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A Case Study For The Evaluation Of Total Quality Of Suburban Buildings In Turkey

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ABSTRACT

Housing demand increased in the 80s and 90s due to rapid industrialization of the Turkey. The rapid and uneven spatial growth within and among cities was largely a result of migration from rural areas during the 80's. Many buildings constructed in this period were characterized with low quality of life. Similar to the situation faced in almost all developing countries, making adequate shelter available, accessible and affordable to meet the housing need for the ever-increasing populations of the urban settlements has always been and remains to be a challenge for Turkey. However, during the past decade, the quality of the life becomes an important issue due to increased wealth of the country. In this study, a case study for the evaluation of the total quality of an existing suburban area that was built in the past and unqualified for today's requirements has been conducted for various criteria.

HOUSING POLICY IN TURKEY

The Constitution of Republic of Turkey states that "The State shall take measures to meet the needs of housing within the framework of a plan which takes into account the characteristics of cities and environmental conditions and shall support mass housing projects" Moreover, the constitution states that; *"every citizen has the right to live in a healthy and balanced environment"* [1,2].

The pace of population increase and migration to urban areas in Turkey has been very high after 80's. The rapid and uneven spatial growth within and among cities was largely a result of migration from rural areas where population declined in absolute numbers during the 80's. Therefore, urbanization process in 80's has been experienced in a short time span, demand for urban land and housing rises to a very high level. Similar to the situation faced in almost all developing countries, making adequate shelter available, accessible and affordable to meet the housing need for the ever-increasing populations of the urban settlements has always been and remains to be a challenge for Turkey. In such a framework, social housing becomes one of the most significant issues of Turkey.

This uneven spatial growth led to uneven distribution of resources and the necessity for increased amounts of investment in physical infrastructure to overcome inequalities. It also conflicts with both the sustainability and liveability of those areas. In many cities, especially those receiving excessive migration, the rate of housing construction has not been able to match the rate of population increase, and this has given rise to unauthorized housing construction. Affordability is also another major issue for a large number of households who do not have the means to purchase and/or rent housing units within the legal housing stock. Still, governement can afford to finance only 5-10% of all housing construction by means of

Housing Development Administration (TOKI). Municipalities have also an important function in covering housing demand. They provide land and infrastructure for housing. Additionally, many municipalities contribute social housing projects as well. An important contribution is made by cooperatives. However, many people end up settling in unauthorized squatter bringing along many problems like urban exclusion, urban poverty, and degradation of the urban environment and the loss of natural resources. On the other hand, due to rapid housing, many authorized buildings were constructed with limited control, which causes construction of low-quality buildings in terms of safety and technical aspects.

Making adequate shelter available and accessible to meet the housing requirements of the ever-increasing populations of the urban settlements remains to be a challenge for Turkey since the needs and demands are diverse because of high portion of young people in the population and the funds are limited.

Land use, spatial planning and construction works are legislated by the law of Public Works in Turkey [3]. More detailed and technical regulations, standads and documents also control the land planning and construction.

The Law of Public Works of Tukey authorizes municipalities for land use and construction and settlement permissions. Technical quality of the buildings is standardized on national level by many regulations and standards. Standards include design of reinforced concrete, steel, masonry, precast and wooden structures. Seperate regulations for seismic safety design [4], fire safety [5], insulation and energy management [6] are also compulsory. These regulations are modified and executed by Ministry of Public Works and Settlement. Both regulations and standards are obligatory. The recent earthquake code also includes a section on seismic performance assessment and improvement of existing buildings which is first in the world as a compulsory regulation [4]. Some municipalities also have local regulations. Besides, Association of Civil Engineers, have some additional technical requirements for project designs to improve seismic performance. Energy efficiency is also a recently promoting issue. The recent code has many improvements. The new regulation, for example, made it compulsory to use a central heating system for new buildings to improve energy efficiency in buildings. Other regulations for the infrastructure and lifeline systems are given by many other documents published by authorized Ministries or Foundations.

