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Comparison of Building Occupancy Loads with the Turkey's Regulation on the Protection of Buildings from Fire and NFPA

Binaların Kullanıcı Yükünün Türkiye'de Binaların Yangından Korunması Hakkındaki Yönetmelik ve NFPA ile Karşılaştırılması

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Öz

Ülkemizdeki ulusal mevzuatta ve Amerikan Ulusal Yangından Korunma Derneğinin (NFPA) normlarına göre binaların yangından korunması için alınması gereken tedbirlerin kapsamı ilei yangından dolayı can ve mal güvenliğinin korunması adına kullanım yükünün doğru hesaplanması büyük önem arz etmektedir. Bu araştırmada, ilk olarak 19.12.2007'de Resmi Gazete'de yayımlanarak yürürlüğe giren ve 10.08.2009'da revize olan ''Binaların Yangından Korunması Hakkındaki Yönetmelik'' kapsamında bina kullanım yük (doluluk) hesabı ile NFPA 101 normları karşılaştırılmaktadır. Gerek tüzel kişi, gerekse gerçek kişilerce kullanılan binalarda bina yükünün nasıl hesaplanacağı ve nelerin göz önünde bulundurulacağı araştırma konusu kapsamındadır. Bina doluluk oranının doğru tespit edilmesi, yangın durumunda güvenli olarak tahliye işleminin gerçekleşmesine olanak sağlamaktadır. Buna göre çıkış sayıları, çıkışların genişliğinin tasarlanmasında en temel bileşen olan "kullanıcı yükü" hesabının doğru belirlenmesi, yangın öncesinde alınması gereken en önemli İSG tedbirlerinden birini oluşturmaktadır.

Anahtar Kelimeler: Yangın, İş Sağlığı ve Güvenliği, Kullanım Yükü, NFPA, Acil Çıkış

ABSTRACT

In order to protect the lives of the occupants and to minimize the possible damages to a property from a fire, it is great importance to accurately calculate the occupancy load of a building both in the Turkey's National Occupational Health and Safety (OHS) legislation and in the American National Fire Protection Association (NFPA). In this research, the building occupancy load calculations were compared with NFPA 101-Life Safety Code 2018 within the scope of the "Turkey's Regulation on the Protection of Buildings from Fire" (ROPBF), which was first published in the Official Gazette on 19.12.2007 and then revised on 10.08.2009. The scope of the research also contains calculation methodology for the occupancy loads and what to consider in buildings that is used by both legal entities and real persons. The correct determination of the "Occupancy load", which is the most basic component of calculating and designing the required number of emergency exits, sizes, widths represents one of the most important and key component of an OHS measure to be taken before a fire occurs.

Keywords: Fire, Occupational Health and Safety, Occupancy Load, NFPA, Emergency Exit

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INTRODUCTION:

The main starting point of this research is the examination of the sections of the Turkey's ROPBF, and the American National Fire Protection Association (NFPA) requirements in the light of the Occupancy load requirements. The design of a building's emergency exits and exit paths are in critical importance in reducing the loss of life and damage to property as much as possible in a possible fire. The main purpose of designing the emergency exit system in all buildings and structures is to develop a methodology to evacuate people in buildings/facilities without being harmed and injury by fire. Basically, the exit system for a building or a facility provides safe means of egress for occupants to evacuate the building while staying away from a fire.

The correct occupancy classification is essential to design the building/facility components and features in order to ensure an ALARP (As Low As Reasonable and Practicable) protection is available to its occupants and the building/facility itself.

These building components and features are.

- The buildings height, area, type of construction,
- Fire resistance (Fire walls, separations), firefighting/protection equipment
- Means of egress (Number, size, etc.)
- Interior finishes (lights, fixtures, signs, etc.)

How these features and equipment to be installed and applied to a building is mostly depend on it's occupancy classification, therefore properly classifying a building/facility is very important.

1. Turkey's Regulation on Protection of Buildings From Fire

The purpose of the Turkey's ROPBF is to determine the procedures and principles of measures, organization, training and supervision in order to ensure that fires are extinguished by minimizing the loss of life and property, that may occur during the design, construction, operation, maintenance and use of various structures, buildings, facilities and businesses used by public institutions and organizations, private organizations and real persons (Binaların Yangından Korunması Hakkındaki Yönetmelik (BYKHY), 2007). The principles of emergency exit systems, which are important for evacuating the occupants of the building during a fire, are explained as follows in the relevant regulation;

Every structure designed for human use shall be equipped with adequate emergency exit routes to enable users to evacuate quickly in the event of fire or other emergency. Evacuation routes and other measures shall be designed in such a way that, in the event of fire or other emergency, the safety of life shall not depend on a single measure (BYKHY, 2007).

