SEISMIC VULNERABILITIES AND RISKS FOR URBAN MITIGATION PLANNING IN TURKEY

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ABSTRACT

SEISMIC VULNERABILITIES AND RISKS FOR URBAN MITIGATION PLANNING IN TURKEY

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Chronic seismic hazards and resulting secondary impacts as natural conditions of the country, and loss of robust building and prudent settlement practices as aggravated by rapid population growth make cities the most vulnerable geographical and social entities in Turkey. In contrast, Turkish disaster policy is solely focused on post-disaster issues and no incentives or provision exist to encourage risk analysis or risk mitigation approaches, despite current international efforts.

For the development of risk reduction policies an essential step is to prioritize settlements according to their vulnerability levels. This could be determined by hazard probabilities and attributes of the building stock of each settlement. Measurement of vulnerability levels allows the ordering of settlements into risk categories.

Vulnerability levels of settlements are then assumed to depend on a number of attributes of cities to explore if vulnerability could be related to a set of urban properties. Results of statistical analyses indicate that total building loss is related to the ratio of population over the total number of buildings in mid-range settlements, and directly related to population in metropolitan cities. Relative loss on the other hand is related with rate of agglomeration and development index in almost every size category of settlements.

Observations provide guiding principles for effective mitigation practices in Turkey by ordering settlements and offer means of differential implementation. These could contribute to improved safety measures in urban standards, building codes, building supervision procedures, insurance systems, investment priorities, and Law (6306) on Redevelopment of Areas under Disaster Risk.

Keywords: Urban Seismic Risk, Seismic Vulnerabilities, Mitigation Planning, Risk Assessment, Mitigation Policies

ÖZ

TÜRKİYE'DE SAKINIM PLANLAMASI İÇİN KENTSEL YERLEŞMELERİN SİSMİK ZARAR GÖREBİLİRLİKLERİNİN VE RİSKLERİNİN BELİRLENMESİ

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Türkiye, jeolojik konumu ve yetersiz yasal düzenlemeleri nedeniyle kronik sismik tehlikeler ve ağır sonuçları olan afetlerle karşı karşıyadır. Yerleşimlerin yer seçiminde yapılan yanlışlıklar, altyapının plansız olması, yapı stokunun yapım aşamasında ve sonrasında denetlenmemesi ile yaratılan kalitesiz yapılaşma gibi nedenler de afetler sonucunda yaşanan can ve mal kayıplarını artırmıştır. Tüm bu bileşenler Türkiye'de şehirleri coğrafi ve sosyal açıdan zarar görebilir duruma getirmiştir. Yüksek risklere sahip Türkiye'de uluslar arası politika değişikliklerine büyük ölçüde yabancı kalınmış, sakınım alanında yetersiz ve yanlış uygulamalara girilmiş ve afet politikaları afet-sonrası çalışmaları odaklanmıştır.

Çalışma kapsamında yerleşimlerin zarar görebilirlik önceliklerine göre sıralanması sakınım politikalarının geliştirilebilmesi açısından en temel adım olarak belirlenmiştir. Yerleşimlerin zarar görebilirliklerin belirlenmesi amacıyla bir yandan tehlike olasılıkları ve bundan doğan kayıplar düzeyi incelenirken, diğer yandan yerleşimlerin temel özellikleri ve bina stoku değişkenleri ile bunların kayıplar düzeyine olan etkileri incelenmiştir. Elde edilen zarar görebilirlik değerleri yerleşimlerin önceliklerine göre sıralanmasında kullanılmıştır.

Zarar görebilirlik seviyelerinin yerleşimlerin hangi özellikleri ile ilişkili olduğu belirlemek amacıyla istatistiksel analizler yapılmıştır. İstatistiksel analizlerin sonuçları incelendiğinde; toplam bina kaybının orta büyüklükteki yerleşimlerde nüfusun toplam bina sayısına oranı ile büyükşehirlerde ise nüfus ile doğrudan ilişkili olduğu, bina kaybının bina stokuna oranının ise tüm yerleşim gruplarında kentleşme oranı ve gelişme indeksi ile ilişkili olduğu görülmektedir.

Çalışmanın sonuçları daha etkili sakınım politikaları geliştirmek için yerleşimlerin zarar görebilirliklerine göre sıralanması ve bu sıralamaya göre farklı uygulamalar yapılması konularında yol gösterici nitelik taşımaktadır. Kentsel standartların geliştirilmesi, yapı yönetmelikleri ve denetim süreçleri, sigorta sistemleri, yatırım öncelikleri ve Afet Riski Altındaki Alanların Dönüştürülmesi (6306) Kanunu konularında ise sakınım politikalarına katkı sağlamaktadır.

Anahtar Kelimeler: Kentsel Sismik Risk, Sismik Zarar Görebilirlik, Sakınım Planlaması, Risk Değerlendirme, Sakınım Politikaları

To My Parents

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LIST OF ABBREVIATIONS

ADPC	Asian Disaster Preparedness Centre
AEL	Annualized Earthquake Loss
AELR	Annualized Earthquake Loss Ratio
AFDB	African Development Bank
CGS	California Geological Survey
CRED	Centre for Research on the Epidemiology of Disasters
DMA-2000	Disaster Mitigation Act of America
DRM	World Institute for Disaster Risk Management
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database
EMPI	Earthquake Master Plan of Istanbul (Istanbul Deprem Master Planı - IDMP)
EMS	European Macro Seismic Scale
FEMA	Federal Emergency Management Agency
GAR	Global Assessment Report on Disaster Risk Reduction
GDCD	General Directorate of Civil Defense (Sivil Savunma Genel Müdürlüğü - SSGM)
GDDA	General Directorate of Disaster Affairs (Afet İşleri Genel Müdürlüğü - AIGM)
HAZUS	Hazards United States
IATF/DR	Inter-Agency Task Force on Disaster Reduction
ICPD	International Conference on Population and Development
IDNDR	International Decade for Natural Disaster Reduction
IFRC	International Federation of Red Cross and Red Crescent Societies
ISDR	International Strategy for Disaster Reduction

ISMEP	Istanbul Seismic Risk Mitigation and Emergency Preparedness Project
JICA	Japan International Cooperation Agency
KOERI	Kandilli Observatory and Earthquake Research Institute (Kandilli Rasathanesi ve Deprem Araştırma Enstitüsü)
LESSLOSS	Risk Mitigation for Earthquakes and Landslides Project
MDG	Millennium Development Goals
MEU	Ministry of Environment and Urbanism
MSK	Medvedev – Sponheuer - Karnik Scale
NAF	North Anatolian Fault Line (Kuzey Anadolu Fay Hattı - KAF)
NGO	Non-governmental Organization (Sivil Toplum Örgütleri - STK)
PGA	Peak Ground Acceleration
R-Sq (adj.)	Adjusted R-Square
SEDI	Socio-Economic Development Index
SPO	State Planning Organization
TCIP	Turkish Catastrophe Insurance Pool (Doğal Afet Sigortalar Kurumu - DASK)
TEFER	Turkey Emergency Flood and Earthquake Recovery
TEMAD	Turkish Emergency Management General Directorate (Türkiye Acil Durum Yönetimi Genel Müdürlüğü - TAY)
TURKSTAT	Turkish Statistical Institute (Türkiye İstatistik Kurumu - TÜİK)
UCTEA	Union of Chambers of Turkish Engineers and Architects (Türk Mühendis ve Mimar Odaları Birliği - TMMOB)
UN	United Nations
UN/ISDR	United Nations Inter-Agency Secretariat for the ISDR
UNDP	United Nations Development Program
USGS	United States Geological Survey

WCDR	Word Conference on Disaster Reduction
WSSD	World Summit for Social Development
WSSD	World Summit on Sustainable Development

CHAPTER 1

VULNERABILITIES AND RISKS IN SETTLEMENTS

Over the past decade, countries across the world have witnessed thousands of major natural disasters that threaten the sustainability of cities, disrupting their resources and affecting millions of people through losses of life, serious injury and loss of assets and livelihoods. The number of reported natural disasters and their impact on human and economic development worldwide has been increasing yearly and shows a relentless upward movement. The well-known statistical analysis of the Munich-Re Geo Risk Research Group shows a threefold increase in the occurrence of extreme natural hazard events and an approximately sixfold increase in associated economic damages over the last three decades.

As shown in the Figure 1.1; the number of reported disasters in 2010 (385) approximated the annual average disaster occurrence during 2000 to 2009 (387). Besides, the number of victims increased from 198.7 million in 2009 to 217.3 million in 2010.

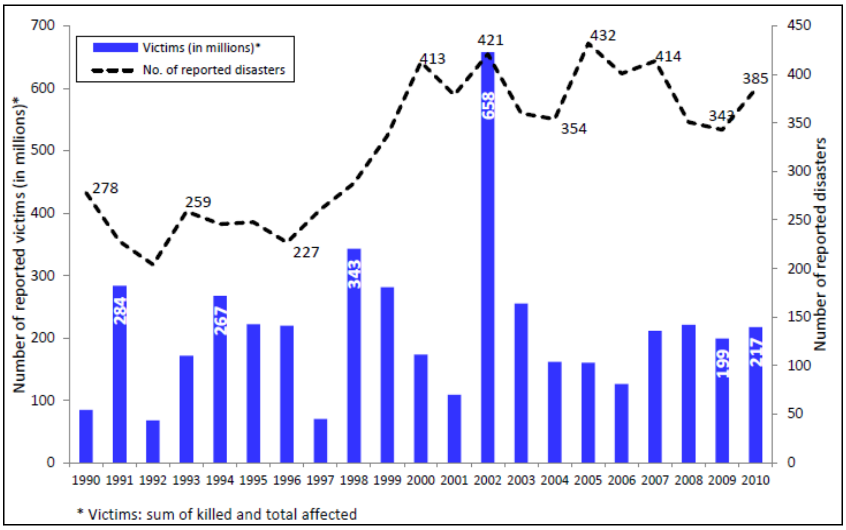


Figure 1.1 Trends in Occurrence and Victims
(Source: CRED, 2010)

These trends especially in urban areas underline the need for still more efforts and more focused disaster risk management and reveal the necessity to recognize risk, make people aware of and prepared to live with risk (Bogardi, 2006).

"The ongoing impacts of disasters have contributed to an increasing perception of human vulnerability to multiple hazards that can negatively impact assets and livelihoods among many people in many places around the world. As a result, there is increasing interest in how to build resilience to multiple hazards/risks at individual, household, community, local, national and international levels" (Siegel, 2011).

According to McEntire (2001) our attitude toward disasters has evolved from a fatalistic fear of 'Acts of God' to a broader understanding of the role human decisions play in determining our vulnerability and capacity to cope with the consequences of extreme events. In fact, we can say that there has been a major paradigm shift in the development community to increasingly focus attention on causes of human vulnerability and on building resilience. In other words the paradigm shifts from relief and response to mitigation, risk assessment and disaster risk management.

Today, there is increasing recognition that risk and vulnerability are crucial elements in reducing the negative impacts of hazards and thus essential to the achievement of sustainable development. This makes natural disaster risk reduction and mitigation ranks among the top 10 most important and urgent global issues of the twenty-first century.

As the number of events and the losses from disasters are increasing worldwide, natural disaster events occurred in Turkey are increasing as well. When we examine the natural disaster profile of Turkey we can easily say that "Turkey is a disaster-prone country and has always been vulnerable to various kinds of natural hazards, because of its geology, topography and meteorological conditions. These hazards, coupled with high physical and social vulnerability, have caused excessive losses of life, injury and damage to property" (Jica, 2004).

According to the Summarized Table of Natural Disasters in Turkey; 151 natural disaster events occurred in Turkey since 1900 and these disasters can be classified in seven groups as earthquakes, epidemic, extreme temperature, flood, slides, storms and wild fires. As a result of these disaster events; 91.431 people lost their lives, 8.902.008 people affected and the total damage is 25 billion USD.

The statistics of number of events, death ratios and all the other values exposed that earthquakes are far and away in the first place and the biggest portion of the losses is related to the earthquakes. This portion is 48.3% of events, 96.9% of deaths, 77.3% of affected people and 91.2% of total damage.

Table 1.1 Summarized Table of Natural Disasters in Turkey from 1900 to 2011 (Source: EM-DAT, 2011)

	Number of Events	Killed	Total Affected	Damage US$ (000's)
Earthquake	73	88.589	6880841	22941400
Epidemic	8	613	204855	0
Extreme Temp.	7	100	8450	1000
Flood	37	1.321	1778517	2195500
Slides	12	693	14556	26000
Storm	9	100	13639	
Wild Fires	5	15	1150	2200

As seen above, the disaster history of Turkey is dominated by earthquakes and earthquake is a synonym with the concept of disaster in Turkey.

Therefore, the United Nations Development Program (2004) announced Turkey as the third country according to the number of deaths as a result of earthquakes (See Figure 1.2) and Global Assessment Report on Disaster Risk Reduction (2009) identified Turkey in high risk class according to mortality risk for earthquakes (See Figure 1.3).

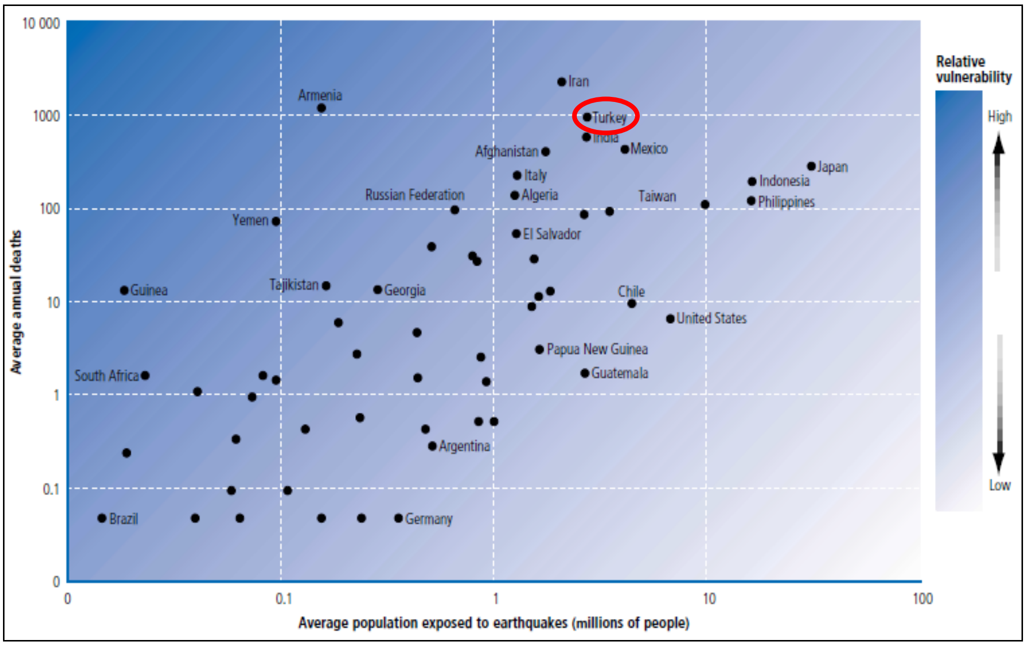


Figure 1.2 Relative Vulnerability for Earthquakes 1980-2000
(Source: UNDP, 2004)

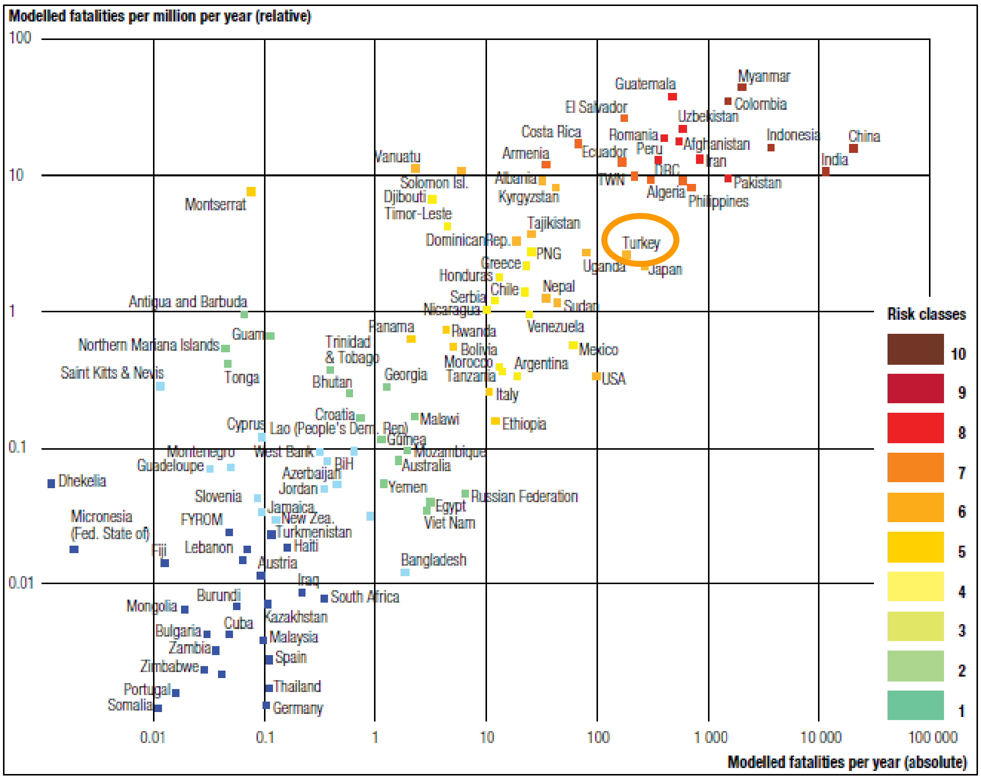


Figure 1.3 Absolute and Relative Mortality Risk for Earthquakes
(Source: GAR, 2009)

1.1. Hazards, Vulnerabilities and Risks in World Cities and in Turkey

As the social and economic effects of natural disasters have been rising in its multiples, an increasing number of hazards and risk researches from several different disciplines in earth, engineering and social sciences have contributed to our current knowledge of disasters and their management.

"However, this multiple exploration is based on different theoretical approaches and definitions. Scholars and practitioners of the hazards and disaster research use the terms hazard, vulnerability, risk and disaster, in multiple ways" (Gencer, 2007). Therefore, these concepts can be defined in a number of ways according to the relevant field, specific application on situational contexts. Although all of these definitions are acceptable, the most comprehensive and relevant definitions about these concepts for our field of thesis is made by United Nations International Strategy for Risk Reduction (UNISDR).

UNISDR Terminology on Disaster Risk Reduction (2009) defines;

Hazard as "A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage".

Hazards can be divided into two categories as natural hazards and human-made hazards. Natural hazards are natural processes or phenomena that may constitute a damaging event like earthquakes, cyclones, floods, landslides and storms. Human-made hazards include dangers originating from technological or industrial accidents, dangerous procedures or infrastructure failures (industrial pollution, nuclear activities and industrial or technological accidents…). It is important to understand that the hazard itself does not result in a disaster.

Vulnerability as "The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard"

Different aspects of vulnerability can be grouped into four categories as physical, social, economic and environmental vulnerabilities, which all categories interact with each other and increase the susceptibility of a community to the impact of hazards.

"Societies need to measure their vulnerabilities in advance and make adequate provisions. In order to do this they have to understand the complex relationships between natural hazards and the related social, economic and environmental vulnerabilities. Recognizing and measuring vulnerabilities is the first and perhaps most important step towards disaster resilient societies" (Bogardi, 2006).

Risk as "The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions".

"The risk of disaster is a compound function of the natural hazard and the number of people, characterized by their varying degrees of vulnerability to that specific hazard, who occupy the space and time of exposure to the hazard event. There are three elements here: hazard, vulnerability and risk" (Wisner et al., 2003).

Conventionally the relation between these elements is expressed by the notation;

Risk = Hazard x Vulnerability
(a probability) (value of likely losses)

As is seen above, risk is the probability that a hazard will turn into a disaster and we can easily say that vulnerability and hazards are not dangerous, taken separately. But if they come together, they become a risk or, in other words, the probability that a disaster will happen (Greene, 2000). Accordingly, two communities located in hazard-prone areas with similar physical settings cannot be described as equal in risk if they differ in their vulnerabilities to the hazard.

The United Nation report (2004) on world urbanization prospects projects that more than 50 percent of the world's population will be dwelling in cities and almost all the growth of the world's population between 2000 and 2030 is expected to be absorbed by the urban areas of less developed regions. This is a clear indication of "the world is steadily becoming urban" (Boulle et al., 1991).

"Urbanization process increases vulnerability to natural disasters through the concentration of people and assets" (Quarantelli 2003). The increasing urban risk results in vicious circle of disasters affecting urbanization and urbanization affecting disasters (Pelling 2003).

By their nature, cities are particularly vulnerable to natural hazards. Many of the elements that define cities also contribute to their vulnerability. One of the key elements to reduce disaster risk is to better understand how urban areas are at risk and how these patterns of risk differ from rural areas. "Under conventional understanding of disasters, public authorities and some of the professional approaches tend to assume that cities are only agglomerations of individual buildings and methods to achieve robust buildings would therefore suffice for seismic safety in a city. This is a misconception. Cities as distinct physical systems have their own complex functional integrity and are subject to failure should any of the sub-components receive a natural or human-made hazard impact. Cities are vulnerable in very many different ways, and manifest a multitude of risks" (Balamir, 2007).

Factors contributing to the increasing vulnerability of urban areas are a complex set of interrelated processes, including: the concentration of people and assets, the location of urban centers, the rapid growth of urban areas and unplanned urbanization, the modification of the built and natural environment through human actions, poverty and other social vulnerabilities and weak urban governance (ADPC, 2010).

"Urban stock texture, networks, distribution of land-uses, public facilities, their interaction with hazard prone locations, size of population served and many other factors have interdependent impacts on the vulnerabilities or resilience of settlements" (Prota, 2011). The risk in urban centers is compounded due to unplanned urbanization, development within high risk zones, lack of adherence to building codes, deficient urban management practices and inappropriate construction practices (Lewis and Mioch, 2005).

According to Pelling (2007), "Cities are better described as hotspots of disaster risk. Risk comes from increasing poverty and inequality and failures in governance, high population density, crowded living conditions and the residential areas close to hazardous industry or in places exposed to natural hazard".

The way in which cities are planned and built also contributes to urban vulnerability. Because resistance to natural hazards is rarely built into new construction and redundancy schemes are rarely incorporated into infrastructure, failure of a particular building or system in the event of a disaster can mean tremendous losses. "Nearsighted land-use planning puts people in harm's way, while a lack of commitment to mitigation leaves inhabitants to bear the full impact of disaster losses" (McBean and Henstra, 2003).

"Sectors of risk are distinctly manageable clusters of vulnerabilities at the city-level for which a coordinated action is necessary. Different levels of spatial units (national, regional, city, local) could have entirely different sets of vulnerability and risk definitions, definitely different from risks at the building level" (Balamir, 2007). As cities have their own complex functional integrity, they are vulnerable in very different ways and very different risk sectors. Risk sectors are areas of causal relations on specific risks according to Earthquake Master Plan of Istanbul (EMPI).

More than a dozen of city-level risk-sectors have been identified in Istanbul. Risk-Sectors of EMPI are given below;

- Risks in Macro-Form and Growth Tendencies (settlement configuration alternatives)
- Urban Fabric Risks (building height/proximity, plots, density, roads, car-parks, etc.)
- Incompatible Land-Use Risks (buildings and districts)
- Risks of Productivity Loss (industrial plants)
- Risks in the Building Stock, Infrastructure and Lifelines
- Risks in Emergency Facilities and Lifelines (hospitals, schools, etc.)
- Special Risk Areas/ Special Buildings (landslide, flooding/historic buildings)
- Risks in Hazardous Uses (LPG and petrol stations, etc.)
- Open Space Deficiency Risks

Besides these risk sectors Balamir (2009) defines some of the city level risks in Turkey as;

"Hazardous locations of cities are historically inherited but it is the manner of our urbanization and deceptively convenient reinforced concrete structures produced at unprecedented rates without supervision that make them deep risk pools. Deficient open spaces, haphazard infrastructure, dangerous neighboring, illogical locationing of emergency facilities, uncontrolled industrial units are some of the city level risks directly related to physical planning. Administrative incapabilities and inert public attitudes are almost genetically programmed."

The deficiences in urban planning and building construction systems and the factors that make these processes more vulnerable is defined by Balamir (2004) as follows. It "indicates how over the decades, the urban planning system in Turkey has been left vacuously devoid of any concern in its provisions and procedures of tools and means for maintaining seismic safety" (Balamir, 2004).

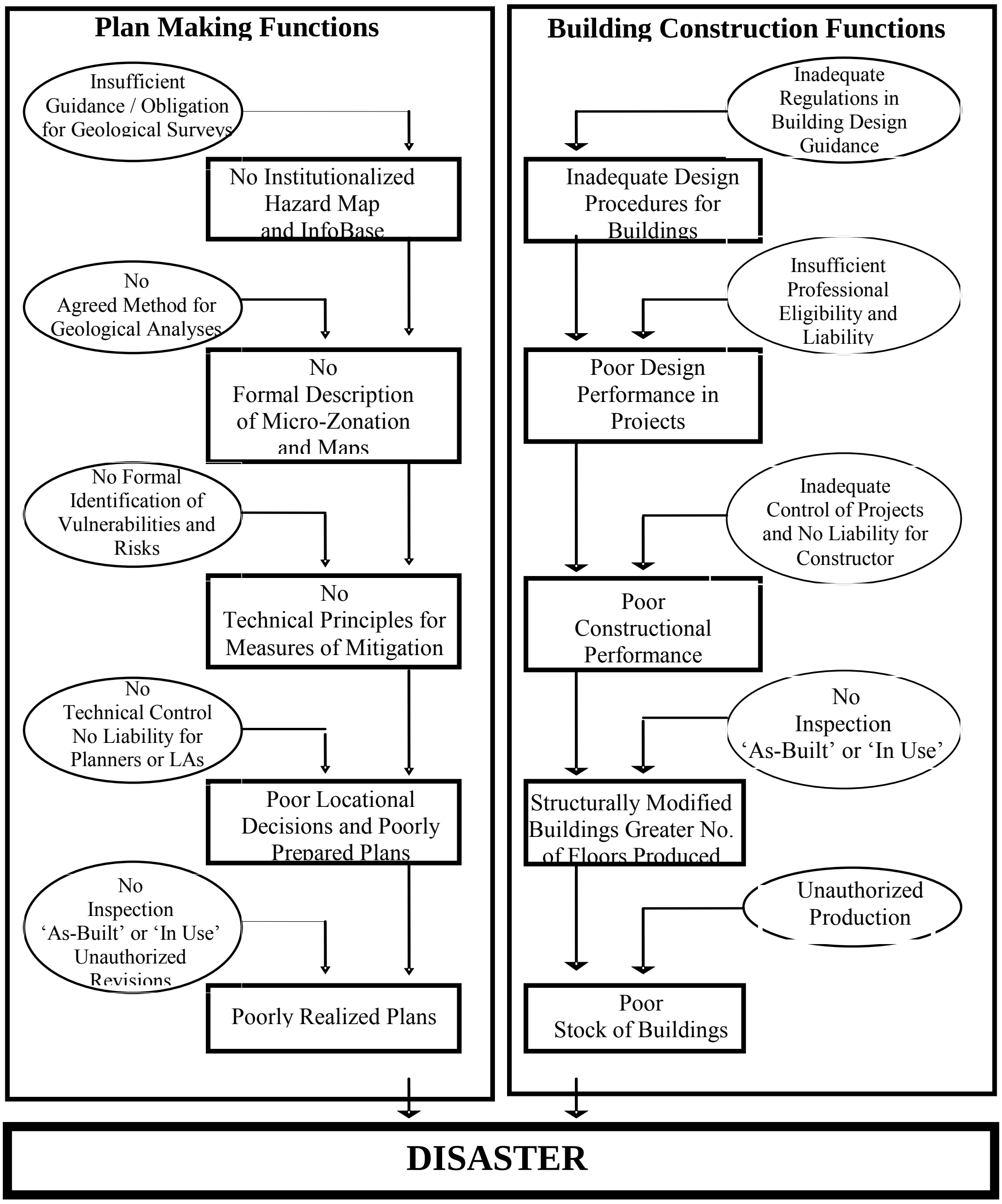


Figure 1.4 Vulnerabilities in Plan Making and Building Construction Functions (Source: Balamir, 2004)

1.2. The Need for Assessing Vulnerabilities for Policy Development and Implementation

Over the past 30 years, disaster reduction has become an increasingly important issue on the international agenda and there has been a continuous evolution in the practice of crisis or disaster management.

These bodies of practice have been known, variously, as civil defense, emergency assistance, disaster response and relief, humanitarian assistance, emergency management, civil protection, disaster mitigation and prevention and total disaster risk management.

An increase in human casualties and property damage in the 1980's motivated the United Nations General Assembly in 1989 to declare the 1990's the International Decade for Natural Disaster Reduction (IDNDR).

With the effect of this declaration, the risk concept became popular in the academic literature after 1990's and the rise of risk reduction concept begs our understanding which accompanied a phenomenal quantitative growth in references to risk.

During the 1990's, stimulated by the IDNDR, many researches dealing with risks and disasters were developed around the world. The topic gained importance and it is being increasingly recognized that the terms hazard, vulnerability and risk have had different meanings and implications from both the methodological and practical angles (Cardona, 2004).

The idea for conducting a global review of disaster reduction initiatives was born in the millennium, following the United Nations International Decade for Natural Disaster Reduction 1990-1999.

In 1999, UN decided to continue the activities on disaster prevention and vulnerability reduction carried out during the IDNDR.

It thus established the International Strategy for Disaster Reduction (ISDR), which is supported by the scientific and technical expertise and knowledge accumulated during the IDNDR.

Following this idea, a series of declarations of interest and determination to reduce risks have taken place at the international context (Balamir, 2005).

These are; World Conferences on "Risk Reduction" in Yokohama, Japan-1994, Toronto, Canada-2004 and Kobe, Japan-2005 have extended and sharpened this awareness about natural hazard risks and efforts of risk reduction on global agenda.

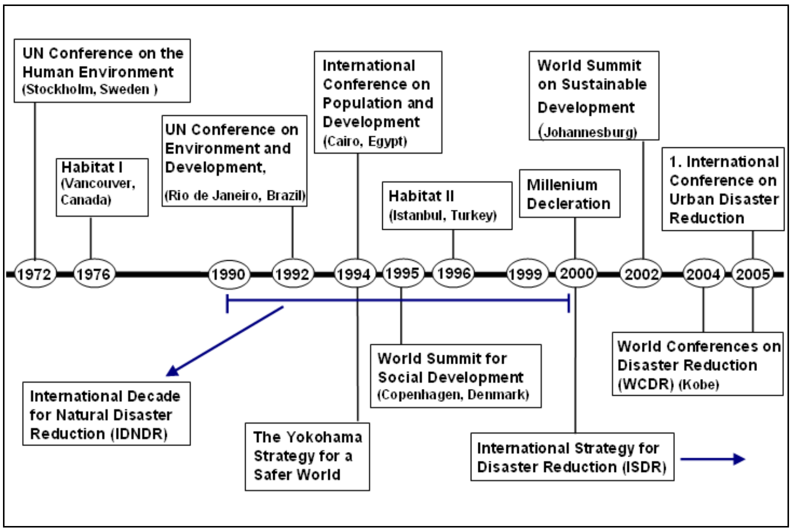


Figure 1.5 Chronology of International Disaster Management Policy Development Process

The Yokohama Strategy for a Safer World and its Plan of Action was a cornerstone point of reference for disaster reduction, comprising a range of commitments and identifying specific activities that have since served as an international blueprint in the field (Briceno, 2004). The Yokohama Strategy sets guidelines for action on prevention, preparedness and mitigation of disaster risk.

The Yokohama Strategy for a Safer World and its Plan of Action stressed that; "... each country has the sovereign responsibility to protect its citizens from the impact of natural disasters" and adopts the following ten principles;

1. "Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures.

2. Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief.

3. Disaster prevention and preparedness should be considered integral aspects of development policy and planning at national, regional, bilateral, multilateral and international levels.

4. The development and strengthening of capacities to prevent, reduce and mitigate disasters is a top priority area to be addressed so as to provide a strong basis for follow-up activities to the Decade.

5. Early warnings of impending disasters and their effective dissemination are key factors to successful disaster prevention and preparedness.

6. Preventive measures are most effective when they involve participation at all levels from the local community through the national government to the regional and international level.

7. Vulnerability can be reduced by the application of proper design and patterns of development focused on target groups by appropriate education and training of the whole community.

8. The international community accepts the need to share the necessary technology to prevent, reduce and mitigate disaster.

9. Environmental protection as a component of sustainable development consistent with poverty alleviation is imperative in the prevention and mitigation of natural disasters.

10. Each country bears the primary responsibility for protecting its people, infrastructure, and other national assets from the impact of natural disasters" (UNISDR, 1994).

After the Yokohama Strategy for a Safer World and its Plan of Action, the World Conference on Disaster Reduction (WCDR) in Kobe presents a milestone opportunity to bring together local, national and international decision-makers active in social and economic development and environmental management; disaster risk managers and practitioners; civil society; and community groups, setting a new international agenda to build disaster-resilient communities.

The WCDR in 2005 has the following five specific objectives;

1- " To conclude and report on the review of the Yokohama Strategy and its Plan of Action, with a view to updating the guiding framework on disaster reduction for the twenty-first century;

2- To identify specific activities aimed at ensuring the implementation of relevant provisions of the Johannesburg Plan of Implementation of the World Summit on Sustainable Development (WSSD) on vulnerability, risk assessment and disaster management;

3- To share good practices and lessons learned to further disaster reduction within the context of attaining sustainable development, and to identify gaps and challenges;

4- To increase awareness of the importance of disaster reduction policies, thereby facilitating and promoting the implementation of those policies;

5- To increase the reliability and availability of appropriate disaster-related information to the public and disaster management agencies in all regions, as set out in relevant provisions of the Johannesburg Plan of Implementation" (UNISDR, 2005).

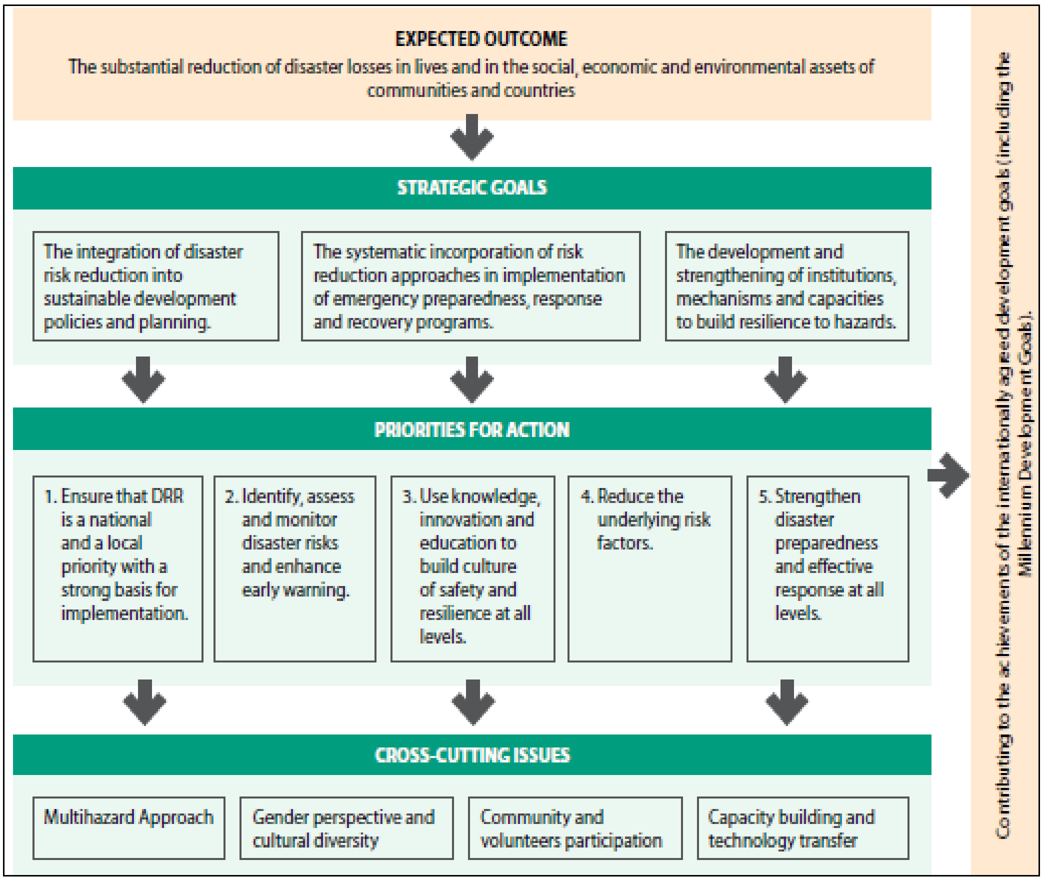


Figure 1.6 Expected Outcome, Strategic Goals and Priorities for Action 2005-2015
Source: (UNISDR, 2005)

Despite the fact that numerous countries revised their disaster policies for risk mitigation, Turkey as one of the current extreme risk cases in the world remains totally alien to the new policy. "Not only the Yokohama and Kobe Conference performances and the national report produced for Kobe fell far from describing the realities, but the administrations have refrained from communicating disaster affairs in the public sphere, abolishing the National EQ Council (2007), avoiding all suggestions made by the Council (2002), ignoring the need for new organizational and legal provisions. Neither has the participation of Turkey in the Global Platform (2007) produced tenable results" (Balamir 2007).

Report on Disaster Reduction prepared by the Republic of Turkey for the World Conference on Disaster Reduction in Kobe (2005) clearly reveals that the approach in Turkey to risk assessment, risk reduction and risk mapping are deficient and remains limited due to development of regulations that can not be fully implemented. This is a clear indication of Turkish disaster policy has mainly focused on the post-disaster period, no incentives or legislation existed to encourage risk analysis, risk mitigation or risk spreading approaches.

The conventional legal provisions and organizational habits in Turkey decisively target the post-disaster period.

"The 'Disasters Law' is a regulatory device primarily for 'healing the wounds' and the Development Law ignores the reality and risks of earthquakes and contains no mechanism or procedure in itself to secure environmental, building and implementation standards for mitigation control. Therefore, a double bias for post-disasters has been the dominant nature of policy in Turkey" (Balamir, 2001).

However, "the earthquakes of 1999 generated a strong national determination in Turkey to devise new and effective methods of tackling disasters". Since then, much effort and debate has been taking place in political, official and academic circles to refresh the attitudes, management and structures of responsibilities, as well as to revise the related legal framework (Balamir, 2002).

After the 1999 earthquakes, three important steps were taken by the government and conventional approach in disaster policy has been restructured. With the newly introduced `Obligatory Building Insurance', `Building Control', and `Professional Proficiency' systems, greater emphasis is given to mitigation efforts and the focus of attention have shifted towards risk management and the pre-disaster period.

Despite its deficiencies, these will hopefully change the conventional policy in building practice. "These decisions may be interpreted as attempts to convert the existing system that is over-occupied with crisis management and the aftermath of disasters into some form of an overall strategy for disaster mitigation" (Balamir, 2002).

On the other hand, risk reduction or mitigation policies demand new approaches, new methods and expertise. "The new policy requires a capacity for identifying various types of risks at different levels, making projections for likely consequences, and also a capacity for devising methods to 'avoid, reduce, and share' risks" (Balamir 2007).

"The disaster information system in Turkey need to concentrate on settlements, and this system be managed by some central authority to maintain the high standards and rigour in upkeep. Settlements under high risks have to revise their development plans according to the micro-zonation information provided, and update them as new information becomes accessible and as new assessments of risks are made based on this set of data. 'Integrated Disasters Maps' need be institutionalized and incorporated in the Development Law, making such maps a prerequisite for all plan preparations and revision activities which in turn need be restructured to allow greater local community participation" (Balamir, 2001).

"World experiences indicate that pre-disaster risk mitigation efforts always prove to represent a more efficient use of resources, compared to costs born at the aftermath of disasters. Investments in the mitigation of seismic risks are particularly relevant in this context. There are numerous reasons why pre-disaster use of resources may be more efficient than resources disposed of in the post-disaster relief activities. Whereas former resources are employed in a carefully planned, transparent and competitive environment, the latter use of resources is often carried out in a panic environment and with the least of accountability" (Balamir, 2011).

“Whereas the acquisition of former resources may be spread in time and between various local donors and may have lower ‘opportunity costs’, the need for immediate use of resources in the emergency environment will often represent random allocations, mistakes, unjustified expenditures, unavoidable high costs for unknown causes. Whereas, the former is likely to generate greater added values, the opportunity costs of immediately needed resources acquired, borrowed or allocated in the emergency environment will have greater and uncontrollable waste rates. The productive use of resources allocated for mitigation would necessitate the determination of risk priorities on the one hand, and different efficiency measures than used in market assessments on the other” (Balamir, 2011).

1.3. Description of the Problem and Its Context

Chronic seismic hazards and resulting secondary impacts are due to the geological conditions of Turkey and the nature of current response mechanisms. Local know-how of building and settlement that evolved over centuries eroded with the growth in population, and the introduction of reinforced concrete building economics. This makes cities the most vulnerable geographical and social entities in Turkey.

On the contrary, Turkish disaster policy has mainly focused on the post-disaster period and remains limited due to development of regulations that can not be fully implemented. No incentives or legislations existed to encourage risk analysis or risk mitigation approaches. This makes Turkey totally alien to the new risk mitigation policies and risk mapping approaches.

Accordingly, the Earthquake Hazard Map of Turkey, prepared by the General Directorate of Disaster Affairs (GDDA) in 1996, that is the basic premise of the disaster management system in Turkey remains deficient to the new risk mitigation policies.

Official Earthquake Hazard Zoning Map of Turkey segments the country into five macro-level regions, as determined by the statistical occurrence of seismic events and only indicates hazard exposure levels of provinces and settlements. Although both of these two notions represent distinct concepts, such distinction is not made in most policy orientations and hazard is often confused with the notion of risk.

Yet, two communities located in hazard-prone areas with similar physical settings cannot be described as of equal in risk if they differ in their vulnerabilities to the hazard.

Consequently, the official hazard map does not consider primary factors of risk, neither social vulnerabilities nor attributes of the building stock. It only indicates hazard exposure levels without providing any information about risk levels and does not specify any quantitative earthquake hazard parameters for any zone. Besides it doesn’t indicates any information about ordering and prioritization of settlements in the same hazard zones, all settlements located in the same hazard zones are accepted as of equal in risk apart from their physical settings and vulnerabilities.

These deficiencies of the official earthquake hazard map and the necessity of differentiations of locations should be made on risk-basis maps constitutes both the most crucial problem in disaster management system of Turkey and the main problematic of the study.

1.4. Scope, Approach and Method of the Study

The World Conferences on 'Risk Reduction' in Yokohama and Kobe provided a unique opportunity to promote a strategic and systematic approach to determination and reducing seismic vulnerabilities and risks of settlements. The principles and priorities determined by these conferences are a guiding framework on disaster reduction for the twenty-first century.

The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters determined five priorities for action:

1. Ensure that disaster risk reduction is a national and a local priority,
2. Identify, assess and monitor disaster risks and enhance early warning,
3. Reduce the underlying risk factors,
4. Use knowledge, innovation and education to build a culture of safety and resilience,
5. Strengthen disaster preparedness for effective response at all levels.

These priorities constitute the starting point of the research and the overall objective of this research is to evaluate how these priorities are served in the settlements of Turkey especially; in the identification, assessment and monitoring of disaster risks, the reduction of the risk factors and the use of knowledge to build a culture of safety and resilience. The major purpose of this research is to develop a method for the identification of vulnerabilities and prioritization of most vulnerable settlements in anticipation of earthquake related hazards.

With this purpose, the aim of this research is to examine the factors that determine seismic vulnerabilities and risks of settlements and establish analysis of seismic risks in cities and living environments could be determined on the basis of a set of attributes of the building stock. The scope is to exhibit and analytically compare such factors in settlements of Turkey.

Quantitative information about a set of attributes of settlements is investigated statistically to determine which of the factors contribute most to risk levels described locally. The seismic hazard maps of the Kandilli Observatory and Earthquake Research Institute (KOERI), Erdik estimations of seismicity and statistics published by the Turkish Statistical Institute (TurkStat), like census and housing data have a leading contribution to make. These secondary sources of information help to compose the database for a series of comparisons in the seismic vulnerabilities and risk levels of cities.

In order to determine the seismic vulnerabilities and risks of settlements, disaster component that reveals the settlement level loss in building stock is examined on one side and the basic attributes of settlements and their effects on loss levels on the other side.

In the determination of seismic vulnerabilities and risks of settlements, risk in settlement units is defined as a function of material loss in the building stock with respect to the expected seismic event. It is assumed that loss in the building stock in each settlement can be used as a proxy to express the comparative loss of human life, economic loss, damages in infrastructural systems, as well as secondary and indirect levels of losses in the settlement. Therefore, settlement level loss in the building stock is the basic indicator of assumed risk and provides the dependent variables of the research.

The basic attributes of settlements are composed of building inventory data and related attributes of building stock on each settlement obtained from TurkStat. 'Building Construction Statistics', 'Building Census' and 'Population Census' prepared by TurkStat and 'Development Index' prepared by State Planning Organization is used within this research. Attributes of settlements that are assumed to contribute to vulnerabilities and estimated loss are measurable indicators as independent variables. Independent variables of the research are; Settlement Population, Population Growth Rate, Rates of Agglomeration, Population/Total Number of Buildings and Development Index.

This study is expected to provide information about the most effective attributes that could describe vulnerabilities best in cities and be related to an expression of risk in cities.

The basic question of the research is: "How do loss levels in building stock correlate to independent variables?" and regression analyses are used to examine this question.

Findings of such analysis could provide guiding criteria for the prioritization of mitigation measures in Turkey and the levels of absolute and relative loss could be used in the ordering of settlements for more effective disaster policy.

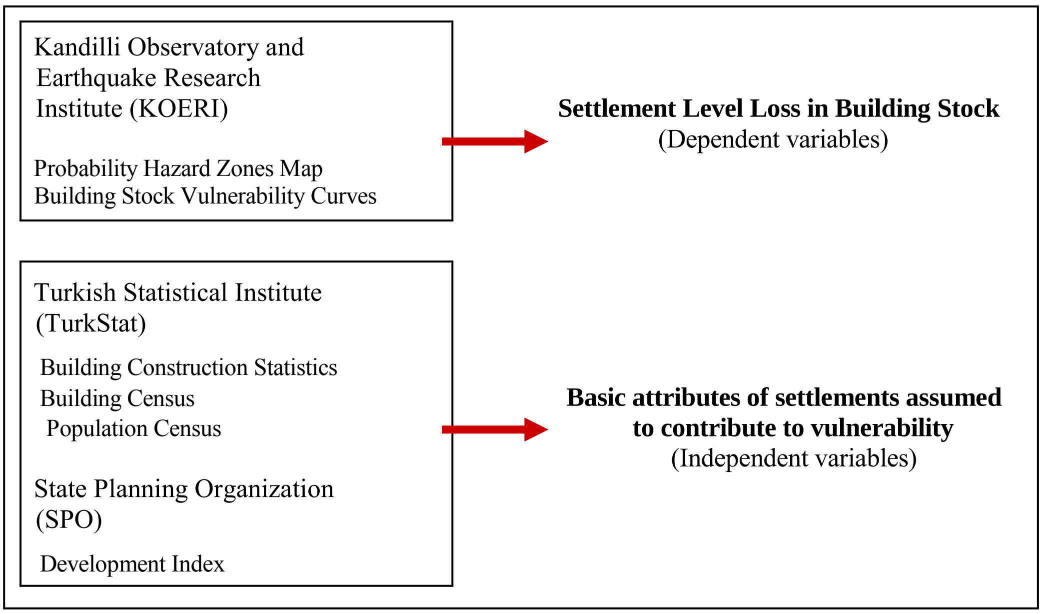


Figure 1.7 Variables of the Research

1.5. Structure of the Study

This study composed of seven chapters. The **first chapter** describes the basic concepts and background of the study briefly, underlines the importance of assessing settlement level vulnerabilities for mitigation policies and defines the problem, scope, approach, method and the policy relevance of the study.

Second chapter identifies risk assessment researches and their relevance for planning and development of mitigation strategies describes stages and essential steps of risk assessment processes, settlement level vulnerabilities and risk mitigation policies and gives examples about settlement level vulnerability and risk assessment studies in Turkey and abroad.

Third chapter of the study determines seismic vulnerabilities and risks of settlements by evaluating seismic hazard intensity via seismic hazard maps and building stock vulnerability curves. Within the third chapter loss levels in building stock is defined as a function of likely seismicity and expected building loss estimations in the settlements of Turkey is identified.

Chapter four examines the attributes assumed to have contributed to vulnerabilities of settlements.

Chapter five investigates relations between estimates of loss and assumed contributing attributes by best subsets regression analyses and analyses by means of regression methods.

Chapter six evaluates the findings of the research according to mitigation policies and urban planning in several lines like Priorities for Mitigation Planning, Urban Standards, Law on Redevelopment of Areas under Disaster Risk, Building Codes, Building Supervision Practices, Insurance System and Investment Priorities.

The last chapter of the study, **Chapter seven,** briefly evaluates the key findings of the research and concludes the study by identifying further lines of investigations.

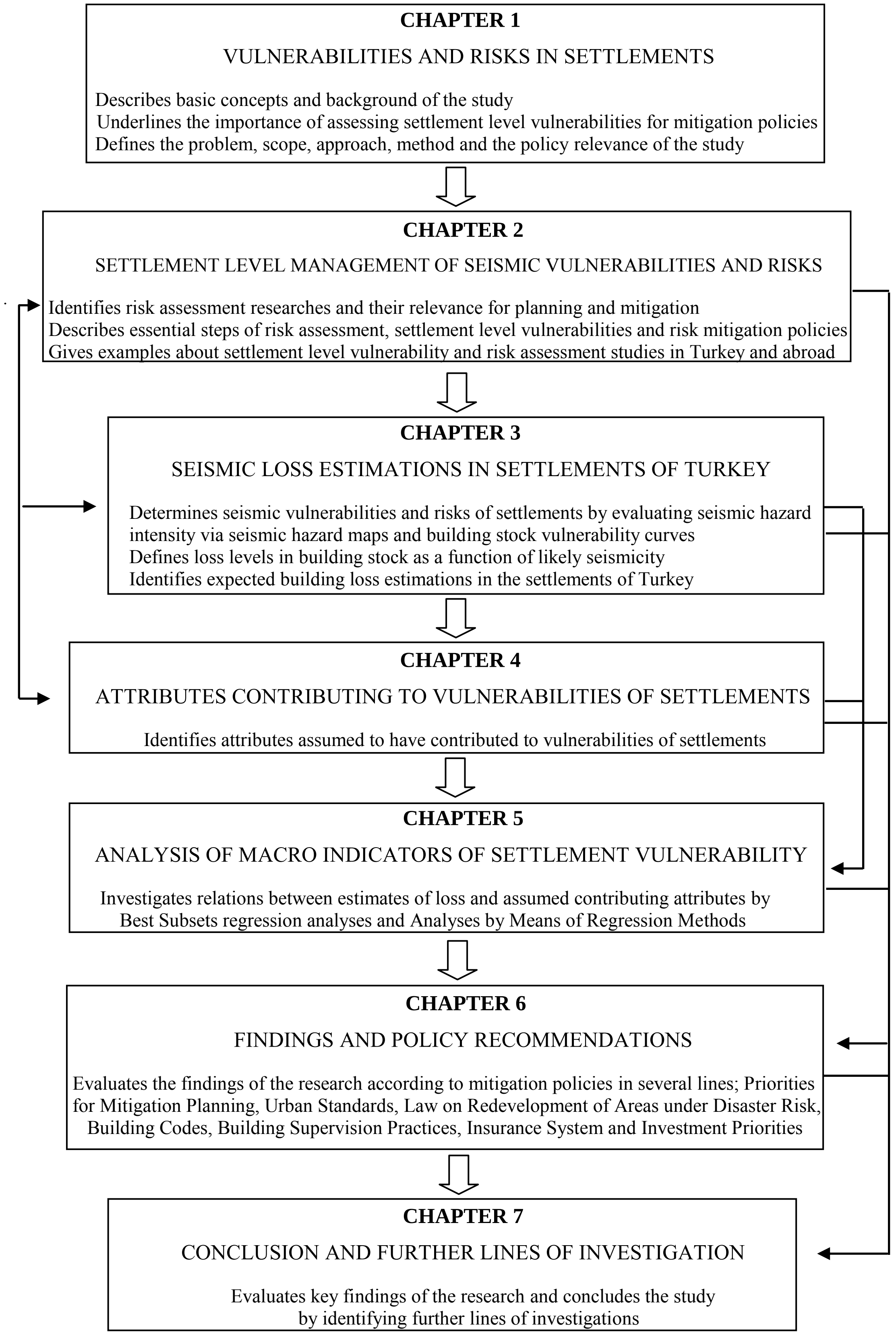


Figure 1.8 Structure of the Study

CHAPTER 2

SETTLEMENT LEVEL MANAGEMENT OF SEISMIC VULNERABILITIES AND RISKS

2.1. Risk Assessment Research and Studies

Risk assessment is the process of measuring the potential loss of life, injury and property damage resulting from natural hazards by assessing the vulnerability of people, buildings and infrastructure to natural hazards. It helps basically to point out the fields has to be prioritized and to make better decisions in management issues and provides to estimate probable losses in human life, economy and infrastructure.

UNISDR Terminology on Disaster Risk Reduction (2009) defines Risk Assessment as "a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend".

Risk assessments include detailed quantitative and qualitative understanding of risk, its physical, social, economic and environmental factors and consequences. It is a necessary first step for any serious consideration of disaster reduction strategies.

Its relevance for planning and development of disaster risk reduction strategies was explicitly addressed during the IDNDR. "In the year 2000, all countries, as part of their plans to achieve sustainable development should have in place comprehensive national assessments of risks from natural hazards, with these assessments taken into account in development plans." This was also outlined in Principle 1 of the 1994 Yokohama Strategy and Plan of Action for a Safer World. "Risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures" (UNISDR, 2004).

Risk assessment researches are conducted at different levels from global to local levels and for different purposes. But essentially, it provides a systematic process to answer questions about the risks faced by the community or city.

The risk assessment process focuses attention on areas most in need by evaluating which populations and facilities are most vulnerable to natural hazards and to what extent injuries and damages may occur. It gives us the answers about what these hazards can do to physical, social, and economic assets; which areas are most vulnerable to damage from these hazards; and the resulting cost of damages or costs avoided through future mitigation projects.

Risk assessment researches should not be undertaken as one-off analyses but as an integral and regular element of the planning process and are essential for disaster mitigation and preparedness (ADPC, 2010).

According to UNISDR, risk assessments include; "a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios". This series of activities is sometimes known as a risk analysis process.

The stages/essential steps of a risk assessment as suggested by UNISDR are given below;

1. **Hazard Identification** – includes identifying the nature and location of a threat.
2. **Hazard Assessment** – includes estimating the likelihood of experiencing the hazards and the characteristics, intensity, probability/frequency and potential severity of the hazards.
3. **Vulnerability and Capacity Assessment** – includes determining the existence and degree of vulnerabilities and exposure to a threat, identify the capacities, resources, and knowledge available to reduce the level of risk or the impact of hazards and cope with them.
4. **Risk Estimation** – includes combining all of the above steps to analyze the identified risks and the extent of their impact to determine levels of risk.
5. **Risk Evaluation** – includes examining how important the risks are to different groups of people and make decisions about which risks need countermeasures and priorities. The purpose of risk evaluation is to help identify and prioritize risk reduction measures.

Each step in a risk assessment process requires different types of data and there are a range of approaches and techniques that can be used to obtain and process the data. They range from quantitative analysis built around scenario modeling and mapping, to qualitative, non-technical approaches. The choice depends upon the kinds of output that need to be generated. The selection of methodology is dependent on the purpose of the assessment, its coverage (city-wide or selected communities), the availability of reliable data and the availability of resources.

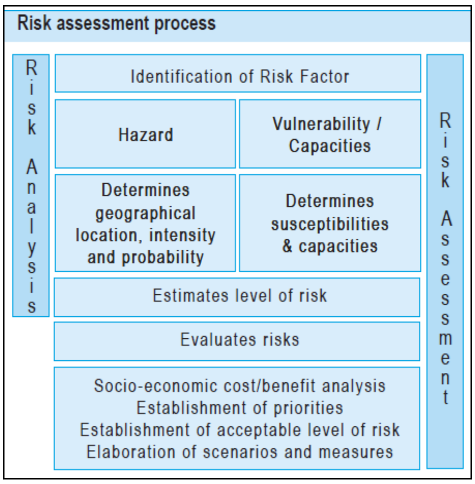


Figure 2.1 Basic Stages in a Risk Assessment Process
(Source: UNISDR, 2004)

The basic stages undertaken in a risk assessment process is shown in Figure 2.1 and the questions that could be asked in the basic stages of a risk assessment process can be seen in the Figure 2.2.

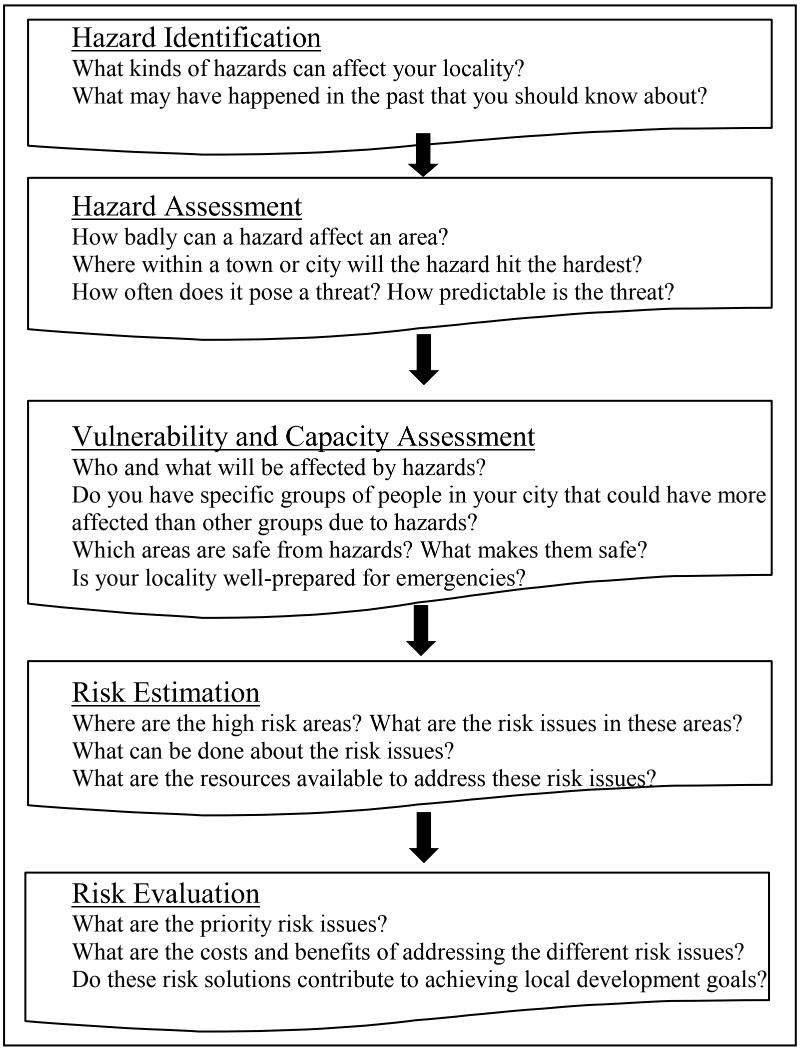


Figure 2.2 Questions to Ask In a Risk Assessment Process
(Source: Adapted from ADPC, 2010)

Risk assessment results allow local government to decide where and what disaster risk reduction interventions can be most effective, establish early response priorities by identifying potential hazards, vulnerable people and assets and the capacities. Findings from risk assessments can be used in training and educational programs and as awareness campaigns in the pre-disaster phases. Risk assessments are also critical for guiding the future growth and land use patterns of cities and contribute to improved development decisions. Risk assessment provides the foundation for the rest of the mitigation planning process.

Institutionalizing disaster risk assessment has many advantages and benefits because the efforts involved are important development management tools on its own. Disaster risk assessment is useful for several purposes, including: making risk-responsive physical and economic policy, regulatory framework for development, promoting participatory development through public education and awareness, private sector and business decision-making and risk sharing and transfer interventions (AFDB, 2004).

For a more effective bundle of mitigation measures, it is essential that the various forms of risk management should be performed in a logical sequence. This sequence is usually identified as the 'priorities of risk management' in any problem context, and is currently adopted by the World Bank (Kreimer, et. al., 1999) and other authors (Burby, 1999).

"'Avoidance of risks' has the foremost priority and largely to be maintained (in the case of earthquakes) by means of renewed land-use planning practices and regulations. 'Minimization of risks' is a second set of tasks to be undertaken in infrastructural networks and the design and production of buildings. Having accomplished both of the former steps of risk management, the remainder unavoidable risks are to be 'shared' between the members of the society by some explicitly preferred method and criteria. This set represents then the most general family of rules to follow at every scale of physical design for safe buildings and environments" (Balamir, 2001).

1
RISK AVOIDANCE
Avoidance (avoiding areas of natural hazard for settlement)
Distancing (specifying minimum distances from nodes of hazard)
Refusal (prohibiting existing uses with high risks and source of chain-disasters)
<u>PLANNING SERVICES</u>
risk zoning; plan preparation, implementation, control and up-dating services

2
RISK MINIMIZATION
Discarding Risks At Source (*eg*. flood reservoirs, induced avalanches or land-slides)
Upgrading Resistance At Location of Effect (*eg*. levees, building codes, retrofitting)
<u>ARCHITECTURAL AND ENGINEERING SERVICES</u>
higher standards in disaster-resistant design and construction;
inspection of construction; building-retrofitting services

3
RISK SHARING
Aids and Subsidies (credits, rent subsidies for dwellings and business premises)
Donations (national/ international, voluntary/ organized, cash/ in kind donations)
Taxes (extra burdens on others than those suffered losses in the disaster)
Insurance (compulsory building insurance)
<u>FINANCIAL MANAGEMENT SERVICES</u>
building up funds for pre-disaster and post-disaster requirements; efficient allocation of funds;
maintaining equity between fund-providers and between fund-users

Figure 2.3 Priorities in Risk Management
Source: (Balamir, 2001)

Consequently, we can say that hazard assessment is an important first step in reducing vulnerability, but in order to reduce future losses from natural hazards, hazard assessment studies must be coordinated with settlement level risk mitigation efforts and planning policies.

2.2. Settlement Level Vulnerability and Risk Mitigation Policies

Mitigation at all levels is the dominant paradigm today as promoted by international organizations and academic circles since 1990s, which changed the conventional mode of thinking focused on emergency and crisis management policies since 1940s (Balamir, 2006).

The scope of mitigation in the new approach is best expressed in questions directed during pre-Kobe Conference (2005) activities, to the national representatives;

1. Political Commitment and Institutional Aspects: as revealed by legislation addressing disaster risk reduction, incorporation of risk reduction concepts, annual budget allocated for disaster risk reduction and encouragement and active participation in disaster risk reduction efforts by the private sector, civil society, NGOs, academia and media;

2. Risk Identification: as evident in hazard mapping, vulnerability and capacity assessments, mechanisms for risk monitoring and risk mapping, socio-economic and environmental impact analyses;

3. Knowledge Management: as practiced in risk information management systems, academic and research communities dealing with disaster reduction, educational programs related to disaster risk reduction, training programs, indigenous knowledge and wisdom, and public awareness programs;

4. Risk Management Applications and Instruments: as implemented through environmental management and risk reduction practices, financial instruments to reduce the impact of disasters, and technical measures or programs on disaster risk reduction. (UNISDR, 2005).

The foregoing themes serve as a core set of principles to understand, guide and monitor current status of disaster risk reduction and the information provided by countries served as one of the main inputs for the "Review of the Yokohama Strategy and Plan of Action for a Safer World.

Information Reports on Disaster Reduction prepared by the governments for the WCDR reveals the approaches of 113 countries to risk assessment, risk reduction and risk mapping. Although these questions refer to activities at a national level, similar issues could be rephrased at other (regional, city, local) levels as well.

Anti-risk regulatory devices have been a priority issue for a considerable number of countries during the past few years either as new laws or amendments made to existing ones (Balamir, 2006). Among these are USA (Disaster Mitigation Law, 2000), New Zealand (Civil Defense Law, 2002), South Africa (Disasters Law, 2002), Australia (COAG Report, 2002), UK (Civil Mitigation Law, 2004), Canada (Risk Mitigation Projects Program, 2004), Greece (Civil Protection Law, 2003), Armenia (2002) and others, apart from Japan which had such regulation in effect since 1961.

Following the Kobe Conference, the Hyogo Framework for Action 2005-2015 was announced which gave greater emphasis on mitigation and also in section four of the declaration pointed to the need for 'mainstreaming disaster risk considerations into planning procedures', and 'develop … tools for the reduction of disaster risk in the context of land-use policy and planning … at the national and local levels' (UNISDR, 2005).

Most relevant, but complicated and least studied among those is the city-level mitigation practices. Formal analyses of risks and action for mitigation in cities are the least mainstreamed of measures into the existing systems of city planning or disaster management.

Concepts and methods of urban mitigation planning are entirely different from those of conventional building-level risk mitigation. Earthquake engineering has during the past 40 years developed an area of expertise that deals with the risk of building collapse due lateral forces. The city however is not just an aggregate of buildings, but a complex system comprising its own nested sets of 'risk sectors', as well as buildings of various categories to acquire different functions and priorities in the context of urban mitigation planning. Cities are vulnerable therefore in very many different ways, and manifest a multitude of risks (Balamir, 2006).

On the other hand, mitigation is a most relevant and rewarding effort particularly at the level of settlements. Cities as distinct physical systems have their own complex functional integrity, and are subject to failure should any of the sub-components receive a natural or man-made hazard impact.

Secondly, cities are usually managed in their totality by an authority explicitly responsible for its functioning and safety. Risk avoidance/ reduction/ sharing as part of such responsibilities is however, a recent awareness, and often an imposed obligation. These are some of the reasons why seismic risk mitigation should be streamlined into city planning functions and must have a formal basis (Balamir, 2006).

Observing the need, Coburn and Spence (1992) claims that: "Earthquake protection should be seen as an additional element of normal urban planning. It should not be a separate activity from other planning operations, but rather an integral part of the planning process…" Despite the statement, no specific method of mitigation planning in cities is offered by him in procedural or in content terms, apart from a general indication to a number of related issues like microzonation, building robustness, classification of uses at risk, etc.

However, awareness of the immense potential urban planning has for the reduction of risks at city-level is expanding. More recently, Wamsler (2006) indicated that city-level impacts of natural hazards could be worse than in environments of other levels, and therefore urban planning with its existing and potential tools could be developed as a proactive and preventive institution. Yet there are external and internal impediments (Balamir, 2006).

Despite the recent international declarations and determination in the new policy of mitigation, many of the international organizations still employ and fund conventional wisdom, depriving mitigation planning from resources necessary for explorations in city level risks.

Examining the 'perceptions and practices of the international aid organizations', Wamsler (2006) concludes that there exists a significant incompatibility between the various professional disciplines. This is largely due to distinct tradition, education, and experiences of these disciplines; different working priorities, different concepts and terminologies, as well as separate legal-institutional structures and financial resources they operate within. It is necessary to 'create new institutional and organizational structures at all levels, which favour integrated risk reduction in urban planning' (Balamir, 2006).

City-level mitigation planning is therefore, universally at the stage of formulation and consolidation in its methods and tools. Experience and know-how related to seismic mitigation at city level is not widely recognized at the moment, nor mainstreamed into the professional modes of conduct and the legal system, despite a number of approaches in this area.

According to Balamir (2007), recent attempts at clarifying urban risks and develop methods for city mitigation could be categorized in a number approaches:

(a) Urban planning services are usually demanded for the post-disaster reconstruction stages and rehabilitation works. Methodological know-how is available in this area, based on case experiences and theoretical discourse (Spangle Assoc., 1991, 1997; Schwab, 1998).

(b) Turning to risk mitigation efforts prior to disasters, one basic approach seems to concentrate at macro assessments of loss. These usually focus at national level policies (Godschalk et. al., 1999). In general, most of pre-disaster management of seismic risks in settlements is either confined to engineering tactics at the individual building level, or to the simulation modeling efforts (as in the case of HAZUS) at system level (Coburn and Spence, 1992; Coburn, 1995). Both approaches rely on expert decision-making and DSS in the monitoring of city systems, rather than community action and local participatory processes (Balamir, 2007).

(c) A third category often implicitly assumes that city-level risks could be identified based on engineering concepts and tools employed in the analysis of risks in building structures. City-level risks are equated to the sum of risks of the urban building stock. The discourse to justify the approach claims that "after all it is the buildings that kill people" (Sucuoğlu, 2006). For this reason it is the robustness of buildings and life-lines in the city (engineering studies) that need be investigated, and mitigation efforts focused in these systems will suffice for the achievement of safety in the city (Scawthorn, et. al. 2006; Cozzi, Menoni, 2006 et. al.; Rosetto, 2006).

(d) Another set of pre-disaster efforts could be identified to fall closer to conventional land-use planning. Burby (1998) considers that land-use planning could provide sufficient means for mitigation by itself.

It is most relevant to survey and register geological attributes of land and local geographical features to determine the hazard zones and then the appropriate zoning of uses and designation of types of buildings for safer city development and functioning. Based on past experience, high hazard zones are avoided for residential purposes, but buildings for storage or animal husbandry could be permitted. Public buildings and emergency facilities must accordingly be allocated to less hazardous zones.

Fault lines must have immediate strips of zones for total building ban, restricted zones for specific uses further away, constraints relaxed with distance. Mitigation decisions are confined to land-use impositions in this approach according to estimations of local hazards (Balamir, 2007).

(e) Cases that directly confront the problem of seismic mitigation, and intend to develop methods in comprehensive urban planning, rather than that of land-use planning tools alone, are few and recent.

Two exercises undertaken by the Columbia International Urban Planning Studio of the post-graduate program, in coordination with other research units, have been dedicated to the seismic problems of highly vulnerable cities of Caracas and Istanbul (Columbia University, 2001, 2002).

This approach does not only consider the city systems in their entirety, but develops also a multi-disciplinary framework, reveal a more comprehensive approach than conventional land-use planning, and define the boundaries of a new form of planning practice.

The Columbia University planning program, following a research format developed in the case of Caracas city, studied the earthquake prone Istanbul in 2002 with the intention of exploring planning and mitigation possibilities. The time and data constraints have largely constrained the Istanbul analyses, and reduced findings to a set of broad recommendations (Balamir, 2007).

Yet there are a number of significant elements within the scope of the study:

1. A post-event analysis focused on a prioritization of 'essential facilities': (a) medical, water, transportation, shelter, communication; (b) fuel, fire, hazardous materials, electricity, food; (c) reserved space, sanitary facilities, and identified the priority of urban activities that have greater contributions as: 'management', SAR, 'law enforcement/security' (Balamir, 2007).

2. Safety implications of various macro-form alternatives were explored. Comparisons were made between centralized metropolitan growth and satellite settlements configurations. The latter was preferred, taking into consideration also the impacts of alternatives on conservation policies (Balamir, 2007).

3. A sample of neighborhoods were investigated, followed by recommendations in infrastructure improvements, urban design propositions, social policies, 'resistance action plans', regulation of building densities and restrictions, and disaster response plans (Balamir, 2007).

Even if the attempts were inconclusive in developing a methodology in mitigation planning, the approach of the Columbia University is in the necessary direction. The study is not trapped in a simple understanding of equating city-level risks solely to those of the building stock. It is not either confined to the narrow scope of conventional land-use planning. The approach considers the urban mitigation issue in terms of a multi-disciplinary attitude in its determination of hazards, specifying an array of risks, assessments of loss, and in its propositions of policies.

"The major deficiency in this approach lies in the implicit assumption that mitigation is a one-way technical and administrative project imposed by the local authorities. Participation methods and interactive involvement processes, which should have been the concomitant of each policy proposition, are omitted in the urban mitigation planning. Temporary public awareness-raising programs are obviously no substitutes for generating a total mobilization" (Balamir, 2007).

(f) The risk analyses and urban mitigation planning approach envisaged for the Earthquake Master Plan of Istanbul (EMPI, 2003) is still another alternative perhaps based on a methodology with wider implications (Balamir, 2006, 2004, 2001, 1999).

A survey of recent attempts in city-level mitigation reveals the nature of the gaps in understanding settlement safety, and the need for the development of a systematic response to risks in urban planning (Balamir, 2007).

The city however is not just an aggregate of buildings, but a complex system comprising its own nested sets of 'risk sectors', as well as buildings of various categories to acquire different functions and priorities in the context of urban mitigation planning. Sectors of risk are distinctly manageable clusters of vulnerabilities at the city-level for which a coordinated action is necessary.

Different levels of spatial units (national, regional, and city) could have entirely different sets of vulnerability and risk definitions, definitely different from risks at the building level (Balamir, 2007).

As cities have their own complex functional integrity, they are vulnerable in very different ways and very different risk sectors. Risk sectors are areas of causal relations on specific risks according to Earthquake Master Plan of Istanbul (EMPI). More than a dozen of city-level risk-sectors have been identified in Istanbul. Risk-Sectors of EMPI are given below;

- Risks in Macro-Form and Growth Tendencies (settlement configuration alternatives)
- Urban Fabric Risks (building height/proximity, plots, density, roads, car-parks, etc.)
- Incompatible Land-Use Risks (buildings and districts)
- Risks of Productivity Loss (industrial plants)
- Risks in the Building Stock, Infrastructure and Lifelines
- Risks in Emergency Facilities and Lifelines (hospitals, schools, etc.)
- Special Risk Areas/ Special Buildings (landslide, flooding/historic buildings)
- Risks in Hazardous Uses (LPG and petrol stations, etc.)
- Open Space Deficiency Risks

2.3. Settlement Level Vulnerability and Risk Assessment Studies in Turkey and Abroad

Vulnerability assessment and seismic risk management using advanced methodologies are of major importance for the reduction of seismic risk in urban areas. Settlements are the most relevant geographical units for vulnerability and risk assessment studies, since greater densities of population occur and most intensive investments are made here, and most complex sets of vulnerabilities prevail in this context.

Settlement vulnerabilities cannot be described simply in terms of robustness of individual buildings, but as a complex system structured with interdependent components. Urban stock texture, networks, distribution of land-uses, public facilities, their interaction with hazard prone locations, size of population served and many other factors have interdependent impacts on the vulnerabilities or resilience of settlements.

A number of risk assessment studies have been carried out in Turkey both at national and local levels after 1999. These studies that related to settlement level risks are given below;

1. The first one is the Earthquake Master Plan of Istanbul (EMPI) tendered by the Metropolitan Municipality of Istanbul and carried out by four universities in 2003 (ITU, METU, BU and Yıldız Tech. Un.).

