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PAPER

ASSESSMENT OF THE EFFECT OF AN EXTERNAL FACTOR FOR DWELLING OCCUPANTS' SATISFACTION: ACCESS TO BASIC ACTIVITIES.

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ABSTRACT

Most approaches in housing research are based on a static perception of the dwelling, occupant and its environment. However, the increasing population settled in a dense urban environment with an increasing complexity of movement and mobility requires more sophisticated approaches than that are currently used. In an attempt to evaluate occupants' perceptions related to compulsory urban mobility and their effects extending to housing satisfaction, a set of researches has been conducted. The aim and the focus of this paper has been to assess the validity of attempts to compose a consolidated indicator to measure the aspects related to that mobility. The significance of the indicator is tested through its incorporation in various housing user satisfaction researches. The results showed that there is a correlation between the home and environment satisfaction levels and the higher grades for the indicator defined as "access to basic activities (ABA) indicator". The vice-versa was also affirmative. One conclusion is that dwelling occupants' easy / enjoyable temporal mobility targeting basic activities would increase housing satisfaction as a greater portion of this mobility originates from or ends up in dwelling. Further analysis of the findings may provide hints for avoiding occupants' dissatisfaction with less dependence on complex, large scale and major physical interventions to existing housing stock and to its environment.

Introduction

Dwelling is a product for which there may be infinite possible variations in location, arrangement, size, shape, space, layout and environment. Identifying user requirements and incorporating values to increase occupant satisfaction necessitates the capturing of user needs, and their transfer to realizable products. Numerous studies evaluated the quantitative and qualitative characteristics of the dwellings to assess the factors that affect the occupants' satisfaction. The target has always been to find out some significant indicators that may pave the way for better housing design and implementation. Although it is not unusual to relate the dwelling occupants' satisfaction to the immediate physical environment and its properties; a set of longitudinal researches showed that some other and less studied "external factors" may considerably affect the perceptions of the dwelling users. The term "external factor" employed here refers to issues which are basically not related to the physical characteristics of the dwelling and to the surrounding environment. The dwelling occupants' socio-cultural or physiological characteristics are as well not considered as an external factor as they are most of the time explicit enough in a way to acquire through basic research mechanisms. In a broader definition, external factors are the ones that are most of the time hidden to the researcher unless explicitly questioned or their research is adequately intended. It is not quite uncommon for researchers to find out some

simple physical or psychological factors that revert the expressed or measured satisfaction of the housing occupants and deviate expected research results. Longitudinal studies sometimes show that the previously measured satisfaction levels considerably change in time for some unknown reasons. This paper explores some of the influences of the so called external factors over dwelling users' satisfaction with special focus on a factor defined as "access to basic activities". Following investigation of several housing researches conducted in urban environments, it has been seen that the various characteristics related to occupants' temporal urban mobility to access to some locations for several reasons such as work, leisure, visits, shopping etc. is one of the major hidden factors affecting housing user satisfaction. Several studies indicated the possibility of measuring people's perceptions related to their trips executed to access their basic needs. The location and characteristics of the dwelling, adjacent physical environment, adequacy and quality of the transport means, social environment, locations and properties of the areas where the concerned occupant expects to perform some activities are some of the issues affecting the so called "access to basic activities (ABA) indicator".

A brief review of the literature on relevant definitions and approaches are provided in the following chapters to explain the basic concepts related to the presented issue. At this context, issues of urban transport, accessibility, and housing occupants' temporal mobility behavior are observed with references to previous researches. The existing approaches to occupancy evaluation are used to structure the main concept of the research. Consequently the empirical assessment model is laid out to discuss the research methodology. The results accompanied by additional explanations are then given. Conclusion is reached after evaluating the findings controlled for most of the parameters, that higher values obtained for the introduced ABA indicator correlated with housing user satisfaction. As the indicator is composed of relatively controllable parameters, opportunities can be found to increase people's home and environment satisfaction with small scale interventions to social and physical milieu.

