LIFE CYCLE ASSESSMENT OF BUILDING MATERIALS IN HOTEL REFURBISHMENT PROJECTS: A CASE STUDY IN ANKARA

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Approval of the Graduate School of Natural and Applied Sciences.

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy in Building Science.

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy in Building Science.

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ABSTRACT

LIFE CYCLE ASSESSMENT OF BUILDING MATERIALS IN HOTEL REFURBISHMENT PROJECTS: A CASE STUDY IN ANKARA

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Buildings generate millions of tons of greenhouse gases, toxic air emissions, water pollutants and solid wastes that contribute to negative environmental impacts. Life Cycle Assessment (LCA) is a methodology for assessing the environmental performance of products over their life time. However, many building products are discarded much before the end of their service life, especially as a result of refurbishment and renovation projects. The need for such projects is increasing because most buildings are not designed to accommodate changes in their functions and needs of their occupants. This is particular to commercial buildings, especially hospitality facilities, which are unique with regard to operational schemes and the type of services offered that are highly resource-intensive.

In this investigation, statistical data related to refurbishment and renovation projects in Turkey were analyzed to determine the percentage of refurbishment projects for hotels. Bills of quantities for refurbishment projects of three five-star hotels in Ankara were obtained and evaluated with regard to the volume and type of material discarded as a result of the renovation works. ATHENA, an LCA software, was used to evaluate these projects according to the six environmental impact indicators: primary energy consumption, solid waste, air pollution index, water pollution index, global warming potential and weighted resource use.

A system was formulated for evaluating materials according to each indicator by calculating their “eco-scores”; the total score is considered to be the yard-stick for comparing environmental appropriateness of these materials. Finally, recommendations on the choice of materials were made, with an aim to reducing material waste and harmful emissions.

Keywords: Life Cycle Assessment, Hotel Buildings, Renovations and Refurbishments, ATHENA software, Environmental Friendly Materials.

ÖZ

ANKARA’DAKİ BİR ÇALIŞMA BAZ ALINARAK YENİLEME PROJELERİNDEKİ BİNA MALZEMELERİNİN HAYAT DÖNGÜLERİNİN DEĞERLENDİRİLMESİ

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Binaların sebep olduğu milyonlarca ton sera gazı ve toksik gaz yayılımı, su ve katı kirliliği çevre üzerinde negatif bir etki yaratmaktadır. Hayat döngüsü değerlendirmesi ise bu noktada ortaya çıkan ve bir malzemenin tüm hayat döngüsü içindeki çevresel etkilerini değerlendirmeyi kapsayan bir metoddur.

Ne yazık ki, pek çok bina malzemesi kendi servis sürelerini tamamlayamadan yenilenmektedirler. Yeni binalar inşa edilirken fonksiyon ve kullanıcı ihtiyacı gözardı edildiği için yenileme projeleri günden güne artmaktadır. Tüm ticari binalar arasında, konaklama sektörü işlem şemaları ve önerdikleri servisler dolayısı ile oldukça yüksek doğal kaynak, su ve enerji tüketimi kapasitelidir.

Bu çalışmada, Türkiye’deki otellerde uygulanan yenileme projelerinin yüzdelerini belirlemek amacı ile yenileme projelerinin istatiksel verileri analiz edildi. Ankara'daki üç tane beş yıldızlı otelin yenileme projelerinin hakediş malzeme listeleri elde edildi. Bu veri, yenileme projelerinin kapsamı ve kullanılan malzemeler dikkate alınarak, hayat döngüsü değerlendirme programlarından ATHENA programı ile altı çevresel etki göstergelerine göre değerlendirildi. Bu göstergeler, birincil enerji tüketimi, katı atık miktarı, hava ve su kirlilik düzeyi, küresel ısınma potansiyeli ve doğal kaynak kullanımıdır.

Herbir çevresel etki göstergesine göre ayrı ayrı değerlendirilen malzemeler için bir sistem formule edildi ve her malzemenin "ekolojik puanı" hesaplandı. Malzemeler çevreye uyumlulukları ve çevre dostlukları bakımından birbirleri ile, hesaplanan toplam eko-puanlarına göre karşılaştırıldı. Sonuç olarak, yenileme projelerinde kullanılan malzemelerin seçimi için bir öneri oluşturuldu, ki çevreye verilen zarar, enerji tüketimi, katı atık miktarı, zararlı emisyonlar ve küresel ısınma potensiyelleri azaltılabilsin.

Anahtar Kelimeler: Hayat Döngüsü Değerlendirmesi, Otel Binaları, Yenileme ve Tadilat Projeleri, ATHENA programı, Çevreyle Dost Malzemeler.

TO MY DAUGHTER

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LIST OF ABBREVIATIONS

ISO	: International Standards Organization
LCA	: Life Cycle Assessment
BOQ	: Bill of Quantities
TURKSTAT	: Turkish Agency for Statistics
LCC	: Life Cycle Costing
ASTM	: American Society for Testing and Materials
AIA	: American Institute of Architects
IEA	: International Energy Agency
SETAC	: Society of Environmental Toxicology and Chemistry
LCI	: Life Cycle Inventory
LCIA	: Life Cycle Inventory Assessment
UNEP	: The United Nations Environment Program
NREL	: The National Renewable Energy Laboratory
EIE	: Environmental Impact Estimator
API	: Air Pollution Index
WPI	: Water Pollution Index
GWP	: Global Warming Potential
IPCC	: International Panel on Climate Change
RSLC	: Reference Service Life of Components
ESLC	: Estimated Service Life of Components
USEPA	: United States Environmental Protection Agency
EPA	: Environmental Protection Agency
APAT	: The Italian National Agency for the Protection of the Environment and for Technical Services

CHAPTER I

INTRODUCTION

In this chapter are presented the argument for and the objectives of the study, together with a precise of the procedure followed in its conduct and the disposition of the topics within the thesis.

1.1. Argument

As the population of the world continues to expand, the need for including quality in environmental management and extending it in time on a sustainable basis has become vital. Buildings should benefit humans, the community, and the environment. The term “sustainability” denotes an approach to the design, construction and operation of buildings that improves their relationship with their environment and their occupants. However, most buildings of today have- and are continuing to- become unquestionable threats to environment; as they consume significant quantities of energy at all stages of their life time. In turn, this causes both short- and long-term environmental and economic problems on local, as well as global scales. According to Li (2006: 1414), the building sector, including housing, comprises 30 to 40% of the world’s total energy demand and approximately 44% of total material use.

Sustainable, or “green”, buildings include appropriate use of land and landscaping, of environmentally friendly materials that have closed loops, and require attention to the life cycle effects of their design, construction and operation stages. Hence, the entire building process -from cradle to grave or even from cradle to cradle- in its relation to the environment due to its energy use and emission should be assessed. This assessment has to include the whole life of the building which is why ISO Standard 14040 evolved regarding Life Cycle Assessment (LCA) of products.

Defining sustainable materials and encouraging their use with a better integration of LCA techniques and LCA-based decision support tools are important to improve environmental quality. When LCA methodology is applied to a building product, it is seen that an important parameter in LCA of buildings and building materials is the prediction of service life to make accurate comment about the environmental impact. The objective of service life planning according to ISO 15686-1 is: “to assure, as far as possible, that the service life of the component will be at least as long as its design life”. Service life planning aims at enabling designers to optimize resource use by ensuring that the building will last for the lifespan that the occupants determine, without incurring large unexpected expenditures. On the other hand, it seems that there is no relationship between structural materials and the service life of a building and that buildings are most likely to be demolished much before useful life of their structural systems end.

While examining the building construction data, it was seen that the number of renovation and alteration projects has increased significantly during the past few years for reasons other than the unsatisfactory condition of the spaces or change in their functions. Even though certain materials have a long life span, they are not required to live it through and some material is discarded regardless of its good condition, usefulness or life span such as in the case of the hospitality sector.

Hotels are one of commercial buildings which have the highest negative impact on the environment. They need to follow technological improvements and apply them to their design processes at appropriate intervals because maintaining high standards for customers are really significant if they are to remain competitive. Environmental management in hotels is an important step towards achieving sustainable tourism and contributing to sustainable development. Renovation or refurbishment in hotels offers opportunities for promoting energy-efficient measures and exploitation of renewable energy resources.

For this reason, there is a need to evaluate the environmental impact of hotel refurbishment projects, and to classify the materials used for this purpose from the point of view of environmental impact indicators. LCA is a methodology that can be adapted to this end. It involves environmental aspects and potential impacts throughout the life of a product, from raw material acquisition through production, use and disposal.

1.2. Objectives

The objectives of this study were:

- To determine the volume of renovation works in Turkey, especially in larger cities.
- To determine the volume of renovation works in the Turkish hospitality sector.
- To determine the types and amounts of material being replaced during hotel refurbishment projects.
- To determine the frequency of and reasons for hotel refurbishment projects and to understand the necessity for such projects.
- To assess the environmental impacts of the materials most commonly replaced during refurbishment projects by using a life cycle assessment tool (ATHENA).

- To analyze the data statistically in order to arrive at reliable conclusions.

1.3. Procedure

This study focused on assessing the refurbishment projects of three five-star hotels in Ankara, in terms of their environmental impacts. At the first stage of the study, the importance of renovation / refurbishment projects in Turkey was assessed by examining official data available from The Turkish Agency for Statistics (TURKSTAT), Ankara Chamber of Architects and the Ministry of Tourism.

At the second stage, data on bills of quantities (BOQ) for renovation projects of the three hotels and their operating energy consumption were obtained, along with their architectural drawings. Administrative staff was also informally interviewed to gather information on the frequency of and reasons for these renovations. An analysis of these BOQ necessitated an environmental impact analysis of the various materials replaced during the refurbishment projects. These selected materials were assessed with an LCA software called ATHENA.

At the third stage of the study, data which were generated by the LCA tool were summarized in graphs and tables and statistically evaluated. Based on findings, a system was proposed for comparing environmental appropriateness of the materials used in three case projects.

1.4. Disposition

The study consists of five chapters. The first one is composed of the argument for, the objectives of, and a general outline of the procedure of the study. It concludes with the disposition of the thesis.

Chapter 2 comprises of the literature survey in which 50 published works and 5 web sites are included covering topics of sustainable architecture, life cycle costing, life cycle assessment, service life prediction, life cycle inventory databases and their importance, life cycle assessment of buildings/hotels, and the importance of renovations in the life cycle of hotels.

Chapter 3 is composed of the survey material, which includes the statistical data on renovation and refurbishment projects in Turkey, information on three five-star hotels in Ankara, the grouped data derived from the bill of quantities for guestroom floors of the three hotel refurbishment projects; and the LCA software and methodology that includes data compilation process, simulation procedure and statistical tests.

Chapter 4 presents discussion on statistical data on renovation and refurbishment projects in Turkey and the frequency of and reasons for hotel refurbishment projects. Then data generated by the LCA software (ATHENA), the statistical analyses of these data using paired-sample *t*-test and the comparative evaluation of the three case studies and seven common materials are given.

Finally, a matrix which is derived from this investigation and can be used to enable designers to choose the suitable material in order to reduce damage to the natural environment, further investigations and recommendations are stated in Chapter 5.

CHAPTER 2

SURVEY OF LITERATURE

This literature review covers a total of 50 published sources and 5 websites. It consists of topics related to sustainable architecture, life cycle costing, life cycle assessment, service life prediction, life cycle inventory databases, and their importance, life cycle assessment tools, life cycle assessment of buildings/hotels, and the importance of renovations in the life cycle of hotels. To render the presentation of the concept of life cycle assessment and, specifically, life cycle assessment of hotel refurbishment projects as systematically as possible, general definitions have been given which are supported by examples, for clarity.

2.1. Sustainable Architecture

Sustainable development is “the challenge of meeting growing human needs for natural resources, industrial products, energy, food, transportation shelter and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future life“ (Bartelmus, 1994: 5). Reduced consumption of energy in use; increased durability of buildings and components are important factors to be considered in sustainable architecture. The world is faced with the problem of global warming, owing to the increased levels of greenhouse gases in the atmosphere that have raised the temperature of the earth above its natural equilibrium level.

According to the Rocky Mountain Institute (2003), if sustainable design principles were incorporated into building projects, benefits could include resource and energy efficiency; healthy buildings and materials; ecologically and socially sensitive land use, transportation efficiency; and strengthened local economies and communities. Sustainable principles were applied to buildings by using such natural resources as the sun, wind, landforms, and natural vegetation to provide heating, cooling, lighting, ventilation. Edwards (1998: 169) stated that the large section of the building sector generally use natural, mostly non-renewable resources and this leads to resource depletion, destruction of valuable landscapes, loss of biodiversity and pollution.

Crosbie's (1994) argument for sustainable architecture is based on the "green building's" multidisciplinary approach to cradle-to-cradle understanding, which consisted of the planning phase; the design, construction and operation phase; and the ultimate reuse or recycle phase. He classified the main cornerstones of green building as to supply thermal comfort, effective lighting, ventilation, high indoor air quality; energy conservation; good waste management; water efficiency; to use renewable energy; to be sufficient for themselves and to decrease site clearing costs by minimizing site disruption.

According to Osso *et al.* (1996: 178), selecting environmentally preferable building materials was one way to improve a building's environmental performance. The building materials, which use minimum energy during their life cycle assessment and cause no problem to the environment, should be the only choice. The authors asserted that key design issues regarding sustainable architecture which were in confirmation with the European Commission's directives were:

- selecting materials with their environmental effects in mind,
- designing according to the durability of materials and components,

- designing for flexibility, allowing for change in building use over time,
- allowing replacement of facades and internal partitioning without structural disturbance,
- incorporating a methodology for dismantling buildings, reusing or recycling building components at the end of their lifespan,
- focusing on easy maintenance of components and systems for long life and low emissions,
- requiring contractors to use eco-friendly cleaning materials during construction and at final clean up.

2.2. Life Cycle Costing

According to Hochschorner and Finnveden (2003), sustainable development required methods and tools to measure and compare the environmental impacts of human activities for the provision of goods and services. Life Cycle Costing (LCC), and Life Cycle Assessment (LCA) were determined as two complementary methodologies, which measure the performances of products or systems in the units appropriate to each emission type or effect category. The American Society for Testing and Material (ASTM) defined the LCC method in terms of ASTM, E833: 84:

> “a technique of economic evaluation that sums over a given study period the costs of initial investment (less resale value), replacements, operations,(including energy use), and maintenance and repair of an investment decision (expressed in present or annual value terms)”.

ASTM (E917: 83) formulates the following relationship for LCC on a ‘before-tax’ basis:

$LCC=C+R+S+A+M+E,$

where

C=investment costs,

R=capital replacement costs,

S=resale value of investment at end of study period,
A=annually recurring operating and repair costs (except energy costs),
M=non-recurrent operating, maintenance and repair costs; and
E=energy costs.

Costs included in LCC somewhat differed depending on the description of the method. The American Institute of Architects had established the following cost categories (AIA, 77):

- initial capital investment cost,
- financing costs,
- operation and maintenance costs,
- replacement costs,
- alteration and improvement costs,
- functional use costs,
- salvage costs.

On the other hand, Zhang (1999: 12) argues that there is a comprehensive, systematic and consistent basis for applying LCC technique in buildings and building systems. The general methodology for LCC is to study all relevant costs associated with the building at an appropriate time period in order to measure economic performance; these relevant costs were:

- Initial cost,
- operation cost,
- maintenance and repair cost.

Zhang (1999: 14-15) also states that the initial cost includes construction and project related costs which are the most critical of the costs associated with design alternatives; the operation cost comprises of the major cost items in this category which are energy cost and personnel salaries required to operate the facility and maintenance; and repair cost includes preventive and corrective maintenance costs, custodial care and minor replacement costs.

According to Ehlen (1997), the point was to be aware of the common tendency to focus only on the initial cost. It was important to assess a given choice among alternative choices after considering all relevant economic consequences over its life cycle.

2.3. Life Cycle Assessment

The philosophy of life cycle is the essence of ecological design which depends on the overall impacts of a product. The general categories of the environmental impact to be considered include resource use, human health and environmental health. As defined by IS0 14040 (1997: iii),

"LCA is a technique for assessing the environmental aspects and potential impacts associated with a product, by:

- compiling an inventory of environmentally relevant inputs and outputs of a system.
- evaluating the potential environmental impact associated with those inputs and outputs.
- interpreting the results of the inventory and impact phases in relation to the objectives of the study.".

According to Trusty (2003) environmental performance is generally measured in terms of several potential effects, such as:

- fossil fuel depletion,
- other non-renewable resource use,
- water use,
- global warming potential,
- stratospheric ozone depletion,
- ground level ozone (smog) creation,
- nitrification / eutrophication of water bodies,
- acidification and acid deposition (dry and wet),
- toxic releases to air, water and land.

The same author points out that all of these measures are indicators of environmental loadings that could result from the manufacture, use and disposal of a product. The indicators did not directly address the ultimate human or ecosystem health effects, but provide good measures of environmental performance.

According to Paulsen (2001), LCA is a dynamic and iterative assessment process which assesses the environmental impacts of products and services from a cradle-to-grave perspective. The ‘cradle’ is defined as the place where or moment when the raw materials or resources are taken from Nature into the technical system and the ‘grave’ is defined as the place where and/or the time when the products or used resources return to Nature.

The Royal Society of Chemistry (1998: 2) defines the LCA for a product as a summation of individual impacts from the stages listed below and defines the procedure of LCA as shown in Figure 2.1.

- extraction of the relevant raw materials,
- refinement and conversion of these to process materials,
- manufacturing and packaging processes,
- transportation and distribution at each stage,
- operation or use during its lifetime,
- final transportation, waste treatment, and disposal at the end of its useful life.

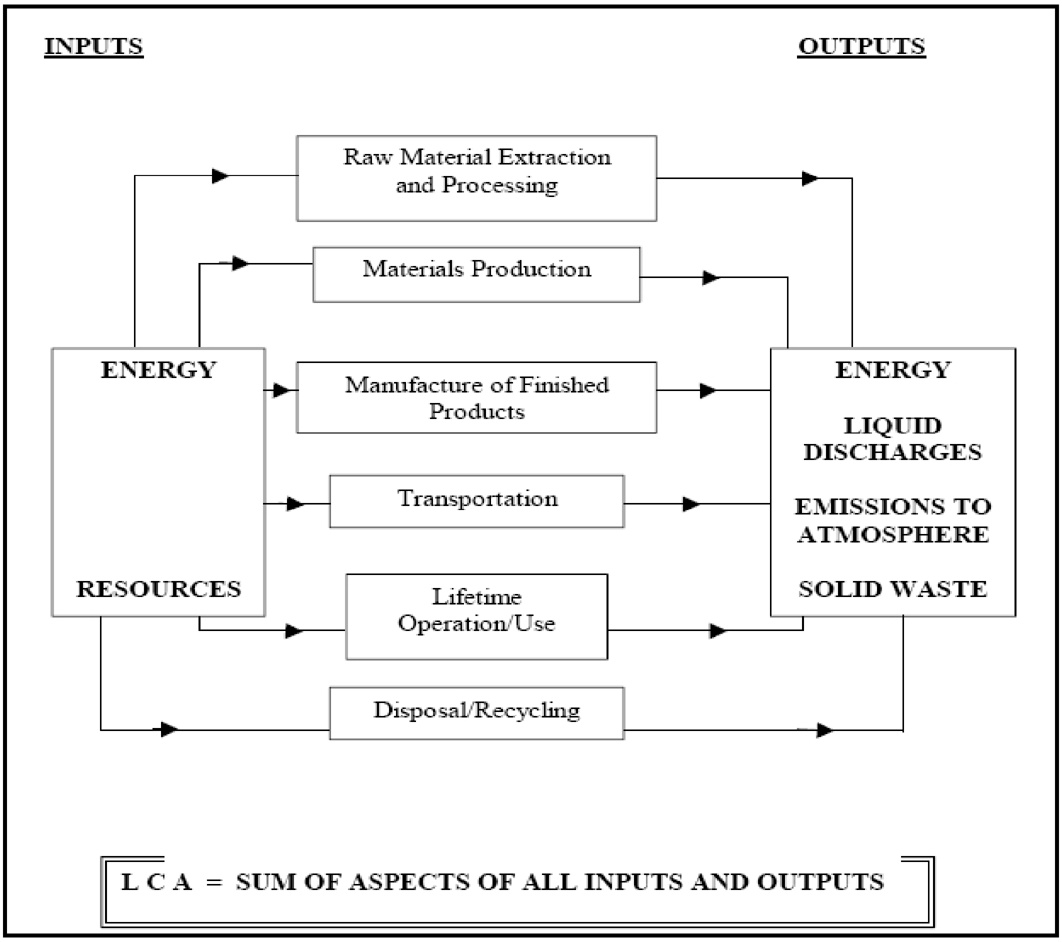

Figure 2.1. Summary of life cycle assessment procedure proposed by the Royal Society of Chemistry (1998: 3).

In order to adapt the application of the assessment process to any product or system, ISO 14040 Standard (1997: 4) proposes a framework, seen in Figure 2.2, that involves four interrelated phases; the goal and scope definition phase, the inventory analysis phase, the impact assessment phase and the interpretation phase which are explained in more detail in the following section.

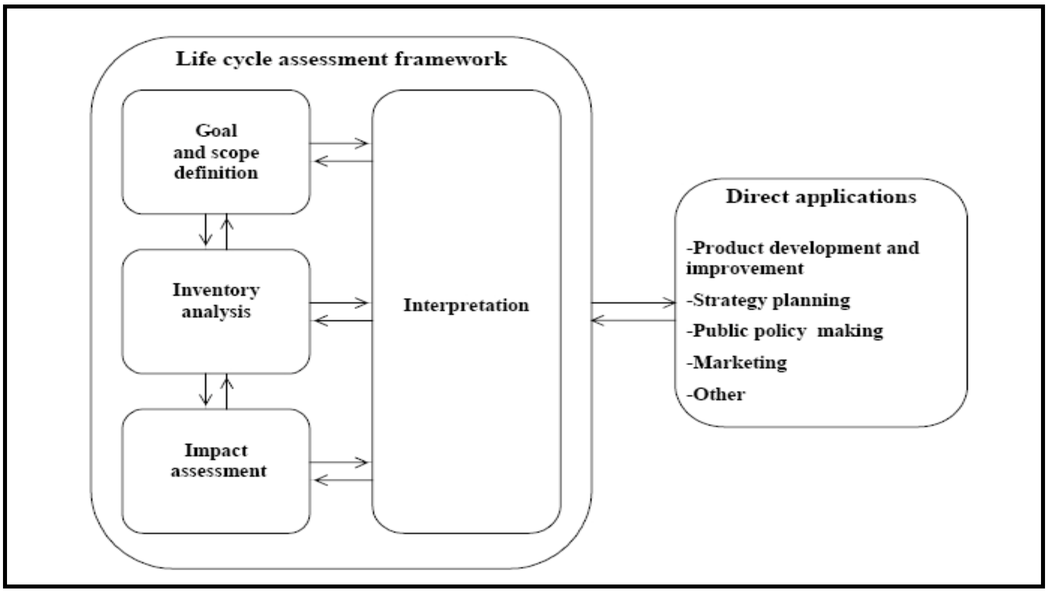

Figure 2.2. The four phases of LCA.
(Source: ISO 14040 Standard, 1997: 4).

i. Goal and Scope Definition Phase

Paulsen (2001) determined that, the first important step of any LCA was the definition of the goal and scope including functional units, system boundaries, data quality requirements, and a critical review process. The choice of elements of the physical system was dependent on the definition of the goal and scope of the study. The overall objectives of the study should be given in a clear and concise statement with the reasons for carrying out the study and intended use of the results detailed. Similarly Erlandsson, and Borg (2003) indicated that a well-defined goal was needed to motivate the choice of the most suitable system boundaries that identify the extent to which specific processes were included or excluded. The methodology, data categories, and assumptions should also be clearly stated and so that they are easily understood.

The International Energy Agency (IEA) (2001) pointed out the importance of the scope of any study in Annex 31 and added that the scope of the study should be defined in sufficient detail to enable the study to address the stated objectives. The usefulness of a product and the actual function of the system in a measurable and quantitative way should be identified through its *functional unit,* which could be expressed by various measures. Comparisons between systems could be made on the basis of the same function, and quantified by the same functional unit. The performance or service of the product could be comparable to the service or performance of another product, not the product itself.

According to IEA (2001), the system boundaries that define and structure the system under assessment identify the extent to which specific processes are included or excluded. Data quality goals and methodology should thus be clearly established and detailed, along with the justification for the assumptions. The results of LCA are only valid for well-defined goals and scopes; hence, it may become necessary to revise both goal and scope during the analysis due to the lack of data or important findings and this causes LCA to be iterative.

ii. Inventory Analysis Phase

ISO 14041 Standard (1998E) defines inventory analysis as the process of compiling the amount of natural resources and energy taken in by the system and the amount of wastes discharged to the environment from the system for each functional unit. In short, this phase is concerned with data collection and calculation procedures. The data required for an LCA study are dependent on the goal of the study. Every activity in the process tree is divided into unit processes, which is the smallest unit in an LCA. According to The Society of Environmental Toxicology and Chemistry (SETAC, 1997), during the inventory analysis, it is important to refine the system boundaries for all stages of the product system life cycle including inputs, processing routes, spatial and temporal considerations, in case there is a lack of data. Inventory data is related to reference flows for each unit process in order to quantify and normalize input and output to the functional unit being investigated. Data would then be aggregated in order to prepare an input-output table for this product or service. Process flow charts describing the complete system, main production sequence, ancillary materials and energy/fuel production are then formulated.

Erlandsson and Borg (2003) determined that any allocation procedures related to inputs and outputs of the multifunctional system should be fully detailed and explained. These procedures should reflect the physical behavior of the system since allocation of building materials is complicated by the large time spans encountered in the lifetime of buildings.

iii. Impact Assessment Phase

According to ISO 14042 Standard (2000: 2), the purpose of the impact assessment phase is to examine the product system from an environmental perspective using impact categories and category indicators connected with LCI results to better understand their environmental significance. This phase could be subdivided into four steps, which are: category definition, classification, characterization as mandatory elements and calculating the magnitude of category indicator results relative to reference values, normalization, grouping and weighting as optional elements, as seen in Figure 2.3.

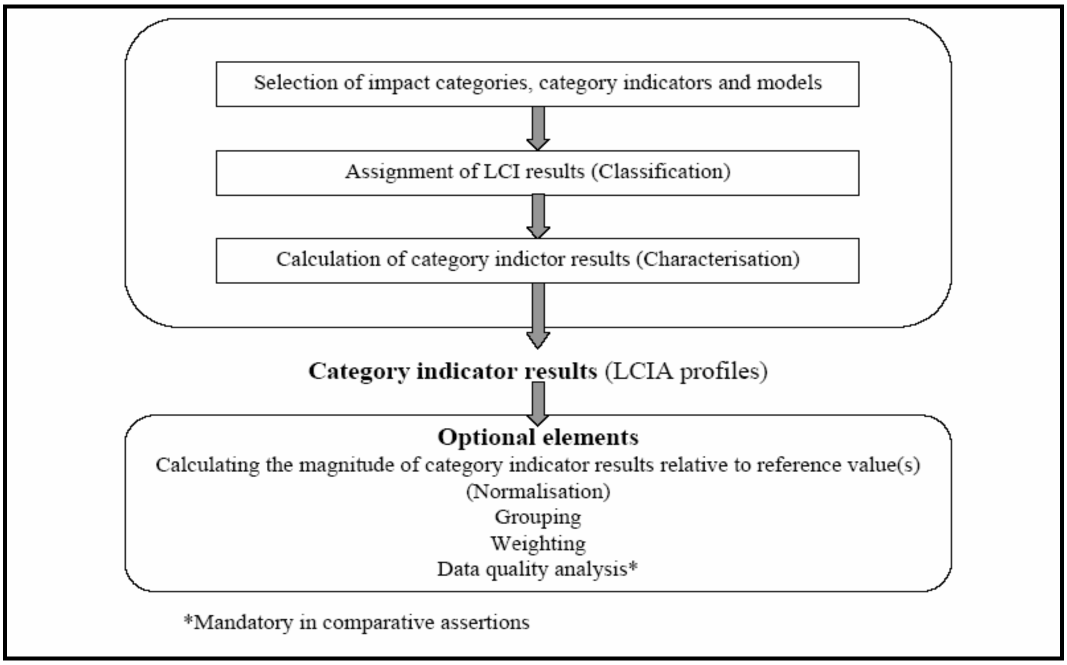

Figure 2.3. Elements of the LCIA phase.
(Source: ISO 14042 Standard, 2000: 3).

Paulsen (2001: 8-9) indicated that; while making an assessment, firstly the categories and category indicators are used to provide guidance for selecting and defining the environmental categories. Then, the classification step is done to assign inventory input and output data to the pre-defined impact categories. This is a qualitative step, which is based on scientific analysis or an understanding of the relevant environmental processes. The author points out that for each impact category, the relative importance of the contributing substances can be modeled and quantified; hence it is important to possess the ability to model the categories in terms of standardized indicators for the characterization step. The indicator chosen is used to represent the overall change or loading in the category, therefore contributions to impact categories are expressed using an equivalency factor. Categories are ranked according to their relative importance to each other and numerical values are assigned to them to represent degrees of the significance, for ease and clarity of decision-making. Such weighting is especially helpful when attempting to reduce LCA to a single score for the environmental impact and then making overall comparisons between alternative buildings and designs.

iv. Interpretation Phase

According to ISO 14043 Standard (2000: 2), the life cycle interpretation phase of an LCA study includes three elements;

- identification of the significant issues based on the results,
- evaluation of the underlying study,
- conclusions, recommendations and reporting.

Firstly, a sensitivity analysis is carried out to assess the reliability and validity of results with particular respect to key assumptions made in calculations, uncertainty or missing data and dependence on particular data sets. The ISO 14043 Standard (2000: 5-6) recommends three techniques using during the evaluation phase. These are:

- Completeness check: to ensure that all relevant information and data needed for the interpretation are available and complete;
- Sensitivity check: to assess the reliability of the final results and conclusions by determining whether they are affected by uncertainties in the data, allocation methods or calculation of category indicator results;
- Consistency check: to determine whether the assumptions, methods and data are consistent with the goal and scope.

According to SETAC (1997), the whole analysis consists of discussions regarding data quality; scope and boundary settings; and completeness and consistency of results. If two product alternatives or systems are compared and one alternative shows higher consumption of each material and of each resource, an interpretation that is based purely on the LCI can be conclusive.

2.3.1. Life Cycle Inventory Databases

Life cycle assessment was originally developed in 1969 for internal use by manufacturers considering options for product development when a certain soft drink producer wanted to determine the environmental impact of switching from glass to plastic bottles (Ecobilan, 2003). According to Zhang *et al*. (2006), LCAs of building materials are different from those for disposable items like packaging, for two reasons: firstly, building materials tend to have a relatively long service life; second their service life is highly variable, as even durable products might be replaced quickly for aesthetic or economic reasons. Estimating the useful service life of any material can introduce a high level uncertainty in the results of any LCA study.

Malin (2002: 3) classified the main problematic areas in LCA studies of buildings to be the quality, consistency, and availability of data on products and processes; the methods used to compile inventories; and especially the assumptions and systems used to translate inputs and outputs into measures of environmental impact. The author's description of the facility and material life cycle is shown in Figure 2.4.

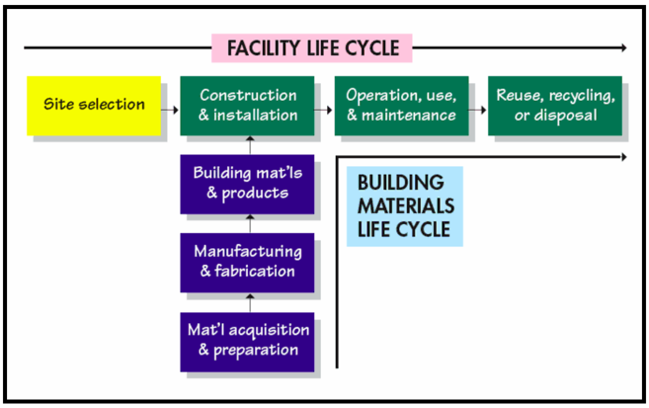

Figure 2.4. Facility and material life cycle (Source: Malin, 2002: 4).

Trusty (2003) argues that life cycle inventory data should come from manufacturers, trade organizations, or from pre-existing databases. Data from any of these sources would vary in accuracy depending on how they were collected and compiled and how current they were. Data collection requires many assumptions and it may be impossible at times to ensure that the inventories of inputs and outputs are compiled consistently.

According to Ekvall (2005: 1), one of the fundamental tasks in LCA procedures was the determination of the quantity and type of the materials in a building. LCA methods varied but typically involve use of databases with LCA related data for various materials and building components and systems. At the heart of an LCA model lies the database, which is developed and maintained through the LCI process. This process was the critical step that tracks and records the basic resource and waste flows to and from the environment. Ekvall (2005) further points out that key issues in data collection includes:

- improving the efficiency and quality of data collection,
- how to facilitate LCI data exchange and presentation,
- how to assess data quality.

The LCI database contains data modules that quantify the material and energy flows into and out of the environment for common unit processes. A full product LCA requires the combination of several unit process LCI data modules (http://www.athenasmi.ca/papers/down_papers/, last access 19.05.2007).

According to the ISO Standard 14042 (2000: 2), it is not the inputs and outputs that are the issue, but the environmental impacts of these flows. First of all, LCI of a product or process has to be analyzed from the point of view of environmental issues. This process, known as life-cycle impact assessment (LCIA), “aims to examine the product system from an environmental perspective using impact categories and category indicators connected with the LCI results”. Guinee (2002: 479) showed the inputs and outputs of environmental interventions and economic flows in Figure 2.5, while assessing a unit process or a product system.

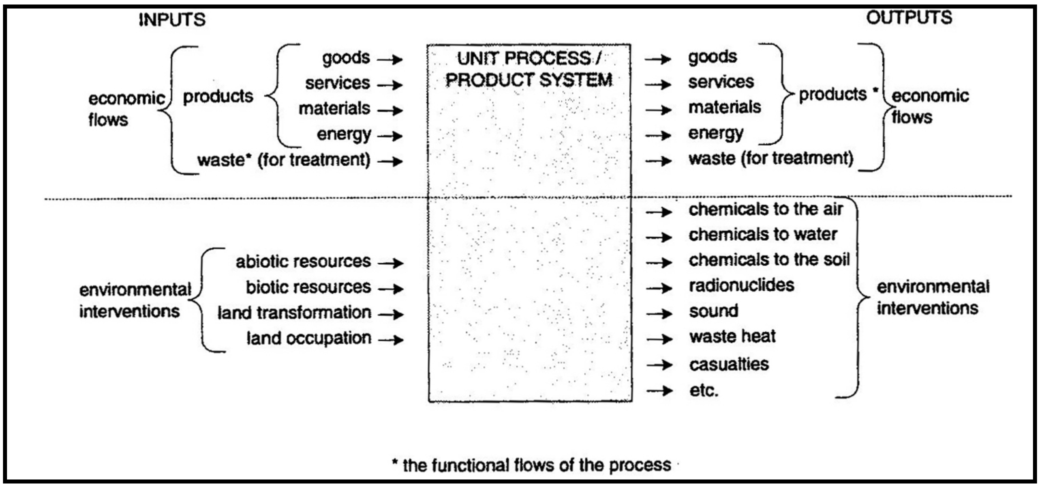

Figure 2.5. Environmental interventions and economic flows.
(Source: Guinee 2002: 479).

According to UNEP-SETAC (2003: 9), the different types of environmental impacts are organized by LCA practitioners into a series of impact categories, such as global warming, ozone depletion, ecosystem toxicity, acidification, diminished human health, resource depletion; and so on. Whereas, Malin (2002) indicates that the LCA methods used to translate inventories into potential impacts. Impacts such as global warming and ozone depletion are estimated based on internationally established methods that convert emissions of a wide range of gases to a cumulative impact measurable on a single scale. However, an impact category like ecosystem toxicity is much more complex to quantify, and therefore the methodology used for impact assessment is less consistent.

According to Paulsen (2001), it was important to add specific manufacturing and use-phase data to construct more complete LCAs, based on knowledge of specific products and their applications. Specific end-of-life data for products that represent recycling or other final disposition of product systems should be added in order to assess the full life cycle. Chanter and Swallow (1996: 167) showed the inputs of this full life cycle of buildings in Figure 2.6.

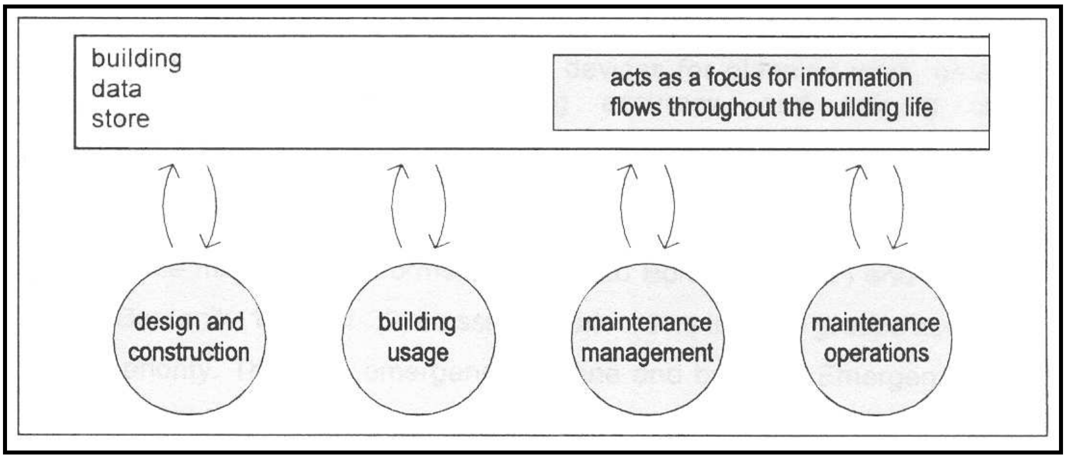

Figure 2.6. Inputs to building data store.
(Source: Chanter and Swallow, 1996: 167).

As stated in IEA Annex 31 (2001), the weighted life cycle inventory data for materials and processes could be used to perform simplified environmental assessments of different designs. The main difficulty encountered in the comparative data analysis can be due to the different data presentation formats encountered in the inventories. Most of the individual product data sets have been developed with the cooperation of associations or companies that operate in countries by using common technologies. The quality of life cycle data and the easy access to the databases are prerequisites to establish LCA as a reliable tool for environmental assessment.

The Importance of National Life Cycle Inventory Databases

Trusty (2003) pointed out that, the development of reliable LCI data typically required considerable expert time inputs and expense. LCAs are generally considered to be too expensive and time consuming because of the lack of widely available, critically reviewed, comprehensive LCI databases. Although there are a few LCI databases available in the market, access to the information contained in them is generally restricted or protected by copyright agreements, or the data are not verifiable. Public availability of the LCI data would make LCAs easier to perform.

According to NREL (2003: 1-2), proprietary LCI databases should be taken as the source for LCI model data by making appropriate adjustments to the process models. Ultimately, a national database can then be established to serve the needs of the potential data users; such a database should have the following criteria:

- Consistency with ISO standards and U.S. guidelines for LCA;
- meet specific transparency criteria;
- uniform treatment of all materials and products;
- regional differentiation that properly reflects critical regional variations within and across industry sectors; and
- full accessibility in a format(s) designed to maximize use.

ARUP Group (2004) insists that input data should reflect the impacts due to consumption of resources and environmental emissions of all functional units. Localization of the data is essential in order to obtain LCA results that are relevant to the geographical region concerned. This localized process is presented in Figure 2.7 below.

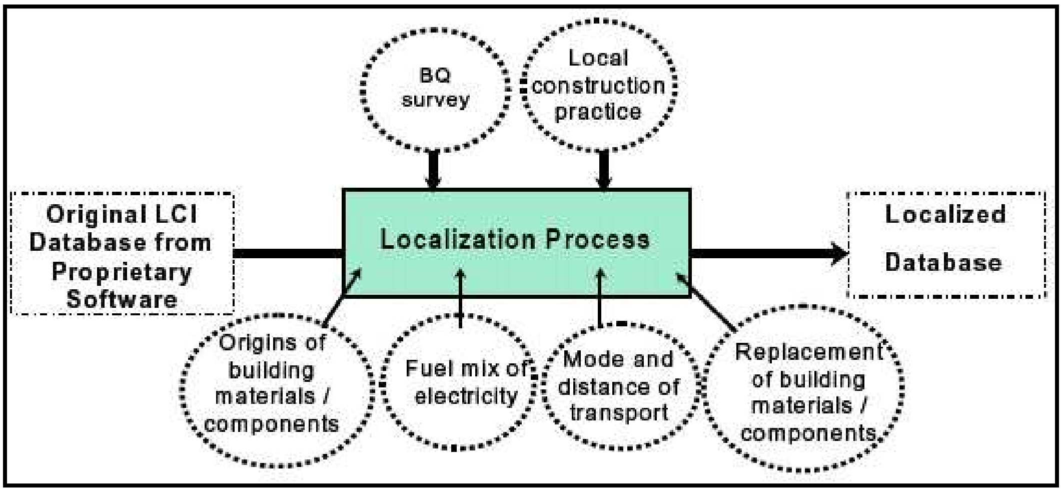

Figure 2.7. Processes for developing a localized database.
(Source: ARUP, 2004: 7).

2.3.2. Life Cycle Assessment Tools

According to Trinius (1999), the need for environmentally related information has been increasing with the rising interest and demand from policy makers to achieve a sustainable society; hence interest in environmental assessments of the built environment is also rising. Consequently, many tools for the assessment of the built environment, focusing on energy use in buildings, the sick building syndrome, indoor climate, building materials containing hazardous substances *etc.*, have been devised.

Reijnders and Roekel (1999) divides environmental assessment tools into two classes: qualitative tools based on scores and criteria, and quantitative tools using a physical life-cycle approach with quantitative input and output data related to flows of matter and energy. Qualitative methods are based on assigning a score to each investigated parameter, resulting in one or several overall scores of a building. On the other hand, quantitative approaches are based on a combination of calculation and evaluation methods. In this process, databases are used to manage information on quantities involved in calculation methods, while base values and specific benchmarks are used for evaluation of the results.

