The structural systems of semi-masonry houses built at Fener (Istanbul) in 19th Century

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ABSTRACT: In this paper the structural systems of semi-masonry houses at Fener (a district in Istanbul) are studied in different aspects as structural analysis, details and deterioration problems encountered today. These houses have special importance in architectural and structural point of views since they reflect the western influence on the form of single house and the urban texture in Ottoman Capital in late 19th century. The district was inhabited by Greek minority of Istanbul. Since they had close relations with western commercial companies as their representatives or clerks general philosophy of life of Greek minority was fairly different from Ottoman Society. On the other hand in 19th century the state have promulgated western originated regulations in order to modernise the society. This has also made the creation of this new urban section possible. The paper tries to present a brief historical background about the houses and explain their structural properties and present situations.

1 INTRODUCTION

The social and economic changes occurred in the western world during 18th and 19th centuries have been also reflected to Ottoman Empire. Numerous reforms were realized in military, social and administrative areas in this state. The authority of sultan has been restricted by the Rearrrangement Law (1839) and the principle of equality has been applied to the society. Hence municipalities have been established, building regulations have been promulgated and planning works have also been started.

The administrators of this era have employed western experts in order to apply the European urban texture to Istanbul. The planning works have been performed to convert the organic texture of the city to an orthogonal form. Then the general view of the city and its urban texture have been changed. Fener district of Istanbul investigated in this paper has also experienced this change.

2 THE FENER DISTRICT

2.1 History

Fener, where is in the historical peninsula and on the cost of Golden-Horn has been existed since the Byzantine era (Fig. 1). It was called as Petron and Monastery of Petron was there (Van Millingen 1899). Today there are Orthodox Patriarchate and its church in the district. After the joining of Istanbul to Ottoman Empire the Greek immigrants brought from Black Sea and Aegean regions have been resettled in this district (Schneider 1952). The moving of Patriarchate office to Agios Yeorgios Monastery (Kömürçüyan 1988, Muller-Weiner 1977) in the district has also emphasized the Fener for Greek originated inhabitants (Ortayli 1995).

The recognition of Mehmed II the Orthodox Patriarchate has resulted in a different legal status
for Greeks comparing other minorities in the Ottoman society. Furthermore the Greeks educated in the school at Fener district have been assigned as translator, consultant and voivode by the state. These close relations between Greeks in Fener district and the state have ended by the Greek Revolution in 1821 (Millas 1994).

The Greeks, like other minorities, have become wealthy by the means of trade in Black Sea and Mediterranean and also cooperation with western merchants and gained a social power. Particularly after the commercial agreements signed in 19th century with European States the Greeks have increased their importance as bankers and representatives of western merchants. Besides the commerce they were engineer, lawyer, high rank officer in European companies and qualified craftsman (Millas 1994).

2.2 *The urban texture and architecture of the district*

Along with the Greek Orthodox Patriarchate in Fener there are also Panagiya Muhliotissa (Muhl- lion) Church, which is the only one continuously in religious service since Byzantine era and Ay- ios Georgios Metohion Church devoted to Patriarchate of Jerusalem and three small mosques.

The Greek High School for boys on the top of the hill has been an important educational institution to educate the young Greeks for Ottoman bureaucracy and Orthodox clergy as well. The Yoakimyon High School for girls and Marasli Greek Elementary School next to the Patriarchate are the other schools in the district (Fig. 2).

The present urban texture in Fener district reflects the western orthogonal texture started to be applied especially in the second half of 19th century. The activities performed in this period have been applied to new residential areas or destroyed sections of the city by fires. The Fener district
as the other parts of Istanbul has suffered from great fires during 19th century (Ergin 1995). Thus after the fires the district has been considered among new planned areas. At the junction of roads in the new geometrical pattern the corners of buildings have been cut at the angles of 45º in order to form a small public squares (Celik 1996). This type of planning has been carried out by Italian engineer Storari (employed between 1855-1863) (Ergin 1995) in the district and the other sections of Istanbul (Yerasimos 1995).

Ottomans have tried to control the developments in settlement and construction activities in non-Muslim sections of the city applying strict inspection. This fact has resulted in high density of population and very narrow lots in those regions (Ortayli 1979). In Fener district after the fires due to the new planning has followed the old pattern in lots the new texture has kept its old congested model.

Fener houses reflected the eclectic style of the period including antique Greek elements. They are designed for single family and have narrow façades and changing heights between two and four stories. In regard to plan schemes their functional use is different from Ottoman houses generally occupied by large families. (Fig. 3)

![Figure 3.](image)

Having an adjacent order and generally row houses style they are for moderate and low-income groups of minorities of the period. In the districts settled by the people working in western companies (these are generally district of minorities) the types of houses taken from western world have been constructed (Kiray 1979). Since the Greeks were in the same group as mentioned above Fener district has also exhibited the same features.