Urban Transport and the Issue of Accessibility

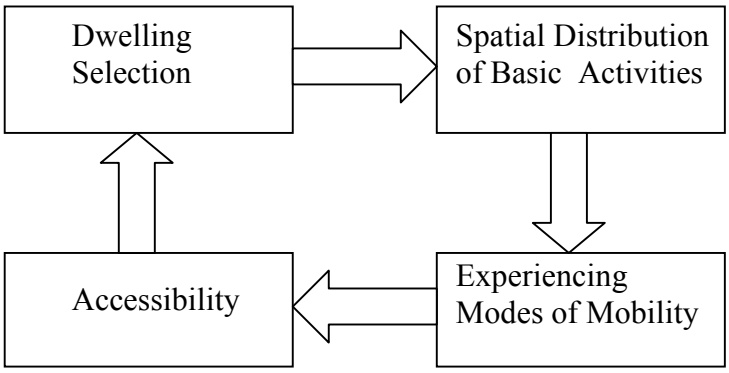
There is a broad agreement that transport is one of the major factors determining the spatial organization of the cities. Medieval cities were built for walking, and this required that living and working areas were close together. In parallel to the development of the industrial era the railway made a spatial division of labor possible and so opened the way for the growth of cities. Rapid transit and the private car have facilitated the expansion of metropolitan areas over wider territories. The growing separation of human activities demanded longer trips and greater volumes of traffic. In our time, everyday millions of trips are made in urban areas, satisfying a wide range of individual needs and using a variety of transportation means. This activity and adjacent properties are analyzed in detail within the field of interest of urban transportation. By definition, urban transportation is the movement of people and goods between origins and destinations within an urban area to accomplish some activity at the destination area [1]. The urban transport movement can be carried out through a variety of modes, and serve different needs. The planning activity for urban transportation requires clear identification of the reasons and characteristics of this mobility. Researches indicate that a huge portion of urban trips originates from, or targets peoples' dwelling. In the 1950's first efforts were made in the US to study systematically the interrelationship between transport and location in cities especially to assess appropriate residential locations. The importance of the

effects of residential land use decisions on the urban development and feed-back on the functional mechanisms of cities are well known since a long time. It has been demonstrated for many cities that, housing locations with good accessibility had a higher chance of being developed in a regular fashion, and at a higher settlement density than remote locations. Accessibility is also a very powerful factor in determining land prices, profitability and intensity of use. Less elaborated residential land use decisions ended up with urban problems and quickly depriving regions [2]. The set of relationships implied by the accessibility factor create a cycle starting from initial land use decision, following functional mechanisms formed within urban area and reaching the re-consideration of the initial decision in accordance with the performance of the accessibility factor [3]. This cycle and its mechanisms are summarized below;

- The land use decisions for residential, industrial or commercial activities across the urban area determines the locations of the human activities such as living, working, shopping, education or leisure,
- The distribution of human activities requires spatial interactions or trips in order to overcome the distance between the locations of activities,
- The distribution of transport system creates spatial interactions that can be measured as accessibility,
- The distribution and performance of accessibility in urban space leads to consistence or re-thinking of initial spatial organization that ends up with changes in land use decisions.

The cycle described to explain the principle of urban mobility is well adaptable to individual level on the basis of dwelling occupant as it sums up the behavior of every single citizen. This cycle adapted to dwelling level is given below;

Figure 1. Dwelling Selection and Accessibility Feed-Back Cycle



Analogy can be made between the re-consideration of the land use decisions in the urban level, and the need to alter the initial decision about the dwelling selection in the individual level. This need for alteration evidently stems from the dissatisfaction caused by the inadequacy of the performance expected from the so called accessibility issue. While evaluating this dissatisfaction attributable to the factors caused by accessibility, the human behavior pattern and characteristics of the compulsory temporal mobility modes merit special attention. Therefore emphasis should be given to rather more implicit dimensions of this issue. It is admitted that, contemporarily, the broader scope of the accessibility issue started to constitute a fundamental design consideration both in housing and urban planning. Increasing attention are being paid to the vehicular or pedestrian mobility needs of children, women with children, elderly and disabled people through promoting safer streets or reducing physical barriers.

