THE INFLUENCE OF DESIGN CONSIDERATIONS OF METRO STATIONS IN THE CONTEXT OF CITY IDENTITY: THE CASE OF ANKARAY AND ANKARA METRO

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_____

Prof. Dr. Canan ÖZGEN
Director

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

_____

Prof. Dr. Melih ERSOY
Head of Department

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.

_____

Assist. Prof. Dr Adnan BARLAS
Supervisor

Examining Committee Members

Assoc. Prof. Dr. Baykan Günay (METU, CRP) _____

Assist. Prof. Dr. Adnan Barlas (METU, CRP) _____

Prof. Dr. Murat Güvenç (Bilgi Unv., ARCH) _____

Assoc. Prof. Dr. Gül Asatekin (METU, ARCH) _____

Assist. Prof. Dr. Naz A. G. Z. Börekçi (METU, ID) _____

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Name, Last Name: SERKAN GÜNEŞ

Signature:

ABSTRACT

THE INFLUENCE OF DESIGN CONSIDERATIONS OF METRO STATIONS IN THE CONTEXT OF CITY IDENTITY: THE CASE OF ANKARAY AND ANKARA METRO

GÜNEŞ, Serkan
Ph.D., Department of City and Regional Planning
Supervisor : Assist. Prof. Dr. Adnan BARLAS
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The theoretical structure of the study is composed of understanding the life cycle of metro system classified in three evolutionary phases. These process definitions respectively start with demand related to metro, continue with the acceptance of metro as the preferential alternative by inhabitants and end with the subway that embedded as an important reason that build city identity. Phases will be studied through its motives and will be analyzed through physical design considerations. The reason of the prevision is stemmed from the hypothetical approach which is stated as the influences of the design considerations of metro utilities are highly related on its life cycle and in forming local identity. The test of the hypothesis will be handled in two methods. The first will be a survey study which will include checklist to portraiture demand and course of the system in first two stages. At the preliminary stage, the topics of underground, underground use and the history of railway and urban railway network in world and Turkey are discussed to get a better and more comprehensive understanding of metro. Next method is designed to cross-examine design considerations and local

identity by value judgment analysis for the last stage. In this phase, validity of the hypothesis will be audited by correspondence analysis. Value judgments depended assertion and expression of values which reached by correspondence analysis and Bertin Graphs, are accepted as the determinations that addresses the relationship between physical structure and local identity. The evaluation of the metro's physical qualifications during its life cycle, which can be noted under several headings and the relationship between the physical aspects and those of the local characteristics, are proposed to be put forth as contributions by this thesis.

Key words: Underground, Underground Utilization, Use of Space, Public Transport, Light Rail, Metro, City Identity, Correspondence Analysis, Bertin Graphs.

ÖZ

KENT KİMLİĞİ BAĞLAMINDA METRO İSTASYONLARINDA TASARIM ETMENLERİNİN ETKİSİ: ANKARAY VE ANKARA METROSU ÖRNEĞİ

GÜNEŞ, Serkan
Doktora, Şehir ve Bölge Planlama Bölümü
Tez Yöneticisi: Yar. Doç. Dr. Adnan BARLAS
Mart 2007, 258 sayfa

Çalışmanın kuramsal çerçevesi metronun hayat döngüsünü üç evrimsel süreç üzerinden tanımlanmakdır. Bu üç evrimsel süreç tanımlaması sırası ile metroya ait bir talebin varlığıyla başlamakta, metronun şehirli tarafından vazgeçilmez bir ulaşım alternatifi olmasıyla devam etmekte, ve son olarak şehir kimliğinin ayrılmaz bir parçası olup onun içine gömülmesi ile son bulmaktadır. Her evrimsel aşamanın ifadesinde metroya ait fiziki tasarım kriterlerine yer verilmektedir. Böyle bir öngörünün gerekçesi metro tasarımının metronun hayat döngüsünün oluşmasında ve şehir kimliğinin yaratılmasında önemli bir rol üstlendiğine dair hipotetik yaklaşımdır. Hipotezlerin sınanması iki yol ile yapılacaktır. Bunlardan ilki evrimsel süreçlerin ilk iki aşamasını tanımlamaya yönelik tetkik çalışması olup talep ve işleyişe dair tasarım niteliklerini ölçen kontrol listesinden oluşmaktadır. İlk aşamada, metro kavramına ulaşırken, yeraltı ve yeraltı kullanılması kavramları ele alınmış, daha sonra dünyada ve ülkemizde demiryolu tarihi ve kenti içi raylı sistemlerin durumu incelenmiştir. İkincisi, tasarım ölçütleri ile yerel kimliğin sorgulandığı kullanıcı değer yargıları analizidir. Bu aşamada

Uygunluk Analizi kullanılarak hipotezin geçereliliği denetlenecektir. Uygunluk Analizi sonucunda ulaşılan kullanıcı değer yargıları, Bertin Grafikleri halinde, değerlerin ifade ve teyit ediliş biçimleri sistemin fiziki yapısının yerel kimlik ile ilişkili saptamalar olarak kabul edilmektedir. Çalışmanın varlığı, metronun fiziki yapısının, kentli için, fizyolojik ve psikolojik konfordan daha fazla değerler ifade ettiğine dair yaklaşımdan kaynaklanmaktadır. Çalışma sonunda, metronun hayat döngüsünün fiziki yeterlilikler açısından sınanması ve alt başlıklar olarak ifade edilmesi ve ayrıca ulaşılan fiziki yapı ve yerel kimlik ilşkisi tezin alana katkıları olarak önerilmektedir.

Anahtar Kelimeler: Yeraltı, Yeraltı Kullanımı, Mekan Kullanımı, Toplu Taşıma, Hafif Raylı, Metro, Kent Kimliği, Uygunluk Analizi, Bertin Grafikleri.

To My Beloved Family …

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

1.1 Transportation

Transport, which is an indispensable part of the lives of city-dwellers, is also one of the main problem areas in the urban realm. It is a problem because “vehicle registrations are growing fast on the basis of increased populations, increased wealth, increased commercial penetration, and probably an increasingly persuasive picture in the developing world of international lifestyle in which a car is an essential element” (Gakenheimer, 1999).

It will be impossible to analyze the real scope of the problem if transport is deemed as a simple relocation of goods and people from one place to another, because, transportation opportunities and facilities not only affect the macro form of the city, but also its economical, social and cultural dynamics. Furthermore, the current agenda as regards transportation also includes solutions of security, speed, comfort, environmental issues and perhaps fun as well as the relocation issue. Briefly, the main expected outcome of these solutions is enhancement of a qualified and satisfying transport service that connects all centers in the city.

Comfort and security, two major quests of humans, are sometimes expected to be provided by spatial constructs; to the extent that the eye looks for the imprints of these sensibilities in the space as if they are already there. On the other hand, availability of sufficient space is a must to fulfill these expectations, which is usually not the case. In daily life, the need for suitable space is not only limited for houses and workplaces but is also valid for vital

support functions such as transportation. However, compensating this need for satisfactory space is becoming increasingly difficult because of a growing shortage of urban land.

Particularly in the present-day urban realm, mobility is chiefly effective on lifestyles. As it is a physical concept, it requires space. Indeed, the distance covered by a person, should be distinguished from the distance from starting point to end point, and this distance refers to a measurable length, space or path whether in the air, on the land or in the sea or even in outer space. The need for physical space for transport may be in conflict with other urban functions; although they might have reciprocal interaction. Yet, availability of sufficient space alone does not render transport reliable. For reliable transport, the process should satisfy comfort and security needs. Any transport that lacks comfort and security will become unbearable and difficulty for passengers. This will automatically trigger problems in other urban roles, depending on common interaction.

In the first half of the 20th century, sociologist Abraham Maslow has suggested that all human beings have universal needs, and those needs could be classified and predicted (Maslow, 1954; 1968). He shows that these needs fall into five categories: physiological, security, social, esteem, and self-actualization. Maslow has developed these needs in a hierarchical pattern, beginning with physiological needs, which are the most proponents. Each level can be satisfied after the satisfaction of its previous level. He defines a proponent need as having a tremendous influence over the subsequent needs until it is fulfilled. For example, it would be difficult to achieve success in higher education (psychological or esteem needs) if one was not properly nurtured.

If one has had his/her physiological needs met, that individual may seek satisfaction for safety and security needs. These would include enough housing, reliable transport, and anything that contributes to the orderliness and predictability of life. When each need is satisfied, people feel nothing,

except the next need above it in the hierarchy. In this theory, only when people reach the fully integrated level of self-actualization they achieve “psychological maturity”. In fact, all human endeavor is to satisfy needs for a more qualified life. Some investigators of quality of life incorporate a needs-based satisfaction model, based on Maslow's hierarchy. It has been argued that human needs are the foundations for quality of life, and, therefore quality of life can be defined by human needs and the satisfactory fulfillment of those needs (for example physical, psychological, social, activity, marital and structural) (Hörnquist 1982).

Most scales that are used to measure the quality of life of people are based on satisfaction of basic human needs, coupled with assessments of global well-being (Bowling 2001). On this account, quality of life is thus a complex collection of interacting needs as well as comfort and security. So all the debate about quality of life, in fact, is an advanced debate and different form of debate that formulated by Maslow.

Debate on quality of life is millennia-old, with Aristotle giving it much thought in his Nicomachean Ethics[1] and eventually settling on the notion of eudaimonia[2] , a Greek term often translated as happiness as central. The neologism livability (or liveability), from the adjective liv (e) able, is an abstract noun now often applied to the built environment or a town or city, meaning its overall contribution to the quality of life of inhabitants. The quality of life is a potent political concept often used to describe citizen satisfaction with different residential locations. Among the community features that contribute either positively or negatively to quality of life are transport, job opportunities and parks.

[1] Nicomachean Ethics focuses on the importance of habitually behaving virtuously and developing a virtuous character. Aristotle emphasized the importance of context to ethical behavior, and the ability of the virtuous person to recognize the best course of action.

[2] Eudaimonia (Greek: εὐδαιμονία) is a classical Greek word commonly translated as 'happiness'. Etymologically, it consists of the word "eu" ("good" or "well being") and "daimōn" ("spirit" or "minor deity", used by extension to mean one's lot or fortune). Although popular usage of the term happiness refers to a state of mind, related to joy or pleasure, eudaimonia rarely describes a state of mind, and the less subjective "human flourishing" is therefore often preferred as a translation.

Several determinants are used to assess and evaluate the quality of life in built environment. Transport, as one of the key quality of living determinants, is important in arguing a good quality of life. As comfort and security can be mentioned as falling into the second level need in Maslowian theory, it is not possible to achieve better in life quality in their absence.

Greater access to public transport is connected with high quality of life. Greater satisfaction with public transport is as well associated with higher quality of life. Quality of life in urban land may depend on the comfort and security needs for satisfaction with public transport. In this respect, metro as one of the significant alternative for public transport in the urban areas should succeed satisfying some basic needs such as comfort and security to provide quality standards. In sum, it can be stated that building, maintaining, and operating an underground transport that is comfortable, reliable and secure, can provide a superior quality of life.

1.2 Metro Transportation

In city, there are several types of transport modes. Each transport type differs from one another by its technology, physical and running characteristics, capacity, investment and operative costs, time to build, credits and environmental issues. There is now international consensus that there is only one way to solve traffic congestion in cities: by the construction of metro (Bennett, 2004). Metro can be described as a rapid transit line that is at least partly underground. Strictly speaking, a metro is an underground line designed for use by usually electrically powered rapid transit cars for urban transit and containing stations spaced at more-or-less regular intervals for the receipt and discharge of passengers.

Metro is a whole system composed of interdependent parts. One of the most important parts of the system is stations. Like in all transportation systems, metro stations are architectural structures to facilitate passengers to board

and discharge. However, metro stations differ from conventional ones, as they are mostly located underground. Therefore, "function" is the priority of station design. In this way, the design idea of transportation architecture differs from the design considerations of other public buildings. Furthermore, in addition to operational demands such as scheduling, the length and width of cars, and the variety of station types according to site conditions, architectural design should also consider psychological, physiological effects, as well as exterior and entrance design, layout and spatial configuration, interior design elements and systems, lighting and safety issues.

Therefore, when the topic is metro that functions under ground, comfort and security appear as a complicated field. Thus, first, one must focus on the reality of underground. Underground disturbs us by its psychological and physiological dynamics which it envelops. This thesis does not aim to promote underground; however, it brings out the current potentials under sufficient conditions. It should be marked that this thesis is not formulated to appreciate “a priori” value to support an alternative to metro, however be aware of the importance of the metro in urban transport. The problem definition does not focus on the locations of the stations and route of the line but the internal design dynamics of stations and their relationship between the sites that they are located in as a landmark.

This study focuses on metro stations. Depending on the multifaceted structure of the issue, the study will be handled in two folds. The first fold focuses on the relationship of metro stations with the city that they are embedded in. There is an organic relationship between metro stations and the city. Metro stations are constitutional parts of the city. Therefore, a part-whole relationship can be discussed. If this mode of relationship is discussed in Gestalt[3] terms, then the contribution of metro stations will be greater than its self-sum. Gestalt theory holds that the whole is more than the sum of its

[3] A German word roughly translates as "whole" or "form." Gestalt theory is involved with visual perception and the psychology of art among other things. A Gestalt is a spatio-temporal organization, or pattern, of matter in which the relations are internal to each other, i.e., there is an interaction between parts and the whole (Reiser, 1934).

parts. Under these circumstances, each urban formation like metro should enclose innovative, artistic and cultural properties to reflect city identity and can be capable to change the city dynamics with its physical properties. Each urban formation (part) should have its autonomous values, but also should be in preferential relation with the city (whole). At this point, the interaction between the whole and the part must be questioned. In this study, aforementioned interaction between underground and aboveground will be analyzed depending on physical properties and representation.

Second fold rather focuses on relationship between the perception of the user (city-dwellers) and metro stations. City is the collection of artifacts created for several purposes. Here, the term “artifact” is used to cover two meanings. First, it is something created by humans usually for a practical purpose and second, it is something characteristic of or resulting from a particular human institution, period, trend, or individual. The cities themselves are harmonized with these two definitions: Humans create them for a purpose in time. They serve for humans for their practical purposes. As human needs are infinite, they are transformed into complex systems for the satisfaction purposes. Certainly, the presence of the metro is just to serve humans. Yet, metro is a human product; it is a human-made object like cities. If there is an interaction between humans and an artifact, somehow, then the study should find out the impression that is yielded. In this framework, the effort of the study will be to constitute a medium where man and artifact meets. When the specific properties of a human artifact (metro) stand in the forefront, the psychological perception of the user (city-dweller) and its physiological usage deserves an academic interest. Therefore, metro is not only the common public transport, but is the foremost public space where interactions among different social classes and various cultures happen. In these days, people need to realize that the metro is not only a means of transport, but also a place for sharing and communicating. Metro is not only a technical construction or a purely urban transport problem. It creates its subculture or phobias because of its unique characteristic. In this way, the quality of perception, its functionality and its acceptance as a way of transport

by the users is important for this vital and critical system. In short, the metro stations should serve physical and psychological comfort.

1.3 The Approach

Thus, the study is organized as follows. The first chapter covers certain physical conditions of metro. The chapter is based on a backward reading about underground. In this context, the underground is examined in detail through a review of religious texts, literary works and cinematography. The aim behind this drive is that the underground frequently elicits negative associations and images. Moreover, the experience of people in underground space suggests several psychological and physiological concerns. The aim of this chapter is to clarify the connection between the psychological concern and underground not only with the metro experience but ages old human experience. An investigation of the concept of underground in religious texts helps gaining insights from different traditions.

The religious texts cover either common or different representations of space whether they are an output of cultural accumulation (Geertz, 1975) or accepted as sacred. The literary observation of the underground invites the study to a fictitious world. The evolution of spatial context and representation about underground in the texts draws attention. It is interesting to observe the curiosity for the unknown that is served in format of voyage to underground. Cinematography observation is accepted as a different way of imagery. In this representation of underground, the relationship of underground and aboveground is more consistent. The underground is defined as a base for struggle, shelter for aggrieves and showed with its own realities in social context. In general, this chapter is designed as a reference text to determine the position of the underground in human mind. The idea of being underground frequently elicits negative associations and images. In addition, the actual experience of humans in underground facilities suggests a number of psychological and physical concerns (Carmody, 1993).

In the second chapter, the city and metro concepts will be dwelled upon together. Fulfilling the need for suitable space is becoming more and more difficult in many areas of the world due to growing shortage of urban land. Therefore, the interest in underground space utilization is increasing throughout the world. Recent technological advancements have enabled builders to overcome prior restrictions that had largely precluded underground construction. For the more effective use of the surface land, underground utilization offers new possibilities. There are many examples of both historical and current use of underground spaces. This chapter will describe the major types of uses of underground space, and will provide examples from the world. This chapter is an outline of underground space use. It discusses more comprehensively the issue that may present advantages or disadvantages for underground facilities; describes and classifies types of underground space and their uses and sketches historical development and present uses of underground space. This chapter aims to place metro depending on the taxonomy that is introduced within.

While the underground space has long been important for the development and advancement of transport systems, in third chapter the study will focus metro in urban land. Historical development of metro and different experiences will be presented. In this chapter, the needs for physical and physiological comfort in underground spaces will be classified and presented in a simple way, because, classification allows the most important attributes of an object to be described in manner that others can understand without detailed examination. In the following parts of the chapter, the examples of world metro will be introduced with the help of visual data. This section will characterize the basics and needs of interaction between station, vehicle (system) and user by the help of the metro practice in world. There are different spatial organizations in world's metros. This differentiation will be introduced by classification of the different spatial organizations and their affect to the identity. This chapter analyzes the identity of the metro station in urban context. In this section, the metro stations will be handled under the light of overall urban identity. Since the stations are a part of the built

environment, each station should reflect identity of aboveground. While the stations serve as an inter-medium between aboveground and underground the characteristics of upper world need to be portrayed in their design to make daily subterranean journey a delight. If metro is seen only as a technical problem, the statement that metro is a part of local identity is not seen. A design, which disregards human factor and only considers the running of the metro refuses the identity problem and is the result of two different reasons. First is trying to build a system, which is just running, but not aesthetic, to become a member of the club of the cities, which have metro. Second is definitely the cost, because building a metro from scratch has a potential to damage the future of the city's economy. However, it is also true that metro has a considerable effect in establishing a local identity. Local identity and metro identity create an identity together. This is an important element in encouraging the passengers to use the metro. The continuity in the metro from ground to underground has a tremendous function to eliminate the negative aspect of the metro. Simultaneously, this often means extra effort and higher costs for the city but it appears to pay when a metro is more than just a means of transport but something the residents can be proud of. In this sense, throughout the chapter, the metro system will be examined in relation to line and station characterization. Each variable will be categorized under singularity and standardization means. Architectural identity of metro will be created by a matrix system as metro consistently planned to have user-friendly and good-looking architecture, thus with most stations looking similar (examples: Bilbao, Washington). Lines with unique and interesting stations by different architects (examples: Hong Kong Airport Line, London Jubilee Line extension, Tokyo Oedo Line). Stations of standardized architecture but with distinct interior designs of good quality (examples: Munich, Prague). The most spectacular metros in former socialist countries, originally designed as 'palaces for the people' using valuable materials (examples: Moscow, Saint Petersburg, and Tashkent). Metros with noteworthy collections of public art in the stations (examples: Brussels, Montreal, and Stockholm). Thie chapter also focuses on Ankara. In this chapter, metro history of Ankara and the anticipated project extensions

for the future are going to be mentioned. Three stations of Ankaray and Ankara Metro are going to be examined. These stations are going to be evaluated by their special values, their psychological and physiological effects on the user.

History of metro is quite recent in Ankara. This provides a disadvantage as well as an advantage. For metros, being brand-new and still developing facilities, provide the opportunity to intervene at the critical points at the beginning in terms of management and projectors. On the other hand, being inexperienced in metro increases the possibility of taking the process from a wrong starting point and making mistakes during the process. In addition, it has to be considered that possible mistakes might cause great costs at the final point. When we approach the subject from the user's view, transportation fact is not a product but a service. This service which is provided by the transportation sector is "mobility". A mobility service is not only provided by companies, but also by car drivers, bicyclists, and pedestrians and in terms of infrastructure by the public administration. That is why it must be consumed in the location and time where and when it is produced. Otherwise, it transforms into a high cost manufacturing method because it cannot be saved or provide any benefits. This high cost influences all the segments of the society directly or indirectly. Because of this reason, the opinion and the contribution of the service user has a different value. That is why perception of the user provides an important source for the coming stages of the process in an "incomplete project". This fact is a proof of the need of this study as well as one of its reasons of existence because; many cities in Turkey, have already reached the threshold of metro system.

While there has been a range of substantive investigations of human behavior and perception in metro, each share a fundamental underlying similarity. Each approach, as ethological and dramaturgical approaches, has its own particular merit but, commonly fosters the view that metros are formless systems of mass heterogeneity (Maines, 1979). In other words, while the environment give shape and direction to interaction and behavioral

patterns, interaction and behavioral patterns are not very homogeneous. Because; in these approaches, the environmental differentiation is thought of as being equally experienced by all passengers and as such, it is regarded as a conceptually unique variable. Yet the heterogeneity is caused by the perception of passengers. These approaches are in obvious contradiction with the two representations that are put forth in the thesis. First, in the thesis, it is stated the psychological drawback occurs homogeneously underground. This homogeneity cannot to be thoroughly discussed according to statements mentioned in ethological and dramaturgical approaches. Second, it has an unfavorable effect to define underground space as a single variable if they obviously displayed differences on design. In this improper sense, this represents the design of the underground space as having no effect on perception because of singularity. The expectation of this chapter is to build a correlation between local identity and the design of the metro station.

1.4 The Method in Brief

To explain complex casual links in real-life context of underground, a case study will be introduced in the following chapter. Nevertheless, the entire city cannot be perceived without a certain simplification. It is a difficult task for a citizen to express the whole city. For this, a questionnaire involving a sample of the citizens of Ankara is performed. By this questionnaire, it is aimed to understand how citizens of Ankara perceive the metro system of their home town. In fact, some spatial characteristics and the individual's life style in a city create the bases of the symbolic definitions in that city. However, a citizen can communicate (tell) her feelings and thoughts about the city by her experiences and activities. In this case, words are generally adjectives because a city can be customized and take on individual adjectives. The same fact can be applied to all the spatial characteristics independently from the scale. While defining their hometown, in fact, the citizen adds the sum of all the pieces that form the city in their statement. Definitions of adjectives belonging to the parts of the city can have common and opposite points with

those pertaining to the whole of the city. Even so, this situation is a fact that forms all the part. It shows that in opposition situation, it separates from the whole but in common, as well as in harmony with the whole. The questionnaire is applied to those who use services and the city. It has two aims. First is to hear the perception of the individual directly from them and the second is to establish the differences in terms of perception that results from the changes in the citizen's (the user's) profile of using the service.

The data gathered through the questionnaire are going to be processed by Correspondence Analysis. By this analysis, the changes in user profile and the answers that are given in perceptional dimension are going to be matched and their validity values are going to be checked. By Correspondence Analyses, user profile, variables of city and metro are going to be analyzed and the results are going to be expressed in a two-dimensional space. Correspondence analysis (has also been called correspondence mapping, perceptual mapping, social space analysis, correspondence factor analysis, principal components analysis of qualitative data, and dual scaling) (CA) is a method of factoring categorical variables and displaying them in a property space which maps their association in two or more dimensions (Greenacre, 1993). It is a descriptive/exploratory technique designed to analyze simple two-way and multi-way tables containing some measure of correspondence between the rows and columns. CA provides a method for representing data in a Euclidean space so the results can be visually examined for structure. For data in a typical two-way Contingency Table, both the row variables and the column variables are represented in the same space. This means that one can examine relations not only among row or column variables but also between column and row variables (Benzecri, 1992). In CA, the data matrix is first transformed by dividing each cell by the square root of the corresponding row and column totals. The transformed matrix is then decomposed with singular value decomposition resulting in the singular values (which in this case are canonical correlations) and a set of row vectors and column vectors. Next, the row and column vectors are rescaled with the original total frequencies to

obtain optimal scores. These optimal scores are weighted by the square root of the singular values.

The most important advantage of CA is the ease of 2D plotting mix data sets in a singular data space whether symmetric or asymmetric map. CA does not aim to accept or reject the hypothesis but seeks to visualize relations between data (Greenacre, 1993). By interpreting the data that are achieved by these analyses, in the conclusion part of the thesis, new data are going to be achieved by the Bertin Graphics. This study aims to become a source for the current and coming metro projects in our country by creating an index of proposals.

The thesis will end with design recommendations that will eliminate psychological and physiological drawbacks in underground. Furthermore the reciprocal interaction of the local identity and station design will be introduced according to the hypotheses which are the “the design of metro stations has an important role to eliminate psychological and physiological drawbacks in underground space” and “design considerations of metros are highly related with the life-cycle and formation of urban local identity”.

CHAPTER 2

THE MYTH OF UNDERGROUND

It is impossible to consider the subway independent from the concept of underground.This conceptualization is mostly derived from the physical layout of the subway system. Indeed, the underneath of the city is desolated for infrastructure, sewer and rarely transportation purposes. In this sense, it will be useful to undertake the underground concept not for the sake of convenience, but for the sake of better understanding the whole metro concept.

Any study that undertakes the metro inevitably includes the phenomenon of underground. The question “what lies beneath us?” has fascinated humans for millennia. Because, today, the human nature, “... tends to be of two minds about the world below. On the one hand, it’s an efficient technological refuge from the problems of urban living, but on the other, it’s the realm of the damned (Pike, 1997)”.

In this sense, one can postulate that underground facilities still trigger the primate fears.

For this reason, this chapter aims to cover an examination of the myths, literature and art related to the underworld. Taking the culturally existing motive of the descent to the underworld will guide and provide insight into the darker recesses of human nature towards the anxiety of underground. The analysis that is traced during the chapter is designed according to the reciprocal relations of key modernist writers and their relations to the ancient and medieval past that they constructed.

Throughout the chapter, authors such as Homer, Dante, Jules Verne, H. G. Wells, Edward Bulwer-Lytton, Dostoyevsky and movies from The Subway, Underground, and The Matrix are integrated according to their portrayals about the underground as under an umbrella of religion dependent doctrines.

2.1 Underground

The term underground is derived from a preposition (under[4]) and a noun (ground). Yet the ground is measureless and artificial fact in human mind, it has neither thickness nor dimension in vertical axis. It serves just as a reference for prepositions as under and above characterization. In three dimensional spaces, the location of an object is described through the referenced one. This reference location is a 'location' that is used in measurement of a huge variety of phenomena. To express notions of an object being lower than a point, English uses the following prepositions: under, underneath, beneath, below for spatial relationships. Whether all foregoing prepositions tell something about the relation to something lower than that of the referenced object, s*ub*- is also a common prefix used to express "under", "below", or "less than" in English (ex: subterrian, subcommittee or substandart).

Throughout the text, the term underground will be used to express the spatial relationship of below, beneath, underneath or down to the ground that is referred to. The term underground, according to dictionary definitions has basically two meanings. While the first mainly focuses on its spatial character as a subterranean space or channel, the second focuses more on the idiomatic side as in or into hiding, harmful or secret operation, or an unofficial, unsanctioned, or illegal but informal movement or group. In economics, the term underground culture refers more or less to the parallel market (underground market) and the orthodox of the individuals who sell

[4] Under (Etymology: Middle English, adverb & preposition, from Old English; akin to Old High German untar under, Latin, inferus situated beneath, lower, infra below, Sanskrit, adha, Turkish, alt.

goods and services and consumes those goods and services (e.g. Prostitution markets and illegal drug trading).

Generally, negative connotation heavily associates with the term underground. Since the term underground is one which has been developing over centuries, a brief review of its earlier meanings must be undertaken before it can be situated in the contemporary context. The review process will be handled in three fold. First, the term will be portrayed in a religious, spatial context. Second, the underground concept will be scrutinized in the context of history of literature and film culture. At last the term will be discussed in psychological context.

2.2 Underground in Religional Context

The idiomatic side of the term is mostly common to all cultures and perhaps takes its roots from a sacred background. Most religious spatial organization is taxonomically divided into three as sky, earth and underground. Sky is defined for holly organization of philanthropic characters, and the earth is defined for humankind life where to prepare themselves for eternal life in heaven and hell. Underground is left to harmful characters and it is represented with badness, blackness, darkness and devilry. This changing attitude towards the physical environment is, however, still common and triggers a wide range of phobias or concerns to avoid all contracts with badness and to survive on earth.

Most of the negative connotations can be identified in ancient (e.g. Greek, Roman, and Aztec) religions as well as in recent religions. The underground God in polytheistic religions is symbolized with badness (e.g. “Hades” the lord of the dead and the ruler of the nether world in Greek mythology; “Mictlantecuhitti” the ruler of the underworld in Aztec mythology). In monotheistic belief, there is but one God, to exist; where the vassals suffer everlasting punishment. In the Life Below the Ground, Lesser quotes that “...the notion of the underground has always held something of mystery and

terror for the living, but with Christianity the subterrain began to be equated with evil- a connotation which is carried through to the present (Lesser, 1987)". The word "underground" is associated with poverty, criminal activity, the society unacceptable. In Islamic discourse, after facing with the judgment of Allah (God), vassals will either be admitted to Heaven by His mercy, or sent to Hell[5] by His justice. Hell or Jahannum is described as underground with its seven layers[6] and for each of those Gates (levels) a (special) class (Of sinners) will be assigned. This kind of hierarchy is sensed as a vertical organization as quoted: "The Hypocrites (polytheists and wrongdoers) will be in the lowest depths of the Fire: no helper wilt thou find for them; (Nisa: 145)" in Quran. Some accounts of Hell describe it as a series of numbered layers or levels (Figure 2.1).

What the layers consist of differ from religion to religion, but the descriptions of certain numbered layers often coincide even between different religions. Examples of these coincidences include a layer of intense flames numbered 54 in several religions or a layer where the world looks like earth underground but is inhabited by demons; the soul experiencing it is never sure enough that it is in Hell to reveal their suspicion for fear of appearing insane, and is numbered 78 in at least 3 distinct religions. Same quotations can be observed in the Christian Bible as the dark and fired place (Yahuda 7, 13) where the Lucifer is pushed to cavity, to Hades (Şeol[7]) the Land of Dead (Hez. 32:21).

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[5] The English word hell is derived from the name of a northern European goddess of the underworld whose name Hel means the one who covers [things] up. Also the Greek words "Hades" and "Gehenna" (or perhaps Jahannum) are sometimes translated into the word "hell". 'Gehenna' is a word tracing to Greek, ultimately from Hebrew Gai-Ben-Hinnom (גיא בן הינום) meaning Valley of the Son of Hinnom. Ge-Hinnom is the name of the valley to the south and south-west of Jerusalem which came to be synonymous with a place of punishment, and thus with Hell.

[6] There are seven layers of Hell: the first and the highest layer is called Jahannam (Cehennem) (a temporal layer for Muslims), the second layer is called Sakher (Sakar) (house of Christians), lower than it is Jai (Sair)(house of Jewish), lower than it is Hotamah, (Hûtame) (house of atheists, elf's),lower than it is Saierr (Leza) (house of magicians and pagans) , lower than it is Jahim (Cehim, also known as The Hole of Gayya) (house of demons) , and the lowest layer is Habiyah (Hâviye, also known as The Hole of Gayya) (house of unbelievers). Each level is divided into 70.000 sub layers and the total is counted as 490.000.

[7] Sheol (לואש) is the Hebrew word denoting the "abode of the dead"; the "underworld", "the common grave of mankind" or "pit".

Figure 2.1: The Hell, Herald von Landsberg: Hortus Deliciarum, XII. Century. (Source: http://www.schulmuseum-ottweiler.net/mason/site/view.html?section=archiv-herrad).

The early Hebrews designated Sheol as their abode of the dead, a subterranean place with several levels, each designed to dispense a certain degree of punishment or torture. In one form or another, the concept persisted through the ages. The Latin languages adopted words related to infernus, referring to the world below, where the wicked are punished. In northern regions, words similar to the English hell were derived from Hel, name of the goddess of the Underworld in Scandinavian mythology. Although hell is usually thought of as a hot place and one to be feared, the northern Helheim, abode of Hel, ranged from a very cold world to sunlit meadows and was not necessarily one to frighten mortal hearts. Likewise, Hades in ancient traditions was not just a place where sinful souls were tortured.

2.3 Underground In Literature

Conceptual projections of the underground in antecedent literature cover a broader context. The evolving understanding of the concept exhibits a respectable shift throughout centuries.

In Homer's Iliad and Virgil's Aeneid the underground is described as in fabulous context. Yet the Greek and Roman mythographers were not perfectly consistent about the geography of the afterlife and underworld; it is still possible to generate the overall fictional framework of the statements. As the Greek and Roman mythology are constructed and nourished from the same root, the expected similarity between Homer's and Virgil's expressions emerge in their writings. According to Homer, the underworld is symbolized as *Tartarus* (Fagles, 1998*)*. Tartarus is both symbolized as a deity and a place in underground, a place so far from sun and so deep in the earth. It was honored as the first existing thing from which the Light and the Cosmos is born. The exact location of the Tartarus is not mentioned in the text; however the Greek poet Hesiod asserts that a bronze anvil falling from the heaven would fall nine days before it reached the Earth where it would take nine more days to fall from Earth to Tartarus. Tartarus is mentioned as a place where sinners are sent. It is a place of death guarded by giants (and also by Cerberus[8] at the Gate) and avoids sinners escaping from it by the walls constructed from bronze. Tartarus is also known as Hades (Figure 2.2).

It is necessary to distinguish between Hades the locality and Hades the god of the Underworld, the god of the dead. Hades comes from a Greek root meaning "unseen," "hidden," or "unknown." Relevant comparisons can be found in the Egyptian religion, where the equivalent of Hades is Amenti, meaning "hidden place" or "place of the hidden god," and in the roots of the word hell, which had a sense of "hiding" or "concealing."

[8] Cerberus was the hound of Hades. It was a monstrous three headed dog with a snake for a tail and innumerable snake heads on its back. It ensures that the dead could not leave the Hades and also the living could not enter.

Figure 2.2: The Map of Hades (Parada, 1993).

It was a place where five rivers attached and the plains where the souls rested. The souls of sinners were carried by the river Acheron. It was the river of woe which formed the boundary between the Gaia (Earth) and the underworld. Charon who was the ferryman of Hades was responsible from this transportation process. There were also four rivers (Cocytus “river of wailing”, Lethe “river of forgetfulness”, Phlegethon “river of fire” and Styx “river of border”) and a plain, Elysian, where the final resting place of souls was fall of Asphodels; the favorite food of the dead.

The prominent residents of Tartarus were Hades and Persephone. Hades was a fearsome figure in Greek mythology who was the god of dead and underworld. He was assisted by demons over whom he had complete authority. Persephone was the queen of the underworld who could destroy the light. Simply to say Hades and his underworld was frightening.

As it is indicated above, in Greek and Roman mythology, there is a negative connotation about underground. The decoration which was predominantly through death and punishment.

In the Medieval era, Dante wrote The Divine Comedy which is widely considered as the central epic poem of Italian literature and the one of the greatest work of literature of the Middle Ages. In his poet he tells his travel through the three realms of the dead with the guidance of Virgil -author of The Aeneid in Roman Mythology (Figure 2.3).

Figure 2.3: Dante and Virgil meet Fraudulent Councelors, Illustration by Gustave Doré (1861) (Source: http://www.mediterranees.net/mythes/ulysse/enfers/dante.html).

Throughout their journey to Hell (Inferno), he and Virgil passed the same stages of the hell as it is indicated in Homer's description (Ciardi, 2003). Yet when they reached Hell they faced nine circles of it. The circles are

concentric, each one representing further evil, culminating in the center of the earth, where Satan is held or bound (Figure 2.4). The description of Hades turned into Satan according to Christian view. The first part of the journey ended with the poets escaping from center world and with their access up the slope of the Mountain of Purgatory[9].

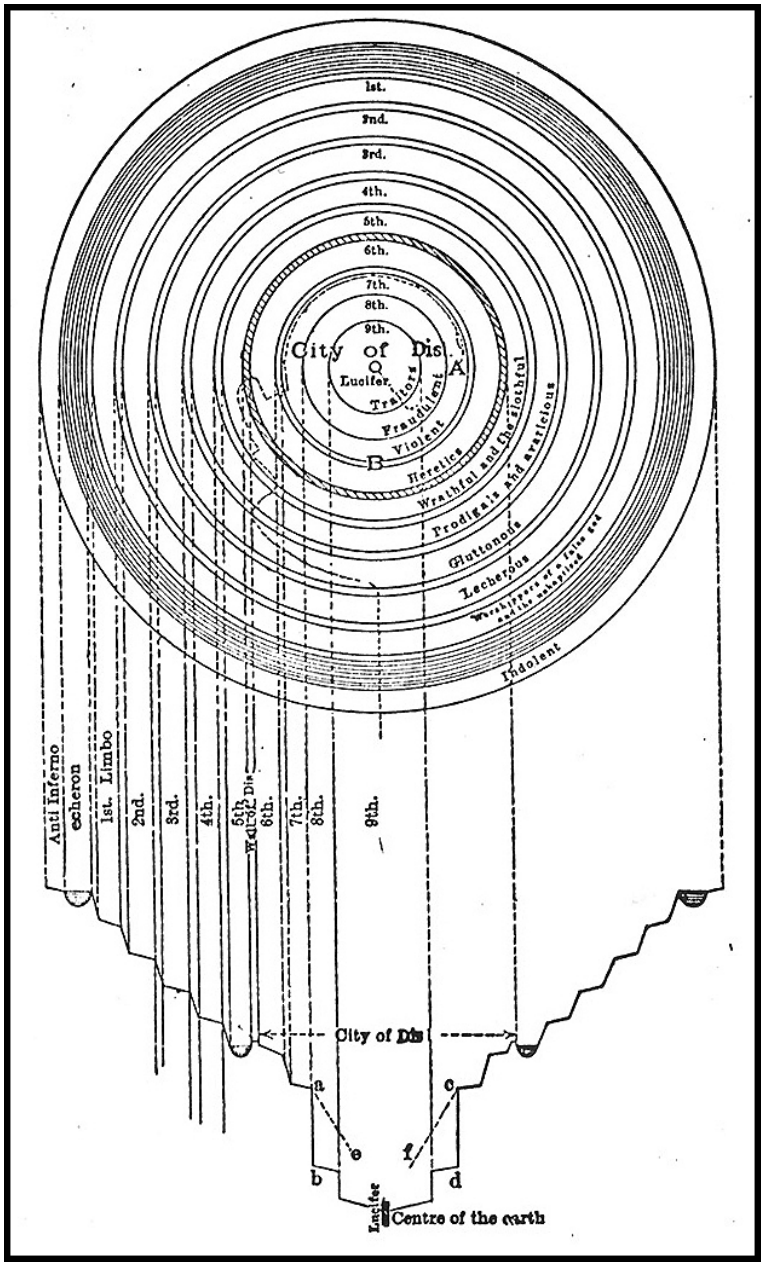


Figure 2.4: Porena's Design of Dante's Hell (1946). (Source: http://www.seniornet.org/php/readerguide.php?GuideID=38&Version=0&Font=0)

[9] In Dante's time, it was believed that Hell existed underneath Jerusalem. The Mountain of Purgatory is located in Jerusalem.

In post-medieval time, a sublime attitude towards underground as well as with the negative understanding of the underground can be observed. This sublimity was based on the writings of Longinus and reached its highest popularity in the 18th century by Burke and Kant. The term was especially referring to greatness to which nothing else can be compared, and sublime is beyond all possibility of calculation, measurement or imitation. Concept of sublime was as an aesthetic quality distinct from beauty. The sublime was determined as an instrument that builds moral origin by indoctrinating human of his limits as well as with respecting and obeying. The sublime may inspire horror, but one can get pleasure in knowing that the perception is a fiction. After his journey to Alps, Dennis (1693, pp. 390-91) commented that “the experience of the journey was at once a pleasure to the eye as music is to the ear, but mingled with Horrours, and sometimes almost with despair.” As the underground was lack of recognizable nature, most authors of the century have built often fantastic understanding about this magical realm.

Although the modern mining in 19th century was serving raw materials for societies, underground was still a virgin territory. This magical and fantastic world became popular for several authors. Most of the novels were undecorated with an imaginary voyage to the depths. The negative connotations about the underground were slowly been replaced by scientific explorations about foreign but earthly environment.

In this period, three writers stand out with their fantastic speculations. The first novelist, Verne, wrote Journey to the Center of the Earth in 1864. In his book, he tells about a voyage of a professor (Otto Lidenbrock) who leads his nephew (Axel Lidenbrock) and a hired guide (Hans) down a volcano in Iceland to the "center of the Earth" (Verne, 1864). During their *scientific* voyage they met a vast cavern, which was enclosing extraordinary life forms and challenging geographical formations (Figure 2.5). General impression of the territory was prehistoric and gigantic. Even there was allusion to proto-human civilization existing so far underground, surprisingly this case was not deeply speculated.

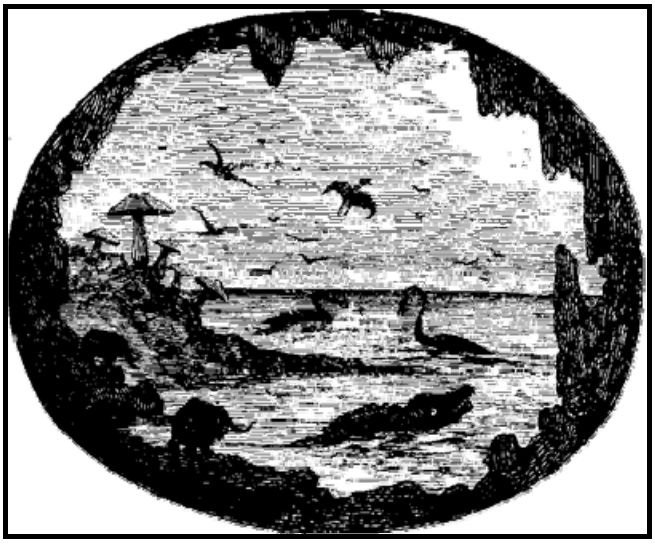


Figure 2.5: Illustration of the Center of the World in Verne's Book. (Source: http://jv.gilead.org.il/vt/c_earth/)

In this novel, the attitude towards underground varies by the characters. While the professor was experiencing the voyage as a scientific journey, the local guide, Hans, was enjoying it as a money-earning business. Axel's way of behaving was much more scared, away from religious doctrines, and claustrophobically entrapped (Figure2.6).

Figure 2.6: Three Adventurers Discovering the Foreign World. (Source: www.swalks.com/earth2.gif).

The quotes of Axel, somehow, betray his psychological states about underground. These physiological states are symbolically represented

throughout the story by oblique hints of horror, "No doubt it is very quiet at the bottom of this well, but there is something alarming in the quietness itself (172)."; entrapment, “I shuddered at the thought of being lost in the mazes of this vast subterranean labyrinth. Besides, if the ascending road did become steeper, I was comforted with the thought that it was bringing us nearer to the surface. There was hope in this (185).”; distress, “We had above us a league and a half of terrestrial crust. The weight of it seemed to be crushing down upon my shoulders (208).”; aspiration, “I no longer thought of sun, moon, and stars, trees, houses, and towns, nor of any of those terrestrial superfluities which are necessaries of men who live upon the earth's surface. Being fossils, we looked upon all those things as mere jokes (225).”; blackout of consciousness, “External objects produce decided effects upon the brain. A man shut up between four walls soon loses the power to associate words and ideas together. How many prisoners in solitary confinement become idiots, if not mad, for want of exercise for the thinking faculty! (234).” and lack of interest, “The general effect was sad, supremely melancholy. Instead of the shining firmament, spangled with its innumerable stars, shining singly or in clusters, I felt that all these subdued and shaded fights were ribbed in by vast walls of granite, which seemed to overpower me with their weight, and that all this space, great as it was, would not be enough for the march of the humblest of satellites (262)”. In this context, going underground was reflected as a heroic attempt by Verne.

H.G Wells is another subterranean fiction writer. Different from Verne, his sci-fi novel, The Time Machine, is limited to description of the advancement of evolved mankind living in caves, tunnels and halls and such, mostly relatively near the surface far away from the earth's core, but also includes disguised critics of modern utopia and the class relations of Victorian society (Wells, 1895).

The Time Machine details the experience of time travel and the evolution of its surroundings as it moves through time. In the novel, The Time Traveler voyages to the year A.D. 802,701 where he finds an apparently peaceful,

pastoral future, filled with happy, simple humans who call themselves the Eloi. The Eloi are “exquisite creatures (37)” and “pretty little people (37)”. They are about “four feet tall, pink-skinned and frail-looking, with curly hair, small ears and mouths and large eyes (38)” and dress in identical clothes. The Eloi are living in a small community within a large and futuristic yet dilapidated building, who are not working and eating fruits all day long; indeed they are vegetarians. The creatures, The Eloi, are “fool (38)”. Thus, he declares, when considering their lack of intelligence, “An animal perfectly in harmony with its environment is a perfect mechanism. Nature never appeals to intelligence until habit and instinct are useless. There is no intelligence where there is no change and no need to change (121).” by invoking Darwinian Law of Evolution. The system is perfect and there was nothing to do or no problem to worry about for The Eloi. With no work to do and no hardships to overcome, society has become non-hierarchical and non-cooperative, with no defined leaders or social classes. One common characteristic was the fear of dark present in the members of the race.

Yet the *time machine* has been lost, the voyage of the time traveler has turned into a dystopian nightmare. The perfect world of the Eloi is deceptive. The Traveller soon has discovered that the human race has been diverged into two branches as he quoted “It was not for some time that I could succeed in persuading myself that the thing I had seen was human. But, gradually, the truth dawned on me: that Man had not remained one species, but had differentiated into two distinct animals: that my graceful children of the Upper-world were not the sole descendants of our generation, but that this bleached, obscene, nocturnal Thing, which had flashed before me, was also heir to all the ages (73).” In fact the Eloi are not masters of the Earth in 802,701; the masters are Morlocks; the ascendant class, ironically living beneath the Eloi, who provide for the Eloi with the cannibalistic feast to consume. This situation represents an antagonistic counter to Traveller’s own world reality depending on class-divided Victorian society. On the other hand, it represents parallelism with Traveller’s own world reality where all industry and working class accommodation are removed underground, and the

surface or the earth is left for the pleasures of ruling class. As the Time Traveller speculates, “At first, proceeding from the problems of our own age, it seemed clear as daylight to me that the gradual widening of the present merely temporary and social difference between the Capitalist and the Labourer, was the key to the whole position. No doubt it will seem grotesque enough to you - and wildly incredible! - and yet even now there are existing circumstances to point that way. There is a tendency to utilize underground space for the less ornamental purposes of civilization; there is the Metropolitan Railway in London, for instance, there are new electric railways, there are subways, there are underground workrooms and restaurants, and they increase and multiply.

Evidently, I thought, this tendency had increased till Industry had gradually lost its birthright in the sky. I mean that it had gone deeper and deeper into larger and ever larger underground factories, spending a still-increasing amount of its time therein, till, in the end - ! Even now, does not an East-end worker live in such artificial conditions as practically to be cut off from the natural surface of the earth? (76)” and later he states “Again, the exclusive tendency of richer people - due, no doubt, to the increasing refinement of their education, and the widening gulf between them and the rude violence of the poor - is already leading to the closing, in their interest, of considerable portions of the surface of the land. About London, for instance, perhaps half the prettier country is shut in against intrusion. And this same widening gulf - which is due to the length and expense of the higher educational process and the increased facilities for and temptations towards refined habits on the part of the rich - will make that exchange between class and class, that promotion by intermarriage which at present retards the splitting of our species along lines of social stratification, less and less frequent. So, in the end, above ground you must have the Haves, pursuing pleasure and comfort and beauty, and below ground the Have-nots, the Workers getting continually adapted to the conditions of their labor. Once they were there, they would no doubt have to pay rent, and not a little of it, for the ventilation of their caverns; and if they refused, they would starve or be suffocated for arrears. Such of them as were

so constituted as to be miserable and rebellious would die; and, in the end, the balance being permanent, the survivors would become as well adapted to the conditions of underground life, and as happy in their way, as the Upper-world people were to theirs (77).” Even though the Morlocks have cannibalistic feast; the tolerant views of Traveller are attractive. According to him as the Eloi never need to work to provide for themselves, and as the Morlocks’ underground habitats mean they have no choice but to labour automatically for the Eloi or face suffocation or starvation, the Eloi no longer required intelligence or strength and thus, they have adopted to their new conditions and have grown mentally and physically weak. Yet the underground has limited food stock for Morlocks; the threat of starvation forces them to break the taboo of cannibalism and they have turned to their above world masters for meat.

The Time Traveller’s impression of the home of the laboring class, The Morlock Underworld, is decorated with horror but also abhorrent as it is introduced in Verne’s book:

“But I was so horribly alone, and even to clamber down into the darkness of the well appalled me. I don't know if you will understand my feeling, but I never felt quite safe at my back (81).

I was in an agony of discomfort. I had some thought of trying to go up the shaft again, and leave the Under-world alone.... the unbroken darkness had had a distressing effect upon my eyes (83).

Great shapes like big machines rose out of the dimness, and cast grotesque black shadows, in which dim spectral Morlocks sheltered from the glare. The place, by the way, was very stuffy and oppressive, and the faint halitus of freshly shed blood was in the air.... It was all very indistinct: the heavy smell, the big unmeaning shapes, the obscene figures lurking in the shadows, and only waiting for the darkness to come at me again! (85).

What is interesting in the text is that of the defense of the symbiosis between under and above world. Wells did not argue that the underground is unnecessary yet he justifies its exigencies. Although the physical and mental differences between Eloi and Morlocks are dramatic in the possibility of living underground is comphasized. Underground was still a foreign habitat for today's human as he experienced in his voyage to underworld. Underground life changed Morlocks physically for seeing in the dark: "their eyes were abnormally large and sensitive, just as are the pupils of the abysmal fishes, and they reflected the light in the same way (84)", "…those pale, chinless faces and great, lidless, pinkish-grey eyes! (87)", and moving in narrow tunnels "stooping white creatures (84)" (Figure 2.7)

Different from religiously driven ancient and sublimely ornamented 18th century writers, some 19th century novelists have been inspired by a new subterranean myth—the underground as technological utopia. Because the new underground paradox began in the nineteenth century when Paris and London have launched construction projects which no city had before.

The images of the underground and metro are introduced as a sanitized, controlled middle class space where everything is functioning perfectly and efficiently. Late nineteenth-century English and French science fiction novels, such as, The Coming Race, have been a wave of novels about utopias that promise technology would allow humankind to make perfect cities underground.

The Coming Race (also known as Vril: The Power of the Coming Race) is a novel published in 1870 by Edward Bulwer-Lytton. The novel was about an English man who falls into a deep chasm and finds himself suddenly trapped in a subterranean world inhabited by an ancient race of advanced beings (Lytton, 1870).

Figure 2.7: The Representation of Eloi Woman (Left) and Hunter Morlock (Right) in the Movie “The Time Machine” (2002) which is Based on Same Novel. (Source: http://dc-mrg.english.ucsb.edu/WarnerTeach/E192/aliensrobotscyborgs/aliens.html).

The story draws upon ideas of Darwinism (like Wells) to describe a near future world (Vril-ya) characterized by female dominance, physical perfection, and vast technological progress. Vril-ya, is a “The Civilized Nation” people by a new race, The Ana. The Ana are an ancient people, “who were tall, equipped by large wings folded over their breast and reaching their knees, with a face of sphinx (16)” (Figure 2.8). They are descended from frogs, and are thousands year more advanced than the surface-dwellers of the Earth.

Different from Eloi, family is the center of the society as well as with a single supreme magistrate. There is no poverty, no forced equity of wealth and property ownership. The main aim of the society is to displace all the mediocre races existing on the upper world when the education of the society becomes finally completed.

The superiority of the society was depending on *vril*[10], “an “all permeating fluid” and “"life-giving elixirs”. Indeed, Vril was a form of energy used for multiple purposes.

Figure 2.8: The Vril-ya. (Source: http://anamnese.online.fr/if/comerace.html).

Under the influence of this kind of sci-fi books, for a definite period, almost until the end of 1960s, the underground is perceived as an advanced technological center. Underground was astounding, however it was also menacing for surface-dwellers. Although at one time adventure literature made this idea popular, the notion now receives little support; substantial geodetic evidence has long controverted it and the scientific community dismisses it as pseudoscience. This rapprochement was nourished from the theory of Hollow World which holds that Earth does not consist of molten metal at its core, as modern science tells us, but is instead quite hollow inside, and supports several different races of sentient beings as well as their impressive underground cities. Those cities are said to be linked to one

[10] The term Vril was formed from the ancient Sumerian word "Vri-Il" ("like god"). Several assertions are claimed about a Vril Gesellschaft (Society), or Luminous Lodge, in last century. The aim of the society was to explore the origins of the Aryan race living on Alpha Tauri (the brightest star in the constellation Taurus). Their main goal was to achieve *Raumflug* (Spaceflight) to reach Alpha Tauri. Members of the Vril Society are said to have included Adolph Hitler, Alfred Rosenberg, Heinrich Himmler, Hermann Göring. According to Nazi mysticism, there are two main goals are defined for Nazis; first to explore the “Ark of Covenant” for to conquer the world, second to get vril, for astral voyage and supra energy.

another by underground tunnels with aboveground openings that the occasional surface-dwelling mortal stumbles on to (Beckley, 1992).

Edmund Halley, who gave an impulse first about Hollow World, put forth the idea of Earth consisting of a hollow shell about 500 miles thick, two inner concentric shells and an innermost core, about the diameters of the planets Venus, Mars, and Mercury with separate atmospheres. In 1906, William Reed propounded the idea of a hollow Earth, but without interior shells or inner suns as Halley. When UFO era begins after post World War II in United States, Hollow World theory shaped its own idea as: UFOs come from the interior.

Generally, scientists have taken neither type of speculation seriously but the theory still lives as in the form of concave worlds, Dyson Sphere, Globus Cassus (Abdelkader, 1983).

The mystical and escape trail structure of the underground is used as a metaphor and a *Locus* in social criticism. Indeed, before underground becomes an urban cult culture, Fyodor Dostoyevsky introduces the “underground man” character in *Notes from Underground*. Underground man is represented as a portrait of retired civil servant as irrational, uncontrollable, and uncooperative (Dostoyevsky, 2005). He was an exemplar of a relatively new class of person that exists within a modern urban underground. He was in his 40 and refused ordinary social life before he took in cover the underground; locus of solitariness, isolation, anger and vile thoughts.

This peevish monolog was a reaction to Chernyshevsky’s “What is to be done?” (Chernyshevsky, 1989). It was an aggression to logical self-interest. Dostoyevsky saw Chernyshevsky's utopian `Crystal Palace' as stripping humanity of its dignity and free will. Indeed the Underground Man disregards completely the rational action and takes some other. According to him, human consciousness is a disease, but all men love their diseases. Actually

The Underground Man searches for the delight enjoyed and nourished from degrade. Being degraded degrades pain and suffering.