PROFILE OF THE CASE STUDY AREA

In scope of the study Adalet Evleri-Denizli, is selected as a representative case for suburban buildings in Turkey. Adalet Evleri is located at north-west part of the Denizli City center (Fig. 1). It was firstly constructed in the suburban areas of the Denizli city in the early 80s for civil servants working for ministry of justice. The main motivation for the suburban public housing in Turkey is the low cost of the land at suburban areas. However, rapid development of the city due to industrialization expanded the city to that region. Nowadays, Adalet Evleri is close to the city center. It is a typical example of the public housing in Turkey funded by government. At that time, many public houses had been constructed at suburban areas, which are now in city centers or very close to city centers. It is surrounded by other settlements now. After 30 years of urban setlement, it is still a low-density residential area.

On the other hand, rapid development of the region in the recent years causes the mixture of the inhabitants from different social, cultural and economical fractions. It seems to be not a major problem for now, but is a possible source for the disharmony of the society.

Denizli city is placed mainly on a plain land surrounded by mountains, which causes the city area to have a microclimate. This makes city warmer and less windy when compared to its neighbouring cities. As the city is sited on a plain land the study area has a flat terrain. The study region does not have many trees like the city. But being a suburban area it has many grassy fields in the close vicinity. Additionally, the forested mountain foots are 2.5 km away.

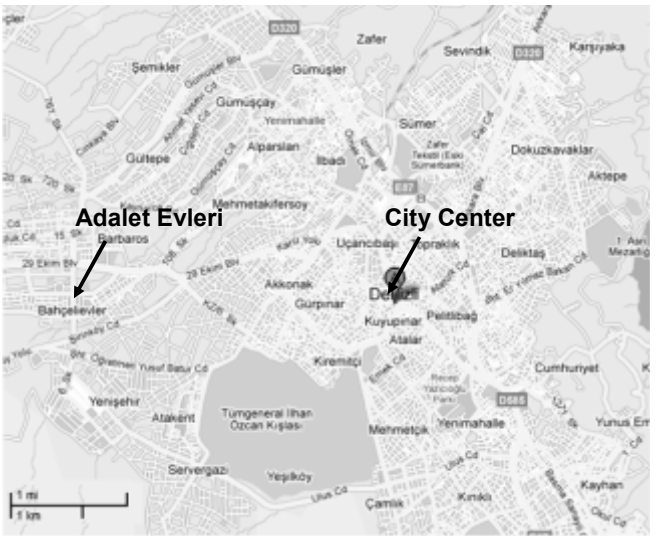

Figure 1. Location of the study area [7].

Denizli city is located on a major seismic zone in Turkey. Ancient cities, Laodikea (1 km) and Hierapolis (15 km) were destroyed by earthquakes. Another natural disaster threating the region is floods. Buildings are located on a river bed.

Services and Technical Aspects

In the past years, the spaces designed for the social and sportive activities cannot respond to the needs of the occupants. However, in the recent times significant improvements are made in the region. There exist 3 elementary schools near to the Adelet Evleri less than 400 m away. Additionally a kindergarden, which is 300 m away, has also been constructed recently. There is a grass football field and running track 250 m away for sportive activities. However, high school buildings are located away from the area and students have to use service buses. There are two mosques, one in close vicinity and one just near the Adalet Evleri for religious needs of the inhabitants, who are all Muslims. There is also a public garden in mosque area and district has many grassy lands nearby.

Although the drawed attraction with construction of new courthouse and hospital, being a suburban and low-density area the commercial activities and services in the region are poor. Closest available mall is 1.7 km away. There are not many groceries, shops, pharmacies, cafes or restaurants in the close neighbourhood.

The old parts of the city have a jumbled transportation network. This disorderliness are also continued in the settlement areas developed in the 80s and 90s because of the rapid development those areas. However, after the 90s, rate of the growth of the city decreased and better plans have been applied for these suburban areas. The area has a good connection to the transportation network and has good and functional roads and pedestrian paths. There is regular bus and private minibus connection to and from the area. In the peak or day time, no traffic problem is observed, although it is a new attraction center of the city, due to hospital and courthouse. Nevertheless, same condition is not true for bicycle roads. Like city and even country level, bicycle roads are not given much importance.