Dwelling Occupants' Mobility and Accessibility

A review of the literature related to the participatory approaches in housing design reveals examples of studies to explore the concept of mobility of dwelling occupants. These studies address general issues so as to define the characteristics and sequencing of occupant activities at the scale of the room, building, block, neighborhood, city or region. The concept introduced as "activity patterns" by Chapin and Brail [4] aimed to study a sample of middle-class urban residents to develop a classification scheme divided into thirteen categories. The first seven were in-home activities. The last six activities were the ones that are performed out-of-home that included household errands, medical care trips, taxi type driving chores, and eating meals out of the home within a non socializing context. In a search to achieve an accurate fit between the activity and the environment, Broadbent [5] developed a scheme called "activity and movement analysis" presented in the form of a flow chart to be able to represent the occupant mobility. A similar approach was adopted by Perin [6] while he explains the categorization of routines that recur so often to have a regularized sequence that a person carries out relatively unconsciously and more or less independently of others. He defines this representation as "behavior circuits". Behavior circuits are presented in the form of graphical explanations of people's mobility in specific building types. Those examples show previous attempts to reduce the physical organization to a matter of reconciling the systems related to human, building and environment. The relations between those are established through the issue of accessibility.

Proposed Structuring for the Research of People's Access to Basic Activities

The evaluation of the issue defined as accessibility (access to basic activities) is based on five main criteria which are the following;

1. Trip purpose
2. Trip route
3. Travel mode used
4. Distance
5. Time

Those criteria are basic to define a travel pattern, however they are interdependent and conditional. The assessment of the individual regarding any trip may vary according to the quality, quantity and frequency of all five items. The content of the "trip purpose" criterion constitute the possible mobility reasons intended with the employment of the term "basic activities". For the sake of generalization the trip purpose are evaluated under four main categories which are;

1. Work trips: Trips made to a person's place of employment.
2. Shopping trips: Trips made to a retail establishment regardless of the size or type of purchase and even though no purchase is made.
3. Social or recreation trips: Trips made to recreational or entertainment facilities (mosque, church, civic meetings, concerts, sporting events). Travel to social activities such as visiting friends, relatives etc. would be included.
4. School trips: Trips made by students to an institution of learning.

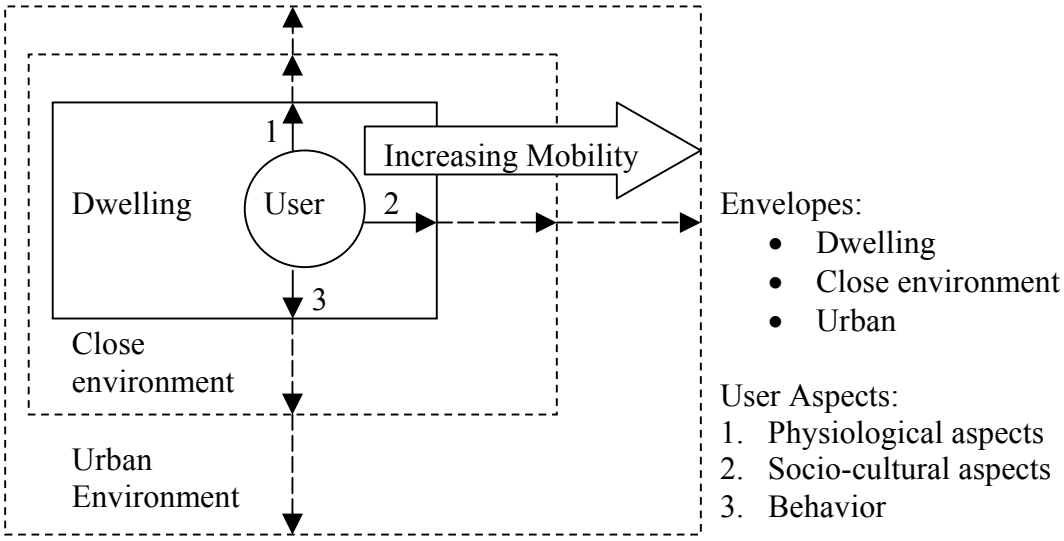
A person's "trip purpose" pre-supposedly creates a perception related to the concerned mobility. Most people prefers better a recreation trip than a school or work trip. It is possible for any individual to make a ranking of trip purposes according to preference. However, this ranking may conditionally change. The

perceptions related to the "trip route" are dependent on the quality of the travel trajectory and the surrounding environment. As pleasant design of pavements, street furniture, vegetation, and lighting enhances the pedestrian route, a well planned and comfortable road adds value to vehicular access. The "travel mode" can be basically separated into two sub-categories consisting of pedestrian or vehicular access modes. The vehicular travel can be by individual cars or by means of public transport. Transport vehicles vary from bikes, busses to trams or rapid transit systems. Equally, external factors such as weather, crowd, congestions etc. may affect the perception related to a given travel mode. Bike riding in a nice weather may be perceived as a great pleasure, but same travel mode while trip purpose, route, distance and time are constant can be hard to support under heavy rain. The considerations related to the distance or travel time are similarly not significant enough to assess the trip aiming to access to a destination. A walk on an interesting shopping street or a pleasant river bank may seem far less than the same distance along a boring underpass. Modes for dealing with the difficulties imposed by the relativity of given criteria are explained in following chapter while describing the research methodology.