“The more aware I was of beauty and of “the highest and the best”, the deeper I sank into my slime, and more capable I become of immersing myself completely in it (18).”

Dostoyevsky’s novels are frequently conceptualized around this anti-hero conceptualization (e.g. Raslonikov and Karamazov’s). Underground Man was not a highborn neither bourgeois who lived underground. Actually, it is not coincidence. Underground is described as a place, which protects him against the fallacy of modernism. In other words underground space is to define virtual space which is performed to interrogate private or personal attribute. In this context underground is an insulated hole to struggle with reality and facts of aboveground.

2.4 Underground In Cinematogrphy

Underground conception, as much as in written literature, has also been mentioned in the cinema. From this point of view three movies will be taken on this study. First of the movies is called “Subway” from the director Luc Besson, and it is cinematized in the year 1985. The drama is set entirely within the Paris Metro and examines the lives and morality of the punks and fringe – dwellers living there. In this movie, subway is presented as a speed-centered subculture and as a world of marginal living and art. The second movie is a Balkans movie from the director Emir Kusturica, called “Underground 1995”. In this movie, funny and touching story of Yugoslavia living underground with the intentionally carried on paranoia of 2nd World War is being told. The last movie going to be mentioned in this section is the series of Wachowski Brothers, called “Matrix”.

Although there are lots of movies covering the subject underground in the history of cinema, there is a reason why these three are chosen and its about

their approach to the concept of underground. In the first movie, Subway, underground is taken as an enchanted world of the marginal urban living embeding the conception of underground into the urban living. Surface-dwellers experience different faces of subway system, which has its own rules. On the other hand, the movie underground expresses underground as a place to escape and presents societies living ironical conflicts at the same time period but in different times. Matrix is a movie in which ancient underground expressions are taken into consideration.

Subway takes us into the underground system in Paris. Fred (Christopher Lambert) has just stolen some major documents from a birthday celebration given by the Paris elite for one of their kind, Helena (Isabelle Adjani). He takes off into the Metro just as it is shut down for the remaining few hours of predawn darkness and once in the Metro, encounters several characters in the tunnels (Figure 2.9). There is a bodybuilder who works out with subway parts, a purse-snatcher, and a flower seller of dubious ethics. Inspired by the moment, Fred decides to recruit a few of the ubiquitous musicians who perform (some of the best music around) on the Metro's byways, and he creates a rock band. Through all of these encounters and activities, the police and others -- including Helena -- are after Fred for their own reasons, none of which coincide. As Fred discovers, going underground can be risky.

Figure 2.9: Fred Experiences the Subway Life. (Source: www.christopherlambert.org).

Luc Besson's movies can all be viewed not just as movies but movies with a meaning. One of his major themes in all his movies is social existentialism - the decline of society and morality. The protagonist develops his own sense of morality and what is right and wrong in relation to their decline in society as a whole. What are noticeable in his movies are the absence of family and the demise of the community, which he brings out with great sophistication.

Quotes are essential in understanding the point that Besson wishes to make through this movie. Man does what he feels he must do and not what is required of him by society. Society may impose laws but his nature and emotions control man more than these laws do. This conflict between civilization and man's nature is one of the key themes of the film.

Fred is not the perfect protagonist but is more attractive than his opponents as he is innocent, direct and acts on what is in his heart. It is a modern play on existentialism, in which the nature and very existence of morality is called into question and each character exercises an influence on the lives and fates of the others.

The principal characters in most of Besson's movies have at least one thing in common – they are all loners and outcasts from society. They do not conform to the norms and regulations of society. At the same time, the societies portrayed are extreme and probably not to be found on earth. They are invariably societies on the decline that have conflicting principles and ideologies with those of the protagonist.

The worlds explored are dark and uncertain places where conventional views of right and wrong are challenged. The principal characters are the only ones to show any real "integrity" although they have their own sense of morality, which the viewer may not always be able to accept or agree with. Luc Besson makes interesting but challenging observations on life, morality and personal development. The characters are all results of this extreme society and therefore extreme and intense in their own way. The extremities in his

movies actually help in providing greater clarity to Besson's ideas (Hayward, 1998).

When the movie is examined, it is come up with the reality that subway more than being a type of transportation is a place to live in. Subway has become a place to take cover for who can not survive above ground. Same as Murlocks, the main needs such as food, clothing and even money are obtained from people living above ground. As the lightning is artificial, there is no sense of day and night, and the living is based on biorhythm.

In the movie, Subway people have less contact with the outer world people, but still try to survive under the rules of above ground world. Although this type of life style can seem very monotonous, the birthday party among the fellows is very affective. When looked from the point of view of the ones living above, subway people are perceived as a treats, and the struggle with this society keeps going. Late at night, when the subway is off, a new life begins. In this life, joy and freedom are enjoyed.

Thus, in this movie, the conception of underground is told as a second world based on subway. This world, even though it feels the impact of the above world, - yet has escaped from it and does not contact with it if it is not mandatory- is a world that formed its own norms. Although the illegal characters are shown as right, underground is taken up as a treat. The approach of the movie to underground is in parallel with Wells'.

The story in the second movie Underground is like the Hollow World theory, but the so-called second world in the movie is an artifact of people.

An unpredictable black comedy with an epic scope, Emir Kusturica's highly acclaimed Underground takes a look at the modern history of Yugoslavia through the often absurd misadventures of two friends over several decades. The film begins in Belgrade in 1941, establishing the friendship between the gregarious Blacky and the more intellectual Marko during a drunken, late-

night musical procession that establishes the riotous tone to follow. Fellow members of the Communist Party, the friends also share an involvement in shady business activities and an attraction for a beautiful actress. Soon, the chaos of World War II forces them to take refuge in an underground shelter with a variety of other townspeople. Years pass and the war ends, but Marko and the actress trick the others into believing that the war is still going on.

One of the basic points of the movie is the harshness of the war, together with the ironic relationship between two parallel worlds. During the movie, while surface is presented as a place of passion, harshness, and deception, underground, even though it portrays the war and the difficulties, is seen as a symbol of cleanness in which traditions are ruling.

After underground stables its order, it fulfills all of the requirements of the everyday life. Marriage, streets, and work- yet it represents the producing for above- have become standards of this artificial life (Figure 2.10).

Figure 2.10: The Set of the Underground, as foreseen by the Original Scenario; the Weaving Looms Will Soon be Transformed into Weapon Assembly Lines (Left). The Practical Organization in the Underground: Toilets, Showers, Wash Basins (Right). (Source: http://www.dhennin.com/kusturica/v2/_croquis_en.html).

There is a symbiotic construct between above and under ground just like in Wells'. While basic needs are obtained from above, the production in the underground continues for the struggle of the people above with the others (Nazis).

After the walls of underground have collapsed by a coincidental explosion, the inhabitants of underground have contacted with the surface. As they have been living under, they have felt the concept of being timeless when they have reached above. This is a different experience for Jovan, the son of Blackly, who has spent his whole life under. Jovan sees the world for the first time, confusing a deer for a horse and the moon for the sun. Indeed, at outside, they react to the world like children who've stepped into alternate universes.

During the film's second part, Ivan, the brother of Marco, and his loyal monkey Sino come across a big underground highway before committing suicide inside a church. This highway connects European cities to each other (Figure 2.11). What was interesting about this highway is that it described as the distinguishing part of the real life as the UN soldiers were carrying victims of war against payment.

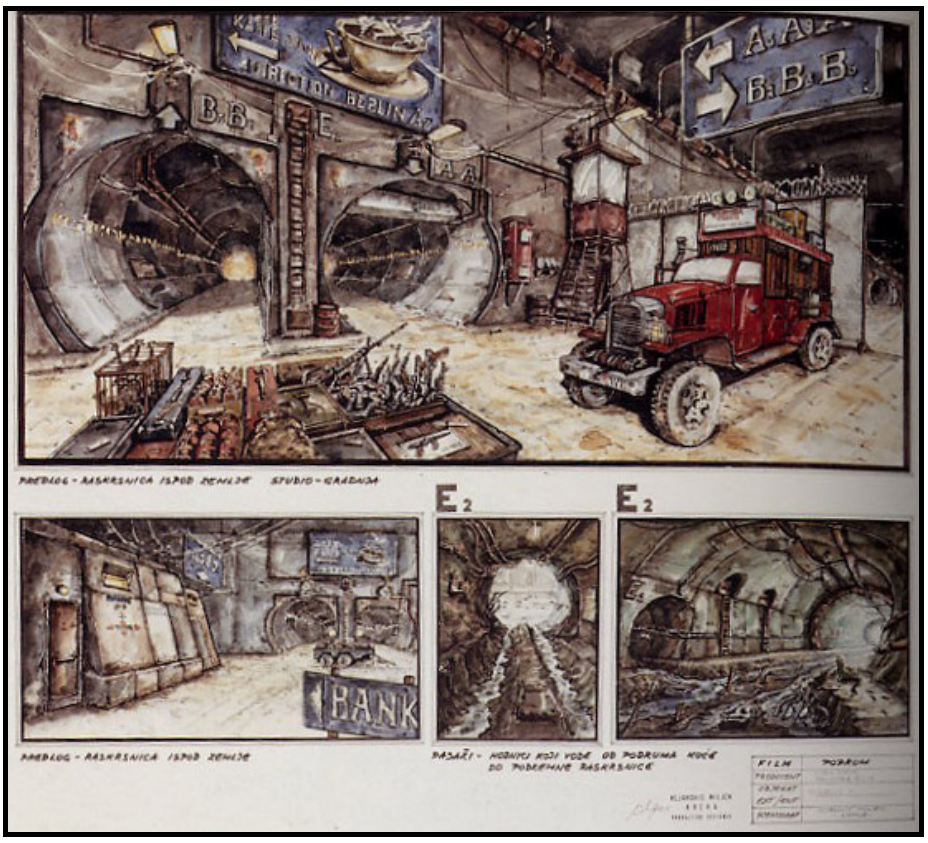


Figure 2.11: The Network of Tunnels Connecting Athens to Berlin. (Source: http://www.dhennin.com/kusturica/v2/_croquis_en.html).

The third film in classification is the Matrix trilogy. The Matrix series consists primarily of three films, The Matrix, the Matrix Reloaded and the Matrix Revolutions, all written and directed by the Wachowski brothers and set in the same universe. The series depict a complex science fiction story incorporating many philosophical elements. Other influences include cyberpunk, mythology, Hong Kong action films, computer science and philosophy of mind. Concepts of several religions are also explored, including Hinduism, Christianity, Atheism, Gnosticism and Buddhism.

The exposition of the trilogy built upon a complex story. Yet it narrates the struggle between human and machines in short, it is decorated with the elements of philosophy, mysticism and science or perhaps pseudo-science:

It's the year 1999, and Thomas Anderson (hacker alias: Neo) works in a cubicle, manning a computer and doing a little hacking on the side. It's through this latter activity that Thomas makes the acquaintance of Morpheus, who has some interesting news for Mr. Anderson -- none of what's going on around him is real. The year is actually closer to 2199, and it seems Thomas, like most people, is a victim of The Matrix, a massive artificial intelligence system that has tapped into people's minds and created the illusion of a real world, while using their brains and bodies for energy, tossing them away like spent batteries when they're through. Morpheus, however, is convinced Neo is "The One" who can crack open The Matrix and bring his people to both physical and psychological freedom. Neo and Trinity have been summoned by Morpheus to join him on a voyage to Zion, the last outpost of free human beings on Earth. Neo and Trinity's work together has been complicated by the fact the two are involved in a serious romantic relationship. Upon their arrival in Zion, Morpheus locks horns with rival Commander Lock and encounters his old flame Niobe. Meanwhile, Agent Smith has returned with some surprises for Neo, most notably the ability to replicate himself as many times as he pleases. Neo makes his way to The Oracle, who informs him that if he wishes to save humankind, he must unlock "The Source," which means having to release The Key Maker from the clutches of Merovingian. While

Merovingian refuses to cooperate, his wife, Persephone, angry at her husband's alliances with other women, offers to help, but only in exchange for a taste of Neo's affections. With The Key maker in tow, Neo, Trinity, and Morpheus are chased by Merovingian's henchmen: a pair of deadly albino twins. Neo remains unconscious in the real world, caught in a mysterious subway station that lies between the machine world and the Matrix, and Bane is still a conduit for Agent Smith, who continues to grow out of control, threatening to destroy both worlds. Meanwhile, as the sentinels get closer and closer to Zion, the citizens of the earth's last inhabited city prepare for the inevitable onslaught. By bargaining with The Merovingian, Trinity and Morpheus are able to free Neo who, after meeting with The Oracle, decides that he must leave Zion and head for the machine mainframe. As Neo and Trinity venture into the dangerous machine world, with hopes of stopping both the machines and Agent Smith, their comrades in Zion attempt to fight off the attacking sentinels with the odds stacked greatly against them.

According the conceptualization of the underground, this trilogy can be analyzed in two folds. First, Zion, the underground city for survival and second the symbiotic relationship between machines and human.

In The Matrix, Zion is the underground home of the free humans never seen on-screen in the first movie, but featured prominently in the two sequels (Figure 2.12). It is possible that this is only a coincidence, and that Zion is used as a generalized metaphor for a mythical city which could be considered to be the last hope for humanity.

The term Zion[11] is an archaic term that originally referred to a specific mountain near Jerusalem (Mount Zion), on which stood a Jebusite fortress of the same name that was conquered by David.

[11] Sion or צִיּוֹן "Height", Standard Hebrew Tziyyon, Tiberian Hebrew Tsiyyôn; Arabic صهيون Ṣuhyūn

Figure 2.12: The Zion. (Source: http://bigdavemclean.tripod.com/matrix.html).

"Zion" is also a metonym for Solomon's Temple. Today, "Zion" is often used metaphorically[12], to symbolize Jerusalem and the Promised Land to come, in which God dwells among his chosen people.

Many other movements utter the ardent desire to Zion. Zion, from a Rasta[13] perspective, refers broadly to Africa and more specifically to Ethiopia as the ancestral homeland of all black peoples. The symbols of Rastafarian culture identify with this domain in its various spiritual, cultural, and political connotations[14].

In the Matrix films, Zion was the last human city on the planet Earth and existed deep underground for both concealment from its enemies as well as with warmth. In this future Earth, the surface was too cold and dangerous for humans to live after a cataclysmic nuclear war between sentient Machines

[12] Zionism is a political movement and ideology that supports a homeland for the Jewish People in the Land of Israel, where the Jewish nation originated over 3200 years ago and where Jewish kingdoms and self-governing states existed at various times in history.

[13] Rasta, or the Rastafari movement, is a religious movement that accepts Haile Selassie I, the former emperor of Ethiopia, as Jah (the Rastafari name for God incarnate, from a shortened form of Jehovah found in Psalms 68:4 in the King James Version of the Bible), and part of the Holy Trinity as the messiah promised to return in the Bible.

[14] Bob Marley, as one of the best popular supporter , reflects the ideology of Rastafarianism in his lyrics:

Open your eyes and look within
Are you satisfied with the life you're living?
We know where we're going;
We know where we're from
We're leaving Babylon, we're going to our fatherland (Zion); Bob Marley "Exodus" 5. 1977.

and Man hundreds of years before left the artificial beings with control over the surface. Zion had been destroyed and rebuilt five times by the time of the Matrix films. It was cylindrical in design, composed of many different levels. The Docks comprise the top level of the city, which contained ports for Zion hovercraft such as the Nebuchadnezzar as well as the city's primary defenses. The city's living quarters, temples, and gathering spaces comprised the intermediate areas. The bottom level contained vital life support machinery such as that which supplied water to Zion's inhabitants. By the final days of the war the knowledge to repair these systems had been lost, though that also have been part of the scenario set up by the Machines every time the city was "reset" following an appearance of The One; The Neo. Zion was led by a Council that made all administrative decisions.

This conceptual approach encloses much of the previous subjects determine underground. Before all else, Zion is portrayed as a place of refuge and hope against surface pressure as in the films Subway, Underground and novel Notes from Underground. It was a machine city with an administrative structure as like Vril-ya. Inhabitants of Zion were systematically visiting above ground to accomplish their goal as in The Time Machine.

Different from ancient beliefs, devilry is located at above; even everywhere. Yet the dark and underground is associated with devilry; this may give us a clue to the question we asked in the debate: Why is Zion underground and dark? The Matrix character Morpheus, like Morpheus the Greek god, both live underground. It is a dark place for both of them. It is also a place where people remain trapped. All the people in The Matrix’s Zion are imprisoned in the underworld by the machines. Both need to be freed. The human community in The Matrix's Zion, just like the Greeks wandering around Hades, will not be truly liberated until they are brought out of the underworld.

In 1889 H. P. Blavatsky wrote that to speak of "anyone as having descended into Hades, was equivalent in antiquity to calling him a full Initiate." (Blavatsky, 1889) The initiate who had made the descent into Hades became

one of a distinguished company who had completed the same journey. As well as Jesus[15] these included Krishna, Gilgamesh, Orpheus, and Aeneas.

One of the earliest known journeys to “Hades” is that of the divine Krishna of India. An esoteric version is presented in the Kathopanishad: the visit of Nachiketas to Yama, Lord of Death, suggests the necessity for making the journey with full consciousness. The reward is immortality. This is a profound theme and no theosophical interpretation of the "descent" is complete unless its implications are taken into account (Davy, 1983).

From the ancient Middle and Near East comes a rich collection of descent myths. One is that of Gilgamesh, hero of the Babylonian epic. Another is the colorful story of the goddess Ishtar who descended into Aralu, the Akkadian Hades; a Sumerian version is similar.

Also from classical sources are two examples from Greek mythology that have stood the test of time and are perennially fascinating. The most famous is the story of Orpheus who went to Hades to plead for the release of the soul of his dead wife, Eurydice.

According to the myth, Orpheus, the greatest of all musicians in Greek mythology, fell in love with a beautiful woman names Eurydice. On the day of their wedding, she stumbled upon a poisonous snake. The huge serpent bit her and she died. Orpheus had been married and widowed on the same day. After many weeks of mourning, he decided that he would go to Hades, the land of the dead. There he would plead for his wife. He came to the gates that lead to the underworld, playing on his harp (Figure 2.13). No living mortals were allowed to cross into the shadowy regions of the underworld. But Orpheus' sweet sad music moved the ferry of the deads and he gave Orpheus a ride across the dark murky river Styx. Thus Orpheus entered the purple-darkened realm of the dead. Finally the musician came before Hades.

[15] The story is that Jesus did a multi-hell tour while he was in the tomb for three days. Jesus not only went to Sheol to free the Jewish Patriarchs (Abraham and friends), he also went to Greek Hades to free humankind there as well.

Here, before the King and Queen of Hades, Orpheus sang his sad, sweet song and pleaded to have his bride back. Even the rulers of the underworld were moved by his music.

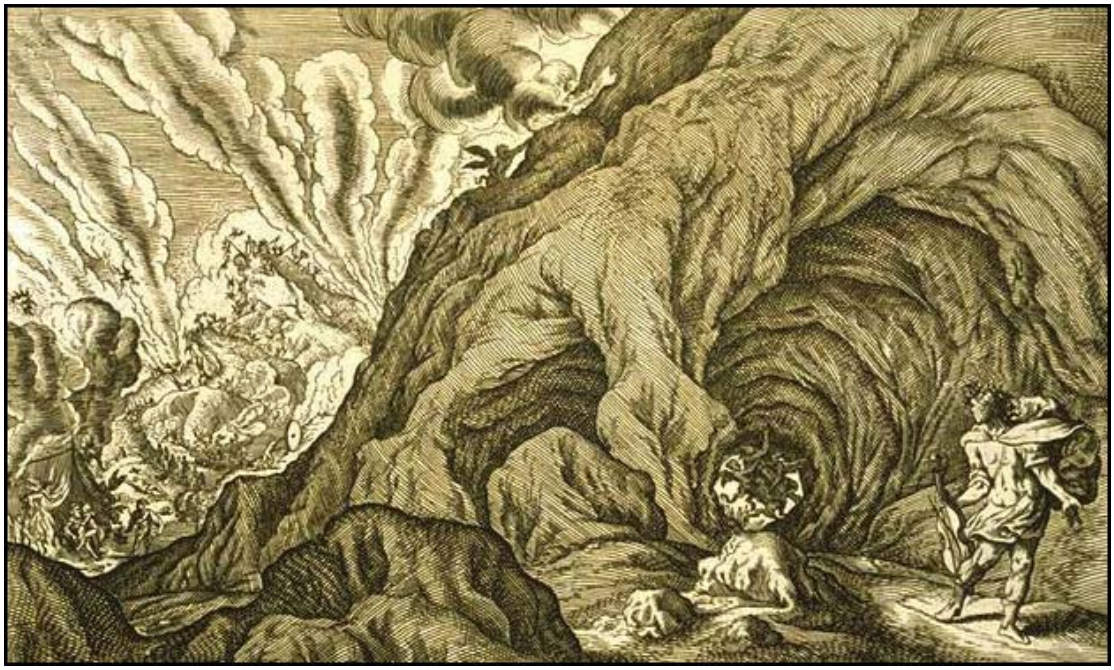


Figure 2.13: Opheus in the Underworld By Johann Whilhelm Baur (1639). (Sources: http://www.rastko.org.yu/drama/zstefanovic/orfej/mit/).

Eurydice was called forth and she came still limping from the wound where the serpent had bitten her. The gods of Hades agreed that Orpheus could have his wife back, but only on the condition that he did not look back until he had reached the land of the living. Orpheus began walking up the long steep path that led to the sunlit world of men. The winding pathway was gloomy and silent. Behind him in the darkness he could hear the soft pad of Eurydice's bare feet upon the rocky steps. At last Orpheus saw sunlight coming through the opening to the over world. He forgot himself and turned to look at his wife. There stood Eurydice, as lovely as a spring morning with her dark wavy hair and her snowy cheeks. But as he looked Orpheus saw his lovely wife begin to fade. He desperately tried to embrace her but she only had time to whisper "Farewell" before she vanished (Guthrie, 1983 and Harrison 1991). A different version of the voyage is told for Aeneas in Homer’s Iliad. After destruction of Troy, Prince Aeneas organizes a travel to Hades (Tartarus). He plans to ask his father (Anchises) for advice to build a

new city (Figure 2.14). He passes al levels of Hades with gifts and builds Rome after his travel.

Figure 2.14 : Aeneas Bribed Charon With The Golden Bough. (Source: http://www.dartmouth.edu/~matc/math5.geometry/unit4/unit4.html).

One frequent expression among the ancients is that hell is the physical body and the descent into incarnation is the imprisonment or death of the human soul as in Matrix. Blavatsky employed this allegory (Blavatsky, 1999).

The film also suggests Zion is heaven, such as when Tank – who was the ship's Operator on board the hovercraft Nebuchadnezzar- says, "If the war was over tomorrow, Zion is where the party would be," evoking the traditional Christian schema of an apocalypse followed by life in heaven or paradise. Ironically, the film locates Zion "underground, near the Earth's core, where it is still warm," which would seem to be a cinematic code for hell. Same dual coding represented in the film Constantine. Constantine tells the story of irreverent supernatural detective John Constantine (Keanu Reeves; who also acts in Matrix, the Neo, The One), who has literally been to hell and back. The film’s representation of heaven and hell as parallel dimensions in, with, and under our own reality provides a fascinating angle on an otherwise medieval cosmology (Mallinson, 2005).

Second point about this film is the structure of the relationship between above and underground. The film represents that AIs have taken over the world of human beings and are now farming humans for the energy they provide in “human farms”. The Matrix is a virtual reality constructed in cyberspace where simulated human beings continue to exist in a 1999 look-alike modeled world in a happy manner. Their real bodies are kept in the farm outside. In human farms, humans are caged in artificial fetuses serving as batteries for the Matrix. They produce electricity for the Matrix and at the same time they also consume the fluid of the dissolved corpses. The role of human beings is now reduced to just a machine of production and consumption. And the purpose of the human farm is to maintain the function of the Matrix.

Similar attitude can be seen in Well’s The Time Machine. The Murlocks offer The Eloi a happy world before they consume them; The Matrix does the same for humans. The structure of the relation is based on symbiosis. If we take virtual (or as real for The Eloi) happiness as an advantage for the host, the structure of the relation can be mutual or noti it will be parasitism where the parasite (The Matrix) benefits and the other (the host human) is harmed. Yet the humans struggle for their freedom unlike the Eloi; according to this clue, the symbiosis in The Matrix should be parasitism. From this position, we can see the conflict that emerge therein, that in every type of relation even mutual or parasitism, above and underground need each other; as conjectural and inseparable pairs.

Indeed, under the light of all statements mentioned above, it is clear that the underground permanently influenced human life in his known history. The drive force behind this can be summarized as *mystery* that it encloses. Depending on the nature of mystery, it always monitored as met agnostic. By their very nature mysteries are ineffable, beyond what can be expressed in words, or esoteric.

The mystical approach about the underground can be explained with three causes. First is person having limited scientific knowledge imputes the unknowns in his life to it. By this way, unknowns about his life are postponed and accepted by overlapping other unknowns until facing with some facts such as heaven and hell by finishing his life. Moreover, this mysticism strengthens by illustrating the underground experiences in an epical way which never exists in an ordinary life (such as Homer and Dante). Darwin adopts and explains this admission in his book named “Life and Letters” like this (Darwin, 2004):

"The mystery of the beginning of all things is insoluble by us; and I for one must be content to remain an Agnostic."

Darwin gives this approach a reason like this:

"I think an Agnostic would be the more correct description of my state of mind. The whole subject is beyond the scope of man's intellect."

Second reason is that the unknown intrigues. Anything preserves its mystery as long as it remains unknown. For getting out of this embarrassing fact, it is necessary to reduce the curiosity by making assumptions. If one does not have any experimental information, turning this curiosity into a tale world is a logical situation, because exaggerating the facts that cannot be proved is not to be judged where science is not enough. Lytton, in his novel in which he does not present any scientific fact, inspires a lot of communities, such as Nazis, who are looking for the origins of their races and ways to find it.

The last reason is eliminating the aspirations by using the unknowns. This is made in two ways for subjects about underground. First is building the physical structures above the ground to underground inversely. This happens either constructing a new physical world in underground in a way of Verne or finding a space in which there is no physical law and the qualifications of the people are exaggerated in a way of the movie Matrix. Second is editing a

rebellion against the social structure above the ground. This happens either exploiting the proletarian (The Morlocks) by aristocracy (The Eloi) in a way of Wells or shouting the ideas that is the underground man identity afraid to confess in a way of Dostoyevsky. In a sense, the criticism of the social, politics and ideology on the earth is done via protected underground (The Subway, Underground). This ideology causes the birth of a new movement which possesses new norms that are critical and not accepted in earth: Underground culture. Underground culture, or just underground, is a term to describe various alternative cultures which either consider themselves different to the mainstream of society and culture, or are considered so by others. The word underground is used because there is a history of resistance movements under harsh regimes where the term underground was employed to refer to the necessary secrecy of the resisters. Since then, the term has come to designate various subcultures such as mod culture, hippie culture, punk rock culture, techno music/rave culture and underground hip hop. The common motto was “Do not want to be”. This term is also used for the expressions in art that away from financial concern or commercial success.

2.5 Underground In Psychology

Although there are a lot of scientific knowledge about the underground today by comparison with the past, underground-oriented anxieties survive inevitably. Then, what causes this? Initially, human physiology has not evolved to live in underground permanently. Because light is usually absent in underground locations. The absence of light causes difficulties in perception and mapping. The perception of underground spaces requires sensory stimulus to trigger a chain reaction of mental processes, which lead to the act of perception. It is the data collected by the eye, and other sensory organs, which are then analyzed and processed by the brain to produce a representation of the physical within the mind of the viewer (Martin, 2000).

Spatial perception of the location begins at a sensory level. As the absence of light cause several defects at sensation level, according to the continuum, perception usually fails. So, underground spaces need artificial lighting. Sound (echo) and touch can work, however ordinary human is sight dominated. Yet perception cannot work without cognition, mapping will fail in blind environment. Evidently perceived world is a synthesis of physical stimulus gained experience, both of which are brought together to create our perception of the world (Hudson, 1998). If the mental mapping is established by high quality perception and cognition, the location becomes recognizable. Because underground landscapes are less dynamic than surface landscape; structures, ecosystems and environments generally change less frequently (Martin, 2000).

As the visual perception is therefore dependant upon light; this physiological deficiency makes underground an unfamiliar world. An unfamiliar world arouses a lot of phobias because of the confidential anxieties. By definition, phobias are irrational which means that they interfere with one's everyday life or daily routine. Psychiatry identifies different categories of phobias and place dependent phobias are listed under agoraphobia category (Lichtenstein and Annas, 2000). Agoraphobia is irrational anxiety about being in places from which escape might be difficult or embarrassing. This fear causes the person to withdraw into safer surroundings, and many agoraphobics will only frequent a few secure locations, such as their home, a specific route to work, or sometimes the homes of friends or relatives. They typically avoid bridges, tunnels, elevators, highways without shoulders, limited access roads with infrequent exits, or being in crowded places. Perhaps the most known phobia in Agoraphobia category is claustrophobia – the fear of confined spaced where one feels "trapped" or unable to get help. Underground spaces might trigger claustrophobia. Another place dependent phobia is bathophobia. Bathophobia is a fear of deeply dimensioned volumes such as lakes or long hallways. Individuals suffering from bathophobia may experience heightened levels of anxiety or fear in the presence of these objects, even though they know that they are under no realistic danger of falling in. Other significant

phobia is nyctophobia (also called scotophobia) which is a pathological fear of the dark.

There are several phobic states as expressed in examples given above. Probably the most denoted one are the Eloi in The Time Machine where the Eloi live in constant fear of underground and dark. Every heroine in the examples faces several phobic states when they experienced the underground. Yet the heroines are human, they are afraid of things that they don't have control over. Most of the underground places in the examples have altered not only physical landscape but its psychic. The mystic journey to the underworld is fearsome because the traveler descends to a realm of dampness, darkness, and formlessness (Williams, 1990).

Remembering Axel's experience in Verne's novel, his scientific thinking turned to a psychic one when he faced the danger of being lost. Similarly, The Time Traveller feels the place as per-dug grave even though he is courageous enough to salvage his Machine. Perhaps this fear associates with the burial. In many human cultures throughout history, human corpses were usually buried in soil. Different cultures bury their dead in different ways. Usually, this is accomplished by digging a pit or trench, placing the person in it, and refilling it with the soil that was dug out of it. This alert usually happens because every traveler of underground bears in mind the risk that underground always provides.

CHAPTER 3

UNDERGROUND UTILIZATION

In the previous chapter, relation between underground idea and human being has examined in different mediums with different approaches. These approaches have both common and distinct points. First and most seen common point is that each approach includes a mysterious speculation in its basis: Underground seems as a mystical aura. Another one is the interaction, *katabasis*[16], between human being and underground. In these journeys, heroes visit the underground with different aims. Some of them experience to settle outstanding accounts, heroism and boycott. On the other hand, the others experience because of apprehension or coincidentally. In every katabasis speculation, underground and aboveground have a tight relation. The underground, existing peculiar to itself and sometimes strange and fantastic, is dependent to aboveground. Besides, in vertical spatial speculation, underground is inevitably in a relation with the spatial speculation above it.

Underground idea can be called as historic since its existence dates back to the presence of human beings as housing. In a sense, each approach has been created on one another in this historicalness. In the course of time, “feelings” about the underground have changed. As mentioned in previous chapter, this fantastic world, which is an inseparable part of the life, has become a focus point of the apprehension and desire of learning unknowns that created world speculations. Beginning with the 19th century, this fantasy world started to become a technological space where the problems of aboveground could be solved. During the 20th century, underground a

[16] Katabasis (Greek κατα, "down" βαινω "go") is the essential epic convention of the hero's trip into the underworld. A hero is not a hero if he does not brave a katabasis.

marginal world by the technological magnificence. According to Pike, in 20th century, the new underground was conceived as a technological space emptied of social relations, distinct in space and outside time, existing only in an abstract realm of instrumentality and efficiency. Pike (2005: pp. 7) notes that “what the goal of application of underground space and the global division of urban space can tell us about this new development of capitalism is where its peripheries are and where its contradiction arise”. Indeed the transformation in the usage in centuries has shown evident trace. Residential to the places of isolation, isolation to the primary input for production and at last, places to solve the problems occurred by mass production in the means of transportation, supply and populations.

In spatial speculation, underground is the one, which is the lowest. In practice, this makes the underground the physical and conceptual trash heap of the modern world above, the place to which everyone and everything posing a problem or no longer useful to it is related (Pike, 2005). This is, in a sense, the one supported by speculation of religious vertical cosmos. Many conflicting images made their way into hell...good as above, evil below, and the earthly city existed in between, with a strongly downward inclination (Pike, 2005).

As the population increases in urban land and humans demand higher standard of living, there occurs a higher pressure in land use of urban land. The main source of pressure is that human activities require more space and intensive use of it, or require another use. Underground space utilization offers opportunities for helping address these trends.

This chapter focuses on a primary issue spurring underground space utilization growing land use pressures as well as the need for careful planning of the underground and potential environmental benefits. Future directions for underground development are also discussed. Throughout the chapter, first, logical needs about underground structures will be addressed in well-reasoned statement as well as with its drawbacks in general sense.

Second, advantages of locating facilities underground will be listed, and drawbacks of underground facilities will be systematically discussed in focused manner. Latter, underground space utilization will be classified by scheme to provide a standardized terminology for analysis and description. Last, metro will be introduced in its formative development. As underground utilization has a very huge history, this study will focus mainly on complains over metro, and its psychological and physiological sides..

3.1 Vertical City

A city is composed of underground and aboveground. However, the ground where the city is settled is most of the time assumed as a thin shell, which has some topographical characteristics. Because of this reason, spatial characteristic of the city is speculated around the horizontal axis. When a city map is investigated, the demonstration is around horizontal relationships. Indeed, topographical characteristics are simplified and demonstration is reduced to two-dimensional plane.

For a citizen, perceiving a city is started from the eye level. When a citizen walks around the city, she can not understand the form of the city because of her scale. As a metaphor, this experience of the citizen is similar to walk around a labyrinth. However, a city labyrinth presents different façades instead of walls and some special gaps and typologies in this journey, different from a labyrinth. The way to comprehend a labyrinth is to look at it from above. Therefore, when a citizen looks at the city from an altitude with a better vista, she gains different kinds of experiences because she sees the city from a different point of view. By this way, citizen has a chance to understand the whole, spatially. In addition, this comprehension is based on the horizontal relationships. By the altitude and topographical characteristics, horizontal relationships acquire three-dimensional characteristics and the start point of this three-dimensionality is again the shell itself. Therefore, horizontal speculation is more dominant than vertical speculation on today's' city approach.

Most of the time land use is perceived as the use of the surface of soil, however it is different in reality. Land use can be broadly defined as human use of space in ecosystems: not only the use of soil, but also of minerals, water and air, of vegetation and wildlife, and of artefacts once constructed by men. However, the study will focus only on the use of soil in urban land. Today, traditional planning techniques have focused on two-dimensional representations of regions and urban areas. This is generally acceptable for surface and aboveground construction, but not adequate for the complex three-dimensional geology and built structures often found in underground (Sterling, 1993). The reason of such outcome is dependent on different facts. Before all else, representation of this three-dimensional information in a form that can readily be interpreted for planning and evaluation is difficult.

Land use has become an important problem after the increase of population in cities. Population increases may lead an absolute need for space, so the cities expand as demography and economies are the two driving factors for urban expansion. Demands for space by humans are the original force for urban expansion (Li, Sato, Zhu, 2003). This expansion can occur in different forms. Most commonly, the city expands outwards on the edges by occupying the adjacent rural areas (Aguliar, Ward, 2002). From the perspective of spatial morphology, it seems that new urban land is generated by extending old urban land characterized by continuity in two-dimensional space (Li, Sato, Zhu, 2003).

As mentioned in the previous paragraph, there are three choices for land use. The first of them is expanding the city from its edges. This is called horizontal expansion and is observed in most of the cities. When a city is enlarged, new centres are formed and horizontal organizations are shown. Second choice is expanding upward vertically because of gaining in value. As expected, the result of this is formation of multiplex structures. Finally, third and most marginal choice is to provide two-dimensional vertical expansion by using underground at the same time when the city grows up

horizontally. Besides, where which functions are, is a different design problem. Positioning the vital functions, which support the city, underground and reservation of aboveground for living areas is a logical approach.

City centres also get their share from high population. Apart from development of suburbs in cities and multi-centered cities coming out, this high population influences inner cities. The result is an astronomically high cost in inner-city centres and difficulty in providing housing, transport, and utility service for the population (Sterling, 1993). As land prices increase, however, placing facilities underground becomes more attractive economically because it is usually not necessary to pay the full cost of the surface land under which the facility is built (Sterling, 1993). Because, when surface space is fully utilized, underground space becomes one of the few development zones available. It offers the possibility of adding needed facilities without further degrading the surface environment.

Sometimes, the importance of the underground on growing up and supporting the growing up city is not considered as important, and potential of the underground is remembered only when problems become insoluble. Besides, the effort to use underground after problems become insoluble creates high costs and interruption on above-ground activities and this is an unacceptable situation. Therefore, in design phase, vertical axis must be taken care as much as horizontal axis; spatial myopia must be prevented in utilization of potentials of the space. Because, "… the time has come to consider urban planning from the vertical viewpoint. Underground development has a great and realistic potential for alleviating congestion" (Sato, 1989: pp. 122).

The term "myopia" is mostly used in management literature to define the failure to recognize the importance of changing external conditions because they are blinded by their shared, strongly held beliefs. It has been 45 years since Theodore Levitt first introduced the term Marketing Myopia in literature; it could produce stemas in many disciplines (Levitt, 1960). In his article,

Levitt argues that companies that see themselves as producers of particular products, rather than as more broadly catering to human needs, are in danger of missing opportunities that mean their own survival. The term product can be converted to any artifact that any discipline produces, whether it is cognitive or physical, any myopia can be assigned as a behavioral limit in producing artifacts through the scope of the discipline.

In this context, the term “Spatial Myopia” is formulated to express the behavior of decision maker that externalizes the possibilities of the space or the disability to realize spatial means with certain and consented motives. Spatial myopia underlines the importance of understanding the perceptual filters through which decision makers view the changing urban environment.

Myopia (Nearsightedness), as it is medically termed, is a vision condition in which near objects are seen clearly, but distant objects do not come into proper focus. Hopefully, physical myopia usually is a mildly debilitating condition that is easily correctible, in most instances with glasses, contacts or vision surgery. However, the cure of spatial myopia needs a paradigmatic shift in cognitive base. It is meant much like Kuhnian way that a radical change in personal beliefs, complex systems or organizations, replacing the former way of thinking or organizing with a radically different way of thinking or organizing in urban space issue. By the way, Kuhnian paradigm shift could find uses in urban planning context, representing the notion of a major change in a certain thought-pattern in land use policies by rethinking space within its conventional above surface and as well as underground. Enough significant indicators have accrued against a current paradigm, the conventional land use policies is thrown into a state of *crisis in* town centers. To handle this crisis, new ideas, perhaps previous ones should be discarded. A *new* paradigm could form by rethinking the possibilities of space.

Spatial myopia can be built upon culture, costs or planning tradition and stands as an invisible barrier to change against urban needs. Several key causes are considered during the decision-making process; however, culture

is the most significant one. Although planners assumed to make rational decisions within the current political framework, the framework, and therefore some of the decisions, is not rational mostly cultural dependent.

Underground utilization and verticality fact is not, of course, a new phenomenon. Indeed, underground has been utilized as a shelter, store place and a graveyard in different cultures and periods. However, arguments about underground utilization in urban land are the fruit of 1900s because of rapid population growth in metropolises. Proposal packages mainly focus in two folds. First fold is mostly intensifying to open up more green spaces and to segregate human functions into separate areas for living, for working, for shopping, for leisure. This effort aims to promote “new expansion territories” in horizontal direction in the context of decentralization, centralization and a combination of the both in the levels of density manner. Second fold, in my conviction, is search for more “compact” and “cross functional” solution to design the city in vertical segregation with multiple layers in sub terrain. This approach can be claimed as futuristic and queer in the period that it is proposed, however it is a necessity in today’s addled metropolises.

One of the iconic characters that proposed vertical segregation is the French architect Eugene Hénard. Hénard (1849-1923) was the son of an architectural professor at the Ecole des Beaux-Arts in Paris and spent much of his time studying the problems of traffic circulation in Paris and proposing solutions for the problems created by the few adequate radial thoroughfares. He went well beyond these analytical studies to plan for the further development of Paris. Perhaps his most popular paper is the “The Cities of the Future” that he proposed in London conference on town planning in 1910.

In his paper, Hénard analysed streets and houses as the primary elements out of which a city is built depending on the urban transportation and drainage of the household wastes. His primary aim was to integrate modern science and industry upon the planning practice. The paper was taken up into two sections and enriched with explanatory illustrations (Figure 3.1).

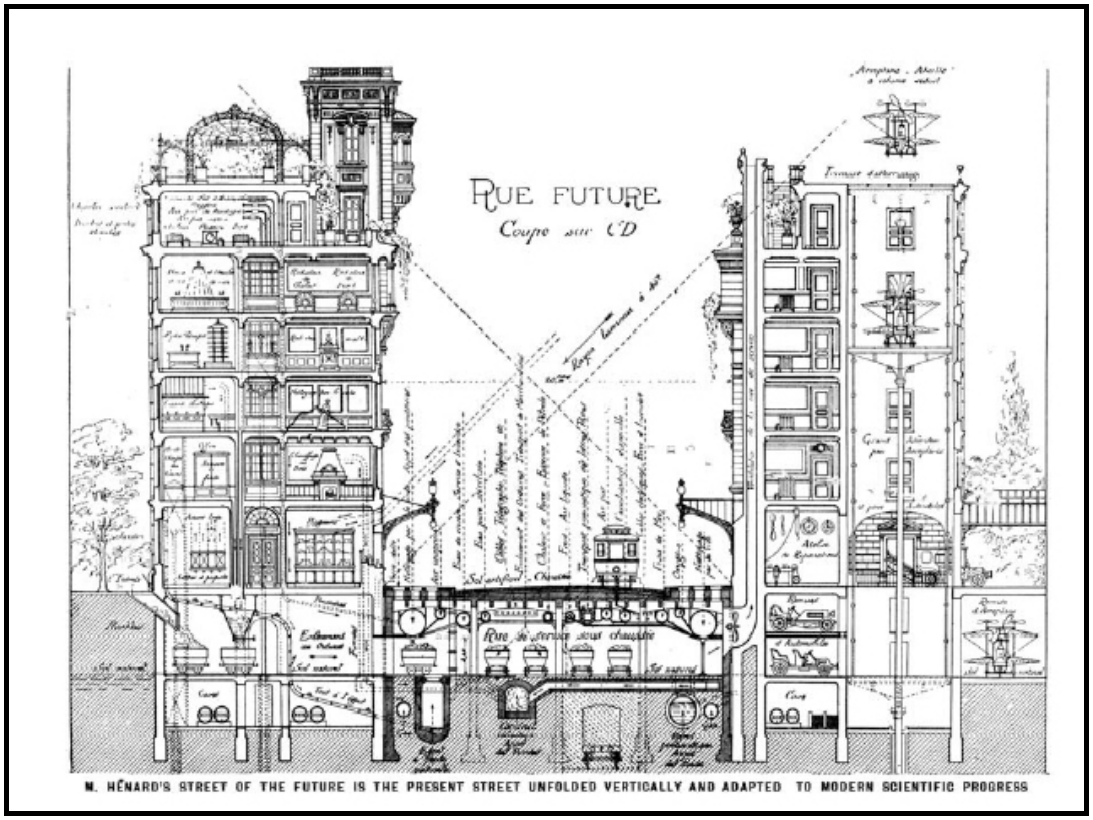


Figure 3.1: Henard's Future City. (Source: http://www.library.cornell.edu/Reps/DOCS/henard.htm)

In the first part, he deals with the defects of the streets and houses of Paris in 1900s and criticies insufficient infrastructure. In the second part, he fights against the concept that "the bottom of the road must be on a level with the ground in its original condition". In this section he illustrates the future city as the city that locates all its functions beneath the surface and attaches importance to aviation. He also notices the cost side and proposes his plan for the new cities.

The futuristic dreams of Hénard can be named as peculiar for his period however his ideas seize today's reality. Because stretching the city borders does not solve the problem just postpones. Thus, city centres remain same due to high density, traffic congestion and any kind of pollution. Hénard mainly focused on discharging household wastes as ash and wastewater but at third level he integrated light rail transit to his layered conceptualization.

He has foreseen aviation as the most particular form of urban transportation for the future cities somehow he could not predict car ownership at the heart of his plan as Le Corbusier and Frank Lloyd Wright. Aviation ownership was the focal point consisting of zeppelins and internal combustion engine planes. This approach also supports layered vertical segregation in cities beginning from sub terrain and sky.

Undoubtedly, one of the most profound discussions about the underground utilization is that provided in a book Urbanisme Souterrain by Edouard Utudjian in which he promotes underground space for better usage based on an observation of chaos in metropolises. He was also the founder (1933) of the Groupe d'Etudes et de Coordination de l'Urbanisme Souterrain (Study and Coordination Group of Underground Urbanism).

However, these colleagues did not foresee effects of neo-liberalism politics and car dependency and sudden expansion of suburbs between 1970 and 1990. A little attention paid to underground urban transport to satisfy residents' requirement to break individualism. Finally, the term "individual" transformed to "common" and the term common is enriched with the concept of "our common future". Reaction was raised against conflict on economic and social development, demolition in environment and reduction in natural resources.

Visionary underground networks of space have been proposed as a comprehensive solution to congestion and environmental problems in many urban areas. Although existing underground facilities and projects throughout the world provide some models for future development, they are limited in scale, in use, or in the lack of comprehensive vision for the total city environment. Most of the projects consist of illustrations with little explanation since they are essentially visual concepts.

There are some examples about vertical usage in space utilization. Yet, these examples are more small scale earth-shelter basis individual residence

projects. Vertical utilization examples about cities mainly in proposal phase. Underground is divided into systems of pedestrian links, underground transportation utility and service in this kind of projects. Each proposal must be evaluated carefully because, nowadays, land use is an important issue. So when current problems are considered, “...an underground city is no longer a dream” (Hanamura, 1989: pp). Yet most of the world cities already have underground shopping malls and parking garages. One of these projects is Urban Geo-Grid proposed by Shimizu Corp. in 1989. The project is consisting of network of subterranean atriums connected by tunnels and filled with such facilities as offices, gymnasiums, libraries, exhibition halls and public baths. The project would be built 164 ft. below the ground in Tokyo's fashionable Roppongi district, sprawl across 485 sq. mi. and accommodate 500,000 people. Not only would temperature and humidity be controlled, but also real sunlight would be reflected in through vents from the surface.

Another Japanese project, “Alice City" (as in Lewis Carroll's "Alice in Wonderland" wherein the heroine found enlightenment and wonder) an underground metropolis designed by The Taisei Corporation of Tokyo for the 24-hour-a-day 21st Century. With the Taisei plan, previously unused valuable underground space can be effectively used for many purposes.

For instance, there are large number above-ground installations that would be more effective in underground. Power stations, warehouses, railway yards and some specialized manufacturing facilities (Figure 3.2). Three elements, which compose Alice city:

Figure 3.2: Alice Town (Source: http://www.gel.civil.nagasaki-u.ac.jp/text/concept/con9/con9.html)

Alice town space aims the enjoyment of person, and openhearted, pleasant space (Figure 3.3) and a underground shopping center road extending over the floor of plural.

Figure 3.3: Alice Town Space. (Source: http://www.gel.civil.nagasaki-u.ac.jp/text/concept/con9/con9.html)

Alice infra space: City ground facilities space that supports activity of person (Figure 3.4). (The one that facilities such as power generation, region heat supply, waste processing, and sewage treatments were made composed.)

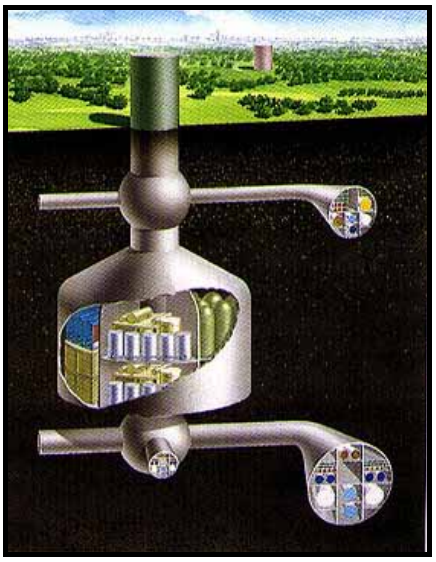


Figure 3.4: Alice Infra Structure. (Source: http://www.gel.civil.nagasaki-u.ac.jp/text/concept/con9/con9.html)

Alice terminal office space: Space in which person uses underground function and acts (Figure 3.5). (Business space with large depth underground station.)

Figure 3.5: Alice Terminal Office Space. (Source: http://www.gel.civil.nagasaki-u.ac.jp/text/concept/con9/con9.html)

According to Drumisevic (1999), in cities, building and roads emerge rapidly, invading the landscape and making horizontal expansion. She notes that to stretching the city borders and therefore invading the countryside does not solve the problems of the city, but only postpones them.

For Drumisevic, underground utilization is one of the alternative solution to create compact cities and urban environmental improvement:

“In order to preserve the city as a cultural, social and economic centre there is a need for more “compact” solutions. Growing cities will require more efficient use of space in the future (or in other words, multi-layered land use) particularly in city centers where demand is highest. Locating some functions (such as traffic, shopping, catering facilities, cinemas, museums and theatres) underground, will create more space aboveground for recreation and social activities in the vicinity of residential areas, and will also create possibilities for the development of new residential areas. In such a way, the city's vertical line can be utilized more efficiently by integrating subsurface spaces with the aboveground city's network. In short, the advantages of compact cities that would make use of subsurface space would be: more efficient use of space; better traffic mobility; more green areas; reduced traffic congestion; better air quality and reduced noise level (Durmisevic, 1999: pp. 235).” This means that by building underground, the quality of the urban environment can be significantly improved. Building underground can be placed in both of the earlier mentioned groups, since it is at the same time an expansion territory, but it is very important for city renewal as well. Its advantage is that by building underground, valuable space is provided without necessarily extending the city's borders, which is always the case in horizontal expansion.

3.2 Historical Development of Underground Spaces and Existing Usage

There are some notable patterns of underground utilization both in past and recent times. Residential uses probably represent the oldest use of

underground space by human kind. Like every living being, human being needs sheltering to be protected from external threats and conditions. Usage of the caves for sheltering began 50000 years ago. According to the archaeological investigations, these needs where met by possibilities existing in the nature. Moreover, main possibility was natural caves and cavities. By the rise of the house concept, using caves for sheltering lost its popularity. Yet, even in times by house concept, human being continued to use caves with different aims on condition that natural and physical conditions were suitable. The main reason of this was that these kinds of spaces provided isolation in necessary situations as much as they were superior in attacks because of façades of them.

Cappadocia (Figure 3.6) in Turkey and Matmata (Figure 3.7) in Tunisia used by Berbers are the most famous examples of this kind.

Figure 3.6: Karst Mountains (Peri Bacaları [Fairy Chimneys]) And Man-Made Caves in Cappadocia. (Source: www.cappadocia.gov.tr/).

Second aim to use is to be protected from negative natural conditions. Earth-sheltered houses are built for this aim. The majority of earth-sheltered houses use earth sheltering around three of the sides and over the roof.

Figure 3.7: Troglodytes[17] Homes in Matmata. (Source: http://fr.wikipedia.org/wiki/Matmata).

The remaining side (facing south in temperate areas of the northern hemisphere and north in temperate areas of the southern hemisphere) is entirely covered with windows to allow passive solar heating and a maximum of natural light from the sun. The most known examples of this kind of constructions are in Iceland and Scotland (Figure 3.8).

Figure 3.8: Earth Covered Farmhouses in Keldur, Iceland. (Source: http://en.wikipedia.org/wiki/Earth_sheltering).

[17] One of a group of people who built homes into the faces of cliffs, connected by underground passageways, such as in France or Tunisia.

In popular culture, the most famous earth-sheltered home is Bag End; the fictional home of Bilbo Baggins and his cousin Frodo in the stories of Middle-earth by J.R.R. Tolkien in Lord of the Rings trilogy (Figure 3.9).

Fig. 3.9: Bilbo Baggin's Hobbit Hole; Bag End. (Source: http://en.wikipedia.org/wiki/Bag_End).

Being more isolated in the underground spaces than aboveground created possibility for usage with religious aims. The underground was serving to eliminate external pressures, providing a separation from normal world, and creating an opportunity for spiritual reflection.

Nowadays, underground is used with different aims. It can be seen that underground is utilized in four main kinds in functional classification (Table 3.1). First of them is residential aims. This utilization mentioned above in historical sense. Today, this subject again attracts attention because of environmental sensibility and energy conservation. Some examples appeared with the energy crisis and environmental movement in 1970s. However, attention to the subject is decreased because of reduction in environmental consciousness, cost of the construction in underground and water isolation and weak architecture in 1980s (Carmody, Sterling 1987).

Table 3.1 Classification of Underground Space Use by Function (Carmody, Sterling. 1987):

UNDERGROUND USAGE BY FUNCTION		
	PEOPLE ORIENTED	PRODUCT ORIENTED
RESIDENTAL	SINGLE FAMILY MULTI FAMILY	
NON RESIDENTAL	RELIGIOUS RECREATIONAL INSTITUTIONAL COMMERCIAL	INDUSTRIAL PARKING STORAGE AGRICULTURE
INFRASTURUCTURE	TRANSPORTATION OF PASSANGERS	TRANSPORTATION OF GOODS UTILITIES ENERGY DISPOSAL MINES
MILITARY	CIVIL DEFENSE	MILITARY FACILITIES

Residential utilization is classified as in respect of human and product. Utilization for human being could have aim of religious, recreational institutional or commercial. On the other hand, utilization for product is mostly with aim of industrial, parking places, storage or agriculture. Full classification can be found in Appendix A.

Nowadays, most intensive utilization of underground is directed towards infrastructure. Most human oriented utilization in infrastructure context is transportation aimed. Then again, product basis utilizations are energy, telecommunication, water and waste aimed.

Undergrounds is always used for military aims, since it provides instinctive defense. Civil defense and most of the military facilities having strategically value are built in underground. Parts of buildings remained in underground, metro and other underground spaces are mostly arranged for refuge.

3.3 Existing Underground Structuring

Today, underground appears in two ways as a space. Natural underground spaces are results of thousands years geological events. Formations of natural underground spaces are physical and chemical processes. In general, expression caves are formed by dissolution of limestone and are investigated in two kinds as interior and exterior. Exterior caves are similar to under rock shoals and not very deep. Most of these kinds of caves are formed by dissolution because of river and sea movements or erosion. Although, they are generally seen on limestone lands, can be seen on other rocks. Interior caves mainly include arcades, halls, and deep underground systems. These kinds of systems are cavities, which go into hills.

