locations where fertile lands and water for agriculture is available. Centuries of experience have taught settlers how the build relatively safely and what materials and detailing to use. All such conditions however were altered with the migrations to cities, high demand for building, and the provision of reinforced concrete construction methods.

Availability of this technology enabled multiple floor multiple-unit construction. Concurrent with high demands for building and the deceptively simple construction in reinforced concrete, together with sufficiently available cement and steel immenseley inflated urban growth at hazardous locations. It is only very recently that the performance of urban areas with this new fabric are tested against natural forces. The results observed strongly imply that we need to revise our attitude towards the physical shaping of our urban environment.

More of similar research as undertaken here could serve the realization of this unacceptable condition. Cities which experienced loss from natural hazards and other dangers generated by plan decisions and human behaviour are a most relevant source of information for this country. Analyses and understanding of reasons that aggravate losses could teach both the planning profession and the city managers to stick with more provident decisions. Identification of more strict standards and criteria in the procedures of planning may filter into the legal system and regulations, and could improve performance in the professional conduct.

A set of recommendations may be identified as a final statement to this research in the performance of planning:

- An integrated and effective planning, implementation, monitoring and control system has to be targeted which implies the inclusion appropriate clauses into the development law and its regulations. This should both improve the contents, the standards and procedures of the planning system.

- A strategic understanding of planning is essential as an approach that promotes sustainable environment and infrastructure, urban risk and mitigation planning and local development. This attitude should be adopted, instead of limited physical planning and deficient plans that can not respond the needs of today's urban planning tendencies and modern management of cities.

- Although the hierarchy of planning approach includes the regional scale within the national level, there are no institutional authority that prepares plans in the regional scale, except the State Planning Organization (DPT) and the South East Anatolian Project (GAP) Administration. Regional institutions are necessary to plan, monitor and evaluate at the regional scale. Hierarchical ordering and feasibility analyses of plans are imperatives.

- Risk management programs at the urban level must be developed. Mitigation plans prepared according to these programs should cover analyses of sources of risks and related hazards in the urban areas, findings of which must be information easily

accessible to general public and citizens. Planning and construction processes should provide the capacities to avoid/remove/reduce these risks.

- Regulations of urban development planning must be renewed; as the building construction regulation was changed after the 17 August earthquake. The new regulations should standardize the analytical studies and all data employed by the planning discipline and should be capable of employing geographic information systems (GIS). Risk analysis should be carried out at any planning area, and the development plans should be accompanied by disaster action plans at national and local levels.

- Today, control of development plans are carried out only upon a complaint or an appeal to courts. Besides this, control mechanisms should implemented by the courts or civil inspectors. So long as civil controllers are not specialized experts in the city planning field, doubts about the accuracy of their decisions will prevail.

  Control of the development plans should be made in two ways;
  - Supervision of development plan preparation
  - Supervision of development plan implementation and management

  After the 17 August earthquake, building inspection supervision system was taken from the municipalities and transferred to private certified companies. Similarly, the control system of the development plans must be reconsidered. In this context, Special Audit Advisory of Development Plan system should be set up.

- For the training the individuals who have awareness of their responsibilities to their environment, an educational system should be developed; for increasing the environmental awareness of inhabitants, educational programs should be organized in elementary school level.

- The Local Planning System that has to be integrated with the Regional Planning System and should be prepared in an enlightened manner as to the effects of

disasters, and with the upgraded control capacities of the planning system, cities must be subject to investigation in terms of their safety.

REFERENCES

Adapazarı Municipality
2009, 1954-1999 arası Adapazarı merkezi Ruhsat Bilgileri ,

ADASU
2009, Deprem Sonrası Adapazarında oluşan altyapı yenileme çalışmalarının ekonomik boyutu raporu

Alyamaç, K. and Erdoğan, A.
2005, Geçmişten Günümüze Afet Yönetmelikleri Ve Uygulamada Karşılaşılan Tasarım Hataları, Kocaeli deprem Sempozyumu

Atabey, E.,
2000, Deprem Eğitim Serisi No: 34'', MTA, Ankara.

Afet İşleri Genel Müdürlüğü
2001, 1999 Doğu Marmara Depremi Yeni Yerleşim Yerlerine Yönelik Gözlemsel Etüt Raporu'' Afet İşleri Genel Müdürlüğü, Afet Etüt Hasar Tespit Dairesi Başkanlığı, Jeolojik Etüt Şube Müdürlüğü, 33-35 Ankara,

Balamir, M.
2001, Disaster Policies and Social Organization, 5th conference of ESA, August 28-september 1, 2001

2003, Istanbul Deprem Master Plani Çalismalarinin Kapsam ve Niteligi, Mimar.Ist, 2003/3, p: 47-54

2002, Kentsel Risk Yönetimi ve Kentlerin Depreme Hazirlanmasi, Kentlerin Depreme Hazirlanmasi ve Istanbul Gerçegi sempozyum, 8-9 Subat 2002, TMMOB Mimarlar Odasi Istanbul Büyükkent Subesi.

2003, Istanbul Deprem Master Plani Çalismalarinin Kapsam ve Niteligi, Mimar.Ist, 2003/3, p: 47-54.

1999, Reproducing the Fatalist Society: An Evaluation of Disasters and Development Laws and Regulations in Turkey, Urban settlements and Natural Disasters, UIA Chamber of Architects of Turkey.

Balamir, M. P. Gülkan and A. Yakut
2003 , Afet Yönetiminin Stratejik İlkeleri: Türkiye Ve Dünyadaki Politikalara Genel Bakış

Bayhan, F.
1998, 1:25 000 Öçekli Adapazarı 2030 Kuzeybatı Gelişim Bölgesi Kent Makroformu Çevre Düzeni Planı

2001, Sakarya Büyükşehir Belediyesi Orta hasar ve yüksek katlı yapıların sorunu raporu

Bayhan, F, Kotaoglu, C, Suna, A, Çelikel
2000, 17 Ağustos Depremi Adapazarı kent merkezi hasar haritası , Sakarya Büyükşehir Belediyesi

Bayhan, F, Kotaoğlu, C, Tokuc, B,
2001, Ağustos 1999 Depremi Sonrası bozulan üst yapının rehabilitasyonu kapsamında Avrupa Yatırım Bankasına sunulan proje teklifi, (EIB, TERRA 1 Project)

Bayhan, F, Kotaoglu, C and Dikmen, B
2009, 17 Ağustos Depreminin sakaryadaki ekonomik kayıpları raporu

Burby R.J.
1999, Unleashing the Power of Planning to Create Disaster-Resistant Communities, APA Journal, Summer, 249-258.

Burby R.J. and May P.J. with Berke P.R., Dalton L.C., French S.P., and Kaiser E.J.
1997, Making Governments Plan: State Experiments in Managing Land Use, Johns, Hopkins University Press, Baltimore, MD.

Burby R.J., May P.J., and Paterson R.B.
1998, Improving compliance with regulations: choices and outcomes for local government, Journal of the American Planning Association, 64 (3), 324-334.

Burby R.J., and May P.J.
1998, Intergovernmental Environmental Planning: Addressing the Commitment Conundrum, Journal of Environmental Planning and Management, Vol. 41.

Ciborowski, A.,
1976, Deprem Bölgelerindeki Yerleşimlerin Gelişme Planlamasının Bazı Yönleri', Deprem Araştırma Enstitüsü Bülteni, Çeviri: N. Bayülke, Ankara, 14: 92-102

Celep Z., Kumbasar N.,
2004, Deprem Mühendisliğine Giriş ve Depreme Dayanıklı Yapı Tasarımı, İstanbul.

Coskun, Z.K
2005, gazi Üniversitesi , Fen Bilimleri Enstitüsü, Deprem sonrası planlamada yeni yerleşim bölgesi yaklaşımı; Adapazarı örneği, Yüksek lisans tezi

Çabuk, A
2001, A Proposal For A Method To Establish Natural-Hazard-Based Land-Use Planning: The Adapazari Case Study , Turkish Journal of Earth Sciences (Turkish J. Earth Sci.), Vol. 10, 2001, pp. 143-152.

Çamur, K.,
2003, Şehir Planlamasına Giriş' Dersi Notları, Gazi Üniversitesi,

DİE
DİE, 2000 Genel Nüfus Sayımı-Nüfusun Sosyal ve Ekonomik Nitelikleri-Sakarya

DPT
1999, Depremin Ekonomik ve Sosyal Etkileri, Muhtemel Finansman İhtiyacı, Kısa-Orta Ve Uzun Vadede Alınabilecek Tedbirler, Ankara.

Ercoskun, O.Y., Sat, A. And Varol, C.
2004, Coğrafi Bilgi Sistemlerinin Şehir Planlama Eğitimindeki Rolü, 3. Coğrafi bilgi Sistemleri Bilişim Günleri

Ersoy, M.
2001, Fiziksel Planlama Sistemimiz ve Dogal Afetler, Dogal Olaylarin Afete Dönüsmesi Ve Planlama 1, Planlama (TMMOB Sehir Plancilari Odasi yayini), 2001/3, Syf: 16-23.

Ergünay, O.,
1977, Fiziksel Planlama Sırasında Deprem Zararlarının Azaltılması, Mimarlık Dergisi, 4: 36-37

1996, Afet Yönetimi Nedir? Nasıl Olmalıdır? Erzincan ve Dinar Depremleri Işığında Türkiye'nin Deprem Sorununa Çözüm Arasyışları Sempozyumu. Tübitak, Şubat 1996, Ankara.

1996, Türkiye'de Afet Zararlarının Azaltılması Konusunda Yapılan ve Yapılması Gereken Çalışmalar, Cumhurbaşkanlığına sunulan rapor, Ankara.

2008, Afet Yönetiminde Kurumsal Yapılanma ve Mevzuat Nedir? Nasıl Olmalıdır?, İstanbul Depremini Beklerken Sorunlar ve Çözümler Bildiriler Kitabı, 20 Eylül 2008 CHP İstanbul Deprem Sempozyumu, sayfa 97-108, İstanbul.

Ergünay, O. ve Polat, G.,
2000, Deprem Zararlarının Azaltılmasında Alan Kullanımı', Kentsel Yerleşmeler ve Doğal Afetler, MO Yayını, Ankara, 51-74

Esen, A.
2007, TMMOB Afet Sempozyumu, Ülkemizde Yerel Yönetimlerin Afet Önleme Çalışmaları; Sorunlar Ve Öneriler

Gedikli, B.
2001, Adapazari'nda Dogu Marmara Depreminin Sonuçlarinin Kentlesme ve Planlama Süreçleri Çerçevesinde Degerlendirilmesi, Dogal Olaylarin Afete Dönüsmesi ve Planlama 1, Planlama(TMMOB Sehir Plancilari Odasi Yayini), 2001/3, Syf:33-39

Gundogdu, O., Sayın, N., Özçep, F., Hisarlı, M.,
Marmara Ve İstanbul'da Deprem Tehlikesi, Beşinci Ulusal Deprem Mühendisliği Konferansı, 26-30 Mayıs 2003, İstanbul

GS, Governorship of Sakarya
2000, Sakarya Valiliği, 2000 Yılında Rakamlarla Sakarya, İl Planlama ve Koordinasyon Müdürlüğü Raporu

2003, Sakarya İl Raporu'', Sakarya Valiliği, 19-22

1999, Deprem Brifing Raporu, Sakarya Valiliği Yayını.

2000, Sakarya ve Deprem, Deprem Serisi:1, Eylül 2000.

Hacettepe University
1999, 17 Ağustos 1999 Doğu Marmara Depremi'nin Jeoteknik Saha İnceleme Raporu'', Hacettepe Üniversitesi Mühendislik Fakültesi, Jeoloji Mühendisliği Bölümü, Uygulamalı Jeoloji Anabilim Dalı, Ankara, 4

Kadıoğlu, M.
2006, Afetler Konusunda Kamuoyunun Bilinçlendirilmesi ve Eğitim), Ankara. TC İçişleri Bakanlığı ve Japonya Uluslar arası İşbirliği Ajansı (JICA). s.67-80.

Kagiya, H.
2006, Yerel Yönetimler ve Taşra Teşkilatlarındaki Afet Önlemleri". JICA Türk Belediye Başkanları İçin Eğitim Programı.

Kalafatçıoğlu, A.,
1968, 1967 Sakarya depremine ait kısa not. MTAD, 70, 129-136.

Kanli, B and Unal, Y
2004, Üst düzey planlama sistemi ve afet yönetimi ilişkileri ITU dergisi/ mimarlık, planlama, tasarım Cilt:3, Sayı:1, 103-112

Kesici, E.,
''Deprem Etkilerinin Azaltılmasında Planlamanın Rolü: Örnek Kent Kocaeli'', Gazi Üniversitesi, Fen Bilimleri Enstitüsü, Ankara,40-58 (2004).

Kiper, P
Dogal Afet Planlama Iliskisi, Dogal Olaylarin AfeteDönüsmesi ve Planlama 1, Planlama (TMMOB Sehir Plancilari Odasi Yayini),2001/3. Syf:4-15

Koçyiğit, A., Tatar, O., Temiz, H. Ve Gürsoy, H.,
1996, Deprem Sorunlarının Çözümüne Eğitsel jeolojik ve Yönetsel Yaklaşımlar, Erzincan ve Dinar Deneyimleri Işığında Türkiye'nin Deprem Sorunlarına Çözüm Arayışları'', Deprem Sempozyumu, TÜBİTAK, Ankara, 47-54 (1996).

Kotil E., Konur F., Özgür H.
2007, The Economıc Impacts Of Gulf Earthquake İnternational Earthquake Symposium Kocaeli

Levy, M., Salvari, M.,
2000,. Deprem Kuşağı. Deprem Nedir Ne Değildir, Doğan Kitap, İstanbul (Çev. T. Gürer).

Mestan, Ç
2005, Deprem Zararlarının Azaltılmasında Fiziksel Planlamanın Rolü- Adapazarı Örneği, Yüksek Lisans tezi, Gazi Üniversitesi Fen Bilimleri Enstitüsü.

MPWS, Ministry of Public Works and Settlement
1997, Depreme Dayanıklı Yapı Teknikleri, BİB Yayını, Ankara, (1997). Afet Bölgelerinde Yapılacak Yapılar Hakkında Yönetmelik - B.I.B.