Earthquake Master Plan of Istanbul (EMPI) developed a comprehensive framework for the determination of urban risks and methods of reducing them. More than a dozen of 'risk sectors' in the Metropolitan City were identified for DRR organization and action. A participatory framework was envisaged in each risk sector organizing the communications between stakeholders. Interrelated set of projects and action were identified in each risk sector with their budgets, responsible authorities, units, and NGOs within an overall implementation program. Within EMPI, a method of seismic risk mitigation model was developed for the high-risk sub-provinces of Istanbul.

Upon the request of the metropolitan municipality, this was followed by a detailed analysis and assessment of risk mitigation measures based on information obtained in extensive field surveys in the sub-province of Zeytinburnu. This approach indicated the viability of comprehensive planning of such high-risk areas, to incorporate the partial physical redevelopment of districts by means of partnerships, to exclude the options of density increases, gentrification, and excessive costs. The objective was to establish the possible set of conditions to maintain residents and tenants, self-financing social reorganization projects, testing the viability of physical rearrangements at higher safety standards and environmental quality. Communities of approximately 1000 dwellings proved to meet all possible constraints and economies required.

2. The second one was tendered by the World Bank for the investigation of risks in six different municipalities (Bakırköy, Bandırma, Eskişehir, Gemlik, Körfez and Tekirdag) and development of recommendations for improvement in their capacities for Disaster Risk Mitigation.

Research and recommendations for the sample of six municipalities followed a similar method in the determination of seismic risks in settlements of different size and character. Having established the hazard probabilities and their distribution in the city landscape by means of microzonation studies, the method described a 'community profile' followed by an identification of the high risk areas. Further to loss estimation and urban risk analyses, municipality capabilities are determined. The mitigation strategies for each of the municipalities are then developed, and some prioritization proposed according to needs for immediate attendance and effectiveness of action with reference to costs of mitigation measures. Both of these studies provide insight into identification of risks and methods of prioritization at settlement level (Prota, 2011).

3. A national level earthquake risk assessment study was carried out in Boğaziçi University (Demircioglu, 2010). In this study, the national hazard maps according to the several ground motion parameters have been prepared and nationwide building damage; casualty and economic losses have been estimated. Both the hazard and risk assessments were grid based. These grids can be clustered into sub-provinces and provinces as per the needs of project. The hazard maps constitute an updated version of those associated with the infrastructure seismic design code published in 2007 for application to transportation structures officially administered by the Ministry of Transportation.

The risk maps produced in this thesis is analogous to the FEMA study entitled Estimated Annualized Earthquake Losses for the United States (FEMA, 2008).

4. An earthquake risk model for Turkey has been developed under the WB Turkish Emergency Flood and Earthquake Recovery Project (TEFER, 2000). An earthquake loss model for the Turkish Catastrophe Insurance Pools (TCIP-DASK) to serve a basis for the making decision process with respect to the pricing of its insure policy, risk control, the purchase of reinsure, and the transfer of seismic risk. The project concluded in 2001 and the software is used for TCIP.

5. At the local level, several earthquake risk assessment studies carried out by local municipalities can be cited. Further to the earthquake master plan for the city of Istanbul (EMPI) a study developed in the year 2009 included a very comprehensive local soil characteristics investigation as well as an updated building inventory development at geographical location level.

   This study was preceded and also used the information provided by three other studies conducted for the city of Istanbul, these being:

   - The earthquake microzonation study for the city of Istanbul conducted by JICA (JICA-IBB, 2002),
   - Earthquake risk assessment study for the Istanbul Metropolitan Area conducted by Boğaziçi University (KOERI, 2002) and
   - The earthquake risk assessment methodology employed in the Earthquake Master Plan of Istanbul (EMPI) study was updated in 2009.

6. At the local level, one of the recent projects is the Istanbul Seismic Risk Mitigation and Emergency Preparedness (ISMEP) Project. The aim of this project is to improve the city of Istanbul’s preparedness for a potential earthquake through enhancing the institutional and technical capacity for disaster management and emergency response, strengthening critical public facilities for earthquake resistance, and supporting measures for better enforcement of building codes and land use plans. The Government of Turkey has initiated, ISMEP, to transform Istanbul into a city resilient to a major earthquake. The project is financed by a World Bank loan and implemented through the Istanbul Special Provincial Administration (ISMEP, 2010).

7. An earthquake master plan was also developed for the city of Izmir in the year 2002 with the contribution of researchers from Boğaziçi and Istanbul Technical Universities as well as the Chamber of Civil Engineers in Izmir. During this study all the buildings in the Izmir metropolitan area were visited by engineers and classified according to their structural characteristics and vulnerability. The study also included risk assessment for the major lifeline systems in the city (KOERI, 2000).

8. In connection with the DRM-MERM Project, the assessment of the seismic hazard for Adapazarı, Gölcük, Değirmendere and İhsaniye regions have been conducted. The project has involved a probabilistic estimate of the expected ground motions at the sited locations for the next 50 years and the associated seismic microzonation essentially intended for the land use management for settlement (DRM, 2004).

9. Several academic researches were also carried out about settlement level vulnerability and risk assessment fields in Turkey. One of the most featured studies related to settlement level risks was carried out by Ezgi Orhan and examines post-disaster recovery processes and location choices of businesses in case of Adapazarı (Orhan, 2012). The second study about settlement level vulnerabilities and risks was carried out by Fikret Bayhan and examines the impacts of urban planning decisions on earthquake vulnerable cities in the case of Adapazarı (Bayhan, 2010).

Apart from estimations of rates of loss in the building stock for an expected seismic hazard, the world experience in this context is not rich with examples and precedents.

Similar risk assessment studies in foreign countries that have been carried out both at national and local levels related to settlement level risks are given below;

United States of America

The Disaster Mitigation Act 2000 (DMA-2000) encourages all units and city administrations in USA to develop DRR plans and projects and submit them to the Federal Administration. The Administration then decides whether there is a justifiable case, and whether it is worth to subsidize the plan/project based on a number of efficiency criteria. Such a competition environment demands and generates a ranking system in itself.

In 2008 US Federal Emergency Management Agency (FEMA) has prepared a study on the estimation of seismic risk in all regions of the United States by using two interrelated risk indicators:

1. Annualized Earthquake Loss (AEL), which is the estimated long-term value of earthquake losses to the general building stock in any single year in a specified geographic area; and

2. Annualized Earthquake Loss Ratio (AELR), which expresses estimated annualized loss as a fraction of the building inventory replacement value (FEMA, 2008).

Similar and more detailed studies have also conducted by California Geological Survey (CGS) under the title "Estimation of Future Earthquake Losses in California".

In these studies losses from potential future earthquake are calculated both as scenarios of potential earthquakes and as annualized losses considering all the potential earthquake sources included in the national seismic hazard maps.

Italy

Crowley et al, (2008) have compared the various seismic risk maps which have been proposed in Italy over the past 10 years.

These maps have been updated over the years following the publication of more detailed seismic hazard and exposure data, and the updating of empirical vulnerability functions. The recent publication of updated seismic hazard maps in Italy has called for further seismic risk studies to be carried out using this state-of-the-art data. These seismic hazard maps are in terms of acceleration and displacement spectral ordinates and thus necessitate the use of more sophisticated models of the vulnerability such that the frequency content of the ground motion and the period of vibration of the building stock can be taken into account (Prota, 2011).

Lisbon

The LESSLOSS (Risk mitigation for earthquakes and landslides) project addressed natural disasters, risk and impact assessment, natural hazard monitoring, mapping and management strategies, improved disaster preparedness and mitigation, development of advanced methods for risk assessment, methods of appraising environmental quality and relevant pre-normative research. In the frame work of project, earthquake disaster scenario prediction and loss modeling, finite-fault seismological models have been proposed to compute the earthquake scenarios for three urban areas, Istanbul (Turkey), Lisbon (Portugal), and Thessaloniki (Greece).

The overall aim of the project was to create a tool, based on state of the art modeling software, to provide strong quantified statement about the benefits and costs of a range of possible mitigation actions, to support decision-making by city and regional authorities for seismic risk mitigation strategies (LESSLOSS, 2004).

CHAPTER 3

SEISMIC LOSS ESTIMATIONS IN SETTLEMENTS OF TURKEY

If vulnerability levels of settlements could be established with reference to seismic shake probabilities and levels of loss in the building stock, the question than is to explore the possible means of expressing this vulnerability in terms of asset of physical and social attributes of settlements.

This approach would identify vulnerabilities of settlements as dependent, and other explanatory attributes of cities as independent variables.

Quantitative information about a set of attributes of settlements is investigated statistically to determine which of the factors contribute most to risk levels described locally. The seismic hazard maps of the Kandilli Observatory and Earthquake Research Institute (KOERI), Erdik estimations of seismicity and statistics published by the Turkish Statistical Institute (TurkStat), like census and housing data have a leading contribution to make. These secondary sources of information help to compose the database for a series of comparisons in the seismic vulnerabilities and risk levels of cities.

In order to determine the seismic vulnerabilities and risks of settlements, disaster component that reveals the settlement level loss in building stock is examined on one side and the basic attributes of settlements and their effects on loss levels on the other side. This double sided process generates the dependent and independent variables of the research.

In the determination of seismic vulnerabilities and risks of settlements, loss levels in the building stock in each settlement will evaluate based on seismic hazard intensity via seismic hazard maps produced by KOERI and building stock vulnerability curves derived by Demircioglu (2010). Settlement level loss in the building stock is the basic indicator of assumed overall vulnerability (risk) and provides the dependent variables of the research.

The independent variables of the research are composed of building inventory data and related attributes of building stock on each settlement obtained from TurkStat. 'Building Construction Statistics', 'Building Census' and 'Population Census' prepared by TurkStat and 'Development Indexes' prepared by SPO is used within this research.

This study is expected to provide information about the critically vulnerable assets in cities, whether this could be considered as a function of hazard-proneness. Otherwise, interpretations of the most effective attributes that could describe vulnerabilities best and be related to risk information in cities could be explored.

The basic question of the research is: "How do loss levels in building stock correlate to independent variables?" and regression analyses are used to examine this question.

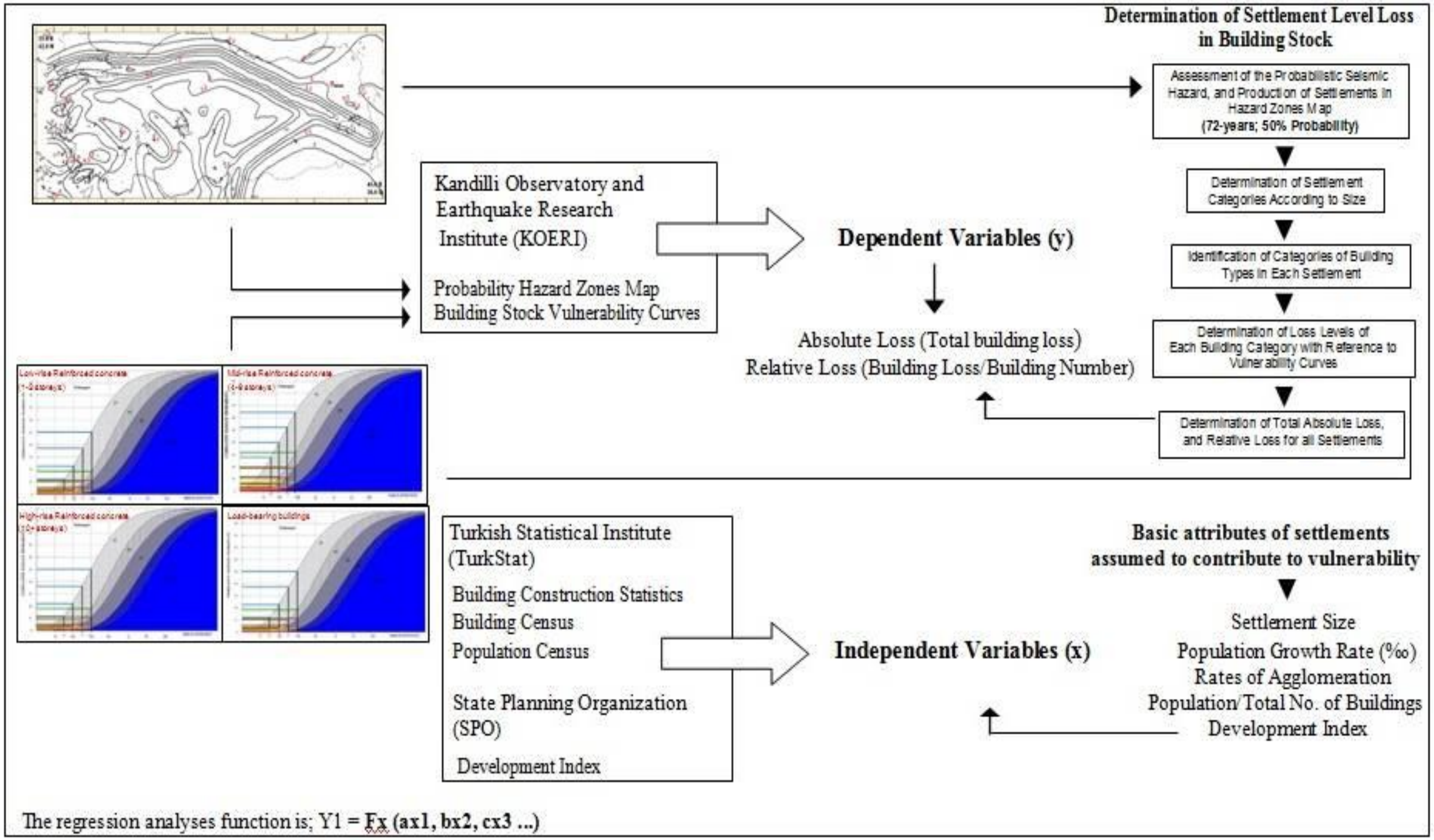


Figure 3.1 Dependent and Independent Variables of the Research

3.1. Seismic Hazard Probabilities of Settlements

Official Earthquake Hazard Map of Turkey is the basic premise of the disaster management system and the common source of earthquake hazard information in Turkey.

Earthquake Hazard Map of Turkey based on probabilistic considerations has been commissioned in 1996 and segments the country into five macro-level regions, as determined by the statistical occurrence of seismic events.

This Map is currently used for two purposes only. One of these is concerned with the building design standards and the other is the pricing of insurance premiums. Both purposes could have been better served if differentiations of locations were made on risk-basis. This demands the identification of relative risk categories of risks in settlements.

In this hazard-zone map essentially all the regions (with exception in East Anatolian Fault) with PGA ≥ 0.4g were assigned Zone I and regions with PGA ≤0.1g were assigned as Zone V. This rounding off features and sub-province level resolution does not allow for its use in risk assessment purposes (Prota, 2011).

Earthquake Hazard Map of Turkey is a general zoning map that does not necessarily consider return periods, event frequencies and randomness of events. It only indicates hazard exposure levels of settlements without providing any information about risk levels and does not specify any quantitative earthquake hazard parameters for any zone. Besides it doesn’t indicates any information about ordering and prioritization of settlements in the same hazard zones, all settlements located in the same hazard zones are accepted as of equal in risk apart from their physical settings and vulnerabilities.

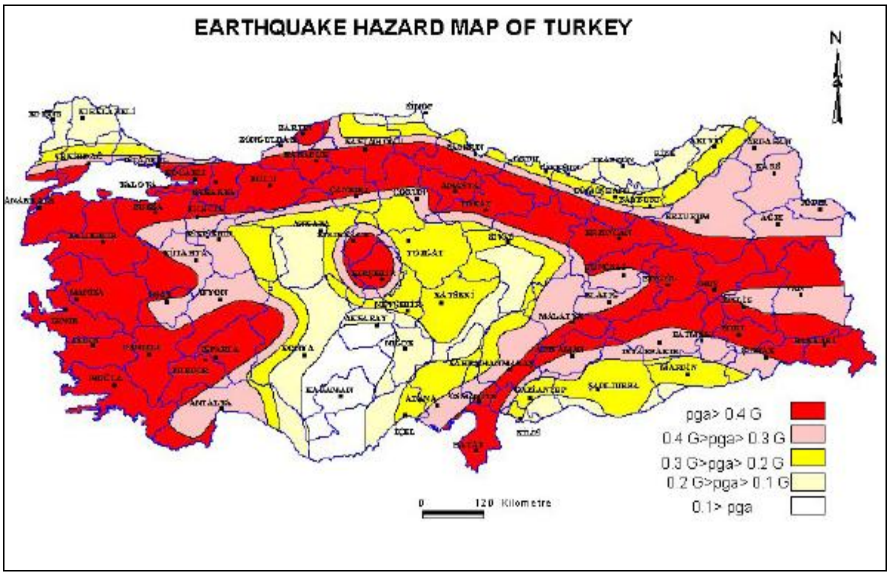


Figure 3.2 Earthquake Hazard Zoning Map of Turkey
(Source: GDDA, 1996)

Due to these deficiencies of the Official Earthquake Hazard Map, it may be more appropriate to employ the probability hazard zones map provided by Erdik et al. (2002) for the identification of settlements under the higher threat of earthquake.

The intensity distribution map provided by Erdik et al. (2002) that is used for the purposes of prioritization of settlements according to their vulnerability levels, is representing 50% probability of occurrence in 72 years of return period.

This shorter - range estimation is more relevant for today's policy decisions rather than very long-term estimations of hazard. A second reason for this preference is the more accurate means of accounting for the recent hazards in a model with 'memory' (Balamir, 2011).

The intensity distribution map differentiates settlements into seven levels on the basis of expected hazard intensities from 5.0 to 8.0, where 5.0 is the least and 8.0 is the highest level of expected hazard intensity.

Within this intensity distribution map, it is assumed that seismic energy along the line-segments is released by characteristic earthquakes; therefore the earthquakes with magnitude ≥ 6.5 are associated with these line sources. Earthquakes with magnitude < 6.5 are assumed to take place within limited areal zones around these linear segments. Smaller en-echelon and/or diffused faults were assumed to be encompassed in these zones. In addition to linear and areal source zones background seismicity zones are defined to model the floating earthquakes that are located outside these distinctly defined source zones and to delineate zones where no significant earthquake has taken place (Erdik et al., 2002).

Therefore expected hazard intensity level of 6.5 is accepted as the breaking-point and all settlements with an expected hazard intensity level of 6.0 and less are excluded from the analyses assuming that insignificant damage is likely to take place in these settlements.

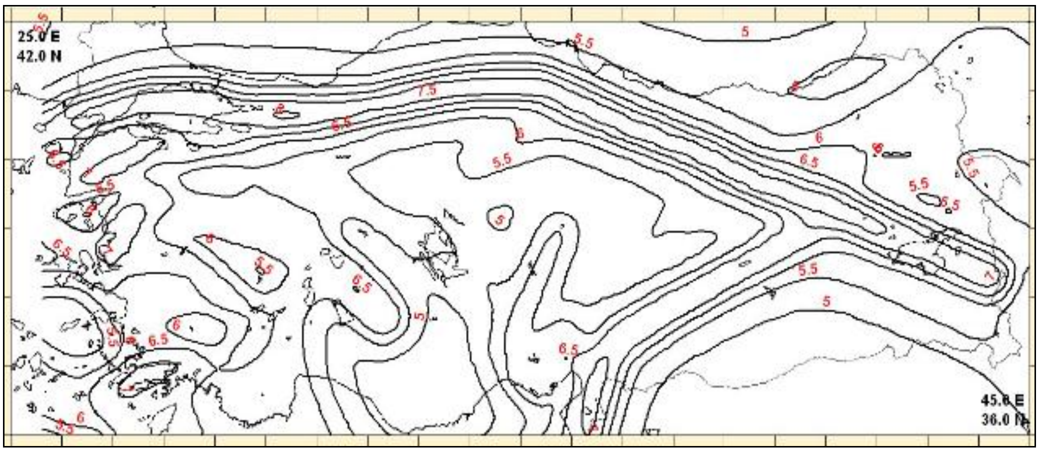


Figure 3.3 Intensity Distributions for 72 Years and %50 Probability
(Source: Erdik et al., 2002)

In order to underline the discrepancies between the Official Earthquake Hazard Map and the Intensity Distribution Map provided by Erdik et al. (2002), the distribution of settlements subject to 6.5 and upper seismic intensities evaluated with respect to the Official Earthquake Hazard Map of Turkey.

When we examine the distribution of settlements according to the Official Earthquake Hazard Zone Map, we observe that 434 sub-provinces and province centers including those of metropolitan cities are located in the I. Degree Earthquake Zone that is the highest hazard probability zone. This is about %50 of all sub-province and province centers of the country.

On the other hand, when we examine the distribution of settlements subject to 6.5+ seismic intensities according to the Seismic Intensity Map, we observe that 498 of settlements are located in high hazard impact zone which is %54, 8 of all settlements. As 6.5 and upper intensities can be classified as the high hazard impact zone, we can easily say that approximately two third of all population living under serious threat.

The distribution of sub-province and province centers according to both maps is as follows:

Table 3.1 Evaluation of Settlements Subject To 6.5+ Seismic Intensities According to the Seismic Intensity Map With Respect to the Official Earthquake Hazard Map

Official Earthquake Hazard Map			**Seismic Intensity Map**		
Earthquake Hazard Zone	Number of Settlements	%	Expected Seismic Intensity	Number of Settlements	%
1	434	47,8	8	59	6,4
2	203	22,3	7.5	79	8,7
3	135	14,9	7	149	16,5
4	115	12,7	6.5	211	23,2
5	21	2,3	6<	410	45,2
Total	**908**	**100**	**Total**	**908**	**100**

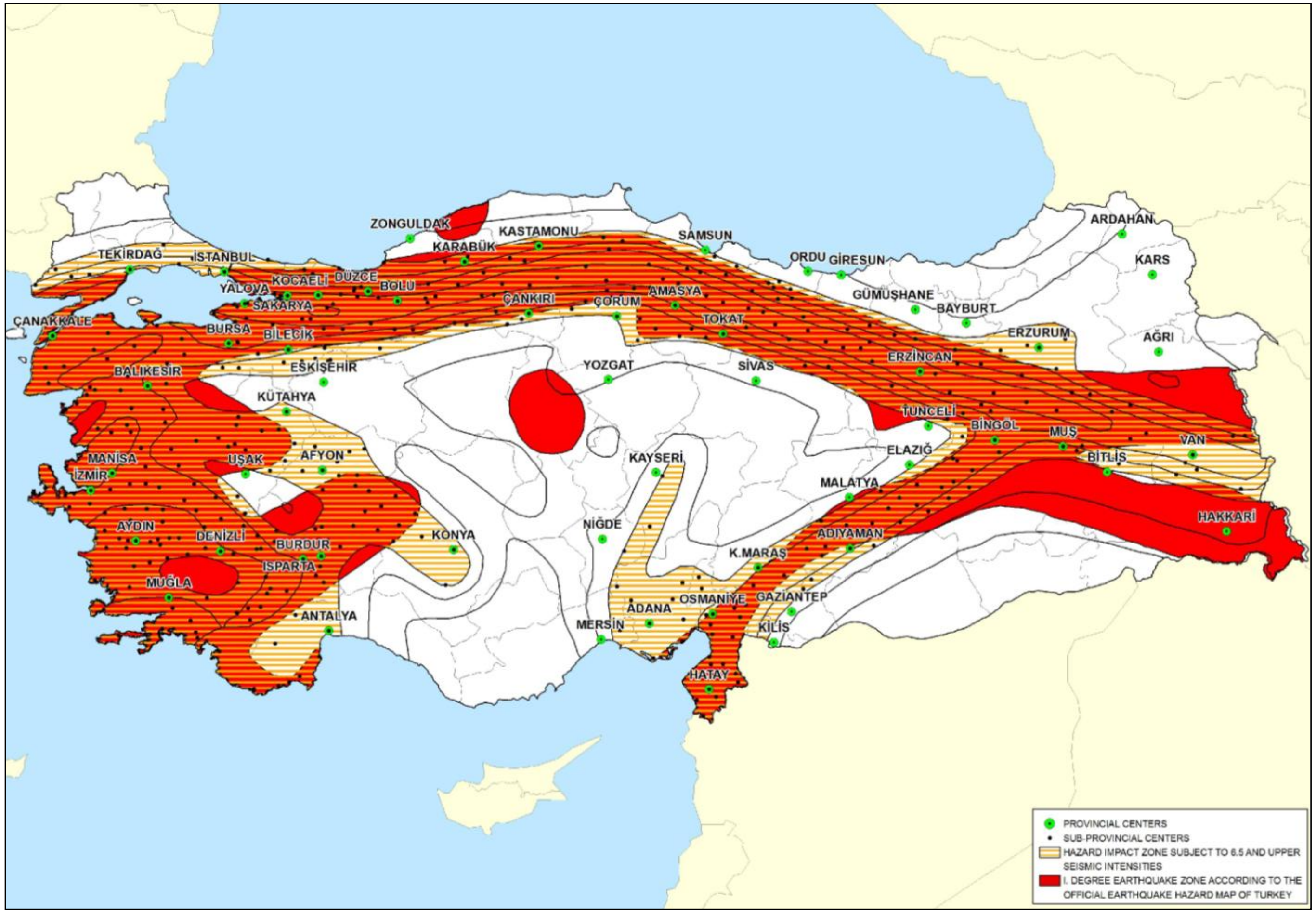


Figure 3.4 Evaluation of Settlements Subject To 6.5+ Seismic Intensities According To the Seismic Intensity Map with Respect to the Official Earthquake Hazard Map

3.1.1. Different Measures of Seismic Hazard

Two different types of scales are commonly used to describe seismic hazards. The original force or energy of an earthquake is measured on a magnitude scale, while the intensity of shaking is measured on an intensity scale. However, these two scales are quite different they are often confused.

Magnitude scale is related to the amount of seismic energy released at the source/epicenter of the earthquake, is determined from measurements on seismographs and is a measurement of the size of the earthquake. Intensity scale measures the strength of shaking produced by the earthquake at a certain location, is determined from effects on people, buildings, human structures and the natural environment and is a measurement of the earthquake effects.

An earthquake has one magnitude, but many intensities, magnitude is a fixed value independent of distance from the epicenter of the earthquake, whereas intensity varies and is measured differently at different places depending upon its distance from the epicenter.

Magnitude is quantitative and exact and it is expressed as a number; intensity is qualitative and more subjective and it is expressed as a roman number.

Magnitude Scales

The Richter scale and The Moment Magnitude scale are both measures of the magnitude of earthquakes. Although, both scales are still used the Moment Magnitude scale is designed to overcome the problems of the Richter scale and is gradually replacing the Richter scale. The numbers generated by the two scales are usually very similar.

The Richter scale is used for the small size earthquakes while the Moment Magnitude scale is used for the medium to large earthquakes mostly.

The Richter Magnitude Scale

The Richter magnitude scale was developed in 1935 by Charles F. Richter to compare the size of earthquakes. It is a logarithmic scale and assigns values from 1-10 to the magnitude of any earthquake.

Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

The Richter scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that doesn’t affect anything (USGS, 2012).

The following is an abbreviated description of the 10 levels of Richter Magnitude Scale.

Table 3.2 Richter Magnitude Scale
(Source: Adapted from USGS, 2012)

Magnitude	Description	Effects
< 2.0	Micro	Micro earthquakes, not felt
2.0 - 2.9	Minor	Generally not felt, but recorded
3.0 - 3.9		Often Felt, but rarely causes damage
4.0 - 4.9	Light	Noticeable shaking of indoor items, ratting noises. Significant damage unlikely
5.0 - 5.9	Moderate	Can cause major damage to poorly constructed buildings over small regions. At most slightly damage to well-designed buildings
6.0 - 6.9	Strong	Can be destructive in areas up to about 160 kilometers across in populated areas
7.0 - 7.9	Major	Can cause serious damage over larger areas
8.0 - 8.9	Great	Can cause serious damage in areas several hundred kilometers across
9.0 - 9.9		Devastating in areas several thousand kilometers across
10.0 +	Massive	Never recorded, widespread devastation across very large areas

The Moment Magnitude scale

The Moment Magnitude scale was introduced in 1979 by Tom Hanks and Hiroo Kanamori as a successor to the Richter scale. It was developed to enable seismologists to better estimate the magnitude of large earthquakes, those greater than 7, as the Richter scale is not accurate at estimating earthquake magnitudes where the epicenter was greater than 600 km from the seismometer station or where the earthquake magnitude was greater than 7.0.

Thus, for medium-sized earthquakes, the moment magnitude values should be similar to Richter values. That is, a magnitude 5.0 earthquake will be about a 5.0 on both scales (Benton, 2012).

Unlike other scales, the moment magnitude scale does not saturate at the upper end; there is no upper limit to the possible measurable magnitudes. However, this has the side-effect that the scales diverge for smaller earthquakes. Therefore, Moment Magnitude scale is now the most common measure for medium to large earthquake magnitudes but breaks down for smaller quakes.

It’s not based on instrumental recordings of an earthquake. It’s based on the area of the fault that moved at the same moment as an earthquake.

Intensity Scales

The first widely adopted intensity scale, the Rossi-Forel scale, was introduced in the late 19th century. Since then numerous intensity scales have been developed and are used in different parts of the world.

Although numerous intensity scales have been developed to evaluate the effects of earthquakes, the most commonly used intensity scales are; the European Macro seismic Scale that is used in Europe, the Modified Mercalli Intensity Scale that is used in USA and Hong Kong and the Medvedev-Sponheuer-Karnik that is used in India, Israel, Kazakhstan and Russia.

Unlike magnitude scales, intensity scales do not have a mathematical basis; instead they are an arbitrary ranking based on observed effects. Most of seismic intensity scales have twelve degrees of intensity and are roughly equivalent to one another in values but vary in the degree of sophistication employed in their formulation.

Values in the intensity scales depend upon the distance to the earthquake, with the highest intensities being around the epicenter. Data gathered from people who have experienced the quake are used to determine an intensity value for their location. The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scales are based on observed structural damage.

The European Macro-seismic Scale (EMS)

The European Macro seismic Scale (EMS) is the basis for evaluation of seismic intensity in European countries and is also used in a number of countries outside Europe. The scale is referred as EMS-98.

The history of the EMS began in 1988 when the European Seismological Commission decided to update the Medvedev-Sponheuer-Karnik scale (MSK-64), which was used in its basic form in Europe for almost a quarter of a century.

EMS-98 is the first seismic intensity scale designed to encourage co-operation between engineers and seismologists, rather than being for use by seismologists alone. Unlike the earthquake magnitude scales, which express the seismic energy released by an earthquake, EMS-98 intensity denotes how strongly an earthquake affects a specific place (SED, 2012).

The European Macro seismic Scale has 12 levels, as follows:

Table 3.3 European Macro Seismic Scale (EMS-98)
(Source: SED, 2012)

EMS intensity	Definition	Description of typical observed effects (abstracted)
I	Not felt	Not felt.
II	Scarcely felt	Felt only by very few individual people at rest in houses.
III	Weak	Felt indoors by a few people. People at rest feel a swaying or light trembling.
IV	Largely observed	Felt indoors by many people, outdoors by very few. A few people are awakened. Windows, doors and dishes rattle.
V	Strong	Felt indoors by most, outdoors by few. Many sleeping people awake. A few are frightened. Buildings tremble throughout. Hanging objects swing considerably. Small objects are shifted. Doors and windows swing open or shut.
VI	Slightly damaging	Many people are frightened and run outdoors. Some objects fall. Many houses suffer slight non-structural damage like hair-line cracks and fall of small pieces of plaster.
VII	Damaging	Most people are frightened and run outdoors. Furniture is shifted and objects fall from shelves in large numbers. Many well built ordinary buildings suffer moderate damage: small cracks in walls, fall of plaster, parts of chimneys fall down; older buildings may show large cracks in walls and failure of fill-in walls.
VIII	Heavily damaging	Many people find it difficult to stand. Many houses have large cracks in walls. A few well built ordinary buildings show serious failure of walls, while weak older structures may collapse.
IX	Destructive	General panic. Many weak constructions collapse. Even well built ordinary buildings show very heavy damage: serious failure of walls and partial structural failure.
X	Very destructive	Many ordinary well built buildings collapse.
XI	Devastating	Most ordinary well built buildings collapse, even some with good earthquake resistant design are destroyed.
XII	Completely devastating	Almost all buildings are destroyed.

The Modified Mercalli Intensity Scale

The Mercalli scale originated with the widely-used simple ten-degree Rossi-Forel scale which was revised by Giuseppe Mercalli in 1884. In 1931 it was modified by Harry Wood and Frank Neumann as the Mercalli-Wood-Neumann (MWN) scale. The scale is known today as the Modified Mercalli scale (MM) Intensity scale.

The Modified Mercalli Intensity scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature and man-made structures on a scale from I (not felt) to XII (total destruction).

This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The following is an abbreviated description of the 12 levels of Modified Mercalli Intensity Scale.

Table 3.4 Modified Mercalli Intensity Scale (MM)
(Source: Wood and Neumann, 1931)

Intensity	Effects
I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XII	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

The Medvedev-Sponheuer-Karnik Scale

The Medvedev-Sponheuer-Karnik scale, also known as the MSK or MSK-64 was first proposed by Sergei Medvedev, Wilhelm Sponheuer and Vit Karnik in 1964. It was based on the experiences being available in the early 1960s from the application of the Modified Mercalli scale and the 1953 version of the Medvedev scale.

With minor modifications in the mid-1970s and early 1980s, the MSK scale became widely used in Europe and the USSR. In early 1990s, the European Seismological Commission used many of the principles formulated in the MSK in the development of the European Macro-seismic scale. The Medvedev-Sponheuer-Karnik scale has 12 intensity degrees and it is similar to the Modified Mercalli (MM) scale (See Table 3.4).

The summarized table of the most featured magnitude and intensity scales are given below.

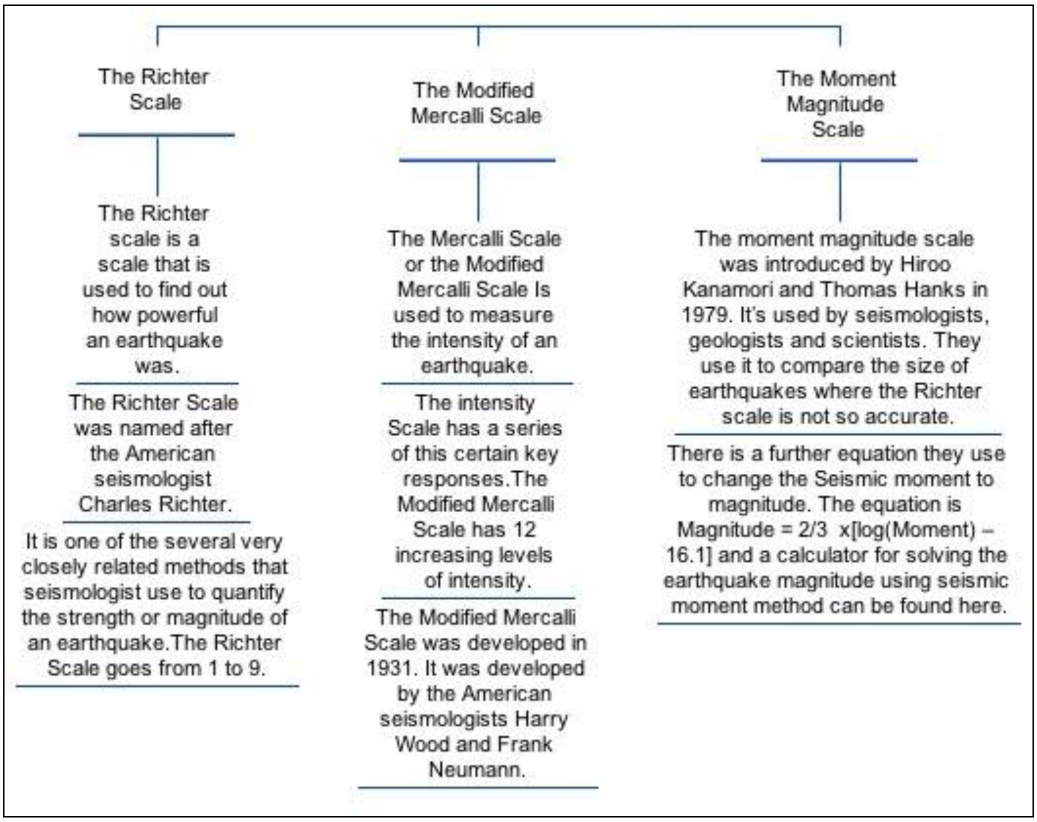


Figure 3.5 The Richter, Modified Mercalli and the Moment Magnitude Scales (Source: Benton, 2012)

The following table gives intensities that are typically observed at locations near the epicenter of earthquakes of different magnitudes.

Table 3.5 Relationship between the Richter Magnitude Scale and Modified Mercalli Intensity Scale
(Source: USGS, 2012)

Magnitude	Modified Mercalli Intensity
1.0 - 3.0	I
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII or higher

3.1.2. Explanation of Erdik Rationale

The technical approach used for the assessment and prioritization of the seismic vulnerabilities in Turkey employed within the study is based on the particular seismic intensity information derived by Erdik et al. (2002).

Two different methodologies have been used by Erdik et al. (2002) to compute the probabilistic hazard in Turkey. These are 'time-dependent approach' for the Marmara region and 'Poisson approach' for the remaining regions of the Turkey.

"Earthquake occurrence and fault segmentation data in the Marmara region are adequate to constrain a time dependent characteristic model for the region. The results of the study indicate a lower future hazard for the region of the 1999 earthquake and a higher hazard for the Central Marmara Sea region corresponding to the un-ruptured segments of the Main Marmara Fault in the Marmara Sea, when compared to Poisson, so-called memory-less models. This finding is also in accordance with (Parsons et al, 2000) indicating heightened probabilities for a major earthquake in the Marmara Sea region based on stress transfer approach" (Erdik at al., 2010).

"In time-dependent models, the probability of earthquake occurrence increases with the elapsed time since the last major earthquake on the fault that controls the regional earthquake hazard. In the case of the main Marmara Fault this earthquake is the 1999 Kocaeli event. This model is characterized by the recurrence-interval probability-density function of the characteristic earthquakes. Extensive paleoseismic and historical seismicity investigations on individual strike-slip faults (especially in California and Northwestern Turkey) indicate a quasi-periodic occurrence of characteristic earthquakes favoring the use of 'time dependent' stochastic models" (Erdik at al., 2010). The methodology, elaborated in Erdik et al., is essentially very similar to the one developed and used by United States Geological Survey - Working Group on California Earthquake Probabilities (WGCEP) for the preparation of US National Seismic Hazard Maps. The main physical ingredients of seismic hazard assessment are the tectonic setting of the region, the earthquake occurrences and the local site conditions.

"While the Poisson process seems to be applicable in a global sense in a regional scale, extensive paleoseismic and historical seismicity investigations on individual faults indicate a somewhat periodic occurrence of large magnitude earthquakes that necessitate the use of 'time dependent' (or 'renewal') stochastic models (Schwartz and Coppersmith, 1984). The time dependent model is based on the assumption that the occurrence of large earthquakes has some periodicity. The conditional probability that an earthquake occurs in the next T years, given that it has not occurred in the last T years is calculated by and integral function. For the renewal model, the conditional probabilities for each fault segment are calculated. These probabilities are said to be conditional since they change as a function of the time elapsed since the last earthquake" (Erdik at al., 2010).

The time-independent probabilistic 'Poissonian model' was used to assess the seismic hazard in the remaining regions of the Turkey. For the earthquake events to follow that model, the following assumptions are in order:
1- Earthquakes are spatially independent;
2- Earthquakes are temporally independent;
3- Probability that two seismic events will take place at the same time and at the same place approaches zero.

"The historical and instrumental seismicity, tectonic models and the known slip rates along the faults constitute the main ingredients of the hazard analysis. Seismic Zonation has been implemented in three levels. The first level consists of linear faults representing the North Anatolian Fault (NAF), the north and east branches of NAF in the Marmara region, Bitlis – Zagros Suture Zone, Hatay Fault, Ezinepazari Fault, East-Anatolian Fault, Goksun Fault, Ecemis Fault, Tuzgolu Fault, Eskisehir Fault Zone, Simav-Sultandağ Fault Zone, Fethiye-Burdur Fault Zone, Gokova Fault Zone, Menderes Fault Zone, Gediz Fault Zone and Bergama Fault Zone. It is assumed that seismic energy along the line-segments is released by characteristic earthquakes; therefore the earthquakes with magnitude Mw≥ 6.5 are associated with these line sources. The second level consists of limited areal zones around these linear segments assuming that earthquakes with magnitude Mw< 6.5 may take place within this zone. Smaller en-echelon and/or diffused faults were assumed to be encompassed in these zones. The third level considers the background seismicity, which represents the diffused seismicity that cannot be associated with known faults" (Erdik et al., 2010).

"Owing to the geological and geo-tectonic similarity of Anatolia to the California (strike slip faults similar to North, Northeast and East Anatolian Faults), the average of Boore et al. (1997), Sadigh et.al. (1997) and Campbell et al.(2003) ground motion prediction models for Peak Ground Acceleration (PGA) and the average of Boore et. al. (1997) and Sadigh et.al. (1997) ground motion prediction models for Spectral accelerations at 0.2 sec. and 1.0 sec. periods currently used for the assessment of earthquake hazard for the Western US were utilized. Another reason for the selection of these models was the good agreement between the instrumental intensities computed with these models with the observed macro seismic intensity distribution" (Erdik et al., 2002).

"The influence of the local geological structure on damage distribution due to ground-motion amplification (also called site effects) has been well known in the literature (Borcherdt, 1994). The construction of the design basis response spectrum for different Site Classes can be achieved through the modification of the spectral acceleration (SA at 0.2s and at 1.0 sec) given by the hazard maps. The Uniform Hazard Response Spectrum presented in NEHRP (2003) that is employed as the appropriate spectral shape for a site is constructed with two parameters: the site-specific short period (SMS); and medium-period (SM1) spectral accelerations" (Erdik et al., 2002).

Site dependent peak ground acceleration (PGA) and peak ground velocities (PGV) for each return period (72, 475 and 2475 years) inferred from site dependent short and medium period spectral accelerations SMS and SM1 are calculated using the site dependent spectral accelerations for T=0.2 sec and T=1.0 sec. Based on the Wald et al (1999) methodology, the intensity distributions corresponding to 50%, 10% and 2% probabilities of exceedence in 50 years (return period of 72, 475, and 2475 years) have been obtained from both the site dependent PGA and PGV values (See Figure 3.7).

The intensity distribution of province and sub-province centers for 72 years return period and %50 probability are thus determined with respect to this research derived by Erdik et al. (2002) and is employed for the assessment and prioritization of the seismic vulnerabilities in Turkey within the study.

3.2. Loss Levels in Building Stock

Observed or estimated loss in settlements experiencing earthquakes could be measured by estimations with reference to the building stock. Risk in settlement units is defined as a function of material loss in the building stock with respect to the expected seismic event. It is assumed that loss in the building stock in each settlement can be used as a proxy to express the comparative loss of human life, economic loss, damages in infrastructural systems, as well as secondary and indirect levels of losses in the settlement. Therefore, settlement level loss in the building stock is the basic indicator of assumed risk and provides the dependent variables of the research.

In the estimation of building stock loss of settlements, three basic information components are employed:

1- The seismic hazard intensity of each settlement is likely to experience, based on a common set of assumptions is the first component. The particular seismic intensity information employed here is the 72-year return intensity with 50% probability and derived by Erdik et al. (2002). The map containing the spatial distribution of this information was used to determine the hazard level of all sub-provincial and provincial centers (See Figure 3.3).

2- Information concerning building stock properties in each settlement is obtained from TurkStat. The Building Census 2000 provides information on aspects of the building stock in each settlement. Following the categorization of the building stock provided in Demircioğlu (2010), four distinct groups of buildings have been identified in terms of number of buildings and number of storeys in each settlement (See Table 3.10).

3- Vulnerability/Fragility curves for each category of the building stock in Turkey, as empirically derived in Demircioğlu (2010) are employed here to determine the likely loss levels in settlements. According to this procedure, each of the four categories of the building stock in every settlement is separately evaluated in their likely response to the estimated intensity of shake (See Figures 3.17, 3.18 and 3.19).

By using three basic information components described above, determination of settlement level loss in the building stock has been realized by the following steps:

1. Assessment of the probabilistic seismic hazard and production of Settlements in Hazard Zones Map (72-years; 50% probability),
2. Determination of Settlement Categories According to Size,
3. Identification of Categories of Building Types in Each Settlement,
4. Determination of Loss Levels of Each Building Category with reference to Vulnerability Curves,
5. Ordering of Settlements in Each Category According to Total Absolute Loss and Relative Loss

Following above described procedure, identification of most vulnerable settlements in each size-category and 'provinces with high-risk' are accomplished.

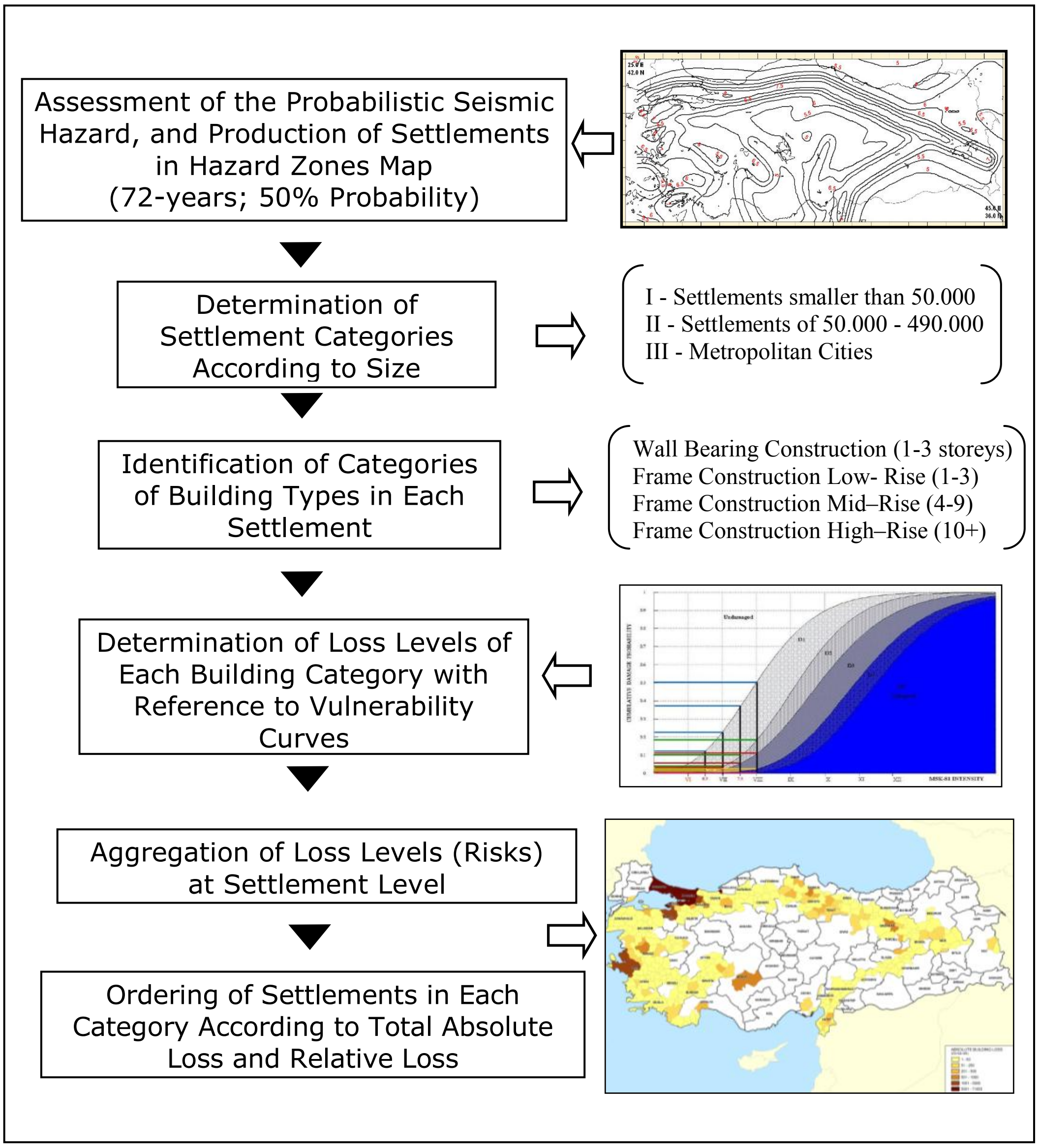


Figure 3.6 Flow Chart of Settlement Level Loss Determination

3.2.1. Loss Levels as a Function of Settlement Attributes

Determination of settlement level loss in the building stock has been realized by the following steps:

1. Assessment of the probabilistic seismic hazard and production of Settlements in Hazard Zones Map

Seismic hazard intensities of each of the province and sub-province centers were determined with reference to the map produced by Erdik et al. (2002) and based on the assumption that such intensities will occur with a 72-year return period at 50% probability.

This shorter - range estimation is more relevant for today's policy decisions rather than very long-term estimations of hazard. A second reason for this preference is the more accurate means of accounting for the recent hazards in a model with 'memory' (Balamir, 2011).

The intensity distribution map with a 72-year return period and 50% probability is digitized and used in the assessment of the probability seismic hazard and production of Settlements in Hazard Zones Map.

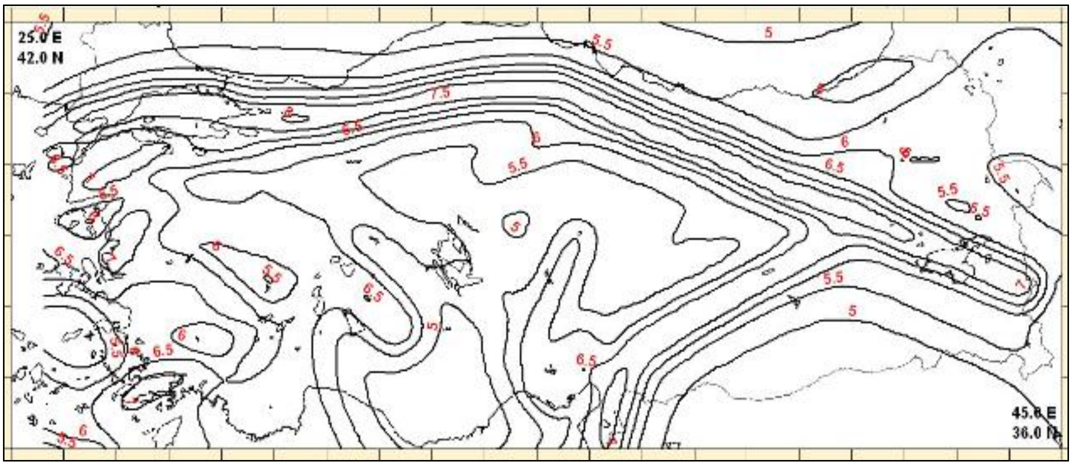


Figure 3.7 Intensity Distributions for 72 Years and %50 Probability
(Source: Erdik et al., 2002)

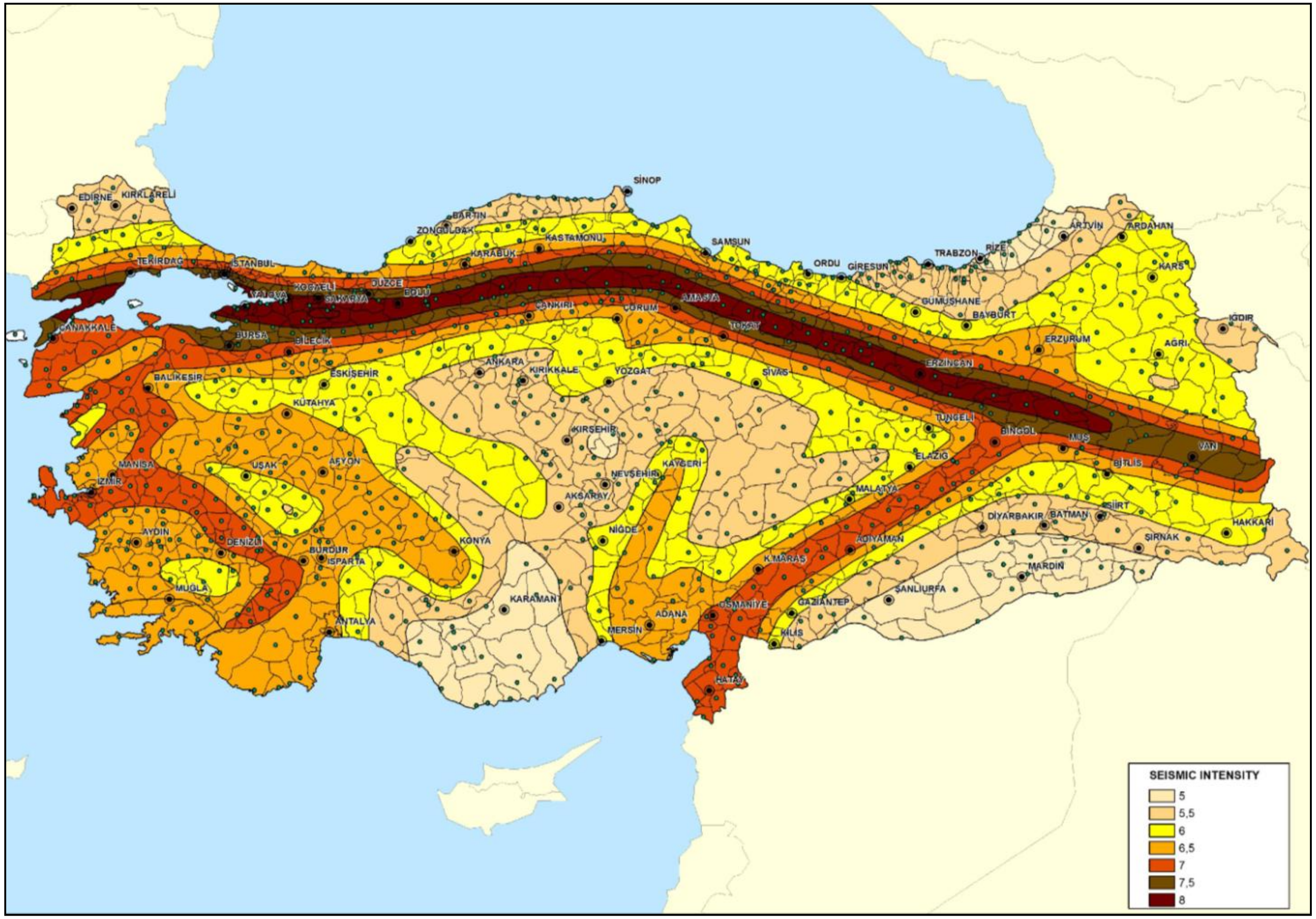


Figure 3.8 Spatial Distributions of 72-Year Return Period Intensity and 50% Probability and Distribution of Settlements

The distribution of province and sub-province centers according to expected hazard intensity levels within 72 years with a probability of 50% are given below in Table 3.6.

All settlements with an expected hazard intensity level of 6.0 and less are excluded from the analyses assuming that insignificant damage is likely to take place in these settlements.

Table 3.6 Expected Hazard Intensity Level Distribution of Province and Sub-Province Centers

Seismic Intensity	Number of Settlements	Number of Settlements %	Total Population	Total Population %
5.0	56	6,17	2.250.086	4,11
5.5	165	18,17	8.758.017	15,98
6.0	189	20,81	8.406.916	15,34
6.5	211	23,24	10.336.721	18,86
7.0	149	16,41	6.890.125	12,57
7.5	79	8,70	15.447.702	28,19
8.0	59	6,50	2.708.513	4,94
Total	**908**	**100**	**54.798.080**	**100**

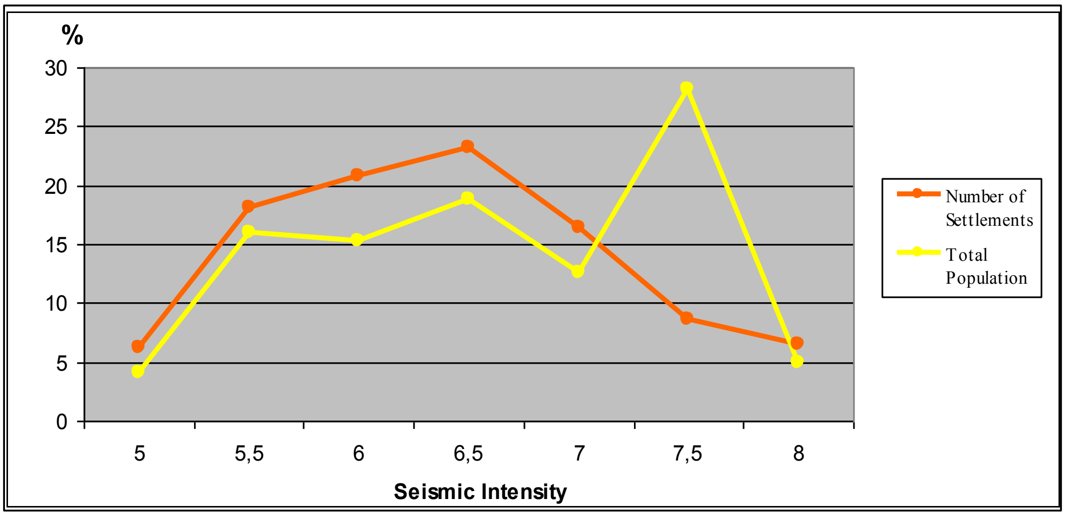


Figure 3.9 Expected Hazard Intensity Level Distributions of Province and Sub-Province Centers

2. Determination of Settlement Categories According to Size

Seeking for settlement attributes that can express overall vulnerability levels of cities could take into consideration the wide range of differences of settlements which could in the first instance be specified by size.

Metropolitan cities, large settlements and a multitude of smaller towns may be distinctly grouped both in terms of dependent and independent variables.

The rationale for categorization of settlements is the nature of vulnerabilities that is likely to vary in each settlement according to many interdependent components in physical and socio-economical terms. Yet settlements subject to similar intensities will have different levels of loss and cannot be described as of equal in vulnerabilities. One of the most featured reasons of this differentiation is the size of settlements.

If absolute vulnerabilities are measured in terms of likely loss levels, a bias for larger settlements and developed regions is inevitable. In order to avoid bias due to size of larger settlements and developed regions, a method of sub-grouping is to be employed. It may be appropriate to categorize the settlements in terms of population size and a categorization of settlements with reference to population is considered as an initial step.

Three groups of settlements are considered according to categorization of settlements with reference to population.

i- Metropolitan cities are identified as a separate category at the upper end. Irrespective of size and location, such province and sub-province centers are considered as a single settlement unit.

The remaining smaller cities are distinguished in two parts, almost identical in terms of total population. This marks the threshold size of 50.000.

ii- Sub-provincial and provincial centers of 50.000-490.000 are identified as a second category of settlements. These are often well-established settlements with higher rates of growth and expanding economies.

iii- Smaller sub-provincial and provincial centers with a population less than 50.000 make the third group of urban centers. These are relatively stagnant settlements.

The frequency distributions of province and sub-province centers subject to seismic disturbance of 6.5+ within 72 years with a probability of 50% are given below in terms of total population. The break-point of 50’000 is indicated in red.

Population distribution of settlements with reference to categories identified in the whole spectrum of seismic intensity levels is an overall indicator of exposure. The distributions of settlements within each size-category are given in the Figure 3.14.

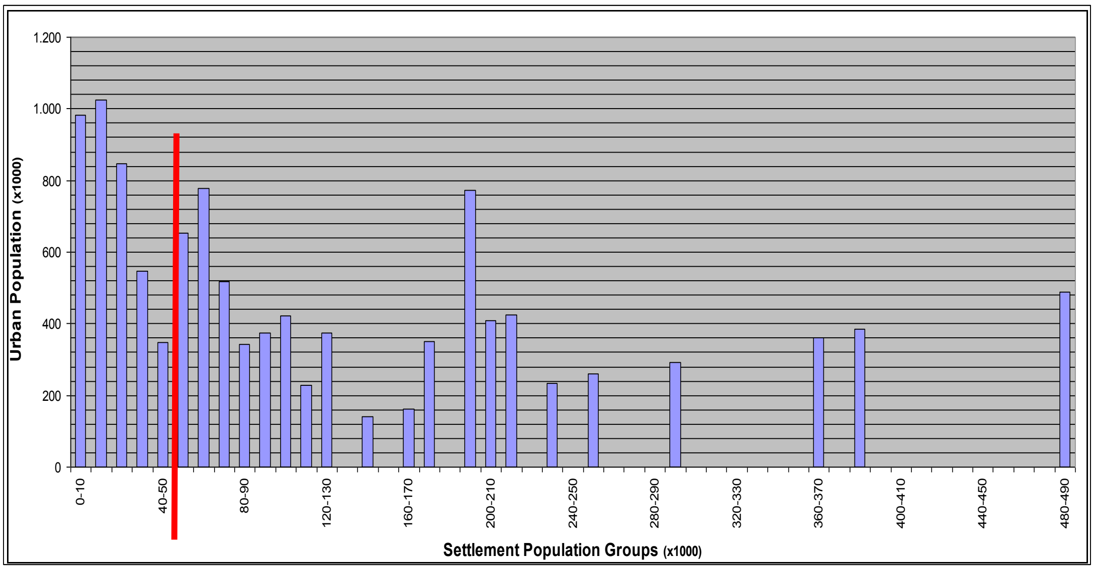


Figure 3.10 The Frequency Distribution of Province and Sub-Province Centers According to Population

The same distribution in terms of number of settlements indicates to a similar break-point.

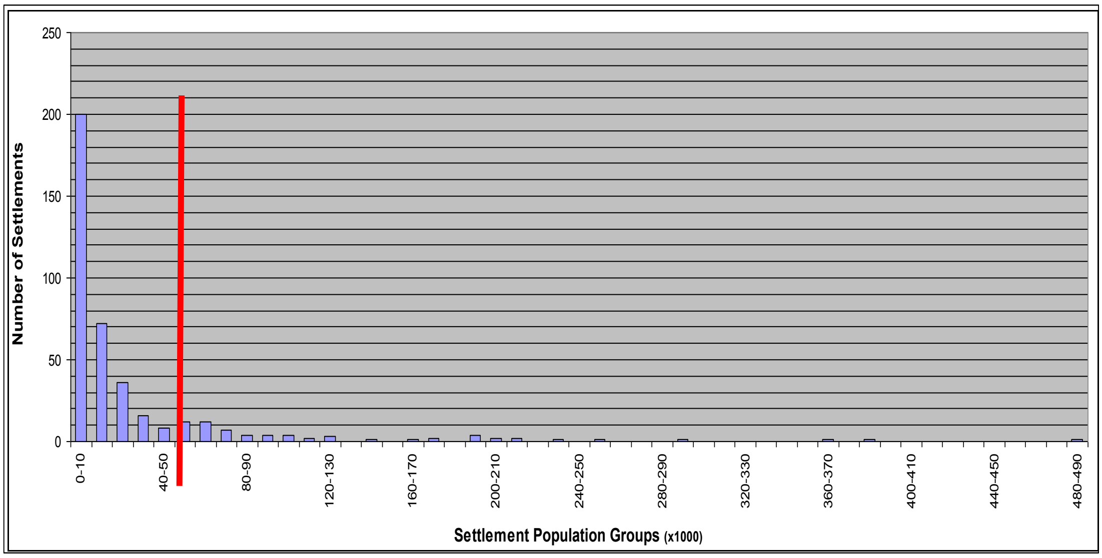


Figure 3.11 The Frequency Distribution of Province and Sub-Province Centers According to Number of Settlements

The overall distributions of settlements are as given in the table below:

Table 3.7 Distribution of Settlements According to Number of Settlements and Total Population with Seismic Hazard Intensity Levels of 6.5 and Above

Settlement Size Categories	Number of Settlements	Total Population
0- 50.000	332	3.748.214
50.000 - 490.000	66	7.972.548
Metropolitan provinces	100	23.662.299
Total	498	35.383.061

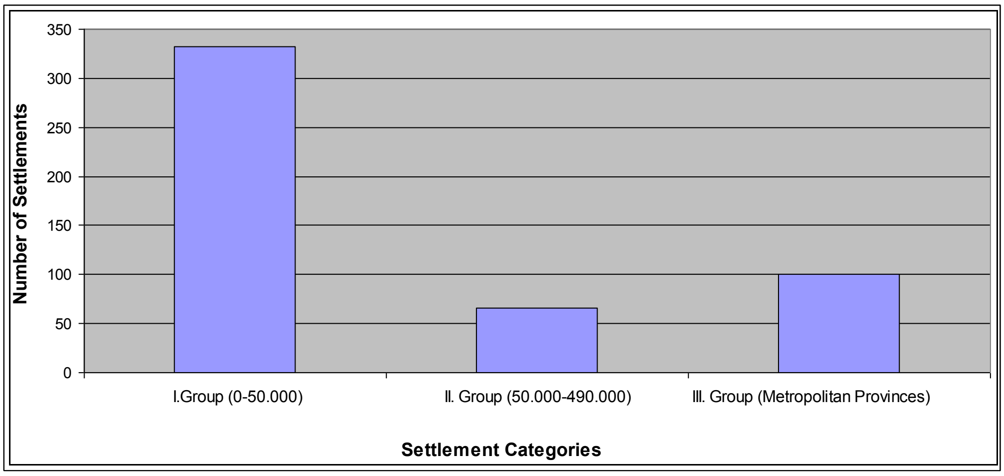


Figure 3.12 The Distribution of Province and Sub-Province Centers According to Number of Settlements

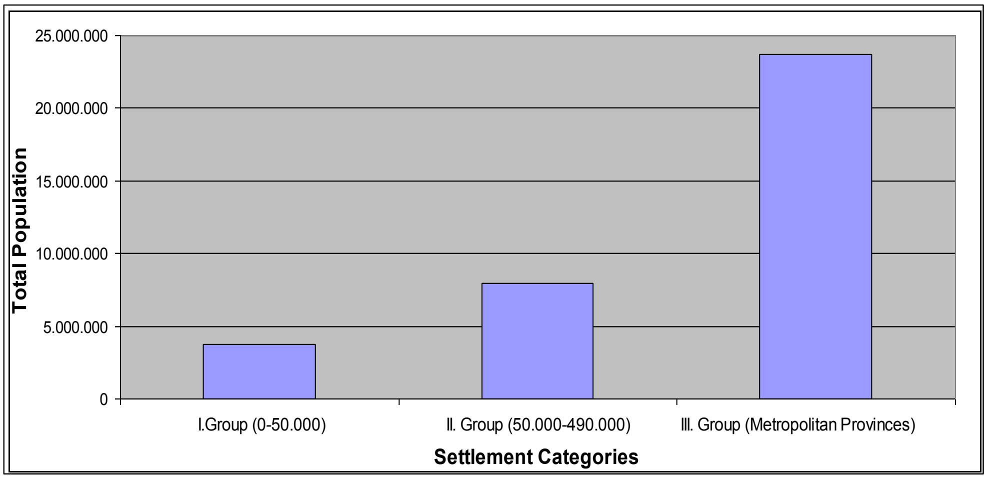


Figure 3.13 The Distribution of Province and Sub-Province Centers According to Total Population

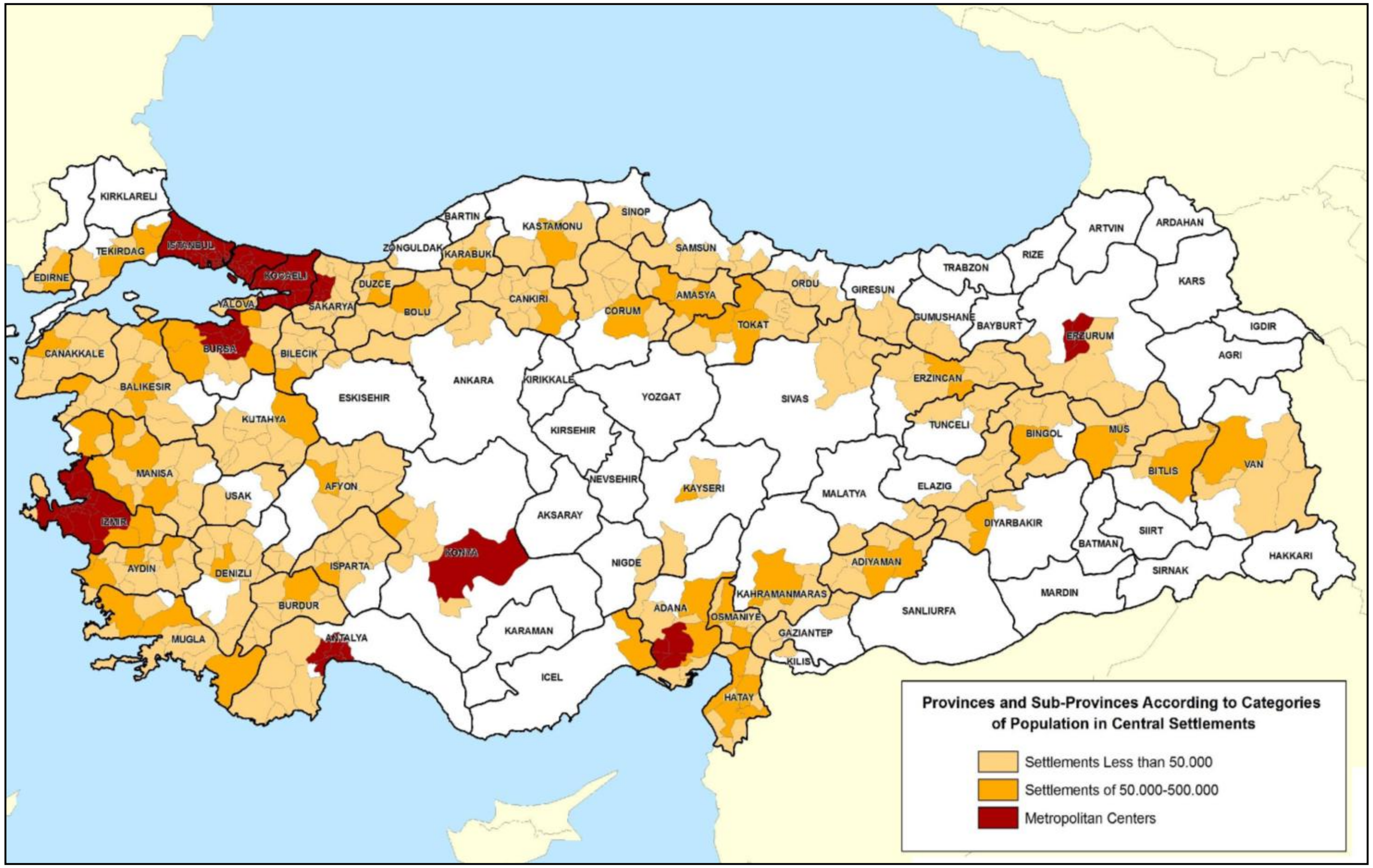


Figure 3.14 Spatial Distributions of Settlement Categories

When settlements and population subject to 6.5+ seismic hazards are compared with those subject to 6.0 and lower intensity seismic hazards, with reference to categories, the observed trend is a bias towards the higher end of the seismic scale both in terms of number of settlements and population.

When we examine the population distribution of settlements with reference to all seismic intensity levels, we saw that 35 % of all urban population in the country lives in settlements subject to intensities lower than 6.0. 65% of settlement population in the country lives in settlements subject to intensities 6.5 and upper. As 6.5+ intensities can be classified as the high hazard impact zone, we can easily say that approximately two third of all population living under serious threat.

Table 3.8 The Distribution of Province and Sub-Province Centers with Reference to all Seismic Intensity Levels According to Total Population

Settlement Size Categories	Total Population	Settlements Subject to Intensity of **5.0**	Settlements Subject to Intensity of **5.5**	Settlements Subject to Intensity of **6**	Settlements Subject to Intensity of **6.5**	Settlements Subject to Intensity of **7**	Settlements Subject to Intensity of **7.5**	Settlements Subject to Intensity of **8**
0- 50.000	7.103.520	578.088	1.256.877	1.520.341	1.780.609	1.213.371	302.697	451.537
50.000 - 490.000	14.823.516	1.671.998	2.360.181	2.818.789	4.339.446	2.538.841	678.810	415.451
Metropolitan provinces	32.871.044	0	5.140.959	4.067.916	4.216.666	3.137.913	14.466.195	1.841.525
Total	54.798.080	2.250.086	8.758.017	8.406.916	10.336.721	6.890.125	15.447.702	2.708.513
Total %	100	4	16	15	19	13	28	5

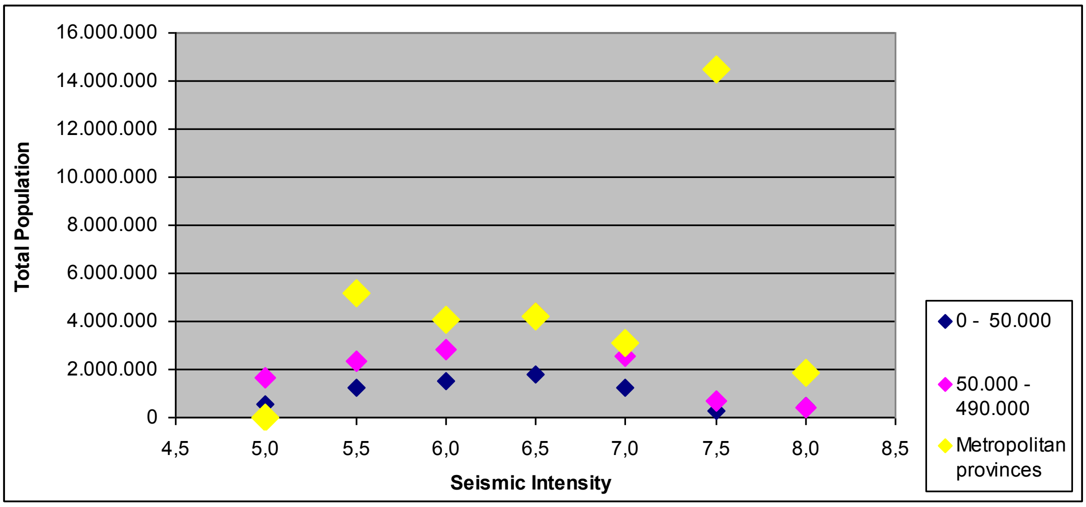


Figure 3.15 The Distribution of Province and Sub-Province Centers with Reference to all Seismic Intensity Levels According to Total Population

When we examine the distribution of settlements with reference to all seismic intensity levels, we saw that 45 % of settlements in the country are subject to intensities lower than 6.0 and 55% of settlements in the country is subject to intensities 6.5 and upper.