These caves, which can be ruins of underground rivers, can turn into a labyrinth system in underground because; water continues to move towards each suitable path. Water begins to leave the materials from outside into the cave by the action of fulfilling the cave. Water, continuing its path through the tectonic cracks, starts to go down in the course of time. When the action of the water stops upper part of the cave, it means that cave becomes fossil. In conclusion, caves are cavities, which are a natural underground void large enough for a human to enter. They are generally formed by corrosion, dissolution, etc.

The first examples of man made (artificial) underground spaces are mines. In mining, there are two main methods. First is surface mining. For surface mining, big amount of overburden is removed from surface to reach the mines closer to surface. Because of removed deposits, radical changes happen on surface (Figure 3.10).

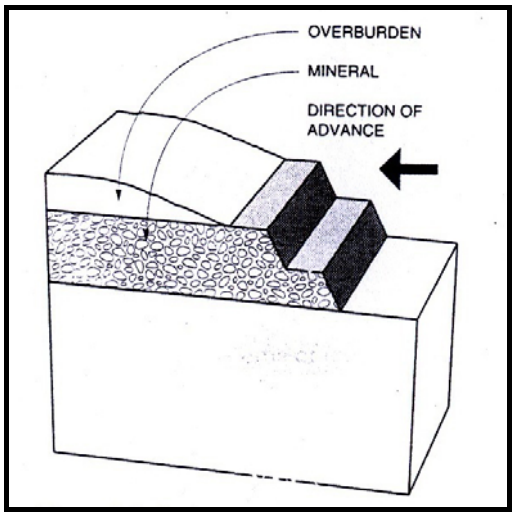


Figure 3.10: Surface Mining (Source: Sterling, 1993).

Second method is underground mining. Underground mining is a method used by human beings hundred years to reach precious mines (Figure 3.11).

Figure 3.11: 6th Century BC Greek Plaque Showing Miners Using Ore Baskets and A Pick. (Source: http://www.unc.edu/~duncan/personal/roman_mining/deep-vein_mining.htm).

Different from surface mining, underground mining uses vertical shafts and supported horizontal tunnels to attain the mineral. Deposits and precious minerals obtained from shafts and tunnels is brought to outside (Figure 3.12). Depth reached in the underground can be extended 1000 meters. Other artificial underground applications are special end use configurations. Two methods are used to create cavities. First is by excavating from the surface a

cavity is created and a structure is placed. Then, around the structure is filled by some excavations. In the second method, independently from the surface, tunnel in the underground and evacuation are performed. Overburden material is extracted from limited surface access points. There are two basic kinds of these configurations (Sterling, 1993).

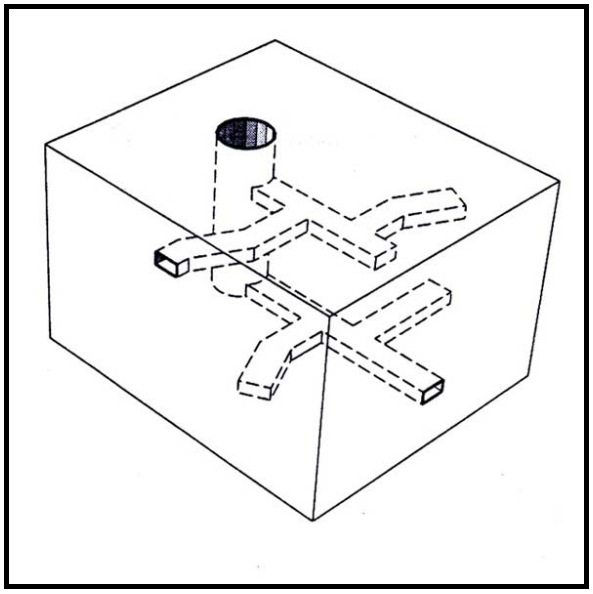


Figure 3.12: Shafts and Tunnels in Underground Mining (Source: Sterling, 1993).

First configuration group is linear or cross-section system composed by pipes and tunnels since most of infrastructure facilities is in underground. Shape of cross section could be circular, rectangular or “U” in these systems (Figure 3.13). These linear systems can be a completely horizontal hole or can be located in an open trench. This kind of usage can be for sewerage system, water transportation lines or transportation tunnels.

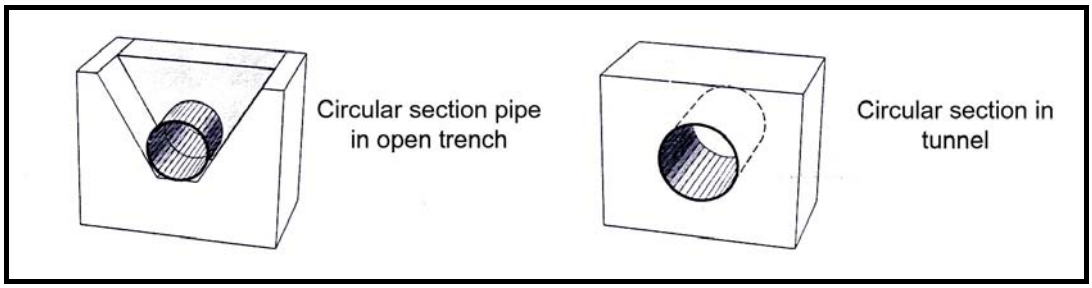


Figure 3.13: End Use Configurations of Utility Pipes or Tunnels (Source: Sterling, 1993).

Other intensively used underground applications are cut and cover structures. In this construction, deep basement of the buildings can be used as well as with terraced or hillside structures by using topographic advantage (Figure 3.14).

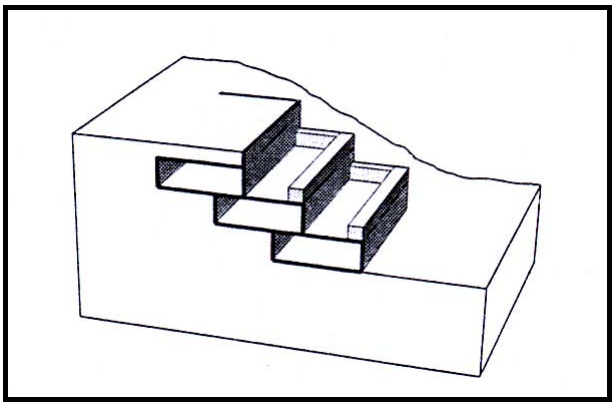


Figure 3.14: Terraced or Hillside Structure (Source: Sterling, 1993).

In atrium type utilization, where both cavities open to underground are separated for utilization, mid cavity is provided so that sun-light enters by leaving the mid cavity empty and being related to surface.

Underground utilization has two different application forms in city planning. These configurations take many forms reflecting different scales of development and relationship to the surface, as well as, land use patterns above and below grade (Sterling, 1993). In most urban setting underground space is utilized to a minimal degree. In these settings, basically, existing infrastructure facilities are found in underground. Besides, telephone, water, gas and sewer system, energy transfer lines are placed in underground in a micro type form. These systems are closer to surface comparatively. Lines are extended along the ways aboveground to service to buildings. Building point of view, cellar floor of the building exists underground independently. These cellars are used as stock house and car park (Figure 3.15).

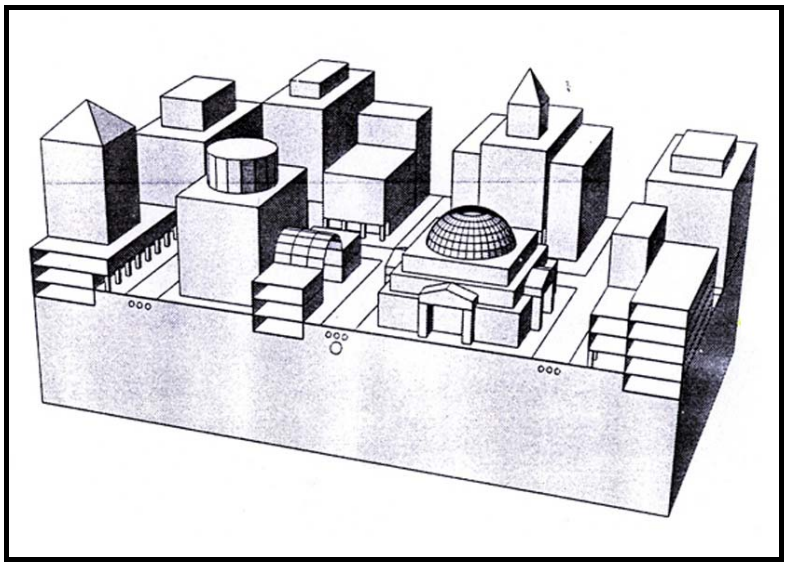


Figure 3.15: Underground Utilization in Minimal Degree (Source: Sterling, 1993).

There are shallow subsurface spaces in second type land use. These spaces are mainly built for commercial aims and pedestrian passing. Surface applications create some open spaces on the ground. If the underground structuring under buildings are connected each other, it creates pedestrian network. Traditional substructure system exists in underground (Figure 3.16).

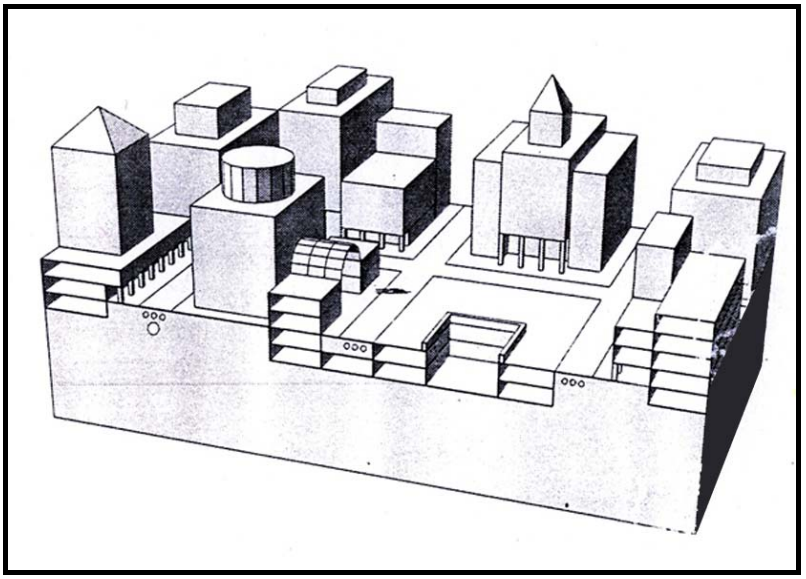


Figure 3.16: Use of Shallow Underground Space (Source: Sterling, 1993).

Other kind underground structuring is application of deep cut structures instead of surface. In this structuring, under buildings have a lot of storied

underground structuring. By this way, dense structuring in underground is allowed, besides, valuable aboveground spaces are utilized as open areas. In this kind of structuring, underground structuring rate is high. Because of multistory structuring in underground, light is transmitted by atriums to these spaces (Figure 3.17).

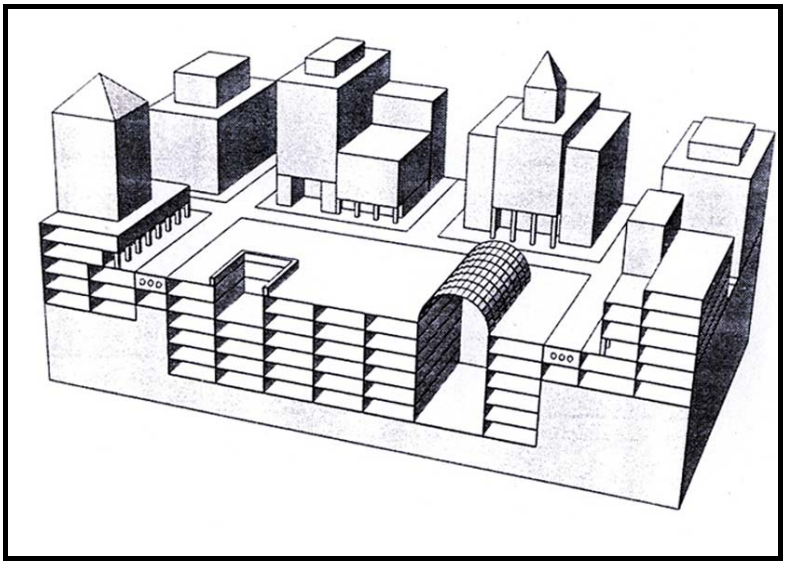


Figure 3.17: Deep Cut and Cover Underground Utilization (Source: Sterling, 1993).

In urban area more traditional utilization of underground structuring is, connecting some transportation functions to underground. Different geometries formed by cut and cover or circular cross section tunnels formed by tunnel boring machine (TBM) create transportation corridors in this system and rail transit systems are built. By this way, other city functions are not interrupted while these systems are being built. If cut and cover construction is preferred, all transportation and infrastructure activities in being constructed corridor are affected in the construction period (Figure 3.18).

Another application is construction of mined space under cities if surface topography is suitable. In some applications, there is not any connection between the above city and mined space because of horizontal access. Yet, in some cases, a connection can be established by using vertical shafts.

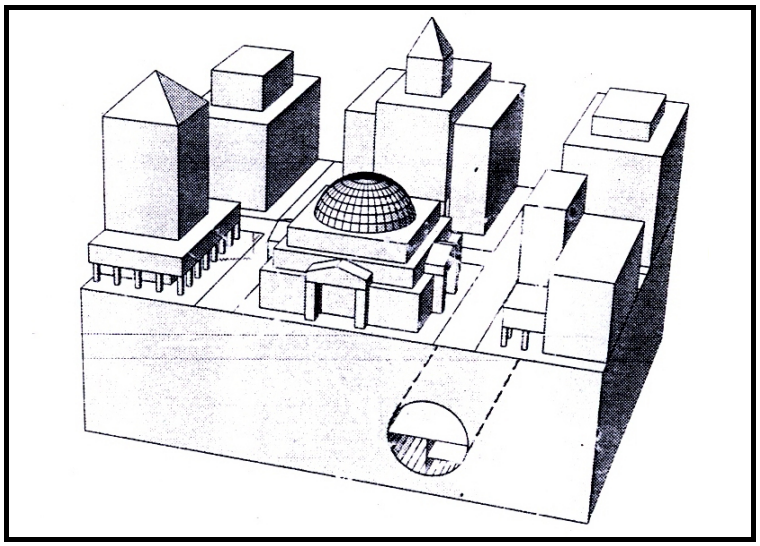


Figure 3.18: Underground Usage by Boring (Source: Sterling, 1993).

Connection can be provided between dependent functions since arrivals can be created by means of these vertical shafts. For example, while the office is above, production or secure laboratory could be speculated in below (Figure 3.19).

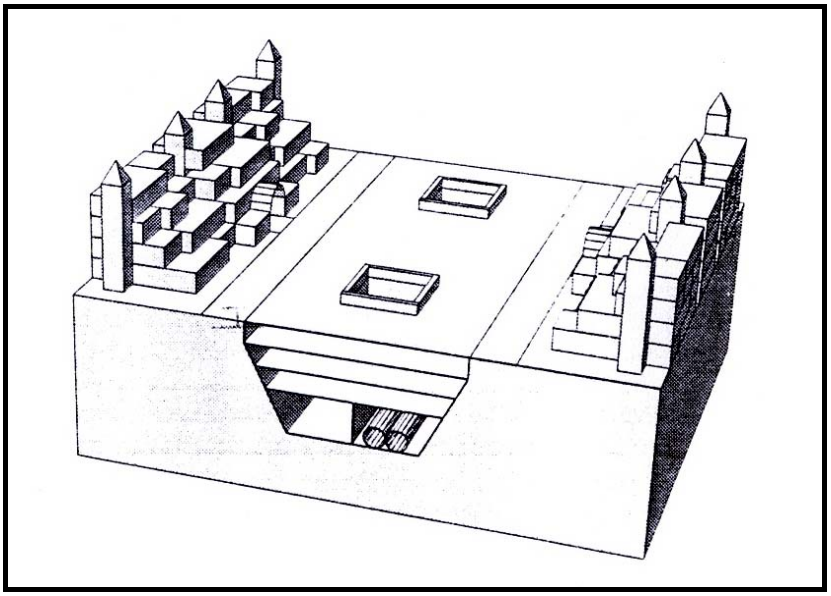


Figure 3.19: Cut and Cover Corridors with High Density of Housing (Source: Sterling, 1993).

Sterling placed infrastructure, transportation, commercial, industrial and storage systems in corridors, formed by cut and cover method, in the conceptual system that he suggested. Lofty structuring on both sides of the

corridors provides open areas suitable for recreation above the ground. According to Sterling, effective utilization of underground in urban scale is not possible by individual projects (Sterling, 1993). For effective utilization of underground in city, long period planning is required. Because of this reason, this kind of projects must be executed in certain coordination. This is not only necessary for a reliable planning but is also an, inseparable part for continuous urban life.

3.4 Transportation and Sustainability

The concept of sustainable development occupied an important place in literature and also in practice. It was a very sarcastic action to reconcile between human needs and the capacity of the ecosystem. The most evident issue that emerged was ironically hidden in the term. Sustainability was a vision that indicates to future and it was not an act for today but an act for common future. It was a development which meets the needs of the present without compromising the future generations to answer theirs. So it was time to use the option of underground utilization to form more compact cities by using untouched resources. However the utilization is still varying depending on economic, demographic and geological conditions as well as technological, political and cultural factors.

Underground utilization based on the principles of sustainable development aims:

- to minimize environmental hazards,
- to save energy,
- to increase the functional diversity of the urban structure,
- to reduce the need for local transportation,
- to make services more easily accessible,
- to protect urban landscape and culture.

However, functional efficiency and low cost are not the only criteria for the creation of an ecologically sustainable urban structure: the aim must also be to create healthy, pleasant areas for people to live in.

Thus, it is an inevitable phenomenon to understand the underground as an alternative according the stated opinions.

Therefore, it is time to ask the question about the utilization frequency of the underground spaces in urban land. Even though the trends give hope, answer will be in a negative position. Because, underground has several characteristics that make good planning especially problematical.

Once underground excavations are made, the ground is permanently altered. Underground structures are not as easily dismantled as surface buildings. An underground excavation may effectively reserve a larger zone of ground required for the stability of the excavation. The underground geologic structure greatly affects the types, sizes and costs of facilities that can be constructed, but the knowledge of a region's subsurface can only be inferred from a limited number of site investigation borings and previous records. Large underground projects may require massive investments with relatively high risk of construction problems, delay and cost overruns. Traditional planning techniques have focused on two- dimensional representations of regions and urban areas. This is adequate for surface and above ground construction but it is not adequate for the complex three-dimensional geology and built structures often found underground. Representation of this three-dimensional information in a form that can readily be interpreted for planning and evaluation is very difficult. At last underground has potential defects and withdraws for the end users. It is understood that, any indented entrepreneur of decision maker should venture this risks in planning. Today, an increasing number of conscious "risk takers" subscribe log-term policies for sustainable development of the cities, including co-coordinated actions as regards the development of the urban underground space. Yet others carry on out-of-

sight out-of mind approach by still pretending not to see underground potentials.

3.5 Underground and Transportation

There is a frequent usage of underground for transportation purposes. Underground tunnel systems are used in arduous terrains and in lands with limited means of access. After the replacement of conventional excavations systems with gunpowder and nitro glycerin, it became possible to open tunnels in brutal surfaces. Tunnels are used to grade and to shorten the roads. One of these tunnels is St. Gotthard Tunnel in Switzerland. This railway tunnel was built as one double-track of 15 km, from 1871 to 1881. Construction was difficult due to financial, technical and geological issues, the latter leading to the death of around 200 workers mainly due to water inrushes; many were also killed by the compressed air-driven lorries carrying excavated material out of the tunnel.

However, gunpowder was not suitable for soft terrains. Later this problem is solved by a English engineer; Marc Isambard Brunel. Brunel worked for nearly two years to create a tunnel under London's River Thames, with tunnellers driving a horizontal shaft from one side of the river to the other under the most difficult and dangerous conditions. Brunel designed a tunnel shield in an iron box form a device that made possible tunneling in safety through water bearing strata (Figure 3.20).

This shield was consisting of twelve vertical cast iron frames arranged side by side across the whole excavation. Each frame was 3 ft wide and 22 ft high and contained three vertical cells in which the tunnellers could work. A series of horizontal board's protected workers from the earth in front of them. These were held in place by a series of screw jacks. Iron plates held the earth at the sides and top in place with the frames being 'jacked' against the completed brick lining. To move forward each poling board was removed and a few inches of earth removed. The board was then replaced and 'jacked' against

the new surface. After excavation of the complete surface, the cast iron frames were moved forward. This was accomplished by each frame, which was pivoted on two feet, being lifted up, moved forward, and screwed back down. By releasing the poling board screw jacks it was possible to move each frame forward by means of the main jack, located at the top and bottom of the frames (Graham, 1988).

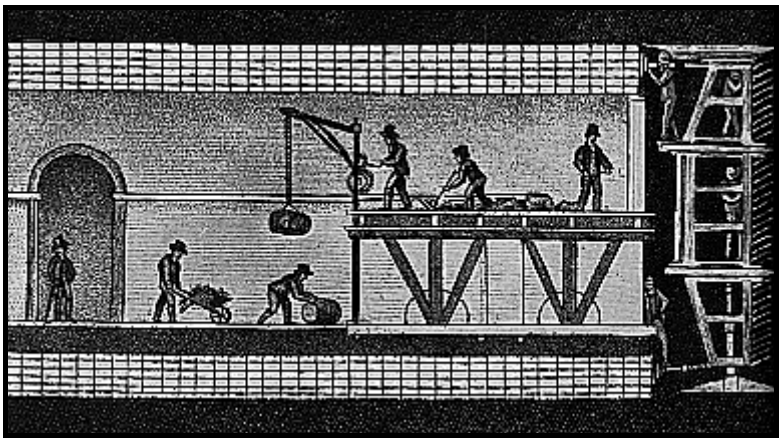


Figure 3.20: Brunel's Tunnel Shield. (Source: http://www.nceplus.co.uk/b_bank/search_results_details/?report_ID=6254&report_num=0&channelid=6).

The Channel Tunnel (Le tunnel sosu la Manche), one of the two most known tunnels of today, is one of the engineering wonders of the century. The tunnel connects England and France 45 meters under the sea level. The structure of the tunnel designed in three parts; two for railway transportation with 7.6 meters radius and one for safety, services, maintains and ventilation. The overall length of the tunnel is 50.5 kilometers.

Other tunnel is the Seikan, which connects Honshū and Hokkaidō islands by railway in Japan. The total length of the tunnel is 54km with 23 kilometers 140 meters deep from the sea ground level. The project started in 1946 geological research and completed in 1988. However, today, the tunnel is not feasible in financial means yet the current transportation is carried by percentage 90 of airline because of fees and speed.

However in cities metro is the most consistent way that utilize underground for transportation purposes. In any case, when the word “underground” crosses one's mind, it is impossible for a city dweller not to recur the metro to the mind (Figure 3.21).

Figure 3.21: London Metro Sign. (Source: http://www.infotransport.co.uk/trains/operator/7).

For this reason, the next chapter will deal with the history of the metro, to emphasize the importance of urban railway systems for a city in all respects.

CHAPTER 4

THE METRO AND METRO TRANSPORTATION

4.1 Introduction

Arise of the idea of “metro” dates from the mid 19th century within the concept of urban transportation. While exploring the history of metro, it has been seen that metro appears within the metropolis of industrialized societies that are the initiators of railway transport. Therefore, there is a strong affiliation between the conventional railway culture and metro ownership.

There are two types of metro ownership seen within the world experience. First is the process leading tramway to metro with the preamble of the railway concept into the city that is caused by the gradual increase in the need of expanding the capacity of transportation. Second is the transition process directly to metro or LRT caused by the population and traffic problems. This mode of metro ownership bypasses the stages between and occurs within the cities that do not have urban railway.

Consequently, if a retrospective reading on the history of metro is done, it is logical to begin the process with the history of railway. However, like in every effort of writing histories about each fact, writing the history of metro also brings difficulties.

In his work, “Thinking on History Writing”, İlhan Tekeli notes that he considers a method that consists of two phases:

“It is accurate to think that our books we write are constituted of two parts. In the first part, a reconstruction of the related fact formed with the utmost

neutral point of view (…), it is our belief that this part does not fundamentally form the history, but provides regular equipment. The second part of the books are reserved for the testing of the set forth thesis, within the handled problematic, that depends on the reconstruction of the facts done in the first part. This part forms the basic of history according to our apprehension" (Tekeli, 1998).

It is seen that, for Tekeli, not only the second part (that tests only the facts) but also the first part (that conveys the facts themselves) is quite problematic. "The reconstruction of the facts with the utmost neutral point of view" marks two drawbacks of Tekeli. First, "it is possible to take sides while mentioning the facts". Second, "facts are never existent with their own occasions; they can only come into being by their reconstruction". This condition of being angled brings problems in writing the history of metro. Because metro is not only a technical problem but also a political decision.

Another problem, that Tekeli mentions, is constituted within the writing of recent history. To the extent that it is difficult to reach the documents of recent period, it is also hard to achieve 'imperturable' evaluations because of the short time period that passes between the experienced facts and the writing of the history. It is even harder, especially evaluating of the related political facts, like metro, when found certain followers within the society and intense discussions occurred.

Therefore, this chapter follows a narrative way as possible, especially in the part that mentions metro is a new concept in Turkey, with the goal of excluding the discussions on the systems that are constructed or still in construction. Furthermore, with the intended world experience in mind, this chapter draws up a recent and possible future inventory of the inner-city railway systems of Turkey.

4.2 The Appearance of the Railway

Although the idea of moving a vehicle on tracked roads is an old idea, the first example to this kind of transportation model is the Wollaton Wagonway constructed in 1604 by Huntingdon Beaumont (New, 1957). While railway transport showing a fast improvement with the establishment of Middleton Railway, which is accepted as the first railway of the world, a basic problem was constantly revolved in minds. The problem was supplying the energy source in order to pull the vehicle on rails. French engineer Nicholas Cugnot proposed the first solution to this problem in 1769. Cugnot's "steam carriage" was a vehicle constituted of two wheels found on back and one in front. Later, Scotch inventor James Watt, developed high performance steam engine which figures large in the Industrial Revolution

Within a short period, this machine began to be used with the goal of transportation. By the year 1784, William Murdoch who was one of the employees of Watt's, invented the "steam locomotive" that elaborated the existed steam engine into a more effective design. As soon as the 19th century began, Richard Trevithick developed the "high-pressure steam locomotive" in the year 1804 (Figure 4.1).

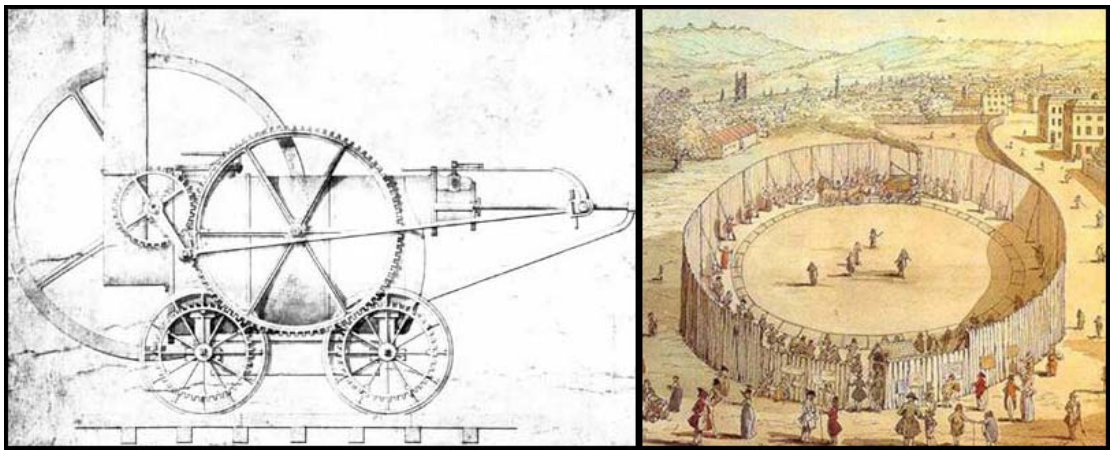


Figure 4.1: Trevithick's Steam Locomotive. 1804. (Left), Demonstration in Euston Square. 1808. (Right). (Source: http://www.locos-in-profile.co.uk/Articles/Early_Locos/early1.html).

Afterwards, Blenkinsopp (1812) and William Hedley (1813) developed their own machines. Subsequently, the commercial locomotive that is improved by George Stephenson and his son Robert ran between Stockton and Darlington line. Accompanied by the wide use of steam force, railway construction pervaded with a rapid spread. Until the end of the Second World War, the steam locomotive had been the basis for diesel and electrical locomotives that became widespread.

While cities are attached with accordance to the scientific improvement of the railway transport, at the same time, they have become the centers for the functions of production, consumption and distribution. Nevermore, achieving the economical strength and competitive advantage was mostly depending on cities' ability of mobilizing the potentials they own. On this account, some key sectors played important roles in their economical development. One of these sectors was certainly the sector of railway construction (Bertoni, Spit. 1998). This constitutes one of the reasons of 'the cities performing a development towards the railway and its related institutions' while the urban forms that appeared after the industrial revolution are analyzed.

Cities are faced with the consequences of being transformed into environments of economical activities, immigration from the rural, and the excessive population increase. One of the basic results rooting from the excessive population increase is 'urban mobility'. Hereby, the concept of railway steps in as a solution to urban transport issues. After the appearance of this solution, cities, formed by the existing urban railway networks, become the scenes of radical transformations with the effect of urban railway systems.

4.3 Urban Transportation and Its Spatial Relation with Urban Form

Transportation systems within big cities are complex structures. The reasons of their complexity are, in conjunction with their inclusion of several transportation modes, the magnitude of the traffic and the variety of points of

departure and arrival. Urban transport does not only contain the function of the means of access within daily activities of citizens, but also the functions of manufacturing, consumption, distribution, and transportation. Conceptually, the urban transportation system is related directly to the spatial structure of the city (Rodrigue, Comtois, Slack 2006).

It is a well-known fact that modes of land use and transportation facilities are mutually related. The relation of urban macro form and land use is constructed by using variables such as the absence or existence of transportation facilities, or the cost of transportation in terms of time or money (Tekeli, Okyay, 1981).

If this relation is reciprocal, then the city itself determines the facilities of transportation. The intention here, by using the term “city itself”, is to refer to the size of the city, its geometry, density, and modes of land use within. On this account, first the city determines its own forms of transportation then these forms of transportation shape the city. This mutual relation creates an urban macro form in the course of time.

“Urban form” is a spatial imprint of the modes that are the elements of urban transportation, transportation substructure, and transportation created by the citizens. Certainly, transportation, and accordingly, the mentioned spatial imprint indicate difference according to the characteristics of each city (Rodrigue *et al.,* 2006).

An urban form is constituted of two structural elements. One of them is the “node”. Nodes are constituted of two types: accessibility and economical nodes. Accessibility nodes are the locations that provide access to market and sources. Economical nodes are the locations where the economical and administrative, etc. functions are operated. The second structural element is the “linkage”. Linkages are the substructures that accommodate the flow in between the nodes.

The change in the urban transportation creates transformations on the urban form. The initial changes are the transformed relations between the new urban activities and elements of urban system. The new economical and population related changes cause transformations within the urban structure and offer a basis for new structures. In fact, the word “urban form” happens to be reminiscent of linear, central-satellite, and radial cities (Tekeli, Okyay, 1981). The four basic transformation types, observed in metropolis scale, are as follows (Thomson, 1977):

Completely Motorized Network: A low-density structure that is individual transport and automobile oriented. The need of high performance lines accompanies a loosely developed public transportation. Centrality level is low (Figure 4.2).

Weak Center: A concentric pattern with a medium-density structure. In this structure, most of the functions are located on the periphery. As much as the individual transport is observed, public transport holds a place on mostly the main traffic arteries (Figure 4.3).

Strong Center: In this type of structure, public transit is widespread within a pattern of high-density. Accompanying the limited access to the city centre, a strong means of public transit is provided (Figure 4.4).

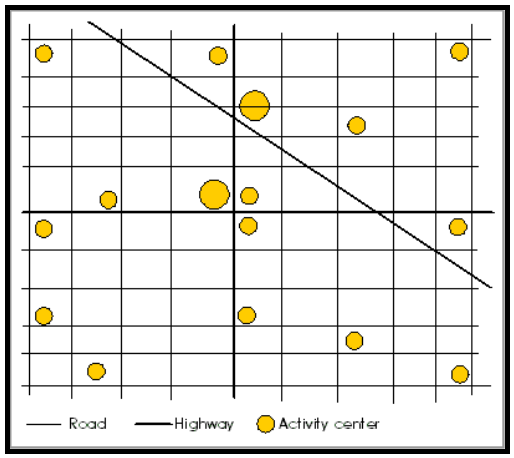


Figure 4.2: Completely Motorized Network (Rodrigue *et al*., 2006).

Traffic Limitation: This type of structure is fully reserved for public transit because of the consideration in conserving the city centre or overload on traffic (Figure 4.5).

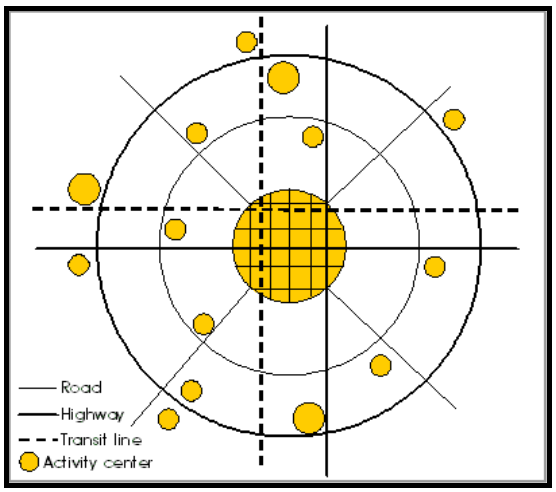


Figure 4.3: Weak Center (Rodrigue *et al*., 2006).

Urban transport appears in three different forms within the structure explained above. First, the “collective transportation system” that provides access to specified regions of the city.

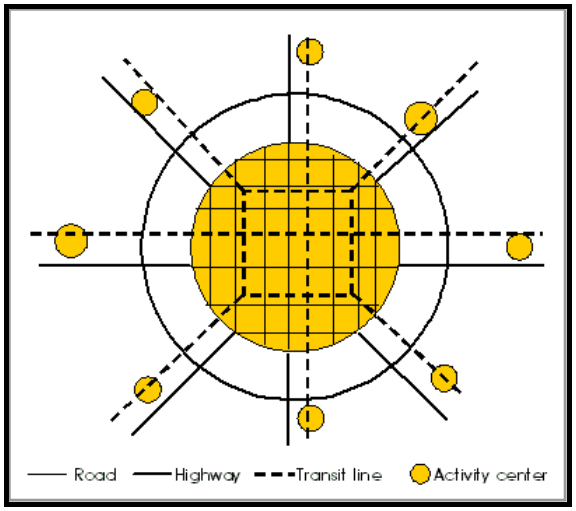


Figure 4.4: Strong Center (Rodrigue *et al*., 2006).

This system takes the advantage of scale economy while large amounts of population are transported. On the other hand, individual transport depends on personal preference. This is a function that occurs as a result of the

individual's use of personal vehicle or choice of walking. "Freight transportation", due to city's character of constituting dominant centers of production-consumption,

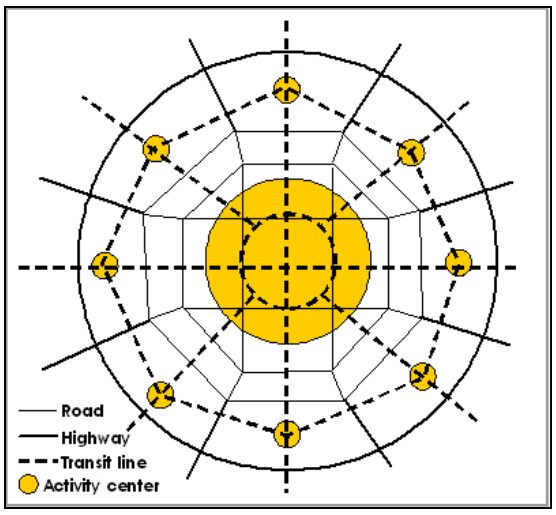


Figure 4.5: Traffic Limitation (Rodrigue *et al*., 2006).

defines the transportation between the activities such as industry, distribution, etc.

Subsequent to the fact that public transportation developing into an urban reality with increasing population and traffic density, the relationship between the city and this type of transportation occurs in different dimensions. The level of this relationship is reflected on the urban form and spatial structure of the city. The cities belonging to the first group, adaptive cities are fully "transit-oriented" (Cervero, 1998). Developments of these cities are evolved in the environs of transit systems and stations. Adaptive cities provide transit transportation while bringing the city centers into consonance with the pedestrians. Yet the peripheral development is determined by the transit lines (Figure 4.6).

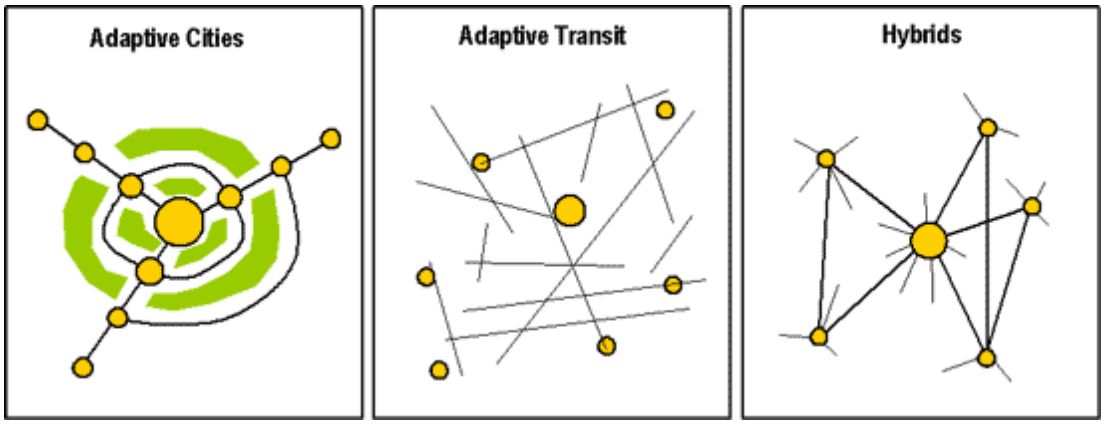


Figure 4.6: The Relation of Public Transport And City (Rodrigue *et al*., 2006).

The second type of urban structure is the “adaptive transit” cities. Automobile owners are observed as the dominating characters and transit systems are constructed for private needs. With a loose central structure, these cities are constituted by the determining elements of express highways and peripheral interurban lines (Figure 4.6).

The last type of urban structure is in a hybrid form that sets up a balance between the transit systems and private automobile ownership. Right along with the support of the city center to the transit systems, automobile owning is dominant on the periphery (Figure 4.6).

Considering the frequency in transit use and with the light of these relations, it is seen that different types of land uses are formed (Rodrigue et. al., 2006) (Figure 4.7). One cause affecting land use is the transit stops. These are the nodes mainly providing accessibility facilities. If these stops are in a low-density use, land use effect is considered to be weak. The higher rate in use of transit system occurs; the growing effect is seen on the land use that is caused by the transit stops. This process is exposed with a band-like structure through the line. Transit stops are the convergence nodes that serve for more than one mode of transport. Therefore, the effect of consonance between the modes of use and transit stops on land use, are exposed variously. Transit stops are the structures where the movement is started, ended and directed. These stops are defined by the points of

departure and arrival while low-density transit use occurs. With the increase in the movement of passengers, they are turned into centers that support other transport systems and receive support from them, run together and direct the transport. Transit stops are the local centers that affect their environment with land use. The denser land use occurred, the higher rate in integrating these stops and their environment is gained. The environment of the high-density transit stops indicates variety and density in use.

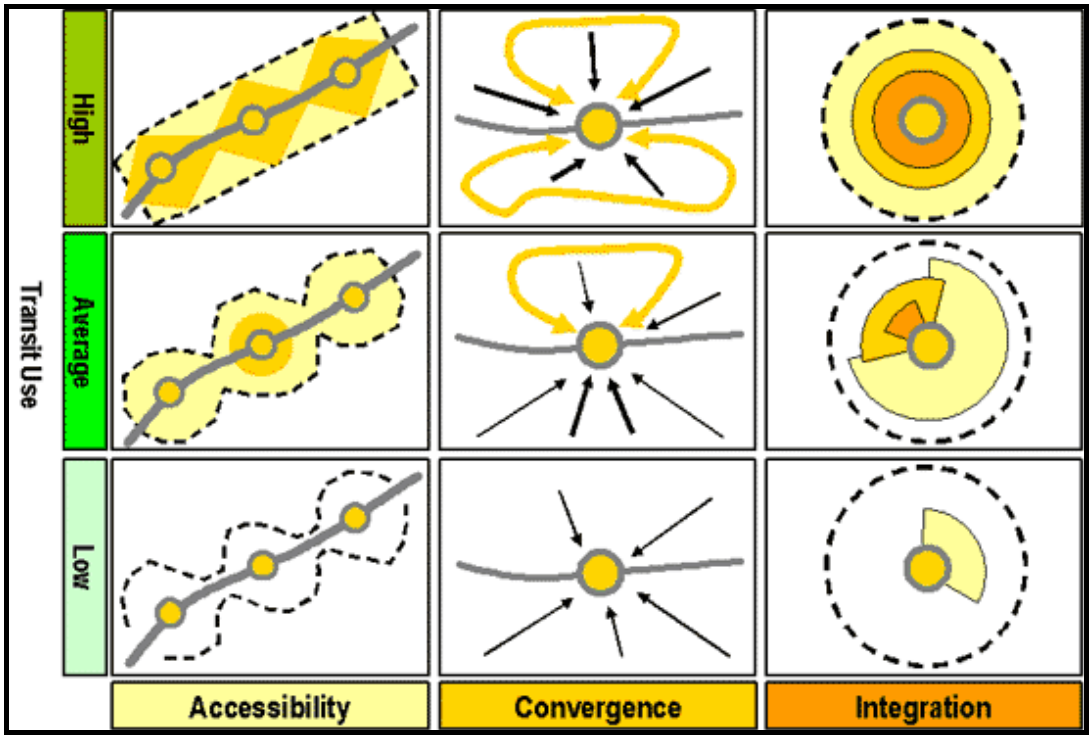


Figure 4.7: Relation between *Urban Transit* and *Land Use* (Rodrigue *et al*., 2006).

4.4. Emergence of Metro

Metro (at the same time, rapid transit, underground, subway, tube, elevated, or metro (politan)) is an urban transit system that is operated underground with a high capacity. The oldest metro has come into service in 1863, in London (Figure 4.8).

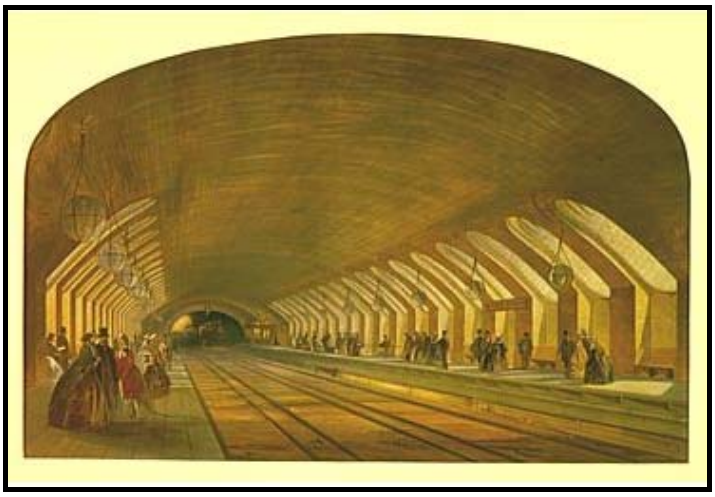


Figure 4.8: London Metro, Baker Street Station, 1863. (Source: http://www.ltmuseum.co.uk/learning/online_resources/ecobus_omnibus/pg/1851a.htm).

After Thames Tunnel was put into service in 1843, Charles Pearson's metro suggestion was wrapped up, that had been in discussion for 10 years, and the construction began in 1860 and ended in 1863. The system of Pearson's was basically consisted of two tunnels located between Farringdon and Paddington with an opening system of cut and cover.

After 8 years from this metro station caming into service, French engineer Eugene Henri Gavand, offered a project of an underground system in order to overcome the obstacles of the pedestrian paths between Galata-Pera in İstanbul. With the privilege given by the Sultan of the term, Abdulaziz, the company of "Metropolitan Railway of Constantinople form Galata to Pera" commenced the construction. After a four years' time, in 1875, the construction of the tunnel was finalized. The tunnel was 573 meters long and has an inclination of 15%. The system was grounded on two wagons that face one another and move in one line.

There are several rumors about this tunnel's ("Tünel" in Turkish) process of occupying a significant place in society. According to one, the advisory opinion ("fetva" in Turkish), given by the chief of religious official in the Ottoman Empire (Şeyhülislam), was declaring that underground travel was not religiously permissible. The same argument was put down to the animal

transport that took place in the period early on. However Engin (2000) opposes to this argument and explains that this animal transport is connected to a reliability test of the system. As a matter of fact, tunnel had become a transportation element that was used by the society later on. This system is still operatingtoday.

In another developed European city, Paris, the first metro (Métro) was put into service in 1900 like a similar way as Exposition Universelle. The studies on metro construction in Paris date back to the year 1845. This project was carried on under the direction of the engineer Fulgence Bienvenue. Today, the line is named as “Line 1”. The Metro of Paris was accepted rapidly and carried 17 million in its first 6 months, 55 million passengers in the following year.

Metro of Paris called to mind with its visual values. Architect Hector Guimard, with emulating French culture, designed entrances (édicules) with the style of *art nouveau*. These *édicules* were similar to Greek entrances of mystic spaces, creatures coming up from underground and *spines of ichthyasaurus* (Pike, 2000).

With the iconic lines depicted above, several metro systems stepped in at the end of 19th century and the first quarter of 20th century: Chicago (1892), Glasgow (1896), Budapest (1896), Wuppertal (1901), Berlin (1902), Madrid (1902), Philadelphia (1907), Buenos Aires (1913), Barcelona (1924), Sydney (1926), Tokyo (1927). The complete list of world metros ranked accordint to their lengths can be found in Appendix B.

The gap of metro ownership, in the beginning of the 20th century (between 1910 and 1920), can be related to World War I (1914-1918). Today, there are 162 metro lines in the world (Serradell, 2006) (Figure 4.9).

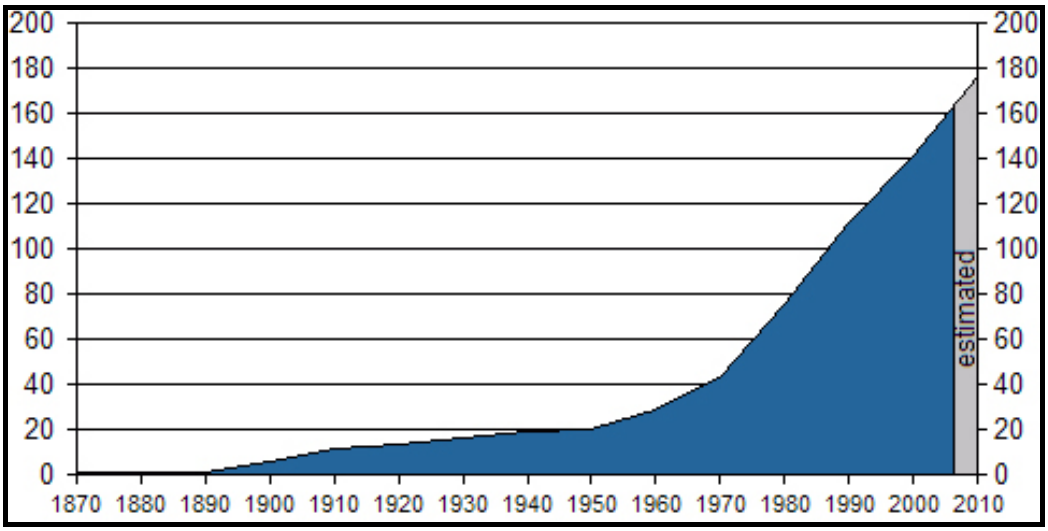


Fig. 4.9 Increase in Metro Ownership Distributed Over Years. (Source: http://micro.com/metro/metrolist.html).

The development of metro is related to technical improvements as much as urban traffic problems.

When the history of construction of metro is considered, two main waves are seen within the world examples. The first wave of metro construction is in the middle of 1960's. The second is in 1900's. In both waves, the development of metro affecting the urban form had been in various ways.

The first wave, with the industrial revolution, is defined as the entrance of the developed railway. Developing interurban railway systems were causing an increase on the population and causing aggregation in cities. As will be discussed further on, the first metro appeared in 1863 in London, however, became widespread in 1900's. Throughout 19th century, the dominant mode of urban transport was individual transport. The radiuses of the cities were 5 kilometers that offered a possibility of walking. With the railway system, there developed several small suburbs on the routes that caused radical changes on the urban morphology. From this point, new urban form was defined by the railway systems.

The first automobile appeared in the year 1890. However, it was commercialized in 1920's. In 1930's, the character of urban transport

transformed with the entrepreneur Henry Ford, who made it possible to afford buying automobiles by the middle class. Public transport turned into a more individual character beginning in 1900's. This kind of transport formed the city all over. Urban growth hastened throughout the whole area of the city center without following the railways. Hereupon, in order to generate solutions to traffic problems, new networks of lines and parking lots were constructed. With the decrease in the use of railway, private automobile became widespread and parallel to this, the inability of mass transport systems pushed the low-income groups out of the city center. Then, residential araes in cities became districts of poverty. Hereby, the second wave of metro and railway transport appeared in developed western cities as a solution attempt to the mentioned problems above. However, the goal of the second is different than the first one. In the first wave, metro appeared as a tool for decreasing the density and a deconcentrating tool for the city. In this period, metro was serving as the only vehicle that offered fast transport to the whole of the society. However, the second wave of metro had the aims of revitalizing the urban centers and providing decrease in traffic on some axes. During this period, metro was meeting the low-income transport need concurrently with the aim of decreasing the private automobile ownership rate. Besides, the appearance of ecological and aesthetic values and the break out of global petrol crisis in 1973-1974, increased the cost of private automobile and caused the highway networks unfeasible. Public transport became the only alternative for automobile focused transport. While analyzing these periods, four different approaches are seen within the transport planning. From 1950s until the 1970s the approach was vehicle focused, then in 1960s there were traditional approaches to transport planning, then, by the 1970s human-focused and after 1980s modern applications depending on the vehicle demand appeared. In the traditional approach, the increase in demand causes traffic jam. To solve this problem, additional capacity is developed. Although this causes a decrease in traffic jam for a limited time, the problem turns into a vicious circle with the increase in demand repeatedly. As the development of public transport accepted as the only solution for urban transport issues, according to modern approach,

the basic strategy was to encourage and deter the private automobile owners to use public transport. Different alternatives were offered to society and integrated with each other. Because, there is a strong relationship between automobile ownership and urban transit use. The automobile ownership is decreased in cities that urban transit is developed (Rodrigue *et al.*, 2006) (Figure 4.10).

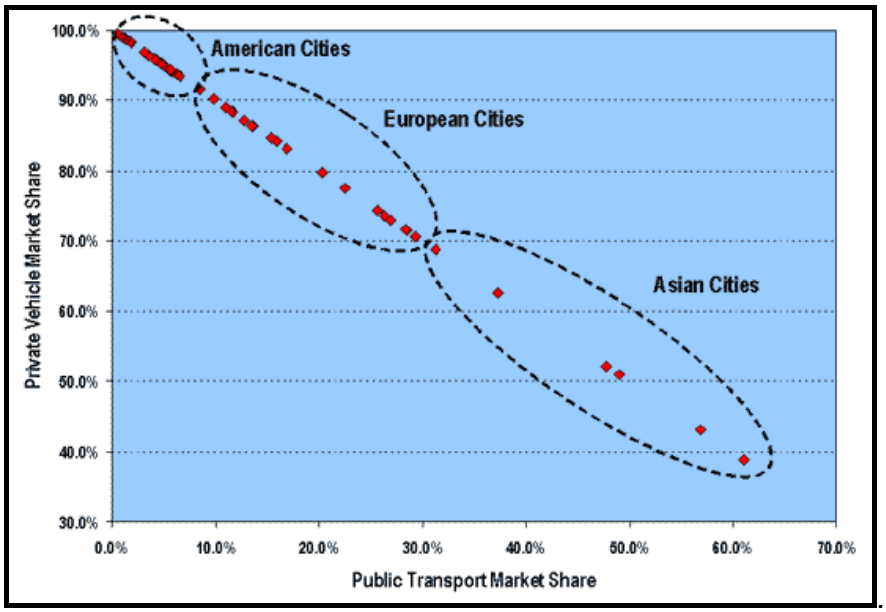


Figure 4.10: Relationship between Private Automobile Ownership and Public Transport. (Source: Rodrigue *et al.*, 2006).

So, what is the threshold value of a city to have a metro line? This question is the essential issue to consider in the first phase of a huge financial investment of the metro project, because metros are mega projects that are not only the determiners of the fate of cities but also drifters to financial crisis. Because of this reason the decision of metro ownership requires a deep and detailed analysis process. However, on the other hand, the delay on this process may draw the city to unsolvable situations.

Today, when the 162 metros are analyzed throughout the world, it's seen that most of the metros are seen in the cities with a population of over 2 millions. Besides, the population of the city is a definitive factor within the justification process of metro.

Certainly, the determining effect of population on metro ownership depends on the characteristics of the city. In a way, the effectiveness and existence of the metro is dependent on the urban form. If automobile ownership is sedentary and infrastructure is required then metro may not be necessary in a city.

If the city is a single-centered and dense one, it's inevitable to own a metro line when the population approaches an amount of 2 million. In this case, determining factors of metro ownership are the center-perimeter connecting main highways and their capacities. The establishment of metro is inevitable when the highway use approaches to 40.000 and over in the morning and evening hours that the travel demand is maximum.

The table below indicates the different transportation methods and their traveler carrying capacities per hour (Table 4.1) (Öncü, 1999).

In the table, the interval of light rail metro is defined generally as "unstable region" and also determined as "region to decide on constructing metro". As metros are long-term projects, it would be too late if the 40.000 threshold value of population is awaited.

Table 4.1: Carrying Capacities of Various Transportation Modes (Öncü, 1999).

NAME OF THE VEHICLE	CAPACITY OF CARRYING (per hour)
Automobile	700-1000
Cessation Public Transport (Minibus etc.)	1000-1500
Bus	6000
Bus Line	10000
Tramway	12000
Light Rail Metro	18000
Metro	33000-40000

In terms of operating costs per unit, it is seen that the cost is decreasing from automobile to metro (Öncü, 1999). However, low-cost and high-capacity rail systems that have huge sums of investment, and relation between capacity

and sum of costs (investment and operation costs) has reveal different characteristics. The cause of this fact is the increasing value of the sum of all costs from automobile to metro-tramway and decreasing value from light rail to metro. Because the applications world-wide indicate that even the most extensive arrangements are made, a bus cost per kilometer is below 1 million $, while light rail system is 10-20 million $, and metro is 50 million $ (Figure 4.11).