Examples of popular qualitative tools are LEED BREAM, GBTool, and EcoProfile; and those of quantitative tools can be listed as ATHENA, BEES, BEAT 2000, and EcoEffect. In this investigation, ATHENA has been used to assess the case study.

Trusty (2000: 18-19) classifies LCA tools into 3 levels according to the level of outputs *e.g.*:

Level 1 Tools such as BEES, SimaPro and TEAM assesses the materials individually. Hence, it can be valuable for building databases and for making comparisons and choices but can not be used to make whole building design decisions.

Level 2 Tools focuses on a specific area of concern, such as life cycle costs, life cycle environmental effects, lighting, or operating energy, and a few combine more than one of these areas. These tools are considered to be building decision support tools, using bases compatible with formal ISO, ASTM, ASHRAE, or national standards and guidelines. Examples of level 2 tools are: ATHENA, EcoQuantum, Envest, DOE2, and E10 .These were consistently data-oriented and objective, and hold on.

Level 3 Tools provided a very broad coverage of environmental, economic, social, and other issues relevant to sustainability. This classification is also accepted as qualitative method of whole building assessment frameworks or systems, such as LEED (US), BREEAM (Canada/UK), GBTool (International), EcoEffect (Sweden). Level 3 tools used a mix of objective and subjective data that depend on Level 2 tools for the objective data.

A comparison of the above mentioned tools is presented in Table A.1 (Appendix A). Of these ATHENA Environmental Impact Estimator (EIE), is an LCA software developed by ATHENA Sustainable Materials Institute in Canada for life cycle assessment of buildings. Existing LCI provides the assembly-specific and site-specific data that is needed for the integrated simulation environment for an LCA analysis. The site-specificity of the data is defined through basic project inputs such as the city location; while the assembly-specificity of the data is derived from the bill of materials of any building project (http://www.athenasmi.ca/, last access 19.05.2007).

As Trusty (2000) points out design teams can use ATHENA® directly to carry out assessments of the structural systems, foundations and envelope systems of a building. The expected life of a component can be input as expected life of the structure and the operating energy conversion calculator module can be used to enter the building's annual operating energy by fuel type. The structure of life cycle information in the ATHENA model is specific to particular building assemblies and construction methods; and not to the categories of building assemblies. For example, the parameters for the "Wall" object in an LCA model are defined according to the type of assembly seen in Table 2.1.

Table 2.1: Different sets of LCA parameters in ATHENA software for the "Wall" object.

Object	Parameters	Object	Parameters
Wood Stud Wall	Assembly name Length Height Openings (area) Stud size Stud spacing Insulation type Sheathing type Finish type	Concrete Block Wall	Assembly name Length Height Openings (area) Block size Rebar size Insulation type Finish type

(Source: http://www.athenasmi.ca/database, last access 19.05.2007).

ATHENA is focused on the level of whole buildings, or complete building assemblies. It had approximately 25 “Assembly Types” which are combination of elements / components in the “Assembly Groups” (Beams and Columns, Extra Basic Materials, Floors and Roofs, Foundations, Walls). The data used in this software are designed to make the LCA task as easy as possible for architects and engineers who need answers about the environmental implications of their decisions. The building elements are further divided into 2 kinds of products: structural and envelope products seen in Table A.2 (Appendix A) (http://www.nrcan.gc.ca/es/etb, last access 08.06.2006).

According to IEA-BCS (1999), in order to assess any building with ATHENA, each individual building assembly is added as a new building object to the building data schema, without breaking the existing schema; thus redefinition of existing building objects is not required.

Pal *et al.* (2001) indicated that it is difficult to abstract or fit into common structural frameworks of building data modeling so the definitions of new building objects which were stored in external databases were used to create alternative options. These databases can be dynamic and continuously updated by manufacturers of building components and systems, and/or by services and organizations. External databases can be used to select options for building components and systems during the development of the project database. The relationships among the building data scheme, the project database and the external databases can be seen in Figure 2.8.

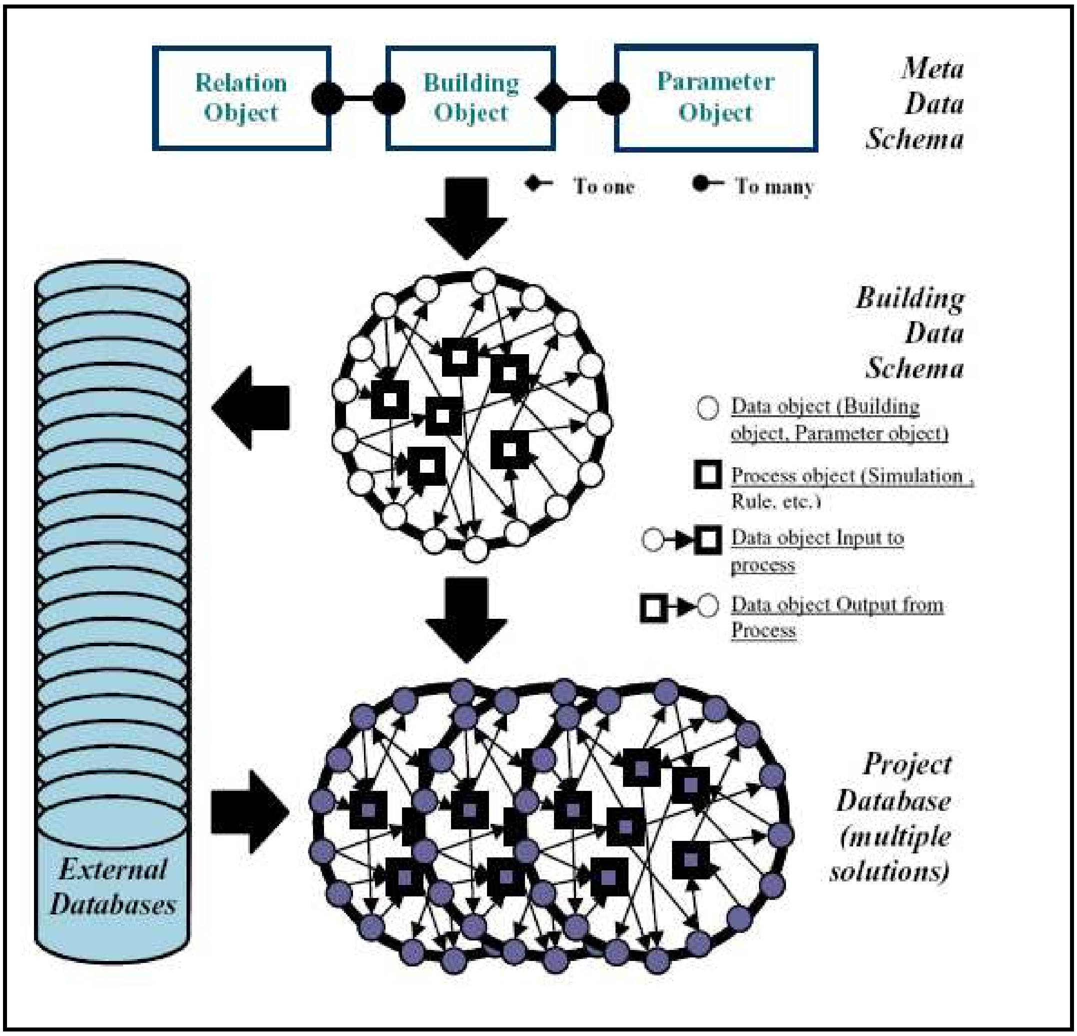

Figure 2.8. The relationships among the building data scheme, the project database and the external databases.
(Source: Pal *et al.,* 2001; 3).

After any building design is entered in the EIE using building assembly dialogues, the user can see the cradle-to-grave, region-specific implications of a design in terms of a detailed list of flows from and to nature in the following summary measures (Trusty, 2003: 6):

- Embodied primary energy consumption;
- solid waste emissions;
- global warming potential;

- pollutants to air;
- pollutants to water; and
- natural resource use.

These summary measures are obtained from four different life stages which are manufacturing, construction, operations and maintenance and building end of life. Manufacturing stage included resource extraction, resource transportation and manufacturing of specific materials, products or building components. The construction stage includes product/component transportation from the point of manufacture to the building site and on-site construction activities. The operation and maintenance stage comprised of life cycle maintenance and replacement activities associated with the structure and envelope components. The last stage, end of life, simulated demolition energy and final disposition of the materials incorporated in a building at the end of building's life (http://www.athenasmi.ca/, last access 19.05.2007).

Definitions of the six indicators as formulated by Norris (2002) are given in the following paragraphs.

i. Embodied primary energy consumption includes all energy, direct and indirect, used to transform or transport raw materials into products and buildings, including inherent energy contained in raw or feedstock materials that were also used as common energy sources. The energy types are determined to be electricity, hydraulic energy, LPG, diesel fuel, natural gas, wood, coal, heavy fuel oil and feedstock fuels. This indicator is measured in mega-joules.

ii. Solid waste is composed of recovered matter resulting from the production and delivery (packaging) process which were bark/wood waste (WFiber), concrete solid waste (CSW), blast furnace slag (BFS), blast furnace dust (BOF), steel waste. It is measured in kilograms.

iii. Air pollution index (API) displays the emissions to air for each air emission type by life cycle stage inclusive of structural and envelope effects as well as annual operating energy. It captures the pollution or human health effects of groups of substances emitted at various life cycle stages. Air emission types are composed of carbon monoxide (CO), sulphur oxides (SO_x), nitrogen oxides (NO_x), nitrous oxides (N_2O), particulates and fumes, volatile organic compounds (VOC), methane (CH_4), phenols, acid gases, non-methane hydrocarbons (NMH), hydrogen chloride (HCl), and metals. Air pollution is measured in grams.

iv. Water pollution index (WPI) displays the emissions to water and can comprise of biochemical oxygen demand (BOD), suspended solids (SusSol), dissolved solids (DisSol), polynuclear aromatic hydrocarbons (PAH), chemical oxygen demand (COD), non-ferrous metals (NFM), cyanide (Cyn), phenols, phosphates, ammonium, halogenated organics (HO), chlorides (Cl), aluminum (Al), oil and grease, sulphates, sulphides, nitrates, dissolved organic compounds, phosphorus, acids, iron and heavy metals. It is measured in milligrams.

v. Global warming potential (GWP) is used to translate the level of emissions of various gases into a common measure. Carbon dioxide is considered to be the common reference standard for global warming or greenhouse gas effects. All other greenhouse gases are referred to as having a "CO_2 equivalence effect" which is simply a multiple of the greenhouse potential (heat trapping capability) of carbon dioxide. GWP is measured in kilograms, while a substance's GWP depends on the time span over which the potential is calculated. A gas which is quickly removed from the atmosphere might initially have a large effect but for longer time periods it becomes less important due to dissipation. 100-year time horizon figures determined by the International Panel on Climate

Change (IPCC) are used in ATHENA as a basis for the equivalence index in Figure 2.9:

CO_2 Equivalent kg = CO_2 kg + (CH_4 kg x 23) + (N_2O kg x 296).

Gas	Lifetime (years)	Time Horizons				
		20 years	50 years	100 years	200 years	500 years
CO_2	#	1	1	1	1	1
CH_4	10.5	35	19	11	7	4
N_2O	132	260	270	270	240	170
CFC-11	55	4500	4100	3400	2400	1400
CFC-12	116	7100	7400	7100	6200	4100
HCFC-22	15.8	4200	2600	1600	970	540
CFC-113	110	4600	4700	4500	3900	2500
CFC-114	220	6100	6700	7000	7000	5800
CFC-115	550	5500	6200	7000	7800	8500
HCFC-123	1.71	330	150	90	55	30
HCFC-124	6.9	1500	760	440	270	150
HFC-125	40.5	5200	4500	3400	2200	1200
HFC-134a	15.6	3100	1900	1200	730	400
HCFC-141b	10.8	1800	980	580	350	200
HCFC-142b	22.4	4000	2800	1800	1100	620
HFC-143a	64.2	4700	4500	3800	2800	1600
HFC-152a	1.8	530	250	150	89	49
CCl_4	47	1800	1600	1300	860	480
CH_3CCl_3	6.1	360	170	100	62	34
CF_3Br	77	5600	5500	4900	3800	2300

Figure 2.9. Global warming potential values and lifetimes from IPCC. (Source: http://people.ccmr.cornell.edu/~plh2/group/glbwarm/potent.gif, last access 19.05.2007).

vi. Weighted resource use includes the amount of raw resources used to manufacture each building product. These raw sources can be limestone (LStn), clay and shale (ClSh), iron ore (IOre), sand, ash, gypsum, semi-cementitous material (SCM), coarse aggregate, fine aggregate, phenol form resins, uranium and natural gas. The weighted resource use is measured in kilograms.

2.4. Service Life Prediction

Nunen *et al.* (2004: 1) indicated that LCA models are utilized according to a predefined linear-life-cycle that is known as technical service life, and is typically given in terms of raw material extraction, manufacturing, on-site construction, operation including maintenance and end-of-life scenarios. Making changes to buildings or rebuilding or replacements are often not taken into account.

The concept of Reference Service Life of Component (RSLC) was firstly introduced in ISO 15686-1 (2000), and is defined as the "service life that a building or parts of a building would be expected or predicted to have in a certain set of reference in-use conditions". The objective of service life planning is to provide reasonable assurance that the estimated service life of a new building on a specific site, with planned maintenance, would be at least as long as it is designed for. A designer involved in the service life planning of a building or other constructed object is faced with the problem of estimating the service life of each components. The reliable input about how many replacements need to take place, and consequently the total quantity of materials used throughout the overall service life of the building becomes important.

Saville and Moss (2002) insists on that even if certain service life data were available; these could rarely be used directly, because the project specific in-use conditions, to which the components would be subjected, were usually different from those for which the service life data were valid. In ISO 15686-1 (2000), the "Factor Method" is described as a means for addressing this problem. This method is used to modify a RSLC to obtain an estimated service life of the components (ESLC) of a design object, by taking account of the difference between the project-specific and the reference conditions. This is carried out by adjusting the RSLC by a function of a number of factors, each being from a particular factor class and reflecting a difference between the two sets of in-use conditions in the factor class. These factors are described in Table 2.2 below. In its simplest form, the function is the product of the factors, as summarized below:

*ESLC = RSLC * factor A* factor B * factor C * factor D * factor E * factor F * factor G*

where:

A = Material / Component factor,

B = Design factor,

C = Workmanship factor,

D = Internal environment factor,

E = External environment factor,

F = In-use factor,

G = Maintenance factor.

Table 2.2: Examples of factors, relevant to building services plant.

Factor Class	Examples
A Quality of components	Manufacture, storage, transport, materials, protective coatings.
B Design / detailing	Incorporation into the building, detailing, system design, interfaces.
C Installation / workmanship	Site management, standard of workmanship, climatic conditions during installation
D Indoor environment	Aggressiveness of environment, ventilation, condensation.
E Outdoor environment	Location of building, micro and macro environment, sheltering, pollution levels, weathering factors.
F In-use conditions	Commissioning, hours/frequency of use, mechanical impact, category of users, wear, tear.
G Maintenance	Quality and frequency of inspection and maintenance, accessibility for maintenance.

(Source: Saville and Moss; 2002: 4).

According to ISO 15686-1 (2000), there are three kinds of end-of-life scenarios in the building sector; namely: technical, economical, and functional end-of-life. The reference service life of components is the technical service life; which ends when the component can no longer sustain its performance. The economical end-of-life occurs when another component can be substituted with lesser costs; while the functional end-of- life occurs, when the component fails to meet the demand of people. In other words, the user decides that the service life of the product is over.

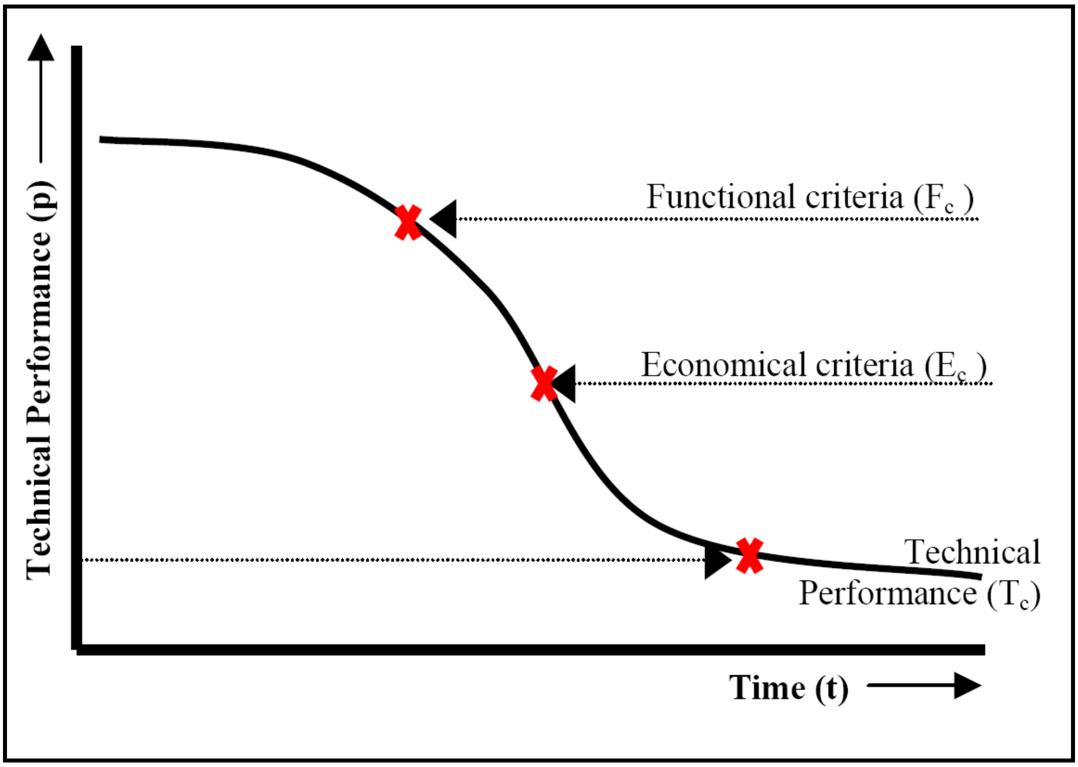

Figure 2.10. Different types ends-of-life scenarios.
(Source: Nunen *et al*., 2004: 5).

Nunen *et al.* (2004) mention that; if functional and economical criteria are included in the prediction of service life, “Trend” and “Related” factors should also be added while calculating the ESLC. The “Trend” factor accounts for the sensitivity to fashion trends which can decrease the functional service life of any component due to the changing fashions. Additionally, the “Related” factor includes two aspects: the accessibility of a product to be replaced in combination with the replacement of components. For example, more replacements can be made if it is possible to do so with much more ease. The replacement of a complete building part, like fenestration, was easier than only any component, frame without glass.

2.5. Life Cycle Assessment of Buildings

According to IEA Annex 31 (2001: 3-4), LCA methods could be directly applied to the building sector but buildings have many characteristics that can complicate the application of standard LCA methods. Buildings are difficult to assess, because:

- The long and unknown life expectancy of a building can cause imprecision. For example, predictions of environmental loadings can not be precise because of the changing of the energy sources or the energy efficiency;
- buildings are site specific and many of the impacts are local;
- buildings and their components are heterogeneous in their composition, the associated product manufacturing processes can vary greatly from one site to another;
- the building life cycle includes specific phases such as resource extraction, construction, use and demolition (Figure 2.11). In the use phase, the behavior of the users and of the services operators or facilities managers have a significant influence on energy consumption;
- . a building is highly multi-functional, which makes it difficult to choose an appropriate functional unit;
- a building creates an indoor living environment, that can be

assessed in terms of comfort and health; and

- buildings are closely integrated with other elements in the building environment, particularly urban infrastructure like roads, pipes, wires, green space and treatment facilities. Because building design characteristics affect the demand for these other systems, it can be highly misleading to conduct LCA on a building in isolation.

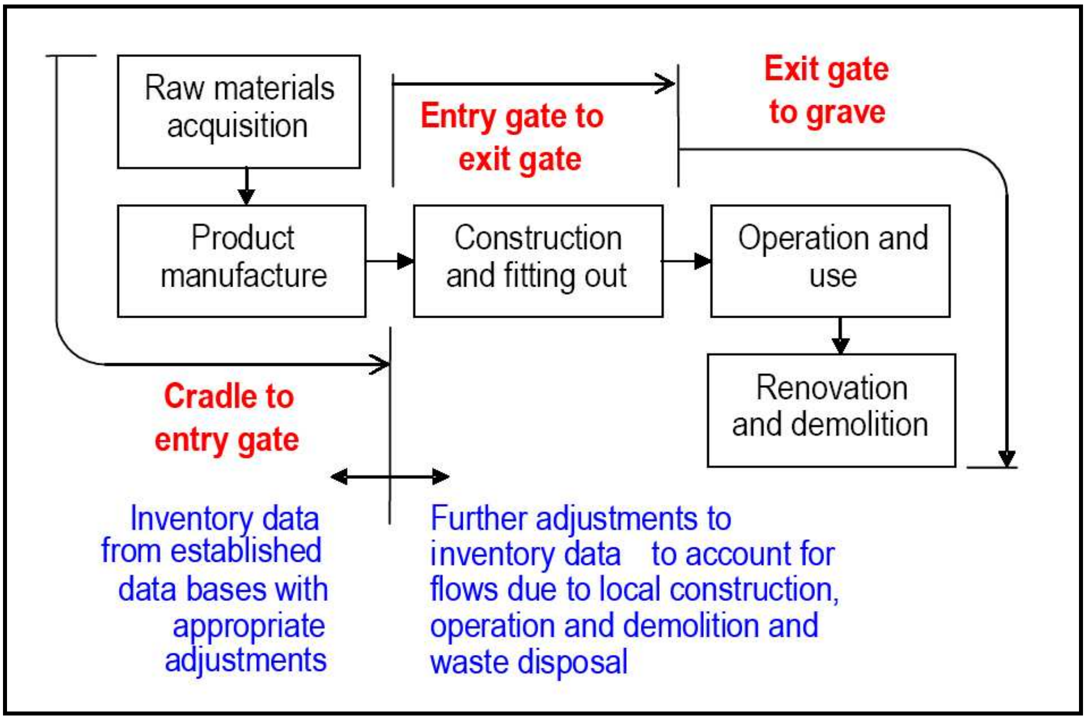

Figure 2.11. Stages of building life cycle.
(Source: USEPA, 2002).

Trusty (2004) emphasizes the greater difficulty in assessing the environmental effects of resource extraction in building life cycle. He points out that since many of the environmental effects are very site specific and not easily measured, they are generally ignored. Additionally, the energy required to operate a building over its life is much greater than the energy attributed to the products used in its construction. However, other embodied effects such as toxic releases to water during the resource extraction and manufacturing stages are greater than during building operations.

2.5.1. Life Cycle Assessment of Renovations and Refurbishments

Erlandsson and Levin (2005: 1460) states that, according to linear building perspective, buildings are constructed and utilized for the intended purpose for a defined period and finally demolished. On the other hand, according to the building service life cycle perspective, the service life cycle accounts for all activities that have to be performed so that all materials in necessary amounts and qualities is available as required for the specified service. The service then accounts for all activities related to the predicted service life.

O'Connor (2004) determined that the service life approach allowed the analysis of renovation and refurbishment works. Knowledge of the probable residual life span of a building element can often be decisive for whether it should be replaced or not. Although most building and construction materials are expected to have service lives of several decades, no set method is available for making reliable predictions of their service lives. The author asserts that, the remaining life span of building elements is an important piece of information for financially and ecologically coherent renovation/refurbishment decisions. However, to determine it correctly, it is necessary to take into account the current deterioration state of the element. The remaining life span of building elements is not only used as a decision criterion in renovation/refurbishment scenarios but also in life cycle energy or ecological assessments.

Nunen *et al.* (2004: 5) pointed out some irregularities that can cause problems when performing service life calculations in the building sector, such as:

- Premature replacement (replacing products before it is a technical necessity);
- sequential use (replacement of (identical) products within the overall service life of building);
- subdivision of environmental burden (regarding environmental burden as a linear process, instead of dividing it in different phases).

According to Flourentzou (2000), a model which could simulate the probable development in the deterioration of all building elements can be used to determine their probable date of replacement. Knowledge of this development for all building elements will make it possible to assess the global development in maintenance and refurbishment costs for the entire building.

2.5.2. Life Cycle Assessment of Hotel Buildings

According to Dascalaki and Balaras (2004), hotels, accommodation facilities, are unique with regard to operational schemes, the type of services offered, as well as the resulting patterns of natural resource consumption. Many of the services to hotel guests are highly resource intensive, whether it concerned energy, water or raw materials. As a consequence, hotels are characterized to have the highest negative impact on the environment, of all commercial buildings, with the exception of hospitals. The authors suggest that this impact can be countered by making hotels more environmentally friendly by constructing them with environmentally sensitive materials, which are less toxic, more durable and stronger, made of recycled materials, or environmentally certified.

Such material should also have low embodied energy and be produced and available locally, in order to avoid transport-related impacts. According to authors, an environmentally responsible design generates a number of benefits including considerably lower resource consumption and operational costs, as well as improved comfort and productivity for the occupants. Consequently, the corporate image is also improved, thereby attracting new customers, as people came to prefer the “green” alternative. Hotels designed according to sustainability principles are considered to be as “sustainable hotels”.

According to Bohdanowicz (2003), the operational stage of a hotel life-cycle is substantial, both from an economic and environmental perspective. This phase defines the purpose of the hotel and typically lasts for 25 to 50 years. However, with proper maintenance, regular refurbishment and renovation the lifespan of a hotel building can be significantly extended. Some of the currently operating hotels are located in buildings erected centuries ago (*e.g.*, European palace and castle hotels).

The Carbon Trust (2005) states that the operation of a hotel is the most resource intensive stage of the entire life-cycle. Hotels utilize large quantities of energy, water and various consumable materials in providing services and comfort to their guests. Furthermore, the efficiency of many end-users in a hotel is very low, resulting in a relatively large impact, as compared to other types of similar sized buildings. The Italian National Agency for the Protection of the Environment and for Technical Services (APAT, 2002) has estimated that 75% of all impacts exerted by hotel facilities on the environment are associated with the extensive use of resources. This has resulted in increased pressure on local utility systems (power and water supply), sometimes leading to shortages experienced by locals. It also contributed to the depletion of resources.

Bohdanowicz (2004) indicated that hotels generated large quantities of waste and sewage, thus increasing pressure on local sewer systems and plants, as well as landfills. Hotels are also responsible for the release of various air pollutants, excessive use of electricity, deterioration of local air quality, acid rain and global warming. Many of the goods purchased have environmental effects associated with their manufacture, transportation, use and disposal. Furthermore, a number of substances and products used at hotel facilities are exceedingly environmentally harmful. Chlorofluorocarbons (CFCs) still used in refrigeration and air conditioning systems contribute to ozone depletion, and various detergents, often released without proper treatment, contributed to eutrophication of surface water.

According to Stipanuk and Roffman (1992: 420), a hotel is constructed to meet the needs of a growing community and it can become the dominant force in the market for a number of years, enjoying higher occupancies and rates than its competitors. However, there are four phases in the lifecycle of a hotel; during the first phase when the property is new, it is more popular and shows a strong performance; in the second phase due to new competition the occupancy and average daily revenue declined over time; the market changes make occupants demand new and different services and so during the third phase the hotel faces functional obsolescence; finally decision has to be made to either dispose of it or rehabilitate it to respond to current needs in the fourth phase. In Figure 2.12, these four phases are presented graphically.

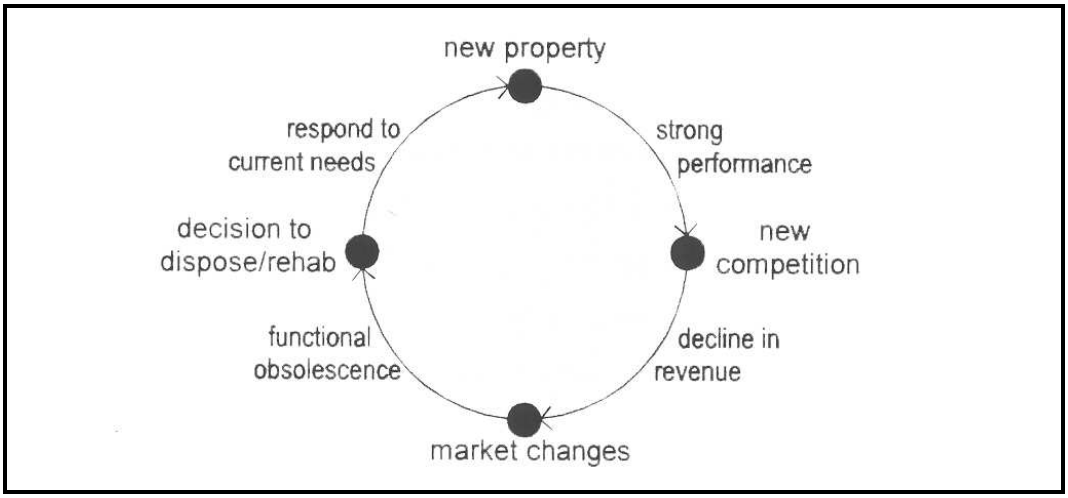

Figure 2.12. Lifecycle of a hotel.
(Source: Stipanuk and Roffman, 1992: 421).

Stipanuk and Roffman (1992: 421) classified renovations in three categories:

- Minor renovation (6 year cycle): the scope of a minor renovation is to replace or renew the non-durable furnishings and finishes within a space without changing the space's use or physical layout such as replacing carpets, wall coverings, drapery, and bedspreads; minor painting; and touching up the furniture.
- Major renovation (12 to 15 year cycle): the scope of a major renovation is to replace or renew all furnishings and finishes within a space, and may include extensive modifications to the use and physical layout of the space itself like replacement of all furniture, bedding, lighting, replacing floor finishing and artwork.
- Restoration (25 to 50 year cycle): the scope of a restoration is to completely gut a space and replace systems that are technically and functionally obsolete, while restoring furnishing and systems that can still be used, given current needs of the facility such as interior demolition of entire guestroom floors to reconfigure the mix of rooms and placement of bathrooms.

According to The Carbon Trust (2005), regular maintenance is crucial to ensure the proper performance of a building and its system, as well as the safety of the occupants. Refurbishment involves the generation of large quantities of waste, and poses a risk involving the emission of various air pollutants (including lead and volatile organic compounds from paints, ozone depleting substances from refrigeration and air conditioning installations).

Dascalaki and Balaras (2004) determined that durability and lifespan are also very important in material selection and detailing, besides initial costs and aesthetics. Making lifetime estimation in preliminary design stage is advantageous in refurbishing programming. The user activities, deterioration agents, and mostly visual obsolescence define the life expectancy of finishes in relation to the maintenance policy concerning renewal cycles. For example, long life expectancy is one of the main criteria in selecting doors, windows and their components because frequent replacement is an expensive and time consuming work in a refurbishment project.

Özgurel (2001) pointed out that special designs for carpeting, wallpapers, upholstery and curtains could limit the future replacements so it is not preferred. She also gave examples by referring to the Hilton International Engineering Manual where the lifetime expectancy for carpets in guestrooms is given as 6 years, for drapes and spreads as 5 years, for beds 15 years, for mattresses 12 years, Venetian blinds 8 years and furniture 10 to 12 years.

Bohdanowicz (2003: 36) summarizes the impacts of the refurbishment and demolition process and also suggest preventive measures for their mitigation in Table 2.3.

Table 2.3: Possible impacts and mitigation measures at the maintenance, refurbishment and demolition stage.

Action	Impact	Mitigation
Refurbishment	Excessive use of resources (energy, water, materials) and associated emissions and wastes.	Consideration of resource saving measures, incorporation of controls and bioclimatic design.
Demolition of the building.	Release of dust, asbestos, emissions from lead- and organic-based paints.	Proper study of the materials used in the construction of the building. In case of possible asbestos presence skilled experts should perform the demolition and removal of asbestos.
	Need for waste landfilling.	Considerations for possible reuse or recycling of building materials, otherwise proper landfilling.
	Reduced safety of the on-site workers and locals.	Skilled personnel aware of possible dangers. Prevention of unauthorized individuals accessing the construction site (fences, signs).
Vehicular traffic and heavy equipment operation.	Excessive use of resources (energy) and associated emissions (impaired air quality). Increased noise levels.	Good quality equipment. Limitation of engines idling. Specific working hours (*e.g.*, 8am to 6pm on weekdays and 10am to 4pm on weekends)
	Reduced safety of the on-site workers and locals.	Skilled personnel aware of possible dangers. Prevention of unauthorized individuals accessing the construction site (fences and signs).
Construction, finishing and furnishing	Decreased safety and well being of occupants due to low quality materials, equipment and furnishings, as well as construction team. Possible moisture in building structure resulting in mould growth, and impaired indoor air quality.	Construction materials and equipment should be chosen based on their life-time costs and good quality, not only initial costs (good quality products will last longer and require less maintenance in the future). Prevention of moisture inside the building materials (covering the building during construction).

(Source: Bohdanowicz, 2003: 36).

CHAPTER 3

MATERIAL AND METHOD

This chapter includes details on two aspects of the study: the research material and methodology. The first covers four subsections; the statistical data on renovation and refurbishment projects in Turkey; information on three five-star hotels in Ankara; the grouped data derived from the bill of quantities for guestroom floors of the three hotel refurbishment projects; and the LCA software. The methodology is comprised of data compilation process, simulation procedure and statistical tests.

3.1. Material

This study was carried out on renovation projects in Turkey; specifically, hotel refurbishment projects in Ankara. In order to fulfill the objectives of this study, information and data were collected from various sources, which are explained in detail under Section 3.1.1. Also details about case study buildings, their refurbishment works and software are given in the following sections.

3.1.1. Statistical Data on Renovation and Refurbishment Projects

In order to determine the volume of renovation works in Turkey, especially in larger cities, the following data were obtained.

- The number of completed or partially completed new buildings and additions by use of buildings according to years (Table B.1,

Appendix B).

- Total floor area of completed or partially completed new buildings and additions by use of building according to years (Table B.1, Appendix B).
- Number of buildings modified for a different use after alterations and repairs by years and use of building (Table B.2, Appendix B).

In order to verify the volume of renovation works in the Turkish hospitality sector, the following data were obtained:

- Data related to the number of tourism establishments in Turkey and Ankara (Table B.3, B.4, B.5, B.6, Appendix B).
- Data related to the different types of alterations and renovation projects approved by the Chamber of Architects in Ankara, during the 6 year period from 2000 to 2006 (Table B.7, Appendix B).

In order to find out the types and amounts of material being replaced during hotel refurbishment projects the BOQ of three five-star hotels were obtained. Raw data is given in Table B.8 (Appendix B), while the derived data is presented in Section 3.1.3.

3.1.2. Case Study Buildings

Data pertaining to refurbishment / renovation projects of the three subject hotels in Ankara was compiled in 2005 and photographs of the refurbished rooms were taken in 2007. Two of these hotels belong to chains of international repute while one is a local hotel of historical importance. Although major renovations included such public areas as the lobby, conference and meeting rooms, ballroom, restaurants *etc.*, only data for guestrooms were analyzed in this study, as the design decisions for one room is repeated many times over. The three subject hotels are described in more detail in the following sections.

Hotel A belongs to an international chain which operates 2,700 hotels in 70 countries. Its construction was completed in 1986. Guestroom floors are located on the upper 16 levels. The hotel consists of 323 standard rooms, 26 suits and one royal suit, one entire floor with extended-stay apartments, 51 executive rooms and other leisure and business facilities. The architectural layout of a typical guestroom floor is presented in Figure 3.1 below.

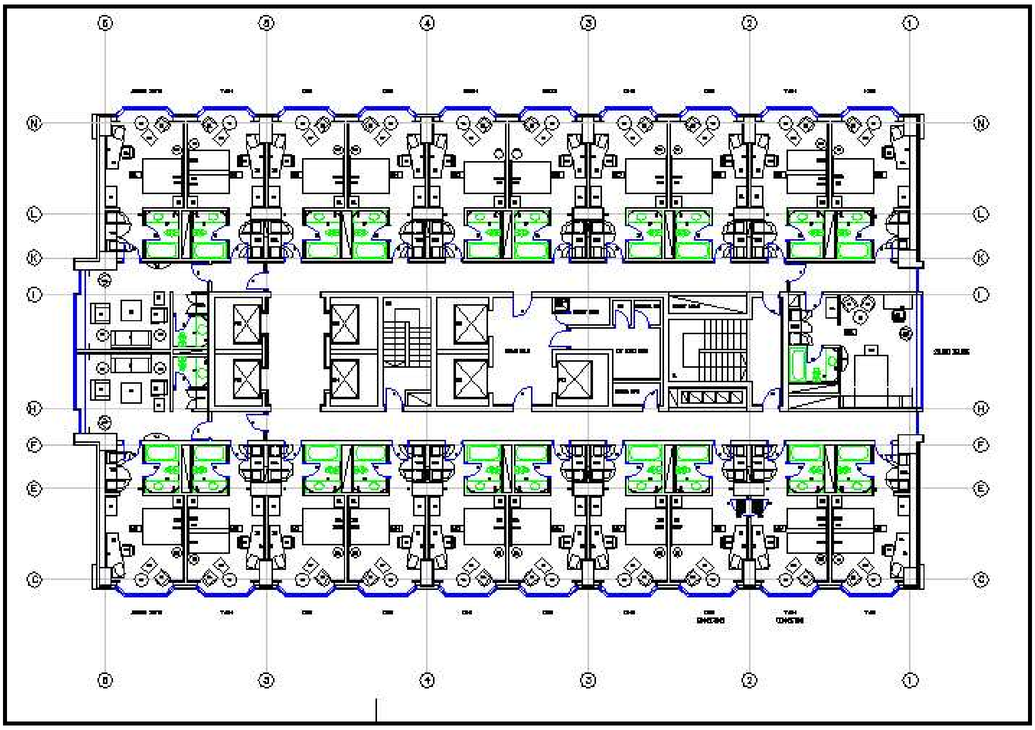

Figure 3.1. Typical guestroom floor plan of Hotel A.

The construction of Hotel B, which is one of the 730 hotels operated by its chain in 80 countries, was finished in 1991. This hotel has 24 floors. It consists of 280 standard rooms, 11 smart rooms, 8 executive suits, 5 smart suits, 2 ambassadorial suits and one royal suit. The major refurbishment in the guestrooms took place in 2002 in order to meet customer demand for high/new technology. Additionally, special rooms were designed for disabled and left-handed guests in order to provide more comfort to them and broaden target clientele. In 2003, construction of a new convention and cultural centre was begun adjacent to the hotel building. At the same time, a renovation project encompassing the main lobby, restaurants, clubhouse, mezzanine and business centre was also started in order to achieve harmony with the design philosophy and style of the new annex building. The architectural layout of a typical guestroom floor is presented in Figure 3.2 below.

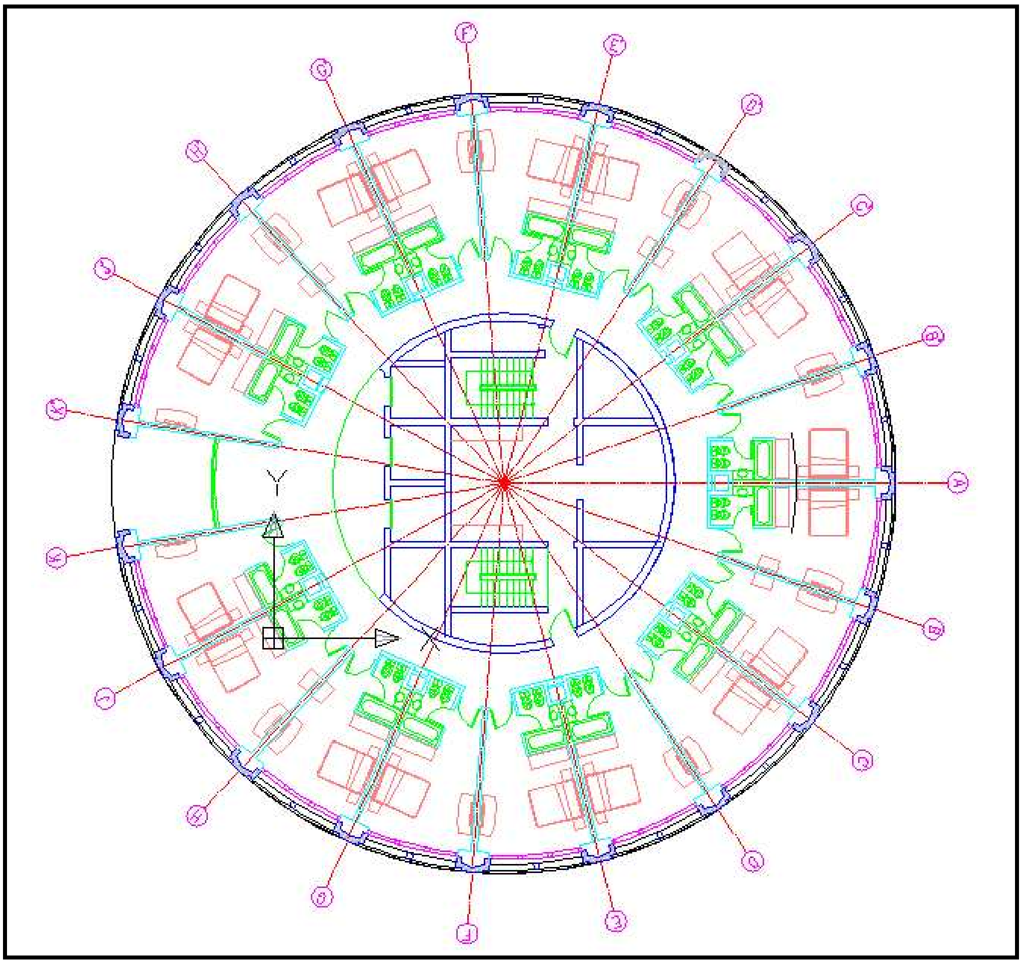

Figure 3.2. Typical guestroom floor plan of Hotel B.

Hotel C is one of the oldest five-star hotels in Ankara, which was constructed in 1966. It has 22 floors, 14 of which have guestrooms. This refurbishment project is different from the other two projects. Although it was planned that in 2003 the hotel be completely renovated and not just refurbished, this renovation was postponed because of financial problems and a change of management. This project was an extensive one and major changes were made in the building. The number of guestrooms was reduced. Standard rooms were also reduced in order to increase the number of suits. Now, there are 110 standard rooms, 26 suits and 23 executive suits; 14 rooms have been converted to club-rooms and 2 for the handicapped. Recreational and business facilities have also been expanded by increasing the number of meeting rooms and ballrooms. The architectural layout of a typical guestroom floor is presented in Figure 3.3.