Research Methodology

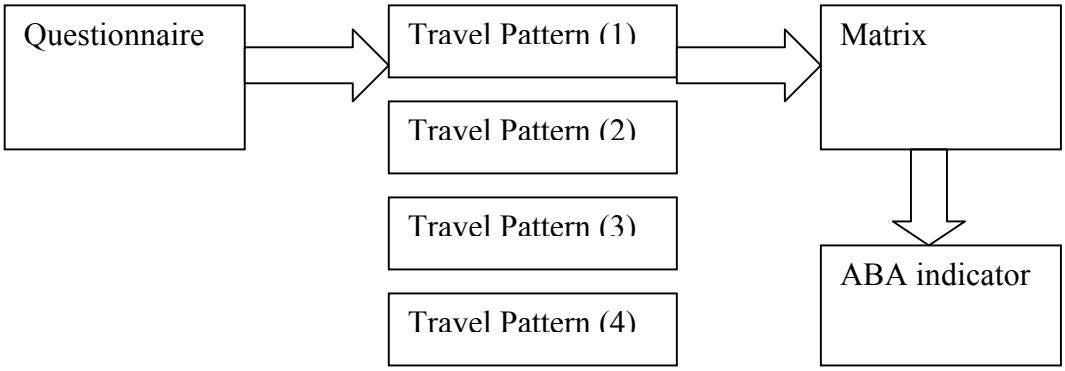
A person is subject to the effects of various physical events in his static environment or while he conducts a mobility. These physical events exist in terms of a dynamically patterned three-dimensional envelope. In occupying any given position in space and time, the individual interrupts and modifies that envelope and is subjected to variations in dynamic patterns of potential and actual proximal stimuli. Therefore, a research of individual-environment interaction should define the limits of this envelope that can vary from the scale of a single room to the urban or regional scale. The person's transactions with this envelope take place via the agency of biological senses that produce a measurable rate of change in the pattern of stimuli. Due to the psychological senses or socio-cultural differences of individuals, different people in the same event field may experience quite different senses. The characteristics of the envelope and the type, pattern, and strength of signals available at the envelope may also be altered through individual reactions such as sleeping, reading etc. (behavior) or through interventions to the physical properties of the envelope [7]. A graphical representation of those interactions are shown in the diagram below;

Figure 2. User – Environment Interactions



The research methodology organized for the targets presented in this paper makes use of an empirical assessment model of the perceptions related to the temporal mobility. Those have been established with the consideration of both above given definitions and with the criteria explained in the previous chapter. In order to evaluate the perceptions related to the issue described as "access to basic activities", a research questionnaire has been created to collect the required information from dwelling users, in a format serving the needs of the research organization. The filling of the questionnaire reveals a so called travel pattern for each of the four trip purposes defined above. The four travel patterns obtained from each individual are merged and observed with a common evaluation method so as to generate numerical values helping to assess differences in perceptions. The generated numerical values are transferred to a matrix allowing the generation of a general indicator. This finding generated for each individual of the house hold, is called the "access to basic activities (ABA) indicator". The research organization is illustrated in the following figure;