As per NFPA, the design of a building's emergency exit system and pathways is critical to ensuring that everyone can evacuate safely. The main purpose of designing the Emergency Exit system in all buildings and structures is to make sure evacuating people without being harmed by fire. The means of egress for a building or structure provides an exit pathway for occupants to evacuate whilst staying away from a fire.

The means of egress has 3 important parts (NFPA 101, 2018):

(1) Access to Exit

(2) Exit

(3) Exit Discharge.

While the regulation on fire protection of buildings includes the concepts of user load and user load coefficient, NFPA norms mentions the concept of Occupancy load. Accordingly, in the Turkey's Regulation on the Protection of Buildings from Fire, the user load is the total number of people likely to be in a building or a certain part of the building at any given time, while the user load coefficient is expressed as m2/person of the usage area per capita in the buildings (BYKHY, 2007); According to the American National Fire Protection Association (NFPA), it is defined as " The occupancy load of a building is total number of people who are allowed in a room or area of a building and it is calculated according to the intended use of the area" (NFPA 101, 2018).

As per Turkey's ROPBF, the sections containing the explanations regarding the concept of user load are listed in Table 1.

Table 1. Sections in the Turkey's Regulation on the Protection of Buildings from Fire, Where the User Load is Included

Sections	Reference
Section 1 **General Condition** **Means of egress, emergency Stairways and Special Situations**	In every building, type of means of egress, number, location and capacity are arranged in accordance with the class of use, user load, fire protection level, structure and height of the building, in order to provide convenient exit for all occupants.
Section 2 **Article 31 Means of egress**	In the determination of means of egress, the usage class of the building, user load, floor area, the way to the exit and the capacity of the exits are taken into consideration. At each floor, exit possibilities are provided according to the user load of that floor and the longest exit distance. The floor areas of the spaces that serve other spaces such as toilets, changing rooms, warehouses and personnel canteens, halls and corridors, but are not used at the same time, although they are on the same floor as other spaces, may not be taken into account in calculating the user load of the floor they are located on.
Article 32 **Discharge capacity and distance to exit**	As the user load coefficient, the values specified in Annex-5/A are taken as basis to be used in the necessary exit and panic calculations. For exit width, the capacities of exit doors, exit stairs, corridors and other exit routes are calculated as 50 cm width units. The number of people passing through the unit width is shown in Annex-5/B according to the building usage classes.
Article 33 **Number and width Of exit routes**	In places where two exits are required, each exit must be wide enough to meet at least half of the total user load.

Article 40 Location and arrangement of exit stairways	Regardless of where the fire breaks out, exit routes and exit stairs must be positioned as alternatives to each other in order to ensure the exit of all people at that level. Exit routes and exit stairways cannot be built side by side. The entrance to the exit stairways and the landing must be at the same level. It is not possible to reach the exit stairways by passing the general stairs. Determining the location of the exit stairways is based on the longest exit distance and user load.
Article 41 **Exit stairways features**	In case the exit staircase descends into a circulation area such as a hall, corridor, foyer, lobby where the exit at ground level is visible and unobstructed, the distance between the point where the exit staircase descends, and the outdoor open area cannot exceed 10 m if the exit staircase serves more than one floor. In structures with a sprinkler system, this distance can be maximum 15 m. The outdoor area must be clearly visible from where the exit stairways descend and be directly accessible in a safe manner. It is imperative that there is a door open to the outside of sufficient width to meet the user load discharged from the interior exit stairs.
Article 43 Circular staircase	If they are made of non-combustible material and are at least 100 cm wide, they can serve as emergency exit from any floor, mezzanine, or balconies with a user load not exceeding 25 people. Circular staircases that do not meet the mentioned regulations may not be used as an emergency exit.
Article 47 Emergency Exit Door	Exit door wings must not impede the movement of users. It is essential that the exit doors in places with a user load exceeding 50 people open towards the exit direction. Emergency Exit doors must be manually opened and not locked.
Article 49 Health Facilities/Buildings **Amende: 10/8/200-2009/15316 K**	Any patient bedroom or suite room with a user load exceeding 15 people must have 2 doors located far from each other. Each of the sleeping floors of hospitals and nursing homes larger than 300 m2 is divided into two or more fire compartments, at least half the size, or protected horizontal evacuation areas are created. The user load is considered as 2.8 m^2/person in the calculation of the horizontal discharge areas.
Article 52 **Factory, workshop, store, shop, warehouse, office buildings and outpatient treatment centre (1)** **Amende: 10/8/200-2009/15316 K**	(1) At least 2 independent escape stairs or other exits must be provided in factories, workshops, stores, shops, warehouses, office buildings and outpatient centers. However, a) The height of the building is less than 21.50 m, b) The number of users on a floor is less than 50 people, c) The maximum escape distance for all floors is in accordance with the distances in Annex-5/B, d) Non-combustible products have been used in the construction, e) Not using easily flammable and combustible materials in production and

