

Istanbul Grand Bazaar Evacuation System Vulnerability Assessment

YÜCEL Gül^{1,a} and ARUN Görün^{1,b}

^{1,2}Faculty of Architecture, Yıldız Technical University, Istanbul, Turkey

^agul@gulyucel.com, ^bgorun@yildiz.edu.tr

Abstract The Grand Bazaar is a historical trade centre more than 500 years in the historical peninsula of Istanbul, Turkey. It consists of almost 3,600 small shops from different sectors (such as jewellery, carpet, leather, souvenir, finance, restaurant, café, confection etc.), two Bedesten, 64 street and 16 Han (inn) buildings. The Bazaar has 21 main gates that open to different streets and have different relation with outside. More than 25000 staff work in the shops and 300-500 thousand users come to Bazaar daily depending on the season and day. The pedestrian density is changeable, depending on the place of the inner street and the type of the sector. The historical disaster records (earthquake, dated 1766 and 1894, the grand bazaar fire, dated 1954) show that there was evacuation vulnerability. The main gates (exit doors) and exit route need some rehabilitation for safety evacuation during any disaster. The aim of this study is to evaluate the Grand Bazaar's emergency evacuation vulnerability. The evacuation vulnerability factors question the width, length and natural illumination of the evacuation route, maintenance of the roof, presence of hazardous materials, door specifications as size, material, opening direction, maintenance and difference in elevation on the route and exit area such as staircase and thresholds.

Keywords: Disaster, vulnerability, evacuation, the Grand Bazaar

Introduction

The Grand Bazaar, situated in Mahmutpaşa area in the historical peninsula of Istanbul, is representative of historical and cultural legacy in every aspect, still keeping its commercial importance today. The Grand Bazaar which is also called Çarşı-ı Kebir has developed in the construction process through centuries and taken its form today with the embodiment of Old Bedesten (Cevahir Bedesten) and New Bedesten (Sandal Bedesten) dating back to Sultan Mehmed in XV. Century (Fig. 1).

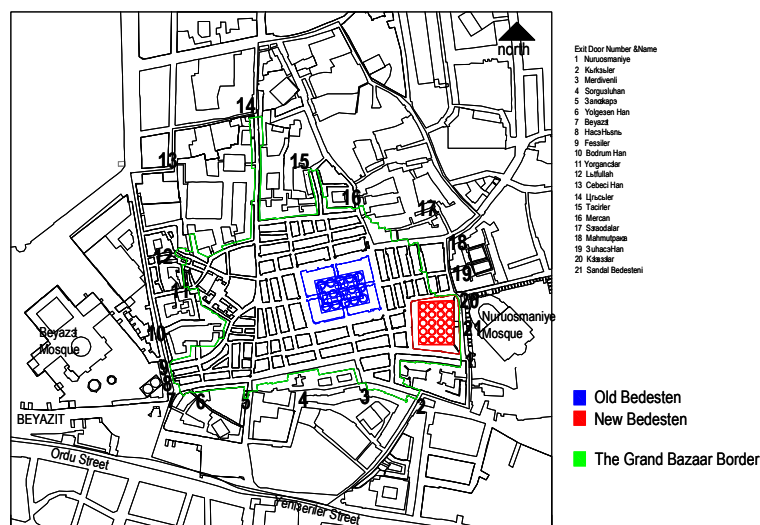


Figure 1: The Grand Bazaar plan with Old and New Bedesten

Through history from past to present; 1546, 1589, 1618, 1652, 1160, 1695, 1701 and 1750 fires, 1766 earthquake, 1791 Uzun Bazaar street fire, 1826 Hocapaşa fire, 1894 earthquake and 1934, 1943

and 1954 fires caused serious damages in the Grand Bazaar that needed a through rehabilitation (Gülersoy 1979). In November 26, 1954 fire two fifth of the bazaar was burnt up and Mahmutpaşa area was rebuilt (Gülersoy 1979).

General Characteristics of the Grand Bazaar

The Grand Bazaar is a historical trade centre with 64 street, 16 Han buildings and two Bedesten constructed in 45.000 m² closed area, where 97 different products are sold in 3600 shops, health centre, post office, police station, mosque and prayers (Gür 2008). 900 jewellers and silversmiths, 500 souvenirs, 250 textile, 200-250 antique shop, 250 carpet and rug shop, 100 restaurants, 10-20 antiquarian maintenance and repair shop, 5 carpet repair shop, 10 weavers, 25 tailors and workshops operate in The Grand Bazaar (Gür 2008). There is a private fire brigade working coordinated with Istanbul Metropolitan Municipality Fire Brigade.