2001, Deprem Sonrasında Bayındırlık ve İskan Bakanlığı'', Bayındırlık ve İskan Bakanlığı Yayınları, Ankara, 3-27 (2001).

2007, Kentleşme Alanına İlişkin Politika Seçenekleri Oluşturma Toplantısı Sonuçlarının Değerlendirilmesi,

Nishikawa, S.
2006, Japonya'da Afet Yönetimi İdaresinin Gelişimi". Japon Hükümeti Kabine ofisi danışmanı. JICA Türk Belediye Başkanları İçin Eğitim Programı.

Nevin Sanlier and Nurcan Yabanci,
2007, The Effects of Two Earthquakes in the Marmara Region of Turkey on the Nutritional Status of Adults Pakistan Journal of Nutrition 6 (4): 327-331, 2007 ISSN 1680-5194

OECD
2000, Economic Effects of the 1999 Turkish Earthquakes: An Interim Report, Economics Department Working Papers No. 247.

Özmen, B., Nurlu, M., Güler, H.,
1997, Coğrafi Bilgi Sistemi ile Deprem Bölgelerinin İncelenmesi'', Bayındırlık ve İskan Bakanlığı, Afet İşleri Genel Müdürlüğü, Ankara, 21-23 (1997).

Özmen, B.,
2000, 17 Ağustos 1999 İzmit Körfezi Depreminin Hasar Durumu (Rakamsal Verilerle)", TDV/DR 010-53, Türkiye Deprem Vakfı, 2000.

Özmen, B.,
2000, İzmit Körfezi Depreminin Hasar Durumu'', İstanbul, 20-24

Özcebe, G., Ramirez, J., Wasti, S. T., Yakut, A.,
2003, 1 May 2003 Bingöl Earthquake Engineering Report, TUBITAK, Turkey, pp. 75-100.

Pampal, S., Özmen, B.
2007, Deprem Bölgeleri Haritaları ve Deprem Yönetmeliklerinin Tarihsel Gelişimi Kitabı , Ankara

SATSO, Sakarya Ticaret ve Sanayi Odası
2000, Adapazarı'nda Deprem ve Sonrası Sakarya,

SMM, Metropolitan Municipality of Sakarya

2000, Adapazarı Revizyon İmar Planına Esas Jeolojik ve Jeoteknik Etüt Raporu, SMM Yayını.

2009, 1954 1:5000 and 1:1000 imar planları, 1985 imar planları, 1999 deprem öncesi son 1:1000 uygulama imar planları,

2009 Sakarya Metropolitan Municipality Archive

Sakarya Sosyal Araştırma Merkezi
1967, Adapazarı ve Fiziksel Planlaması

Şaroğlu, F., Emre, Ö., Kuşçu, İ.,
1996, Yerbilim Verileri Işığında Türkiye'de Deprem Sorununun Boyutları, Erzincan ve Dinar Deneyimleri Işığında Türkiye'nin Deprem Sorunlarına Çözüm Arayışları'', Deprem Sempozyumu, TÜBİTAK, Ankara, 73-78 (1996).

Şengezer, B. Ş., Özkaraman, M.,
1996, Deprem Etkilerinin Azaltılmasında Kent Planlaması-Yapı Uygulanması Süreci, Erzincan ve Dinar Deneyimleri Işığında Türkiye'nin Deprem Sorunlarına Çözüm Arayışları'', Deprem Sempozyumu, TÜBİTAK, Ankara, 353 (1996).

Sengezer,B,
13 Mart 1992 Erzincan Depremi Ve Hasar Analizi Ve Türkiye'de Deprem Sorunu, Yildiz Teknik Üniversitesi,1999

Sengül, H.S.
2001, Dogu Marmara Depreminin Kentlerin Yapilanmasi Üzerine Düsündürdükleri, Dogal Olaylarin Afete Dönüsmesi ve Planlama1, Planlama(TMMOB Sehir Plancilari Odasi Yayini),2001/3. Syf:24-33

Sey, Y.,
1999, Deprem Bölgelerinde Yerleşme ve Konut', Deprem Güvenlikli Konut Sempozyumu, Mesa Yayını, Derleyen: Teoman Aktüre, Ankara, 57-63

Soylu, N.
2000, Türkiye Ziraat Mühendisliği V. Teknik Kongresi kitabı

Sünbül, A.B, Dağdeviren, U., Gündüz, Z., Arman, H
1999, Marmara Depremi Sonrası Adapazarı Şehir Merkezi Hasar Durumlarının Analizi Ve Depremin Ekonomik Boyutu

Sünbül, A.B.,
2004, "Adapazarı Zeminlerinde Sıvılaşma Unsurlarının Belirlenmesine ve Sıvılaşmanın Önlenmesi için Çözümler geliştirilmesi", Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Sakarya Üniversitesi,

Taymaz, T.,
1996, Deprem Sorunlarının Çözümünde Ulusal Deprem İstasyonları Ağının Önemi, Erzincan ve Dinar Deneyimleri Işığında Türkiye'nin Deprem Sorunlarına Çözüm Arayışları'', Deprem Sempozyumu, TÜBİTAK, Ankara, 58-59 (1996).

Tercan, B.
2001, Afet Sonrasi Yerlesimde Yer Seçimi, Dogal Olaylarin Afete Dönüsmesi Ve Planlama 1, Planlama (TMMOB Sehir Plancilari Odasi Yayini), 2001/3. Syf:43-49

TDV, Türkiye Deprem Vakfı
2000, Türkiye ve Çevresinin tarihsel deprem kataloğunun bölgesel düzenlenmesi, TDV/KT 014-59, İstanbul

1997 Deprem Her An Gelebilir, Deprem Broşürü, Türkiye Deprem Vakfı, İstanbul, 1-4 (1997).

Turkish Republic Ministry of Interior Affairs and JICA,
2004, (Minister of Interior) TC İçişleri Bakanlığı ve Japonya Uluslar arası İşbirliği Ajansı (JICA), (Temmuz 2004) Türkiye'de Doğal Afetler Konulu Ülke Strateji Raporu. Ankara.

TMMOB Mimarlar Odasi
2001, Büyük Depremin 2. Yilinda Durum Degerlendirmesi, 18 Agustos 2001.

TÜBİTAK
2002, Deprem Zararlarini Azaltma Ulusal Stratejisi.

2005 ,Türkiye Ulusal Deprem Araştırmaları Programı.

APPENDIX A

DATABASE STUDIES (FOR GIS)

Table A.1. List Of The Revisions Done Between 1985 and 1999 According To The Districts

Number	District Name	Revision Type	Rev. Date	Rev. Area	Sheet No	Rev. GIS id
1	Akıncılar	Other	93	3474	28L2	600
2	Akıncılar	Other	86	7084	28L2	303
3	Akıncılar	Other	89	19951	28M1	459
4	Akıncılar	Removing Green+Floor Increase	89	5430	28L2	633
5	Akıncılar	Other	92	2667	28L3	577
6	Akıncılar	Remain Green	90	5287	28M4	159
7	Akıncılar	Structure Straight	88	12321	28M1	238
8	Akıncılar	Other	90	12992	28L2	308
9	Akıncılar	Remain Green	90	6067	28M4	311
10	Akıncılar	Other	89	11817	28L2	403
11	Akıncılar	Other	93	6144	28L2	671
12	Akıncılar	Remain Green	91	2368	28M1	605
13	Akıncılar	Remain Green	87	5340	28L2	401
14	Beskopru	Remain Green	90	20262	25J4	465
15	Beskopru	Function	94	2159	25J2	686
16	Beskopru	Function	94	1815	25J2	689
17	Beskopru	Other	90	9908	25K4	466
18	Beskopru	Remain Green	98	18458	26K4	599
19	Beskopru	Remain Green	90	150562	26J3	23
20	Beskopru	Function	97	15390	25I3	535
21	Beskopru	Remain Green	93	7315	25J3	674
22	Beskopru	Remain Green	91	94890	25J2	39
23	Beskopru	Remain Green	94	2711	25J3	640
24	Beskopru	Other	95	47128	25J4	81
25	Beskopru	Remain Green	96	207027	25J1	87
26	Beskopru	Remain Green	94	29963	25J1	667
27	Beskopru	Remain Green	95	7720	25J2	517
28	Beskopru	Remain Green	95	43055	25J2	516
29	Beskopru	Function	95	671388	25K1	134
30	Beskopru	Function	96	966	25J1	478
31	Beskopru	Function	97	9039	25J2	496

Table A.1 (Cont)

32	Beskopru	Remain Green	95	4019	25J3	641
33	Cukurahmediye	Function	87	35643	28M1	444
34	Cukurahmediye	Floor+Structure Straight	89	35943	28M1	378
35	Cukurahmediye	Other	98	9678	28M4	539
36	Cukurahmediye	Other	87	3041	28M1	360
37	Cukurahmediye	Remain Green	87	15407	28M1	362
38	Cukurahmediye	Floor Increase	90	2573	28M1	162
39	Cumhuriyet	Remain Green	87	4968	29L2	316
40	Cumhuriyet	Floor+Structure Straight	89	7337	29L2	442
41	Cumhuriyet	Removing Green+Floor Increase	87	34144	29L2	368
42	Cumhuriyet	Function	90	13967	29L2	96
43	Cumhuriyet	Remain Green	87	1596	29L2	353
44	Cumhuriyet	Floor+Structure Straight	86	12229	29L2	268
45	Cumhuriyet	Other	86	22273	29L2	239
46	Cumhuriyet	Remain Green	88	12763	29L2	380
47	Cumhuriyet	Remain Green	86	1852	29L2	480
48	Cumhuriyet	Remain Green	91	1846	29L2	618
49	Cumhuriyet	Floor+Structure Straight	98	2737	29L2	482
50	Cumhuriyet	Floor Increase	90	1861	29L3	241
51	Cumhuriyet	Function	86	109027	29L4	250
52	Cumhuriyet	Floor Increase	97	4726	29L2	494
53	Cumhuriyet	Function	89	31923	29L2	296
54	Cumhuriyet	Floor Increase	88	3450	29L2	292
55	Cumhuriyet	Remain Green	88	1941	29L2	288
56	Cumhuriyet	Other	88	2624	29L2	287
57	Cumhuriyet	Other	90	3346	29L2	247
58	Cumhuriyet	Function	86	1937	29L2	168
59	Cumhuriyet	Function	87	6343	29L2	312
60	Cumhuriyet	Removing Green+Floor Increase	86	4815	29L2	80
61	Cumhuriyet	Floor Increase	98	5109	29L2	590
62	Cumhuriyet	Floor Increase	93	1475	29L2	589
63	Cumhuriyet	Floor+Structure Straight	93	3088	29L2	685
64	Cumhuriyet	Removing Green+Floor Increase	86	3096	29L2	428
65	Cumhuriyet	Other	89	3474	29L2	423
66	Cumhuriyet	Other	86	4956	29L2	283
67	Cumhuriyet	Remain Green	92	30352	29L2	596
68	Cumhuriyet	Function	96	3409	29L2	638
69	Cumhuriyet	Other	94	2612	29L2	649
70	Cumhuriyet	Floor+Structure Straight	89	4578	29L2	409
71	Cumhuriyet	Floor+Structure Straight	94	29895	29L2	636
72	Cumhuriyet	Other	89	7439	29L4	407
73	Cumhuriyet	Other	86	7581	29L4	189
74	Cumhuriyet	Floor+Structure Straight	91	3549	29L4	631
75	Cumhuriyet	Other	86	2176	29L4	291
76	Cumhuriyet	Remain Green	86	6439	29L2	201
77	Cumhuriyet	Remain Green	93	2834	29L2	602
78	Cumhuriyet	Removing Green+Floor Increase	86	5718	29L2	537

Table A.1. (Cont)

79	Cumhuriyet	Other	86	5507	29L2	76
80	Cumhuriyet	Remain Green	93	3745	29L2	541
81	Cumhuriyet	Floor Increase	98	11404	29L2	528
82	Cumhuriyet	Function	97	6444	29L2	545
83	Cumhuriyet	Remain Green	87	1057	29L3	10
84	Gulluk	Function	92	2604	28L4	572
85	Gulluk	Remain Green	87	83127	27L1	299
86	Gulluk	Remain Green	93	203943	27L2	60
87	Gulluk	Function	93	23949	27L1	673
88	Gulluk	Other	86	3770	27L4	33
89	Gulluk	Remain Green	92	16009	28L3	583
90	Gulluk	Function	86	10425	27L1	110
91	Gulluk	Remain Green	98	540	27L4	524
92	Gulluk	Remain Green	86	55272	28L3	117
93	Gulluk	Floor Increase	91	1575	27L2	610
94	Gulluk	Floor Increase	93	4939	27L2	672
95	Gulluk	Other	94	1118	27L4	644
96	Gulluk	Floor Increase	97	9281	27L2	556
97	Gulluk	Other	86	8245	27L4	174
98	Gulluk	Remain Green	86	84138	27L1	2
99	Gulluk	Function	92	5023	27L1	578
100	Hızırtepe	Other	88	3329	27L4	196
101	Hızırtepe	Removing Green+Floor Increase	86	5587	27L4	192
102	Hızırtepe	Remain Green	87	7877	27K3	349
103	Hızırtepe	Other	95	4118	26L1	515
104	Hızırtepe	Other	97	6459	27K3	490
105	Hızırtepe	Floor Increase	94	1100	27K3	646
106	Hızırtepe	Function	86	23946	27L4	35
107	Hızırtepe	Remain Green	90	5891	26L1	469
108	Hızırtepe	Remain Green	92	947	26L1	626
109	Hızırtepe	Other	86	2870	27L4	180
110	Hızırtepe	Floor Increase	90	2556	27L4	20
111	Hızırtepe	Floor Increase	98	262	26L1	566
112	Hızırtepe	Remain Green	89	11954	27L4	399
113	Hızırtepe	Other	94	3462	27L1	700
114	Hızırtepe	Other	91	4327	26L1	468
115	Istiklal	Remain Green	94	2317	30L3	504
116	Istiklal	Floor+Structure Straight	86	36730	30L3	259
117	Istiklal	Structure Straight	90	4632	30L4	155
118	Istiklal	Floor+Structure Straight	93	8353	30L3	669
119	Istiklal	Floor Increase	91	7126	30L4	606
120	Istiklal	Other	88	7382	30L3	397
121	Istiklal	Other	95	8445	30L3	519
122	Istiklal	Other	96	2747	29L2	492
123	Istiklal	Other	89	11430	30L3	427
124	Istiklal	Other	90	5403	30L3	295
125	Istiklal	Floor Increase	91	20899	29L2	611