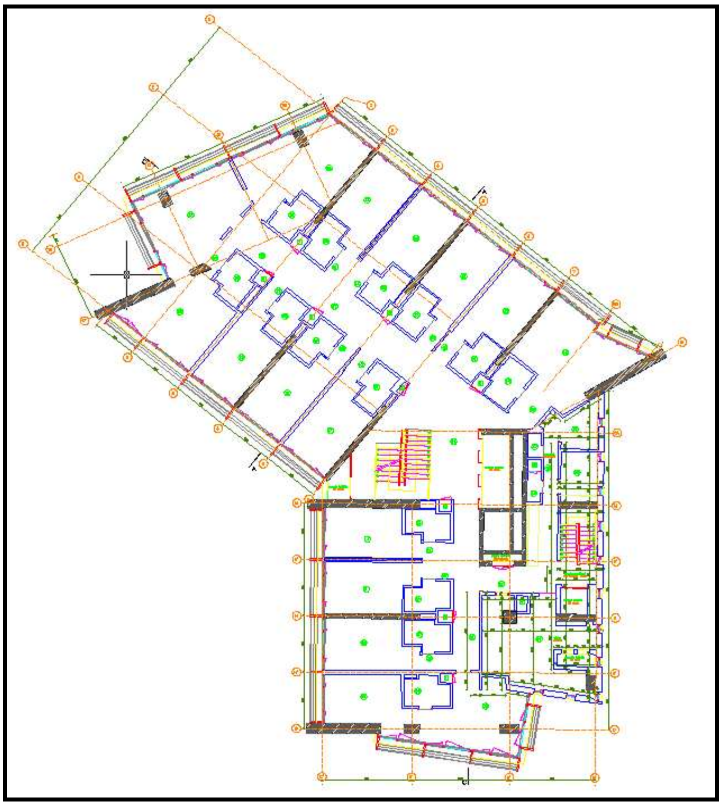

Figure 3.3. Typical guestroom floor plan of Hotel C.

3.1.3. Bills of Quantities of Three Refurbishment Projects

The grouped data for the renovation of the three hotels was gathered from the BOQs of Hotels A, B and C. As mentioned earlier, data for only the guestrooms and corridors on the guestroom floors has been analyzed. More variety and amount of material was used in Hotel C as a result of the volume of the refurbishment.

Most significant were the materials used for finishing the surfaces, such as vinyl wall coverings, carpets and suspended ceilings. Additionally bathroom fittings and fixtures as well as doors (with frames) have been replaced in all the hotels. The walls were covered with embossed vinyl wallpaper, which was replaced with new wallpaper to the tune of 20,000 square meters in Hotel A, 12,500 square meters in Hotel B and 15,000 square meters in Hotel C; most of this washable textile backed wallpaper was imported. The number of doors replaced with new ones was also significant; the number of new doors in Hotels A, B, and C were 720, 387, and 490 respectively.

In Table 3.1 below, the description of renovation works are given in the first column. These works are divided according to assembly groups such as: demolition works, floor and ceiling finishing works, skirting and wall finishing works, doors, windows, furniture and fixtures. The unit of wall, floor and ceiling finishing works is square meter; doors, windows, furniture and fixtures are listed in set. Quantities of refurbishment projects of three subject hotels for settled works are presented separately as Hotel A, Hotel B, and Hotel C. The quantities of some works were not determined in the bill of materials of subject hotels; therefore it is presented as “not quantified” in Table 3.1.

Table 3.1: Derived bill of quantities for renovation works in the three five-star hotels in Ankara, Turkey.

	DESCRIPTION OF RENOVATION WORKS		Hotel A	Hotel B	Hotel C
1	**CIVIL WORKS**	**UNIT**	**QTY**	**QTY**	**QTY**
A	**DEMOLITION WORKS**				
1A1	Demolition of brick wall	M^3	Not quantified		1250
1A2	Demolition of r/c	M^3			35
1A3	Removal of suspended ceilings	M^2	106		7100
1A4	Scraping of existing wall plaster and ceramics	M^2	20119		2680
1A5	Demolition of existing flooring and removal	M^2	10054		8900
1A7	Demolition of piping and mechanical ducts	TON			350
1A8	Dismantling all electrical systems	MT			15000
	Removal of doors with frames	SET	480		
	Removal of bathroom fittings and fixtures	SET	360	186	
E	**FLOORING**				
1E1	Levelling concrete	M^2	5026	26	1586
1E2	Self levelling screed	M^2	9615		9500
1E4	Ceramic flooring	M^2	2784		2805
1E7	Heavy-duty board-room type fire-proof carpet (80 wool/20 nylon	M^2	7272	7560	7656
1E8	1st Quality walnut-finished parquet floor with varnish	M^2			1100
1E9	Mechanical polishing of existing marble floors	M^2		504	800
1E10	PVC flooring for floor service rooms	M^2			980
1E11	Solid walnut guestroom entrance door threshold	MT			150
F	**SKIRTING**				
1F1	Hardwood(walnut) veneered over mdf varnished skirting	MT			5400
1F2	Hardwood skirting (varnished)	MT	8093	4281	970
1F3	Ceramic skirting	MT			2100
1F4	Softwood skirting (varnished)	MT			450
G	**CEILING**				
1G1	Ceiling plastering	M^2	11097		1670
1G2	Gypsum speckling	M^2	7846		11170
1G3	Gypsum board(fire resistant) suspended ceiling	M^2	4413	563	6050

Table 3.1: (continued)

1G6	Satin finish acrylic paint (3 layers)	M^2	12488	6275	8596
K	**PARTITION WALLS**				
1K1	Hollow block brick wall(20 cm)	M^2	217.6	7	500
1K2	Gypsum board wall (double sided water &-fire proof)	M^2	2774	1128	4150
1K3	Single sided gypsum board wall	M^2			1500
1K4	Gypsum board partition wall (double)	M^2			500
1K5	Hollow block bims concrete wall (10*39*19)	M^2			500
L	**WALL COVERINGS&FINISHES**				
1L1	Interior wall plastering	M^2	23181	83	12839
1L2	Gypsum speckling	M^2	27148		12839
1L3	Satin finish acrylic paint (3 layers)	M^2	4366		12839
1L4	Oil paint(3 layers)	M^2			500
1L5	Ceramic wall tiles	M^2			3250
1L6	Walnut finish wall panels (varnished)	M^2			240
1L7	Marble wall covering(textured finish)	M^2			320
1L8	Coloured back glass wall tiles	M^2			200
1L9	Textile backed vinyl wall paper	M^2	21697	24476	15000
1L10	Mid-rail on corridor walls of guestroom floors (150 mm)	MT			700
M	**DOORS & WINDOWS**				
1M1	Walnut veneered solid wood fire resistant doors with frames and fitting	EA	720	387	250
1M2	Toughened glass shower door	EA			178
1M6	Executive suits fire resistant walnut doors including frame and fittings	M^2			100
1M7	Solid core laminate facing wooden doors with frame	M^2			120
1M8	Solid core sound proof wooden doors with frame and fitting	M^2			20
1M9	Aluminium window frame replacement with (4+4 double glass)	M^2			710
N	**FURNITURE/ FIXTURES**				
1N1	Guestroom furniture units including all accessories	SET	352	180	177
1N2	Upholsteries & linens & drapery & cushions	SET			354
1N6	Shelving units	EA			187
1N7	All mirrors	EA	352		200
	Bathrooms	SET	360	186	177

3.1.4. LCA Software

To assess the environmental impacts of the materials most commonly replaced during refurbishment projects, a life-cycle assessment software called ATHENA® was used, which is produced by the Athena Sustainable Materials Institute in Canada.

ATHENA® separately assesses and compares conceptual design options for structural systems and envelope alternatives. Some general information about the project is entered into the software, such as: location, gross floor area, building type, and operating energy consumption. The SI (metric) unit designation is the default unit measure for entering assembly information, while inputs for the model can be specified in either imperial or (SI) metric. However, the model's internal calculations and final results are computed in metric units. The Add Assembly menu is used to define foundations, additional walls, floors/roofs and column and beam assemblies to complete a three-dimensional building space. Extra basic materials may also be added to augment any particular assembly selection.

This tool also has an operating energy conversion calculator module which allows software users to enter their building's annual operating energy by fuel type; the EIE software calculates both the pre-combustion and direct combustion emissions associated with that fuel use. These emissions can be compared to those embodied in the materials making up the building.

ATHENA® uses European databases which include materials that are commonly being manufactured with western technology. However, in this program the properties of the material in the database can not be changed or added by the users. In order to assess materials which are not found in its database, the author had to contact the ATHENA Institute to seek guidance with regards to a best match from the database for the material in question.

3.2. Methodology

Statistical data on building types, renovation and refurbishment projects in Turkey and specifically that on hotels were obtained from TURKSTAT and Ministry of Tourism, in order to present the volume of the refurbishment works and to assess the importance of renovation/refurbishment projects in Turkey. Statistics on renovation/refurbishment projects in Ankara were obtained from the Ankara Chamber of Architects as the municipalities in Ankara did not have this kind of database. These data were used to analyze the volume of these works in Ankara between 2000 and 2006. After comparing them, it was found that approximately 53% of hotels were refurbished in Ankara in 6 years.

Generally speaking, initiating a refurbishment project mainly depends on the financial situation of the building owners/management. On the other hand, refurbishment is an obligatory requirement for the success of the hospitality sector. However, in contrast to touristic cities where financial concerns are of prime importance; hotels in a capital city, especially those belonging to an international chain, are seen as a prestige symbol. Also there is a stipulation for all hotels belonging to a particular international chain to refurbish between definite intervals determined in the agreements. From this point of view, Ankara was chosen as the location; hotels were chosen as the building type whose service life does not depend on its physical condition; and five-star hotels that belong to international chain were chosen as the hotel type for which the refurbishment is inevitable.

In accordance with the concerns mentioned above, three five-star hotels in Ankara, belonging to international chains were chosen as case studies for this investigation. The architectural design projects, the BOQ for the renovation/refurbishment projects and data on their operating-energy consumption were obtained from the management of these hotels and photographs of refurbished rooms were taken in March 2007. Furthermore, the management was also interviewed informally to gather information on the frequency of and reasons for these renovations.

The contents of the refurbishment projects and the stages in their life cycle were assessed with the LCA tool, ATHENA. The inventory analysis was made according to their bill of quantities for renovation projects. From their bill of quantities, data related to refurbishments of only the guestrooms are obtained since refurbishments in other common spaces were different for each of these hotels. (Some of them are more extensive than the others). The waste produced during renovations and its recycling capacity should also be considered. However, this stage was generally ignored and only a few parts were reused or recycled.

The methodology adapted for this investigation is summarized in Figure 3.4. In order to fulfill the objectives of methodology of this investigation, the bill of materials of refurbishment works of three subject hotels are compiled and its process is stated in Section 3.2.1. The simulation of refurbishment works is given in Section 3.2.2. Also included are the simulation procedure, the phases of this LCA study and interpretations of six environmental impact indicators according to international standards. Finally, the hypotheses were formulated according to data generated from software and listed in Section 3.2.3.

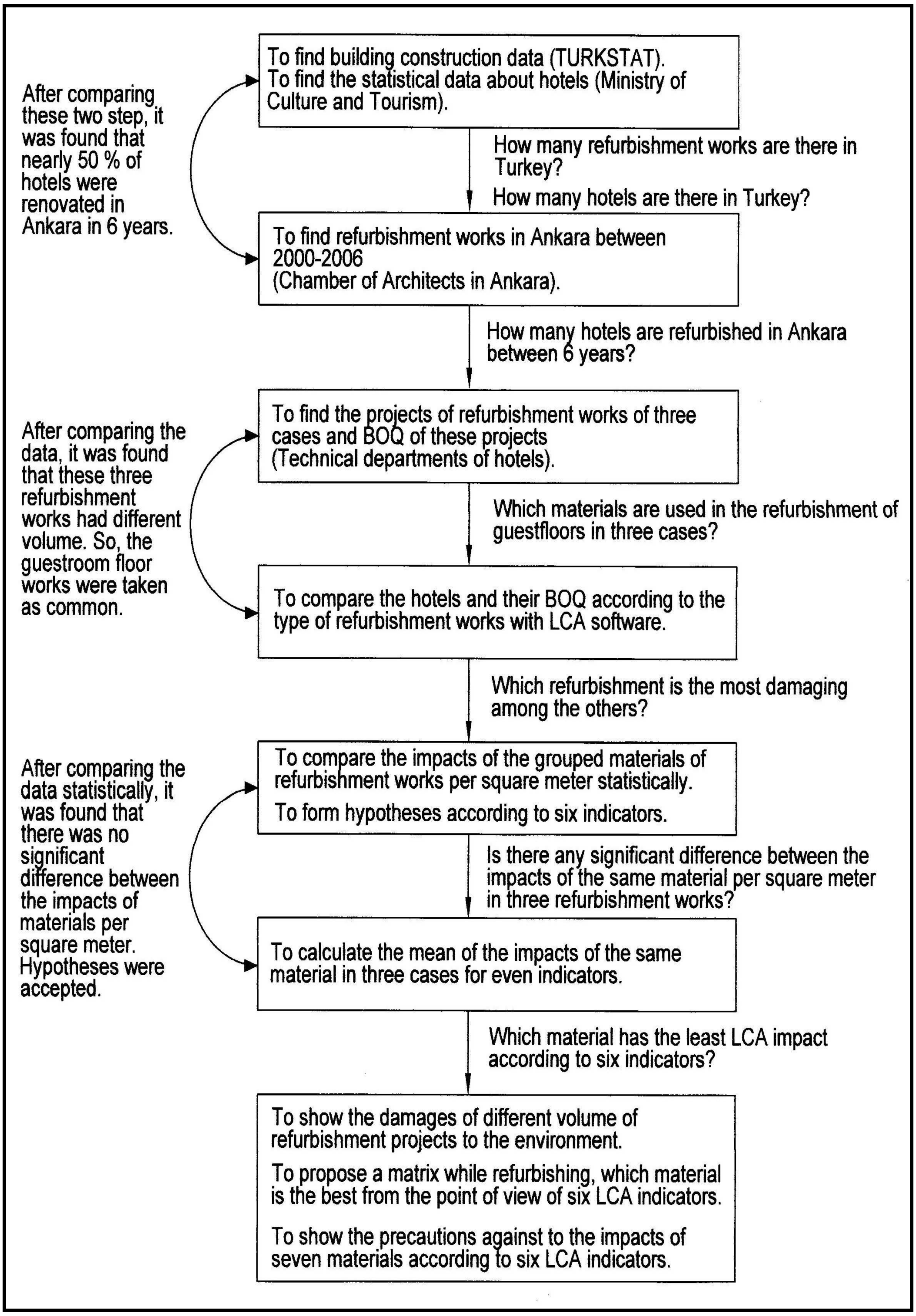

Figure 3.4. The methodology adapted by the author.

3.2.1. Data Compilation Process

First of all, the bill of materials of refurbishment projects of hotel buildings are confidential files so the author is very grateful to the technical management of these hotels. Data pertaining to refurbishment/renovation projects of the three abovementioned five star hotels in Ankara was gathered in 2005.

After grouping these data, they were classified as guestroom floors and general spaces. In these data, there are structural materials and also the finishing materials. In the computer program, the structural materials can be assessed but fixtures like bathtubs, closets and beds can not be assessed. Data for only guestrooms and corridors on the guestroom floors has been analyzed and only those materials that were used in the refurbishment projects of all the three hotels were chosen for the analyses. These common materials were levelling concrete, brick, stucco, gypsum board, wallpaper, hardwood (skirting) and paint.

It should be noted that in Hotel C the rooms were converted to suits and more changes in the designs were made compared to Hotels A and B; therefore, the variety and amount of material were more than the other two hotels, seen in Table 3.1.

3.2.2. Simulation

This study consists of three different refurbishment projects. The hotels are assessed one by one and then they are compared with each other. The assessment procedure for Hotel A is explained as an example. According to the phases of an LCA study, the first phase is goal and scope definition as mentioned before. In scope, this case study estimates the life cycle environmental impacts of material manufacturing, maintenance, repair and replacement effects of the refurbishment project of Hotel A. The goal of this study is to provide an interactive LCA case study which allows investigation of the life cycle impacts of a similar range construction. To define the system boundaries is very important. The study is confined to effects on the natural environment; while local indoor effects on human health are omitted. The software database is used; the materials which have the similar impacts are used instead of missing materials. General information about the project, which is: project name, location, gross floor area, building life expectancy, building type, units (SI or Imperial), project description and operating energy consumption is entered on the computer.

The most important location factor for the use of the software is not climatic zone, but rather how the electricity is generated in the region and the author must choose from the existing location options. The ATHENA Institute offered Toronto location as best match for Turkey's grid according to the electricity profile of Turkey, which was obtained from TURKSTAT (Table B.9, Appendix B). If operating energy consumption of building in a year is given, the location data can be ignored. So the yearly operating energy consumption data was found and average value was calculated that was derived from the data belonging to a twelve year period (Table B.10, Appendix B).

The building life expectancy was defined as 37 years for Hotel C, because in this hotel major renovation was needed in this time period. As a second step, the materials were quantified according to the bill of quantities. These materials are put under the heading of extra basic materials because this project is a refurbishment project; so foundation, structure, beam, column roof and their materials are not changed. After entering the materials as the input, the summary tables and graphs about six indicators; such as primary energy consumption, solid waste, global warming potential, air pollution index, water pollution index and weighted resource use; are obtained as the output. Accordingly, this project can be evaluated on the basis of these graphs and tables.

The limit conditions and specific benchmarks of these six environmental impact indicators can not be found, and also the found values can not be correlated with the software summary measures. So the found international standards can be used and a comparison between all case studies will be more illustrative to the readers.

For solid waste indicator, the limit value is generally measured in ton/person and this limit was 1.35 ton/person in Turkey (TURKSTAT). For water pollution, the ranges of index values could be categorized as follows in EPA standards:

very small,	0 - 0.20
small,	0.21 - 0.40
medium,	0.41 - 0.60
high,	0.61 - 0.80
very high,	0.81 - 1.00.

However, the results of the software about water pollution could not be correlated with these values. For air pollution index, it is developed in easily understood ranges of values, instead of using the actual concentrations of air pollutants, as a means for reporting the quality of air or level of air pollution. To reflect the status of the air quality and its effects on human health, the ranges of index values should be categorized. For Turkey, there was not an index like this. Only the amount of special gases such as sulphur oxide was determined seen in Table B.11, Appendix B (TURKSTAT). But the results of this software about air pollution could not be correlated with these values for Turkey. So the EPA standards were used to assess the materials. The corresponding pollutant concentrations and API value according to EPA is given in Table 3.2, and the API values regards to the effects to human health are also given in Table 3.3.

Table 3.2: Air pollution index value and corresponding pollutant concentrations according to EPA.

Pollution Index	Pollutant Concentrations (mg/cubic meter)				
API	SO_2 (daily average)	NO_2 (daily average)	PM_{10} (daily average)	CO (hourly average)	O_3 (hourly average)
50	0.050	0.080	0.050	5	0.120
100	0.150	0.120	0.150	10	0.200
200	0.800	0.280	0.350	60	0.400
300	1.600	0.565	0.420	90	0.800
400	2.100	0.750	0.500	120	1.000
500	2.620	0.940	0.600	150	1.200

(Source: http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf, last access 08.06.2007).

Table 3.3: Air pollution index and air quality grading regards to health.

API	Air quality Description	Grade	Effects to health	Measures suggested
0-50	Excellent	1	Daily activities not be affected	
51-100	Good	2		
101-150	Slightly polluted	3A	The symptom of the susceptible is aggravated slightly, while the healthy people will appear stimulate symptom.	The cardiac and respiratory system patients should reduce strength draining and outdoor activities.
151-200	Light polluted	3B		
201-250	Moderate polluted	4A	The symptoms of the cardiac and lung disease patients aggravate remarkably, and the exercise endurance drop lower. The healthy crowds popularly appear some symptoms.	The aged, cardiac and lung disease patients should stay indoors and reduce physical activities.
251-300	Moderate-heavy polluted	4B		
>300	Heavy polluted	5	The exercise endurance of the healthy people drops down, some appears strong symptoms remarkably. Some diseases appear earlier.	The aged and patients should stay indoors and avoid strength draining; the ordinary should avoid outdoor activities.

(Source: http://www.zhb.gov.ca/english/airqualityinfo.htm, last access 08.06.2007).

Basic formula of the API calculation method according to EPA was given below (http://www.epa.gov/ttn/oarpg/t1/memoranda/rg701.pdf):

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{low}) + I_{low}$$

where

I = Index value,

I_{high} and I_{low} = the maximum and minimum value of the API index range, which the concentration of pollutants take place.

C_{high} and C_{low} = the maximum and minimum value of the concentration range, which the concentration of pollutants take place.

C = the concentration of pollutants.

3.2.3. Tests of Hypotheses

Tests of hypotheses were formulated according to data derived from simulation modelling in order to determine whether or not any significant relationships existed between the life cycle environmental impacts of the same material per square meter in three refurbishment works. The hypotheses were:

– H_{01}: There is no difference in primary energy consumption between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

– H_{02}: There is no difference in solid waste between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

– H_{03}: There is no difference in the air pollution index between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

– H_{04}: There is no difference in water pollution index between refurbishment projects of three hotels according to the impacts of seven materials per m^2.
– H_{05}: There is no difference in global warming potential between refurbishment projects of three hotels according to the impacts of seven materials per m^2.
– H_{06}: There is no difference in weighted resource use between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

The paired-sample *t*-test was used to analyze the refurbishment works of subject hotels. Three pairs from three hotels were formed such as: Hotel B - Hotel A, Hotel B - Hotel C, and Hotel A – Hotel C. 5 % level of significance (α=0,05) was prescribed. These analyses were done using SPSS 11® software for Windows®, wherefrom significance is established on the basis of p-value outputs.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter includes details on five aspects of the investigation. The first covers discussion of statistical data on renovation and refurbishment projects in Turkey and the second covers the frequency of and reasons for hotel refurbishment projects, as elicited through informal interviews. After gathering data generated by the LCA software (ATHENA), the statistical analyses of these data using paired-sample *t*-test are presented in the fourth section. The last section covers the comparative evaluation of the three case studies and seven common materials that were used in all three refurbishment projects.

4.1. Discussion on Statistical Data for Refurbishment Projects

Building construction statistics that are prepared by TURKSTAT in 2003 were analyzed. The buildings are classified according to their use; residential, commercial, industrial, cultural, religious, administrative and other. As shown in Figure 4.2, it was observed that floor area of completed or partially completed new buildings and additions by use of building in the last fifteen years reached its highest value for residential buildings in 1996, for commercial buildings in 1997, and for administrative buildings in 1991. While the total floor area of construction increased, there was a decrease in the floor area of cultural and administrative buildings (Table B.1, Appendix B).

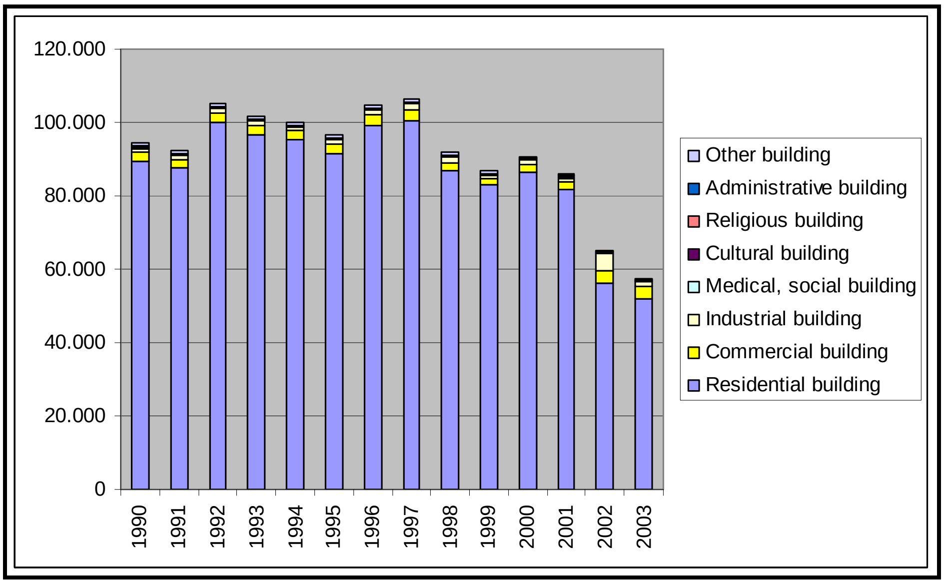

Figure 4.1. The number of completed or partially completed new buildings and additions by use of building according to years Table B.2. (Source: TURKSTAT).

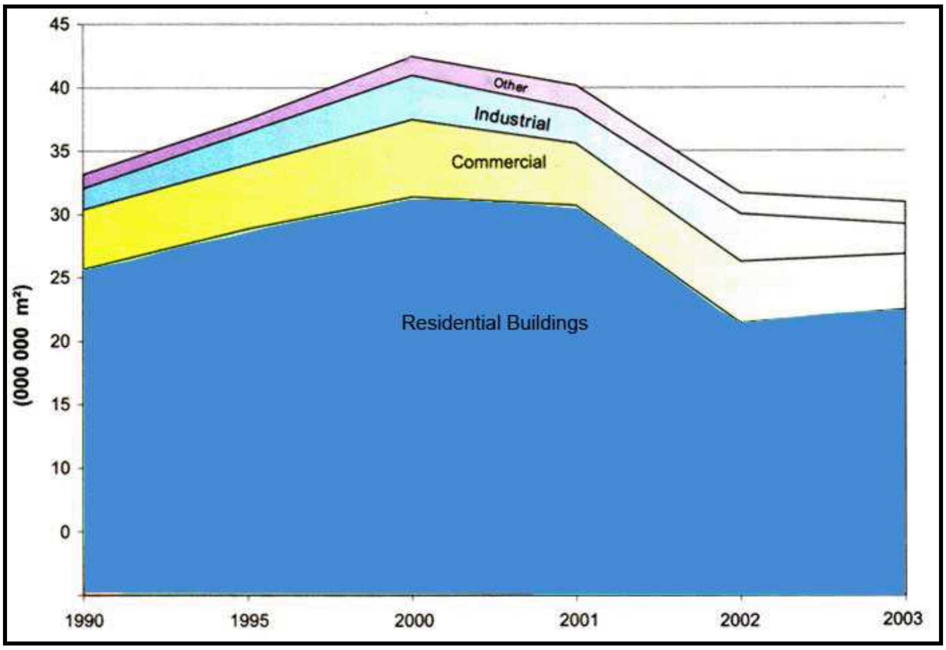

Figure 4.2. Total floor area of completed or partially completed new buildings and additions by use of building according to years Table B.2. (Source: TURKSTAT).

The statistics for tourism licensed facilities of Turkey and Ankara were obtained from T.C. Kültür ve Turizm Bakanlığı (The General Directorate of Investment and Enterprises Ministry Culture and Tourism Republic of Turkey).

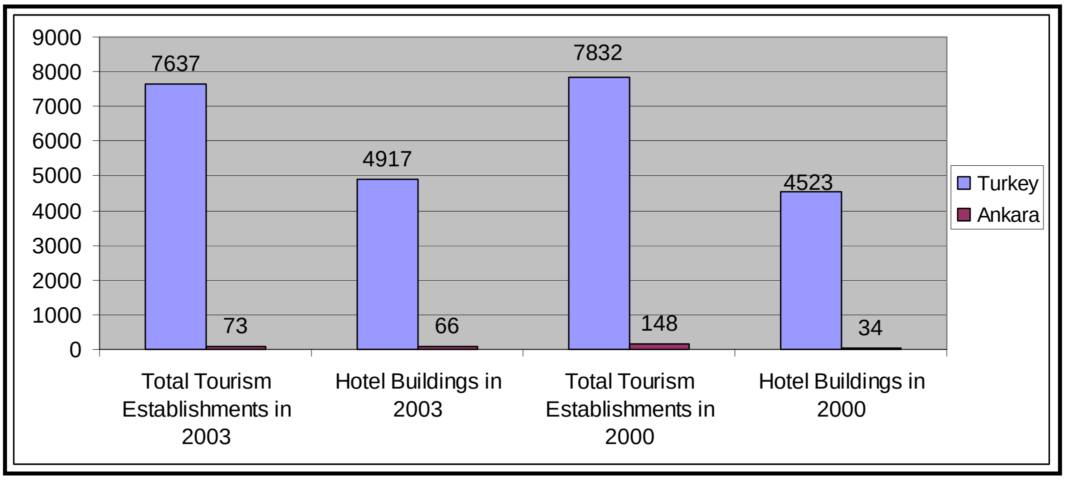

Figure 4.3. Data related to the number of tourism establishments in Turkey and Ankara derived from Table B.3, B.4, B.5, B.6.
(Source: Ministry of Culture and Tourism).

As can be seen in Table B.5, Ankara ranks twelfth amongst the 81 provinces in Turkey according to the number of tourism licensed facilities in 2003. If this data is analyzed, coastal cities rank the highest. Although Ankara is not a coastal city, nor a mountain resort, it is the capital city and therefore hosts many delegations, which is why it has many hotels. This being the case it needs to have world-class hotels to accommodate the official guests. This in turn means that the hotels in Ankara have to be kept up to date and must be renovated every how and then to meet the high standards of equivalent hotels elsewhere.

The number of completed new buildings and additions decreases day by day and it becomes nearly the half of the peak value in 2003. This affects to increase the number of all type of renovations and refurbishments. Besides this, the rate of change of function of buildings is very high because users do not have much choice but to purchase what is on the market, even though the property does not meet their requirements; hence, the need for additions and alterations to the spaces (T.C. Başbakanlık Aile Araştırma Kurumu Başkanlığı, 1999: 12).

In Table B.2, the change of use of buildings is examined according to year 2002 to 2004, and old and new use of building. These alterations are only large-scale alterations which include the change of function of the building. Besides these, data about different types of alterations of buildings in Turkey would not be obtained so that for Ankara only is presented; as the case studies were also conducted in Ankara.

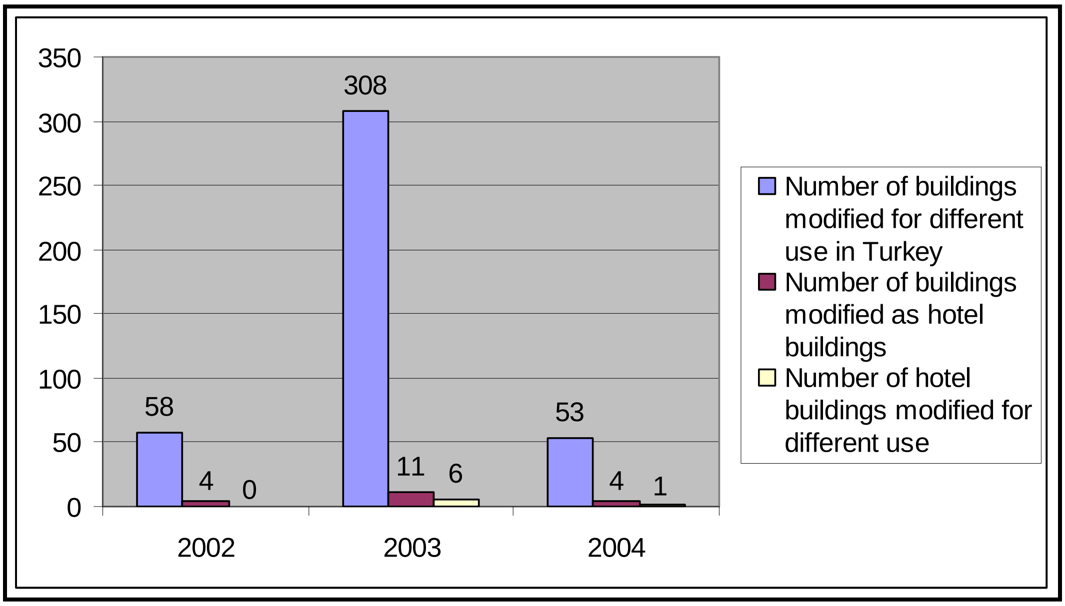

Figure 4.4. Number of buildings modified for a different use after alterations and repairs by year and use of building derived from Table B.2. (Source: TURKSTAT).

According to The Chamber of Architects in Ankara, the types of alteration/renovation works in buildings are as follows:

- *small-scale alterations* that concerned only changes in internal partitions, which do not reflect on the building's structural system or its façade;
- *medium-scale alterations* consisted of alterations in plans which reflected on the façade also but not in the building's function;
- *large-scale alterations* that included changes in plans, facades, structural system and also the function of the building;
- *major renovation* projects that entailed an increase in the covered area, have totally different function and plan and also were regarded as new projects;
- *additions plus alterations* contained additions to the building.

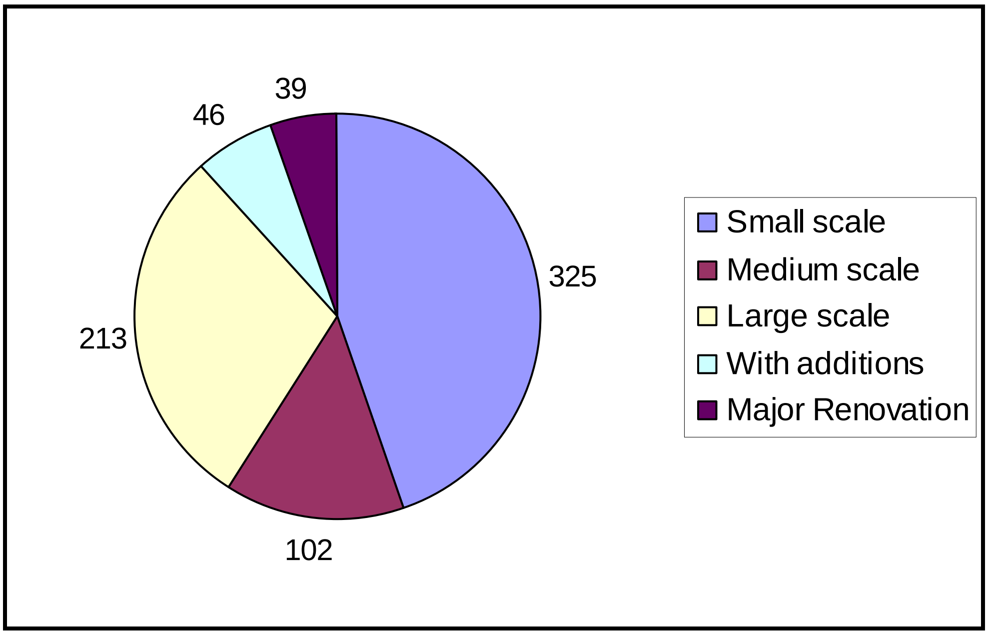

Figure 4.5. Data related to the different types of renovation projects approved by the Chamber of Architects in Ankara, during the 6 year period of 2000-2006, derived from Table B.7, Appendix B.
(Source: Turkish Chamber of Architects in Ankara).

According to data taken from Ankara Chamber of Architects, 18 out of 725 projects *i.e.* approximately 2.5 % belong to hotels in Ankara, between 2000 and 2006. If we compare this number with the total number of hotels in Ankara in the year 2000 (Figure 4.3), which was 34 only, the percentage of hotels renovated in the six year period is almost 53%.

4.2. Frequency of and Reasons for Hotel Refurbishment Projects

Renovation of guestrooms, bathrooms and common/entertainment areas was mostly done to keep up with new fashion dictates on style and color-schemes. Meanwhile, major renovation of rooms took place also because there was a need to provide extra and different facilities to the guests. For example, to keep up with new technologies, the electrical wiring system had to be replaced in order to provide high-speed internet connection, data-port, satellite TV, fax machine, conference call availability photocopy/printer machines, as well as plugs suitable for both 110 & 220 V. Rooms for left-handed guests required replacement of all fixtures; whereas, rooms for the disabled had to be equipped with special features and fixtures. In view of the market demand some rooms were combined to make extra suits and some were converted into special guest rooms for non-smokers, disabled or left-handed guests, while some were knocked down and the space was used to build self-contained apartments for extended stay. Apart from guestrooms, major renovation works included the creation of theme restaurants and bars, hi-tech conference and meeting rooms.

Informal interviews were conducted with the technical managers of hotels and the general manager of construction company of Hotel B to determine the frequency of and reasons for hotel refurbishment projects, and to understand the necessity for such projects.

Figure 4.6. Typical standard suit of Hotel A after refurbishment.

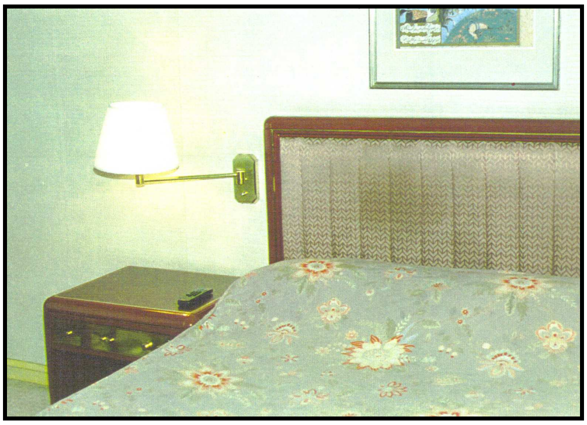

Figure 4.7. Typical standard room of Hotel A before refurbishment.
(Source: Ozgurel, 2001: 85).

Figure 4.8. Typical standard room of Hotel A after refurbishment.

Renovation works in hotels were undertaken mostly from the point of view of customer satisfaction. The guests were asked to fill up a questionnaire to assess their satisfaction. Some of the questions were posed to determine those aspects which impressed the guests most. The aim was also to find out whether the guests were bored with the decor or not. Unless there was a sudden change in fashion trends, this was one of the reasons of refurbishment.

According to Mr. Çalışkan who was the technical manager of Hotel A, their main environmental issues were energy, waste and raw materials and purchasing efficiency; and these issues were their main concern in their refurbishment projects. According to their refurbishment program, the guestroom floors of this hotel have to be refurbished every ten years and the general spaces must be refurbished every twelve years. This is a stipulation for all hotels belonging to this particular international chain. The franchising and management agreement for Hotel B was similar to that. Mr Birkan, the general manager of the construction company of Hotel B, gave an example from Istanbul where a hotel was excluded from their international chain because of non-compliance with the agreement concerning refurbishment periods.

On the other hand, Mr. Birkan added that besides the agreement, the refurbishment decision depended on their board of directors, their financial situation and prevailing fashions. The hotels, especially in Ankara, were a prestige symbol for the directors and being seen as up-to-date and luxurious was more important for them than being feasible.

The budget of the hotels was planned for one-year and five-year periods. According to Mr Birkan, 4% of the annual budget of Hotel B was assigned to all types of refurbishments apart from the day-to-day maintenance. An example of the budget is given in Table C.1, Appendix C. The refurbishment activities are divided into hard and soft refurbishments. In soft refurbishment, the materials such as carpets, curtains, fabrics, and cladding were replaced and marble and wood surfaces are polished. In hard refurbishment, replacement of the wall and floor materials; wallpaper, gypsum boards, suspended ceilings, partition walls, bathroom walls, *etc.* is undertaken. The period of soft refurbishment was generally fixed for every 3 to 4 years; while hard refurbishment was undertaken every 8 to 10 years, according to their budget.

According to Mr, Yasav, who was the technical manager of Hotel B, Hotel B had an extension built in 2006, comprising of a convention and cultural centre and above them the guestroom floors. Because of this, the existing ballroom, whole lobby and the theme-restaurants and bars were refurbished in order to have the same design theme as that of the new annex building. Also, the guestroom floor refurbishment mostly depended on this extension in order not to be labeled as old.

Mr. Çalışkan stated that, the refurbishment of guestroom floors of Hotel A was started in 2002 and finished at the end of 2004. The guestroom floors were divided into four sections. The rooms were decorated in light colors to offer a comfortable and spacious working environment. Ash veneered chip-board panels were disassembled and gypsum-board panels were used for the suspended ceiling. Vinyl wallpaper on walls was renewed and timber beading used as wall trimming. Also, the wooden pelmets were disassembled and replaced with gypsum pelmets. There were light-colored marble tiles and vanity basin with matching faucet fittings in the bathroom of the guestrooms before refurbishment. Although these fittings and fixtures were in good condition, they were replaced with darker new marble cladding and fittings only because of the changing fashion trends; as seen below in Figure 4.9 and Figure 4.10.

Figure 4.9. The faucet fittings and marble claddings in typical standard room of Hotel A before refurbishment.
(Source: Ozgurel, 2001: 92).

Figure 4.10. Typical bathroom of a standard room of Hotel A after refurbishment.

The technical managers of these hotels said that the furniture should be utilized as much as possible. The management generally has agreements with suppliers of electronic equipment and electrical parts to replace old equipment with new ones. In Hotel A, the room furniture, such as discarded beds, was donated to Çocuk Esirgeme Kurumu (child protection agency) and Huzurevi (old people's home). In this refurbishment, all the locks were changed and electronic door locks were installed. The old locks were sent to be used in another 3 star hotel near the airport in Ankara. In Hotel B, the beds and room furniture were sold to their personnel by private auction. On the other hand, the faucet fittings and marble claddings could not be utilized so they were either scrapped or auctioned.

4.3. Data Generated By Software

After entering the BOQ of guestrooms as the input to the software, the summary tables and graphs were obtained as the output. According to these graphs and tables, these projects could be evaluated and comparisons could be made between three case studies and the common materials that were used in all case guestrooms.

As an output of this software, the projects were evaluated according to six indicators. These were:

- Primary Energy Consumption: Absolute primary energy consumption by fuel type for each life cycle stage as well as annual operating energy.
- Solid Waste: Recovered matter resulting from the production and delivery (packaging) process.
- Air Pollution Index: Inflows and outflows that contribute pollutants to the air.
- Water Pollution Index: Inflows and outflows that contribute pollutants to the water.

- Global Warming Potential: How much a given mass of greenhouse gas is estimated to contribute to global warming over a specific time interval.
- Weighted Resource Use: The quantities of raw materials or intermediary products consumed, including water, during the processing or manufacturing of the product.