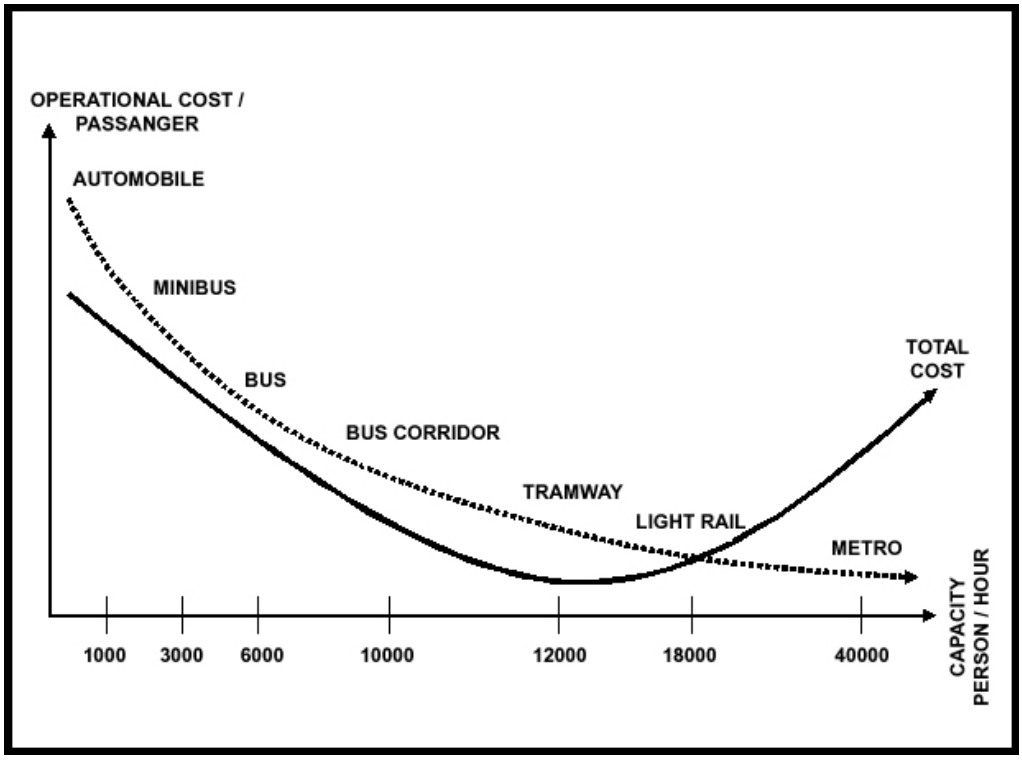


Fig. 4.11: Relation between Operating Costs of Carrying Types and Their Capacities. (Öncü,1999)

Because of this reason, throughout the process of decision in type of transport, while bearing in mind the capacities, total cost factors, and financial resources, each technology of transport should be used in right place and right time. For wide-acceptance of metro, the ticket fees should be proper for the low-income.

4.5 Railway Systems in Turkey and Metro

The history of railway has a past of 150 years in Turkey. However, urban underground railway transport system is relatively new. The general view on railway history is important, because, Turkish railway history and urban railway transport system have a strong relationship.

Turkish railway history is analyzed under three headlines: before proclamation of the republic, republican government period (1923-1950), and the period after 1950. The most distinct features of these periods are: in the first period, most of the lines were constructed with foreign concession; second, was the golden era for railway; and third, the negligence of railway transport (TCDD, 2006).

Recently, the problems in highway transport cause a growing attention on railways. The main reason of the long traveling duration that caused highways preferred to railways is tried to be eliminated by making arrangements on existing lines to shorten this traveling time. However, these arrangements failed with fatal accidents and new attempts are put in agenda. Today, Turkish State Railways is running three projects with this aim. One of them is Ankara-Istanbul High Speed Train Project, which aims to shorten the traveling time between the two developed cities with a comfortable, safe and fast transport facility. The second project is Ankara-Konya High-Speed Train Project. This line is constructed with the aim of connecting Konya, one of the developed cities of Turkey, to three other developed cities (İstanbul, Ankara, İzmir) with a fast railway line. The last project is Marmaray Project, attempting to bring a permanent solution by connecting Asian mainland to European side with integrating itself to urban transport network of the city.

The urban rail history of the Turkey shows similarities with its railway history. The first urban rail systems are constructed and operated by foreigner capitalists again by the given some privileges. However, the rash towards railways in Republic Period reached to most of the cities, but did not prefer in

urban transportation. In 1950s, the dominancy of car and land route can be observed in Turkish cities. Unfortunately, during 1960s, the interest towards urban rail systems in world cities is not reflected to Turkish ones.

In the history of Turkey, the first urban railway system was put into force in Istanbul during the Ottoman Empire period. Of course, it is not by chance that the first implementation has done in the capital of the Empire. İlber Ortaylı, in his conference called "Industrial City Istanbul", has mentioned Istanbul's need for a railway transport system in the 19th Century, by describing the city as "metropolis mundi" (world city) since 4th Century A.C. Ortaylı has talked about Istanbul being exposed to a huge migration, a result of the modernization period starting in 18th Century. In this period, squatter housing has gained an increase in number. He mentioned that this migration and increase in the slum areas have not helped Istanbul to become a metropolis, provided that the changes in living style, physical structure and organization of spaces have been limited by only being squatted, having suburban areas, integration of the disconnected districts to the city, and modernization of the intercity transportation. According to Ortaylı, as Karaköy is an active business district and its relation with Beyoğlu's housing areas gets condensed, has required a metro system which is one of the firsts around Europe, and in June 10, 1869 the "Tünel" (Tunnel) between Karaköy and Beyoğlu (formerly called Pera). has been commissioned. The crowded traffic between housing and business areas has required the need for operation tramway, constructing new roads and widening the old ones (Ortaylı, 1996).

Tramway has existed in three different forms in Istanbul's history on transportation. According to the legal web site of Istanbul transportation facilities (İETT, 2006), the government has been facing with the demands on tramway privilege since 1860, and the demands have been turned down as the demands are whether nor accurate or the redundancy of the destruction along the line. However a year later, Dersaadet[18] Tramway Company was

[18] Dersaadet is one of the former names of İstanbul. The word is originally written as "der-i saadet" and meant "door of happiness".

established to which the privilege has been transferred (Kayserilioğlu, 1999). In the tramway transportation system, there have been 45 tramways and 400 horses.

By the Balkan War as all the horses of the tramways were issued upon the charge of the military, the transportation system has been interrupted, and there have been looked for new solutions. Thus, in 1914, all of them are transformed into electric tramways (IETT). In the year 1961, the tramways were cancelled in the European part of Istanbul and cancelled completely in 1966. In 1990, the municipality blocked the İstiklal Street to traffic at Beyoğlu, and "Nostalgic Tramway" went into service on 29 December 1990 as in Kadıköy in 2003. Like in İstanbul, two another tramway line (İzmir and Konya) has operated at 19th century in recent Republic borders. The use of tramway in İzmir started in 1881, then replaced with electrical ones in 1914 and put out of service in 1954 (İBB, 2006). In Konya however, the first tramway service began at the end of 19th century due to the need for public transportation caused by the increase of distance between housing and business spaces. In 1930s the tramway is reunited with electricity and reached 30 kilometers as a distance. After then, two lines of total 24 kilometers are established by municipality in 1992. In Antalya, a 5 kilometers long of a tramway line opened to service in 1999. In most of the Turkish cities, the new tramways that fit to contemporary technology are either in service or under construction or planned. These street tramways opened in 1992 in İstanbul; in 2003 Eskişehir.

In Turkey, in four cities, there are LRT systems build or planned. These cities are: Ankara, İstanbul, Bursa and Kayseri as underconstruction.

As the study and its case focus on the city of Ankara, the urban railway history and its organization deserves a detailed attention. So, the comprehensive presentation of the case will be introduced after for the sake of integrity.

In Turkey, the second LRT system is built in Bursa. For the resolution and manage of the urban transportation problems, a LRT project placed in to the agenda (Saydam, 1999). In July 1998 the construction of BURSARAY has been started and has been finished in April 2002. The first running phase consists of 2 lines with a total length of 17.5 km, with one under construction of 5 kilometers and a planned line of 7 kilomters.

In İstanbul, on September 3, 1989, Aksaray – Havalimanı LRT line was on service. On December 2002 the system reached total length of 19.3 kilometers. Currently, 6.1 kilometers of new lines are under construction and total 46 kilometers of new ones are planned.

Another LRT, Kayseray was tendered by Greater City Kayseri Municipality on June 16, 2004 The system is still underconstruction with 17,8 km length of rail system and 31 passenger stations.

Now, in Turkey, there are four metro, three of them run and one is still under construction. After the rapid increase on population in one of the largest and most dynamic cities in Turkey; Adana required a state of demand for metro in 1990s. The construction has started in 1996, but stopped because of route modification and financial crises until 2001. Adana Metro is consisting of two lines, a line with 19.3 km length and a planned line that connects local university to the center.

By 1990, İzmir's existing transportation network could no longer meet the needs of the growing population, especially because the centre corridor was squeezed on both sides by the restricting topography (Aykar, 2004). The lines suggested in the Transportation Master Plan were proposed to build a 43-km rail network. After the foundation laid in 1994 and tThe construction is finished in April 2000. 11.5 km length of first phase of İzmir Metro is still on service and the system will be extended 9.5 kilometers to west, 8 kilometers to south west and 3.2 kilometers to east directions.

In İstanbul, construction of the first full metro line started in 1991 and the first section between Taksim and 4 Levent opened after some delays in September 2000. Today, in İstanbul, there are four lines still under construction (50.9 km) and other four is planned (44.6 km) (IETT,2006).

4.6 Ankara Urban Rail System

Ankara is the capital of Turkey and the country's second largest city after İstanbul. After the War of Independence was won and the Ottoman Empire was dissolved, Turkey was declared a republic on October 29, 1923, Ankara having replaced İstanbul as the capital of the new Republic of Turkey on October 13, 1923. After Ankara became the capital of the newly founded Republic of Turkey, new development divided the city into an old section, called Ulus, and a new section, called Yenişehir. Then, the city took an active part in reflecting modernity project as a pioneer and a symbol to fulfill the new world conception by appropriate life styles and spatial organization (Tankut, 1990). The city itself was the symbol of national independence and the new republic in the 1920s and 1930s.

After the declaration of Ankara as the capital of the Republic of Turkey, a planning competition was held in 1927. Herman Jansen's proposal was awarded the first prize, and the plan, prepared by him was put into implementation in 1932. In 1932, Jansen's complete plan was approved and implemented extensively between 1932 and 1939 (Tankut, 1990). The development of Ankara continued until 1950s according to the general framework of this plan. The plan proposed a development into the Yenişehir-Kavaklıdere axis in the south, the Maltepe-Tandoğan axis in the west and Cebeci in the east.

In the Jansen plan, the major focus for transportation was depending on automobile ownership. For this purpose, the plan was including wide streets and side roads to connect streets to the blocks (Cengizkan,1994) (Figure 4.12).

Figure 4.12: A View From Yenişehir, Ankara in 1930s. (Source: www.wowturkey.com).

The plan was prepared for a 300.000 population within a time period of 50 years. However the city reached 300.000 borders in 1950s. The rapid migration towards the capital city caused unplanned developments different from what Jansen predicted. The next plan, approved in 1957, was prepared by N. Yücel and R. Uybadin, following their winning of the first prize in the competition held in 1954. Next, ‘’1990 Ankara Master Plan’’, so called, was prepared by the Ankara Metropolitan Area Master Plan Office, established in 1969 by the Ministry of Public Works and Housing for 14440 hectares and for 3.6 million population. Different from Jansen, this plan was keeping an east to west development in mind. The plan was also putting previously unheard of urban rail transit down on the urban transport agenda.

Ankara reunited with railways at the beginning of the 20th century. After the contract with Deutshe Bank and Ottoman Empire, the railway arrived in the city in 1892. The line was a as a leg of railway project between Istanbul and Baghdad (Figure 4.13).

In Ankara, suburban train operation started in 1929. The first train service between Ankara-Kayaş (in the East) became one meeting the demand of passengers traveling in their free times, rather than satisfying the need of typical daily travel requirement. Suburban railway transportation started to effect the way of development of the Urban immediately after its establishment.

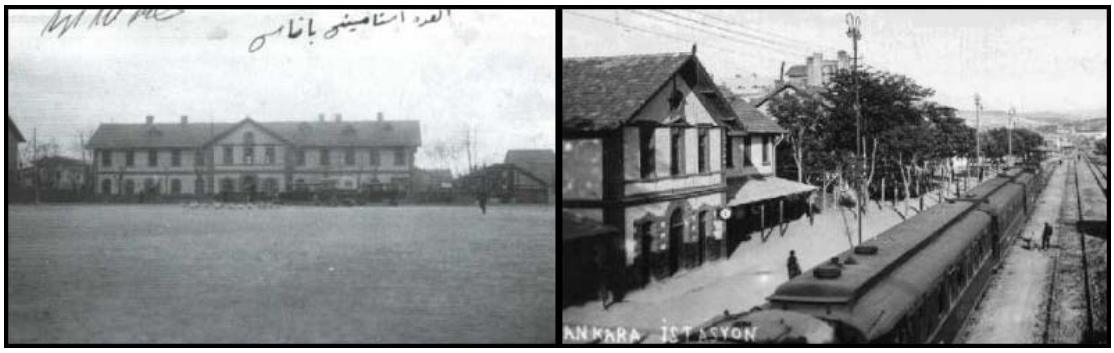


Figure 4.13: Ankara Station. Station is then dismantled. The current station of Ankara was inaugurated by the republic on 10 october 1937. Today, the streeing building is used as Ankara Railway History Museum. (Source: www.wowturkey.com).

In 1950s the number of shanties started to increase along the railroad between Cebeci and Mamak. Service of suburban train in the west particularly encouraged inclines of population in districts like Sincan and Etimesgut. The dual line between Ankara-Kayaş is completed at 1970 and the locomotives converted to electrical ones in 1972.

On 22 January 1930 the authority of operating buses, minibuses and electrical tram-cars was given to the Municipality by a Decree of Ministers; however, the Municipality could make its first effort in 1935 by organizing the Ankara Municipality Bus Management and importing 100 buses from Russia. In addition to these buses which operated on 15 lines, each having an average length of 6 km, the Kaptı-kaçtı (Pick-Up and go) continued their existence on other particularly on lines on which buses did not operate. Due to insufficiency of EGO's supply, particularly in the Center of the Urban, new types of entrepreneurship emerged in those areas, and operators of dolmuş[19] carrying 11 passengers started to operate with 330 vehicles on Bahçelievler-Dörtyol, Aydınlıkevler-Çankaya line in 1959. In the mean times these vehicle types that were converted to "Dolmuş" went through many changes: Today, the dolmuþ transportation carried out by minibuses has exceeded one fourth of the total daily travels in Ankara.

[19] A Turkish dolmus (DOHL-moosh) is a shared taxi or minibus running a pre-determined route, with each passenger paying only a portion of the normal fare.

There are four different studies conducted to this date on the subject of Ankara Rail Mass Transportation System and Transportation Study (EGO, 2006):

1) Ankara Urban Transportation Study conducted jointly by SOFRETU (France) and Ankara Municipality in 1972.

2) Rail Mass Transportation Study carried out by EGO and Construction Center between the years 1978 and 1980.

3) Light Rail Mass Transportation Study made jointly by Ankara Municipality and Transurb Consult (Belgium) in 1980-1984.

4) Ankara Urban Transportation Study carried out by EGO Canada Consortium and Kutlutaş in 1985 - 1987.

Ankara Urban Transportation Study. (Ankara Municipality-SOFRETU)1972:

On 7 October 1969 an agreement was reached by and between EGO General Directorate and SOFRETU to make a study reviewing such subjects as modernization of buses, reorganization of existing conditions and use of metro in Ankara in order to solve the problems of the Urban. Under this agreement, following subjects have been studied:

a) Organization of administrative structure,

b) Fare collection system,

c) Study of trolley bus and bus network of the traffic,

d) Determination of demographic structure,

e) Future oriented recommendations for development of a transportation system to allow high capacity urban passenger transportation.

At the end of the study, the construction of a metro, 14 km long, all underground, was recommended. The firs stage is the 7 km long Bahçelievler Cebeci line I. As a result of the study completed in 1972, a metro line wholly underground, between Dışkapı and Kavaklıdere .was developed. The criticism directed at this project may be briefed as follows:

a) The technology recommended offers full dependence on French technology other than using local manufacturing potential (due to rubber wheels);

b) Necessary clearness was not brought on the subject of financing.

Studies conducted between 1978-1980 (EGO Construction Center)

This study was realized solely by EGO without the assistance of any foreign company. This study was carried out by a separate unit specialized in urban transportation planning established in the structure of the directorate of EGO. This was responsible for the control of design activities local advisory services were provided by the Construction Center. This study recommended a mass transportation system 25 km long, whose 90 percent would be at grade. At the stage, a 3.5 km long to be between Stad Hotel and (Ulus) İnönü Square. This project was criticized for following reasons:

a) The recommended system was not based on an extensive transportation study and transportation master plan. It was based on a single corridor analysis and it did not take into consideration the systems integrity with the suburban train and bus network.

b) This recommended line was not in harmony with the urban growth strategies contained in Ankara Urban land utilization master plan.

c) Projections regarding cost, revenues and traffic levels are not realistic.

The project documents were given to related public agencies for approval in may 1980. Construction started at Opera Square but it was stopped by the government after 19 days.

Project and Feasibility Studies Conducted between 1980-1984:

This study was conducted to also assess the government views in respect of previous fast rail transportation studies. This study also made use of the 1979 household population inquiry made by the EGO-Construction Center but it brought lower traffic projections due to Construction Center Project's 110 person/hectare assumptions. Thus the study concluded the feasibility of a light rail system. A short time consultancy service was obtained from Transub Consultant a Belgian Company, under the United Nations Development Program Technical Program. This Project was rejected for following reasons in August the Ministry of Reconstruction and Housing, which was the approval authority for such projects prior to Metropolitan Municipalities Act 3030, - 1979 study results were used without being upgraded in the study. - Such a study should have been based on a larger land use plan. - Projecting was inefficient in respect of capacity Urban because it was made on the basis of 1990 projection.

Ankara Urban Transportation Study (EGO; Canada Consortium Kutlutaş) 1985-1987

On 19 July 1985, An interim agreement was signed by and between Reid Crowther International and EGO in connection with Ankara Urban Transportation Study. On 3 October 1985 the Agreement was replaced by a an official agreement. 1 November 1985 ü partnership agreement was signed by and between Reid Crowther International Ltd. and Kutlutaş Engineering Representation Consultancy Industry and Trading Co. Inc. On the same day,

General Directorate of EGO to Kutlutaş to proceed and the work officially started. Ankara Urban Transportation Study, completed on 31 December 1986, consisted of four stages:

(1) Transportation study.

(2) Transportation master Plan

(3) Feasibility Study and Concept Project.

(4) System Characteristics and Preliminary Design Transportation Study, being the first stage of the study, had two objectives: first objective is the analysis of the existing transportation demand in Ankara. Second objective is the preparation of a general assessment of the factors forming the whole transportation system. Three separate data were used for the analysis of the transportation demand which help the realization of the first objective. The data are:

(1) Land use data

(2) Transportation Study Data

(3) Transportation System Data.

Land use data was obtained from the Land Use Master Plan That Contained the values projected for 1990, and which were prepared for Ankara Municipality in 1970s. While this plan was prepared, the 327 quarters had by 5 districts (Altındağ Çankaya, Keçiören, Mamak, and Yenimahalle) were grouped and 62 transportation regions were made. Among the data taken as a basis for the transportation study commenced by the General Directorate of EGO there was the housing inquiry which it had made in 1979 with 1% sampling. Transportation housing inquiry constituted a basis for the calibration of computerized transportation model. Population and

employment projections were developed for 1990 and the model calculated the travel demand for future demands. In 1980 a second transportation housing inquiry was implemented in 14.107 dwellings with a participation rate of 3 %. This was used in the creation and calibration of the system. Another data was the traffic count made at 24 different places in a central district between 1979-1980. Additionally, in November 1975 and 1980 the vehicles volumes were determined in typical week days These inventories were made in May 1985 In addition thereto the intersection traffic count and EGFR bus raw passenger load and speed inquires are also are imported data for transportation study. Transportation- system data is the collected data, pertaining to statistics, private auto, minibus taxi, suburban train. The objective of the Transportation Master Plan, being the 2nd stage, is the development of an urban transportation plan which shall not only assess future trends but at the same time influence and direct them. The studies that may be made to attain this end may be gathered under two headings. First of which is the studies regarding land use. Following are included in the scope of this study: projection of work force according to occupational branches, upgrading of Ankara Master Plan. Second is the projection of transportation activities in future, development of urban transportation alternatives, and development of urban transportation activities, which relate to urban Transportation Master Plan. Objective of the 3rd stage, which being The feasibility study and concept design, is to make concept designs in order to insure necessary planning basis for the following stage, which covers the system determination and preliminary planning activities and to complete the economic and financial solutions. In this At this stage, by completing the 1:5000 scaled alignment plan for the first priority corridor and determining the station sites, and the depot locations, economic evaluation and environmental studies have been attained and environmental and financial analysis have been realized. The system characteristics and preliminary project activities constituted the 4 stage of the project. Determination of the presentation characteristics of the fast rail transportation system and preparation of preliminary design project providing the necessary details for the construction of the system has been planned to be completed at this

stage. Service specification has been prepared and project standards have been defined; the geographical and infrastructure charting and technical report have been completed and the activities relating to preliminary design project have been realized. The system characteristics of the long term 54.4 km rail system network of Ankara Light Rail System and characteristics of the alignment and system characteristics of the 15 km long first stage(Kızılay-Batıkent line) were approved with the Decision of UKOME dated 22.9.1986 No. 86/22

General planing objectives of the plan can be listed as follows (EGO, 2006):

- To realize an effective transportation structure which shall assist healthy development of Urban form and density structure.

- To manage transportation investments that shall pioneer urban expansions based on transportation.

- To minimize traffic jams in particularly the center of the Urban and elevate environmental conditions and the living condition of people. By enhancing the accessibility and service level of mass transportation, to increase its share in total travels, and to give continuity to this increase in time.

- To accept mass transportation as a public service and to increase all citizens ability access to various urban uses by insuring the equal distribution of transportation service in a balanced way to different social groups.

- To insure most logical distribution, of resources in time. In the planning period, to insure the organization as required by the metropolitan scale and envisaged transportation structure.

Ankara Transportation Master Plan recommends 130 km rail mass transportation network consisting of metro, light rail mass transportation system and suburban train. Alignments, locations and sizes the metro lines,

stations, and depot Work shop areas have been indicated in general. The locations, and alignments of the stations and warehouse-shops shall become definite by the 1/1000 scaled reconstruction plans which will prepared an the basis of the preliminary design drawings to be prepared by the General Directorate of EGO and be approved by UKOME. In all stations connected to rail transportation system, measures shall be taken to meet that station's passenger transfer requirement to this end the station preliminary design drawings shall be prepared together with the environment arrangement plans and be entered in reconstruction plan. Efforts shall be made for the construction of auto parks around station on condition that they are outside pedestrian priority areas and that priority is given to mass transportation transfer areas.

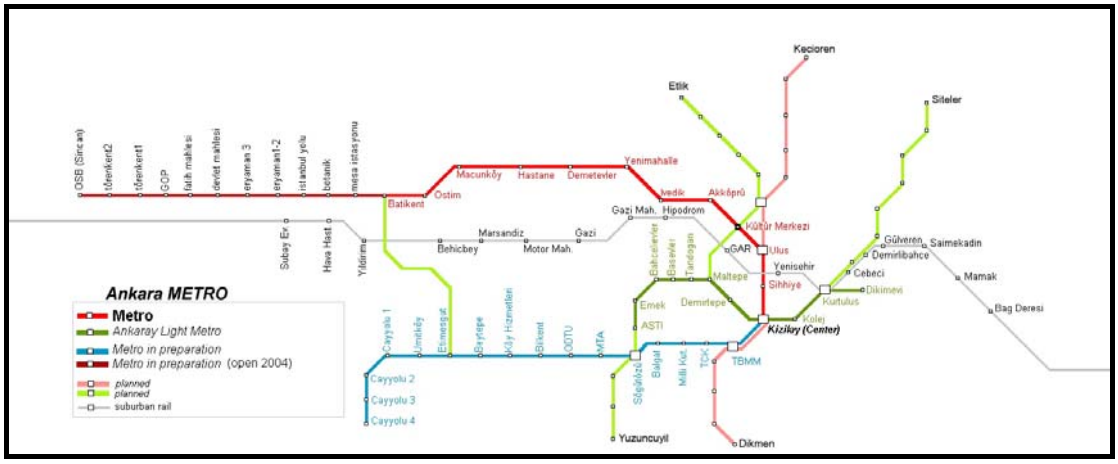


Figure 4.14: Transportation Master Plan, 2015. (Source: www.ego.gov.tr)

The possible lines for rail systems are considered in the second plan in the order of priority and in general after 2015 (Figure 4.14). Until the construction of all system tracks, bus operations are considered.

METRO SYSTEM: Metro System shall have a network of 44.5 km. by 2015 Metro in 2015 shall have the following four lines:

1. Kızılay - Batıkent
2. Kızılay - Çayyolu
3. Ulus - Keçiören

4. TBMM - Dikmen

The station Structure of Metro System at Kızılay, İskitler, Atatürk Culture Center and Balgat shall be made in a way to enable passengers to transfer to Ankara light Rail Mass Transportation (ANKARAY) System The made of passenger transfer at Balgat shall be determined separately after detailed designing.

Main depot-shop area of Metro System shall be located at Macunköy. When system is expanded and when it is needed, a second main depot and shop shall be erected at Çayyolu.

Expansion project of suburban train shall be considered together with metro, if for any reason what so ever the expansion of suburban train towards the North Eryaman and Sincan, Kızılay and Batıkent line shall be extended in this direction so that Metro may serve the area in the north of Eryaman and Sincan.

After 2015, it shall be insured that the Kızılay – Batıkent - Eryaman line and Kızılay - Çayyolu line of metro shall join another line extending towards the south of Eryaman.

Even the Suburban train system extends towards the north of Eryaman and Sincan; it shall be considered that metro shall operate on Eryaman Batıkent suburban train line after 2015.

ANKARA LIGHT RAIL TRANSPORTATION SYSTEM (ANKARAY): The length of ANKARAY net work which shall be realized by 2015 shall be 22 km. ANKARAY shall consist of the following lines:

1. Dikimevi – AŞOT (Now, AŞTİ)
2. Kurtuluş - Siteler
3. Maltepe – Etlik

ANKARAY system shall allow transfer with Metro at the stations indicated under the heading of Metro System above. Additionally, passenger transfer at the Central Gar station of Maltepe-Etlik Line and Cebeci-Demirlibahçe stations of Kurtuluş - Siteler line shall be reviewed. ANKARAY's central depot and shop areas shall be located in the south of ANKARA INTER URBAN BUS STATION(ASTI) As the system expanded and as necessity arouse, ANKARAY system shall have a depot and shop in the North of Siteler. The possibility of expansion of ANKARAY from AŞTİ to Çukurambar and from Dikimevi to Doğukent shall be considered.

That part of the suburban train lines serving public in Ankara section is 37, 5 Km and there are 28 stations thereon. Its capacity shall be increased, which at the present time, in addition to serving as a double line suburban train, render service to national and international railway transportation, by increasing the number of lines on the alignment, and by eliminating the national and international traffic. Expansion of the Suburban Train system in the North of Eryaman and Sincan shall be designed by considering the Metro operation on the same line in future. The length of the said line is approximately 26 km. The suburban train system shall use its present Behiçbey Facilities as the depot and shop facilities. Necessary arrangements shall be made to transfer the operation of Suburban Rail System from TCDD to Ankara Metropolitan Municipality.
After the raising of a loan under the government guarantor on 14.01.1992, the construction of ANKARAY has started on 07.04.1992. The construction continued approximately four years and the system came into service on 30 August 1996.

It is 8725 m. long, 11 stations between A.Ş.T.İ Intercity bus Terminal in the western section of Ankara and Dikimevi (Figure 4.15). The transport capacity is 16 000 passengers per hour and direction with a train interval of 3 minutes. With more trains an train interval of 2 minutes will be possible which will increase the transport capacity up to 25 000 passengers per hour and direction.

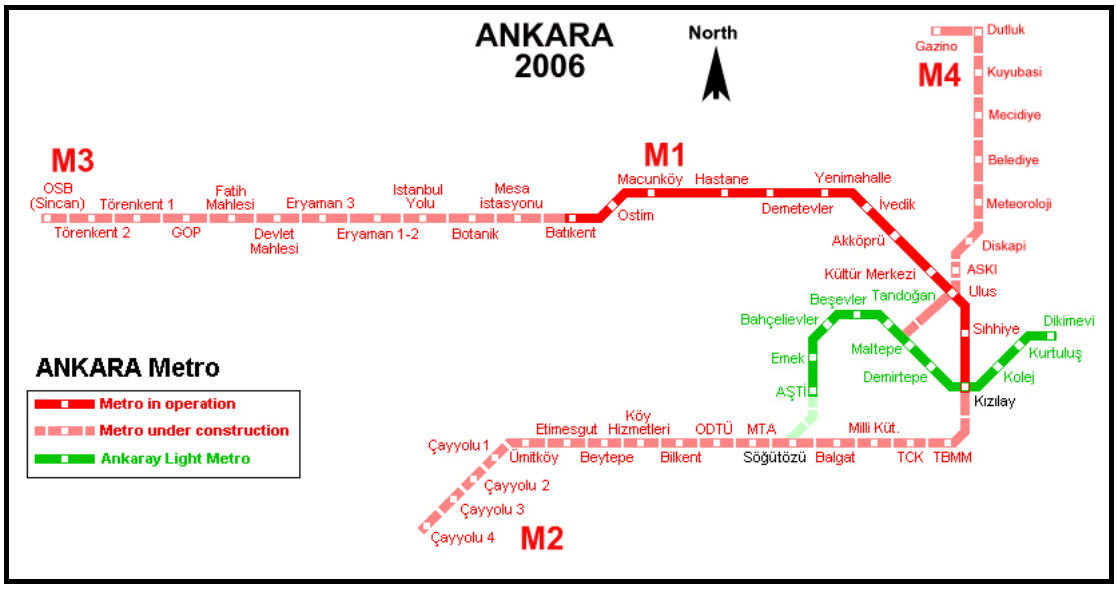


Figure 4.15: Ankara Rail Systems (2006).

As it is mentioned before, the construction of Ankara Metro has started in 1980, however stopped by government after 19 days. Subsequently, 15 kilometers of line between Kızılay and Batıkent is offered by 1985-1987 AKUÇ. The line is approved by UKOME on 22 September 1986. Immediately after, the length of the line is increased to 44.5 kilometers by Ankara Transportation Master Plan in 1991-1994. These lines are determined as Kızılay – Batıkent, Kızılay - Çayyolu, Ulus-Keçiören and TBMM – Dikmen.

ANKARA Metro Project was produced in 1987 by as a result of a joint effort of the General Directorate of EGO being the assigned Agency of Ankara Metropolitan Municipality and the Canadian Raid CRAWTHER- IBI Group Consortium Canadian Consortium operated with the grant provided by the Canadian Government under technical assistance package; additionally the Turkish Government put total of TL 800.000.000. - into her 1985 and 1986 investment program for Metro projects.

Ankara Metropolitan Municipality signed the Ankara Metro Construction Agreement with Ankara Metro consortium on 18.12.1992. Ankara Metro Consortium was formed by its Canadian member UTDC Consortium (SNC, Lavalin, Bombardier Companies) and its local member (Türk Gama, GÜRİŞ

Partnership). The cost of Ankara Metro Consecution Agreement is a package of foreign exchange consisting of the following:

241.285.000 Canadian Dollars
281.985.000 U.S.Dollars
281.985.000 U.S.Dollars
13.942.000 German Marks
65.900.000 Sterling Pounds

This package corresponds nearly to 582.000.000 US Dollars. A financing package consisting of:

Canada/EDC guaranteed export credit corresponding to USD 235.910.000. Canadian government loft loan (10 year grace period, with a term of 50 years and with zero interest).

A UK. ECGD Guaranteed export credit of 38.085.482. - Sterling pounds. A grant aid made by the British Government in the amount of 22.069.000 Sterling Pounds. A commercial credit in the amount of 220.000.000 US Dollars. And a grant, which is a result of all of these credits, was signed and came into effect on 26.02.1993. In 1987 an effort was made to realize the Ankara Metro on Build-Operate - Trans. for basis. But after long discussions carried out with the State Planning Organization (Foreign Capital Department) and the Undersecretaries of Treasury and Foreign Trade (General Directorate of Foreign Economic Relations) it was seen that the Ankara Metro could not be realized by this method and in 1991 classical turn key method was adopted. In the mean time Ankara Metropolitan Municipality developed ANKARAY Project Municipality developed ANKARAY Project intersecting metro at Kızılay. While trying to find solution for both projects' financing problems, the municipality started Kızılay joint stations construction with its own financing resources in July 1991 (EGO, 2006).

After 6 years of construction the came into service on 28 December 1997. Then, the line is defined as “M1” hereafter.

The current Ankara fixed-track public transport system consists of the 14.5km metro line. It has 12 stations and consists of 6.5km of underground running, 4.5km on the surface and 3.7km of elevated railway. This line is fully automated, and runs between Kizilay (with a connection to the ANKARAY system) and northwest to the rapidly growing suburb of Batikent.

In the following years, the municipality brought up the Batıkent- Sincan (Törekent) M3 metro line. This line is not defined in Ankara Transportation Master Plan and provided material for discussion between interested parties. While the parties were keeping up a discussion, the municipality called for tenders on 21.09.2000 and after the tender, the construction has started on 19.02.2001 on a turn-key basis for 151.156.982 dollars to be completed in 36 months.

In the meantime, the municipality is accused of on the part of opposition for giving decisions depending on political currents and ignoring the required Kızılay – Çayyolu M2 metro line. On the other, the opposition was complaining about the insufficient feasibility study before the construction. The municipality stands its policy by following reasons:

- The consistency of actual exploratory surveys and modeling results,

- The dense mass housing areas and industrial and business districts at the corridor,

- The low and middle income profile of the local inhabitants,

- The great distance to the city center,

- The demand of the inhabitants (EGO,2006).

The M3 line lies throughout north - west direction with the length of 17.7 kilometers. The line starts at from existing Batıkent M1 station and ends at industrial zone (OSB). The system encloses 12 stations (Batı Merkezi, Mesa, Botanik, İstanbul Yolu, Eryaman 1-2, Eryaman 3, Devlet Mahallesi, Fatih Mahallesi, GOP, Törekent 1, Törekent 2, OSB). The system will use of a high percentage of existing suburb rail of DLH (State Railways, Harbours, Airports Administration) and viaducts.

The construction of the M2 line (Kızılay – Çayyolu) has started on 27.08.2002. Different from the Ankara Transportation Master Plan, the line is connected to the ANKARAY at Söğütözü whereas the plan was offering a line throughout Kızılay and Çayyolu. For this reason, the municipality again, faced under the lash of criticism by reason of supplementary load on the ANKARAY. Later on the municipality revised the line by adding 4 extra stations (Balgat, Milli Kütüphane, TCK, and TBMM) to connect the system to the Kızılay as declared in Ankara Transportation Master Plan.

In sum, the construction is still proceeds in four stages:

1. AŞTİ – Söğütözü ANKARAY Attachment[20], 1.3 kilometers
2. Söğütözü – Ümitköy Metro Attachment, 8.2 kilometers, 6 Stations (MTA, ODTÜ, Bilkent, Köy Hizmetleri, Beytepe ve Ümitköy),
3. Söğütözü – Kızılay Metro Attachment, 4 stations (Balgat, Milli Kütüphane, TCK, and TBMM),
4. Ümitköy – Çayyolu Attachment, 4 Stations (Çayyolu 1-2-3-4)

The construction of the M4 line (Ulus – Keçiören) has started on 15.07.2003. However, according the municipality's records, M4 line is not connecting to Ulus. The actual project is carried between Gazino Station (Keçiören) and Tandoğan Station (ANKARAY). Likewise, in the municipality's booklet, dated

[20] According to the contractors' booklet, the Söğütözü Station is defined as the station of AŞTİ Karakusunlar ANKARAY LRT. However there is no significant record about this line in municipalitys' sources.

6 -12 September 2006, the line is defined as Tandoğan – Keçiören Metro. This line is 10.5 kilometers in length and covers 8 stations (ASKİ, Dışkapı, Meteoroloji, Belediye, Mecidiye, Kuyubaşı, Dutluk, and Gazino) (EGO,1996).

4.7 Conclusion

The development of railway systems worldwide and their use in urban context is highly related. The main motive for this choice is the growth of population. By the technological achievements and increase in capacity, the developments of the systems follow a correct course from tramway to metro.

On the scale of Turkey, a delay in using urban rail can be followed. The processed began with the constitution horse and electrified tramway at the beginning of 20th century, however did not show improvement in conformity with the hierarchy of rail transit. So, for urban rail transit, the time between the first quarter and the last quarter of the century is the lost years for Turkey. Probably, the basic cause of this is the car ownership and dominancy. The complete list of the urban rail systems in Turkey can be found in Figure 4.16. The details are listed in Appendix C.

While the populations of Turkish cities were reaching the metro threshold bit by bit, one can note vivacity for the feasibility studies and planning in 1970s. Unfortunately, the constructions did not begin in the prescribed time, until 1990s.

Several reasons can be listed for this interruption. First, the municipalities were in short of finance budgets. So, many municipalities raised foreign loans with high interest to keep the business running. Many of the projects go at a crawl because of ill-structured financing. Many others faced increase in cost because of inflationist markets. To clear up the problems, today, build-operate-transfer models came up to solve the pending projects. Second, former transport plans consistently changed according to present-day political concerns. Besides the plans are revised during the constructions;

this gave occasions to breakdowns in continuity and increase in costs. Another reason is the technological dependence to the foreign countries. In Turkey, most of the metros are building by syndicate agreements. The shareholding of the businesses is on joint account of local builder and external installation and carriage firms. The monopoly in technological dependence continues. Local lack in soft metro technology besieges. The growth of the metro cannot catch the rapid increase in population. The need of new lines emerges as soon as the other came into service. In reality metro projects never stops because of city dynamics. However, local metros are not forerunner but the pursuer of urbanization.

4.8 The Metro Stations

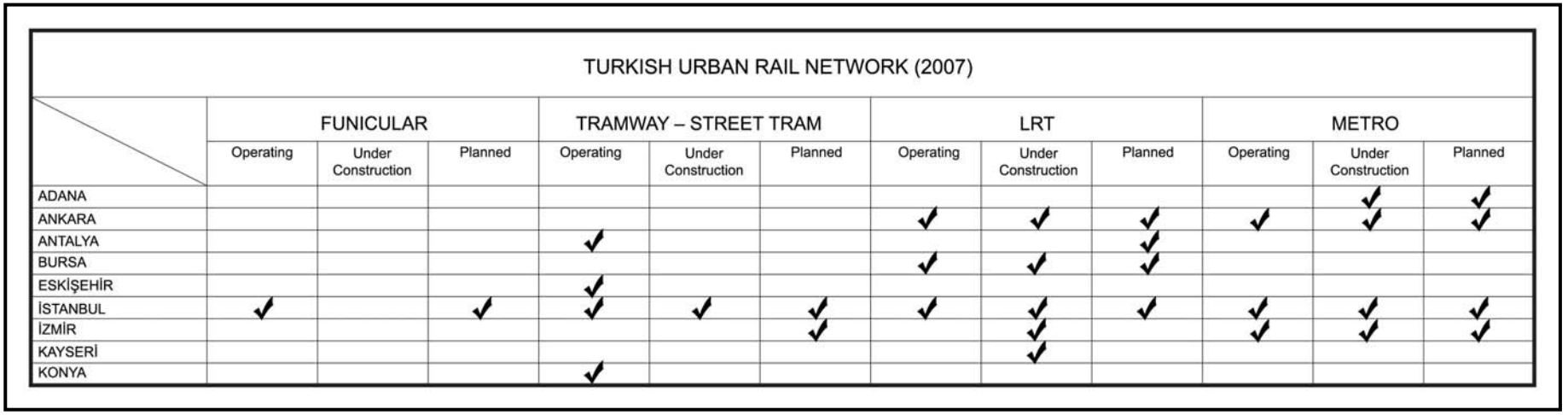
4.8.1 The Station

To understand the specific meaning of stations it is necessary to clarify some definitions. In common parlance, a station is:

Etymology: Middle English stacioun, from Anglo-French estation, statiun, from Latin station-, statio, from stare to stand -- more at STAND

1 a : the place or position in which something or someone stands or is assigned to stand or remain b : any of the places in a manufacturing operation at which one part of the work is done c : equipment used usually by one person for performing a particular job
2 : a stopping place: as a (1) : a regular stopping place in a transportation route <a bus station> (2) : the building connected with such a stopping place : DEPOT 2 b : one of the stations of the cross
(Merriam-Webster Online, 2006).

If we consider the second definition, stations are set of buildings where the passengers or goods board and move off the vehicle and places where necessary functions organised for transportation services.



TURKISH URBAN RAIL NETWORK (2007)

	FUNICULAR			TRAMWAY – STREET TRAM			LRT			METRO		
	Operating	Under Construction	Planned	Operating	Under Construction	Planned	Operating	Under Construction	Planned	Operating	Under Construction	Planned
ADANA											✓	✓
ANKARA							✓	✓	✓	✓	✓	✓
ANTALYA				✓					✓			
BURSA							✓	✓	✓			
ESKİŞEHİR				✓								
İSTANBUL	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
İZMİR						✓		✓		✓	✓	✓
KAYSERİ								✓				
KONYA				✓								

Figure 4.16: Turkish Urban Rail Network

In this way, stations are part and parcel of transportation. Each station is the subcomponent of any transportation system. In this network, each station covers several characteristics. First, as a geographical entity, a station has two basic, through partly contradictory, identities. It is a node: a point of access to trains and increasingly to other transportation networks. At the same time, it is place: a specific section of city with a concentration of infrastructure but also with a diversification collection of buildings and open spaces (Bertoni, Spit. 1998).

Nodes have two basic tasks in network. Before all else, nodes connect network units which intersect on it. Second, whether there is an intersection or not, nodes direct or indirectly associate them. Thus, if there is no limit, it is possible to enter or to reach any point of the network by nodes. Thus, nodes are premise ingredient to enter or leave the networks.

In transportation nodes can be note as junctions, stations or parking garages (Figure 4.17). These type systems provide inflow and outflow as well as commit orientation for the wished route.

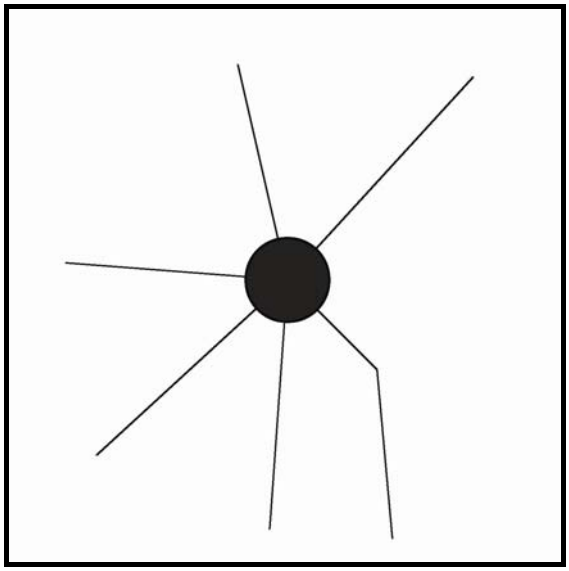


Figure 4.17. Station as a Node.

Each node is inevitably an attraction point of the system that it exists. Simultaneously it is with socio-economic structure of the place that it locates.

In this context, each node represents a physical space while contacting with spatial values as urban environment, people and activities. Because of this reason, stations as a node are a physical place, which interacts with their environments.

What is the level of interaction between a station and its surroundings? Firstly as a network part, each station is in the relation with other network parts in different form and level. Another interaction is the affect space. Every node has a specific affect space. This space of affect creates the place of the station.

A station's line - environment relation, on the other hand, is the result of that specific line's importance. A simple model can interpret the cause of unavoidable interaction intensity. Let us think of country, which has only one airport. Because of the lack of any airports, the environmental impact of the airport covers the whole country. To widen the example, let us think of a city with one train station. The environmental impact of this station will be the whole city, yet it servers as a unique station for railway alternative.

“Walkable radius” is the determining reason while considering a network with multiple stations (Figure 4.18). Bertoni and Spit explains this as follows: All the built and open spaces, together with the activities they host, contained with in the perimeter designed by a “walkable radius” centered on the station building, as amended to take account of case-specific physical – physiological, functional – historical and development features. The “walkable radius” is a relative idea. For different sources, it differs from 400 metres to one kilometre (Kusumo, 2005; Morris, 2006).

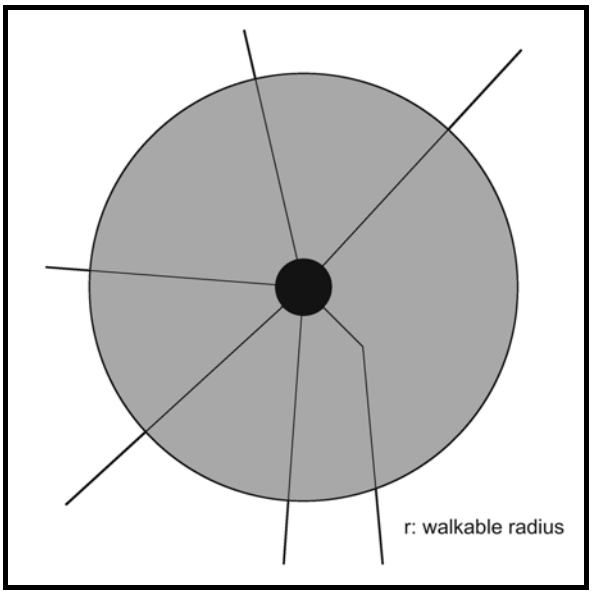


Figure 4.18: Station as a Place.

The walkable radius can be interpreted as a circle with a station at centre; however, this walk able radius can take different forms depending on the land use patterns of the location (Figure 4.19).

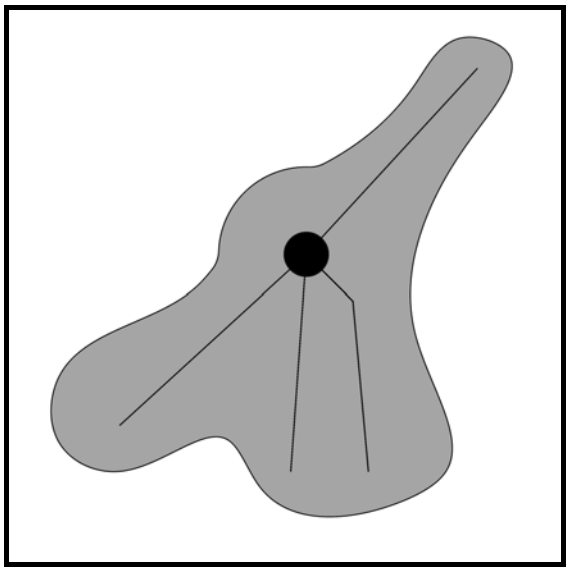


Figure 4.19: Distortion of Place According to Land Use Pattern.

As an example, a coordinated bus-ring that runs with the metro station or the intensity of the use of metro station can widens the efficiency of this radius. The new shaded area defines the actual place of the station (Figure 4.20).

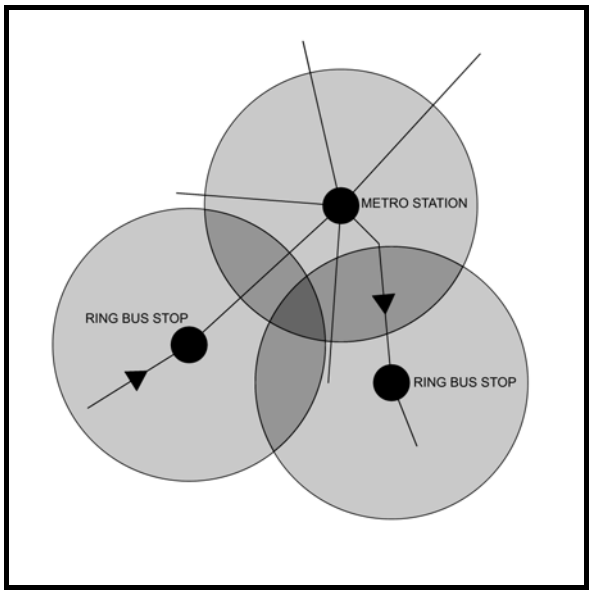


Figure 4.20: Active Place of Station by Interconnected Systems.

Different form transport based relations; metro stations also settle relations with their surroundings on identity. This identity relation converts two-dimensional transport-based relation to the third dimension (Figure 4.21). In such a case, the radius of walkable circle transforms to the radius of identity sphere. By the reason of underground character of the metro stations, shaded volume also conceptually covers underground. On this account, the design of metro stations steps in. The identity based relations between metro station and its surroundings are important. Thus, the design stations symbolizes the metro and identifies to whom it bears.

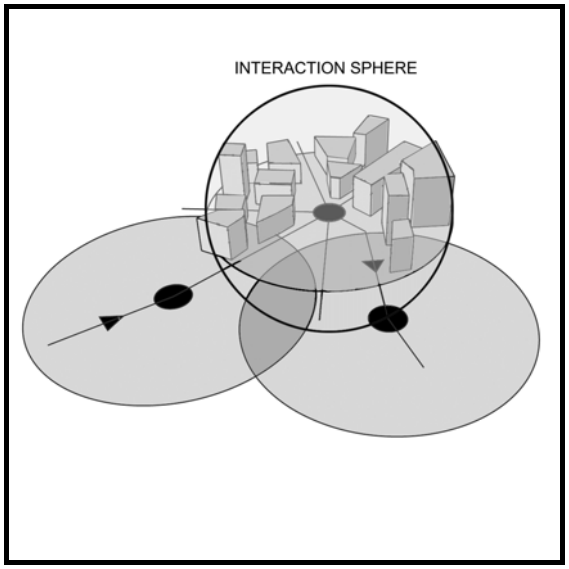


Figure 4.21: The Station and Interaction Sphere.

After mentioning a brief structure of the relation of stations with city and transport system, it is worthwhile to analyse metro stations. Therefore, metro stations offer significant differences from the conventional ones.

4.8.2 Metro Station

Metro stations are part and parcel of metro. They act as node and place and connect passengers to the metro. A metro station is composed of a corridor to serve vehicles to run and platforms for boarding and getting off. In is facilitated with horizontal and vertical circulation places. The metro station has ticket offices, information and sales kiosks as well as toilets for passenger based purposes. For the smoothest and safest service and economical use, metro stations has also technical operating installations such as power supplies, telecommunication systems, signaling equipments, emergency generators, waste water lifting devices.

Two causes effect the design of metro station: first, construction method, and second, the location of lines according to stations.

In metro station construction, local geological and topographic are the primary factors that have influence on the construction preferences. But first and foremost the budget is the determining cause. Nevertheless, the characteristics of above ground, underground water and the depth of the line are also plays and active role in preferences.

There are two basic excavation techniques used in metro construction. First technique is the cut and cover and the other is tunneling. In cut and cover techniques there are several methods are developed by the influence of recent technologies:

Open Cast Construction: This kind of construction is specially suited for stations just below the surface. The building pit is beveled of secured with shuttering, tongue and grove or bored pile walls. In places where the building

pit is below groundwater levels, secants piling of thin sealing walls are required. This construction method is the cheapest but requires large areas. In a simpler version, the structure is mostly built block by block to the form of a rectangular which is then backfilled and covered with the excavated soil.

The Bored Pile and Cover Slab Construction: Where there is not enough space for open-cast construction, e.g. in the sub grade of public traffic areas, and in places where the highest groundwater levels do not rise above the base of construction, the station is built by means of bored piles and pile-capping and floor slab. First, the construction pit is framed with bored piles, then they are connected with a pile cap beam, and the substratum serves as a floor to cast the concrete cover slab between the lateral bored file walls. This construction method offers two advantages: it generates column free spaces and the surface traffic is only interrupted for a short period. However, lateral bored piles cannot be entirely watertight.

The Bored Pile and Cover Slab Construction with Inner Shell: In this method, same technique in The Bored Pile and Cover Slab Construction is used. Thus, an inner concrete shell is constructed against underground water. In deep applications, the inner cell provides a guard against sheel lateral stratum and water pressure.

The Diaphragm Wall and Cover Slab Construction: In case of station structures to be built fully underground-water levels and with several stories, the construction by means of a diaphragm wall with cover slab has proved successful. The building pit is covered with two diaphragm walls in each side to remove leakage, which is a main problem in bored pile method. This construction method is suited to large structures at great depths- quick, economical technology.

In places where stations have to built at extremely deep levels because of line routing underneath existing buildings or due to special geological

conditions, it is necessary to build station by Mine Tunnelling Construction. In this method boring and concreting is applied at the same time. Driller head cuts a circular section and the excavated soil is carried out by a conveyor. Such a station consists of two tunnels with one platform and running track each. The method has high cost but does not disturbs surface activates. An average TBM (Tunnel Boring Machine) can excavate 20 meters per day depending on of the geology.

Another cause that affects the design of the stations is the location of lines. There can only be two forms: the line at the middle and the platforms at edges, or platform in the middle and the lines at the edges. The second solution creates more crowded and vivid platforms. However, at the peek hours middle platforms can create problems for the circulation. The first solution needs a mezzanine above the line to connect platforms. This mezzanine can cause the platforms remained low.

After these technical details, the major goal of the station is to provide the shortest and clearest possible way for the passengers that he or she can reach the platform, or the street level. On the other hand, each station should fulfil several needs if the human is the focus point. These needs can be classified as physiological, functional, psychological and safety.

4.8.3 Metro Station as an Underground Structure

For the most part, metro stations are located in the underground. As they are located in the underground, they cover several characteristics different from conventional above-ground structures.

According to Carmody when underground space is to be utilized for functions that human occupancy as transportation or office, initial reactions are often negative and a wide range of concerns and question raised (Carmody, and Sterling, 1993).

One cause of this case is the heritage descended from the past. Therefore, the first chapter of this study handled this in detailed manner. Depending to the religion context, the past image is mostly occurs because of sensing underground as a place of origin and place of final rest. (Lesser, 1987). It is such a strong conviction, still, in spite of the usually well-lighted and well-ventilated examples of modern subsurface environments; the idea of the underground seems to provoke some powerful images and associations from the past (Carmody and Sterling, 1993).