Table 3.9 The Distribution of Province and Sub-Province Centers with Reference to all Seismic Intensity Levels According to Number of Settlements

Settlement Size Categories	Number of Settle-ments	Settlements Subject to Intensity of **5.0**	Settlements Subject to Intensity of **5.5**	Settlements Subject to Intensity of **6**	Settlements Subject to Intensity of **6.5**	Settlements Subject to Intensity of **7**	Settlements Subject to Intensity of **7.5**	Settlements Subject to Intensity of **8**
0- 50.000	677	43	142	160	154	108	32	38
50.000 - 490.000	124	13	21	24	35	22	4	5
Metropolitan provinces	107	0	2	5	22	19	43	16
Total	908	56	165	189	211	149	79	59
Total %	100	6	18	21	23	17	9	6

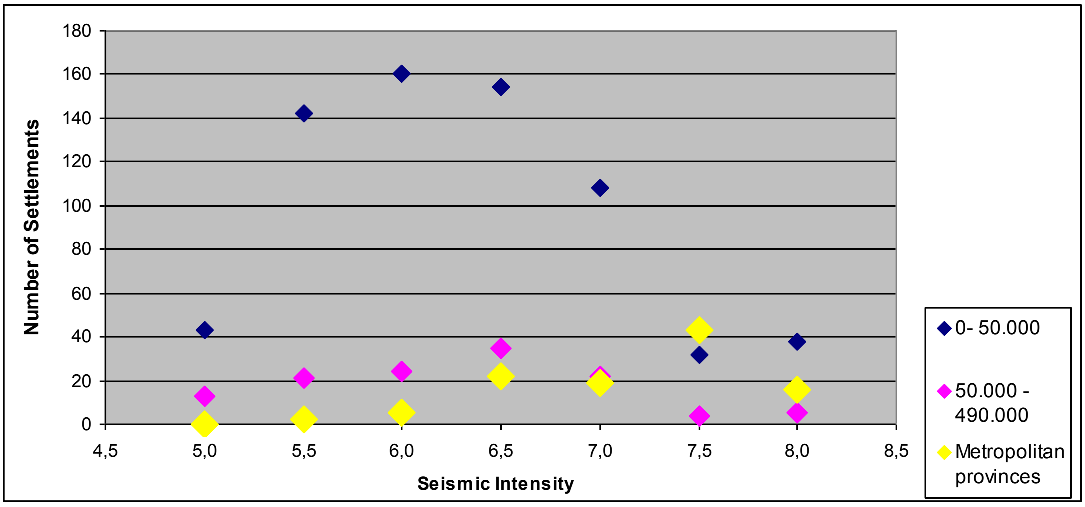


Figure 3.16 The Distribution of Province and Sub-Province Centers with Reference to all Seismic Intensity Levels According to Number of Settlements

Distribution of settlement categories indicates significant variation with reference to intensity of seismic hazard. Almost half of the smaller settlements prove take place at the lowest end of the seismic scale under consideration. This is reversed in the case of metropolitan centers as it can be seen in Table 3.4. This trend is observed to repeat itself with even greater shares in terms of population.

3. Identification of Categories of Building Types in Each Settlement

Following the categorization of the building stock provided in Demircioğlu et al. (2010), four distinct groups of buildings have been identified. Load-bearing buildings, reinforced concrete structures of low-rise, medium-rise, and high-rise building categories are available in terms of number of buildings in each settlement.

Information concerning building stock properties in each settlement is obtained from Building Census-2000 produced by Turkish Statistical Institute. The publication however of this source of information was not aggregated at the settlement level. A special disaggregated version of the building census 2000 at the level of settlements was accessed for this research.

Data available for the building stock in the TurkStat statistics at settlement level provide information on number of buildings in each group separate from number of storey. These statistics provide information on the structural properties of buildings in Table 5 and the distribution of the number of storeys in Table 8 for the same building stock in every municipality.

These two tables were integrated on the basis that almost all buildings of 4+ storey's were frame structures, residual numbers of frame structures were attributed to lower storey buildings, and compositions of wall-bearing and frame structures established for each municipality corresponding to province and sub-province centers.

A re-aggregation based on number of storeys was necessary for an adjustment for the use of the vulnerability curves of buildings. The number of storey grouping has been organized so that 1-3 storey reinforced concrete buildings and load-bearing buildings have been combined. The mid-rise group was determined as 4-9 storey buildings. The 10+ storey buildings were identified as the high-rise group of buildings.

The distribution of building stock attributes for all settlements according to construction type and number of storeys is given in the Appendix A.

In this minor re-appointment procedure of building categories special consideration was given to remain on the safer side, avoiding the likelihood of under-estimations of building vulnerabilities. The redistribution of the building stock thus maintained the compatibility with the definitions of the building vulnerability/fragility curves developed for Turkey (Balamir, 2011).

Table 3.10 Building Stock Categories of Settlements According to Construction Type and Number of Storeys (6.5 + Seismic Intensity)

Settlement Size Categories	Number of Settlements	Wall Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)	Total Number of Buildings
0-50.000	332	440.905	341.875	54.309	80	843.188
50.000 – 500.000	66	482.844	357.630	128.564	619	973.014
Metropolitan cities	100	655.200	899.892	541.888	10.862	2.116.296
Total	498	1.578.949	1.599.397	724.761	11.561	3.932.498

Table 3.11 Building Stock Averages of Settlements According to Construction Type and Number of Storeys (6.5 + Seismic Intensity)

Settlement Size Categories	Wall Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
0-50.000	1328	1030	164	0,24
50.000 – 500.000	7316	5419	1948	9
Metropolitan cities	72.800	99.988	60.210	1207
Turkey Total	4.001.954	2.735.955	1.038.730	17.407
Mean	1246	852	323	5

Table 3.12 Building Stock Categories of Settlements According to Construction Type and Number and Storeys by Percentages (6.5 + Seismic Intensity)

Settlement Size Categories	Number of Settlements %	Wall Bearing Construction (1-3 storeys) (%)	Frame Construction Low- Rise (1-3) (%)	Frame Construction Mid – Rise (4-9) (%)	Frame Construction High – Rise (10+) (%)	Total Number of Buildings %
0-50.000	67	28	21	8	1	21
50.000 – 500.000	13	31	23	17	5	25
Metropolitan cities	20	41	56	75	94	54
Total	100	100	100	100	100	100

Table 3.13 Building Stock Categories of Settlements According to Construction Type and Number and Storeys by Percentages (6.5 + Seismic Intensity)

Settlement Size Categories	Wall Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid – Rise (4-9)	Frame Construction High – Rise (10+)
0-50.000 (%)	53	41	6	0
50.000 – 500.000 (%)	50	37	13	0
Metropolitan cities (%)	31	43	26	1
Total (%)	40	41	19	0

4. Determination of Loss Levels of Each Building Category with Reference to Vulnerability Curves

Vulnerability functions or fragility curves of an element at risk represent the probability that its response to earthquake excitation exceeds its various performance limit states based on physical and socioeconomic considerations (Erdik et al, 2002).

Vulnerability/fragility curves for each category of the building stock in Turkey, as empirically derived in Demircioğlu et al. (2010), are employed here to determine the likely loss levels therefore risks in settlements.

The horizontal axis indicates the range (uncertainty) of MSK intensities and the vertical scale indicates the percentage loss for the five different damage grades, D1 through D5, as described in EMS-98.

Building type categories are adjusted according to the definitions of the vulnerability curves based on empirical observations. These curves are devoted for low-rise reinforced concrete buildings, as well as mid-rise and high-rise reinforced concrete buildings. The vulnerability curve of the load-bearing category is assumed to approximate with the low-rise reinforced concrete type of buildings (See Figure 3.17, 3.18 and 3.19).

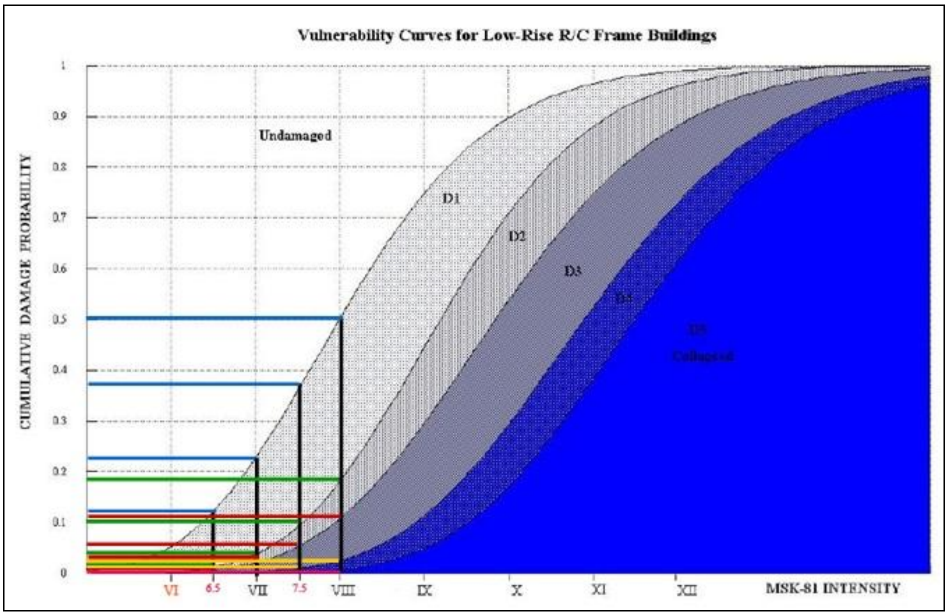


Figure 3.17 Intensity Based Vulnerability Curves for Load-Bearing and Low-Rise Reinforced Concrete Frame Type Buildings
(Source: Demircioğlu et al., 2010)

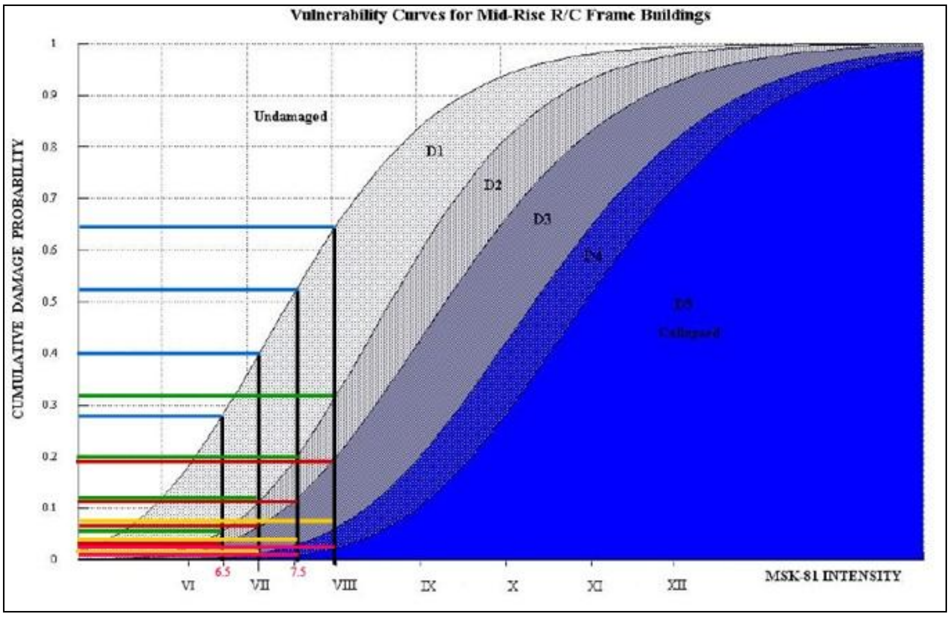


Figure 3.18 Intensity Based Vulnerability Curves for Mid-Rise Reinforced Concrete Frame Type Buildings
(Source: Demircioğlu et al., 2010)

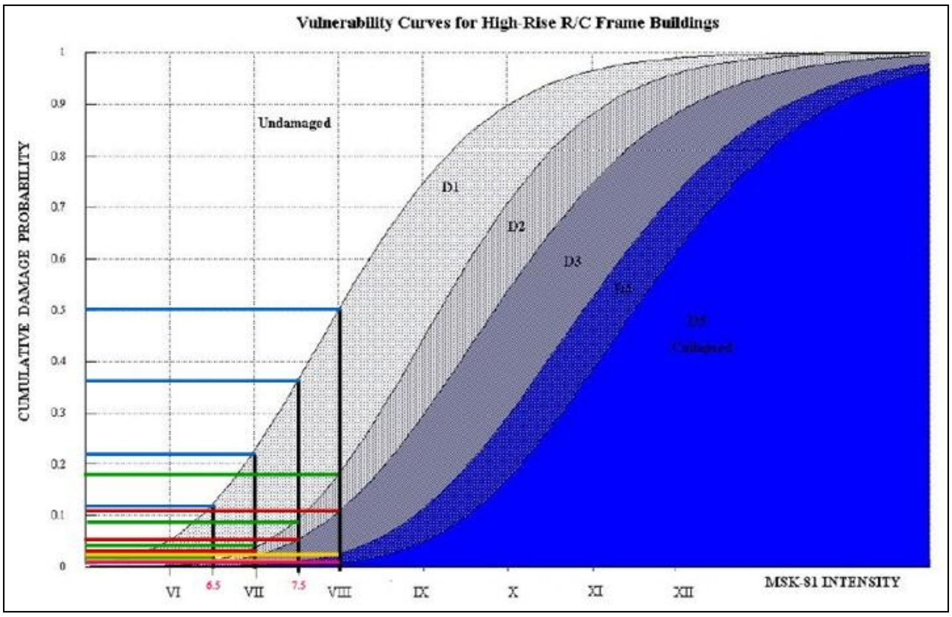


Figure 3.19 Intensity Based Vulnerability Curves for High-Rise Reinforced Concrete Frame Type Buildings
(Source: Demircioğlu et al., 2010)

The 1998 European Macro seismic Scale (EMS, 1998) differentiates the structural vulnerabilities into six classes (A to F). Reinforced Concrete buildings with low levels of earthquake resistant design are assigned an average vulnerability class of C (Erdik et. al. 2002).

As illustrated in Figure 3.20 damage to reinforced concrete buildings are classified as: D1-Negligible to slight damage, D2-Moderate damage, D3-Substantial to heavy damage, D4-Very heavy damage and D5-Destruction.

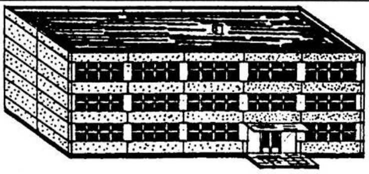
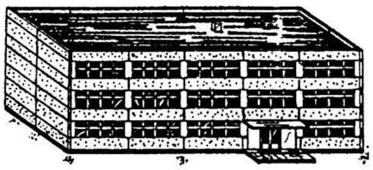
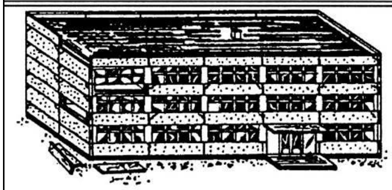
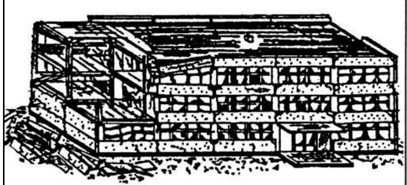
Classification of damage to buildings of reinforced concrete	
	**Grade 1: Negligible to slight damage** **(no structural damage,** **slight non-structural damage)** Fine cracks in plaster over frame members or in walls at the base. Fine cracks in partitions and infills.
	**Grade 2: Moderate damage** **(slight structural damage,** **moderate non-structural damage)** Cracks in columns and beams of frames and in structural walls. Cracks in partition and infill walls; fall of brittle cladding and plaster. Falling mortar from the joints of wall panels.
	**Grade 3: Substantial to heavy damage** **(moderate structural damage,** **heavy non-structural damage)** Cracks in columns and beam column joints of frames at the base and at joints of coupled walls. Spalling of conrete cover, buckling of reinforced rods. Large cracks in partition and infill walls, failure of individual infill panels.
	**Grade 4: Very heavy damage** **(heavy structural damage,** **very heavy non-structural damage)** Large cracks in structural elements with compression failure of concrete and fracture of rebars; bond failure of beam reinforced bars; tilting of columns. Collapse of a few columns or of a single upper floor.
	**Grade 5: Destruction** **(very heavy structural damage)** Collapse of ground floor or parts (e. g. wings) of buildings.

Figure 3.20 Classification of Damage to Reinforced Concrete Buildings (Source: EMS, 1998)

Essentially using definitions from MSK-81 Scale, Coburn and Spence (1992) associates damage grades with following definitions:

Table 3.14 Description of Damage Grades in MSK-81 Intensity Scale (Source: Coburn & Spence, 1992)

Damage Grade	Masonry Buildings	Reinforced Concrete Buildings
D1-Slight	Hairline cracks	Panels cracked (Non-structural)
D2-Moderate	Cracks 0.5-2cm	Structural Cracks <1cm
D3-Heavy	Cracks >2cm. or wall material dislodged	Heavy damage to structural members, loss of concrete
D4-Partial Destruction	Complete collapse of individual wall or roof support	Complete collapse of individual structural member or major deflection of structure
D5-Collapse		Failure of structural members to allow fall of slabs.

The ratio of the cost of repair of the damage to the cost of reconstruction, expressed as the Repair-Cost Ratio, corresponding to the damage grades D1 through D5 can be approximately given as 0.05, 0.20, 0.50, 0.80 and 1.0. Damage levels encompassing damages D3, D4 and D5 is an important descriptor of the earthquake damage since D3 represents an approximate borderline between repair and replacement of the building stock exposed to an earthquake (Erdik et. al., 2002).

EMS-98 differentiates buildings into 6 classes on the basis of their vulnerabilities from A to F. Rubble stone masonry constitutes the most vulnerable - A class. Properly built R/C and steel buildings are in class D to F. For the vulnerability class C, where the general R/C building stock in Turkey is located, EMS-98 provides the following definitions of intensity where ‘few’ describes less than 20% and ‘many’ describes between 20% and 60%.

Intensity VI : A few buildings of vulnerability class C sustain Damage of Grade 1

Intensity VII : A few buildings of vulnerability class C sustain Damage of Grade 2

Intensity VIII : Many buildings of vulnerability class C suffer Damage of Grade 2, a few of grade 3

Intensity IX : Many buildings of vulnerability class C suffer Damage of Grade 3, a few of grade 4

Intensity X : Many buildings of vulnerability class C suffer damage of Grade 4, a few of grade 5

The redistribution of the building stock maintained the compatibility with the definitions of the building vulnerability/fragility curves developed for Turkey. According to this procedure, each of the four categories of the building stock in every settlement is separately evaluated in their likely response to the estimated intensity of shake. As a statistical distribution, specific levels of loss from each category of the building stock can be determined by means of the vulnerability curves. The rationale behind the vulnerability curves is based on international taxonomies and the empirical findings of research on the experience in Turkey.

With reference to the seismic hazard intensity that any settlement is likely to experience, total loss in building stock with its various types and categories are estimated in each group of settlements relying on the vulnerability curves of each building type. The coefficients of damage in buildings with reference to seismic intensities were employed as in Table 3.15 below.

Table 3.15 Coefficients of Likely Forms of Loss in the Building Stock of Settlements Subject to Varying Levels of Seismic Intensity

Seismic Intensity	**D1** (Slight Damage)	**D2** (Medium Damage)	**D3** (Heavy Damage)	**D4** (Partial Collapse)	**D5** (Collapse)
Low – Rise & Load Bearing					
6.5	0,12	0,02	0,01	0	0
7.0	0,22	0,04	0,03	0	0
7.5	0,37	0,10	0,05	0,01	0
8.0	0,50	0,18	0,11	0,03	0,01
Mid - Rise					
6.5	0,26	0,05	0,03	0	0
7.0	0,40	0,12	0,05	0,01	0
7.5	0,52	0,20	0,11	0,03	0,01
8.0	0,65	0,32	0,19	0,05	0,03
High - Rise					
6.5	0,12	0,01	0	0	0
7.0	0,22	0,03	0,02	0	0
7.5	0,36	0,09	0,05	0,01	0
8.0	0,50	0,18	0,11	0,02	0,01

Building loss in each damage grade is obtained by multiplying the coefficients of damage in buildings with the distribution of building stock attributes according to construction type and number of storeys.

With the assumption that D3 represents an approximate borderline between repair and replacement of the building stock, total number of building lost is determined by the combined levels of loss, which means adding up the three categories of the most severe forms of damage in buildings. These are 'heavy damage' - D3, 'partial collapse' - D4 and 'total collapse' - D5 as identified in the building vulnerability curves for each type of building.

Loss in each category of building types in each settlement is determined in absolute terms (total number of building loss) and relative terms (ratio of loss to the total building stock/ loss rate) with reference to the table above.

Total number of building loss = D3 + D4 + D5 → Absolute Loss

Loss Rate = (D3 + D4 + D5) / Total Building Stock → Relative Loss

The distribution of the total loss in building stock according to building types with reference to vulnerability curves in each settlement is given in the Appendix B.

It is then possible to have priority lists in each category of settlement-size in absolute and relative terms. Determination of loss could be interpreted by either of these criteria of absolute and relative loss. Even though these ratios may somewhat represent approximations, this may not represent a severe distortion in the estimations of loss in relative terms in the prioritization exercise carried out here.

3.2.2. Building Loss Estimates as a Function of Likely Seismicity and Building Categories

5. Ordering of Settlements in Each Category According to Total Absolute Loss and Relative Loss

Following above described procedure; loss in each settlement is determined, identification of most vulnerable settlements in each size-category and 'provinces with high-risk' are accomplished. This level of loss can be expressed in absolute terms (total number of buildings lost) or in relative terms (ratio of loss to the total building stock).

Although absolute loss may represent a concrete measure of loss, relative loss in settlements must also be taken into account. Small settlements with low values of absolute loss, but with high ratios may indicate greater impact and disturbance of hazard in urban life, than loss of similar or higher magnitude but smaller ratios in the larger cities or metropolitan agglomerations (Balamir, 2011).

Therefore the level of loss is expressed both in absolute terms (total number of buildings lost) and in relative terms (ratio of loss to the total building stock).

Total Lists of Categories of Settlements Prioritized According to Absolute Loss is given in the Appendix C and Total Lists of Categories of Settlements Prioritized According to Relative Loss is given in the Appendix D.

The top-20 settlements of the complete lists in each size category according to absolute loss levels and relative loss levels are examined below.

Absolute Loss in Categories of Settlements

The top-20 settlements (out of 332) of the complete list in each size category according to absolute loss levels (See Table 3.16, 3.17, 3.18) and the spatial distribution figures of settlements according to absolute loss is given below (See Figure 3.21). In the small-sized group of settlements, greatest loss is observed as in the Table 3.16, exhibiting the number of building loss.

The top 20 of the settlements of the complete list are significantly above the category averages in terms of absolute loss, total number of buildings and loss rates. Settlements subject to seismic intensities of 7.5 and 7.0 seem to have significantly and consistently lower rates of loss, even though absolute loss in these settlements are of comparable magnitude with those subject to the seismic intensity of 8.0.

Almost half of the top 20 in the list are shrinking economies and are losing population. This implies least of care and maintenance in the privately owned property, and very low levels of public investments, and obviously higher risks (Balamir, 2011).

Table 3.16 Top-20 Settlements for 0-50.000 Population Prioritized According to Absolute Loss

CATEGORY 0-50.000	SUB-PROVINCE	Expected Seismic Intensity	Absolute Building Loss	Total Building	Loss Rate	Settlement Population (2009)
TOKAT	NIKSAR	8	1400	8343	0,17	33.682
KASTAMONU	TOSYA	8	1364	8575	0,16	27.624
SAKARYA	HENDEK	8	869	4969	0,17	44.418
CORUM	OSMANCIK	8	786	5037	0,16	25.829
SAMSUN	HAVZA	8	735	4620	0,16	20.204
TEKIRDAG	SARKOY	8	712	4059	0,18	16.624
SAKARYA	AKYAZI	8	681	3668	0,19	41.179
AMASYA	SULUOVA	7,5	633	9653	0,07	37.151
ERZINCAN	UZUMLU	8	631	4187	0,15	8.288
BOLU	GEREDE	8	583	3439	0,17	23.808
SAKARYA	GEYVE	8	543	3491	0,16	20.318
BALIKESIR	AYVALIK	7	442	14115	0,03	35.986
SIVAS	SUSEHRI	8	424	2589	0,16	15.304
BALIKESIR	BURHANIYE	7	410	13164	0,03	38.156
SAKARYA	PAMUKOVA	8	403	2600	0,15	16.047
MUS	VARTO	8	384	2562	0,15	9.585
SAMSUN	LADIK	8	377	2426	0,16	8.316
YALOVA	CINARCIK	8	357	1675	0,21	11.080
IZMIR	CESME	7	348	11532	0,03	20.455
BURSA	YENISEHIR	7,5	339	5028	0,07	29.275
Group Average			**96**	**2540**	**0.04**	**11.290**

The second category of settlement with 50.000-490.000 inhabitants gives the following levels of building loss at top-20 of the list (out of 66) and rates of loss compared to the total building stock in the settlement (See Table 3.17, Figure 3.21).

In contrast to the previous category of settlements, many cases here prove high levels of absolute loss determined less dependently on strength of seismic shake and there are variations in seismic intensity levels and rates of loss. Apart from a very few of the cases here, rates of loss seem to be lower than observed in the previous category and almost half of the top 20 in the list have higher rates than the average rate for this category.

Table 3.17 Top-20 Settlements for 50.000-490.000 Population Prioritized According to Absolute Loss

CATEGORY 50.000-490.000	SUB-PROVINCE	Expected Seismic Intensity	Absolute Building Loss	Total Building	Loss Rate	Settlement Population (2009)
VAN	CENTRAL	7,5	2285	36.235	0,06	360.810
ERZINCAN	CENTRAL	8	2025	12.678	0,16	90.100
BOLU	CENTRAL	8	1841	10.516	0,18	120.021
YALOVA	CENTRAL	8	1507	8.302	0,18	92.166
TEKIRDAG	CENTRAL	7,5	1347	15.683	0,09	140.535
TOKAT	ERBAA	8	1251	7.895	0,16	58.845
BURSA	ORHANGAZİ	8	945	5.313	0,18	54.319
MANISA	CENTRAL	7	919	24.785	0,04	291.374
OSMANIYE	CENTRAL	7	905	29.408	0,03	194.339
HATAY	ANTAKYA	7	768	23.471	0,03	202.216
HATAY	ISKENDERUN	7	705	21.169	0,03	190.279
ADIYAMAN	CENTRAL	7	696	21.965	0,03	198.433
AMASYA	MERZİFON	7,5	666	9.411	0,07	52.225
MANISA	TURGUTLU	7	639	19.331	0,03	115.930
DUZCE	CENTRAL	7,5	612	8.593	0,07	125.240
DENIZLI	CENTRAL	6,5	586	41.993	0,01	488.768
MANISA	AKHİSAR	7	585	17.775	0,03	100.897
BURSA	INEGOL	7	536	14.095	0,04	161.541
TOKAT	CENTRAL	7	528	15.371	0,03	129.879
MANISA	SALİHLİ	7	483	13.639	0,04	96.503
Group Average			**454**	**14.743**	**0,03**	**120.796**

The third category of settlements as agglomerations of sub-provinces at metropolitan centers indicate the following set of priorities in Table 3.18. Ordering seems to follow seismic intensities rather than absolute size of the building stock in metropolitan provinces.

Table 3.18 Metropolitan Provinces Prioritized According to Absolute Loss Levels

CATEGORY Metropolitan Cities	SUB-PROVINCE	Expected Seismic Intensity	Absolute Building Loss	Total Building	Loss Rate	Settlement Population (2009)
ISTANBUL	ISTANBUL (M)	7,5	83824	864.540	0,10	12.782.960
KOCAELI	KOCAELI (M)	8	24077	139.423	0,17	1.422.752
BURSA	BURSA (M)	7,5	16506	204.907	0,08	1.854.285
IZMIR	IZMIR (M)	7	14531	421.397	0,03	3.276.815
SAKARYA	SAKARYA (M)	8	8070	49.609	0,16	442.157
ADANA	ADANA (M)	6,5	1913	175.697	0,01	1.556.238
ANTALYA	ANTALYA (M)	6,5	1402	114.998	0,01	955.573
KONYA	KONYA (M)	6,5	1355	113.267	0,01	1.003.373
ERZURUM	ERZURUM (M)	6,5	439	32.458	0,01	368.146
Group Average			**16.902**	**235.144**	**0,07**	**2.629.144**

Table 3.19 Average Absolute Loss According to the Settlement Categories

Settlement Size Categories	Total Absolute Loss	Total Building	Average Absolute Loss	Minimum Absolute Loss	Maximum Absolute Loss
0-50.000	31.966	843.188	96	2	1400
50.000 – 500.000	29.965	973.014	454	42	2285
Metropolitan cities	152.115	2.116.296	16.902	439	83.824

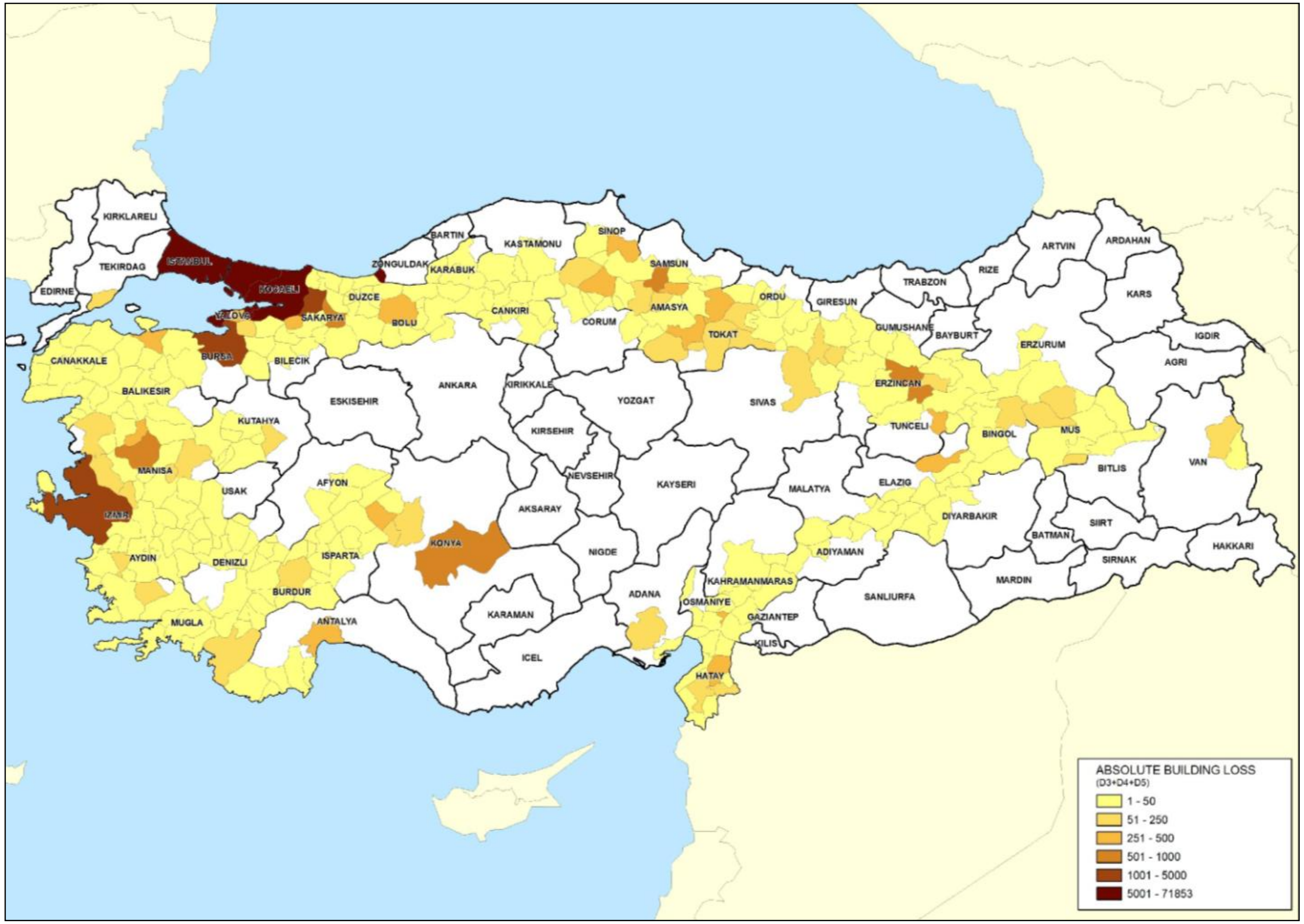


Figure 3.21 Absolute Building Loss Distributions

Relative Loss in Categories of Settlements

The top-20 settlements (out of 332) of the complete list in each size category according to relative loss levels (See Table 3.20, 3.21, 3.22) and the spatial distribution figures of settlements according to relative loss is given below (See Figure 3.22).

In the small-sized group of settlements, all cases prove high levels of relative loss determined dependently on strength of seismic shake and there are no variations in seismic intensity levels (See Table 3.20).

The top 20 of the settlements of the complete list are significantly above the category averages in terms of relative loss and absolute loss.

Table 3.20 Top-20 Settlements for 0-50.000 Population Prioritized According to Relative Loss

CATEGORY 0-50.000	SUB-PROVINCE	Expected Seismic Intensity	Relative Building Loss	Total Building	Absolute Loss	Sub-Province Population (2009)
YALOVA	CINARCIK	8	0,21	1675	357	11.080
SAKARYA	AKYAZI	8	0,19	3668	681	41.179
YALOVA	CIFTLIKKOY	8	0,19	1594	298	17.052
TEKIRDAG	SARKOY	8	0,18	4059	712	16.624
TOKAT	NIKSAR	8	0,17	8343	1400	33.682
SAKARYA	HENDEK	8	0,17	4969	869	44.418
BOLU	GEREDE	8	0,17	3439	583	23.808
AMASYA	TASOVA	8	0,17	1677	282	10.821
YALOVA	TERMAL	8	0,17	425	73	2.340
KASTAMONU	TOSYA	8	0,16	8575	1364	27.624
CORUM	OSMANCIK	8	0,16	5037	786	25.829
SAMSUN	HAVZA	8	0,16	4620	735	20.204
SAKARYA	GEYVE	8	0,16	3491	543	20.318
SIVAS	SUSEHRI	8	0,16	2589	424	15.304
SAMSUN	LADIK	8	0,16	2426	377	8.316
CANKIRI	ILGAZ	8	0,16	1913	312	7.738
TOKAT	RESADIYE	8	0,16	1941	309	9.027
BOLU	YENICAGA	8	0,16	1120	183	5.175
GIRESUN	CAMOLUK	8	0,16	859	133	2.023
TUNCELI	PULUMUR	8	0,16	572	94	1.656
Group Average			**0.04**	**2540**	**96**	**11.290**

The second category of settlement with 50.000-490.000 inhabitants gives the following levels of relative loss at top-20 of the list (See Table 3.21).

In contrast to the previous category of settlements, many cases here prove low levels of relative loss determined dependently on strength of seismic shake and there are variations in seismic intensity levels and relative loss.

Apart from a very few of the cases here, relative loss seem to be lower than observed in the previous category and more than half of the top 20 in the list have higher rates than the average rate for this category.

Table 3.21 Top-20 Settlements for 50.000-490.000 Population Prioritized According to Relative Loss

CATEGORY 50.000-490.000	SUB-PROVINCE	Expected Seismic Intensity	Relative Building Loss	Total Building	Absolute Loss	Sub-Province Population (2009)
BOLU	BOLU M.	8	0,18	10516	1841	120.021
YALOVA	YALOVA M.	8	0,18	8302	1507	92.166
BURSA	ORHANGAZI	8	0,18	5313	945	54.319
ERZINCAN	ERZİNCAN M.	8	0,16	12678	2025	90.100
TOKAT	ERBAA	8	0,16	7895	1251	58.845
TEKIRDAG	TEKİRDAĞ M.	7,5	0,09	15683	1347	140.535
AMASYA	MERZIFON	7,5	0,07	9411	666	52.225
DUZCE	DÜZCE M.	7,5	0,07	8593	612	125.240
VAN	VAN M.	7,5	0,06	36235	2285	360.810
MANISA	MANİSA M.	7	0,04	24785	919	291.374
BURSA	INEGOL	7	0,04	14095	536	161.541
MANISA	SALIHLI	7	0,04	13639	483	96.503
BALIKESIR	BANDIRMA	7	0,04	12035	460	113.385
CANAKKALE	ÇANAKKALE M.	7	0,04	9281	339	96.588
AMASYA	AMASYA M.	7	0,04	9432	336	86.667
BURSA	M.KEMALPASA	7	0,04	8460	304	57.097
OSMANIYE	OSMANİYE M.	7	0,03	29408	905	194.339
HATAY	ANTAKYA	7	0,03	23471	768	202.216
HATAY	ISKENDERUN	7	0,03	21169	705	190.279
ADIYAMAN	ADIYAMAN M.	7	0,03	21965	696	198.433
Group Average			**0,03**	**14743**	**454**	**120.796**

The third category of settlements as agglomerations of sub-provinces at metropolitan centers indicate the following set of priorities in Table 3.22.

Ordering seems to follow seismic intensities rather than absolute size of the building stock in metropolitan provinces and a very distinct group of four metropolitan cities with high ratio of loss are observed.

Table 3.22 Metropolitan Provinces Prioritized According to Relative Loss Levels

CATEGORY III Metropolitan Provinces	SUB-PROVINCE	Expected Seismic Intensity	Relative Building Loss	Total Building	Absolute Loss	Sub-Province Population (2009)
KOCAELI	KOCAELİ	8	0,17	139423	24077	1.422.752
SAKARYA	SAKARYA	8	0,16	49609	8070	442.157
ISTANBUL	ISTANBUL	7,5	0,10	864540	83824	12.782.960
BURSA	BURSA	7,5	0,08	204907	16506	1.854.285
IZMIR	IZMIR	7	0,03	421397	14531	3.276.815
ADANA	ADANA	6,5	0,01	175697	1913	1.556.238
ANTALYA	ANTALYA	6,5	0,01	114998	1402	955.573
KONYA	KONYA	6,5	0,01	113267	1355	1.003.373
ERZURUM	ERZURUM	6,5	0,01	32458	439	368.146
Group Average			**0,07**	**235.144**	**16.902**	**2.629.144**

Table 3.23 Average Relative Loss According to the Settlement Categories

Settlement Size Categories	Total Building	Average Relative Loss	Minimum Relative Loss	Maximum Relative Loss
0-50.000	843.188	0,04	0	0,21
50.000 – 500.000	973.014	0,03	0,01	0,18
Metropolitan cities	2.116.296	0,07	0,01	0,17

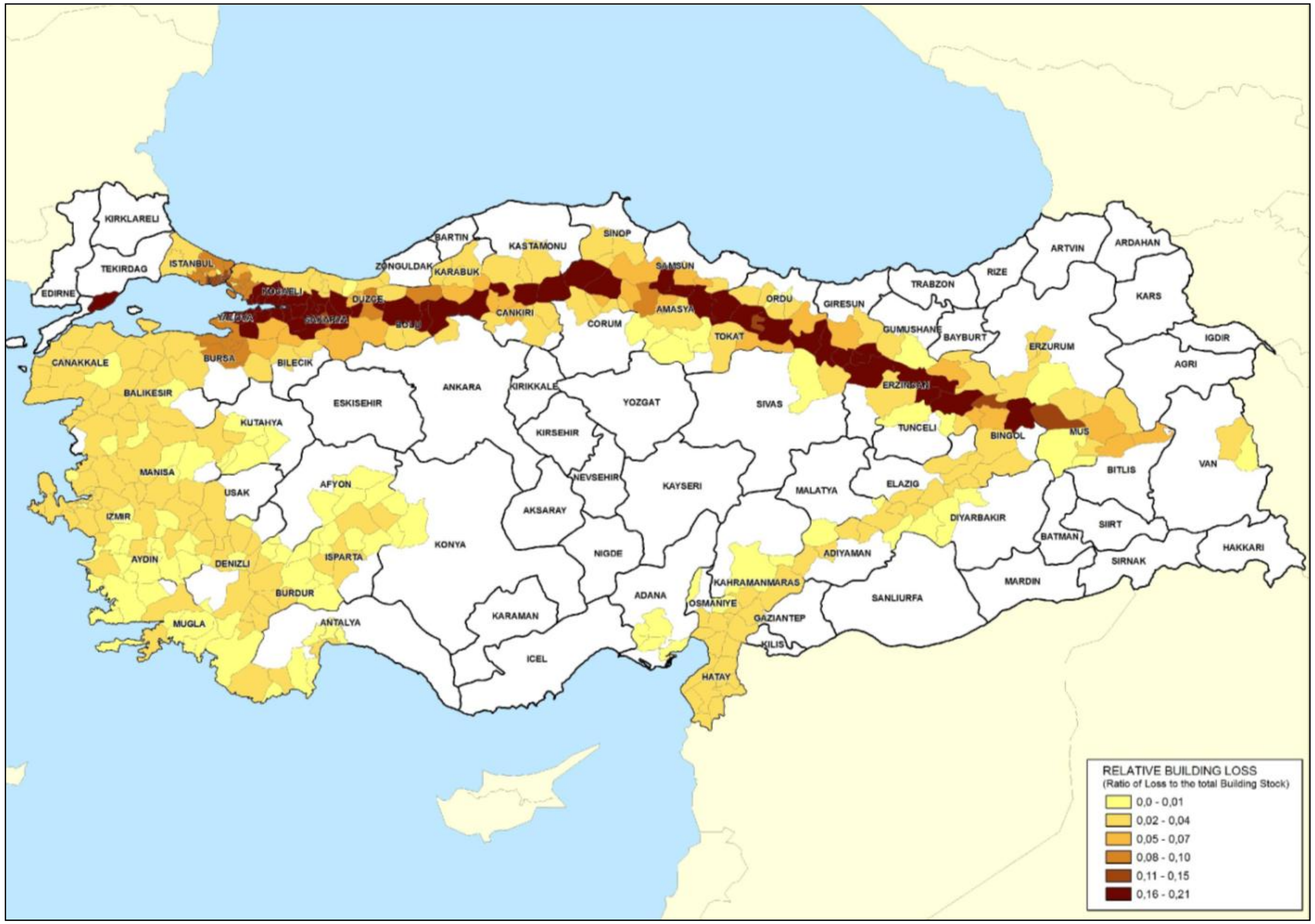


Figure 3.22 Relative Building Loss/ Loss Rate Distributions

After determining the level of loss both in absolute terms (total number of buildings lost) and relative terms (ratio of loss to the total building stock), two dependent variables of the research is obtained.

Y1 that is determined as Absolute Loss is the first dependent variable of the research and composed of the total number of building loss.

$$Y1 \longrightarrow \text{Absolute Loss} = \left(\underset{\text{'heavy damage'}}{D3} + \underset{\text{'partial collapse'}}{D4} + \underset{\text{'total collapse'}}{D5} \right)$$

Y2 that is determined as Relative Loss is the other dependent variable of the research and composed of the ratio of loss to the total building stock.

$$Y2 \longrightarrow \text{Relative Loss} = \left(\frac{\underset{\text{'heavy damage'}}{D3} + \underset{\text{'partial collapse'}}{D4} + \underset{\text{'total collapse'}}{D5}}{\text{Total Building Stock}} \right)$$

The distribution of dependent variables of the top-20 settlements for each size-category is given in the Table 3.24, Table 3.25, Table 3.26 and the distribution of dependent variables for all settlements in each size-category is given in the Appendix E.

Table 3.24 Dependent Variables of the top-20 Settlements for 0-50.000 Population

			Y1	**Y2**
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**
TOKAT	NIKSAR	8	1400	0,17
KASTAMONU	TOSYA	8	1364	0,16
SAKARYA	HENDEK	8	869	0,17
CORUM	OSMANCIK	8	786	0,16
SAMSUN	HAVZA	8	735	0,16
TEKIRDAG	SARKOY	8	712	0,18
SAKARYA	AKYAZI	8	681	0,19
AMASYA	SULUOVA	7,5	633	0,07
ERZINCAN	UZUMLU	8	631	0,15
BOLU	GEREDE	8	583	0,17
SAKARYA	GEYVE	8	543	0,16
BALIKESIR	AYVALIK	7	442	0,03
SIVAS	SUSEHRI	8	424	0,16
BALIKESIR	BURHANIYE	7	410	0,03
SAKARYA	PAMUKOVA	8	403	0,15
MUS	VARTO	8	384	0,15
SAMSUN	LADIK	8	377	0,16
YALOVA	CINARCIK	8	357	0,21
IZMIR	CESME	7	348	0,03
BURSA	YENISEHIR	7,5	339	0,07
Group Average			**96**	**0,04**

Table 3.25 Dependent Variables of the top-20 Settlements for 50.000 – 490.000 Population

CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Y1 Absolute Loss	Y2 Relative Loss (Loss / Building)
VAN	VAN C.	7,5	2285	0,06
ERZINCAN	ERZİNCAN C.	8	2025	0,16
BOLU	BOLU C.	8	1841	0,18
YALOVA	YALOVA C.	8	1507	0,18
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	0,09
TOKAT	ERBAA	8	1251	0,16
BURSA	ORHANGAZI	8	945	0,18
MANISA	MANİSA C.	7	919	0,04
OSMANIYE	OSMANİYE C.	7	905	0,03
HATAY	ANTAKYA	7	768	0,03
HATAY	ISKENDERUN	7	705	0,03
ADIYAMAN	ADIYAMAN C.	7	696	0,03
AMASYA	MERZIFON	7,5	666	0,07
MANISA	TURGUTLU	7	639	0,03
DUZCE	DÜZCE C.	7,5	612	0,07
DENIZLI	DENİZLİ C.	6,5	586	0,01
MANISA	AKHISAR	7	585	0,03
BURSA	INEGOL	7	536	0,04
TOKAT	TOKAT C.	7	528	0,03
MANISA	SALIHLI	7	483	0,04
Group Average			**454**	**0,03**

Table 3.26 Dependent Variables of the Research for Metropolitan Cities

CATEGORY Metropolitan Cities	SUB-PROVINCE	Intensity	Y1 Absolute Loss	Y2 Relative Loss (Loss / Building)
ISTANBUL	ISTANBUL (M)	7,5	83824	0,10
KOCAELI	KOCAELI (M)	8	24077	0,17
BURSA	BURSA (M)	7,5	16506	0,08
IZMIR	IZMIR (M)	7	14531	0,03
SAKARYA	SAKARYA (M)	8	8070	0,16
ADANA	ADANA (M)	6,5	1913	0,01
ANTALYA	ANTALYA (M)	6,5	1402	0,01
KONYA	KONYA (M)	6,5	1355	0,01
ERZURUM	ERZURUM (M)	6,5	439	0,01
Group Average			**16902**	**0,07**

Consequently, two dependent variables, Y1 and Y2 are determined for all settlements in each size category in order to examine the basic question of the research "How do loss levels in building stock correlate to independent variables?"

Therefore the next step of the study is to determine the independent variables of the research in order to be used in regression equations with dependent variables.

CHAPTER 4

ATTRIBUTES CONTRIBUTING TO VULNERABILITIES OF SETTLEMENTS

Settlement vulnerabilities cannot be described simply in terms of robustness of individual buildings, but as a complex system structured with interdependent components. Urban stock texture, networks, distribution of land-uses, public facilities, their interaction with hazard prone locations, size of population served and many other factors have interdependent impacts on the vulnerabilities of settlements as mentioned in foregoing chapters.

Attributes of settlements that can be inferred to give rise to vulnerabilities are determined as the independent variables of research. These variables are composed of building inventory data and related attributes of building stock on each settlement obtained from Turkish Statistical Institute (TurkStat) and State Planning Organization (SPO).

'Building Construction Statistics', 'Building Census' and 'Population Census' prepared by TurkStat and 'Development Index' prepared by SPO were utilized to compose the building inventory data and related attributes on each settlement within this research.

Building Construction Statistics have been compiled by TurkStat annually since 1954 from information on building permits in cities and towns where municipalities exist. Information in this publication is obtained from construction permits and occupancy permits.

Building Census-2000 provided information on aspects of the building stock in each settlement and provided information for 3212 administrative units (provinces, districts and villages) in Turkey. Building inventory data on each settlement is provided in four separate sheets for the distributions of number of stories, the construction type, construction date and purpose of usage. The publication however of this source of information was not aggregated at the settlement level. A special disaggregated version of the building census 2000 at the level of settlements was accessed for this study.

Population Census-2000 provided urban and rural populations for 3212 administrative units (provinces, districts and villages) in Turkey. Urban and rural populations after the year 2000 are obtained from 'Address Based Population Registration System Database' prepared by TurkStat.

Development Index provided a wealth of socio-economic characteristics and covers demography, employment, education, infrastructure, construction and other welfare indicators.

In terms of available data independent variables of the research are determined as;

X1 = Settlement Population
X2 = Population Growth Rate (%o)
X3 = Rates of Agglomeration
X4 = Population/Total Number of Buildings
X5 = Development Index

4.1. Settlement Population

We can consider that as the settlement population increases, building densities will increase also and this will increase the potential loss in human life. Besides larger settlements in general have higher index of development implying greater likelihood of direct and indirect economic loss. So, we can say that larger the settlement population, greater is the risk for several reasons.

Population Distributions is obtained from 'Address Based Population Registration System Database' and 'Population Census' prepared by TurkStat and determined as the first independent variable (X1) of the study.

Table 4.1 Average Values of Population in Settlement Categories

Settlement Size Categories	Total Number of Buildings	Settlement Population (2000)	Total Population (2000)	Settlement Population (2009)	Total Population (2009)
0-50.000	2540	12.292	32.033	11.290	27.276
50.000-490.000	14.743	96.999	152.395	120.796	169.592
Metropolitan Cities	235.144	2.086.170	187.9779	2.629.144	2.697.045

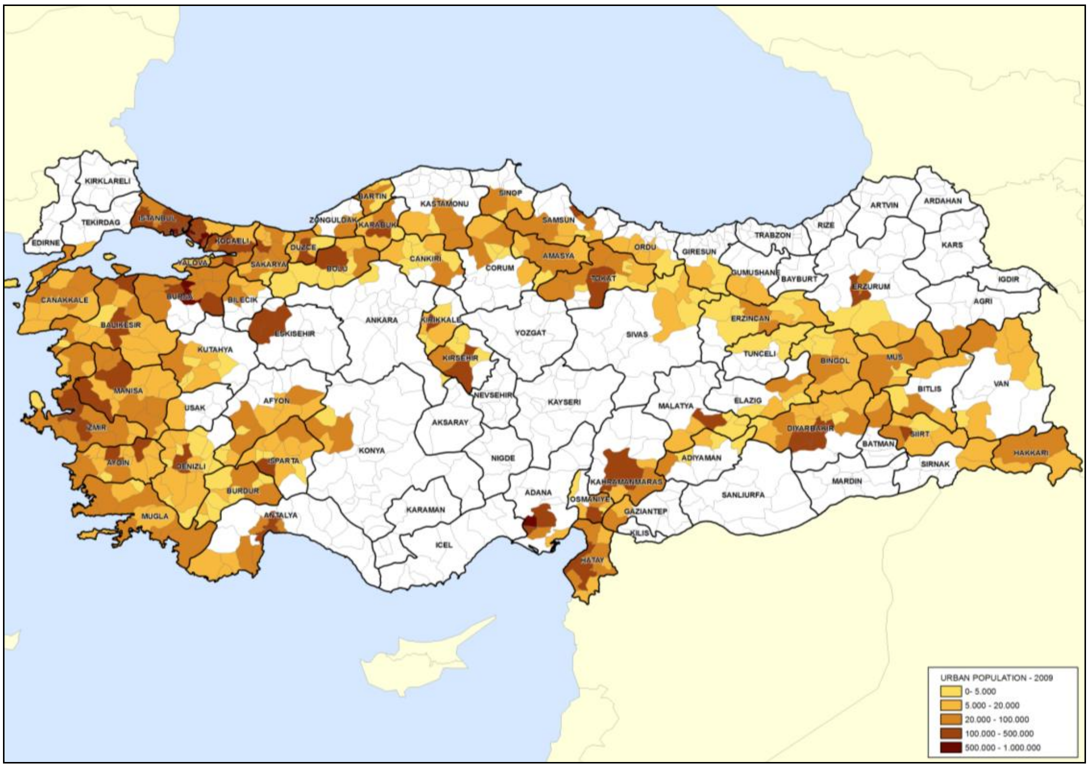


Figure 4.1 Urban Population Distributions

4.2. Population Growth Rate

We can consider that as the rate of growth increases, control deficiencies will increase and this will increase the potential loss. Therefore, population growth rate is determined as the second independent variable (X2) of the study.

According to the Table 4.2; the smaller settlements in the average are either losing population or are stagnant. On the contrary larger cities and metropolitan cities are significantly growing and at the same pace.

Table 4.2 Average Values of Population Growth Rates in Settlement Categories

Settlement Size Categories	Total Number of Buildings	Settlement Population (2000)	Total Population (2000)	Settlement Population (2009)	Total Population (2009)	Population Growth Rate (Log-%)
0-50.000	2540	12.292	32.033	11.290	27.276	-0,945
50.000-490.000	14.743	96.999	152.395	120.796	169.592	2,438
Metropolitan Cities	235.144	2.086.170	187.9779	2.629.144	2.697.045	2,570

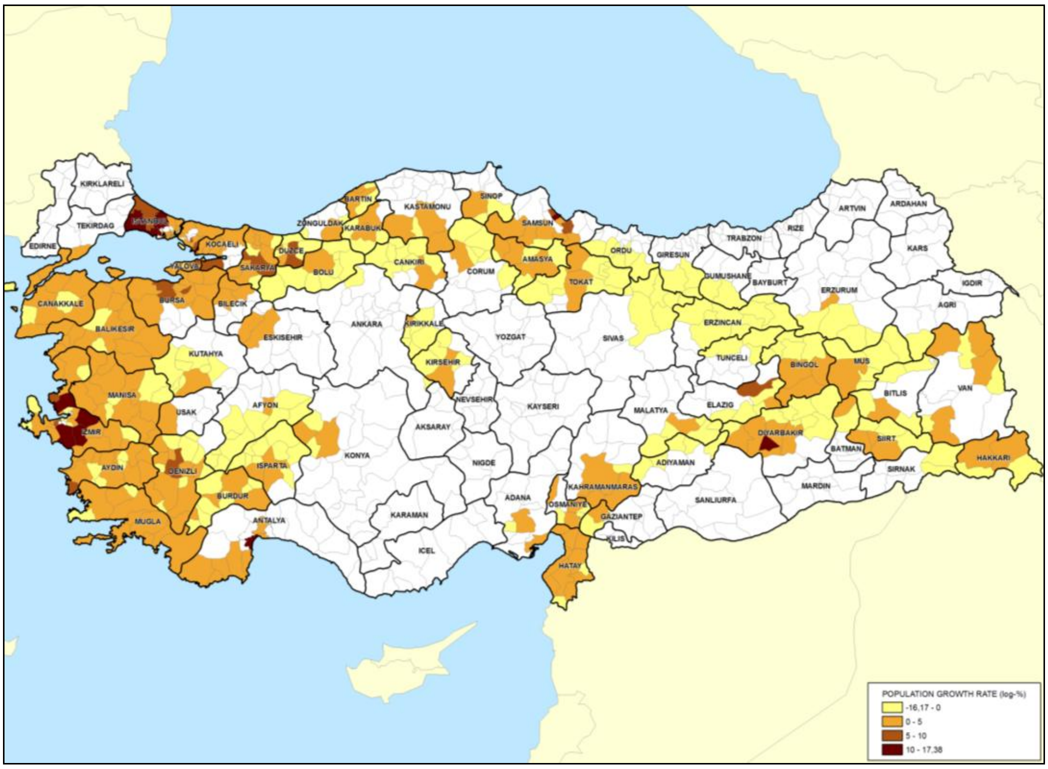


Figure 4.2 Population Growth Rates

4.3. Rates of Agglomeration

Rate of agglomeration is the ratio of urban population to the total population and express the urbanization level of the settlement. Distinct rates of agglomeration are also a good indicator of how rural/urban natures of the sub-province or province differ. We can consider that as the rate of agglomeration increases, required urban services will increase and this will increase the potential loss. Therefore, rate of agglomeration is determined as the third independent variable (X3) of the study.

According to the Table 4.3; Metropolitan settlements seem to have absorbed almost all of the population into their area of jurisdiction. However in provinces with smaller central settlements, greater parts of population live in the rural area.

Table 4.3 Average Values of Agglomeration Rates in Settlement Categories

Settlement Size Categories	Total Number of Buildings	Settlement Population (2000)	Total Population (2000)	Settlement Population (2009)	Total Population (2009)	Rate of Agglomeration
0-50.000	2540	12.292	32.033	11.290	27.276	0,41
50.000-490.000	14.743	96.999	152.395	120.796	169.592	0,71
Metropolitan Cities	235.144	2.086.170	187.9779	2.629.144	2.697.045	0,97

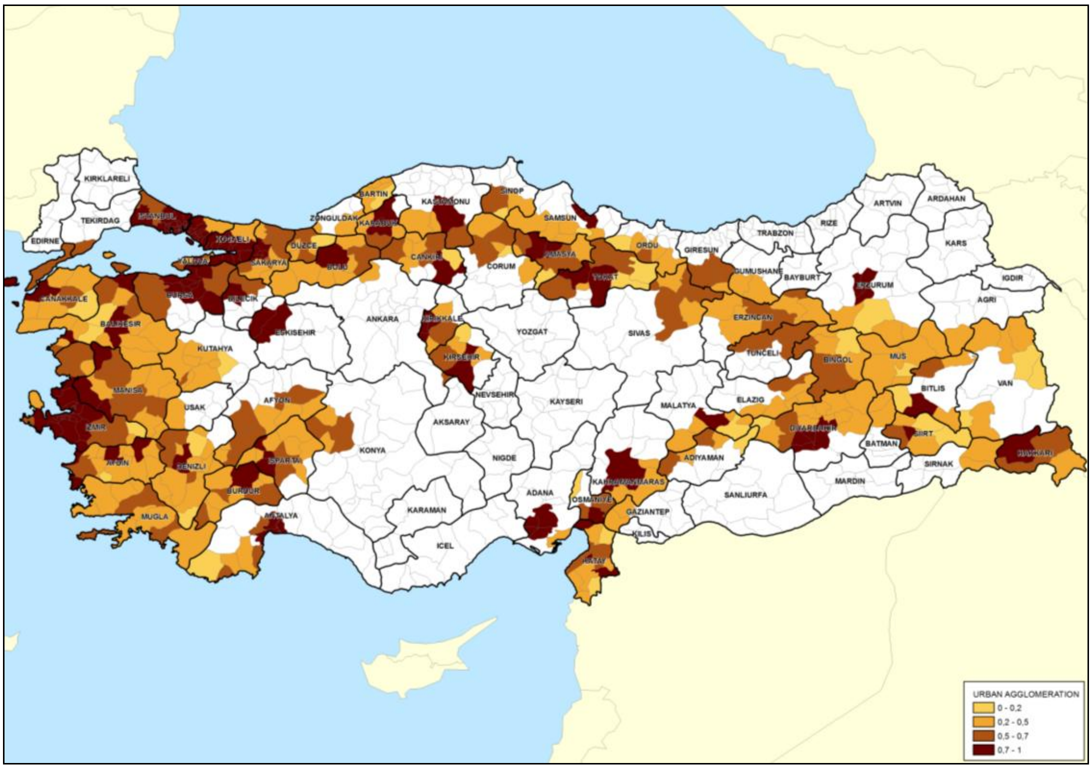


Figure 4.3 Urban Agglomeration

4.4. Population/Total Number of Buildings

Average population density per building (2000) is significantly different in the categories identified. This is also a measure or indication of the increasing rate of human life losses in larger cities, another factor to reinforce the probable bias favoring larger settlements.

Therefore, population density is determined as the fourth independent variable (X4) of the study.

Table 4.4 Population Density in Settlement Categories

Settlement Size Categories	Population (2000)	Total Number of Buildings	Population / Building
0-50.000	4.080.822	843.188	4,84
50.000-490.000	6.401.962	973.014	6,58
Metropolitan Cities	18.775.534	2.116.296	8,87
Total	29.258.318	3.932.498	7.44

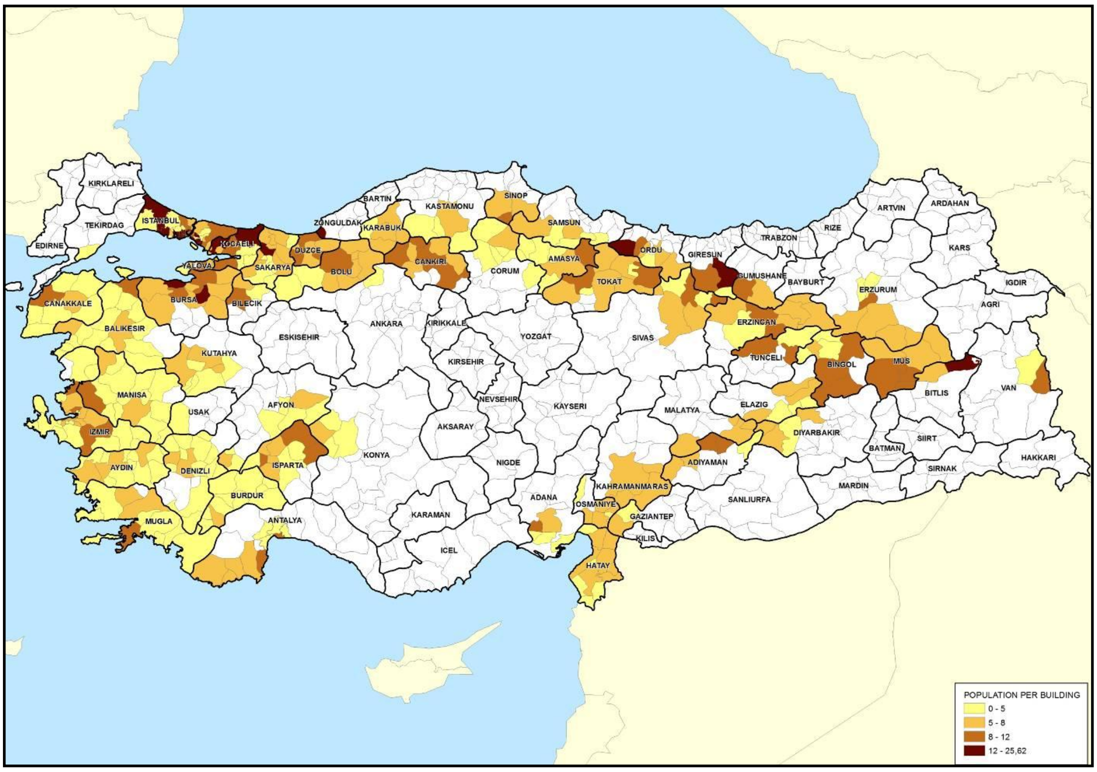


Figure 4.4 Population per Buildings

4.5. Development Index

Socio-Economic Development Index (SEDI) prepared by SPO covers demography, employment, education, infrastructure, construction and other welfare indicators. SEDI use a large number of variables selected from economic and social fields that may best reflect the level of development (See Appendix F for all SEDI variables). These variables determine the economic and social structural characteristics of settlements. Therefore, development index is determined as the fifth independent variable (X5) of the study.

The group of settlements with lower levels of population than 50.000 has a negative average development index of (-0.171). The average development index of category of 50.000-490.000 is 1.096. The average development index available for the third group representing metropolitan settlements is distinctly higher (4.181).

Table 4.5 Average Values of Development Index in Settlement Categories

Settlement Size Categories	Average Development index
0-50.000	-0,171
50.000 – 490.000	1,096
Metropolitan Cities	4.181

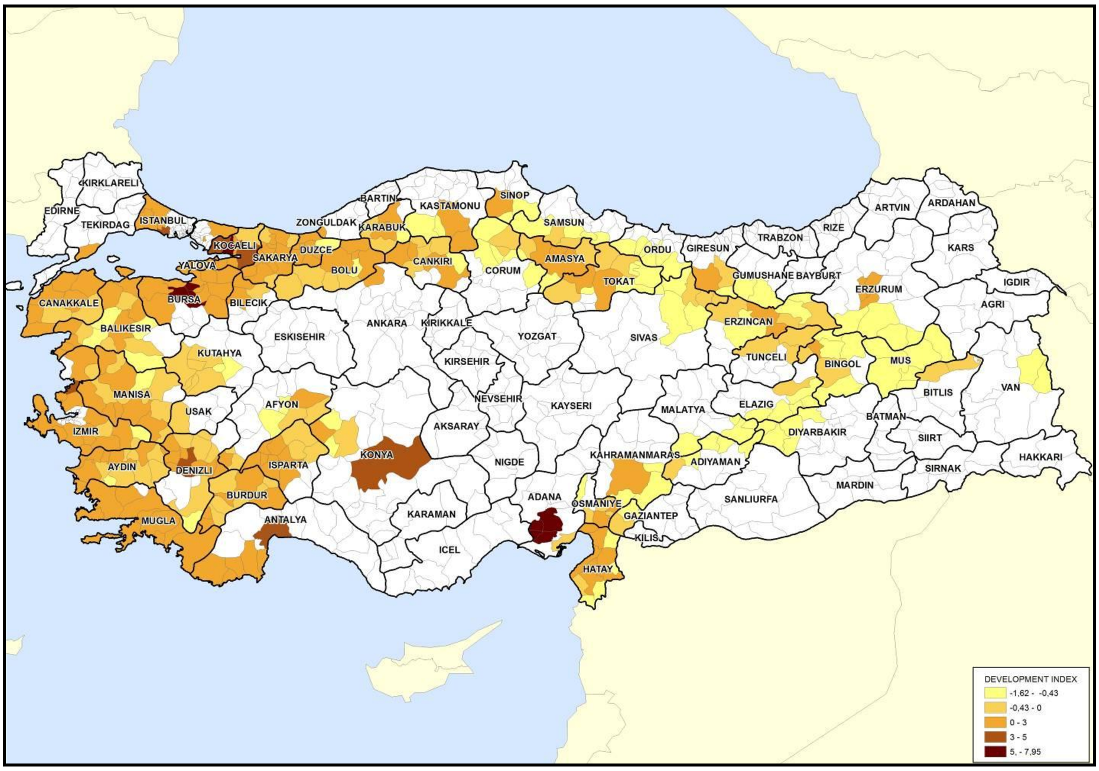


Figure 4.5 Development Index

Consequently, all of the five independent variables of the research are obtained. The distribution of independent variables of the top-20 settlements for each size-category is given in the Table 4.6, Table 4.7, Table 4.8 and the distribution of independent variables for all settlements in each size-category is given in the Appendix E.

Table 4.6 Independent Variables of the Top-20 Settlements for 0-50.000 Population

		X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglome-ration**	**Population / Total No. of Buildings**	**Development Index**
TOKAT	NIKSAR	33.682	-3,171	0,52	5,37	-0,077
KASTAMONU	TOSYA	27.624	1,912	0,68	2,71	0,137
SAKARYA	HENDEK	44.418	4,916	0,60	5,74	0,245
CORUM	OSMANCIK	25.829	-1,063	0,57	5,64	-0,038
SAMSUN	HAVZA	20.204	0,460	0,44	4,20	-0,374
TEKIRDAG	SARKOY	16.624	0,291	0,55	3,99	0,627
SAKARYA	AKYAZI	41.179	6,379	0,49	6,32	0,264
AMASYA	SULUOVA	37.151	-1,551	0,78	4,43	0,581
ERZINCAN	UZUMLU	8.288	-14,403	0,52	7,24	-0,239
BOLU	GEREDE	23.808	-0,626	0,69	7,32	0,374
SAKARYA	GEYVE	20.318	1,775	0,44	4,96	0,144
BALIKESIR	AYVALIK	35.986	1,309	0,58	2,27	1,459
SIVAS	SUSEHRI	15.304	-5,514	0,55	9,71	-0,212
BALIKESIR	BURHANIYE	38.156	2,227	0,77	2,37	1,127
SAKARYA	PAMUKOVA	16.047	2,170	0,60	5,08	0,464
MUS	VARTO	9.585	-5,955	0,28	6,39	-1,038
SAMSUN	LADIK	8.316	-0,999	0,46	3,75	-0,241
YALOVA	CINARCIK	11.080	2,368	0,43	5,35	1,174
IZMIR	CESME	20.455	-2,343	0,63	2,19	2,692
BURSA	YENISEHIR	29.275	1,289	0,57	5,18	0,289
Group Average		**11.290**	**-0,945**	**0,41**	**4,84**	**-0,171**

The top-20 settlements for 0-50.000 population are significantly above the category averages in terms of 'settlement population' and 'rate of agglomeration'.

The average rates of growth and development indices are either negative or very small. Many of the settlements in this category are stagnant or in the process of negative growth.

Greater numbers of settlements that take place in the upper 20 in this category have relatively central status within their sub-province. Rates of agglomeration for these settlements are more or less leveled in the sub-province with the rural population.

Only a few of these settlements represent stronger agglomeration centers. These also indicate positive growth and development.

Table 4.7 Independent Variables of the Top-20 Settlements for 50.000 – 490.000 Population

		X1	X2	X3	X4	X5
CATEGORY 50.000-490.000	SUB-PROVINCE	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglome-ration	Population / Total No. of Buildings	Development Index
VAN	VAN C.	360.810	2,642	0,80	7,851	0,716
ERZINCAN	ERZİNCAN C.	90.100	-1,928	0,65	8,454	0,785
BOLU	BOLU C.	120.021	3,891	0,75	8,042	1,795
YALOVA	YALOVA C.	92.166	3,038	0,81	8,446	2,422
TEKIRDAG	TEKİRDAĞ C.	140.535	3,009	0,82	6,835	1,864
TOKAT	ERBAA	58.845	2,835	0,60	5,775	-0,252
BURSA	ORHANGAZI	54.319	2,234	0,72	8,362	1,130
MANISA	MANİSA C.	291.374	3,411	0,86	8,648	2,465
OSMANIYE	OSMANİYE C.	194.339	1,230	0,86	5,916	0,976
HATAY	ANTAKYA	202.216	3,702	0,45	6,174	0,983
HATAY	ISKENDERUN	190.279	1,985	0,60	7,518	2,562
ADIYAMAN	ADIYAMAN C.	198.433	1,174	0,76	8,128	0,576
AMASYA	MERZIFON	52.225	1,504	0,76	4,847	0,711
MANISA	TURGUTLU	115.930	2,362	0,82	4,849	1,239
DUZCE	DÜZCE C.	125.240	8,815	0,65	6,592	1,115
DENIZLI	DENİZLİ C.	488.768	6,371	0,94	6,560	3,691
MANISA	AKHISAR	100.897	2,371	0,64	4,586	0,540
BURSA	INEGOL	161.541	4,686	0,75	7,517	1,361
TOKAT	TOKAT C.	129.879	1,537	0,71	7,358	0,817
MANISA	SALIHLI	96.503	1,656	0,62	6,096	0,821
Group Average		**120.796**	**2,438**	**0,71**	**6,582**	**1,096**

Rate of population increases in 50.000-490.00 population category and almost identical rates of growth are observed. Apart from the province center of Erzincan, all settlements are in the process of growth, and half of the top 20 at higher rates than the average rate for this category.

This is further confirmed by the development index figures, again half of the top 20 at higher rates than the average development index for this category.

Stronger agglomeration is observed in this category of settlements, compared to the weak agglomeration rates of the previous category of settlements, even though growth is also an attribute of the rural context for settlements.

The top 20 of the settlements for metropolitan cities are significantly below the category averages in terms of 'settlement population' and 'development index'.

Apart from Sakarya, all settlements are in the process of growth, and half of the top-20 at higher rates than the average rate for this category.

Stronger agglomeration and population density is observed in metropolitan cities than the other two categories.

Table 4.8 Independent Variables for Metropolitan Cities

		X1	X2	X3	X4	X5
CATEGORY Metropolitan Cities	**SUB-PROVINCE**	**Settlement Population (2009)**	**Population Growth Rate (%0)**	**Rates of Agglome-ration**	**Population / Total No. of Buildings**	**Development Index**
ISTANBUL	ISTANBUL (M)	12.782.960	2,563	0,99	11,74	N.A.
KOCAELI	KOCAELI (M)	1.422.752	4,249	0,93	6,96	3,525
BURSA	BURSA (M)	1.854.285	2,239	0,96	7,40	7,953
IZMIR	IZMIR (M)	3.276.815	1,414	0,96	6,85	N.A.
SAKARYA	SAKARYA (M)	442.157	-1,154	0,91	9,89	2,607
ADANA	ADANA (M)	1.556.238	1,973	0,98	7,42	5,715
ANTALYA	ANTALYA (M)	955.573	5,112	0,96	5,25	3,990
KONYA	KONYA (M)	1.003.373	3,343	0,95	6,56	3,549
ERZURUM	ERZURUM (M)	368.146	12,976	0,96	3,53	1,924
Group Average		**2.629.144**	**2,570**	**0,97**	**8,87**	**4.181**

Consequently, five independent variables, X1, X2, X3, X4 and X5 are determined for all settlements in each size category in order to examine the relationship between these attributes of settlements and measures of estimated loss in earthquakes.

Therefore the next step of the study is to investigate the relations between measures of vulnerability (dependent variables) and contributing attributes (independent variables) by means of regression methods.

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CHAPTER 5

ANALYSIS OF MACRO INDICATORS OF SETTLEMENT VULNERABILITY

Measures of vulnerability (dependent) and assumed contributing attributes (independent variables) are explained for each category of settlements in foregoing chapters. The distribution of dependent and independent variables of the research according to the each size-category is indicated here and for each settlement is given in the Appendix E.

Relations between estimates of loss and contributing attributes are to be investigated as dependent and independent sets of variables of regression equations.

Best subsets regression analyses are employed to determine what combinations of the independent variables might best denote city-level risks.

The results of the best subsets analyses should give us the "most appropriate combination" for the regression analyses.

The regression analyses function is; Y1 = Fx (ax1, bx2, cx3 ...)

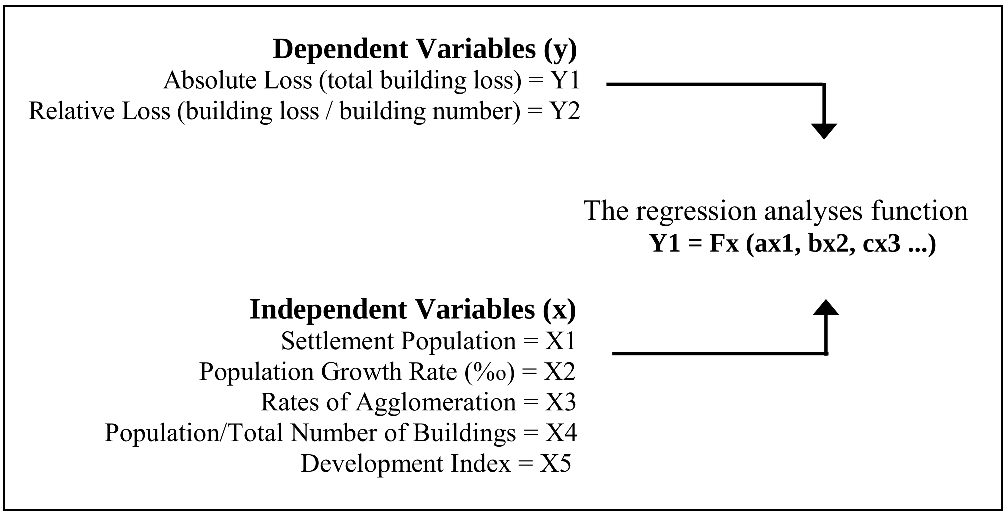

Figure 5.1 Vulnerability Measures and Assumed Contributing Attributes Overview

5.1. Best Subsets Regression Analyses

Best Subsets regression analyses consider all possible combinations of predictors to find the best set to predict a variable. This procedure does not produce a regression equation but identifies the best combination of predictors to put into a regression equation.