	storage, If all the conditions are met together, a single escape ladder is considered sufficient
Article 70 **Emergency lighting and guidance**	In the escape routes, necessary lighting must be provided for the escape of the users. If the lighting units used for the emergency lighting and guidance are selected as non-illuminating when normal lighting is present,automatic activation shall be established when the normal lights are off.
Article 72 Emergency lighting system	In all buildings with a user load of more than 200, Emergency lighting must be provided for at least 60 minutes in case of interruption of normal lighting. The emergency run time must be at least 120 minutes if the user load is more than 200.
Article 73 **Emergency lights for guidance**	Emergency lights for guidance must be provided for at least 60 minutes if normal lighting is interrupted. If the user load is more than 200, the operating time of the emergency lights for guidance must be at least 120 minutes.
Article 81 Audible and illuminated warning devices **Amende: 10/8/200-2009/15316 K.**	(7) Where mentioned below, automatically broadcast voice messages and live audio messages broadcast to allow residents to evacuate or relocate within the building. the installation of announcement systems is mandatory: In hotels, motels and dormitories with more than 200 beds in the building, In public buildings with a construction area of more than 5000 m2 or a total number of users exceeding 1000 people, shopping malls, supermarkets, industrial facilities and similar buildings, In all buildings with a building height exceeding 51.50 m.
Article 83 Cables Appendi: 10/8/200-2009/15316 K.	(5) In health care buildings, accommodation buildings with more than 100 people and gathering buildings with more than 1000 users, materials used in all kinds of feeding and distribution cables and cable enclosures must be halogen-free and do not produce any toxic gases when exposed to fire.
Article 112 Natural gas usage principles	i) Natural gas users should know their installations, learn the locations of gas shut off valves and have knowledge of the course of action when there is a gas leak.

Article 146 Escape Routes **Amended first sentence: 10/8/2009-2009/15316 K.**	Existing buildings other than hospitals, hotels, retirement homes, primary schools, nurseries and similar places For escape routes, on the basis of the provisions of Article 31, the issues specified in this article are also accepted. In existing structures, provided that the number of users on the first floor is not more than 25 people. Windows with a maximum openable wing width and a height of at least 70 cm, with a maximum height of 4 m from the outer floor, opening to the safety zone outside the building can be considered as an escape route when necessary. In the existing buildings, if the number of users on the floor does not exceeds 50, the exits with the following characteristics are considered and permitted as the second escape route if all below conditions are met; a) Access to the escape ladder through a window in buildings with a building height of not more than 30.50 m; 1) The window parapet level should not be higher than 80 cm from the floor level, 2) The clean opening-closing part of the window should be at least 70/140 cm in size, 3) Stepping to reach the parapet level, 4) The materials used in the window passage should be made of fire resistant materials for at least 30 minutes. c) If the number of users of the first floor on the ground floor is less than 25 people and the distance from the furthest point of the used area to the exit door of the floor provides one-way escape distance, and provided that the staircase serving this floor is independent from the ground floor and the entrance is arranged independently, regardless of the height of this floor, single output is considered sufficient.
Article 147 **Discharge capacity and exit distance**	(2) As the user load coefficient, the values in Annex-5/A are taken as basis to be used in the necessary exit and panic calculations. (6) In shops and similar places on the ground floor, if the number of users is less than 50 and the escape distance from the furthest point to the door opening to the outside environment is not more than 25 m, a single exit out of the building is considered sufficient.
Article 148 **Number and width of escape routes**	(1) In the existing structures, the following points shall be complied with regards to the number and width of the escape route and escape ladder. a) The total escape route width is found in centimeters by multiplying the total number of users on the floor calculated according to Annex-5/A by 0,4. b) The width of the escape ladder cannot be less than 60 cm for a straight arm landing ladder or 70 cm for a circular ladder. In floors with a total number of users more than 60 people, this width cannot be less than 70 cm in straight arm landing stairs or 80 cm in circular stairs. In hospitals, nursing homes, kindergartens and primary schools, only straight-armed stairs with a landing can be arranged and the width of this staircase cannot be less than 100 cm.