Recent studies showed that underground, independently from culture, affect people in the same way. Some case studies shows the anxiety, depression and hostility (Hollon et al. 1980, Muro et al. 1990, Su and Peng 1990), absenteesim (Holister, 1968) and claustrophobia, timelessness (Sommer, 1974) are reported by underground workers. Underground spaces share some basic characteristics with certain similar environments. This includes completely artificial environments like spaceships, capsules, submarines, and Arctic or Antarctic bases (Carmody and Sterling, 1993). Same, underground is the combinations of enclosure and verticality – a combination is not found either cities or spaceships – that gives the image of underground its unique power as a model of a technological environment (Williams, 1990).

To discover the imagery associated with the underground, Pike states the Western culture associates several ideas as illegality, conflict, secret and isolation with underground, which are not so familiar at surface (Pike, 2005). While he gives recent examples of cinema industry, he claims the Western city has long been associated with the underground in moral terms as the centre of iniquity and dissolution.

According to Pike, it all began with the nineteenth century. It was the time with the development of the nineteenth-century city; with it is complex drainage systems, underground railways, utility tunnels, and storage vaults, that the urban landscape superseded the countryside of caverns and mines

as the primary location of actual subterranean spaces (Pike, 2005). In that time by the help of metro, underground transformed to the abstract form of modernity.

According to Lefebvre the social relations of production have a social existence to the extend that they have spatial existence; they project themselves into a space, becoming inscribed there, and in the process producing the space itself (Lefebvre, 1974). Similarly, Edward Soja noted there is not spatialsocial reality (Soja, 1996).

While the nineteenth century was dominated by the representation of aboveground space as if it were subterranean, and the increasingly predominant experience of underground space in everyday life of the lower class and for raw materials; the twentieth century was characterized by the representation of subterranean space as above ground, and the increasingly predominance of underground space in the every day life of the middle classes and modern city life. However, underground is never got clear of its marginality during the past decades, and still known as a place of alternative cultures and illegality.

Considering early times of London and Paris metros, foregoing can be observed markedly. According the Pike, metro was still carrying traditional negative associations although it was a representation of modern metropolis and capitalism (Figure 4.22). It was not a new space; it was just representing the new vertical threshold (Pike, 2005). Metro was not a place for everyone because of its technology and zone of occupation by poverty (Blumenfeld, 1930). It was not genteel and it was threatening the glory of the cities (Pike, 2005).

Later, with the spread of metro to all over the world, it shifted form to represent modernity or an utopian dream to a necessary transportation mode for the cites because of the traffic problems.

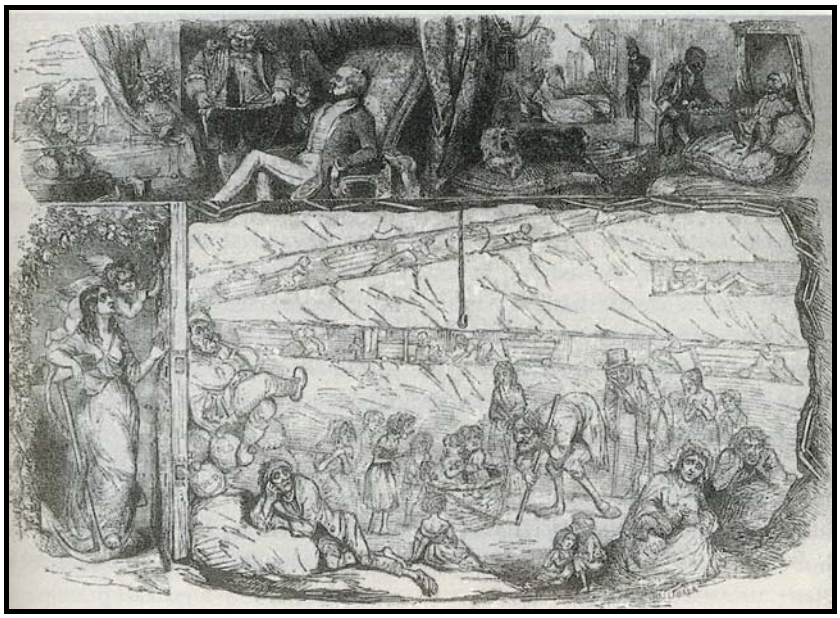


Figure 4.22: Verticalized Space: The Argument for Social Hierarchy Graphically Rendered. *Capital and Labour, Punch 5* (Source: Pike, 2005)

Today, as in the movie “Devil’s Advocate”, John Milton (Al Pacino), the Prince of Darkness himself, Satan, believes metro is "the only way to travel"[21] even if there are negative associations and crime (Figure 4.23).

Figure 4.23: Satan and His Apprentice on Rail.
(Source:http://movies.warnerbros.com/devils/main.html)

Drawing from the existing researches and as well as from the shared images and associations of the underground discussed earlier, it is possible to

[21] John Milton: Come on. I'll show you the fastest way uptown. Learn the subways, Kevin. Use them. Stay in the trenches. Only way I travel. Devil’s Advocate, Movie, 1997.

identify a set of potentially negative psychological and physiological effects. Carmody notes the physical concerns (sunlight, ventilation, and humidity) have a physiological part. According to Carmody, potential negative effects are all related one of three basic characteristics of underground buildings: Lack of visibility from outside, lack of windows and, being underground (Carmody, and Sterling, 1993).

Lack of visibility from the exterior causes the lack of a distinct image and the inability to find the entrance, while it contributes to a lack of spatial orientation inside the building since the overall arrangement cannot be easily understood. The absence of windows causes a sense of confinement, lack of stimulation and connection to the outdoors, and lack of sunlight. The windowless nature of the underground buildings also contributes to a lack of spatial orientation and … a fear of not being able to escape…Finally simply being underground elicits associations with darkness, coldness, dampness, poor air quality, lower status and fear of collapse and entrapment in a fire, flood and earthquake (Carmody, and Sterling, 1993).

Under the circumstances, to remove these associations, it is necessary to put forth an effort and careful attention for the design of underground. In fact, it needs a different view to the metro stations.

4.8.4 Designs for Human

In consideration of the part of urban transportation, before all else, metro is a public space. It is a consistent public space, perhaps the most consistent one. To give a case in point, Tokyo Metro carries 5.5 million people a day with its 14 line and 168 stations. Thus, stations of Tokyo, which has 12.500.000 populations in total, are visited in 5.5 million times.

The method of the approach of the Munich Municipality acquires a different character to the architecture of metro stations. For them metro is much more than any public transit. According to the municipality; metro station is a

lebensraum (living room) where hundreds of thousands of people spend some of their time every day – a true public space and much more important than a hotly debated, but rather deserted , public space (Ude,1997). Therefore, whether all financial and technical difficulties, the focus point of the metro architecture should be human. The passengers should not only reach his destination quickly, comfortably and safely, he or she should also experience a "positive feel" during his or her wait in metro stations. Thus, acting on behalf of the public welfare also presupposed a commitment to the aesthetic needs of the public.

Under these circumstances, metro architecture can be accumulated in three interrelated topic:

4.8.4.1 Functional Design

The basic of this design approach is to contribute the passengers with transport service in a fastest way. Functional metro station design is a way finding architecture problem. Some environments – hospitals, airports, institutional buildings, urban commercial complexes, underground transportation and parking facilities – are particularly well known for their way finding difficulties (Passini, 1984). Because of the complexity, these places give occasion to be lost. The state of being disoriented, of being confused about one's position in a surrounding space and the actions necessary to get out of it, is a deeply felt experience. Disorientation can provoke frustration and stress and may have disastrous consequences (Passini, 1984). Lynch notes that to get completely lost is a rare happening but:

"…Let the mishap of disorientation occur and the sense of anxiety and even terror that accompanies it reveals to us how closely it is linked to our sense of balance and well being. The very word –lost- in our language means much more than simple geographical uncertainty: it carries a tone of utter disaster. (Lynch, 1960)"

People are normally quite aware of their position in the surrounding space and in the larger environmental context (Passini, 1984), however if they lost in an underground space like metro, the stress level will increases because of the entrapment fear.

Spatial orientation and way finding include an ensemble of complex mental process. Yet it is a spatial problem solving. Academic interest on orientation and way finding has started at sixties. Boulding, for example, has summarized his view as: to understand what people do, one has to understand what people know or, more precisely, what they believe to know. In this context, the human images about the environment are subjective and abstract. Therefore, it is better to understand human behavior to understand the image of the environment (Boulding, 1956). According to the Lynch, particularly at the urban scale, the environmental image or cognitive map of human is highly linked with the design of the environment (Lynch, 1960). So, if this image is clear, human can function efficiently in the environment with a better way finding. However, clear image is highly dependent to the legible and imaginable environment.

Ideal environment gives occasion to functionality. Any space is legible and tangible within the bounds of its possibility. For every scale, this should be the major criteria. Besides, by taking design decisions, the planner or an architect determines consciously or unconsciously, the way finding problems future users will have to solve.

Any person, who tries to find his way in a space, collects information from two elements: environmental information that is represented by space support function like signs and maps that are located in the space. The architecture and the configuration of the space create way-finding problems but it also encloses information and clues for answers. For example, stairs and elevators define clues for vertical circulation. Because of spatial character, some spaces transfer qualified spatial knowledge than others. This transfer is called as “legibility factor”. However, the high-quality legibility does

not always guarantee imageability (Passini, 1984). According to Lynch; that quality in a physical object which gives it a high probability of evoking a strong image in any observer. Imageability constitutes the shape color or arrangement which facilitates the making of vividly identified powerfully structured highly useful mental images (Lynch 1960). In The Image of the City, on how people understand and way find in cities, Kevin Lynch introduces the concept of imageability (how easy it is for a dialogue between the person and the environment to build into a good mental image), and five basic elements of these images: paths, edges, districts, nodes and landmarks. These elements may be defined as follows (Figure 4.24):

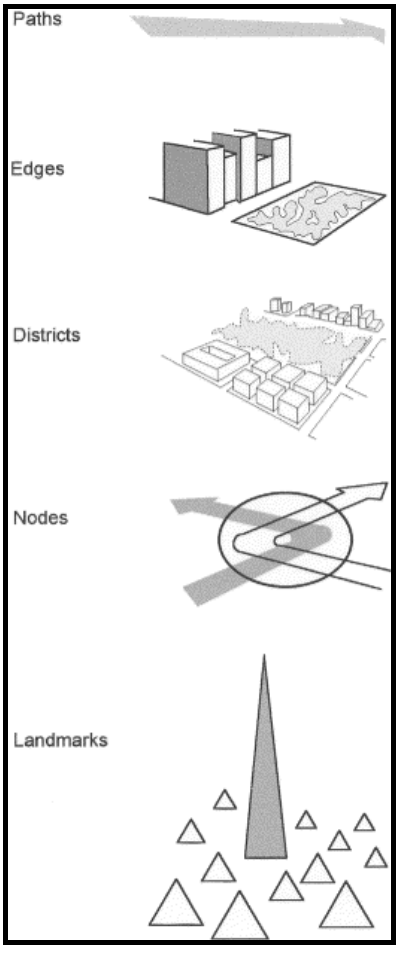


Figure 4.24: Lynch's (1960) Five Elements.

Paths are the channels along which the observer customarily, occasionally, or potentially moves. They may be streets, walkways, transit lines, canals, railroads. For many people, these are the predominant elements in their

image. People observer the city while moving through it, and along these paths the other environmental images are arranged and related. Edges are the linear elements not used or considered as paths by the observer. They are the boundaries between two phases, linear breaks in continuity: shores, railroad cuts, edges of development, walls. They are lateral references rather than coordinate axes. Such edges may be barriers, more or less penetrable, which close one region off from another; or they may be seams, lines along which two regions are related and joined together. These edge elements, although probably not as dominant as paths, are for many people important organizing features, particularly in the role of holding together generalized areas, as in the outline of a city by water or wall. Districts are the medium-to-large sections of the city, conceived of as having two-dimensional extent, which the observer mentally enters "inside of," and which are recognizable as having some common, identifying character. Always identifiable from the inside, they are also used for exterior reference if visible from the outside. Most people structure their city to some extent in this way, with individual differences as to whether paths or districts are the dominant elements. It seems to depend not only upon the individual but also upon the given city. Nodes are points, the strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is traveling. They may be primarily junctions, places of a break in transportation, a crossing or convergence of paths, moments of shift from one structure to another. Or the nodes may be simply concentrations, which gain their importance from being the condensation of some use or physical character, as a street-corner hangout or an enclosed square. Some of these concentration nodes are the focus and epitome of a district, over which their influence radiates and of which they stand out as a symbol. They may be called cores. Many nodes, of course, partake of the nature of both junctions and concentrations. The concept of node is related to the concept of path, since junctions are typically the convergence of paths, events on the journey. It is similarly related to the concept of district, since cores are typically the intensive foci of districts, their polarizing center. In any event, some nodal points are to be found in almost every image, and in certain cases they may be the dominant feature.

Landmarks are another type of point-reference, but in this case the observer does not enter within them, they are external. They are usually a rather simply defined physical object: building, sign, store, or mountain. Their use involves the singling out of one element from a host of possibilities. Some landmarks are distant ones, typically seen from many angles and distances, over the tops of smaller elements, and used as radial references.

They may be within the city or at such a distance that for all practical purposes they symbolize a constant direction. Such are isolated towers, golden domes, great hills. Even a mobile point, like the sun, whose motion is sufficiently slow and regular, may be employed. Other landmarks are primarily local, being visible only in restricted localities and from certain approaches. They are the innumerable signs, store fronts, trees, doorknobs, and other urban detail, which fill in the image of most observers. They are frequently used clues of identity and even of structure, and seem to be increasingly relied upon as a journey becomes more and more familiar (Lynch, 1960). In building scale, as an example, paths refer corridors, stairs, elevators where landmark refers special shops, sculptors, structural or decorative elements. Nodes can be referred as circulative intersection and halls and edges define walls. Districts are the floors that are appointed for different functions.

As Lynch, in his book Wayfinding in Architecture, Passini suggest that there are three important causes in enabling people create a mental image of places so they can orient themselves and find their ways in buildings. These are, understanding the internal organization of the building (spatial orientation), perceiving the external organization principle by the spatial enclosure or building volume (spatial enclosure) and understanding relationships among spaces (spatial correspondence). Passini has suggesting architects and planners to pay particular attention to the clear expression of the organizing factors if image formation and way finding is to be facilitated.

Information can be obtained from various way finding support systems as signs. Sings are communicative environmental information. Major difficulties in perceiving signs are because of a lack in design and placement consistency. Therefore they must be visually accessible, be sufficiently differentiated, be in consistent and predictable locations, be differentiated from other types of signs, be sufficiently large to be read from a distance, be visually structured in small packages and have consistent design features so they can be easily recognized (Passini, 1984).

For the metro stations, before all else, there should be a legible mass. This mass should portray itself as node and landmark and should give clues about its enclosure by means of spatial enclosure. In metro entrances, there should be a legible sign about metro and also name of the station should be clarified. The entrances should be inviting and accessible for the mobility-impaired.

To manage the spatial circulation, satisfactory waiting spaces should be created to eliminate the accumulation of passengers and the obstacles that block visibility must be avoided. Paths should be defined and should be supported by architectural landmarks. Order should be respected in corridors due to spatial orientation. For the legibility of the signs, correct placement, coding, sizing and lighting should be established. Because, all underground facilities should provide a clear, complete of signs and maps to aid in way finding and preserving spatial orientation (Carmody and Sterling 1983).

As another way finding support system, maps and directories should be placed, attainable enough, simple enough to be understood by everyone. Access control systems must effectively control the flow and be protected against vandalism. These systems should be capable to respond to the tariff changes.

4.8.4.2 Physiological, Psychological and Safety Design

These design criteria have a close-fit relation with each other. Each has a potential to trigger the other. For instance, psychologically abrasive spaces weaken safety feeling or low secured places can trigger negative associations.

There are difficulties in the design of underground spaces yet they are located in underground. For, they are almost invisible. Consequently, one should enter the space to perceive. Therefore, entrances play a significant role. Entrance gives people sense of arrival; it can set the mood of the building; it strengthens the represent a place of psychological and physical transition between the exterior and interior world (Bain, 1990).

Generally, a limited mass of the underground buildings is located at the surface. This mass assumes overall aesthetic responsibilities and visual connection between the exterior surface. This limited mass also decreases the distinctive potentials.

According to Lynch, image; is the production of both immediate sensation and of the memory of past experience and it is used to interpret information and guide action. In this situation, another problem comes out about the image of underground building in terms of its problematic past (Lynch,1960). Entrance design is important, because it is the unique visual for immediate sensation. Therefore, entrances, depending on spatial enclosure, will define the overall layout. In spatial correspondence, entries act an element to correspond to the surface environment above yet it is the only place for connection.

Carmody has summarized design objectives of exterior and entrance design in underground buildings as follows:

- When appropriate to the building function, create a distinct overall building image. Articulate building boundaries and exposed architectural elements to clarify the building's location and extent.

- Avoid permitting the building services (ventilator shafts, loading docks, fire escape doors) to create the dominant building image. Separate the pedestrian entrances, vehicular drop-off, and service entries as much as possible.

- Provide a clear, legible entrance (or entrances) that can be recognized from a distance along major paths of approach.

- Give the entrance a sense of place by creating variety and complexity in the entry approach that stimulates curiosity and heightens experience.

- When the underground facility is entered through adjacent above – or below – grade buildings, crate a distinct entrance or demarcation where people cross into the facility.
- Provide a graceful transition to lower levels.

- Make the entrance area and vertical circulation spacious and well lighted.

- Use the entrance to establish a visual connection between the exterior surface environment and the building interior.

- Provide a barrier – free entrances for mobility – impaired individuals. Make these entrances part of the main entry sequence, not a separate secondary path (Carmody and Sterling, 1993)

According to Passini, in the logic of way finding, human display two types of behaviors. In the first logic, they trust the signs and second humans are dependent on developing a spatial understanding of the settings. Carmody suggest the combination of the both for the maximum legibility.

In this context, many diverse design objectives can be developed based on the objectives of layout and spatial configuration (Carmody and Sterling, 1993)

- Create an interior layout that is easy to understand, thereby enhancing orientation as well as emergency egress.

- Arrange space to create a district image within the building to compensate for the lack of image outside.

- Develop a layout and spatial configuration that contributes to creating a stimulating, varied indoor environment to compensate for a lack of windows. Create stimulating environment from the point of view of people occupying the facility as well as people passing through.

- Provide visual connection between the interior and exterior environments whenever possible.

- Arrange spaces and buildings circulation to enhance a feeling of spaciousness through the facility by providing extended interior views as much as possible.

- Design each space to enhance a feeling of spaciousness by manipulating room size and shape.

- Arrange spaces to protect privacy as much as possible.

Enhancing spaciousness, however, has many aspects beyond simply making spaces larger and creating long interiors. Spaciousness is also mean to free the movement, eliminate monotony as well as facilitate “difference within sameness” (Olds, 1987). Thus in underground buildings colorful and warm spaciousness can be obtained by the use of lines, textures, patterns, natural

elements and materials, sculptures, manmade artifacts, warm uncluttered furnishings, mirrors, alcoves, paintings and photographs as well as with a good ventilation and signage system(Carmody and Sterling,1983).

Light is important in underground structure. Thus, these spaces have limited light possibilities. As the human needs a continuous natural light, (Wurtman, 1968; Spivack and Tamer 1981) this need should also be satisfied in the underground. In underground structures, there can be used two type of lighting: natural light by using windows, skylights and reflection and artificial lighting.

About underground lighting Carmody suggests as follows:

- Provide appropriate levels of illumination to enhance visual clarity and facilitate all activities. Spaces should be well lighted to offset associations with darkness underground.

- Provide natural light whenever possible.

- Design artificial lighting systems to simulate the characteristics of natural light.

- Use lighting to enhance feelings of spaciousness.

- Use lighting to create a stimulating, varied environment. Lighting patterns should define and reinforce social spaces (Carmody, and Sterling, 1993).

Life safety is an important design issue related to placing people in underground facilities. One reason is that most underground buildings present some constraints that require special design features to ensure basic safety in emergency (Degenkolb, 1981; Sterling et al. 1988, Wise and Wise 1984). The other reason can be connoted as the fear of entrapment and past dependent negative associations.

In underground facilities, the limited number of access points and lack of windows decreases evacuation possibilities in case of emergency. In case of intervention most of the movement occurs in down to top vertical direction different from conventional surface buildings. This requires considerably more exertion than downward travel, slowing exit speeds, and the direction of travel is into the rising smoke rather than away from it (Carmody and Sterling, 1993). Besides, it is difficult to draw mental map by spatial enclosure and orientation in panic cases. A weak probability of to be rescued is possible when the artificial ventilation and lighting remains out-of-service in emergency.

As a matter of fact, in 10 August 1903, after the explosion of a locomotive in Paris Metro (Couronnes disaster), 84 people died by the burned wooden wagons and poison gas. Only people who are familiar to the place are survived, others are found in masses at the counter direction (Figure 4.25).

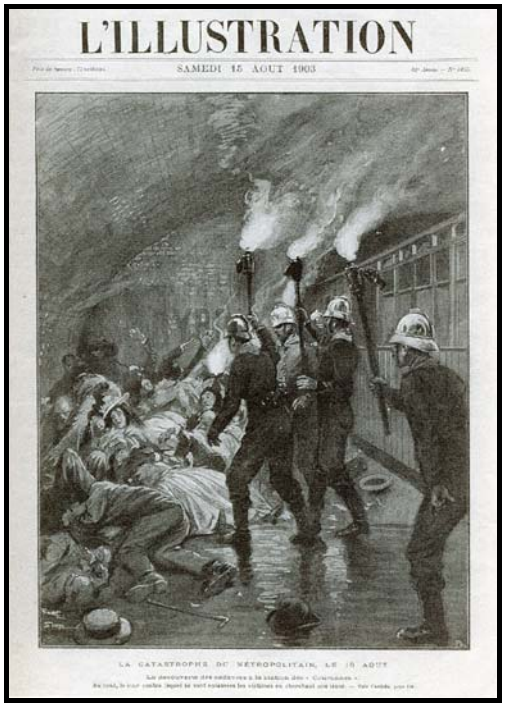


Figure 4.25: The Métropolitan Catastrophe. Caption to the Cover of L'Illustration 122, no.3155. (Source: Pike, 2005)

The fear of fire continued to loom large in iconography pf the Metro, although the since The Metropolitan Railway Company soon replaced the wooden wagons with steel (Pike, 2005) (Figure 4.26).

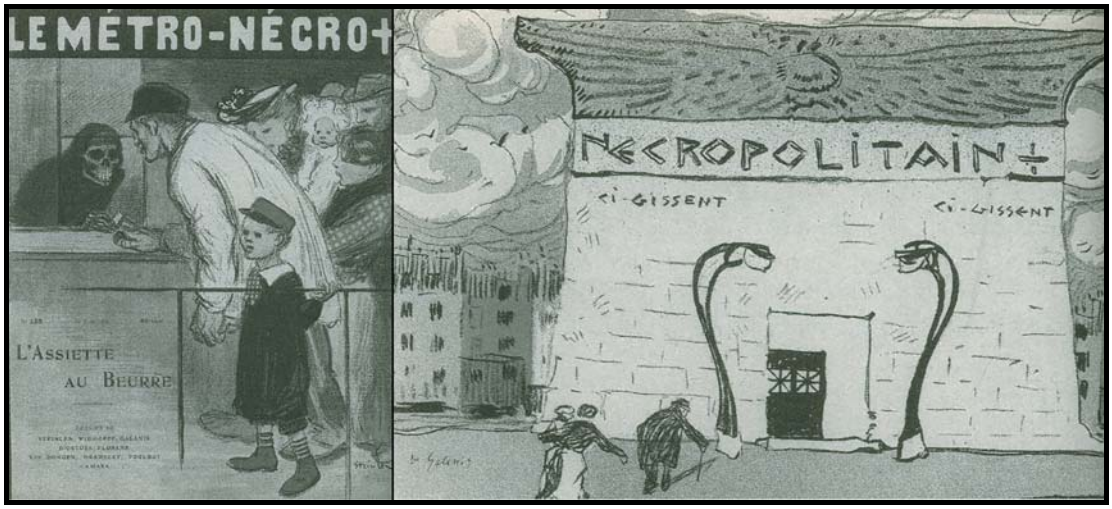


Figure 4.26: Le Métro-Nécro, L'Assiette Au Beurre 125 (Left), Nécropolitain L'Assiette Au Beurre 125 (right) (Source Pike, 2005).

However, in 4 March 1911, another accident happens and the passengers confined in the steel carriages and died (Figure 4.27).

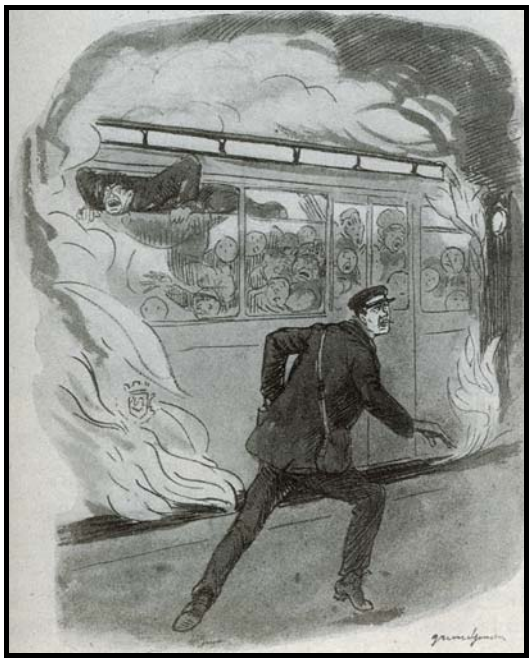


Figure 4.27: The Caption: "The Employee- Darn, I've lost the key for opening the tin." L'Assiette au beurre 518 (Source: Pike, 2005).

In 20 March 1995, an attack was directed against by sarin gas on several lines of the Tokyo Metro, killing twelve people and injuring nearly a thousand others. It was an act of domestic terrorism perpetrated by members of Aum Shinrikyo.

The attack came at the peak of the Monday morning rush hour on one of the world's busiest commuter transport systems. Recent surveys of the victims (in 1998 and 2001) show that many are still suffering from post-traumatic stress disorder. In one survey, twenty per cent of 837 respondents complained that they feel insecure whenever riding a train; while ten percent answered that, they try to avoid any gas-attack related news. Over sixty percent reported chronic eyestrain and said their vision has worsened.

The Daegu subway fire of February 18, 2003 killed at least 198 people and injured at least 147. An arsonist named Kim Dae-han set fire to a train stopped at the Jungangno station of the Daegu Metropolitan Subway in Daegu, South Korea. The fire then spread to a second train that had entered the station from the opposite direction.

The commonality in the four cases is the desperation of the victims that are entrapped in the tunnels or the carriages. The close structure of the underground facilities did not give a chance to passengers to escape.

However, at Channel Tunnel fire in 18 October 1996, the passengers and crew evacuated into the adjacent service tunnel without any casualties.

Carmody lists security measures as follows:

- Minimize hazardous, combustible materials or separate them from occupied area.

- Construct a fire resistant building.

- Construct an earthquake – resistant building where appropriate.

- Provide systems for early detection of emergencies and alarm systems with directive information for the occupants.

- Remove smoke from the area of the fire and suppress or extinguish the fire quickly as possible.

- provide for the efficient evacuation of people from areas of danger to places of safety (either within or outside facility.) (Carmody, and Sterling, 1993).

Taking the metro station as an underground facility, the physiological, psychological and safety based design criteria are inquired as follows:

Each metro train moves in a tube. As the train act like a piston, this movement creates airflow at the platforms due to the artificial ventilation and the piston effect of the trains. Nevertheless, this piston effect is not experienced in mezzanine. Rather, it is irrelevant to trust this airflow solely. Therefore, it is better to facilitate qualified ventilation especially in crowded places. As the metro stations located in underground, they are always exposed to humidity. To consider human breath, ventilation systems should be equipped with humidity control systems.

The structure and material used in stations can set up the sound. The noise that may be caused by trains, machinery and passengers should be avoided.

In stations, light has vital importance. The contrast between daylight and artificial light may disturb passengers while entering to the station. Thus, this transition should be smooth. For security purposes, dark corners should be eliminated, and urgent case light should be in operation in emergencies. It is highly recommended to use daylight in stations if it is possible (Carmody and Sterling, 1993)

Underground must facilitate spacious places depending on volume, layout and lighting. Entrances may provide clues on what may be inside. The corridors should not be boring and too long, on the contrary they should be short and well illuminated at itself and at its end. Blind spots and isolated places should be avoided. It is not adequate to design station as labyrinth; besides, they should enclose wide halls if possible. The space may shelter architectural patterns to provide against monotonous. To help mental mapping they should be equipped with maps and signage systems.

For the emergency state, to avoid aggregation of passengers', corridors, vertical circulation elements and footpaces should be widened. The used materials must be non-combustible or at least fire resistant, durable, robust and break-resistant, easy to clean, dismountable, replicable and safe. In the knowledge the metro train is moving mass; platforms should be wide enough to create safety margin.

4.8.4.3 Identity Design

Are the metro stations only consisting of solutions of technical problems? Can a station be claimed as an "accomplished" artifact whether it fulfilled the compulsory requirements? Despite the budgetary troubles, can any system grab at an opportunity to distinguish? The answers of these questions will shape the contents of the following discussion.

One basic aspect of architecture – which is one of the most essential means of human expression – is its visible form. Unlike music and the spoken word (i.e. the means by which we convey our feelings and thoughts), architecture cannot be experienced with out form, without haptic materiality (Hackelsberger, 1997). Form (Lat. forma), in general, refers to the external shape, appearance, configuration of an object. Thus, it comprehends much more then. Because, it is in this way that our world becomes familiar to us, through the areas we have designed and created ourselves, and proves to

be a part of how we express ourselves (Hackelsberger, 1997). How, then is architecture a language? Obviously, buildings do not name anything, they are not words and it is even doubtful whether they may be considered ‘signs.” Yet they speak. Over and over again those who have open to listen, have beheld the “sayings” of works of architecture (Schultz, 1985).

It is redundant to rehearse a comprehensive debate about architecture and its relation with form at this point but it is meaningful to understand the architecture and building as the result of poetic understanding of the world as Shultz notes. According to Shultz, only the vita poetica makes it possible for man to translate his practical and theoretical understanding to a concrete image, and to perceive its meanings. Public dwelling therefore, does not consist in social identification, but poetical relationship to the shared world (Shultz, 1985).

Therefore, as an architectural artifact, a metro station should serve society, as it express, identifies, orients and connects. The theory of identification suggests that identity consists rather in an interior organization of understood things, and that growing up therefore depends on being open to what surrounds us. We have to know where we are and how we are, to experience existence as meaningful. Orientation and identification are satisfied by organized space and built form, which together constitute the concrete place (Schultz, 1985). The structural features mentioned characterize our relationship to the urban environment, but at the same time they describe what it means to live in a city “milieu”; that is, they characterize humans as urban dwellers and urban identity (Haapala, 1998).

In this regard, it is inconsequent to assess metro just as a technical problem. Metro system is a fact:

- Which express itself as it expresses the city,
- Which has an identity as it contribute to collective identity of the city as it take,

- Which orients itself to the city as well as guiding city dweller and city,
- Which connects city dweller and city to itself as it connect city-to-city dweller and city dweller to city.

Thus, the metro station architecture is therefore at least as significant for our vital consciousness as many a surface building (Vogel, 1997). Architectural interventions must reflect new ideas of creating identity that represents the underground and the surrounding environment above-ground (Chin, 2003).

Hence the metro station can not be reduced to a facility to people to catch their train.

What is a station? Different from dictionary definition it is clear the function of the station as a distinctive building type is changing. The station in its own right, with retail, social and cultural facilities enclosed within its shell. Unlike an art gallery or shopping mall that people travel to, stations are places that people travel through. Movement of people, mainly in a hurry is characteristic to metro stations. For many city dwellers, back to work and school means taking the metro. However, how many of them have ever appreciated the aesthetics of the underground terrain as they go from here to there (Sell, 2004). The buildings of metro network, which hundreds of thousands of passengers see everyday – not always fully conscious what they see.

Thus, most metro systems are rather dull from an aesthetic point of view. On the other hand, there are which explicitly foster arts and good architecture or both in metros (Rohde.2007). This often means extra effort and higher costs for the metro operators but it seems to pay when a metro is more than just a means of transport but something the residents can be proud of. Surely, this is how contemporary art (and architecture) can really connect with society and brighten up a daily mundane trudge (Bennett, 2004).

The design of the metro stations can be handled in three ways. The first one is the design language of each station on the same line (1). Second is the

design of metro stations on different lines but at the same city (2). Last, the design totality of all metro stations accompanying with the city (3).

In what type totality the design of metro stations should express? Should the metro stations will look like in a same design approach? Alternatively, should the metro stations will look like in different design approach? If so, how will the metro system maintain a totality? These questions will be discussed in the following section.

There are two choices in design of station at the same line. They can be either designed alike or designed in different fashion. As herein defined, difference is not disparity caused by the construction methods or capacity. It is caused because of the variety in design style. These, in the strict sense, are minor differences as color, material or extreme differences to make each station unique.

Alike station designs on the same line result in monotonous travel. More importantly, inside the carriage, passenger does not notice in which station is he is. In such a case, only way that he can trust for orientation is the intercom paging in the carriage and the sign in the station. Distinguished stations help lost passengers to orient themselves. At this point, intercom paging and sign functions emerge as encouraging rather than major determining factor for orientation.

Some of the metro operatives try to distinguish their stations by difference in color and material used, where some of them try for radical distinction. For example, Stockholm Metro is one of radical one.

Stockholm's metro is the world's longest art exhibition, 110 kilometers long. Several of the stations (especially on the Blue line) are left with the bedrock exposed, crude and unfinished, or as part of the decorations (Figure 4.28).

Figure 4.28: Stockholm Metro; Blue Line. (Source: www.sl.se).

At the Rissne station, an informative wall fresque about the history of Earth's civilizations runs all along both sides of the platform. In some 90 of the 100 metro stations, travelers can enjoy exciting, beautiful and varying artistic experiences - sculptures, mosaics, paintings, installations, engravings and relief's (Figure 4.29). Around 140 artists have helped to create underground grottoes, verdant gardens, rippling springs, water lily ponds and fabulous caves, reflections on times of old and documentation of contemporary life. An additional few hundred artists have added temporary art features.

Fig. 4.29: Stockholm Metro; Platform of T-Centralen Station on the Blue Line (Source: http://mic-ro.com/metro/400/stockholm-centralen-400.jpg)

How did it happen? Swedish artists Siri Derkert and Vera Nilsson delivered many articulate and persuasive arguments to the railway board and local council during the time the metro was being planned. This resulted in two motions being submitted to the Stockholm City Council in 1955 for debate. One of them read:

Although it may not be possible to turn each underground station into a fairytale castle, artists, sculptors, potters, and craftsmen should, in association with architects and engineers, nevertheless be given the opportunity to create beautiful rooms and stimulating station environments throughout, and also mould one of the main stations into an underground cathedral with a fanfare of color and rhythm.

All political parties rallied supports the motion, and shortly afterwards, in March 1956, a competition to decorate T-Centralen, the main station, was announced. In the years that followed, a series of art works were implemented on the upper platforms and in the ticket halls of the station. The whole enterprise was a great success: art as an architectural concept became rooted in the Stockholm metro and continued to flourish in the rest of the stations as they were built, through T-Centralen still contains more works of art and sculpture than any other station an the network (Bennett, 2003).

Another example to create differentiation by artistic tastes is Brussels metro. Thirty years after the first underground line was put into service, the Brussels metro has become a living museum like Stockholm. The Brussels metro has a well-earned reputation for encouraging work on contemporary art in its stations (Figure 4.30).

Such is the importance of art in the metro that in 1990 the Minister of Public Works set up an independent art commission that is responsible for recommending and approving art to all the transit facilities and sites in the Greater Brussels area.

Figure 4.30: "De Odyssee" Sculpture by Martin Guyaux in Kruidtuin Station in Brussels (Source: http://www.stib.irisnet.be).

There certainly appears to have been greater freedom of expression for the artists' personalities and emotions in the artworks created before the new arts committee was set up (Bennett, 2003). The metro contains more than 60 works of art decorate its platforms and concourses where every genre is represented (Sell, 2004).

There is something common in each example. It is the power of art, which can connect with society, also enliven monotonous journey to, and form work everyday. A divergent approach to differentiate station on a same line is to design each line by different architects. One of the well-known examples is the Jubilee Line in London (Figure 4.31).

The Jubilee line is the Underground's newest line, but serves stations, which originally opened over 100 years ago. All have vast tracts of space and project architect Roland Paoletti CBE has employed world famous architects at the various stations resulting in a statement of importance not seen on the Underground since Charles Holden's designs of the 1930s (London City Council).

Thus, each station of the line would be designed as an individual entity, linked to the others by an underlying philosophy. Each station should be

unique and should contribute strongly to its neighborhood (Bennett, 2003) (Figure 4.31).

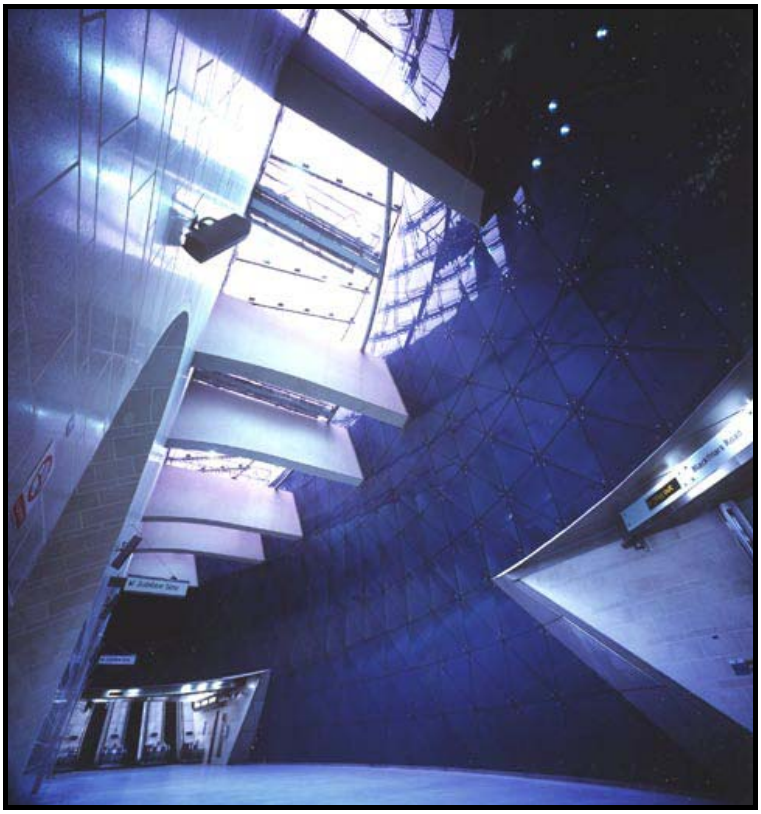


Figure 4.31: Southwark Station, Jubilee Line Extension, London (Source: http://www.mjparchitects.co.uk/index.php?show=southwarkstation&navid=b6d767&navrid=projects).

There is good precedent for involvement of independent architects in designing public transport facilities (Fuchigami, 2001). Thus, in Jubilee line, a different architect was chosen for each station. None of the architects was selected on reputation alone: like-minded architects were chosen, who, it was thought, would fulfill the brief well and who possessed the necessary understanding of the engineering requirements (Bennett, 2003).

The Jubilee Line Extension's extraordinary achievement has been to break with a tradition of design conformity, developed and consolidated for over a century, and creates something of exceptional quality from something as ordinary as the tail end of an existing tube line. What the extension managed to do was to allow heavy engineering, which is so often static and inhuman,

to become instead resourceful, brilliant, and active in response to architectural initiatives (Bennett, 2004). As a result, each station is a fusion of architecture and engineering, giving birth to an austere elegance, through which all the station share a common vocabulary of high technology and hard-edged functionality which reflects a previous tradition of English metro design by leading architects in 1930s (Fuchigami, 2001).

Differentiation of station design on a same line is important because of three reasons. First, the society can reflect its common cultural collection by using metro as a public place like Stockholm and Brussels in a controlled fashion. Throughout generations, it will be possible to examine the changes in expressive culture of the society. If not, the society will use different methods (tagging, graffiti, etc.) to communicate (Figure 4.32). Even though, graffiti is not a direct technical risk for public transportation, however, it creates image of that state loses the authority on it and opposition (Güneş, Yılmaz, 2006).

Figure 4.32: Inside of the New York Metro Train (Source: http://www.romanvirdi.com)

Therefore, in metro like public spaces, operators should provide clues about the culture of the society to passengers consciously. The aesthetic tastes of the society can be generated by the art pieces as well as by the architecture of the stations. According to Scrimer, the passenger should not only reach his destination quickly, comfortably and safety, he or she should also

experience a “positive feel” during his or her wait in metro stations. The use of artistic elements should help make a passenger’s wait more pleasant, something that cannot generally be said of subterranean, mostly artificially lit, spaces. This also suggests what a metro station should not be: provocative, aggressive, dreary or oppressive. The artistic design of metro stations should radiate a positive mood since passengers cannot decide on whether to meet any “art challenges” or not (Schirmer, 1993).

The second reason is to free passenger from a feeling of monotony and lack of orientation. Let us think of an underground metro travel between similar stations. Lacking visual reference to surface, a passenger can determine his location by three ways. Either by counting the stations by monitoring intercom paging or checking the station names. In such a case, the passenger can trust only to his attention and the sing systems for orientation. Differently, succesfully designed stations avoid monotony and facilitate orientation. The simple way to distinguish is to use various color-coding and texture. Therefore, their memory retention is weak in comparison with the extreme station differentiation.

Third point is the level of interaction between station and its surroundings. How a passenger can imagine the surface from the underground? At this point it is useful to reverse the Passini’s third logic; spatial enclosure. As a place, station has an identity interaction from bottom to up as well as up to bottom. How the surface land-use patterns are represented in the underground? It would be nicer if facilities that will be used by hundreds and thousands to millions of people each day could have been designed in more memorable way with cleaner individual touches and that the site that it is located (Fuchigami, 2001). This effort would also serve as a resource for the cultural richness at the surface. The dominant construction culture of the surface should also be coherently represented in underground. The purpose is not to represent negativities at surface, but to advance in positive fashion. For example, the aim is not to make a concession from glory and quality of metro in the route from centre to the suburbs.

Unfortunately, some metro systems are still monotonous. The reasons can be explained as follows:

- Quite often, stations are perceived only as physical structures joining passengers to metro. Many operators treat stations cursorily and see it is a technical problem. So for a long-time, there still exists a gap between architecture and civil engineering in station design (Fuchigami, 2001).

- For the sake of to create an “running” system, design related budget items are reduced to avoid deficit in the limited budgets. Most of the municipalities are motivated to accomplish the projects in budgetary target. Designs of the station are seen as secondary question.

- Most of the project proposals are focused on functionality and feasibility studies on the route. In planning schemes, project schedules are focused achievement of an “running” system and the debates on station design is avoided without further loss of time.

- There is a lack of vision to see the potential and power of stations as a public place.

Certainly, there are metro systems planned and designed concurrently with functionality and aesthetics. Munich U-Bahn will be a good example. When taking a ride on a Munich metro train the attentive passenger will notice that the station were simply bent on the functionality of spatial structures for handling passenger flow or on a durability of materials, but rather contemporary appearance and the architectural gestalt of public spaces. The metro design made rather a grouping beginning: would it be best model it on the architecture of the city’s mostly classical, historic buildings (being re-built after the destruction of the war) and revive the historicism of the late nineteenth century? But no, this contradicted the spirit of the times and would have blocked the opportunity of expressing both the vital consciousness of the post-war era and changing tastes (Ude, 1997).

Is it possible to have different design styles in different lines in the same city? It is answer is definitely yes. Especially, it is unavoidable if the city has been hosting the metro for a long-time. In time with the changes in the construction techniques; architectural styles, budget and metro architecture perspective will change. In Munich the change of style through eighties and early nineties is unmistakable: away from a certain monotony of the early years to well-conceived spaces with daylight openings, good forms, curved lines, vivid and light color schemes, color contrasts and wealth of decorative elements, inlaid floors, panels worked in enamel, mosaics, Works in multi-colored glass, artistically “alienated” photographs. To take in the wealth of impressions and forms in many stations provides real visual pleasure (Ude, 1997).

Some may see the architecture of the 1970’s U-Bahn stations as restrained, sober, and functional – characteristics of the Bauhaus movement (Bennett, 2003). Stations built in the 1980s and early 1990s are more eclectic, with curved lines, colored cladding panels to ensure dirt-free surfaces, dramatic lighting effects, and the use of enameled and multi-colored glass (Bennett, 2003) (Figure 4.33).

Another example for the line based differentiation is can be examined in Taipei. The main design characteristic of the system is based on function. The architectural theory "Forms follow function" explains the design of metro stations. Therefore, "function" is the first priority of station design. In this way, the design concept of transportation architecture differs from the design considerations of other public buildings. However, architectural styles vary on each line. On the first two metro lines starting revenue service, namely, the Muzha Line and part of the Danshui Line, the stations are elevated. Each line was given a specific theme, leading to unique identities in architectural design. The "high-tech" style of the Muzha Line and the variations on traditional Chinese architecture on the Danshui Line have made their stations landmarks in their respective environments.

Figure 4.33: Dülferstraße, U-Bahn, Munich (Source: www.mic-ro.com/metro).

Running for 22.8 km from the suburban Danshui station to Taipei Main Station, the Danshui Line is noted for its unique architectural characteristics. In the suburban part of the Danshui Line, station design has many special features, not only reflecting the heritage of local architectural, but in some ways imitating the architectural elements adopted by Chinese ancestors. An example is Jiantan Station, where the entire station structure was erected on two huge concrete columns and suspended, forming an overall image of the "dragon-boat", an important feature of Chinese culture (Figure 4.34).

Danshui Station, located in the heart of Danshui Township, based the design for its key stoned arches and brick walls from the local colonial-era building known as "Fort San Domingo". In Muzha Line, glass and steel create a high-tech appearance. The Muzha Line is the first and the only MCT line in the Taipei area. Since all the stations are elevated and most of them are located above streets, station design was strictly limited by clearances and related buildings codes. The minimal use of decorations, along with the glass and

steel, create the look and feel of modern-style architecture, and the stations' structure does not conflict with nearby buildings.

Figure 4.34: Jiantan Station Taipei. (Source: TGC).

In Zhonge Line, the design of this line does not try to create a new architectural style, instead aiming at an economical way of generating the renewal in its surroundings. In the construction of this line, join adventures with surrounding buildings were actively promoted. As for aboveground facilities, the principle is to avoid heavy impact on the urban landscape. With no special landscaping or distinguishing outside features, the interior became the key point in station design. Therefore, the main design goals on this Nangang Line are not to establish one architecture style but to integrate into the environmental context, redefine the existing commercial spaces and activities by means of new transportation facilities, and to create a new commercial area along the underground streets connecting metro stations. The underground streets link activities that are separated by roads at ground level. Because land is expensive and sites for equipment hard to acquire, vent shafts ground level entrances are reduced in size and designed in a simple style in order to avoid a heavy impact on the urban landscape. Some

vent shafts are even designed as public art to create new landmarks in urban spaces. Stations design in Xindian Line was not regulated by a monotonous style but coherence with the surroundings and specific characteristics for each station were emphasized. For example, the design elements of wall finishing, grille windows and the glaze-tiled roof of the CKS Memorial Hall Station are clearly visible both inside and outside the CKS Memorial Hall. The entrances to Jingmei Station are a simplified arcade while Gongguan Station uses roofs and octagonal windows, which often appear, in Chinese gardens. Guting Station, with its metal arches and glass, has light and transparent entrances that integrate with the modern steel and glass buildings nearby. The unique feature of this line is not the stations themselves but their integration with the architectural environment. The scope and local characteristics of the Luzhou Line are easily defined. The name "Luzhou" in Chinese means the "land of egrets" or the "land of reeds", both of which were formerly a feature of the scenery of the area. Therefore, the common design theme of the five underground stations is the egret. These birds are depicted in various way, such as gliding with the winds, playing in the water and flying over treetops, and have been adopted to form a series sub-title related to egrets, such as "Wind", "Water", "Reeds", "Sand" and "Fields". These sub-themes are presented in concrete or abstract form in the entrances and interior finishing's to create the architectural character of this line (TCG, 2007).

However, in some metro systems there is limited differentiation between the line themes. Ankara Metro, for example, has limited architectural variations. In Ankara, metro stations were built or still building with a view of usefulness. Most of the stations are themed with colored tile combinations as well as with a colored border including tiles bearing each station name. These fulfill the aesthetic needs while simultaneously distinguishing one station from another. Everything is executed in the hardest glazed ceramics.

In Ankara, there is one metro line in operation and three under construction. Despite the ten years of contraction break, new lines still carry the same

architectural taste as in the first M1 line. There is no noteworthy differentiation between stations and lines. Lack in art objects, the architecture of stations reflects the task of civil engineering. In this regard to rigid technical standards and budgets which, on the other hand, fix price parameters and, on the other provide a large measure of design scope within these limits. Two stations, Kızılay (M1) and Köy Kizmetleri (M2) will match to debate that mentioned above. Kızılay Station the biggest station in the system serves M1, M2 and M3 lines directly and M4 indirectly with the transfer station located in Tandoğan. The station is also a transfer station of ANKARAY LRT. The station has composed three levels: Mezzaanine, platform floor (ANKARAY) and platform floor (Metro). The station is highly dominated under the influence of blue mosaics and with its saturated tones (Figure 4.35). The technical operated installations are integrated to the systems as well as with stairways, escalators and information and ticket desks at the ticket barrier level. Although, the station encloses several blazonry commercial shops (low-grade custom manufacturing, spot market and gift shops etc.), a small mosque and box offices of municipality services as gas, disposal tax and so on. The station is decorated with wide-screen monitors which serve for commercial advertisement loops and short films on new municipal services.

No Brussels or Stockholm type of artworks can be recognized. The centrality of the station can only be read off from its size, not with it is indistinctive architecture or its interaction with above-ground.

The Köy Hizmetleri Station still under construction and display similar characteristics. This station is located at M2 line and it is close to the Köy Hizmetleri Genel Müdürlüğü (General Directorate of Rural Services). In accordance to the emblem of the General Directorate, the station is decorated with the combinations of orange, green and light brown color. The station is also decorated with abstracts “gleanings” with the expectation of passengers to construct a rationale to help their orientations (Figure 4.36).

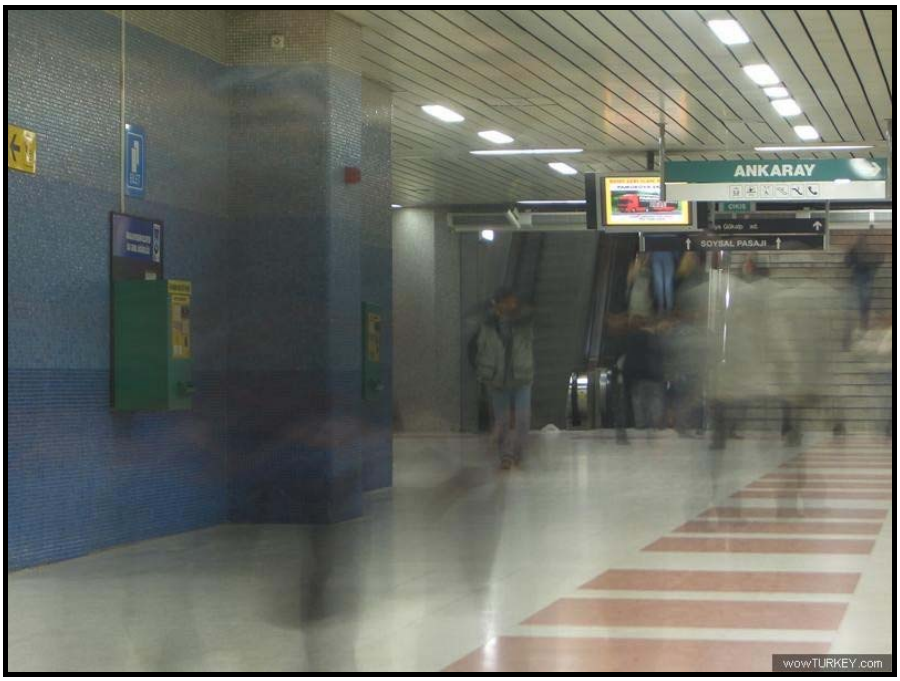


Figure 4.35: Kızılay Station, Ankara Metro (Source: www.wowturkey.com).

According to Hackelsberger, this type of architecture reflects the taste of nineteenth century metro architecture, which would be monotonous to continue along the lines of established standard model.

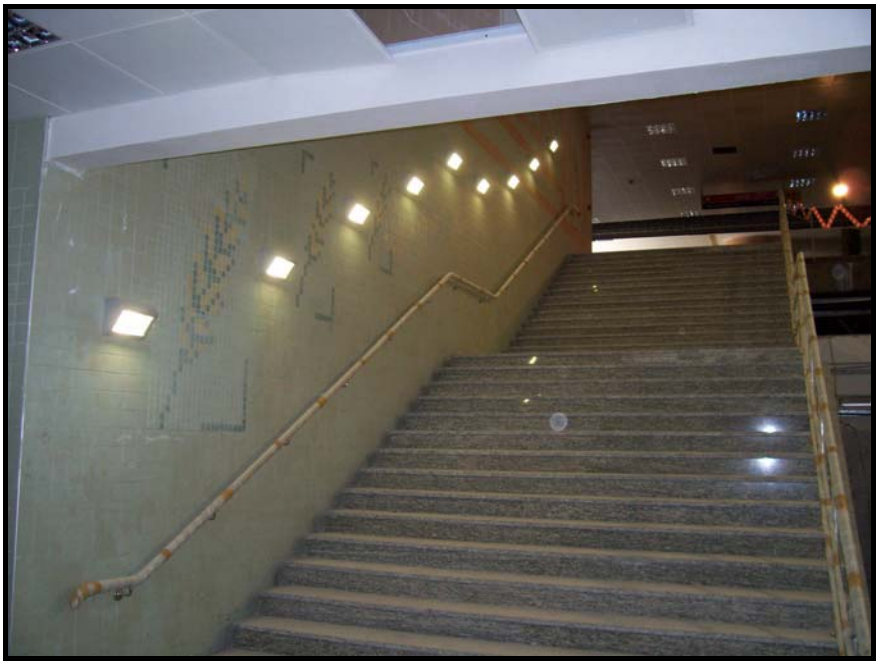


Figure 4.36: Köy Hizmetleri Durağı and Gleaning Abstractions, 2006.

Even though the dull example mentioned above, there are spectacular examples of metro stations found in world cities. Moscow metro deserves this appellation. That is 70 years of people learning from its walls while waiting for friends and lovers; 70 years of vapor exhaled by millions of daily passengers; 70 years of *slyakot* (dirty slush) brought in on Muscovites' muddy winter boots; 70 years of washing and scrubbing that still makes Moscow's one of the spectacular undergrounds in the world (Scheib, 2005) (Figure 4.37).