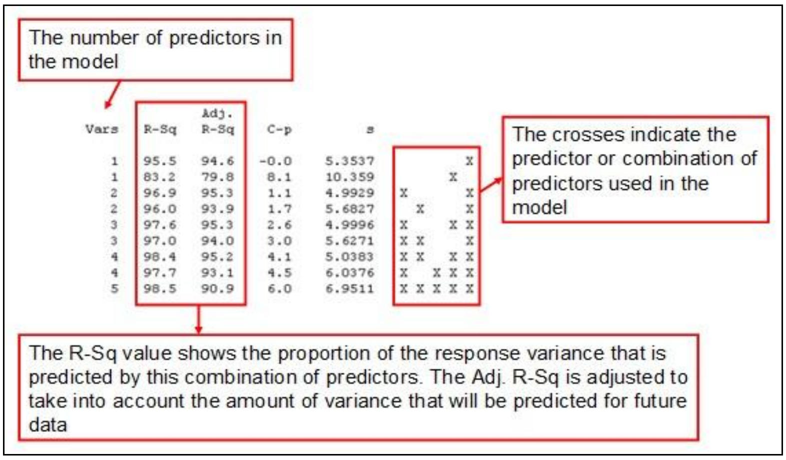

Figure 5.2 An Example For The Best Subset Regression Analyses

In best subsets regression analyses the more related variable is the one that have the biggest number of R-Sq (adj.). Also the C-p value shows which combination of predictors will make the best predictions, the smallest C-p value shows the best combination.

Accordingly, the biggest number of R-Sq (adj.) and the smallest C-p value in the results of best subset regression analyses will give us the "most appropriate combination" for the regression analyses.

5.1.1. Best Subsets Regression Analyses for Category I (0-50.000 Inhabitants)

Best Subsets Regression Analyses for the first Category, that considers settlements having population up to 50.000, is employed between the dependent and independent variables of the top-20 settlements in the first category prioritized according to absolute loss levels.

Dependent and independent variables of the top-20 settlements in the first category prioritized according to absolute loss levels are given below.

Table 5.1 Dependent and Independent Variables of the Top-20 Settlements for Category I

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss /Building)	Settlement Population (2009)	Population Growth Rate (%o)	Rates of Agglome -ration	Population / Total No. of Buildings	Dev. Index
TOKAT	NIKSAR	8	1400	0,17	33.682	-3,171	0,52	5,37	-0,07744
KASTAMONU	TOSYA	8	1364	0,16	27.624	1,912	0,68	2,71	0,13718
SAKARYA	HENDEK	8	869	0,17	44.418	4,916	0,60	5,74	0,24465
CORUM	OSMANCIK	8	786	0,16	25.829	-1,063	0,57	5,64	-0,03846
SAMSUN	HAVZA	8	735	0,16	20.204	0,460	0,44	4,20	-0,37355
TEKIRDAG	SARKOY	8	712	0,18	16.624	0,291	0,55	3,99	0,62666
SAKARYA	AKYAZI	8	681	0,19	41.179	6,379	0,49	6,32	0,26360
AMASYA	SULUOVA	7,5	633	0,07	37.151	-1,551	0,78	4,43	0,58123
ERZINCAN	UZUMLU	8	631	0,15	8.288	-14,403	0,52	7,24	-0,23858
BOLU	GEREDE	8	583	0,17	23.808	-0,626	0,69	7,32	0,37367
SAKARYA	GEYVE	8	543	0,16	20.318	1,775	0,44	4,96	0,14350
BALIKESIR	AYVALIK	7	442	0,03	35.986	1,309	0,58	2,27	1,45980
SIVAS	SUSEHRI	8	424	0,16	15.304	-5,514	0,55	9,71	-0,21177
BALIKESIR	BURHANIYE	7	410	0,03	38.156	2,227	0,77	2,37	1,12760
SAKARYA	PAMUKOVA	8	403	0,15	16.047	2,170	0,60	5,08	0,46365
MUS	VARTO	8	384	0,15	9.585	-5,955	0,28	6,39	-1,03815
SAMSUN	LADIK	8	377	0,16	8.316	-0,999	0,46	3,75	-0,24068
YALOVA	CINARCIK	8	357	0,21	11.080	2,368	0,43	5,35	1,17381
IZMIR	CESME	7	348	0,03	20.455	-2,343	0,63	2,19	2,69252
BURSA	YENISEHIR	7,5	339	0,07	29.275	1,289	0,57	5,18	0,28969

The first best subsets regression analyses is employed between the first dependent variable Y1 (absolute loss) and independent variables (X1, X2, X3, X4, X5) in order to see which independent variable is more related with Y1.

According to the Table 5.2 the biggest R-Sq (adj.) is 19, 1% in the third line and this means that the most related variables with Y1 is X1 and X5, which is settlement population and development index.

Table 5.2 Best Subsets Regression 1: Y1 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y1 versus X1; X2; X3; X4; X5

Response is Y1

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	**X 1**	X 2	X 3	X 4	**X 5**
1	13,4	8,6	2,6	292,87	X				
1	7,6	2,4	3,9	302,54					X
2	27,7	**19,1**	1,6	275,42	**X**				**X**
2	18,1	8,4	3,6	293,09			X		X
3	31,5	18,7	2,7	276,18	X			X	X
3	29,0	15,7	3,3	281,28	X	X			X
4	34,4	16,9	4,1	279,26	X	X		X	X
4	33,0	15,2	4,4	282,10	X		X	X	X
5	35,0	11,7	6,0	287,76	X	X	X	X	X

As a result of this analysis we can say that;
Y1 that is determined as absolute loss is correlated with X1 and X5.

Accordingly, the regression analysis is performed with;

Y1 (Absolute loss) and X1 (Settlement Population)
Y1 (Absolute loss) and X5 (Development Index)

The second best subsets regression analysis is employed between the second dependent variable Y2 (rate of loss) and other independent variables (X1, X2, X3, X4, X5).

Table 5.3 shows us that the biggest R-Sq (adj.) is 54, 5% in the seventh line and this means that the most related variables with Y2 is X1, X3, X4 and X5 that is settlement population, rate of agglomeration, ratio of population to the total number of building and development index.

Table 5.3 Best Subsets Regression 2: Y2 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y2 versus X1; X2; X3; X4; X5

Response is Y2

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	**X 1**	X 2	**X 3**	**X** 4	**X** 5
1	34,3	30,7	9,9	0,046885					X
1	31,2	27,4	11,2	0,047974				X	
2	44,1	37,5	8,1	0,044518			X	X	
2	41,8	35,0	9,0	0,045417				X	X
3	54,2	45,6	6,1	0,041549	X	X		X	
3	52,7	43,8	6,7	0,042223		X	X	X	
4	64,1	**54,5**	4,2	0,037995	**X**		**X**	**X**	**X**
4	57,8	46,6	6,6	0,041151	X	X	X	X	
5	64,5	51,9	6,0	0,039062	X	X	X	X	X

As a result of this analysis we can say that;
Y2 that is determined as rate of loss is correlated with X1, X3, X4 and X5.

Accordingly, regression analysis is performed with;

Y2 (Rate of Loss) and X1 (Settlement Population)
Y2 (Rate of Loss) and X3 (Rates of Agglomeration)
Y2 (Rate of Loss) and X4 (Population/Total Number of Buildings)
Y2 (Rate of Loss) and X5 (Development Index)

The results of best subsets regression analyses of top-20 settlements for the first category, that considers settlements having population up to 50.000, shows that X1 (settlement population) and X5 (development index) are the most effective independent variables that correlates with both dependent variables.

Six regression analyses are performed according to the results of best subsets regression analyses for Category I, which considers settlements having population up to 50.000. These are;

Regression Analysis: Y1 versus X1,
Y1 versus X5,
Y2 versus X1,
Y2 versus X3,
Y2 versus X4 and
Y2 versus X5.

5.1.2. Best Subsets Regression Analyses for Category II (50.000-490.000 Inhabitants)

Best Subsets Regression Analyses for the second Category, that considers settlements having population between 50.000 and 490.000, is employed between the dependent and independent variables of the top-20 settlements in the second category prioritized according to absolute loss levels.

Dependent and independent variables of the top-20 settlements in the second category prioritized according to absolute loss levels are given below.

Table 5.4 Dependent and Independent Variables of the Top-20 Settlements for Category II

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 50.000-490.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss /Building)**	**Settlement Population (2009)**	**Population Growth Rate (%o)**	**Rates of Agglome -ration**	**Pop. / Total No. of Buildings**	**Dev. Index**
VAN	VAN M.	7,5	2285	0,06	360.810	2,642	0,80	7,851	0,71686
ERZINCAN	ERZİNCAN M.	8	2025	0,16	90.100	-1,928	0,65	8,454	0,78524
BOLU	BOLU M.	8	1841	0,18	120.021	3,891	0,75	8,042	1,79561
YALOVA	YALOVA M.	8	1507	0,18	92.166	3,038	0,81	8,446	2,42273
TEKIRDAG	TEKİRDAĞ M.	7,5	1347	0,09	140.535	3,009	0,82	6,835	1,86420
TOKAT	ERBAA	8	1251	0,16	58.845	2,835	0,60	5,775	-0,25251
BURSA	ORHANGAZI	8	945	0,18	54.319	2,234	0,72	8,362	1,13050
MANISA	MANİSA M.	7	919	0,04	291.374	3,411	0,86	8,648	2,46533
OSMANIYE	OSMANİYE M.	7	905	0,03	194.339	1,230	0,86	5,916	0,97609
HATAY	ANTAKYA	7	768	0,03	202.216	3,702	0,45	6,174	0,98304
HATAY	ISKENDERUN	7	705	0,03	190.279	1,985	0,60	7,518	2,56211
ADIYAMAN	ADIYAMAN M.	7	696	0,03	198.433	1,174	0,76	8,128	0,57604
AMASYA	MERZIFON	7,5	666	0,07	52.225	1,504	0,76	4,847	0,71109
MANISA	TURGUTLU	7	639	0,03	115.930	2,362	0,82	4,849	1,23913
DUZCE	DÜZCE M.	7,5	612	0,07	125.240	8,815	0,65	6,592	1,11568
DENIZLI	DENİZLİ M.	6,5	586	0,01	488.768	6,371	0,94	6,560	3,69197
MANISA	AKHISAR	7	585	0,03	100.897	2,371	0,64	4,586	0,54044
BURSA	INEGOL	7	536	0,04	161.541	4,686	0,75	7,517	1,36120
TOKAT	TOKAT M.	7	528	0,03	129.879	1,537	0,71	7,358	0,81785
MANISA	SALIHLI	7	483	0,04	96.503	1,656	0,62	6,096	0,82197

Best subsets regression analyses is employed between the first dependent variable Y1 (absolute loss) and other independent variables in order to see which independent variable is more related with Y1.

According to the Table 5.5 the biggest R-Sq (adj.) is 19, 3% in the third line and this means that the most related variables with Y1 is X2 and X4, that is population growth rate and ratio of population to the total number of building.

Table 5.5 Best Subsets Regression 3: Y1 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y1 versus X1; X2; X3; X4; X5

Response is Y1

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	X1	X2	X3	X4	X5
1	22,4	18,0	1,1	488,91				X	
1	7,3	2,2	3,2	534,07		X			
2	27,8	**19,3**	1,0	485,11		**X**		**X**	
2	27,6	19,1	1,0	485,88				X	X
3	30,1	17,0	2,5	491,99			X	X	X
3	29,8	16,6	2,6	493,19		X		X	X
4	31,9	13,7	4,1	501,71		X	X	X	X
4	31,2	12,9	4,3	504,14	X	X		X	X
5	32,6	8,5	6,0	516,65	X	X	X	X	X

As a result of this analysis we can say that; Y1 that is determined as absolute loss is correlated with X2 and X4. Accordingly, the regression analysis is performed with;

Y1 (Absolute loss) and X2 (Population Growth Rate)
Y1 (Absolute loss) and X4 (Population/Total Number of Buildings)

The second best subsets regression analysis is employed between the second dependent variable Y2 (rate of loss) and other independent variables, Table 5.6 shows us that the biggest R-Sq (adj.) is 45, 8% in the third line and this means that the most related variables with Y2 is X1 and X4, that is settlement population and ratio of population to the total number of building.

Table 5.6 Best Subsets Regression 4: Y2 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y2 versus X1; X2; X3; X4; X5

Response is Y2

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	X1	X2	X3	X4	X5
1	25,6	21,5	6,7	0,053812	X				
1	16,3	11,7	9,6	0,057075				X	
2	51,5	**45,8**	0,8	0,044715	**X**			**X**	
2	30,1	21,8	7,4	0,053701	X				X
3	53,1	44,3	2,4	0,045351	X		X	X	
3	52,6	43,7	2,5	0,045585	X	X		X	
4	54,2	42,0	4,0	0,046251	X	X	X	X	
4	53,2	40,7	4,3	0,046775	X		X	X	X
5	54,2	37,9	6,0	0,047874	X	X	X	X	X

As a result of this analysis we can say that; Y2 that is determined as rate of loss is correlated with X1 and X4. Accordingly, the regression analysis is performed with;

Y2 (Rate of Loss) and X1 (Settlement Population)
Y2 (Rate of Loss) and X4 (Population/Total Number of Buildings)

The results of best subsets regression analyses of top-20 settlements for the second category, that considers settlements having population between 50.000 and 490.000, shows that X4, the ratio of population to total number of buildings, is the most effective and only independent variable that correlates with both dependent variables.

Four regression analyses are performed according to the results of best subsets regression analyses for Category II that considers settlements having population between 50.000 and 490.000. These are;

Regression Analysis: Y1 versus X2,
Y1 versus X4,
Y2 versus X1 and
Y2 versus X4

5.1.3. Best Subsets Regression Analyses for Category III (Metropolitan Cities)

Best Subsets Regression Analyses for the third Category, that considers metropolitan cities, is employed between the dependent and independent variables of the metropolitan cities prioritized according to absolute loss levels.

Dependent and independent variables of metropolitan cities in the third category prioritized according to absolute loss levels are given below.

Table 5.7 Dependent and Independent Variables of the Top-20 Settlements for Category II

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY Metropolitan Cities	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss /Building)	Settlement Population (2009)	Population Growth Rate (%0)	Rates of Agglome-ration	Population / Total No. of Buildings	Dev. Index
ISTANBUL	ISTANBUL (M)	7,5	83824	0,10	12.782.960	2,563	0,99	11,74	N.A.
KOCAELI	KOCAELI (M)	8	24077	0,17	1.422.752	4,249	0,93	6,96	
BURSA	BURSA (M)	7,5	16506	0,08	1.854.285	2,239	0,96	7,40	7,95333
IZMIR	IZMIR (M)	7	14531	0,03	3.276.815	1,414	0,96	6,85	N.A.
SAKARYA	SAKARYA (M)	8	8070	0,16	442.157	-1,154	0,91	9,89	
ADANA	ADANA (M)	6,5	1913	0,01	1.556.238	1,973	0,98	7,42	5,71564
ANTALYA	ANTALYA (M)	6,5	1402	0,01	955.573	5,112	0,96	5,25	
KONYA	KONYA (M)	6,5	1355	0,01	1.003.373	3,343	0,95	6,56	3,54941
ERZURUM	ERZURUM (M)	6,5	439	0,01	368.146	12,976	0,96	3,53	

Best subsets regression analyses is employed between the first dependent variable Y1 (absolute loss) and other independent variables in order to see which independent variable is more related with Y1.

According to the Table 5.8 the biggest R-Sq (adj.) is 95, 5% in the seventh line and this means that the most related variables with Y1 is X1, X3 and X4 that is settlement population, rate of agglomeration and ratio of population to the total number of building.

Table 5.8 Best Subsets Regression 5: Y1 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y1 versus X1; X2; X3; X4; X5

Response is Y1

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	X 1	X 2	X 3	X 4	X 5
1	92,2	91,1	5,7	7871,2	X				
1	55,4	49,0	56,6	18873				X	
2	96,1	94,8	4,4	6040,9	X		X		
2	93,2	90,9	6,4	7960,2	X			X	
3	96,5	94,4	3,9	6278,2	X	X	X		
3	96,4	94,3	3,9	6327,2	X		X		X
4	97,8	**95,5**	4,1	5579,2	**X**		**X**	**X**	
4	97,5	95,0	4,5	5917,6	X		X	X	X
5	97,8	94,2	6,0	6364,5	X	X	X	X	X

As a result of this analysis we can say that; Y1 that is determined as absolute loss is correlated with X1, X3 and X4.

Accordingly, the regression analysis is performed with;

Y1 (Absolute loss) and X1 (Settlement Population)
Y1 (Absolute loss) and X3 (Rates of Agglomeration)
Y1 (Absolute loss) and X4 (Population/Total Number of Buildings)

The second best subsets regression analysis is employed between the second dependent variable Y2 (rate of loss) and other independent variables, Table 5.9 shows us that the biggest R-Sq (adj.) is 68, 6% in the fifth line and this means that the most related variables with Y2 is X2, X3 and X4, that is population growth rate, rate of agglomeration and ratio of population to the total number of buildings.

Table 5.9 Best Subsets Regression 6: Y2 versus x1; x2; x3; x4; x5

Best Subsets Regression: Y2 versus X1; X2; X3; X4; X5

Response is Y2

Vars	R-Sq	R-Sq(adj)	Mallows Cp	S	X 1	X 2	X 3	X 4	X 5
1	34,2	24,8	6,0	0,057201			X		
1	34,1	24,7	6,0	0,057245				X	
2	75,4	67,2	2,4	0,037776	X		X		
2	72,0	62,7	2,7	0,040316			X	X	
3	80,4	**68,6**	2,3	0,036964		**X**	**X**	**X**	
3	78,5	65,6	2,6	0,038679		X	X	X	
4	81,3	62,6	4,1	0,040366	X	X	X		X
4	80,4	60,8	4,3	0,041301	X		X	X	X
5	82,1	52,2	6,0	0,045637	X	X	X	X	X

As a result of this analysis we can say that; Y2 that is determined as rate of loss is correlated with X2, X3 and X4. Accordingly, the regression analysis is performed with;

Y2 (Rate of Loss) and X2 (Population Growth Rate)
Y2 (Rate of Loss) and X3 (Rates of Agglomeration)
Y2 (Rate of Loss) and X4 (Population/Total Number of Buildings)

The results of best subsets regression analyses for the third category, that considers metropolitan cities, shows that X3 (Rates of Agglomeration) and X4 (Population/Total Number of Buildings) are the most effective independent variables that correlates with both dependent variables.

Five regression analyses are performed according to the results of best subsets regression analyses for Category III that considers metropolitan cities. These are;

Regression Analysis: Y1 versus X1,
Y1 versus X3,
Y1 versus X4,
Y2 versus X3 and
Y2 versus X4

5.1.4. Evaluation of Best Subsets Regression Analyses

The results of best subsets regression analyses of top-20 settlements for the first category, that considers settlements having population up to 50.000, shows that X1 (settlement population) and X5 (development index) are the most effective independent variables that correlates with both dependent variables.

Six regression analyses are performed according to the results of best subsets regression analyses for Category I, which considers settlements having population up to 50.000. These are; Regression Analysis: Y1 versus X1, Y1 versus X5, Y2 versus X1,Y2 versus X3, Y2 versus X4 and Y2 versus X5.

The results of best subsets regression analyses of top-20 settlements for the second category, that considers settlements having population between 50.000 and 490.000, shows that X4, the ratio of population to total number of buildings, is the most effective and only independent variable that correlates with both dependent variables.

Four regression analyses are performed according to the results of best subsets regression analyses for Category II, which considers settlements having population between 50.000 and 490.000. These are; Regression Analysis: Y1 versus X2, Y1 versus X4, Y2 versus X1 and Y2 versus X4.

The results of best subsets regression analyses for the third category, that considers metropolitan cities, shows that X3 (Rates of Agglomeration) and X4 (Population/Total Number of Buildings) are the most effective independent variables that correlates with both dependent variables.

Five regression analyses are performed according to the results of best subsets regression analyses for Category III that considers metropolitan cities. These are; Regression Analysis: Y1 versus X1, Y1 versus X3, Y1 versus X4, Y2 versus X3 and Y2 versus X4.

Table 5.10 Evaluation of Best Subsets Regression Analyses

First Category settlements having population up to 50.000 ⇨	Y1 versus X1 Y1 versus X5 Y2 versus X1 Y2 versus X3 Y2 versus X4 Y2 versus X5	Six regression analyses for Category I
Second Category settlements having population between 50.000 and 490.000 ⇨	Y1 versus X2 Y1 versus X4 Y2 versus X1 Y2 versus X4	Four regression analyses for Category II
Third Category metropolitan cities ⇨	Y1 versus X1 Y1 versus X3 Y1 versus X4 Y2 versus X3 Y2 versus X4	Five regression analyses for Category III

*Y1 (absolute loss), Y2 (relative loss), X1 (settlement population), X2 (population growth rate), X3 (rates of agglomeration), X4 (population /total number of buildings), X5 (development index)

5.2. Analyses by Means of Regression Methods

According to the results of best subsets regression analyses; six regression analyses for Category I, four regression analyses for Category II and five regression analyses for Category III are performed. Regression analyses are performed within top-20 settlements prioritized according to absolute loss in Category I and Category II and nine metropolitan cities in Category III.

In regression analyses in order to say that there is a relation between variables, the R-Sq (adj.) must be minimum 64%. The ratios lower than 64% is insufficient to verify the relationship between variables and we can say that there is a weak relation or there isn't any relation between variables. If the ratio is higher than 64% we can say that there is a strong relation between variables.

5.2.1. Analyses by Means of Regression Methods for Category I (0-50.000)

Six regression analyses are performed according to the results of best subsets regression analyses for Category I that considers settlements having population up to 50.000. These are; Regression Analysis: Y1 versus X1, Y1 versus X5, Y2 versus X1, Y2 versus X3, Y2 versus X4 and Y2 versus X5.

Regression Analysis 1:

Regression Analysis 1 is performed with Y1 (absolute loss) and X1(settlement population). As shown in the Table 5.11, the R-Sq (adj.) is 8, 6%. This ratio is insufficient to verify the relationship between Y1 and X1, so we can say that there is **no relation** between the regression equations of Y1 versus X1.

Table 5.11 Regression Analysis 1: Y1 versus X1

Regression Analysis: Y1 versus X1

```
The regression equation is
Y1 = 383 + 0,00983 X1

Predictor       Coef    SE Coef      T      P
Constant       383,4      156,8   2,45  0,025
X1          0,009835   0,005895   1,67  0,113

S = 292,871   R-Sq = 13,4%   R-Sq(adj) = 8,6%

Analysis of Variance
Source          DF       SS      MS     F      P
Regression       1   238694  238694  2,78  0,113
Residual Error  18  1543923   85773
Total           19  1782617

Unusual Observations
Obs     X1      Y1     Fit  SE Fit  Residual  St Resid
  1  33682  1400,0   714,6    86,2     685,4     2,45R
  2  27624  1364,0   655,1    68,6     708,9     2,49R

R denotes an observation with a large standardized residual.
```

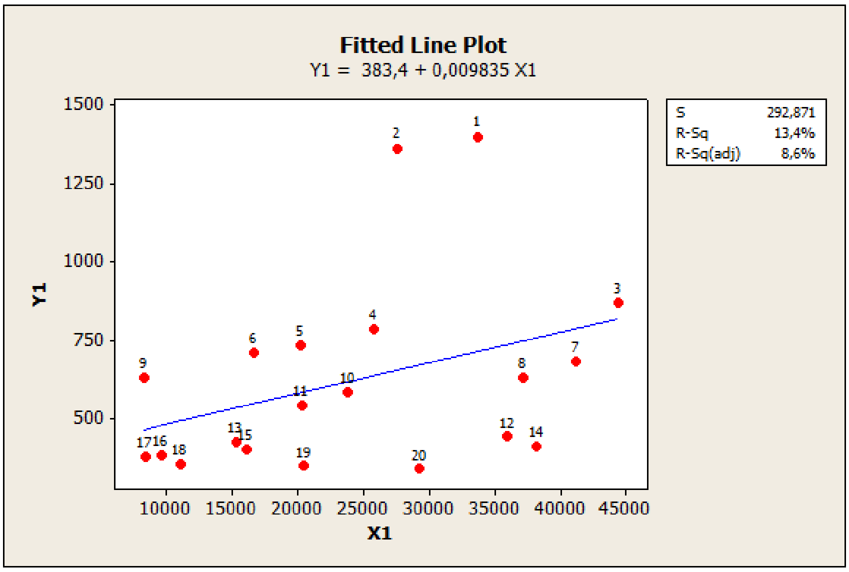

Figure 5.3 Regression Analysis 1: Y1 versus X1

Regression equation of Y1 versus X1 is; Y1 = 383 + 0, 00983 X1 and
R-Sq (adj.) = 8, 6%

Consequently, we can say that there is no relation between Absolute Loss and Settlement Population for the top-20 settlements less than 50.000 inhabitants.

Regression Analysis 2:

Regression Analysis 2 is performed with Y1 (absolute loss) and X5 (development index). As shown in the Table 5.12, the R-Sq (adj.) is 2, 4%.

This ratio is insufficient to verify the relationship between Y1 and X5, so we can say that there is **no relation** between the regression equations of Y1 versus X5.

Table 5.12 Regression Analysis 2: Y1 versus X5

Regression Analysis: Y1 versus X5

```
The regression equation is
Y1 = 660 - 106 X5

Predictor      Coef  SE Coef      T      P
Constant     660,01    74,87   8,82  0,000
X5          -105,89    87,17  -1,21  0,240

S = 302,541   R-Sq = 7,6%   R-Sq(adj) = 2,4%

Analysis of Variance
Source          DF       SS      MS     F      P
Regression       1   135061  135061  1,48  0,240
Residual Error  18  1647556   91531
Total           19  1782617

Unusual Observations

Obs     X5      Y1    Fit  SE Fit  Residual  St Resid
  1  -0,08  1400,0  668,2    78,0     731,8     2,50R
  2   0,14  1364,0  645,5    70,6     718,5     2,44R
 19   2,69   348,0  374,9   213,6     -26,9    -0,13 X

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.
```

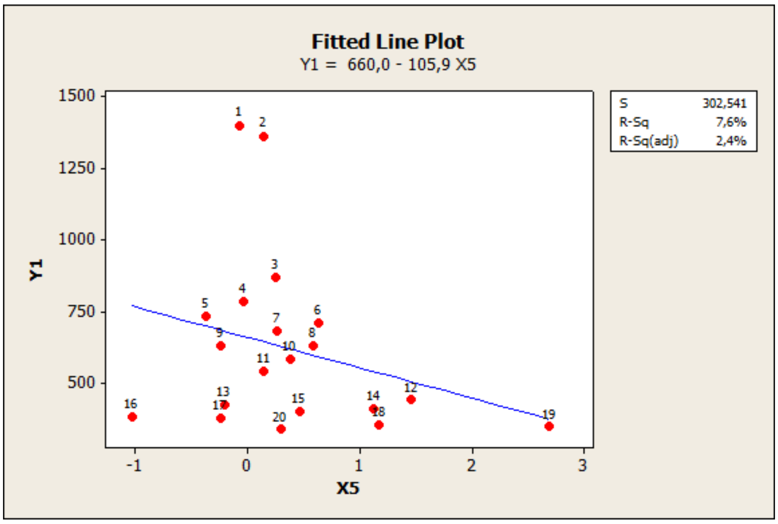

Figure 5.4 Regression Analysis 2: Y1 versus X5

Regression equation of Y1 versus X5 is;

Y1 = 660 - 106 X5 and
R-Sq (adj.) = 2, 4%

Consequently, we can say that there is no relation between Absolute Loss and Development Index for the top-20 settlements less than 50.000 inhabitants.

Regression Analysis 3:

Regression Analysis 3 is performed with Y2 (rate of loss) and X1 (settlement population). As shown in the Table 5.13, the R-Sq (adj.) is 6, 5%.

This ratio is insufficient to verify the relationship between Y2 and X1, so we can say that there is **no relation** between the regression equations of Y2 versus X1.

Table 5.13 Regression Analysis 3: Y2 versus X1

Regression Analysis: Y2 versus X1

```
The regression equation is
Y2 = 0,177 - 0,000002 X1

Predictor           Coef      SE Coef       T      P
Constant         0,17680      0,02916    6,06  0,000
X1           -0,00000167  0,00000110   -1,52  0,146

S = 0,0544622   R-Sq = 11,4%   R-Sq(adj) = 6,5%

Analysis of Variance

Source           DF        SS        MS     F      P
Regression        1  0,006865  0,006865  2,31  0,146
Residual Error   18  0,053390  0,002966
Total            19  0,060255

Unusual Observations

Obs     X1      Y2     Fit  SE Fit  Residual  St Resid
 19  20455  0,0300  0,1427  0,0128   -0,1127    -2,13R

R denotes an observation with a large standardized residual.
```

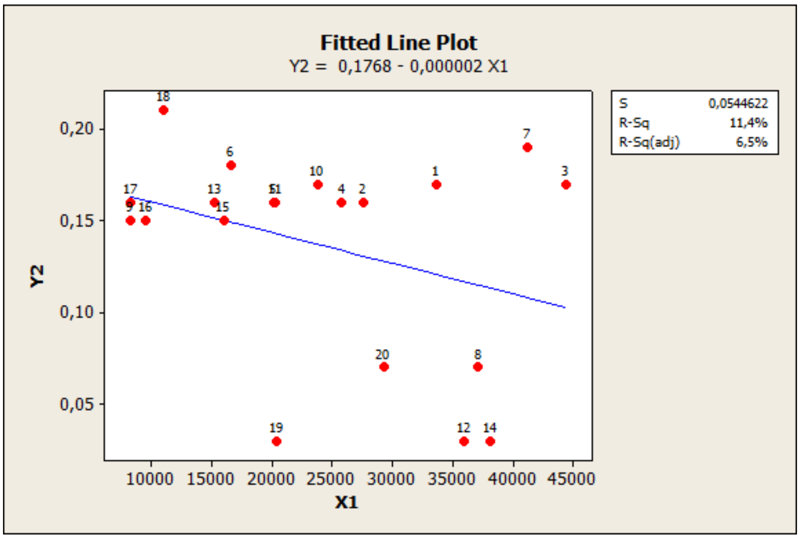

Figure 5.5 Regression Analysis 3: Y2 versus X1

Regression equation of Y2 versus X1 is;

Y2 = 0, 177 - 0, 000002 X1
R-Sq (adj.) = 6, 5%

Consequently, we can say that there is no relation between Rate of Loss and Settlement Population for the top-20 settlements less than 50.000 inhabitants.

Regression Analysis 4:

Regression Analysis 4 is performed with Y2 (rate of loss) and X3 (rates of agglomeration). As shown in the Table 5.14, the R-Sq (adj.) is 21, 9%.

Although this ratio isn't sufficient enough to verify the relationship between Y2 and X3, we can say that there is a **weak relation** between the regression equations of Y2 versus X3.

Table 5.14 Regression Analysis 4: Y2 versus X3

Regression Analysis: Y2 versus X3

```
The regression equation is
Y2 = 0,270 - 0,239 X3

Predictor        Coef   SE Coef       T      P
Constant      0,26955   0,05410    4,98  0,000
X3           -0,23865   0,09497   -2,51  0,022

S = 0,0497804   R-Sq = 26,0%   R-Sq(adj) = 21,9%

Analysis of Variance
Source          DF        SS        MS     F      P
Regression       1  0,015649  0,015649  6,32  0,022
Residual Error  18  0,044606  0,002478
Total           19  0,060255

Unusual Observations

Obs     X3      Y2     Fit  SE Fit  Residual  St Resid
 12  0,580  0,0300  0,1311  0,0113   -0,1011    -2,09R
 16  0,280  0,1500  0,2027  0,0286   -0,0527    -1,29 X

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.
```

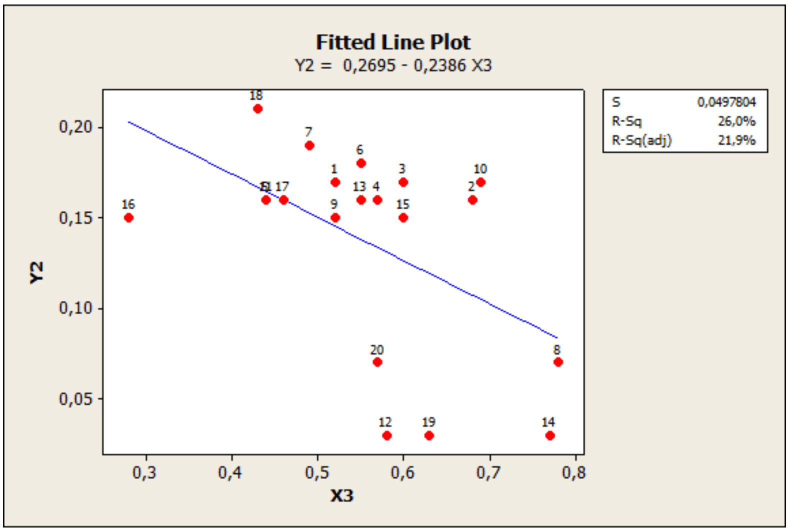

Figure 5.6 Regression Analysis 4: Y2 versus X3

Regression equation of Y2 versus X3 is;

Y2 = 0, 270 - 0, 239 X3
R-Sq (adj.) = 21, 9%

Consequently, we can say that there is a weak relation between Rate of Loss and Rates of Agglomeration for the top-20 settlements less than 50.000 inhabitants.

Regression Analysis 5:

Regression Analysis 5 is performed with Y2 (rate of loss) and X4 (pop. /total number of buildings). As shown in the Table 5.15, the R-Sq (adj.) is 27, 4%.

Although this ratio isn't sufficient enough to verify the relationship between Y2 and X4, we can say that there is a **weak relation** between the regression equations of Y2 versus X4.

Table 5.15 Regression Analysis 5: Y2 versus X4

Regression Analysis: Y2 versus X4

```
The regression equation is
Y2 = 0,0535 + 0,0166 X4

Predictor       Coef    SE Coef      T      P
Constant     0,05347    0,03095   1,73  0,101
X4          0,016570   0,005793   2,86  0,010

S = 0,0479741   R-Sq = 31,2%   R-Sq(adj) = 27,4%

Analysis of Variance

Source          DF        SS        MS     F      P
Regression       1  0,018828  0,018828  8,18  0,010
Residual Error  18  0,041427  0,002302
Total           19  0,060255

Unusual Observations

Obs    X4      Y2     Fit  SE Fit  Residual  St Resid
 13  9,71  0,1600  0,2144  0,0293   -0,0544     -1,43 X

X denotes an observation whose X value gives it large leverage.
```

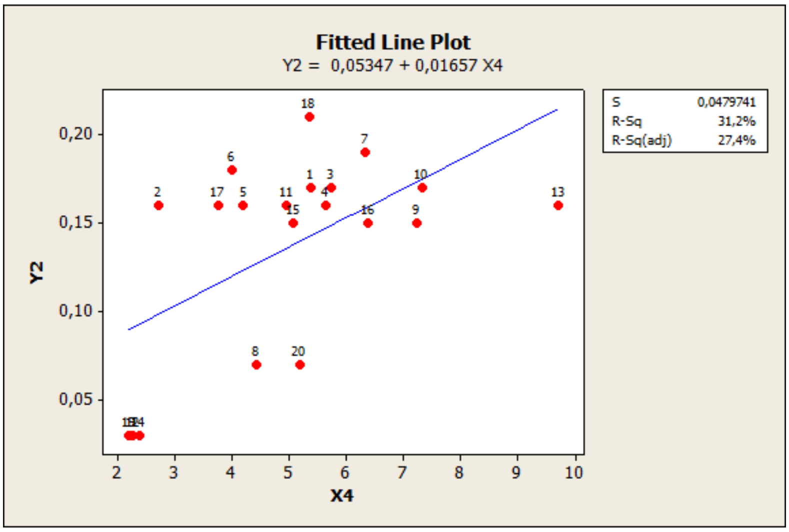

Figure 5.7 Regression Analysis 5: Y2 versus X4

Regression equation of Y2 versus X4 is;

Y2 = 0, 0535 + 0, 0166 X4
R-Sq (adj.) = 27, 4%

Consequently, we can say that there is a weak relation between Rate of Loss and the Ratio of Population to the Number of Buildings for the top-20 settlements less than 50.000 inhabitants.

Regression Analysis 6:

Regression Analysis 6 is performed with Y2 (rate of loss) and X5 (development index). As shown in the Table 5.16, the R-Sq (adj.) is 30, 7%.

Although this ratio isn't sufficient enough to verify the relationship between Y2 and X5, 30, 7% is a strong verification of relation for this type of datasets. So, we can say that there is a **weak relation** between the regression equations of Y2 versus X5.

Table 5.16 Regression Analysis 6: Y2 versus X5

Regression Analysis: Y2 versus X5

```
The regression equation is
Y2 = 0,152 - 0,0414 X5

Predictor       Coef  SE Coef      T      P
Constant     0,15175  0,01160  13,08  0,000
X5          -0,04144  0,01351  -3,07  0,007

S = 0,0468852   R-Sq = 34,3%   R-Sq(adj) = 30,7%

Analysis of Variance

Source          DF        SS        MS     F      P
Regression       1  0,020687  0,020687  9,41  0,007
Residual Error  18  0,039568  0,002198
Total           19  0,060255

Unusual Observations
 Obs    X5      Y2     Fit  SE Fit  Residual  St Residual
  18  1,17  0,2100  0,1031  0,0151    0,1069        2,41R
  19  2,69  0,0300  0,0402  0,0331   -0,0102       -0,31 X

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.
```

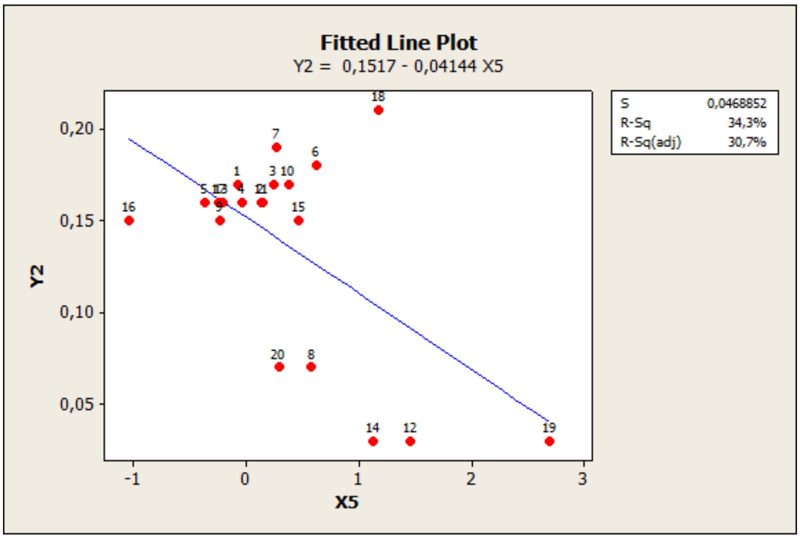

Figure 5.8 Regression Analysis 6: Y2 versus X5

Regression equation of Y2 versus X5 is;

Y2 = 0,152 - 0, 0414 X5
R-Sq (adj.) = 30, 7%

Consequently, we can say that there is a weak relation between Rate of Loss and Development Index for the top-20 settlements less than 50.000 inhabitants.

Six regression analyses are performed for top-20 settlements in the first category that considers settlements having populations up to 50.000. The Results of these analyses show that;

Y1 (absolute loss) has no relation with independent variables and,
Y2 (rate of loss) has weak relations with X3 (Rates of Agglomeration)
X4 (Pop./Total Number of Buildings)
X5 (Development Index)

5.2.2. Analyses by Means of Regression Methods for Category II (50.000-490.000)

Four regression analyses are performed according to the results of best subsets regression analyses for Category II that considers settlements having population between 50.000-490.000 inhabitants.

These are; Regression Analysis: Y1 versus X2, Y1 versus X4, Y2 versus X1 and Y2 versus X4.

Regression Analysis 7:

Regression Analysis 7 is performed with Y1 (absolute loss) and X2 (population growth rate). As shown in the Table 5.17, the R-Sq (adj.) is 2, 2%.

This ratio is insufficient to verify the relationship between Y1 and X2, so we can say that there is **no relation** between the regression equations of Y1 versus X2.

Table 5.17 Regression Analysis 7: Y1 versus X2

Regression Analysis: Y1 versus X2

```
The regression equation is
Y1 = 1183 - 67,9 X2

Predictor     Coef  SE Coef      T      P
Constant    1183,3    200,1   5,91  0,000
X2          -67,88    56,81  -1,19  0,248

S = 534,070   R-Sq = 7,3%   R-Sq(adj) = 2,2%

Analysis of Variance

Source          DF       SS      MS     F      P
Regression       1   407264  407264  1,43  0,248
Residual Error  18  5134151  285231
Total           19  5541415

Unusual Observations

Obs     X2    Y1   Fit  SE Fit  Residual  St Resid
  1   2,64  2285  1004     120      1281     2,46R
  2  -1,93  2025  1314     295       711     1,60 X
 15   8,81   612   585     361        27     0,07 X
```

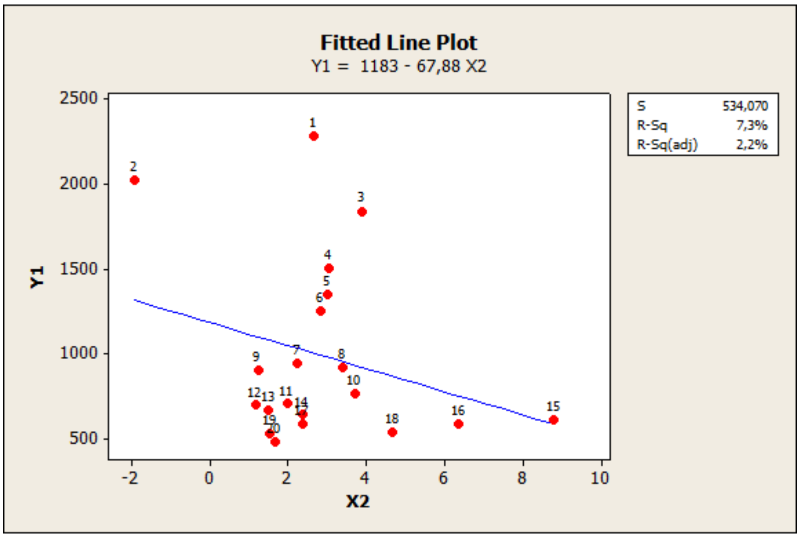

Figure 5.9 Regression Analysis 7: Y1 versus X2

Regression equation of Y1 versus X2 is;

Y1 = 1183 - 67, 9 X2
R-Sq (adj.) = 2, 2%

Consequently, we can say that there is no relation between Absolute Loss and Population Growth Rate for the top-20 settlements between 50.000-490.000 inhabitants.

Regression Analysis 8:

Regression Analysis 8 is performed with Y1 (absolute loss) and X4 (population/total number of buildings). As shown in the Table 5.18, the R-Sq (adj.) is 18, 0%.

Although this ratio isn't sufficient enough to verify the relationship between Y1 and X4, we can say that there is a **weak relation** between the regression equations of Y1 and X4.

Table 5.18 Regression Analysis 8: Y1 versus X4

Regression Analysis: Y1 versus X4

```
The regression equation is
Y1 = - 370 + 197 X4

Predictor     Coef  SE Coef      T      P
Constant    -370,2    608,0  -0,61  0,550
X4          196,54    86,33   2,28  0,035

S = 488,909   R-Sq = 22,4%   R-Sq(adj) = 18,0%

Analysis of Variance

Source          DF       SS       MS     F      P
Regression       1  1238845  1238845  5,18  0,035
Residual Error  18  4302570   239032
Total           19  5541415

Unusual Observations

Obs    X4    Y1   Fit  SE Fit  Residual  St Resid
  1  7,85  2285  1173     135      1112     2,37R

R denotes an observation with a large standardized residual.
```

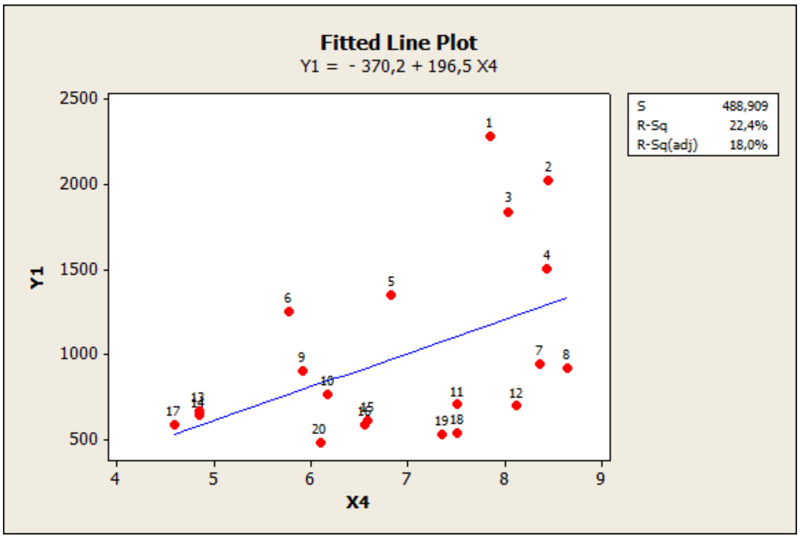

Figure 5.10 Regression Analysis 8: Y1 versus X4

Regression equation of Y1 versus X4 is;

Y1 = - 370 + 197 X4
R-Sq (adj.) = 18, 0%

Consequently, we can say that there is a weak relation between Absolute Loss and the ratio of population to the number of buildings for the top-20 settlements between 50.000-490.000 inhabitants.

<u>Regression Analysis 9:</u>

Regression Analysis 9 is performed with Y2 (rate of loss) and X1 (settlement population). As shown in the Table 5.19, the R-Sq (adj.) is 21, 5%.

Although this ratio isn't sufficient enough to verify the relationship, we can say that there is a **weak relation** between the regression equations of Y2 and X1.

Table 5.19 Regression Analysis 9: Y2 versus X1

Regression Analysis: Y2 versus X1

```
The regression equation is
Y2 = 0,120 - 0,000000 X1

Predictor          Coef     SE Coef      T      P
Constant        0,12044     0,02202   5,47  0,000
X1          -0,00000028  0,00000011  -2,49  0,023

S = 0,0538125   R-Sq = 25,6%   R-Sq(adj) = 21,5%

Analysis of Variance

Source          DF        SS        MS     F      P
Regression       1  0,017971  0,017971  6,21  0,023
Residual Error  18  0,052124  0,002896
Total           19  0,070095

Unusual Observations

Obs      X1      Y2      Fit  SE Fit  Residual  St Resid
 16  488768  0,0100  -0,0171  0,0387    0,0271      0,73 X

X denotes an observation whose X value gives it large leverage.
```

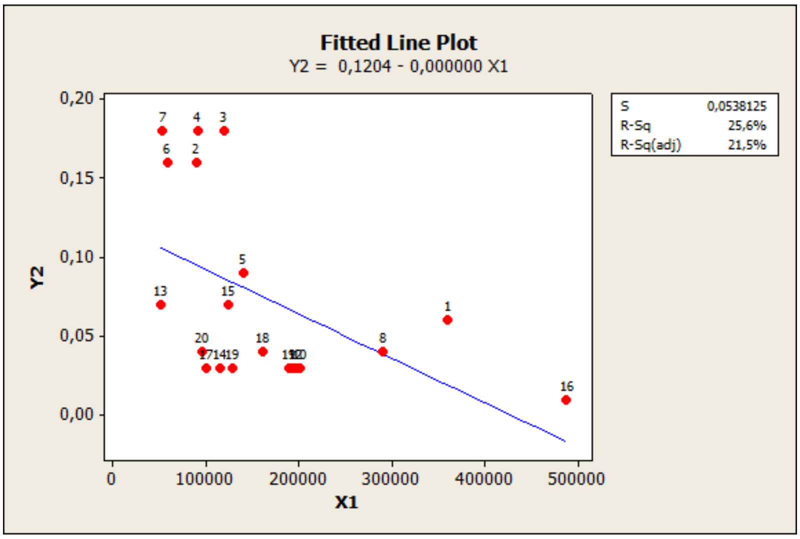

Figure 5.11 Regression Analysis 9: Y2 versus X1

Regression equation of Y2 versus X1 is;

Y2 = 0,120 - 0, 000000 X1
R-Sq (adj.) = 21, 5%

Consequently, we can say that there is a weak relation between Rate of Loss and Settlement Population for the top-20 settlements between 50.000-490.000 inhabitants.

Regression Analysis 10:

Regression Analysis 10 is performed with Y2 (rate of loss) and X4 (population/total number of buildings).

As shown in the Table 5.20, the R-Sq (adj.) is 11, 7%. This ratio is insufficient to verify the relationship, so we can say that there is **no relation** between the regression equations of Y2 versus X4.

Table 5.20 Regression Analysis 10: Y2 versus X4

Regression Analysis: Y2 versus X4

```
The regression equation is
Y2 = - 0,0565 + 0,0189 X4

Predictor       Coef  SE Coef      T      P
Constant    -0,05646  0,07098  -0,80  0,437
X4           0,01890  0,01008   1,88  0,077

S = 0,0570748   R-Sq = 16,3%   R-Sq(adj) = 11,7%

Analysis of Variance

Source          DF        SS        MS     F      P
Regression       1  0,011459  0,011459  3,52  0,077
Residual Error  18  0,058636  0,003258
Total           19  0,070095
```

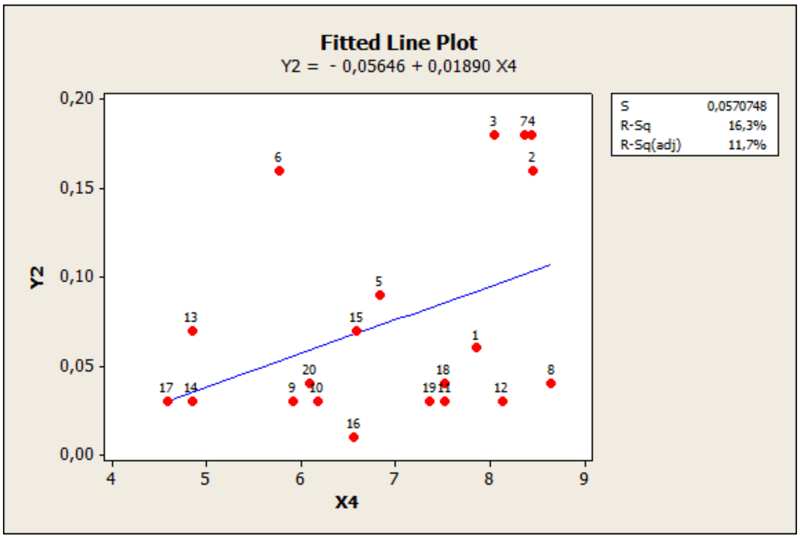

Figure 5.12 Regression Analysis 10: Y2 versus X4

Regression equation of Y2 versus X4 is;

Y2 = - 0, 0565 + 0, 0189 X4
R-Sq (adj.) = 11, 7%

Consequently, we can say that there is no relation between Rate of Loss and the Ratio of Population to the Number of Buildings for the top-20 settlements between 50.000-490.000 inhabitants.

Four regression analyses are performed for top-20 settlements in the second category that considers settlements having population between 50.000-490.000 inhabitants.

The Results of these analyses show that;

Y1 (absolute loss) has no relation with X2 (population growth rate) and weak relations with X4 (Population/Total Number of Buildings).

Y2 (rate of loss) has weak relations with X1(settlement population) and no relation with X4 (Population/Total Number of Buildings).

5.2.3. Analyses by Means of Regression Methods for Category III (Metropolitan Cities)

Five regression analyses are performed according to the results of best subsets regression analyses for Category III that considers metropolitan cities.

These are; Regression Analysis: Y1 versus X1, Y1 versus X3, Y1 versus X4, Y2 versus X3 and Y2 versus X4.

Regression Analysis 11:

Regression Analysis 11 is performed with Y1 (absolute loss) and X1(settlement population). As shown in the Table 5.21, the R-Sq (adj.) is 91, 1%.
This ratio is sufficient to verify the relationship and we can say that there is a **strong relation** between the regression equations of Y1 versus X1.

Table 5.21 Regression Analysis 11: Y1 versus X1

Regression Analysis: Y1 versus X1

```
The regression equation is
Y1 = - 188 + 0,00650 X1

Predictor        Coef    SE Coef      T      P
Constant         -188       3224  -0,06  0,955
X1          0,0065003  0,0007124   9,12  0,000

S = 7871,19   R-Sq = 92,2%   R-Sq(adj) = 91,1%

Analysis of Variance
Source          DF          SS          MS      F      P
Regression       1  5157787220  5157787220  83,25  0,000
Residual Error   7   433689869    61955696
Total            8  5591477089

Unusual Observations
Obs        X1     Y1    Fit  SE Fit  Residual  St Resid
  1  12782960  83824  82905    7695       919    0,55 X
  2   1422752  24077   9060    2761     15017    2,04R

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large leverage.
```

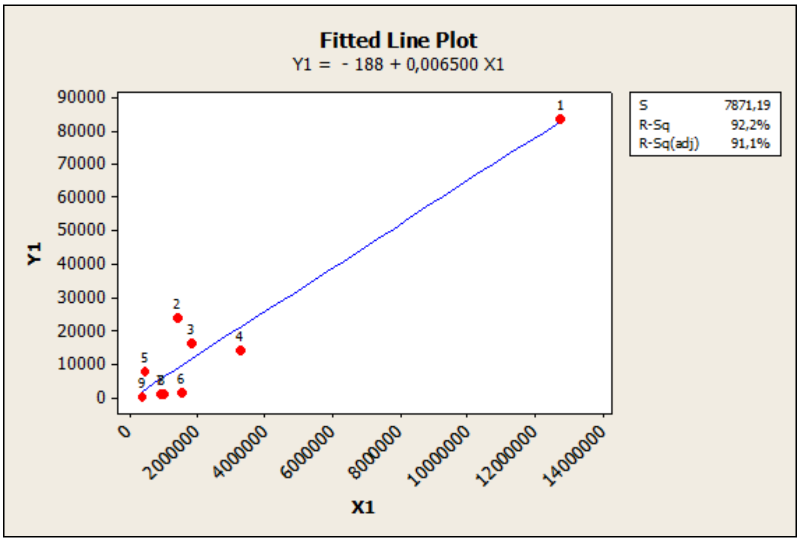

Figure 5.13 Regression Analysis 11: Y1 versus X1

Regression equation of Y1 versus X1 is;

Y1 = - 188 + 0, 00650 X1
R-Sq (adj.) = 91, 1%

Consequently, we can say that there is a strong relation between Absolute Loss and Settlement Population for the metropolitan provinces.

Regression Analysis 12:

Regression Analysis 12 is performed with Y1 (absolute loss) and X3 (rates of agglomeration). As shown in the Table 5.22, the R-Sq (adj.) is 5, 0%.

This ratio is insufficient to verify the relationship and we can say that there is **no relation** between the regression equations of Y1 versus X3.

Table 5.22 Regression Analysis 12: Y1 versus X3

Regression Analysis: Y1 versus X3

```
The regression equation is
Y1 = - 415102 + 452098 X3

Predictor      Coef  SE Coef      T      P
Constant    -415102   362224  -1,15  0,289
X3           452098   378965   1,19  0,272

S = 25764,7   R-Sq = 16,9%   R-Sq(adj) = 5,0%

Analysis of Variance

Source          DF          SS         MS     F      P
Regression       1   944746337  944746337  1,42  0,272
Residual Error   7  4646730752  663818679
Total            8  5591477089

Unusual Observations

Obs     X3     Y1    Fit  SE Fit  Residual  St Resid
  1  0,990  83824  32474   15625     51350     2,51R

R denotes an observation with a large standardized residual.
```

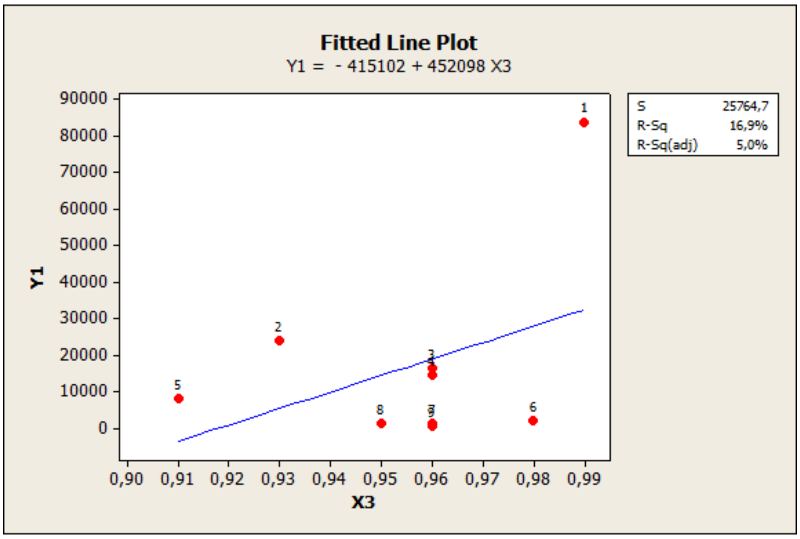

Figure 5.14 Regression Analysis 12: Y1 versus X3

Regression equation of Y1 versus X3 is;

Y1 = - 415102 + 452098 X3
R-Sq (adj.) = 5, 0%

Consequently, we can say that there is no relation between Absolute Loss and Rates of Agglomeration for the metropolitan provinces.

Regression Analysis 13:

Regression Analysis 13 is performed with Y1 (absolute loss) and X4 (population/total number of buildings). As shown in the Table 5.23, the R-Sq (adj.) is 49, 0%.

Although this ratio isn't sufficient enough to verify the relationship, we can say that there is a **weak relation** between the regression equations of Y1 versus X4.

Table 5.23 Regression Analysis 13: Y1 versus X4

Regression Analysis: Y1 versus X4

```
The regression equation is
Y1 = - 43096 + 8231 X4

Predictor     Coef  SE Coef      T      P
Constant    -43096    21293  -2,02  0,083
X4            8231     2791   2,95  0,021


S = 18872,5   R-Sq = 55,4%   R-Sq(adj) = 49,0%

Analysis of Variance
Source          DF          SS          MS     F      P
Regression       1  3098272370  3098272370  8,70  0,021
Residual Error   7  2493204719   356172103
Total            8  5591477089

Unusual Observations
Obs    X4     Y1    Fit  SE Fit  Residual  St Resid
  1  11,7  83824  53541   13925     30283     2,38R

R denotes an observation with a large standardized residual.
```

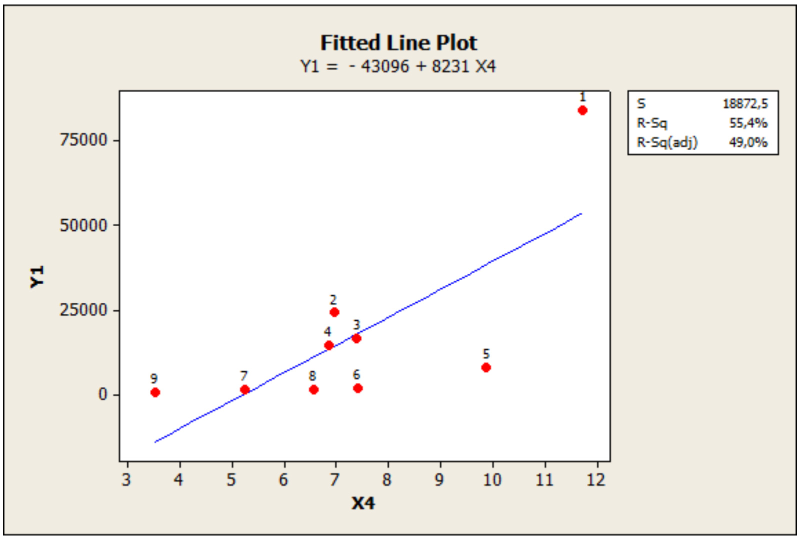

Figure 5.15 Regression Analysis 13: Y1 versus X4

Regression equation of Y1 versus X4 is;

Y1 = - 43096 + 8231 X4
R-Sq (adj.) = 49, 0%

Consequently, there is a weak relation between Absolute Loss and the Ratio of Population to the Number of Buildings for the metropolitan provinces.

Regression Analysis 14:

Regression Analysis 14 is performed with Y2 (rate of loss) and X3 (rates of agglomeration). As shown in the Table 5.24, the R-Sq (adj.) is 24, 8%.

Although this ratio isn't sufficient enough to verify the relationship, we can say that there is a **weak relation** between the regression equations of Y2 versus X3.

Table 5.24 Regression Analysis 14: Y2 versus X3

Regression Analysis: Y2 versus X3

```
The regression equation is
Y2 = 1,60 - 1,61 X3

Predictor      Coef  SE Coef      T      P
Constant     1,5988   0,8042   1,99  0,087
X3          -1,6058   0,8414  -1,91  0,098

S = 0,0572012   R-Sq = 34,2%   R-Sq(adj) = 24,8%

Analysis of Variance
Source          DF        SS        MS     F      P
Regression       1  0,011918  0,011918  3,64  0,098
Residual Error   7  0,022904  0,003272
Total            8  0,034822
```

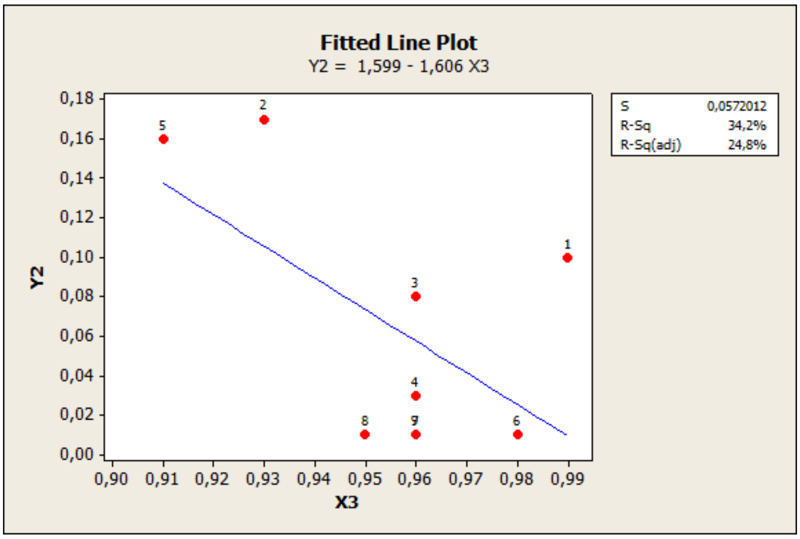

Figure 5.16 Regression Analysis 14: Y2 versus X3

Regression equation of Y2 versus X3 is;

Y2 = 1, 60 - 1, 61 X3
R-Sq (adj.) = 24, 8%

Consequently, we can say that there is a weak relation between Rate of Loss and the Rates of Agglomeration for the metropolitan provinces.

Regression Analysis 15:

Regression Analysis 15 is performed with Y2 (rate of loss) and X4 (population/total number of buildings). As shown in the Table 5.25, the R-Sq (adj.) is 24, 7%.

Although this ratio isn't sufficient enough to verify the relationship, we can say that there is a **weak relation** between the regression equations of Y2 versus X4.

Table 5.25 Regression Analysis 15: Y2 versus X4

Regression Analysis: Y2 versus X4

```
The regression equation is
Y2 = - 0,0531 + 0,0161 X4

Predictor       Coef    SE Coef       T      P
Constant   -0,05306    0,06459   -0,82  0,438
X4         0,016121   0,008466    1,90  0,099

S = 0,0572449   R-Sq = 34,1%   R-Sq(adj) = 24,7%

Analysis of Variance
Source          DF        SS        MS     F      P
Regression       1  0,011883  0,011883  3,63  0,099
Residual Error   7  0,022939  0,003277
Total            8  0,034822

Unusual Observations
Obs   X4      Y2      Fit  SE Fit  Residual  St Resid
  2  7,0  0,1700   0,0591  0,0193    0,1109     2,06R

R denotes an observation with a large standardized residual.
```

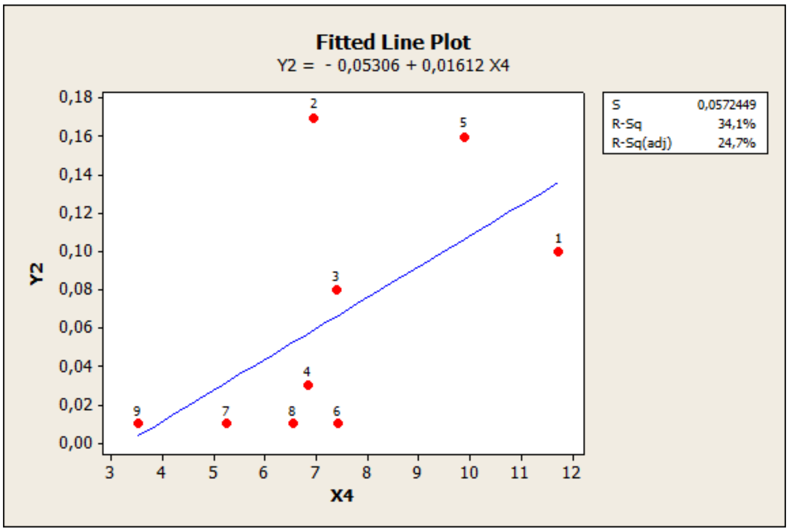

Figure 5.17 Regression Analysis 15: Y2 versus X4

Regression equation of Y2 versus X4 is;

Y2 = - 0, 0531 + 0, 0161 X4
R-Sq (adj.) = 24, 7%

Consequently, we can say that there is a weak relation between Rate of Loss and the Ratio of Population to the Number of Buildings for the metropolitan provinces.

Five regression analyses are performed for settlements in the third category that considers metropolitan cities. The Results of these analyses show that;

Y1 (absolute loss) has strong relations with X1 (settlement population), no relation with X3 (Rates of Agglomeration) and weak relations with X4 (pop./ total number of buildings).

Y2 (rate of loss) has weak relations with X3 (rates of agglomeration) and X4 (pop./total number of buildings).

5.3. Evaluation of Regression Analyses

Six regression analyses are performed for top-20 settlements in Category I. The results of these analyses show that; Y1 (absolute loss) has no relations with independent variables, Y2 (rate of loss) has weak relations with X3 (rates of agglomeration), X4 (population /total number of buildings) and X5 (development index).

Four regression analyses are performed for top-20 settlements in Category II. The results of these analyses show that; Y1 (absolute loss) has no relations with X2 (population growth rate) and weak relations with X4 (population /total number of buildings). Y2 (rate of loss) has weak relations with X1(settlement population) and no relations with X4 (population/ total number of buildings).

Five regression analyses are performed for the top-20 settlements in Category III. The results of these analyses show that; Y1 (absolute loss) has strong relations with X1 (settlement population), no relation with X3 (rates of agglomeration) and weak relations with X4 (population / total number of buildings). Y2 (rate of loss) has weak relations with X3 (rates of agglomeration) and X4 (population /total number of buildings).

As a result of these analyses we can say that Absolute Loss (YI) has no significant relations with independent variables of settlements in Category I that have populations up to 50.000 and settlements in Category II that have populations between 50.000 and 490.000. Disparately, Absolute Loss is strongly related with settlement populations of metropolitan cities in Category III.

When we examine the results of analyses according to Relative Loss/Rate of Loss (Y2), we can say that Rate of Loss has weak relations both with independent variables of settlements in Category I that have populations up to 50.000, settlements in Category II that have populations between 50.000 and 490.000 and metropolitan cities in Category III.

Table 5.26 Evaluation of Regression Analyses

Categories	Relations with Absolute Loss (Y1)	Relations with Relative Loss (Y2)
First Category settlements having population up to 50.000	no relations with X1 no relations with X5	weak relations with X3 weak relations with X4 weak relations with X5
Second Category settlements having population between 50.000 and 490.000	no relations with X2 weak relations with X4	weak relations with X1 no relations with X4
Third Category Metropolitan Cities	strong relations with X1 no relations with X3 weak relations with X4	weak relations with X3 weak relations with X4

*X1(settlement population), X2(population growth rate), X3 (rates of agglomeration), X4 (population /total number of buildings), X5 (development index)

CHAPTER 6

FINDINGS and POLICY RECOMMENDATIONS

The method and findings of this study may contribute to a more effective disaster policy and urban planning in several lines of policy development.

Suggestions and recommendations are briefly explored in this chapter indicating also areas of further research and policy development.

6.1. Priorities for Mitigation Planning

Mitigation planning is the process of figuring out how to reduce or eliminate the loss of life and property damage resulting from natural hazards and described by Kreimer et. al (1999) as an attempt to avoid, minimize, and share the costs of likely disasters. Mitigation planning is necessarily based on the identification and analysis of risks, and the development of methods for the management of urban risks. "An intensive collaboration of the disciplines is required, orchestrated preferably by the planners" (Balamir, 2006).

The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation Plans form the foundation for a community's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage (FEMA, 2012).

The planning process is as important as the plan itself. It creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters and help communities to become more sustainable and resilience by focusing efforts on the hazards, disaster-prone areas and identifying appropriate mitigation actions (FEMA, 2012).

Mitigation Planning identifies cost effective actions for risk reduction that are agreed upon by stakeholders and the public, focus resources on the greatest risks and vulnerabilities, builds partnerships by involving people and organizations, increases education and awareness of hazards and risk and aligns risk reduction with other community objectives.

Mitigation planning refers to a process that leads a planning committee through a framework of steps to develop a mitigation plan. The primary objective of the planning process is to facilitate development of strategies that will reduce damage, protect people and property, and improve resistance to natural hazards.

According to FEMA (2012) this process involves four basic steps:

1. **Organize Resources:** communities should focus on the resources needed for a successful mitigation planning process. Essential steps include identifying and organizing interested members of the community as well as the technical expertise required during the planning process.

2. **Identify Hazards and Assess Risks:** communities need to identify the characteristics and potential consequences of hazards. It is important to understand how much of the community can be affected by specific hazards and what the impacts would be on important community assets.

3. **Develop a Mitigation Plan:** Armed with an understanding of the risks posed by hazards, communities need to determine what their priorities should be and then look at possible ways to avoid or minimize the undesired effects. The result is a hazard mitigation plan and strategy for implementation.

4. **Implement Plan and Monitor Progress:** Communities can bring the plan to life in a variety of ways, ranging from implementing specific mitigation projects to changes in day-to-day organizational operations. To ensure the success of an ongoing program, it is critical that the plan remains relevant. Thus, it is important to conduct periodic evaluations and make revisions as needed.

Consequently, mitigation planning at all levels is the dominant paradigm today as promoted by international organizations and academic circles since 1990s. Observations of this study provide guiding principles for effective mitigation practices in Turkey by ordering settlements and offer means of differential implementation.

The prioritized list of settlements according to their vulnerability levels should be accepted as the basis of the mitigation policies in higher-risk settlements and these cities within the highest hazard zone should obviously be the object of mitigation programs before those in areas of lower hazard.

Effective disaster mitigation strategies and more strict legal regulations about preparation of mitigation plans should be executed in higher-risk settlements and cities within the highest hazard zone.

Priorities of mitigation planning should be constituted with respect to the prioritized list of settlements according to their vulnerability levels and it should be compulsory to prepare mitigation plans for the settlements that have rank in the top-20 high risk lists.

The top-20 high risk settlements and metropolitan cities prioritized according to the absolute loss and relative loss that mitigation plans should be executed compulsorily are given below in the Table 6.1, Table 6.2, Table 6.3 and Table 6.4.

The top-20 of the settlements prioritized according to absolute loss are significantly above the category averages in terms of absolute loss and implementation of laws and regulations concerning mitigation policies and mitigation plans should be compulsory in these high-risk settlements.

Table 6.1 Top-20 Settlements Prioritized According to Absolute Loss that Mitigation Plans Should be Compulsory

Settlements of 0 – 490.000 Population	Sub-Province	Expected Intensity	Absolute Loss	Relative Loss of Settlements (Loss Rate)
VAN	VAN C.	7,5	2285	0,06
ERZINCAN	ERZİNCAN C.	8	2025	0,16
BOLU	BOLU C.	8	1841	0,18
YALOVA	YALOVA C.	8	1507	0,18
TOKAT	NIKSAR	8	1400	0,17
KASTAMONU	TOSYA	8	1364	0,16
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	0,09
TOKAT	ERBAA	8	1251	0,16
BURSA	ORHANGAZI	8	945	0,18
MANISA	MANİSA C.	7	919	0,04
OSMANIYE	OSMANİYE C.	7	905	0,03
SAKARYA	HENDEK	8	869	0,17
CORUM	OSMANCIK	8	786	0,16
HATAY	ANTAKYA	7	768	0,03
SAMSUN	HAVZA	8	735	0,16
TEKIRDAG	SARKOY	8	712	0,18
HATAY	ISKENDERUN	7	705	0,03
ADIYAMAN	ADIYAMAN C.	7	696	0,03
SAKARYA	AKYAZI	8	681	0,19
AMASYA	MERZIFON	7,5	666	0,07
Group Average			**156**	**0,03**

Table 6.2 Metropolitan Provinces Prioritized According to Absolute Loss that Mitigation Plans Should be Compulsory

Metropolitan Cities	Sub-Province	Expected Intensity	Absolute Loss	Relative Loss of Settlements (Loss Rate)
ISTANBUL	ISTANBUL (M)	7,5	83824	0,10
KOCAELI	KOCAELI (M)	8	24077	0,17
BURSA	BURSA (M)	7,5	16506	0,08
IZMIR	IZMIR (M)	7	14531	0,03
SAKARYA	SAKARYA (M)	8	8070	0,16
ADANA	ADANA (M)	6,5	1913	0,01
ANTALYA	ANTALYA (M)	6,5	1402	0,01
KONYA	KONYA (M)	6,5	1355	0,01
ERZURUM	ERZURUM (M)	6,5	439	0,01
Group Average			**16.902**	**0,07**

The top-20 of the settlements prioritized according to relative loss are significantly above the category averages in terms of relative loss and implementation of laws and regulations concerning mitigation policies and mitigation plans should be compulsory in these high-risk settlements.