Table 4.1: BOQ of guestroom floors of three hotels included common materials in all cases and used in the software.

Material	Unit	HOTEL A	HOTEL B	HOTEL C
Levelling Concrete - Screed	m3	1576.7357	27.30	1193.8815
1/2" Fire-Rated TypeX Suspended	m2	4854.608	619.3	9565.6
5/8" Fire-Rated TypeX Gypsum Board	m2	3051.488	1240.305	6765
Wallpaper Tape	tones	13.5629	15.3006	9.3765
Water Based Latex Paint	l	1719.1080	639.999	2186.37
Hardwood Skirting	m2	424.8825	247.8735	586.425
(Modular) Brick Wall	m2	228.48	7.3395	525
Plaster, gypsum spackling	m2	76199.024	91.30	42369.8
Oriented Strand Board	m2			1155
Vinyl	m2			1048.6
Solvent based paint	l			51

Firstly, the hotel guestroom refurbishment projects, which include the materials seen above in Table 4.1, were evaluated with the software. The output was divided into 4 stages: manufacturing, construction, operations and maintenance, and end of life. In summary tables, after these stages the total embodied of this project was given by adding of all impacts of these four stages. The operations and maintenance stage has the value zero for all indicators, because the materials database of the software did not include the knowledge about this stage, so this stage was ignored. The impacts of the operating energy of the projects was calculated according to the electricity and natural gas consumption of them in output tables as the last raw. The raw data of these consumptions were seen in Table B.10. And as a total life cycle impact was given by adding of the impacts of all stages seen in Table 4.2 for Hotel A, in Table 4.3 for Hotel B and in Table 4.4 for Hotel C.

Table 4.2: Summary measures by life cycle stages of Hotel A obtained from ATHENA software.

	Primary Energy Consumption (MJ)	Solid Waste (Kg)	Air Pollution Index	Water Pollution Index	Global Warming Potential (kg)	Weighted Resource Use (kg)
Manufacturing						
Material:	3895168	125957	65263	2	379395	5395879
Transportation:	177714	2	57	0	321	4396
Total:	4072882	125959	65320	2	379716	5400275
Construction						
Material:	0	0	0	0	0	0
Transportation:	388409	4	125	0	699	8814
Total:	388409	4	125	0	699	8814
End-Of-Life						
Material:	183	0	4	0	13	4
Transportation:	300512	3	96	0	541	6819
Total:	300695	3	100	0	554	6823
Total Embodied						
Material:	3895351	125957	65267	2	379408	5395883
Transportation:	866635	9	278	0	1561	20029
Total:	**4761986**	**125966**	**65545**	**2**	**380969**	**5415912**
Operating Energy						
Annual Operating Energy:	75708212	350905	1189069	54	3145474	9271680
Total Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
Total Life Cycle:	**2805965813**	**13109464**	**44061089**	**2006**	**116763511**	**348468071**

Table 4.3: Summary measures by life cycle stages of Hotel B obtained from ATHENA software.

	Primary Energy Consumption (MJ)	Solid Waste (Kg)	Air Pollution Index	Water Pollution Index	Global Warming Potential (kg)	Weighted Resource Use (kg)
Manufacturing						
Material:	645033	13773	10110	1	28331	150122
Transportation:	8421	0	3	0	15	197
Total:	653454	13773	10113	1	28346	150319
Construction						
Material:	0	0	0	0	0	0
Transportation:	13956	0	4	0	25	317
Total:	13956	0	4	0	25	317
End-Of-Life						
Material:	3	0	0	0	0	
Transportation:	4489	0	1	0	8	102
Total:	4492	0	1	0	8	102
Total Embodied						
Material:	645036	13773	10110	1	28331	150122
Transportation:	26866	0	8	0	48	616
Total:	**671902**	**13773**	**10118**	**1**	**28379**	**150738**
Operating Ener.						
Annual Op. En.:	48463215	244106	692567	27	1937695	6732178
Total Op. En.:	1793138937	9031928	25624988	982	71694723	249090594
Total Life Cycle:	1793810839	9045701	25635106	983	71723102	249241332

Table 4.4: Summary measures by life cycle stages of Hotel C obtained from ATHENA software.

	Primary Energy Consumption (MJ)	Solid Waste (Kg)	Air Pollution Index	Water Pollution Index	Global Warming Potential (kg)	Weighted Resource Use (kg)
Manufacturing						
Material:	4261159	125912	68626	3	338714	4072072
Transportation:	136604	1	44	0	246	3371
Total:	4397763	125913	68670	3	338960	4075443
Construction						
Material:	0	0	0	0	0	0
Transportation:	290922	3	93	0	524	6601
Total:	290922	3	93	0	524	6601
End-Of-Life						
Material:	144	0	3	0	11	3
Transportation:	197653	2	63	0	356	4485
Total:	197797	2	66	0	367	4488
Total Embodied						
Material:	4261303	125912	68629	3	338725	4072075
Transportation:	625179	6	200	0	1126	14457
Total:	4886482	125918	68829	3	339851	4086532
Operating Ener.						
Annual Op. En.:	41034340	199619	611292	25	1668179	5411003
Total Op. En.:	1518270563	7385911	22617808	917	61722607	200207100
Total Life Cycle:	**1523157045**	**7511829**	**22686637**	**920**	**62062458**	**204293632**

The comparisons of three hotels according to the absolute values of six indicators in total stages -excluded operating energy- were shown in Figure 4.11, Figure 4.12, and Figure 4.13. The operating energy stages were ignored while discussing the results in graphs because the impacts of these stages were calculated according to only the area of the hotels. This was not changed due to the magnitude of the project. So if only the impacts of the refurbishment and the materials used in the refurbishments were wanted to analyze, this stage should be ignored.

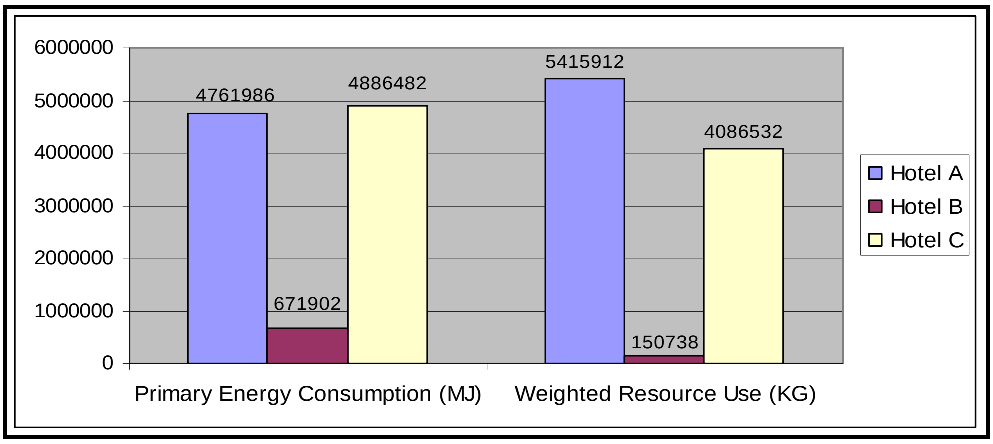

Figure 4.11. The impacts of three hotels according to primary energy consumption and weighted resource use.

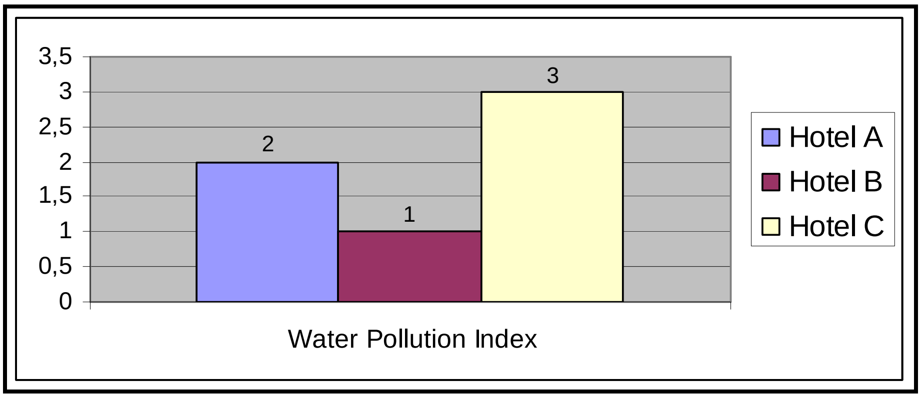

Figure 4.12. The impacts of three hotels according to water pollution index

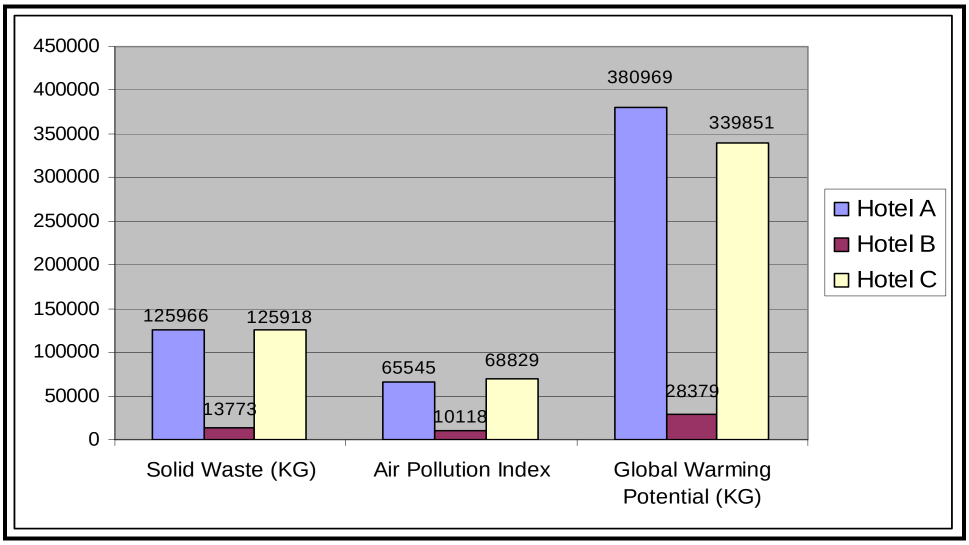

Figure 4.13. The impacts of three hotels according to solid waste, air pollution index and global warming potential.

On the next step, the comparisons between three hotels were made according to the six categories of impacts, per m^2. In Table 4.5., the last analyses shown as comparisons of all indicators -excluded the operating energy stage- in %, were made according to base project. Hotel B was chosen as base project because in this hotel it was seen that this refurbishment included only the soft renovation, so its total impacts were lower than the other projects.

Table 4.5: The comparisons of cases according to six indicators per m^2.

INDICATORS	**HOTEL A**	**HOTEL B**	**HOTEL C**
Primary Energy Consumption (Gigajoules / m^2)			
Manufacturing	258.946	55.799	471.873
Construction	24.694	1.192	31.215
End-of-Life	19.118	000.384	21.223
Total Embodied **Sub-Total**	**302.758**	**57.374**	**0524.312**
Operating Energy	4813.379	4138.308	4402.921
Total	**5116.137**	**4195.682**	**4927.233**

Table 4.5: (continued)

INDICATORS	HOTEL A	HOTEL B	HOTEL C
Solid Waste (kg / m^2)			
Manufacturing	8.008188	1.176117	13.510261
Construction	0.000230	0.000011	0.000290
End-of-Life	0.000182	0.000004	0.000203
Total Embodied **Sub-Total**	**8.008600**	**1.176132**	**13.510754**
Operating Energy	22.309870	20.844397	21.418830
Total	**30.318470**	**22.020529**	**34.929584**
Air Pollution (Index / m^2)			
Manufacturing	4.152916	0.863496	7.368108
Construction	0.007925	0.000382	0.010018
End-of-Life	0.006398	0.000129	0.007160
Total Embodied **Sub-Total**	**4.157329**	**0.863600**	**7.373201**
Operating Energy	75.598647	59.138808	65.590691
Total	**79.755976**	**60.002408**	**72.963892**
Water Pollution (Index / m^2)			
Manufacturing	0.134786	0.052282	0.287388
Construction	0.000140	0.000007	0.000177
End-of-Life	0.000111	0.000002	0.000124
Total Embodied **Sub-Total**	**0.135037**	**0.052291**	**0.287689**
Operating Energy	3.444364	2.266466	2.659070
Total	**3.579401**	**2.318757**	**2.946759**
Global Warming Potential (CO_2 - kg)			
Manufacturing	24.141584	2.420455	36.369968
Construction	0.044467	0.002146	0.056210
Operations and Maintenance	0.000000	0.000000	0.000000
End-of-Life	0.035261	0.000710	0.039328
Total Embodied **Sub-Total**	**24.221312**	**2.423311**	**36.465507**
Operating Energy	199.983044	165.461168	178.992959
Total	**224.204356**	**167.884479**	**215.458466**
Weighted Resource Use (kg /m^2)			
Manufacturing	343.338865	12.835846	437.288688
Construction	0.560352	0.027042	0.708328
Operations and Maintenance	0.000000	0.000000	0.000000
End-of-Life	0.433806	0.008704	0.481588
Total Embodied **Sub-Total**	**344.333023**	**12.871592**	**438.478604**
Operating Energy	589.475138	574.865468	580.592147
Total	**933.808161**	**587.737060**	**1019.070751**
Comparisons of all (%)			
Primary Energy Consumption	527.688832	100.000000	913.845045
Solid Waste	680.926927	100.000000	1148.744691
Air Pollution Index	482.314811	100.000000	854.770565
Water Pollution Index	258.240292	100.000000	550.166052
Global Warming Potential	999.513203	100.000000	1504.780408
Weighted Resource use	2675.139325	100.000000	3406.560831

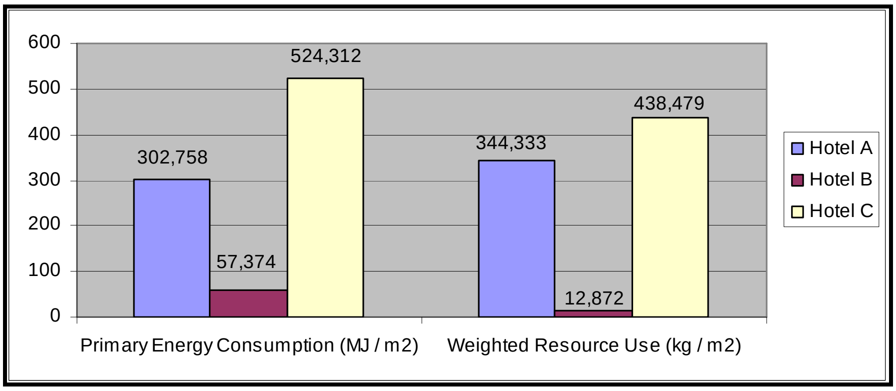

Figure 4.14. The impacts of three hotels per m^2 according to primary energy consumption and weighted resource use.

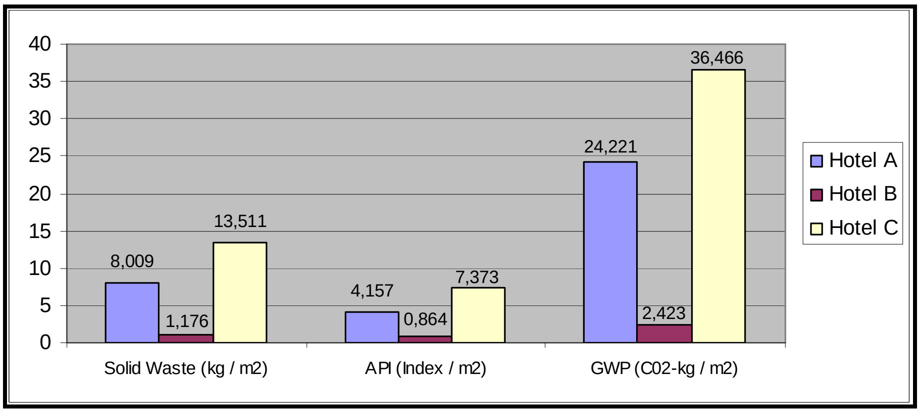

Figure 4.15. The impacts of three hotels per m^2 according to solid waste, air pollution index and global warming potential.

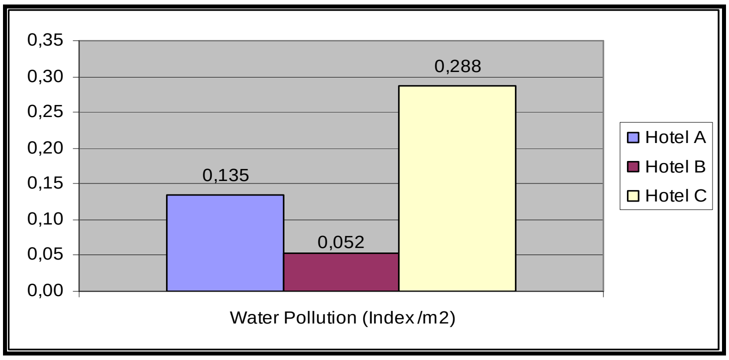

Figure 4.16. The impacts of three hotels per m^2 according to WPI.

According to the figures above, Hotel B had the minimum impacts for every indicator and Hotel A was the second. This was the result of the volume of the refurbishment project. If the refurbishment type changes from soft to hard, the impacts will increase.

4.4. Hypotheses Tested

In these refurbishment projects seven common materials were used. These seven materials wanted to analyze according to six indicators in three hotels as a third step. While comparing these materials, the mean values of the impacts of them in three cases were decided to use. Because of this, the statistical analysis of the seven materials in three hotels was made in order to find if there is any difference between the impacts of them per m^2 in three cases. The paired-sample *t*-test was used to analyze. Three pairs from three hotels were formed.

H_{01}: There is no difference in primary energy consumption between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.6: Paired-sample *t*-test results – primary energy consumption

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-,037155	,073985401	********	-,105580	,03127008	-1,329	6	,232
Pair 2	HOTEL_B - HOTEL_C	-,067684	,096931049	********	-,157331	,02196184	-1,847	6	,114
Pair 3	HOTEL_A - HOTEL_C	-,030529	,039774216	********	-,067314	,00625559	-2,031	6	,089

According to Table 4.6, at a prescribed 5 % level of significance (α=0,05) in regard to the primary energy consumption; the sig. (2-tailed) value for pair1 was 0,232 (p=0,232), for pair2 0,114 (p=0,114), and for pair3 0,089 (p=0,089). All these values were above 0,05, so the null hypothesis was accepted and it can be said that there was no difference between three hotels in case of primary energy consumption according to seven materials. This was because of the materials were made the same impact per m^2 for three hotels.

H_{02}: There is no difference in solid waste between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.7: Paired-sample *t*-test results – solid waste

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-1,03109	2,389082382	********	-3,24062	1,178444	-1,142	6	,297
Pair 2	HOTEL_B - HOTEL_C	-1,85796	3,279146649	********	-4,89067	1,174741	-1,499	6	,185
Pair 3	HOTEL_A - HOTEL_C	-,826876	1,413924681	********	-2,13454	,48078652	-1,547	6	,173

The sig. (2-tailed) value for pair1 was 0,297 (p=0,297), for pair2 0,185 (p=0,185), and for pair3 0,173 (p=0,173) in Table 4.7 in the significance interval of 95 % (α=0,05) in regard to the solid waste. The null hypothesis was accepted because all significance values were above 0,05. Therefore, there was no significant difference between three hotels in case of solid waste according to the impacts seven materials per m^2.

H_{03}: There is no difference in air pollution index between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.8: Paired-sample *t*-test results – air pollution index

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-,498940	1,134308817	********	-1,54800	,55012083	-1,164	6	,289
Pair 2	HOTEL_B - HOTEL_C	-,960301	1,511524733	********	-2,35823	,43762637	-1,681	6	,144
Pair 3	HOTEL_A - HOTEL_C	-,461361	,623025806	********	-1,03756	,11484177	-1,959	6	,098

According to Table 4.8, $H0_3$ was accepted at a prescribed 5 % level of significance (α=0,05). The sig. (2-tailed) value for pair1 was 0,289 (p=0,289), for pair2 0,144 (p=0,144), and for pair3 0,098 (p=0,098). All these values were above 0,05, hence H_{03} was accepted.

H_{04}: There is no difference in water pollution index between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.9: Paired-sample *t*-test Results – Water Pollution Index

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-,019656	,043115288	********	-,059531	,02021871	-1,206	6	,273
Pair 2	HOTEL_B - HOTEL_C	-,044033	,066815859	********	-,105827	,01776136	-1,744	6	,132
Pair 3	HOTEL_A - HOTEL_C	-,024377	,038210547	********	-,059716	,01096215	-1,688	6	,142

According to Table 4.9, at a prescribed 5 % level of significance (α=0,05) in regard to the solid waste; the sig. (2-tailed) value for pair1 was 0,273 (p=0,273), for pair2 0,132 (p=0,132), and for pair3 0,142 (p=0,142). All these values were above 0,05, so H_{04} was accepted. Like the other four indicators, the impacts of the material per m^2 had no significant difference between three hotels.

H_{05}: There is no difference in global warming potential between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.10: Paired-sample *t*-test results – global warming potential

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-3,27664	8,158476274	********	-10,8220	4,268692	-1,063	6	,329
Pair 2	HOTEL_B - HOTEL_C	-4,99701	10,289448418	********	-14,5132	4,519139	-1,285	6	,246
Pair 3	HOTEL_A - HOTEL_C	-1,72037	2,443760617	********	-3,98048	,53972762	-1,863	6	,112

The sig. (2-tailed) value for pair1 was 0,329 (p=0,329), for pair2 0,246 (p=0,246), and for pair3 0,112 (p=0,112) in Table 4.10 in the significance interval of 95 % (α=0,05) in regard to the solid waste. H_{05} was accepted because all significance values were above 0,05.

H_{06}: There is no difference in weighted resource use between refurbishment projects of three hotels according to the impacts of seven materials per m^2.

Table 4.11: Paired-sample *t*-test results – weighted resource use

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	HOTEL_B - HOTEL_A	-50,2509	100,6438329	********	-143,331	42,82913	-1,321	6	,235
Pair 2	HOTEL_B - HOTEL_C	-63,8741	126,9534837	********	-181,286	53,53832	-1,331	6	,231
Pair 3	HOTEL_A - HOTEL_C	-13,6232	28,567566060	********	-40,0438	12,79742	-1,262	6	,254

According to Table 4.11, H_{06} was accepted at a prescribed 5 % level of significance (α=0,05). The sig. (2-tailed) value for pair1 was 0,235 (p=0,235), for pair2 0,231 (p=0,231), and for pair3 0,254 (p=0,254). All these values were above 0,05.

Consequently, the results of paired-sample *t*-test showed that there was no significance difference between the six impact categories of used materials per square meter in cases. This statistical analysis was made because of while comparing the materials with each other, the mean values of the impacts of materials in three hotels could be gotten as derived data from software.

4.5. Analysis of Materials According to Six LCA Indicators

In Table 4.1, the material list of three projects was given. From that list, the seven common materials that were used in all projects were gotten as data for this section. According to Section 4.4, there was no significant difference between the impacts of materials per m^2 used in three cases. The mean values of the impacts of the materials in three case projects were derived from Table 4.12 for every indicator and listed in Table 4.13.

Table 4.12: The impacts of seven materials according to six indicators in three hotels.

MATERIALS		Primary Energy Consumption (MJ)	Solid Waste (KG)	API	WPI	GWP (KG)	Weighted Resource Use (KG)
Hotel A	Levelling Concrete	3244607	102758	48898	2	350177	4332806
	Gypsum Board	647917	22922	10324	1	24763	106365
	Wallpaper	402919	6210	6223	0	14914	41270
	Water-Based Paint	50739	53	497	0	944	3343
	Hardwood	21128	89	199	0	610	12495
	Brick	246331	1263	3304	0	8933	26757
	Plaster	433034	4	139	0	781	1223392
Hotel B	Levelling Concrete	56178	1779	846	0	6064	75019
	Gypsum Board	161316	5827	2569	0	6167	26718
	Wallpaper	454541	7005	7020	0	16824	46559
	Water Based Paint	18889	20	185	0	351	1245

Table 4.12: (continued)

MATERIALS		Primary Energy Consumption (MJ)	Solid Waste (KG)	API	WPI	GWP (KG)	Weighted Resource Use (KG
Hotel B	Hardwood	12326	52	116	0	356	7289
	Brick	7913	41	106	0	286	860
	Plaster	519	0	0	0	0	1466
Hotel C	Levelling Concrete	2456770	77807	37024	1	265150	3280739
	Gypsum Board	1346202	47733	21449	1	51450	221207
	Wallpaper	278551	4293	4302	0	10310	28532
	Water Based Paint	64531	68	632	0	1200	4252
	Hardwood	29162	122	276	0	843	17244
	Brick	566018	2903	7591	0	20526	61484
	Plaster	240785	2	78	0	434	680257

Table 4.13: The mean values of impacts of materials according to six indicators.

MATERIALS	Primary Energy Consumption (MJ)	Solid Waste (KG)	API	WPI	GWP (KG)	Weighted Resource Use (KG)
Levelling Concrete	1919185	60781	28923	1	207130	2562855
Gypsum Board	718478	25494	11447	1	27460	118097
Wallpaper	378670	5836	5848	0	14016	38787
Water Based Paint	44720	47	438	0	832	2947
Hardwood	20872	88	197	0	603	12343
Brick	273421	1402	3667	0	9915	29700
Plaster	224779	2	72	0	405	635038

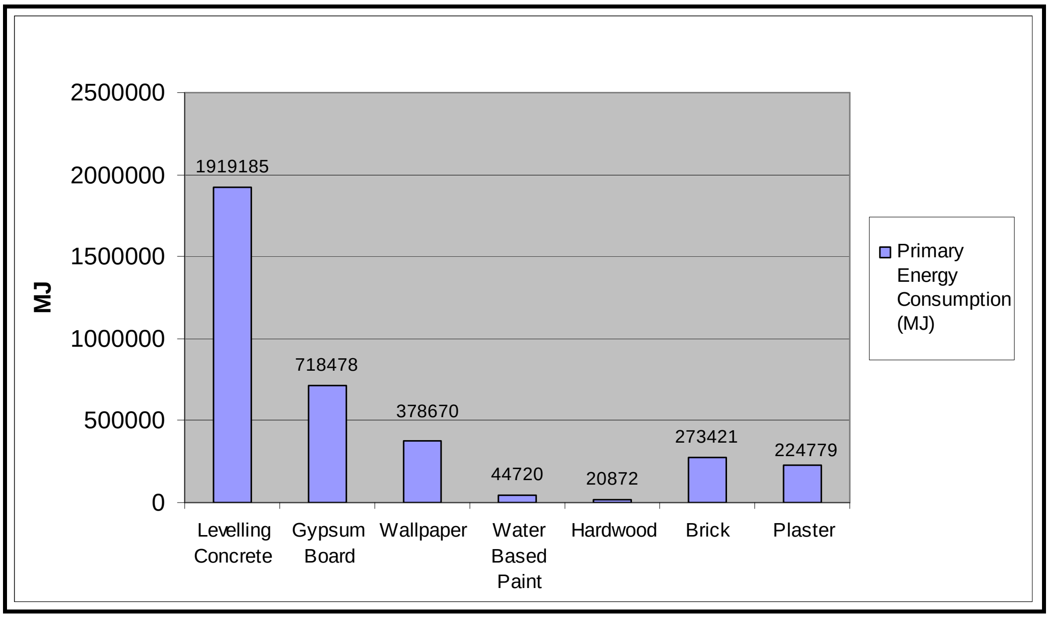

Figure 4.17. Comparison of seven materials according to the primary energy consumption.

According to Figure 4.17, levelling concrete created more primary energy consumption than the others. This consumption mostly depended on the cement manufacture, occurred especially during the manufacturing stage. When Table C.3 was analyzed, the total stage primary energy consumption of the other materials was less than the consumption of leveling concrete in the manufacturing stage. Therefore alternative energy sources and processes should be found during manufacturing cement. While the energy consumption of gypsum board was nearly the half of leveling concrete, the consumption of wallpaper was almost nearly the half of gypsum board. Hardwood had the minimum value among the others, so it should be chosen in order to decrease energy consumption.

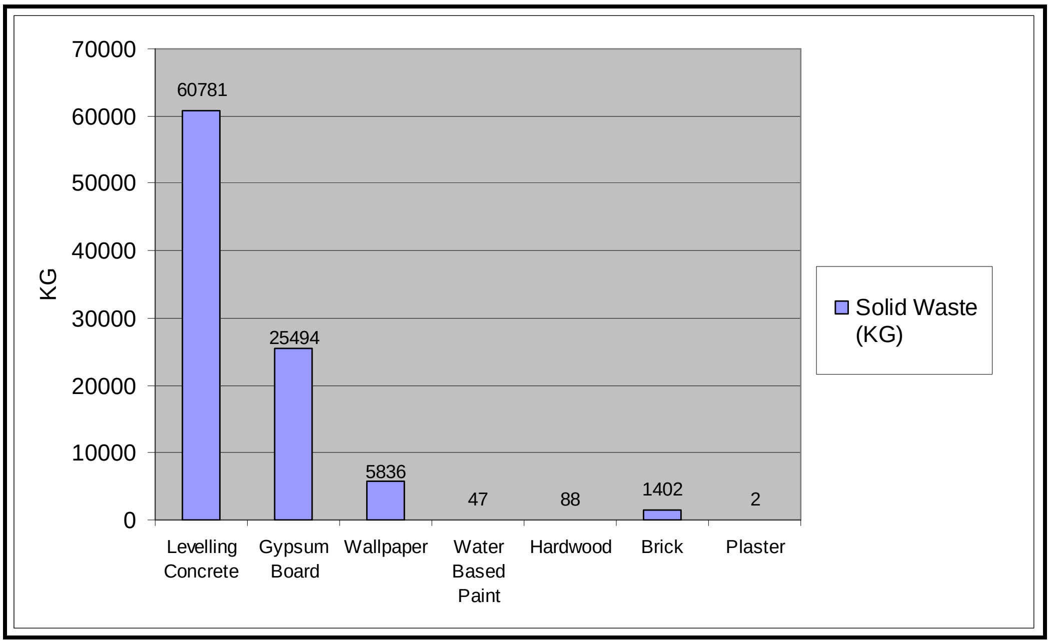

Figure 4.18. Comparison of seven materials according to the solid waste.

According to Figure 4.18, levelling concrete also created more solid waste than the others. This indicator was nearly arranged in order like the primary energy consumption. The leveling concrete had the most solid waste like the first indicator but the last one was plaster not hardwood. The limit value for solid waste was generally measured in ton/person and this limit was 1.35 ton/person. In this example if the number of population was gotten as 500 according to the number of guestrooms, only the amount of the solid waste of leveling concrete was 0,12152 ton/person which was reasonably high. In order to decrease the amount of solid waste, the recycling and reuse strategies should be applied to the refurbishment projects.

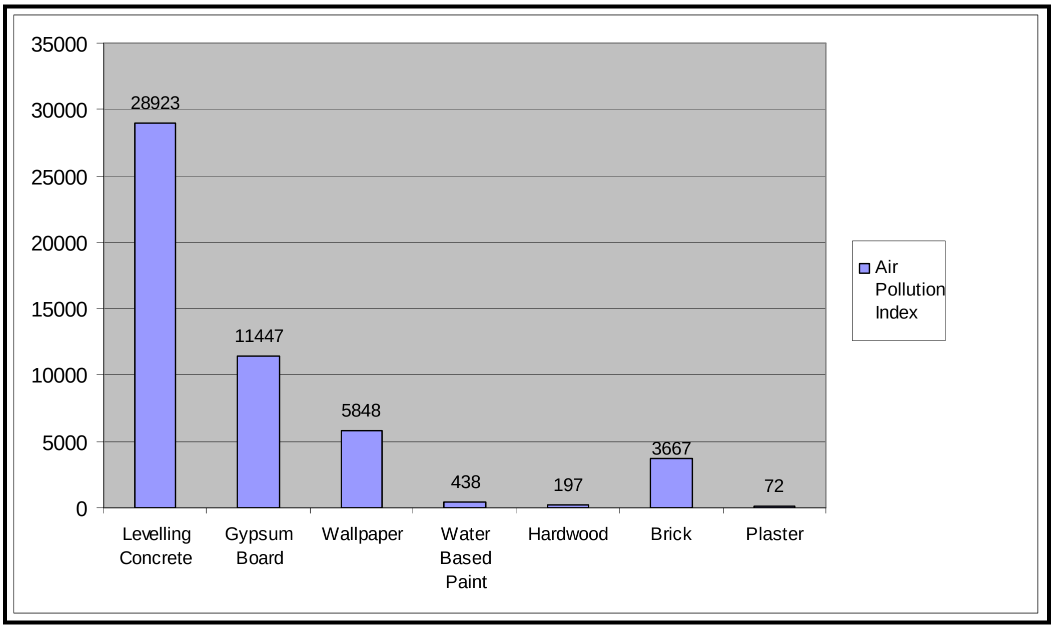

Figure 4.19. Comparison of seven materials according to the air pollution index.

The graph showed to us, the leveling concrete emitted maximum pollution or human health effects of groups of substances at various life cycle stages. The manufacturing stage was also the most important stage in this indicator. The filtering measurements during manufacturing were more important to decrease air pollution. The first four ranks were nearly the same for all indicators, except the resource use. The places of the last three ones were changed indicator by indicator. For air pollution, the plaster had the least effect.

According to the formula given in section 3.2.2, the API values of seven materials were calculated and the results were given in Table 4.14. According to these results, all materials were in safety side; the limit values stated in section 3.2.2; therefore the daily activities were not affected with that much emission. At that point, the total emission of all these materials should be thought in any project because they were not used by one by. Total emission of Hotel A had 106 API values which were categorized as slightly polluted and also Hotel C was in the same category with Hotel A.

Table 4.14: Calculated air pollution index value

MATERIALS	API obtained from software	API value calculated by the given formula
Levelling Concrete	28923	75
Gypsum Board	11447	40
Wallpaper	5848	20
Water Based Paint	438	2
Hardwood	197	0,7
Brick	3667	13
Plaster	72	0,3
Total - Hotel A	65545	106
Total - Hotel B	10118	35
Total - Hotel C	68829	107

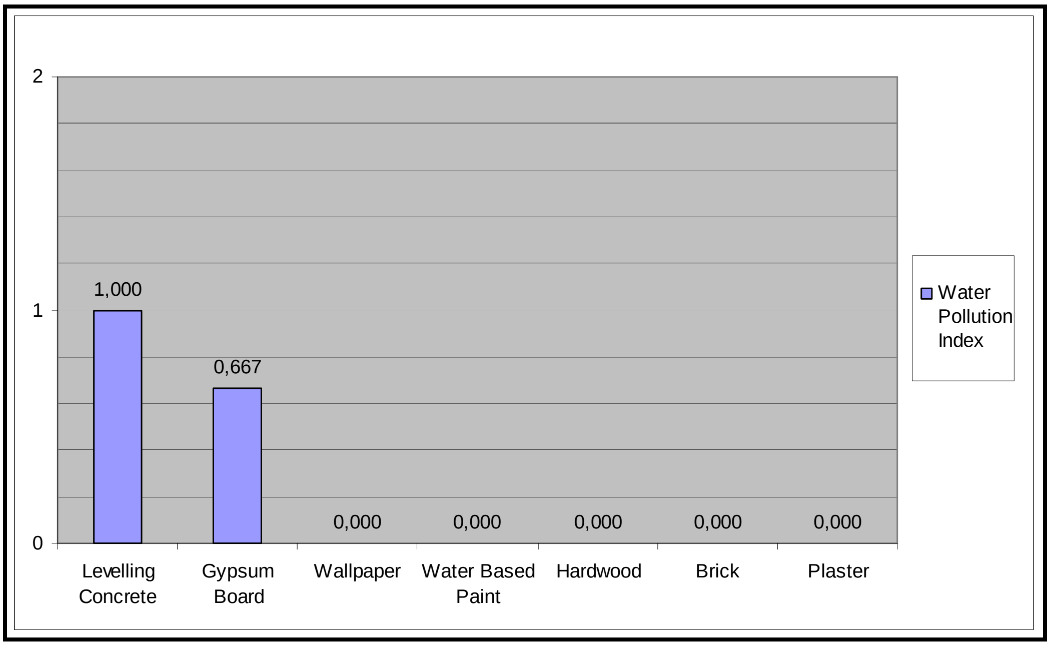

Figure 4.20: Comparison of seven materials according to the water pollution index.

According to Figure 4.20, only levelling concrete and gypsum board created emissions to water. The leveling concrete had the maximum emissions. In Section 3.2.2, specific benchmarks for water pollution due to EPA were given. However, this categorization could not be correlated with the software absolute results. This type of correlation problems were also stated in section 2.3.1 and this was depended on the different data presentation formats encountered in the inventories. The ATHENA Institute did not give any limit conditions about the indicators, only the absolute values of summaries were given such as the amount of each type of emissions to water listed in section 2.3.2; the amount of emission of chlorides, phenols.

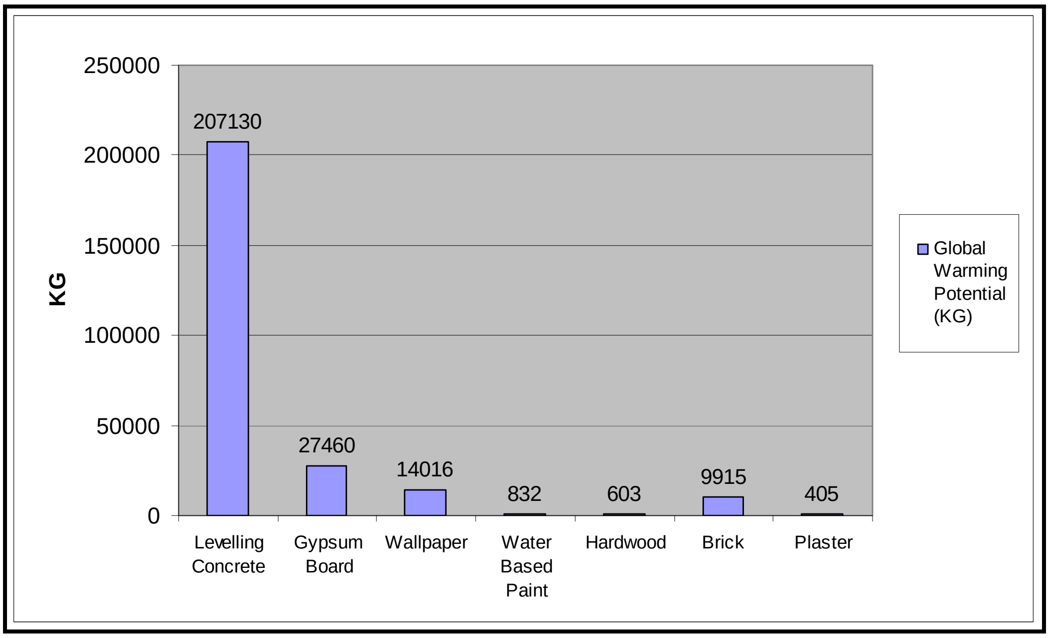

Figure 4.21: Comparison of seven materials according to the global warming potential.

The graph showed to us, the levelling concrete had maximum global warming potential impact. Additionally, the manufacturing stage was the stage which was the reason of that much amount of the greenhouse gas emissions. Plaster was the best choice among these materials listed above for global warming potential; however it caused more weighted resource use seen in Figure 4.22. This indicator becomes very important especially in these days when the main environmental problem is the global warming and its effects.

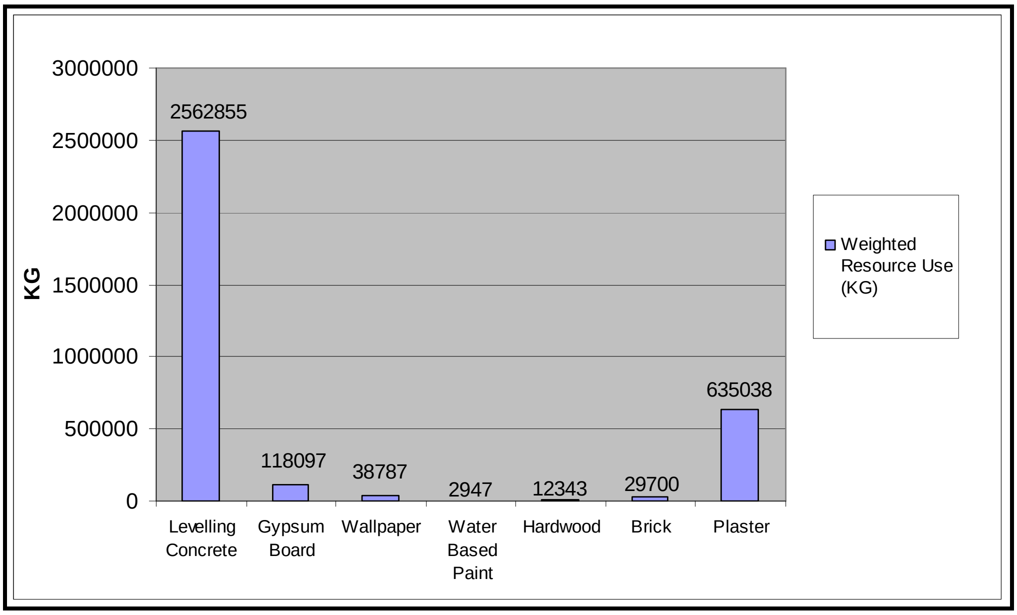

Figure 4.22: Comparison of seven materials according to the weighted resource use.

The levelling concrete was also in the first rank for this indicator. And the results showed us levelling concrete had 4 times more impacts than the plaster in the second rank, and nearly 21 times more than gypsum board in the third rank. So while designing, the impacts of concrete, cement should be thought in details and unnecessary use of this material should be taken care in order not to deplete natural resources.

CHAPTER 5

CONCLUSION

After generating LCA data for the three refurbishment projects with the help of the software the results were interpreted. The refurbishment materials were compared with each other according to the six LCA impact indicators and a matrix was formed to enable designers to choose the suitable material in order to reduce damage to the natural environment. At the end of this study further investigations are proposed and recommendations have been made for establishing a database.