The Moscow metro was designed at the beginning of the Stalin regime and the construction work started in 1932 with the east-west line between Sokolniki and Gorky Park. The metro opened in 1935. The present network of three through routes and a circle line linking them together was completed in the1960s.

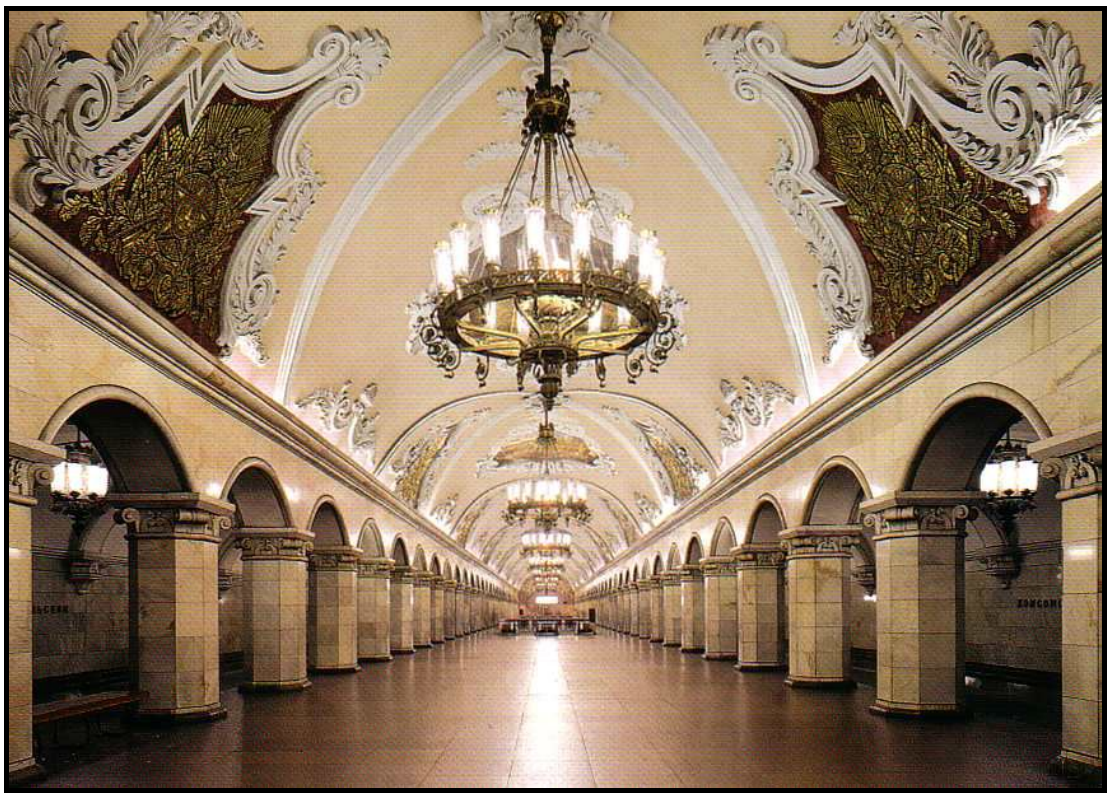


Figure 4.37: "Ballroom Interior" of Komsomolskaya Station, Moscow (Source: http://www.cla.purdue.edu).

Today, the Moscow metro hast the fourth largest networks in the world and carries more passengers per year than any other (Bennett, 2003).

What is important to give Moscow metro, as an example in this section, is not only its spectacular impression but also the ideology behind its design. According to Basili, every plant, in Russia, had to be “bigger than the greatest in the world,” regardless of whether or not such massive project made any economic sense, as metro had to. But of course, the metro was to serve purposes far greater than just transportation; bomb shelters in the event of war and a wonder of socialist regime. But, more importantly, the metro would also be a show piece of what *homo sovietcus* could accomplish (Scheib, 2005).

Its designers intended to impress citizens and visitors to the capital of the world’s only socialist state with the remarkable architectural quality: a repository for acres of granite and mahogany, porphyry and semi-precious stones like onyx and 23 varieties of marble.

The design motto was simple: to create “palaces for the public” and should be built purely local artistic taste. For this sublime mission the metro was built in a very Russian way: under coercion. Yet the metro was a product of a Soviet industrialization, as period as famous for the grandeur of its projects, as it was infamous for its leaders’ cavalier attitudes toward both resources and human lives (Scheib, 2005). As Nikita Khrushchev, who was assigned from Stain for construction, notes: We thought of a subway as something almost super natural. I think it’s probably easier to contemplate space flights today than it was for us to complete the construction of Moscow Metro in the early 1930s.

In any case, on May 1935 the metro was opened with a holiday that commemorate the opening of it is to the public. According to Bennett, it is still one of the finniest collections of underground stations ever built without question.

As it is understood, metro acquires a different character upward of functionality. As it is mentioned at foregoing sections, it is a public sphere.

Therefore, operators should become conscious that the metro is something which is designed by humans to serve public. If the method of approach remodels technical problem to human based problem, then, people in charge will become aware of that the metro is something different from a system that just transports people one place to another.

Certainly, it is impossible to omit functionality if the human is art and part of the system. Therefore, the passenger should not only reach his destination quickly and safe, he should also experience comfort and pleasure during his travel. At this point, physiological, psychological and aesthetics criteria steps in as well as functional criteria. If this travel is accomplished in underground, the mentioned criteria become more important. Another important point is the interaction of metro station with its surroundings. What is the thing that determines the state of metro being the property of the city that it is built in? To what extent does the architecture of metro stations is influenced from its surroundings and the culture of society that is serves? This can be determined by identity. This identity is expressed by the metro architecture. In this subject there are several positive efforts. Some metro systems are successful in represent in the city-metro-identity trio, some are not. Budget a major cause in the success of representing city-metro-identity trio. However it is not enough the single rationale. Desire and consciousness are other factors. These should exists in planning. Yet, the transformation of the underground utilities at afterwards is expensive and difficult at operating systems.

None of the metro projects are totally accomplished. As the city develops they will spread. This gives opportunity to reproduce and support the underground culture in new lines. Also, a metro which does not reflects the soul of the city is not accomplished. In this regard, like surface public spaces, the potentials of underground should be used in a conscious manner.

The following section of the study will focus Ankara Metro and ANKARAY to cross-examine city-metro and identity trio. In this context, the metro passengers are interwieved about their travel choices and their opinions about underground public transit in Ankara. The gained opinions will be discussed with their likenesses and differences in a conceptual space.

CHAPTER 5

THE METHOD

5.1 Indeterminism in Social Sciences

As people, develop ways of dealing with practical tasks and problems in their worlds scientific thinking is changing continiously. Some approaches work, others fail. Some problems keep steady, but the ways of dealing changes by new knowledge mostly new ways of thinking. On this account, there is a perception among a growing number of practitioners and academics that we have unnecessarily prolonged the lives of many social science research methods that long ago lost their usefulness to society and an ability to explain and predict (Overman, 1996).

The scientific logic and method to social theory and practice changed in the last century and was effected by the scientific development in natural sciences. James Gleick notes that " . . . twentieth century science will be remembered for just three things: relativity, quantum mechanics, and chaos" (Gleick, 1987). These scientific developments points out the incapability in measurement and conceptualization.

As Heisenberg introduced his uncertainty principle with his famous quote "…the more precisely the position is determined, the less precisely the momentum is known", these uncertainties or imprecisions in the measurements were not the fault of the experimenter of the devices, said Heisenberg, they were inherent in nature of quantum mechanics. This reality triggered attention to complex and dynamic systems and created many models as chaos, self-organizing systems, fractals, fuzzy logic and so on. The theories of chaos and quantum theory offer valuable metaphors and

methods that can challenge the social research agenda into the next century. These methods of approach have a basis in fact indeterminism in natural sciences, which is a philosophical belief contradictory to determinism: that there are events, which do not correspond with determinism. An alternative formulation is that some event could, or might, have been different even if everything in the universe up to the time of its occurrence had been the same.

Now, some questions appear: Are traditional social science methods incapable of dealing with the complex and indeterminant problems? Does indetermination in measurement limit the effectiveness of the social theories?

Social systems are complex and dynamic. On this account, social science theories, whether by everyday people or scholars, are rarely accepted or dismissed because of the data. As Kenneth Gergen has shown, the major theories that have shaped everyday thinking and definition of social science problems have had little direct emprical data support. Rather they offered compelling conceptions of core life issues challenging both existing assumptions and the supporting dominant values (Gergen, 1994). Definitely, because of the dynamic and complex nature, all studies should renew own data to meet their critic goals and needs. Because, one of the main problems in the behaviours of the living organisms is that they cannot demote to qualitative values, as they are complex and dynamic. Therefore, qualitative analysis is limited. We can have an opinion if the observation contributes with emprical evidence.

Research designs in social research can be divided into two types: quantitative and qualitative. Quantitative research usually involve large amounts of numerical data that will be interpreted through statistical analysis. Qualitative research designs are more Gestalt-oriented, that is, they are designed to help the researcher develop an overall understanding and a wholistic view of the phenomena at hand.

Up to now, human and his/her interaction to a specific physical environment developed on several positions by fictional structure of the study. However, occasionally literature review is limited to explanation. On this account, the findings from literature review should be tested by creating its own data. To create own data, the study will focus on human as the source.

This study concentrates human and his interaction with his artifacts. On this account, this study will probably face with the several limits of the social research. Method of the study shelters diverse components concerning tthe human. Quite often, issues related to describe, explore and understand human nature are weak in persuasiveness because of polyphony in social research. There are still elements of uncertainty between major social research-related concepts, depending on their relevance to the performance of sociological investigations. Each social research method employed by advantages and disadvantages.

5.2 The Human Artifact Relationship

In this study, the research approach will be to try to understand the complex casual process of the interactions between the social and built environment through a relational perspective. However, the capacity to explore this complex interaction in a quantitative way is limited because of dealing with a large number of measurements and specific problems of social research as a non-linear world. Certainly, the research will be faced with deficiencies in measurement as a matter of both scale and dynamism caused by the complex structure of the society.

Social research is involved in the interaction between ideas and evidence. Ideas help social researchers make sense of evidence, and researchers use evidence to extend, revise and test ideas. The performance factor of the study will be measured as to whether it can describe lrelationships between variables.

Human always interacted with their environment whether it is natural or built. Nevertheless, most of the discussion focuses on built than natural environment. Quite often, natural environment is accepted as neutral, yet it is a faulty statement. Because, yet the built environment positioned whether on or inside natural, it is inevitably influenced by it.

The interplay between humans and their surroundings (built or natural) is sphere of interest of the field of environmental psychology (EP). The field is within psychology, but is interdisciplinary (Canter, Craik. 1981). EP is oriented towards influencing the work of design professionals (architects, interior designers, urban planners, etc.) and thereby improving the human environment. The field is growing by number of papers and books over years but still rests on underlying assumptions about human perception, which is not fully understood.

It is common in EP that the humans interact with an environment whether it is physical or socio-physical. Indeed, every artifact around human embodies and conveys information to trigger for human to perceive, store and remember for further processes. However, to measure user's perception of an artifact is always difficult because of subjective functions and criteria are often neither named nor objectively assessed. Some elements, including those that compose the face of city or its utilities, are quantitatively and qualitatively more informative than others and are therefore more legible and better perceived and remembered (Haken, Protugali. 2003).

This interaction between human and environment is by in stages upward from primitive sensation to higher levels of processing, in accordance with the traditional simple to complex hierarchy of sensation, perception and cognition (Bloomer 1989). This is based on a chain (network) of information processing: bottom up processes transmit information into higher areas of the human nervous system. This staging process is not fragmented by distinct levels, but in continuum. In the sensation level, the sensory organs code the collection of low-level information in an automatic and unaware manner. In

perception usually cortex of the human brain processes high level of information to create conscious sensory experience. In cognition, human, acquires, handles, stores and uses knowledge.

The earth is increasingly a product of human engineering. Until very recently, however, this engineering process has occurred without conscious recognition; it consists of the sum of human activities, grown to scales unprecedented in the history of the globe. As every human artifact occurred on the globe, the city is an artifact of the social process, which is collectively idealized and built. This production is not limited only by physical change but also social interactions. For example, Simmel understood the city as an artifact that was marked by the continual experience of fragmentation and change. The term “artifact” used here covers two meanings. First, one is something created by humans usually for a practical purpose and the other something characteristic of or resulting from a particular human institution, period, trend, or individual. The cities as themselves harmonized with these two definitions: Humans create them for a purpose in time. They serve for humans for their practical purposes. As human needs are infinite, they are transformed in to complex systems for the satisfaction purposes. Complex systems have emergent properties – they have properties that cannot be explained by the properties of their components. These systems are to be understood not the terms of their parts, the analytical error, not in terms of their wholes, the reverse holistic error, but in terms of parts, interaction among parts, the whole, and the interaction of the whole with the parts (Byrne, 2003). The word interaction is vitally important. By tracing interaction, we can plot the system change the whole towards its parts.

City is the collection of artifacts created for several purposes. The study accepts metro as an artifact, a human-made object like cities, in advance. It is embedded in city while creating a collective whole with it. A man-made object can give information about the culture of its creator and users and where it is located. Also artefacts serve as a communication medium between its creator and user.

If there is an interaction between human and an artifact, somehow, then the study should determine the impression that is yielded. In this framework, the effort of the study will be to set up a medium where human and artifact meets. On this account, the study needs a favorable medium to establish the perception between human and artifact. This medium will be the verbal communication itself. However, for the sake of coherence, the structure of the verbal communication should be in structured means. The best way to conduct this type of research, first the observer should interact with the samples face-to-face, second the survey should be structured interview to measure the perceptual level towards the perception of metro.

Individual spatial experiences are expressed in words. These experiences are communicated to others, and the semantic notions of a spatial environment are collectively constructed in language as well. Language organizes much of our experiences, both the concrete and abstract encounters with the physical world and our responses to them. Human spatial behavior and experience cannot be investigated independently from the shape and configuration of environments. However, in verbal accounts of how individuals relate to their own spatial environments, the recognition of an artifact's meaning is as important as its usability is in ergonomic terms, its mechanical functionality in engineering terms, its form in spatial terms or its utility in economic terms.

5.3 The Research Structure

The research method is organized around a questionnaire (see Appendix D). The interview aims to measure the perception of symbolic qualities of man-made utility in the context of its use: Metro. In this context, the study proposes a method, which combines methods and techniques derived both from environmental psychology and from statistics. From environmental psychology, the study keeps the fact that users' perceptions are expressed in advance with concrete and abstract meanings. From statistics, the study

uses techniques, which allow researcher to comprehend user's perceptions and to grasp user's feeling and assessments. The method, first, attempts to find relevant criteria to characterize and express perceptual meanings. So, several semantic helpers introduced as Word Net.

The data derived from structured interviews is processed in two ways. First the data is examined by chi square analysis to form a hypothetical output. Second, the data is analyzed by correspondence analysis and represented in Bertin graphics to track the shifts and relationships to correlate with the help of SPSS and Stata software packs.

Approximately 90.000.000 passengers/year travel in Ankara's underground network. This means the system carries 250.000 passengers per day. It is assumed that the double journey the new figure will be 125.000 passengers in one route. In consequence of the two systems (ANKARAY and Ankara METRO) the final value will be 62.500 passengers that use either one system or another. With approximately %1 of these passengers is conducted structured interview which is 600. The structured interview is conducted in two ways: %66 of them via internet[22] (400), and %33 of them by face to face interviews. Face to face interviews are conducted by random sampling. Internet surveys are conducted by announcement in different network societies to get heterogeneous sampling group in terms of age and profession.

5.4 The Questionnaire

To produce a perceptual map, which aims to build a multi attribute perceptual space, several methods are used.

Semantic differential method (SDM) consists of listing the semantic attributes of the artifact analyzed, and carrying out user-tests in which the user must asses the artifact according to these attributes (Petiot, Yannou 2003). The

[22] http://FreeOnlineSurveys.com/rendersurvey.asp?sid=52s07htboeetmcj250960

attributes are often defined by pairs of antonymous adjectives, which lie at either end of a Likert scale.

At this point, selecting ideal adjectives becomes an important concern. Because, the user's opinion of an artifact is by essence subjective and difficult to express and asses with mere evaluation criteria. This is because of the fact that subjective functions and criteria are often neither named nor objectively assessed. According to Lannoch (1989), the notion of space is intended to encompass the whole complex of person- artifact relationships as viewed by the very individuals who participate in these relationships. Thus, the human is concerned with not physical but mental abstractions. Therefore, the space becomes a semantic space.

There are six interrelated types of linguistic expressions of meaning for concerning space. These are called semantic dimensions. These semantic dimensions coordinate with more than human perceptions of space, human decisions and actions with in the space, and cleaver alterations of space through design (Lannoch,1989)

The first dimension is the dimension of experimental qualities. It refers to qualities that are attributed to spatial forms based on an individual's immediate sensory experiences such as smooth, hard, angular, soft and rough. The dimension of orientation contains directional assertions indicating the location or position of something relative to a typical user or observer. Being in front of or behind, inside or outside such references. The next dimension state, refers to state of something may occupy or the range of conditions under which something can operate as closed, hanging, standing and so on. Comparative judgment entails expressions of a form's deviation of some aspect from the ideal or referent, real or imagined. For example, a chrome plated plastic object can invoke the light object as heavy. Following dimension, affordance, is the dimension that gives impression about how something can be used of perform. An elastic object can trigger flexibility or a door handle can invoke turn ability. The last but the perhaps most important

dimension in comparison to the scope of the study is the values and conventions; which refer to statements that are derived from the assumption of socially shared and conventional standards, relative to which something is evaluated or appraised. A sofa can invoke comfort whereas a cellular phone can derive practicality.

Lannoch defines semantic analysis of linguistic expressions within spatial forms as semantic transfer. It is semantic because it is based on speech and transfer because the method proceeds from one medium to another, that is, from the medium of language to the medium of space.

The semantic transfer begins with the examination and selection of words, mostly adjectives. These adjectives should be selected carefully, which can define the semantic spatiality of objects or the adjectives that define the interaction between human and their environment.

Adjectives are modifiers. Noun modification is primarily associated with the syntactic category “adjective”. Adjectives have their sole function the modification of nouns, where as modification is not the preliminary function of noun, verb and prepositions phrases.

English contains descriptive adjectives (such as big, interesting, possible) and relational adjectives (such as presidential and nuclear). A descriptive adjective is one that ascribes a value of an attribute to a noun. To say “T*he watermelon is heavy”* presupposes that there is an attribute WEIGHT such that WEIGHT (watermelon) = heavy. Similarly, low and high are values for the attribute HEIGHT. Another kind of adjective, relational ones, are relating/ pertaining to, of associated with some noun, and they play a role similar to that of modifying noun. For example, the adjective *dental* is related to *tooth* or *atomic,* which is derived form noun atom, with the usage of atomic bomb that defines a bomb is composed of the reactions of atoms.

An adjective can be similar to another one or antonymous to another. The basic semantic relations among descriptive adjectives are antonymy. The importance of antonymy in organization of descriptive adjectives is understandable when it is recognized that the function of these adjectives is to express values of attributes and that nearly all attributes are bipolar. Antonymous adjectives express opposing values of an attribute. For example, the antonym of low and high, which expresses a value at the opposite pole of the height attribute.

In bipolar adjective structure, an adjective can have an antonymy and similarity with others. For example, the adjectives *heavy* and *light* have a common attribute on WEIGHT (the vertical force exerted by a mass as a result of gravity). Both adjectives are antonymous to each other. Heavy has similarity with the adjectives of dense, doughy, soggy, hefty, massive non-buoyant, ponderous harsh, burdensome, onerous, taxing, distressing, distressful, disturbing, perturbing, troubling, worrisome, leaden, weighted, oppressive, weighty, fat, thick depending on WEIGHT attribute. Light has similarity with the adjectives of airy, buoyant, floaty, lighter-than-air, low-density (predicate), nonfat depending on WEIGHT attribute. A detailed analysis of these adjectives is created by the WordNet 2.1 software to define exact ones.

WordNet® is a large lexical database of English, developed under the direction of George A. Miller. Nouns, verbs, adjectives and adverbs are grouped into sets of cognitive synonyms (synsets), each expressing a distinct concept. Synsets are interlinked by means of conceptual-semantic and lexical relations. The resulting network of meaningfully related words and concepts can be navigated with the browser. Wordnets have been created in dozens of other languages. For example, Turkish WordNet, is a part of BalkaNet Project. This project is a cooperative research project between Sabancı University and University of California at Berkeley and is supported by TUBITAK and USA NSF. The project will be integrated with the TELL

project in University of California at Berkeley. This project database is not effective as WordNet but helpful for creating antonyms.

The bipolar structure of the antonymous adjectives will help the study to locate the adjectives to the pole of the Likert chart. The raw data that will be generated by the questionnaires will be coded by assigning each answer a value from positive 2 to negative 2 according to the polarity of adjectives. There are two positive value (Çok and Oldukça) at the end of each scale because the study aims being neutral about the impressions of adjectives.

Table 5.1: Bipolar Adjectives for Concrete Meanings.

Bipolar Adjectives for Concrete Meanings	
Geniş (Wide)	Dar (Narrow)
Yüksek (High)	Alçak (Low)
Sık (Dense)	Seyrek (Rare)
Çeşitli (Varied)	Tekdüze (Monotonous)
Temiz (Clean)	Kirli (Dirty)
Kalabalık (Crowded)	Tenha (Uncrowded)
Açık (Open)	Kapalı (Close)
Hareketli (Dynamic)	Durağan (Static)
Sessiz (Silent)	Gürültülü (Noisy)
Renkli (Colorful)	Renksiz (Colourless)
Süslü (Decorated)	Sade (Plain)
Yoğun (Consistent)	Yoğun Değil (Inconsistent)
Yeşil (Verdant)	Kurak (Dry)

The impressions about spatial configuration of the metro station and metro as itself will be organized by two headings. First set will focus on concrete means enclosing the five dimensions of Lannochian definitions. Second set will focus on more values and abstract meaning as values and conventions dimension. The concrete meanings in the form of bipolar adjectives are listed below (Table 5.1):

The abstract meanings in the form of bipolar adjectives are listed below (Table 5.2):

Table 5.2: Bipolar Adjectives for Abstract Meanings.

Bipolar Adjectives for Abstract Meanings	
Düzenli (Regular)	Düzensiz (Irregular)
Ferah (Airy)	Boğucu (Suffocating)
Karmaşık (Complex)	Basit (Simple)
Uyumlu (Harmonic)	Uyumsuz (Inharmonious)
Çekici (Desirable)	İtici (Undesirable)
Bakımlı (Cared)	Bakımsız (Uncared)
Özgün (Original)	Sıradan (Ordinary)
Kontrollü (Controled)	Kontrolsüz (Unconcroled)
Hoş (Charming)	Hoş Değil (Displeasing)
Lüks (Luxurious)	Vasat (Average)
Yeni (New)	Eski (Old)
Neşelendirici (Cheering)	İç Karartıcı (Depressing)
Moda (Fashionable)	Demode (Oldfashioned)
Korkutucu (Scary)	Büyüleyici (Fantastic)
Kimlikli	Kimliksiz

According to the bipolar adjective pairs sample Linkert chart is composed as follows (Table 5.3):

Table 5.3: Sample Likert Chart.

	Çok (3)	Oldukça (2)	Normal (1)	Oldukça (2)	Çok (3)	
Özgün						Sıradan

The survey is composed of three sections. In the first section, the samples are asked about their personal information and transportation habits. In the following sections, samples are asked about their perception about the city Ankara and the Metro/Ankaray Light Rail system. The last section is composed of matching questions about the metro systems all around world and a simple quiz about domestic rail system supported by pictures. All sample mass is informed about their personal information will be used for gathering public perspectives on transportation issues and summarizing the

relevant information for the thesis. The complete questionnaire can be examined in Appendix D.

5.5 The Analysis

Correspondence analysis (has also been called correspondence mapping, perceptual mapping, social space analysis, correspondence factor analysis, principal components analysis of qualitative data, and dual scaling) (CA) is a method of factoring categorical variables and displaying them in a property space which maps their association in two or more dimensions (Greenacre, 1993). It is a descriptive/exploratory technique designed to analyze simple two-way and multi-way tables containing some measure of correspondence between the rows and columns. CA provides a method for representing data in an Euclidean space so that the results can be visually examined for structure. For data in a typical two-way Contingency Table, both the row variables and the column variables are represented in the same space. This means that one can examine relations not only among row or column variables but also between row and column variables (Benzecri, 1992). In CA, the data matrix is first transformed by dividing each cell by the square root of the corresponding row and column totals. The transformed matrix is then decomposed with singular value decomposition resulting in the singular values (which in this case are canonical correlations) and a set of row vectors and column vectors. Next, the row and column vectors are rescaled with the original total frequencies to obtain optimal scores. These optimal scores are weighted by the square root of the singular values.

The most important advantage of CA is the ease of 2D plotting mix data sets in a singular data space whether symmetric or asymmetric map. CA does not aims too accept or reject the hypothesis but seeks to visualize relations between data (Greenacre, 1993).

A classical CA begins with the cross-tabulation *N (I,J)* categorical data, which are numerically coded in matrix sense. The elements of this matrix are $n_{ij.}$

The contingency table with *I* rows (*i*=1, 2, *I*) and *J* columns (*j* =1,2,…,*J*) having frequencies n_{ij}. Marginal frequencies are denoted by n_{i+} and $n_{+j..}$:

$n_{i+} = \sum_j n_{ij}$, $n_{+j} = \sum_i n_{ij}$. In addition, the Total frequency is given by $n = \sum\sum_{j\ i} n_{ij}$.

The profile[23] of each row *I* is a vector of conditional densities:

$n_{ij} / n_{i+} (j = 1,2,\ldots,J)$ and $i = n_{ij} / n_{i+} \ldots\ldots (j = 1,2,\ldots\ldots,J)$. The complete set of the row profile may be denoted by *I* × *J* matrix R (Table 6.4).

Table 5.4: The Complete Set of the Row Profiles.

Rows	*Columns*			*Total*
	1	2	J	
1.	n_{11}/n_{1+}	n_{12}/n_{1+}	..... n_{1j}/n_{1+}	1
2.	n_{21}/n_{2+}	n_{22}/n_{2+}	..... n_{2j}/n_{2+}	1
3.	n_{31}/n_{3+}	n_{32}/n_{3+}	..... n_{3j}/n_{3+}	1
.	.	.		
I	n_{i1}/n_{i+}	n_{i2}/n_{i+}	..... n_{ij}/n_{i+}	1
Column mass	n_{+1}/n_{++}	n_{+2}/n_{++}	n_{+j}/n_{++}	1

The profile of each column *j* is a vector of conditional densities $n_{ij} / n_{+j} (i = 1,2,\ldots,I)$. The complete set of the column profiles may be denoted by (*i x j*) matrix C (Table 5.5).

[23] The most basic concept in correspondence analysis is that of a profile. The profile of a set of frequencies is simply the frequencies divided by their own total.

Table 5.5: The Complete Set of the Column Profiles.

Rows	*Columns*			*Row Mass*
	1	2	J	
1.	n_{11}/n_{+1}	n_{12}/n_{+2}	..... n_{1j}/n_{+j}	n_{i1}/n_{++}
2.	n_{21}/n_{+1}	n_{22}/n_{+2}	..... n_{2j}/n_{+j}	n_{+2}/n_{++}
3.	n_{31}/n_{+1}	n_{32}/n_{+2}	..... n_{3j}/n_{+j}	
.	.	.		
I	n_{i1}/n_{+1}	n_{i2}/n_{+2}	..... n_{ij}/n_{+j}	n_{i1}/n_{++}
Column mass	1	…1	1	1

Average row profile $\bar{r} = n_{+j}/N \quad (j=1,2,\ldots,J)$

Average column profile $\bar{c} = n_{i+}/N \quad (i=1,2,\ldots,I)$

Another fundamental concept in correspondence analysis is the concept of mass[24]. The mass of the i^{th} row =

Marginal frequency of the i^{th} row/Grand total

$= n_{+i}/n$

Similarly the mass of the j^{th} column =

Marginal frequency of the j^{th} column/Grand total

$= n_{j+}/n$

The correspondence matrix P is defined as the original table N divided by the grand total *n,* P = (1/*n*) N. Thus, each cell of the correspondence matrix is given by the cell frequency divided by the grand total.

[24] The mass is the preferred term meaning "weight" in correspondence analysis. Alternative terms for mass are centroid or barycentre.

The correspondence matrix shows how one unit of *mass* is distributed across the cells. The row and column totals of the correspondence matrix are the row mass and column mass, respectively.

Clouds of Points N (*I*) *and N* (*J*)

The cloud of points *N* (*I*) is the set of elements of points $i \in I$, whose coordinates are the components of the profile and whose mass is n_{i+} / n_{++}

The cloud of points *N (J)* is the set of elements of points $j \in J$, whose coordinates are the components of the profile and whose mass is n_{j+} / n_{++}.

A variant of Euclidean distance, called the weighted Euclidean distance, is used to measure and thereby depict the distances between profile points. Here, the weighting refers to differential weighting of the dimensions of the space and not to the weighting of the profiles.

Distance between two rows *i* and *I'* is given by

$$d^2(i,i') = \sum_{j=1}^{J} \frac{1}{n_{+j}} \left(\frac{n_{ij}}{n_{i+}} - \frac{n_{i'j}}{n_{i'+}} \right)^2$$

In a symmetric fashion, the distance between two columns *j* and *j'* is given by

$$d^2(j,j') = \sum_{i=1}^{I} \frac{1}{n_{i+}} \left(\frac{n_{ij}}{n_{+j}} - \frac{n_{ij'}}{n_{+j'}} \right)^2$$

The distance thus obtained is called the *Chi-square distance*[25]. The Chi-square distance differs from the usual Euclidean distance in that each square is weighted by the inverse of the frequency corresponding to each term.

The division of each squared term by the expected frequency is "variance – standardizing" and compensates for the larger variance in high frequencies

[25] Correspondence analysis uses chi-square distances, d. These are measures of distance between the row and column profiles for a set of points. A large d means the two profiles are very different.

and the smaller variance in low frequencies. If no such standardization were performed, the differences between larger proportions would tend to be large and thus dominate the distance calculation, while the differences between the smaller proportions would tend to be swamped. The weighting factors are used to equalize these differences.

Essentially, the reason for choosing the Chi-square distance is that it satisfies the principle of *distributional equivalence*, expressed as follows:

- If two rows *i* and *I'* of *I* of *N* (*I*, *J*) are proportioned and if they are replaced by only one, which is the sum, column-by-column, then the distances between columns are not changed in *N* (*J*).
- If two columns *j* and *j'* of *J* of *N* (*I*, *J*) are proportioned and if they are replaced by only one, which is the sum, row-by-row, then the distances between rows are not changed in *N* (*I*).

Inertia[26] is a term borrowed from the "moment of inertia" in mechanics. A physical object has a center of gravity (or centroid). Every particle of the object has a certain mass *m* and a certain distance *d* from the centroid. The moment of inertia of the object is the quantity md^2 summed over all the particles that constitute the object.

Moment of inertia $= \sum md^2$

This concept has an analogy in correspondence analysis. There is a cloud of profile points with masses adding up to 1. These points have a centroid (*i.e.,* the average profile) and a distance (Chi-square distance) between profile points. Each profile point contributes to the inertia of the whole cloud. The inertia of a profile point can be computed by the following formula.

For the i^{th} row profile,

[26] The quantity x2/n occurs so frequently in correspondence analysis that it is given a special name, the total inertia, or simply inertia. The inertia of a table is the weighted average of the squared x2 distances between the row profiles and their average profile.

Inertia = $\sum_i \sum_j \frac{(r_{ij} - \bar{r}_j)^2}{\bar{r}_j}$

where r_{ij} is the ratio n_w/n_{i+} and $\bar{r}_j$ is $n_{.j}/n$

The inertia of the j^{th} column profile is computed similarly.

The total inertia of the contingency table is given by:

Total inertia $= \sum_i \sum_j \frac{(r_{ij} - \bar{r}_j)^2}{\bar{r}_j}$

which is the Chi-square statistic divided by *n*?

Yet the CA does not any hypothetical asset according the data Chi-Square Analysis can help for hypothetical testing. The Chi-Square statistic measures the discrepancy between the observed frequencies in a contingency table and the expected frequencies calculated under hypothesis of homogeneity of the row profiles (or of the column profiles). In Chi-Square Analysis, same cross-tabulation table in CA can be used. A Chi-Square statistic is a statistic whose values are given by $X^2 = [(n - 1) * s^2] / \sigma^2$ where σ is the standard deviation of the population, s is the standard deviation of the sample, and n is the sample size. The distribution of the chi-square has n-1 degrees of freedom [27](dof). Let a cross- tabulation table has I rows and J columns. Than the dof will be: Dof = [(I-1) . (J-1)].

Chi-Square is calculated according to observed and expected values. Let we have a 2*2 contingency table (Table 5.6).

[27] In statistics, the term degrees of freedom (df, dof) is a measure of the number of independent pieces of information on which a parameter estimate is based. It is a measure of how much precision an estimate of variability has. The degrees of freedom for an estimate equal the number of observations (values) minus the number of additional parameters estimated for that calculation. As we have to estimate more parameters, the degrees of freedom available decreases. It can also be thought of as the number of observations (values) which are freely available to vary given the additional parameters estimated

Table 5.6: Sample Contingency Table.

Variable 2	Data Type	Data Type	Totals
Category 1	a	b	a + b
Category 2	c	d	c + d
Total	a + b	b + d	a + b + c + d = N

For a 2 x 2 contingency table the Chi Square statistic is calculated by the formula:

$$\chi^2 = \frac{(ad - bc)^2 (a+b+c+d)}{(a+b)(c+d)(b+d)(a+c)}$$

The chi distribution is an asymmetric distribution that has a minimum value of 0, but no maximum value. The curve reaches a peak to the right of 0, and then gradually declines in height, the larger the chi value is. The curve approaches, but never quite touches, the horizontal axis. For each degree of freedom, there is a different chi distribution. The mean of the chi square distribution is the degree of freedom and the standard deviation is twice the degrees of freedom. This implies that the chi distribution is more spread out, with a peak farther to the right, for larger than for smaller degrees of freedom. As a result, for any given level of significance, the critical region begins at a larger chi square value, the larger the degree of freedom. Figure 1 shows the shape of the distribution. The chi value is on the horizontal axis, with the probability for each chi2 value being represented by the vertical axis. The shaded area in the diagram represents the level of significance α shown in the Figure 5.1

The chi table, which follows, gives chi values for selected levels of significance. All of the levels of significance shown represent areas in the right tail of the chi square distribution.

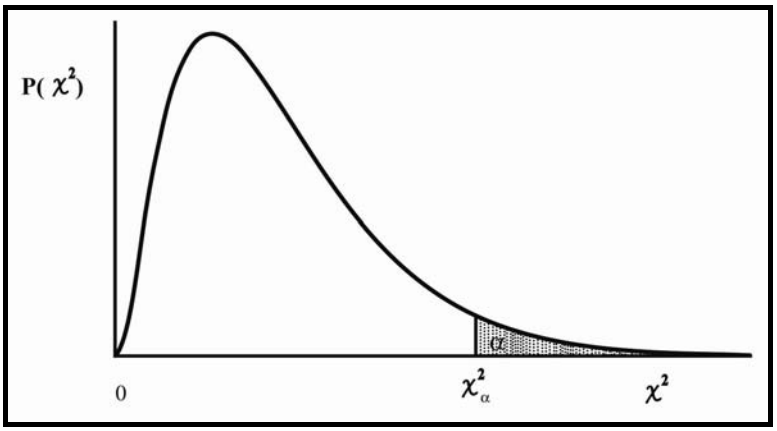


Figure 5.1: The Chi Square Distribution.

The table shows chi values for the commonly used levels of significance. For example, if the α = 0:05 level of significance is selected, and there are 8 degrees of freedom, the critical chi square value is 14.067. This means that for 8 degrees of freedom, there is exactly 0.05 of the area under the chi square distribution that lies to the right of chi = 14.067 (Table 5.7).

In a statistics book, the sampling distribution of chi square (also know as 'critical values of chi square') is typically listed in Table. You read down the column representing your previously chosen probability of error threshold (e.g., p < .05) and across the row representing the degrees of freedom in the table. If the chi square value is larger than the critical value in that cell, the data present a statistically significant relationship between the variables in the table.

If the chi square value is larger than the critical value in that cell, the data present a statistically significant relationship between the variables in the table.

Statistical significance does not help to interpret the nature or explanation of that relationship; that must be done by other means (including bivariate tabular analysis and qualitative analysis of the data).

Table 5.7: Significance Values for Chi Square.

df	0.200	0.100	0.075	0.050	0.025	0.010	0.005	0.001	0.0005
1	1.642	2.706	3.170	3.841	5.024	6.635	7.879	10.82	12.11
2	3.219	4.605	5.181	5.991	7.378	9.210	10.59	13.81	15.20
3	4.642	6.251	6.905	7.815	9.348	11.34	12.83	16.26	17.73
4	5.989	7.779	8.496	9.488	11.14	13.27	14.86	18.46	19.99
5	7.289	9.236	10.00	11.07	12.83	15.08	16.75	20.51	22.10
6	8.558	10.64	11.46	12.59	14.44	16.81	18.54	22.45	24.10
7	9.803	12.01	12.88	**14.06**	16.01	18.47	20.27	24.32	26.01
8	11.03	13.36	14.27	15.50	17.53	20.09	21.95	26.12	27.86
9	12.24	14.68	15.63	16.91	19.02	21.66	23.58	27.87	29.66
10	13.44	15.98	16.97	18.30	20.48	23.20	25.18	29.58	31.42

However, a statistically significant chi square value does denote the degree of confidence that may hold that relationship between variables described in the results is systematic in the larger population and not attributable to random error.

Statistical significance also does not ensure substantive significance. A large enough sample may demonstrate a statistically significant relationship between two variables, but that relationship may be a trivially weak one. Statistical significance means only that the pattern of distribution and relationship between variables, which is found in the data from a sample, can be confidently generalized to the larger population from which the sample was randomly drawn. By itself, it does not ensure that the relationship is theoretically or practically important or even very large.

5.6 Representation of Correspondence Analysis

Every Correspondence Analysis concludes with a graphic representation. In this graphical representation, all data derived from cross-tabulation is reflected on a coordinate system. Depending to the characteristic of cross tabulation any profile has at least one dimension on coordinate system. In most applications, however, the cross tabulation of interest lie in a space of much higher dimensionality. Since it is not easily observe or even imagine

points in a space with more than three dimensions, it becomes necessary to reduce the dimensionality of the points. This reduction of dimensionality cannot be made without certain amount of loss of information, but the idea is to restrict this loss to a minimum (Greenacre, 1993).

In order to make this subject understood more clear, it is better to give an example. At this stage it is worthwhile to consider an example of correspondence analysis to real data and obtain more practice in interpreting the maps. In this example the relationship between frequency of metro usage and identification of a specific metro station (Maltepe) is examined (Table 5.8). The data comes from the content of this study which classified 600 passengers into five categories for the metro usage frequency. The passengers are cross classified according to their usage frequency (the 5 rows of the table) and answers category (the 8 columns of the table).

Table 5.8: Cross-Tabulation of the Example.

	AŞTİ	HASTANE	DİKİMEVİ	OSTİM	MALTEPE	MTA	İVEDİK	BAH.EV	**TOTAL**
YILDA BİR KAÇ KEZ	13	7	28	6	24	4	12	21	115
AYDA BİR KAÇ KEZ	23	6	21	18	20	2	13	31	134
HAFTADA BİR KAÇ KEZ	13	0	20	5	52	1	4	23	118
HAFTA İÇİ HERGÜN	6	0	43	4	86	0	1	36	176
HİÇ	17	4	3	9	4	6	3	11	57
TOTAL	72	17	115	42	186	13	33	122	**600**

Figure 5.2 shows the initial part of printout from the Stata program. The figure shows the decomposition of inertia with respect to four principal axes. Each axis accounts for a part of the inertia and this is expressed as a percentage.

Correspondence analysis

Number of obs	= 600
Pearson chi2(28)	= 172.64
Prob > chi2	= 0.0000
Total inertia	= 0.2877
5 active rows	
8 active columns	
Number of dim.	= 2
Expl. inertia (%)	= 92.41

Dimensions	singular values	principal inertia	chi2	percent	cumul percent
dim 1	.4800601	.2304577	138.27	80.09	80.09
dim 2	.1882342	.0354321	21.26	12.31	92.41
dim 3	.1354102	.0183359	11.00	6.37	98.78
dim 4	.0592688	.0035128	2.11	1.22	100.00
total		.2877385	172.64	100	

Statistics for row and column categories in symmetric normalization

Figure 5.2: Correspondence Analysis of the Example Including Dimensional Values.

Thus the first two dimensions accounts for almost %92.4 of the inertia. The sum of principal inertias is 0.2877385, which is the chi square statistics divided by n= 0.2777385 = 172.64 / 600.

As it is seen, every profile has a coordinate in four dimensional spaces. However it is impossible to represent the four dimensions on two dimensional spaces with out any loss of information. So, the representation should be based on the contribution levels of each dimension.

Figure 5.3 shows the initial part of printout from the SPSS program derived from the same data. The figure shows overview of row and column points with the score in dimension point and their contribution on dimension of inertia of point. When it is come to this stage level, because of the practical impossibility of three-dimensional display, a dimensional reduction is needed. For this reduction, each dimension's contribution level on data is looked up. In the example, as the first two axes have a contribution level of 92.4%, the other dimensions having 6.12% and 1.22% contribution levels can be omitted. The fair representation (symbolization) level of the two-dimensional figure derived from this reduction, with a 7.34% loss, is 92.4%.

This forms the main two axes of the two-axed pilot This pilot, in fact, is a projection of all dimensional coordinates.

Overview Row Points[a]

ROW	Mass	Score in Dimension				Inertia	Contribution								
							Of Point to Inertia of Dimension				Of Dimension to Inertia of Point				
		1	2	3	4		1	2	3	4	1	2	3	4	Total
y_1	.192	.287	-.603	.507	.112	.028	.033	.371	.364	.040	.276	.477	.242	.005	1.000
a_1	.223	.583	-.275	-.549	-.093	.049	.158	.090	.496	.033	.746	.065	.186	.002	1.000
h_1	.197	-.415	.306	-.153	.426	.022	.070	.098	.034	.601	.724	.155	.028	.094	1.000
hr	.293	-.789	.101	.069	-.246	.089	.380	.016	.010	.300	.980	.006	.002	.012	1.000
hc	.095	1.345	.918	.368	-.128	.099	.358	.426	.095	.026	.830	.152	.018	.001	1.000
Active Total	1.000					.288	1.000	1.000	1.000	1.000					

a. Symmetrical normalization

Overview Column Points[a]

COL	Mass	Score in Dimension				Inertia	Contribution								
							Of Point to Inertia of Dimension				Of Dimension to Inertia of Point				
		1	2	3	4		1	2	3	4	1	2	3	4	Total
1	.120	.865	.445	-.136	.281	.048	.187	.126	.016	.160	.890	.092	.006	.012	1.000
2	.028	1.334	-.687	.753	-.284	.029	.105	.071	.119	.039	.834	.087	.075	.005	1.000
3	.192	-.324	-.437	.239	-.188	.018	.042	.194	.081	.114	.525	.373	.080	.022	1.000
4	.070	.947	.206	-.704	-.406	.036	.131	.016	.256	.194	.835	.016	.130	.019	1.000
5	.310	-.734	.237	.028	.115	.084	.347	.092	.002	.069	.958	.039	.000	.003	1.000
6	.022	1.598	1.166	1.698	-.103	.041	.115	.157	.461	.004	.654	.137	.209	.000	1.000
7	.055	.796	-1.084	-.107	.616	.030	.073	.343	.005	.353	.554	.402	.003	.041	1.000
8	.203	.016	-.018	-.201	-.140	.001	.000	.000	.061	.068	.019	.009	.801	.171	1.000
Active Total	1.000					.288	1.000	1.000	1.000	1.000					

a. Symmetrical normalization

Figure 5.3: Overview of Row and Coulmn Points.

While every point has a coordinate relating to two axes, at the same time, has a coordinate related to other two axes which are not shown. These coordinates cannot be shown because of the lack of representation.

Figure 5.4 shows the plot from the Stata program derived from the same data. As it is seen, all the data is located between the first and second dimension with the %7.34 loss.

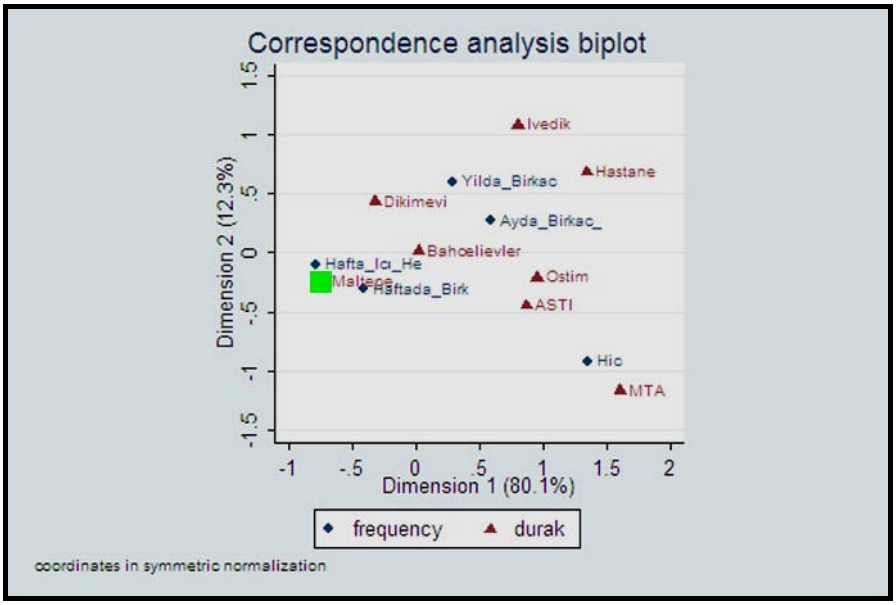


Figure 5.4: The Biplot of the Correspondence Analysis.

This map might hard to be read: many people will read that “MTA” is highly related with “Hiç”, because these two points appear near one another on the plot, or that there are more correct answer related with “Hafta_Ici_Hergun” than “Yılda_Birkaç_Kez” frequencies because the former is closer to “Maltepe” than the latter.

According to Chauchat and Risson, in some CA plots, erroneous conclusions are possible, yet these CA plots does not depicts the raw data after rows and columns have been permuted with respect to their order on the first CA axis.

To improve the legibility of the CA plots Bertin developed a graphic method. The purpose of the method was permuting the rows and columns of a matrix for the purpose of revealing hidden structure in data matrix. Bertin's graphics can be seen as a type of scatter plot: coordinates from CA become ranks, and the area of each rectangle is proportional to the number of observations/cases with those ranks (Chauchat and Risson, 1998).

In 1977 J. Bertin introduced a display and an analysis strategy for multivariate data with low or medium sample size. Bertin tries to make the information in a data set understandable. He does not fit models: he tries to provide simple tools to interrogate data. The tools operate simultaneously on cases and variables, combining aspects otherwise separately encountered in cluster analysis (on cases) and principal component analysis or factor analysis (on variables) (Bertin, 1977).

In abstract terms, a Bertin matrix is a matrix of displays. Bertin matrices allow rearrangements to transform an initial matrix to a more homogeneous structure. The rearrangements are row or column permutations, and groupings of rows or columns. To fix ideas, think of a data matrix, variable by case, with real valued variables. For each variable, draw a bar chart of variable value by case. Highlight all bars representing a value above some sample threshold for that variable (De Falguerolles, 1996) (Figure 5.5).

,

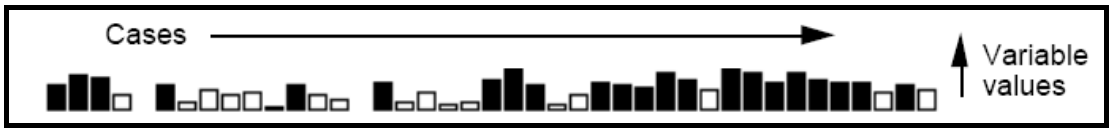


Figure 5.5: Univariate Simple Bertin Plot of One Quantitative Variable
(Source: De Falguerolles, 1996).

First, the logic of the system is based on simple reordering. Bertin first reordered the matrix tables depending on visual reclassing. By this way reordered matrixes become legible by defined characteristic groups along

with particular situations. Thence, the columns or rows are either rearranged or inversed (Figure 5.6).

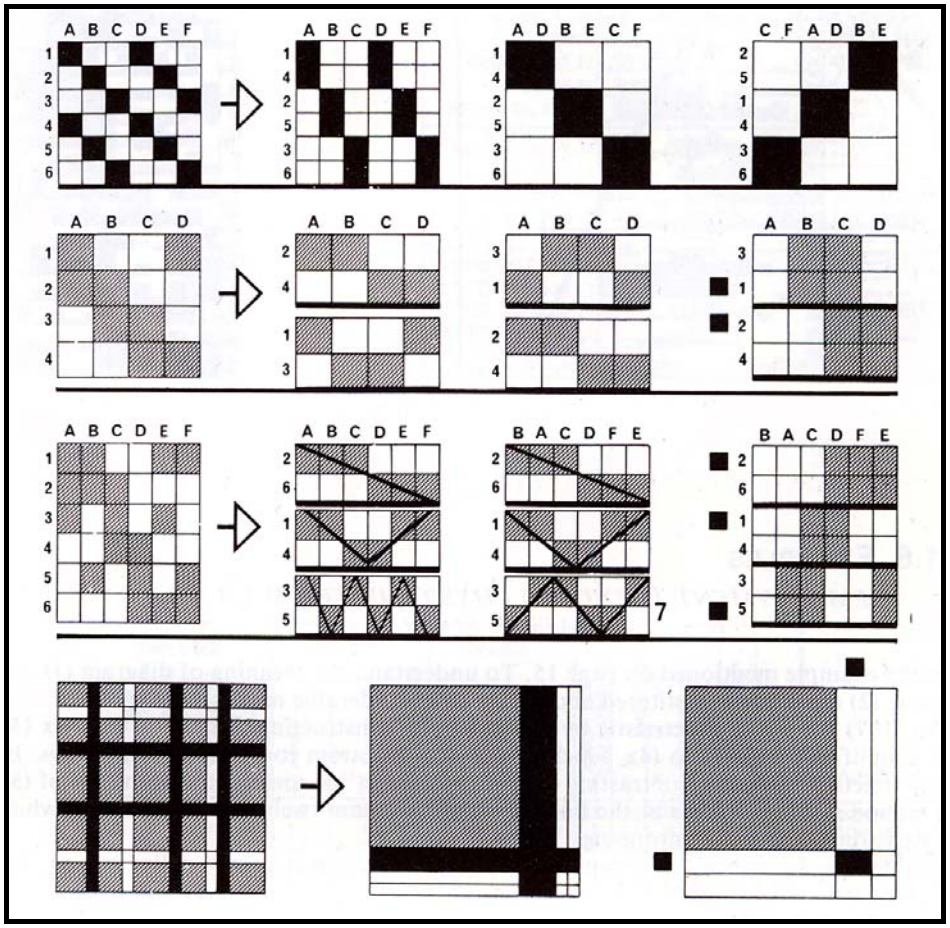


Figure 5.6: Reordering the Matrixes (Source: Bertin, 1977).

In the reorderable matrix the elementary areas are equal. In the weighted matrix x and y vary in relation to a certain quantity. The areas become meaningful; the rows and/or columns are unequal. The weighted matrix must therefore be drawn and can only be applied to tables of limited dimensions (Bertin, 1977). To generate plots Bertin uses four steps for the construction (Figure 5.7):

1- Calculating the vertical percentages of the table,
2- Construction of drawing directly according to these percentages. Darken whatever exceeds the mean per row. Reclassing rows and columns.

3- Giving the columns a width proportional to the totals obtained from table.
4- In the final drawing; writing the totals per column.

The weighted matrix shows :

- The totals by column profile along x,
- The percentage of each column profile in each row profiles along y,
- The partial quantities by area,
- And whatever exceeds the mean in black, that is, whatever characterizes each row data and each column data.

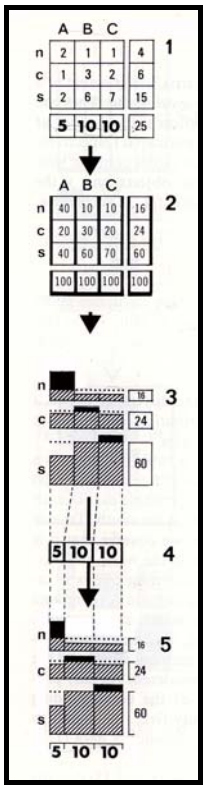


Figure 5.7: Construction of the Bertin Graph (Source: Bertin, 1977).

In the light of these explanations the Bertin type graphic of the previous example will be as follows:

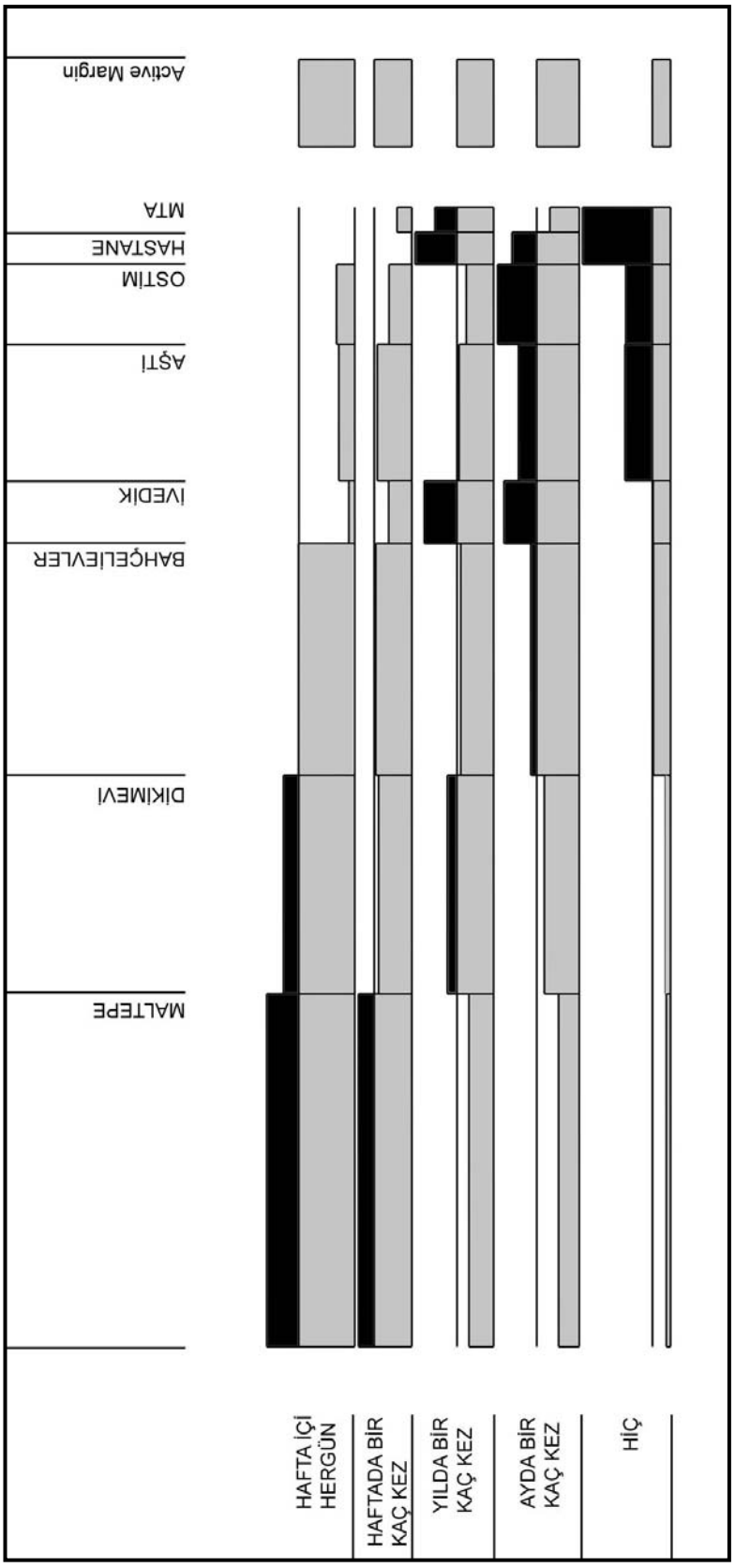


Figure 5.8: The Bertin Graph of Analysis.