Table 6.3 Top-20 Settlements Prioritized According to Relative Loss that Mitigation Plans Should be Compulsory

Settlements of 0 – 490.000 Population	Sub-Province	Expected Intensity	Relative Loss of Settlements (Loss Rate)	Absolute Loss
YALOVA	CINARCIK	8	0,21	357
SAKARYA	AKYAZI	8	0,19	681
YALOVA	CIFTLIKKOY	8	0,19	298
BOLU	BOLU M.	8	0,18	1841
YALOVA	YALOVA C.	8	0,18	1507
BURSA	ORHANGAZI	8	0,18	945
TEKIRDAG	SARKOY	8	0,18	712
TOKAT	NIKSAR	8	0,17	1400
SAKARYA	HENDEK	8	0,17	869
BOLU	GEREDE	8	0,17	583
AMASYA	TASOVA	8	0,17	282
YALOVA	TERMAL	8	0,17	73
ERZINCAN	ERZİNCAN C.	8	0,16	2025
KASTAMONU	TOSYA	8	0,16	1364
TOKAT	ERBAA	8	0,16	1251
CORUM	OSMANCIK	8	0,16	786
SAMSUN	HAVZA	8	0,16	735
SAKARYA	GEYVE	8	0,16	543
SIVAS	SUSEHRI	8	0,16	424
SAMSUN	LADIK	8	0,16	377
Group Average			**0,03**	**156**

Table 6.4 Metropolitan Provinces Prioritized According to Relative Loss that Mitigation Plans Should be Compulsory

Metropolitan Cities	Sub-Province	Expected Intensity	Relative Loss Of Settlements (Loss Rate)	Absolute Loss
KOCAELI	KOCAELİ	8	0,17	24077
SAKARYA	SAKARYA	8	0,16	8070
ISTANBUL	ISTANBUL	7,5	0,10	83824
BURSA	BURSA	7,5	0,08	16506
IZMIR	IZMIR	7	0,03	14531
ADANA	ADANA	6,5	0,01	1913
ANTALYA	ANTALYA	6,5	0,01	1402
KONYA	KONYA	6,5	0,01	1355
ERZURUM	ERZURUM	6,5	0,01	439
Group Average			**0,07**	**16.902**

6.2. Urban Planning Standards and Principles

One of the key elements in disaster risk reduction is effective management of land-use planning, urban planning standards and principles.

Global Assessment Report (GAR, 2011) recognized the opportunities of mainstreaming disaster risk reduction into land use planning and urban planning and the Hyogo Framework for Action 2005–2015 endorsed efforts in this field. Therefore, land use planning and urban planning standards became effective tools for disaster risk reduction by reducing risk factors, vulnerabilities and potential losses. Through land use planning, disaster risk factors can be modified to increase resilience.

"Land-use planning concerned with mitigation and equipped with the essential tools of implementation, does not only imply wider streets, lower densities, and larger open spaces in disaster-prone areas, but also a context in which individuals and institutions are alertly responsive and explicitly responsible for all eventualities" (Balamir, 2002).

Land use management is more than regulating development activities in the area with laws, ordinances and regulations. It should be linked to comprehensive land use plans and zoning ordinances to establish the bases for resilient development of the city. Land use management should seriously be taken into consideration, especially in cities with land use problems like high population density, high-rise buildings or vulnerable buildings in earthquake hazard-prone areas (Banba et. al, 2004).

Settlements in Turkey exceedingly perform all of these problems and it may be relevant to perform effective land-use planning and urban planning standards for the implementation of more effective disaster policies in Turkey.

Planning for resilient cities involves more than being occupied with minimum standards or widely-accepted spatial designs. Urban planning standards and principles together with risk-minimizing planning systems could effectively serve to mitigate risks and promote strict building supervision practices in disaster prone cities. To this end, urban planning standards and principles could be determined according to risk levels/zones determined by vulnerability maps and more strict planning standards could be executed in higher-risk settlements. Although, cities within the highest risk zones should obviously be the object of more strict inspection mechanisms than those of lower risks.

Urban standards for land use management as well as building construction are essential elements of disaster mitigation and it should be taken into consideration that different seismic intensity levels have different requirements of standards. Land-use planning and zoning, planning of open-spaces, transportation and infrastructure planning are all distinct aspects of disaster mitigation and all these systems are to be implemented at different standards according to risk levels. Rigorous implementation and enforcement of differentiated standards according to risk levels must be the highest priority for reducing risk factors, vulnerabilities and potential losses.

The regulations of land-use planning and urban planning standards can reduce the vulnerability of natural hazards by locational and/or design approaches.

The locational approach is to avoid and restrict development in high-risk areas in order to reduce property loss and human casualties resulting from disasters. Determination of less hazardous areas for the expansion and direction of urban development is also used for reducing losses in this approach.

The design approach deals with the design and construction of buildings and infrastructure to resist expected earthquake loads and encourage safe design in order to make structures more resistant to disasters. Generally the locational and design strategies is used together to reduce urban risks.

An increasingly popular locational approach is public purchase of hazardous areas for use as recreational areas, parks and open spaces in high-risk settlements.

Adequate amounts of open and green areas systems have enormous value both during and after an earthquake event; they serve as potential evacuation places and temporary dwelling areas. After a major earthquake, the open space network becomes a kind of 'second city', providing multiple complex functions such as gathering and shelter, the distribution of goods and services and temporary inhabitation (McGregor, 1998, Middleton, 2007).

Another locational approach should be implemented for schools and health facilities not only because of the highly vulnerable population they accommodate, but also because they provide essential social services and serve as shelter sites for the community.

It is essential that these buildings function after a seismic event and special attention must be paid to their safety. Risk reduction efforts must focus on ensuring they can continue providing services when most needed. These facilities should be located on safest areas and follow current seismic codes in construction resistant to damage. These precautions should be implemented other public facilities also.

Critical infrastructure and lifelines services such as electricity, energy, telecommunication and water are systems that could serve for the emergency response and recovery of a community in the post-disaster context.

Protecting these utilities from damage and avoiding these services to be located in high-risk areas can minimize the economic and social disruptions caused by natural disasters.

Underground systems for critical infrastructure and lifelines services in high-risk settlements are effective measures against disaster. Another important point is the accessibility options, roads and sites are designed to be accessible in case of emergencies.

6.3. Law on Redevelopment of Areas under Disaster Risk (6306)

The Law No. 6306 on "Redevelopment of Areas under Disaster Risk" put into force by publication at the Official Gazette dated May 31, 2012. The governing authority of the law is the Ministry of Environment and Urbanism (MEU). The Law has the objective of "determining the principles and methods of improvement, liquidation and renewal geared towards the constitution of healthy and safe living spaces in line with scientific and esthetic norms and standards in areas under disaster risk and in any high risk development".

The Redevelopment Law is intended to regulate the improvement, settlement and renovation of areas at risk of disaster and other lots which support risk-bearing buildings, even if outside of a designated disaster risk area. The purpose of the Redevelopment Law which is defined in Article 1 is determining all kinds of principles, methods and processes in connection with rehabilitation, demolition and reconstruction at areas under disaster risk and at other areas, whether planned or not, where there are structures under risk, with the aim of providing habitats conforming to technical, health, environmental and zoning plan requirements.

The Law outlines the methods for the identification of such high risk areas and structures, evacuation and demolition processes, development of projects after demolition and it also lists the duties and responsibilities of public agencies.

The Law specifically focuses on the risk areas and defines "risk area" as areas that may cause loss of life or assets. These areas are identified by the Ministry, Housing Development Administration or municipalities, by taking the opinions of the Presidency of Management of Disaster and Emergency and decided by the Council of Ministers upon proposal of the Ministry.

According to the Law, the buildings that are at risk ("risky buildings") are defined as buildings within or outside risk areas that have completed their economic life, or which are scientifically and technically proven to be at risk of demolition or high damage. It should be underlined that if the Ministry deems necessary, a building that is not specified as a property at risk may also be subject to regeneration procedures for the purpose of maintaining the integrity of the enforceability of the Law.

Besides, there are various ambiguous and grey areas regarding this Law and it is likely that the Law is subject to objections in various aspects. The foremost of these objections about the Law is the restrictions imposed on the ownership rights and the granting of broad authority to the Ministry.

The Law noticeably brings all authorities under one institution - the Ministry of Environment and Urbanism. MEU is authorized to expropriate the immovable or exchange them with others; to transfer immovable property rights and zoning rights to other areas; to divide and to allocate shares forming the immovable's; and to establish rights on immovable's located within the risk areas" (Akalın and Sürel, 2012).

In addition to above mentioned deficiencies, another criticism about the Law is the Article 9. According to the Article 9 preventive provisions of other laws contrary to the implementation of this law shall not be applicable.

These aspects of the law has already caused widespread protests from circles such as Professional chambers and current residents of redevelopment areas due to social, cultural and environmental concerns as it opens a way for new means of maximum use of land at centrally located urban land through higher floor area ratios which are to be determined by central and local administration institutions such as Housing Development Administration of Turkey, metropolitan municipalities and county municipalities (Akalın and Sürel, 2012).

Therefore, the law as proposed does not provide adequate protection mechanisms to individuals, inadequate to reduce the destructive effects of earthquakes and does not establish adequate and effective consultation mechanisms with the owners and/or tenants of the buildings which may be affected. Also, the language of the law is ambiguous and there are various points in the law which may be open to arbitrary interpretation besides giving immense powers to authorities.

The Union of Chambers of Turkish Engineers and Architects (UCTEA) stated their opinion about the Disaster Law as "All laws that protect the immunity of cities, habitats, nature and professional fields are getting scrapped. The government is rendering our cities more vulnerable to disasters through laws and administrative regulations that amount to plundering nature and history and which aim for 'profiteering' under the [disguise] of 'urban transformation'".

The contradictions of the Law with basic human rights and the Constitution are listed by the Chamber of City Planners under UCTEA as given below;

- The law penalizes any objection to an imposed agreement on disaster prevention

- Risk-free buildings can be brought under the scope of law for the sake of "practical coherence"

- The statement "Buildings in high risk areas are not to be provided power, water or natural gas, and all such services will be discontinued" is a clear violation of basic rights

- Obliging local residents to cover all infrastructure costs (including the cost of identification and demolition of high risk buildings) will increase the debt burden of these already impoverished populations

- The authorization of the Ministry of Environment and Urban Planning further enhances centralization

- The few plots remaining in the public sector could be Privatized Real estate owned by public agencies outside of the Treasury (schools, hospitals and public housing) could be transferred to the Ministry, whether prone to disasters or not

- Laws protecting natural and historical riches are made null and void, defined as "inapplicable legislation"

- Development of grazing land is made easier

- The temporary ban on all zoning and construction in reserve building areas constitutes a violation of property rights

- The authority to impose "special" standards on planning resolutions could make the renewed areas unlivable

Aside from these arguments, it is suggested in some circles that high risk areas will be identified arbitrarily. Also, the Law on Disaster Prevention does not take into account any disaster other than earthquakes. The condition of tenants is not given due consideration, and no mechanism is designed for their protection, except for a one-off rent allowance.

Besides, there are no price-control measures to prevent impoverished residents from running into repayment problems or being obliged to sell their property for immediate gain, and thus be uprooted from their communities. The participation of local stakeholders was envisaged neither during the drafting of the law nor in the aftermath – aside from bearing its costs.

Finally, the law in question centered on demolition does not approach transformation comprehensively, in the light of healthy urban development, ecological sustainability and social justice – the indisputable principles of urban planning. Criticisms get only stronger once you add the fact that previous transformation projects were far from exemplary in many aspects not least design, and that market players focus on profit maximization and give a back seat to public interest (Adanalı, 2012).

Consequently, all of above mentioned deficiencies should be improved in order to provide adequate protection mechanisms to individuals, to reduce the destructive effects of earthquakes and establish adequate and effective consultation mechanisms with the owners and/or tenants of the buildings which may be affected.

Observations of this study provide guiding principles for effective mitigation practices in Turkey by ordering settlements and offer means of differential implementation. These could contribute to improved safety measures in Law (6306) on Redevelopment of Areas under Disaster Risk.

6.4. Building Codes and Development Regulations

Regulatory frameworks for building and planning should be one of the key tools for reducing disaster risk in the built environment. Indeed, safer regulations, which define design loads, specify construction details and provide hazard zoning, have been shown to minimize damage and save lives. Many countries are developing good regulatory frameworks; however the difficulties lie in implementation (Johnson, 2012).

Among these are USA (Disaster Mitigation Law, 2000), New Zealand (Civil Defense Law, 2002), South Africa (Disasters Law, 2002), Australia (COAG Report, 2002), UK (Civil Mitigation Law, 2004), Canada (Risk Mitigation Projects Program, 2004), Greece (Civil Protection Law, 2003), Armenia (2002) and others, apart from Japan which had such regulation in effect since 1961.

Major earthquakes in Turkey have led to substantial changes in the practice of seismic design and construction. After the 1939 Erzincan earthquake, a committee formed to prepare a seismic zone map. The formation of this committee was the first step towards developing regulations for the seismic design of buildings in Turkey and since then specifications for construction in disaster areas have been changed many times.

The first seismic design code for buildings was published one year after the destructive Erzincan earthquake in 1940. Destructive earthquakes have usually resulted in revisions to the codes and the 1940's building code revised 9 times in the years of 1944, 1947, 1949, 1953, 1961, 1968, 1975, 1997 and 1998. Key events in the evolution of seismic codes in Turkey are listed below.

Table 6.5 Key events in the evolution of seismic design codes in Turkey (Source: PEER, 2000)

Year	*Event*	*Code development*
1939	Erzincan earthquake (M7.9)	
1940	Committee formed to develop a seismic zonation map for Turkey	First seismic code published
1942		Earthquake zone map prepared; map promulgated in 1945
1943	Tosya earthquake (M7.2)	
1944	Gerede earthquake (M7.2)	Seismic code revised
1947		Seismic code revised
1949		Seismic code revised
1953		Seismic code revised
1958	Ministry of Reconstruction and Resettlement established	
1961		Seismic code revised
1963		Earthquake zone map revised
1966	Varto earthquake (M7.1)	
1967	Adapazari earthquake (M7.1)	
1968		Seismic code revised
1975		Seismic code revised; ductile detailing introduced
1992	Erzincan earthquake (M6.9)	
1997		Seismic code revised; ductile detailing required
1999	Izmit earthquake (M7.4) Dűzce earthquake (M7.2)	

Destructive earthquakes that occurred in 1999 have been a milestone in the improvement of seismic resistant design of structures and the latest Turkish building code, “Specification for Buildings to be built in Disaster Areas” (TEC-2007) put into effect in March 2007.

"Specifications for Structures to be built in the Disaster Areas" that establish standards for building design and construction, refers to Official Earthquake Hazard Zoning Map of Turkey for the calculation of acceleration values that could affect the structure. Therefore, Earthquake Hazard Zoning Map of Turkey based on probabilistic considerations and divides the country into five macro-level regions as determined by the statistical occurrence of seismic events. This is currently used as a basis for engineering design safety of buildings with variant design standards imposed in each region.

Relevant building standards for a particular structure are defined by the location of the buildings according to earthquake hazard zones, soil conditions at the building site and construction type of the buildings.

The Earthquake Zoning Map shows the different macro-zones of Turkey, for which minimum effective acceleration coefficients and corresponding design spectra are defined in the Building Code. Seismic Zonation is based on ground acceleration values with 10% probability of exceedance in 50 years and 475 years mean return period. Five seismic zones are classified, as shown in the Table 6.6 due to expected acceleration values.

Table 6.6 The Effective Ground Acceleration Coefficient
(Source: TEC-2007)

Seismic Zone	Acceleration Coefficient (Ao)
I	more than 0.4g
II	between 0.3g - 0.4g
III	between 0.2g - 0.3g
IV	between 0.2g - 0.1g
V	less than 0.1g

However, this macro-zonation map does not specify any quantitative earthquake hazard parameters for any zone; it only indicates hazard exposure levels of provinces and settlements without providing any information about risk levels. The purpose could have been better served if differentiations of locations were made on risk-basis. This demands the identification of relative risk categories of risks in settlements.

Consequently, the official hazard map does not consider primary factors of risk, neither vulnerabilities nor attributes of the building stock. In order to underline this problem, the discrepancies between the location of settlements according to the hazard zones determined by the official earthquake hazard map and the prioritized lists of settlements according to the absolute and relative loss are examined in this research.

To this end, first of all the top-20 settlements prioritized according to the absolute loss is compared with the location of these settlements according to the hazard zones determined by the official earthquake hazard map of Turkey (See Appendix G for the total list).

When we examine the top-20 high risk settlements prioritized according to the absolute loss, we observe that three of these high risk settlements are located in the second hazard zone according to the official earthquake hazard map of Turkey. This shows that although these three settlements have rank in the top-20 high risk list, they are classified in the second hazard zone and their acceleration values that will effect the construction of buildings are calculated according to the second hazard zone.

But the most remarkable result is seen in the city of Van that was struck by a devastating earthquake recently. Although centre of Van ranks in the first place of the high-risk settlements according to the absolute loss, it is classified in the second hazard zone according to the earthquake hazard map and its acceleration coefficient is calculated according to the second hazard level.

Appropriate locational differentiation is a crucial input in engineering design safety of buildings based on risk maps.

Table 6.7 Evaluation of the Top-20 Settlements Prioritized According to the Absolute Loss with respect to the Hazard Zones Determined by the Official Earthquake Hazard Map

PROVINCE	SUB-PROVINCE	Expected Intensity	Absolute Loss	Hazard Zone	Relative Loss of Settlements (Loss Rate)
VAN	VAN C.	7,5	2285	2	0,06
ERZINCAN	ERZİNCAN C.	8	2025	1	0,16
BOLU	BOLU C.	8	1841	1	0,18
YALOVA	YALOVA C.	8	1507	1	0,18
TOKAT	NIKSAR	8	1400	1	0,17
KASTAMONU	TOSYA	8	1364	1	0,16
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	2	0,09
TOKAT	ERBAA	8	1251	1	0,16
BURSA	ORHANGAZI	8	945	1	0,18
MANISA	MANİSA C.	7	919	1	0,04
OSMANIYE	OSMANİYE C.	7	905	1	0,03
SAKARYA	HENDEK	8	869	1	0,17
CORUM	OSMANCIK	8	786	1	0,16
HATAY	ANTAKYA	7	768	1	0,03
SAMSUN	HAVZA	8	735	1	0,16
TEKIRDAG	SARKOY	8	712	1	0,18
HATAY	ISKENDERUN	7	705	1	0,03
ADIYAMAN	ADIYAMAN C.	7	696	2	0,03
SAKARYA	AKYAZI	8	681	1	0,19
AMASYA	MERZIFON	7,5	666	1	0,07

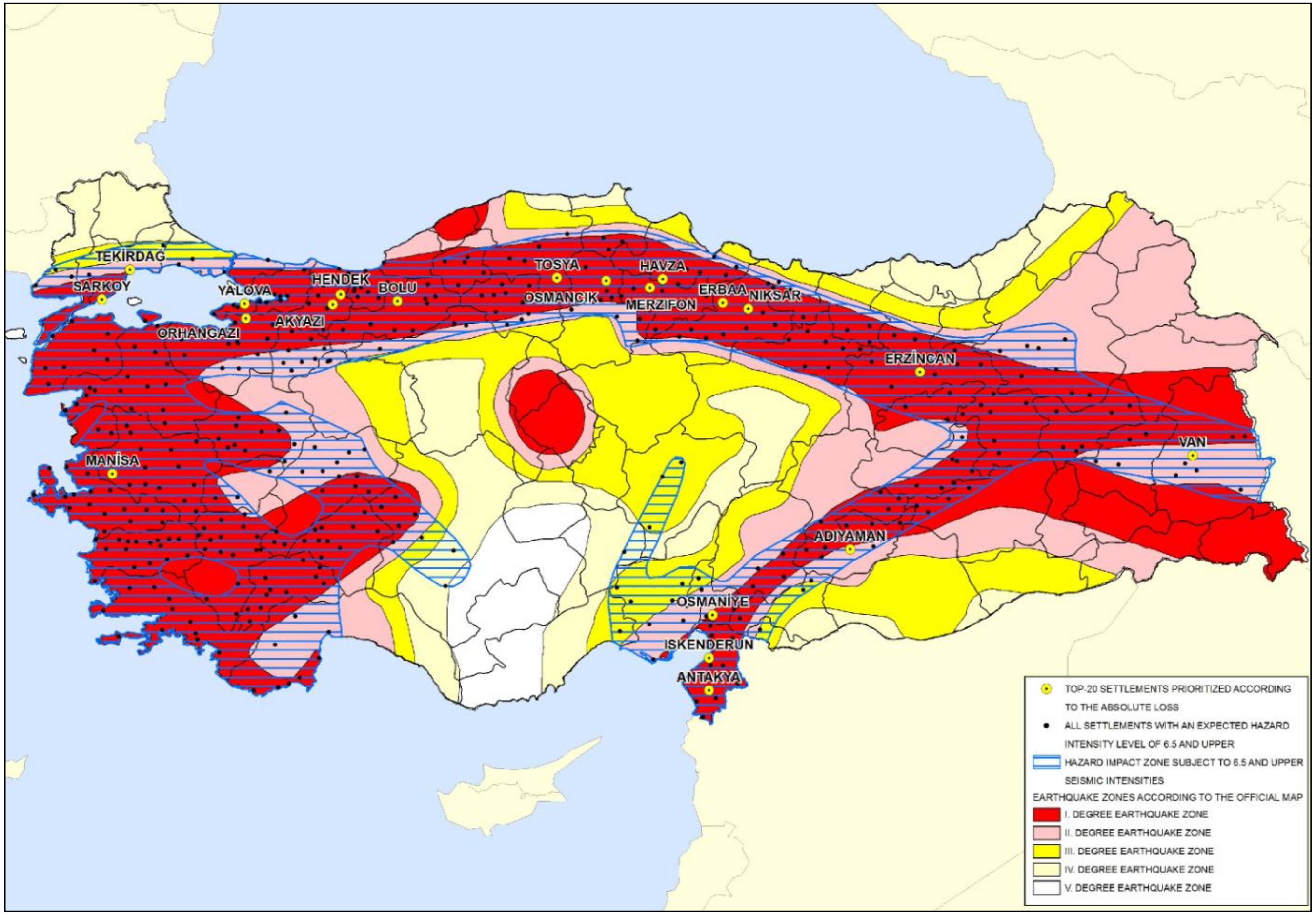

Figure 6.1 Evaluation of the Top-20 Settlements Prioritized According to the Absolute Loss with Respect to the Hazard Zones Determined by the Official Earthquake Hazard Map

Other settlements rank in the Top-100 high risk list prioritized according to absolute loss that shows discrepancy with the hazard zones determined by the Official Earthquake Hazard Map are; centre of Kütahya that ranks in the 40th place, Tarsus that ranks in the 43rd place, Çorum that ranks in the 59th place, Keşan that ranks in the 65th place, Afyon that ranks in the 72nd place, Çorlu that ranks in the 76th place, Kozan that ranks in the 85th place, Ceyhan that ranks in the 92nd place, Kadirli that ranks in the 94th place and Malkara that ranks in the 100th place (See Appendix G for the total list).

In the examination of the metropolitan cities prioritized according to the absolute loss, the most remarkable result is seen in the Istanbul metropolitan city. Although it ranks in the first place of the high-risk metropolitan cities, it is classified in the second hazard zone according to the earthquake hazard map.

As a result of this classification, acceleration coefficient of the most vulnerable metropolitan city of the country is calculated according to the second hazard level. This is another specific example that shows the inconsistency of using official earthquake hazard zoning map as a basis for calculating acceleration values for engineering design safety of buildings.

Other metropolitan cities prioritized according to the absolute loss are consistent with hazard zones determined by the official earthquake hazard map (See Appendix G).

Secondly, the top-20 settlements prioritized according to the relative loss is compared with the location of these settlements according to the hazard zones determined by the official earthquake hazard map of Turkey (See Appendix H for the total list).

When we examine the top-20 high risk settlements prioritized according to the relative loss, we observe that all of these high risk settlements are located in the first hazard zone according to the official earthquake hazard map of Turkey.

This shows that the prioritization of settlements according to relative loss is consistent with hazard zones determined by the official earthquake hazard map and this also makes their acceleration values calculation consistent with our prioritization.

Table 6.8 Comparison of the Top-20 Settlements Prioritized According to the Relative Loss with the Hazard Zones Determined by the Official Earthquake Hazard Map

PROVINCE	SUB-PROVINCE	Expected Intensity	Relative Loss of Settlements (Loss Rate)	Hazard Zone	Absolute Loss
YALOVA	CINARCIK	8	0,21	1	357
SAKARYA	AKYAZI	8	0,19	1	681
YALOVA	CIFTLIKKOY	8	0,19	1	298
BOLU	BOLU M.	8	0,18	1	1841
YALOVA	YALOVA C.	8	0,18	1	1507
BURSA	ORHANGAZI	8	0,18	1	945
TEKIRDAG	SARKOY	8	0,18	1	712
TOKAT	NIKSAR	8	0,17	1	1400
SAKARYA	HENDEK	8	0,17	1	869
BOLU	GEREDE	8	0,17	1	583
AMASYA	TASOVA	8	0,17	1	282
YALOVA	TERMAL	8	0,17	1	73
ERZINCAN	ERZİNCAN C.	8	0,16	1	2025
KASTAMONU	TOSYA	8	0,16	1	1364
TOKAT	ERBAA	8	0,16	1	1251
CORUM	OSMANCIK	8	0,16	1	786
SAMSUN	HAVZA	8	0,16	1	735
SAKARYA	GEYVE	8	0,16	1	543
SIVAS	SUSEHRI	8	0,16	1	424
SAMSUN	LADIK	8	0,16	1	377

Other settlements rank in the Top-100 high risk list prioritized according to relative loss that shows discrepancy with the hazard zones determined by the Official Earthquake Hazard Map are; centre of Tekirdağ that ranks in the 44th place, centre of Van that ranks in the 59th place and centre of Adıyaman that ranks in the 94th place (See Appendix H for the total list).

The examination of the metropolitan cities prioritized according to the relative loss, shows parallel results with other prioritized settlements according to the relative loss. Metropolitan cities prioritized according to the absolute loss are consistent with hazard zones determined by the official earthquake hazard map with the exception of the Istanbul metropolitan city.

Consequently, the comparison of prioritized list of settlements according to both absolute and relative losses, with the hazard zones determined by the official earthquake hazard map shows us that the discrepancies between two approaches is seen more acute in absolute losses than relative losses.

The results of the evaluation of acceleration values for engineering design safety of buildings show that; absolute loss is a more distinctive factor than relative loss in the evaluation of building codes.

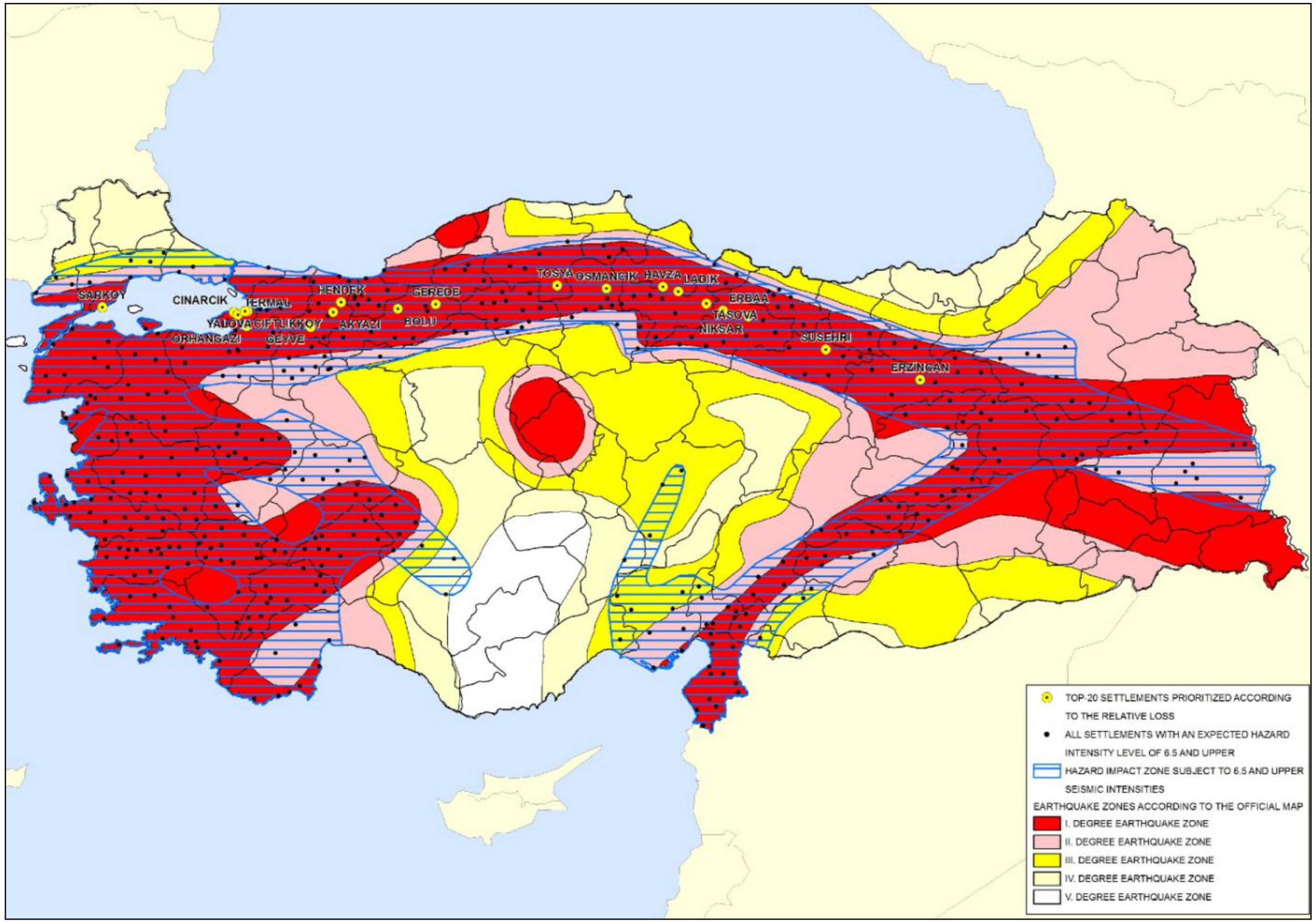

Figure 6.2 Evaluation of the Top-20 Settlements Prioritized According to the Relative Loss with Respect to the Hazard Zones Determined by the Official Earthquake Hazard Map

6.5. Building Supervision Practices

An effective disaster mitigation strategy must depend on two basic premises: One is the effective planning system that considers risk-basis regulatory frameworks and the second is the strict building supervision practices.

Many countries are developing good regulatory frameworks; however the difficulties lie in implementation (Johnson, 2012). Enforcement of related codes and standards during the construction of new buildings is as vital as devising appropriate building codes and legislation to support enforcement processes. Moreover, we must underline the fact that an effective construction supervision system can not be created through the legal text alone. It should be supported by such instruments as professional liability insurance, professional supervision and licensing.

Turkey has deficiencies in both the nature and implementation of laws and regulations concerning the planning system and the system of supervision. But the lack of implementation and control of current regulations resulted further devastating impacts than the regulations itself.

Although, the Turkish Building Code was updated in 1997 to include modern earthquake provisions, weaknesses in construction which were exposed in the 1999 Marmara earthquake, revealed that compliance with the intent of the code was poor and the effectiveness of the code enforcement was insufficient (Yüzügüllü et. al, 2004).

The devastating results of the 1999 East Marmara Earthquakes have provided tragic experiences of the ineffectiveness of the regulatory frameworks in implementing building standards and proved the need to review and reduce the deficiencies in the disaster management system and related legislations. Several steps were taken by the government in order to reduce deficiencies in the pre-disaster assessments.

Some of these steps are: the introduction of institutions of ‘construction inspection functions’ and provisions for the improvements in ‘professional competence’ (Keles, 2004; Balamir, 2001).

Within the scope of ‘construction inspection functions’ the supervision of building standards become mandatory and “The Building Supervision Law” (4708) put into force in 2001 “for the aim of assuring the safety of health and property, ensuring design and building inspection to construct buildings of good quality appropriate with improvement plans, science, art and health rules and standards and arranging the procedures and principles of building inspection”.

"Specifications for Structures to be Built in the Disaster Areas" that established standards for building design and construction is used as a basis for construction inspection functions. As “Specifications for Structures to be built in the Disaster Areas” refers to Earthquake Hazard Zoning Map for the calculation of acceleration values that will effect the construction, same criticisms as mentioned in section 6.4 about the deficiencies of Hazard Zoning Map and the discrepancies between this map and the prioritized lists of settlements according to the absolute and relative loss are also valid for construction inspection functions.

Therefore, the purpose of a strict inspection system could have been better served if construction inspections functions are differentiate according to the hazard zones determined by risk-basis maps.

Accordingly, more strict inspection mechanisms should be executed in high-risk settlements and cities within the highest hazard zone should obviously be the object of supervision programs before those in areas of lower hazard.

However, without appropriate means and tools of land-use planning that take into account seismic risks, individual building safety may have only little meaning (Balamir, 2001). Since current supervision is limited to buildings, it should be extended to control planning and implementation as well. Improvements in supervision are necessary for physical development which should be incorporated in the main body of the Development Law as a local government obligation (Balamir, 2004).

6.6. Insurance System

Following the 1999 Marmara Earthquake, one of the steps taken by the government has been the Obligatory Earthquake Insurance that became effective with the decree Law No. 587 "Decree Law Relating to Compulsory Earthquake Insurance". With this decree, the Turkish Catastrophe Insurance Pool (TCIP) was established and become responsible for the obligatory earthquake insurance.

"Compulsory Earthquake Insurance system has removed the conventional obligation of the state to provide dwellings to every disaster victim. With this insurance system, only households who have insured dwellings are entitled to compensation" (Balamir, 2004). Therefore, the state has no more responsibility to compensate any damage occurred due to earthquakes. The damages are to be compensated by the Compulsory Earthquake Insurance System.

Official Earthquake Hazard Zoning Map of Turkey is used as a basis for calculating insurance costs for the purchasers of obligatory earthquake insurance. Pricing takes into account the location of the buildings according to earthquake hazard zones and the construction type of the buildings. There are fifteen different rates determined according to five seismic hazard zones and three different building construction type.

Table 6.9 Rates of Compulsory Earthquake Insurance Scheme
(Source: TCIP, 2012)

REGION BASED RATES ACCORDING TO Construction Type (‰)	ZONE I	ZONE II	ZONE III	ZONE IV	ZONE V
A-Steel, Reinforced Concrete Frame Structures	2.20	1.55	0.83	0.55	0.44
B-Masonry Stone Structures	3.85	2.75	1.43	0.60	0.50
C-Other Structures	5.50	3.53	1.76	0.78	0.58

"The system functions currently at a high cost since the probability of earthquakes are high, land use and location decisions do not take into account the findings of microzonation. All contribute to the intensification of risk" (Balamir, 2004).

The basic reason of this intensification of risk is the Earthquake Hazard Map of Turkey that only indicates hazard exposure levels of provinces and settlements without providing any information about risk levels. The purpose could have been better served if differentiations of locations were made on risk-basis. This demands the identification of relative risk categories of risks in settlements.

Consequently, the official hazard map considers only probabilities of seismic hazard not necessarily the vulnerabilities or attributes of the building stock. In order to underline this problem, we examine the discrepancies between the location of settlements according to the hazard zones determined by the official earthquake hazard map and the prioritized lists of settlements according to the absolute and relative loss.

To this end, first of all the top-20 settlements prioritized according to the absolute loss is compared with the location of these settlements according to the hazard zones determined by the official earthquake hazard map of Turkey (See Appendix G for the total list).

When we examine the top-20 high risk settlements prioritized according to the absolute loss, we observe that three of these high risk settlements Van Center, Tekirdağ Center and Adıyaman Center are located in the second hazard zone according to the official earthquake hazard map of Turkey.

Although these settlements have rank in the top-20 high risk list, they classified in the second hazard zone and their insurance rates are calculated according to the second hazard level.

But the most remarkable result is seen in the centre of Van that struck by a devastating earthquake recently. Although centre of Van ranks in the first place of the high-risk settlements according to the absolute loss, it is classified in the second hazard zone according to the earthquake hazard map and insurance rates are calculated according to the second hazard level.

This is a clear indication of the importance of both making differentiation of locations and calculating of insurance rates on risk-basis maps.

Table 6.10 Comparison of the Top-20 Settlements Prioritized According to the Absolute Loss with the Hazard Zones Determined by the Official Earthquake Hazard Map

PROVINCE	SUB-PROVINCE	Expected Intensity	Absolute Loss	Hazard Zone	Relative Loss of Settlements (Loss Rate)
VAN	VAN C.	7,5	2285	2	0,06
ERZINCAN	ERZİNCAN C.	8	2025	1	0,16
BOLU	BOLU C.	8	1841	1	0,18
YALOVA	YALOVA C.	8	1507	1	0,18
TOKAT	NIKSAR	8	1400	1	0,17
KASTAMONU	TOSYA	8	1364	1	0,16
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	2	0,09
TOKAT	ERBAA	8	1251	1	0,16
BURSA	ORHANGAZI	8	945	1	0,18
MANISA	MANİSA C.	7	919	1	0,04
OSMANIYE	OSMANİYE C.	7	905	1	0,03
SAKARYA	HENDEK	8	869	1	0,17
CORUM	OSMANCIK	8	786	1	0,16
HATAY	ANTAKYA	7	768	1	0,03
SAMSUN	HAVZA	8	735	1	0,16
TEKIRDAG	SARKOY	8	712	1	0,18
HATAY	ISKENDERUN	7	705	1	0,03
ADIYAMAN	ADIYAMAN C.	7	696	2	0,03
SAKARYA	AKYAZI	8	681	1	0,19
AMASYA	MERZIFON	7,5	666	1	0,07

Other settlements rank in the Top-100 high risk list prioritized according to absolute loss that shows discrepancy with the hazard zones determined by the Official Earthquake Hazard Map are; centre of Kütahya that ranks in the 40th place, Tarsus that ranks in the 43rd place, Çorum that ranks in the 59th place, Keşan that ranks in the 65th place, Afyon that ranks in the 72nd place, Çorlu that ranks in the 76th place, Kozan that ranks in the 85th place, Ceyhan that ranks in the 92nd place, Kadirli that ranks in the 94th place and Malkara that ranks in the 100th place (See Appendix G for the total list).

In the examination of the metropolitan cities prioritized according to the absolute loss, the most remarkable result is seen in the Istanbul metropolitan city. Although it ranks in the first place of the high-risk metropolitan cities, it is classified in the second hazard zone according to the earthquake hazard map. As a result of this classification, insurance rate is calculated according to the second hazard level in the most vulnerable metropolitan city of the country.

This is another definite example that shows the inconsistency of using official earthquake hazard zoning map as a basis for calculating insurance costs for earthquake insurance.

Other metropolitan cities prioritized according to the absolute loss are consistent with hazard zones determined by the official earthquake hazard map (See Appendix G).

Secondly, the top-20 settlements prioritized according to the relative loss is compared with the location of these settlements according to the hazard zones determined by the official earthquake hazard map of Turkey (See Appendix H for the total list).

When we examine the top-20 high risk settlements prioritized according to the relative loss, we observe that all of these high risk settlements are located in the first hazard zone according to the official earthquake hazard map of Turkey. This shows that the prioritization of settlements according to relative loss is consistent with hazard zones determined by the official earthquake hazard map and this also makes their insurance rate calculation consistent with our prioritization.

Table 6.11 Comparison of the Top-20 Settlements Prioritized According to the Relative Loss with the Hazard Zones Determined by the Official Earthquake Hazard Map

PROVINCE	SUB-PROVINCE	Expected Intensity	Relative Loss of Settlements (Loss Rate)	Hazard Zone	Absolute Loss
YALOVA	CINARCIK	8	0,21	1	357
SAKARYA	AKYAZI	8	0,19	1	681
YALOVA	CIFTLIKKOY	8	0,19	1	298
BOLU	BOLU M.	8	0,18	1	1841
YALOVA	YALOVA C.	8	0,18	1	1507
BURSA	ORHANGAZI	8	0,18	1	945
TEKIRDAG	SARKOY	8	0,18	1	712
TOKAT	NIKSAR	8	0,17	1	1400
SAKARYA	HENDEK	8	0,17	1	869
BOLU	GEREDE	8	0,17	1	583
AMASYA	TASOVA	8	0,17	1	282
YALOVA	TERMAL	8	0,17	1	73
ERZINCAN	ERZİNCAN C.	8	0,16	1	2025
KASTAMONU	TOSYA	8	0,16	1	1364
TOKAT	ERBAA	8	0,16	1	1251
CORUM	OSMANCIK	8	0,16	1	786
SAMSUN	HAVZA	8	0,16	1	735
SAKARYA	GEYVE	8	0,16	1	543
SIVAS	SUSEHRI	8	0,16	1	424
SAMSUN	LADIK	8	0,16	1	377

Other settlements rank in the Top-100 high-risk list prioritized according to relative loss that shows discrepancy with the hazard zones determined by the Official Earthquake Hazard Map are; centre of Tekirdağ that ranks in the 44th place, centre of Van that ranks in the 59th place and centre of Adıyaman that ranks in the 94th place (See Appendix H for the total list).

The examination of the metropolitan cities prioritized according to the relative loss, shows parallel results with other prioritized settlements according to the relative loss. Metropolitan cities prioritized according to the absolute loss are consistent with hazard zones determined by the official earthquake hazard map with the exception of the Istanbul metropolitan city.

Consequently, the comparison of prioritized list of settlements according to both absolute and relative losses, with the hazard zones determined by the official earthquake hazard map shows us that the discrepancies is seen more in absolute losses than relative losses.

The results of the evaluation of insurance schemes show that; absolute loss is a more distinctive and important factor than relative loss in the evaluation of insurance schemes.

6.7. National Investment Priorities and Regional Planning

Regional inequalities have been one of the major problems of regional development policies in Turkey. Although various efforts have been made, socio-economic disparities between regions have remained as an important development problem.

First efforts to reduce regional disparities within the country are started with the identification of Priority Provinces for Development (PPDs) in 1968. PPDs were defined to address regional inequalities by the State Planning Organization and over time its objectives have been revised and adjusted according to changing socio-economic conditions. The scope of PPDs was broadened in 1990s and reached 49 provinces and 2 districts in 2003. The failure of the PPD policies to reduce regional inequalities is accepted in the 8th Five Year Development Plan (2000-2005) and a new investment package is created with Law No. 5084 in 2004 and improved in 2006.

A completely new incentive system was improved in 2009 and the provinces of Turkey were divided into four regions on the basis of NUTS 2 classification. This system that support amounts were differentiated among regional groups didn’t solve the problems either. Accordingly the latest incentive system Degree No. 2012/3005 “Concerning State Encouragement to Investment” that increases the number of regions from four to six and differentiates the incentive amounts in order to provide advantageous schemes for less developed regions is devised in 2012.

The new investment incentive program differentiates from the previous ones with its province-based categorization. Provinces are divided into six regions in terms of priority of incentives where the provinces in the Region 6 will take the highest support and the provinces in Region 1 will take the lowest support.

Figure 6.3 Investment Priority Regions
(Source: Ministry of Economy, 2012)

The core of these investment incentive system is to reduce socio-economic and regional inequalities by increasing the production and employment, providing economic growth and social improvement. But this drive in economic growth and social improvement will bring together rapid urbanization, informal settlements and unstable living environments that will increase the vulnerabilities of cities and raise the devastating effects of disaster risks.

Accordingly it is crucial to evaluate these investment incentives together with risk-sensitive planning systems, effective disaster mitigation strategies and strict building supervision practices in disaster prone cities. But neither the previous encouragements for investment nor the latest degree "Concerning State Encouragement to Investment" considers any risk-basis regulatory frameworks.

Another remarkable point of the latest degree is the priorities given to investments in industries such as defense, pharmaceuticals, mining, rail/sea transportation, education, tourism and test facilities for automotive/space industry.

Investments in these prioritized sectors will benefit from rates of the support measures of Region 5 even they are made in Regions 1, 2, 3 and 4. Most of these prioritized sectors can be classified as hazardous vulnerable facilities and should be coordinated with effective disaster mitigation strategies in the risk prone cities.

Besides, these sectoral priorities without discriminating disparities between regions are away from to overcome regional disparities and have only contributed the persistence of inequalities between regions despite the scope of the system.

Considering all of these deficiencies of the latest investment system, the discrepancies between the location of settlements according to the investment priority regions and the prioritized lists of settlements according to the absolute and relative loss are examined.

To this end, first of all the top-20 settlements prioritized according to the absolute loss is compared with the location of these settlements according to the investment priority regions (See Appendix I for the total list).

Table 6.12 Comparisons of the Top-20 Settlements Prioritized According to the Absolute Loss with the Location of Settlements According to the Investment Priority Regions

Province	Absolute Loss	Priority of Incentives Region	Relative Loss of Settlements (Loss Rate)
ISTANBUL (M.)	83824	1	0,10
KOCAELI (M.)	24077	1	0,17
BURSA (M.)	19168	1	0,08
IZMIR (M.)	15727	1	0,03
SAKARYA (M.)	10936	2	0,14
TOKAT	3985	5	0,07
MANISA	3875	3	0,03
HATAY	3189	4	0,03
BALIKESIR	3111	3	0,03
BOLU	2990	2	0,14
ERZINCAN	2925	4	0,14
TEKIRDAG	2558	2	0,05
YALOVA	2484	2	0,17
VAN	2474	6	0,06
ADANA (M.)	2343	2	0,01
AMASYA	2210	4	0,06
CORUM	1687	4	0,04
ANTALYA (M.)	1644	1	0,01
KONYA (M.)	1617	2	0,01
KASTAMONU	1614	4	0,07

When we examine the top-20 high risk settlements prioritized according to the absolute loss, we observe that two of these high risk settlements Tokat and Van are located in the region 5 and region 6 that will take the highest support in terms of priority of incentives (See Table 6.12 and Figure 6.4).

It can be evaluated so normal that less developed settlements needs investment incentives to increase production/employment in order to provide economic growth and the investment system gives the highest support to these less developed cities.

But the specious point of the system is; although these settlements have rank in the top-20 high risk list, they classified in the highest support regions according to investment priority regions without taking any effective disaster mitigation and supervision strategies.

This inconsistent point of the system can be clearly seen in the example of Van, although the centre of Van is struck by a devastating earthquake recently and the city is highly vulnerable to seismic risks, the investors are supported especially in such industries mentioned above by the government without any mitigation and supervision strategies. This is a clear indication that the government didn’t take any lessons from the devastating effects of earlier earthquakes.

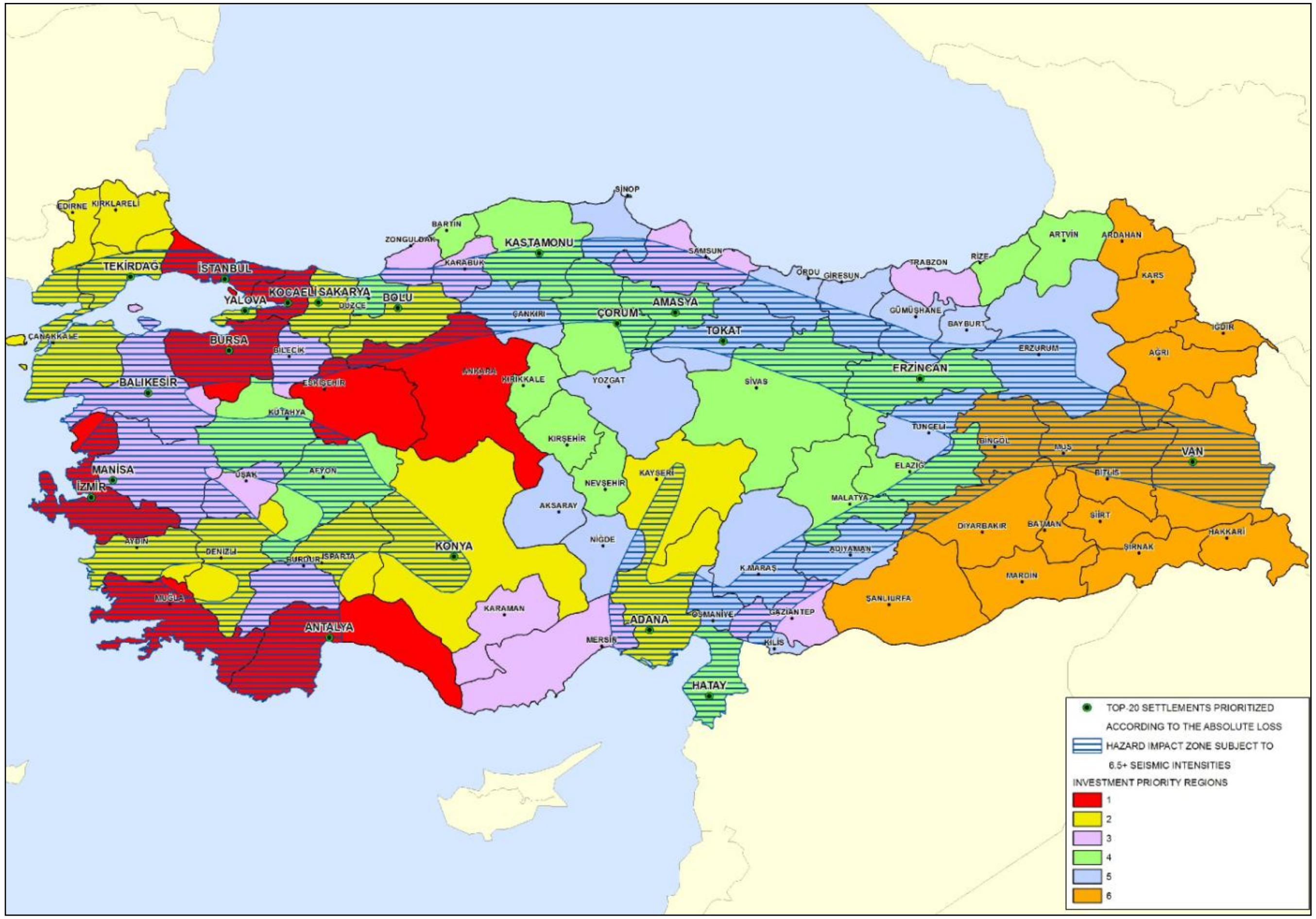

Figure 6.4 Evaluation of the Top-20 Settlements Prioritized According to the Absolute Loss with Respect to Investment Priority Region

Other high-risk settlements located in the region 6 that will take the highest support in terms of priority of incentives are; Mus that ranks in the 30th place, Bingöl that ranks in the 35th place, Bitlis that ranks in the 40th place and Diyarbakır that ranks in the 49th place.

Settlements that are located in the Region 6 and assuming that insignificant damage is likely to take place in these settlements are also given below.

Table 6.13 High Risk Settlements Located in the Region Six Prioritized According to the Absolute Loss

Province	**Absolute Loss**	**Priority of Incentives Region**	**Relative Loss of Settlements (Loss Rate)**
14-VAN	2474	6	0,06
30-MUS	875	6	0,04
35-BINGOL	630	6	0,05
40-BITLIS	494	6	0,03
49-DIYARBAKIR	177	6	0,01
60-AĞRI, 62-ARDAHAN, 65-BATMAN, 67-HAKKARİ, 68-IĞDIR, 70-KARS, 74-MARDİN, 77-SİİRT, 78-ŞANLIURFA, 79-ŞIRNAK, GÖKÇEADA AND BOZCAADA DİSTRİCTS*	-	6	-

*All settlements with an expected hazard intensity level of 6.0 and less are excluded from the analyses assuming that insignificant damage is likely to take place in these settlements.

Secondly, the top-20 settlements prioritized according to the relative loss is compared with the location of these settlements according to the investment priority regions (See Appendix J for the total list).

When we examine the top-20 high risk settlements prioritized according to the relative loss, we observe that six of these high risk settlements; Tokat, Giresun, Tunceli and Çankırı are located in the region 5 and Van and Bingöl are located in the region 6 that will take the highest support in terms of priority of incentives (See Table 6.14 and Figure 6.5).

As mentioned above, although these settlements have rank in the top-20 high risk list, they classified in the highest support regions without taking any effective disaster mitigation and supervision strategies. This will raise the vulnerabilities of these settlements and the devastating effects of disaster risks.

Table 6.14 Comparison of the Top-20 Settlements Prioritized According to the Relative Loss with the Location of Settlements According to the Investment Priority Regions

Province	Relative Loss of Settlements (Loss Rate)	Priority of Incentives Region	Absolute Loss
KOCAELI (M.)	0,17	1	24077
YALOVA	0,17	2	2484
SAKARYA (M.)	0,14	2	10936
BOLU	0,14	2	2990
ERZINCAN	0,14	4	2925
ISTANBUL (M.)	0,10	1	83824
SIVAS	0,10	4	1094
SAMSUN	0,09	3	1614
BURSA (M.)	0,08	1	19168
TOKAT	0,07	5	3985
KASTAMONU	0,07	4	1614
DUZCE	0,07	4	1179
GIRESUN	0,07	5	384
TUNCELI	0,07	5	104
VAN	0,06	6	2474
AMASYA	0,06	4	2210
TEKIRDAG	0,05	2	2558
CANKIRI	0,05	5	957
BINGOL	0,05	6	630
CORUM	0,04	4	1687

Other high risk settlements prioritized according to the Relative Loss and located in the region 6 that will take the highest support are; Muş, Bingöl, Bitlis and Diyarbakır as same as given in the Table 6.13. Investment incentives in these provinces should put into practice together with risk-sensitive planning systems, effective disaster mitigation and building supervision strategies.

Consequently, the comparison of prioritized list of settlements according to both absolute and relative losses, with the location of these settlements according to the investment priority regions shows us that the discrepancies is seen more in relative losses than absolute losses.

The results of the evaluation of investment incentives show that; relative loss is a more distinctive and important factor than absolute loss in the evaluation of investments.

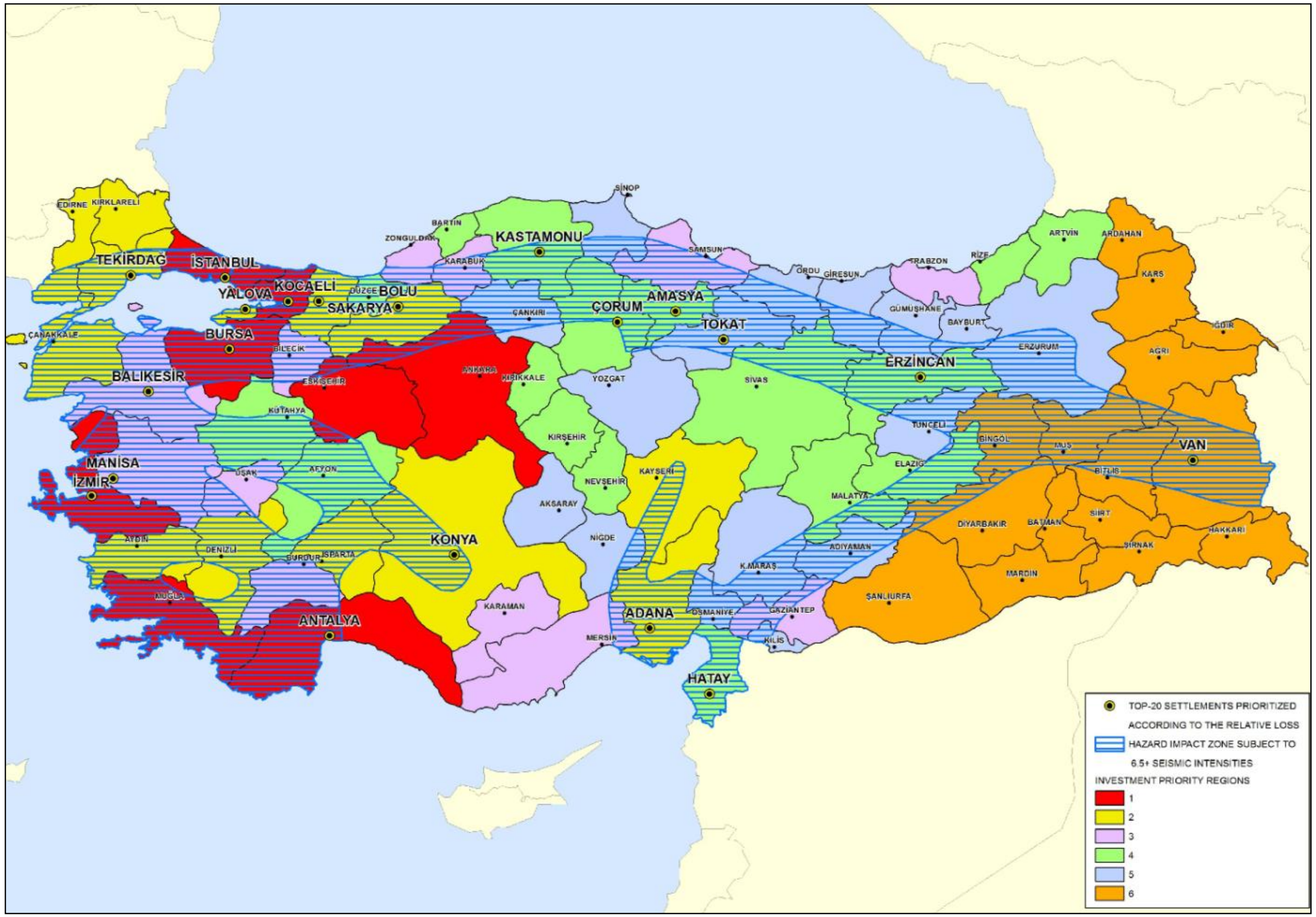

Figure 6.5 Evaluation of the Top-20 Settlements Prioritized According to the Relative Loss with Respect to Investment Priority Regions

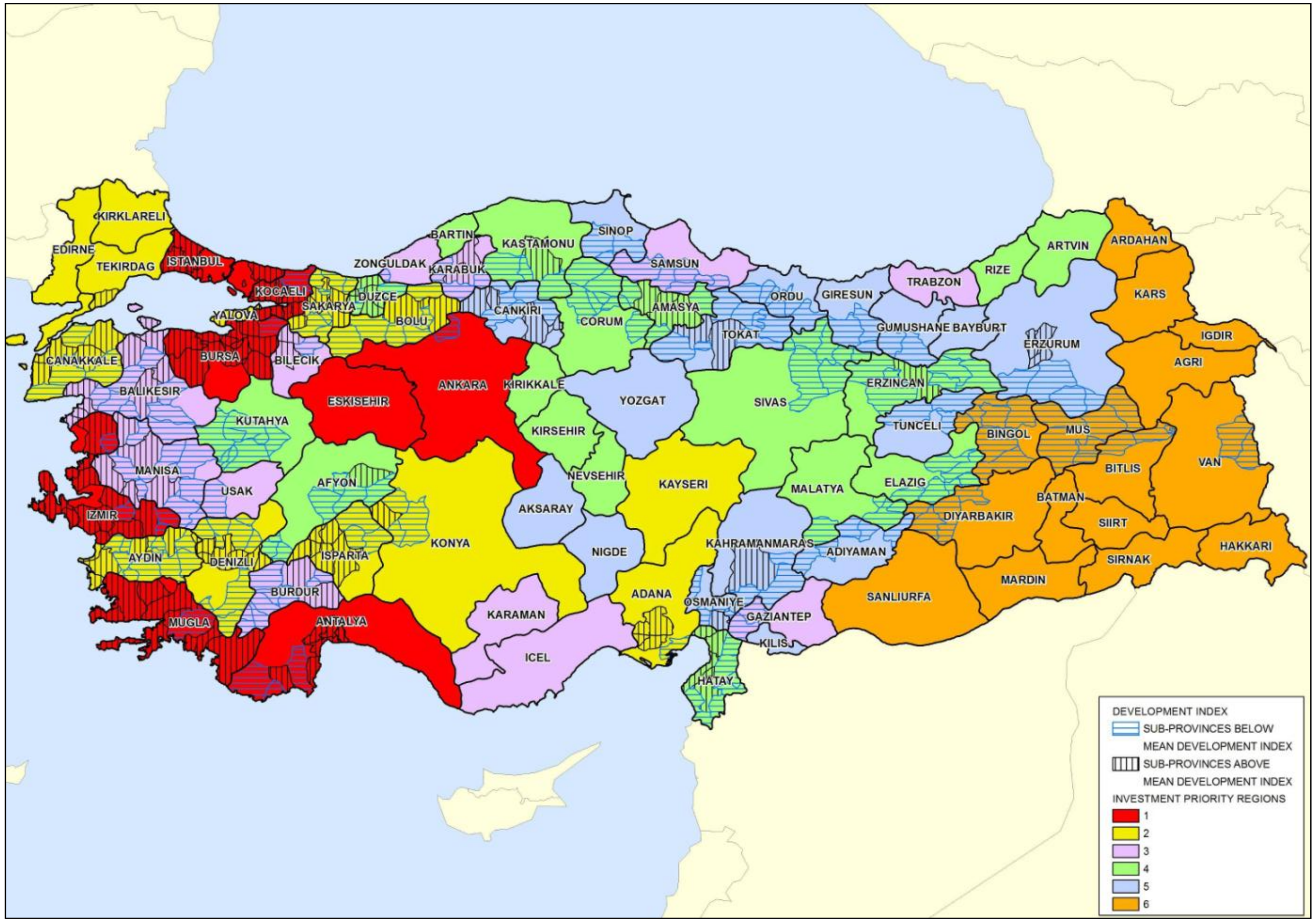

Figure 6.6 Evaluation of Development Index Rates with Respect to the Investment Priority Regions

CHAPTER 7

CONCLUSION AND FURTHER LINES OF INVESTIGATION

Chronic seismic hazards and resulting secondary impacts as natural conditions of the country, and loss of robust building and prudent settlement practices as aggravated by rapid population growth make cities the most vulnerable geographical and social entities in Turkey. In contrast, Turkish disaster policy is solely focused on post-disaster issues and no incentives or provision exist to encourage risk analysis or risk mitigation approaches, despite current international efforts.

For the development of risk reduction policies an essential step is to prioritize settlements according to their vulnerability levels. This is determined by hazard probabilities and attributes of the building stock of each settlement. Measurement of vulnerability levels allows the ordering of settlements into risk categories.

Quantitative information about a set of attributes of settlements is investigated statistically to determine which of the factors contribute most to risk levels described locally. The seismic hazard maps of the Kandilli Observatory and Earthquake Research Institute (KOERI), Erdik estimations of seismicity and statistics published by the Turkish Statistical Institute (TurkStat), like census and housing data have a leading contribution to make.

In order to determine the seismic vulnerabilities and risks of settlements, disaster component that reveals the settlement level loss in building stock is examined on one side and the basic attributes of settlements and their effects on loss levels on the other side. This double sided process generates the dependent and independent variables of the research.

In the determination of seismic vulnerabilities and risks of settlements, loss levels in the building stock in each settlement evaluated based on seismic hazard intensity via seismic hazard maps produced by KOERI and building stock vulnerability curves derived by Demircioglu. Settlement level loss in the building stock is the basic indicator of assumed overall vulnerability (risk) and provides the dependent variables of the research.

Y1 that is determined as Absolute Loss is the first dependent variable of the research and composed of the total number of building loss. Y2 that is determined as Relative Loss is the other dependent variable of the research and composed of the ratio of loss to the total building stock

Vulnerability levels of settlements are then assumed to depend on a number of attributes of cities to explore if vulnerability could be related to a set of urban properties.

The basic attributes of settlements are composed of building inventory data and related attributes of building stock on each settlement obtained from TurkStat.

'Building Construction Statistics', 'Building Census' and 'Population Census' prepared by TurkStat and 'Development Index' prepared by State Planning Organization is used within this research.

Attributes of settlements that are assumed to contribute to vulnerabilities and estimated loss are measurable indicators as independent variables. In terms of available data independent variables of the research are determined as; X1 = Settlement Population, X2 = Population Growth Rate (‰), X3 = Rates of Agglomeration, X4 = Population/Total Number of Buildings, X5 = Development Index.

Although absolute loss may represent a concrete measure of loss, relative loss in settlements also is taken into account. Small settlements with low values of absolute loss, but with high ratios may indicate greater impact and disturbance of hazard in urban life, than loss of similar or higher magnitude but smaller ratios in the larger cities or metropolitan agglomerations. Therefore the level of loss in each category of building types in each settlement is expressed both in absolute terms (total number of buildings lost) and in relative terms (ratio of loss to the total building stock/loss rate).

After determining the level of loss both in absolute terms (total number of buildings lost) and relative terms (ratio of loss to the total building stock), and the attributes of settlements that are assumed to contribute to vulnerabilities, all settlements in each size category are prioritized according to absolute and relative losses.

The top-20 settlements for 0-50.000 population are significantly above the category averages in terms of 'settlement population' and 'rate of agglomeration'. The average rates of growth and development indices are either negative or very small. Many of the settlements in this category are stagnant or in the process of negative growth.

Greater numbers of settlements that take place in the upper 20 in this category have relatively central status within their sub-province. Rates of agglomeration for these settlements are more or less leveled in the sub-province with the rural population. Only a few of these settlements represent stronger agglomeration centers. These also indicate positive growth and development.

Top-20 Settlements for 0-50.000 Population Prioritized According to Absolute Loss are; 1-Niksar (Tokat), 2-Tosya (Kastamonu), 3-Hendek (Sakarya), 4-Osmancık (Çorum), 5-Havza (Samsun), 6-Şarköy (Tekirdag), 7-Akyazı (Sakarya), 8-Suluova (Amasya), 9-Üzümlü (Erzincan), 10-Gerede (Bolu), 11-Geyve (Sakarya), 12-Ayvalık (Balıkesir), 13-Suşehri (Sivas), 14-Burhaniye (Balıkesir), 15-Pamukova (Sakarya), 16-Varto (Mus), 17-Ladik (Samsun), 18-Çınarcık (Yalova), 19-Çeşme (İzmir), 20-Yenişehir (Bursa).

Top-20 Settlements for 0-50.000 Population Prioritized According to Relative Loss are; 1-Çınarcık (Yalova), 2-Akyazı (Sakarya), 3-Çiftlikköy (Yalova), 4-Şarköy (Tekirdag), 5-Niksar (Tokat), 6-Hendek (Sakarya), 7-Gerede (Bolu), 8-Taşova (Amasya), 9-Termal (Yalova), 10-Tosya (Kastamonu), 11-Osmancık (Corum), 12-Havza (Samsun), 13-Geyve (Sakarya), 14-Suşehri (Sivas), 15-Ladik (Samsun), 16-Ilgaz (Çankırı), 17-Reşadiye (Tokat), 18-Yeniçağa (Bolu), 19-Çamoluk (Giresun), 20-Pülümür (Tunceli).

In contrast to the previous category of settlements, many cases in 50.000-490.00 population categories prove high levels of absolute loss determined less dependently on strength of seismic shake and there are variations in seismic intensity levels and rates of loss. Apart from a very few of the cases here, rates of loss seem to be lower than observed in the previous category and almost half of the top 20 in the list have higher rates than the average rate for this category.

Rate of population increases in 50.000-490.00 population category and almost identical rates of growth are observed. Apart from the province center of Erzincan, all settlements are in the process of growth, and half of the top 20 at higher rates than the average rate for this category. This is further confirmed by the development index figures, again half of the top 20 at higher rates than the average development index for this category.

Stronger agglomeration is observed in this category of settlements, compared to the weak agglomeration rates of the previous category of settlements, even though growth is also an attribute of the rural context for settlements.

Top-20 Settlements for 50.000-490.000 Population Prioritized According to Absolute Loss are; 1-Van Central, 2-Erzincan Central, 3-Bolu Central, 4-Yalova Central, 5-Tekirdag Central, 6-Erbaa (Tokat), 7-Orhangazi (Bursa), 8-Manisa Central, 9-Osmaniye Central, 10-Antakya (Hatay), 11-İskenderun (Hatay), 12-Adiyaman Central, 13-Merzifon (Amasya), 14-Turgutlu (Manisa), 15-Düzce Central, 16-Denizli Central, 17-Akhisar (Manisa), 18-İnegöl (Bursa), 19-Tokat Central, 20-Salihli (Manisa).

Top-20 Settlements for 50.000-490.000 Population Prioritized According to Relative Loss are; 1-Bolu Central, 2-Yalova Central, 3-Orhangazi (Bursa), 4-Erzincan Central, 5-Erbaa (Tokat), 6-Tekirdağ Central, 7-Merzifon (Amasya), 8-Düzce Central, 9-Van Central, 10-Manisa Central, 11-İnegöl (Bursa), 12-Salihli (Manisa), 13-Bandirma (Balıkesir), 14-Çanakkale Central, 15-Amasya Central, 16-Mustafakemalpaşa (Bursa), 17- Osmaniye Central, 18-Antakya (Hatay), 19-İskenderun (Hatay), 20-Adiyaman Central.

Ordering seems to follow seismic intensities rather than absolute size of the building stock in metropolitan provinces and a very distinct group of four metropolitan cities (Kocaeli, Sakarya, İstanbul, İzmir) with high ratio of loss are observed.

The top 20 of the settlements for metropolitan cities are significantly below the category averages in terms of ‘settlement population’ and ‘development index’.

Metropolitan Provinces Prioritized According to Absolute Loss Levels are; İstanbul, Kocaeli Bursa, İzmir, Sakarya, Adana, Antalya, Konya, Erzurum.

Metropolitan Provinces Prioritized According to Relative Loss Levels are; Kocaeli, Sakarya, İstanbul, Bursa, İzmir, Adana, Antalya, Konya, Erzurum.

These prioritized lists of settlements according to their vulnerability levels should be accepted as the basis of the mitigation policies in higher-risk settlements and these cities within the highest hazard zone should obviously be the object of mitigation programs before those in areas of lower hazard.

Priorities of mitigation planning should be constituted with respect to these prioritized lists of settlements according to their vulnerability levels and it should be compulsory to prepare mitigation plans for the settlements that have rank in the top-20 high risk lists.

Effective disaster mitigation strategies and more strict legal regulations about preparation of mitigation plans should be executed in these higher-risk settlements and cities within the highest hazard zone. Although, cities within the highest risk zones should obviously be the object of more strict inspection mechanisms than those of lower risks.

Urban standards for land use management as well as building construction are essential elements of disaster mitigation and it should be taken into consideration that different seismic intensity levels have different requirements of standards.

Land-use planning and zoning, planning of open-spaces, transportation and infrastructure planning are all distinct aspects of disaster mitigation and all these systems are to be implemented at different standards according to risk levels. Rigorous implementation and enforcement of differentiated standards according to risk levels must be the highest priority for reducing risk factors, vulnerabilities and potential losses.

Appropriate locational differentiation is a crucial input in engineering design safety of buildings based on risk maps. Urban planning standards and principles together with risk-minimizing planning systems could effectively serve to mitigate risks and promote strict building supervision practices in these disaster prone cities. To this end, urban planning standards and principles could be determined according to risk levels/zones determined by vulnerability maps and more strict planning standards could be executed in these higher-risk settlements. Although, it is crucial to evaluate investment incentives together with risk-sensitive planning systems, effective disaster mitigation strategies and strict building supervision practices in disaster prone cities.

Besides providing guiding principles for effective mitigation practices in Turkey by ordering settlements and offer means of differential implementation, another purpose of the study is to investigate the relations between measures of vulnerability (dependent variables) and contributing attributes (independent variables) by means of regression methods.

Best subsets regression analyses are employed to determine what combinations of the independent variables might best denote city-level risks. The results of the best subsets analyses give us the "most appropriate combination" for the regression analyses.

The results of best subsets regression analyses of top-20 settlements for the first category, that considers settlements having population up to 50.000, shows that X1 (settlement population) and X5 (development index) are the most effective independent variables that correlates with both dependent variables.

Six regression analyses are performed according to the results of best subsets regression analyses for Category I, which considers settlements having population up to 50.000.

These are; Regression Analysis: Y1 (absolute loss) versus X1 (settlement population), Y1 versus X5 (development index), Y2 (rate of loss) versus X1 (settlement population), Y2 versus X3 (rates of agglomeration), Y2 versus X4 (population /total number of buildings) and Y2 versus X5 (development index).

The results of best subsets regression analyses of top-20 settlements for the second category, that considers settlements having population between 50.000 and 490.000, shows that X4, the ratio of population to total number of buildings, is the most effective and only independent variable that correlates with both dependent variables.

Four regression analyses are performed according to the results of best subsets regression analyses for Category II that considers settlements having population between 50.000 and 490.000. These are; Regression Analysis: Y1 (absolute loss) versus X2 (population growth rate), Y1 versus X4 (population /total number of buildings), Y2 (rate of loss) versus X1 (settlement population), and Y2 versus X4 (population /total number of buildings.

The results of best subsets regression analyses for the third category, that considers metropolitan cities, shows that X3 (Rates of Agglomeration) and X4 (Population/Total Number of Buildings) are the most effective independent variables that correlates with both dependent variables.

Five regression analyses are performed according to the results of best subsets regression analyses for Category III that considers metropolitan cities. These are; Regression Analysis: Y1 (absolute loss) versus X1 (settlement population), Y1 versus X3 (rates of agglomeration), Y1 versus X4 (population /total number of buildings), Y2 (rate of loss) versus X3 (rates of agglomeration) and Y2 versus X4 (population /total number of buildings).

After obtaining the "most appropriate combinations" for the regression analyses by best subsets regression analyses, regression analyses are performed in all settlements in each size category.

Six regression analyses are performed according to the results of best subsets regression analyses for Category I, which considers settlements having population up to 50.000. The results of these analyses show that; Y1 (absolute loss) has no relations with independent variables, Y2 (rate of loss) has weak relations with X3 (rates of agglomeration), X4 (population /total number of buildings) and X5 (development index).

Four regression analyses are performed according to the results of best subsets regression analyses for Category II, which considers settlements having population between 50.000-490.000 inhabitants. The results of these analyses show that; Y1 (absolute loss) has no relations with X2 (population growth rate) and weak relations with X4 (population /total number of buildings). Y2 (rate of loss) has weak relations with X1(settlement population) and no relations with X4 (population/ total number of buildings).

Five regression analyses are performed according to the results of best subsets regression analyses for Category III, which considers metropolitan cities.

The results of these analyses show that; Y1 (absolute loss) has strong relations with X1 (settlement population), no relation with X3 (rates of agglomeration) and weak relations with X4 (population / total number of buildings). Y2 (rate of loss) has weak relations with X3 (rates of agglomeration) and X4 (population /total number of buildings).

As a result of these analyses we can say that Absolute Loss (YI) has no significant relations with independent variables of settlements in Category I that have populations up to 50.000 and settlements in Category II that have populations between 50.000 and 490.000. Disparately, Absolute Loss is strongly related with settlement populations of metropolitan cities in Category III.

When we examine the results of analyses according to Relative Loss/Rate of Loss (Y2), we can say that Rate of Loss has weak relations both with independent variables of settlements in Category I that have populations up to 50.000, settlements in Category II that have populations between 50.000 and 490.000, and metropolitan cities in Category III.

Consequently, results of statistical analyses indicate that total building loss is related to the ratio of population over the total number of buildings in mid-range settlements, and directly related to population in metropolitan cities. Relative loss on the other hand is related with rate of agglomeration and development index in almost every size category of settlements.