Although Adalet Evleri has its own parking lot, many buildings do not have. Since the district is not crowded, insufficiency of parking lots is not feeled by inhabitants for the time being. However, it is a potential problem for the future.

City municipality is responsible for the clean water distribution and wastewater collection systems. Electricity, telephone and internet systems are present in the area.

Accessibility to and from district is satisfactory. There are buses run by the municipality and private owned minibuses to the centre of the city and other districts. Accessibility within the district is not well designed for elderly and disabled persons. Pavements are rather high and oblique surfaces are not sufficient.

Open spaces, adequate distance between buildings and gardens around buildings and the new park area make the area relieving in visual sense. Because of low population density and non-existence of industrial facilities, no noise problem exists in the region. However, the illumination in the area is not sufficient when the today's standards are considered.

Health and Safety

Despite the poor traffic signs and marking of zebra crossings, because of low density population not many accidents are encountered in the region.

City municipality is responsible for the cleaning of the public spaces, clean water supply and wastewater collection, cleaning of the area and fire safety. There is not much problem about that and the area is clean and healthy in scope of these services. There is not any soil pollution in the area. Denizli city is placed mainly on a plain land surrounded by mountains, which causes the city area to have a microclimate. This makes city warmer and less windy when compared to its neighbouring cities. Nevertheless, because of this warmer air (slowing down the rising of hot gases from chimneys) and lack of enough wind to spread the air around the city, in winter air pollution becomes a major problem that affecting the quality of life. Since 2006, Denizli City started to use natural gas for heating in main settlement areas and industry. This improves the situation sensibly. However, the problem has not been overcomed completely. Being a low density population area at the edge of the city and with less number of buildings, the region is less affected by the air pollution.

Earthquake is one of the major problems for many Turkish cities, like Denizli. City is on a region that is highest one of the 5 seismic zones of Turkey. Although, Adalet evleri is located on a hard soil layer, expected peak ground accelerations (PGA) at the area reaches up to 0.21g for a scenario earthquake of M6.9 as shown in the Fig. 2 [8].

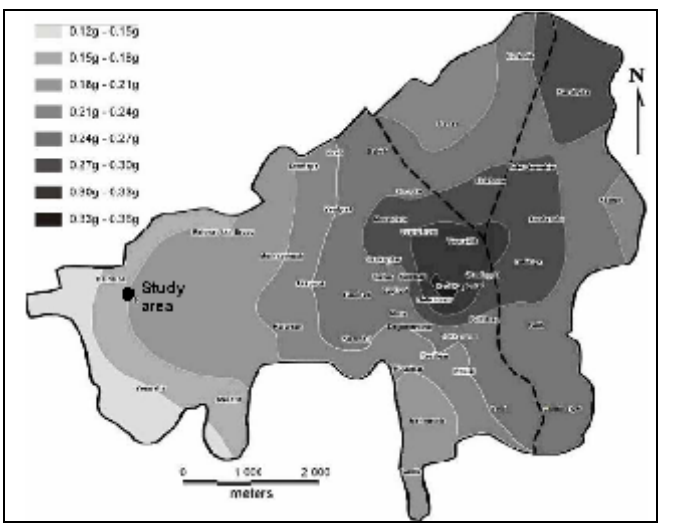

Figure 2. Distribution of the expected PGA values for M 6.9 earthquake at Pamukkale Fault

Another important possibility of natural disaster is flooding. The buildings in the region were constructed very near to the bed of two streams. These two stream beds can be seen on the Fig. 3. The rehabilitation of these streams is essential for the safety of the inhabitants.