For the graphical legibility the Bertin graphics mostly organizes permutations in diagonal equivalences (Figure 5.8). In this way, the graph becomes clearer by the cluster groups. For this, columns are reorganized for simplifying the image. One advantage of the Bertin graphics is the graphic communication. Graphic communication involves transcribing and telling others what is discovered. Its aim is to facilitate rapid perception and, potentially, memorization of the overall information. Graphic communication poses problems on the level of simplification and selectivity (Bertin, 1977).

There are twos way to make graphic more communicative. First is dendogram. Figure 5.9 shows the initial part of dendogram printout from the SPSS program.This dendogram is generated by Ward Method.

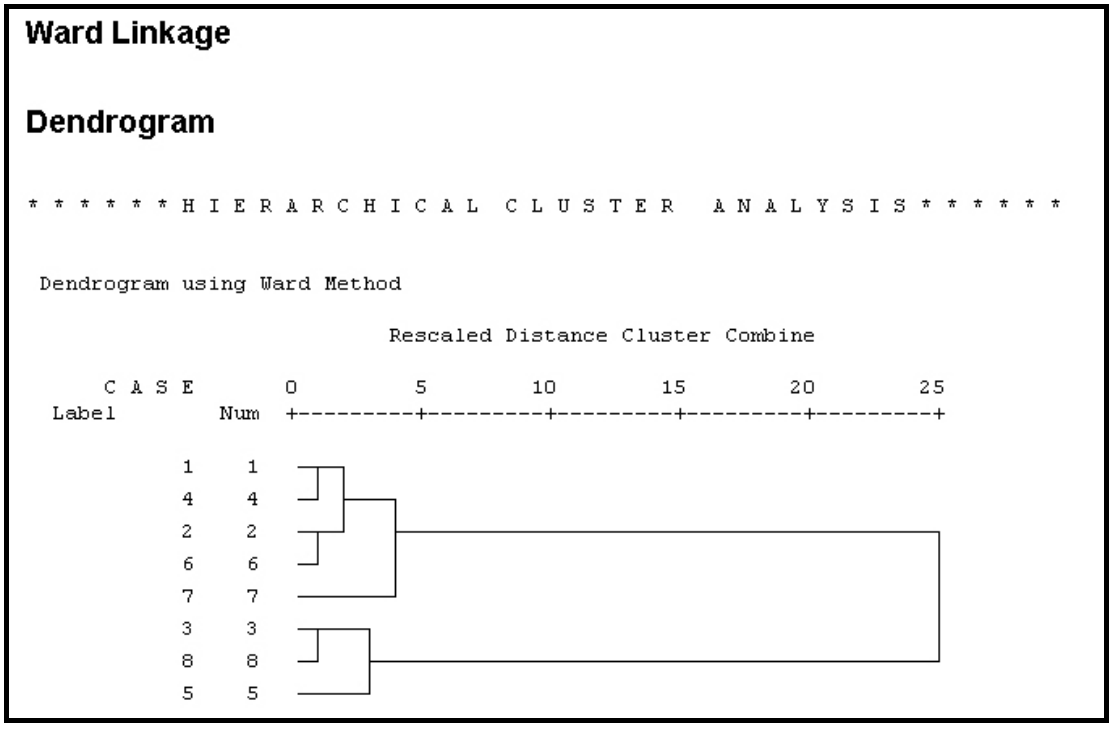


Figure 5.9: Dendogram by Using Ward Method.

It is a simple hierarchical cluster analysis of previous example. The numbers on the network tree represents the columns of the example as in order (1: AŞTİ, 2: HASTANE, 3: DİKİMEVİ, …, 8: BAHÇELİEVLER). By this hierarchical tree, the columns can reduce eight parameters to five. As seen in the figure the 1 and 4 can be grouped into one new group because of their

graphic similarities. According to hierarchical tree the most primitive cluster is the total of 1, 4, 2, 6, 7 and 3, 8, 5.

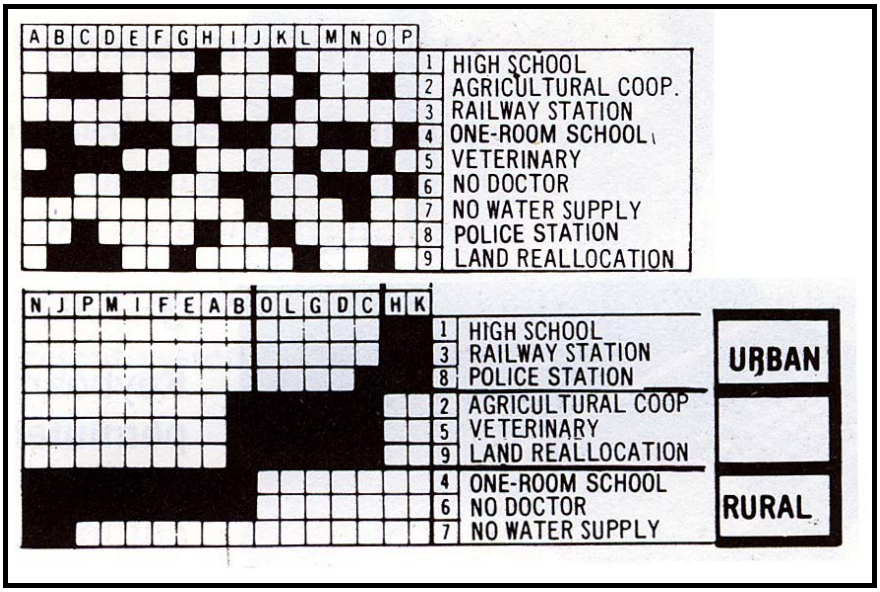


Figure 5.10: Reclassing Of Rows Depending On Inter Relations (Source: Bertin, 1977).

Another alternative to simplify the Bertin graphs for legibility is the clustering the rows in similar fashion. Figure 5.10 shows the reclassing of the rows of a weighted matrix.

CHAPTER 6

THE ANALYSIS

6.1 Introduction

Within the context of the study, a questionnaire was conducted among the city dwellers of Ankara by clarifying the aim of the study and taking permission from the participants to collect data (Appendix D). The data gained from the questionnaires are edited and formatted by Microsoft Excel® and transferred to SPSS® software to analyze by correspondence analysis for data reduction or to form hierarchical clusters for legibility if necessary. The SPSS outputs are again transferred to Excel to draw Bertin graphics introduced in the previous chapter. The graphics are drawn by two methods; first they are processed by a private property numerical code created by researcher with FORTRAN programming language to convert data to point clouds for Excel graphics. Second, SPSS outputs are accepted as raw coordinate codes and they are drawn by Rhinoceros® 3D visualization software by point to point coordinate entry. Final outputs are fixed by Adobe Illustrator® software for the final touch for legibility. The achieved statuses of processed and reorganized data are introduced as in the form hereinafter set forth.

6.2 Basic Transportation Routes and Purposes

In the questionnaire, the participants were asked about their basic transportation routes and purposes upon the 1st and 8th questions (Figure 6.1). The survey data indicated that the majority of the participants aim

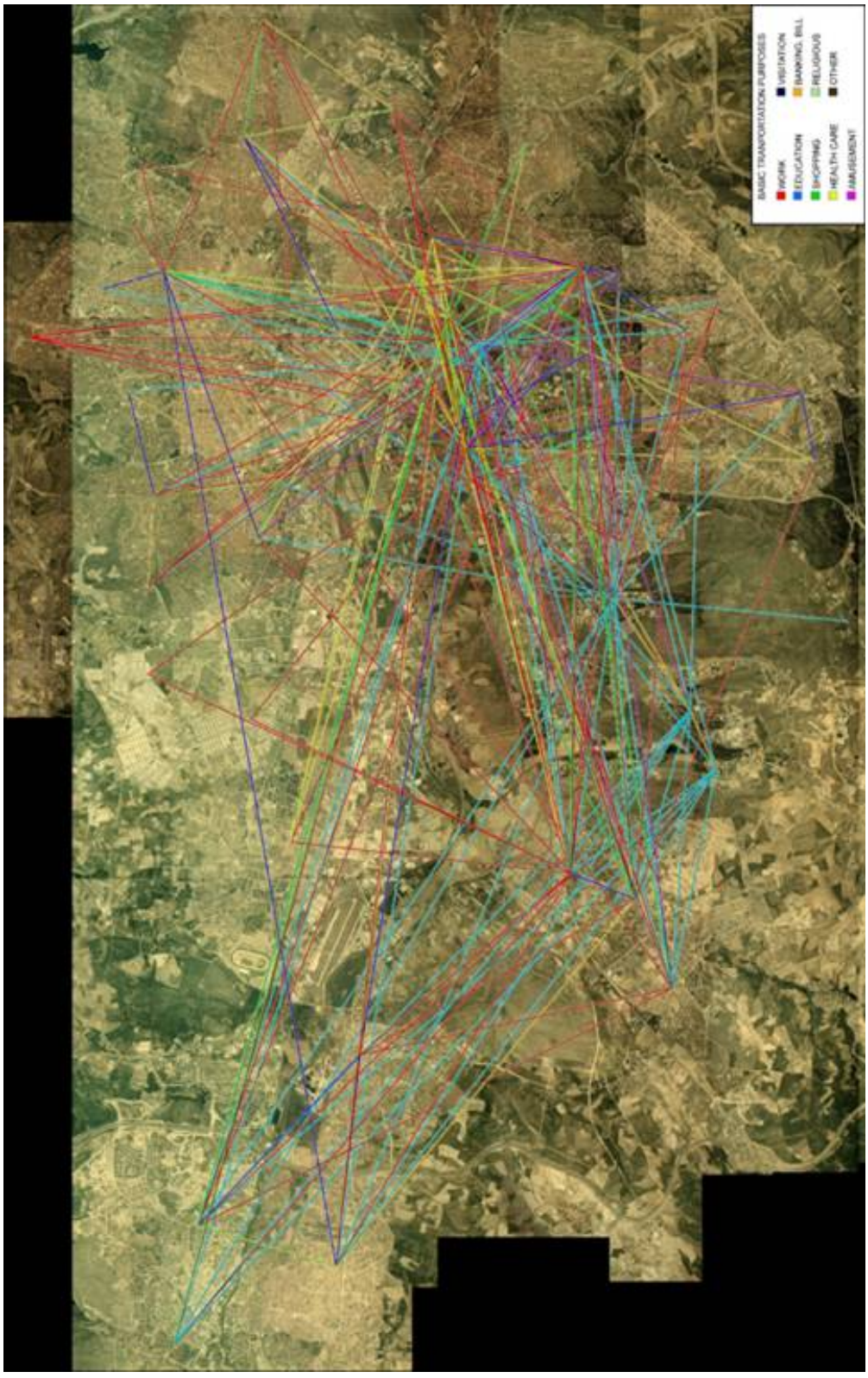


Figure 6.1: The Transportation Routes and Purposes of Participants.

work" and "education" and most of the flow is observed from residential area to city centers, organized industrial regions in the west and the universities at Eskişehir route and universities located at Tandoğan and Maltepe. Of those

surveyed, few routes overlap with LRT and Metro routes directly. Other routes make distance with other transport means or indirectly with LRT and Metro routes. As is understood from the figure, the new metro lines M2, M3 and M4 will undertake an important task in the axes. However there still will be a serious public transit problem in the south east regions as GOP and Çankaya.

6.3 Residence Frequency / Ankara Perception

In the questionnaire, the participants were asked about their opinions about Ankara depending on their residence frequency (Figure 6.2). Each participant answered questions by selecting an adjective (Table 6.1) in the Likert scale. Most popular adjectives to define Ankara are as follows: Controlled, Dry, Orderly, Crowded, Banal, Depressing, Stifling and Old. At first appearance, these adjectives enclose dissatisfaction about the city; however, there are also some hidden values for the positive attitudes depending on the residence frequency differences.

Table 6.1: The Complete List of Adjectives Used in the Questionnaire.

1	**BIG**	15	**ACTIVE**	29	**SPACIOUS**	43	**AMUSING**
2	**SMALL**	16	**PASSIVE**	30	**STIFLING**	44	**AWFUL**
3	**HIGH**	17	**QUIET**	31	**COMPLEX**	45	**LUXURY**
4	**LOW**	18	**NOISY**	32	**SIMPLE**	46	**AVERAGE**
5	**DENSE**	19	**COLORED**	33	**HARMONIC**	47	**NEW**
6	**RARE**	20	**UNCOLORED**	34	**DISHARMONIC**	48	**OLD**
7	**ASSORTED**	21	**FLORID**	35	**ATTRACTIVE**	49	**CHEERING**
8	**UNIFORM**	22	**PLAIN**	36	**UNATTRACTIVE**	50	**DEPRESSING**
9	**CLEAN**	23	**CONSISTENT**	37	**CRISP**	51	**POPULAR**
10	**DIRTY**	24	**UNCONSISTENT**	38	**UNKEPT**	52	**DOWDY**
11	**CROWDED**	25	**GREEN**	39	**ORIGINAL**	53	**FREAKY**
12	**DESOLATE**	26	**DRY**	40	**BANAL**	54	**CHARMING**
13	**OPEN**	27	**ORDERLY**	41	**CONTROLLED**	55	**IDENTICAL**
14	**CLOSE**	28	**CHAOTIC**	42	**UNCONTROLLED**	56	**UNIDENTICAL**

For example, different from the other residence intervals, the “20 - … group” has a concurrence of opinion that the city is getting “bigger, densely crowded, noisy, consistent and assorted”. This situation is overlapping with the rapidly

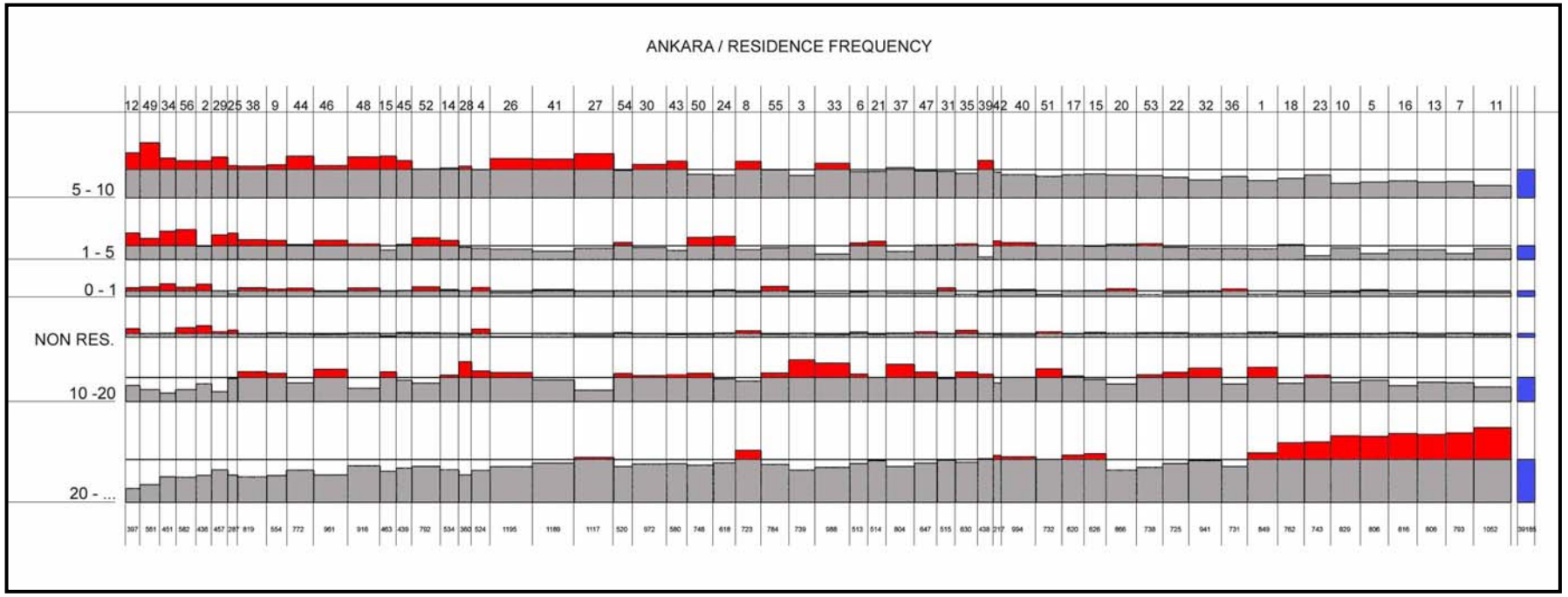


Figure 6.2: Bertin Graph of Residence Frequency / Ankara Perception.

growth of the city within the 20 and over years period. On the other hand, other residence intervals show a heterogeneous opinion pool. Their opinions take into consideration antagonistic adjective pairs as “green and dry”, “luxury and average” “new and old” at the same time in the left columns of the figure. Differently, the nonresidential group has a concrete negative and relative attitude about the city. The adjectives that exceed the mean per row are “uniform, uncolored, unattractive, complex” and “small, low, green, spacious”. Consequently, there are no legible regular relation corresponding to residence frequencies; on the contrary the serialization is occurred in “1-10 years” at the top, “nonresidential-1 years” in the middle and “10 and over” at the bottom.

6.4 Ankara / Metro- Ankaray Perception

The participants are asked to put a mark on the adjectives of Likert chart for their perception about the Ankara and Metro-Ankaray separately. Each data is crosschecked by correspondence analysis with adequate software packs. Depending on the output, the results are presented in Figure 6.3. In the figure the red shaded areas represents the maximum diversification. In interpreting the figure, after all, all adjectives gain a point for each row; however because of the diversification they get relatively lower score depending on the other row. At this juncture, it is a special occasion to emphasize the superiority of Bertin Graphics. Bertin Graphics locates maximum diversification at the corners of graph in terms of both columns and rows for the for the sake of legibility. Basically, the diagonal increase and decreases in the rows indicates that there is a respectable amount of diversification between the row variables. On this account, it is possible to make coherent comments depending on the maximum diversification. If one examines the figure in detail, it will appear that Metro-ANKARAY differs from general perception of Ankara by the adjectives of “unidentical, complex, small, low, uniform, clean, desolate, close, passive, colored, plain, inconsistent, green, chaotic, spacious, disharmonic, crisp, luxury, new, depressing and freaky”.

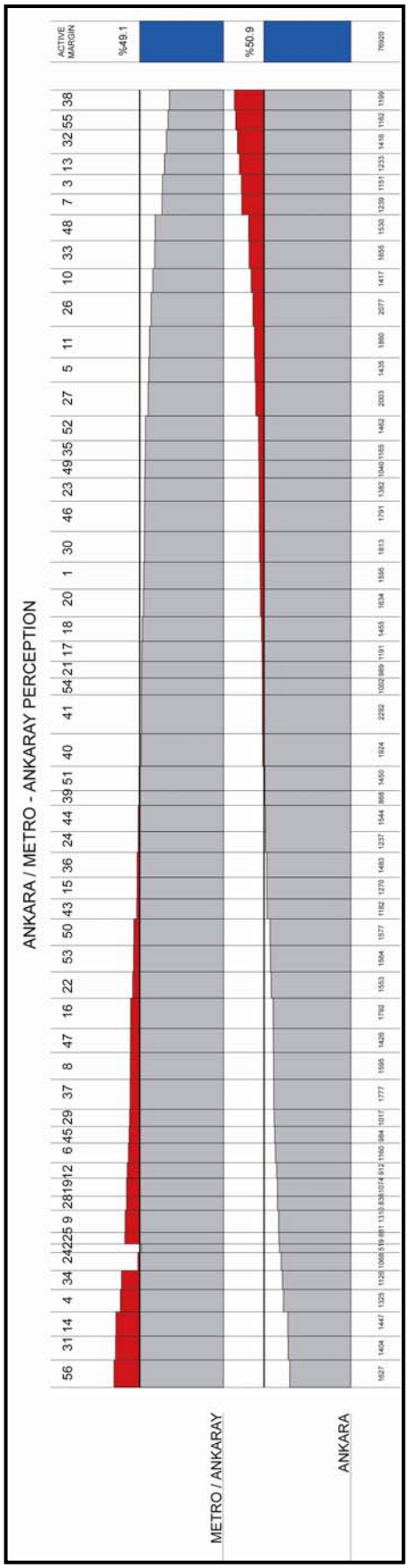


Figure 6.3: The Bertin Graph of Ankara and Metro-ANKARAY Perception.

As it is understood from the results whether the transit is brand new or clean it still encloses negative associations that are seen in common underground structures in means of user perception. That means there is a common pronounced dissatisfaction about the physical structure of the underground rail system of the city.

In the context of Ankara, common adjectives are expressed as: “identical, high, dowdy, cheering, old, unkept, attractive, harmonic, orderly, dry, consistent, dirty, crowded, dense and assorted”. These adjectives are also scored as lowest in Metro-ANKARAY perception.

There are interesting findings in the perception of Ankara / Metro-ANKARAY in the examination of the Bertin Graph. The common adjectives are confirmed as: “big, active, quiet, noisy, uncolored, florid, simple, unattractive, original, banal, controlled, uncontrolled, amusing, awful, average and popular”. The popularity of the antagonistic adjectives merits attention. Depending on the common adjectives the perception of Ankara and Metro-ANKARAY does not diverse to much. In the image of the both rows, the dominant adjectives are” banal, controlled, crisp and orderly”.

If the figure is examined in an overall sense, no marginal gulf appears between the city and the rail transit image. However, the dominant negative association about rail transit shows that the rail transit still does not satisfy the expectations.

The best structure for the overlap of the identities can be examined by the lack of red shaded areas above the active margin or average. However this situation is not identified in the figure. So, one can say that there are diversities between the identity representations of both rows.

If the rail transit shows positive associations in comparison with the city identity, so this situation can be defined as an affirmative development. Yet this is not observed in Ankara situation. In other words, the rail transit of

Ankara does not make positive contributions to the city identity. Worse still, it makes identity more negative. In conclusion, the rail transit does not have satisfactory physical utilities according to user perception, and misses out the positive opportunities.

6.5 Word Cities and Metro Identity Comparison

In the questionnaire, the participants were asked to match the six city names with the colored six metro pictures in terms of the state of belonging to. The result of the question is represented in Figure 6.4. In evaluation of all relevant factors in the question, most of the participants identified or expected Moscow and its metro as a correct match depending on their identical image (%86.2).

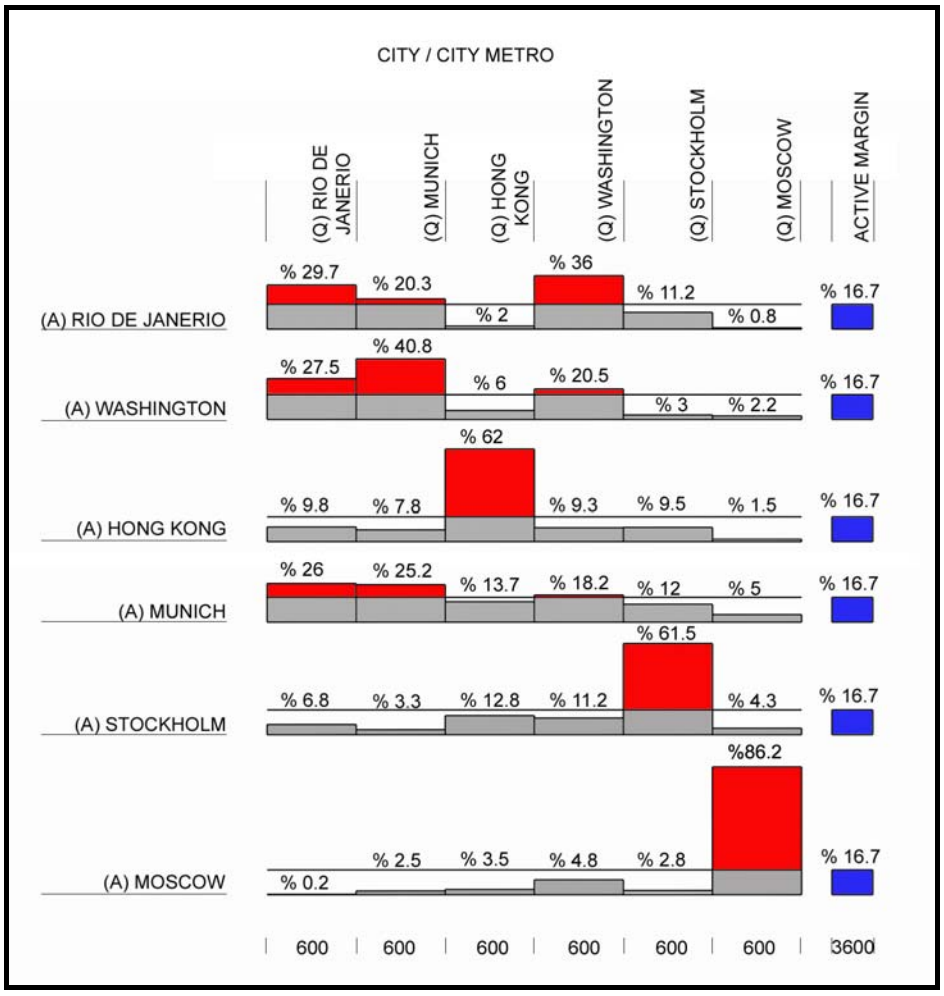


Figure 6.4: The Bertin Graph of World's Metro Identity Comparisons.

In a decided tone, the participants matched Hong Kong and Stockholm correctly with approximate value of %60. The weakest identical match is observed in Washington (%20.5). Quite a few participants confused to portray the match with in the cities of Rio de Janeiro, Munich and Washington.

Consequently the strong identical expression of Moscow became apparent where the few failed in to represent strength of character in the associative memory of the participants.

6.6 Gender / Metro-ANKARAY Perception

The results of Metro-ANKARAY perception are reclassified in terms of gender discrepancy (Figure 6.5). Men profile is acquired a different character from women profiles with the adjectives of uncontrolled, charming, assorted, simple, original, luxury, green, unkept, awful. Women profile is altered from men profile mainly by the adjectives as cheering, freaky, chaotic, average, unidentical, controlled, banal and quiet. Within each gender group of two rows, responded mostly the adjectives of controlled, unidentical, close, passive and crisp. In the analysis of the figure, men profile has more positive opinions about the rail system where women profile seems more unsatisfied.

6.7 Age / Metro-ANKARAY Perception

Both data acquired from the Metro-ANKARAY Perception and age profiles are analyzed with the correspondence analysis. The Bertin graph of the analysis is shown in Figure 6.6. The major difference that is observed between in the graph is the variety between age groups of 35-44 and 25-34, 15-24. The responses of these age groups are diametrically opposite to each other. Much younger groups (25-34, 15-24) define the rail system more old fashioned and dismal where 35-44 group finds rail system dynamic and humanitarian. According to the graph, it is legible that other age groups did not respond with the peak adjective definitions, at variance, they mostly

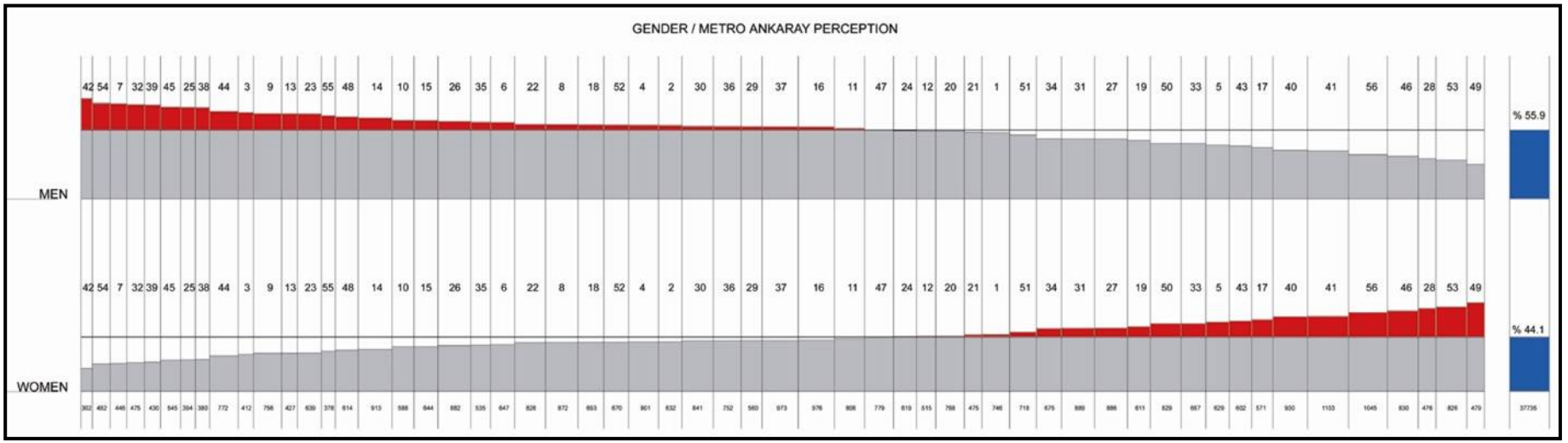


Figure 6.5: The Bertin Graph of Gender and Metro-ANKARAY Perception.

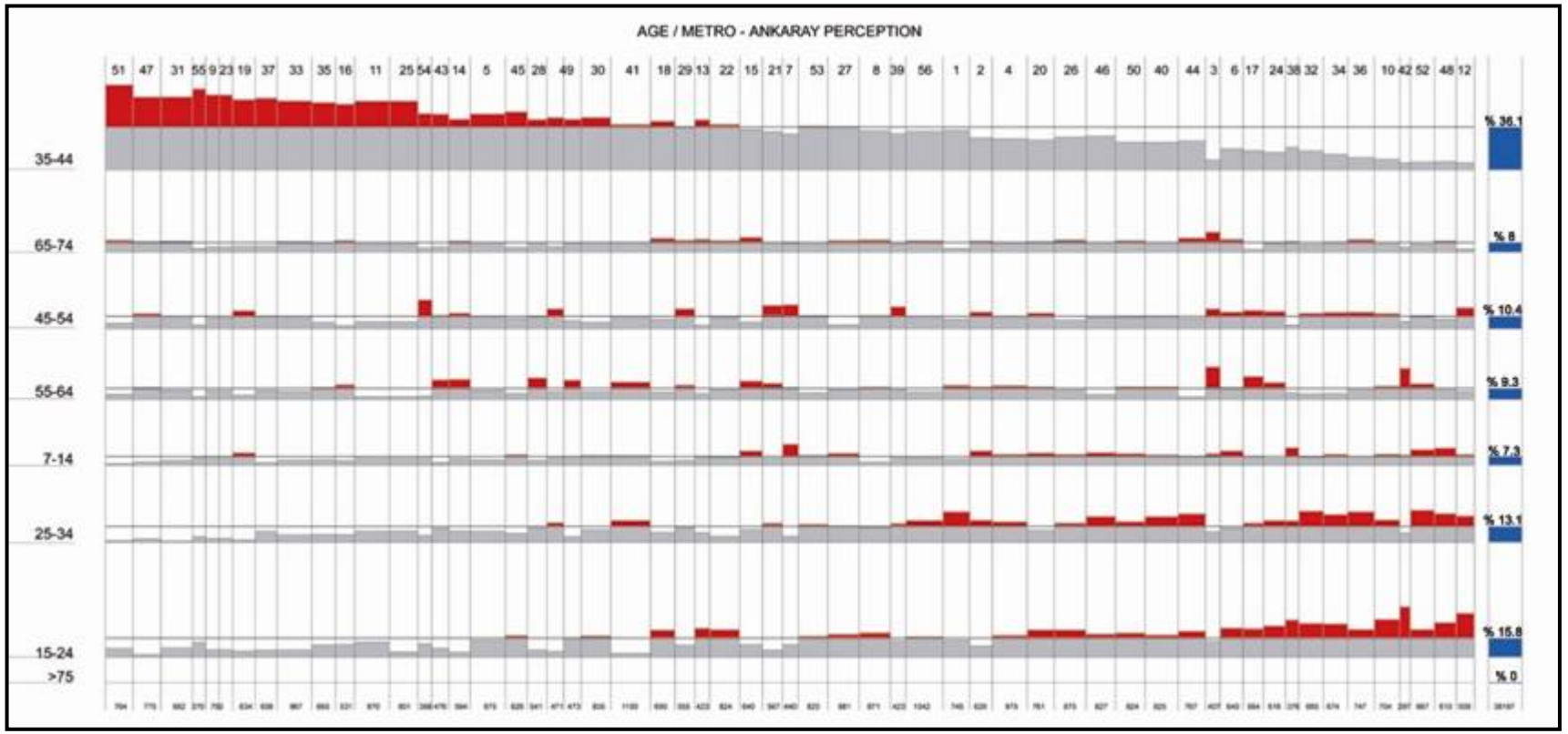


Figure 6.6: The Bertin Graph of Age and Metro-ANKARAY Perception.

respond as “normal” in Likert scale. Therefore, there are limited numbers of red shaded areas above the active margin or average.

For the sake of legibility, the acquired data is simplified by hierarchical cluster analysis with the Ward method. The Ward's method is a hierarchical method designed to optimize the minimum variance within clusters. Ward's method creates clusters of near equal size or character. The algorithm begins with one large cluster encompassing all objects to be clustered. The method searches objects that can be grouped together while minimizing the increase in error sum of squares.

The data about Age / Metro-ANKARAY is clustered by Ward method and the Bertin graph of the hierarchical clusters are shown in the Figure 6.7.

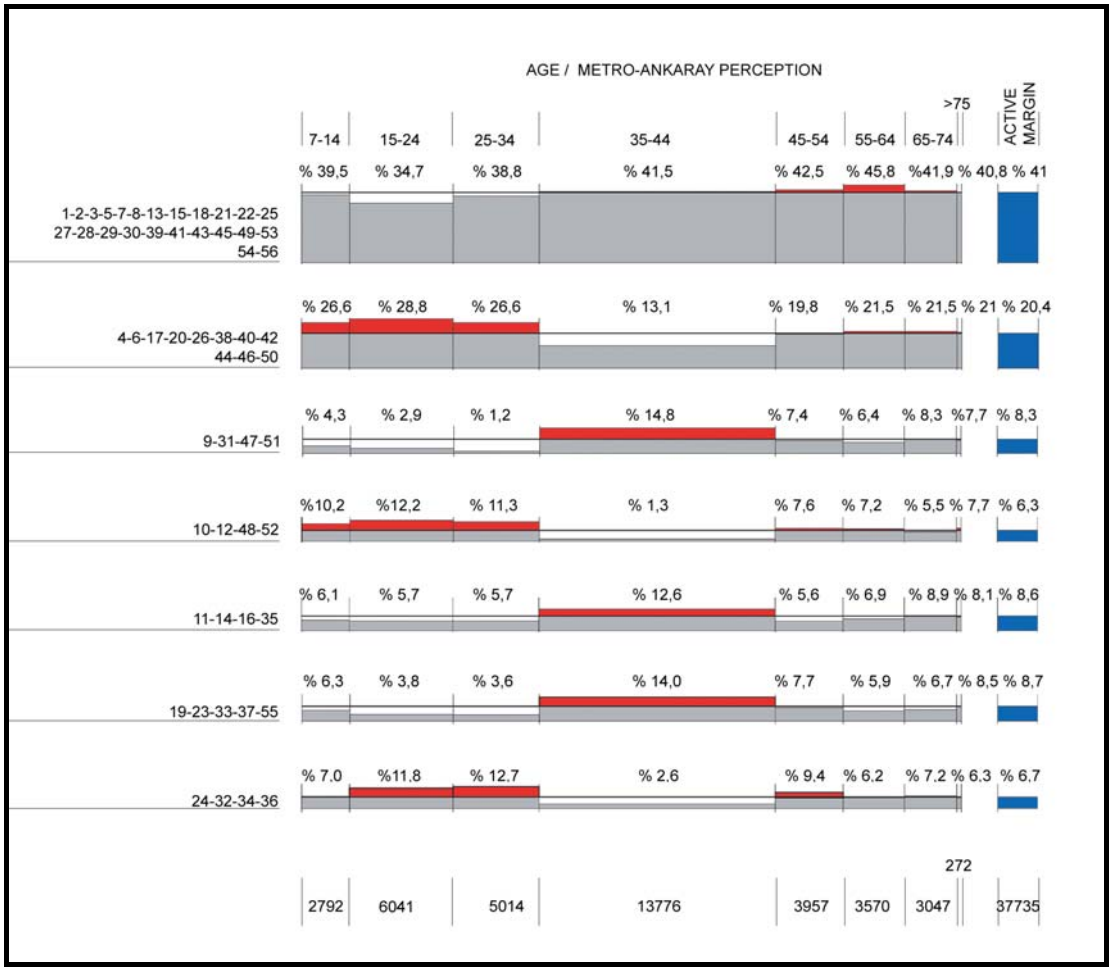


Figure 6.7: The Bertin Graph of Age / Metro- ANKARAY Perception.

The Ward method clustered the adjectives depending on their size but not in statement of fact. On this account the analysis should not be annotate on the meaning of the adjectives but on scores that they gained. According to graph, the third cluster from the top consists of adjectives of clean, complex, new and popular. In interpretation terms, it can be said that the 35-44 age group rather focused on these adjective as well as also responding others. By the same token, these adjectives are more preferred markedly by the age group 35-44.

6.8 Usage Frequency / Metro-ANKARAY Perception

The analysis between usage frequency and the Metro-ANKARAY perception is shown at Figure 6.8. The figure suggests that the adjectives of chaotic, colored, inconsistent, green, unkept, big, dirty, active and disharmonic are closely associated with the minimal frequency. For example, the score of the adjective “chaotic” of the minimal frequency indicates that the rail system has less orientation means for the new users. There is a clear left right dimension of low to high on both minimal and maximal frequencies. The maximal frequency differentiates most clearly along the adjectives of unidentical, controlled, stifling, average and small. Majority of these adjectives cover adverse criticism. Most of the positive attitudes are responded by the relatively low frequencies as Several times / month and Never.

The hierarchical cluster of the analysis is shown at Figure 6.9. This hierarchical clustering process can be represented as a tree, or dendrogram, where each step in the clustering process is illustrated by a join of the tree.

This dendrogram shows relatively homogeneous clusters of adjectives based on measured characteristics. The vertical scale corresponds to the fusion values obtained from the hierarchical cluster analysis. This example illustrates cluster of adjectives 15, 41 and cluster of adjectives 10, 34, 6,18, 56, 30, 51,12 being combined at the fusion value of x, and the vertical axis of the tree reflects the fusion values {x} of all the fusions, drawn to scale. In this

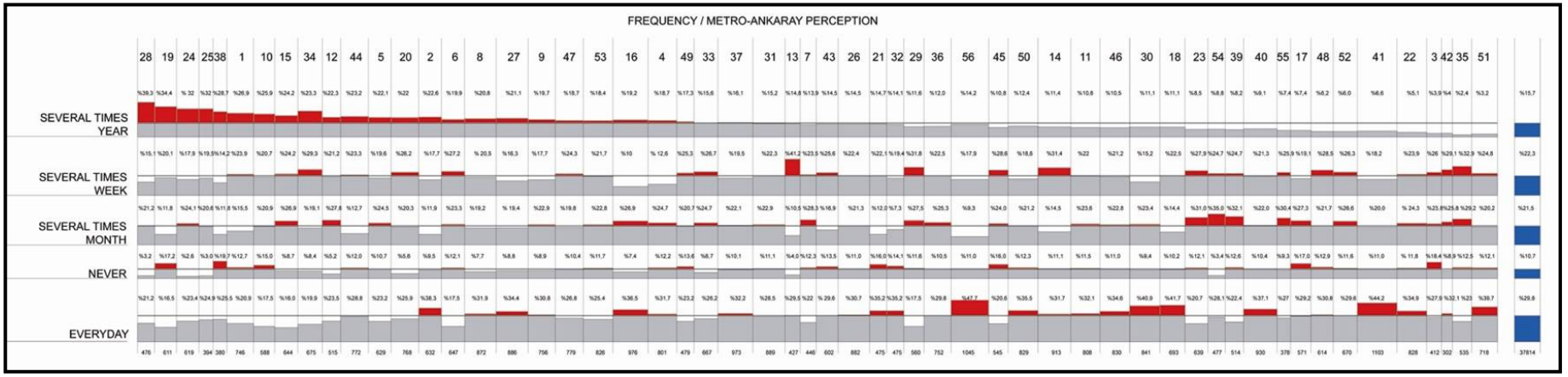


Figure 6.8: The Bertin Graph of Usage Frequency and Metro-ANKARAY Perception.

way, at first sight, one can identify that the fusion intensity by the length of vertical axes.

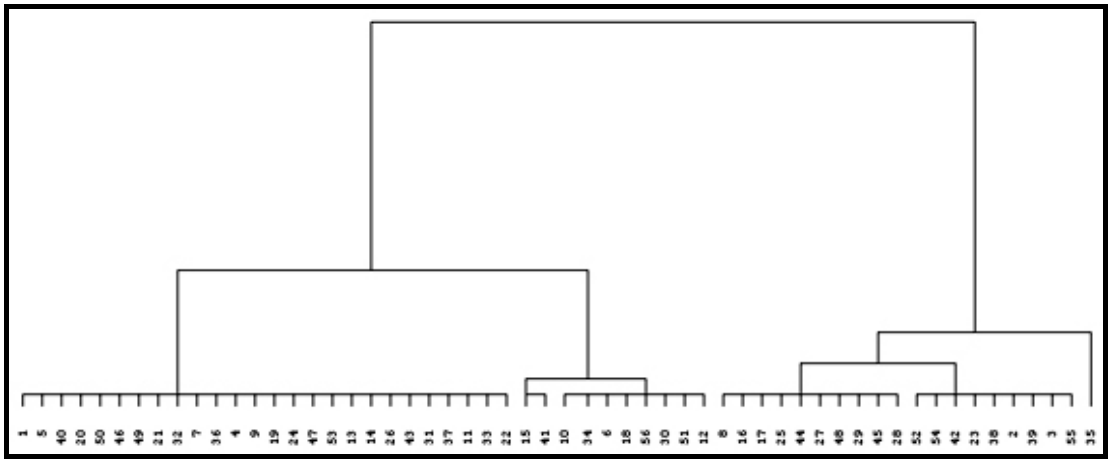


Figure 6.9: The Dendrogram of Usage Frequency / Metro- ANKARAY Perception.

The Bertin type representation of the foregoing dendrogram is illustrated at figure 6.10.

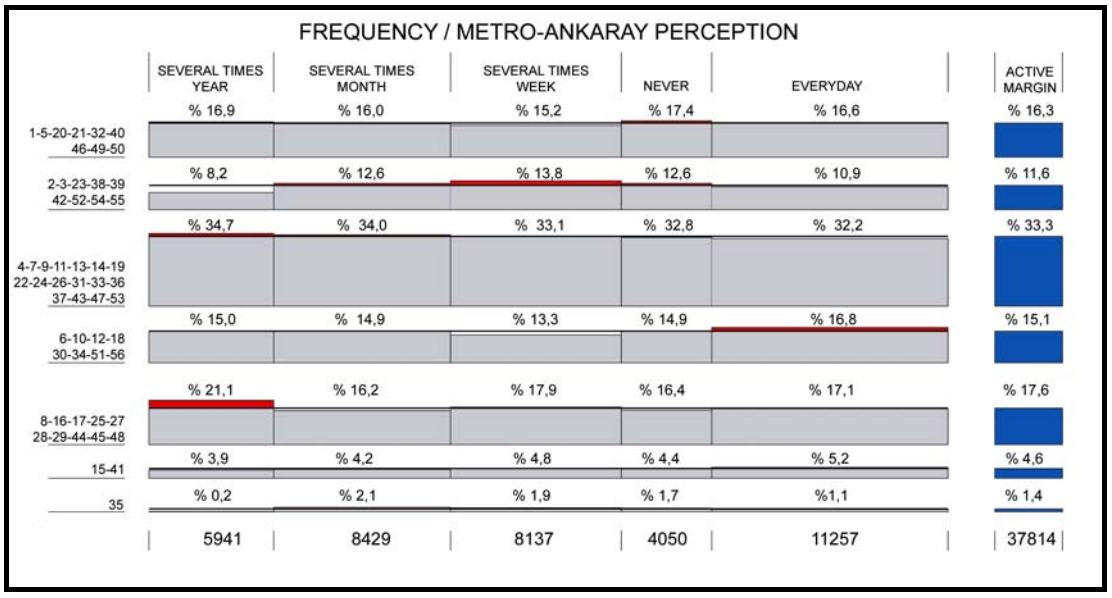


Figure 6.10: The Bertin Graph of Usage Frequency / Metro- ANKARAY Perception.

As the numerical values mentioned above are adjectives, it is difficult to threat of a general attitude encloses the row values seen on the left. The main reason for this is that these adjectives may be very different from each other and moreover be incompatible. So, it would be better to evaluate the

figure 6.10 in terms of frequency. For example, when the everyday-users are analyzed, the adjectives highlighted mostly have both positive and negative attributes. When a further analysis is done, a fact is occurred: While the users belonging to this frequency are traveling by metro because of its popularity, at the same time they are not pleased by its physical structure. On the other hand, the metro is called desolated by these users. Another critique on metro is that it is not widely spread throughout the town. These analyses can be diversified.

6.9 Transportation Choice / Metro-ANKARAY Perception

In the questionnaire, the participants were asked about their basic transportation choices. The analysis between transportation choice and the Metro-ANKARAY perception is shown at figure 6.11. When the figure is examined, an aggregation stands out diagonally from taxi usage to suburban train usage. In a detail analysis, it is seen that the users' choices for transportation are mostly on institutional bus services, school buses, automobiles, and LRT/Metro. It is not strange in such a city like Ankara which has most of the governmental institutions. When the group preferring to use automobiles is examined, it is senn from the the results that they are not interested in metro. However, the group preferring to use institutional bus services also does prefer to use metro. The users of metro mostly find it unkept and dirty, but still express their positive views on it. The system is chaotic when compared to other public transportation means.

6.10 Occupation / Usage Frequency

When the relation between the occupation groups and the metro usage frequency is examined, various differences are found out (6.12). Metro is mostly preferred by low and middle class groups, and students.

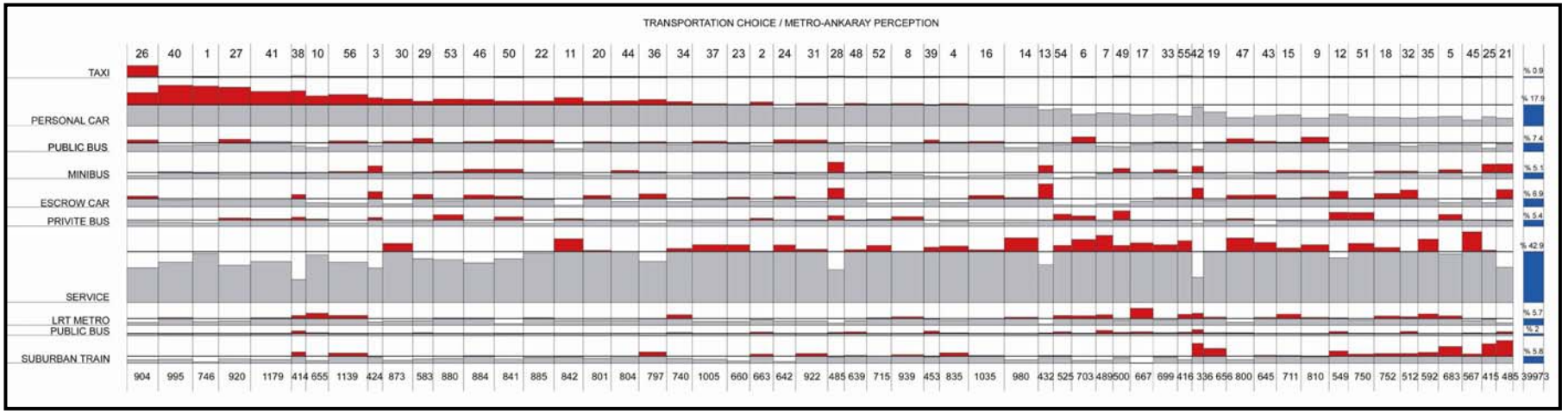


Figure 6.11: The Bertin Graph of Transportation Choice and Metro-ANKARAY Perception.

Other occupation groups such as economists, medical specialists, legists, dealers or employers do not prefer it or rarely use it. Unoccupied people having need of metro, retired people and housewives expressed that they use it a few times a week.

In actual state, the metro has not reached to the desired prevalence in urban scale. If there have been widespread metro lines running all around the city, it would be possible to get different outcomes from this analysis. So, it is important for the outcomes of the analysis that the working places are close by to the metro lines, because the questionnaire conducted working class' routes to their offices do not overlap with the metro lines.

In metro usage, whether it is of economic or social choice, the prevalence of it plays a very effective role. Thus, when a metro is decided to be conducted, the user profile gains importance. In this tendency, the features of the physical spaces and the fee policy have to be considered as much as the lines of the metro. Metro has to be inviting for every income group and be also affordable.

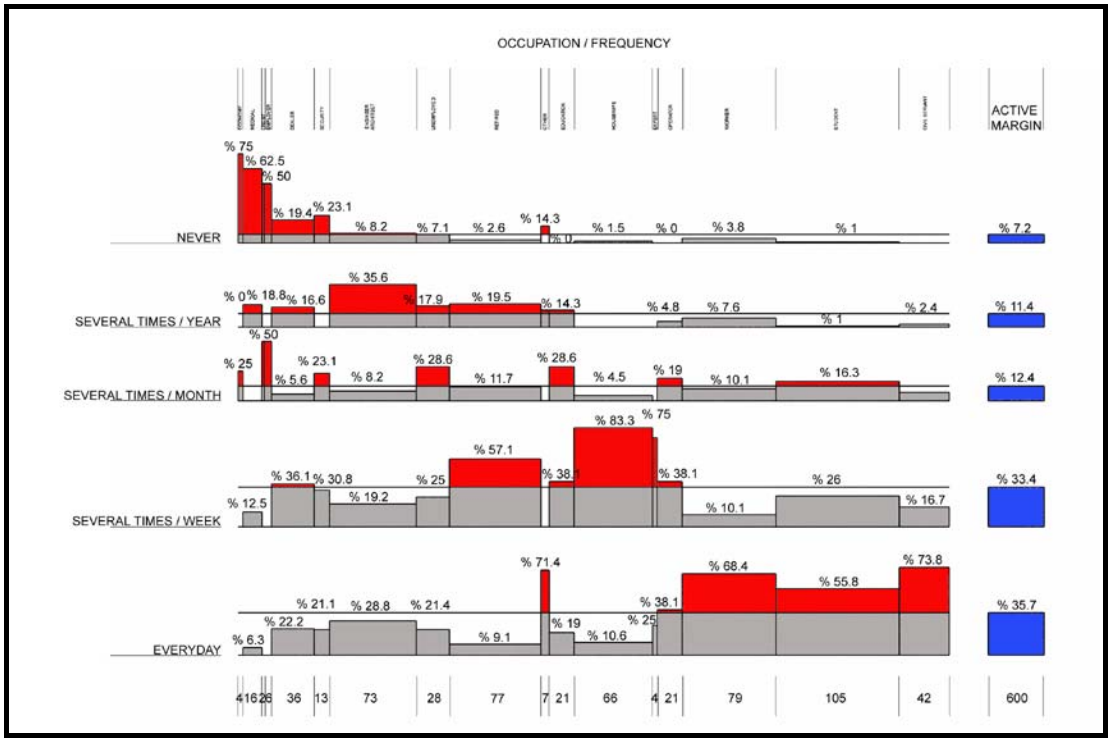


Figure 6.12: The Bertin Graph of Occupation / Usage Frequency.

6.11 Station Recognition / Usage Frequency

Within the limits of the questionnaire, an interior picture of the ANKARAY Maltepe station has shown to the participants and wanted them to choose the right answer among eight different choices. Four of the choices are of ANKARAY stations, three of them are of Metro stations, and one is of an ongoing station construction on M2 line (Figure 6.13). Everyday users have realized that the picture belongs to one of the ANKARAY stations but only 46.2% of them have given the correct answer, and only few of them has reported it as one of the Metro stations. This result is most probably come out from the different color-coding of ANKARAY (as green) and Metro (as red). Everyday users are also aware of the new ANKARAY station, which is called MTA and is still under construction. Despite the low percentage of correct answer, participants using the subway a few times a week have answered the question alike. As this result is not seen in the other groups, it is more likely the opposite of the outcome mentioned above. Moreover, it is strange that the nonusers have attained the picture to the nonexistent station, MTA.

In the analysis, AŞTİ station has right to be examined separately as it is connected with the intercity bus station, AŞTİ. Because of this reason, most of the city dwellers are made to use this station unavoidable. For the infrequent users, the AŞTİ station could be a memory souvenir figure for the overall system and this, perhaps give raise this station to get higher scores. If the figure is examined on the whole, it can be said that there is a linear relationship between the station recognition and frequency. First of all, however, one of the most the important thing is to increase the capability of all the users to recognize the stations by differentiating them.

It is interesting that the stations are confusing for even the passengers of Ankara subway system which does not have a complicated network. Because the subway stations are similar to each other and they can only be differentiated by passengers according to their color coding or structure as elevated, underground or ground levels.