2.3 Construction requirements in building regulations, Rules for form

The avenues have been classified in five groups with respect to their widths in the Regulations dated 1864 and 1882. For example first class avenue is 11.4 m and 15.2 m in width in 1864 and 1882 regulations respectively (Ergin 1995).

In the first Regulation (1848) height of a building has been specified considering the structural material used in construction. In the following Regulations this height has also depended on the width of street where the house to be built. The width of street has also determined the projection span of a bay window which is an important element of classical architecture. The width of bay window has been arranged with respect to the width of the lot. The positions of threshold, ornamental elements, architraves, window leaves, rain pipes, iron window guards and lightening elements on the façade have been defined in detail in Building Regulations (Ergin 1995).

2.4 Rules for construction material

In general, houses have been built in timber in Ottoman Empire and Istanbul. Since timber structures were not fire resistant fires have spread up in vast residential areas and caused great damages. Therefore the regulation compelling to be built masonry houses was promulgated before 1839 but it was not applicable in practice and timber house construction has continued.

In all Building Regulations promulgated after Rearrangement Law (1839) it was compulsory to build masonry houses in order to prevent fire hazards. The result of this application has ap-
Historical Constructions

Appeared in the late 19th century, the present masonry building stock in Istanbul consists of buildings constructed in that era.

In the first Building Regulation (1848) buildings have been divided into two groups as full masonry and semi masonry with respect to their construction material. In full masonry buildings all the walls and floors would be constructed in masonry and in semi masonry buildings only outer walls were masonry inner partitions and floors were made of timber. Properties of construction materials and mortar and life span of building have also been specified in this Regulation (Ergin 1995).

The measures against fire have been detailed in Building Regulations. The main cause of fires was chimneys in kitchens then an example of fireproof chimney construction has been given.

In the districts of high density of buildings as Fener district, gardens which were an important feature of traditional Ottoman house and urban texture have been removed. In order to provide similar function the terraces on the top story have been constructed using fireproof materials. It was also compulsory to cover the roofs using the fireproof material (Ergin 1995).

3 THE CONSTRUCTION SYSTEM OF THE HOUSES IN FENER DISTRICT

The houses in the district have been constructed to form a masonry box in accordance with the building regulations promulgated in 19th century. The height of these houses change between two and four stories. It is observed that in walls of basement brick or stone and in walls of main and upper floors only brick have been used. In contrast to masonry outer walls inner partitions are made of timber framework (Fig. 4).

![Figure 4.](image)

Each building has its independent walls. Basement walls have been constructed using horizontal beams to provide the integrity of wall structure. It is observed during repair works that some buildings have no footings namely basement walls are supported by soil surfaces. The floor above
basement (main floor) are made of either barrel vault system or timber beams. In some cases both have been used together. For example although ceiling of kitchen (requirement of Regulation) and floor of main entrance are made of barrel vault system and the floors of other spaces are constructed in timber beams. Nevertheless there are some other cases in which whole main floor are made of barrel vault system (Photo 1, 2).

Terrace which is for drying laundry has a masonry floor constructed in barrel vault system. Floor covering is terra-cotta tiles or zinc plates. The floors of other places than terrace on top floor are made of timber beams and wooden covering. The roof construction covered with fire-proof tiles has been constructed on the top floor except terrace. (Fig. 4)

Timber floor beams are generally located parallel to façade and connected to the outer walls by metal clamps at every three beams (Fig. 4, 5). In some buildings under the partitions it is placed steel I profile between timber beams. This profile is also connected to the outer masonry walls by metal clamps (Photo 3, 4).
Thicknesses of load bearing walls are two, one and a half and one brick length in main and upper floors respectively. Inner partitions are made of timber framework using vertical struts. The spacing between these struts are generally empty as it is in traditional timber houses but in some examples there are brick fillings in there especially in the partitions of main floors (Photo 5, 6). The thickness of inner walls is 16 cm in general. In the cases with brick fillings there are shallow arches on the door openings.

Photo 5, 6.

The openings in façades have been spanned by circular, shallow arches or linear beams. The thrust of arch has been compensated inner resistance of wall structure since openings are relatively small with respect to wall in dimensions. On the other hand openings on bay windows have been equipped by metal tension ties against lateral thrust. (Fig. 6)

Figure 6.

Figure 7.
Bay window is usually located in the first floor. Its floor system changes depending on the position of bay window and the place of house in the block. In general floor of bay window has been supported by a barrel vault system with I beams located perpendicular to the façade of house (Fig. 7). In some other cases there are I beams only perimeters of bay windows. In these cases the floor construction of bay windows are made of timber beams covered by laths and plaster at bottom surfaces (Photo 7).