5.1. Hotel Refurbishment Projects

Increasing awareness of the scarcity of conventional energy sources mandates the need to take measures for energy conservation in buildings. Moreover, the ever-growing global environmental concerns are dictating the adoption of a “green” policy, even in the hospitality sector. Hotels rank highest amongst building types according to the levels of energy consumption; they interact with the environment at every stage of their life cycle, and this influence is often negative. They are designed to provide multi-facetted comfort and services to guests, which require the consumption of substantial quantities of energy, water and non-durable products.

The operational stage of a hotel life-cycle is substantial, both from an economic and environmental perspective; especially since this stage also includes refurbishment works. As a result of these works, hotels generate large quantities of waste, thus increasing pressure on waste disposal systems, as well as landfills. They are also responsible for the release of various air pollutants, either directly from on-site heat and power generation, or indirectly by the use of electricity and heat/cold produced at power plants, thereby contributing to the deterioration of local air quality, acid rain and global warming.

The remaining life span of building elements is an important piece of information for financially and ecologically coherent refurbishment decisions. In order to determine life-spans correctly, it is necessary to take into account the current deterioration state of the element. It is also necessary to define a yardstick to measure deterioration, so as to quantify it. However, in hotel buildings the service life span of materials is usually ignored because of the strategies of refurbishment, which is mostly carried out as a result of the decision to give updated service to customers.

As mentioned earlier, refurbishment involves the generation of large quantities of waste, and poses a risk involving the discharge of various air pollutants (including lead and volatile organic compounds from paints, and ozone depleting substances from refrigeration and air conditioning installations). However, the refurbishment stage is an excellent opportunity in making the facility more environmentally friendly by introducing many energy and water efficiency measures, or even changing to renewable energy sources. More environmentally benign construction materials and furnishings can be used during refurbishments.

Within the scope of this study, the amounts of primary energy consumption, solid waste, air pollution, water pollution, global warming and weighted resource use indices were calculated, which were produced by three hotel refurbishment projects. These data show the damage to nature caused by these projects. The difference between the volumes of the projects can also change the amount of damage. According to the comparison tables and charts presented in the previous chapter, the minimum impacts belong to Hotel B refurbishment works. For primary energy consumption it is nearly one fifth of Hotel A and one ninth of Hotel C. For solid waste, the rates were one sixth of Hotel A and one eleventh of Hotel C. The air pollution produced by Hotel B refurbishment works was one fifth of Hotel A and one eighth of Hotel C. Hotel A refurbishment produced ten times more CO_2 emission than Hotel B and Hotel C produced fifteen times more than Hotel B. For water pollution the rate is slightly less: one third of Hotel A and one sixth of Hotel C.

These results mostly depend on the magnitude of the refurbishment project. The project applied to Hotel B can be considered as soft refurbishment which includes only the replacing of carpets, curtains, fabrics, cladding and fittings *etc*. as stated in Section 4.3. On the other hand, refurbishments made in Hotel A and C can be defined as hard refurbishments, which included replacement of wall and floor materials; wallpaper, gypsum boards, suspended ceilings, partition walls, bathroom walls, *etc.*

The results of Hotel B for the six indicators were less than the others but the period of soft refurbishment, generally fixed for every 3 to 4 years, was shorter than hard refurbishment undertaken every 8 to 10 years, depending on their budget. Consequently, it can be said that the decision for and design of refurbishment should be considered more carefully because the impacts of Hotel B refurbishment, according to six indicators, which is considerably high, are given every 3 to 4 years.

Although such a refurbishment decision adds considerably to the financial burden of the hotel in addition to its negative environmental impacts, the managements of these hotels pointed out that renovations are on-going in the system in order to maintain excellence in appearance and accommodation. Consequently, material is sometimes dumped as waste even before it has started to deteriorate due to wear and tear, let alone before the end of its expected lifetime.

5.2. Choice of Materials for Refurbishment Projects

The choice of materials and components has an important role in determining energy performance. Some objectives for environmentally sustainable design can be achieved by taking into consideration the six LCA indicators which are: reducing energy consumption and embodied energy by specifying products made with local materials and labor, in addition to decreasing the transportation costs; reducing use of excessive amount of materials; reducing indoor and outdoor air pollution which directly affects global warming potential; reducing construction waste production; and reducing clean water use in buildings.

Reuse represents the best and highest level of resource efficiency for the buildings. If reusing is not possible, preferring non-renewable energy sources should be the only choice in order to prevent scarcity of raw materials. Designers can specify materials made from waste in preference to virgin materials, so that negative impacts of solid waste and weighted resource use can be reduced. Moreover, recycling is another strategy which considers not only the sources but also by-products and waste disposal. The increasing complexity of materials and products has made recycling more difficult in many cases so more efficient technologies for separating materials have to be developed.

When a pollutant such as sulfuric acid, which is accounted for in the air pollution index indicator, combines with droplets of water in the air it can cause acid rain which has serious environmental implications. It damages plants by destroying their leaves, it poisons the soil, and it changes the chemistry of lakes and streams. Damage due to acid rain kills trees and harms animals, fish, and other wildlife.

Water pollution due to human activities causes adverse effects upon water bodies such as lakes, rivers, oceans, and groundwater. Organic wastes such as sewage impose high oxygen demands on the receiving water leading to oxygen depletion with potentially severe impacts on the whole eco-system.

The amount of carbon dioxide in the air is continuing to increase. This build-up acts like a blanket and traps heat close to the surface of the earth, thus causing global warming. Increase of even a few degrees in temperature will affect the eco-balance through changes in the climate and the possibility of polar ice caps melting. Chemicals released by activities, such as construction and renovation works; affect the ozone layer which protects the earth from harmful ultraviolet radiation from the sun. Release of chlorofluorocarbon, one of greenhouse gases, from aerosol cans, cooling systems and refrigerator equipment removes some of the ozone, causing holes; to open up in this layer and allowing the radiation to reach the earth. This ultraviolet radiation is known to cause skin cancer and has damaging effects on plants and wildlife.

The negative environmental impacts of the six LCA indicators for building construction works are presented in Table 5.1 below. Based on the findings of this study some precautions have been recommended for their mitigation; these precautions are listed for each impact separately in the last row.

Table 5.1: Precautions versus Impacts of LCA Indicators

	Primary Energy Consumption	**Solid Waste**	**Air Pollution Index**	**Water Pollution Index**	**Global Warming Potential**	**Weighted Resource Use**
Impacts	Having high embodied energy means consuming more energy. This causes the depletion of resources, scarcity of raw materials.	It has the most environmental damage on-site and is uncontrolled. The waste causes the soil pollution and unproductiveness and also air pollution.	The pollutant gases give harm directly to the ecosystem. Damage due to acid rain changes the chemistry of nature, kills trees and animals.	The pollutant emissions deplete the water bodies and the ecological balance between them can be endangered.	Emitting greenhouse gases causes global warming. This causes the increase of temperature, melting of glaciers, rising in sea level and coastal flooding.	Producing from non-renewable raw materials causes more resource depletion, scarcity of raw natural resources.
Precautions	Reusing methodologies or alternative renewable energy sources should be used in especially manufacturing phase.	The reusing or recycling potentials should be taken into consideration during demolition. Choosing materials made from waste should be preferred than virgin ones.	The pollution should be controlled especially in manufacturing phase. The alternative filtering methods should be found.	The new filtering and cleaning procedures should be found. The methods should be used which compensates the pollutants.	Filtering methods and the sources that do not include greenhouse gases should be used. The usage of CFCs should be controlled.	Alternative renewable sources can be found. Recycling and reusing should be basic strategies while designing and during demolition.

In Section 4.5, LCA of the seven materials, namely; leveling concrete, gypsum board, textile backed wallpaper, water based paint, hardwood, brick and plaster, which were common to all the three projects were analyzed. Although, there were other common materials, such as: wall and floor ceramic tiles, marble claddings and carpet; they could not be analyzed because the database of the software does not include information on these materials. For this reason, materials and process selection databases of the CES V4 software, which is used in Department of Metallurgical and Materials Engineering in METU, were consulted. While information about $C0_2$ emission and the amount of embodied energy could be taken from this database, it does not include information that is required to evaluate the material (such as the impacts of indicators according to life cycle stages, emissions to air and water) with the LCA software ATHENA. Hence, the analyses comprised of only the seven materials mentioned above.

The author formulated a system to evaluate building materials according to the six LCA environmental impact indicators, by calculating their "Eco-scores". As shown in the proposed matrix below, the selected materials were evaluated on the basis of the seven LCA indicators; primary energy consumption, solid waste, air pollution index, water pollution index, global warming potential and weighted resource use.

The evaluation was done by assigning ecological scores to each material, ranging from 1 to 7 where 1 indicates the least damaging and 7 the most; 0 was assigned to a material, which had no known impact. Mean values for each environmental impact indicator for the material (listed in Table 4.13) were used to calculate the related eco-scores. The largest amount of impact of any material for each indicator was denoted as the maximum eco-score of 7 and the least amount was denoted as 1; the intermediary range was divided into 5 equal grades. Hence, the total eco-score for any material was obtained by adding all the individual indicator scores, which in turn helped to determine its environmental appropriateness. In other words, materials with lesser scores will indicate least LCA impact and will be more desirable for the project, especially in refurbishment projects.

Table 5.2: Proposed matrix for calculating "Eco-scores" for building materials according to the six LCA environmental impact indicators.

MATERIALS	Primary Energy Consumption	Solid Waste	Air Pollution Index	Water Pollution Index	Global Warming Potential	Weighted Resource Use	Ecological Scores
Levelling Concrete	7	7	7	7	7	7	42
Gypsum Board	6	6	6	6	6	5	35
Wallpaper	5	5	5	0	5	4	24
Water Based Paint	2	2	3	0	3	1	11
Hardwood	1	3	2	0	2	2	10
Brick	4	4	4	0	4	3	19
Plaster	3	1	1	0	1	6	12
7 points = Most damaging 1 point = Least damaging 0 point = No damaging							

According to Table 5.2, the maximum score, which is forty-two for levelling concrete, means it is the most damaging material in these refurbishment works; while the minimum score, which is 10 for hardwood, is the least damaging material. Paint is ranked second, plaster third, brick fourth; wallpaper fifth and gypsum is ranked sixth.

As indicated in Table 5.1, use of levelling concrete should be minimized in refurbishment projects, in order reduce the damage to the ecosystem. Cement in leveling concrete consumes more energy and raw materials in the manufacturing phase due to high temperature in the kiln where it is produced. The cement industry should use industrial by-products as raw materials to mitigate its environmental impact, including aluminum ore refuse, blast-furnace slag, or fly ash. The kilns must be strictly controlled not to cause smoke emissions and atmospheric pollution. Mineral admixtures, called pozzolana, are finely ground mineral substances to form compounds with cement-like properties. Industrial by-products produce the most readily available pozzolana, including fly ash, ground blast furnace slag and silica fume. Use of these materials increases the strength of concrete while reducing the amount of cement required and recycling industrial waste.

Usage of gypsum board should also be reconsidered and alternatives should be evaluated carefully. For these two materials, i.e. gypsum and concrete, the recycling, reducing and reusing strategies are most significant. Hardwood has the minimum ecological score so wood should be preferred while refurbishing. However, dangers of deforestation should not be ignored and regeneration of eco-balance can be assured through re-plantation in forests.

As mentioned earlier, Hotel A had 4500 square meters of wooden suspended ceiling replaced by gypsum board false ceilings, which are not as durable as wood. Even the wooden pelmets were replaced with gypsum ones. From these examples it can be seen that sometimes good quality and durable materials are replaced with those of poorer quality and strength, which also have worse impacts on nature. Additionally, these materials and components, which are replaced in bulk just after a few years, are incorporated into the structure with permanent joints, anchors and glues. Since the hotel maintenance and renovation guideline dictate a shorter useful life than their expected life, it would be prudent to use replaceable material and components with de-mountable joints.

Since furniture is changed after every 8 to 10 years, it is advisable not to use fixed furniture or parts thereof, such as wall mounted headboards or night stands. It would also be more economical and healthy if floors were covered with wooden parquet or marble tiles depending on the climatic region, and rugs were used instead of wall to wall carpeting, which attracts dust and stains easily. These rugs can be washed or replaced at considerably lesser costs.

5.3. Further Investigations

LCA methodologies used so far have been developed for individual products only, whereas ATHENA is a software that has been developed specifically for evaluating whole buildings. On the other hand this software does not include database for all types of material, which is limiting to the assessment process. It is therefore essential to add information regarding more types of materials with varied specifications. Moreover, since benchmarking is not available, assessments are made on a comparative basis.

While assessing the hotels and materials in this study, the limit values for the impact indicators could not be found; therefore, international standards were used instead. The limit conditions for all indicators and air and water pollution index tables correlated with the software generated results can be prepared in order to make the assessment according to the local index values. Ecological scores similar to the ones formulated by the author and proposed in this dissertation can be determined and tabulated for other materials also, in order to assess whole buildings.

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APPENDIX A

Table A. 1: Comparison of 5 LCA tools according to different topics. (Source: Erlandsson & Borg, 2003: 933-936).

Topic/question	ATHENA	Envest	Eco-Quantum 3	BEAT 2000	BEES
Are a fix number of buildings life-cycle phases defined?	√ Extraction, manufacturing, on-site construction, occupancy and end of life	√ (Built in)	√ The total chain is part of the determination method divided in three phases: production, use and waste handling	√ Construction, maintenance, operation and demolition	√ Raw materials acquisition, manufacturing, transportation, use, end of life
Is assessment of new buildings included?	√ Either at a conceptual stage or from architectural and structural drawings	√	√	√	(√) Building PRODUCTS, not entire buildings
Is assessment of an existing building included?	√ Building is reverse engineered from drawings	(√) Can be used for that purpose	×	× BEAT 2000 can be used for assessment of both new and existing buildings, but no examples of existing buildings are included	(√) Building PRODUCTS, not entire buildings
Is assessment of an activity, i.e. rebuilding, extension, demolition included?	√ All results can be viewed by life-cycle stage	× Not explicitly, could be	√	× See above	(√) Building PRODUCTS, not entire buildings
Are the following services included and briefly how?				All the below-mentioned services can be included, but at present some are left out due to missing data	
Water supply	×	√ Benchmark-econ 19 guide	√ All effects: LCA data	×	× BEES only covers products, not entire buildings and its systems
Wastewater handling system	×	×	√ All effects: LCA data	×	×
Heating and Cooling system	√ User must enter energy use and type from external energy simulation programme	√ Benchmark-econ 19 guide	√ Dutch EPC calculation method all LCA effects	√ Energy use and emissions	×
Ventilation system		√ Benchmark-econ 19 guide	√ Idem	√ Energy use and emission	×
Building maintenance, i.e. durability aspects	√ Preset defaults are called upon to replace various building elements over the building's stipulated life	√ Defaults inbuilt	√ Periodic maintenance all effects	√ Replacement of materials or building elements with a lifetime shorter than the building	√ Product repairs and replacements over a 50-year use phase are included in both the LCA and the life-cycle costing evaluation

Table A.1: (continued)

Topic/question	ATHENA	Envest	Eco-Quantum 3	BEAT 2000	BEES
Operation waste handling systems	×	×	√ Only data of current situation and waste scenarios	×	×
Plot operation and maintenance[a]	×	?	?	×	× Not sure what you mean by this question
It is possible to separate between building-related choice versus user related impact?	√ Occupancy effects are separately reported from the embodied effects of the building	√ Operational and embodied are separate	√		? Not sure what you mean by this question
Is today's practice utilised for LCI and LCIA data for all activities in the building scenario? If no, answer the two following questions	?	√		√	√
Is time dependence affecting LCI included (i.e. additional data for future processes)?	√ LCI database supports various technologies		×		
Time dependence affecting LCIA. Is time dependence affecting LCIA included (i.e. additional data for future environmental context i.e. increased No_x concentration concerning photochemical ozone formation)?	×		×		
Describe allocation procedure for a process	Mass basis. We attempt to break apart individual unit processes or machine centres to minimize the use of allocation	See BRE environmental profiles methodology	Economic allocation method	The tool does not perform allocations—this is done by the user who enters the data—e.g. combined electricity and district heating production is not entered as one process, but as two separate processes, where the user performs the allocation ones and for all	BEES 2.0 Technical Manual Sections 2.1.1. and 2.1.2

Table A.1: (continued)

Topic/question	ATHENA	Envest	Eco-Quantum 3	BEAT 2000	BEES
Describe allocation procedure for handling of material recycling (i.e. open loop recycling, boundary setting between products)	See Section 5.5 of attached protocol for steel recycling	See BRE environmental profiles methodology	Input and output cut by economic allocation rules	Again individual, but usually (because of the very long lifetime of buildings, and because reuse is often "low-level-reuse" i.e. bricks crushed and used as sand/stone) all environmental impacts from the production of a material is allocated to the first user.	BEES 2.0 Technical Manual Sections 2.1.1 and 2.1.2
Is environmental sunk costs (compare with LCC) allowed as cut off[b]	×	?	×	?	BEES 2.0 Technical Manual Sections 2.1.1 and 2.1.2
Describe procedure for scenario-modelling[c]	?	Current practice		?	A limited number of parameters may be set by user
Specify procedure obtaining or choice for specific or generic LCI data	Generally we do not use secondary LCI information. All LCIs are completed by industry experts using our LCI protocol in tandem with direct industry participation	Generic only	√/× Both generic and company specific LCA profiles are available	Most of the building materials used in the Danish building industry is produced in Denmark. In these cases we (SBI) have collected product specific data from most the actual producers. For other products data from literature are used	BEES 2.0 Technical Manual Section 2.1.2
Specify procedure for dealing with data gaps		Best estimates	×	They are simply left out	BEES 2.0 Technical Manual Section 2.1.2
Are the following topics included and how?[c]					
Indoor air quality, IAQ	×	×	×	×	√ BEES 2.0 Technical Manual Section 2.1.3
Time dependence	√ Building life span dictates replacement and maintenance scenarios	×	×	×	× Not sure what you mean by this question
Spatial difference	×	×	×	×	× Not sure what You mean by this question

Table A.1: (continued)

Topic/question	ATHENA	Envest	Eco-Quantum 3	BEAT 2000	BEES
Geographical difference	√ All LCIs reflect regional technology differences, electricity grids and transportation modes and distances	√ UK average data based on appropriate transport distances, mode, grid mix, etc.	×	×	× US average
Impact categories	√ Use six impact indicators primarily characterization with some valuation measures	√, some CML and some BRE	√ CML 11	?	√ BEES 2.0 Technical Manual Section 2.1.3
Conservation of resources	√ Via recycling modeling	×	√	√ Consumption of non-renewable resources are included in the environmental profile	√ BEES 2.0 Technical Manual Section 2.1.3
Valuation methods	√ Valuation scenario used to compare and contrast the impacts of extracting disparate resources	√ Ecopoints (BRE Digest 446)	√ To 4 and 1 score	√ UMIP-method (it is not "hard coded" into the tool (and can therefore be changed by the user))	√ BEES 2.0 Technical Manuarl Section 2.1.4

Table A. 2: ATHENA Products.
(Source: http://www.athenasmi.ca/database/, last access 19.05.2007).

Structural Products

Wood Products

16 products available in various length, thickness, and load carrying designations. Some available in a number of combinations for both Canada and the United States. Data initially developed in 1993; softwood lumber database updated in 1999. US data developed between 2000 and 2002.

- Softwood Lumber (Green & KD)
- Plywood
- Oriented Strand Board (OSB)
- Glulam
- Laminated Veneer Lumber (LVL)
- Parallel Strand Lumber PSL
- Wood I - Joists
- Lumber or LVL flange
- Plywood or OSB web
- Light Frame Trusses
- Pitched Roof
- Parallel Chord Truss
- Composite wood/steel trusses
- Lumber flange(s) and steel tubing web

Steel Products

17 products available in various length, thickness (ga.), and load carrying designations produced in virgin (integrated), electric-arc (mini-mill) and in combination integrated and mini-mills. Data initially developed in the period 1992-1995. Data updated 2002 for both Canada and the United States.

- Galvanized C-studs and tracks
- Galvanized C-joists
- Wire Mesh
- Ladder Wire
- Fasteners
- screws
- nails
- nuts and bolts
- Open Web Joists
- Rebar and Rod
- Light sections
- Hollow Structural Steel
- Tubing and bracing
- Hot rolled sheet

Table A.2: (continued)

Concrete Structural Products

8 products in various mixes, sizes and structural strength designations. Data first developed in 1993 / 94, updated in 1999.

- 20 MPa ready-mixed with industry average, 25% and 35% fly ash concentrations
- 30 MPa ready-mixed with industry average, 25% and 35% fly ash concentrations 60 MPa ready-mixed
- Precast double T beams
- Precast hollow deck
- Concrete block
- Mortar

Envelope Products

Cladding Products

14 products in various sizes, species (wood), types and firing regimes (*e.g.*, brick products), gauges as well as mortar and stucco products. Data developed between 1995 and 1998.

- Wood bevel siding Wood tongue and groove siding
- Wood shiplap siding
- Sheet steel cladding
- Common brick
- Modular brick
- Face brick
- Glazed face brick
- Fire brick
- Thin veneer brick
- Concrete brick
- Silicate (sand lime) brick
- Vinyl siding

Gypsum Wallboard and Finishing Materials

10 products available in various thicknesses and sizes. Data developed in 1996.

- Regular paper faced gypsum board
- Type X (fire resistant) gypsum board
- Moisture resistant gypsum board
- Mobile-home gypsum board
- Gypsum fiberboard
- Shaft liner board
- Drying type ready-mixed joint compound
- Setting type dry joint compound
- Paper joint tape

Table A.2: (continued)

Insulation and Vapor Barriers 7 products in various densities and thicknesses (R-values). First developed in 1998 and verified, expanded and updated in 1999. • Rockwool(mineral) batt • Fiberglass Batt • Cellulose • Polystyrene Rigid • expanded (XPS) • extruded (EPS) • Polisocyanurate foam board • Polyethylene vapor barrier
Residential Roofing • #15 and #30 building paper (felt) • Organic (paper) and fiberglass based asphalt shingles of various durability weights • Clay tiles - various weights and shapes • Concrete tiles - various weights and shapes **Commercial Roofing** • Type III & IV fiberglass underlayment felt metal roofing • Asphalt Built-up roofing • Modified Bitumen (2-ply) roofing • EPDM & PVC single-ply roofing membranes
Windows & Glazed Curtain Wall 4 double pane sealed glazing unit types using 4 different frame materials in various combinations and dimensions plus a curtain wall application with viewable and opaque glazing as well as spandrel panel. Data first developed in 1998 and verified, expanded and updated in 1999. **Double Glazed Systems** • Standard • Tin-coated glass • Tin coated glass, argon filled Silver-coated glass, argon filled **Window Frame Materials** • Wood • PVC • PVC clad wood • Aluminum
Paint Finishes • 3 paint types developed in 1998. • Latex acrylic (water-based) • Oil alkyd (solvent-based) • Oil alkyd varnish (solvent-based)

APPENDIX B

Table B.1: Completed or partially completed new buildings and additions by use of building. (Source: TURKSTAT).

A. Number of buildings			B. Floor area		C. Value						
Year		Total		Apartment house	Commercial building	Industrial building	Medical, social building	Cultural building	Religious building	Administ. building	Other building
1990	A	**94.489**	36.048	53.169	2.676	1.077	177	87	29	159	1.067
	B	**33.169.629**	4.110.786	21.581.218	4.656.375	1.708.516	260.743	222.626	9.663	245.346	374.356
	C	**14.424.550**	1.678.795	9.487.170	1.993.664	771.511	116.660	106.888	4.155	112.341	153.366
1991	A	**92.388**	36.899	50.607	2.298	1.090	150	103	55	169	1.017
	B	**32.590.638**	4.286.847	21.101.759	4.204.463	1.805.789	175.064	246.457	24.013	367.787	378.459
	C	**27.305.193**	3.548.114	18.009.042	3.229.334	1.530.200	151.654	203.249	21.706	313.001	298.893
1992	A	**105.293**	44.307	55.783	2.487	1.282	140	92	45	153	1.004
	B	**38.359.909**	5.062.814	25.477.066	4.716.275	2.048.257	235.061	132.721	18.941	282.593	386.181
	C	**56.522.107**	7.210.533	38.429.093	6.312.049	3.056.396	339.612	195.541	28.801	434.157	515.925
1993	A	**101.712**	41.469	55.225	2.479	1.101	164	85	31	144	1.014
	B	**39.153.372**	4.938.012	25.548.667	5.373.318	2.161.100	290.637	157.485	11.673	256.956	415.524
	C	**98.971.828**	12.290.890	65.583.225	12.780.042	5.449.901	784.796	416.816	29.156	687.275	949.727
1994	A	**99.993**	42.945	52.524	2.257	937	171	99	38	103	919
	B	**37.054.113**	5.108.723	23.014.355	5.722.169	1.845.823	394.586	302.097	13.170	211.982	441.208
	C	**183.159.221**	24.020.563	116.320.460	26.213.201	9.743.691	1.966.513	1.633.900	66.246	1.096.741	2.097.906
1995	A	**96.661**	39.512	52.036	2.599	1.208	160	86	33	91	936
	B	**37.509.886**	4.664.209	24.204.604	5.072.920	2.579.224	212.934	167.027	16.684	177.151	415.133
	C	**330.304.980**	40.698.680	214.590.740	42.200.325	24.139.489	1.935.771	1.558.523	139.007	1.496.772	3.545.673
1996	A	**104.776**	42.883	56.374	2.822	1.303	231	106	53	97	907
	B	**41.764.477**	5.266.939	26.291.940	6.340.233	2.699.996	373.791	233.765	40.767	133.022	384.024
	C	**659.075.144**	83.438.462	417.694.419	94.339.388	44.954.650	6.291.690	3.837.794	627.687	2.130.508	5.760.546

Table B.1: (continued)

A. Number of buildings B. Floor area C. Value

Year		Total		Apartment house	Commercial building	Industrial building	Medical, social building	Cultural building	Religious building	Administ. building	Other building
1997	A	**106.406**	44.893	55.553	3.150	1.502	225	86	35	93	869
	B	**45.166.855**	5.690.252	27.717.422	6.942.356	3.715.514	277.886	250.156	13.188	135.493	424.588
	C	**1.378.973.558**	171.195.825	858.979.669	199.862.741	114.870.908	8.313.629	8.114.332	410.656	4.154.396	13.071.402
1998	A	**91.816**	34.641	52.129	2.192	1.614	295	111	34	91	709
	B	**42.166.845**	4.719.167	25.020.772	6.540.851	4.428.688	539.404	293.156	19.177	198.826	406.804
	C	**2.254.934.012**	244.192.361	1.361.482.482	330.967.506	238.999.576	30.436.492	16.060.132	970.133	10.819.646	21.005.684
1999	A	**86.777**	37.021	45.828	1.718	1.055	199	210	30	108	608
	B	**38.499.532**	4.621.711	22.441.429	6.499.858	3.318.517	288.224	818.050	18.569	195.623	297.551
	C	**3.081.051.406**	355.367.991	1.848.700.455	483.502.899	261.865.982	22.384.391	69.523.702	1.545.560	15.273.362	22.887.064
2000	A	**90.849**	36.184	50.095	2.120	1.328	286	133	35	100	568
	B	**42.462.925**	4.748.079	26.617.844	6.123.379	3.472.715	457.963	385.997	24.632	186.985	445.331
	C	**4.879.976.504**	533.783.108	3.128.983.890	657.205.902	390.553.383	52.237.989	43.311.738	2.739.959	22.010.970	49.149.565
2001	A	**86.155**	38.499	43.069	2.087	1.182	299	197	32	129	661
	B	**40.178.879**	5.206.187	25.525.761	4.839.300	2.709.666	422.616	726.207	26.169	286.778	436.195
	C	**7.417.320.699**	911.261.832	4.827.263.928	819.409.283	503.831.776	79.890.247	139.606.288	4.517.098	51.095.334	80.444.913
2002	A	**65.180**	26.376	29.653	3.586	4.776	133	193	12	119	332
	B	**31.676.425**	4.049.822	17.387.339	4.838.296	3.747.667	311.577	759.483	20.311	267.633	294.297
	C	**7.634.637.406**	940.021.245	4.219.917.357	1.151.332.754	911.626.170	78.600.372	193.866.249	4.498.620	65.687.056	69.087.583
2003	A	**57.542**	24.300	27.534	3.617	1.212	140	212	13	130	384
	B	**30.936.681**	4.280.700	18.236.890	4.347.691	2.324.051	273.734	924.208	11.218	307.311	230.878
	C	**9.037.163.884**	1.230.698.545	5.309.352.786	1.281.209.559	701.529.131	82.401.259	272.937.476	3.268.647	89.281.428	66.485.053

Table B.2: Buildings modified for a different use after alterations and repairs by year and use of building. (Source: TURKSTAT).

A. Number of buildings B. Floor area C. Number of dwelling units

			New use of Building								
			Residential buildings		Non-residential buildings						
Old use of Building	Year		1 - Buildings	11 - Residential buildings	12 - Non-residential buildings	121 - Hotel buildings	122 - Office buildings	123 - Wholesale, retail trade buildings	125 -Industrial buildings and warehouses	126 - Public entertainment, education, hospital or institutional buildings	127 - Other non-residential buildings
1 - Buildings	2002	A	58	14	44	4	1	23	7	6	3
		B	75 412	22 242	53 170	4 229	49	29 382	4 192	8 928	6 390
		C	239	239	-	-	-	-	-	-	-
	2003	A	308	117	191	11	1	143	26	3	7
		B	71 653	17 404	54 249	6 793	1 420	20 413	3 895	16 438	5 290
		C	149	149	-	-	-	-	-	-	-
	2004	A	53	9	44	4	-	20	11	8	1
		B	68 973	18 593	50 380	4 277	-	24 004	7 161	14 307	631
		C	166	164	2	-	-	2	-	-	-
11 - Residential buildings	2002	A	12	-	12	2	-	9	-	-	1
		B	3 888	-	3 888	412	-	2 888	529	-	59
		C	-	-	-	-	-	-	-	-	-
	2003	A	22	-	22	-	-	21	-	-	1
		B	3 101	-	3 101	-	-	2 976	-	-	125
		C	-	-	-	-	-	-	-	-	-
	2004	A	11	-	11	1	-	10	-	-	-
		B	3 006	-	3 006	120	-	2 601	285	-	-
		C	-	-	-	-	-	-	-	-	-
12 - Non-residential buildings	2002	A	46	14	32	2	1	14	7	6	2
		B	71 524	22 242	49 282	3 817	49	26 494	3 663	8 928	6 331
		C	239	239	-	-	-	-	-	-	-
	2003	A	286	117	169	11	1	122	26	3	6
		B	68 552	17 404	51 148	6 793	1 420	17 437	3 895	16 438	5 165
		C	149	149	-	-	-	-	-	-	-
	2004	A	42	9	33	3	-	10	11	8	1
		B	65 967	18 593	47 374	4 157	-	21 403	6 876	14 307	631
		C	166	164	2	-	-	2	-	-	-

Table B.2: (continued).

A. Number of buildings B. Floor area C. Number of dwelling units

Old use of Building	Year		1 - Buildings	11 - Residential buildings	12 - Non-residential buildings	121 - Hotel buildings	122 - Office buildings	123 - Wholesale, retail trade buildings	125 - Industrial buildings and warehouses	126 - Public entertainment, education, hospital or institutional buildings	127 - Other non-residential buildings
			New use of Building								
				Residential buildings	Non-residential buildings						
121 - Hotel buildings	2002	A	-	-	-	-	-	-	-	-	-
		B	**5 780**	2 282	3 498	529	-	1 934	-	1 035	-
		C	**21**	21	-	-	-	-	-	-	-
	2003	A	**6**	1	5	-	-	3	1	1	-
		B	**5 180**	50	5 130	-	-	2 087	1 092	1 951	-
		C	**1**	1	-	-	-	-	-	-	-
	2004	A	**1**	-	1	-	-	-	-	1	-
		B	**6 595**	536	6 059	-	-	204	-	5 855	-
		C	**11**	11	-	-	-	-	-	-	-
122 - Office buildings	2002	A	**14**	-	14	1	1	8	2	2	-
		B	**27 314**	-	27 314	976	49	18 715	860	3 787	2 927
		C	-	-	-	-	-	-	-	-	-
	2003	A	**101**	-	101	7	1	82	8	1	2
		B	**19 412**	-	19 412	4 827	1 420	11 362	726	842	235
		C	-	-	-	-	-	-	-	-	-
	2004	A	**9**	-	9	-	-	6	-	3	-
		B	**19 182**	140	19 042	-	-	13 046	1 841	3 862	293
		C	**3**	2	1	-	-	1	-	-	-
123 - Wholesale and retail trade buildings	2002	A	**17**	12	5	-	-	-	3	-	2
		B	**15 263**	11 171	4 092	1 138	-	-	1 428	25	1 501
		C	**118**	118	-	-	-	-	-	-	-
	2003	A	**86**	66	20	3	-	-	14	1	2
		B	**27 338**	10 243	17 095	1 649	-	-	1 630	13 645	171
		C	**88**	88	-	-	-	-	-	-	-
	2004	A	**20**	6	14	3	-	-	8	2	1
		B	**23 061**	11 603	11 458	4 157	-	-	3 828	3 264	209

Table B.2: (continued).

A. Number of buildings B. Floor area C. Number of dwelling units

Old use of Building	Year		**1** - Buildings	**11** - Residential buildings	**12** - Non-residential buildings	**121** - Hotel buildings	**122** - Office buildings	**123** - Wholesale, retail trade buildings	**125** -Industrial buildings and warehouses	**126** - Public entertainment, education, hospital or institutional buildings	**127** - Other non-residential buildings
			New use of Building								
			Residential buildings		Non-residential buildings						
125 - Industrial buildings and warehouses	2002	A	**3**	1	2	-	-	1	1	-	-
		B	**6 737**	2 046	4 691	-	-	1 776	1 012	-	1 903
		C	**26**	26	-	-	-	-	-	-	-
	2003	A	**16**	6	10	-	-	9	-	-	1
		B	**1 873**	632	1 241	-	-	1 090	-	-	151
		C	**6**	6	-	-	-	-	-	-	-
	2004	A	**5**	-	5	-	-	1	3	1	-
		B	**5 376**	253	5 123	-	-	3 856	406	732	129
		C	**3**	3	-	-	-	-	-	-	-
126 - Public entertainment, education, hospital or institutional care buildings	2002	A	**1**	-	1	1	-	-	-	-	-
		B	**1 664**	760	904	690	-	214	-	-	-
		C	**5**	5	-	-	-	-	-	-	-
	2003	A	**2**	1	1	-	-	-	-	-	1
		B	**6 100**	1 492	4 608	-	-	-	-	-	4 608
		C	**4**	4	-	-	-	-	-	-	-
	2004	A	**1**	-	1	-	-	-	-	1	-
		B	**714**	-	714	-	-	120	-	594	-
		C	-	-	-	-	-	-	-	-	-
127 - Other non-residential buildings	2002	A	**11**	1	10	-	-	5	1	4	-
		B	**14 766**	5 983	8 783	484	-	3 855	363	4 081	-
		C	**69**	69	-	-	-	-	-	-	-
	2003	A	**75**	43	32	1	-	28	3	-	-
		B	**8 649**	4 987	3 662	317	-	2 898	447	-	-
		C	**50**	50	-	-	-	-	-	-	-
	2004	A	**6**	3	3	-	-	3	-	-	-
		B	**11 039**	6 061	4 978	-	-	4 177	801	-	-
		C	**57**	56	1	-	-	1	-	-	-

Table B. 3: Number of qualified and unqualified municipality establishments and rooms in Turkey by types and years. (Source: Ministry of Culture and Tourism).

Type of Establishment	Years	Total Number of Establishments	Qualified Number of Establishments	Unqualified Number of Establishments
HOTEL	**2003**	**4 917**	3 527	1 390
	2002	**4 964**	3 598	1 366
	2001	**4 446**	3 494	952
	2000	**4 523**	3 498	1 025
	1997	**4 632**	3 297	1 335
	1992	**4 279**	2 248	2 031
	1987	**3 363**	930	2 433
MOTEL	**2003**	**542**	447	95
	2002	**556**	457	99
	2001	**755**	653	102
	2000	**788**	679	109
	1997	**804**	669	135
	1992	**750**	595	155
	1987	**397**	267	130
BOARDING HOUSE	**2003**	**2 037**	1 139	898
	2002	**2 109**	1 191	918
	2001	**2 284**	1 688	596
	2000	**2 330**	1 689	641
	1997	**2 353**	1 633	720
	1992	**2 304**	1 045	1 259
	1987	**1 689**	354	1 335
HOLIDAY VILLAGE	**2003**	**26**	25	1
	2002	**28**	27	1
	2001	**17**	17	-
	2000	**21**	21	-
	1997	**18**	18	-
	1992	**13**	13	-
	1987	**8**	8	-

Table B.3: (continued)

Type of Establishment	Years	Total Number of Establishments	Qualified Number of Establishments	Unqualified Number of Establishments
CAMPING	**2003**	**79**	60	19
	2002	**75**	56	19
	2001	**118**	93	25
	2000	**129**	98	31
	1997	**126**	87	39
	1992	**84**	50	34
	1987	**73**	38	35
THERMAL RESORT	**2003**	**36**	31	5
	2002	**40**	35	5
	2001	**41**	36	5
	2000	**41**	35	6
	1997	**42**	30	12
	1992	**14**	12	2
	1987	**6**	2	4
TOTAL	**2003**	**7 637**	**5 229**	**2 408**
	2002	**7 772**	**5 364**	**2 408**
	2001	**7 661**	**5 981**	**1 680**
	2000	**7 832**	**6 020**	**1 812**
	1997	**7 975**	**5 734**	**2 241**
	1992	**7 444**	**3 963**	**3 481**
	1987	**5 536**	**1 599**	**3 937**

Table B.4: Number of Municipality Licensed Accommodation Establishments (Qualified + Unqualified) in Ankara and Its Districts by Types- 2003.
(Source: Ministry of Culture and Tourism).

	Total	Hotel	Motel	Boarding House	Holiday Village	Camping	Thermal Resort
District	Number of Establishments	Number of Establishments	Number of Establishments	Number of Establishments	Number of Establishments	Number of Establishments	Number of Establishments
ALTINDAĞ	**28**	25	-	3	-	-	-
ÇANKAYA	**7**	7	-	-	-	-	-
MAMAK	**2**	2	-	-	-	-	-
SİNCAN	**2**	2	-	-	-	-	-
YENİMAHALLE	**6**	5	1	-	-	-	-
BALA	**2**	2	-	-	-	-	-
BEYPAZARI	**1**	1	-	-	-	-	-
ÇAMLIDERE	**1**	1	-	-	-	-	-
EVREN	**1**	1	-	-	-	-	-
GÖLBAŞI	**7**	6	1	-	-	-	-
HAYMANA	**2**	2	-	-	-	-	-
KALECİK	**1**	1	-	-	-	-	-
KIZILCAHAMAM	**5**	3	1	-	-	-	1
NALLIHAN	**1**	1	-	-	-	-	-
POLATLI	**5**	5	-	-	-	-	-
ŞEREFLİKOÇHİSAR	**2**	2	-	-	-	-	-
TOTAL	73	**66**	**3**	**3**	-	-	**1**

Table B. 5: Number of qualified and unqualified municipality licensed hotels by provinces in Turkey – 2003.
(Source: Ministry of Culture and Tourism).

		Qualified	Unqualified	**Total**
Rank	**Provinces**	Number of Establishments	Number of Establishments	**Number of Establishments**
1	**ANTALYA**	652	287	**939**
2	**MUĞLA**	577	58	**635**
3	**İSTANBUL**	294	113	**407**
4	**AYDIN**	376	22	**398**
5	**İZMİR**	141	90	**231**
6	**BALIKESİR**	103	27	**130**
7	**BURSA**	71	47	**118**
8	**MERSİN**	65	50	**115**
9	**TRABZON**	57	52	**109**
10	**ÇANAKKALE**	48	41	**89**
11	**ARTVİN**	28	41	**69**
12	**ANKARA**	36	30	**66**
13	**KONYA**	30	36	**66**
14	**NEVŞEHİR**	49	4	**53**
15	**RİZE**	45	8	**53**
16	**ERZURUM**	47	5	**52**
17	**DENİZLİ**	29	22	**51**
18	**MANİSA**	28	20	**48**
19	**GAZİANTEP**	18	28	**46**
20	**SAMSUN**	37	9	**46**
21	**AFYON**	31	14	**45**
22	**ADANA**	24	17	**41**
23	**DİYARBAKIR**	37	4	**41**
24	**K.MARAŞ**	27	12	**39**
25	**KOCAELİ**	13	25	**38**
26	**SİVAS**	17	18	**35**
27	**TEKİRDAĞ**	28	7	**35**
28	**YALOVA**	18	17	**35**
29	**ISPARTA**	25	8	**33**
30	**SAKARYA**	13	20	**33**
31	**HATAY**	25	5	**30**
32	**ORDU**	15	15	**30**
33	**KAYSERİ**	18	11	**29**
34	**ERZİNCAN**	16	11	**27**
35	**KASTAMONU**	15	12	**27**
36	**ARDAHAN**	20	6	**26**
37	**TOKAT**	15	10	**25**
38	**KARABÜK**	20	5	**25**
39	**AMASYA**	16	8	**24**
40	**DÜZCE**	14	10	**24**

Table B.5: (continued)

Rank	Provinces	Qualified Number of Establishments	Unqualified Number of Establishments	**Total Number of Establishments**
41	**AĞRI**	13	10	**23**
42	**KÜTAHYA**	19	4	**23**
43	**SİNOP**	13	10	**23**
44	**VAN**	15	8	**23**
45	**YOZGAT**	13	10	**23**
46	**ZONGULDAK**	17	6	**23**
47	**EDİRNE**	15	7	**22**
48	**KARS**	10	12	**22**
49	**MALATYA**	11	10	**21**
50	**BARTIN**	18	3	**21**
51	**BOLU**	15	5	**20**
52	**KIRKLARELİ**	16	4	**20**
53	**ÇORUM**	17	2	**19**
54	**IĞDIR**	10	9	**19**
55	**ELAZIĞ**	5	12	**17**
56	**ŞANLIURFA**	14	3	**17**
57	**BURDUR**	16	-	**16**
58	**UŞAK**	10	6	**16**
59	**GİRESUN**	9	6	**15**
60	**ŞIRNAK**	11	4	**15**
61	**BİLECİK**	9	5	**14**
62	**BİTLİS**	7	4	**11**
63	**ÇANKIRI**	11	-	**11**
64	**TUNCELİ**	8	3	**11**
65	**ESKİŞEHİR**	10	-	**10**
66	**AKSARAY**	6	4	**10**
67	**NİĞDE**	6	3	**9**
68	**ADIYAMAN**	5	3	**8**
69	**GÜMÜŞHANE**	6	2	**8**
70	**KIRŞEHİR**	8	-	**8**
71	**HAKKARİ**	5	2	**7**
72	**MARDİN**	3	4	**7**
73	**SİİRT**	7	-	**7**
74	**MUŞ**	5	1	**6**
75	**KARAMAN**	5	1	**6**
76	**KIRIKKALE**	4	2	**6**
77	**OSMANİYE**	6	-	**6**
78	**BİNGÖL**	4	-	**4**
79	**BAYBURT**	3	-	**3**
80	**BATMAN**	2	-	**2**
81	**KİLİS**	2	-	**2**
	TOTAL	**3 527**	**1 390**	**4 917**

Table B. 6: Number of qualified and unqualified municipality licensed hotels by provinces in Turkey – 2000.
(Source: Ministry of Culture and Tourism).