The Grand Bazaar was built on a thick filled soil between Nuruosmaniye and Beyazıt Mosques (Sayar and Sayar 1962). The thickness of fill at the Beyazıt exit door is about 5,70 m and in the Nuruosmaniye Mosque garden 7,60 m (Sayar and Sayar 1962).

The Grand Bazaar is of a single-storey structure except the Han (inn) buildings and Fur (Kürkçüler) Bazaar. Han buildings are of double or triple storey with courtyard. The walls are of alternating stone and brick plastered on two faces. Vaults are of brick and columns are of cut stone (Gülersoy 1979).

The Bazaar's roof covering material is tile. During the investigation, it is seen that the roof maintenance is insufficient (Fig. 2). The rain water of the roof is discharged to underground drainage system by the gutters landing into the bazaar. The rain stream coming from the roofs of different levels and the leakages of the channels revealed problems in many areas.



Figure 2: The Grand Bazaar roof (Photo by Gül Yücel, 2008)

Natural illumination, daylight, is taken from the windows organized on the sides of the vaults (Fig. 3). Besides, electricity is used for the illumination of the shops and streets. Natural ventilation is provided by operable windows and bazaar exit doors which are open all day. Organization of the bazaar doors at different levels, provide good air circulation in the streets of the bazaar. But in the shops, air conditioning systems are used. Such use of electricity sometimes results with the malfunction in electricity infrastructure. Besides, these additional units on the roof destroy the roof tiles.



Figure 3: The Grand Bazaar street (indoor) (Photo by Gül Yücel, 2008)

The Grand Bazaar Evacuation Organization and Structural Problems

The study based on the eye inspection in and around the Grand Bazaar is executed during August 18 – September 30, 2008. In the scope of study, function distribution inside the bazaar, present fire precautions, street and door characteristics and structural problems of inner bazaar are evaluated. In the evaluation Hans which are inside the bazaar are excluded.

In the scope of function distribution, the current situation of the shops of valuable metals (gold, silver, copper etc.), antiquarian, carpet-rug, food and clothing are searched and evaluated.

In the scope of physical characteristics; structural problems as existing cracks and fractures on the walls and ceiling, water insulation problem, physical condition of the evacuation doors (width, height, material and maintenance condition) and usage of the interior and exterior surrounding of the doors are evaluated. The inspection was very hard due to the attached products as rugs, carpets, clothes, bags and garments on the walls of the inner streets and the pedestrian density.

The Distribution of Occupational Branches in the Grand Bazaar Although the names of the streets generally symbolize the products manufactured and sold in the bazaar; different usages parallel to current needs continues its existence inside the bazaar. Though food and drink service was limited with tea shops before, in the course of time its scope is broadened with restaurants. Though these restaurants had to use electricity for cooking, usage of bottled Liquid Petroleum Gas (LPG) is observed as well. The existence of such shops especially around the exit doors will influence the safety of escape way negatively in case of emergency. Jewellery shops with valuable metals, antiquarian, carpet-rug stores, and leather confection trade centres are grouped in specific streets. Recently confection sector has found a place in the body of bazaar and is added into the traditional shopping structure of the bazaar (Fig. 4).

Constructional Problems Physical features and problems about the exit doors and their surroundings including the roof, ceiling and walls are evaluated through the existence of humidity and constructional problems. The problem of insufficient rain water insulation of the roof often results with stain on the vaults over the streets, degradation of the paint, cracking etc. The structural cracks observed on the walls and vaults are seen together with water insulation problems. The cracks are generally parallel to the vault curvature starting from the window openings at both sides of the vault and in the direction of vault length on supports and at the top. This indicates that there might be a soil settlement problem due to the leakages in the underground drainage system.

During the inspection, it is seen that the water leakage problems are in a wide area and cause structural deformations around Cevahir Bedesten (Old Bedesten), Yağlıkçılar Street, Yorgancılar Street and Sandal Bedesten Street (Fig. 5). Repairing the water insulation properly is of great importance to save the structural system of the Grand Bazaar.