Article 151 **Location and arrangement of escape ladder slots**	(1) In the existing structures, the following points are to be complied for the location and arrangement of the escape ladder slots. b) It is essential that the escape ladders reach the natural ground. The escape ladder is lowered to the natural ground with an articulated ladder, with a landing of at least 1 m2 at the end point and a slope of no more than 50 degrees down from this point. If it is not possible to lower the escape ladder to the natural ground, it can be finished 3 m above the ground. However, It is obligatory to lower the fire escape ladder to the natural ground in education facilities, health care buildings, entertainment venues, accommodation facilities with more than 50 users and all buildings with more than 100 users.
Article 154 Circular Stairs Amended: 10/8/2009-2009/15316 K.	(1) The circular staircase may serve as a mandatory exit from any floor, mezzanine or balconies where the number of users does not exceed 100 people. (2) Circular stairs in existing buildings must be made of non-combustible material and must be at least 70 cm wide. The width of the circular staircase cannot be less than 80 cm if the number of users on a floor is more than 60 people. (3) Circular stairs cannot be higher than 51.50 m in residences and 30.50 m in other buildings. (4) The step width at a distance of 50 cm from the centre of the bucket cannot be less than 25 cm and the step height cannot be more than 175 mm. (5) External escape stairs; It must be protected against corrosion, have sufficient strength and bearing capacity, and be usable in emergency situations. (6) Circular stairs are not allowed in inpatient health care buildings, nursing homes, kindergartens and primary schools, and entertainment venues where the number of users on one floor exceeds 50 people.
Article 156 Basement Emergency Exit Stairs	(1) In existing structures, regardless of the escape distance in basements; a) Gas use in kitchens in basements, excluding residences, b) (Amendment: 10/8/2009-2009/15316 K.) The number of users in the basements used as public spaces exceeds 25, and in the basements with a direct exit, 50 people exceed
Article 157 **Escape Route Exits**	(2) It is essential that the wings of the escape route doors do not hinder the movement of the users and that the exit doors in the places where the number of users exceed 50 people should be opened towards the escape direction. Escape route doors must be able to be opened manually and not kept locked. Revolving doors and turnstiles cannot be used as exit doors. (4) All escape route doors opening from the staircase to a secure area at the natural ground level, and if the number of users on a floor exceeds 100, the doors of the escape stairs must be able to be opened with a panic lever or similar mechanism without using the door handle. The doors are designed in such a way that they can be opened with a maximum force of 110 N.

Article 159 **Exit stairs and exits in buildings according to usage characteristics**	(1) At least 2 independent escape stairs or other exits must be provided in factories, workshops, shops, stores, warehouses, office buildings, outpatient treatment centers, museums, exhibition halls and similar places. However; a) The height of the building is less than 21.50 m, b) The number of users on a floor is less than 50 people, c) The maximum escape distance for all floors is in accordance with the distances in Annex-14, d) Non-combustible products have been used in the construction, e) Not using easily flammable and combustible materials in manufacturing and storage, If all the conditions are met together, one escape ladder is sufficient.
Means of egress, emergency Stairways and Special Situations Amended: 10/8/2009-2009/15316 K.	In every building, type of means of egress, number, location and capacity are arranged in accordance with the class of use, user load, fire protection level, structure and height of the building, in order to provide convenient exit for all occupants.

The user load coefficient calculated as m2/person according to the usage areas in Annex-5/A of the Regulation on Fire Protection of Buildings is given in Table 2.