Table A.1 (Cont)

126	Karaosman	Remain Green	88	7181	30M4	220
127	Karaosman	Other	94	5858	30L3	643
128	Karaosman	Remain Green	86	9544	30M4	71
129	Karaosman	Structure Straight	90	5791	30M4	109
130	Karaosman	Other	87	8706	30L3	370
131	Karaosman	Removing Green+Floor Increase	86	18815	30L3	400
132	Karaosman	Structure Straight	86	22391	30M4	65
133	Karaosman	Function	90	7675	30M4	135
134	Karaosman	Other	88	3815	30L3	323
135	Karaosman	Remain Green	89	4406	30M4	215
136	Karaosman	Remain Green	89	7937	30L3	432
137	Karaosman	Floor Increase	97	7685	30M4	487
138	Karaosman	Other	86	25008	29M1	46
139	Karaosman	Other	97	996	30L3	491
140	Karaosman	Remain Green	90	12388	30L3	263
141	Karaosman	Other	86	748	30M4	474
142	Karaosman	Other	86	4580	30M4	398
143	Karaosman	Other	87	27885	30L3	116
144	Karaosman	Removing Green+Floor Increase	86	22934	30L3	232
145	Karaosman	Other	90	6463	30M4	142
146	Karaosman	Other	91	9219	30M4	630
147	Karaosman	Remain Green	90	3340	30M4	139
148	Karaosman	Other	89	2898	30L3	438
149	Kurtulus	Other	86	9872	30L3	294
150	Kurtulus	Remain Green	89	5525	29L2	439
151	Kurtulus	Floor Increase	97	5290	29L2	547
152	Kurtulus	Removing Green+Floor Increase	89	1892	29L2	411
153	Kurtulus	Floor Increase	90	16735	29L2	347
154	Kurtulus	Other	89	9149	29L2	413
155	Kurtulus	Floor Increase	89	5848	29L2	422
156	Kurtulus	Structure Straight	86	9039	29L2	206
157	Kurtulus	Other	90	4766	29L2	156
158	Kurtulus	Floor+Structure Straight	90	10775	29L2	298
159	Kurtulus	Other	86	7104	29L2	188
160	Kurtulus	Floor+Structure Straight	90	8483	29L2	576
161	Kurtulus	Remain Green	86	137252	29L2	242
162	Kurtulus	Removing Green+Floor Increase	86	9847	29L2	249
163	Kurtulus	Other	88	7020	29L2	230
164	Maltepe	Function	98	1952	26K3	534
165	Maltepe	Remain Green	86	81402	26K3	280
166	Maltepe	Remain Green	90	774	27K3	471
167	Maltepe	Remain Green	90	1863	26K2	470
168	Maltepe	Function	89	34167	26K3	467
169	Maltepe	Remain Green	92	60706	26K3	54
170	Maltepe	Remain Green	92	3125	27K3	574
171	Maltepe	Remain Green	92	31701	26K4	51
172	Maltepe	Remain Green	90	2834	26K3	463

Table A.1 (Cont)

173	Maltepe	Remain Green	89	1554	26K4	178
174	Maltepe	Remain Green	89	9839	25K2	172
175	Maltepe	Remain Green	88	490	26K2	191
176	Maltepe	Remain Green	89	6115	25K2	175
177	Maltepe	Other	86	3662	26K2	285
178	Maltepe	Structure Straight	90	66773	25K2	15
179	Maltepe	Other	88	9001	26K3	182
180	Maltepe	Remain Green	90	1934	27K3	17
181	Maltepe	Remain Green	88	2955	26K3	183
182	Maltepe	Remain Green	88	1851	26K3	187
183	Maltepe	Remain Green	95	2187	26K3	462
184	Maltepe	Remain Green	97	3063	26K3	567
185	Maltepe	Remain Green	86	7783	26K2	656
186	Maltepe	Remain Green	95	3913	26K3	503
187	Maltepe	Floor Increase	98	3901	26K2	525
188	Maltepe	Floor Increase	87	113021	26K3	341
189	Maltepe	Remain Green	95	35735	27K3	114
190	Maltepe	Remain Green	86	3681	26K2	99
191	Maltepe	Other	86	2715	26K3	701
192	Maltepe	Remain Green	89	2935	26K3	331
193	Maltepe	Other	94	7522	26K2	95
194	Maltepe	Floor+Structure Straight	86	14188	26K2	270
195	Maltepe	Remain Green	89	3955	26K3	325
196	Maltepe	Remain Green	94	2177	27K3	653
197	Maltepe	Floor+Structure Straight	97	73146	26K2	121
198	Maltepe	Other	96	7575	26K3	483
199	Maltepe	Floor Increase	97	4173	27K3	568
200	Maltepe	Structure Straight	86	43400	25K2	16
201	Maltepe	Function	86	30585	25K2	12
202	Maltepe	Floor+Structure Straight	86	9598	25K2	264
203	Maltepe	Remain Green	86	7006	26K2	260
204	Maltepe	Function	97	4316	26K2	485
205	Maltepe	Remain Green	97	6877	26K2	551
206	Maltepe	Function	89	37107	26K3	329
207	Maltepe	Remain Green	90	21886	26K2	340
208	Maltepe	Remain Green	86	6462	26K3	200
209	Maltepe	Remain Green	88	2926	27K3	193
210	Maltepe	Function	86	8246	26K2	26
211	Maltepe	Remain Green	86	6802	26K3	22
212	Maltepe	Other	94	3252	26K2	647
213	Maltepe	Function	86	7299	26K2	359
214	Maltepe	Remain Green	86	200158	27K3	219
215	Maltepe	Remain Green	88	5131	25K2	391
216	Maltepe	Remain Green	86	2325	25K1	21
217	Maltepe	Function	86	58375	25K3	9
218	Maltepe	Other	88	4631	25K2	396
219	Maltepe	Function	98	9984	25K2	526

Table A.1 (Cont)

220	Mithatpasa	Remain Green	90	722	28L4	1
221	Mithatpasa	Other	90	11089	28K2	235
222	Mithatpasa	Removing Green+Floor Increase	94	5005	28L4	195
223	Mithatpasa	Remain Green	90	29446	27K2	240
224	Mithatpasa	Removing Green+Floor Increase	86	8020	28L4	253
225	Mithatpasa	Remain Green	86	2598	28L4	216
226	Mithatpasa	Floor Increase	86	6307	27L1	210
227	Mithatpasa	Remain Green	90	3428	27K2	72
228	Mithatpasa	Remain Green	86	17473	28L4	185
229	Mithatpasa	Remain Green	90	1117	28L1	66
230	Mithatpasa	Floor Increase	90	7803	28K3	25
231	Mithatpasa	Removing Green+Floor Increase	88	2603	28L4	64
232	Mithatpasa	Remain Green	90	5120	27K2	293
233	Mithatpasa	Floor+Structure Straight	91	7047	29K3	619
234	Mithatpasa	Other	90	8670	28L4	8
235	Mithatpasa	Remain Green	91	3185	27K2	608
236	Mithatpasa	Other	86	1594	28L4	119
237	Mithatpasa	Other	86	12893	27K2	91
238	Mithatpasa	Other	98	2291	27K2	559
239	Mithatpasa	Floor+Structure Straight	86	6818	28L4	151
240	Mithatpasa	Floor Increase	98	1811	28L1	561
241	Mithatpasa	Function	95	3146	28L4	498
242	Mithatpasa	Remain Green	86	6139	28L4	691
243	Mithatpasa	Remain Green	94	1748	27L1	645
244	Mithatpasa	Remain Green	86	33492	28K3	140
245	Mithatpasa	Floor Increase	87	17746	29K3	354
246	Mithatpasa	Other	86	3644	28L4	158
247	Mithatpasa	Other	87	3185	28L4	374
248	Mithatpasa	Remain Green	87	4174	28L4	375
249	Mithatpasa	Remain Green	88	3336	27K2	198
250	Mithatpasa	Other	88	9362	27K1	384
251	Mithatpasa	Other	88	10310	27K2	203
252	Mithatpasa	Other	88	8984	28K2	204
253	Mithatpasa	Floor Increase	91	1848	28K3	472
254	Mithatpasa	Remain Green	86	7068	28L1	145
255	Mithatpasa	Other	86	23363	28K3	143
256	Mithatpasa	Remain Green	92	20928	29K3	49
257	Mithatpasa	Other	97	7614	29K3	495
258	Mithatpasa	Function	93	6463	28L4	593
259	Mithatpasa	Function	89	5199	28L1	307
260	Mithatpasa	Removing Green+Floor Increase	86	4400	28K3	314
261	Mithatpasa	Removing Green+Floor Increase	97	9837	28K3	477
262	Mithatpasa	Remain Green	88	15186	28L4	309
263	Mithatpasa	Floor Increase	93	5275	28L4	680
264	Mithatpasa	Other	87	6957	28L4	301
265	Mithatpasa	Other	90	928	28K2	28

Table A.1 (Cont)

266	Orta	Function	97	6634	29L2	564
267	Orta	Other	97	5148	29M1	554
268	Orta	Floor Increase	96	3917	29L2	475
269	Orta	Other	88	7620	29M1	214
270	Orta	Other	86	18482	29M4	50
271	Orta	Floor+Structure Straight	86	18513	29L2	161
272	Orta	Other	86	6288	30M4	382
273	Orta	Removing Green+Floor Increase	90	7243	29L2	300
274	Orta	Other	97	15302	29M4	563
275	Orta	Floor+Structure Straight	90	6811	29L2	273
276	Orta	Other	89	11789	29M1	383
277	Orta	Structure Straight	87	18487	29L2	257
278	Orta	Other	93	3886	29L2	613
279	Orta	Function	93	962	29L2	697
280	Orta	Other	89	11005	29M1	461
281	Orta	Other	87	12011	29M1	456
282	Orta	Other	90	1935	29L2	101
283	Orta	Remain Green	89	7817	30L3	435
284	Orta	Remain Green	94	4837	29L2	692
285	Orta	Remain Green	98	3018	29L2	542
286	Orta	Other	90	1083	29L2	102
287	Orta	Function	98	20001	29L2	540
288	Orta	Floor+Structure Straight	89	6208	29L2	221
289	Orta	Structure Straight	93	10085	29L2	670
290	Orta	Other	94	8329	29L2	637
291	Orta	Other	98	7796	29L2	522
292	Orta	Other	86	20514	29L2	78
293	Orta	Other	91	6395	29M1	634
294	Ozanlar	Other	92	5795	30L3	623
295	Ozanlar	Other	91	11145	30L1	176
296	Ozanlar	Other	86	276067	34K2	19
297	Ozanlar	Remain Green	88	13655	30L1	261
298	Ozanlar	Other	88	3990	30L2	274
299	Ozanlar	Remain Green	86	5001	30L1	67
300	Ozanlar	Floor+Structure Straight	90	21178	30L3	199
301	Ozanlar	Other	86	9866	30L1	73
302	Ozanlar	Other	88	13691	30L1	278
303	Ozanlar	Other	92	4437	30L1	571
304	Ozanlar	Remain Green	90	8081	30L3	197
305	Ozanlar	Remain Green	87	11819	30L3	24
306	Ozanlar	Remain Green	93	2351	30L1	684
307	Ozanlar	Remain Green	90	12337	30L1	286
308	Ozanlar	Remain Green	87	4702	33K2	338
309	Ozanlar	Other	89	10449	30L2	430
310	Ozanlar	Remain Green	89	4372	30L1	429
311	Ozanlar	Remain Green	89	2636	30N1	416
312	Ozanlar	Floor Increase	87	18499	33K2	229

Table A.1 (Cont)

313	Ozanlar	Other	88	7803	30L3	226
314	Ozanlar	Removing Green+Floor Increase	88	31465	30L1	393
315	Ozanlar	Remain Green	86	108968	30L3	276
316	Ozanlar	Other	89	6911	30L4	437
317	Papuccullar	Remain Green	86	34637	29L3	319
318	Papuccullar	Function	90	1203	28L3	61
319	Papuccullar	Floor Increase	91	8867	28L2	209
320	Papuccullar	Other	91	10986	28L2	676
321	Papuccullar	Remain Green	86	5960	28L2	699
322	Papuccullar	Function	94	4888	28L3	690
323	Papuccullar	Function	94	10792	28L2	668
324	Papuccullar	Remain Green	93	10762	28L2	632
325	Papuccullar	Function	91	1966	28L3	609
326	Papuccullar	Floor+Structure Straight	90	9117	28L2	366
327	Papuccullar	Floor+Structure Straight	90	3524	29L3	361
328	Papuccullar	Other	88	26048	29L3	113
329	Papuccullar	Other	90	5121	28L2	336
330	Papuccullar	Other	87	11624	28L2	38
331	Papuccullar	Other	90	1172	28L2	327
332	Papuccullar	Remain Green	86	24530	28L2	236
333	Papuccullar	Floor Increase	86	8342	28L3	83
334	Papuccullar	Floor+Structure Straight	94	4444	28L2	68
335	Papuccullar	Other	86	9221	28L2	607
336	Sakarya	Remain Green	87	15186	30L2	342
337	Sakarya	Function	90	7076	30M1	244
338	Sakarya	Remain Green	86	29466	30L3	82
339	Sakarya	Other	93	3867	30M1	694
340	Sakarya	Remain Green	87	9116	30L2	419
341	Sakarya	Remain Green	86	27238	31L4	124
342	Sakarya	Remain Green	91	7804	30L2	629
343	Sakarya	Floor Increase	87	18509	30L1	421
344	Sakarya	Other	86	17939	30L2	108
345	Sakarya	Other	86	14098	30L3	343
346	Sakarya	Remain Green	90	1181	30L2	177
347	Sakarya	Remain Green	86	16146	30L3	58
348	Sakarya	Remain Green	86	4572	30L2	111
349	Sakarya	Other	89	6997	30L2	431
350	Sakarya	Floor Increase	95	12942	30L2	500
351	Sakarya	Other	87	3937	30M4	224
352	Sakarya	Other	89	6991	31L3	436
353	Sakarya	Floor Increase	90	14135	30L3	57
354	Sakarya	Remain Green	98	6805	31L4	532
355	Sakarya	Other	94	4531	30L2	665
356	Sakarya	Other	86	9582	30M4	402
357	Sakarya	Floor+Structure Straight	93	3379	30L3	681
358	Sakarya	Floor+Structure Straight	90	31603	30L3	271
359	Seker	Function	91	30426	29K2	27