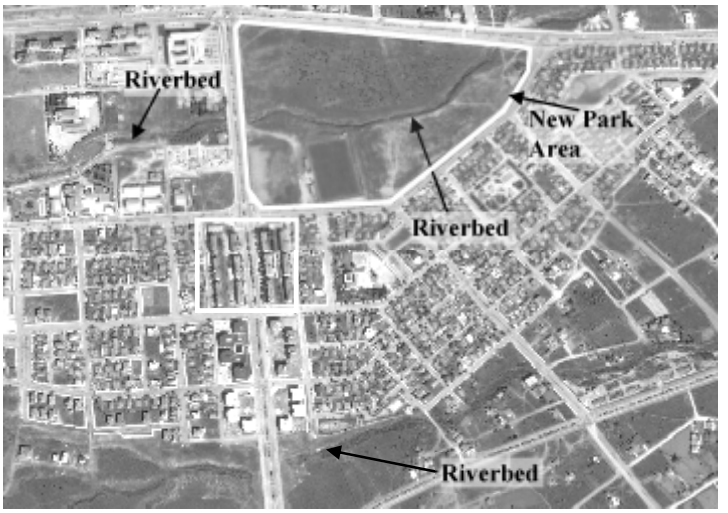

Figure 3. Aerial view of the Adalet Evleri and surroundings.

Social aspects

Adalet Evleri, has been constructed by the government as social houses for civil servants mainly for the employers of Ministry of Justice. Therefore, inhabitants are civil servants and they are typical middle and lower-middle class Turkish family. Like Adalet Evleri, some of the inhabitants of the district are civil servants. The district has also inhabitants that are belong to lower class Turkish family types with lower incomes who are moved the district from rural areas between 80s and 90s when the land and rent for apartments are relatively cheap when compared to city center.

Because of the high and dense buildings and lack of recreational areas, the city center became more crowded and unpleasant when the visual and acoustic comforts are considered. As a result, the people with high incomes started to move outside the city center. Therefore, with the recent expansion of city to urban areas, increasing number of luxury apartment blocks has started to be built in the area for these people.

For this reasons there are inhabitants in the district with wide range of income values and classes. This may seem to be a potential for social disturbance. However, the culture of Turkish people that is unaccustomed to clash between social classes and low density of population prevents such uneasiness. Additionally the people who are moved the district from rural areas are started to move outside the district as the region becomes richer and rents become higher. This situation helps the region to develop into a more homogeneous place. And the recreational and sportive areas for hobbies, which relaxes people and also helps meeting of them, is useful for relieving social tension. In that sense, these facilities are important for social interaction, especially for the teenagers who acts relatively more with emotions and be a source of social problems. For the mentioned reasons any conflict between different social classes is not expected in near future.

Figure 4 illustrates the distribution of the criminal events in the region [9]. All of the shown crimes are ordinary crimes that are not specific for the area. There are not any organized crime events, act of vandalism, hooliganism, crime organizations or gangs known in the region. Crime rate is low as expected due to low population density and cultural uniformity in the area. But some inhabitants prefer to have private security as well. As a result some buildings have security cabinets near to them.

Although, crime is not a big problem for the area, Adalet Evleri has its own security. Therefore, crime risk is very low for the case.

Green areas in the region is somewhat neglected. Insufficiency of parking lots is a possible future problem. Besides, pavements are rather high and oblique surfaces are not sufficient. Therefore, some improvements are needed for the accessibility.

Interventions, repairs and rehabilitation

Many of the buildings' seismic safety level ara not acceptable in the region. Expected rate of building collapse after a probable earthquake with a magnitude of 6.9 is between 1% and 2%. However, after such a moderate earthquake almost half of the dwellings are expected to be damaged. Expected ratio of death and serious injuries are about 1‰ [9]. Major portion of the buildings in the district is unsafe when the seismic standards are considered and need to be substantially refurbished.

Many buildings do not have a satisfying level of structural and fire safety. Major portion of the buildings do not have fire alarms, proper number of extinguishers and many do not have fire exits. Even they have steel stairs attached to the buildings as fire exits in their designs, by the enforcement of the regulations; it is not constructed for some old buildings. The newer ones have because of more strict supervision.

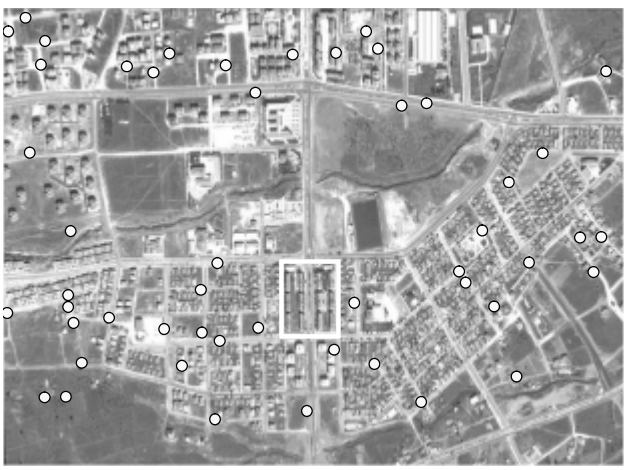

Figure 4. Distribution of the criminal events.