		Qualified	Unqualified	**Total**
	Provinces	Number of Establishments	Number of Establishments	**Number of Establishments**
1	**MUĞLA**	145	1217	**1362**
2	**ANTALYA**	154	952	**1106**
3	**AYDIN**	54	561	**615**
4	**İZMİR**	259	257	**516**
5	**İSTANBUL**	85	384	**469**
6	**BALIKESİR**	106	341	**447**
7	**MERSİN**	31	200	**231**
8	**DENİZLİ**	42	165	**207**
9	**ÇANAKKALE**	55	96	**151**
10	**ANKARA**	34	114	**148**
11	**BURSA**	46	97	**143**
12	**TRABZON**	34	101	**135**
13	**NEVŞEHİR**	45	89	**134**
14	**KONYA**	42	54	**96**
15	**ERZURUM**	31	64	**95**
16	**TEKİRDAĞ**	26	58	**84**
17	**YALOVA**	12	71	**83**
18	**ARTVİN**	18	61	**79**
19	**RİZE**	21	55	**76**
20	**K.MARAŞ**	22	48	**70**
21	**HATAY**	32	37	**69**
22	**ADANA**	18	45	**63**
23	**MANİSA**	30	31	**61**
24	**SAKARYA**	3	54	**57**
25	**ISPARTA**	18	37	**55**
26	**KASTAMONU**	30	24	**54**
27	**SİVAS**	24	30	**54**
28	**AFYON**	19	34	**53**
29	**SAMSUN**	13	39	**52**
30	**DİYARBAKIR**	6	43	**49**
31	**KOCAELİ**	4	40	**44**
32	**ORDU**	23	20	**43**
33	**SİNOP**	18	25	**43**
34	**KÜTAHYA**	17	2	**37**
35	**GAZİANTEP**	8	28	**36**
36	**ERZİNCAN**	8	24	**32**
37	**ÇORUM**	10	21	**31**
38	**ZONGULDAK**	13	18	**31**
39	**BARTIN**	14	16	**30**
40	**BOLU**	5	25	**30**

Table B.6: (continued)

		Qualified	Unqualified	**Total**
	Provinces	Number of Establishments	Number of Establishments	**Number of Establishments**
41	**DÜZCE**	4	26	**30**
42	**EDİRNE**	17	12	**29**
43	**KAYSERİ**	8	21	**29**
44	**AMASYA**	13	15	**28**
45	**KARABÜK**	9	19	**28**
46	**TOKAT**	14	14	**28**
47	**KIRKLARELİ**	12	15	**27**
48	**MALATYA**	10	17	**27**
49	**VAN**	4	21	**25**
50	**AKSARAY**	11	12	**23**
51	**ELAZIĞ**	5	18	**23**
52	**IĞDIR**	7	16	**23**
53	**ŞANLIURFA**	15	8	**23**
54	**ARDAHAN**	3	18	**21**
55	**AĞRI**	2	18	**20**
56	**GİRESUN**	11	9	**20**
57	**UŞAK**	8	12	**20**
58	**KARS**	8	9	**17**
59	**YOZGAT**	11	6	**17**
60	**ADIYAMAN**	10	6	**16**
61	**BİTLİS**	6	10	**16**
62	**BİLECİK**	7	8	**15**
63	**BURDUR**	7	7	**14**
64	**ÇANKIRI**	6	8	**14**
65	**TUNCELİ**	4	10	**14**
66	**BİNGÖL**	9	4	**13**
67	**ESKİŞEHİR**	13	0	**13**
68	**ŞIRNAK**	4	7	**11**
69	**MARDİN**	3	7	**10**
70	**SİİRT**	3	6	**9**
71	**KIRŞEHİR**	7	1	**8**
72	**NİĞDE**	4	4	**8**
73	**KARAMAN**	4	3	**7**
74	**GÜMÜŞHANE**	4	2	**6**
75	**MUŞ**	3	3	**6**
76	**BAYBURT**	3	2	**5**
77	**KIRIKKALE**	3	2	**5**
78	**OSMANİYE**	5	0	**5**
79	**BATMAN**	2	2	**4**
80	**HAKKARİ**	3	1	**4**
81	**KİLİS**	2	1	**3**
	TOTAL	**1859**	**5958**	**7835**

Table B. 7: Data related to the different types of alterations and renovation projects approved by the Chamber of Architects in Ankara, during the 5 year period of 2000-2005.

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
FAİK AHMET ŞENEL	ORTA TADİLAT	KONUT	15-Feb-00
HACI BEKİR ÜNÜVAR	TADİLAT	DUKKAN	23-Dec-00
CELAL ÇAMLIBEL	TADİLAT	IS MERK.	9-Jan-01
MEHMET FUAT KARAOĞLU	TADİLAT	KONUT	10-May-01
NURİ OSMAN YURDAKUL	TADİLAT	DÜKKAN+KONUT	4-Jun-01
NURİ OSMAN YURDAKUL	TADİLAT	OTEL	15-Jun-01
MEHMET FUAT KARAOĞLU	İLAVE + TADİLAT	KONUT	3-Aug-01
REFİK ERDOĞAN	TADİLAT	KONUT	25-Oct-01
NURİ OSMAN YURDAKUL	İLAVE + TADİLAT	EĞİTİM YAPILARI	10-Jun-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	2-Oct-02
A.İMRAN KARAMAN	TADİLAT	KONUT	4-Oct-02
	BASİT TADİLAT	KONUT	10-Oct-02
M.ALİ YAPICIOĞLU	İLAVE + TADİLAT		15-Oct-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	17-Oct-02
NURİ OSMAN YURDAKUL	İLAVE + TADİLAT	BURO	18-Oct-02
SEVİM NOYAN	TADİLAT	KONUT	18-Oct-02
CELAL ÇAMLIBEL	TADİLAT	ATOLYE	24-Oct-02
HALDUN ERTEKİN	TADİLAT	KONUT	8-Nov-02
ALİ RAGIP BULUÇ	TADİLAT	KONUT	14-Nov-02
MUSTAFA ÜMİT KALELİOĞLU	TADİLAT	DÜKKAN+KONUT	27-Nov-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	29-Nov-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	29-Nov-02
ADEM KOÇ	TADİLAT	KONUT	9-Dec-02
HACI BEKİR ÜNÜVAR	TADİLAT	KONUT	9-Dec-02
AYDOĞAN ÜNSÜN	TADİLAT		11-Dec-02
HACI BEKİR ÜNÜVAR	TADİLAT	IS MERK.	11-Dec-02
HACI BEKİR ÜNÜVAR	TADİLAT	ÇARŞI	24-Dec-02
HACI BEKİR ÜNÜVAR	TADİLAT	BURO	24-Dec-02
AYŞE GÜLDER TAŞÇIOĞLU	TADİLAT	KONUT	26-Dec-02
ALTAN ERSOY	TADİLAT	OTEL	30-Dec-02
ATİLLA ŞENGONCA	TADİLAT	KONUT	30-Dec-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	31-Dec-02
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	31-Dec-02
ZİYA TANALI	TADİLAT		6-Jan-03
B.HALDUN ERDOĞAN	TADİLAT	TİC.MALİ END.TAR.YP.	13-Jan-03
METİN TAMER	TADİLAT	ISYERI+KONUT	13-Jan-03
EMİN ALPER GÜNER	TADİLAT	KONUT	21-Jan-03
METİN AYGÜN	TADİLAT	OTEL	21-Jan-03
METİN TAMER	TADİLAT	KONUT	27-Jan-03
M.CEMAL ÖZER	TADİLAT	KONUT	3-Feb-03

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
SEMRA TEBER YENER	TADİLAT	KONUT	3-Feb-03
SERCİHAN MADEN	TADİLAT	KONUT	3-Feb-03
MUSTAFA ZÜHTÜ BAYER	TADİLAT	KONUT	20-Feb-03
ATİLLA ŞENGONCA	TADİLAT	KONUT	26-Feb-03
ABDÜLHALİM BÜYÜKBAY	TADİLAT	KONUT	27-Feb-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	27-Feb-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	27-Feb-03
CELAL ÇAMLIBEL	ORTA TADİLAT	IMALATHANE	10-Mar-03
ÖZGÜR ECEVİT	TADİLAT	KONUT	11-Mar-03
MURAT LALECİ	BASİT TADİLAT	KONUT	25-Mar-03
ÖNDER ÇOLAK	TADİLAT	KONUT	28-Mar-03
MUSTAFA ARSLAN	TADİLAT	KONUT	31-Mar-03
İHSAN SİNAN ÇETİNTAŞ	TADİLAT	TİCARİ VE SANAİ	2-Apr-03
METİN TAMER	TADİLAT	DUKKAN	4-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	7-Apr-03
SAİT OĞUZHAN ÖZTURAN	TADİLAT	KONUT	7-Apr-03
HÜDAVERDİ GÖKÇEN	TADİLAT	GENEL HASTANE	8-Apr-03
LÜTFÜ KOCAOĞLU	TADİLAT	KONUT	8-Apr-03
HALİME ÖZSÜT ŞENOL	TADİLAT	KONUT	10-Apr-03
ERKUT ŞAHİNBAŞ	TADİLAT	OZEL ISLEVLI OKUL	16-Apr-03
MİTAT KARA	TADİLAT	BURO	17-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	18-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	18-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	18-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	18-Apr-03
HAKAN BÜLBÜL	TADİLAT	KONUT	18-Apr-03
HATİCE GÜL GÜVEN	TADİLAT	DUKKAN	18-Apr-03
SEVİM NOYAN	TADİLAT	IMALATHANE	22-Apr-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	1-May-03
İRFAN ÇAKALLI	TADİLAT	KONUT	10-May-03
ERHAN KOCABIYIKOĞLU	TADİLAT	KONUT	12-May-03
MUSTAFA MÜRŞİT GÜNDAY	TADİLAT	GUNDUZ BAKIM EVI	12-May-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	13-May-03
ALPER AYLAN	İLAVE + TADİLAT	DEPO	15-May-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	16-May-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	16-May-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	16-May-03
İRFAN SEZER	TADİLAT	KONUT	16-May-03
FAİK AHMET ŞENEL	TADİLAT	KONUT	21-May-03
MEHMET GÜNER	TADİLAT	DEPO	27-May-03
MUZAFFER IŞIK	TADİLAT	KONUT	28-May-03
AHMET FUAT ÖZKOÇAK	TADİLAT	OTEL	2-Jun-03

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
MUAMMER AYDIN	TADİLAT	OTEL	4-Jun-03
SERCAN ÜNAL	BASİT TADİLAT	KONUT	5-Jun-03
HACI BEKİR ÜNÜVAR	TADİLAT	BURO	11-Jun-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	13-Jun-03
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	13-Jun-03
MURAT ÇAĞLAYAN BUDAK	BASİT TADİLAT	KONUT	17-Jun-03
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	19-Jun-03
ALP KAĞAN DURAN	BASİT TADİLAT	KONUT	23-Jun-03
ATİLLA ŞENGONCA	KÜÇÜK TADİLAT	KONUT	26-Jun-03
ERHAN KOCABIYIKOĞLU	TADİLAT	FABRİKA	1-Jul-03
CİHANGİR ÖZYER	BASİT TADİLAT	KONUT	7-Jul-03
HASAN ER	TADİLAT	KONUT	11-Jul-03
DENİZ AYBARS	TADİLAT	ISYERI+KONUT	17-Jul-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	21-Jul-03
COŞKUN ÜREYEN	TADİLAT	OTEL	22-Jul-03
CEMAL BAYSAL	TADİLAT	KONUT	31-Jul-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Aug-03
HALİL OĞUZ ARIK	TADİLAT	KONUT	18-Aug-03
HAKAN BÜLBÜL	BASİT TADİLAT	DÜKKAN+KONUT	21-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	25-Aug-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	25-Aug-03
MÜJDAT KADRİ ATABAŞ	TADİLAT	DUKKAN	28-Aug-03
MÜJDAT KADRİ ATABAŞ	TADİLAT	DUKKAN	28-Aug-03
Y.TOLGA DİKER	TADİLAT	KONUT	1-Sep-03
AYTEN KART	TADİLAT	OTEL	3-Sep-03
HİKMET ÇENGEL	TADİLAT	İŞ-TİCARET MERK.	3-Sep-03
HACI BEKİR ÜNÜVAR	TADİLAT	DUKKAN	5-Sep-03
MEHMET GÜNER	ORTA TADİLAT	DEPO	18-Sep-03
MAHİR AYDUĞAN	TADİLAT	DÜKKAN+KONUT	29-Sep-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	3-Oct-03
VELİ AKTÜRK	BASİT TADİLAT	KONUT	3-Oct-03
İHSAN SİNAN ÇETİNTAŞ	TADİLAT	FABRİKA	6-Oct-03
MUZAFFER IŞIK	BASİT TADİLAT	DÜKKAN+KONUT	6-Oct-03
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	BURO	9-Oct-03
MEHMET TURHAN KAYASÜ	BASİT TADİLAT	GENEL HASTANE	9-Oct-03

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
MEHLİKA MIHOĞLU	TADİLAT		14-Oct-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Oct-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Oct-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Oct-03
SEVİM NOYAN	TADİLAT	DÜKKAN+KONUT	22-Oct-03
MURAT LALECİ	BASİT TADİLAT	KONUT	24-Oct-03
COŞKUN TORUN	BASİT TADİLAT	KONUT	30-Oct-03
HALİL OĞUZ ARIK	KÜÇÜK TADİLAT	DÜKKAN+KONUT	3-Nov-03
FATMA CEBECİ	KAPSAMLI TADİLAT	BURO	10-Nov-03
OKTAY AKDUMANLI	KÜÇÜK TADİLAT	DÜKKAN+KONUT	12-Nov-03
MUSTAFA ARSLAN	KAPSAMLI TADİLAT	DÜKKAN+KONUT	17-Nov-03
MUSTAFA ARSLAN	KAPSAMLI TADİLAT	BENZIN ISTASYONU	17-Nov-03
ZEHRA TÜRKCAN AKSU	TADİLAT	KONUT	17-Nov-03
MEHMET ILGIN	KAPSAMLI TADİLAT	KONUT	19-Nov-03
AYSUN COŞAR	BASİT TADİLAT	KONUT	2-Dec-03
METİN TAMER	BASİT TADİLAT	KONUT	11-Dec-03
MİTHAT AKMAN	KÜÇÜK TADİLAT	DÜKKAN+KONUT	12-Dec-03
MEHLİKA MIHOĞLU	İLAVE + TADİLAT	DÜKKAN+KONUT	15-Dec-03
MUSTAFA ÖZKARAKAYA	BASİT TADİLAT	KONUT	15-Dec-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Dec-03
İLKAY TAVLI	KÜÇÜK TADİLAT	KONUT	22-Dec-03
İLKAY TAVLI	BASİT TADİLAT	KONUT	22-Dec-03
MUSTAFA ZÜHTÜ BAYER	KÜÇÜK TADİLAT	MARKET	22-Dec-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	24-Dec-03
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	13-Jan-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	13-Jan-04
ÖNDER ÇOLAK	İLAVE + TADİLAT	DÜKKAN+KONUT	19-Jan-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Jan-04
HACI BEKİR ÜNÜVAR	KAPSAMLI TADİLAT	ÇOK AMAÇLI SAL.	26-Jan-04
SEMRA TEBER YENER	KAPSAMLI TADİLAT	KONUT	5-Feb-04
AYLA TÜFEKCİOĞLU	KÜÇÜK TADİLAT	İDARİ BİNA	6-Feb-04
SUAT ZOBU	BASİT TADİLAT	APARTMAN	6-Feb-04
MEHMET AYDIN	BASİT TADİLAT		9-Feb-04
ERHAN KORKMAZ	KAPSAMLI TADİLAT	KONUT	19-Feb-04
MEHMET KİBAR	BASİT TADİLAT	KONUT	27-Feb-04
YUSUF AYGAR	KAPSAMLI TADİLAT	KONUT	27-Feb-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	1-Mar-04
	İLAVE + TADİLAT	IS MERK.	2-Mar-04
HASAN ÖZBAY	BASİT TADİLAT	BURO	3-Mar-04
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	IMALATHANE	5-Mar-04
HAKAN BÜLBÜL	İLAVE + TADİLAT	OTEL	5-Mar-04
MUSTAFA ARSLAN	KAPSAMLI TADİLAT	KONUT	5-Mar-04
AHMET ENGİN FIRAT	TADİLAT	İDARİ BİNA	9-Mar-04

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
İRFAN ÇAKALLI	BASİT TADİLAT	KONUT	10-Mar-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	12-Mar-04
MURAT LALECİ	İLAVE + TADİLAT	KONUT	12-Mar-04
MURAT LALECİ	KÜÇÜK TADİLAT	KONUT	12-Mar-04
MURAT LALECİ	KÜÇÜK TADİLAT	KONUT	12-Mar-04
ABDULLAH EMRE ÖZİKİNCİ	BASİT TADİLAT	KONUT	19-Mar-04
MEHMET ALTUNTAŞ	İLAVE + TADİLAT	HASTANE	19-Mar-04
A.CAN ERSAN	KÜÇÜK TADİLAT	BENZIN ISTASYONU	22-Mar-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	22-Mar-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	22-Mar-04
AYKUT SONOL TOLGAY	BASİT TADİLAT	BURO	22-Mar-04
RÜSTEM CANTÜRK	KÜÇÜK TADİLAT	KONUT	22-Mar-04
HASAN AKYÜZ	KÜÇÜK TADİLAT	DÜKKAN+KONUT	23-Mar-04
AHMET HALİS TURGAY	İLAVE + TADİLAT	DUKKAN	24-Mar-04
FATMA CEBECİ	BASİT TADİLAT	BURO	24-Mar-04
TURGUT YURT	ORTA TADİLAT	KONUT	24-Mar-04
HASAN ER	İLAVE + TADİLAT	KONUT	26-Mar-04
MUSTAFA ŞAHİN	ORTA TADİLAT	ISYERI+KONUT	26-Mar-04
SAİT OĞUZHAN ÖZTURAN	BASİT TADİLAT	KONUT	26-Mar-04
BÜLENT BİROĞLU	İLAVE + TADİLAT	KONUT	29-Mar-04
AHMET ENDER EROL	KAPSAMLI TADİLAT	LOKANTA	5-Apr-04
İHSAN BİGE	KAPSAMLI TADİLAT	DUKKAN	6-Apr-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	13-Apr-04
YUSUF AYGAR	BASİT TADİLAT	DÜKKAN+KONUT	19-Apr-04
ALİŞAN BAYRAKDAR	BASİT TADİLAT	IMALATHANE	20-Apr-04
ALİŞAN BAYRAKDAR	BASİT TADİLAT	IMALATHANE	20-Apr-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Apr-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Apr-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Apr-04
BÜLENT BİROĞLU	KÜÇÜK TADİLAT	ISYERI+KONUT	26-Apr-04
MURAT ÇAĞLAYAN BUDAK	KAPSAMLI TADİLAT	SHOWROOM	26-Apr-04
ALP KAĞAN DURAN	BASİT TADİLAT	DUKKAN	28-Apr-04
MEHLİKA MIHOĞLU	BASİT TADİLAT	KONUT	28-Apr-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	29-Apr-04
ÖMER FARUK SUMMAK	BASİT TADİLAT	APARTMAN	29-Apr-04
FAİK AHMET ŞENEL	BASİT TADİLAT	IS HANI	30-Apr-04
FAİK AHMET ŞENEL	TADİLAT	IS HANI	30-Apr-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	7-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	7-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	7-May-04
M.ALİ YAPICIOĞLU	KAPSAMLI TADİLAT	KONUT	10-May-04
HADİ EMİROĞLU	BASİT TADİLAT	IS MERK.	14-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	20-May-04

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	20-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	20-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	20-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	20-May-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	31-May-04
NURİ KURTULUŞ KONUR	İLAVE + TADİLAT	BURO	1-Jun-04
MİTHAT DEMİRCİ	BASİT TADİLAT	APARTMAN	3-Jun-04
MİTHAT DEMİRCİ	BASİT TADİLAT	APARTMAN	3-Jun-04
MÜJDAT KADRİ ATABAŞ	ORTA TADİLAT	KONUT	3-Jun-04
AYSUN COŞAR	BASİT TADİLAT	KONUT	15-Jun-04
NURİ KURTULUŞ KONUR	İLAVE + TADİLAT	İDARİ BİNA	15-Jun-04
MURAT LALECİ	ORTA TADİLAT	KONUT	18-Jun-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	21-Jun-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	21-Jun-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	21-Jun-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	21-Jun-04
MEHMET TURHAN KAYASÜ	BASİT TADİLAT	GENEL HASTANE	21-Jun-04
	BASİT TADİLAT	MAĞAZA	22-Jun-04
FERHAT ERDEM KARAORMAN	TADİLAT	DEPO	22-Jun-04
ÖNDER ÇOLAK	BASİT TADİLAT	DUKKAN	28-Jun-04
MURAT LALECİ	BASİT TADİLAT	KONUT	30-Jun-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	1-Jul-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	1-Jul-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	8-Jul-04
EROL USTA	BASİT TADİLAT	DUKKAN	12-Jul-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	13-Jul-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	14-Jul-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	14-Jul-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	2-Aug-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	2-Aug-04
BÜLENT BİROĞLU	ORTA TADİLAT	DÜKKAN+KONUT	5-Aug-04
GÜNERİ IRMAK	BASİT TADİLAT	KONUT	12-Aug-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	13-Aug-04
H.HÜSEYİN KEÇECİ	BASİT TADİLAT	KONUT	18-Aug-04
AZİZ SERDAR CEYHAN	ORTA TADİLAT	KONUT	23-Aug-04
AYDOĞAN ÜNSÜN	KÜÇÜK TADİLAT	KONUT	24-Aug-04
FATMA CEBECİ	BASİT TADİLAT	İŞYERİ	24-Aug-04
LEYLA MERAL	BASİT TADİLAT	KONUT	26-Aug-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	2-Sep-04
MAHİR AYDUĞAN	BASİT TADİLAT	DÜKKAN+KONUT	2-Sep-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	7-Sep-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	7-Sep-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	7-Sep-04

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
MÜKREMİN MUNGAN	İLAVE + TADİLAT	KONUT	7-Sep-04
MÜKREMİN MUNGAN	BASİT TADİLAT	KONUT	7-Sep-04
MÜKREMİN MUNGAN	BASİT TADİLAT	KONUT	7-Sep-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	8-Sep-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	8-Sep-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Sep-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Sep-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Sep-04
MEHMET GÜNER	KAPSAMLI TADİLAT	BENZIN IST.	14-Sep-04
T.BERKAY YALIN	TADİLAT	ISYERI+KONUT	22-Sep-04
DİLEK ALKA AYDEMİR	ORTA TADİLAT	IMALATHANE	24-Sep-04
H.ALİ ULUSOY	BASİT TADİLAT	ISYERI+KONUT	27-Sep-04
İBRAHİM TEVFİK PARABAKAN	ORTA TADİLAT	BENZIN ISTASYONU	29-Sep-04
MUSTAFA YÜCESAN	ORTA TADİLAT	DUKKAN	4-Oct-04
SERDAR AKÜNAL	TADİLAT	OTEL	4-Oct-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	5-Oct-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	5-Oct-04
MAHİR AYDUĞAN	BASİT TADİLAT	DÜKKAN+KONUT	5-Oct-04
ÖNDER ÇOLAK	TADİLAT	KONUT	6-Oct-04
HAZELİ AKGÖL	BASİT TADİLAT	KONUT	8-Oct-04
METİN TAMER	TADİLAT	DÜKKAN+KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	12-Oct-04
İHSAN SİNAN ÇETİNTAŞ	TADİLAT	KONUT	15-Oct-04
MURAT LALECİ	TADİLAT	KONUT	15-Oct-04
MÜJDAT KADRİ ATABAŞ	ORTA TADİLAT	IS HANI	18-Oct-04
MURAT ÇAĞLAYAN BUDAK	TADİLAT	KONUT	20-Oct-04
ONUR BAYER	BASİT TADİLAT	KONUT	20-Oct-04
ONUR BAYER	BASİT TADİLAT	KONUT	21-Oct-04
A.CAN ERSAN	TADİLAT	KONUT	22-Oct-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	25-Oct-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	25-Oct-04

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
REFİK ERDOĞAN	KAPSAMLI TADİLAT	OTEL	25-Oct-04
HALİL FAZLIOĞLU	BASİT TADİLAT	KONUT	28-Oct-04
HALİL FAZLIOĞLU	BASİT TADİLAT	KONUT	5-Nov-04
AHMET YILMAZ	TADİLAT	DÜKKAN+KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	8-Nov-04
CANAN KAÇAR	BASİT TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	9-Nov-04
AHMET ENGİN FIRAT	KAPSAMLI TADİLAT	ISYERI+KONUT	18-Nov-04
YENER GÜRAN	TADİLAT	KONUT	30-Nov-04
İSMAİL ÇAĞLAR	ORTA TADİLAT	KONUT	2-Dec-04
SERCİHAN MADEN	BASİT TADİLAT	KONUT	6-Dec-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	7-Dec-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	7-Dec-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	7-Dec-04

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	7-Dec-04
M.ALİ YAPICIOĞLU	BASİT TADİLAT	YURT	9-Dec-04
ERGİN DİLSİZ	BASİT TADİLAT	DÜKKAN+KONUT	10-Dec-04
AYDIN ÖZDEMİR	BASİT TADİLAT	KONUT	14-Dec-04
ÖNDER ÇOLAK	BASİT TADİLAT	KONUT	14-Dec-04
VELİ AKTÜRK	İLAVE + TADİLAT	DUKKAN	14-Dec-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Dec-04
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Dec-04
HALİL FAZLIOĞLU	BASİT TADİLAT	KONUT	16-Dec-04
SÜLEYMAN ÇETİNTAŞ	BASİT TADİLAT	KONUT	16-Dec-04
HASAN ER	BASİT TADİLAT	KONUT	20-Dec-04
MÜJDAT KADRİ ATABAŞ	TADİLAT	BANKA	20-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	ORTA TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MÜKREMİN MUNGAN	TADİLAT	KONUT	21-Dec-04
MEHMET YALÇIN EMMİLER	TADİLAT	KONUT	23-Dec-04
SEVİM NOYAN	TADİLAT	KONUT	23-Dec-04
TURAN TEKİN	TADİLAT	DÜKKAN+KONUT	23-Dec-04
YAVUZ ÖNEN	TADİLAT	KONUT	24-Dec-04
MÜJDAT KADRİ ATABAŞ	BASİT TADİLAT	DÜKKAN+KONUT	27-Dec-04
AYŞE ERGÜL	TADİLAT	KONUT	28-Dec-04
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	30-Dec-04
BORA TUBAY	ORTA TADİLAT	KONUT	30-Dec-04
DÜRRİYE MİNE KARATAŞ	BASİT TADİLAT		31-Dec-04
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	7-Jan-05
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	7-Jan-05
TAHSİN TAŞKIRAN	KAPSAMLI TADİLAT	OTEL	7-Jan-05
MÜKREMİN MUNGAN	TADİLAT	KONUT	10-Jan-05
FAHİRE SAATÇİ	KAPSAMLI TADİLAT	HASTANE	13-Jan-05
AHMET HALİS TURGAY	BASİT TADİLAT	DÜKKAN+KONUT	19-Jan-05
İHSAN BİGE	KÜÇÜK TADİLAT	EĞİTİM YAPILARI	24-Jan-05
DİLEK ALKA AYDEMİR	KÜÇÜK TADİLAT	DÜKKAN+KONUT	27-Jan-05
MUSTAFA YÜCESAN	BASİT TADİLAT	KONUT	28-Jan-05
KEMAL MÜKREMİN BARUT	ORTA TADİLAT	KONUT	1-Feb-05
AYŞE ERGÜL	BASİT TADİLAT	DÜKKAN+KONUT	10-Feb-05

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Feb-05
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Feb-05
ERKUT ŞAHİNBAŞ	BASİT TADİLAT	KONUT	11-Feb-05
MUSTAFA AYTÖRE	KAPSAMLI TADİLAT	HASTANE	11-Feb-05
TURAN TEKİN	TADİLAT	BURO	18-Feb-05
BÜLENT BİROĞLU	BASİT TADİLAT	DÜKKAN+KONUT	21-Feb-05
BÜLENT BİROĞLU	TADİLAT	İŞYERİ	21-Feb-05
HASAN ÇINAR	TADİLAT	DÜKKAN+KONUT	21-Feb-05
HASAN ÇINAR	ORTA TADİLAT	DÜKKAN+KONUT	22-Feb-05
ERKUT ŞAHİNBAŞ	BASİT TADİLAT	BURO	24-Feb-05
KALİP HERGÜL	BASİT TADİLAT	ISYERI+KONUT	24-Feb-05
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	İŞ-TİCARET MER.	7-Mar-05
RÜSTEM CANTÜRK	TADİLAT	DÜKKAN+KONUT	8-Mar-05
ALİ TEPE	BASİT TADİLAT	DÜKKAN+KONUT	14-Mar-05
HÜLYA HANCI	ORTA TADİLAT	KONUT	14-Mar-05
CENGİZ DÖNMEZ	KAPSAMLI TADİLAT	KONUT	21-Mar-05
MUZAFFER IŞIK	BASİT TADİLAT	KONUT	7-Apr-05
ADNAN KÖPRÜLÜ	BASİT TADİLAT	DÜKKAN+KONUT	11-Apr-05
AHMET HALİS TURGAY	BASİT TADİLAT	OTEL	11-Apr-05
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Apr-05
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Apr-05
AYDOĞAN ÜNSÜN	TADİLAT	KONUT	11-Apr-05
BOZKURT GÜRSOYTRAK	TADİLAT	BURO	11-Apr-05
SEVİM NOYAN	TADİLAT	KONUT	12-Apr-05
REFİK ERDOĞAN	TADİLAT	KONUT	20-Apr-05
SERVER TUNÇAY	BASİT TADİLAT	KONUT	20-Apr-05
ERHAN KOCABIYIKOĞLU	BASİT TADİLAT	BURO	21-Apr-05
MURAT ARTU	TADİLAT	KONUT	26-Apr-05
SONER GÖKDEMİR	TADİLAT	IS HANI	26-Apr-05
SERCİHAN MADEN	BASİT TADİLAT	DÜKKAN+KONUT	27-Apr-05
MURAT ARTU	BASİT TADİLAT	KONUT	28-Apr-05
MUSTAFA YÜCESAN	BASİT TADİLAT	DÜKKAN+KONUT	28-Apr-05
TANER DEMİRDAĞ	KAPSAMLI TADİLAT	KONUT	3-May-05
MÜJDAT KADRİ ATABAŞ	BASİT TADİLAT	SHOWROOM	5-May-05
AHMET HALİS TURGAY	TADİLAT	BURO	6-May-05
MÜKREMİN MUNGAN	KAPSAMLI TADİLAT	KONUT	6-May-05
MÜKREMİN MUNGAN	KAPSAMLI TADİLAT	KONUT	6-May-05
MÜKREMİN MUNGAN	KAPSAMLI TADİLAT	KONUT	6-May-05
İHSAN SİNAN ÇETİNTAŞ	ORTA TADİLAT	KONUT	9-May-05
GÜROL AYDIN	BASİT TADİLAT	KONUT	21-May-05
İSMET BAYAR	BASİT TADİLAT	KONUT	25-May-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-May-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-May-05

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
KEMAL MÜKREMİN BARUT	KÜÇÜK TADİLAT	OTEL	27-May-05
BURHAN ÖZÇELİK	BASİT TADİLAT	KONUT	30-May-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	1-Jun-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	1-Jun-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	1-Jun-05
FATMA CEBECİ	KAPSAMLI TADİLAT	DÜKKAN+KONUT	1-Jun-05
HACER AYRANCIOĞLU YETİŞ	BASİT TADİLAT	KONUT	1-Jun-05
HACER AYRANCIOĞLU YETİŞ	BASİT TADİLAT	IS MERK.	1-Jun-05
HÜDAVERDİ GÖKÇEN	KAPSAMLI TADİLAT	KONUT	1-Jun-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	3-Jun-05
YİĞİT GÜLÖKSÜZ	BASİT TADİLAT	KONUT	3-Jun-05
FAİK AHMET ŞENEL	BASİT TADİLAT	DÜKKAN+KONUT	6-Jun-05
SEVİM NOYAN	BASİT TADİLAT	KONUT	7-Jun-05
MUZAFFER IŞIK	KAPSAMLI TADİLAT	İŞYERİ	9-Jun-05
RASİM ÖZVEREN	BASİT TADİLAT	KONUT	14-Jun-05
ORHAN GÖNÜLAL	BASİT TADİLAT	KONUT	16-Jun-05
YENER GÜRAN	BASİT TADİLAT	LOKANTA	16-Jun-05
YENER GÜRAN	BASİT TADİLAT	KONUT	16-Jun-05
HATİCE GÜL GÜVEN	KAPSAMLI TADİLAT	DÜKKAN+KONUT	17-Jun-05
MEHMET GÜNER	KAPSAMLI TADİLAT	KONUT	17-Jun-05
CİHANGİR ÖZYER	KAPSAMLI TADİLAT	DÜKKAN+KONUT	20-Jun-05
ESER ÖNAL	BASİT TADİLAT	DÜKKAN+KONUT	4-Jul-05
DANYAL TEVFİK ÇİPER	BASİT TADİLAT	DÜKKAN+KONUT	6-Jul-05
FATMA CEBECİ	BASİT TADİLAT	APARTMAN	6-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	18-Jul-05
MELTEM MIZRAK	KAPSAMLI TADİLAT	LOKANTA	21-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Jul-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	27-Jul-05
ADNAN CEYHUN YAVUZ	ORTA TADİLAT	KONUT	29-Jul-05
TEOMAN TANJU ZENCİRCİ	BASİT TADİLAT	DÜKKAN+KONUT	2-Aug-05
TEOMAN TANJU ZENCİRCİ	BASİT TADİLAT	DÜKKAN+KONUT	2-Aug-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	3-Aug-05
NAMİ HATIRLI	TADİLAT	KONUT	4-Aug-05
BÜLENT BİROĞLU	ORTA TADİLAT	OTEL	9-Aug-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Aug-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	11-Aug-05
AHMET AKIN	ORTA TADİLAT	KONUT	12-Aug-05
AHMET FUAT ÖZKOÇAK	TADİLAT	ISYERI+KONUT	16-Aug-05
ARZU BAŞAL	TADİLAT	DÜKKAN+KONUT	19-Aug-05
HAKAN BÜLBÜL	BASİT TADİLAT	DÜKKAN+KONUT	23-Aug-05

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
YÜKSEL BEŞBAŞ	ORTA TADİLAT	LOKANTA	23-Aug-05
YÜKSEL BEŞBAŞ	ORTA TADİLAT	KONUT	23-Aug-05
YÜKSEL BEŞBAŞ	ORTA TADİLAT	KONUT	23-Aug-05
YÜKSEL BEŞBAŞ	ORTA TADİLAT	KONUT	23-Aug-05
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	KONUT	24-Aug-05
HAKAN BÜLBÜL	ORTA TADİLAT	KONUT	26-Aug-05
ÖNDER ÇOLAK	ORTA TADİLAT	KONUT	26-Aug-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	29-Aug-05
CANAN KAÇAR	TADİLAT	KONUT	29-Aug-05
MUZAFFER IŞIK	TADİLAT	KONUT	31-Aug-05
TURAN TEKİN	KAPSAMLI TADİLAT	DÜKKAN+KONUT	01-Sep-05
NAMİ HATIRLI	BASİT TADİLAT	KONUT	05-Sep-05
TEOMAN TANJU ZENCİRCİ	BASİT TADİLAT	KONUT	05-Sep-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	06-Sep-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	06-Sep-05
ÖMER FARUK SUMMAK	ORTA TADİLAT	KONUT	08-Sep-05
HALE EREN BAŞAL	ORTA TADİLAT	IS MERK.	09-Sep-05
İHSAN BİGE	BASİT TADİLAT	DÜKKAN+KONUT	13-Sep-05
MUZAFFER IŞIK	TADİLAT	KONUT	14-Sep-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	16-Sep-05
DÜRRİYE MİNE KARATAŞ	BASİT TADİLAT	KONUT	22-Sep-05
	ORTA TADİLAT	KONUT	22-Sep-05
AHMET SİNAN KINIKOĞLU	TADİLAT		26-Sep-05
AHMET SİNAN KINIKOĞLU	TADİLAT		26-Sep-05
AHMET SİNAN KINIKOĞLU	TADİLAT		26-Sep-05
AHMET SİNAN KINIKOĞLU	TADİLAT		26-Sep-05
ÜNAL KARA	BASİT TADİLAT		29-Sep-05
TURAN TEKİN	BASİT TADİLAT	KONUT	04-Oct-05
HACI BEKİR ÜNÜVAR	BASİT TADİLAT		04-Oct-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	06-Oct-05
SÜLEYMAN ÇETİNTAŞ	ORTA TADİLAT	KONUT	06-Oct-05
ALİ TEPE	BASİT TADİLAT	KONUT	06-Oct-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Oct-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Oct-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Oct-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Oct-05
CANAN KAÇAR	BASİT TADİLAT	KONUT	10-Oct-05
MİTHAT DEMİRCİ	BASİT TADİLAT	KONUT	12-Oct-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	20-Oct-05
AZİZE MANAP	BASİT TADİLAT	KONUT	20-Oct-05
TURAN TEKİN	BASİT TADİLAT	KONUT	25-Oct-05
MUAMMER KOÇ	TADİLAT	KONUT	08-Nov-05
HİKMET ÇENGEL	BASİT TADİLAT	İŞ MERKEZİ	11-Nov-05

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	11-Nov-05
TURAN TEKİN	TADİLAT	TİCARİ VE SANAİ	14-Nov-05
HALİL FAZLIOĞLU	TADİLAT	KONUT	14-Nov-05
HALİL FAZLIOĞLU	BASİT TADİLAT	KONUT	14-Nov-05
ÖZGÜR TOP	ORTA TADİLAT	IS MERK.	16-Nov-05
HAKAN BÜLBÜL	TADİLAT	KONUT	17-Nov-05
HAKAN BÜLBÜL	BASİT TADİLAT	KONUT	17-Nov-05
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	İŞYERİ	18-Nov-05
AYŞE ERGÜL	BASİT TADİLAT		21-Nov-05
ALİ TEPE	BASİT TADİLAT	DÜKKAN+KONUT	22-Nov-05
TÜMAY KORUCUOĞLU	BASİT TADİLAT	KONUT	23-Nov-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	23-Nov-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	23-Nov-05
MEHMET KİBAR	TADİLAT	KONUT	23-Nov-05
MELTEM MIZRAK	TADİLAT	DUKKAN	23-Nov-05
ALİ OSMAN ÖZTÜRK	TADİLAT	KONUT	01-Dec-05
SÜLEYMAN ÇETİNTAŞ	ORTA TADİLAT	KONUT	01-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	02-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	02-Dec-05
ÖNDER ÇOLAK	TADİLAT	KONUT	05-Dec-05
İLKNUR ÇOPUR ÇAĞLAR	ORTA TADİLAT	APARTMAN	09-Dec-05
İLYAS DOĞAN	TADİLAT	KONUT	12-Dec-05
ARZU BAŞAL	TADİLAT	KONUT	13-Dec-05
HATİCE GÜL GÜVEN	ORTA TADİLAT	KONUT	13-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	13-Dec-05
SEVİM NOYAN	BASİT TADİLAT	KONUT	13-Dec-05
ESER ÖNAL	BASİT TADİLAT	KONUT	14-Dec-05
ÖNDER ÇOLAK	BASİT TADİLAT	KONUT	15-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	15-Dec-05
BURHAN ÖZÇELİK	ORTA TADİLAT	K.SAN. SIT.	19-Dec-05
HATİCE GÜL GÜVEN	ORTA TADİLAT	KONUT	20-Dec-05
ALPER AYLAN	ORTA TADİLAT	KONUT	20-Dec-05
ERHAN KORKMAZ	TADİLAT	KONUT	20-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	22-Dec-05
CİHANGİR ÖZYER	BASİT TADİLAT	KONUT	26-Dec-05
RÜSTEM CANTÜRK	BASİT TADİLAT	DÜKKAN+KONUT	26-Dec-05
RÜSTEM CANTÜRK	BASİT TADİLAT	DÜKKAN+KONUT	26-Dec-05
MİTHAT AKMAN	BASİT TADİLAT	DÜKKAN+KONUT	28-Dec-05
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	30-Dec-05
ÖMER FARUK SUMMAK	TADİLAT	KONUT	05-Jan-06
ERHAN KORKMAZ	BASİT TADİLAT	DÜKKAN+KONUT	06-Jan-06
BEKİR CİNCİOĞLU	BASİT TADİLAT	DÜKKAN+KONUT	16-Jan-06