Table A.1 (Cont)

360	Seker	Remain Green	86	7781	30K3	47
361	Seker	Function	86	3060	29K3	179
362	Seker	Other	86	3633	30K3	42
363	Seker	Floor+Structure Straight	86	4689	30K3	171
364	Seker	Removing Green+Floor Increase	86	34367	29K3	167
365	Seker	Remain Green	92	2794	29K3	575
366	Seker	Function	92	5202	30L4	595
367	Seker	Function	87	3180	30L4	404
368	Seker	Remain Green	87	5799	30K2	255
369	Seker	Other	93	1078	30K3	695
370	Seker	Other	94	15303	29K3	701
371	Seker	Function	90	33070	30L4	425
372	Seker	Remain Green	94	4724	30K3	687
373	Seker	Function	86	4781	30L4	59
374	Seker	Function	97	11741	30L4	565
375	Seker	Remain Green	86	5281	30L4	52
376	Seker	Remain Green	86	3308	30L4	63
377	Seker	Remain Green	94	8621	29K2	651
378	Seker	Other	90	7717	29K2	55
379	Seker	Other	96	26870	30K2	473
380	Seker	Function	94	5032	30L4	642
381	Seker	Function	89	4150	30L4	405
382	Seker	Structure Straight	88	7134	30L1	256
383	Seker	Floor Increase	90	6250	30K3	150
384	Seker	Floor Increase	90	14965	30L1	352
385	Seker	Floor Increase	95	7079	29K3	502
386	Seker	Remain Green	95	3296	29K2	501
387	Seker	Other	87	10834	30K3	426
388	Seker	Remain Green	90	4240	29K2	324
389	Seker	Function	90	5513	29K2	89
390	Seker	Function	90	4886	30L4	147
391	Seker	Remain Green	90	2051	29K2	92
392	Seker	Remain Green	90	20230	29K2	318
393	Seker	Other	87	27086	30K3	127
394	Seker	Remain Green	90	932	30L1	282
395	Seker	Floor Increase	90	5821	30L4	269
396	Seker	Floor Increase	90	24443	30K3	258
397	Seker	Other	89	7058	29K3	333
398	Seker	Function	91	3873	30L1	144
399	Seker	Other	93	9689	29K3	594
400	Seker	Other	97	5813	30L4	548
401	Seker	Floor Increase	88	6428	30L4	281
402	Seker	Removing Green+Floor Increase	86	4277	29K2	284
403	Seker	Floor Increase	86	7648	29K2	357
404	Seker	Remain Green	97	6644	29K2	493
405	Seker	Remain Green	90	28926	29K2	234

Table A.1 (Cont)

406	Seker	Other	86	49335	30K2	41
407	Seker	Function	95	2016	29K2	509
408	Semerciler	Remain Green	95	3363	29L3	481
409	Semerciler	Floor+Structure Straight	86	42897	29L3	104
410	Semerciler	Floor+Structure Straight	86	10196	29L3	132
411	Semerciler	Other	86	19692	29L4	128
412	Semerciler	Remain Green	97	4439	29L3	488
413	Semerciler	Floor Increase	95	9547	29L4	508
414	Semerciler	Other	94	1621	29L3	569
415	Semerciler	Remain Green	86	4712	29L3	107
416	Semerciler	Function	94	30042	29L3	553
417	Semerciler	Floor+Structure Straight	86	2241	29L4	505
418	Semerciler	Other	86	3215	29L3	137
419	Semerciler	Other	89	10297	29L4	218
420	Semerciler	Other	93	11234	29L3	588
421	Semerciler	Remain Green	90	6434	29L3	363
422	Semerciler	Other	91	2727	29L3	628
423	Semerciler	Other	93	13141	29L3	75
424	Semerciler	Other	90	13193	29L3	591
425	Semerciler	Other	86	975	29L3	222
426	Semerciler	Remain Green	89	7404	29L4	433
427	Semerciler	Remain Green	92	498	29L3	625
428	Semerciler	Remain Green	90	23643	29L3	350
429	Semerciler	Other	92	11129	29L4	580
430	Semerciler	Function	91	10642	29L3	581
431	Semerciler	Other	88	46702	29L3	275
432	Semerciler	Function	97	21455	29L3	31
433	Semerciler	Floor+Structure Straight	95	23219	29L4	11
434	Semerciler	Other	95	836	29L3	624
435	Semerciler	Other	90	4847	29L3	251
436	Semerciler	Remain Green	89	7533	29L3	434
437	Semerciler	Function	87	10329	29L3	237
438	Semerciler	Other	89	6551	29L4	440
439	Semerciler	Floor+Structure Straight	89	1772	29L3	441
440	Semerciler	Other	87	5342	29L4	233
441	Semerciler	Removing Green+Floor Increase	90	2945	29L3	330
442	Semerciler	Other	98	2864	29L4	529
443	Semerciler	Remain Green	86	22375	29L3	266
444	Semerciler	Other	87	6865	29L4	7
445	Semerciler	Floor+Structure Straight	86	46835	28L1	245
446	Semerciler	Floor+Structure Straight	93	4349	29L3	679
447	Semerciler	Function	86	11666	29L3	227
448	Sirinevler	Floor Increase	90	8075	27K3	334
449	Sirinevler	Other	86	7758	27L1	88
450	Sirinevler	Floor Increase	95	10188	27L1	657
451	Sirinevler	Function	94	207000	27L4	74
452	Sirinevler	Other	94	1738	27L1	639

Table A.1 (Cont)

453	Sirinevler	Floor+Structure Straight	86	9757	27L1	153
454	Sirinevler	Other	94	862	27L1	688
455	Sirinevler	Other	91	4732	27K3	622
456	Sirinevler	Floor Increase	90	3204	27K3	13
457	Sirinevler	Function	98	1170	27L1	531
458	Tekeler	Remain Green	86	312	31L4	536
459	Tekeler	Remain Green	87	5864	31M1	304
460	Tekeler	Floor Increase	98	25312	30M1	527
461	Tekeler	Remain Green	88	30132	32L3	302
462	Tekeler	Remain Green	88	12000	31L3	262
463	Tekeler	Remain Green	97	2683	31M1	552
464	Tekeler	Other	92	12207	31L3	265
465	Tekeler	Remain Green	86	11327	30M1	410
466	Tekeler	Other	87	21764	30M1	267
467	Tekeler	Remain Green	86	3717	31L3	406
468	Tekeler	Remain Green	88	48517	31M4	272
469	Tekeler	Remain Green	86	2803	31M4	408
470	Tekeler	Remain Green	86	7982	31M4	417
471	Tekeler	Remain Green	86	15033	31M4	415
472	Tekeler	Remain Green	98	3502	31M4	521
473	Tekeler	Remain Green	90	8808	31L3	190
474	Tekeler	Floor Increase	93	15313	31M1	682
475	Tekeler	Remain Green	86	11459	31M1	678
476	Tekeler	Function	89	13333	31L3	458
477	Tekeler	Remain Green	86	24445	30L2	326
478	Tekeler	Remain Green	86	38912	31L3	322
479	Tekeler	Function	87	23008	32M4	320
480	Tekeler	Remain Green	89	16172	31M1	205
481	Tekeler	Other	90	9335	32M4	211
482	Tekeler	Floor Increase	95	16034	30L2	484
483	Tekeler	Other	91	17858	31M1	208
484	Tekeler	Remain Green	92	13276	32L3	598
485	Tekeler	Remain Green	88	12108	31L3	573
486	Tekeler	Function	92	2382	30M1	579
487	Tekeler	Other	90	3132	31M4	371
488	Tekeler	Other	91	4539	30M1	130
489	Tekeler	Remain Green	90	2741	31L3	186
490	Tekeler	Other	91	1032	31M4	181
491	Tekeler	Remain Green	90	2976	31M4	184
492	Tekeler	Remain Green	90	4643	31M1	202
493	Tekeler	Function	94	1740	30M1	664
494	Tekeler	Remain Green	89	4042	30M1	231
495	Tekeler	Remain Green	96	2075	31M1	512
496	Tekeler	Remain Green	95	8826	31M4	513
497	Tekeler	Other	94	7748	32L3	660
498	Tekeler	Other	89	48171	31M4	228

Table A.1 (Cont)

499	Tekeler	Remain Green	94	1706	31M1	655
500	Tekeler	Structure Straight	94	12157	31L3	666
501	Tekeler	Remain Green	94	9474	31L3	661
502	Tepekum	Remain Green	87	6411	27M2	351
503	Tepekum	Removing Green+Floor Increase	92	1521	28M3	597
504	Tepekum	Remain Green	90	33868	25J3	464
505	Tepekum	Remain Green	88	34163	27M2	170
506	Tepekum	Remain Green	88	24236	28M3	165
507	Tepekum	Remain Green	89	6245	28M2	445
508	Tepekum	Floor Increase	90	14789	28M4	32
509	Tepekum	Remain Green	90	6632	27M2	34
510	Tepekum	Function	90	2703	28M2	40
511	Tepekum	Removing Green+Floor Increase	97	7331	29N4	486
512	Tepekum	Remain Green	93	56140	27N4	62
513	Tepekum	Remain Green	87	8058	27M2	355
514	Tepekum	Removing Green+Floor Increase	96	10131	28M3	511
515	Tepekum	Function	97	6753	28M2	489
516	Tepekum	Function	87	945	28M2	346
517	Tepekum	Removing Green+Floor Increase	98	17577	29N4	133
518	Tepekum	Other	87	19557	29M3	36
519	Tepekum	Other	95	3811	28M3	683
520	Tepekum	Other	97	5782	28N1	562
521	Tepekum	Remain Green	98	5172	28M2	560
522	Tepekum	Other	93	9359	28M4	601
523	Tepekum	Function	97	10967	28M2	557
524	Tepekum	Other	94	7360	28M4	652
525	Tepekum	Other	89	8941	28M4	443
526	Tepekum	Floor Increase	94	6914	28M4	693
527	Tepekum	Remain Green	91	59406	28M4	43
528	Tepekum	Remain Green	87	5016	28M2	29
529	Tepekum	Remain Green	88	46002	28M4	387
530	Tepekum	Other	87	14541	27N4	310
531	Tepekum	Remain Green	87	4290	27M2	348
532	Tepekum	Other	98	12430	28M3	558
533	Tepekum	Remain Green	97	40344	27N4	106
534	Tıgcilar	Other	86	60962	29M4	105
535	Tıgcilar	Floor Increase	87	21201	29M4	90
536	Tıgcilar	Floor Increase	90	30452	29M4	97
537	Tıgcilar	Floor Increase	89	10657	29M4	452
538	Tıgcilar	Floor Increase	86	11954	29M4	389
539	Tıgcilar	Floor Increase	93	3990	29M4	675
540	Tıgcilar	Function	87	8482	29M4	248
541	Tıgcilar	Floor Increase	86	1540	29M4	246
542	Tıgcilar	Floor+Structure Straight	93	8625	29M4	592
543	Tıgcilar	Floor Increase	87	13606	29L3	315
544	Tıgcilar	Floor+Structure Straight	87	25215	29M4	120

Table A.1 (Cont)

545	Tıgcilar	Other	98	987	29M4	543
546	Tıgcilar	Other	90	3125	29M4	79
547	Tıgcilar	Other	90	6235	29M4	254
548	Tıgcilar	Floor Increase	87	1615	29L3	123
549	Tıgcilar	Floor Increase	98	4742	29M4	530
550	Tuzla	Function	86	12467	30M2	412
551	Tuzla	Remain Green	86	14170	30M2	414
552	Tuzla	Remain Green	86	4188	30M1	328
553	Tuzla	Function	87	8997	30M4	395
554	Tuzla	Other	90	9691	30M3	115
555	Tuzla	Other	86	9234	30M3	332
556	Tuzla	Removing Green+Floor Increase	94	8514	30M2	662
557	Tuzla	Floor Increase	90	6909	30M1	194
558	Tuzla	Remain Green	89	9600	30M1	225
559	Tuzla	Floor+Structure Straight	97	18185	30M1	549
560	Tuzla	Other	90	17937	30M2	289
561	Tuzla	Remain Green	90	11325	30M2	305
562	Tuzla	Remain Green	90	6670	30M3	112
563	Tuzla	Other	90	5292	30M4	372
564	Tuzla	Remain Green	88	17262	30M3	223
565	Tuzla	Remain Green	94	76347	31M3	70
566	Tuzla	Remain Green	91	11485	30M2	129
567	Tuzla	Removing Green+Floor Increase	91	8610	30M2	603
568	Tuzla	Structure Straight	89	6984	30M2	457
569	Tuzla	Other	94	5828	31N4	648
570	Tuzla	Remain Green	92	11611	31M3	570
571	Tuzla	Floor Increase	96	13566	30M3	514
572	Tuzla	Other	92	13855	30M2	584
573	Tuzla	Remain Green	94	6853	30M2	700
574	Tuzla	Remain Green	86	11743	30M4	77
575	Tuzla	Remain Green	91	6345	30M2	616
576	Tuzla	Other	93	6393	31M3	677
577	Yagcilar	Remain Green	88	4511	30N1	141
578	Yagcilar	Remain Green	90	9078	30N4	118
579	Yagcilar	Other	87	16461	30N1	138
580	Yagcilar	Other	90	24081	30N1	122
581	Yagcilar	Other	92	14922	30N1	585
582	Yagcilar	Other	88	9992	30N4	146
583	Yagcilar	Floor+Structure Straight	86	44788	30N1	6
584	Yagcilar	Remain Green	89	2514	29M2	449
585	Yagcilar	Function	90	6809	29M2	173
586	Yagcilar	Removing Green+Floor Increase	95	5343	29M3	499
587	Yagcilar	Remain Green	89	16590	29M3	451
588	Yagcilar	Other	90	9619	29M2	53
589	Yagcilar	Other	95	6121	29M3	497
590	Yagcilar	Remain Green	94	9631	29M2	654