For further lines of investigation, the results of this study can be converted into more precise information on actual volume of building stock by converting the loss in number of buildings by estimations of building floor area. Still further, it is possible to have an economic estimation of the loss in physical stock by taking into consideration the building costs and values.

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APPENDIX A

BUILDING STOCK ATTRIBUTES ACCORDING TO CONSTRUCTION TYPE AND NUMBER OF STOREYS

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
ADANA	YUMURTALIK	6,5	1377	194	74	1
ADANA	KARAISALI	6,5	2187	54	42	0
ADANA	KARATAS	6,5	17	2144	79	0
ADANA	POZANTI	6,5	115	2346	33	0
ADANA	IMAMOGLU	6,5	1513	3553	44	0
ADANA	KOZAN	6,5	15750	1461	412	15
ADANA	CEYHAN	6,5	14967	374	589	13
ADIYAMAN	GERGER	6,5	875	1	0	0
ADIYAMAN	KAHTA	6,5	2415	4397	180	0
AFYON	IHSANIYE	6,5	574	123	9	0
AFYON	EVCILER	6,5	846	207	18	0
AFYON	DAZKIRI	6,5	1014	71	74	0
AFYON	BAYAT	6,5	1484	144	17	0
AFYON	BASMAKCI	6,5	1395	634	44	0
AFYON	SULTANDAGI	6,5	865	839	108	0
AFYON	COBANLAR	6,5	1652	145	25	0
AFYON	ISCEHISAR	6,5	2177	397	115	0
AFYON	SUHUT	6,5	2821	233	110	0
AFYON	CAY	6,5	3837	916	373	0
AFYON	EMIRDAG	6,5	3236	1505	515	0
AFYON	BOLVADIN	6,5	8322	929	409	0
AFYON	AFYON M.	6,5	14832	115	3005	5
AMASYA	GOYNUCEK	6,5	440	156	23	0
ANKARA	NALLIHAN	6,5	642	1357	278	1
ANKARA	KIZILCAHAMAM	6,5	999	496	402	0
ANTALYA	KAS	6,5	739	313	173	0
ANTALYA	FINIKE	6,5	603	838	292	2
ANTALYA	ELMALI	6,5	1833	1527	278	1
ANTALYA	KALE (DEMRE)	6,5	1313	898	145	0
ANTALYA	KORKUTELI	6,5	2738	876	604	0
ANTALYA	KEMER	6,5	971	962	156	0
ANTALYA	KUMLUCA	6,5	3249	968	476	0
AYDIN	KARPUZLU	6,5	592	250	17	2
AYDIN	KARACASU	6,5	2096	276	105	0
AYDIN	SULTANHISAR	6,5	1319	270	106	0
AYDIN	YENIPAZAR	6,5	2349	714	62	0
AYDIN	KOCARLI	6,5	1026	605	65	0
AYDIN	BUHARKENT	6,5	1123	465	141	0
AYDIN	KUYUCAK	6,5	1338	622	123	0
AYDIN	BOZDOGAN	6,5	3698	258	171	0
AYDIN	KOSK	6,5	1054	836	104	0
AYDIN	GERMENCIK	6,5	2044	908	129	0
AYDIN	INCIRLIOVA	6,5	2295	1374	350	0
AYDIN	CINE	6,5	3432	1814	375	0
AYDIN	DİDİM	6,5	1144	16706	835	1

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
AYDIN	KUSADASI	6,5	2261	13730	1690	4
AYDIN	SOKE	6,5	7167	1565	1687	1
AYDIN	NAZILLI	6,5	9704	4610	2224	6
AYDIN	AYDIN C.	6,5	7877	5837	5533	21
BALIKESIR	KEPSUT	6,5	1655	390	133	0
BALIKESIR	GONEN	6,5	3409	3187	911	1
BALIKESIR	BALIKESİR C.	6,5	14168	8515	8074	21
BILECIK	INHISAR	6,5	476	28	12	0
BILECIK	YENIPAZAR	6,5	383	62	26	0
BILECIK	PAZARYERI	6,5	1600	168	40	0
BILECIK	SOGUT	6,5	1009	787	373	0
BILECIK	BOZUYUK	6,5	6720	266	873	1
BITLIS	GUROYMAK	6,5	2134	103	35	0
BITLIS	TATVAN	6,5	1150	4329	340	1
BURDUR	CELTIKCI	6,5	385	456	12	0
BURDUR	AGLASUN	6,5	1321	70	38	0
BURDUR	BUCAK	6,5	5515	1196	674	0
BURDUR	BURDUR C.	6,5	7925	3775	1287	0
BURSA	KELES	6,5	258	580	34	0
BURSA	ORHANELI	6,5	1470	106	132	0
CANAKKALE	YENICE	6,5	900	492	58	0
CANKIRI	ELDIVAN	6,5	1280	29	19	0
CANKIRI	SABANOZU	6,5	588	283	17	0
CANKIRI	ÇANKIRI C.	6,5	2553	3486	995	2
CORUM	ORTAKOY	6,5	534	266	28	0
CORUM	MECITOZU	6,5	860	615	47	0
CORUM	BAYAT	6,5	588	846	94	0
CORUM	ÇORUM C.	6,5	15849	1330	3809	27
DENIZLI	BEYAGAC	6,5	700	89	17	0
DENIZLI	CAMELI	6,5	601	198	50	0
DENIZLI	BEKILLI	6,5	1419	378	25	0
DENIZLI	BABADAG	6,5	1342	300	35	0
DENIZLI	HONAZ	6,5	1205	489	51	0
DENIZLI	ACIPAYAM	6,5	982	647	369	1
DENIZLI	SARAYKOY	6,5	1879	962	477	0
DENIZLI	DENİZLİ C.	6,5	14680	18818	8365	48
DIYARBAKIR	DICLE	6,5	1442	0	9	0
DIYARBAKIR	CERMIK	6,5	2668	0	41	0
DIYARBAKIR	ERGANI	6,5	4623	5700	152	0
DUZCE	AKCAKOCA	6,5	1014	972	748	1
EDIRNE	IPSALA	6,5	1802	457	55	0
ELAZIG	KARAKOCAN	6,5	1319	553	118	0
ERZURUM	TEKMAN	6,5	882	146	9	0
ERZURUM	ASKALE	6,5	1318	1309	71	2
ERZURUM	PASINLER	6,5	3164	965	73	0
ESKISEHIR	MIHALGAZI	6,5	471	265	29	0
ESKISEHIR	SARICAKAYA	6,5	271	163	24	0
GAZIANTEP	YAVUZELI	6,5	320	569	20	0
GAZIANTEP	ARABAN	6,5	1882	178	8	0
GUMUSHANE	KELKIT	6,5	1022	1265	153	0
ICEL(MERSIN)	TARSUS	6,5	6652	25176	1413	2
ISPARTA	GONEN	6,5	1049	95	35	0
ISPARTA	ATABEY	6,5	1334	74	47	2
ISPARTA	GELENDOST	6,5	1630	73	26	0
ISPARTA	ULUBORLU	6,5	1950	53	48	0
ISPARTA	SENIRKENT	6,5	1455	682	160	0

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
ISPARTA	KECIBORLU	6,5	2228	187	81	0
ISPARTA	S.KARAAĞAÇ	6,5	2286	397	258	0
ISPARTA	EGIRDIR	6,5	2754	762	493	0
ISPARTA	YALVAC	6,5	1773	896	656	0
ISPARTA	ISPARTA C.	6,5	16760	4958	4569	9
IZMIR	BEYDAG	6,5	1384	580	128	0
IZMIR	KIRAZ	6,5	1571	628	80	0
IZMIR	KINIK	6,5	3375	458	35	0
IZMIR	TIRE	6,5	7784	1677	963	0
IZMIR	ODEMIS	6,5	9711	2729	2195	1
K.MARAS	CAGLAYANCERIT	6,5	2234	202	13	0
K.MARAS	K.MARAŞ C.	6,5	17205	21891	2190	36
KARABUK	YENICE	6,5	646	1149	518	1
KARABUK	SAFRANBOLU	6,5	2642	2547	794	0
KARABUK	KARABÜK C.	6,5	9520	1981	2182	1
KASTAMONU	TASKOPRU	6,5	664	1440	524	0
KASTAMONU	KASTAMONU C.	6,5	726	6958	1474	1
KAYSERI	BUNYAN	6,5	2321	381	109	0
KAYSERI	YAHYALI	6,5	3241	1111	154	0
KAYSERI	TALAS	6,5	1555	604	690	52
KILIS	MUSABEYLI	6,5	103	68	3	0
KONYA	DERBENT	6,5	1523	174	15	0
KONYA	AKOREN	6,5	524	0	11	0
KONYA	HUYUK	6,5	1414	32	65	0
KONYA	TUZLUKCU	6,5	1179	35	3	0
KONYA	DOGANHISAR	6,5	1798	342	199	0
KONYA	ILGIN	6,5	3053	2079	349	0
KONYA	AKSEHIR	6,5	5944	1180	1663	0
KUTAHYA	DUMLUPINAR	6,5	491	89	19	0
KUTAHYA	ASLANAPA	6,5	101	372	8	0
KUTAHYA	CAVDARHISAR	6,5	32	756	20	1
KUTAHYA	SAPHANE	6,5	314	1136	39	0
KUTAHYA	PAZARLAR	6,5	853	198	51	0
KUTAHYA	HISARCIK	6,5	876	324	189	0
KUTAHYA	ALTINTAS	6,5	699	429	60	0
KUTAHYA	EMET	6,5	95	2469	191	0
KUTAHYA	GEDIZ	6,5	124	4295	51	0
KUTAHYA	SIMAV	6,5	1701	1925	1229	2
KUTAHYA	KÜTAHYA C.	6,5	20105	1829	5474	41
MALATYA	KALE	6,5	632	35	6	1
MALATYA	DOGANSEHIR	6,5	1480	292	69	0
MANISA	KOPRUBASI	6,5	915	611	51	0
MANISA	GORDES	6,5	2158	882	209	0
MANISA	DEMIRCI	6,5	3791	425	206	0
MANISA	KIRKAGAC	6,5	3707	1177	228	0
MANISA	SOMA	6,5	6200	1954	1713	0
MUGLA	ULA	6,5	2044	98	4	0
MUGLA	KOYCEGIZ	6,5	1627	670	13	0
MUGLA	DATCA	6,5	2297	1169	78	0
MUGLA	YATAGAN	6,5	2099	457	249	0
MUGLA	DALAMAN	6,5	3022	1004	209	0
MUGLA	ORTACA	6,5	2642	1495	280	0
MUGLA	MARMARIS	6,5	1018	1553	958	0
MUGLA	BODRUM	6,5	1583	11195	68	0
MUGLA	MILAS	6,5	3298	4270	533	1
MUGLA	MUĞLA C.	6,5	5797	1801	1084	3

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
MUGLA	FETHIYE	6,5	3709	8242	822	8
MUS	HASKOY	6,5	1096	1184	33	0
MUS	MUŞ C.	6,5	2189	3862	545	0
NIGDE	CAMARDI	6,5	1316	4	29	0
ORDU	CATALPINAR	6,5	127	793	71	0
ORDU	GURGENTEPE	6,5	292	2027	151	0
ORDU	KUMRU	6,5	566	1249	311	1
ORDU	KORGAN	6,5	1074	1624	236	0
OSMANIYE	SUMBAS	6,5	690	43	0	0
OSMANIYE	DUZICI	6,5	2118	5368	36	0
OSMANIYE	KADIRLI	6,5	15757	66	289	3
SAKARYA	KAYNARCA	6,5	506	292	111	0
SAKARYA	KOCAALI	6,5	1087	2146	221	0
SAKARYA	KARASU	6,5	1683	1797	730	1
SAMSUN	SALIPAZARI	6,5	231	801	125	0
SAMSUN	TEKKEKÖY	6,5	883	1256	308	3
SINOP	DURAGAN	6,5	547	725	316	0
SINOP	BOYABAT	6,5	1045	1878	686	1
SIVAS	ZARA	6,5	2855	275	118	0
TEKIRDAG	MURATLI	6,5	1427	1958	167	0
TEKIRDAG	CERKEZKOY	6,5	1958	2021	1100	57
TEKIRDAG	CORLU	6,5	5293	6389	3781	41
TOKAT	PAZAR	6,5	858	461	38	0
TOKAT	ZILE	6,5	143	8771	358	1
TOKAT	TURHAL	6,5	7569	2322	868	0
TUNCELI	NAZIMIYE	6,5	247	34	30	0
TUNCELI	OVACIK	6,5	443	172	27	0
USAK	ULUBEY	6,5	665	937	113	0
USAK	BANAZ	6,5	991	1683	555	1
VAN	SARAY	6,5	469	104	2	0
VAN	GEVAS	6,5	1055	1001	18	0
ZONGULDAK	ALAPLI	6,5	483	192	774	0
ADANA	ADANA (M.)	6,5	27107	137530	8880	1955
ANTALYA	ANTALYA (M.)	6,5	69699	30230	13410	878
ERZURUM	ERZURUM (M.)	6,5	18261	8426	5732	23
KONYA	KONYA (M.)	6,5	88979	11939	11516	280
ADIYAMAN	TUT	7	592	489	22	0
ADIYAMAN	SINCIK	7	494	139	4	0
ADIYAMAN	CELIKHAN	7	669	563	24	0
ADIYAMAN	BESNI	7	977	2900	169	1
ADIYAMAN	GOLBASI	7	1005	2995	275	0
ADIYAMAN	ADIYAMAN C.	7	5668	14695	1412	9
AMASYA	HAMAMOZU	7	373	83	23	0
AMASYA	AMASYA C.	7	4782	2787	1821	1
ANKARA	CAMLIDERE	7	1909	327	44	0
BALIKESIR	BALYA	7	532	105	15	0
BALIKESIR	GOMEC	7	1549	1355	5	0
BALIKESIR	IVRINDI	7	970	464	101	0
BALIKESIR	MANYAS	7	1154	354	95	0
BALIKESIR	SAVASTEPE	7	1473	713	113	2
BALIKESIR	HAVRAN	7	2600	590	195	0
BALIKESIR	SINDIRGI	7	2021	884	217	0
BALIKESIR	BIGADIC	7	1801	1404	297	0
BALIKESIR	ERDEK	7	1896	1150	1124	0
BALIKESIR	SUSURLUK	7	4046	990	653	0
BALIKESIR	AYVALIK	7	7027	6407	650	0

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
BALIKESIR	BURHANIYE	7	6182	6478	497	0
BALIKESIR	EDREMIT	7	5153	1318	1133	0
BALIKESIR	BANDIRMA	7	3658	5002	3320	31
BILECIK	GOLPAZARI	7	911	862	86	0
BILECIK	BİLECİK C.	7	2955	233	828	1
BINGOL	YAYLADERE	7	776	9	27	0
BINGOL	GENC	7	1086	480	109	0
BINGOL	BİNGÖL C.	7	3143	2903	1157	1
BOLU	KIBRISCIK	7	392	6	7	0
BOLU	SEBEN	7	15	715	22	0
BURDUR	KEMER	7	666	115	17	0
BURDUR	CAVDIR	7	633	203	43	0
BURDUR	ALTINYAYLA	7	1087	30	30	0
BURDUR	TEFENNI	7	1417	124	61	0
BURDUR	YESILOVA	7	920	595	67	0
BURDUR	KARAMANLI	7	1575	222	109	0
BURDUR	GOLHISAR	7	2773	536	179	0
BURSA	KARACABEY	7	3772	2915	956	0
BURSA	M.KEMALPASA	7	4386	2368	1688	0
BURSA	INEGOL	7	3845	6469	3770	0
CANAKKALE	AYVACIK	7	1242	556	50	0
CANAKKALE	LAPSEKI	7	1330	539	301	0
CANAKKALE	EZINE	7	2507	1120	209	3
CANAKKALE	BAYRAMIC	7	2703	1293	154	0
CANAKKALE	CAN	7	2022	2632	357	0
CANAKKALE	BIGA	7	2363	2300	809	0
CANAKKALE	ÇANAKKALE C.	7	3620	3533	2067	11
CANKIRI	YAPRAKLI	7	218	538	18	0
CANKIRI	ORTA	7	680	215	29	0
CORUM	LACIN	7	505	6	8	0
CORUM	OGUZLAR	7	193	1211	39	0
CORUM	ISKILIP	7	1222	3407	470	0
DENIZLI	BAKLAN	7	803	131	8	0
DENIZLI	AKKOY	7	376	252	6	0
DENIZLI	CAL	7	1456	256	24	0
DENIZLI	BOZKURT	7	692	253	50	0
DENIZLI	CARDAK	7	720	568	65	0
DENIZLI	GUNEY	7	1178	629	40	0
DENIZLI	BULDAN	7	2206	1718	324	1
DIYARBAKIR	CUNGUS	7	787	65	13	0
DUZCE	YIGILCA	7	77	368	110	0
EDIRNE	ENEZ	7	1131	2322	31	0
EDIRNE	KESAN	7	5460	1641	940	0
ELAZIG	ALACAKAYA	7	626	193	7	0
ELAZIG	ARICAK	7	513	0	19	0
ELAZIG	SIVRICE	7	947	48	13	0
ELAZIG	MADEN	7	1333	263	48	0
ELAZIG	PALU	7	1619	142	38	0
ELAZIG	KOVANCILAR	7	1500	99	428	16
ERZINCAN	OTLUKBELI	7	341	81	9	0
ERZINCAN	KEMAH	7	458	191	22	0
ERZINCAN	TERCAN	7	1249	144	29	0
ERZURUM	CAT	7	1101	122	9	0
ERZURUM	KARACOBAN	7	2190	205	17	0
ERZURUM	HINIS	7	1058	2467	17	1
GAZIANTEP	NURDAGI	7	125	2132	14	0

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
GAZIANTEP	ISLAHIYE	7	2350	2254	162	8
GIRESUN	ALUCRA	7	574	315	37	0
GUMUSHANE	SIRAN	7	756	276	89	0
HATAY	KUMLU	7	1096	0	3	0
HATAY	YAYLADAGI	7	859	885	23	0
HATAY	ALTINOZU	7	288	1025	23	0
HATAY	HASSA	7	1076	583	12	0
HATAY	BELEN	7	2588	2246	237	2
HATAY	ERZIN	7	5650	26	48	0
HATAY	SAMANDAG	7	1615	5083	512	1
HATAY	REYHANLI	7	3588	5405	175	0
HATAY	KIRIKHAN	7	3824	7711	237	1
HATAY	DORTYOL	7	3431	6712	485	0
HATAY	ISKENDERUN	7	5491	13296	2354	2
HATAY	ANTAKYA	7	7589	13344	2330	20
IZMIR	KARABURUN	7	814	649	14	0
IZMIR	CESME	7	666	10711	116	1
IZMIR	BERGAMA	7	7971	3337	1041	4
K.MARAS	TURKOGLU	7	386	1842	18	0
K.MARAS	PAZARCIK	7	592	3267	65	0
KASTAMONU	IHSANGAZI	7	874	476	121	0
KASTAMONU	ARAC	7	718	554	120	0
MALATYA	DOGANYOL	7	822	3	2	0
MALATYA	PUTURGE	7	789	101	20	0
MANISA	GOLMARMARA	7	2439	479	52	0
MANISA	AHMETLI	7	1839	784	76	0
MANISA	SARIGOL	7	2740	1393	101	0
MANISA	SARUHANLI	7	2795	696	128	0
MANISA	KULA	7	4676	2836	182	0
MANISA	ALASEHIR	7	6240	2619	667	1
MANISA	SALIHLI	7	5707	5420	2484	1
MANISA	AKHISAR	7	13022	2956	1760	0
MANISA	TURGUTLU	7	9088	8193	2017	1
MANISA	MANİSA C.	7	13664	5204	5873	6
MUS	KORKUT	7	406	213	4	0
MUS	MALAZGIRT	7	2305	1778	47	0
ORDU	AKKUS	7	208	272	86	0
ORDU	AYBASTI	7	440	2773	469	0
ORDU	GOLKOY	7	2586	1416	234	2
OSMANIYE	HASANBEYLI	7	798	644	0	0
OSMANIYE	TOPRAKKALE	7	67	1590	2	0
OSMANIYE	BAHCE	7	353	1912	32	1
OSMANIYE	OSMANİYE C.	7	5283	23167	827	79
SAKARYA	FERIZLI	7	779	1032	111	0
SAMSUN	AYVACIK	7	369	782	37	0
SINOP	SARAYDUZU	7	192	173	19	0
SIVAS	IMRANLI	7	572	707	24	0
TEKIRDAG	MALKARA	7	2236	1533	733	0
TOKAT	TOKAT C.	7	4506	8516	2295	2
USAK	ESME	7	3047	570	176	0
VAN	GURPINAR	7	814	25	11	0
VAN	OZALP	7	1051	313	41	0
VAN	EDREMIT	7	929	145	12	0
VAN	BASKALE	7	1373	586	18	0
IZMIR	IZMIR (M.)	7	138577	216090	64466	1171
AMASYA	GUMUSHACIKOY	7,5	3164	775	234	0

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
AMASYA	SULUOVA	7,5	4768	4253	610	0
AMASYA	MERZIFON	7,5	6112	2164	1126	2
BILECIK	OSMANELI	7,5	1459	762	163	0
BINGOL	ADAKLI	7,5	833	7	9	0
BINGOL	KIGI	7,5	601	88	9	0
BITLIS	ADILCEVAZ	7,5	2025	629	82	0
BITLIS	AHLAT	7,5	2000	1721	71	0
BOLU	GOYNUK	7,5	221	984	18	0
BOLU	MUDURNU	7,5	170	1422	56	2
BOLU	MENGEN	7,5	297	587	151	0
BURSA	IZNIK	7,5	1483	2324	158	0
BURSA	YENISEHIR	7,5	3093	1509	419	0
CANKIRI	KORGUN	7,5	580	106	18	0
CANKIRI	ATKARACALAR	7,5	319	373	21	0
CANKIRI	KURSUNLU	7,5	1094	159	57	0
CORUM	DODURGA	7,5	907	74	10	0
DUZCE	CILIMLI	7,5	38	733	16	0
DUZCE	GUMUSOVA	7,5	207	979	100	0
DUZCE	CUMAYERI	7,5	55	961	38	0
DUZCE	DÜZCE M.	7,5	1957	5446	1121	0
ERZINCAN	CAYIRLI	7,5	889	63	27	0
GIRESUN	S.KARAHISAR	7,5	1453	1627	247	0
KARABUK	OVACIK	7,5	68	152	9	0
KARABUK	ESKIPAZAR	7,5	931	314	141	0
MUS	BULANIK	7,5	2701	1296	42	0
ORDU	MESUDIYE	7,5	200	726	31	0
SAKARYA	TARAKLI	7,5	129	940	16	0
SAMSUN	ASARCIK	7,5	149	205	30	0
SAMSUN	KAVAK	7,5	507	737	146	0
SAMSUN	VEZIRKOPRU	7,5	502	3539	369	0
SIVAS	DOGANSAR	7,5	409	177	14	0
TEKIRDAG	TEKİRDAĞ C.	7,5	3040	7989	4560	15
TOKAT	ALMUS	7,5	768	186	113	0
VAN	VAN C.	7,5	34404	243	1372	1
YALOVA	ARMUTLU	7,5	862	778	440	0
BURSA	BURSA (M.)	7,5	55416	101949	47028	158
ISTANBUL	ISTANBUL (M.)	7,5	200025	295927	357937	6271
AMASYA	TASOVA	8	874	535	263	0
BINGOL	YEDISU	8	432	11	7	0
BINGOL	KARLIOVA	8	754	142	12	0
BOLU	DORTDIVAN	8	161	381	44	0
BOLU	YENICAGA	8	623	362	129	0
BOLU	GEREDE	8	1011	1841	576	0
BOLU	BOLU C.	8	3362	4846	2257	2
BURSA	ORHANGAZI	8	1818	2246	1241	1
CANKIRI	BAYRAMOREN	8	1	268	11	0
CANKIRI	ILGAZ	8	791	893	219	5
CANKIRI	CERKES	8	214	1474	38	0
CORUM	KARGI	8	1750	95	29	0
CORUM	OSMANCIK	8	4026	720	275	1
DUZCE	GOLYAKA	8	111	671	33	0
DUZCE	KAYNASLI	8	345	814	11	0
ERZINCAN	REFAHIYE	8	624	189	30	0
ERZINCAN	UZUMLU	8	2817	1341	28	0
ERZINCAN	ERZİNCAN C.	8	8815	2637	1138	0
GIRESUN	CAMOLUK	8	547	275	37	0

Provinces	Sub-Provinces	Intensity	Load Bearing Construction (1-3 storeys)	Frame Construction Low- Rise (1-3)	Frame Construction Mid–Rise (4-9)	Frame Construction High–Rise (10+)
KASTAMONU	TOSYA	8	586	7299	669	1
MUS	VARTO	8	1673	848	22	0
SAKARYA	KARAPURCEK	8	0	892	8	0
SAKARYA	PAMUKOVA	8	1642	810	129	1
SAKARYA	GEYVE	8	720	2552	194	0
SAKARYA	AKYAZI	8	1212	2710	342	1
SAKARYA	HENDEK	8	277	4795	401	0
SAMSUN	LADIK	8	1168	1114	130	0
SAMSUN	HAVZA	8	2052	2189	366	0
SIVAS	GOLOVA	8	185	250	34	0
SIVAS	AKINCILAR	8	1039	309	31	0
SIVAS	KOYULHISAR	8	1106	666	28	0
SIVAS	SUSEHRI	8	1173	1115	298	0
TEKIRDAG	SARKOY	8	787	2394	871	0
TOKAT	BASCIFTLIK	8	726	477	7	0
TOKAT	RESADIYE	8	976	806	156	0
TOKAT	NIKSAR	8	1774	5316	1248	0
TOKAT	ERBAA	8	3859	3402	598	1
TUNCELI	PULUMUR	8	455	51	66	0
YALOVA	TERMAL	8	61	283	79	0
YALOVA	ALTINOVA	8	205	280	41	0
YALOVA	CINARCIK	8	289	496	886	0
YALOVA	CIFTLIKKOY	8	381	703	502	0
YALOVA	YALOVA C.	8	2453	3547	2246	7
KOCAELI	KOCAELI (M.)	8	37086	74363	27196	117
SAKARYA	SAKARYA (M.)	8	20050	23438	5723	9

C: Central
M: Metropolitan

APPENDIX B

TOTAL LOSS IN BUILDING STOCK ACCORDING TO BUILDING TYPES WITH REFERENCE TO VULNERABILITY CURVES

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
ADANA	YUMURTALIK	6,5	13,77	1,94	2,22	0	18
ADANA	KARAISALI	6,5	21,87	0,54	1,26	0	24
ADANA	KARATAS	6,5	0,17	21,44	2,37	0	24
ADANA	POZANTI	6,5	1,15	23,46	0,99	0	26
ADANA	IMAMOGLU	6,5	15,13	35,53	1,32	0	52
ADANA	KOZAN	6,5	157,5	14,61	12,36	0	184
ADANA	CEYHAN	6,5	149,67	3,74	17,67	0	171
ADIYAMAN	GERGER	6,5	8,75	0,01	0	0	9
ADIYAMAN	KAHTA	6,5	24,15	43,97	5,4	0	74
AFYON	IHSANIYE	6,5	5,74	1,23	0,27	0	7
AFYON	EVCILER	6,5	8,46	2,07	0,54	0	11
AFYON	DAZKIRI	6,5	10,14	0,71	2,22	0	13
AFYON	BAYAT	6,5	14,84	1,44	0,51	0	17
AFYON	BASMAKCI	6,5	13,95	6,34	1,32	0	22
AFYON	SULTANDAGI	6,5	8,65	8,39	3,24	0	20
AFYON	COBANLAR	6,5	16,52	1,45	0,75	0	19
AFYON	ISCEHISAR	6,5	21,77	3,97	3,45	0	29
AFYON	SUHUT	6,5	28,21	2,33	3,3	0	34
AFYON	CAY	6,5	38,37	9,16	11,19	0	59
AFYON	EMIRDAG	6,5	32,36	15,05	15,45	0	63
AFYON	BOLVADIN	6,5	83,22	9,29	12,27	0	105
AFYON	AFYON M.	6,5	148,32	1,15	90,15	0	240
AMASYA	GOYNUCEK	6,5	4,4	1,56	0,69	0	7
ANKARA	NALLIHAN	6,5	6,42	13,57	8,34	0	28
ANKARA	K.HAMAM	6,5	9,99	4,96	12,06	0	27
ANTALYA	KAS	6,5	7,39	3,13	5,19	0	16
ANTALYA	FINIKE	6,5	6,03	8,38	8,76	0	23
ANTALYA	ELMALI	6,5	18,33	15,27	8,34	0	42
ANTALYA	KALE (DEMRE)	6,5	13,13	8,98	4,35	0	26
ANTALYA	KORKUTELI	6,5	27,38	8,76	18,12	0	54
ANTALYA	KEMER	6,5	9,71	9,62	4,68	0	24
ANTALYA	KUMLUCA	6,5	32,49	9,68	14,28	0	56
AYDIN	KARPUZLU	6,5	5,92	2,5	0,51	0	9
AYDIN	KARACASU	6,5	20,96	2,76	3,15	0	27
AYDIN	SULTANHISAR	6,5	13,19	2,7	3,18	0	19
AYDIN	YENIPAZAR	6,5	23,49	7,14	1,86	0	32
AYDIN	KOCARLI	6,5	10,26	6,05	1,95	0	18
AYDIN	BUHARKENT	6,5	11,23	4,65	4,23	0	20
AYDIN	KUYUCAK	6,5	13,38	6,22	3,69	0	23
AYDIN	BOZDOGAN	6,5	36,98	2,58	5,13	0	45
AYDIN	KOSK	6,5	10,54	8,36	3,12	0	22

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
AYDIN	GERMENCIK	6,5	20,44	9,08	3,87	0	33
AYDIN	INCIRLIOVA	6,5	22,95	13,74	10,5	0	47
AYDIN	CINE	6,5	34,32	18,14	11,25	0	64
AYDIN	DİDİM	6,5	11,44	167,06	25,05	0	204
AYDIN	KUSADASI	6,5	22,61	137,3	50,7	0	211
AYDIN	SOKE	6,5	71,67	15,65	50,61	0	138
AYDIN	NAZILLI	6,5	97,04	46,1	66,72	0	210
AYDIN	AYDIN C.	6,5	78,77	58,37	165,99	0	303
BALIKESIR	KEPSUT	6,5	16,55	3,9	3,99	0	24
BALIKESIR	GONEN	6,5	34,09	31,87	27,33	0	93
BALIKESIR	BALIKESİR C.	6,5	141,68	85,15	242,22	0	469
BILECIK	INHISAR	6,5	4,76	0,28	0,36	0	5
BILECIK	YENIPAZAR	6,5	3,83	0,62	0,78	0	5
BILECIK	PAZARYERI	6,5	16	1,68	1,2	0	19
BILECIK	SOGUT	6,5	10,09	7,87	11,19	0	29
BILECIK	BOZUYUK	6,5	67,2	2,66	26,19	0	96
BITLIS	GUROYMAK	6,5	21,34	1,03	1,05	0	23
BITLIS	TATVAN	6,5	11,5	43,29	10,2	0	65
BURDUR	CELTIKCI	6,5	3,85	4,56	0,36	0	9
BURDUR	AGLASUN	6,5	13,21	0,7	1,14	0	15
BURDUR	BUCAK	6,5	55,15	11,96	20,22	0	87
BURDUR	BURDUR C.	6,5	79,25	37,75	38,61	0	156
BURSA	KELES	6,5	2,58	5,8	1,02	0	9
BURSA	ORHANELI	6,5	14,7	1,06	3,96	0	20
CANAKKALE	YENICE	6,5	9	4,92	1,74	0	16
CANKIRI	ELDIVAN	6,5	12,8	0,29	0,57	0	14
CANKIRI	SABANOZU	6,5	5,88	2,83	0,51	0	9
CANKIRI	ÇANKIRI C.	6,5	25,53	34,86	29,85	0	90
CORUM	ORTAKOY	6,5	5,34	2,66	0,84	0	9
CORUM	MECITOZU	6,5	8,6	6,15	1,41	0	16
CORUM	BAYAT	6,5	5,88	8,46	2,82	0	17
CORUM	ÇORUM C.	6,5	158,49	13,3	114,27	0	286
DENIZLI	BEYAGAC	6,5	7	0,89	0,51	0	8
DENIZLI	CAMELI	6,5	6,01	1,98	1,5	0	9
DENIZLI	BEKILLI	6,5	14,19	3,78	0,75	0	19
DENIZLI	BABADAG	6,5	13,42	3	1,05	0	17
DENIZLI	HONAZ	6,5	12,05	4,89	1,53	0	18
DENIZLI	ACIPAYAM	6,5	9,82	6,47	11,07	0	27
DENIZLI	SARAYKOY	6,5	18,79	9,62	14,31	0	43
DENIZLI	DENİZLİ C.	6,5	146,8	188,18	250,95	0	586
DIYARBAKIR	DICLE	6,5	14,42	0	0,27	0	15
DIYARBAKIR	CERMIK	6,5	26,68	0	1,23	0	28
DIYARBAKIR	ERGANI	6,5	46,23	57	4,56	0	108
DUZCE	AKCAKOCA	6,5	10,14	9,72	22,44	0	42
EDIRNE	IPSALA	6,5	18,02	4,57	1,65	0	24
ELAZIG	KARAKOCAN	6,5	13,19	5,53	3,54	0	22
ERZURUM	TEKMAN	6,5	8,82	1,46	0,27	0	11
ERZURUM	ASKALE	6,5	13,18	13,09	2,13	0	28
ERZURUM	PASINLER	6,5	31,64	9,65	2,19	0	43
ESKISEHIR	MIHALGAZI	6,5	4,71	2,65	0,87	0	8
ESKISEHIR	SARICAKAYA	6,5	2,71	1,63	0,72	0	5

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
GAZIANTEP	YAVUZELI	6,5	3,2	5,69	0,6	0	9
GAZIANTEP	ARABAN	6,5	18,82	1,78	0,24	0	21
GUMUSHANE	KELKIT	6,5	10,22	12,65	4,59	0	27
ICEL(MERSIN)	TARSUS	6,5	66,52	251,76	42,39	0	361
ISPARTA	GONEN	6,5	10,49	0,95	1,05	0	12
ISPARTA	ATABEY	6,5	13,34	0,74	1,41	0	15
ISPARTA	GELENDOST	6,5	16,3	0,73	0,78	0	18
ISPARTA	ULUBORLU	6,5	19,5	0,53	1,44	0	21
ISPARTA	SENIRKENT	6,5	14,55	6,82	4,8	0	26
ISPARTA	KECIBORLU	6,5	22,28	1,87	2,43	0	27
ISPARTA	S.KARAAGAC	6,5	22,86	3,97	7,74	0	35
ISPARTA	EGIRDIR	6,5	27,54	7,62	14,79	0	50
ISPARTA	YALVAC	6,5	17,73	8,96	19,68	0	46
ISPARTA	ISPARTA C.	6,5	167,6	49,58	137,07	0	354
IZMIR	BEYDAG	6,5	13,84	5,8	3,84	0	23
IZMIR	KIRAZ	6,5	15,71	6,28	2,4	0	24
IZMIR	KINIK	6,5	33,75	4,58	1,05	0	39
IZMIR	TIRE	6,5	77,84	16,77	28,89	0	124
IZMIR	ODEMIS	6,5	97,11	27,29	65,85	0	190
K.MARAS	CAG.CERIT	6,5	22,34	2,02	0,39	0	25
K.MARAS	K.MARAŞ C.	6,5	172,05	218,91	65,7	0	457
KARABUK	YENICE	6,5	6,46	11,49	15,54	0	33
KARABUK	SAFRANBOLU	6,5	26,42	25,47	23,82	0	76
KARABUK	KARABÜK C.	6,5	95,2	19,81	65,46	0	180
KASTAMONU	TASKOPRU	6,5	6,64	14,4	15,72	0	37
KASTAMONU	KASTAMONU C.	6,5	7,26	69,58	44,22	0	121
KAYSERI	BUNYAN	6,5	23,21	3,81	3,27	0	30
KAYSERI	YAHYALI	6,5	32,41	11,11	4,62	0	48
KAYSERI	TALAS	6,5	15,55	6,04	20,7	0	42
KILIS	MUSABEYLI	6,5	1,03	0,68	0,09	0	2
KONYA	DERBENT	6,5	15,23	1,74	0,45	0	17
KONYA	AKOREN	6,5	5,24	0	0,33	0	6
KONYA	HUYUK	6,5	14,14	0,32	1,95	0	16
KONYA	TUZLUKCU	6,5	11,79	0,35	0,09	0	12
KONYA	DOGANHISAR	6,5	17,98	3,42	5,97	0	27
KONYA	ILGIN	6,5	30,53	20,79	10,47	0	62
KONYA	AKSEHIR	6,5	59,44	11,8	49,89	0	121
KUTAHYA	DUMLUPINAR	6,5	4,91	0,89	0,57	0	6
KUTAHYA	ASLANAPA	6,5	1,01	3,72	0,24	0	5
KUTAHYA	CAVDARHISAR	6,5	0,32	7,56	0,6	0	8
KUTAHYA	SAPHANE	6,5	3,14	11,36	1,17	0	16
KUTAHYA	PAZARLAR	6,5	8,53	1,98	1,53	0	12
KUTAHYA	HISARCIK	6,5	8,76	3,24	5,67	0	18
KUTAHYA	ALTINTAS	6,5	6,99	4,29	1,8	0	13
KUTAHYA	EMET	6,5	0,95	24,69	5,73	0	31
KUTAHYA	GEDIZ	6,5	1,24	42,95	1,53	0	46
KUTAHYA	SIMAV	6,5	17,01	19,25	36,87	0	73
KUTAHYA	KÜTAHYA C.	6,5	201,05	18,29	164,22	0	384
MALATYA	KALE	6,5	6,32	0,35	0,18	0	7
MALATYA	DOGANSEHIR	6,5	14,8	2,92	2,07	0	20
MANISA	KOPRUBASI	6,5	9,15	6,11	1,53	0	17

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
MANISA	GORDES	6,5	21,58	8,82	6,27	0	37
MANISA	DEMIRCI	6,5	37,91	4,25	6,18	0	48
MANISA	KIRKAGAC	6,5	37,07	11,77	6,84	0	56
MANISA	SOMA	6,5	62	19,54	51,39	0	133
MUGLA	ULA	6,5	20,44	0,98	0,12	0	22
MUGLA	KOYCEGIZ	6,5	16,27	6,7	0,39	0	23
MUGLA	DATCA	6,5	22,97	11,69	2,34	0	37
MUGLA	YATAGAN	6,5	20,99	4,57	7,47	0	33
MUGLA	DALAMAN	6,5	30,22	10,04	6,27	0	47
MUGLA	ORTACA	6,5	26,42	14,95	8,4	0	50
MUGLA	MARMARIS	6,5	10,18	15,53	28,74	0	54
MUGLA	BODRUM	6,5	15,83	111,95	2,04	0	130
MUGLA	MILAS	6,5	32,98	42,7	15,99	0	92
MUGLA	MUĞLA C.	6,5	57,97	18,01	32,52	0	109
MUGLA	FETHIYE	6,5	37,09	82,42	24,66	0	144
MUS	HASKOY	6,5	10,96	11,84	0,99	0	24
MUS	MUŞ C.	6,5	21,89	38,62	16,35	0	77
NIGDE	CAMARDI	6,5	13,16	0,04	0,87	0	14
ORDU	CATALPINAR	6,5	1,27	7,93	2,13	0	11
ORDU	GURGENTEPE	6,5	2,92	20,27	4,53	0	28
ORDU	KUMRU	6,5	5,66	12,49	9,33	0	27
ORDU	KORGAN	6,5	10,74	16,24	7,08	0	34
OSMANIYE	SUMBAS	6,5	6,9	0,43	0	0	7
OSMANIYE	DUZICI	6,5	21,18	53,68	1,08	0	76
OSMANIYE	KADIRLI	6,5	157,57	0,66	8,67	0	167
SAKARYA	KAYNARCA	6,5	5,06	2,92	3,33	0	11
SAKARYA	KOCAALI	6,5	10,87	21,46	6,63	0	39
SAKARYA	KARASU	6,5	16,83	17,97	21,9	0	57
SAMSUN	SALIPAZARI	6,5	2,31	8,01	3,75	0	14
SAMSUN	TEKKEKÖY	6,5	8,83	12,56	9,24	0	31
SINOP	DURAGAN	6,5	5,47	7,25	9,48	0	22
SINOP	BOYABAT	6,5	10,45	18,78	20,58	0	50
SIVAS	ZARA	6,5	28,55	2,75	3,54	0	35
TEKIRDAG	MURATLI	6,5	14,27	19,58	5,01	0	39
TEKIRDAG	CERKEZKOY	6,5	19,58	20,21	33	0	73
TEKIRDAG	CORLU	6,5	52,93	63,89	113,43	0	230
TOKAT	PAZAR	6,5	8,58	4,61	1,14	0	14
TOKAT	ZILE	6,5	1,43	87,71	10,74	0	100
TOKAT	TURHAL	6,5	75,69	23,22	26,04	0	125
TUNCELI	NAZIMIYE	6,5	2,47	0,34	0,9	0	4
TUNCELI	OVACIK	6,5	4,43	1,72	0,81	0	7
USAK	ULUBEY	6,5	6,65	9,37	3,39	0	19
USAK	BANAZ	6,5	9,91	16,83	16,65	0	43
VAN	SARAY	6,5	4,69	1,04	0,06	0	6
VAN	GEVAS	6,5	10,55	10,01	0,54	0	21
ZONGULDAK	ALAPLI	6,5	4,83	1,92	23,22	0	30
ADANA	ADANA (M.)	6,5	271,07	1375,3	266,4	0	1913
ANTALYA	ANTALYA (M.)	6,5	696,99	302,3	402,3	0	1402
ERZURUM	ERZURUM (M.)	6,5	182,61	84,26	171,96	0	439
KONYA	KONYA (M.)	6,5	889,79	119,39	345,48	0	1355
ADIYAMAN	TUT	7	17,76	14,67	1,32	0	34

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
ADIYAMAN	SINCIK	7	14,82	4,17	0,24	0	19
ADIYAMAN	CELIKHAN	7	20,07	16,89	1,44	0	38
ADIYAMAN	BESNI	7	29,31	87	10,14	0,02	126
ADIYAMAN	GOLBASI	7	30,15	89,85	16,5	0	137
ADIYAMAN	ADIYAMAN C.	7	170,04	440,85	84,72	0,18	696
AMASYA	HAMAMOZU	7	11,19	2,49	1,38	0	15
AMASYA	AMASYA C.	7	143,46	83,61	109,26	0,02	336
ANKARA	CAMLIDERE	7	57,27	9,81	2,64	0	70
BALIKESIR	BALYA	7	15,96	3,15	0,9	0	20
BALIKESIR	GOMEC	7	46,47	40,65	0,3	0	87
BALIKESIR	IVRINDI	7	29,1	13,92	6,06	0	49
BALIKESIR	MANYAS	7	34,62	10,62	5,7	0	51
BALIKESIR	SAVASTEPE	7	44,19	21,39	6,78	0,04	72
BALIKESIR	HAVRAN	7	78	17,7	11,7	0	107
BALIKESIR	SINDIRGI	7	60,63	26,52	13,02	0	100
BALIKESIR	BIGADIC	7	54,03	42,12	17,82	0	114
BALIKESIR	ERDEK	7	56,88	34,5	67,44	0	159
BALIKESIR	SUSURLUK	7	121,38	29,7	39,18	0	190
BALIKESIR	AYVALIK	7	210,81	192,21	39	0	442
BALIKESIR	BURHANIYE	7	185,46	194,34	29,82	0	410
BALIKESIR	EDREMIT	7	154,59	39,54	67,98	0	262
BALIKESIR	BANDIRMA	7	109,74	150,06	199,2	0,62	460
BILECIK	GOLPAZARI	7	27,33	25,86	5,16	0	58
BILECIK	BİLECİK C.	7	88,65	6,99	49,68	0,02	145
BINGOL	YAYLADERE	7	23,28	0,27	1,62	0	25
BINGOL	GENC	7	32,58	14,4	6,54	0	54
BINGOL	BİNGÖL C.	7	94,29	87,09	69,42	0,02	251
BOLU	KIBRISCIK	7	11,76	0,18	0,42	0	12
BOLU	SEBEN	7	0,45	21,45	1,32	0	23
BURDUR	KEMER	7	19,98	3,45	1,02	0	24
BURDUR	CAVDIR	7	18,99	6,09	2,58	0	28
BURDUR	ALTINYAYLA	7	32,61	0,9	1,8	0	35
BURDUR	TEFENNI	7	42,51	3,72	3,66	0	50
BURDUR	YESILOVA	7	27,6	17,85	4,02	0	49
BURDUR	KARAMANLI	7	47,25	6,66	6,54	0	60
BURDUR	GOLHISAR	7	83,19	16,08	10,74	0	110
BURSA	KARACABEY	7	113,16	87,45	57,36	0	258
BURSA	M.KEMALPASA	7	131,58	71,04	101,28	0	304
BURSA	INEGOL	7	115,35	194,07	226,2	0	536
CANAKKALE	AYVACIK	7	37,26	16,68	3	0	57
CANAKKALE	LAPSEKI	7	39,9	16,17	18,06	0	74
CANAKKALE	EZINE	7	75,21	33,6	12,54	0,06	121
CANAKKALE	BAYRAMIC	7	81,09	38,79	9,24	0	129
CANAKKALE	CAN	7	60,66	78,96	21,42	0	161
CANAKKALE	BIGA	7	70,89	69	48,54	0	188
CANAKKALE	ÇANAKKALE C.	7	108,6	105,99	124,02	0,22	339
CANKIRI	YAPRAKLI	7	6,54	16,14	1,08	0	24
CANKIRI	ORTA	7	20,4	6,45	1,74	0	29
CORUM	LACIN	7	15,15	0,18	0,48	0	16
CORUM	OGUZLAR	7	5,79	36,33	2,34	0	44
CORUM	ISKILIP	7	36,66	102,21	28,2	0	167

Provinces	**Sub-Provinces**	**Intensity**	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	**TOTAL LOST**
DENIZLI	BAKLAN	7	24,09	3,93	0,48	0	29
DENIZLI	AKKOY	7	11,28	7,56	0,36	0	19
DENIZLI	CAL	7	43,68	7,68	1,44	0	53
DENIZLI	BOZKURT	7	20,76	7,59	3	0	31
DENIZLI	CARDAK	7	21,6	17,04	3,9	0	43
DENIZLI	GUNEY	7	35,34	18,87	2,4	0	57
DENIZLI	BULDAN	7	66,18	51,54	19,44	0,02	137
DIYARBAKIR	CUNGUS	7	23,61	1,95	0,78	0	26
DUZCE	YIGILCA	7	2,31	11,04	6,6	0	20
EDIRNE	ENEZ	7	33,93	69,66	1,86	0	105
EDIRNE	KESAN	7	163,8	49,23	56,4	0	269
ELAZIG	ALACAKAYA	7	18,78	5,79	0,42	0	25
ELAZIG	ARICAK	7	15,39	0	1,14	0	17
ELAZIG	SIVRICE	7	28,41	1,44	0,78	0	31
ELAZIG	MADEN	7	39,99	7,89	2,88	0	51
ELAZIG	PALU	7	48,57	4,26	2,28	0	55
ELAZIG	KOVANCILAR	7	45	2,97	25,68	0,32	74
ERZINCAN	OTLUKBELI	7	10,23	2,43	0,54	0	13
ERZINCAN	KEMAH	7	13,74	5,73	1,32	0	21
ERZINCAN	TERCAN	7	37,47	4,32	1,74	0	44
ERZURUM	CAT	7	33,03	3,66	0,54	0	37
ERZURUM	KARACOBAN	7	65,7	6,15	1,02	0	73
ERZURUM	HINIS	7	31,74	74,01	1,02	0,02	107
GAZIANTEP	NURDAGI	7	3,75	63,96	0,84	0	69
GAZIANTEP	ISLAHIYE	7	70,5	67,62	9,72	0,16	148
GIRESUN	ALUCRA	7	17,22	9,45	2,22	0	29
GUMUSHANE	SIRAN	7	22,68	8,28	5,34	0	36
HATAY	KUMLU	7	32,88	0	0,18	0	33
HATAY	YAYLADAGI	7	25,77	26,55	1,38	0	54
HATAY	ALTINOZU	7	8,64	30,75	1,38	0	41
HATAY	HASSA	7	32,28	17,49	0,72	0	50
HATAY	BELEN	7	77,64	67,38	14,22	0,04	159
HATAY	ERZIN	7	169,5	0,78	2,88	0	173
HATAY	SAMANDAG	7	48,45	152,49	30,72	0,02	232
HATAY	REYHANLI	7	107,64	162,15	10,5	0	280
HATAY	KIRIKHAN	7	114,72	231,33	14,22	0,02	360
HATAY	DORTYOL	7	102,93	201,36	29,1	0	333
HATAY	ISKENDERUN	7	164,73	398,88	141,24	0,04	705
HATAY	ANTAKYA	7	227,67	400,32	139,8	0,4	768
IZMIR	KARABURUN	7	24,42	19,47	0,84	0	45
IZMIR	CESME	7	19,98	321,33	6,96	0,02	348
IZMIR	BERGAMA	7	239,13	100,11	62,46	0,08	402
K.MARAS	TURKOGLU	7	11,58	55,26	1,08	0	68
K.MARAS	PAZARCIK	7	17,76	98,01	3,9	0	120
KASTAMONU	IHSANGAZI	7	26,22	14,28	7,26	0	48
KASTAMONU	ARAC	7	21,54	16,62	7,2	0	45
MALATYA	DOGANYOL	7	24,66	0,09	0,12	0	25
MALATYA	PUTURGE	7	23,67	3,03	1,2	0	28
MANISA	GOLMARMARA	7	73,17	14,37	3,12	0	91
MANISA	AHMETLI	7	55,17	23,52	4,56	0	83
MANISA	SARIGOL	7	82,2	41,79	6,06	0	130

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
MANISA	SARUHANLI	7	83,85	20,88	7,68	0	112
MANISA	KULA	7	140,28	85,08	10,92	0	236
MANISA	ALASEHIR	7	187,2	78,57	40,02	0,02	306
MANISA	SALIHLI	7	171,21	162,6	149,04	0,02	483
MANISA	AKHISAR	7	390,66	88,68	105,6	0	585
MANISA	TURGUTLU	7	272,64	245,79	121,02	0,02	639
MANISA	MANİSA C.	7	409,92	156,12	352,38	0,12	919
MUS	KORKUT	7	12,18	6,39	0,24	0	19
MUS	MALAZGIRT	7	69,15	53,34	2,82	0	125
ORDU	AKKUS	7	6,24	8,16	5,16	0	20
ORDU	AYBASTI	7	13,2	83,19	28,14	0	125
ORDU	GOLKOY	7	77,58	42,48	14,04	0,04	134
OSMANIYE	HASANBEYLI	7	23,94	19,32	0	0	43
OSMANIYE	TOPRAKKALE	7	2,01	47,7	0,12	0	50
OSMANIYE	BAHCE	7	10,59	57,36	1,92	0,02	70
OSMANIYE	OSMANİYE C.	7	158,49	695,01	49,62	1,58	905
SAKARYA	FERIZLI	7	23,37	30,96	6,66	0	61
SAMSUN	AYVACIK	7	11,07	23,46	2,22	0	37
SINOP	SARAYDUZU	7	5,76	5,19	1,14	0	12
SIVAS	IMRANLI	7	17,16	21,21	1,44	0	40
TEKIRDAG	MALKARA	7	67,08	45,99	43,98	0	157
TOKAT	TOKAT C.	7	135,18	255,48	137,7	0,04	528
USAK	ESME	7	91,41	17,1	10,56	0	119
VAN	GURPINAR	7	24,42	0,75	0,66	0	26
VAN	OZALP	7	31,53	9,39	2,46	0	43
VAN	EDREMIT	7	27,87	4,35	0,72	0	33
VAN	BASKALE	7	41,19	17,58	1,08	0	60
IZMIR	IZMIR (M.)	7	4157,31	6482,7	3867,96	23,42	14531
AMASYA	GUMSHACIKOY	7,5	189,84	46,5	35,1	0	271
AMASYA	SULUOVA	7,5	286,08	255,18	91,5	0	633
AMASYA	MERZIFON	7,5	366,72	129,84	168,9	0,12	666
BILECIK	OSMANELI	7,5	87,54	45,72	24,45	0	158
BINGOL	ADAKLI	7,5	49,98	0,42	1,35	0	52
BINGOL	KIGI	7,5	36,06	5,28	1,35	0	43
BITLIS	ADILCEVAZ	7,5	121,5	37,74	12,3	0	172
BITLIS	AHLAT	7,5	120	103,26	10,65	0	234
BOLU	GOYNUK	7,5	13,26	59,04	2,7	0	75
BOLU	MUDURNU	7,5	10,2	85,32	8,4	0,12	104
BOLU	MENGEN	7,5	17,82	35,22	22,65	0	76
BURSA	IZNIK	7,5	88,98	139,44	23,7	0	252
BURSA	YENISEHIR	7,5	185,58	90,54	62,85	0	339
CANKIRI	KORGUN	7,5	34,8	6,36	2,7	0	44
CANKIRI	ATKARACALAR	7,5	19,14	22,38	3,15	0	45
CANKIRI	KURSUNLU	7,5	65,64	9,54	8,55	0	84
CORUM	DODURGA	7,5	54,42	4,44	1,5	0	60
DUZCE	CILIMLI	7,5	2,28	43,98	2,4	0	49
DUZCE	GUMUSOVA	7,5	12,42	58,74	15	0	86
DUZCE	CUMAYERI	7,5	3,3	57,66	5,7	0	67
DUZCE	DÜZCE M.	7,5	117,42	326,76	168,15	0	612
ERZINCAN	CAYIRLI	7,5	53,34	3,78	4,05	0	61
GIRESUN	S.KARAHISAR	7,5	87,18	97,62	37,05	0	222

Provinces	Sub-Provinces	Intensity	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	TOTAL LOST
KARABUK	OVACIK	7,5	4,08	9,12	1,35	0	15
KARABUK	ESKIPAZAR	7,5	55,86	18,84	21,15	0	96
MUS	BULANIK	7,5	162,06	77,76	6,3	0	246
ORDU	MESUDIYE	7,5	12	43,56	4,65	0	60
SAKARYA	TARAKLI	7,5	7,74	56,4	2,4	0	67
SAMSUN	ASARCIK	7,5	8,94	12,3	4,5	0	26
SAMSUN	KAVAK	7,5	30,42	44,22	21,9	0	97
SAMSUN	VEZIRKOPRU	7,5	30,12	212,34	55,35	0	298
SIVAS	DOGANSAR	7,5	24,54	10,62	2,1	0	37
TEKIRDAG	TEKİRDAĞ C.	7,5	182,4	479,34	684	0,9	1347
TOKAT	ALMUS	7,5	46,08	11,16	16,95	0	74
VAN	VAN C.	7,5	2064,24	14,58	205,8	0,06	2285
YALOVA	ARMUTLU	7,5	51,72	46,68	66	0	164
BURSA	BURSA (M.)	7,5	3324,96	6116,94	7054,2	9,48	16506
ISTANBUL	ISTANBUL (M.)	7,5	12001,5	17755,62	53690,55	376,26	83824
AMASYA	TASOVA	8	131,1	80,25	71,01	0	282
BINGOL	YEDISU	8	64,8	1,65	1,89	0	68
BINGOL	KARLIOVA	8	113,1	21,3	3,24	0	138
BOLU	DORTDIVAN	8	24,15	57,15	11,88	0	93
BOLU	YENICAGA	8	93,45	54,3	34,83	0	183
BOLU	GEREDE	8	151,65	276,15	155,52	0	583
BOLU	BOLU M.	8	504,3	726,9	609,39	0,28	1841
BURSA	ORHANGAZI	8	272,7	336,9	335,07	0,14	945
CANKIRI	BAYRAMOREN	8	0,15	40,2	2,97	0	43
CANKIRI	ILGAZ	8	118,65	133,95	59,13	0,7	312
CANKIRI	CERKES	8	32,1	221,1	10,26	0	263
CORUM	KARGI	8	262,5	14,25	7,83	0	285
CORUM	OSMANCIK	8	603,9	108	74,25	0,14	786
DUZCE	GOLYAKA	8	16,65	100,65	8,91	0	126
DUZCE	KAYNASLI	8	51,75	122,1	2,97	0	177
ERZINCAN	REFAHIYE	8	93,6	28,35	8,1	0	130
ERZINCAN	UZUMLU	8	422,55	201,15	7,56	0	631
ERZINCAN	ERZİNCAN C.	8	1322,25	395,55	307,26	0	2025
GIRESUN	CAMOLUK	8	82,05	41,25	9,99	0	133
KASTAMONU	TOSYA	8	87,9	1094,85	180,63	0,14	1364
MUS	VARTO	8	250,95	127,2	5,94	0	384
SAKARYA	KARAPURCEK	8	0	133,8	2,16	0	136
SAKARYA	PAMUKOVA	8	246,3	121,5	34,83	0,14	403
SAKARYA	GEYVE	8	108	382,8	52,38	0	543
SAKARYA	AKYAZI	8	181,8	406,5	92,34	0,14	681
SAKARYA	HENDEK	8	41,55	719,25	108,27	0	869
SAMSUN	LADIK	8	175,2	167,1	35,1	0	377
SAMSUN	HAVZA	8	307,8	328,35	98,82	0	735
SIVAS	GOLOVA	8	27,75	37,5	9,18	0	74
SIVAS	AKINCILAR	8	155,85	46,35	8,37	0	211
SIVAS	KOYULHISAR	8	165,9	99,9	7,56	0	273
SIVAS	SUSEHRI	8	175,95	167,25	80,46	0	424
TEKIRDAG	SARKOY	8	118,05	359,1	235,17	0	712
TOKAT	BASCIFTLIK	8	108,9	71,55	1,89	0	182
TOKAT	RESADIYE	8	146,4	120,9	42,12	0	309
TOKAT	NIKSAR	8	266,1	797,4	336,96	0	1400

Provinces	**Sub-Provinces**	**Intensity**	**Load Bearing Construction (1-3 storeys)** Combined levels of loss (D3+D4+D5)	**Frame Construction Low-Rise (1-3)** Combined levels of loss (D3+D4+D5)	**Frame Construction Mid–Rise (4-9)** Combined levels of loss (D3+D4+D5)	**Frame Construction High–Rise (10+)** Combined levels of loss (D3+D4+D5)	**TOTAL LOST**
TOKAT	ERBAA	8	578,85	510,3	161,46	0,14	1251
TUNCELI	PULUMUR	8	68,25	7,65	17,82	0	94
YALOVA	TERMAL	8	9,15	42,45	21,33	0	73
YALOVA	ALTINOVA	8	30,75	42	11,07	0	84
YALOVA	CINARCIK	8	43,35	74,4	239,22	0	357
YALOVA	CIFTLIKKOY	8	57,15	105,45	135,54	0	298
YALOVA	YALOVA C.	8	367,95	532,05	606,42	0,98	1507
KOCAELI	KOCAELI (M.)	8	5562,9	11154,45	7342,92	16,38	24077
SAKARYA	SAKARYA (M.)	8	3007,5	3515,7	1545,21	1,26	8070

C: Central
M: Metropolitan

APPENDIX C

TOTAL LISTS OF CATEGORIES OF SETTLEMENTS PRIORITIZED ACCORDING TO ABSOLUTE LOSS

CATEGORY I – SETTLEMENTS HAVING POPULATION UP TO 50.000

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
TOKAT	NIKSAR	8	1400	8343	0,17	33.682
KASTAMONU	TOSYA	8	1364	8575	0,16	27.624
SAKARYA	HENDEK	8	869	4969	0,17	44.418
CORUM	OSMANCIK	8	786	5037	0,16	25.829
SAMSUN	HAVZA	8	735	4620	0,16	20.204
TEKIRDAG	SARKOY	8	712	4059	0,18	16.624
SAKARYA	AKYAZI	8	681	3668	0,19	41.179
AMASYA	SULUOVA	7,5	633	9653	0,07	37.151
ERZINCAN	UZUMLU	8	631	4187	0,15	8.288
BOLU	GEREDE	8	583	3439	0,17	23.808
SAKARYA	GEYVE	8	543	3491	0,16	20.318
BALIKESIR	AYVALIK	7	442	14115	0,03	35.986
SIVAS	SUSEHRI	8	424	2589	0,16	15.304
BALIKESIR	BURHANIYE	7	410	13164	0,03	38.156
SAKARYA	PAMUKOVA	8	403	2600	0,15	16.047
MUS	VARTO	8	384	2562	0,15	9.585
SAMSUN	LADIK	8	377	2426	0,16	8.316
YALOVA	CINARCIK	8	357	1675	0,21	11.080
IZMIR	CESME	7	348	11532	0,03	20.455
BURSA	YENISEHIR	7,5	339	5028	0,07	29.275
CANKIRI	ILGAZ	8	312	1913	0,16	7.738
TOKAT	RESADIYE	8	309	1941	0,16	9.027
MANISA	ALASEHIR	7	306	9553	0,03	47.942
YALOVA	CIFTLIKKOY	8	298	1594	0,19	17.052
SAMSUN	VEZIRKOPRU	7,5	298	4455	0,07	26.724
CORUM	KARGI	8	285	1878	0,15	5.226
AMASYA	TASOVA	8	282	1677	0,17	10.821
SIVAS	KOYULHISAR	8	273	1806	0,15	4.426
AMASYA	GUMUSHACIKOY	7,5	271	4176	0,07	14.620
CANKIRI	CERKES	8	263	1728	0,15	9.404
BURSA	IZNIK	7,5	252	3968	0,06	22.574
MUS	BULANIK	7,5	246	4278	0,06	21.352
MANISA	KULA	7	236	7694	0,03	24.241
BITLIS	AHLAT	7,5	234	5609	0,04	19.078
HATAY	SAMANDAG	7	232	7232	0,03	44.137
GIRESUN	SEBINKARAHISAR	7,5	222	3441	0,06	11.921
SIVAS	AKINCILAR	8	211	1379	0,15	2.775
AYDIN	DİDİM(YENİHİSAR)	6,5	204	18697	0,01	41.246
BALIKESIR	SUSURLUK	7	190	5693	0,03	23.952
CANAKKALE	BIGA	7	188	5654	0,03	36.520
BOLU	YENICAGA	8	183	1120	0,16	5.175
TOKAT	BASCIFTLIK	8	182	1225	0,15	3.840
DUZCE	KAYNASLI	8	177	1171	0,15	9.418

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
HATAY	ERZIN	7	173	5749	0,03	30.356
BITLIS	ADILCEVAZ	7,5	172	2866	0,06	14.428
CORUM	ISKILIP	7	167	5106	0,03	20.724
YALOVA	ARMUTLU	7,5	164	2083	0,08	5.223
CANAKKALE	CAN	7	161	5016	0,03	28.769
HATAY	BELEN	7	159	5093	0,03	20.892
BALIKESIR	ERDEK	7	159	4193	0,04	20.876
BILECIK	OSMANELI	7,5	158	2390	0,07	13.760
TEKIRDAG	MALKARA	7	157	4518	0,03	27.371
GAZIANTEP	ISLAHIYE	7	148	4949	0,03	30.904
BILECIK	BİLECİK C.	7	145	4025	0,04	46.403
BINGOL	KARLIOVA	8	138	911	0,15	6.202
DENIZLI	BULDAN	7	137	4282	0,03	15.197
ADIYAMAN	GOLBASI	7	137	4284	0,03	27.800
SAKARYA	KARAPURCEK	8	136	910	0,15	7.452
ORDU	GOLKOY	7	134	4246	0,03	16.410
GIRESUN	CAMOLUK	8	133	859	0,16	2.023
ERZINCAN	REFAHIYE	8	130	849	0,15	3.563
MANISA	SARIGOL	7	130	4250	0,03	13.406
MUGLA	BODRUM	6,5	130	12850	0,01	31.590
CANAKKALE	BAYRAMIC	7	129	4157	0,03	13.290
ADIYAMAN	BESNI	7	126	4254	0,03	26.788
DUZCE	GOLYAKA	8	126	819	0,15	8.793
MUS	MALAZGIRT	7	125	4146	0,03	19.130
ORDU	AYBASTI	7	125	3742	0,03	14.175
CANAKKALE	EZINE	7	121	3901	0,03	13.202
K.MARAS	PAZARCIK	7	120	3944	0,03	28.713
USAK	ESME	7	119	3797	0,03	13.532
BALIKESIR	BIGADIC	7	114	3533	0,03	16.062
MANISA	SARUHANLI	7	112	3637	0,03	15.336
BURDUR	GOLHISAR	7	110	3496	0,03	13.424
BALIKESIR	HAVRAN	7	107	3389	0,03	10.671
ERZURUM	HINIS	7	107	3551	0,03	9.654
EDIRNE	ENEZ	7	105	3484	0,03	3.820
AFYON	BOLVADIN	6,5	105	9687	0,01	31.284
BOLU	MUDURNU	7,5	104	1656	0,06	4.596
BALIKESIR	SINDIRGI	7	100	3141	0,03	12.672
TOKAT	ZILE	6,5	100	9275	0,01	35.417
SAMSUN	KAVAK	7,5	97	1393	0,07	8.435
KARABUK	ESKIPAZAR	7,5	96	1394	0,07	6.916
TUNCELI	PULUMUR	8	94	572	0,16	1.656
BALIKESIR	GONEN	6,5	93	7512	0,01	42.939
BOLU	DORTDIVAN	8	93	589	0,16	2.952
MANISA	GOLMARMARA	7	91	2983	0,03	9.840
BALIKESIR	GOMEC	7	87	2927	0,03	4.788
BURDUR	BUCAK	6,5	87	7405	0,01	36.370
DUZCE	GUMUSOVA	7,5	86	1294	0,07	6.483
YALOVA	ALTINOVA	8	84	534	0,16	4.942
CANKIRI	KURSUNLU	7,5	84	1312	0,06	3.939
MANISA	AHMETLI	7	83	2704	0,03	9.916
OSMANIYE	DUZICI	6,5	76	7540	0,01	40.823
KARABUK	SAFRANBOLU	6,5	76	6030	0,01	39.669
BOLU	MENGEN	7,5	76	1038	0,07	5.170
BOLU	GOYNUK	7,5	75	1223	0,06	4.182
SIVAS	GOLOVA	8	74	469	0,16	2.174

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
TOKAT	ALMUS	7,5	74	1070	0,07	4.408
CANAKKALE	LAPSEKI	7	74	2184	0,03	10.624
ELAZIG	KOVANCILAR	7	74	2060	0,04	20.246
KUTAHYA	SIMAV	6,5	73	4870	0,02	24.799
YALOVA	TERMAL	8	73	425	0,17	2.340
ERZURUM	KARACOBAN	7	73	2423	0,03	8.804
BALIKESIR	SAVASTEPE	7	72	2307	0,03	9.368
OSMANIYE	BAHCE	7	70	2305	0,03	12.917
ANKARA	CAMLIDERE	7	70	2285	0,03	3.747
GAZIANTEP	NURDAGI	7	69	2273	0,03	16.328
BINGOL	YEDISU	8	68	460	0,15	1.352
K.MARAS	TURKOGLU	7	68	2262	0,03	14.274
DUZCE	CUMAYERI	7,5	67	1056	0,06	7.824
SAKARYA	TARAKLI	7,5	67	1087	0,06	3.055
AYDIN	CINE	6,5	64	5631	0,01	20.416
AFYON	EMIRDAG	6,5	63	5372	0,01	20.253
KONYA	ILGIN	6,5	62	5510	0,01	31.171
ERZINCAN	CAYIRLI	7,5	61	1000	0,06	3.089
SAKARYA	FERIZLI	7	61	1924	0,03	12.914
BURDUR	KARAMANLI	7	60	1914	0,03	5.251
CORUM	DODURGA	7,5	60	991	0,06	3.065
ORDU	MESUDIYE	7,5	60	965	0,06	3.031
VAN	BASKALE	7	60	1986	0,03	12.562
AFYON	CAY	6,5	59	5129	0,01	14.592
BILECIK	GOLPAZARI	7	58	1862	0,03	7.697
CANAKKALE	AYVACIK	7	57	1849	0,03	7.538
SAKARYA	KARASU	6,5	57	4218	0,01	27.914
DENIZLI	GUNEY	7	57	1857	0,03	5.908
ANTALYA	KUMLUCA	6,5	56	4711	0,01	30.939
MANISA	KIRKAGAC	6,5	56	5152	0,01	26.660
ELAZIG	PALU	7	55	1812	0,03	8.837
MUGLA	MARMARIS	6,5	54	3545	0,02	30.101
ANTALYA	KORKUTELI	6,5	54	4225	0,01	20.109
HATAY	YAYLADAGI	7	54	1774	0,03	5.843
BINGOL	GENC	7	54	1676	0,03	18.691
DENIZLI	CAL	7	53	1738	0,03	3.887
ADANA	IMAMOGLU	6,5	52	5136	0,01	20.636
BINGOL	ADAKLI	7,5	52	851	0,06	3.143
BALIKESIR	MANYAS	7	51	1607	0,03	6.578
ELAZIG	MADEN	7	51	1653	0,03	5.314
HATAY	HASSA	7	50	1673	0,03	9.207
ISPARTA	EGIRDIR	6,5	50	4014	0,01	18.402
BURDUR	TEFENNI	7	50	1606	0,03	4.626
OSMANIYE	TOPRAKKALE	7	50	1661	0,03	7.843
SINOP	BOYABAT	6,5	50	3732	0,01	25.271
MUGLA	ORTACA	6,5	50	4427	0,01	25.816
BURDUR	YESILOVA	7	49	1587	0,03	4.724
BALIKESIR	IVRINDI	7	49	1537	0,03	6.514
DUZCE	CILIMLI	7,5	49	794	0,06	6.348
MANISA	DEMIRCI	6,5	48	4448	0,01	19.550
KAYSERI	YAHYALI	6,5	48	4513	0,01	20.066
KASTAMONU	IHSANGAZI	7	48	1473	0,03	2.715
AYDIN	INCIRLIOVA	6,5	47	4029	0,01	19.438
MUGLA	DALAMAN	6,5	47	4248	0,01	22.956
ISPARTA	YALVAC	6,5	46	3371	0,01	20.448

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
KUTAHYA	GEDIZ	6,5	46	4525	0,01	19.546
KASTAMONU	ARAC	7	45	1393	0,03	5.776
IZMIR	KARABURUN	7	45	1485	0,03	2.785
AYDIN	BOZDOGAN	6,5	45	4128	0,01	9.713
CANKIRI	ATKARACALAR	7,5	45	713	0,06	2.730
CORUM	OGUZLAR	7	44	1463	0,03	3.741
CANKIRI	KORGUN	7,5	44	704	0,06	2.129
ERZINCAN	TERCAN	7	44	1430	0,03	5.416
ERZURUM	PASINLER	6,5	43	4237	0,01	13.969
USAK	BANAZ	6,5	43	3252	0,01	15.395
VAN	OZALP	7	43	1417	0,03	10.166
CANKIRI	BAYRAMOREN	8	43	282	0,15	880
OSMANIYE	HASANBEYLI	7	43	1446	0,03	2.559
DENIZLI	SARAYKOY	6,5	43	3360	0,01	18.526
BINGOL	KIGI	7,5	43	698	0,06	3.220
DENIZLI	CARDAK	7	43	1360	0,03	4.634
DUZCE	AKCAKOCA	6,5	42	2751	0,02	23.378
ANTALYA	ELMALI	6,5	42	3649	0,01	14.478
HATAY	ALTINOZU	7	41	1345	0,03	7.458
SIVAS	IMRANLI	7	40	1304	0,03	3.303
IZMIR	KINIK	6,5	39	3869	0,01	11.919
SAKARYA	KOCAALI	6,5	39	3461	0,01	12.560
TEKIRDAG	MURATLI	6,5	39	3558	0,01	19.107
ADIYAMAN	CELIKHAN	7	38	1265	0,03	8.224
SIVAS	DOGANSAR	7,5	37	600	0,06	1.508
ERZURUM	CAT	7	37	1234	0,03	4.527
MUGLA	DATCA	6,5	37	3566	0,01	9.958
KASTAMONU	TASKOPRU	6,5	37	2643	0,01	16.385
SAMSUN	AYVACIK	7	37	1189	0,03	6.702
MANISA	GORDES	6,5	37	3263	0,01	10.812
GUMUSHANE	SIRAN	7	36	1124	0,03	6.854
BURDUR	ALTINYAYLA	7	35	1149	0,03	3.240
SIVAS	ZARA	6,5	35	3296	0,01	11.996
ISPARTA	SARKIKARAAGAC	6,5	35	2955	0,01	10.473
ORDU	KORGAN	6,5	34	2958	0,01	13.018
AFYON	SUHUT	6,5	34	3171	0,01	12.479
ADIYAMAN	TUT	7	34	1104	0,03	4.101
KARABUK	YENICE	6,5	33	2332	0,01	9.772
AYDIN	GERMENCIK	6,5	33	3082	0,01	12.588
HATAY	KUMLU	7	33	1101	0,03	5.167
MUGLA	YATAGAN	6,5	33	2808	0,01	17.707
VAN	EDREMIT	7	33	1088	0,03	12.426
AYDIN	YENIPAZAR	6,5	32	3125	0,01	6.609
KUTAHYA	EMET	6,5	31	2759	0,01	10.547
DENIZLI	BOZKURT	7	31	995	0,03	4.360
ELAZIG	SIVRICE	7	31	1011	0,03	4.236
SAMSUN	TEKKEKÖY	6,5	31	2451	0,01	36.728
KAYSERI	BUNYAN	6,5	30	2833	0,01	12.431
ZONGULDAK	ALAPLI	6,5	30	1457	0,02	18.194
AFYON	ISCEHISAR	6,5	29	2692	0,01	11.910
BILECIK	SOGUT	6,5	29	2169	0,01	15.007
GIRESUN	ALUCRA	7	29	928	0,03	4.970
CANKIRI	ORTA	7	29	925	0,03	3.815
DENIZLI	BAKLAN	7	29	942	0,03	2.062
ERZURUM	ASKALE	6,5	28	2705	0,01	12.447