BUILDING PROFILE

There is government owned social houses and private owned buildings at the region. Buildings have started to be constructed at the area since 80s. Each block has 4 dwellings on each floor. In the settlement there are 240 dwellings that are occupied by about 900 people. As there is still empty plot of lands around the settlement, building construction is still on going at the region. Therefore, the ages of the buildings are between 0 and 30. While the new buildings are technically and architecturally good, the old ones are unpleasant.

By visual inspection of the physical state of the buildings in the region (excluding new buildings newer than 5 years), it is determined that 53% of the buildings need minor, 2% need major amendment where as only 45 % of the buildings do not need any improvements [10].

Buildings in the area are in very various styles and sizes with different ages. This gives a feeling of disorderliness in the area in some sense. But the relatively large distances between buildings and grassy lands ease this feeling and make the place more pleasant in visual sense.

Especially the old buildings suffer from technical degrade (Fig. 5a). The outer paintings of these buildings are in poor condition and unseemly. The window frames are old with spoiled paints and ugly looking, railings at the balconies are rusted, some windows have

sunblinds and some do not. Non-uniformity of buildings' windows, balconies and overall appearance that belongs to different apartment levels is a common problem.

Besides these old buildings there are new buildings at the region. These buildings have very beautiful appearances with modern architectural features, nice colours, new window frames and aluminium railings (Fig. 5b).

Figure 5. a) Degradation of the old buildings and b) high technical quality of new buildings

Structural system, loading and fire performance

Almost all the buildings in the area have cast on the spot concrete structural systems. Buildings with reinforced concrete load carrying systems are very common in Turkey and constitute the majority of the existing building stock. These systems may be composed of solely by frames, shear walls or frame and shear walls together. For safety against seismic actions systems with shear walls has more advantages and preferable over the only frame systems. Nevertheless, constructions of shear walls were considered as expensive by the contractors and they were not common in the past. Fortunately, with the recent awakening about seismic events after devastating Marmara Earthquake, use of shear walls has been increased.

Same situation is also valid for foundation of the buildings. Old buildings have very simple footings, which has many disadvantages like vulnerability for differential settlements, lack of sufficient flexural rigidity and lack of structural integrity at the foundation level. But, in the new buildings more sophisticated foundation systems like continuous foundation or raft foundations has been preferred.

The distribution of unusable buildings after scenario earthquake for Denizli City is given in Fig. 6 [8]. As illustrated in the figure the expected percentage of the unusable buildings is between 0% and 8%. The values are highest in the city centre due to high number of old and deficient buildings in that area.

Since structural system of many of the buildings is reinforced concrete, which has some degree of fire resistance naturally, fire performance of structural systems is relatively good.

Energy efficiency and building physics

Even if it is very important for financial, medical and environmental concerns, isolation has just recently started to be given importance in Turkey mainly for short-term economical reasons. As a result most of the buildings in the area, especially the old ones, has poor isolation.

Most of the buildings have brick as wall elements which has not good isolation properties. Thermal isolation has been poor, especially on building roofs and facades because of use of these bricks and lack of special isolation precautions. With the use of pvc frames, double glasses and aerated concrete blocks as outer wall elements some buildings has a better degree of isolation for windows and facade.

Since Denizli has a varying temperature in a wide range both heating and cooling systems are essential. Generally central heating exists in apartment houses whereas cooling is done in dwelling level.