Table A.1 (Cont)

591	Yagcilar	Floor Increase	95	31640	30M3	518
592	Yagcilar	Other	88	20752	29M3	84
593	Yagcilar	Function	89	13071	30M3	213
594	Yagcilar	Remain Green	90	13590	29M2	279
595	Yagcilar	Remain Green	89	1410	29M4	448
596	Yagcilar	Other	94	7707	30N4	659
597	Yagcilar	Remain Green	89	6794	29M3	450
598	Yagcilar	Other	91	10242	30N4	614
599	Yagcilar	Removing Green+Floor Increase	91	4194	30M3	615
600	Yagcilar	Other	91	11354	29M2	635
601	Yagcilar	Floor Increase	91	2814	29M1	620
602	Yagcilar	Function	92	4870	30M3	627
603	Yagcilar	Other	92	10049	29M1	582
604	Yagcilar	Remain Green	92	6814	29M3	586
605	Yagcilar	Removing Green+Floor Increase	93	8924	29M1	587
606	Yagcilar	Removing Green+Floor Increase	94	12792	29N1	663
607	Yagcilar	Other	90	5765	29M2	313
608	Yagcilar	Other	88	8787	29N4	154
609	Yagcilar	Remain Green	89	3345	29M3	447
610	Yagcilar	Floor+Structure Straight	91	81709	30M3	37
611	Yagcilar	Remain Green	87	10205	29M2	392
612	Yagcilar	Other	86	14311	30M3	394
613	Yagcilar	Other	88	4008	29M1	217
614	Yagcilar	Floor+Structure Straight	96	46352	29M3	85
615	Yagcilar	Function	98	3040	29M2	538
616	Yagcilar	Other	90	20784	29M3	157
617	Yagcilar	Other	87	6446	29M3	386
618	Yagcilar	Remain Green	87	21861	29M2	152
619	Yagcilar	Remain Green	89	8293	30N4	149
620	Yagcilar	Remain Green	96	395503	29N4	94
621	Yagcilar	Remain Green	96	319161	29N1	98
622	Yagcilar	Remain Green	97	15092	29M3	103
623	Yagcilar	Function	86	14096	30M4	69
624	Yagcilar	Function	96	62260	29N2	93
625	Yagcilar	Function	87	15980	29M2	337
626	Yagcilar	Remain Green	89	9358	29N1	420
627	Yagcilar	Other	87	19271	29M3	344
628	Yagcilar	Other	89	5567	30N4	418
629	Yagcilar	Remain Green	87	11261	29M2	390
630	Yagcilar	Remain Green	87	4971	29M3	339
631	Yagcilar	Other	97	1258	29M2	550
632	Yagcilar	Remain Green	86	4973	30M3	335
633	Yagcilar	Removing Green+Floor Increase	96	11483	30M3	479
634	Yahyalar	Remain Green	89	1381	29M1	454
635	Yahyalar	Remain Green	89	12393	29M1	455
636	Yahyalar	Other	86	12981	29M1	424
637	Yahyalar	Floor+Structure Straight	91	6706	29M4	612

Table A.1 (Cont)

638	Yahyalar	Structure Straight	88	11647	29M4	243
639	Yahyalar	Remain Green	90	3475	29M1	317
640	Yahyalar	Other	91	6197	29M1	617
641	Yahyalar	Floor Increase	86	37117	29M4	377
642	Yahyalar	Other	87	7005	29M1	376
643	Yahyalar	Remain Green	86	30411	29M1	163
644	Yahyalar	Floor Increase	86	5146	29M4	86
645	Yahyalar	Remain Green	93	930	29M1	696
646	Yenicami	Other	91	10376	28L2	621
647	Yenicami	Structure Straight	87	40387	28L2	14
648	Yenicami	Floor+Structure Straight	90	5667	28L2	277
649	Yenicami	Other	87	9900	28L2	379
650	Yenicami	Other	87	11210	28M1	306
651	Yenicami	Other	97	2344	28L2	476
652	Yenidogan	Floor Increase	86	5403	28L1	148
653	Yenidogan	Other	88	2384	28L2	207
654	Yenidogan	Other	86	9530	28L2	290
655	Yenigun	Removing Green+Floor Increase	86	2295	29M3	506
656	Yenigun	Function	96	4614	29M3	510
657	Yenigun	Floor Increase	97	5816	29M4	555
658	Yenigun	Floor Increase	97	1544	28M1	546
659	Yenigun	Floor+Structure Straight	98	73562	28M2	125
660	Yenigun	Removing Green+Floor Increase	98	8060	29M4	533
661	Yenigun	Other	95	2834	28M1	658
662	Yenigun	Removing Green+Floor Increase	95	7361	29M4	507
663	Yenigun	Floor+Structure Straight	98	25816	28M1	126
664	Yenigun	Function	98	2749	29M3	544
665	Yenigun	Remain Green	95	5184	29M3	523
666	Yenigun	Floor Increase	95	7729	29M4	520
667	Yenigun	Remain Green	88	1480	28M2	164
668	Yenigun	Other	87	16419	28M1	365
669	Yenigun	Other	87	8280	28M1	367
670	Yenigun	Other	87	42034	28M2	369
671	Yenigun	Other	87	12059	28M1	373
672	Yenigun	Other	88	6235	29M4	297
673	Yenigun	Function	87	5461	29M4	252
674	Yenigun	Removing Green+Floor Increase	90	12860	29M4	169
675	Yenigun	Other	88	6294	29M4	212
676	Yenigun	Other	87	6313	28M1	364
677	Yenigun	Floor Increase	88	42203	29M3	160
678	Yenigun	Floor+Structure Straight	87	20509	28M1	136
679	Yenigun	Other	87	23457	28M1	131
680	Yenigun	Floor Increase	86	12350	29M4	100
681	Yenigun	Other	87	34590	28M1	18
682	Yenigun	Other	89	7527	28M2	30
683	Yenigun	Floor Increase	86	17538	29M3	388

Table A.1 (Cont)

684	Yenigun	Remain Green	87	17023	29M3	48
685	Yenigun	Floor Increase	94	1677	29M4	698
686	Yenigun	Removing Green+Floor Increase	91	8800	29M4	604
687	Yenigun	Other	90	434	28M1	356
688	Yenigun	Remain Green	90	4042	29M4	321
689	Yenigun	Structure Straight	90	4266	28M2	166
690	Yenigun	Other	87	23306	28M2	45
691	Yenigun	Remain Green	87	32230	29M4	345
692	Yenigun	Other	90	6066	28M1	56
693	Yenigun	Other	87	5619	28M1	358
694	Yenigun	Other	90	1604	29M4	44
695	Yenigun	Function	89	40376	28M2	460
696	Yenigun	Other	89	10974	29M4	453
697	Yenigun	Other	87	7409	28M2	446
698	Yenigun	Other	88	45207	28M2	385
699	Yenigun	Floor Increase	87	8246	28M1	381
700	Yenigun	Other	94	2646	28M2	650
701	Yenigun	Removing Green+Floor Increase	86	9337	29M4	5

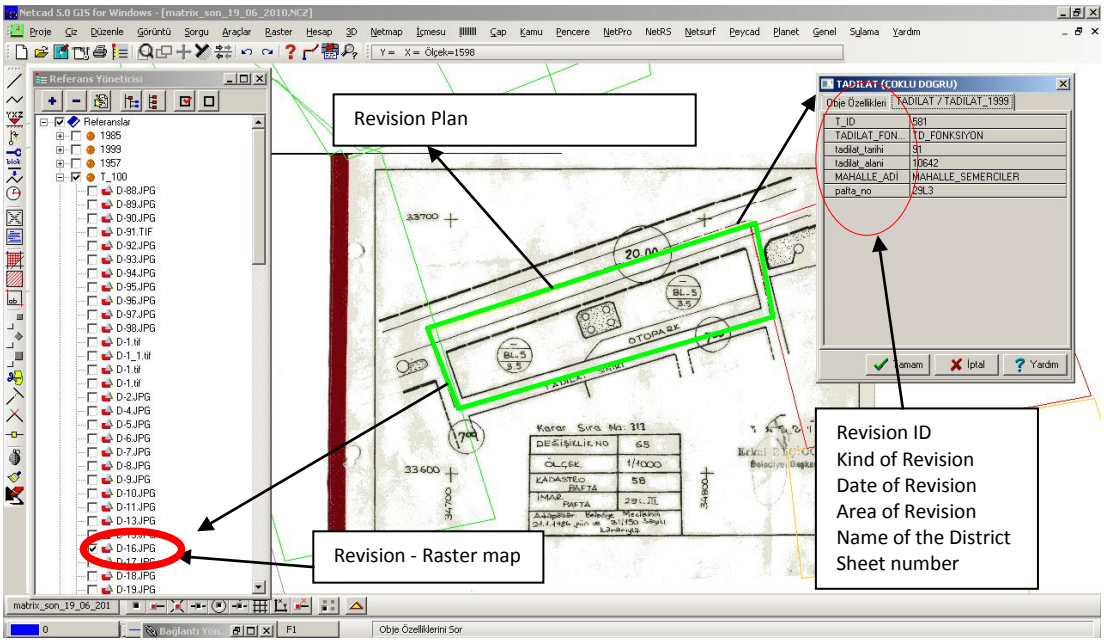


Figure A.1 Preperation of Database for Revision

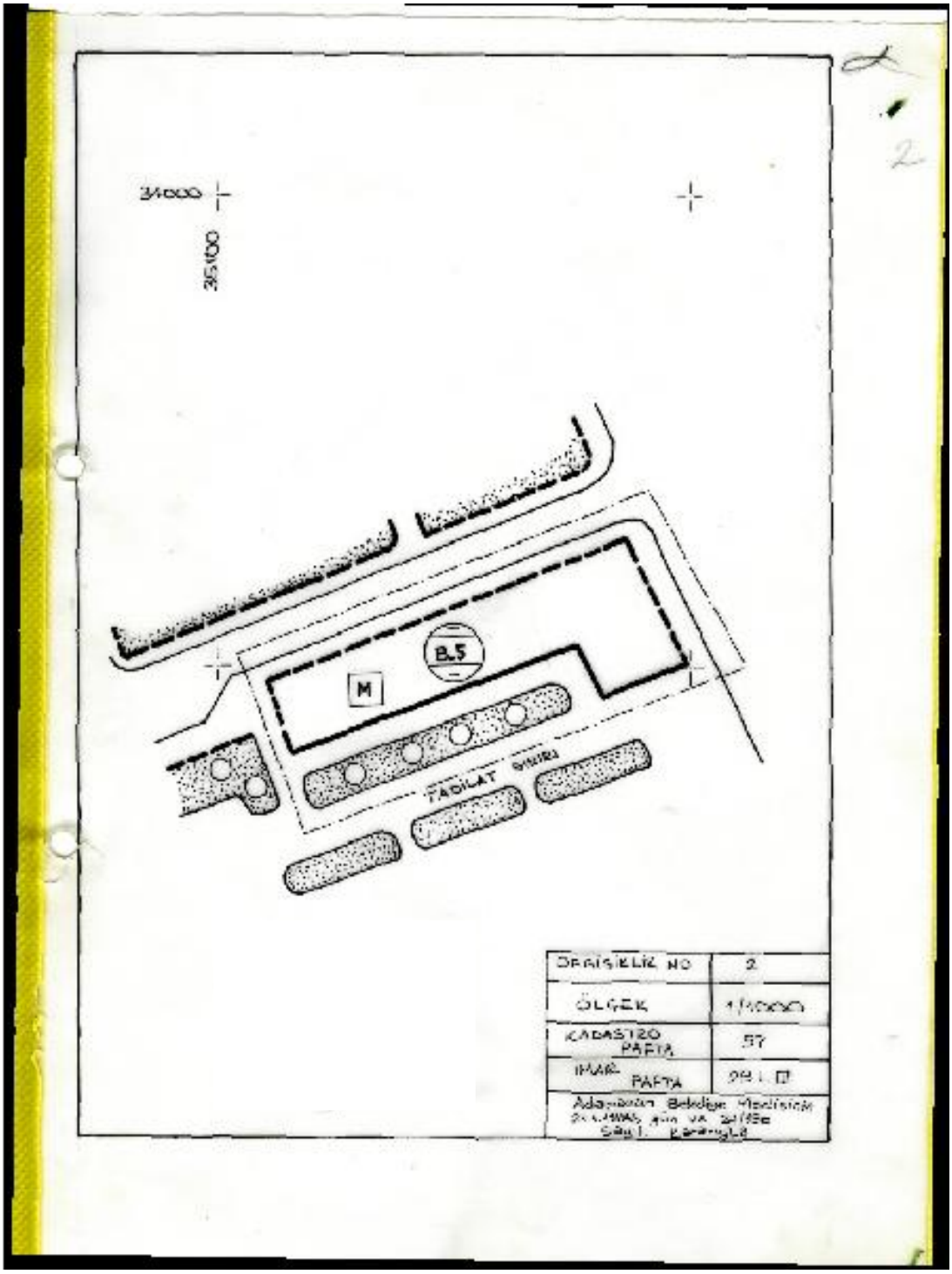


Figure A.2 Example of Revision in 1986 (Remine Green)