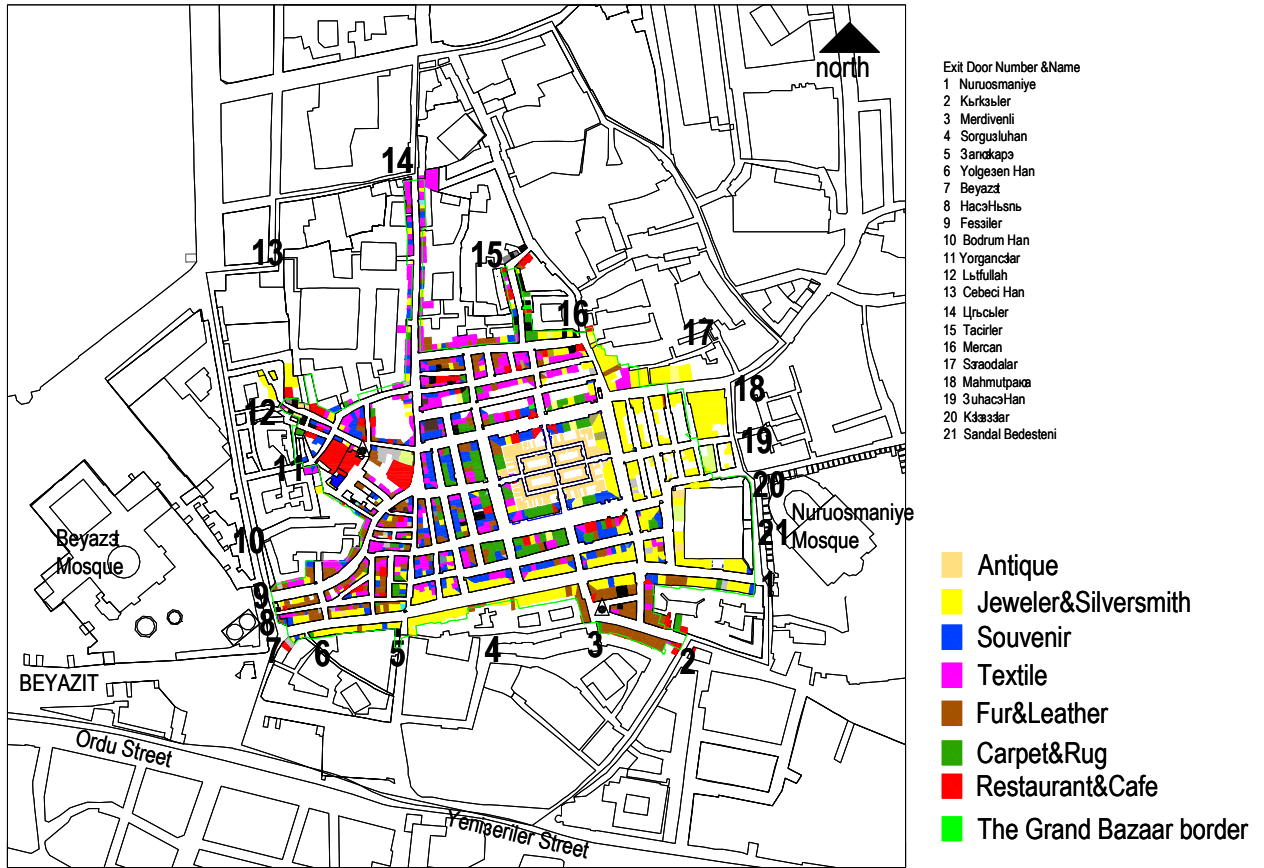


Figure 4: The Grand Bazaar plan with occupational distribution (Prepared by Gül Yücel, 2008)