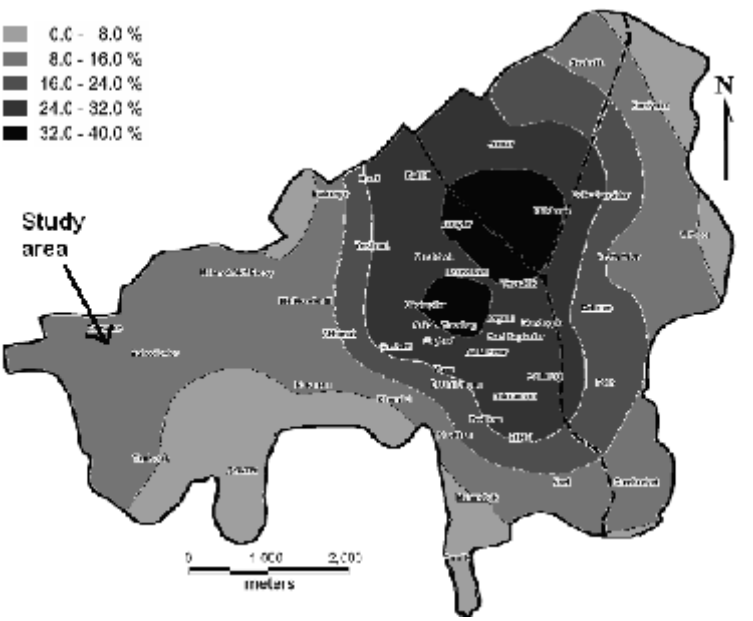

Figure 6. Distribution of unusable buildings for a M 6.3 earthquake at Pamukkale Fault.

Accessibility

Major portion of the buildings do not have elevators in the region. In Turkey it is mandatory by building regulations for the buildings to have elevators but only for the ones with more than four storeys. While new buildings are constructed with elevators, many old ones even with five stories are not. Lack of elevators is an important problem for the dwellers. It causes accessibility problems especially for the disabled and elderly and for parents with small children.

Also area for some staircases is not sufficient for supplying comfortable accessibility. The staircases were used to be considered as waste space by building contractors and they were trying to minimize this area. Stair widths are too narrow in some buildings likewise. Even some of the buildings with stairs at the entrances is not suitable for the access of the prams or wheelchairs. In general, very little or no attention has been given for the accessibility of disabled or elderly persons in or out of the most of the buildings.

Social aspects

Adalet Evleri is mainly occupied by families with children. The number of households in each dwelling varies between 2-6 people. Average household size is 3.75 people [11]. Most of the households of Adalet Evleri are the officers working in the Court of Justice located close to the buildings. It has a uniform cultural structure with some minor changes through all households. That structure minimizes the problems due cultural misunderstandings and minor changes even serves as diversity.

Although they are not in good condition, a playground and common green spaces exist in the Adalet Evleri. However, no other common services are provided.

Interventions, repairs and rehabilitation

Like many other buildings constructed at the same time with old earthquake code requirements seismic resistance of the buildings are not sufficient. Therefore, structural systems of the buildings need substantial rehabilitation. In addition, thermal isolation of the buildings is not satisfactory and especially heat transfer from façade should be prevented with isolation elements. There are not any fire alarms or extinguishers in the building, and fire exits do not exists. For that reason, some measures regarding the fire safety are needed to be taken.

DWELLINGS PROFILE

The average size of dwelling space for Denizli City is 106 m². In this figure the average per inhabitant is about one-third of this area. It is clear that the district has a more uniform dwelling profile (Table 1). This profile is also proved in the Adalet Evleri, in which the dwellings have 3 rooms also.

Table 1.Typology of dwellings in the City and the District [10, 11].

Scale	1 room dwellings, %	2 room dwellings, %	3 room dwellings, %	4 room dwellings, %	5+ room dwellings, %
City	0.3	6.4	49.3	36.5	7.4
District	0.2	2.5	90.6	5.1	1.6

Architectural and functional aspects

Building blocks were constructed adjacently. Dwellings have the same architectural plan. Limited dwelling space also restricts to make major revisions. In terms of aesthetics, the dwelling quality is below the normal. There are two types of dwellings in the building with a surface area of 75 m2 and 100 m2. Even if 100 m2 dwellings may be taken as an average value for Turkish buildings, 75 m2 are a bit low for regional standards. These figures are acceptable when the time of construction of Adalet Evleri is considered. However, with economical and social development of the country people started to demand bigger and more comfortable houses.