Bay window is supported either, by a supporting element (iron stanchion or marble cantilever) or its own beams (Fig. 8, 9). The form of iron stanchion reflects the architectural tastes valid in the period. In some examples the spacing between stanchion and building has been filled by brick filling and ornamental plasterwork made on it (Photo 8, 9). The outer walls of bay window are half brick length in thickness in order to provide a light construction on the supporting system.

In buildings on the lots in the corners of the block it is observed that bay windows have been supported by I beams continuing in the whole room space at the angle of 45° against the façades of the building (Fig. 10, Photo 10). So the room with bay window has also the barrel vault floor system.
4 DETERIORATION OF BUILDINGS

4.1 Causes of deterioration

There are two main factors, which cause an increasing damage on Fener houses, first social changes and second physical effects.

Changes in social structure in some cases is an important factor causing deterioration of historical districts. To day Fener district shelters low income people coming from rural area recently. The former inhabitants of district, the Greeks, have left there due to the political issues. So, their evacuated houses with low rents have been very suitable for the new settlers. But these new settlers have not enough consciousness to live in and maintain such kind of houses. Their different way of life have caused drastic changes on the houses such as converting a single family house to a multifamily accommodation and poor or no maintenance for their preservation.

The new type of accommodation has brought great changes on architectural and structural systems of the houses. Mainly each story has been converted to an independent flat for a single family, open terrace spaces have been covered by roofs to have more rooms and in some cases an additional story has been constructed on top floor. All these interventions have added extra loads and caused damage on structural systems of the houses (Photo 11).

On the other hand fires in late 70’s have resulted in loss in building stock at Fener. In these fires inner timber structures of houses have been heavily damaged and the only surviving parts have been outer masonry walls (Photo 12).

The physical effects of deterioration are soil settlement, weather conditions, constructional defects and material wearings. The soil which the Fener houses have been built on has two layers of practical importance such as the weak surface layer and the relatively strong layer of clay and schist. The surface layer consists of deposit of earth and debris formed due to constructional works done since almost foundation of the city. It is a soft and loose layer of 2.5-8 m in thickness and has a little resistance against vertical settlements of wall footings caused by gravity loads. In addition to this fact the expansion works of waste water system of Istanbul in 80’s has also given rise to excessive soil movements and subsequently damages in some houses (Togrol et al. 1986).

4.2 Examples of deterioration

Load bearing walls: Main deterioration on these elements are the formation of cracks because of unequal soil settlements. Due to the deformations on wall structure the bond between covering material e.g. plaster and wall surface weakens and cracks occur on the covering material. If there is no repair work for these cracks in the course of time they spread on the wall surface and the effects of rain and weather can easily penetrate into brick body and start to destroy it. This is because of poor maintenance and insufficient care for these houses. Furthermore there are typical cracks caused by unequal settlement on façades at weak locations such as upper and lower sides of openings for window and doors (Photo 13, 14). There are also gaps between adjacent houses due to the rotations in foundations caused by unequal settlements (Photo 15).
Bay windows: The marble cantilevers supporting bay windows have cracked and been broken under the effect of compressive stresses (Photo 9). The effects of rain and weather have also spread up this deterioration. In the case of iron stanchions it is observed that the protecting plasterwork on fillings material containing the stanchion have been destroyed at first. Then the filling material has cracked and been broken afterwards the iron stanchion has exposed to direct weather conditions and corroded. The plasterwork on the bottom surface of bay window has also been broken and the weather effects coming into floor system of the bay window (barrel vault or timber beams) have caused great damage there (Photo 7, 17). In some cases upper lintel of bay window (Fig. 6) have lost its resistance and caused cracks on the upper brick work (Photo 16).

Terraces: In the original houses there are no roofs on terraces used for laundry drying. The covering material on terrace floors are terra-cottatiles or zinc plates. Due to the insufficient insulation or damages resulted from age and poor maintenance water can easily penetrate into barrel vault floor system and causes corrosion on I beams and deterioration on tile fillings.

Stairs: The wooden structure of stairs in Fener houses behaves as a unified system against loads although it consists of many pieces of wood. But by the time constructional defects or loosening in joints or supports cause initial deformations in whole system. At each use of stairs these deformations proceed and the loosening develops. If there is no care for stairs such as preventive maintenance and repair and only using without care can cause damage on this vulnerable element. It is unfortunately the situation encountered in Fener houses.

5 CONCLUSIONS

The Fener houses built in the late 19th century in Istanbul were the residences for Greek minority having close relations with western commercial companies. Their houses and district reflect differences in form and urban texture than the traditional Ottomans counterparts. The structural systems of the houses are also different from traditional timber structures in Istanbul. Because of the political issues the Greek minority has immigrated from the Fener district and their evacuated houses have accommodated new settlers coming from rural area between 50’s and 80’s. The different philosophy of life and low income conditions of new settlers have been causing damages on
the houses in the district. This paper aims to introduce the condition given rise to their coming into view and present their structural features and causes of their deteriorations.

REFERENCES