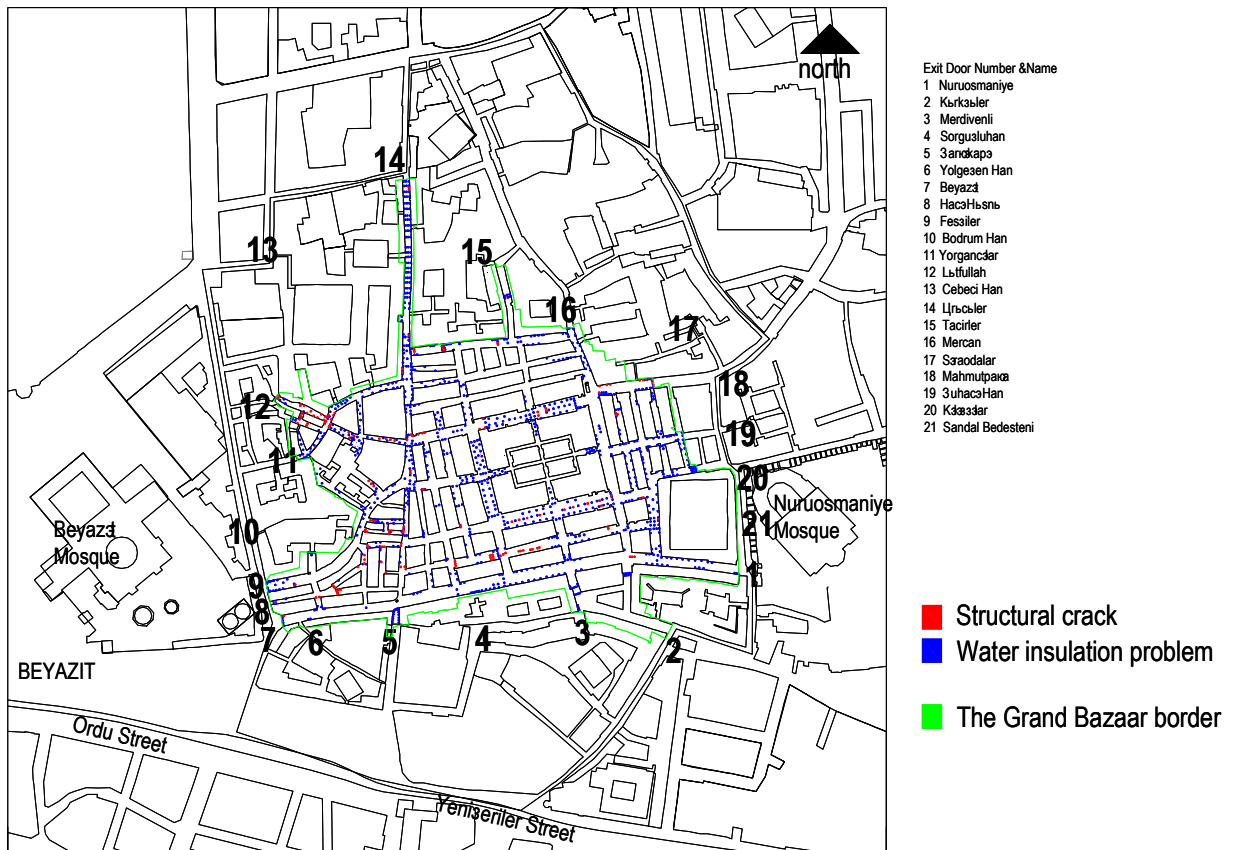


Figure 5: The Grand Bazaar plan showing the water insulation and distribution of structural cracks on vaults and exit door numbers (Prepared by Gül Yücel, 2008)

Evacuation Exit Doors In the scope of study; 21 doors in various dimensions and characteristics are numerated in clockwise (Fig. 5) starting from Nuruosmaniye door. Yolgeçen Han Door on the Yağlıkçılar Street which is currently closed is not evaluated. There are 12 doors which directly open to the outer streets and 7 doors which open to the Han buildings in the bazaar and have exit to the street as a passage. Two of the exits are in the Kürkçüler Bazaar. These doors which enable access to the surrounding streets are open during working hours and are closed at 19.00 from Monday to Saturday.

Table 1: the grand bazaar evacuation system, gate specification (prepared by Gül Yücel, 2008)