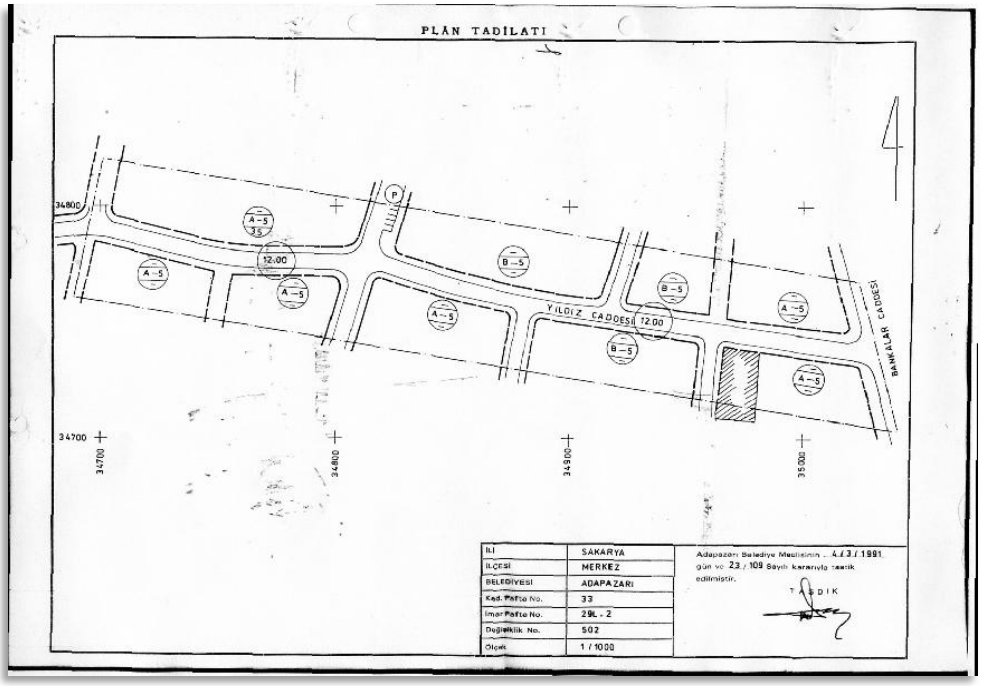


Figure A.3 Example of Revision in 1991 (Increase in Floor)

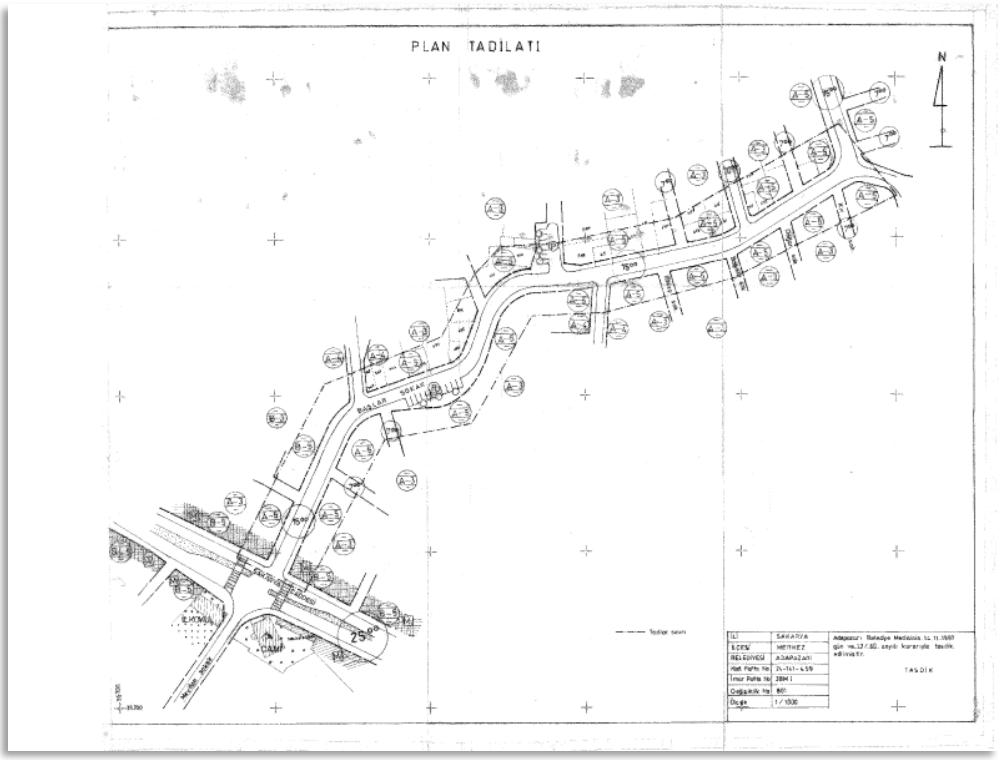
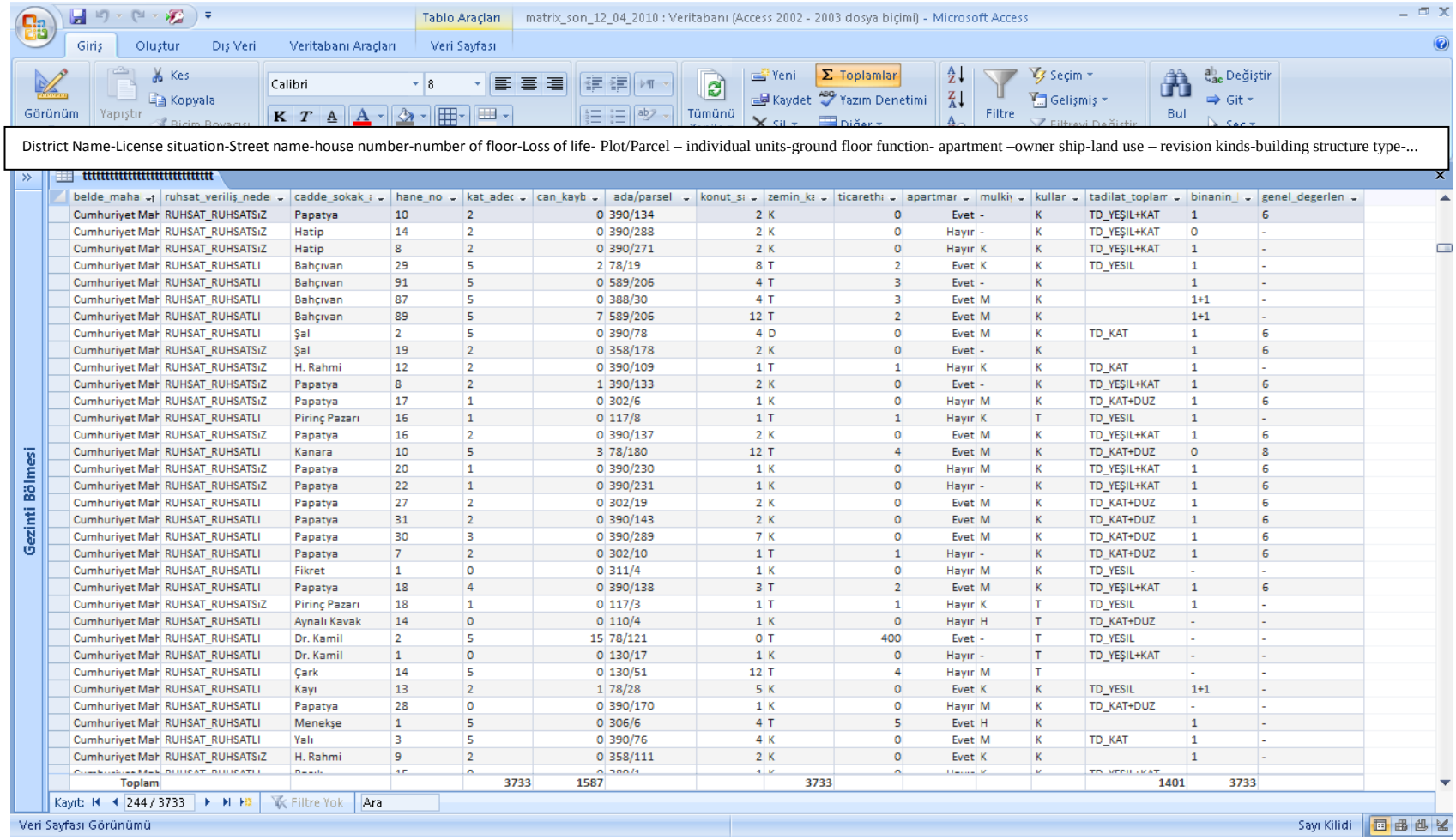


Figure A.4 Example of Revision in 1994 (Increase in Floor)



belde_maha	ruhsat_veriliş_nede	cadde_sokak_i	hane_no	kat_adec	can_kayb	ada/parsel	konut_si	zemin_ka	ticarethi	apartmar	mulkiy	kullar	tadilat_toplam	binanin_	genel_degerlen
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	10	2	0	390/134	2	K	0	Evet	-	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Hatip	14	2	0	390/288	2	K	0	Hayır	-	K	TD_YEŞIL+KAT	0	-
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Hatip	8	2	0	390/271	2	K	0	Hayır	K	K	TD_YEŞIL+KAT	1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Bahçıvan	29	5	2	78/19	8	T	2	Evet	K	K	TD_YESIL	1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Bahçıvan	91	5	0	589/206	4	T	3	Evet	-	K		1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Bahçıvan	87	5	0	388/30	4	T	3	Evet	M	K		1+1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Bahçıvan	89	5	7	589/206	12	T	2	Evet	M	K		1+1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Şal	2	5	0	390/78	4	D	0	Evet	M	K	TD_KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Şal	19	2	0	358/178	2	K	0	Evet	-	K		1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	H. Rahmi	12	2	0	390/109	1	T	1	Hayır	K	K	TD_KAT	1	-
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	8	2	1	390/133	2	K	0	Evet	-	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	17	1	0	302/6	1	K	0	Hayır	M	K	TD_KAT+DUZ	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Pirinç Pazarı	16	1	0	117/8	1	T	1	Hayır	K	T	TD_YESIL	1	-
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	16	2	0	390/137	2	K	0	Evet	M	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Kanara	10	5	3	78/180	12	T	4	Evet	M	K	TD_KAT+DUZ	0	8
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	20	1	0	390/230	1	K	0	Hayır	M	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Papatya	22	1	0	390/231	1	K	0	Hayır	-	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	27	2	0	302/19	2	K	0	Evet	M	K	TD_KAT+DUZ	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	31	2	0	390/143	2	K	0	Evet	M	K	TD_KAT+DUZ	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	30	3	0	390/289	7	K	0	Evet	M	K	TD_KAT+DUZ	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	7	2	0	302/10	1	T	1	Hayır	-	K	TD_KAT+DUZ	1	6
Cumhuriyet Mah	RUHSAT_RUHSATLI	Fikret	1	0	0	311/4	1	K	0	Hayır	M	K	TD_YESIL	-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	18	4	0	390/138	3	T	2	Evet	M	K	TD_YEŞIL+KAT	1	6
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	Pirinç Pazarı	18	1	0	117/3	1	T	1	Hayır	K	T	TD_YESIL	1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Aynalı Kavak	14	0	0	110/4	1	K	0	Hayır	H	T	TD_KAT+DUZ	-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Dr. Kamil	2	5	15	78/121	0	T	400	Evet	-	T	TD_YESIL	-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Dr. Kamil	1	0	0	130/17	1	K	0	Hayır	-	T	TD_YEŞIL+KAT	-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Çark	14	5	0	130/51	12	T	4	Hayır	M	T		-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Kayı	13	2	1	78/28	5	K	0	Evet	K	K	TD_YESIL	1+1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Papatya	28	0	0	390/170	1	K	0	Hayır	M	K	TD_KAT+DUZ	-	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Menekşe	1	5	0	306/6	4	T	5	Evet	H	K		1	-
Cumhuriyet Mah	RUHSAT_RUHSATLI	Yalı	3	5	0	390/76	4	K	0	Evet	M	K	TD_KAT	1	-
Cumhuriyet Mah	RUHSAT_RUHSATSIZ	H. Rahmi	9	2	0	358/111	2	K	0	Evet	K	K		1	-
Toplam				3733	1587			3733					1401	3733	

Figure A.5 Prepared Database Result

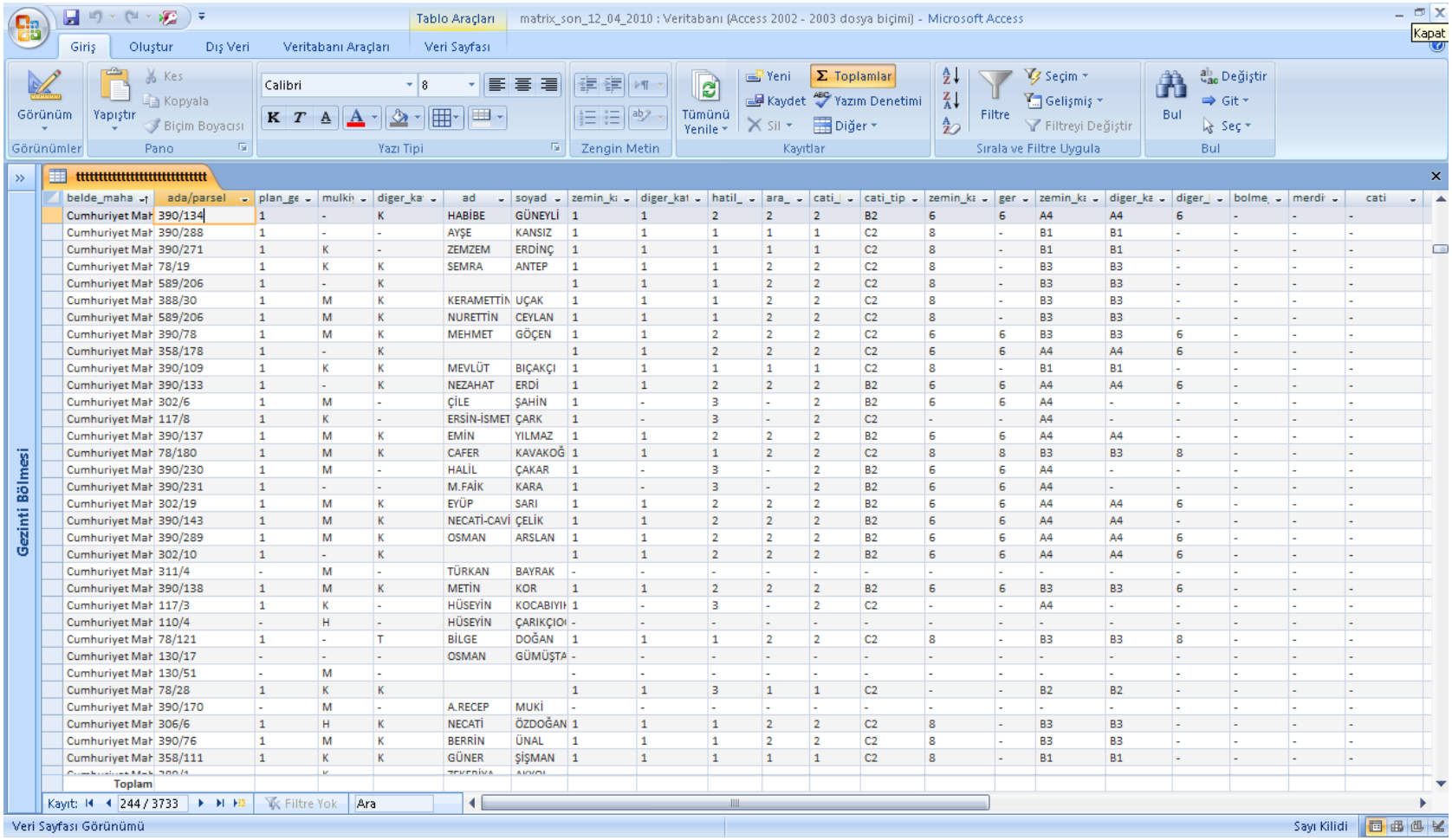


Figure A.5 (cont.)