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
ANKARA	NALLIHAN	6,5	28	2373	0,01	12.585
DIYARBAKIR	CERMIK	6,5	28	2819	0,01	17.389
MALATYA	POTURGE	7	28	910	0,03	2.751
ORDU	GURGENTEPE	6,5	28	2479	0,01	7.844
BURDUR	CAVDIR	7	28	882	0,03	3.112
ORDU	KUMRU	6,5	27	2138	0,01	11.948
GUMUSHANE	KELKIT	6,5	27	2452	0,01	14.012
KONYA	DOGANHISAR	6,5	27	2349	0,01	6.233
DENIZLI	ACIPAYAM	6,5	27	2009	0,01	12.588
ANKARA	KIZILCAHAMAM	6,5	27	1910	0,01	16.810
AYDIN	KARACASU	6,5	27	2488	0,01	6.154
ISPARTA	KECIBORLU	6,5	27	2503	0,01	7.134
ANTALYA	KALE (DEMRE)	6,5	26	2358	0,01	15.574
DIYARBAKIR	CUNGUS	7	26	868	0,03	2.544
ISPARTA	SENIRKENT	6,5	26	2301	0,01	6.932
VAN	GURPINAR	7	26	858	0,03	5.166
SAMSUN	ASARCIK	7,5	26	386	0,07	2.537
ADANA	POZANTI	6,5	26	2496	0,01	9.880
BINGOL	YAYLADERE	7	25	818	0,03	989
ELAZIG	ALACAKAYA	7	25	830	0,03	2.598
MALATYA	DOGANYOL	7	25	827	0,03	1.774
K.MARAS	CAGLAYANCERIT	6,5	25	2453	0,01	12.428
BURDUR	KEMER	7	24	799	0,03	2.012
BALIKESIR	KEPSUT	6,5	24	2183	0,01	5.763
IZMIR	KIRAZ	6,5	24	2303	0,01	8.469
EDIRNE	IPSALA	6,5	24	2325	0,01	8.033
ANTALYA	KEMER	6,5	24	2091	0,01	20.110
ADANA	KARATAS	6,5	24	2240	0,01	8.504
MUS	HASKOY	6,5	24	2332	0,01	13.389
CANKIRI	YAPRAKLI	7	24	776	0,03	1.771
ADANA	KARAISALI	6,5	24	2284	0,01	7.307
IZMIR	BEYDAG	6,5	23	2098	0,01	5.710
BITLIS	GUROYMAK	6,5	23	2288	0,01	20.226
MUGLA	KOYCEGIZ	6,5	23	2317	0,01	8.677
AYDIN	KUYUCAK	6,5	23	2091	0,01	7.701
BOLU	SEBEN	7	23	755	0,03	2.822
ANTALYA	FINIKE	6,5	23	1752	0,01	11.199
ELAZIG	KARAKOCAN	6,5	22	2016	0,01	12.708
SINOP	DURAGAN	6,5	22	1592	0,01	7.442
AYDIN	KOSK	6,5	22	2006	0,01	9.854
AFYON	BASMAKCI	6,5	22	2080	0,01	5.681
MUGLA	ULA	6,5	22	2151	0,01	5.602
ISPARTA	ULUBORLU	6,5	21	2051	0,01	6.520
VAN	GEVAS	6,5	21	2080	0,01	10.432
GAZIANTEP	ARABAN	6,5	21	2075	0,01	9.758
ERZINCAN	KEMAH	7	21	674	0,03	1.929
AFYON	SULTANDAGI	6,5	20	1822	0,01	6.288
AYDIN	BUHARKENT	6,5	20	1744	0,01	6.891
BALIKESIR	BALYA	7	20	653	0,03	1.901
DUZCE	YIGILCA	7	20	555	0,04	3.141
MALATYA	DOGANSEHIR	6,5	20	1843	0,01	10.800
BURSA	ORHANELI	6,5	20	1714	0,01	7.934
ORDU	AKKUS	7	20	572	0,03	5.746
USAK	ULUBEY	6,5	19	1716	0,01	4.945
ADIYAMAN	SINCIK	7	19	638	0,03	4.331

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
DENIZLI	AKKOY	7	19	634	0,03	2.755
AYDIN	SULTANHISAR	6,5	19	1695	0,01	6.229
BILECIK	PAZARYERI	6,5	19	1810	0,01	6.481
MUS	KORKUT	7	19	625	0,03	3.102
AFYON	COBANLAR	6,5	19	1831	0,01	8.774
DENIZLI	BEKILLI	6,5	19	1823	0,01	3.481
DENIZLI	HONAZ	6,5	18	1757	0,01	9.788
AYDIN	KOCARLI	6,5	18	1697	0,01	6.822
ADANA	YUMURTALIK	6,5	18	1650	0,01	5.220
ISPARTA	GELENDOST	6,5	18	1730	0,01	5.351
KUTAHYA	HISARCIK	6,5	18	1395	0,01	4.877
DENIZLI	BABADAG	6,5	17	1684	0,01	4.185
KONYA	DERBENT	6,5	17	1713	0,01	2.922
CORUM	BAYAT	6,5	17	1531	0,01	8.828
AFYON	BAYAT	6,5	17	1654	0,01	4.489
MANISA	KOPRUBASI	6,5	17	1587	0,01	5.283
ELAZIG	ARICAK	7	17	538	0,03	3.380
KONYA	HUYUK	6,5	16	1513	0,01	3.695
CORUM	MECITOZU	6,5	16	1522	0,01	5.261
CORUM	LACIN	7	16	521	0,03	1.227
ANTALYA	KAS	6,5	16	1126	0,01	6.857
KUTAHYA	SAPHANE	6,5	16	1491	0,01	3.623
CANAKKALE	YENICE	6,5	16	1463	0,01	6.830
ISPARTA	ATABEY	6,5	15	1462	0,01	4.355
AMASYA	HAMAMOZU	7	15	481	0,03	1.405
BURDUR	AGLASUN	6,5	15	1443	0,01	4.414
DIYARBAKIR	DICLE	6,5	15	1482	0,01	8.610
KARABUK	OVACIK	7,5	15	229	0,06	783
TOKAT	PAZAR	6,5	14	1358	0,01	4.986
NIGDE	CAMARDI	6,5	14	1353	0,01	3.480
SAMSUN	SALIPAZARI	6,5	14	1162	0,01	6.156
CANKIRI	ELDIVAN	6,5	14	1329	0,01	3.034
ERZINCAN	OTLUKBELI	7	13	435	0,03	1.630
KUTAHYA	ALTINTAS	6,5	13	1192	0,01	5.538
AFYON	DAZKIRI	6,5	13	1162	0,01	4.470
ISPARTA	GONEN	6,5	12	1185	0,01	3.663
BOLU	KIBRISCIK	7	12	405	0,03	1.345
KONYA	TUZLUKCU	6,5	12	1218	0,01	3.912
SINOP	SARAYDUZU	7	12	388	0,03	951
KUTAHYA	PAZARLAR	6,5	12	1103	0,01	3.660
ORDU	CATALPINAR	6,5	11	999	0,01	5.333
SAKARYA	KAYNARCA	6,5	11	911	0,01	5.144
AFYON	EVCILER	6,5	11	1071	0,01	4.142
ERZURUM	TEKMAN	6,5	11	1040	0,01	3.957
DENIZLI	CAMELI	6,5	9	854	0,01	2.837
GAZIANTEP	YAVUZELI	6,5	9	909	0,01	4.093
BURSA	KELES	6,5	9	873	0,01	3.681
CANKIRI	SABANOZU	6,5	9	897	0,01	5.124
AYDIN	KARPUZLU	6,5	9	863	0,01	2.116
CORUM	ORTAKOY	6,5	9	834	0,01	2.945
BURDUR	CELTIKCI	6,5	9	856	0,01	2.374
ADIYAMAN	GERGER	6,5	9	901	0,01	3.242
KUTAHYA	CAVDARHISAR	6,5	8	809	0,01	2.412
DENIZLI	BEYAGAC	6,5	8	807	0,01	2.664
ESKISEHIR	MIHALGAZI	6,5	8	765	0,01	1.951

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
OSMANIYE	SUMBAS	6,5	7	733	0,01	2.114
AFYON	IHSANIYE	6,5	7	711	0,01	2.341
TUNCELI	OVACIK	6,5	7	642	0,01	3.227
MALATYA	KALE	6,5	7	675	0,01	2.030
AMASYA	GOYNUCEK	6,5	7	620	0,01	2.421
KUTAHYA	DUMLUPINAR	6,5	6	599	0,01	1.438
VAN	SARAY	6,5	6	585	0,01	3.591
KONYA	AKOREN	6,5	6	1214	0,00	3.442
BILECIK	INHISAR	6,5	5	516	0,01	1.085
BILECIK	YENIPAZAR	6,5	5	473	0,01	1.115
ESKISEHIR	SARICAKAYA	6,5	5	971	0,01	2.150
KUTAHYA	ASLANAPA	6,5	5	483	0,01	1.893
TUNCELI	NAZIMIYE	6,5	4	313	0,01	1.636
KILIS	MUSABEYLI	6,5	2	175	0,01	856

C: Central

CATEGORY II - SETTLEMENTS HAVING POPULATION BETWEEN 50.000 AND 490.000

CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
VAN	VAN C.	7,5	2285	36235	0,06	360.810
ERZINCAN	ERZİNCAN C.	8	2025	12678	0,16	90.100
BOLU	BOLU C.	8	1841	10516	0,18	120.021
YALOVA	YALOVA C.	8	1507	8302	0,18	92.166
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	15683	0,09	140.535
TOKAT	ERBAA	8	1251	7895	0,16	58.845
BURSA	ORHANGAZI	8	945	5313	0,18	54.319
MANISA	MANİSA C.	7	919	24785	0,04	291.374
OSMANIYE	OSMANİYE C.	7	905	29408	0,03	194.339
HATAY	ANTAKYA	7	768	23471	0,03	202.216
HATAY	ISKENDERUN	7	705	21169	0,03	190.279
ADIYAMAN	ADIYAMAN C.	7	696	21965	0,03	198.433
AMASYA	MERZIFON	7,5	666	9411	0,07	52.225
MANISA	TURGUTLU	7	639	19331	0,03	115.930
DUZCE	DÜZCE C.	7,5	612	8593	0,07	125.240
DENIZLI	DENİZLİ C.	6,5	586	41993	0,01	488.768
MANISA	AKHISAR	7	585	17775	0,03	100.897
BURSA	INEGOL	7	536	14095	0,04	161.541
TOKAT	TOKAT C.	7	528	15371	0,03	129.879
MANISA	SALIHLI	7	483	13639	0,04	96.503
BALIKESIR	BALIKESİR C.	6,5	469	30918	0,02	259.157
BALIKESIR	BANDIRMA	7	460	12035	0,04	113.385
K.MARAS	K.MARAŞ C.	6,5	457	41470	0,01	384.953
IZMIR	BERGAMA	7	402	12446	0,03	58.570
KUTAHYA	KÜTAHYA C.	6,5	384	27490	0,01	212.444
ICEL(MERSIN)	TARSUS	6,5	361	33303	0,01	233.436
HATAY	KIRIKHAN	7	360	11860	0,03	69.285
ISPARTA	ISPARTA C.	6,5	354	26357	0,01	190.084
CANAKKALE	ÇANAKKALE C.	7	339	9281	0,04	96.588

CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
AMASYA	AMASYA C.	7	336	9432	0,04	86.667
HATAY	DORTYOL	7	333	10708	0,03	69.507
BURSA	M.KEMALPASA	7	304	8460	0,04	57.097
AYDIN	AYDIN C.	6,5	303	19320	0,02	179.425
CORUM	ÇORUM C.	6,5	286	21086	0,01	212.418
HATAY	REYHANLI	7	280	9267	0,03	61.306
EDIRNE	KESAN	7	269	8056	0,03	53.391
BALIKESIR	EDREMIT	7	262	7636	0,03	50.523
BURSA	KARACABEY	7	258	7657	0,03	51.907
BINGOL	BİNGÖL C.	7	251	7211	0,03	89.224
AFYON	AFYON C.	6,5	240	17973	0,01	170.455
TEKIRDAG	CORLU	6,5	230	15526	0,01	206.134
AYDIN	KUSADASI	6,5	211	17726	0,01	61.648
AYDIN	NAZILLI	6,5	210	16583	0,01	109.800
IZMIR	ODEMIS	6,5	190	14665	0,01	73.310
ADANA	KOZAN	6,5	184	17670	0,01	74.521
KARABUK	KARABÜK C.	6,5	180	13714	0,01	108.167
ADANA	CEYHAN	6,5	171	16033	0,01	104.572
OSMANIYE	KADIRLI	6,5	167	16164	0,01	78.964
BURDUR	BURDUR C.	6,5	156	13011	0,01	71.611
MUGLA	FETHIYE	6,5	144	12810	0,01	72.003
AYDIN	SOKE	6,5	138	10442	0,01	67.234
MANISA	SOMA	6,5	133	9885	0,01	74.158
TOKAT	TURHAL	6,5	125	10797	0,01	64.090
IZMIR	TIRE	6,5	124	10443	0,01	50.900
KONYA	AKSEHIR	6,5	121	8790	0,01	61.196
KASTAMONU	KASTAMONU C.	6,5	121	9197	0,01	86.085
MUGLA	MUĞLA C.	6,5	109	8723	0,01	61.550
DIYARBAKIR	ERGANI	6,5	108	10522	0,01	63.065
BILECIK	BOZUYUK	6,5	96	7901	0,01	56.782
MUGLA	MILAS	6,5	92	8112	0,01	50.975
CANKIRI	ÇANKIRI C.	6,5	90	7084	0,01	69.087
MUS	MUŞ C.	6,5	77	6631	0,01	72.774
ADIYAMAN	KAHTA	6,5	74	7031	0,01	61.243
TEKIRDAG	CERKEZKOY	6,5	73	5172	0,01	69.875
BITLIS	TATVAN	6,5	65	5864	0,01	56.996
KAYSERI	TALAS	6,5	42	2924	0,01	81.566

C: Central

CATEGORY III - METROPOLITAN CITIES

CATEGORY Metropolitan Cities	SUB-PROVINCE	Intensity	Absolute Loss	Total Building	Relative Loss, Loss Rate	Settlement Population (2009)
ISTANBUL	ISTANBUL (M.)	7,5	83824	864540	0,10	12.782.960
KOCAELI	KOCAELI (M.)	8	24077	139423	0,17	1.422.752
BURSA	BURSA (M.)	7,5	16506	204907	0,08	1.854.285
IZMIR	IZMIR (M.)	7	14531	421397	0,03	3.276.815
SAKARYA	SAKARYA (M.)	8	8070	49609	0,16	442.157
ADANA	ADANA (M.)	6,5	1913	175697	0,01	1.556.238
ANTALYA	ANTALYA (M.)	6,5	1402	114998	0,01	955.573
KONYA	KONYA (M.)	6,5	1355	113267	0,01	1.003.373
ERZURUM	ERZURUM (M.)	6,5	439	32458	0,01	368.146

M: Metropolitan

APPENDIX D

TOTAL LISTS OF CATEGORIES OF SETTLEMENTS PRIORITIZED ACCORDING TO RELATIVE LOSS

CATEGORY I – SETTLEMENTS HAVING POPULATION UP TO 50.000

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
YALOVA	CINARCIK	8	0,21	1675	357	11.080
SAKARYA	AKYAZI	8	0,19	3668	681	41.179
YALOVA	CIFTLIKKOY	8	0,19	1594	298	17.052
TEKIRDAG	SARKOY	8	0,18	4059	712	16.624
TOKAT	NIKSAR	8	0,17	8343	1400	33.682
SAKARYA	HENDEK	8	0,17	4969	869	44.418
BOLU	GEREDE	8	0,17	3439	583	23.808
AMASYA	TASOVA	8	0,17	1677	282	10.821
YALOVA	TERMAL	8	0,17	425	73	2.340
KASTAMONU	TOSYA	8	0,16	8575	1364	27.624
CORUM	OSMANCIK	8	0,16	5037	786	25.829
SAMSUN	HAVZA	8	0,16	4620	735	20.204
SAKARYA	GEYVE	8	0,16	3491	543	20.318
SIVAS	SUSEHRI	8	0,16	2589	424	15.304
SAMSUN	LADIK	8	0,16	2426	377	8.316
CANKIRI	ILGAZ	8	0,16	1913	312	7.738
TOKAT	RESADIYE	8	0,16	1941	309	9.027
BOLU	YENICAGA	8	0,16	1120	183	5.175
GIRESUN	CAMOLUK	8	0,16	859	133	2.023
TUNCELI	PULUMUR	8	0,16	572	94	1.656
BOLU	DORTDIVAN	8	0,16	589	93	2.952
YALOVA	ALTINOVA	8	0,16	534	84	4.942
SIVAS	GOLOVA	8	0,16	469	74	2.174
ERZINCAN	UZUMLU	8	0,15	4187	631	8.288
SAKARYA	PAMUKOVA	8	0,15	2600	403	16.047
MUS	VARTO	8	0,15	2562	384	9.585
CORUM	KARGI	8	0,15	1878	285	5.226
SIVAS	KOYULHISAR	8	0,15	1806	273	4.426
CANKIRI	CERKES	8	0,15	1728	263	9.404
SIVAS	AKINCILAR	8	0,15	1379	211	2.775
TOKAT	BASCIFTLIK	8	0,15	1225	182	3.840
DUZCE	KAYNASLI	8	0,15	1171	177	9.418
BINGOL	KARLIOVA	8	0,15	911	138	6.202
SAKARYA	KARAPURCEK	8	0,15	910	136	7.452
ERZINCAN	REFAHIYE	8	0,15	849	130	3.563
DUZCE	GOLYAKA	8	0,15	819	126	8.793
BINGOL	YEDISU	8	0,15	460	68	1.352
CANKIRI	BAYRAMOREN	8	0,15	282	43	880
YALOVA	ARMUTLU	7,5	0,08	2083	164	5.223
AMASYA	SULUOVA	7,5	0,07	9653	633	37.151
BURSA	YENISEHIR	7,5	0,07	5028	339	29.275
SAMSUN	VEZIRKOPRU	7,5	0,07	4455	298	26.724
AMASYA	GUMUSHACIKOY	7,5	0,07	4176	271	14.620

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
BILECIK	OSMANELI	7,5	0,07	2390	158	13.760
SAMSUN	KAVAK	7,5	0,07	1393	97	8.435
KARABUK	ESKIPAZAR	7,5	0,07	1394	96	6.916
DUZCE	GUMUSOVA	7,5	0,07	1294	86	6.483
BOLU	MENGEN	7,5	0,07	1038	76	5.170
TOKAT	ALMUS	7,5	0,07	1070	74	4.408
SAMSUN	ASARCIK	7,5	0,07	386	26	2.537
BURSA	IZNIK	7,5	0,06	3968	252	22.574
MUS	BULANIK	7,5	0,06	4278	246	21.352
GIRESUN	SEBINKARAHISAR	7,5	0,06	3441	222	11.921
BITLIS	ADILCEVAZ	7,5	0,06	2866	172	14.428
BOLU	MUDURNU	7,5	0,06	1656	104	4.596
CANKIRI	KURSUNLU	7,5	0,06	1312	84	3.939
BOLU	GOYNUK	7,5	0,06	1223	75	4.182
DUZCE	CUMAYERI	7,5	0,06	1056	67	7.824
SAKARYA	TARAKLI	7,5	0,06	1087	67	3.055
ERZINCAN	CAYIRLI	7,5	0,06	1000	61	3.089
CORUM	DODURGA	7,5	0,06	991	60	3.065
ORDU	MESUDIYE	7,5	0,06	965	60	3.031
BINGOL	ADAKLI	7,5	0,06	851	52	3.143
DUZCE	CILIMLI	7,5	0,06	794	49	6.348
CANKIRI	ATKARACALAR	7,5	0,06	713	45	2.730
CANKIRI	KORGUN	7,5	0,06	704	44	2.129
BINGOL	KIGI	7,5	0,06	698	43	3.220
SIVAS	DOGANSAR	7,5	0,06	600	37	1.508
KARABUK	OVACIK	7,5	0,06	229	15	783
BITLIS	AHLAT	7,5	0,04	5609	234	19.078
BALIKESIR	ERDEK	7	0,04	4193	159	20.876
BILECIK	BİLECİK C.	7	0,04	4025	145	46.403
ELAZIG	KOVANCILAR	7	0,04	2060	74	20.246
DUZCE	YIGILCA	7	0,04	555	20	3.141
BALIKESIR	AYVALIK	7	0,03	14115	442	35.986
BALIKESIR	BURHANIYE	7	0,03	13164	410	38.156
IZMIR	CESME	7	0,03	11532	348	20.455
MANISA	ALASEHIR	7	0,03	9553	306	47.942
MANISA	KULA	7	0,03	7694	236	24.241
HATAY	SAMANDAG	7	0,03	7232	232	44.137
BALIKESIR	SUSURLUK	7	0,03	5693	190	23.952
CANAKKALE	BIGA	7	0,03	5654	188	36.520
HATAY	ERZIN	7	0,03	5749	173	30.356
CORUM	ISKILIP	7	0,03	5106	167	20.724
CANAKKALE	CAN	7	0,03	5016	161	28.769
HATAY	BELEN	7	0,03	5093	159	20.892
TEKIRDAG	MALKARA	7	0,03	4518	157	27.371
GAZIANTEP	ISLAHIYE	7	0,03	4949	148	30.904
DENIZLI	BULDAN	7	0,03	4282	137	15.197
ADIYAMAN	GOLBASI	7	0,03	4284	137	27.800
ORDU	GOLKOY	7	0,03	4246	134	16.410
MANISA	SARIGOL	7	0,03	4250	130	13.406
CANAKKALE	BAYRAMIC	7	0,03	4157	129	13.290
ADIYAMAN	BESNI	7	0,03	4254	126	26.788
MUS	MALAZGIRT	7	0,03	4146	125	19.130
ORDU	AYBASTI	7	0,03	3742	125	14.175
CANAKKALE	EZINE	7	0,03	3901	121	13.202
K.MARAS	PAZARCIK	7	0,03	3944	120	28.713

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
USAK	ESME	7	0,03	3797	119	13.532
BALIKESIR	BIGADIC	7	0,03	3533	114	16.062
MANISA	SARUHANLI	7	0,03	3637	112	15.336
BURDUR	GOLHISAR	7	0,03	3496	110	13.424
BALIKESIR	HAVRAN	7	0,03	3389	107	10.671
ERZURUM	HINIS	7	0,03	3551	107	9.654
EDIRNE	ENEZ	7	0,03	3484	105	3.820
BALIKESIR	SINDIRGI	7	0,03	3141	100	12.672
MANISA	GOLMARMARA	7	0,03	2983	91	9.840
BALIKESIR	GOMEC	7	0,03	2927	87	4.788
MANISA	AHMETLI	7	0,03	2704	83	9.916
CANAKKALE	LAPSEKI	7	0,03	2184	74	10.624
ERZURUM	KARACOBAN	7	0,03	2423	73	8.804
BALIKESIR	SAVASTEPE	7	0,03	2307	72	9.368
OSMANIYE	BAHCE	7	0,03	2305	70	12.917
ANKARA	CAMLIDERE	7	0,03	2285	70	3.747
GAZIANTEP	NURDAGI	7	0,03	2273	69	16.328
K.MARAS	TURKOGLU	7	0,03	2262	68	14.274
SAKARYA	FERIZLI	7	0,03	1924	61	12.914
BURDUR	KARAMANLI	7	0,03	1914	60	5.251
VAN	BASKALE	7	0,03	1986	60	12.562
BILECIK	GOLPAZARI	7	0,03	1862	58	7.697
CANAKKALE	AYVACIK	7	0,03	1849	57	7.538
DENIZLI	GUNEY	7	0,03	1857	57	5.908
ELAZIG	PALU	7	0,03	1812	55	8.837
HATAY	YAYLADAGI	7	0,03	1774	54	5.843
BINGOL	GENC	7	0,03	1676	54	18.691
DENIZLI	CAL	7	0,03	1738	53	3.887
BALIKESIR	MANYAS	7	0,03	1607	51	6.578
ELAZIG	MADEN	7	0,03	1653	51	5.314
HATAY	HASSA	7	0,03	1673	50	9.207
BURDUR	TEFENNI	7	0,03	1606	50	4.626
OSMANIYE	TOPRAKKALE	7	0,03	1661	50	7.843
BURDUR	YESILOVA	7	0,03	1587	49	4.724
BALIKESIR	IVRINDI	7	0,03	1537	49	6.514
KASTAMONU	IHSANGAZI	7	0,03	1473	48	2.715
KASTAMONU	ARAC	7	0,03	1393	45	5.776
IZMIR	KARABURUN	7	0,03	1485	45	2.785
CORUM	OGUZLAR	7	0,03	1463	44	3.741
ERZINCAN	TERCAN	7	0,03	1430	44	5.416
VAN	OZALP	7	0,03	1417	43	10.166
OSMANIYE	HASANBEYLI	7	0,03	1446	43	2.559
DENIZLI	CARDAK	7	0,03	1360	43	4.634
HATAY	ALTINOZU	7	0,03	1345	41	7.458
SIVAS	IMRANLI	7	0,03	1304	40	3.303
ADIYAMAN	CELIKHAN	7	0,03	1265	38	8.224
ERZURUM	CAT	7	0,03	1234	37	4.527
SAMSUN	AYVACIK	7	0,03	1189	37	6.702
GUMUSHANE	SIRAN	7	0,03	1124	36	6.854
BURDUR	ALTINYAYLA	7	0,03	1149	35	3.240
ADIYAMAN	TUT	7	0,03	1104	34	4.101
HATAY	KUMLU	7	0,03	1101	33	5.167
VAN	EDREMIT	7	0,03	1088	33	12.426
DENIZLI	BOZKURT	7	0,03	995	31	4.360
ELAZIG	SIVRICE	7	0,03	1011	31	4.236

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
GIRESUN	ALUCRA	7	0,03	928	29	4.970
CANKIRI	ORTA	7	0,03	925	29	3.815
DENIZLI	BAKLAN	7	0,03	942	29	2.062
MALATYA	POTURGE	7	0,03	910	28	2.751
BURDUR	CAVDIR	7	0,03	882	28	3.112
DIYARBAKIR	CUNGUS	7	0,03	868	26	2.544
VAN	GURPINAR	7	0,03	858	26	5.166
BINGOL	YAYLADERE	7	0,03	818	25	989
ELAZIG	ALACAKAYA	7	0,03	830	25	2.598
MALATYA	DOGANYOL	7	0,03	827	25	1.774
BURDUR	KEMER	7	0,03	799	24	2.012
CANKIRI	YAPRAKLI	7	0,03	776	24	1.771
BOLU	SEBEN	7	0,03	755	23	2.822
ERZINCAN	KEMAH	7	0,03	674	21	1.929
BALIKESIR	BALYA	7	0,03	653	20	1.901
ORDU	AKKUS	7	0,03	572	20	5.746
ADIYAMAN	SINCIK	7	0,03	638	19	4.331
DENIZLI	AKKOY	7	0,03	634	19	2.755
MUS	KORKUT	7	0,03	625	19	3.102
ELAZIG	ARICAK	7	0,03	538	17	3.380
CORUM	LACIN	7	0,03	521	16	1.227
AMASYA	HAMAMOZU	7	0,03	481	15	1.405
ERZINCAN	OTLUKBELI	7	0,03	435	13	1.630
BOLU	KIBRISCIK	7	0,03	405	12	1.345
SINOP	SARAYDUZU	7	0,03	388	12	951
KUTAHYA	SIMAV	6,5	0,02	4870	73	24.799
MUGLA	MARMARIS	6,5	0,02	3545	54	30.101
DUZCE	AKCAKOCA	6,5	0,02	2751	42	23.378
ZONGULDAK	ALAPLI	6,5	0,02	1457	30	18.194
AYDIN	DİDİM(YENİHİSAR)	6,5	0,01	18697	204	41.246
MUGLA	BODRUM	6,5	0,01	12850	130	31.590
AFYON	BOLVADIN	6,5	0,01	9687	105	31.284
TOKAT	ZILE	6,5	0,01	9275	100	35.417
BALIKESIR	GONEN	6,5	0,01	7512	93	42.939
BURDUR	BUCAK	6,5	0,01	7405	87	36.370
OSMANIYE	DUZICI	6,5	0,01	7540	76	40.823
KARABUK	SAFRANBOLU	6,5	0,01	6030	76	39.669
AYDIN	CINE	6,5	0,01	5631	64	20.416
AFYON	EMIRDAG	6,5	0,01	5372	63	20.253
KONYA	ILGIN	6,5	0,01	5510	62	31.171
AFYON	CAY	6,5	0,01	5129	59	14.592
SAKARYA	KARASU	6,5	0,01	4218	57	27.914
ANTALYA	KUMLUCA	6,5	0,01	4711	56	30.939
MANISA	KIRKAGAC	6,5	0,01	5152	56	26.660
ANTALYA	KORKUTELI	6,5	0,01	4225	54	20.109
ADANA	IMAMOGLU	6,5	0,01	5136	52	20.636
ISPARTA	EGIRDIR	6,5	0,01	4014	50	18.402
SINOP	BOYABAT	6,5	0,01	3732	50	25.271
MUGLA	ORTACA	6,5	0,01	4427	50	25.816
MANISA	DEMIRCI	6,5	0,01	4448	48	19.550
KAYSERI	YAHYALI	6,5	0,01	4513	48	20.066
AYDIN	INCIRLIOVA	6,5	0,01	4029	47	19.438
MUGLA	DALAMAN	6,5	0,01	4248	47	22.956
ISPARTA	YALVAC	6,5	0,01	3371	46	20.448
KUTAHYA	GEDIZ	6,5	0,01	4525	46	19.546

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
AYDIN	BOZDOGAN	6,5	0,01	4128	45	9.713
ERZURUM	PASINLER	6,5	0,01	4237	43	13.969
USAK	BANAZ	6,5	0,01	3252	43	15.395
DENIZLI	SARAYKOY	6,5	0,01	3360	43	18.526
ANTALYA	ELMALI	6,5	0,01	3649	42	14.478
IZMIR	KINIK	6,5	0,01	3869	39	11.919
SAKARYA	KOCAALI	6,5	0,01	3461	39	12.560
TEKIRDAG	MURATLI	6,5	0,01	3558	39	19.107
MUGLA	DATCA	6,5	0,01	3566	37	9.958
KASTAMONU	TASKOPRU	6,5	0,01	2643	37	16.385
MANISA	GORDES	6,5	0,01	3263	37	10.812
SIVAS	ZARA	6,5	0,01	3296	35	11.996
ISPARTA	SARKIKARAAGAC	6,5	0,01	2955	35	10.473
ORDU	KORGAN	6,5	0,01	2958	34	13.018
AFYON	SUHUT	6,5	0,01	3171	34	12.479
KARABUK	YENICE	6,5	0,01	2332	33	9.772
AYDIN	GERMENCIK	6,5	0,01	3082	33	12.588
MUGLA	YATAGAN	6,5	0,01	2808	33	17.707
AYDIN	YENIPAZAR	6,5	0,01	3125	32	6.609
KUTAHYA	EMET	6,5	0,01	2759	31	10.547
SAMSUN	TEKKEKÖY	6,5	0,01	2451	31	36.728
KAYSERI	BUNYAN	6,5	0,01	2833	30	12.431
AFYON	ISCEHISAR	6,5	0,01	2692	29	11.910
BILECIK	SOGUT	6,5	0,01	2169	29	15.007
ERZURUM	ASKALE	6,5	0,01	2705	28	12.447
ANKARA	NALLIHAN	6,5	0,01	2373	28	12.585
DIYARBAKIR	CERMIK	6,5	0,01	2819	28	17.389
ORDU	GURGENTEPE	6,5	0,01	2479	28	7.844
ORDU	KUMRU	6,5	0,01	2138	27	11.948
GUMUSHANE	KELKIT	6,5	0,01	2452	27	14.012
KONYA	DOGANHISAR	6,5	0,01	2349	27	6.233
DENIZLI	ACIPAYAM	6,5	0,01	2009	27	12.588
ANKARA	KIZILCAHAMAM	6,5	0,01	1910	27	16.810
AYDIN	KARACASU	6,5	0,01	2488	27	6.154
ISPARTA	KECIBORLU	6,5	0,01	2503	27	7.134
ANTALYA	KALE (DEMRE)	6,5	0,01	2358	26	15.574
ISPARTA	SENIRKENT	6,5	0,01	2301	26	6.932
ADANA	POZANTI	6,5	0,01	2496	26	9.880
K.MARAS	CAGLAYANCERIT	6,5	0,01	2453	25	12.428
BALIKESIR	KEPSUT	6,5	0,01	2183	24	5.763
IZMIR	KIRAZ	6,5	0,01	2303	24	8.469
EDIRNE	IPSALA	6,5	0,01	2325	24	8.033
ANTALYA	KEMER	6,5	0,01	2091	24	20.110
ADANA	KARATAS	6,5	0,01	2240	24	8.504
MUS	HASKOY	6,5	0,01	2332	24	13.389
ADANA	KARAISALI	6,5	0,01	2284	24	7.307
IZMIR	BEYDAG	6,5	0,01	2098	23	5.710
BITLIS	GUROYMAK	6,5	0,01	2288	23	20.226
MUGLA	KOYCEGIZ	6,5	0,01	2317	23	8.677
AYDIN	KUYUCAK	6,5	0,01	2091	23	7.701
ANTALYA	FINIKE	6,5	0,01	1752	23	11.199
ELAZIG	KARAKOCAN	6,5	0,01	2016	22	12.708
SINOP	DURAGAN	6,5	0,01	1592	22	7.442
AYDIN	KOSK	6,5	0,01	2006	22	9.854
AFYON	BASMAKCI	6,5	0,01	2080	22	5.681

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
MUGLA	ULA	6,5	0,01	2151	22	5.602
ISPARTA	ULUBORLU	6,5	0,01	2051	21	6.520
VAN	GEVAS	6,5	0,01	2080	21	10.432
GAZIANTEP	ARABAN	6,5	0,01	2075	21	9.758
AFYON	SULTANDAGI	6,5	0,01	1822	20	6.288
AYDIN	BUHARKENT	6,5	0,01	1744	20	6.891
MALATYA	DOGANSEHIR	6,5	0,01	1843	20	10.800
BURSA	ORHANELI	6,5	0,01	1714	20	7.934
USAK	ULUBEY	6,5	0,01	1716	19	4.945
AYDIN	SULTANHISAR	6,5	0,01	1695	19	6.229
BILECIK	PAZARYERI	6,5	0,01	1810	19	6.481
AFYON	COBANLAR	6,5	0,01	1831	19	8.774
DENIZLI	BEKILLI	6,5	0,01	1823	19	3.481
DENIZLI	HONAZ	6,5	0,01	1757	18	9.788
AYDIN	KOCARLI	6,5	0,01	1697	18	6.822
ADANA	YUMURTALIK	6,5	0,01	1650	18	5.220
ISPARTA	GELENDOST	6,5	0,01	1730	18	5.351
KUTAHYA	HISARCIK	6,5	0,01	1395	18	4.877
DENIZLI	BABADAG	6,5	0,01	1684	17	4.185
KONYA	DERBENT	6,5	0,01	1713	17	2.922
CORUM	BAYAT	6,5	0,01	1531	17	8.828
AFYON	BAYAT	6,5	0,01	1654	17	4.489
MANISA	KOPRUBASI	6,5	0,01	1587	17	5.283
KONYA	HUYUK	6,5	0,01	1513	16	3.695
CORUM	MECITOZU	6,5	0,01	1522	16	5.261
ANTALYA	KAS	6,5	0,01	1126	16	6.857
KUTAHYA	SAPHANE	6,5	0,01	1491	16	3.623
CANAKKALE	YENICE	6,5	0,01	1463	16	6.830
ISPARTA	ATABEY	6,5	0,01	1462	15	4.355
BURDUR	AGLASUN	6,5	0,01	1443	15	4.414
DIYARBAKIR	DICLE	6,5	0,01	1482	15	8.610
TOKAT	PAZAR	6,5	0,01	1358	14	4.986
NIGDE	CAMARDI	6,5	0,01	1353	14	3.480
SAMSUN	SALIPAZARI	6,5	0,01	1162	14	6.156
CANKIRI	ELDIVAN	6,5	0,01	1329	14	3.034
KUTAHYA	ALTINTAS	6,5	0,01	1192	13	5.538
AFYON	DAZKIRI	6,5	0,01	1162	13	4.470
ISPARTA	GONEN	6,5	0,01	1185	12	3.663
KONYA	TUZLUKCU	6,5	0,01	1218	12	3.912
KUTAHYA	PAZARLAR	6,5	0,01	1103	12	3.660
ORDU	CATALPINAR	6,5	0,01	999	11	5.333
SAKARYA	KAYNARCA	6,5	0,01	911	11	5.144
AFYON	EVCILER	6,5	0,01	1071	11	4.142
ERZURUM	TEKMAN	6,5	0,01	1040	11	3.957
DENIZLI	CAMELI	6,5	0,01	854	9	2.837
GAZIANTEP	YAVUZELI	6,5	0,01	909	9	4.093
BURSA	KELES	6,5	0,01	873	9	3.681
CANKIRI	SABANOZU	6,5	0,01	897	9	5.124
AYDIN	KARPUZLU	6,5	0,01	863	9	2.116
CORUM	ORTAKOY	6,5	0,01	834	9	2.945
BURDUR	CELTIKCI	6,5	0,01	856	9	2.374
ADIYAMAN	GERGER	6,5	0,01	901	9	3.242
KUTAHYA	CAVDARHISAR	6,5	0,01	809	8	2.412
DENIZLI	BEYAGAC	6,5	0,01	807	8	2.664
ESKISEHIR	MIHALGAZI	6,5	0,01	765	8	1.951

CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
OSMANIYE	SUMBAS	6,5	0,01	733	7	2.114
AFYON	IHSANIYE	6,5	0,01	711	7	2.341
TUNCELI	OVACIK	6,5	0,01	642	7	3.227
MALATYA	KALE	6,5	0,01	675	7	2.030
AMASYA	GOYNUCEK	6,5	0,01	620	7	2.421
KUTAHYA	DUMLUPINAR	6,5	0,01	599	6	1.438
VAN	SARAY	6,5	0,01	585	6	3.591
BILECIK	INHISAR	6,5	0,01	516	5	1.085
BILECIK	YENIPAZAR	6,5	0,01	473	5	1.115
ESKISEHIR	SARICAKAYA	6,5	0,01	971	5	2.150
KUTAHYA	ASLANAPA	6,5	0,01	483	5	1.893
TUNCELI	NAZIMIYE	6,5	0,01	313	4	1.636
KILIS	MUSABEYLI	6,5	0,01	175	2	856
KONYA	AKOREN	6,5	0,00	1214	6	3.442

C: Central

CATEGORY II - SETTLEMENTS HAVING POPULATION BETWEEN 50.000 AND 490.000

CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
BOLU	BOLU C.	8	0,18	10516	1841	120.021
YALOVA	YALOVA C.	8	0,18	8302	1507	92.166
BURSA	ORHANGAZI	8	0,18	5313	945	54.319
ERZINCAN	ERZİNCAN C.	8	0,16	12678	2025	90.100
TOKAT	ERBAA	8	0,16	7895	1251	58.845
TEKIRDAG	TEKİRDAĞ C.	7,5	0,09	15683	1347	140.535
AMASYA	MERZIFON	7,5	0,07	9411	666	52.225
DUZCE	DÜZCE C.	7,5	0,07	8593	612	125.240
VAN	VAN C.	7,5	0,06	36235	2285	360.810
MANISA	MANİSA C.	7	0,04	24785	919	291.374
BURSA	INEGOL	7	0,04	14095	536	161.541
MANISA	SALIHLI	7	0,04	13639	483	96.503
BALIKESIR	BANDIRMA	7	0,04	12035	460	113.385
CANAKKALE	ÇANAKKALE C.	7	0,04	9281	339	96.588
AMASYA	AMASYA C.	7	0,04	9432	336	86.667
BURSA	M.KEMALPASA	7	0,04	8460	304	57.097
OSMANIYE	OSMANİYE C.	7	0,03	29408	905	194.339
HATAY	ANTAKYA	7	0,03	23471	768	202.216
HATAY	ISKENDERUN	7	0,03	21169	705	190.279
ADIYAMAN	ADIYAMAN C.	7	0,03	21965	696	198.433
MANISA	TURGUTLU	7	0,03	19331	639	115.930
MANISA	AKHISAR	7	0,03	17775	585	100.897
TOKAT	TOKAT C.	7	0,03	15371	528	129.879
IZMIR	BERGAMA	7	0,03	12446	402	58.570
HATAY	KIRIKHAN	7	0,03	11860	360	69.285
HATAY	DORTYOL	7	0,03	10708	333	69.507
HATAY	REYHANLI	7	0,03	9267	280	61.306
EDIRNE	KESAN	7	0,03	8056	269	53.391
BALIKESIR	EDREMIT	7	0,03	7636	262	50.523
BURSA	KARACABEY	7	0,03	7657	258	51.907
BINGOL	BİNGÖL C.	7	0,03	7211	251	89.224

CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
BALIKESIR	BALIKESİR C.	6,5	0,02	30918	469	259.157
AYDIN	AYDIN C.	6,5	0,02	19320	303	179.425
DENIZLI	DENİZLİ C.	6,5	0,01	41993	586	488.768
K.MARAS	K.MARAŞ C.	6,5	0,01	41470	457	384.953
KUTAHYA	KÜTAHYA C.	6,5	0,01	27490	384	212.444
ICEL(MERSIN)	TARSUS	6,5	0,01	33303	361	233.436
ISPARTA	ISPARTA C.	6,5	0,01	26357	354	190.084
CORUM	ÇORUM C.	6,5	0,01	21086	286	212.418
AFYON	AFYON C.	6,5	0,01	17973	240	170.455
TEKIRDAG	CORLU	6,5	0,01	15526	230	206.134
AYDIN	KUSADASI	6,5	0,01	17726	211	61.648
AYDIN	NAZILLI	6,5	0,01	16583	210	109.800
IZMIR	ODEMIS	6,5	0,01	14665	190	73.310
ADANA	KOZAN	6,5	0,01	17670	184	74.521
KARABUK	KARABÜK C.	6,5	0,01	13714	180	108.167
ADANA	CEYHAN	6,5	0,01	16033	171	104.572
OSMANIYE	KADIRLI	6,5	0,01	16164	167	78.964
BURDUR	BURDUR C.	6,5	0,01	13011	156	71.611
MUGLA	FETHIYE	6,5	0,01	12810	144	72.003
AYDIN	SOKE	6,5	0,01	10442	138	67.234
MANISA	SOMA	6,5	0,01	9885	133	74.158
TOKAT	TURHAL	6,5	0,01	10797	125	64.090
IZMIR	TIRE	6,5	0,01	10443	124	50.900
KONYA	AKSEHIR	6,5	0,01	8790	121	61.196
KASTAMONU	KASTAMONU C.	6,5	0,01	9197	121	86.085
MUGLA	MUĞLA C.	6,5	0,01	8723	109	61.550
DIYARBAKIR	ERGANI	6,5	0,01	10522	108	63.065
BILECIK	BOZUYUK	6,5	0,01	7901	96	56.782
MUGLA	MILAS	6,5	0,01	8112	92	50.975
CANKIRI	ÇANKIRI C.	6,5	0,01	7084	90	69.087
MUS	MUŞ C.	6,5	0,01	6631	77	72.774
ADIYAMAN	KAHTA	6,5	0,01	7031	74	61.243
TEKIRDAG	CERKEZKOY	6,5	0,01	5172	73	69.875
BITLIS	TATVAN	6,5	0,01	5864	65	56.996
KAYSERI	TALAS	6,5	0,01	2924	42	81.566

C: Central

CATEGORY III - METROPOLITAN CITIES

CATEGORY Metropolitan Cities	SUB-PROVINCE	Intensity	Relative Loss, Loss Rate	Total Building	Absolute Loss	Settlement Population (2009)
KOCAELI	KOCAELI (M.)	8	0,17	139423	24077	1.422.752
SAKARYA	SAKARYA (M.)	8	0,16	49609	8070	442.157
ISTANBUL	ISTANBUL (M.)	7,5	0,10	864540	83824	12.782.960
BURSA	BURSA (M.)	7,5	0,08	204907	16506	1.854.285
IZMIR	IZMIR (M.)	7	0,03	421397	14531	3.276.815
ADANA	ADANA (M.)	6,5	0,01	175697	1913	1.556.238
ANTALYA	ANTALYA (M.)	6,5	0,01	114998	1402	955.573
KONYA	KONYA (M.)	6,5	0,01	113267	1355	1.003.373
ERZURUM	ERZURUM (M.)	6,5	0,01	32458	439	368.146

M: Metropolitan

APPENDIX E

DEPENDENT AND INDEPENDENT VARIABLES OF THE RESEARCH

CATEGORY I – SETTLEMENTS HAVING POPULATION UP TO 50.000

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
TOKAT	NIKSAR	8	1400	0,17	33.682	-3,171	0,52	5,37	-0,07744
KASTAMONU	TOSYA	8	1364	0,16	27.624	1,912	0,68	2,71	0,13718
SAKARYA	HENDEK	8	869	0,17	44.418	4,916	0,60	5,74	0,24465
CORUM	OSMANCIK	8	786	0,16	25.829	-1,063	0,57	5,64	-0,03846
SAMSUN	HAVZA	8	735	0,16	20.204	0,460	0,44	4,20	-0,37355
TEKIRDAG	SARKOY	8	712	0,18	16.624	0,291	0,55	3,99	0,62666
SAKARYA	AKYAZI	8	681	0,19	41.179	6,379	0,49	6,32	0,26360
AMASYA	SULUOVA	7,5	633	0,07	37.151	-1,551	0,78	4,43	0,58123
ERZINCAN	UZUMLU	8	631	0,15	8.288	-14,403	0,52	7,24	-0,23858
BOLU	GEREDE	8	583	0,17	23.808	-0,626	0,69	7,32	0,37367
SAKARYA	GEYVE	8	543	0,16	20.318	1,775	0,44	4,96	0,14350
BALIKESIR	AYVALIK	7	442	0,03	35.986	1,309	0,58	2,27	1,45980
SIVAS	SUSEHRI	8	424	0,16	15.304	-5,514	0,55	9,71	-0,21177
BALIKESIR	BURHANIYE	7	410	0,03	38.156	2,227	0,77	2,37	1,12760
SAKARYA	PAMUKOVA	8	403	0,15	16.047	2,170	0,60	5,08	0,46365
MUS	VARTO	8	384	0,15	9.585	-5,955	0,28	6,39	-1,03815
SAMSUN	LADIK	8	377	0,16	8.316	-0,999	0,46	3,75	-0,24068
YALOVA	CINARCIK	8	357	0,21	11.080	2,368	0,43	5,35	1,17381
IZMIR	CESME	7	348	0,03	20.455	-2,343	0,63	2,19	2,69252
BURSA	YENISEHIR	7,5	339	0,07	29.275	1,289	0,57	5,18	0,28969
CANKIRI	ILGAZ	8	312	0,16	7.738	-4,144	0,56	5,87	-0,06033

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
TOKAT	RESADIYE	8	309	0,16	9.027	-6,627	0,20	8,44	-0,55114
MANISA	ALASEHIR	7	306	0,03	47.942	2,127	0,48	4,14	0,11107
YALOVA	CIFTLIKKOY	8	298	0,19	17.052	6,358	0,65	6,04	1,10206
SAMSUN	VEZIRKOPRU	7,5	298	0,07	26.724	1,566	0,25	5,21	-0,70191
CORUM	KARGI	8	285	0,15	5.226	-1,019	0,32	3,05	-0,52154
AMASYA	TASOVA	8	282	0,17	10.821	-4,033	0,32	9,28	-0,36901
SIVAS	KOYULHISAR	8	273	0,15	4.426	-2,822	0,34	3,16	-0,66182
AMASYA	GUMUSHACIKOY	7,5	271	0,07	14.620	0,436	0,58	3,37	-0,18357
CANKIRI	CERKES	8	263	0,15	9.404	-5,578	0,58	8,99	0,37131
BURSA	IZNIK	7,5	252	0,06	22.574	1,252	0,50	5,08	0,09069
MUS	BULANIK	7,5	246	0,06	21.352	-1,308	0,26	5,61	-1,42226
MANISA	KULA	7	236	0,03	24.241	0,011	0,51	3,15	-0,09144
BITLIS	AHLAT	7,5	234	0,04	19.078	-6,675	0,54	6,20	-0,21237
HATAY	SAMANDAG	7	232	0,03	44.137	2,692	0,34	4,79	-0,06135
GIRESUN	SEBINKARAHISAR	7,5	222	0,06	11.921	-12,498	0,53	10,67	0,05037
SIVAS	AKINCILAR	8	211	0,15	2.775	-6,502	0,53	3,61	-0,25162
AYDIN	DİDİM(YENİHİSAR)	6,5	204	0,01	41.246	5,257	0,78	1,37	1,75196
BALIKESIR	SUSURLUK	7	190	0,03	23.952	0,792	0,57	3,92	0,59933
CANAKKALE	BIGA	7	188	0,03	36.520	3,132	0,45	4,87	0,42349
BOLU	YENICAGA	8	183	0,16	5.175	-2,298	0,64	5,68	0,72530
TOKAT	BASCIFTLIK	8	182	0,15	3.840	-4,905	0,55	4,87	-0,47428
DUZCE	KAYNASLI	8	177	0,15	9.418	-0,025	0,45	8,06	0,46294
HATAY	ERZIN	7	173	0,03	30.356	1,773	0,76	4,50	0,45779
BITLIS	ADILCEVAZ	7,5	172	0,06	14.428	-9,902	0,44	12,27	-0,32168
CORUM	ISKILIP	7	167	0,03	20.724	0,592	0,51	3,85	-0,50544
YALOVA	ARMUTLU	7,5	164	0,08	5.223	2,367	0,65	2,03	1,02851
CANAKKALE	CAN	7	161	0,03	28.769	-0,042	0,56	5,76	0,97671
HATAY	BELEN	7	159	0,03	20.892	1,264	0,75	3,66	0,80827
BALIKESIR	ERDEK	7	159	0,04	20.876	1,267	0,62	4,44	0,96294
BILECIK	OSMANELI	7,5	158	0,07	13.760	0,791	0,65	5,36	0,49485
TEKIRDAG	MALKARA	7	157	0,03	27.371	1,052	0,50	5,51	0,20256

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss / Building)	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglomeration	Population / Total No. of Buildings	Development Index
GAZIANTEP	ISLAHIYE	7	148	0,03	30.904	-2,520	0,47	7,83	-0,33183
BILECIK	BİLECİK C.	7	145	0,04	46.403	3,421	0,74	8,47	1,21727
BINGOL	KARLIOVA	8	138	0,15	6.202	-3,838	0,19	9,62	-1,15444
DENIZLI	BULDAN	7	137	0,03	15.197	0,923	0,55	3,27	0,19298
ADIYAMAN	GOLBASI	7	137	0,03	27.800	-0,337	0,58	6,69	-0,16573
SAKARYA	KARAPURCEK	8	136	0,15	7.452	6,408	0,60	4,60	0,00414
ORDU	GOLKOY	7	134	0,03	16.410	-4,299	0,38	5,69	-0,62230
GIRESUN	CAMOLUK	8	133	0,16	2.023	-8,096	0,30	4,88	-0,73863
ERZINCAN	REFAHIYE	8	130	0,15	3.563	-5,853	0,34	7,11	-0,30873
MANISA	SARIGOL	7	130	0,03	13.406	1,191	0,37	2,83	-0,21863
MUGLA	BODRUM	6,5	130	0,01	31.590	-0,222	0,27	2,51	2,42137
CANAKKALE	BAYRAMIC	7	129	0,03	13.290	1,146	0,43	2,88	-0,09300
ADIYAMAN	BESNI	7	126	0,03	26.788	-3,322	0,33	8,49	-0,40959
DUZCE	GOLYAKA	8	126	0,15	8.793	0,283	0,43	10,47	0,05986
MUS	MALAZGIRT	7	125	0,03	19.130	-2,379	0,33	5,72	-1,24760
ORDU	AYBASTI	7	125	0,03	14.175	-0,118	0,56	3,83	-0,45952
CANAKKALE	EZINE	7	121	0,03	13.202	-0,090	0,41	3,41	0,49619
K.MARAS	PAZARCIK	7	120	0,03	28.713	1,820	0,38	6,18	-0,49233
USAK	ESME	7	119	0,03	13.532	1,697	0,37	3,06	-0,34158
BALIKESIR	BIGADIC	7	114	0,03	16.062	1,099	0,33	4,12	-0,19705
MANISA	SARUHANLI	7	112	0,03	15.336	1,815	0,27	3,58	-0,08950
BURDUR	GOLHISAR	7	110	0,03	13.424	0,851	0,64	3,56	0,19023
BALIKESIR	HAVRAN	7	107	0,03	10.671	0,587	0,38	2,99	-0,11492
ERZURUM	HINIS	7	107	0,03	9.654	-11,633	0,31	7,75	-0,87891
EDIRNE	ENEZ	7	105	0,03	3.820	-0,346	0,35	1,13	0,06856
AFYON	BOLVADIN	6,5	105	0,01	31.284	-5,731	0,68	5,41	0,25014
BOLU	MUDURNU	7,5	104	0,06	4.596	-2,878	0,22	3,60	-0,17344
BALIKESIR	SINDIRGI	7	100	0,03	12.672	2,098	0,32	3,34	-0,57904
TOKAT	ZILE	6,5	100	0,01	35.417	-4,403	0,54	5,68	-0,24669
SAMSUN	KAVAK	7,5	97	0,07	8.435	0,769	0,39	5,65	-0,46485
KARABUK	ESKIPAZAR	7,5	96	0,07	6.916	-2,235	0,55	6,07	-0,09796

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
TUNCELI	PULUMUR	8	94	0,16	1.656	-1,486	0,53	3,31	-0,20297
BALIKESIR	GONEN	6,5	93	0,01	42.939	1,878	0,59	4,83	0,67568
BOLU	DORTDIVAN	8	93	0,16	2.952	-1,355	0,43	5,66	-0,44608
MANISA	GOLMARMARA	7	91	0,03	9.840	-1,443	0,62	3,76	-0,06818
BALIKESIR	GOMEC	7	87	0,03	4.788	1,664	0,41	1,41	0,25481
BURDUR	BUCAK	6,5	87	0,01	36.370	2,580	0,61	3,89	0,50648
DUZCE	GUMUSOVA	7,5	86	0,07	6.483	-6,936	0,44	9,35	0,87346
YALOVA	ALTINOVA	8	84	0,16	4.942	4,722	0,21	6,05	1,09948
CANKIRI	KURSUNLU	7,5	84	0,06	3.939	-11,971	0,42	8,82	-0,14303
MANISA	AHMETLI	7	83	0,03	9.916	-1,164	0,62	4,07	0,06626
OSMANIYE	DUZICI	6,5	76	0,01	40.823	0,480	0,53	5,19	-0,21929
KARABUK	SAFRANBOLU	6,5	76	0,01	39.669	2,493	0,78	5,26	1,04657
BOLU	MENGEN	7,5	76	0,07	5.170	-0,506	0,33	5,21	0,20002
BOLU	GOYNUK	7,5	75	0,06	4.182	-1,949	0,25	4,08	-0,38182
SIVAS	GOLOVA	8	74	0,16	2.174	-7,103	0,61	8,78	-0,32642
TOKAT	ALMUS	7,5	74	0,07	4.408	-3,785	0,16	5,79	-0,73644
CANAKKALE	LAPSEKI	7	74	0,03	10.624	2,493	0,40	3,89	0,11279
ELAZIG	KOVANCILAR	7	74	0,04	20.246	7,058	0,52	5,21	-0,20055
KUTAHYA	SIMAV	6,5	73	0,02	24.799	-1,512	0,35	5,83	-0,12338
YALOVA	TERMAL	8	73	0,17	2.340	-0,806	0,46	5,92	0,78017
ERZURUM	KARACOBAN	7	73	0,03	8.804	-4,056	0,34	5,23	-1,46360
BALIKESIR	SAVASTEPE	7	72	0,03	9.368	-1,041	0,46	4,46	-0,24773
OSMANIYE	BAHCE	7	70	0,03	12.917	-3,938	0,62	7,99	0,31628
ANKARA	CAMLIDERE	7	70	0,03	3.747	-5,779	0,45	2,76	0,05674
GAZIANTEP	NURDAGI	7	69	0,03	16.328	4,525	0,43	4,78	-0,48473
BINGOL	YEDISU	8	68	0,15	1.352	-4,200	0,46	4,29	-0,89771
K.MARAS	TURKOGLU	7	68	0,03	14.274	2,004	0,22	5,27	-0,52882
DUZCE	CUMAYERI	7,5	67	0,06	7.824	0,568	0,61	7,04	0,37792
SAKARYA	TARAKLI	7,5	67	0,06	3.055	-3,393	0,40	3,81	-0,33647
AYDIN	CINE	6,5	64	0,01	20.416	1,482	0,38	3,17	-0,00190
AFYON	EMIRDAG	6,5	63	0,01	20.253	-0,139	0,47	3,82	-0,12461

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
KONYA	ILGIN	6,5	62	0,01	31.171	1,721	0,51	4,85	-0,15085
ERZINCAN	CAYIRLI	7,5	61	0,06	3.089	-8,346	0,31	6,55	-0,66601
SAKARYA	FERIZLI	7	61	0,03	12.914	0,470	0,54	6,43	0,31085
BURDUR	KARAMANLI	7	60	0,03	5.251	0,544	0,67	2,61	0,06611
CORUM	DODURGA	7,5	60	0,06	3.065	-1,253	0,40	3,46	-0,29713
ORDU	MESUDIYE	7,5	60	0,06	3.031	-6,949	0,21	5,87	-0,52609
VAN	BASKALE	7	60	0,03	12.562	-1,294	0,20	7,11	-1,55537
AFYON	CAY	6,5	59	0,01	14.592	-2,416	0,42	3,54	-0,10024
BILECIK	GOLPAZARI	7	58	0,03	7.697	1,051	0,62	3,76	-0,16945
CANAKKALE	AYVACIK	7	57	0,03	7.538	1,689	0,25	3,50	0,08642
SAKARYA	KARASU	6,5	57	0,01	27.914	1,372	0,52	5,85	0,17887
DENIZLI	GUNEY	7	57	0,03	5.908	-0,673	0,50	3,38	-0,31210
ANTALYA	KUMLUCA	6,5	56	0,01	30.939	2,332	0,47	5,32	0,20565
MANISA	KIRKAGAC	6,5	56	0,01	26.660	0,673	0,57	4,87	-0,14244
ELAZIG	PALU	7	55	0,03	8.837	-1,488	0,41	5,58	-0,81209
MUGLA	MARMARIS	6,5	54	0,02	30.101	0,545	0,40	8,08	2,51737
ANTALYA	KORKUTELI	6,5	54	0,01	20.109	2,244	0,40	3,89	0,01904
HATAY	YAYLADAGI	7	54	0,03	5.843	-3,091	0,26	4,35	-0,55389
BINGOL	GENC	7	54	0,03	18.691	0,208	0,52	10,95	-1,02405
DENIZLI	CAL	7	53	0,03	3.887	-2,632	0,17	2,83	-0,11527
ADANA	IMAMOGLU	6,5	52	0,01	20.636	-4,315	0,67	5,92	-0,06441
BINGOL	ADAKLI	7,5	52	0,06	3.143	-0,775	0,31	3,96	-1,31228
BALIKESIR	MANYAS	7	51	0,03	6.578	2,080	0,29	3,39	-0,24757
ELAZIG	MADEN	7	51	0,03	5.314	-3,311	0,36	4,33	-0,53517
HATAY	HASSA	7	50	0,03	9.207	0,165	0,17	5,42	-0,64875
ISPARTA	EGIRDIR	6,5	50	0,01	18.402	0,943	0,51	4,21	0,31113
BURDUR	TEFENNI	7	50	0,03	4.626	-1,715	0,45	3,36	-0,13255
OSMANIYE	TOPRAKKALE	7	50	0,03	7.843	-0,780	0,58	5,07	-0,09807
SINOP	BOYABAT	6,5	50	0,01	25.271	0,262	0,59	6,61	0,07266
MUGLA	ORTACA	6,5	50	0,01	25.816	4,692	0,62	3,82	1,07099
BURDUR	YESILOVA	7	49	0,03	4.724	-3,414	0,27	4,05	-0,23627

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
BALIKESIR	IVRINDI	7	49	0,03	6.514	1,344	0,17	3,76	-0,54161
DUZCE	CILIMLI	7,5	49	0,06	6.348	-1,317	0,38	9,00	0,11615
MANISA	DEMIRCI	6,5	48	0,01	19.550	-0,916	0,39	4,77	-0,20870
KAYSERI	YAHYALI	6,5	48	0,01	20.066	-1,353	0,52	5,02	-0,20205
KASTAMONU	IHSANGAZI	7	48	0,03	2.715	-1,570	0,46	2,12	-0,62152
AYDIN	INCIRLIOVA	6,5	47	0,01	19.438	1,137	0,45	4,36	0,16257
MUGLA	DALAMAN	6,5	47	0,01	22.956	2,948	0,69	4,14	1,03833
ISPARTA	YALVAC	6,5	46	0,01	20.448	-6,072	0,37	10,48	-0,12494
KUTAHYA	GEDIZ	6,5	46	0,01	19.546	0,098	0,37	4,28	-0,07805
KASTAMONU	ARAC	7	45	0,03	5.776	0,155	0,29	4,09	-0,47076
IZMIR	KARABURUN	7	45	0,03	2.785	-0,572	0,31	1,97	1,22390
AYDIN	BOZDOGAN	6,5	45	0,01	9.713	1,747	0,27	2,01	-0,40162
CANKIRI	ATKARACALAR	7,5	45	0,06	2.730	-7,718	0,48	7,67	0,21143
CORUM	OGUZLAR	7	44	0,03	3.741	-2,484	0,51	3,20	-0,58102
CANKIRI	KORGUN	7,5	44	0,06	2.129	-11,570	0,54	8,57	0,10665
ERZINCAN	TERCAN	7	44	0,03	5.416	-8,080	0,29	7,84	-0,37623
ERZURUM	PASINLER	6,5	43	0,01	13.969	-5,437	0,43	5,38	-0,48145
USAK	BANAZ	6,5	43	0,01	15.395	-0,575	0,40	4,99	-0,11276
VAN	OZALP	7	43	0,03	10.166	4,151	0,14	4,94	-1,54656
CANKIRI	BAYRAMOREN	8	43	0,15	880	-12,444	0,33	9,56	-0,31727
OSMANIYE	HASANBEYLI	7	43	0,03	2.559	-6,910	0,53	3,30	-0,07696
DENIZLI	SARAYKOY	6,5	43	0,01	18.526	0,469	0,62	5,29	0,71456
BINGOL	KIGI	7,5	43	0,06	3.220	-4,164	0,65	6,71	0,12384
DENIZLI	CARDAK	7	43	0,03	4.634	-2,201	0,49	4,15	0,43032
DUZCE	AKCAKOCA	6,5	42	0,02	23.378	-0,991	0,61	9,29	0,69084
ANTALYA	ELMALI	6,5	42	0,01	14.478	-0,064	0,38	3,99	0,06088
HATAY	ALTINOZU	7	41	0,03	7.458	3,687	0,12	3,98	-0,91636
SIVAS	IMRANLI	7	40	0,03	3.303	-8,836	0,44	5,61	-0,42572
IZMIR	KINIK	6,5	39	0,01	11.919	-1,080	0,42	3,40	-0,17482
SAKARYA	KOCAALI	6,5	39	0,01	12.560	-1,040	0,52	3,99	-0,05069
TEKIRDAG	MURATLI	6,5	39	0,01	19.107	0,316	0,73	5,22	1,04158

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss / Building)	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglomeration	Population / Total No. of Buildings	Development Index
ADIYAMAN	CELIKHAN	7	38	0,03	8.224	-3,536	0,53	8,94	-0,54032
SIVAS	DOGANSAR	7,5	37	0,06	1.508	-10,850	0,51	6,67	-0,68753
ERZURUM	CAT	7	37	0,03	4.527	-5,108	0,22	5,81	-1,09209
MUGLA	DATCA	6,5	37	0,01	9.958	2,284	0,63	2,27	1,26732
KASTAMONU	TASKOPRU	6,5	37	0,01	16.385	0,139	0,41	6,12	-0,24479
SAMSUN	AYVACIK	7	37	0,03	6.702	1,897	0,27	4,75	-0,93524
MANISA	GORDES	6,5	37	0,01	10.812	0,003	0,34	3,31	-0,49382
GUMUSHANE	SIRAN	7	36	0,03	6.854	-6,202	0,39	10,66	-0,43399
BURDUR	ALTINYAYLA	7	35	0,03	3.240	-2,812	0,57	3,63	0,15277
SIVAS	ZARA	6,5	35	0,01	11.996	-4,413	0,51	5,41	-0,44251
ISPARTA	SARKIKARAAGAC	6,5	35	0,01	10.473	-9,444	0,38	8,29	-0,05641
ORDU	KORGAN	6,5	34	0,01	13.018	-2,001	0,39	5,27	-0,79407
AFYON	SUHUT	6,5	34	0,01	12.479	-0,980	0,31	4,30	-0,46041
ADIYAMAN	TUT	7	34	0,03	4.101	-6,274	0,36	6,53	-0,65274
KARABUK	YENICE	6,5	33	0,01	9.772	-1,543	0,42	4,81	-0,17532
AYDIN	GERMENCIK	6,5	33	0,01	12.588	0,912	0,29	3,76	0,03258
HATAY	KUMLU	7	33	0,03	5.167	-2,768	0,38	6,02	-0,55694
MUGLA	YATAGAN	6,5	33	0,01	17.707	1,121	0,39	5,70	0,29571
VAN	EDREMIT	7	33	0,03	12.426	7,232	0,51	5,96	-0,70601
AYDIN	YENIPAZAR	6,5	32	0,01	6.609	-0,648	0,49	2,24	0,06672
KUTAHYA	EMET	6,5	31	0,01	10.547	-6,743	0,45	7,01	-0,21206
DENIZLI	BOZKURT	7	31	0,03	4.360	0,439	0,38	4,21	0,26045
ELAZIG	SIVRICE	7	31	0,03	4.236	-2,763	0,44	5,37	-0,65316
SAMSUN	TEKKEKÖY	6,5	31	0,01	36.728	-3,533	0,74	6,15	0,30310
KAYSERI	BUNYAN	6,5	30	0,01	12.431	-0,070	0,37	4,42	-0,28162
ZONGULDAK	ALAPLI	6,5	30	0,02	18.194	-0,178	0,39	12,69	0,19278
AFYON	ISCEHISAR	6,5	29	0,01	11.910	1,356	0,50	3,92	-0,11249
BILECIK	SOGUT	6,5	29	0,01	15.007	1,904	0,70	5,83	0,56238
GIRESUN	ALUCRA	7	29	0,03	4.970	-11,793	0,54	15,48	-0,41270
CANKIRI	ORTA	7	29	0,03	3.815	-5,114	0,22	6,54	-0,39171
DENIZLI	BAKLAN	7	29	0,03	2.062	-3,147	0,32	2,91	-0,30078

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
ERZURUM	ASKALE	6,5	28	0,01	12.447	-2,472	0,50	5,75	-0,08951
ANKARA	NALLIHAN	6,5	28	0,01	12.585	-1,503	0,41	7,24	0,41900
DIYARBAKIR	CERMIK	6,5	28	0,01	17.389	1,035	0,35	5,62	-1,07902
MALATYA	POTURGE	7	28	0,03	2.751	-6,173	0,13	5,27	-1,16639
ORDU	GURGENTEPE	6,5	28	0,01	7.844	-9,421	0,46	7,39	-0,65266
BURDUR	CAVDIR	7	28	0,03	3.112	-4,673	0,24	5,37	-0,25648
ORDU	KUMRU	6,5	27	0,01	11.948	-4,589	0,37	8,45	-0,48426
GUMUSHANE	KELKIT	6,5	27	0,01	14.012	-3,436	0,34	7,79	-0,46566
KONYA	DOGANHISAR	6,5	27	0,01	6.233	-4,978	0,29	4,15	-0,43335
DENIZLI	ACIPAYAM	6,5	27	0,01	12.588	2,606	0,22	4,96	-0,21246
ANKARA	KIZILCAHAMAM	6,5	27	0,01	16.810	-18,327	0,66	8,48	0,20565
AYDIN	KARACASU	6,5	27	0,01	6.154	0,440	0,30	2,38	-0,24860
ISPARTA	KECIBORLU	6,5	27	0,01	7.134	-4,177	0,45	4,15	0,29912
ANTALYA	KALE (DEMRE)	6,5	26	0,01	15.574	1,263	0,63	5,89	0,12003
DIYARBAKIR	CUNGUS	7	26	0,03	2.544	-6,839	0,19	5,42	-0,91268
ISPARTA	SENIRKENT	6,5	26	0,01	6.932	-7,568	0,48	5,95	0,33158
VAN	GURPINAR	7	26	0,03	5.166	-2,047	0,13	7,24	-1,51778
SAMSUN	ASARCIK	7,5	26	0,07	2.537	3,062	0,13	4,99	-0,99161
ADANA	POZANTI	6,5	26	0,01	9.880	0,288	0,48	3,86	0,46680
BINGOL	YAYLADERE	7	25	0,03	989	-12,822	0,58	3,83	-0,17023
ELAZIG	ALACAKAYA	7	25	0,03	2.598	-4,889	0,32	4,86	-0,55474
MALATYA	DOGANYOL	7	25	0,03	1.774	-12,286	0,35	6,48	-0,78937
K.MARAS	CAGLAYANCERIT	6,5	25	0,01	12.428	-0,190	0,46	5,15	-0,85395
BURDUR	KEMER	7	24	0,03	2.012	-1,301	0,49	2,83	-0,21369
BALIKESIR	KEPSUT	6,5	24	0,01	5.763	0,428	0,23	2,54	-0,63967
IZMIR	KIRAZ	6,5	24	0,01	8.469	-1,847	0,19	4,34	-0,58546
EDIRNE	IPSALA	6,5	24	0,01	8.033	-0,590	0,27	3,64	-0,17208
ANTALYA	KEMER	6,5	24	0,01	20.110	1,701	0,56	8,25	2,79398
ADANA	KARATAS	6,5	24	0,01	8.504	-0,861	0,39	4,10	0,01236
MUS	HASKOY	6,5	24	0,01	13.389	-5,180	0,46	9,15	-1,17070
CANKIRI	YAPRAKLI	7	24	0,03	1.771	-12,354	0,18	6,94	-0,65187

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
ADANA	KARAISALI	6,5	24	0,01	7.307	0,664	0,32	3,01	-0,61422
IZMIR	BEYDAG	6,5	23	0,01	5.710	0,374	0,44	2,63	-0,22276
BITLIS	GUROYMAK	6,5	23	0,01	20.226	-1,194	0,46	9,84	-1,19314
MUGLA	KOYCEGIZ	6,5	23	0,01	8.677	1,586	0,26	3,25	0,17722
AYDIN	KUYUCAK	6,5	23	0,01	7.701	0,622	0,26	3,48	-0,10149
BOLU	SEBEN	7	23	0,03	2.822	-4,767	0,44	5,74	-0,16630
ANTALYA	FINIKE	6,5	23	0,01	11.199	1,544	0,24	5,56	0,34021
ELAZIG	KARAKOCAN	6,5	22	0,01	12.708	-7,062	0,44	11,90	-0,50382
SINOP	DURAGAN	6,5	22	0,01	7.442	-2,973	0,34	6,11	-1,02911
AYDIN	KOSK	6,5	22	0,01	9.854	1,842	0,36	4,16	-0,14465
AFYON	BASMAKCI	6,5	22	0,01	5.681	-3,545	0,52	3,76	-0,08177
MUGLA	ULA	6,5	22	0,01	5.602	0,706	0,23	2,44	0,37142
ISPARTA	ULUBORLU	6,5	21	0,01	6.520	-6,513	0,86	5,71	1,40411
VAN	GEVAS	6,5	21	0,01	10.432	-0,577	0,35	5,28	-0,91217
GAZIANTEP	ARABAN	6,5	21	0,01	9.758	-0,989	0,31	5,14	-0,74659
ERZINCAN	KEMAH	7	21	0,03	1.929	-4,384	0,30	4,25	-0,63593
AFYON	SULTANDAGI	6,5	20	0,01	6.288	-1,021	0,34	3,78	-0,24347
AYDIN	BUHARKENT	6,5	20	0,01	6.891	-0,291	0,54	4,06	0,31566
BALIKESIR	BALYA	7	20	0,03	1.901	-0,087	0,12	2,93	-0,68318
DUZCE	YIGILCA	7	20	0,04	3.141	-1,904	0,17	6,72	-0,78858
MALATYA	DOGANSEHIR	6,5	20	0,01	10.800	-2,493	0,26	7,33	-0,61192
BURSA	ORHANELI	6,5	20	0,01	7.934	-0,190	0,33	4,71	-0,22601
ORDU	AKKUS	7	20	0,03	5.746	-4,696	0,20	15,33	-1,07261
USAK	ULUBEY	6,5	19	0,01	4.945	-0,412	0,33	2,99	-0,35792
ADIYAMAN	SINCIK	7	19	0,03	4.331	-2,189	0,21	8,27	-1,38337
DENIZLI	AKKOY	7	19	0,03	2.755	0,158	0,50	4,28	0,04098
AYDIN	SULTANHISAR	6,5	19	0,01	6.229	-0,048	0,29	3,69	-0,00602
BILECIK	PAZARYERI	6,5	19	0,01	6.481	-0,301	0,56	3,68	0,20538
MUS	KORKUT	7	19	0,03	3.102	-7,577	0,11	9,82	-1,45230
AFYON	COBANLAR	6,5	19	0,01	8.774	0,597	0,65	4,54	-0,50727
DENIZLI	BEKILLI	6,5	19	0,01	3.481	-1,351	0,42	2,16	-0,23477

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
DENIZLI	HONAZ	6,5	18	0,01	9.788	3,045	0,32	4,24	0,93721
AYDIN	KOCARLI	6,5	18	0,01	6.822	-2,988	0,26	5,26	-0,31431
ADANA	YUMURTALIK	6,5	18	0,01	5.220	1,060	0,27	2,88	-0,22099
ISPARTA	GELENDOST	6,5	18	0,01	5.351	-3,483	0,31	4,23	-0,28054
KUTAHYA	HISARCIK	6,5	18	0,01	4.877	-2,882	0,34	4,53	-0,37653
DENIZLI	BABADAG	6,5	17	0,01	4.185	-1,597	0,54	2,87	0,66462
KONYA	DERBENT	6,5	17	0,01	2.922	-10,384	0,53	4,34	-0,57624
CORUM	BAYAT	6,5	17	0,01	8.828	1,989	0,36	4,82	-0,76073
AFYON	BAYAT	6,5	17	0,01	4.489	-0,515	0,53	2,84	-0,45446
MANISA	KOPRUBASI	6,5	17	0,01	5.283	0,503	0,54	3,18	-0,39239
ELAZIG	ARICAK	7	17	0,03	3.380	2,915	0,21	4,83	-1,21134
KONYA	HUYUK	6,5	16	0,01	3.695	-9,220	0,18	5,60	-0,35658
CORUM	MECITOZU	6,5	16	0,01	5.261	-1,059	0,28	3,80	-0,68249
CORUM	LACIN	7	16	0,03	1.227	-6,248	0,20	4,13	-0,74580
ANTALYA	KAS	6,5	16	0,01	6.857	0,834	0,13	5,65	0,03027
KUTAHYA	SAPHANE	6,5	16	0,01	3.623	-2,823	0,47	3,13	-0,26337
CANAKKALE	YENICE	6,5	16	0,01	6.830	2,433	0,19	3,75	-0,37841
ISPARTA	ATABEY	6,5	15	0,01	4.355	-8,901	0,71	6,64	0,93583
AMASYA	HAMAMOZU	7	15	0,03	1.405	-0,808	0,30	3,14	-0,75302
BURDUR	AGLASUN	6,5	15	0,01	4.414	-0,787	0,47	3,28	-0,16927
DIYARBAKIR	DICLE	6,5	15	0,01	8.610	-1,507	0,21	6,65	-1,42443
KARABUK	OVACIK	7,5	15	0,06	783	-8,795	0,22	7,55	-0,85157
TOKAT	PAZAR	6,5	14	0,01	4.986	-0,681	0,33	3,90	-0,55623
NIGDE	CAMARDI	6,5	14	0,01	3.480	-1,784	0,21	3,02	-0,64168
SAMSUN	SALIPAZARI	6,5	14	0,01	6.156	-15,622	0,29	5,42	-0,82056
CANKIRI	ELDIVAN	6,5	14	0,01	3.034	-7,022	0,55	4,29	-0,19899
ERZINCAN	OTLUKBELI	7	13	0,03	1.630	-8,424	0,62	8,00	-0,45080
KUTAHYA	ALTINTAS	6,5	13	0,01	5.538	-1,564	0,29	5,35	-0,47960
AFYON	DAZKIRI	6,5	13	0,01	4.470	-4,254	0,40	5,64	0,18716
ISPARTA	GONEN	6,5	12	0,01	3.663	-12,041	0,45	9,14	0,69437
BOLU	KIBRISCIK	7	12	0,03	1.345	-7,103	0,35	6,29	-0,26884