Figure 3. Organization and flow chart of the research process



The questionnaires are prepared in a fashion to reveal the necessary data related to a person's temporal mobility serving to access the basic activities. Initially, the user is asked to list the trips made from home to several destinations. This list is grouped under four main trip purposes indicated above with clear indications of preference ranking and trip frequencies. The highest frequencies of each of the four group are selected to determine other required details for the researcher to eventually establish the travel pattern scheme. These details consists of a sequential statement of activities performed to accomplish a trip with information on trip route, travel mode, distance and time. Perceptions related to each of the activities are questioned through a general satisfaction inquiry on a variant scale of five levels which are; "1-adore, 2-enjoy, 3-no difference, 4-dislike, and 5-hate". A reservation is made for conditional evaluations such as "like bus trip stage if a seating place is available". The respondent is also asked to state the reasons for extreme evaluations which are the ones scaled (1) or (5). The possibility of changes in evaluations in relation with external factors such as the outdoor climatic conditions are taken into consideration through making necessary adaptations to questionnaire for different seasons and weather conditions. Those adaptations consist of additional questions helping to get more information on possible reactions to conditional changes stemming from social, psychological or physical environment characteristics. Questionnaire findings provided creation of travel patterns for several types of dwellers during their categorized access to basic activities. A travel pattern aimed to consolidate the various activities performed within the course of a trip that looked like the example below;

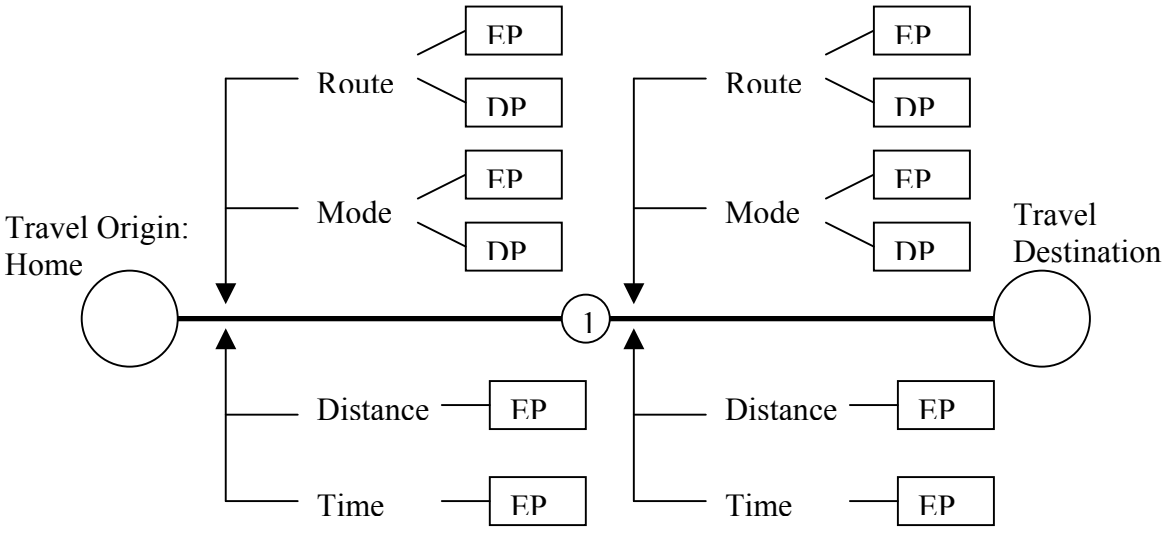
1-Exit home, 2-Ascend / Descend (Stair, elevator, ramp etc.), 3-Walk, 4-Public or Private Transport Vehicle (Car, bicycle, bus, tram etc.), 5-Walk, 6-Ascend / Descend (Stair, elevator, ramp etc.), 7-Reach destination (work, school etc.)

The periods for each stage of a travel pattern are revealed in minutes. The distances for each divisible portion of the trip are revealed in meters or kilometers. Each activity of the travel stage are coupled with an accompanying activity as shown in example below;

1-None, 2-Chat with neighbor, 3-Watch gardens, 4-Read newspaper and so on.

The resulting travel pattern scheme gives the so called EP (Expressed Perception by respondent) and DP (Derived Perception by the researcher) values for each of the criteria defined above attributable to a sequence of the travel. The sequencing of the travel is arranged according to the change of travel mode, route or compulsory or volunteer intermediary stops.

Figure 4. Travel Pattern Scheme



The evaluation is made for each sequence of the travel. For each single sequence, the PV (Perception Value) is generated for route and mode criteria through division of the arithmetic mean of EP and DP values to 5 which is the highest score in assessment ranking. Therefore the formula for the first sequence of the route and mode criteria of the travel pattern are;

PV1 route = (EP1 route+DP1 route) / 2 / 5 and

PV1 mode = (EP1 mode+DP1 mode) / 2 / 5

The PV1 for distance and time criteria are calculated through division of the expressed distance and time to the totals for the overall travel pattern. Thus;

PV1 distance = EP distance / total travel distance

PV1 time = EP time / total travel time

The calculations are repeated for each sequence of the travel. The total PV (PVt) related to the overall travel process is calculated for each of the route, mode, distance and time criteria by merging values obtained from each sequence with incorporation defined weights. Accordingly;

PVt route= [(PV1 route x PV1 time)+.. (PVn route x PVn time)]

PVt mode= [(PV1 mode x PV1 time)+.. (PVn mode x PVn time)]

The calculations of PVt for distance and time criteria incorporates the information obtained from regional statistics for maximum travel distance and time.