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	DUKKAN	18-Jan-06
CİHANGİR ÖZYER	BASİT TADİLAT	KONUT	26-Jan-06
TEOMAN TANJU ZENCİRCİ	BASİT TADİLAT	KONUT	26-Jan-06
HACI BEKİR ÜNÜVAR	TADİLAT	IMALATHANE	27-Jan-06
MUAMMER KOÇ	BASİT TADİLAT	KONUT	27-Jan-06
MURAT ÇAĞLAYAN BUDAK	TADİLAT	KONUT	31-Jan-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Feb-06
TURGUT YURT	BASİT TADİLAT	IS MERK.	02-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	07-Feb-06
AHMET SİNAN KINIKOĞLU	BASİT TADİLAT	İŞYERİ	09-Feb-06
MAHMUT NEDİM DİKMEN	BASİT TADİLAT	KÜLTÜR MERK.	09-Feb-06
YÜKSEL ODABAŞI	BASİT TADİLAT	DÜKKAN+KONUT	10-Feb-06
AHMET AKIN	ORTA TADİLAT	KONUT	10-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT		14-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	14-Feb-06
SÜLEYMAN ÇETİNTAŞ	TADİLAT	ISYERI+KONUT	14-Feb-06
İSMET BAYAR	TADİLAT	KONUT	15-Feb-06
VELİ AKTÜRK	TADİLAT	KONUT	17-Feb-06
H.ALİ ULUSOY	ORTA TADİLAT	APARTMAN	20-Feb-06
H.ALİ ULUSOY	ORTA TADİLAT	APARTMAN	20-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	24-Feb-06
FATİH AÇIKALIN	TADİLAT	KONUT	27-Feb-06
ÜNAL AKPINAR	KAPSAMLI TADİLAT	SAĞLIK VE SOS. HİZ.	28-Feb-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	28-Feb-06
ŞÜKRÜ DİKİCİ	TADİLAT	KONUT	01-Mar-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Mar-06
AYŞE BOZYEL	BASİT TADİLAT	DÜKKAN+KONUT	03-Mar-06
HACI MEHMET TEZEL	BASİT TADİLAT	KONUT	04-Mar-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT		04-Mar-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	07-Mar-06
ÜNAL AKPINAR	KAPSAMLI TADİLAT	SAĞLIK VE SOS. HİZ.	09-Mar-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	23-Mar-06
CİHANGİR ÖZYER	KAPSAMLI TADİLAT	DÜKKAN+KONUT	04-Apr-06
ALİ RAGIP BULUÇ	BASİT TADİLAT	IS MERK.	05-Apr-06
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	İŞYERİ	07-Apr-06
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	BENZIN ISTASYONU	07-Apr-06
HACI BEKİR ÜNÜVAR	BASİT TADİLAT	BURO	07-Apr-06
	ORTA TADİLAT	KONUT	10-Apr-06
MURAT ÇAĞLAYAN BUDAK	BASİT TADİLAT	KONUT	10-Apr-06
MUZAFFER IŞIK	ORTA TADİLAT	KONUT	10-Apr-06

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
MEHMET GÜNER	ORTA TADİLAT	FABRİKA	10-Apr-06
ERDAL ALTUN	ORTA TADİLAT	BENZIN ISTASYONU	10-Apr-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	12-Apr-06
AYŞE ERGÜL	BASİT TADİLAT	İŞ VE TİCARET MERKEZ	13-Apr-06
ÖZGÜR YAKIN	ORTA TADİLAT	K.SAN. SIT.	13-Apr-06
HALİL FAZLIOĞLU	BASİT TADİLAT	DÜKKAN+KONUT	13-Apr-06
ÖZKAN ÖZGÜR	TADİLAT	DUKKAN	20-Apr-06
MUZAFFER IŞIK	ORTA TADİLAT	DÜKKAN+KONUT	25-Apr-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	26-Apr-06
OSMAN SADIKOĞLU	BASİT TADİLAT	KONUT	28-Apr-06
	TADİLAT	KONUT	28-Apr-06
ERCİHAN KORKMAZ	TADİLAT	KONUT	03-May-06
HAKAN BÜLBÜL	TADİLAT	KONUT	05-May-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	08-May-06
MİTHAT AKMAN	BASİT TADİLAT	DÜKKAN+KONUT	12-May-06
HAKAN BÜLBÜL	ORTA TADİLAT	MAĞAZA	17-May-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	17-May-06
SÜLEYMAN ÇETİNTAŞ	BASİT TADİLAT	KONUT	24-May-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	24-May-06
DİLEK ALKA AYDEMİR	ORTA TADİLAT	KONUT	26-May-06
AHMET FUAT ÖZKOÇAK	ORTA TADİLAT	KONUT	26-May-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	31-May-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	31-May-06
ERCÜMENT YAĞMUR	BASİT TADİLAT	KONUT	31-May-06
ŞÜKRÜ DİKİCİ	BASİT TADİLAT	KONUT	01-Jun-06
SONER GÖKDEMİR	ORTA TADİLAT	KONUT	06-Jun-06
MUSTAFA ÜMİT KALELİOĞLU	ORTA TADİLAT	KONUT	07-Jun-06
ALİ OSMAN ÖZTÜRK	İLAVE + TADİLAT	İŞ MERKEZİ	13-Jun-06
METİN BOZBOĞA	ORTA TADİLAT	KONUT	14-Jun-06
SEFA GÖRGÜN	İLAVE + TADİLAT	BURO	16-Jun-06
MUZAFFER IŞIK	ORTA TADİLAT	KONUT	19-Jun-06
MUZAFFER IŞIK	ORTA TADİLAT	İŞ VE TİCARET MERKEZİ	19-Jun-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	20-Jun-06
GÜNERİ IRMAK	ORTA TADİLAT	KONUT	21-Jun-06
GÜNERİ IRMAK	ORTA TADİLAT	KONUT	21-Jun-06
DİLEK ALKA AYDEMİR	ORTA TADİLAT	DÜKKAN+KONUT	22-Jun-06
TURAN TEKİN	BASİT TADİLAT	KONUT	22-Jun-06
TURAN TEKİN	ORTA TADİLAT	KONUT	22-Jun-06
SALİH KOÇAK	ORTA TADİLAT	KONUT	27-Jun-06
YENER GÜRAN	BASİT TADİLAT	KONUT	29-Jun-06
HALİME ÖZSÜT ŞENOL	ORTA TADİLAT	KONUT	29-Jun-06

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	30-Jun-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	30-Jun-06
TURAN TEKİN	ORTA TADİLAT	DÜKKAN+KONUT	30-Jun-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
MEHMET HİKMET BOZKURT	ORTA TADİLAT	KONUT	06-Jul-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	06-Jul-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	07-Jul-06
ALİ OSMAN ÖZTÜRK	ORTA TADİLAT	BURO+MAĞAZA	10-Jul-06
HASAN KILIÇ	ORTA TADİLAT	KONUT	10-Jul-06
CELAL ÇAMLIBEL	BASİT TADİLAT	İMALATHANE	11-Jul-06
ŞERİFE MERİÇ	BASİT TADİLAT	KONUT	11-Jul-06
B.HALDUN ERDOĞAN	BASİT TADİLAT	BENZİN İSTASYONU	12-Jul-06
ERCÜMENT YAĞMUR	BASİT TADİLAT	DÜKKAN+KONUT	14-Jul-06
MUZAFFER IŞIK	İLAVE + TADİLAT	İŞYERİ	20-Jul-06
MUZAFFER IŞIK	İLAVE + TADİLAT	İŞYERİ	20-Jul-06
TEOMAN TANJU ZENCİRCİ	İLAVE + TADİLAT	KONUT	21-Jul-06
MUZAFFER IŞIK	İLAVE + TADİLAT	KONUT	21-Jul-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	24-Jul-06
İHSAN BİGE	İLAVE + TADİLAT	BÜRO	26-Jul-06
HASAN ÇEVİK	İLAVE + TADİLAT	KONUT	27-Jul-06
ÖMER FARUK SUMMAK	BASİT TADİLAT	DÜKKAN+KONUT	31-Jul-06
REFİK ERDOĞAN	BASİT TADİLAT	BENZİN İSTASYONU	31-Jul-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Aug-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	01-Aug-06
BOZKURT GÜRSOYTRAK	BASİT TADİLAT	KONUT	02-Aug-06
HALİL FAZLIOĞLU	BASİT TADİLAT	KONUT+DÜKKAN	03-Aug-06
HİKMET ÇENGEL	ORTA TADİLAT	DÜKKAN+KONUT	03-Aug-06
HÜSNÜ CEYHAN	BASİT TADİLAT	OTEL	07-Aug-06
ESER ÖNAL	TADİLAT	KONUT	09-Aug-06
FAİK AHMET ŞENEL	İLAVE + TADİLAT	KONUT	10-Aug-06
HASAN AKYÜZ	İLAVE + TADİLAT	KONUT	11-Aug-06
METİN BOZBOĞA	İLAVE + TADİLAT	DÜKKAN+KONUT	11-Aug-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	16-Aug-06
HAKAN BÜLBÜL	İLAVE + TADİLAT	KONUT	16-Aug-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	16-Aug-06
HAKAN BÜLBÜL	ORTA TADİLAT	DÜKKAN+KONUT	17-Aug-06
GÜRKAN DEMİRCİ	BASİT TADİLAT	KONUT	18-Aug-06
TÜLİN ÇETİN	İLAVE + TADİLAT	KONUT	22-Aug-06

Table B.7: (continued).

NAME SURNAME	PROJECT TYPE	PROJECT FIELD	PROJECT DATE
MURAT ARTU	İLAVE + TADİLAT	KONUT	23-Aug-06
HALİL OĞUZ ARIK	İLAVE + TADİLAT	KONUT	24-Aug-06
BOZKURT GÜRSOYTRAK	TADİLAT	BURO	25-Aug-06
AHMET FUAT ÖZKOÇAK	İLAVE + TADİLAT	KONUT	29-Aug-06
SERCİHAN MADEN	İLAVE + TADİLAT	DÜKKAN+KONUT	01-Sep-06
SERCİHAN MADEN	ORTA TADİLAT	DÜKKAN+KONUT	01-Sep-06
BÜLENT BİROĞLU	İLAVE + TADİLAT	OTEL	04-Sep-06
	ORTA TADİLAT	ALIŞVERİŞ KOMPLEKSİ	07-Sep-06
ESER ÖNAL	İLAVE + TADİLAT	DÜKKAN+KONUT	08-Sep-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	19-Sep-06
ÖZLEN ÇAĞIL	İLAVE + TADİLAT	DÜKKAN+KONUT	21-Sep-06
AZİZ SERDAR CEYHAN	KAPSAMLI TADİLAT	KONUT	22-Sep-06
AHMET NECATİ KÜÇÜKKÖMÜRLER	TADİLAT	DÜKKAN+KONUT	29-Sep-06
KAAN ÖZER	KAPSAMLI TADİLAT	BURO	05-Oct-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	09-Oct-06
HAKAN BÜLBÜL	İLAVE + TADİLAT	KONUT	12-Oct-06
ERCÜMENT YAĞMUR	İLAVE + TADİLAT	KONUT	13-Oct-06
AHMET HALİS TURGAY	BASİT TADİLAT	KONUT	16-Oct-06
ALİ TEPE	İLAVE + TADİLAT	KONUT	18-Oct-06
HİKMET ÇENGEL	BASİT TADİLAT	DÜKKAN+KONUT	19-Oct-06
	ORTA TADİLAT	KONUT	01-Nov-06
ŞAKİR MERAKİ	İLAVE + TADİLAT	KRES	02-Nov-06
HALİL FAZLIOĞLU	TADİLAT	KONUT	02-Nov-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	03-Nov-06
HALİL FAZLIOĞLU	İLAVE + TADİLAT	DÜKKAN+KONUT	07-Nov-06
HACI CANATAN	BASİT TADİLAT	KONUT	07-Nov-06
FATMA CEBECİ	KAPSAMLI TADİLAT	APART OTEL	13-Nov-06
AYDOĞAN ÜNSÜN	BASİT TADİLAT	KONUT	13-Nov-06
ÖZLEN ÇAĞIL	TADİLAT	DÜKKAN+KONUT	15-Nov-06
TÜLAY ASLAN	ORTA TADİLAT	İŞYERİ	15-Nov-06
SAİT OĞUZHAN ÖZTURAN	İLAVE + TADİLAT	KONUT	20-Nov-06
İSA PARLAK	ORTA TADİLAT	KONUT	22-Nov-06
MEMET YILMAZ HELVACIOĞLU	BASİT TADİLAT	APARTMAN	28-Nov-06
CİHANGİR ÖZYER	ORTA TADİLAT	DÜKKAN+KONUT	28-Nov-06
İSMET BAYAR	BASİT TADİLAT	KONUT	29-Nov-06
NURİ OSMAN YURDAKUL	İLAVE + TADİLAT	İŞYERİ	30-Nov-06
GÜRKAN DEMİRCİ	KAPSAMLI TADİLAT	DÜKKAN+KONUT	30-Nov-06
İSMET BAYAR	BASİT TADİLAT	KONUT	30-Nov-06
ALİ TEPE	BASİT TADİLAT	KONUT	07-Dec-06
HAYRİYE KORHAN	BASİT TADİLAT	İŞMERKEZİ	07-Dec-06
ALTAN ERSOY	ORTA TADİLAT	OTEL	08-Dec-06
BOZKURT GÜRSOYTRAK	ORTA TADİLAT	SHOWROOM;BURO; LOKANTA	12-Dec-06

Table B. 8: Total bill of quantities of three case studies.
(Source: The technical departments of three hotels).

Table B.8. 1: Bill of quantities of Hotel A.

POZ	AÇIKLAMA	BİRİM	TOPLAM
A.			
A.1.	**ODA SÖKÜM İŞLERİ**		
A.1.1	ODA GİRİŞ KAPI VE KASA SÖKÜMÜ	adet	**352,00**
A.1.2	CONNECTING KAPI VE KASA SÖKÜMÜ	adet	**16,00**
A.1.3	SIUTE ARA KAPI VE KASA SÖKÜMÜ	adet	**16,00**
A.1.4	GARDROP SÖKÜMÜ	adet	**-**
A.1.5	YATAK BAŞI SÖKÜMÜ	adet	**416,00**
A.1.6	KORNİŞ PERDE KAFESİ PERDELİK SÖKÜMÜ	adet	**336,00**
A.1.7	SÜPÜRGELİK SÖKÜMÜ	mt	**6.139,20**
A.1.8	HALI 0 KEÇE SÖKÜMÜ	m2	**7.272,00**
A.1.9	TAVAN AHŞAP ÇITA SÖKÜMÜ	mt	**6.753,60**
A.1.10	AHŞAP ASMA TAVAN SÖKÜMÜ	m2	**-**
A.1.11	TUĞLA DUVAR YIKILMASI	m2	**-**
A.1.12	DUVAR KAĞIDI SÖKÜLMESİ	m2	**13.651,20**
A.2.	**ODA İMALATLAR**		
A.2.1.	ŞAP YAPILMASI	m2	**2.992,00**
A.2.2.	SELF0LEVELLING YAPILMASI	m2	**7.580,32**
A.2.3.	FEB0CLEAR SÜRÜLMESİ	m2	**7.580,32**
A.2.4.	TAVAN ALÇI SIVA YAPILMASI	m2	**7.278,56**
A.2.5.	ALÇIPAN ASMATAVAN İMALATI	m2	**1.088,00**
A.2.6.	TAVAN SATEN SIVA YAPILMASI	m2	**7.182,56**
A.2.7.	ALIN ALÇIPAN İMALATI	m2	**121,12**
A.2.8.	ALÇIPAN PELMET İMALATI	m2	**2.652,96**
A.2.9.	HAZIR KARTONPİYER VE MONTAJI	mt	**5.827,68**
A.2.10.	TAVAN BOYA YAPILMASI	m2	**8.006,24**
A.2.11.	DUVAR ALÇI SIVA YAPILMASI	m2	**17.641,92**
A.2.12.	DUVARKAĞIDI ÖNCESİ MACUN0SATEN0ASTAR YAPILMASI	m2	**17.005,76**
A.2.13.	DUVARKAĞIDI KAPLAMA (MALZEME HARİÇ)	m2	**15.506,08**
A.2.14.	DUVAR BOYA YAPILMASI	m2	**-**
A.2.15.	MENFEZ İMALATI VE MONTAJI (LİNEER)	ad	**336,00**
A.2.16.	TUĞLA DUVAR ÖRME İŞİ	m2	**-**
A.2.17.	İKİ KAT ALÇIPAN DUVAR YAPILMASI	m2	**-**
A.2.18	ODA GİRİŞ KAPI SAÇ KASA İMALAT0MONTAJ	ad	**352,00**
A.2.19.	BANYO KAPI SAÇ KASA İMALAT0MONTAJ	ad	**336,00**
A.2.20.	CONNECTING KAPI SAÇ KASA İMALAT0MONTAJ	ad	**16,00**
A.2.21.	SUIT ARA KAPI SAÇ KASA İMALAT0MONTAJ	ad	**16,00**
A.2.22.	SAÇ KAPI KASA BOYA YAPILMASI	ad	**800,00**

Table B.8.1: (continued).

POZ	AÇIKLAMA	BİRİM	TOPLAM
B.			
B.1.	**BANYO SÖKÜM İŞLERİ**		
B.1.1	BANYO KAPI VE KASA SÖKÜMÜ	ad	**-**
B.1.2.	BANYO AYNA ÇERÇEVE MDF ARKALIK IŞIKLIK SÖKÜMÜ	ad	**336,00**
B.1.3.	ALÇIPAN DUVAR YIKIM İŞLERİ	m2	**-**
B.1.4.	TUĞLA DUVAR YIKIM İŞİ	m2	**-**
B.1.5.	DUVAR KAĞIDI SÖKÜMÜ	m2	**1.656,64**
B.1.6.	BANYO ALÇI ASMA TAVAN SÖKÜMÜ	m2	**105,92**
B.1.7.	KÜVET SÖKÜMÜ	ad	**320,00**
B.1.8.	LAVABO SÖKÜMÜ	ad	**336,00**
B.1.9.	KLOZET SÖKÜMÜ	ad	**-**
B.1.10.	BANYO PERDE SÖKÜMÜ	ad	**320,00**
B.1.11.	LAVABO TEZGAH SÖKÜMÜ	ad	**336,00**
B.1.12.	ANKASTRE BANYO BATARYASI SÖKÜMÜ	ad	**320,00**
B.1.13.	LAVABO BATARYA VE ARAMUSLUK SÖKÜMÜ	ad	**336,00**
B.1.14.	TAHARET MUSLUĞU SÖKÜMÜ	ad	**336,00**
B.1.15.	MAKYAJ AYNASI SÖKÜMÜ	ad	**320,00**
B.1.16.	SAÇ KURUTMA MAKİNASI SÖKÜMÜ	ad	**-**
B.1.17.	HAVLU ÇUBUĞU SÖKÜMÜ	ad	**336,00**
B.1.18.	TUVALET KAĞITLIĞI SÖKÜMÜ	ad	**672,00**
B.1.19	HAVLU RAFI SÖKÜMÜ	ad	**320,00**
B.2.	**BANYO İMALATLAR**		
B.2.1	GRANİT TEZGAH İMALAT0MONTAJ (BALTIC BROWN)	ad	**-**
B.2.2	GRANİT TEZGAH ALTI KARKAS VE PROFİL	ad	**336,00**
B.2.3	MERMER DERZ ARASI DOLGU0TADİLAT	oda	**-**
B.2.4	MEVCUT BANYO DÖŞEME MERMER CİLA	m2	**-**
B.2.5	MEVCUT BANYO DUVAR MERMER CİLA	m2	**-**
B.2.6	BANYO KAPI GRANİT EŞİK İMALAT0MONTAJ	ad	**-**
B.2.7	ALÇIPAN ASMATAVAN İMALATI	m2	**1.424,00**
B.2.8	TAVAN SATEN SIVA YAPILMASI	m2	**1.424,00**
B.2.9	TAVAN BOYA YAPILMASI	m2	**1.424,00**
B.2.10	DUVAR BOYA YAPILMASI	m2	**-**
B.2.11	DUVAR ALÇI SIVA YAPILMASI (KAZIMA0YOKLAMA DAHİL)	m2	**-**
B.2.12	DUVARKAĞIDI ÖNCESİ MACUN0SATEN0ASTAR YAPILMASI	m2	**-**
B.2.13	DUVARKAĞIDI KAPLAMA (MALZEME HARİÇ)	m2	**-**
B.2.14	ALÇIPAN MÜDAHALE KAPAĞI İMALAT VE MONTAJI	ad	**-**
B.2.15	İKİ KAT ALÇIPAN DUVAR ÖRME İŞİ	m2	**-**
B.2.16	TUĞLA DUVAR ÖRME İŞİ	m2	**217,60**
B.2.17	SİLİKON ÇEKİLMESİ (RENKLİ VEYA ŞEFFAF)	mt	**2.662,08**

Table B.8.1: (continued).

POZ	AÇIKLAMA	BİRİM	TOPLAM
B.2.18	KÜVET MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.19	LAVABO MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.20	KLOZET MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.21	BANYO PERDE MONTAJI (MALZEME HARİÇ)	ad	**336,00**
B.2.22	LAVABO TEZGAH MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.23	ANKASTRE BANYO BATARYASI MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.24	LAVABO BATARYA VE ARA MUSLUK MONTAJI (MALZ.HARİÇ)	ad	**-**
B.2.25	TAHARET MUSLUĞU MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.26	MAKYAJ AYNASI MONTAJI (MALZEME HARİÇ)	ad	**320,00**
B.2.27	SAÇ KURUTMA MAKİNASI MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.28	HAVLU ÇUBUĞU MONTAJI (MALZEME HARİÇ)	ad	**336,00**
B.2.29	TUVALET KAĞITLIĞI MONTAJI (MALZEME HARİÇ)	ad	**336,00**
B.2.30	YEDEK TUVALET KAĞITLIĞI MONTAJI (MALZEME HARİÇ)	ad	**336,00**
B.2.31	HAVLU RAFI MONTAJI (MALZEME HARİÇ)	ad	**320,00**
B.2.32	KAPI ARKASI ASKI MONTAJI (MALZEME HARİÇ)	ad	**-**
B.2.33	TUTAMAKLI SABUNLUK MONTAJI (MALZEME HARİÇ)	ad	**320,00**
B.2.34	ÇAMAŞIR İPİ MONTAJI (MALZEME HARİÇ)	ad	**-**
C.			
C.1.	**KORİDOR SÖKÜM İŞLERİ**		
C.1.1	ALÇIPAN ASMA TAVAN SÖKÜMÜ	m2	**-**
C.1.2	DUVAR AHŞAP PANEL SÖKÜMÜ	m2	**1.028,96**
C.1.3	DUVAR AYNA SÖKÜMÜ	m2	**363,20**
C.1.4	DUVAR KAĞIDI SÖKÜMÜ	m2	**3.420,16**
C.1.5	ŞAFT KAPAK SÖKÜMÜ	ad	**16,00**
C.1.6	SÜPÜRGELİK SÖKÜMÜ	mt	**1.953,28**
C.1.7	HALI KEÇE SÖKÜMÜ	m2	**-**
C.1.8	YANGIN MERDİVENİ KAPI VE KASA SÖKÜMÜ	ad	**48,00**
C.1.9	BUZ ODASI KAPI VE KASA SÖKÜMÜ	ad	**16,00**
C.1.10	ALÇIPAN DUVAR YIKIM İŞLERİ	m2	**148,64**
C.1.11	TUĞLA DUVAR YIKIM İŞLERİ	m2	**-**
C.1.12	SERVİS HOLÜ KAPI VE KASA SÖKÜMÜ	ad	**32,00**
C.1.13	SERVİS HOLÜ WC KLOZET SÖKÜMÜ	ad	**-**
C.1.14	SERVİS HOLÜ DUVAR DÖŞEME SERAMİK SÖKÜMÜ	m2	**2.784,32**

Table B.8.1: (continued).

POZ	AÇIKLAMA	BİRİM	TOPLAM
C.2.	**KORİDOR İMALATLAR**		
C.2.1	ŞAP YAPILMASI	m2	**-**
C.2.2	SELF0LEVELLING YAPILMASI	m2	**2.034,40**
C.2.3	FEB0CLEAR SÜRÜLMESİ	m2	**2.034,40**
C.2.4	DUVAR ALÇI SIVA YAPILMASI	m2	**5.139,68**
C.2.5	DUVARKAĞIDI ÖNCESİ MACUN0SATEN0ASTAR YAPILMASI	m2	**4.518,56**
C.2.6	DUVARKAĞIDI KAPLAMA (MALZEME HARİÇ)	m2	**4.534,56**
C.2.7	DUVAR SATEN SIVA YAPILMASI	m2	**-**
C.2.8	DUVAR BOYA YAPILMASI	m2	**-**
C.2.9	ALÇIPAN ASMATAVAN İMALATI	m2	**1.901,28**
C.2.10	TAVAN SATEN SIVA YAPILMASI	m2	**2.034,40**
C.2.11	TAVAN BOYA YAPILMASI	m2	**2.034,40**
C.2.12	SERVİS HOLÜ KAPISI METAL TEKMELİK VE MONTAJI	ad	**64,00**
C.2.13	YANGIN KAÇIŞ YÖNLENDİRME LEVHASI VE MONTAJI	ad	**48,00**
C.2.14	ASANSÖR YÖNLENDİRME LEVHASI VE MONTAJI	ad	**32,00**
C.2.15	SERVİS HOLÜ KAPI SAÇ KASA (İM+MONTAJ)	ad	**32,00**
C.2.16	YANGIN MERDİVEN KAPISI SAÇ KASA	ad	**48,00**
C.2.17	BUZ MAKİNA ODA KAPISI SAÇ KASA (İM+MO)	ad	**16,00**
C.2.18	SAÇ KAPI KASA BOYA YAPILMASI	ad	**96,00**
C.2.19	YANGIN MERDİVEB KAPISI İMALAT0MONTAJ	ad	**16,00**
C.2.20	SAÇ KAPI BOYA YAPILMASI	ad	**16,00**
C.2.21	YANGIN DOLABI İMALAT VE MONTAJI	ad	**32,00**
C.2.22	ŞAFT KAPAKLARI ALÇIPAN DARALTMA	ad	**-**
C.2.23	HAZIR KARTONPİYER VE MONTAJI	mt	**-**
C.2.24	TUĞLA DUVAR ÖRME İŞİ	m2	**-**
C.2.25	MENFEZ İMALATI VE MONTAJI	ad	**144,00**
C.2.26	ANEMOSTAD İMALATI VE MONTAJI	ad	**-**
C.2.27	SERVİS HOLÜ TAVAN SATEN SIVA	m2	**456,32**
C.2.28	SERVİS HOLÜ TAVAN BOYA YAPILMASI	m2	**456,32**
C.2.29	SERVİS HOLÜ DUVAR SERAMİK İMALATI	m2	**-**
C.2.30	SERVİS HOLÜ DÖŞEME SERAMİK İMALATI	m2	**-**
C.2.31	SERVİS HOLÜ DUVAR ALÇI SIVA YAPILMASI	m2	**1.252,48**
C.2.32	SERVİS HOLÜ+MİNİBAR DEPO DUVAR BOYA	m2	**1.252,48**
C.2.33	SERVİS HOLÜ+MİNİBAR DEPO DÖŞEME VİNİL KAPL. (LAYSAN)	m2	**-**
C.2.34	SERVİS HOLÜ WC KLOZET MONTAJI	ad	**-**
C.2.35	YANGIN MERDİVEN DUVAR ALÇI SIVA YAP.	m2	**1.457,12**
C.2.36	YANGIN MERDİVEN DUVAR BOYA	m2	**1.457,12**
C.2.37	YANGIN MERDİVEN TAVAN ALÇI SIVA	m2	**567,20**
C.2.38	YANGIN MERDİVEN TAVAN BOYA	m2	**567,20**
C.2.39	YANGIN MERDİVENİ KORKULUK ZIMPARA+MACUN+BOYA	mt	**403,20**

Table B.8. 2: Bill of quantities of Hotel B.

AÇIKLAMA	QUAN.	UNIT	TOTAL
QUEEN – MOBİLYA			
YATAK BAŞI KOMODİNİ	138	adet	276
YATAK BAŞI	138	adet	138
ÇALIŞMA MASASI	132	adet	132
SMART ÇALIŞMA MASASI	6	adet	6
SMART MASA ÜNİTESİ	6	adet	6
ORTA SEHPA	138	adet	138
TV-MINIBAR ÜNİTESİ	132	adet	132
TV-MINIBAR ÜNİTESİ	6	adet	6
ÇALIŞMA MASA SANDALYESİ	132	adet	132
KOLTUK	132	adet	264
KOLTUK	6	adet	6
OTTOMAN	6	adet	6
DEKORATİF AYNA	135	adet	135
DEKORATİF AYNA	3	adet	3
YATAK ÖRTÜ DİKİM	138	adet	138
BAZA DİKİM	138	adet	138
YATAK ÜSTÜ YASTIK DİKİM	138	adet	414
PERDE-TÜL-BLACKOUT DİKİM	138	set	138
BANYO PERDESİ DİKİM	138	set	138
PORTATİF BAVULLUK	138	adet	138
LAMP @ TV ARMOIRE	138	adet	0
QUEEN – İMALAT			
GİRİŞ KAPI KANADI	138	adet	138
BANYO KAPI KANADI	138	adet	138
SÖVE	138	adet	138
GARDROP	135	adet	135
GARDROP (KAYAR KAPAKLI)	3	adet	3
GARDROP İÇİ ÜNİTE	138	adet	138
AHŞAP SÜPÜRGELİK	138	mt	2511,6
PENCERE CEPHE (wd.pelmet and side panels)	138	m2	752,1
KAPI KASA FINISHING	138	adet	276
GİRİŞ TAVAN FINISHING	138	adet	138
YENİ PERDE PANELİ	138	adet	138
MEVCUT KARTONPİYE FINISHING	138	mt	2691
İLAVE KARTONPİYE	138	mt	717,6

Table B.8.2: (continued).

AÇIKLAMA	QUAN.	UNIT	TOTAL
TAVAN BOYASI	138	m2	3643,2
DUVAR KAĞIDI KAPLAMA	138	m2	7479,6
HALI VE ALT KEÇE DÖŞEME	138	m2	3312
HALI BAĞLANTI PROFİLİ	138	adet	276
BANYO LAVABO TEZGAHI	138	adet	138
AHŞAP AYNA ÇERÇEVESİ	138	adet	138
AYNA ARKASI HAZIRLAMA	138	m2	207
BANYO ZEMİN CİLASI	138	m2	386,4
MERMER DUVARLARIN TEMİZLİĞİ	138	MAKTU	138
TEZGAH ALTI SÜPÜRGELİK	138	ADET	138
DOĞRAMA YANI ALÇIPAN TAMİRATI	138	adet	138
BANYO SPOT KAPATMA	138	adet	138
ELEKTRİK İŞLERİ	138	MAKTU	138
TESİSAT İŞLERİ	138	MAKTU	138
ELLE ÇEKMELİ PERDE RAYI VE MONTAJI	138	SET	138
REMOVAL	138	MAKTU	138
QUEEN - TURSER İŞLERİ			
HALI	138	m2	4140
ALTKEÇE	138	m2	3450
YATAK BAŞI KUMAŞI	138	mt	138
PERDE KUMAŞI	138	mt	2484
TÜL KUMAŞI	138	mt	1656
BLACKOUT KUMAŞI	138	mt	1656
YATAK ÖRTÜSÜ KUMAŞI	138	mt	1104
BAZA - BİYE KUMAŞI	138	mt	621
SANDALYE KUMAŞI	132	mt	132
YASTIK KUMAŞI (bej kareli 2 adet)	138	mt	207
YASTIK KUMAŞI (lacivert kareli 1 adet)	138	mt	103,5
KOLTUK KUMAŞI (2 ADET)	132	mt	1848
KOLTUK + OTOMAN KUMAŞI	6	mt	51
KOLTUK YASTIK KUMAŞI	6	MT	3,6
DUŞ PERDESİ KUMAŞI	138	mt	552
SİLİNDİRİK MASA LAMBASI	138	adet	276
SİLİNDİRİK LAMBADER	138	adet	138
YATAK (160 cm)	138	adet	138
YATAKBAŞI RESİM + ÇERÇEVE	138	set	138
KASA	138	adet	138

Table B.8.2: (continued).

AÇIKLAMA	QUAN.	UNIT	TOTAL
SAÇ KURUTMA MAKİNASI	138	adet	138
TRAŞ AYNASI	138	adet	138
ÇALIŞMA MASA LAMBASI	138	adet	138
ODA DUVAR KAĞIDI	138	m2	5658
BANYO DUVAR KAĞIDI	138	m2	1794
LAVABO ARMATÜR	138	takım	138
ELEKTRİK PRİZ+ENERGY SAVER+VB.	138	MAKTU	138
DOWNLIGHT	138	adet	414
TWIN - MOBİLYA			
YATAK BAŞI KOMODİNİ	42	adet	42
YATAK BAŞI	42	adet	84
ÇALIŞMA MASASI	42	adet	42
ORTA SEHPA	42	adet	42
TV-MINIBAR ÜNİTESİ	42	adet	42
ÇALIŞMA MASA SANDALYESİ	42	adet	42
KOLTUK	42	adet	42
OTTOMAN	42	adet	42
DEKORATİF AYNA	42	adet	42
YATAK ÖRTÜ DİKİM	42	adet	84
BAZA DİKİM	42	adet	84
YATAK ÜSTÜ YASTIK DİKİM	42	adet	84
PERDE-TÜL-BLACKOUT DİKİM	42	SET	42
BANYO PERDESİ DİKİM	42	SET	42
PORTATİF BAVULLUK	42	adet	42
LAMP @ TV ARMOIRE	42	adet	0
TWIN - İMALAT			
GİRİŞ KAPI KANADI	42	adet	42
BANYO KAPI KANADI	42	adet	42
BAĞLANTI KAPI KANADI	8	adet	16
SÖVE	42	adet	42
GARDROP (nişsiz)	42	adet	42
GARDROP İÇİ ÜNİTE	42	adet	42
AHŞAP SÜPÜRGELİK	34	mt	618,8
AHŞAP SÜPÜRGELİK	8	mt	138
PENCERE CEPHE (wd.pelmet and side panels)	42	m2	229,2
KAPI KASA FINISHING	34	adet	68
KAPI KASA FINISHING	8	adet	24

Table B.8.2: (continued).

AÇIKLAMA	QUAN.	UNIT	TOTAL
GİRİŞ TAVAN FINISHING	42	adet	42
YENİ PERDE PANELİ	42	adet	42
MEVCUT KARTONPİYE FINISHING	42	mt	819
İLAVE KARTONPİYE	42	mt	218,4
TAVAN BOYASI	42	m2	1108,8
DUVAR KAĞIDI KAPLAMA	34	m2	1842,8
DUVAR KAĞIDI KAPLAMA	8	M2	420
HALI VE ALT KEÇE DÖŞEME	42	m2	1008
HALI BAĞLANTI PROFİLİ	34	adet	68
HALI BAĞLANTI PROFİLİ	8	adet	24
BANYO LAVABO TEZGAHI	42	adet	42
AHŞAP AYNA ÇERÇEVESİ	42	adet	42
AYNA ARKASI HAZIRLAMA	42	m2	63
BANYO ZEMİN CİLASI	42	m2	117,6
MERMER DUVARLARIN TEMİZLİĞİ	42	MAKTU	42
TEZGAH ALTI SÜPÜRGELİK	42	adet	42
DOĞRAMA YANI ALÇIPAN TAMİRATI	42	adet	42
BANYO SPOT KAPATMA	42	adet	42
ELEKTRİK İŞLERİ	42	MAKTU	42
TESİSAT İŞLERİ	42	MAKTU	42
ELLE ÇEKMELİ PERDE RAYI VE MONTAJI	42	SET	42
REMOVAL	42	MAKTU	42
TWIN - TURSER İŞLERİ			
HALI	42	m2	1260
ALTKEÇE	42	m2	1050
YATAK BAŞI KUMAŞI	42	mt	84
PERDE KUMAŞI	42	mt	756
TÜL KUMAŞI	42	mt	504
BLACKOUT KUMAŞI	42	mt	504
YATAK ÖRTÜSÜ KUMAŞI	42	mt	630
BAZA - BİYE KUMAŞI	42	mt	336
SANDALYE KUMAŞI	42	mt	42
YASTIK KUMAŞI (45754)	42	mt	126
YASTIK KUMAŞI (01157)	42	mt	25,2
KOLTUK + OTOMAN KUMAŞI	42	mt	357
KOLTUK YASTIK KUMAŞI	42	MT	25,2
DUŞ PERDESİ KUMAŞI	42	mt	168

Table B.8.2: (continued).

AÇIKLAMA	QUAN.	UNIT	TOTAL
SİLİNDİRİK MASA LAMBASI	42	adet	42
SİLİNDİRİK LAMBADER	42	adet	42
YATAK (100 cm)	42	adet	84
YATAKBAŞI RESİM + ÇERÇEVE	42	set	42
KASA	42	adet	42
SAÇ KURUTMA MAKİNASI	42	adet	42
TRAŞ AYNASI	42	adet	42
ÇALIŞMA MASA LAMBASI	42	adet	42
ODA DUVAR KAĞIDI	42	m2	1722
BANYO DUVAR KAĞIDI	42	m2	546
LAVABO ARMATÜR	42	takım	42
ELEKTRİK PRİZ+ENERGY SAVER+VB.	42	MAKTU	42
DOWNLIGHT	42	adet	126
HOTEL SUIT - MOBİLYA			
YATAK BAŞI KOMODİNİ	3	ADET	6
TV DOLABI @YATAK ODASI	3	ADET	3
YUVARLAK SEHPA @ YATAK ODASI	3	ADET	3
TV-ARMUAR @OTURMA ODASI	3	ADET	0
ÇALIŞMA MASASI	3	ADET	3
ÇALIŞMA MASA ÜNİTESİ	3	ADET	3
MERMER TABLALI KAHVE SEHPASI	3	ADET	3
KARE SEHPA @ OTURMA ODASI	3	ADET	3
YUVARLAK SEHPA @OTURMA ODASI	3	ADET	3
KOLTUK	3	ADET	3
OTTOMAN	3	ADET	3
BAVULLUK	3	ADET	3
SOFA	3	ADET	6
PORTATİF BAVULLUK	3	ADET	3
DEKORATİF AYNA	3	ADET	3
YATAK ÖRTÜ DİKİM	3	ADET	3
BAZA DİKİM	3	ADET	3
YATAK ÜSTÜ YASTIK DİKİM	3	ADET	9
PERDE-TÜL-BLACKOUT DİKİM	3	SET	6
ABAJUR @TV ARMUAR	3	ADET	3
HOTEL SUIT - İMALAT			
GİRİŞ KAPI KANADI	3	ADET	3
BANYO KAPI KANADI	3	ADET	6

Table B.8.2: (continued).

AÇIKLAMA	**QUAN.**	**UNIT**	**TOTAL**
BAĞLANTI KAPI KANADI	3	ADET	3
GARDROP	3	ADET	3
PENCERE CEPHESİ	3	m2	33
KUMAŞ-AHŞAP YATAKBAŞI	3	m2	36
DUVAR KAĞIDI UYGULAMA	3	m2	192,75
AHŞAP SÜPÜRGELİK	3	mt	78
MEVCUT KAPI KASA FINISHING	3	ADET	12
MEVCUT KARTONPİYE FINISHING	3	mt	51
TAVAN BOYASI	3	m2	172,5
ELEKTRİK İŞLERİ	3	MAKTU	3
TESİSAT İŞLERİ	3	MAKTU	3
YENİ PERDE PANELİ	3	ADET	6
ELLE ÇEKMELİ PERDE RAYI VE MONTAJI	3	SET	6
HALI VE ALT KEÇE DÖŞEME	3	m2	165
HALI BAĞLANTI PROFİLİ	3	ADET	12
KAPI İPTALİ VE YERİNİN KAPATILMASI	3	M2	6,99
GİRİŞ HOLU TAVANI YAPILMASI	3	M2	18
ODA İLAVE KARTONPİYE YAPILMASI	3	MT	66
ŞAP TAMİRİ VE SU İZOLASYONU YAPILMASI	3	M2	9
REMOVAL	3	MAKTU	3
HS BANYO - İMALAT			
MEVCUT BANYO DUVARLARI YIKIM	3	ADET	3
İLAVE BANYO DUVARI YAPIMI	3	m2	86,25
ALÇIPAN ASMA TAVAN	3	m2	21
ALÇI KARTONPİYE	3	mt	35,25
MERMER YER DÖŞEME (AMASYA)	3	m2	9,75
MERMER BORDÜR (SIVRIHISAR)	3	mt	45,75
MERMER DUVAR KAPLAMA (AMAS+SIVRI)	3	m2	54
MERMER BANT (GIALLO)	3	mt	31,5
MERMER SÜPÜRGELİK (SIVRIHİSAR)	3	mt	16,5
MARBLE BATH TUB SET (SIVRI)	3	ADET	3
MERMR SET @WC ARKASI(GIALLO)	3	ADET	3
MARBLE SET @SHOWER	3	ADET	3
MERMER DUŞ TAŞI	3	ADET	3
CAM DUŞ KAPISI	3	ADET	3
DUŞUN CAM YAN PANELİ	3	ADET	3
LAVABO TEZGAHI	3	ADET	3

Table B.8.2: (continued)

AÇIKLAMA	**QUAN.**	**UNIT**	**TOTAL**
LAVABO AYNASI	3	ADET	3
TAVAN BOYASI	3	m2	21
HS KÜÇÜK TUVALET - İMALAT			
MERMER YER DÖŞEME (AMASYA)	3	m2	7,5
MERMER DUVAR DÖŞEME (AMAS+SIVRI)	3	m2	28,5
MERMER BANT (GIALLO)	3	mt	15
MERMER SÜPÜRGELİK (SIVRIHİSAR)	3	mt	15
S-03 İLE AYNA NİŞİ (SIVRIHİSAR)	3	ADET	3
LAVABO TEZGAHI	3	ADET	3
LAVABO AYNASI	3	ADET	3
ALÇI KARTONPİYE	3	mt	21
TAVAN BOYASI	3	m2	9
YIKMA-KIRMA	3	MAKTU	3
WALLS	3	m2	27
CEILING	3	m2	9
HOTEL SUIT - TURSER İŞLERİ			
HALI	3	m2	180
ALTKEÇE	3	m2	150
YATAK BAŞI KUMAŞI	3	mt	12
PERDE KUMAŞI	3	mt	39
TÜL KUMAŞI	3	mt	72
BLACKOUT KUMAŞI	3	mt	72
YATAK ÖRTÜSÜ KUMAŞI	3	mt	36
BAZA KUMAŞI	3	mt	12
SANDALYE KUMAŞI	3	mt	3,6
YATAK ÜSTÜ YASTIK KUMAŞI	3	mt	6
YATAK ÜSTÜ YASTIK KUMAŞI	3	mt	3
BİYE KUMAŞI	3	mt	3
KANEPE KUMAŞI	3	mt	52,5
KANEPE YASTIK KUMAŞI (gold)	3	mt	6
KANEPE YASTIK KUMAŞI (laci)	3	mt	3
KOLTUK + OTOMAN KUMAŞI	3	mt	16,5
KOLTUK YASTIK KUMAŞI	3	mt	3
YATAK (200 cm)	3	adet	3
YATAKBAŞI RESİMLERİ	3		0
KASA	3	adet	3
SAÇ KURUTMA MAKİNASI	3	adet	3

Table B.8.2: (continued)

AÇIKLAMA	QUAN.	UNIT	TOTAL
TRAŞ AYNASI	3	adet	3
PANTALON PRESİ	3	adet	3
ÇALIŞMA MASA LAMBASI	3	adet	3
ABAJUR @ YATAK BAŞI	3	ADET	6
AYAKLI LAMBA	3	ADET	3
ABAJUR @KARE SEHPA	3	ADET	6
DUVAR APLİĞİ @ OTURMA ODASI	3	ADET	6
ODA DUVAR KAĞIDI	3	m2	210
LAVABO ARMATÜR	3	takım	3
ELEKTRİK PRİZ+ENERGY SAVER+VB.	3	maktuen	3
SEALED DOWNLIGHT	3	adet	9
KORİDOR - MOBİLYA			
KONSOL	11	ADET	0
SEHPA	11	ADET	0
KOLTUK	11	ADET	0
TORCHIERE	11	ADET	0
PERDE-TÜL DİKİM	11	SET	0
KORİDOR - İMALAT			
PERDE-TÜL DİKİM	11	SET	11
HALI VE ALT KEÇE DÖŞEME	11	M2	1210
PERDE RAYI VE MONTAJI	11	SET	11
DUVAR KAĞIDI KAPLAMA	11	M2	2090
MEVCUT SÜPÜRGELİK FINISHING	11	MT	935
MEVCUT KARTONPİYE FINISHING	11	MT	1595
TAVAN BOYASI	11	M2	1320
MEVCUT KAPI TAMİR-BOYAMA	11	ADET	55
AKSES KAPILARI FINISHING	11	ADET	22
AHŞAP LAMBRİ	11	M2	22
ELEKTRİK İŞLERİ	11	MAKTU	0
KORİDOR - TURSER İŞLERİ			
HALI	11	M2	1980
ALTKEÇE	11	M2	1188,88
KOLTUK KUMAŞI (2 KOLTUK)	11	MT	66
PERDE KUMAŞI	11	MT	176
TÜL KUMAŞI	11	MT	99
DUVAR KAĞIDI	11	M2	2520,804
ARTWORK	11		0
ACCESSORIES	11		0

Table B.8. 3: Bill of quantities of Hotel C.