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss / Building)	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglomeration	Population / Total No. of Buildings	Development Index
KONYA	TUZLUKCU	6,5	12	0,01	3.912	-4,462	0,49	4,80	-0,46594
SINOP	SARAYDUZU	7	12	0,03	951	-14,179	0,19	8,78	-0,67727
KUTAHYA	PAZARLAR	6,5	12	0,01	3.660	-4,434	0,58	4,95	-0,38982
ORDU	CATALPINAR	6,5	11	0,01	5.333	-7,276	0,33	10,28	-0,56750
SAKARYA	KAYNARCA	6,5	11	0,01	5.144	0,174	0,22	5,56	-0,22225
AFYON	EVCILER	6,5	11	0,01	4.142	-2,386	0,50	4,79	-0,19677
ERZURUM	TEKMAN	6,5	11	0,01	3.957	-5,255	0,13	6,11	-1,62149
DENIZLI	CAMELI	6,5	9	0,01	2.837	0,387	0,14	3,21	-0,70180
GAZIANTEP	YAVUZELI	6,5	9	0,01	4.093	-7,083	0,47	8,52	-0,90075
BURSA	KELES	6,5	9	0,01	3.681	0,137	0,24	4,16	-0,51616
CANKIRI	SABANOZU	6,5	9	0,01	5.124	-1,746	0,44	6,68	0,11004
AYDIN	KARPUZLU	6,5	9	0,01	2.116	-1,013	0,17	2,69	-0,62809
CORUM	ORTAKOY	6,5	9	0,01	2.945	-1,428	0,31	4,02	-0,65301
BURDUR	CELTIKCI	6,5	9	0,01	2.374	-0,725	0,38	2,96	-0,16090
ADIYAMAN	GERGER	6,5	9	0,01	3.242	-2,937	0,13	4,69	-1,46753
KUTAHYA	CAVDARHISAR	6,5	8	0,01	2.412	-7,382	0,28	5,79	-0,50739
DENIZLI	BEYAGAC	6,5	8	0,01	2.664	-0,509	0,37	3,46	-0,36165
ESKISEHIR	MIHALGAZI	6,5	8	0,01	1.951	-15,128	0,48	9,95	0,16385
OSMANIYE	SUMBAS	6,5	7	0,01	2.114	0,058	0,13	2,87	-0,86007
AFYON	IHSANIYE	6,5	7	0,01	2.341	-7,177	0,08	6,28	-0,54316
TUNCELI	OVACIK	6,5	7	0,01	3.227	-6,721	0,54	9,20	-0,10444
MALATYA	KALE	6,5	7	0,01	2.030	-7,441	0,30	5,88	-0,77807
AMASYA	GOYNUCEK	6,5	7	0,01	2.421	-1,520	0,20	4,48	-0,77616
KUTAHYA	DUMLUPINAR	6,5	6	0,01	1.438	-9,263	0,44	5,53	-0,23004
VAN	SARAY	6,5	6	0,01	3.591	-3,410	0,15	8,34	-1,41712
KONYA	AKOREN	6,5	6	0,00	3.442	0	0,47	9,02	-0,28035
BILECIK	INHISAR	6,5	5	0,01	1.085	-8,435	0,33	4,49	-0,44544
BILECIK	YENIPAZAR	6,5	5	0,01	1.115	-2,280	0,30	2,89	-0,55126
ESKISEHIR	SARICAKAYA	6,5	5	0,01	2.150	-14,519	0,41	8,18	-0,07744
KUTAHYA	ASLANAPA	6,5	5	0,01	1.893	-2,393	0,17	4,86	-0,72882
TUNCELI	NAZIMIYE	6,5	4	0,01	1.636	-6,418	0,51	9,31	-0,34895

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 0-50.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
KILIS	MUSABEYLI	6,5	2	0,01	856	-6,633	0,06	8,89	-1,34019

C: Central

CATEGORY II - SETTLEMENTS HAVING POPULATION BETWEEN 50.000 AND 490.000

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 50.000-490.000	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (‰)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
VAN	VAN C.	7,5	2285	0,06	360.810	2,642	0,80	7,851	0,71686
ERZINCAN	ERZİNCAN C.	8	2025	0,16	90.100	-1,928	0,65	8,454	0,78524
BOLU	BOLU C.	8	1841	0,18	120.021	3,891	0,75	8,042	1,79561
YALOVA	YALOVA C.	8	1507	0,18	92.166	3,038	0,81	8,446	2,42273
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	0,09	140.535	3,009	0,82	6,835	1,86420
TOKAT	ERBAA	8	1251	0,16	58.845	2,835	0,60	5,775	-0,25251
BURSA	ORHANGAZI	8	945	0,18	54.319	2,234	0,72	8,362	1,13050
MANISA	MANİSA C.	7	919	0,04	291.374	3,411	0,86	8,648	2,46533
OSMANIYE	OSMANİYE C.	7	905	0,03	194.339	1,230	0,86	5,916	0,97609
HATAY	ANTAKYA	7	768	0,03	202.216	3,702	0,45	6,174	0,98304
HATAY	ISKENDERUN	7	705	0,03	190.279	1,985	0,60	7,518	2,56211
ADIYAMAN	ADIYAMAN C.	7	696	0,03	198.433	1,174	0,76	8,128	0,57604
AMASYA	MERZIFON	7,5	666	0,07	52.225	1,504	0,76	4,847	0,71109
MANISA	TURGUTLU	7	639	0,03	115.930	2,362	0,82	4,849	1,23913
DUZCE	DÜZCE C.	7,5	612	0,07	125.240	8,815	0,65	6,592	1,11568
DENIZLI	DENİZLİ C.	6,5	586	0,01	488.768	6,371	0,94	6,560	3,69197
MANISA	AKHISAR	7	585	0,03	100.897	2,371	0,64	4,586	0,54044

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss / Building)	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglomeration	Population / Total No. of Buildings	Development Index
BURSA	INEGOL	7	536	0,04	161.541	4,686	0,75	7,517	1,36120
TOKAT	TOKAT C.	7	528	0,03	129.879	1,537	0,71	7,358	0,81785
MANISA	SALIHLI	7	483	0,04	96.503	1,656	0,62	6,096	0,82197
BALIKESIR	BALIKESİR C.	6,5	469	0,02	259.157	2,053	0,79	6,968	2,09334
BALIKESIR	BANDIRMA	7	460	0,04	113.385	1,686	0,86	8,095	2,51255
K.MARAS	K.MARAŞ C.	6,5	457	0,01	384.953	1,840	0,74	7,866	1,37067
IZMIR	BERGAMA	7	402	0,03	58.570	1,285	0,58	4,192	0,52172
KUTAHYA	KÜTAHYA C.	6,5	384	0,01	212.444	2,697	0,90	6,063	1,64375
ICEL(MERSIN)	TARSUS	6,5	361	0,01	233.436	0,843	0,76	6,497	1,29431
HATAY	KIRIKHAN	7	360	0,03	69.285	0,949	0,67	5,364	0,03957
ISPARTA	ISPARTA C.	6,5	354	0,01	190.084	2,743	0,90	5,634	2,09238
CANAKKALE	ÇANAKKALE C.	7	339	0,04	96.588	2,691	0,77	8,168	1,95451
AMASYA	AMASYA C.	7	336	0,04	86.667	1,697	0,66	7,887	0,68128
HATAY	DORTYOL	7	333	0,03	69.507	2,888	0,48	5,005	0,51668
BURSA	M.KEMALPASA	7	304	0,04	57.097	2,226	0,56	5,524	0,45191
AYDIN	AYDIN C.	6,5	303	0,02	179.425	2,501	0,74	7,415	1,69830
CORUM	ÇORUM C.	6,5	286	0,01	212.418	3,057	0,84	7,651	1,47724
HATAY	REYHANLI	7	280	0,03	61.306	1,800	0,71	5,626	0,05528
EDIRNE	KESAN	7	269	0,03	53.391	2,468	0,70	5,307	0,84485
BALIKESIR	EDREMIT	7	262	0,03	50.523	2,819	0,43	5,134	1,33150
BURSA	KARACABEY	7	258	0,03	51.907	2,723	0,66	5,305	0,76269
BINGOL	BİNGÖL C.	7	251	0,03	89.224	2,876	0,66	9,552	-0,04734
AFYON	AFYON C.	6,5	240	0,01	170.455	3,138	0,69	7,151	1,53160
TEKIRDAG	CORLU	6,5	230	0,01	206.134	4,178	0,85	9,115	3,08189
AYDIN	KUSADASI	6,5	211	0,01	61.648	2,859	0,76	2,689	2,75635
AYDIN	NAZILLI	6,5	210	0,01	109.800	0,427	0,75	6,372	1,22549
IZMIR	ODEMIS	6,5	190	0,01	73.310	1,880	0,57	4,221	0,44508
ADANA	KOZAN	6,5	184	0,01	74.521	-0,194	0,59	4,292	0,14144
KARABUK	KARABÜK C.	6,5	180	0,01	108.167	0,789	0,91	7,346	2,10701
ADANA	CEYHAN	6,5	171	0,01	104.572	-0,420	0,66	6,774	0,50077
OSMANIYE	KADIRLI	6,5	167	0,01	78.964	2,124	0,69	4,035	0,19675

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY 50.000-490.000	SUB-PROVINCE	Intensity	Absolute Loss	Relative Loss (Loss / Building)	Settlement Population (2009)	Population Growth Rate (‰)	Rates of Agglomeration	Population / Total No. of Buildings	Development Index
BURDUR	BURDUR C.	6,5	156	0,01	71.611	1,360	0,74	4,870	1,28548
MUGLA	FETHIYE	6,5	144	0,01	72.003	3,900	0,39	3,957	0,91185
AYDIN	SOKE	6,5	138	0,01	67.234	0,832	0,58	5,974	1,04132
MANISA	SOMA	6,5	133	0,01	74.158	2,230	0,73	6,138	1,01445
TOKAT	TURHAL	6,5	125	0,01	64.090	-4,436	0,73	8,848	0,47802
IZMIR	TIRE	6,5	124	0,01	50.900	1,877	0,65	4,116	0,58065
KONYA	AKSEHIR	6,5	121	0,01	61.196	0,178	0,64	6,852	0,39866
KASTAMONU	KASTAMONU C.	6,5	121	0,01	86.085	3,189	0,72	7,025	0,99032
MUGLA	MUĞLA C.	6,5	109	0,01	61.550	3,769	0,64	5,026	1,41047
DIYARBAKIR	ERGANI	6,5	108	0,01	63.065	3,188	0,56	4,498	-0,52199
BILECIK	BOZUYUK	6,5	96	0,01	56.782	1,990	0,86	6,008	1,71347
MUGLA	MILAS	6,5	92	0,01	50.975	3,245	0,41	4,692	0,63003
CANKIRI	ÇANKIRI C.	6,5	90	0,01	69.087	1,112	0,86	8,824	1,04942
MUS	MUŞ C.	6,5	77	0,01	72.774	0,766	0,42	10,244	-0,59441
ADIYAMAN	KAHTA	6,5	74	0,01	61.243	0,101	0,52	8,632	-0,61547
TEKIRDAG	CERKEZKOY	6,5	73	0,01	69.875	5,752	0,45	8,051	2,23899
BITLIS	TATVAN	6,5	65	0,01	56.996	-1,755	0,75	11,383	0,14517
KAYSERI	TALAS	6,5	42	0,01	81.566	9,439	0,93	11,929	0,59817

C: Central

CATEGORY III - METROPOLITAN CITIES

			Y1	Y2	X1	X2	X3	X4	X5
CATEGORY Metropolitan Cities	**SUB-PROVINCE**	**Intensity**	**Absolute Loss**	**Relative Loss (Loss / Building)**	**Settlement Population (2009)**	**Population Growth Rate (%0)**	**Rates of Agglomeration**	**Population / Total No. of Buildings**	**Development Index**
ISTANBUL	ISTANBUL (M)	7,5	83824	0,10	12.782.960	2,563	0,99	11,74	N.A.
KOCAELI	KOCAELI (M)	8	24077	0,17	1.422.752	4,249	0,93	6,96	3,52581
BURSA	BURSA (M)	7,5	16506	0,08	1.854.285	2,239	0,96	7,40	7,95333
IZMIR	IZMIR (M)	7	14531	0,03	3.276.815	1,414	0,96	6,85	N.A.
SAKARYA	SAKARYA (M)	8	8070	0,16	442.157	-1,154	0,91	9,89	2,60751
ADANA	ADANA (M)	6,5	1913	0,01	1.556.238	1,973	0,98	7,42	5,71564
ANTALYA	ANTALYA (M)	6,5	1402	0,01	955.573	5,112	0,96	5,25	3,99069
KONYA	KONYA (M)	6,5	1355	0,01	1.003.373	3,343	0,95	6,56	3,54941
ERZURUM	ERZURUM (M)	6,5	439	0,01	368.146	12,976	0,96	3,53	1,92489

M: Metropolitan
N.A.: Not Applicable

APPENDIX F

SOCIO-ECONOMIC DEVELOPMENT INDEX (SEDI) VARIABLES

YEAR	VARIABLES
	DEMOGRAPHIC INDICATORS
2000	Total Population
2000	Urbanization Rate
1990-2000	Annual Population Growth Rate
2000	Population Density
2000	Average Household Size
	EMPLOYMENT INDICATORS
2000	Ratio of people employed in industrial sector to the total employment
2000	Ratio of people employed in commercial sector to the total employment
2000	Ratio of people employed in agricultural sector to the total employment
2000	Ratio of people employed in financial sector to the total employment
2000	Proportion of regular or casual employee
2000	Proportion of regular or casual woman employee
2000	Proportion of employer
	EDUCATION INDICATORS
2000	Literacy rate
2000	Woman literate rate
2000	Proportion of higher education graduate population
	HEALTH INDICATORS
2000	Infant mortality rate
2000	Number of medical doctors per 10000 person
2000	Number of dentists per 10000 person
2000	Number of pharmacies per 10000 person
2000	Number of hospital beds per 10000 person
	INDUSTRY INDICATORS
2000	Number of plots in organized industrial estates
2000	Annual average number of employees in manufacturing industry
2000	Total capacity of power equipment installed at the end of year
2000	Per capita value added in manufacturing industry
2000	Per capita electricity consumption in manufacturing industry
	AGRICULTURE INDICATORS
2000	Share of agricultural production value in national production
	FINANCIAL INDICATORS
2000	Number of bank branches
2000	Total exports per capita
2000	Total imports per capita
2000	Amount of income and corporation tax per capita
2000	Total public expenditures per capita
2000	Per capita gross domestic product
2000	Share in total gross domestic product
	INFRASTRUCTURE
2000	Proportion of asphalt road in rural settlements
2000	Proportion of total asphalt road
2000	Proportion of population in rural settlements with adequate drinking water

	OTHER WEALTH INDICATORS
2000	Total telephone counters per person
2000	Total electricity consumption per capita
2000	Number of private cars per 10000 population
2000	Number of motor vehicles per 10000 population
2000	Proportion of population having a card for free health services

APPENDIX G

COMPARISON OF THE SETTLEMENTS PRIORITIZED ACCORDING TO THE ABSOLUTE LOSS WITH THE HAZARD ZONES DETERMINED BY THE OFFICIAL EARTHQUAKE HAZARD MAP

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
VAN	VAN C.	7,5	2285	2	0,06
ERZINCAN	ERZİNCAN C.	8	2025	1	0,16
BOLU	BOLU C.	8	1841	1	0,18
YALOVA	YALOVA C.	8	1507	1	0,18
TOKAT	NIKSAR	8	1400	1	0,17
KASTAMONU	TOSYA	8	1364	1	0,16
TEKIRDAG	TEKİRDAĞ C.	7,5	1347	2	0,09
TOKAT	ERBAA	8	1251	1	0,16
BURSA	ORHANGAZI	8	945	1	0,18
MANISA	MANİSA C.	7	919	1	0,04
OSMANIYE	OSMANİYE C.	7	905	1	0,03
SAKARYA	HENDEK	8	869	1	0,17
CORUM	OSMANCIK	8	786	1	0,16
HATAY	ANTAKYA	7	768	1	0,03
SAMSUN	HAVZA	8	735	1	0,16
TEKIRDAG	SARKOY	8	712	1	0,18
HATAY	ISKENDERUN	7	705	1	0,03
ADIYAMAN	ADIYAMAN C.	7	696	2	0,03
SAKARYA	AKYAZI	8	681	1	0,19
AMASYA	MERZIFON	7,5	666	1	0,07
MANISA	TURGUTLU	7	639	1	0,03
AMASYA	SULUOVA	7,5	633	1	0,07
ERZINCAN	UZUMLU	8	631	1	0,15
DUZCE	DÜZCE C.	7,5	612	1	0,07
DENIZLI	DENİZLİ C.	6,5	586	1	0,01
MANISA	AKHISAR	7	585	1	0,03
BOLU	GEREDE	8	583	1	0,17
SAKARYA	GEYVE	8	543	1	0,16
BURSA	INEGOL	7	536	1	0,04
TOKAT	TOKAT C.	7	528	1	0,03
MANISA	SALIHLI	7	483	1	0,04
BALIKESIR	BALIKESİR C.	6,5	469	1	0,02
BALIKESIR	BANDIRMA	7	460	1	0,04
K.MARAS	K.MARAŞ C.	6,5	457	1	0,01
BALIKESIR	AYVALIK	7	442	1	0,03
SIVAS	SUSEHRI	8	424	1	0,16
BALIKESIR	BURHANIYE	7	410	1	0,03
SAKARYA	PAMUKOVA	8	403	1	0,15
IZMIR	BERGAMA	7	402	1	0,03
KUTAHYA	KÜTAHYA C.	6,5	384	2	0,01
MUS	VARTO	8	384	1	0,15
SAMSUN	LADIK	8	377	1	0,16
ICEL(MERSIN)	TARSUS	6,5	361	3	0,01
HATAY	KIRIKHAN	7	360	1	0,03
YALOVA	CINARCIK	8	357	1	0,21
ISPARTA	ISPARTA C.	6,5	354	1	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
IZMIR	CESME	7	348	1	0,03
BURSA	YENISEHIR	7,5	339	1	0,07
CANAKKALE	ÇANAKKALE C.	7	339	1	0,04
AMASYA	AMASYA C.	7	336	1	0,04
HATAY	DORTYOL	7	333	1	0,03
CANKIRI	ILGAZ	8	312	1	0,16
TOKAT	RESADIYE	8	309	1	0,16
MANISA	ALASEHIR	7	306	1	0,03
BURSA	M.KEMALPASA	7	304	1	0,04
AYDIN	AYDIN C.	6,5	303	1	0,02
SAMSUN	VEZIRKOPRU	7,5	298	1	0,07
YALOVA	CIFTLIKKOY	8	298	1	0,19
CORUM	ÇORUM C.	6,5	286	2	0,01
CORUM	KARGI	8	285	1	0,15
AMASYA	TASOVA	8	282	1	0,17
HATAY	REYHANLI	7	280	1	0,03
SIVAS	KOYULHISAR	8	273	1	0,15
AMASYA	GUMUSHACIKOY	7,5	271	1	0,07
EDIRNE	KESAN	7	269	2	0,03
CANKIRI	CERKES	8	263	1	0,15
BALIKESIR	EDREMIT	7	262	1	0,03
BURSA	KARACABEY	7	258	1	0,03
BURSA	IZNIK	7,5	252	1	0,06
BINGOL	BİNGÖL C.	7	251	1	0,03
MUS	BULANIK	7,5	246	1	0,06
AFYON	AFYON C.	6,5	240	2	0,01
MANISA	KULA	7	236	1	0,03
BITLIS	AHLAT	7,5	234	1	0,04
HATAY	SAMANDAG	7	232	1	0,03
TEKIRDAG	CORLU	6,5	230	3	0,01
GIRESUN	SEBINKARAHISAR	7,5	222	1	0,06
AYDIN	KUSADASI	6,5	211	1	0,01
SIVAS	AKINCILAR	8	211	1	0,15
AYDIN	NAZILLI	6,5	210	1	0,01
AYDIN	DİDİM(YENİHİSAR)	6,5	204	1	0,01
BALIKESIR	SUSURLUK	7	190	1	0,03
IZMIR	ODEMIS	6,5	190	1	0,01
CANAKKALE	BIGA	7	188	1	0,03
ADANA	KOZAN	6,5	184	3	0,01
BOLU	YENICAGA	8	183	1	0,16
TOKAT	BASCIFTLIK	8	182	1	0,15
KARABUK	KARABÜK C.	6,5	180	1	0,01
DUZCE	KAYNASLI	8	177	1	0,15
HATAY	ERZIN	7	173	1	0,03
BITLIS	ADILCEVAZ	7,5	172	1	0,06
ADANA	CEYHAN	6,5	171	2	0,01
CORUM	ISKILIP	7	167	1	0,03
OSMANIYE	KADIRLI	6,5	167	2	0,01
YALOVA	ARMUTLU	7,5	164	1	0,08
CANAKKALE	CAN	7	161	1	0,03
BALIKESIR	ERDEK	7	159	1	0,04
HATAY	BELEN	7	159	1	0,03
BILECIK	OSMANELI	7,5	158	1	0,07
TEKIRDAG	MALKARA	7	157	2	0,03
BURDUR	BURDUR C.	6,5	156	1	0,01
GAZIANTEP	ISLAHIYE	7	148	1	0,03
BILECIK	BİLECİK C.	7	145	1	0,04

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
MUGLA	FETHIYE	6,5	144	1	0,01
AYDIN	SOKE	6,5	138	1	0,01
BINGOL	KARLIOVA	8	138	1	0,15
ADIYAMAN	GOLBASI	7	137	1	0,03
DENIZLI	BULDAN	7	137	1	0,03
SAKARYA	KARAPURCEK	8	136	1	0,15
ORDU	GOLKOY	7	134	1	0,03
GIRESUN	CAMOLUK	8	133	1	0,16
MANISA	SOMA	6,5	133	1	0,01
ERZINCAN	REFAHIYE	8	130	1	0,15
MANISA	SARIGOL	7	130	1	0,03
MUGLA	BODRUM	6,5	130	1	0,01
CANAKKALE	BAYRAMIC	7	129	1	0,03
ADIYAMAN	BESNI	7	126	2	0,03
DUZCE	GOLYAKA	8	126	1	0,15
MUS	MALAZGIRT	7	125	1	0,03
ORDU	AYBASTI	7	125	1	0,03
TOKAT	TURHAL	6,5	125	1	0,01
IZMIR	TIRE	6,5	124	1	0,01
CANAKKALE	EZINE	7	121	1	0,03
KASTAMONU	KASTAMONU C.	6,5	121	1	0,01
KONYA	AKSEHIR	6,5	121	1	0,01
K.MARAS	PAZARCIK	7	120	1	0,03
USAK	ESME	7	119	1	0,03
BALIKESIR	BIGADIC	7	114	1	0,03
MANISA	SARUHANLI	7	112	1	0,03
BURDUR	GOLHISAR	7	110	1	0,03
MUGLA	MUĞLA C.	6,5	109	1	0,01
DIYARBAKIR	ERGANI	6,5	108	1	0,01
BALIKESIR	HAVRAN	7	107	1	0,03
ERZURUM	HINIS	7	107	1	0,03
AFYON	BOLVADIN	6,5	105	1	0,01
EDIRNE	ENEZ	7	105	2	0,03
BOLU	MUDURNU	7,5	104	1	0,06
BALIKESIR	SINDIRGI	7	100	1	0,03
TOKAT	ZILE	6,5	100	1	0,01
SAMSUN	KAVAK	7,5	97	1	0,07
BILECIK	BOZUYUK	6,5	96	2	0,01
KARABUK	ESKIPAZAR	7,5	96	1	0,07
TUNCELI	PULUMUR	8	94	1	0,16
BALIKESIR	GONEN	6,5	93	1	0,01
BOLU	DORTDIVAN	8	93	1	0,16
MUGLA	MILAS	6,5	92	1	0,01
MANISA	GOLMARMARA	7	91	1	0,03
CANKIRI	ÇANKIRI C.	6,5	90	1	0,01
BALIKESIR	GOMEC	7	87	1	0,03
BURDUR	BUCAK	6,5	87	1	0,01
DUZCE	GUMUSOVA	7,5	86	1	0,07
CANKIRI	KURSUNLU	7,5	84	1	0,06
YALOVA	ALTINOVA	8	84	1	0,16
MANISA	AHMETLI	7	83	1	0,03
MUS	MUŞ C.	6,5	77	1	0,01
BOLU	MENGEN	7,5	76	1	0,07
KARABUK	SAFRANBOLU	6,5	76	1	0,01
OSMANIYE	DUZICI	6,5	76	1	0,01
BOLU	GOYNUK	7,5	75	1	0,06
ADIYAMAN	KAHTA	6,5	74	2	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
CANAKKALE	LAPSEKI	7	74	1	0,03
ELAZIG	KOVANCILAR	7	74	1	0,04
SIVAS	GOLOVA	8	74	1	0,16
TOKAT	ALMUS	7,5	74	1	0,07
ERZURUM	KARACOBAN	7	73	1	0,03
KUTAHYA	SIMAV	6,5	73	1	0,02
TEKIRDAG	CERKEZKOY	6,5	73	3	0,01
YALOVA	TERMAL	8	73	1	0,17
BALIKESIR	SAVASTEPE	7	72	1	0,03
ANKARA	CAMLIDERE	7	70	1	0,03
OSMANIYE	BAHCE	7	70	1	0,03
GAZIANTEP	NURDAGI	7	69	1	0,03
BINGOL	YEDISU	8	68	1	0,15
K.MARAS	TURKOGLU	7	68	1	0,03
DUZCE	CUMAYERI	7,5	67	1	0,06
SAKARYA	TARAKLI	7,5	67	1	0,06
BITLIS	TATVAN	6,5	65	2	0,01
AYDIN	CINE	6,5	64	1	0,01
AFYON	EMIRDAG	6,5	63	2	0,01
KONYA	ILGIN	6,5	62	1	0,01
ERZINCAN	CAYIRLI	7,5	61	1	0,06
SAKARYA	FERIZLI	7	61	1	0,03
BURDUR	KARAMANLI	7	60	1	0,03
CORUM	DODURGA	7,5	60	1	0,06
ORDU	MESUDIYE	7,5	60	1	0,06
VAN	BASKALE	7	60	2	0,03
AFYON	CAY	6,5	59	1	0,01
BILECIK	GOLPAZARI	7	58	1	0,03
CANAKKALE	AYVACIK	7	57	1	0,03
DENIZLI	GUNEY	7	57	1	0,03
SAKARYA	KARASU	6,5	57	1	0,01
ANTALYA	KUMLUCA	6,5	56	1	0,01
MANISA	KIRKAGAC	6,5	56	1	0,01
ELAZIG	PALU	7	55	1	0,03
ANTALYA	KORKUTELI	6,5	54	2	0,01
BINGOL	GENC	7	54	1	0,03
HATAY	YAYLADAGI	7	54	1	0,03
MUGLA	MARMARIS	6,5	54	1	0,02
DENIZLI	CAL	7	53	1	0,03
ADANA	IMAMOGLU	6,5	52	3	0,01
BINGOL	ADAKLI	7,5	52	1	0,06
BALIKESIR	MANYAS	7	51	1	0,03
ELAZIG	MADEN	7	51	1	0,03
BURDUR	TEFENNI	7	50	1	0,03
HATAY	HASSA	7	50	1	0,03
ISPARTA	EGIRDIR	6,5	50	1	0,01
MUGLA	ORTACA	6,5	50	1	0,01
OSMANIYE	TOPRAKKALE	7	50	1	0,03
SINOP	BOYABAT	6,5	50	1	0,01
BALIKESIR	IVRINDI	7	49	1	0,03
BURDUR	YESILOVA	7	49	1	0,03
DUZCE	CILIMLI	7,5	49	1	0,06
KASTAMONU	IHSANGAZI	7	48	1	0,03
KAYSERI	YAHYALI	6,5	48	3	0,01
MANISA	DEMIRCI	6,5	48	1	0,01
AYDIN	INCIRLIOVA	6,5	47	1	0,01
MUGLA	DALAMAN	6,5	47	1	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
ISPARTA	YALVAC	6,5	46	1	0,01
KUTAHYA	GEDIZ	6,5	46	1	0,01
AYDIN	BOZDOGAN	6,5	45	1	0,01
CANKIRI	ATKARACALAR	7,5	45	1	0,06
IZMIR	KARABURUN	7	45	1	0,03
KASTAMONU	ARAC	7	45	1	0,03
CANKIRI	KORGUN	7,5	44	1	0,06
CORUM	OGUZLAR	7	44	1	0,03
ERZINCAN	TERCAN	7	44	1	0,03
BINGOL	KIGI	7,5	43	1	0,06
CANKIRI	BAYRAMOREN	8	43	1	0,15
DENIZLI	SARAYKOY	6,5	43	1	0,01
DENIZLI	CARDAK	7	43	1	0,03
ERZURUM	PASINLER	6,5	43	2	0,01
OSMANIYE	HASANBEYLI	7	43	1	0,03
USAK	BANAZ	6,5	43	2	0,01
VAN	OZALP	7	43	1	0,03
ANTALYA	ELMALI	6,5	42	2	0,01
DUZCE	AKCAKOCA	6,5	42	1	0,02
KAYSERI	TALAS	6,5	42	3	0,01
HATAY	ALTINOZU	7	41	1	0,03
SIVAS	IMRANLI	7	40	1	0,03
IZMIR	KINIK	6,5	39	1	0,01
SAKARYA	KOCAALI	6,5	39	1	0,01
TEKIRDAG	MURATLI	6,5	39	3	0,01
ADIYAMAN	CELIKHAN	7	38	1	0,03
ERZURUM	CAT	7	37	1	0,03
KASTAMONU	TASKOPRU	6,5	37	2	0,01
MANISA	GORDES	6,5	37	1	0,01
MUGLA	DATCA	6,5	37	1	0,01
SAMSUN	AYVACIK	7	37	1	0,03
SIVAS	DOGANSAR	7,5	37	1	0,06
GUMUSHANE	SIRAN	7	36	1	0,03
BURDUR	ALTINYAYLA	7	35	1	0,03
ISPARTA	SARKIKARAAGAC	6,5	35	1	0,01
SIVAS	ZARA	6,5	35	1	0,01
ADIYAMAN	TUT	7	34	1	0,03
AFYON	SUHUT	6,5	34	1	0,01
ORDU	KORGAN	6,5	34	1	0,01
AYDIN	GERMENCIK	6,5	33	1	0,01
HATAY	KUMLU	7	33	1	0,03
KARABUK	YENICE	6,5	33	1	0,01
MUGLA	YATAGAN	6,5	33	1	0,01
VAN	EDREMIT	7	33	2	0,03
AYDIN	YENIPAZAR	6,5	32	1	0,01
DENIZLI	BOZKURT	7	31	1	0,03
ELAZIG	SIVRICE	7	31	1	0,03
KUTAHYA	EMET	6,5	31	1	0,01
SAMSUN	TEKKEKÖY	6,5	31	2	0,01
KAYSERI	BUNYAN	6,5	30	3	0,01
ZONGULDAK	ALAPLI	6,5	30	1	0,02
AFYON	ISCEHISAR	6,5	29	2	0,01
BILECIK	SOGUT	6,5	29	2	0,01
CANKIRI	ORTA	7	29	1	0,03
DENIZLI	BAKLAN	7	29	1	0,03
GIRESUN	ALUCRA	7	29	1	0,03
ANKARA	NALLIHAN	6,5	28	2	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
BURDUR	CAVDIR	7	28	1	0,03
DIYARBAKIR	CERMIK	6,5	28	1	0,01
ERZURUM	ASKALE	6,5	28	2	0,01
MALATYA	POTURGE	7	28	1	0,03
ORDU	GURGENTEPE	6,5	28	1	0,01
ANKARA	KIZILCAHAMAM	6,5	27	2	0,01
AYDIN	KARACASU	6,5	27	1	0,01
DENIZLI	ACIPAYAM	6,5	27	1	0,01
GUMUSHANE	KELKIT	6,5	27	1	0,01
ISPARTA	KECIBORLU	6,5	27	1	0,01
KONYA	DOGANHISAR	6,5	27	1	0,01
ORDU	KUMRU	6,5	27	1	0,01
ADANA	POZANTI	6,5	26	3	0,01
ANTALYA	KALE (DEMRE)	6,5	26	1	0,01
DIYARBAKIR	CUNGUS	7	26	1	0,03
ISPARTA	SENIRKENT	6,5	26	1	0,01
SAMSUN	ASARCIK	7,5	26	1	0,07
VAN	GURPINAR	7	26	2	0,03
BINGOL	YAYLADERE	7	25	1	0,03
ELAZIG	ALACAKAYA	7	25	1	0,03
K.MARAS	CAGLAYANCERIT	6,5	25	1	0,01
MALATYA	DOGANYOL	7	25	1	0,03
ADANA	KARATAS	6,5	24	2	0,01
ADANA	KARAISALI	6,5	24	3	0,01
ANTALYA	KEMER	6,5	24	1	0,01
BALIKESIR	KEPSUT	6,5	24	1	0,01
BURDUR	KEMER	7	24	1	0,03
CANKIRI	YAPRAKLI	7	24	1	0,03
EDIRNE	IPSALA	6,5	24	3	0,01
IZMIR	KIRAZ	6,5	24	1	0,01
MUS	HASKOY	6,5	24	1	0,01
ANTALYA	FINIKE	6,5	23	1	0,01
AYDIN	KUYUCAK	6,5	23	1	0,01
BITLIS	GUROYMAK	6,5	23	2	0,01
BOLU	SEBEN	7	23	1	0,03
IZMIR	BEYDAG	6,5	23	1	0,01
MUGLA	KOYCEGIZ	6,5	23	1	0,01
AFYON	BASMAKCI	6,5	22	1	0,01
AYDIN	KOSK	6,5	22	1	0,01
ELAZIG	KARAKOCAN	6,5	22	2	0,01
MUGLA	ULA	6,5	22	1	0,01
SINOP	DURAGAN	6,5	22	1	0,01
ERZINCAN	KEMAH	7	21	1	0,03
GAZIANTEP	ARABAN	6,5	21	3	0,01
ISPARTA	ULUBORLU	6,5	21	1	0,01
VAN	GEVAS	6,5	21	2	0,01
AFYON	SULTANDAGI	6,5	20	1	0,01
AYDIN	BUHARKENT	6,5	20	1	0,01
BALIKESIR	BALYA	7	20	1	0,03
BURSA	ORHANELI	6,5	20	2	0,01
DUZCE	YIGILCA	7	20	1	0,04
MALATYA	DOGANSEHIR	6,5	20	1	0,01
ORDU	AKKUS	7	20	1	0,03
ADIYAMAN	SINCIK	7	19	1	0,03
AFYON	COBANLAR	6,5	19	1	0,01
AYDIN	SULTANHISAR	6,5	19	1	0,01
BILECIK	PAZARYERI	6,5	19	2	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
DENIZLI	AKKOY	7	19	1	0,03
DENIZLI	BEKILLI	6,5	19	1	0,01
MUS	KORKUT	7	19	1	0,03
USAK	ULUBEY	6,5	19	2	0,01
ADANA	YUMURTALIK	6,5	18	1	0,01
AYDIN	KOCARLI	6,5	18	1	0,01
DENIZLI	HONAZ	6,5	18	1	0,01
ISPARTA	GELENDOST	6,5	18	1	0,01
KUTAHYA	HISARCIK	6,5	18	1	0,01
AFYON	BAYAT	6,5	17	2	0,01
CORUM	BAYAT	6,5	17	2	0,01
DENIZLI	BABADAG	6,5	17	1	0,01
ELAZIG	ARICAK	7	17	1	0,03
KONYA	DERBENT	6,5	17	3	0,01
MANISA	KOPRUBASI	6,5	17	1	0,01
ANTALYA	KAS	6,5	16	1	0,01
CANAKKALE	YENICE	6,5	16	1	0,01
CORUM	MECITOZU	6,5	16	1	0,01
CORUM	LACIN	7	16	1	0,03
KONYA	HUYUK	6,5	16	2	0,01
KUTAHYA	SAPHANE	6,5	16	1	0,01
AMASYA	HAMAMOZU	7	15	1	0,03
BURDUR	AGLASUN	6,5	15	1	0,01
DIYARBAKIR	DICLE	6,5	15	1	0,01
ISPARTA	ATABEY	6,5	15	1	0,01
KARABUK	OVACIK	7,5	15	1	0,06
CANKIRI	ELDIVAN	6,5	14	2	0,01
NIGDE	CAMARDI	6,5	14	4	0,01
SAMSUN	SALIPAZARI	6,5	14	2	0,01
TOKAT	PAZAR	6,5	14	1	0,01
AFYON	DAZKIRI	6,5	13	1	0,01
ERZINCAN	OTLUKBELI	7	13	1	0,03
KUTAHYA	ALTINTAS	6,5	13	2	0,01
BOLU	KIBRISCIK	7	12	1	0,03
ISPARTA	GONEN	6,5	12	1	0,01
KONYA	TUZLUKCU	6,5	12	1	0,01
KUTAHYA	PAZARLAR	6,5	12	1	0,01
SINOP	SARAYDUZU	7	12	1	0,03
AFYON	EVCILER	6,5	11	1	0,01
ERZURUM	TEKMAN	6,5	11	1	0,01
ORDU	CATALPINAR	6,5	11	2	0,01
SAKARYA	KAYNARCA	6,5	11	1	0,01
ADIYAMAN	GERGER	6,5	9	1	0,01
AYDIN	KARPUZLU	6,5	9	1	0,01
BURDUR	CELTIKCI	6,5	9	1	0,01
BURSA	KELES	6,5	9	2	0,01
CANKIRI	SABANOZU	6,5	9	2	0,01
CORUM	ORTAKOY	6,5	9	2	0,01
DENIZLI	CAMELI	6,5	9	1	0,01
GAZIANTEP	YAVUZELI	6,5	9	3	0,01
DENIZLI	BEYAGAC	6,5	8	1	0,01
ESKISEHIR	MIHALGAZI	6,5	8	2	0,01
KUTAHYA	CAVDARHISAR	6,5	8	1	0,01
AFYON	IHSANIYE	6,5	7	2	0,01
AMASYA	GOYNUCEK	6,5	7	1	0,01
MALATYA	KALE	6,5	7	1	0,01
OSMANIYE	SUMBAS	6,5	7	1	0,01

	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
TUNCELI	OVACIK	6,5	7	1	0,01
KONYA	AKOREN	6,5	6	4	0
KUTAHYA	DUMLUPINAR	6,5	6	2	0,01
VAN	SARAY	6,5	6	1	0,01
BILECIK	INHISAR	6,5	5	2	0,01
BILECIK	YENIPAZAR	6,5	5	1	0,01
ESKISEHIR	SARICAKAYA	6,5	5	2	0,01
KUTAHYA	ASLANAPA	6,5	5	1	0,01
TUNCELI	NAZIMIYE	6,5	4	1	0,01
KILIS	MUSABEYLI	6,5	2	3	0,01

C: Central

Comparison of the Metropolitan Cities Prioritized According to the Absolute Loss with the Hazard Zones Determined by the Official Earthquake Hazard Map

Metropolitan Cities	SUB-PROVINCE	Intensity	Absolute Loss	Hazard Zone	Relative Loss (Loss / Building)
ISTANBUL	ISTANBUL (M)	7,5	83824	2*	0,10
KOCAELI	KOCAELI (M)	8	24077	1	0,17
BURSA	BURSA (M)	7,5	16506	1	0,08
IZMIR	IZMIR (M)	7	14531	1	0,03
SAKARYA	SAKARYA (M)	8	8070	1	0,16
ADANA	ADANA (M)	6,5	1913	2	0,01
ANTALYA	ANTALYA (M)	6,5	1402	2	0,01
KONYA	KONYA (M)	6,5	1355	4	0,01
ERZURUM	ERZURUM (M)	6,5	439	2	0,01

M: Metropolitan

* 22 settlements are located in the second degree hazard zone, 15 settlements are located in the first degree hazard zone and 2 settlements are located in the third degree hazard zone in Istanbul. Therefore, the hazard zone of Istanbul Metropolitan city is accepted as second degree hazard zone.

APPENDIX H

COMPARISON OF THE SETTLEMENTS PRIORITIZED ACCORDING TO THE RELATIVE LOSS WITH THE HAZARD ZONES DETERMINED BY THE OFFICIAL EARTHQUAKE HAZARD MAP

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
YALOVA	CINARCIK	8	0,21	1	357
SAKARYA	AKYAZI	8	0,19	1	681
YALOVA	CIFTLIKKOY	8	0,19	1	298
BOLU	BOLU C.	8	0,18	1	1841
YALOVA	YALOVA C.	8	0,18	1	1507
BURSA	ORHANGAZI	8	0,18	1	945
TEKIRDAG	SARKOY	8	0,18	1	712
TOKAT	NIKSAR	8	0,17	1	1400
SAKARYA	HENDEK	8	0,17	1	869
BOLU	GEREDE	8	0,17	1	583
AMASYA	TASOVA	8	0,17	1	282
YALOVA	TERMAL	8	0,17	1	73
ERZINCAN	ERZİNCAN C.	8	0,16	1	2025
KASTAMONU	TOSYA	8	0,16	1	1364
TOKAT	ERBAA	8	0,16	1	1251
CORUM	OSMANCIK	8	0,16	1	786
SAMSUN	HAVZA	8	0,16	1	735
SAKARYA	GEYVE	8	0,16	1	543
SIVAS	SUSEHRI	8	0,16	1	424
SAMSUN	LADIK	8	0,16	1	377
CANKIRI	ILGAZ	8	0,16	1	312
TOKAT	RESADIYE	8	0,16	1	309
BOLU	YENICAGA	8	0,16	1	183
GIRESUN	CAMOLUK	8	0,16	1	133
TUNCELI	PULUMUR	8	0,16	1	94
BOLU	DORTDIVAN	8	0,16	1	93
YALOVA	ALTINOVA	8	0,16	1	84
SIVAS	GOLOVA	8	0,16	1	74
ERZINCAN	UZUMLU	8	0,15	1	631
SAKARYA	PAMUKOVA	8	0,15	1	403
MUS	VARTO	8	0,15	1	384
CORUM	KARGI	8	0,15	1	285
SIVAS	KOYULHISAR	8	0,15	1	273
CANKIRI	CERKES	8	0,15	1	263
SIVAS	AKINCILAR	8	0,15	1	211
TOKAT	BASCIFTLIK	8	0,15	1	182
DUZCE	KAYNASLI	8	0,15	1	177
BINGOL	KARLIOVA	8	0,15	1	138
SAKARYA	KARAPURCEK	8	0,15	1	136
ERZINCAN	REFAHIYE	8	0,15	1	130
DUZCE	GOLYAKA	8	0,15	1	126
BINGOL	YEDISU	8	0,15	1	68
CANKIRI	BAYRAMOREN	8	0,15	1	43
TEKIRDAG	TEKİRDAĞ C.	7,5	0,09	2	1347
YALOVA	ARMUTLU	7,5	0,08	1	164
AMASYA	MERZIFON	7,5	0,07	1	666

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
AMASYA	SULUOVA	7,5	0,07	1	633
DUZCE	DÜZCE C.	7,5	0,07	1	612
BURSA	YENISEHIR	7,5	0,07	1	339
SAMSUN	VEZIRKOPRU	7,5	0,07	1	298
AMASYA	GUMUSHACIKOY	7,5	0,07	1	271
BILECIK	OSMANELI	7,5	0,07	1	158
SAMSUN	KAVAK	7,5	0,07	1	97
KARABUK	ESKIPAZAR	7,5	0,07	1	96
DUZCE	GUMUSOVA	7,5	0,07	1	86
BOLU	MENGEN	7,5	0,07	1	76
TOKAT	ALMUS	7,5	0,07	1	74
SAMSUN	ASARCIK	7,5	0,07	1	26
VAN	VAN C.	7,5	0,06	2	2285
BURSA	IZNIK	7,5	0,06	1	252
MUS	BULANIK	7,5	0,06	1	246
GIRESUN	SEBINKARAHISAR	7,5	0,06	1	222
BITLIS	ADILCEVAZ	7,5	0,06	1	172
BOLU	MUDURNU	7,5	0,06	1	104
CANKIRI	KURSUNLU	7,5	0,06	1	84
BOLU	GOYNUK	7,5	0,06	1	75
DUZCE	CUMAYERI	7,5	0,06	1	67
SAKARYA	TARAKLI	7,5	0,06	1	67
ERZINCAN	CAYIRLI	7,5	0,06	1	61
CORUM	DODURGA	7,5	0,06	1	60
ORDU	MESUDIYE	7,5	0,06	1	60
BINGOL	ADAKLI	7,5	0,06	1	52
DUZCE	CILIMLI	7,5	0,06	1	49
CANKIRI	ATKARACALAR	7,5	0,06	1	45
CANKIRI	KORGUN	7,5	0,06	1	44
BINGOL	KIGI	7,5	0,06	1	43
SIVAS	DOGANSAR	7,5	0,06	1	37
KARABUK	OVACIK	7,5	0,06	1	15
MANISA	MANİSA C.	7	0,04	1	919
BURSA	INEGOL	7	0,04	1	536
MANISA	SALIHLI	7	0,04	1	483
BALIKESIR	BANDIRMA	7	0,04	1	460
CANAKKALE	ÇANAKKALE C.	7	0,04	1	339
AMASYA	AMASYA C.	7	0,04	1	336
BURSA	M.KEMALPASA	7	0,04	1	304
BITLIS	AHLAT	7,5	0,04	1	234
BALIKESIR	ERDEK	7	0,04	1	159
BILECIK	BİLECİK C.	7	0,04	1	145
ELAZIG	KOVANCILAR	7	0,04	1	74
DUZCE	YIGILCA	7	0,04	1	20
OSMANIYE	OSMANİYE C.	7	0,03	1	905
HATAY	ANTAKYA	7	0,03	1	768
HATAY	ISKENDERUN	7	0,03	1	705
ADIYAMAN	ADIYAMAN C.	7	0,03	2	696
MANISA	TURGUTLU	7	0,03	1	639
MANISA	AKHISAR	7	0,03	1	585
TOKAT	TOKAT C.	7	0,03	1	528
BALIKESIR	AYVALIK	7	0,03	1	442
BALIKESIR	BURHANIYE	7	0,03	1	410
IZMIR	BERGAMA	7	0,03	1	402
HATAY	KIRIKHAN	7	0,03	1	360
IZMIR	CESME	7	0,03	1	348
HATAY	DORTYOL	7	0,03	1	333

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
MANISA	ALASEHIR	7	0,03	1	306
HATAY	REYHANLI	7	0,03	1	280
EDIRNE	KESAN	7	0,03	2	269
BALIKESIR	EDREMIT	7	0,03	1	262
BURSA	KARACABEY	7	0,03	1	258
BINGOL	BİNGÖL C.	7	0,03	1	251
MANISA	KULA	7	0,03	1	236
HATAY	SAMANDAG	7	0,03	1	232
BALIKESIR	SUSURLUK	7	0,03	1	190
CANAKKALE	BIGA	7	0,03	1	188
HATAY	ERZIN	7	0,03	1	173
CORUM	ISKILIP	7	0,03	1	167
CANAKKALE	CAN	7	0,03	1	161
HATAY	BELEN	7	0,03	1	159
TEKIRDAG	MALKARA	7	0,03	2	157
GAZIANTEP	ISLAHIYE	7	0,03	1	148
ADIYAMAN	GOLBASI	7	0,03	1	137
DENIZLI	BULDAN	7	0,03	1	137
ORDU	GOLKOY	7	0,03	1	134
MANISA	SARIGOL	7	0,03	1	130
CANAKKALE	BAYRAMIC	7	0,03	1	129
ADIYAMAN	BESNI	7	0,03	2	126
MUS	MALAZGIRT	7	0,03	1	125
ORDU	AYBASTI	7	0,03	1	125
CANAKKALE	EZINE	7	0,03	1	121
K.MARAS	PAZARCIK	7	0,03	1	120
USAK	ESME	7	0,03	1	119
BALIKESIR	BIGADIC	7	0,03	1	114
MANISA	SARUHANLI	7	0,03	1	112
BURDUR	GOLHISAR	7	0,03	1	110
BALIKESIR	HAVRAN	7	0,03	1	107
ERZURUM	HINIS	7	0,03	1	107
EDIRNE	ENEZ	7	0,03	2	105
BALIKESIR	SINDIRGI	7	0,03	1	100
MANISA	GOLMARMARA	7	0,03	1	91
BALIKESIR	GOMEC	7	0,03	1	87
MANISA	AHMETLI	7	0,03	1	83
CANAKKALE	LAPSEKI	7	0,03	1	74
ERZURUM	KARACOBAN	7	0,03	1	73
BALIKESIR	SAVASTEPE	7	0,03	1	72
ANKARA	CAMLIDERE	7	0,03	1	70
OSMANIYE	BAHCE	7	0,03	1	70
GAZIANTEP	NURDAGI	7	0,03	1	69
K.MARAS	TURKOGLU	7	0,03	1	68
SAKARYA	FERIZLI	7	0,03	1	61
BURDUR	KARAMANLI	7	0,03	1	60
VAN	BASKALE	7	0,03	2	60
BILECIK	GOLPAZARI	7	0,03	1	58
CANAKKALE	AYVACIK	7	0,03	1	57
DENIZLI	GUNEY	7	0,03	1	57
ELAZIG	PALU	7	0,03	1	55
BINGOL	GENC	7	0,03	1	54
HATAY	YAYLADAGI	7	0,03	1	54
DENIZLI	CAL	7	0,03	1	53
BALIKESIR	MANYAS	7	0,03	1	51
ELAZIG	MADEN	7	0,03	1	51
BURDUR	TEFENNI	7	0,03	1	50

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
HATAY	HASSA	7	0,03	1	50
OSMANIYE	TOPRAKKALE	7	0,03	1	50
BALIKESIR	IVRINDI	7	0,03	1	49
BURDUR	YESILOVA	7	0,03	1	49
KASTAMONU	IHSANGAZI	7	0,03	1	48
IZMIR	KARABURUN	7	0,03	1	45
KASTAMONU	ARAC	7	0,03	1	45
CORUM	OGUZLAR	7	0,03	1	44
ERZINCAN	TERCAN	7	0,03	1	44
DENIZLI	CARDAK	7	0,03	1	43
OSMANIYE	HASANBEYLI	7	0,03	1	43
VAN	OZALP	7	0,03	1	43
HATAY	ALTINOZU	7	0,03	1	41
SIVAS	IMRANLI	7	0,03	1	40
ADIYAMAN	CELIKHAN	7	0,03	1	38
ERZURUM	CAT	7	0,03	1	37
SAMSUN	AYVACIK	7	0,03	1	37
GUMUSHANE	SIRAN	7	0,03	1	36
BURDUR	ALTINYAYLA	7	0,03	1	35
ADIYAMAN	TUT	7	0,03	1	34
HATAY	KUMLU	7	0,03	1	33
VAN	EDREMIT	7	0,03	2	33
DENIZLI	BOZKURT	7	0,03	1	31
ELAZIG	SIVRICE	7	0,03	1	31
CANKIRI	ORTA	7	0,03	1	29
DENIZLI	BAKLAN	7	0,03	1	29
GIRESUN	ALUCRA	7	0,03	1	29
BURDUR	CAVDIR	7	0,03	1	28
MALATYA	POTURGE	7	0,03	1	28
DIYARBAKIR	CUNGUS	7	0,03	1	26
VAN	GURPINAR	7	0,03	2	26
BINGOL	YAYLADERE	7	0,03	1	25
ELAZIG	ALACAKAYA	7	0,03	1	25
MALATYA	DOGANYOL	7	0,03	1	25
BURDUR	KEMER	7	0,03	1	24
CANKIRI	YAPRAKLI	7	0,03	1	24
BOLU	SEBEN	7	0,03	1	23
ERZINCAN	KEMAH	7	0,03	1	21
BALIKESIR	BALYA	7	0,03	1	20
ORDU	AKKUS	7	0,03	1	20
ADIYAMAN	SINCIK	7	0,03	1	19
DENIZLI	AKKOY	7	0,03	1	19
MUS	KORKUT	7	0,03	1	19
ELAZIG	ARICAK	7	0,03	1	17
CORUM	LACIN	7	0,03	1	16
AMASYA	HAMAMOZU	7	0,03	1	15
ERZINCAN	OTLUKBELI	7	0,03	1	13
BOLU	KIBRISCIK	7	0,03	1	12
SINOP	SARAYDUZU	7	0,03	1	12
BALIKESIR	BALIKESİR C.	6,5	0,02	1	469
AYDIN	AYDIN C.	6,5	0,02	1	303
KUTAHYA	SIMAV	6,5	0,02	1	73
MUGLA	MARMARIS	6,5	0,02	1	54
DUZCE	AKCAKOCA	6,5	0,02	1	42
ZONGULDAK	ALAPLI	6,5	0,02	1	30
DENIZLI	DENİZLİ C.	6,5	0,01	1	586
K.MARAS	K.MARAŞ C.	6,5	0,01	1	457

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
KUTAHYA	KÜTAHYA C.	6,5	0,01	2	384
ICEL(MERSIN)	TARSUS	6,5	0,01	3	361
ISPARTA	ISPARTA C.	6,5	0,01	1	354
CORUM	ÇORUM C.	6,5	0,01	2	286
AFYON	AFYON C.	6,5	0,01	2	240
TEKIRDAG	CORLU	6,5	0,01	3	230
AYDIN	KUSADASI	6,5	0,01	1	211
AYDIN	NAZILLI	6,5	0,01	1	210
AYDIN	DİDİM(YENİHİSAR)	6,5	0,01	1	204
IZMIR	ODEMIS	6,5	0,01	1	190
ADANA	KOZAN	6,5	0,01	3	184
KARABUK	KARABÜK C.	6,5	0,01	1	180
ADANA	CEYHAN	6,5	0,01	2	171
OSMANIYE	KADIRLI	6,5	0,01	2	167
BURDUR	BURDUR C.	6,5	0,01	1	156
MUGLA	FETHIYE	6,5	0,01	1	144
AYDIN	SOKE	6,5	0,01	1	138
MANISA	SOMA	6,5	0,01	1	133
MUGLA	BODRUM	6,5	0,01	1	130
TOKAT	TURHAL	6,5	0,01	1	125
IZMIR	TIRE	6,5	0,01	1	124
KASTAMONU	KASTAMONU C.	6,5	0,01	1	121
KONYA	AKSEHIR	6,5	0,01	1	121
MUGLA	MUĞLA C.	6,5	0,01	1	109
DIYARBAKIR	ERGANI	6,5	0,01	1	108
AFYON	BOLVADIN	6,5	0,01	1	105
TOKAT	ZILE	6,5	0,01	1	100
BILECIK	BOZUYUK	6,5	0,01	2	96
BALIKESIR	GONEN	6,5	0,01	1	93
MUGLA	MILAS	6,5	0,01	1	92
CANKIRI	ÇANKIRI C.	6,5	0,01	1	90
BURDUR	BUCAK	6,5	0,01	1	87
MUS	MUŞ C.	6,5	0,01	1	77
KARABUK	SAFRANBOLU	6,5	0,01	1	76
OSMANIYE	DUZICI	6,5	0,01	1	76
ADIYAMAN	KAHTA	6,5	0,01	2	74
TEKIRDAG	CERKEZKOY	6,5	0,01	3	73
BITLIS	TATVAN	6,5	0,01	2	65
AYDIN	CINE	6,5	0,01	1	64
AFYON	EMIRDAG	6,5	0,01	2	63
KONYA	ILGIN	6,5	0,01	1	62
AFYON	CAY	6,5	0,01	1	59
SAKARYA	KARASU	6,5	0,01	1	57
ANTALYA	KUMLUCA	6,5	0,01	1	56
MANISA	KIRKAGAC	6,5	0,01	1	56
ANTALYA	KORKUTELI	6,5	0,01	2	54
ADANA	IMAMOGLU	6,5	0,01	3	52
ISPARTA	EGIRDIR	6,5	0,01	1	50
MUGLA	ORTACA	6,5	0,01	1	50
SINOP	BOYABAT	6,5	0,01	1	50
KAYSERI	YAHYALI	6,5	0,01	3	48
MANISA	DEMIRCI	6,5	0,01	1	48
AYDIN	INCIRLIOVA	6,5	0,01	1	47
MUGLA	DALAMAN	6,5	0,01	1	47
ISPARTA	YALVAC	6,5	0,01	1	46
KUTAHYA	GEDIZ	6,5	0,01	1	46
AYDIN	BOZDOGAN	6,5	0,01	1	45

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
DENIZLI	SARAYKOY	6,5	0,01	1	43
ERZURUM	PASINLER	6,5	0,01	2	43
USAK	BANAZ	6,5	0,01	2	43
ANTALYA	ELMALI	6,5	0,01	2	42
KAYSERI	TALAS	6,5	0,01	3	42
IZMIR	KINIK	6,5	0,01	1	39
SAKARYA	KOCAALI	6,5	0,01	1	39
TEKIRDAG	MURATLI	6,5	0,01	3	39
KASTAMONU	TASKOPRU	6,5	0,01	2	37
MANISA	GORDES	6,5	0,01	1	37
MUGLA	DATCA	6,5	0,01	1	37
ISPARTA	SARKIKARAAGAC	6,5	0,01	1	35
SIVAS	ZARA	6,5	0,01	1	35
AFYON	SUHUT	6,5	0,01	1	34
ORDU	KORGAN	6,5	0,01	1	34
AYDIN	GERMENCIK	6,5	0,01	1	33
KARABUK	YENICE	6,5	0,01	1	33
MUGLA	YATAGAN	6,5	0,01	1	33
AYDIN	YENIPAZAR	6,5	0,01	1	32
KUTAHYA	EMET	6,5	0,01	1	31
SAMSUN	TEKKEKÖY	6,5	0,01	2	31
KAYSERI	BUNYAN	6,5	0,01	3	30
AFYON	ISCEHISAR	6,5	0,01	2	29
BILECIK	SOGUT	6,5	0,01	2	29
ANKARA	NALLIHAN	6,5	0,01	2	28
DIYARBAKIR	CERMIK	6,5	0,01	1	28
ERZURUM	ASKALE	6,5	0,01	2	28
ORDU	GURGENTEPE	6,5	0,01	1	28
ANKARA	KIZILCAHAMAM	6,5	0,01	2	27
AYDIN	KARACASU	6,5	0,01	1	27
DENIZLI	ACIPAYAM	6,5	0,01	1	27
GUMUSHANE	KELKIT	6,5	0,01	1	27
ISPARTA	KECIBORLU	6,5	0,01	1	27
KONYA	DOGANHISAR	6,5	0,01	1	27
ORDU	KUMRU	6,5	0,01	1	27
ADANA	POZANTI	6,5	0,01	3	26
ANTALYA	KALE (DEMRE)	6,5	0,01	1	26
ISPARTA	SENIRKENT	6,5	0,01	1	26
K.MARAS	CAGLAYANCERIT	6,5	0,01	1	25
ADANA	KARATAS	6,5	0,01	2	24
ADANA	KARAISALI	6,5	0,01	3	24
ANTALYA	KEMER	6,5	0,01	1	24
BALIKESIR	KEPSUT	6,5	0,01	1	24
EDIRNE	IPSALA	6,5	0,01	3	24
IZMIR	KIRAZ	6,5	0,01	1	24
MUS	HASKOY	6,5	0,01	1	24
ANTALYA	FINIKE	6,5	0,01	1	23
AYDIN	KUYUCAK	6,5	0,01	1	23
BITLIS	GUROYMAK	6,5	0,01	2	23
IZMIR	BEYDAG	6,5	0,01	1	23
MUGLA	KOYCEGIZ	6,5	0,01	1	23
AFYON	BASMAKCI	6,5	0,01	1	22
AYDIN	KOSK	6,5	0,01	1	22
ELAZIG	KARAKOCAN	6,5	0,01	2	22
MUGLA	ULA	6,5	0,01	1	22
SINOP	DURAGAN	6,5	0,01	1	22
GAZIANTEP	ARABAN	6,5	0,01	3	21

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
ISPARTA	ULUBORLU	6,5	0,01	1	21
VAN	GEVAS	6,5	0,01	2	21
AFYON	SULTANDAGI	6,5	0,01	1	20
AYDIN	BUHARKENT	6,5	0,01	1	20
BURSA	ORHANELI	6,5	0,01	2	20
MALATYA	DOGANSEHIR	6,5	0,01	1	20
AFYON	COBANLAR	6,5	0,01	1	19
AYDIN	SULTANHISAR	6,5	0,01	1	19
BILECIK	PAZARYERI	6,5	0,01	2	19
DENIZLI	BEKILLI	6,5	0,01	1	19
USAK	ULUBEY	6,5	0,01	2	19
ADANA	YUMURTALIK	6,5	0,01	1	18
AYDIN	KOCARLI	6,5	0,01	1	18
DENIZLI	HONAZ	6,5	0,01	1	18
ISPARTA	GELENDOST	6,5	0,01	1	18
KUTAHYA	HISARCIK	6,5	0,01	1	18
AFYON	BAYAT	6,5	0,01	2	17
CORUM	BAYAT	6,5	0,01	2	17
DENIZLI	BABADAG	6,5	0,01	1	17
KONYA	DERBENT	6,5	0,01	3	17
MANISA	KOPRUBASI	6,5	0,01	1	17
ANTALYA	KAS	6,5	0,01	1	16
CANAKKALE	YENICE	6,5	0,01	1	16
CORUM	MECITOZU	6,5	0,01	1	16
KONYA	HUYUK	6,5	0,01	2	16
KUTAHYA	SAPHANE	6,5	0,01	1	16
BURDUR	AGLASUN	6,5	0,01	1	15
DIYARBAKIR	DICLE	6,5	0,01	1	15
ISPARTA	ATABEY	6,5	0,01	1	15
CANKIRI	ELDIVAN	6,5	0,01	2	14
NIGDE	CAMARDI	6,5	0,01	4	14
SAMSUN	SALIPAZARI	6,5	0,01	2	14
TOKAT	PAZAR	6,5	0,01	1	14
AFYON	DAZKIRI	6,5	0,01	1	13
KUTAHYA	ALTINTAS	6,5	0,01	2	13
ISPARTA	GONEN	6,5	0,01	1	12
KONYA	TUZLUKCU	6,5	0,01	1	12
KUTAHYA	PAZARLAR	6,5	0,01	1	12
AFYON	EVCILER	6,5	0,01	1	11
ERZURUM	TEKMAN	6,5	0,01	1	11
ORDU	CATALPINAR	6,5	0,01	2	11
SAKARYA	KAYNARCA	6,5	0,01	1	11
ADIYAMAN	GERGER	6,5	0,01	1	9
AYDIN	KARPUZLU	6,5	0,01	1	9
BURDUR	CELTIKCI	6,5	0,01	1	9
BURSA	KELES	6,5	0,01	2	9
CANKIRI	SABANOZU	6,5	0,01	2	9
CORUM	ORTAKOY	6,5	0,01	2	9
DENIZLI	CAMELI	6,5	0,01	1	9
GAZIANTEP	YAVUZELI	6,5	0,01	3	9
DENIZLI	BEYAGAC	6,5	0,01	1	8
ESKISEHIR	MIHALGAZI	6,5	0,01	2	8
KUTAHYA	CAVDARHISAR	6,5	0,01	1	8
AFYON	IHSANIYE	6,5	0,01	2	7
AMASYA	GOYNUCEK	6,5	0,01	1	7
MALATYA	KALE	6,5	0,01	1	7
OSMANIYE	SUMBAS	6,5	0,01	1	7

	SUB-PROVINCE	Intensity	Relative Loss/ Loss Rate	Hazard Zone	Absolute Loss
TUNCELI	OVACIK	6,5	0,01	1	7
KUTAHYA	DUMLUPINAR	6,5	0,01	2	6
VAN	SARAY	6,5	0,01	1	6
BILECIK	INHISAR	6,5	0,01	2	5
BILECIK	YENIPAZAR	6,5	0,01	1	5
ESKISEHIR	SARICAKAYA	6,5	0,01	2	5
KUTAHYA	ASLANAPA	6,5	0,01	1	5
TUNCELI	NAZIMIYE	6,5	0,01	1	4
KILIS	MUSABEYLI	6,5	0,01	3	2
KONYA	AKOREN	6,5	0	4	6

C: Central

Comparison of the Metropolitan Cities Prioritized According to the Absolute Loss with the Hazard Zones Determined by the Official Earthquake Hazard Map

Metropolitan Cities	SUB-PROVINCE	Intensity	Relative Loss (Loss / Building)	Hazard Zone	Absolute Loss
KOCAELI	KOCAELI (M)	8	0,17	1	24077
SAKARYA	SAKARYA (M)	8	0,16	1	8070
ISTANBUL	ISTANBUL (M)	7,5	0,10	2	83824
BURSA	BURSA (M)	7,5	0,08	1	16506
IZMIR	IZMIR (M)	7	0,03	1	14531
ADANA	ADANA (M)	6,5	0,01	2	1913
ANTALYA	ANTALYA (M)	6,5	0,01	2	1402
KONYA	KONYA (M)	6,5	0,01	4	1355
ERZURUM	ERZURUM (M)	6,5	0,01	2	439

M: Metropolitan

APPENDIX I

COMPARISON OF THE PROVINCES PRIORITIZED ACCORDING TO THE ABSOLUTE LOSS WITH THE LOCATION OF SETTLEMENTS ACCORDING TO THE INVESTMENT PRIORITY REGIONS

PROVINCE	Absolute Loss	Priority of Incentives Region	Relative Loss/ Loss Rate
ISTANBUL (M.)	83824	1	0,10
KOCAELI (M.)	24077	1	0,17
BURSA (M.)	19168	1	0,08
IZMIR (M.)	15727	1	0,03
SAKARYA (M.)	10936	2	0,14
TOKAT	3985	5	0,07
MANISA	3875	3	0,03
HATAY	3189	4	0,03
BALIKESIR	3111	3	0,03
BOLU	2990	2	0,14
ERZINCAN	2925	4	0,14
TEKIRDAG	2558	2	0,05
YALOVA	2484	2	0,17
VAN	2474	6	0,06
ADANA (M.)	2343	2	0,01
AMASYA	2210	4	0,06
CORUM	1687	4	0,04
ANTALYA (M.)	1644	1	0,01
KONYA (M.)	1617	2	0,01
KASTAMONU	1614	4	0,07
SAMSUN	1614	3	0,09
AYDIN	1425	2	0,01
OSMANIYE	1318	5	0,02
DUZCE	1179	4	0,07
ADIYAMAN	1132	5	0,03
DENIZLI	1097	2	0,02
SIVAS	1094	4	0,10
CANAKKALE	1086	2	0,03
CANKIRI	957	5	0,05
MUS	875	6	0,04
MUGLA	740	1	0,01
ERZURUM	738	5	0,02
K.MARAS	669	5	0,01
AFYON	638	4	0,01
BINGOL	630	6	0,05
BURDUR	624	3	0,02
KUTAHYA	612	4	0,01
ISPARTA	605	2	0,01

PROVINCE	Absolute Loss	Priority of Incentives Region	Relative Loss/ Loss Rate
BILECIK	516	3	0,02
BITLIS	494	6	0,03
ORDU	439	5	0,02
KARABUK	400	3	0,02
EDIRNE	399	2	0,03
GIRESUN	384	5	0,07
ICEL(MERSIN)	361	3	0,01
ELAZIG	274	4	0,03
GAZIANTEP	247	3	0,02
USAK	182	3	0,02
DIYARBAKIR	177	6	0,01
ANKARA	125	1	0,02
KAYSERI	121	2	0,01
TUNCELI	104	5	0,07
SINOP	84	5	0,01
MALATYA	79	4	0,02
GUMUSHANE	64	5	0,02
ZONGULDAK	30	3	0,02
NIGDE	14	5	0,01
ESKISEHIR	13	1	0,01
KILIS	2	5	0,01
AĞRI*	-	6	-
AKSARAY*	-	5	-
ARDAHAN*	-	6	-
ARTVİN*	-	4	-
BARTIN*	-	4	-
BATMAN*	-	6	-
BAYBURT*	-	5	-
HAKKARİ*	-	6	-
IĞDIR*	-	6	-
KARAMAN*	-	3	-
KARS*	-	6	-
KIRIKKALE*	-	4	-
KIRKLARELİ*	-	2	-
KIRŞEHİR*	-	4	-
MARDİN*	-	6	-
NEVŞEHİR*	-	4	-
RİZE*	-	4	-
SİİRT*	-	6	-
ŞANLIURFA*	-	6	-
ŞIRNAK*	-	6	-
TRABZON*	-	3	-
YOZGAT*	-	5	-
GÖKCEADA-BOZCADA DISTRICTS*	-	6	-

* All settlements with an expected hazard intensity level of 6.0 and less are excluded from the analyses assuming that insignificant damage is likely to take place in these settlements.

APPENDIX J

COMPARISON OF THE SETTLEMENTS PRIORITIZED ACCORDING TO THE RELATIVE LOSS WITH THE LOCATION OF SETTLEMENTS ACCORDING TO THE INVESTMENT PRIORITY REGIONS

PROVINCE	Relative Loss/ Loss Rate	Priority of Incentives Region	Absolute Loss
KOCAELI (M.)	0,17	1	24077
YALOVA	0,17	2	2484
SAKARYA (M.)	0,14	2	10936
BOLU	0,14	2	2990
ERZINCAN	0,14	4	2925
ISTANBUL (M.)	0,10	1	83824
SIVAS	0,10	4	1094
SAMSUN	0,09	3	1614
BURSA (M.)	0,08	1	19168
TOKAT	0,07	5	3985
KASTAMONU	0,07	4	1614
DUZCE	0,07	4	1179
GIRESUN	0,07	5	384
TUNCELI	0,07	5	104
VAN	0,06	6	2474
AMASYA	0,06	4	2210
TEKIRDAG	0,05	2	2558
CANKIRI	0,05	5	957
BINGOL	0,05	6	630
CORUM	0,04	4	1687
MUS	0,04	6	875
IZMIR (M.)	0,03	1	15727
MANISA	0,03	3	3875
HATAY	0,03	4	3189
BALIKESIR	0,03	3	3111
ADIYAMAN	0,03	5	1132
CANAKKALE	0,03	2	1086
BITLIS	0,03	6	494
EDIRNE	0,03	2	399
ELAZIG	0,03	4	274
OSMANIYE	0,02	5	1318
DENIZLI	0,02	2	1097
ERZURUM	0,02	5	738
BURDUR	0,02	3	624
BILECIK	0,02	3	516
ORDU	0,02	5	439
KARABUK	0,02	3	400
GAZIANTEP	0,02	3	247

PROVINCE	Relative Loss/ Loss Rate	Priority of Incentives Region	Absolute Loss
USAK	0,02	3	182
ANKARA	0,02	1	125
MALATYA	0,02	4	79
GUMUSHANE	0,02	5	64
ZONGULDAK	0,02	3	30
ADANA (M.)	0,01	2	2343
ANTALYA (M.)	0,01	1	1644
KONYA (M.)	0,01	2	1617
AYDIN	0,01	2	1425
MUGLA	0,01	1	740
K.MARAS	0,01	5	669
AFYON	0,01	4	638
KUTAHYA	0,01	4	612
ISPARTA	0,01	2	605
ICEL(MERSIN)	0,01	3	361
DIYARBAKIR	0,01	6	177
KAYSERI	0,01	2	121
SINOP	0,01	5	84
NIGDE	0,01	5	14
ESKISEHIR	0,01	1	13
KILIS	0,01	5	2
AĞRI*	-	6	-
AKSARAY*	-	5	-
ARDAHAN*	-	6	-
ARTVİN*	-	4	-
BARTIN*	-	4	-
BATMAN*	-	6	-
BAYBURT*	-	5	-
HAKKÂRİ*	-	6	-
IĞDIR*	-	6	-
KARAMAN*	-	3	-
KARS*	-	6	-
KIRIKKALE*	-	4	-
KIRKLARELİ*	-	2	-
KIRŞEHİR*	-	4	-
MARDİN*	-	6	-
NEVŞEHİR*	-	4	-
RİZE*	-	4	-
SİİRT*	-	6	-
ŞANLIURFA*	-	6	-
ŞIRNAK*	-	6	-
TRABZON*	-	3	-
YOZGAT*	-	5	-
GÖKCEADA-BOZCADA DISTRICTS*	-	6	-

* All settlements with an expected hazard intensity level of 6.0 and less are excluded from the analyses assuming that insignificant damage is likely to take place in these settlements.

VITA

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EDUCATION

Degree	Institution	Year of Graduation
MS	METU City Planning	2008
BS	GAZI University City and Regional Planning	2005
High School	19 Mayıs TMK, Girne	2000

WORK EXPERINCE

Year	Place	Enrollment
2006-2008	InfoPlan GIS Planning	City Planner
2003	Pamir Planning	Intern Planner
2002	Nicosia Municipality	Intern Planner

FOREIGN LANGUAGES

Advanced English, Intermediate German

PUBLICATIONS

1. Sönmez T., "Determination of Seismic Vulnerabilities and Risks for Urban Mitigation Planning in Turkey", The Association of European Schools of Planning (AESOP) 26th Annual Congress, Ankara, July 2012.

2. Sönmez T., Türkiye'de Sakınım Planlaması için Kentsel Yerleşmelerin Sismik Zarar Görebilirliklerinin ve Risklerinin Belirlenmesi, Kentsel ve Bölgesel Araştırmalar Ağı (KBAM) -2.Sempozyumu, Ankara, 2011.

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