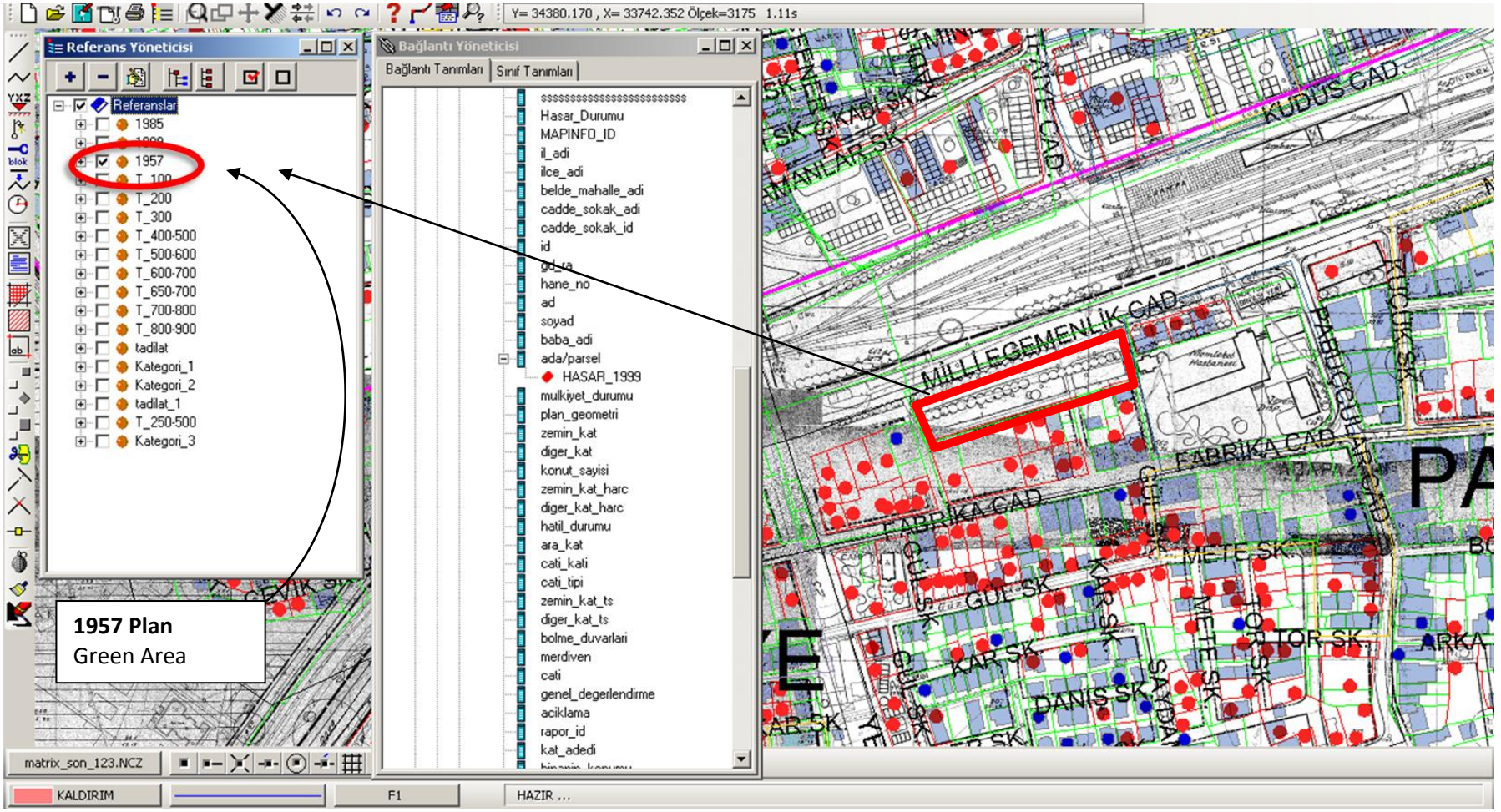


Figure A.6 An Example Of Database interrogation (GIS) for Collapsed Buildings

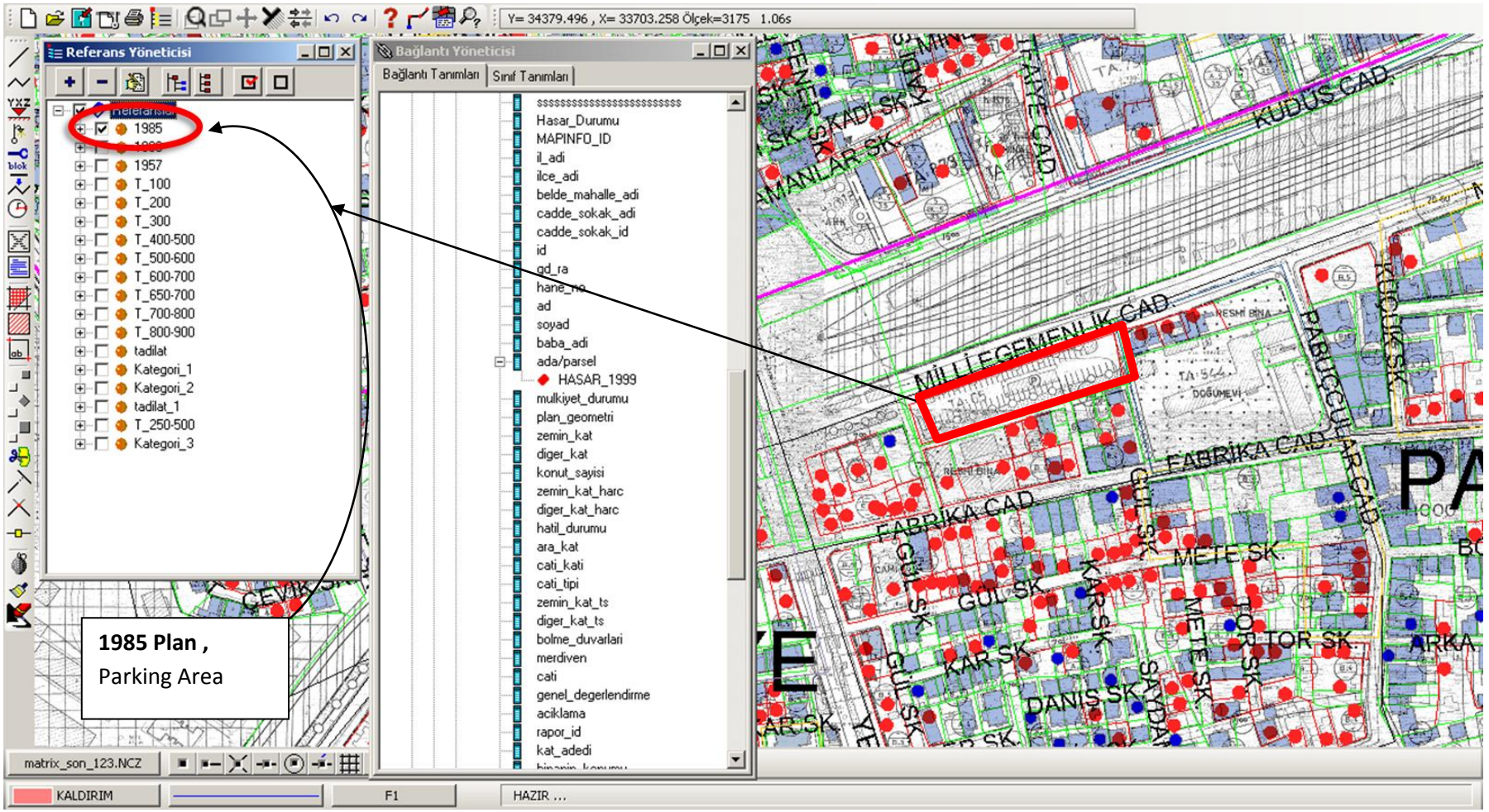


Figure A.6 (cont.)

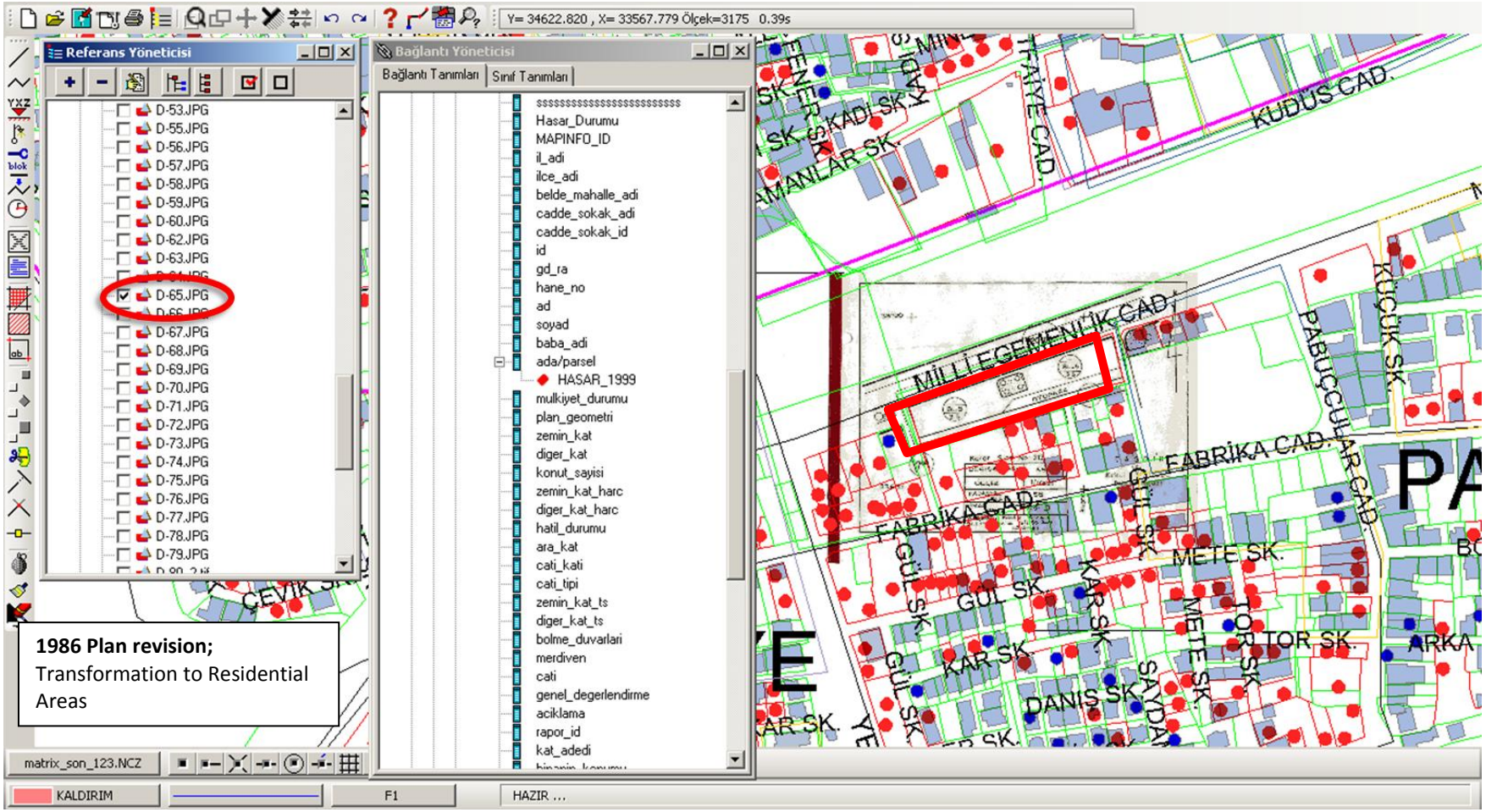


Figure A.6 (cont.)