EXIT DOOR SPECIFICATION									
DOOR NUMBER	EXIT DOOR NAME	type	Width (cm)	Height (max.) (cm)	Height (min.) (cm)	Passage Length (cm)	Street height (indoor) (cm)	Street width(indoor) (cm)	Street width (outdoor)
1	Nuruosmaniye	Door	305	370		-	795	560	475
2	Kürkçüler	Door	215	416			965	600	610
		Door	100	260					
		Door	100	260					
3	Merdivenli Kapı	Door	160	260			965	600	140
4	Sorguçlu Han	Passage	93	225	-		-	100	450
5	Çarşıkapı	Door	244	305	220			345	585
6		Passage	130					600	140
7	Beyazıt	Door	305	370			795	600	500
8	Hacı Hüsnü	Door	150	280			600	200	650
9	Fesçiler	Door	280	320			630	650	650
10	Bodrum Han	Passage	88	200			200	-	650
	Bodrum Han- The Grand Bazaar passage	Door	238	255				480	-
11	Yorgancılar	Door	198	290	245		708	250	380
12	Lütfullah	Door	197	277			635	200	385
13	Cebeci Han	Door	99	217		1195	217	-	560
14	Örücüler	Door	295	376	310		616	410	440
15	Tacirler	Door	180	250			555	460	270
16	Mercan	Door	256	290			570	405	300
17	Sıra Odalar	Passage	74	360		1220		640	-
	Sıra Odalar-Kalcılar Han	Passage	125	220		200	-	-	655
18	Mahmutpaşa	Door	270	285				720	655
		Door	78	285					
		Door	78	285					
19	Çuhacılar Han	Door	270	410				340	-
20	Kılıççılar	Door	279	342				340	640
21	Sandal Bedesteni	Door	280	530				-	640

Exit Doors and Usage Density The usage density of the evacuation doors in the Grand Bazaar are evaluated by the observations during investigation, by the interviews with the private security crew of the bazaar and by monitoring each door for a period of time. The busiest doors in the sense of usage density are respectively Çarşıkapı (05), Beyazıt (07), Nuruosmaniye (01), Mahmutpaşa (18), Mercan (16) and Örücüler (14) doors. The most frequent exit is done from Mahmutpaşa door (18). The safety of these doors also effect the safety of the pedestrians passing by the streets around the Bazaar.

Fire Safety Precautions For the fire safety precautions in The Grand Bazaar; permanent plumbing systems embedded under the streets, fire cabinets and hydrants in the streets that open to the evacuation doors are evaluated. It is observed that hydrants that are close to the exit doors are hindered under the goods as clothes or carpets attached on the walls. Similarly, the usage of inlets of

the plumbing system and the usage of fire cabinets in case of emergency is difficult due to the display of such products.

The two electric transformers very close to Fur Bazaar's exit door (No.3) and Lütfullah door poses a risk in terms of evacuation safety. Considering the fire safety distribution distances in the bazaar; it is seen that there is a possibility of problem in many points in case of emergency.

The Results of Application and Evaluation

The Grand Bazaar's evacuation vulnerability is evaluated through study of the usage, structural problems, evacuation organization and fire safety.

The distribution of the usage types is very important in the sense of pedestrian density and fire safety. Especially the food and drink areas must be situated in the specific points and must not prevent evacuation through the exit doors.

In the sense of physical features and problems, water insulation problems of the roof must be initially solved and structural safety must be provided by repairing structural cracks. The maintenance of windows which enable natural illumination must be done and a system must be developed for their open-close positions.

For the emergency evacuation of the Grand Bazaar, present exit points have to be improved and additional exit points are necessary. The narrow passages should be widened to standard width and sufficient information about the exit route should take place in the Bazaar. The exit doors should be marked properly and legibly according to the international standards.

The interviews with the shopkeepers during the investigation showed that the preparations in case of disaster and emergency are inadequate. The shopkeepers of the Bazaar must be informed about possible disaster, about the risks of their branch of occupation and about the measures to be taken during any disaster. Informational brochures must be prepared and given to the domestic and foreign tourists who come for visiting or shopping in the bazaar.

References

- [1] Gülersoy, Ç (1979). "The Story of the Grand Bazaar." Istanbul, Turkey: Istanbul Kitaplığı Ltd. Publication. (in Turkish)
- [2] Gür, M (2008). Interview with Muzaffer Gür, the director of the Grand Bazaar Association on Jan.09, 2008, Istanbul, Turkey.
- [3] Sakin, O (2002). "*Istanbul Earthquakes in Historical Reference.*" Istanbul, Turkey, Kitabevi Publication. (in Turkish)
- [4] Sayar, M, and Sayar, C (1962). "*The Geology of Istanbul Historical Peninsula.*" Istanbul, Turkey, Publication of ITU Faculty of Mining. (in Turkish)
- [5] Ürekli, F (1999). "*1894 Earthquake in Istanbul.*" 1st ed., Istanbul, Turkey, İletişim Publication. (in Turkish)