In Turkey children live with their parents until they get married. People, particularly men do not get married until they have decent jobs. For the ones that take university education living with their parents may easily continue until the age of 25 or more. Therefore, in general dwellings should meet the requirements of four or more grown people. Moreover due to hospitality of the Turkish people, they like to spare one of the rooms for their guests only. Therefore one room is not used for the owners' needs which additionally increase the need for space.

When the social life of the country is taken into account the surface area of the dwellings may be considered as insufficient especially the ones with 75 m^2 area.

Limited area of balconies may be mentioned as a major architectural drawback of these buildings. A small balcony only serves for drying laundry of dwellings. As the city has a hot climate, it is a pleasure for many people to use balconies for refreshment. However, it is very hard to recover that problem because recovery will necessarily reduce net area of the dwelling.

Structural system, loading and fire performance

The structural system of the buildings is reinforced concrete frames. Partitioning walls are made of masonry and are not to be considered as load-bearing elements. On the time of

construction, concrete quality in Turkey was quite low, i.e. it has a compressive strength about 10 MPa.

No exceptional loads like overloaded slabs acting on the building in the time of investigation. However, the buildings can experince exceptional seismic loads in future.

Fire safety of the buildings is low as the fire safety design is not a major concern in the time of construction. Buildings have no fire escapes or fire stairs. However, main structural material is concrete and therefore a structural failure due to fire is not expected.

For fire safety, a fire extinguisher is a key fixture to give a rapid response to especially small fires. Fire alarms are also important and must be situated in every flat. However, both of them are missing in the dwellings. Besides, lack of fire escapes is also an important drawback.

Energy efficiency and building physics

In Denizli City, average lower temperature in January is 2.2^0C, and average higher temperature in July is 34.3^0C [12]. Therefore, both heating and cooling performance is important. Central heating system exists in the case study buildings. However, water is heated in each dwelling seperately. Room temperature is varying througout the site due to insufficient thermal insulation. Air conditioning is needed especially in June, July and August. This service is supplied by discrete systems for each house. In either case, poor insulation is a major problem. It is needed to improve thermal insulation of the buildings.

User's possibilities to influence to their dwellings and illegal interventions

Dwellings and living spaces are designed to meet the demands of the users generally. However, Turkish families are mainly multy-children families and many of the dwellings do not have enough room for children. Therefore, illegally merged balconies with indoor spaces are a frequent problem for Turkey. However, these buildings belong to the state and these kind of illegal interventions are very limited.

Management and financial aspects

Almost all of the dwellings are occupied by tenants. The quality of the buildings is quite low with respect to the surrounding buildings. This is because of the special lower rental rates applied to state officers by governement. Rental rate for the dwellings is about 1-1.5 €/m^2.

Interventions, repairs and rehabilitation

In the Turkish case, dwellings should meet the requirements of four or more grown people usually. Moreover a guest room is also an essential for Turkish culture. The surface area of the dwellings may be considered as insufficient especially the ones with 75 m^2 area. Limited area of balconies may be mentioned as a major architectural drawback of these buildings. A small balcony only serves for drying laundry of dwellings. As the city has a hot climate, it is a pleasure for many people to use balconies for refreshment. However, it is very hard to recover that problem because recovery will necessarily reduce net area of the dwelling.

CONCLUSION

In the past years Bahçelievler and surrounding districts, where the Adalet Evleri is located, has been a new expansion area of the city. Although, there exists some old suburban housing in the area, some of the spaces are occupied by new buildings of high technical quality. Due to increase in the population, municipal and governmental bodies directed many public services to the area.

The new courthouse of the city is constructed within 500 meters from the Adalet Evleri. Additionally, a new hospital building were started to serve in 2004. All these services attract many people to the area and it causes an economical revival. These services also cause an improvement in the transportation scheme of the area.

On the other hand, lack of places for social activities is an important problem. However, new Public Park planned to be constructed by municipality that is close to the Adalet Evleri will definetely improve social interaction. Besides, Adalet Evleri has many other problems to be solved on building and dwelling scale, such as structural, architectural and insulation problems.

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