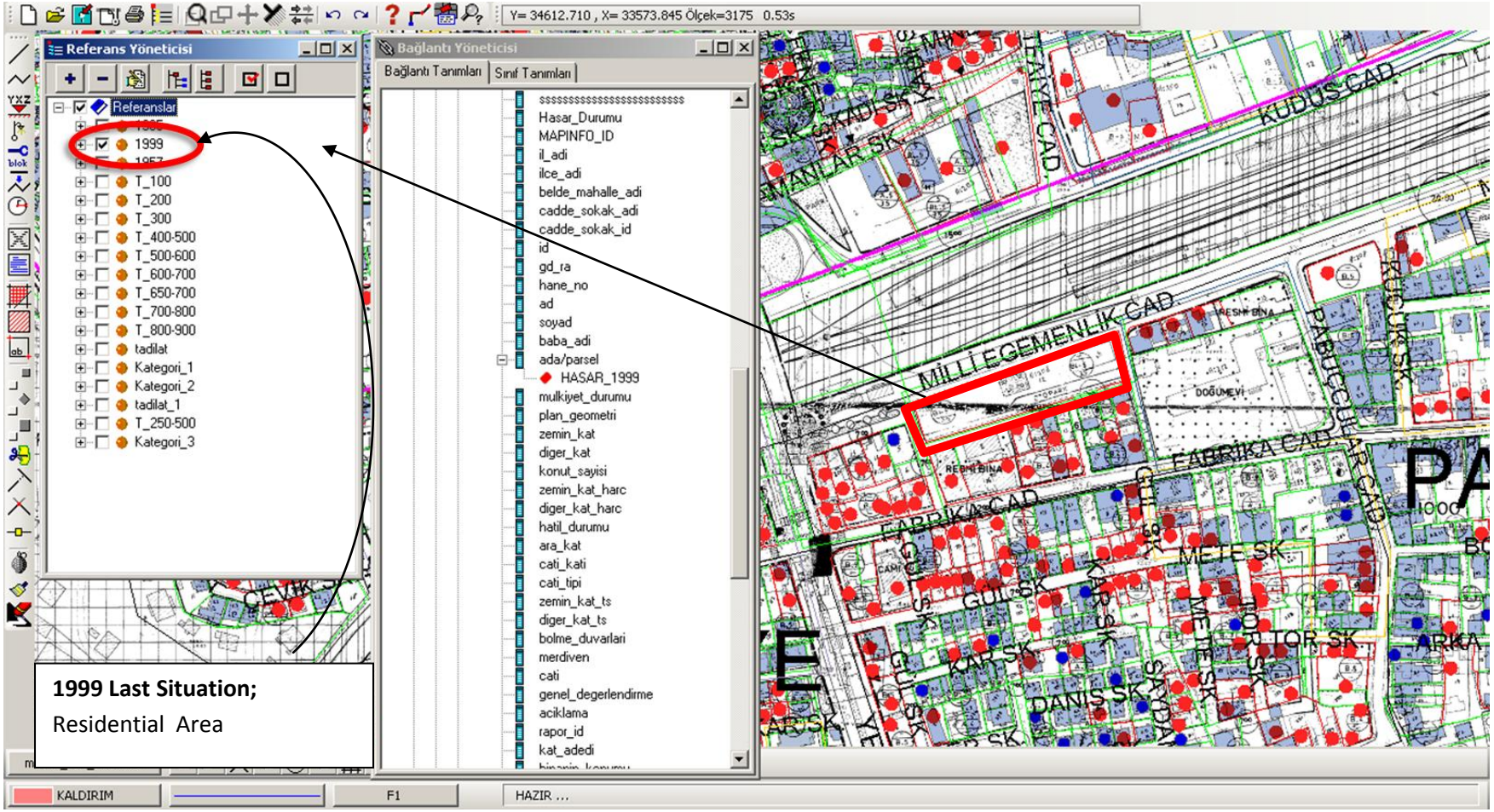


Figure A.6 (cont.)

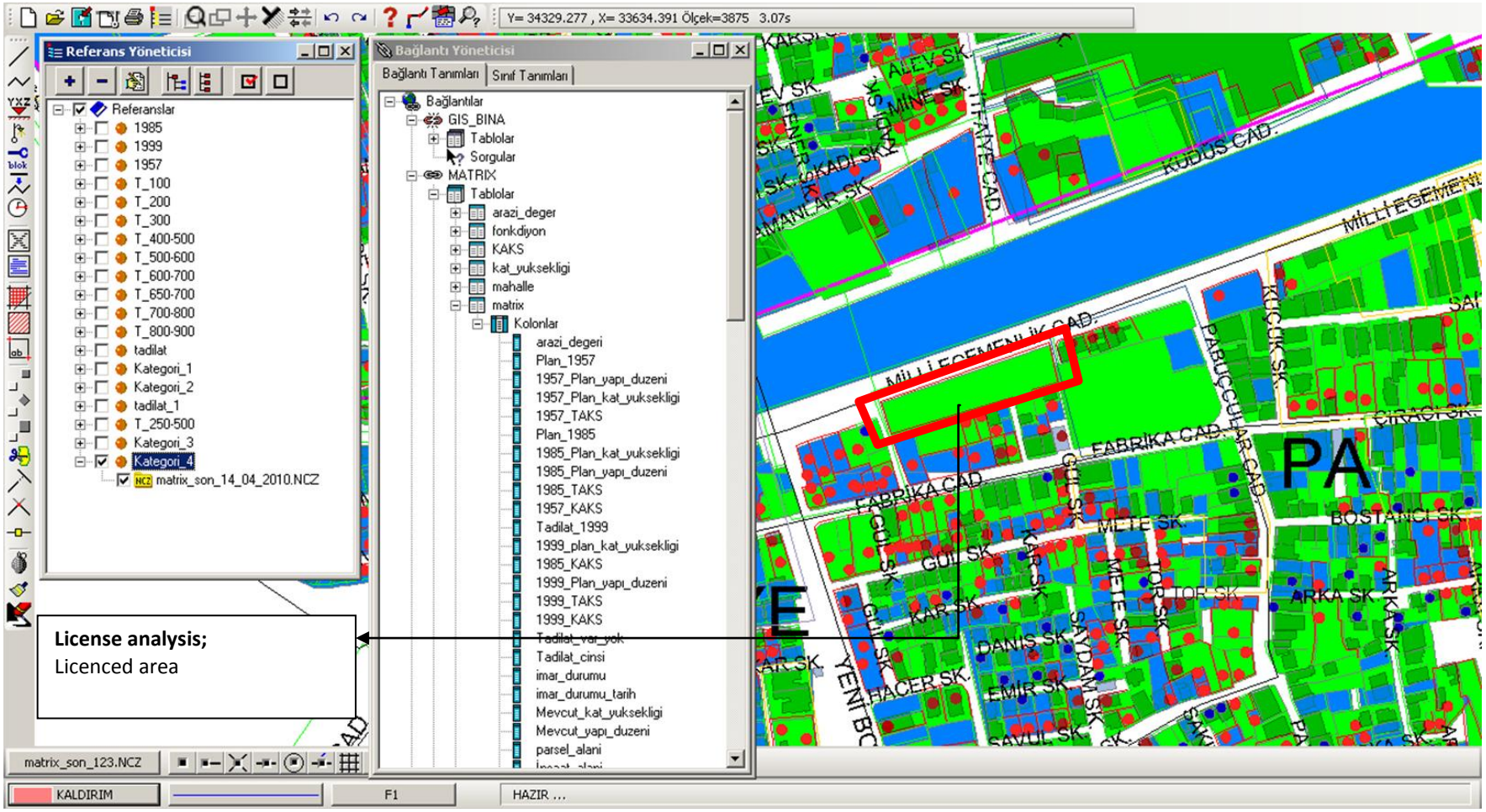


Figure A.6 (cont.)

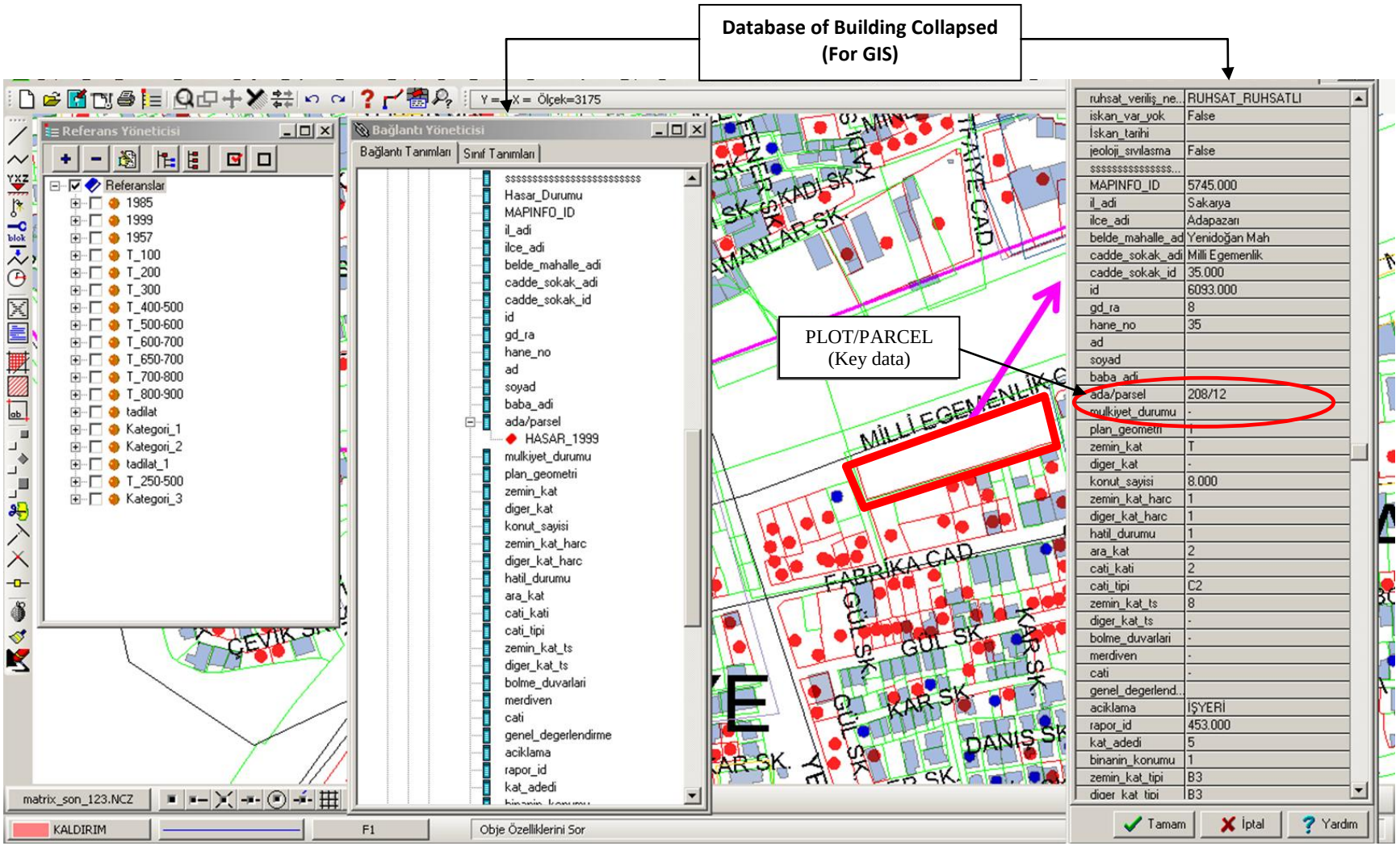


Figure A.6 (cont.)

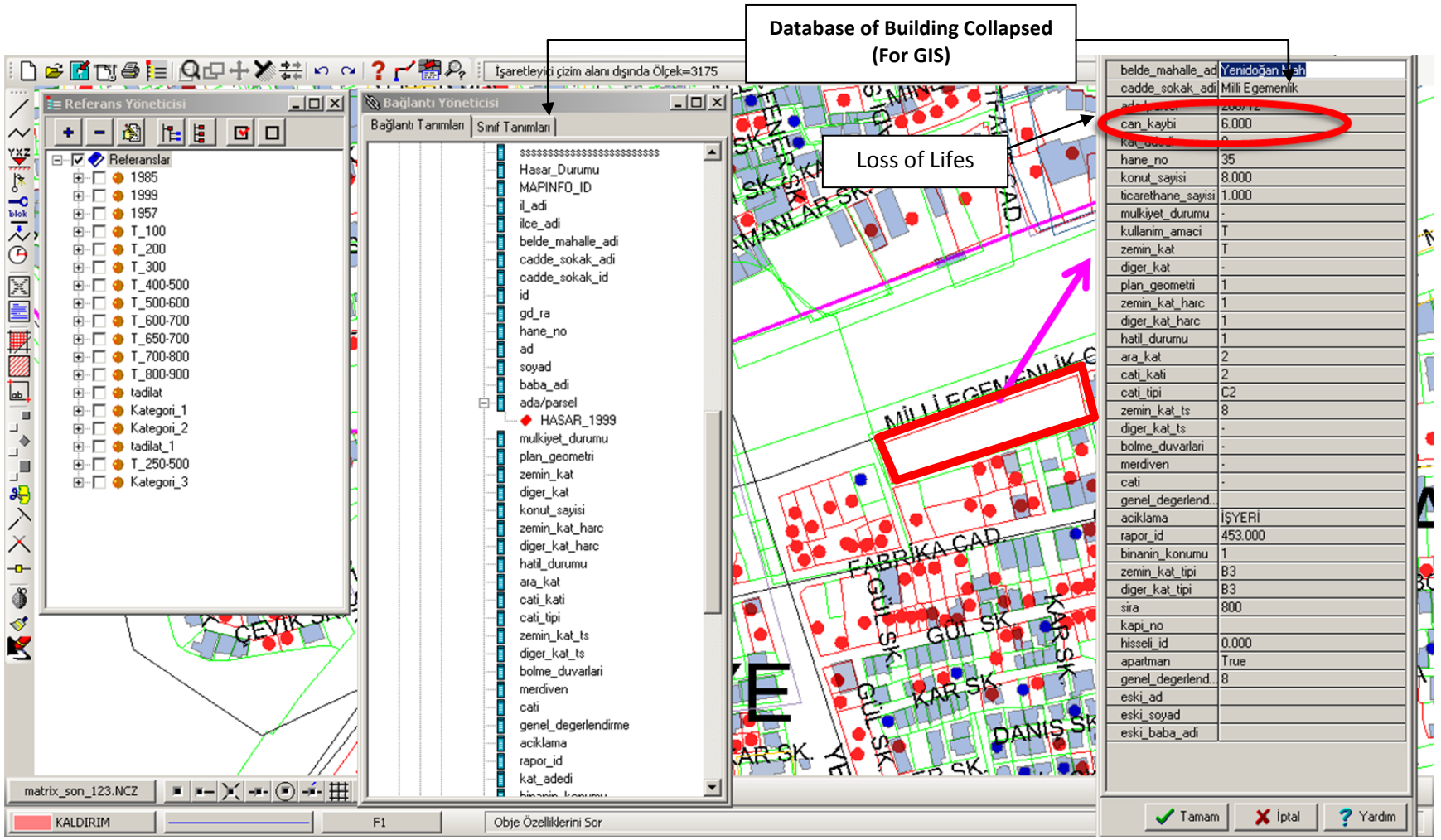


Figure A.6 (cont.)