	MILLENIUM HOTEL ANKARA ESTIMATED COST BREAKDOWN		
		TASKS	
	DESCRIPTION	UNIT	QTY
1	CIVIL WORKS		
A	DEMOLITION WORKS		
1A1	DEMOLITION OF BRICK WALL	M3	1250
1A2	DEMOLITION OF R/C	M3	35
1A3	REMOVAL OF SUSPENDED CEILINGS	M2	7100
1A4	SCRAPING OF EXISTING WALL PLASTER AND CERAMICS	M2	2680
1A5	DEMOLITION OF EXISTING FLOORING AND REMOVAL	M2	8900
1A6	REMOVAL OF DECORATIVE ELEMENTS IN LOWER FLOORS	M2	415
1A7	DEMOLITION OF PIPING AND MECHANICAL DUCTS	TON	350
1A8	DISMANTLING ALL ELECTRICAL SYSTEMS	MT	15000
1A9	TRANSPORTATION OF DISMANTLED AND DEMOLISHED MAT.	LS	
	DEMOLITION OF STEEL MEZZANINE FLOOR	TON	4.5
B	EARTH WORKS		
1B1	EXCAVATION (GENERAL)	M3	250
1B2	DITCH EXCAVATION	M3	1590
1B3	TOP SOIL EXCAVATION BY HAND	M3	50
1B4	REMOVAL OF EXCAVATED EARTH	M3	450
1B5	TOP SOIL REFILL	M3	1590
1B6	ASPHALT REPAIR	MT	20
C	INFRASTRUCTURE		
1C1	LEAN CONCRETE(300 KG/M3)	M3	250
1C2	READY MIX CONCRETE (B 225)	M3	500
1C3	LAYING GRAVEL ON BASE	M3	80
1C4	REINFORCEMENT STEEL	TON	5
1C5	BASEMENT WALLS WATER INSULATION(PVC JEOMEN BRANE 2 mm)	M2	1050
1C6	BASEMENT FLOOR WATER INSULATION	M2	770
1C7	Φ 15 PVC DRAINAGE INSTALLATION	MT	450
D	ROOFING		
1D1	LEVELLING CONCRETE	M2	1800
1D2	SELF LEVELLING SCREED	M2	2805
1D3	PVC BASED JEOMEMBERANE WATER INSULATION 2 mm		2805
1D4	ROOF HEAT INSULATION WITH EXTRUDED POLYSTYRENE	M2	2805

Table B.8.3: (continued)

	DESCRIPTION	UNIT	QTY
E	**FLOORING**		
1E1	LEVELLING CONCRETE	M2	1586
1E2	SELF LEVELLING SCREED	M2	9500
1E3	ANTIACID CERAMIC FLOORING WITH EPOXY GROUT	M2	770
1E4	CERAMIC FLOORING	M2	2805
1E5	PVC FOR MEDICAL AREAS AND PATIENT ROOMS	M2	100
1E6	PVC FLOORING FOR FLOOR SERVICE ROOMS (3 mm)	M2	980
1E7	HEAVY DUTY BOARD ROOM TYPE FIRE PROOF CARPET (80 wool/20 nylon) WITH FELT UNDERLAYER FOR SOUND INSULATION	M2	7656
1E8	1st QUALITY WALNUT FINISHED PARQUET FLOOR WITH VARNISH w	M2	1100
1E9	MECHANICAL POLISHING OF EXISTING MARBLE FLOORS	M2	800
1E10	BATHROOM DOOR THRESHOLD	MT	150
1E11	SOLID WALNUT GUESTROOM ENTRANCE DOOR TRESHOLD	MT	150
1E12	TERAZZO FLOOR IN STORAGE AREAS&MACHINE ROOMS	M2	1190
1E13	TEAK DECKING ON ROOF TERRACE	M2	190
1E14	NYLON CARPET	M2	300
1E15	CARPET TILE	M2	400
F	**SKIRTING**		
1F1	HARDWOOD(WALNUT) VENEERED OVER MDF VARNISHED SKIRTING	MT	5400
1F2	HARDWOOD SKIRTING (VARNİSHED)	MT	970
1F3	CERAMIC SKIRTING	**MT**	2100
1F4	SOFTWOOD SKIRTING (VARNISHED)	**MT**	450
G	**CEILING**		
1G1	CEILING PLASTERING	M2	1670
1G2	GYPSIUM SPACKLING	M2	11170
1G3	GYPSIUM BOARD(FIRE RESISTANT) SUSPENDED CEILING	M2	6050
1G4	METAL PLATE (HEAT CURED PAINTED) SUSPENDED CEILING		400
1G5	FIRE RESISTANT ACOUSTICAL GYPSIUM BOARD SUSPENDED CEILING	M2	2246
1G6	SATIN FINISH ACRYLIC PAINT (3 LAYERS)	M2	8596
H	**EXTERIOR WORKS**		
1H1	THE DISASSEMBLY OF THE TREE WHITE VERTICAL PRECAST TERRAZZO MEMBERS ON THE LOAD BEARING WALLS AND THE BLACK PRECAST TERRAZZO MEMBERS COVERING THE MAIN BEAM	M2	3050
1H2	THE MONTAGE OF NEW PRECAST FIBER REINFORCED CONCRETE ELEMENTS WITH INSULATION WITH AISI 304 STAINLESS STEEL MEMBERS OF MECHANICAL ANCHORAGE	M2	1400

Table B.8.3: (continued)

	DESCRIPTION	UNIT	QTY
1H3	THE MONTAGE OF NEW PRECAST FIBER REINFORCED CONCRETE BEAM COVERS WITH AISI 304 STAINLESS STEEL MEMBERS OF MECHANICAL ANCHORAGE	M3	1650
1H4	THE MAINTENANCE OF THE PRECAST TERRAZZO MEMBERS ON THE REAR FACADE	M2	1510
1H5	SCAFFOLDING	M2	5907
1H6	SATIN FINISHED STAINLESS STEEL CANOPY WITH TOUGHED GLASS TOP COVER	LS	1
1H7	DISMANTLING AND REINSTALLING ALUMINIUM SHADING PANELS	LS	1
1H8	EXTRIOR HANGING SCAFFOLDING	EA	2
1H9	NEW RAMP & CANOPY CONSTRUCTION	EA	1
1H10	SERVICE ENTRANCE - GOOD RECEIVING AREA CANOPY	EA	1
I	**STAIRCASES**		
1I1	STEEL FIRE STAIRS	TON	4.5
1I2	REPAIR OF EXISTING HAND RAILS AND STUDS	LS	
1I3	SATIN (BRUSHED) FINISHED STAINLESS STEEL HANDRAIL WITH SECURIT GLASS PANELS	MT	55
1I4	STAIR IN ROOF FROM STEEL PROFILES	TON	2.5
1I5	GRANITE SATIR THERADS	MT	35
1I6	COLORED GLASS PROECTIVE BALUSTRADE	M2	20
J	**RAINWATER DRAINAGE WORKS**		
1J1	PVC RAINWATER DRAINAGE(VERTICAL)	MT	480
1J2	Φ 40 REINFORCED PVC RAIN WATER DRAIN PIPE	MT	122
1J3	MANHOLE WITH CAST IRON COVERTOP	EA	4
1J4	COPPER GUTTERS	MT	200
1J5	Φ 30 REINFORCED PVC WASTE WATER DRAIN PIPE	MT	90
1J6	CONCRETE MANHOLE WITH CAST-IRON COVER TOP	EA	7
K	**PARTITION WALLS**		
1K1	HOLLOW BLOCK BRICK WALL(20 CM)	M3	100
1K2	GYPSIUM BOARD WALL (DOUBLE SIDED WATER PROOF-FIRE PROOF)	M2	4150
1K3	SINGLE SIDED GYPSIUM BOARD WALL	**M2**	1500
1K4	GYPSIUM BOARD PARTITION WALL (DOUBLE PANEL)	M2	500
1K5	HOLLOW BLOCK BIMSCONCRETE WALL (10*39*19)	M2	500
1K6	ACOUSTICAL WALL	M2	640
1K7	GENERAL TOILET CABINS WITH DOORS FROM LAMINAT CONSTRUCTION	EA	49
L	**WALL COVERINGS&FINISHES**		
1L1	INTERIOR WALL PLASTERING	M2	12839

Table B.8.3: (continued)

	DESCRIPTION	UNIT	QTY
1L2	GYPSIUM SPACKLING	M2	12839
1L3	SATIN FINISH ACRYLIC PAINT (3 LAYERS)	M2	12839
1L4	OIL PAINT(3 LAYERS)	M2	500
1L5	CERAMIC WALL TILES	M2	3250
1L6	WALNUT FINISH WALL PANELS (VARNISHED)	M2	240
1L7	MARBLE WALL COVERING(TEXTURED FINISH)	M2	320
1L8	COLOURED BACK GLASS WALL TILES	M2	200
1L9	TEXTILE BACKED VINLY WALL PAPER	M2	15000
1L10	MIDRAIL ON CORRIDOR WALLS OF GUESTROOM FLOORS (150 MM) WALNUT VENEER OVER MDF+VARNISHED	MT	700
1L11	FROSTED GLASS PARTITION WALLS IN RESTAURANT	M2	60
1L12	BLACK GRANITE WALL COVERING IN THE RECEPTION	M2	45
1L13	TRANSLUCENT ONYX SHEET WALL (20 MM) SATINLESS STEEL	M2	8
1L14	DECORATIVE ACRYLIC PLASTER	M2	800
1L15	SWIMMING POOL AREA BACK ILLUMINATED PLASTIC WALL COVER	M2	30
M	**DOORS & WINDOWS**		
1M1	WALNUT VENEERED SOLID WOOD FIRE RESISTANT DOORS WITH FRAMES AND FITTINGS	EA	250
1M2	TOUGNENED GLASS SHOWER DOOR	EA	178
1M3	ALUMINIUM FRAMED GLASS REVOLVING DOOR	EA	2
1M4	FIRE RESISTANT WOODEN DOORS(WITH GLASS)&FRAME AND FITTINGS	M2	56
1M5	FIRE RESISTANT STEEL DOORS	KG	400
1M6	EXECUTIVE SUITS FIRE RESISTANT WALNUT DOORS INCLUDING FRAME AND FITTINGS	M2	100
1M7	SOLID CORE LAMINANT FACING WOODEN DOORS WITH FRAME	M2	120
1M8	SOLID CORE SOUND PROOF WOODEN DOORS WITH FRAME AND FITTING	M2	20
1M9	ALUMINIUM WINDOW FRAME REPLACEMENT WITH (4+4 DOUBLE GLAZING GLASS) 1/4 OF GUEST ROOMS	M2	710
1M10	ALUMINIUM SLIDING FENESTRATION IN RESTAURANT WITH 4+4 MM DOUBLE GLAZING	M2	200
1M11	AUTOMATIC(RADIO CONTROLLED) GARAGE DOOR	EA	1
1M12	SOLAR CONTROL WINDOW FILM COVERING (EXTERIOR WINDOW)	M2	3350
N	**FURNITURE**		
1N1	GUESTROOM FURNITURE UNITS INCLUDING ALL ACCESSORIES	SETS	177
1N2	UPHOLSTERIES & LINENS & DRAPERY & CUSHIONS	SETS	354

Table B.8.3: (continued)

	DESCRIPTION	UNIT	QTY
1N3	PUBLIC AREAS FURNITURE UNITS INCLUDING ALL ACCESSORIES	LS	1
1N4	STAINLESS STEEL-GLASS RECEPTION- CONSIERGE DESKS INCLUDING ALL ACCESSORIES	EA	5
1N5	CHANGING ROOM LOCKERS	EA	175
1N6	SHELVING UNITS	EA	187
1N7	ALL MIRRORS	EA	200
1N8	POTS	LS	1
1N9	WASTEBIN-ASHTRAY	EA	22
1N10	EXTERIOR FURNITURE AROUND POOL AREA	LS	1
1N11	FITNESS CENTER EQUIPMENT	LS	1
1N12	OFFICE FURNITURE	SETS	64
O	**MISCELLANEOUS**		
1O1	IRONMONGERY (SATIN STAINLESS STEEL CARD CONTROLLED DOOR LOCKS)	EA	178
1O2	IRONMONGERY (DOOR KNOB - HARDWARE - STOPPERS & ACCESSORIES)	EA	180
1O3	SAUNA INCLUDING ALL ACCESSORIES	EA	2
1O4	STEAM ROOM INCLUDING ALL ACCESSORIES	EA	2
1O5	SATIN FINISH+TOUGHED GLASS CONFERENCE CENTER ENTRANCE CANOPY	EA	1
1O6	STEEL WATER TANK (3 COAT PAINTED)	EA	25
1O7	FIRE STOPERS	LS	1
1O8	SAFES (GUESTROOMS)	EA	180
1O9	CENTRAL SAFE	EA	1
1O10	GALVANISED STEEL FLAGPOSTS	EA	4
1O11	CORNER GUARDS FROM STAINLESS STEEL IN ALL SERVIS AREAS	LS	1
1O12	INTERIOR SIGNAGE	LS	1
1O13	EXTERIOR SIGNAGE WITH BACKLIGHT	LS	1
1O14	FAX MACHINES	EA	7
1O15	SMALL PHOTOCOPY MACHINES	EA	5
1O16	PROFESSIONAL PHOTOCOPY MACHINE	EA	1
1O17	DESKTOP COMPUTERS	EA	20
1O20	SWIMMING POOL MECHANICAL EQUIPMENT SERVICE AND REPAIR	LS	1
1O21	METAL DETECTORS IN LOWER LOBBY, UPPER LOBBY AND CONFERENCE CENTER ENTRANCES	EA	3
P	**EARTHQUAKE REINFORCEMENT**		
1P1	B 225 RC CONCRETE WITH GRANUMETRIC SAND AND CRUSHED STONE	M3	29

Table B.8.3: (continued)

	DESCRIPTION	UNIT	QTY
1P2	POURING OF CONCRETE WITH PUMP	M3	29
1P3	STEEL MESH ENVELOPE OVER OLD COLUMN FOR ADHERENCE	Kg	500
1P4	CONCRETE FORMWORK WITH TONGUE&GROVE JOINTS AND FINE FINISHED SURFACE	M2	216
1P5	Φ 8-12 MM REINFORCING BAR	TON	2.46
1P6	Φ 14-18 MM REINFORCING BAR	TON	7.055
1P7	SCRAPING THE EXISTING PLASTER	M2	216
1P8	SCRAPING FLOOR CONCRETE AROUND THE COLUMN AND CORNERS	M2	216
1P9	CLEANING THE COLUMN SURFACE WITH AIR COMPRESSOR	M2	216
1P10	CARBONFIBER SIKA CARBODUR ENVELOPE WRAPPED AROUND COLUMN WITH FIXING TYPE AND SIKADUR 30 ADHESIVE	M2	115
1P11	SCAFFOLDING AROUND THE COLUMN TO SUPPORT THE BEAMS AND FLOORSLAB	M3	1000
1P12	EPOXY RESIN GROUT APPLIED TO CARCKS AND THE ENDS OF REINFORCEMENT BARS AND AROUND THE OLD COLUMN SURFACES	Kg	450

TO PROVIDE FOR CONTINGENCIES FOR TEN YEARS PERIOD		
1	For ceramic tiles for walls and floors	7% For each specific type
2	For telecommunication apparatus	2%
3	For drapery	2%
4	For carpets	5% For each class
5	For magnetic door locks	5%
6	For window hardware	5%
7	For paint material	10% For each type and color
8	For wallpaper	2% For each type
9	For parquet flooring	2% For each type
10	For textile (Table cloth)	5% For each type
11	For lighting fixtures	10% For each fixture
12	For bathroom fixtures	5% For each fixture
13	For furnishings	5% For each loose furniture

Table B. 9: Electricity profile of Turkey.

T.C. BAŞBAKANLIK
TÜRKİYE İSTATİSTİK KURUMU

Haber Bülteni

ELEKTRİK ÜRETİM VE DAĞITIMI 2006 III. DÖNEM (Temmuz – Ağustos – Eylül)

Sayı:204
21 Aralık 2006
10:00

Elektrik enerjisi üretimi 2006 yılı III. döneminde, bir önceki yılın aynı dönemine göre % 9,21 artarak 46.360,4 GWh olarak gerçekleşmiştir.
Elektrik enerjisi üretimi 2006 yılı III. döneminde bir önceki döneme göre % 10,95 artmıştır. Üretilen elektriğin 2005 yılı III. döneminde; 32.394,5 GWh'ı termik, 10.043,0 GWh'ı hidrolik ve 11,9 GWh'ı da rüzgar enerjisi iken, 2006 yılı III.döneminde ise; 36.059,7 GWh'ı termik, 10.254,5 GWh'ı hidrolik ve 46,2 GWh'ı da rüzgar enerjisi olarak gerçekleşmiştir. 2006 yılı III. döneminde, 2005 yılı III. dönemine göre termik elektrik enerjisi üretiminde %11,31, hidroelektrik enerjisi üretiminde ise %2,11 oranında üretim artışı görülmüştür.
2006 Yılı III. döneminde elektrik enerjisinin % 49,64'ü Elektrik Üretim A.Ş. (EÜAŞ) ve EÜAŞ'a bağlı ortaklıklar, % 41,66'sı üretim şirketleri, %8,70'i otoprodüktörler tarafından gerçekleştirilmiştir. Elektrik üretimi bir önceki yılın aynı dönemine göre EÜAŞ ve EÜAŞ'a bağlı ortaklıklarda %8,78, üretim şirketlerinde %12,71 artmış, otoprodüktörlerde ise %2,99 oranında azalmıştır. Brüt elektrik enerjisi üretiminin, enerji kaynaklarına göre 2005 yılı III. döneminde %46,84'ü doğal gaz, %23,66'sı su, %18,20'si linyit, 2006 yılı III. döneminde ise %46,74'ü doğal gaz, %22,12'si su, %18,05'i linyit ile çalışan santrallerden sağlanmıştır. Bir önceki yılın aynı dönemine göre elektrik üretimi, doğal gaz santrallerinde %9, linyit santrallerinde %8,29 oranında artmıştır.
Elektrik tüketimi, 2006 yılı III. döneminde bir önceki yılın aynı dönemine göre %11,62 artarak **34.306** GWh olarak gerçekleşmiştir. Elektrik enerjisinin %41,23'ü sanayide, %23,81'i meskenlerde, %15,85'i ticarethanelerde, %4,14'ü tarımsal sulamada, %3,52'si resmi dairelerde, %2,06'sı sokak aydınlatmasında, %1,81'i şantiyelerde ve %7,58'i ise diğer ve doğrudan satışlar olarak tüketilmiştir.
2006 Yılı III. döneminde, 2005 yılı III. dönemine göre elektrik dağıtım şirketlerinin elektrik satış gelirleri cari fiyatlarla %15,72 oranında artmıştır.

Table B. 10: Operating energy consumptions of hotels.
(Source: Technical departments of hotels).

Table B.10.1: Operating energy consumption of Hotel A by years.

Year	**Natural Gas Consumption (m3)**	**Eletricity Consumption (KWh)**	**Water Consumption (m3)**
1989		5.828.209	
1990		5.285.160	
1991		4.984.752	
1992		5.147.070	
1993		4.938.750	
1994	454.623	4.934.790	82.706
1995	523.688	5.005.290	84.975
1996	586.779	5.020.230	88.723
1997	622.218	5.029.410	91.704
1998	643.848	5.145.576	81.898
1999	636.288	4.655.834	74.783
2000	664.498	4.632.279	75.760
2001	612.967	4.331.341	60.083
2002	675.167	4.462.333	65.679
2003	648.180	4.909.046	61.621
2004	660.344	4.783.144	71.099
2005	619.666	4.983.540	67.475
Average Annual Consumption:	612.356	4.824.401	75.542

Table B.10.2: Operating energy consumption of Hotel B for 2006.

Months	**Natural Gas Consumption (m3)**	**Eletricity Consumption (KWh)**	**Water Consumption (m3)**
January	2963	493185	80526
February	3346	497494	83061
March	4200	494266	61077
April	5203	528928	38461
May	4847	594827	35434
June	5863	782335	31331
July	8806	826988	33688
August	656	926762	27771
September	5919	721124	29184
October	3982	531827	33620
November	3928	524015	62763
December	3529	530134	68747
Annual Consumption:	**53242**	**7451885**	**585663**

Table B. 11: Air pollution profile of Turkey.

T.C. BAŞBAKANLIK
TÜRKİYE İSTATİSTİK KURUMU

Haber Bülteni

HAVA KİRLİLİĞİ, ŞUBAT 2007
Sayı:69
27 Nisan 2007
10:00

Bir önceki yıla göre SO_2 ve duman ortalamalarında artışlar görüldü.

Sağlık Bakanlığı tarafından hava kalitesi ölçümü yapılan il ve ilçe merkezlerinden elde edilen sonuçlara göre 2007 yılı Şubat ayı kükürtdioksit (SO_2) ortalamaları, bir önceki yılın Şubat ayına göre Gaziantep'de %193, Bilecik (Merkez)'de %67, Karaman'da %58, Zonguldak'da %32, Malatya ve Sivas'da %31 oranında artmıştır. Aynı dönemde Bayburt'da %88, Elazığ'da %71, Antalya'da %64, Bilecik (Bozüyük)'de %63 ve İzmir (Merkez)'de %54 oranında azalmıştır. 2007 yılı Şubat ayı partiküler madde (duman) ortalamaları ise Bilecik (Bozüyük)'de %157, Gaziantep'de %127, Bilecik (Merkez)'de %88, Karaman'da %79 ve Malatya'da %55 oranında artarken, aynı dönemde Trabzon'da %73, Antalya, İzmir (Merkez) ve İzmir (Ödemiş)'de %56, Bayburt'da %54, Kocaeli (Gölcük)'de %45, Bursa (İnegöl) ve Kocaeli (Gebze)'de %43 oranında azalmıştır.

SO_2 ortalamalarında Hedef Sınır değeri aşıldı.

2007 yılı Şubat ayında il ve ilçe merkezlerinde ölçüm yapılan istasyonlardan elde edilen kükürtdioksit ortalamaları incelendiğinde, Hedef Sınır (HS) değeri Amasya, Burdur, Diyarbakır, Erzurum, Gaziantep, Kayseri, Kütahya, Malatya, Manisa, Sivas, Trabzon ve Karaman'da aşılmıştır. Kısa Vadeli Sınır (KVS) değeri ve 1. Uyarı Kademesi Sınır (1.UKS) değeri ölçüm yapılan hiçbir istasyonda aşılmamıştır.

Duman ortalamalarında Hedef ve Kısa Vadeli Sınır değerleri aşıldı.

Aynı dönemde partiküler madde ortalamaları incelendiğinde, Hedef Sınır (HS) değeri Amasya, Burdur, Elazığ, Gaziantep, Isparta, Kayseri, Konya, Kütahya, Malatya, Manisa, Samsun, Zonguldak, Bayburt ve Karaman'da aşılmıştır. Kısa Vadeli Sınır (KVS) değeri Isparta'da aşılırken, 1. Uyarı Kademesi Sınır (1.UKS) değeri ölçüm yapılan hiçbir istasyonda aşılmamıştır.

		SO_2	Partiküler Madde
	Hedef Sınır Değeri	150 µg/m^3	150 µg/m^3
	Kısa Vadeli Sınır Değeri	400 µg/m^3	300 µg/m^3
	1. Uyarı Kademesi Sınır Değeri	700 µg/m^3	400 µg/m^3

APPENDIX C

Table C. 1: An example budget list of Hotel B.
(Source: Technical Department of Hotel B).

Current Period

Actual	%	Budget	Var.	Last Year	%	ENERGY EXPENSES
15773	-19,1	16600	-827	19580	-22,7	Sale of Utilities
45356	54,8	70000	24644	61633	71,6	Electricity
279	0,3		-279	556	0,6	Fuel-oil
18247	22,1	26000	7753	15667	18,2	Water
34585	41,8	36300	1715	27800	32,3	Gas
						Misc. Exp.
82694	100,0	115700	330006	86076	100,0	Total

						PROPERTY OPERATIONS
31961	34,3	26366	-5595	26506	27,4	Salaries & Wages
2550	2,7		2550	2266	2,3	Overtime
14978	16,1	24656	9678	25916	26,8	Benefits
1520	1,6	2000	480			Furniture
						Floor Covering
1155	1,2	2000	845	5	5,7	Paint & Decoration
1237	1,3	200	-1037	745	0,8	Radio & TV.
		250	250			Signs
7549	8,1	1250	-6299	4134	4,3	Heat. Vent. & Air Cond.
1855	2,0	300	-1555			Kitchen Equipment
892	1,0	250	-642			Laundry Equipment
						Refrigeration
173	0,2	1250	1077	914	0,9	Boiler Room
						Office Equipment
433	0,5	2000	1567	7941	8,2	Plumbing
10462	11,2	4000	-6462	5869	6,1	Elec. & Mec. Equipment
2501	2,7	2561	60	1740	1,8	Data Proc.Maint.
7779	8,4	6500	-1279	5039	5,2	Elevator
						Building
143	0,2		-143			Landscaping
324	0,3	600	276			Swimming pool
1024	1,1	2000	976	223	0,2	Electric Bulbs
1612	1,7	100	-1512	1281	1,3	Removal of Waste
1075	1,2		-1075	2158	2,2	Water Treatment
677	0,7	1000	323	2647	2,7	Misc. Exp.
484	0,5	1300	816	1662	1,7	Communication Exp.
646	0,7	652	6	641	0,7	Training Exp.
1409	1,5	200	-1209	96	0,1	Operating Exp.
		1000	1000	1056	1,1	Uniform Exp.
268	0,3	100	-168	31	0,0	Cargo Exp.
						Cleaning Exp.
411	0,4	419	8	516	0,5	Six Sigma Exp.
93118	**100,0**	**80954**	**-12164**	**96865**	**100,0**	**Total**

Table C. 2: The paired-sample *t*-test tables.

Table C.2. 1: Paired-sample *t*-test – primary energy consumption

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	,00868171	7	,014117677	********
	HOTEL_A	,04583671	7	,072128832	********
Pair 2	HOTEL_B	,00868171	7	,014117677	********
	HOTEL_C	,07636614	7	,095601641	********
Pair 3	HOTEL_A	,04583671	7	,072128832	********
	HOTEL_C	,07636614	7	,095601641	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	-,035	,940
Pair 2	HOTEL_B & HOTEL_C	7	-,021	,964
Pair 3	HOTEL_A & HOTEL_C	7	,925	,003

Table C.2. 2: Paired-sample *t*-test – solid waste

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	,17961243	7	,259079185	********
	HOTEL_A	1,210701	7	2,405120221	********
Pair 2	HOTEL_B	,17961243	7	,259079185	********
	HOTEL_C	2,037577	7	3,346088660	********
Pair 3	HOTEL_A	1,210701	7	2,405120221	********
	HOTEL_C	2,037577	7	3,346088660	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	,116	,805
Pair 2	HOTEL_B & HOTEL_C	7	,295	,521
Pair 3	HOTEL_A & HOTEL_C	7	,931	,002

Table C.2. 3: Paired-sample *t*-test – air pollution index

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	,13224086	7	,220062660	********
	HOTEL_A	,63118071	7	1,116234869	********
Pair 2	HOTEL_B	,13224086	7	,220062660	********
	HOTEL_C	1,092542	7	1,502638136	********
Pair 3	HOTEL_A	,63118071	7	1,116234869	********
	HOTEL_C	1,092542	7	1,502638136	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	,016	,973
Pair 2	HOTEL_B & HOTEL_C	7	,033	,944
Pair 3	HOTEL_A & HOTEL_C	7	,929	,002

Table C.2. 4: Paired-sample *t*-test – water pollution index

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	,00811443	7	,014511885	********
	HOTEL_A	,02777071	7	,041944442	********
Pair 2	HOTEL_B	,00811443	7	,014511885	********
	HOTEL_C	,05214743	7	,066975546	********
Pair 3	HOTEL_A	,02777071	7	,041944442	********
	HOTEL_C	,05214743	7	,066975546	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	,091	,846
Pair 2	HOTEL_B & HOTEL_C	7	,119	,799
Pair 3	HOTEL_A & HOTEL_C	7	,852	,015

Table C.2. 5: Paired-sample *t*-test – global warming potential

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	,36657300	7	,527770405	********
	HOTEL_A	3,643213	7	8,230690916	********
Pair 2	HOTEL_B	,36657300	7	,527770405	********
	HOTEL_C	5,363587	7	10,365103857	********
Pair 3	HOTEL_A	3,643213	7	8,230690916	********
	HOTEL_C	5,363587	7	10,365103857	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	,168	,718
Pair 2	HOTEL_B & HOTEL_C	7	,168	,718
Pair 3	HOTEL_A & HOTEL_C	7	,992	,000

Table C.2. 6: Paired-sample *t*-test – weighted resource use

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	HOTEL_B	1,941474	7	2,452265062	********
	HOTEL_A	52,19237	7	102,4061927	********
Pair 2	HOTEL_B	1,941474	7	2,452265062	********
	HOTEL_C	65,81554	7	128,8037514	********
Pair 3	HOTEL_A	52,19237	7	102,4061927	********
	HOTEL_C	65,81554	7	128,8037514	********

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	HOTEL_B & HOTEL_A	7	,724	,066
Pair 2	HOTEL_B & HOTEL_C	7	,759	,048
Pair 3	HOTEL_A & HOTEL_C	7	,995	,000

Table C. 3: The impacts of seven materials during life cycle stages according to six LCA indicators.

			Primary Energy Consumption	Solid Waste	API	WPI	Global Warming Potential	Weighted Resource Use
LEVELLING CONCRETE	HOTEL A	Manufacturing	2938312	102755	48796	2	349612	4325856
		Construction	218645	2	70	0	394	4961
		End-Of-Life	87650	1	32	0	171	1989
		Total Embodied Sub-Total	3244607	102758	48898	2	350177	4332806
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2804448434	13086256	44044442	2006	116732719	347384965
	HOTEL B	Manufacturing	50875	1779	845	0	6054	74899
		Construction	3786	0	1	0	7	86
		End-Of-Life	1517	0	0	0	3	34
		Total Embodied Sub-Total	56178	1779	846	0	6064	75019
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793195115	9033707	25625834	982	71700787	249165613
	HOTEL C	Manufacturing	2224848	77804	36947	1	264722	3275476
		Construction	165555	2	53	0	298	3757
		End-Of-Life	66367	1	24	0	130	1506
		Total Embodied Sub-Total	2456770	77807	37024	1	265150	3280739
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1520727333	7463718	22654832	918	61987757	203487839
GYPSUM BOARD	HOTEL A	Manufacturing	627510	22922	10317	1	24726	105902
		Construction	14427	0	5	0	26	327
		End-Of-Life	5980	0	2	0	11	136
		Total Embodied Sub-Total	647917	22922	10324	1	24763	106365
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2801851744	13006420	44005868	2005	116407305	343158524
	HOTEL B	Manufacturing	156170	5827	2568	0	6157	26601
		Construction	3638	0	1	0	7	83
		End-Of-Life	1508	0	0	0	3	34
		Total Embodied Sub-Total	161316	5827	2569	0	6167	26718
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793300253	9037755	25627557	982	71700890	249117312
	HOTEL C	Manufacturing	1303743	47733	21435	1	51374	220244
		Construction	30017	0	10	0	54	681
		End-Of-Life	12442	0	4	0	22	282
		Total Embodied Sub-Total	1346202	47733	21449	1	51450	221207
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1519616765	7433644	22639257	918	61774057	200428307

Table C.3: (continued)

			Primary Energy Consumption	Solid Waste	API	WPI	Global Warming Potential	Weighted Resource Use
WALLPAPER	HOTEL A	Manufacturing	396285	6210	6221	0	14902	41120
		Construction	5555	0	2	0	10	126
		End-Of-Life	1079	0	0	0	2	24
		Total Embodied Sub-Total	402919	6210	6223	0	14914	41270
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2801606746	12989708	44001767	2004	116397456	343093429
	HOTEL B	Manufacturing	447058	7005	7018	0	16811	46389
		Construction	6266	0	2	0	11	142
		End-Of-Life	1217	0	0	0	2	28
		Total Embodied Sub-Total	454541	7005	7020	0	16824	46559
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793593478	9038933	25632008	982	71711547	249137153
	HOTEL C	Manufacturing	273965	4293	4301	0	10302	28428
		Construction	3840	0	1	0	7	87
		End-Of-Life	746	0	0	0	1	17
		Total Embodied Sub-Total	278551	4293	4302	0	10310	28532
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1518549114	7390204	22622110	917	61732917	200235632
WATER BASED PAINT	HOTEL A	Manufacturing	50502	53	497	0	944	3338
		Construction	137	0	0	0	0	3
		End-Of-Life	100	0	0	0	0	2
		Total Embodied Sub-Total	50739	53	497	0	944	3343
		Operating Energy:	2801203827	1298349	43995544	2004	116382542	343052159
		Total Life Cycle:	2801254566	1298402	43996041	2004	116383486	343055502
	HOTEL B	Manufacturing	18801	20	185	0	351	1243
		Construction	51	0	0	0	0	1
		End-Of-Life	37	0	0	0	0	1
		Total Embodied Sub-Total	18889	20	185	0	351	1245
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793157826	9031948	25625173	982	71695074	249091839
	HOTEL C	Manufacturing	64230	68	632	0	1200	4245
		Construction	174	0	0	0	0	4
		End-Of-Life	127	0	0	0	0	3
		Total Embodied Sub-Total	64531	68	632	0	1200	4252
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1518335094	7385979	22618440	917	61723807	200211352

Table C.3: (continued)

			Primary Energy Consumption	Solid Waste	API	WPI	Global Warming Potential	Weighted Resource Use
HARDWOOD	HOTEL A	Manufacturing	19694	89	199	0	608	12462
		Construction	1183	0	0	0	2	27
		End-Of-Life	251	0	0	0	0	6
		Total Embodied Sub-Total	21128	89	199	0	610	12495
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2801224955	12983587	43995743	2004	116383152	343064654
	HOTEL B	Manufacturing	11490	52	116	0	355	7270
		Construction	690	0	0	0	1	16
		End-Of-Life	146	0	0	0	0	3
		Total Embodied Sub-Total	12326	52	116	0	356	7289
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793151263	9031980	25625104	982	71695079	249097883
	HOTEL C	Manufacturing	27183	122	275	0	839	17199
		Construction	1633	0	1	0	3	37
		End-Of-Life	346	0	0	0	1	8
		Total Embodied Sub-Total	29162	122	276	0	843	17244
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1518299725	7386033	22618084	917	61723450	200224344
BRICK	HOTEL A	Manufacturing	238686	1263	3301	0	8919	26584
		Construction	4865	0	2	0	9	110
		End-Of-Life	2780	0	1	0	5	63
		Total Embodied Sub-Total	246331	1263	3304	0	8933	26757
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2801450158	12984761	43998848	2004	116391475	343078916
	HOTEL B	Manufacturing	7668	41	106	0	286	854
		Construction	156	0	0	0	0	4
		End-Of-Life	89	0	0	0	0	2
		Total Embodied Sub-Total	7913	41	106	0	286	860
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793146850	9031969	25625094	982	71695009	249091454
	HOTEL C	Manufacturing	548451	2903	7585	0	20494	61085
		Construction	11179	0	4	0	20	254
		End-Of-Life	6388	0	2	0	12	145
		Total Embodied Sub-Total	566018	2903	7591	0	20526	61484
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1518836581	7388814	22625399	917	61743133	200268584

Table C.3: (continued)

			Primary Energy Consumption	Solid Waste	API	WPI	Global Warming Potential	Weighted Resource Use
PLASTER	HOTEL A	Manufacturing	33098	0	11	0	60	1214317
		Construction	171401	2	55	0	309	3889
		End-Of-Life	228535	2	73	0	412	5186
		Total Embodied Sub-Total	433034	4	139	0	781	1223392
		Operating Energy:	2801203827	12983498	43995544	2004	116382542	343052159
		Total Life Cycle:	2801636861	12983502	43995683	2004	116383323	344275551
	HOTEL B	Manufacturing	40	0	0	0	0	1455
		Construction	205	0	0	0	0	5
		End-Of-Life	274	0	0	0	0	6
		Total Embodied Sub-Total	519	0	0	0	0	1466
		Operating Energy:	1793138937	9031928	25624988	982	71694723	249090594
		Total Life Cycle:	1793139456	9031928	25624988	982	71694723	249092060
	HOTEL C	Manufacturing	18404	0	6	0	33	675210
		Construction	95306	1	31	0	172	2163
		End-Of-Life	127075	1	41	0	229	2884
		Total Embodied Sub-Total	240785	2	78	0	434	680257
		Operating Energy:	1518270563	7385911	22617808	917	61722607	200207100
		Total Life Cycle:	1518511348	7385913	22617886	917	61723041	200887357

CURRICULUM VITAE

PERSONEL INFORMATION

Surname, Name : Çakmaklı (Zeytun), Ayşem Berrin
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Date of Birth : 05.11.1974
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EDUCATION

Expected date of Comp., June. 2007	**PhD., METU,** Faculty of Architecture Department of Architecture, Ankara. GPA: 3.89
June 2003	**CISCO** Networking Academy CCNA Certificate, METU SEM, Ankara.
June 2000	**MS, METU,** Faculty of Architecture Department of Architecture, Ankara. GPA: 3.68
June 1997	**BS, METU,** Faculty of Architecture Department of Architecture, Ankara. GPA: 2.74
June 1992	**High School,** Meram Anadolu Lisesi, Konya. GPA: 9.01

WORK EXPERIENCE

Dec. 1997 – July 2005	METU Faculty of Architecture, Research Assistant as a Computer Coordinator of Faculty of Architecture. 2000 – 2005.
1998 - 2001 Fall and Spring Semesters	*Research Assistant in "ARCH 488 Solar Control and Utilization in Architecture".*
1998 - 2005 Fall Semesters	*Research Assistant in "ARCH 281 Environmental Design I"*
1998 - 2005 Spring Semesters	*Research Assistant in "ARCH 282 Environmental Design II*
1998 - 2005 Fall and Spring Semesters	*Research Assistant in "ARCH 461 Computer Literacy in Architecture"*

October 2005 - present	Başkent University GSTMF, Department of Interior Architecture and Environmental Design, Instructor.
2005 - 2007 Fall Semesters	*IMB 111- Computer Aided Drawing I* *IMB 220 – Physical Environmental Control I* *IMB 313 - Physical Environmental Control II*
2005 - 2007 Spring Semesters	*IMB 112- Computer Aided Drawing II* *MUH 122- Technical Drawing* *ARCH 282- Environmental Design I* *(as Part-time Instructor)*

FOREIGN LANGUAGES

Advanced English, Intermediate German

CONFERENCES

Sept. 1999	Presenting a paper named as "**Sürdürülebilir ve Ekolojik Yüzey Malzemeleri**" in **"Mimari Biçimlendirmede Yüzey Sempozyumu"** that was organized by Gazi University Faculty of Engineering and Architecture Department of Architecture and Chamber of Architecture in Ankara.
Oct. 2002 – Sept. 2003	Taking task in organizing committee of "**"CIB W62 2003 29th International Symposium on Water Supply and Drainage for Buildings"** at September 11-12, 2003 in Ankara .
18-20 January 2006	Presenting a paper named as "**Hotel Renovation Projects and LCC** in **"CIB W107 International Symposium on Construction in Developing Economies: New Issues and Challenges"** that was organized by CIB in Santiago, CHILE.
23-25 March 2006	Presenting a paper named as **"Designing Living Spaces In Contemporary Architecture"** in **"18th International Building and Life Congress"** that was organized by Bursa Chamber of Architects in Bursa.