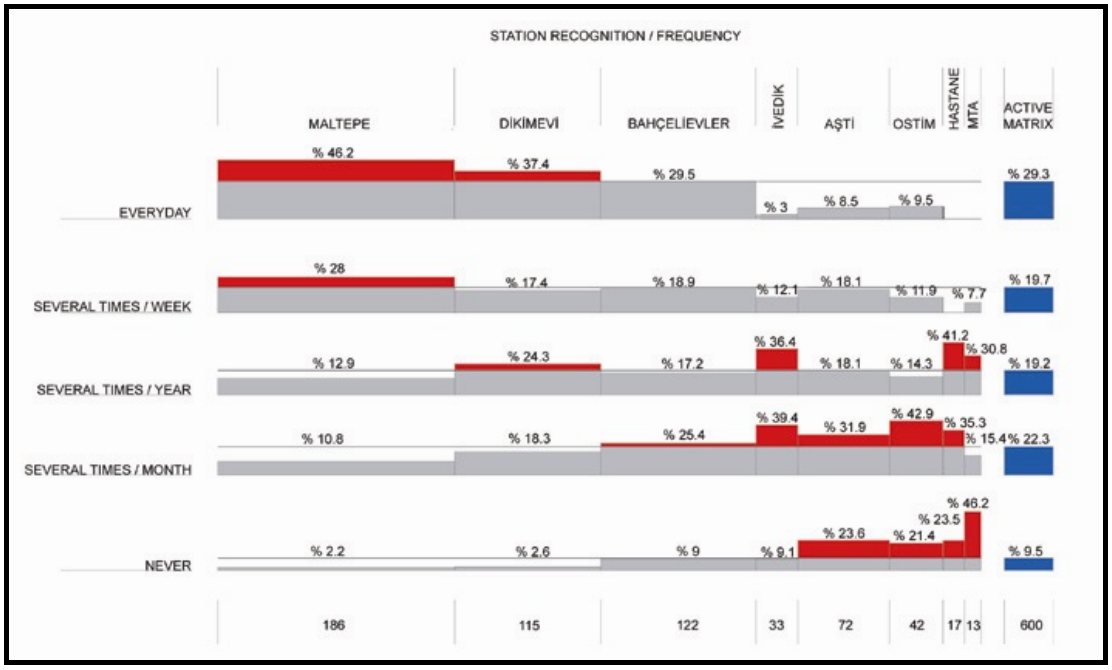


Figure 6.13: The Bertin Graph of Station Recognition / Usage Frequency.

6.12 Color Recognition / Usage Frequency

Equally, the participants are asked to find right color of the Akköprü Station on M1 line. Each participant answered questions by selecting an answer from the options. The right answer was red. The analysis between color recognition and the frequency is shown at figure 6.14.

According the Bertin Graph, similarly same situation is examined as in foregoing case. Namely, there is a noteworthy relation between the frequency and color recognition. The number of correct answers is more in higher frequencies, whereas there are few in low frequencies. In a novel tone, a definite amount, many of the everyday users responded as blue in an erroneous manner.

The color brown is scored high in the overall questionnaire. Brown, when used as a general term, is a color which is a dark orange, red or rose, of very low intensity. On this account, there is a high probability to confuse brown with red.

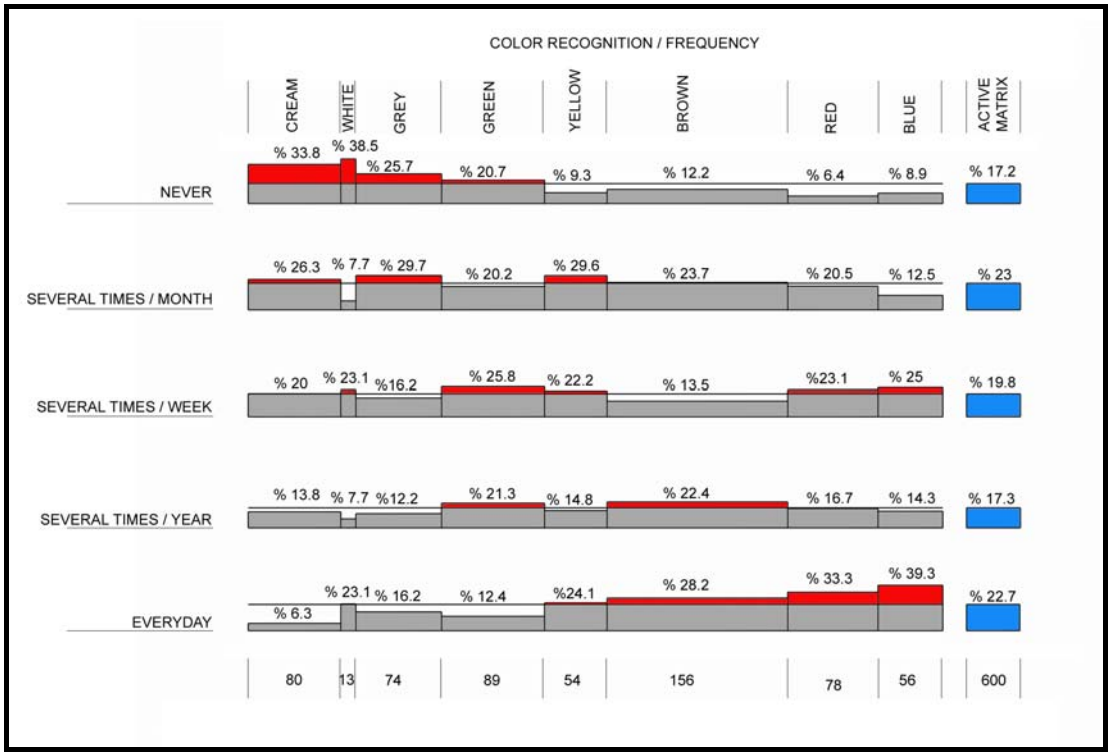


Figure 6.14: The Bertin Graph of Color Recognition / Usage Frequency.

That means, depending on the analysis, the color coding is not sufficient enough to differentiate the stations. There should be some other identical clues for the passengers to recognize the stations in their mental map.

6.13 Driving license / Usage Frequency

In the questionnaire, the participants were asked about their driver license and the data is analyzed by correspondence analysis (Figure 6.15). The Bertin graph indicates those without driver license are frequent users. As expected, those with driving license depict a totally different profile.

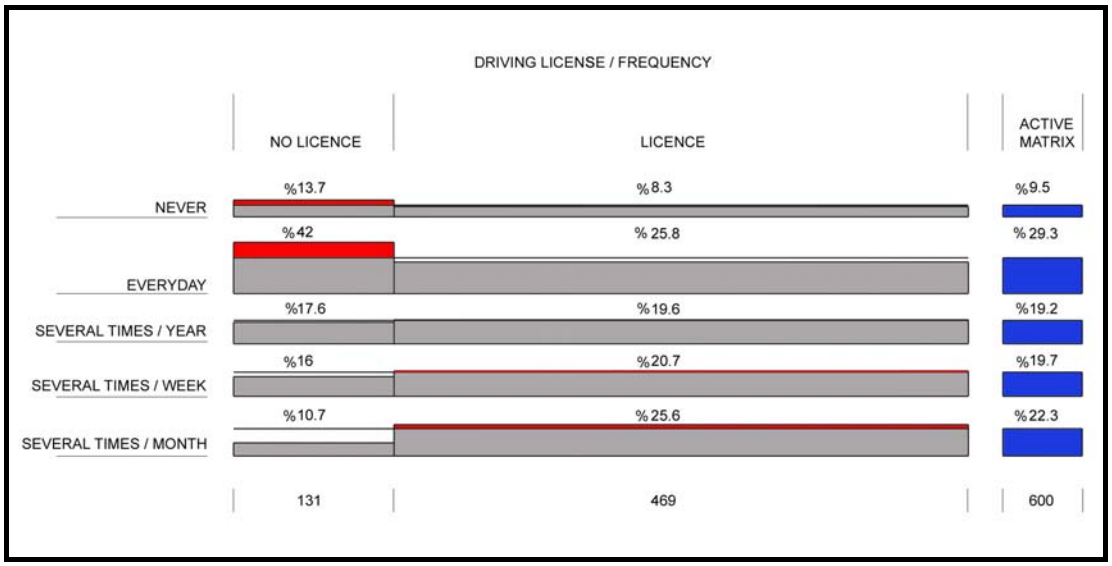


Figure 6.15: The Bertin Graph of Driver License Ownership /Usage Frequency.

It is of course difficult to correlate and equate driver licenses car ownership. However there are regulations and promotions to use of metro as the first transportation choice. In this regard, municipalities and local authorities should pay attention to the design features of metro to make it more attractive.

The metro should not be preferred as a quasi obligations. It should be preferred because of it is rationale, efficiency and human friendly atmosphere.

Another contribution for the scope of the study is the official web site of Ankara Electric, Gas and Bus Operations. Ankara Electric, Gas and Bus Operations asked its web site visitors for their choice about public transportation. In respect of results, %67.74 of respondents prefers Metro, where % 23.94 favors bus and remains use minibuses.

According to the survey polls of the web site, the %54.98 of the 49325 respondents emphasized that the Ankara Metro enhanceed their life quality where %45.01 responded negatively. The number of negative votes is imperesive. The causes of this dissatisfaction should be interrogated. Likewise, another survey poll about ANKARAY at the same web site shows

that the %50 of the ANKARAY passengers are satisfied by the system where % 36.54 of them responded that there can be improvements. % 28.62 respondents answered as “perfect” for the cleanliness of the station where as % 15.22 found it “awful”.

CHAPTER 7

CONCLUSIONS

The research symbolized in this thesis addresses the problem mainly on metro stations and their interactive with passengers. After years of research in this field, several contributions toward the resolution of this problem have been made. Now, it is useful to discuss some general conclusions here, as well as further efforts that could stem from that presented in this thesis. Certainly, the conclusion that will be drawn here will stand in the boundaries of the sui generis limits of the research.

The research in this thesis introduces several interesting topics. The first portion of this thesis discussed the great potential of underground as a space. The chapters 2 and 3 focused the underground and its effect in human culture and its utilization for economy and to satisfy city needs. Later, the research displayed the underground utilization for transportation purposes and introduced railway and underground transportation in historical sense. The world experience on city scale railway transportation is enriched with the national one. Chapter 4 represented the current state of railway transit in Turkey's cities. After this representation on the urban railway systems, the chapter mentioned about stations and searched for the functional, physiological, and psychological and safety criteria that should be take into account. The method, in Chapter 5 developed on the basis of semantics by adjectives to express general impression about stations and Correspondence Analysis for evaluation; besides Bertin Graphics for representation of findings. Chapter 6 summarizes the main findings of this study and draws out their implications as well as informing about actual web based polls conducted by the municipality.

After highlighting these sections in brief, a few conclusions can be drawn. This thesis set out to find out a widely held belief about the underground at first. The aim was to get a better perhaps more comprehensive understanding of the concept of underground as a whole. So, the investigation was fairly extensive and covered a wide range. One of the most interesting observations researcher made through this thesis's unique course of research was that many of the cultures' response mirrored that the underground, itself, is a part and parcel of life during all times. With this in mind, the findings about underground described in this thesis showed that underground served as a space of fear, mystery, fantasy and a place of refuge during all centuries. In this regard, this result demonstrates the important role of a paradigmatic shift in underground utilization design. It should be noted that the any design attempt in underground should regard this common cultural collection as well as with state-of-the-art technology in practice. Because of this reason, there still exist negative associations about underground which are being nourished from past.

While a philosophical research was focused on the analysis of existing concepts of the underground, the importance of underground utilization is stressed in the context of research as has been discussed in the Introduction to this thesis. One of the two main goals of the research described in this thesis was to explore the potential of underground utilization. The findings suggests that not only can economic reasons change understanding depending on the lack of space in urban scale, as Hénard identified, but also within the discovering the advantages offered by underground utilization within itself. On this account, the concept of vertical city is introduced and justified by spatial myopia because of higher pressure in land use of urban land. The research work presented in this subject is developed and implemented by several motives. First, the underground is a valuable space not only for infrastructure purposes. Second, opinion leaders should pay more attention to the utilization of underground spaces by three-dimensional thinking. However, as seen in the first chapter, as with other types of settling areas, underground utilization cannot be treated simply as if it is a threshold

in vertical axis, or as if it is object to be perceived without physiological needs; but also a space of possibilities and more human friendly environment.

Metro is a well known example. On this account, the thesis paid a notable amount of attention to this subject by it's history and recent developments in global and local scale. Within the period covered by this research, an obvious and continuous interest to the metro can be observed in the global experience. However, local interest on the subject delayed because of different political choices. The rapid growth of Turkey's cities and related problems necessitated the subject. In such case, each city which is in metro threshold wished for the metro ownership, some succeeded others is still struggle with financial problems and technical difficulties caused by existing physical circumstance at the above. Therefore major handicaps of local metro experience which are running throughout the chapters of this thesis can be listed as follows:

- Lack of well-balanced distribution between transportation choices in cities, encouraging and domination of car ownership,

- To pretend not to see the prescribed plans or continuous revisions,

- Starting constructions without enough source of financing, exceeding the prescribed construction periods or even stopping constructions because of money gaps.

- Problems or delays in bidding and construction periods,

- Basic motivation is only limited with an "operating" metro ownership, the perception of metro is just qualified as a technical problem, and lack of diligence usual in design of stations and other utilities or yield it as secondary.

At the outset of the research, the study was initialized by the author's curiosity on the metro and its station design. Therefore, there should be a deeper investigation of the railway / metro literature and the station / underground space design combined with considerations on actual metro practices. The two bodies of literature seemed to focus on other issues than linkages between station design and human dimension. First, the literature on railway / metro focuses on technology and economy and pays little attention to station design upon which passenger satisfaction supervene. Thus, primarily this is concerned with functional, physical, physiological and safety dimensions 'added' to stations by design. As a result, this stream of research holds the design dimension constant. Secondly, the station / underground space design focuses on development of new functional trends and thus, one would intuitively expect development of line extensions to be an integral part of this stream of research. However, mostly the station / underground space design literature ignores again station designs in psychological and identical sense. In sum, it thus seemed that both streams of literature told part of the story on how to identify, evaluate, and develop metro and/or line extensions and stations. Barely, any of them seemed to offer the 'whole' story. As a result, the purpose of the study was to offer a 'better' story or more precisely on psychology and identity.

Because of its highly subjective nature, it is difficult, if not impossible to evaluate the overall *quality* of an architectural production, in other words metro stations. For this purpose, a questionnaire is conducted to the passengers of Ankara Metro and ANKARAY. Data collected were used to provide an explanation of the constructive processes of the criteria debate. According to the general results, the participants are not truly satisfied with design of stations. This dissatisfaction is mostly reasoned by the physical structure of the stations and expressed by psychological complaints. Besides, the urban rail network of the city is not at wished level.

On this account, the design of stations deserves compulsory interest in means of functional, physical, psychological, safety and identity. There are

two kinds of need for this endeavor. First one is financing. Firstly, the municipalities which have enough budgets should engage in metro business. Otherwise, lack of financing becomes an assignment of reasons for being behind the project schedule and poor or inadequate quality as a matter of habit. Second need is consciousness. This consciousness is two-sided. One side of the commitment is in the charge of municipalities. On the other hand, other is society itself.

Above all, the basic motivation of the municipalities should not be just an “running” metro. In the scope of motivation, municipalities should seek for possibilities to reflect the accumulation and identity of society and city through metro. This important case is essential by two reasons: First, it registers the state of metro belonging to that city. Second, it gets off to a good start and prevents higher cost in ulterior revisions differently starting from a scratch.

If the society becomes conscious, then they will have a voice in the process to represent themselves in this important public place. Will-power of the society will create a choice for them to represent themselves out of a space. For those reasons, the metro design should be transformed into a public place of possibilities and representations by the participatory processes of all interveners.

The design of the metros stations should fit to the identity of the city because the collective identity demands that the each component be considered as part of dynamic relationship as in Gestalt. This relation should be constructed not only in functional base but also in from. Whether the foregoing “desire for distinguishing expression” collides with the current approach; the main need is perceptual invariance based on same statement. In design, these variances can be expressed by elastic deformations in form, different lighting and different component features. By this way, the station emerges and harmonizes with the general system. Another important point in design can be facilitated by reification of design elements. In reification, the passengers

could construct an apparent image of above and whole with the help of clues or design element that are used in the design. However, the specific identity of stations should not be destroyed or distorted for the sake of reflecting of above. It is a matter of balance. The main goal is to reflect the station and above simultaneously by multi-stable perception. This elicits a dual alternated identity by creating variances in terms of perceptual reveals.

7.1 Ankara

As the city identity is multidimensional, there is not just one city identity, there are characters and personalities. The adjectives mentioned characterize city dweller's relationship to the urban environment, but at the same time they describe what it means to live in a city; that is, they characterize humans as city dwellers and city identity.

In the context of the study, the Ankara case also encloses several interesting results for Ankara. As the formation of identity is not limited with the physical framework, the capital Ankara deserved an independent analysis according to its national and international political, economical, social and cultural values.

The relationship of present to past is neither a question of simply going back, it is a continuous exploring of the hidden intersections, and dysfunctions, between the two-time spans. So to represent the dynamic and flexible nature of urban identity the study contained an evaluation of adjective based analysis based on residence frequency.

According to the results of the case, Ankara does not harbor the liveliness of being a capital city in itself. In a sense, in spite of continuous changes, it still protects its administrative monotonous identity. The ordered and controlled city image provokes city as passive and banal. Therefore the city should be rid of these imputed negative associations.

The conflicting evidence of fewer frequencies in residence refers to a lack of common opinion. In one way this group has expectations and these expectations can transform to a potential if they are understood and satisfied in a positive manner. As the development of the city is absorbed negatively by higher frequencies, the negative effects of the developments should be minimized. Nevermore, the city is perceived as un-identical and desolate by non residential group. So the external representation of the city is still problematical. Considering the conservation of the it's republican and nation state identity and current way of approaching to the it's public spaces, these type of reference indicators can serve as guiding principles to Ankara.

7.2 Limits and Further Studies

Before the results are discussed and recommendations made, it is useful to highlight some of the limits the researcher faced in conducting this research.

The present study has certain limits that need to be taken into account when considering the study and its contributions. Yet the study focuses on the individual subjective responses it has only one of its kind limits. This study has focused on a phenomenon that is a very extensive and major one, that is the metro and its stations. Clearly, this represents a challenging task for research regardless of the more specific interests the study may have. In this study, this extensive and complex phenomenon has been studied from a narrow empirical perspective. Selecting the single case study design naturally brings forth many limits as far as the generalization of the results of the study is concerned. On the other hand, this also represents the whole idea of making a case study. By understanding something about this particular case more in-depth, we might eventually also learn something about more general phenomena.

A limit of this study is the perspective adopted. Instead of trying to understand the whole design and performing of stations in general, this study has been first and foremost limited to the metro user's perspective. Although

the study has also considered other views along the theoretical analysis, the main perspective from which conclusions are drawn is that of the user. This can thus also be seen as a limiting cause in this study.

Another limit can be mentioned as the sample number of the questionnaire. Aspects of modeling and data were inadequate in some areas because data were lacking and the models used could not simulate all relevant aspects of the missions. The sample size in the study corresponds to %1 of the total daily random metro users. In the further studies, it is recommended to increment percent to %5 for more accurate result that covers the more sententious sample size. In this way, according the results of the study, the municipality will have a chance to improve its daily and routine services not only for metro but for the whole city.

In the context of the study, the perceptions of the stations are handled about general opinion of Ankara. This is favored because of the similar station architecture in the system. However, each station can be identified and analyzed by its peripheral context, so they each could be examined individually. The next step would be to identify the interconnections between the stations and to model a general view as interplay of these elements. Metro stations are located on the different characteristic spaces of the city. Therefore, to research on periphery of each station has a great potential to identify the relationship between different urban characteristics and station identity.

In Ankara, the metro station architecture is not a popular discussion in common opinion. Most of the argumentations focus on the route, schedule and financing of metro. So, there are limited numbers of academic research on this issue. Also most of the researches on public places are tend to above ground structuring. For this reason, a respectable number of academic interests on underground and metro station as a public place are needed for a comprehensive analogy.

A few barriers restricted the number of Bertin Graphics available. These limits are mostly accumulated on personal data as income. The results of the questionnaire are represented accordingly to the sincerity of samples in mind but several incongruities in answers are observed as bias.

Criticism can also be presented concerning the way the theories are applied in this study. Various extra theoretical perspectives would also need attention based on this research as research of aesthetics, financing and urban macro form and history. Thus, to apply these theoretical perspectives remain important avenues for future research on the theme of this study.

7.3 Recommendations

The conclusions as well as the limits of this study also bring forth some fruitful and interesting possible avenues for future research that might be needed towards the theme of the study. The most important avenue for future research obviously lies in continuing the elaboration of the metro stations of the in urban transportation. A more thorough understanding of the underground from the user's perspective could be achieved by considering the connections, hierarchies in design choices and interplay of the process more exactly.

According to the research results, some recommendations on the metro station design can be made. The recommendations can be fall under three headings:

1- According to Design Process
2- According to Design Criteria
3- According to Operational Process

Design Process

a. Each municipality has its own implementing regulation. However, implementation decision should be made by an expert body to expel waste of resources and time.

b. In the construction process, routes of the system are tendered to the contracting firms. Occasionally, contracts include station designs and construction as a contractual clause. In this way the contracting firms are authorized in station designs.

c. Municipalities can organize competitions for the design of the stations.

d. Municipalities can employ different architects or offices for each station design.

e. The design of the stations can vary under a common design statement or style.

f. The municipalities can make public aware of station design to ask their opinions. So this try can cause a great excitement in public because of participation.

Design Criteria

a. Feasibility study and design are two important factors in station design. In metro station design, each two stand in the forefront due to underground construction. The architectural design should be aware of standards and norms as far as possible like in form and aesthetics.

b. In station design chaos/ mass psychology (Panic theory) should be taken into account.

c. Individual psychology should be considered. Although the main argument in station design focuses to circulation of the passenger,

design motto should also attach importance to individual psychology, physiology and safety.

d. Entrance design should be distinguishing and inviting.

e. The color coding in similar stations is insufficient in acquiring a different station characters. Dissimilarity should be realized by different architectural touches.

f. The urban characteristic at the above should be reflected in underground as far as possible.

g. The designs should not be influenced by politics; it should be in a continuum.

h. The design should expand wide galleries and allow to sunlight to reach them. The passengers should feel three dimensional experience by volume in halls and stratification in levels

Operational Process

a. As the problem-free transportation is the primarily purpose for stations; they should not transform to an economic rent.

b. Whether the municipality holds the rights of the property, the stations, first, should serve to satisfy economic, social and cultural objectives of the society.

c. As the stations are a public place, they should enable public to express and socialize and share itself.

From this summary of findings from the main text, it is possible to draw together an answer to the central question. It can be said that the design of metro stations has an important role to eliminate psychological and physiological drawbacks in underground space. For this a sincere consciousness is needed. Second, design considerations of metros are highly related with the life-cycle and formation of urban local identity. To achieve this, participation of both shareholders and a disclosure policy should be provided.

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APPENDIX A

Table 1.Major Grouping of Underground Structures (Source: Carmody, Sterling 1987)

MAJOR GROUPING	**MAJOR SUBCATAGORIES**		
FUNCTION		PEOPLE ORIENTED	PRODUCT ORIENTED
	RESIDENTAL	SINGLE FAMILY MULTI FAMILY	
	NONRESIDENTAL	RELIGIOUS RECREATIONAL INSTITUTIONAL COMMERCIAL	
	INFRASTURUCTURE	**TRANSPORTATION OF PASSANGERS**	TRANSPORTATION OF GOODS UTILITIES ENERGY DISPOSAL MINES
	MILITARY	CIVIL DEFENSE	MILITARY FACILITIES
GEOMETRY	TYPE OF SPACE FENESTRATION RELATION TO SURFACE DEPTH DIMENSIONS SCALE OF PROJECT		
ORIGIN	NATURAL MINED END USE		
SITE FEATURES	GEOGRAPHY CLIMATE LAND USE GROUND CONDITIONS BUILDING RELATIONS		
PROJECT FEATURES	RATIONALE DESIGN CONSTRUCTION AGE		

APPENDIX B

Table 1. World Metro List (Length) (Source: Rohde, 2007)

CITY	LENGTH (KM)	STN	STN (*)	L	KM/STN	KM/L	STNS/L
TOTAL	8110.41	7747	7020	492			
London	421.00	382	275	12	1.53	35.08	31.83
New York	370.00	468	468	27	0.79	13.70	17.33
Tokyo	292.20	274	202	13	1.45	22.48	21.08
Seoul	286.90	348	298	10	0.96	28.69	34.80
Moscow	277.90	171	138	12	2.01	23.16	14.25
Madrid	226.90	237	188	13	1.21	17.45	18.23
Paris	211.99	381	297	16	0.71	13.25	23.81
Mexico City	201.70	175	147	11	1.37	18.34	15.91
Washington	171.20	90	86	5	1.99	34.24	18.00
Mumbai	171.00	73	73	5	2.34	34.20	14.60
San Francisco	166.90	43	43	5	3.88	33.38	8.60
Chicago	166.00	151	144	8	1.15	20.75	18.88
Berlin	144.10	192	170	9	0.85	16.01	21.33
Osaka	115.60	111	89	7	1.30	16.51	15.86
Beijing	114.00	68	64	4	1.78	28.50	17.00
Singapore	109.00	69	64	3	1.70	36.33	23.00
Stockholm	105.70	104	100	3	1.06	35.23	34.67
Barcelona	104.80	145	123	9	0.85	11.64	16.11
Saint Petersburg	103.30	59	52	4	1.99	25.83	14.75
Hamburg	100.70	97	89	3	1.13	33.57	32.33
Hong Kong	91.00	62	51	5	1.78	18.20	12.40
Munich	86.00	96	91	6	0.95	14.33	16.00
Shanghai	82.80	79	73	5	1.13	16.56	15.80
Nagoya	81.60	93	82	4	1.00	20.40	23.25
Atlanta	79.20	39	38	2	2.08	39.60	19.50
Newcastle	76.50	60	59	2	1.30	38.25	30.00
Taipei	74.50	64	61	7	1.22	10.64	9.14
Milan	73.80	88	84	3	0.88	24.60	29.33
Santiago de Chile	72.90	83	78	4	0.93	18.23	20.75
Busan	72.00	90	86	3	0.84	24.00	30.00
Tianjin	71.98	37	37	2	1.95	35.99	18.50
Toronto	71.30	74	69	4	1.03	17.83	18.50
Cairo	65.50	55	53	2	1.24	32.75	27.50
Montreal	64.00	70	65	4	0.98	16.00	17.50
Kuala Lumpur	64.00	60	56	3	1.14	21.33	20.00
Bucharest	63.00	46	40	4	1.58	15.75	11.50
Philadelphia	62.00	66	62	3	1.00	20.67	22.00
Delhi	61.70	56	54	3	1.14	20.57	18.67
Vienna	60.50	86	75	5	0.81	12.10	17.20
Boston	60.50	66	60	3	1.01	20.17	22.00
Saint Louis	60.50	27	27	1	2.24	60.50	27.00
Oslo	59.00	68	68	5	0.87	11.80	13.60
Kiev	58.80	45	42	3	1.40	19.60	15.00
Sao Paulo	58.40	57	54	4	1.08	14.60	14.25
Frankfurt	57.27	28	28	7	2.05	8.18	4.00
Rotterdam	55.00	37	36	2	1.53	27.50	18.50
Prague	54.70	54	51	3	1.07	18.23	18.00
Daegu	53.90	56	55	2	0.98	26.95	28.00
Guangzhou	52.81	44	39	4	1.35	13.20	11.00
Athens	52.00	48	44	3	1.18	17.33	16.00
Caracas	50.70	45	41	4	1.24	12.68	11.25
AVERAGE	50.69	47.82	43.33	3.06	1.15	15.88	14.25
Vancouver	50.00	33	32	2	1.56	25.00	16.50

Sapporo	48.00	49	46	3	1.04	16.00	16.33
Manila	45.70	42	39	3	1.17	15.23	14.00
Lille	45.50	62	60	2	0.76	22.75	31.00
Cologne	44.90	51	51	15	0.88	2.99	3.40
Yokohama	44.44	38	37	2	1.20	22.22	19.00
Bangkok	44.00	44	40	3	1.10	14.67	14.67
Valparaiso	43.00	20	20	1	2.15	43.00	20.00
Buenos Aires	42.70	69	63	5	0.68	8.54	13.80
Amsterdam	40.00	33	33	4	1.21	10.00	8.25
Rome	37.40	49	48	2	0.78	18.70	24.50
Lisbon	36.90	48	44	4	0.84	9.23	12.00
Bilbao	36.39	34	34	2	1.07	18.20	17.00
Tashkent	36.10	29	26	3	1.39	12.03	9.67
Miami	36.00	22	22	1	1.64	36.00	22.00
Kharkov	35.40	28	25	3	1.42	11.80	9.33
Rio de Janeiro	35.33	33	32	2	1.10	17.67	16.50
Porto Alegre	33.80	17	17	1	1.99	33.80	17.00
Budapest	33.00	42	40	3	0.83	11.00	14.00
Brussels	32.20	60	58	3	0.56	10.73	20.00
Brasilia	31.00	14	14	1	2.21	31.00	14.00
Cleveland	31.00	18	18	1	1.72	31.00	18.00
Kobe	30.60	26	24	2	1.28	15.30	13.00
Tehran	30.00	31	30	2	1.00	15.00	15.50
Baku	29.90	20	19	2	1.57	14.95	10.00
Fukuoka	29.80	35	34	3	0.88	9.93	11.67
Lyon	29.50	42	38	4	0.78	7.38	10.50
Recife	29.30	22	20	2	1.47	14.65	11.00
Medellin	28.80	26	25	2	1.15	14.40	13.00
Kyoto	28.80	30	29	2	0.99	14.40	15.00
Nuremberg	28.20	42	40	2	0.71	14.10	21.00
Belo Horizonte	28.13	19	19	1	1.48	28.13	19.00
Naples	28.00	26	25	2	1.12	14.00	13.00
Los Angeles	28.00	16	16	1	1.75	28.00	16.00
Minsk	27.60	23	22	2	1.25	13.80	11.50
Valencia	26.90	30	30	2	0.90	13.45	15.00
Tblisi	26.30	22	21	2	1.25	13.15	11.00
Baltimore	24.50	14	14	1	1.75	24.50	14.00
Guadalajara	24.00	29	28	2	0.86	12.00	14.50
Ankara	23.10	23	22	2	1.05	11.55	11.50
Monterrey	23.00	25	24	2	0.96	11.50	12.50
Incheon	23.00	22	22	1	1.05	23.00	22.00
Pyongyang	22.50	16	15	2	1.50	11.25	8.00
Stuttgart	22.50	17	15	2	1.50	11.25	8.50
Sydney	22.06	14	14	3	1.58	7.35	4.67
Porto	21.70	15	14	2	1.55	10.85	7.50
Nanjing	21.70	16	16	1	1.36	21.70	16.00
Shenzhen	21.50	19	18	2	1.19	10.75	9.50
Helsinki	21.00	16	16	1	1.31	21.00	16.00
Chongqing	19.50	18	18	1	1.08	19.50	18.00
Marseille	19.30	26	24	2	0.80	9.65	13.00
Hiroshima	18.40	21	21	1	0.88	18.40	21.00
Kryvyy Rih	18.00	12	12	1	1.50	18.00	12.00
Bursa	17.50	17	17	2	1.03	8.75	8.50
Dortmund	17.50	24	23	2	0.76	8.75	12.00
Warsaw	17.30	16	16	1	1.08	17.30	16.00
San Juan	17.20	16	16	1	1.08	17.20	16.00
Hannover	17.00	21	17	3	1.00	5.67	7.00
Copenhagen	16.80	17	17	2	0.99	8.40	8.50
Kolkata	16.50	17	17	1	0.97	16.50	17.00
Essen	16.00	22	20	3	0.80	5.33	7.33
Tama	16.00	19	19	1	0.84	16.00	19.00
Nizhni Novgorod	15.50	14	13	2	1.19	7.75	7.00
Chiba	15.50	18	18	2	0.86	7.75	9.00

Torino	15.00	11	11	1	1.36	15.00	11.00
Chennai	15.00	14	14	1	1.07	15.00	14.00
Sendai	14.80	17	17	1	0.87	14.80	17.00
Novosibirsk	14.30	12	11	2	1.30	7.15	6.00
Wuppertal	13.30	20	20	1	0.67	13.30	20.00
Edmonton	13.10	11	11	1	1.19	13.10	11.00
Naha	12.80	15	15	1	0.85	12.80	15.00
Toulouse	12.50	18	18	1	0.69	12.50	18.00
Daejon	12.40	12	12	1	1.03	12.40	12.00
Erevan	12.10	10	10	1	1.21	12.10	10.00
Dusseldorf	11.60	11	11	2	1.05	5.80	5.50
Izmir	11.50	10	10	1	1.15	11.50	10.00
Gwuanju	11.00	14	14	1	0.79	11.00	14.00
Glasgow	10.40	15	15	1	0.69	10.40	15.00
Wuhan	10.20	10	10	1	1.02	10.20	10.00
Bochum	10.00	29	27	2	0.37	5.00	14.50
Lima	10.00	6	6	1	1.67	10.00	6.00
Sofia	9.90	8	8	1	1.24	9.90	8.00
Samara	9.10	8	8	1	1.14	9.10	8.00
Rennes	9.00	15	15	1	0.60	9.00	15.00
Kitakyushu	8.80	13	13	1	0.68	8.80	13.00
Ekaterinburg	8.50	7	7	1	1.21	8.50	7.00
Buffalo	8.36	8	8	1	1.05	8.36	8.00
Lausanne	8.20	20	19	2	0.43	4.10	10.00
Istanbul	7.90	6	6	1	1.32	7.90	6.00
Antwerp	7.60	11	11	1	0.69	7.60	11.00
Dnepropetrovsk	7.10	6	6	1	1.18	7.10	6.00
Kazan	7.00	5	5	1	1.40	7.00	5.00
Jacksonville	6.90	6	6	1	1.15	6.90	6.00
Mulheim	6.80	10	9	2	0.76	3.40	5.00
Kamakura	6.60	8	8	1	0.83	6.60	8.00
Las Vegas	6.20	7	7	1	0.89	6.20	7.00
Poznan	6.10	6	6	1	1.02	6.10	6.00
Duisburg	6.00	9	7	2	0.86	3.00	4.50
Bonn	5.20	12	12	1	0.43	5.20	12.00
Bielefeld	5.00	7	7	4	0.71	1.25	1.75
Detroit	4.80	13	13	1	0.37	4.80	13.00
Genoa	4.50	7	7	1	0.64	4.50	7.00
Ludwigshafen	4.00	11	11		0.36		
Catania	3.80	6	6	1	0.63	3.80	6.00
Gelsenkirchen	3.70	8	8	1	0.46	3.70	8.00
Volgograd	3.30	2	2	1	1.65	3.30	2.00
Newark	2.20	4	4	1	0.55	2.20	4.00
Rouen	2.20	5	5	1	0.44	2.20	5.00
Haifa	1.75	6	6	1	0.29	1.75	6.00
Charleroi		9	9	4			2.25
Pittsburg		3	3	1			3.00

Stations* counts interchange stations as one station. **L**: Length.

APPENDIX C

Turkish Urban Rail Network

Table 1. Funicular Networks

TURKISH URBAN FUNICULAR NETWORKS			
CITY	**OPERATING**	**UNDER CONSTRUCTION**	**PLANNED**
İSTANBUL	*Galata – Beyoğlu * Kabataş - Taksim		

Table 2. Tramway / Street Tram Networks

TURKISH URBAN TRAMWAY / STREET TRAM NETWORKS			
CITY	**OPERATING**	**UNDER CONSTRUCTION**	**PLANNED**
ANTALYA	*Lara - Konyaaltı		
ESKİŞEHİR	*Otogar – Uluönder *Kuyubaşı – Osmangazi Üni.		
İSTANBUL	*Tünel – Taksim *Kadıköy – Moda *Eminönü – Karaköy – Kabataş *Eminönü – Zeytinburnu *Zeytinburnu – Güngören-Bağcılar	*Edirnekapı - Sultançiftliği	* Kabataş – Beşiktaş – M.köy – Kağıthane – Alibeyköy * Haliç Region
İZMİR			* Narlıdere – Sahilevler
KONYA	Otogar – Alaaddin Selçuk Üni. Alaaddin		

Table 3. LRT Networks

TURKISH URBAN LRT NETWORKS			
CITY	**OPERATING**	**UNDER CONSTRUCTION**	**PLANNED**
ANKARA	* AŞTİ – Dikimevi	* AŞTİ - Söğütözü	* Söğütözü – Karakusunlar * Maltepe – Etlik * Kurtuluş – Siteler * Etimesgut - Batıkent
ANTALYA			* Fatih - Meydan
BURSA	* A1 Şehreküstü – Organize Sanayi * A2 Şehreküstü – Küçük Sanayii	* B Şehreküstü – Araba Yatağı	* C Küçüksanayi - Altınşehir
İSTANBUL	* Aksaray – Otogar - Havaalanı	* Otogar – Bağcılar * Aksaray - Yenikapı	* Bakırköy – Şirinevler – Sefaköy – Avcılar – Beylikdüzü * Üsküdar – Atlunizade – Ümraniye – Dudulu - Samandıra
İZMİR		* Aliağa – Alsancak * Alsancak - Havaalanı	
KAYSERİ		* Sanayi - Çaykur	

Table 4. Metro Networks

TURKISH URBAN METRO NETWORKS			
CITY	**OPERATING**	**UNDER CONSTRUCTION**	**PLANNED**
ADANA		* Akıncılar – Hastane	* Akıncılar – Çukurova Üni.
ANKARA	* M1 Kızılay - Batıkent	* M2/A Söğütözü – Ümitköy * M2/B Söğütözü – Kızılay * M2/C Ümitköy – Çayyolu 4 * M3 Batıkent – Sincan * M4 Tandoğan - Gazino	* TBMM - Dikmen
İSTANBUL	* Taksim – 4. Levent	* 4. Levent – Seyrantepe – Ayazağa – Darüşşafaka * Kadiköy – Kartal * Taksim – Yenikapı * Bağcılar – M.Bey – İkitelli – Olimpiyat Köyü	* Alibeyköy – GOP – Tekstilkent – Bağcılar * Yeşilköy – Atatürk H.L. – B.Evler – İkitelli * Yenikapı – Bakırköy * Bakırköy – B.Evler - Bağcılar
İZMİR	* Üçyol - Bornova	* 2 Üçyol – Fahrettin Altay	* 3 A Bornova – Bornova Merkez * 3 B Halkalıpınar – Otogar * 4 Fahrettin Altay – D.E.U Hastanesi * 5 Üçyol – Dokuz Eylül Üni. Kampüsü

APPENDIX D

QUESTIONNAIRE

SIRA: ..... TARİH: ..... / ..... / 2006 **SÜRE: .....**dakika **YER: .....**
Bu görüşmede size ulaşım tercihleriniz ve ulaşım tercihlerinizi etkileyen faktörler hakkında sorular soracağım. Görüşme sırasında verdiğiniz cevaplar kimliğiniz açıklanmadan, konuyla ilgili bir doktora çalışmasında kullanılacaktır. Sizden istenilen cevaplar bilimsel bir çalışmada temel veriler olarak kabul edileceği için, vereceğiniz cevapların doğruluğu ve samimiyeti, size ileride sunulacak hizmetlerin niteliğini etkileyeceği için çok önemlidir.

1. Yaşanılan Semt: **Çalışılan/ Okunan Semt:**

---------- ----------

2. Yaş : ☐ 7-14 ☐ 15-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ ≥ 75

3. Cinsiyet : ☐ Erkek ☐ Kadın

4. Meslek :

☐ Avukat/Savcı/Yargıç ☐ Doktor/Diş Hekimi/Eczacı/Psikolog
☐ Çiftçi ☐ Emekli
☐ Emniyet/Ordu Mensubu ☐ Esnaf/Tüccar/Zanaatkar
☐ Ev hanımı ☐ Halkla İlişkiler
☐ İşçi ☐ İşsiz
☐ İşletme/Ekonomist ☐ İşveren /Sanayici
☐ İdari/Mali müşavir/uzman ☐ Memur
☐ Mimar/ Mühendis ☐ Öğretmen / Öğretim Elemanı
☐ Öğrenci ☐ Sanatçı
☐ Sporcu ☐ Teknik Eleman ☐ Diğer

5. Sürücü Ehliyeti Sahipliği: ☐ Evet ☐ Hayır **6. Sürüş Kabiliyeti** : ☐ Zayıf ☐ Orta ☐ İyi

7. Ulaşım Tercihi:

☐ Kişisel Araç ☐ Aile veya arkadaşın aracı ☐ Taksi ☐ Yayan ☐ Minibüs / Dolmuş ☐ Bisiklet ☐ Belediye Otobüsü ☐ Metro/Ankaray ☐ Banliyö ☐ Kurum / Şirket Servisi ☐ Özel Halk Otobüsü

8. Temel Ulaşım Amacı:

☐ İş ☐ Okul/Üniversite ☐ Alışveriş ☐ Eğlence ☐ Dini

☐ Tıbbi kontrol /Bakım ☐ Ziyaret ☐ Banka / Fatura ☐ Diğer İşler

9. Metro/Ankaray Kullanım Sıklığı:

☐ Yılda Birkaç Kez ☐ Ayda Birkaç Kez ☐ Haftada Birkaç Kez

☐ Hafta İçi Her Gün ☐ Hiç

10. Kaç Yıldır Ankara Yaşıyorsunuz?:

☐ Ankara'da Yaşamıyorum ☐ 0-1 Yıl ☐ 1-5 Yıl ☐ 5-10 Yıl ☐ 10-20 Yıl

☐ 20 Yıl Üstü

Aşağıdaki soruları Ankara ve Metro bağlamında cevaplayınız. Her anlam ifadesi için, ifadeye yakınlık derecesi açısından lütfen sadece bir adet kutu işaretleyiniz

11. Ankara:

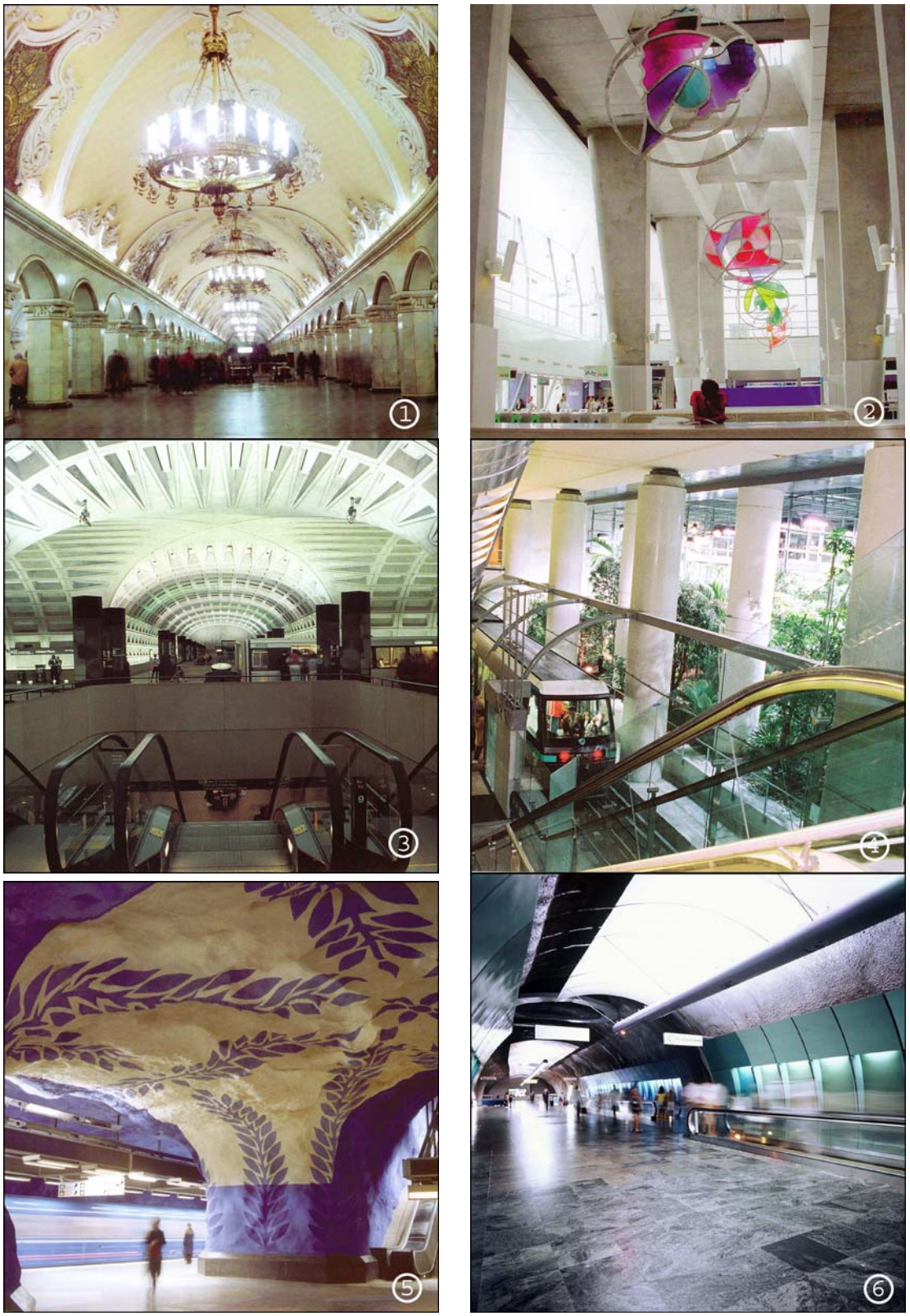
	Çok	Oldukça	Norma	Oldukça	Çok	
Büyük						**Küçük**
Yüksek						**Alçak**
Sık						**Seyrek**
Çeşitli						**Tekdüze**
Temiz						**Kirli**
Kalabalık						**Tenha**
Açık						**Kapalı**
Hareketli						**Durağan**
Sessiz						**Gürültülü**
Renkli						**Renksiz**
Süslü						**Sade**
Yoğun						**Yoğun Değil**
Yeşil						**Kurak**
Düzenli						**Düzensiz**
Ferah						**Boğucu**
Karmaşık						**Basit**
Uyumlu						**Uyumsuz**
Çekici						**İtici**
Bakımlı						**Bakımsız**
Özgün						**Sıradan**
Kontrollü						**Kontrolsüz**
Hoş						**Hoş Değil**
Lüks						**Vasat**
Yeni						**Eski**
Neşelendirici						**İç Karartıcı**
Moda						**Demode**
Korkutucu						**Büyüleyici**
Kimlikli						**Kimliksiz**

12. Metro / Ankaray:

	Çok	Oldukça	Normal	Oldukça	Çok	
Büyük						**Küçük**
Yüksek						**Alçak**
Sık						**Seyrek**
Çeşitli						**Tekdüze**
Temiz						**Kirli**
Kalabalık						**Tenha**
Açık						**Kapalı**
Hareketli						**Durağan**
Sessiz						**Gürültülü**
Renkli						**Renksiz**
Süslü						**Sade**
Yoğun						**Yoğun Değil**
Yeşil						**Kurak**
Düzenli						**Düzensiz**
Ferah						**Boğucu**
Karmaşık						**Basit**
Uyumlu						**Uyumsuz**
Çekici						**İtici**
Bakımlı						**Bakımsız**
Özgün						**Sıradan**
Kontrollü						**Kontrolsüz**
Hoş						**Hoş Değil**
Lüks						**Vasat**
Yeni						**Eski**
Neşelendirici						**İç Karartıcı**
Moda						**Demode**
Korkutucu						**Büyüleyici**
Kimlikli						**Kimliksiz**

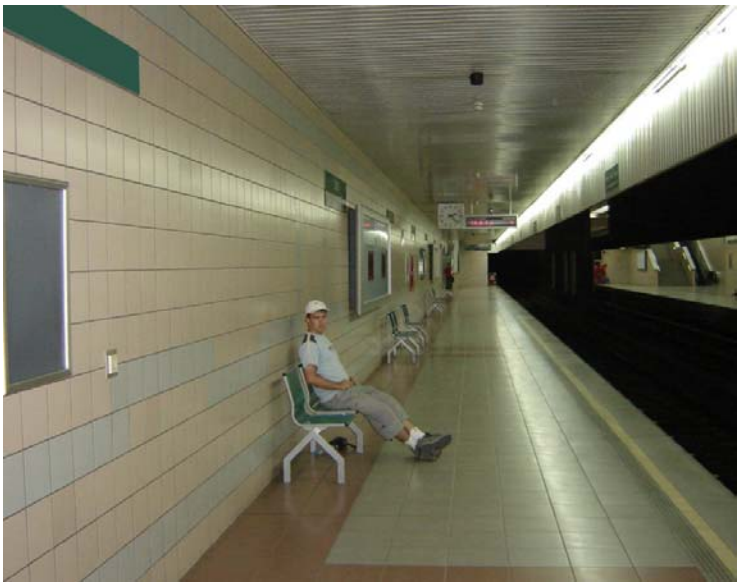
Lütfen aşağıdaki resimleri inceleyerek, tahmininizi resim numarasını dikkate alarak aşağıdaki şehir resimlerinin yanına numarası ile yazınız.

13.



Münih □ Moskova □ Stockholm □ Hong Kong □ Rio de Janerio □ Washington □

14. Aşağıdaki Resim Hangi İstasyona Aittir?:



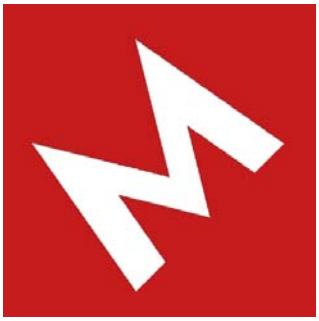
AŞTİ ☐ Hastane ☐ Dikimevi ☐ Ostim ☐ Maltepe ☐ MTA ☐ İvedik ☐ Bahçelievler ☐

17. Metro <u>Akköprü</u> İstasyonunda Hakim Renk Nedir?:

Krem ☐ Mavi ☐ Kırmızı ☐ Yeşil ☐ Sarı ☐ Beyaz ☐ Gri ☐ Kahverengi ☐

18. Ankara Metrosu'nun Amblemi Aşağıdakilerden Hangisidir?:

☐   ☐

☐   ☐

CURRICULUM VITAE

1. Name, Surname **:** Serkan Güneş

2. Date of Birth / Place **:** 11 March 1975 / Kırıkkale

3. Contact **:** Kazakistan Caddesi (4. Cadde) 57/3 06490 Bahçelievler/ANKARA, Tel: (0312) 21520 15 , (0532) 6816769, E-mail: sgunes@metu.edu.tr, serkangunes@hotmail.com

4. Education **:**

Degree	Institution	Year of Grad.
MS	METU Industrial Design	2001
BID	METU Industrial Design	1999
High School	Eskişehir Anadolu High School, Eskişehir	1993

5. Work Experience **:**

Year	Place	Enrollment
2006-2007	Designnobis	Designer
1999-2006	METU Department of Industrial Design	Res. Assistant
1998 August	Kurgu Mobilya	Intern
1997 August	Artema	Intern

6. Publications **:**

S.Güneş, G. Yılmaz (2006) "Understanding Graffiti in The Built Environment: The Case in Ankara, Turkey", *42nd International Society of City and Regional Planners Congress (ISOCARP): Cities Between Integration and Disintegration,* İstanbul: Yıldız Teknik Üniversitesi.

S.Güneş, G. Yılmaz (2006) " Human Rights and Urban Ecology", *The 8th SEAGA Conference*, Singapore.

S. Güneş(2005) "Kent Mobilyası Tasarımında Disiplinler Arası Etkileşim", *Planlama*, 2005/3, ISSN 1300–7319, TMMOB Şehir Plancıları Odası Yayını, Ankara.

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S.Güneş (2006) “Ar-Ge Hizmetlerinde Ürün Tasarımı Fonksiyonun Yeri ve Ulusal tasarımın Savunma Sanayinde Önemi” *3. Savunma Teknolojileri Kongresi,* Ankara, Orta Doğu Teknik Üniversitesi.

S. Güneş, H. Gürsu, A. Özdemir, (2005). Chapter 5: Zeytin ve Yan Mamullerine Yönelik Ambalaj Tasarımı. “*Proceedings of the Exhibition and Conference on: Two Edges of Aegean -I: Studies on Urban History of Ayvalik, organized by the cooperation of "Baykus (hé glaukós) Aegean Cultures Research Group*", METU and Municipality of Ayvalık, Ayvalık.

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S. Güneş (2005) “Rational Product Design: Opportunities and Limitations” Unpublished.

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S. Güneş (2003) “Tasarım Tarihine Kısa Bir Bakış: Ekonomik Bağlam” Unpublished.

7. Wokshops :

“Bugünden Yarına Türk Tasarımı için Stratejiler”, İstanbul Teknik Üniversitesi, 19–22 Haziran 2006.

ETMK Strategic Planning Workshop, Anadolu Üniversitesi, 14-15 Ekim 2006.

ETMK Strategic Planning Workshop, Türkiye İhracatçılar Meclisi, 23-24 Aralık 2006.

8. Projects and consultancies:

Design Consultancy, TOFAŞ Türk Oto Fab. A.Ş. 2001.

Education Consultancy, TRIZ (Teoriya Resheniya Izobretatelskikh Zadatch), S.P.A.C Danışmanlık. 2004.

Education Consultancy, Kurumların Gelecekleri Nasıl Planlanır?, Republic Of Turkey Ministry Of Culture And Tourism, 2004.

Design Consultancy, DANONESA*,* 2004.

Design Consultancy, ROKETSAN Roket Sanayi ve Ticaret A.Ş. 2004.

Design Consultancy, Ayvalık Belediyesi and Baykuş Grubu. 2005.

Design Colsuntancy, Designnobis Ltd. Şti. 2006.

9. Awards :

December 2001 - ODTÜ Yaya ve Bisikletli Yaşam Fikir Proje Yarışması, 1. Prize

May 2005 - Türkray Monorail Tasarım Yarışması, 1. Prize

May 2005 - Türkray Monorail Tasarım Yarışması, 3. Prize

May 2005 - Türkray monorail Tasarım Yarışması, 1. Honorable Mention

March 2006 - Türkiye Metal İhracatçıları Birliği, Metal Ürün Tasarımları Yarışması, Cosmetic, 1. Prize

March 2006 - Türkiye Metal İhracatçıları Birliği, Metal Ürün Tasarımları Yarışması, Metal, 2. Prize

March 2006 - Türkiye Metal İhracatçıları Birliği, Metal Ürün Tasarımları Yarışması, Plastic, 3. Prize

March 2006 - Türkiye Metal İhracatçıları Birliği, Metal Ürün Tasarımları Yarışması, Plastik Grubu, 1. Honorable Mention

July 2006 - Duyar Vana Uluslararası Tasarım Yarışması, 2. Prize

August 2006 - Routledge Poster Prize, ISOCARP, 1. Prize

10. Expertises :

Ankara Intellectual Property Penal Court, 14 Judical Document.