PVt distance= [(PV1 route+PV1 mode)/2 x PV1 distance)+.. (PVn route + PVn mode) /2 x PVn distance] x [1 - (PVt distance / DT] where, MD is the maximum urban transport distance revealed in relevant regional statistics [8].

PVt time= [(PV1 route+PV1 mode)/2 x PV1 time)+.. (PVn route + PVn mode) /2 x PVn time] x [1 - (PVt time / MT] where, MT is the maximum urban transport time revealed in relevant regional statistics [8].

The obtained PVt values for each of the four trip categories are placed in relevant cells of the evaluation matrix. The content of the matrix is given in table below;

Table 1. Travel Pattern Matrix

	(1)	(2)	(3)	(4)
Trip Purpose	Work Trip	Shopping Trip	Social Trip	School Trip
Trip Route	PVt route	PVt route	PVt route	PVt route
Travel Mode	PVt mode	PVt mode	PVt mode	PVt mode
Distance	PVt distance	PVt distance	PVt distance	PVt distance
Time	PVt time	PVt time	PVt time	PVt time

(*) PVt: Total Perception Values obtained from Travel Pattern

While using the matrix for the calculation of ABA indicator, ranking of trip purpose is arranged according to individual preferences expressed in the questionnaire. The order of preferences are given weight coefficients scaled from 1 to 4 from least preferred to most preferred. Other coefficients are defined to incorporate differences stemming from changing physical environment and individual characteristics. Those coefficients covered the issues such as the factors derived for conditional expressions, seasons and climate, physical properties of the environment and individual factors such as age, socio-economic status, sex, and occupation. It has been possible to evaluate the matrix both in rows for focus on a selected trip criteria and totally for the computation of ABA indicator. The general formula for the ABA indicator is organized as follows;

ABA indicator = [Σ PVt1 x (Rc1) + Σ PVt2 x (Rc2) + Σ PVt3 x (Rc3) + Σ PVt4 x (Rc4)]x Cc x Pc where Rc is the ranking coefficient, Cc is the "conditions coefficient", and Pc is "personal characteristics" coefficient.

The derivation of the Cc and Pc coefficients is based on general local demographic and statistical data. The physical environment characteristics are given more weight than the respondent's individual characteristics due to the assumptions based on the existing local housing research data [9]. In order to assess numerical values to the coefficients, the above stated factors are grouped and ranked according to the order of importance.

As the total maximum value for any PVt situated in the matrix is 1, the summing up of a column of the matrix gives a total maximum value of 4. Therefore the "Σ PVt" can take a value between 0 and 4. The Rc are ranked from 1 to 4, and the total maximum Cc is limited to 2. The Pc value can take a maximum value of 1,25. Therefore, in all cases, the ABA indicator takes a value between 0 and 100 as demonstrated below;

[Σ PVt1 x (Rc1) + Σ PVt2 x (Rc2) + Σ PVt3 x (Rc3) + Σ PVt4 x (Rc4)]x Cc x Pc

[(0 x 4)+ (0 x 3) + (0 x 2) + (0 x 1)]x 2 x 1,25 = 0

[(4 x 4)+ (4 x 3) + (4 x 2) + (4 x 1)]x 2 x 1,25 = 100

Results

The validity of the effect of the issue of "access to basic activities" is tested through re-evaluating the results of two housing researches previously conducted in Ankara, Turkey on different periods. The findings of those researches are compared with the new research conducted in similar locations. The research is conducted with a total of 32 householders. The first research used for comparison purpose was conducted in Ankara in 1992 by İmamoğlu, V., İmamoğlu, O., and Pamir, H. [10] with a total number of 874 housing occupants. The other research by Berk, G. [11] in 1996, is in fact a longitudinal study based on this previous research conducted with 51 persons with a special focus on one single region. Both researches gave results to assess correlations between the dwellers' satisfaction and other physical and psychological issues related to the houses and environment. For the purpose of the evaluation of the effect of the issue "access to basic activities", three distinct locations are selected within the survey areas. Although the physical environment remained more or less same for those three locations, some changes occurred for the private and public transportation means since the last research. The selected locations are 1.Ümitköy, where the road access is ameliorated, and the construction of a rail transit system is ongoing, 2.Batıkent, where a rail transit system connection is established since 4 years, and 3.Bahçelievler, where the public and private transport possibilities are worsened due to the adjacent commercial development, and shortage of car park facilities causing traffic jams. A division of the respondents according to locations, gender and age structure are given in the following table;

Table 2. Questioned householders

	Location 1	Location 2	Location 3	Total
Male	6	4	6	16
Female	5	5	7	17
Average Age	36,4	28,7	41,2	35,43

The dwelling occupants' average travel period and means to access basic activities (work place, city centers, sports area, leisure and recreation areas, relatives and friends etc.) are initially broadly observed in a general fashion to reveal the measurable facts and to get the basic information. Consequently, the dwelling occupants in locations stated above are investigated with the use of above defined questionnaires applied generally by direct communication. Questionnaires are sent to those who prefer communication by e-mail. While conducting the comparisons with above mentioned previous researches, techniques such as correlation and factor analysis are employed. The general trends observed in the results showed that the there is a significant correlation between the home and environment satisfaction levels and the higher grades for ABA indicator. The vice-versa is also affirmative. Analysis showed that lower satisfaction is also correlated with lower ABA indicator.

Table 3. ABA indicators

	Location 1	Location 2	Location 3	Average
Male Average	56,87	46,74	36,23	46,61
Female Average	47,51	35,21	27,11	36,61
Total Average	52,19	40,98	31,67	41,62

The previous researches showed a satisfaction level ranging of locations from highest to lowest as follows;

Location 1 > Location 3 > Location 2

The comparison of the ABA indicators shows a different ranging which is;

Location 1 > Location 2 > Location 3

This variation can be commented to indicate that the changes in the conditions and availability of the public and private transport means in Location 2 considerably increased the ABA indicator. Equally, the Location 2 is marked with recent developments for the construction of facilities such as leisure, shopping and sports areas in the neighborhood. This kind of changes of the physical environment together with a pleasant environment, vegetation, regular, safe and clean streets, walkways and outdoor spaces are factors that increase the ABA indicator as well. This evaluation may lead to a conclusion that the decreasing of the ABA indicator possibly decreases the housing occupants' satisfaction levels. The reverse condition, which is the correlation between the increase of the ABA indicator and the increase of the satisfaction level seems significant as well. One of the striking findings of the research was the considerable difference of ABA indicator of male and female respondents. This situation leads to a conclusion that the physical environment and transport means are less pleasant to female, possibly due to the basic gender differences and feeling of safety.

Conclusion

Like so much of the research conducted by those concerned with the impact of the housing and its physical environment on people's lives, attempts have been made to go beyond mere description of the physical conditions and human behaviors while conducting this research. The extraction of numerical data providing easy understanding of the factors related to specific issues that have impacts over housing occupants satisfaction aimed to facilitate applications of research findings to solutions of practical problems.

The ABA indicator introduced here show significant relation between residents' access characteristics to basic activities and housing satisfaction. The indicator is a numerical expression that can be defined with relatively simple investigation, without leaving much exposure to the individual feelings and perceptions that can affect accuracy of results. The indicator is related both to the existing physical conditions and to the human attitudes. It represents the measured value relevant to the dynamic instants in daily human life rather than static conditions.

The evaluation of the research findings gives the possibility to derive a general conclusion to say that attempts serving to increase the ABA indicator seem to increase the dwellers home and environment satisfaction, and its effect over the general satisfaction levels is significant. At that context there may be opportunities to increase the dwelling user satisfaction without being obliged to modify the existing static physical conditions causing dissatisfaction to residents.

Attempts concentrated in increasing the ABA indicator may provide higher home and environment satisfaction to dwellers through minor interventions. Those interventions may be as simple as changing the pavement of the patio, converting a stair to a ramp, illuminating an entrance or adding a seating unit to the bus stop.

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