Table 2. User Load Coefficient

Usage Function			m^2/person
1	Conference hall, multi-purpose hall, restaurant, canteen, waiting halls, concert halls, cinema and theater halls, public studio, wedding hall etc.		1.5
2	Dance halls, bars, nightclubs, and similar places	Seating parts Standing parts	1.0 0,5
3	Exhibition spaces, studios (film, radio, television, recording)		1.5
4	Passenger arrival and departure waiting rooms of the terminals		3
5	Classrooms, computer rooms, seminar rooms		1.5
6	Reception areas, waiting areas, atrium floor		3
7	Multi-purpose sports facilities		3

8	Supermarkets, stores, shops	5
9	Art galleries, museums, workshops	5
10	Fitness centers, aerobics halls, reading rooms	5
11	Offices, association centers, public libraries	10
12	Student dormitories	10
13	Packing places, factory production areas	10
14	Hospital bedrooms, nurse rooms	20
15	Kitchens, laundries	10
16	Hotel rooms	20
17	Hospital laboratories, pharmacies	20
18	Doctor clinics, student labs	5
19	Warehouses, warehouses, engine rooms	30
20	Parking lots	30
User load; It is calculated according to the net area in the usage areas in the 1st, 2nd, 3rd and 4th lines to be used in the necessary exit and panic calculations, and according to the gross area for the usage areas in the other lines. In places where the number of people is certain, the specified number of people is taken as a basis, not less than the value calculated according to the values above.		

One of the most important components when calculating the user load is the intended use of the structure. The purpose for which the building will be used and the estimated number of people who will use it are the most important factors for the correct calculation. For example, university hospitals have a higher user load and fire load than other hospitals due to their activities such as medical education and research, as well as the diagnosis and treatment of the patient, and are riskier in terms of fire compared to other institution buildings (Yıldız, 2020). At the same time, the number of user load is an effective factor in determining the number of emergency exits. If the User Load is between 500-1000 people, there must be at least 3 emergency exits. If the user load is 1000 people or more, there must be at least 4 exits. NFPA 101 [36,37] Clause: 7.4.1.2 (Gönüllüoğlu, 2018).

2. Occupancy Load as Per NFPA

The American National Fire Protection Association (NFPA), which sets mandatory fire regulations and fire protection standards in the United States of America is considered as a universal organization on fire safety issues.

Building and fire codes such as NFPA 101 specify occupancy load factors according to the intended use of the space, which architects, engineers and designers must apply when determining the number of people likely to be in buildings (Muha, 2012).

The most basic component of evacuating safely in case of fire is to determine the "occupancy" correctly which helps us to calculate how many exits are required, how wide they should be and designing them appropriately, in other words, the number of people who will/should reside in the building must be accurately estimated. The term "building occupancy/ occupancy" can be confounding for the owners of the buildings, since the term is used differently in the NFPA standards in different chapters where fire protection is involved. In one section, the occupancy load can be used to design the means of the emergency exits, while in other sections it can be used to identify other required components within a building or structure. As an example, the design occupancy load can be used to identify required type of and number of the fire alarm detection systems, type and number of plumbing fixtures needed, also where and how automatic sprinkler system to be installed. Moreover, occupancy classifications are existing for the design, installation and water supply requirements of the sprinkler systems. All these requirements are described in different NFPA standards, for example Installation of Sprinkler Systems are in described in NFPA13 and occupancy classifications in NFPA 13 drives the construction of safer buildings by making sure that installed sprinkler systems are qualified for the potential hazards that building contains. On the other hand, Fire Extinguisher requirements based on occupancy type can be found in Table 13.6.1.2 of NFPA 1, Fire Code (2018) (NFPA 1, 2018). Although both sets of requirements are aiming towards protecting human beings in the case of a fire, they may reflect very different two ways of looking at the 'occupancy' definition.

Once the building has been constructed with all suitable fire fighting features (Sprinkler systems, hose reels, etc), building/facility owners may not need to worry about occupancy in their daily operations within this context, except, when necessary, inspections and maintenance are carried out for the sprinkler systems. However, they must consider and comply with occupancy load requirements which is clearly set and defined in NFPA1 and NFPA 101. In this sense, "occupancy" is all about safely evacuating occupants out of the building to a safer place through the designed emergency exits in an emergency, and the NFPA regulations limit the number of people inside a building or area to provide sufficient for occupants in the event of a fire.

The total number of people allowed in a room or area of a building and its calculation based on the intended use of that space is defined as the occupancy load of a building/facility. The building/facility may have some places with multiple uses hence different occupancy loads. For example, if there are tables and chairs located in a room, we should consider more space around the tables to allow for adequate exit and even considering reducing the number of people who can leave the room safely in the case of an emergency. But, if there are rows of chairs located in the same room, more capacity of people will be allowed, since it will provide sufficient exit between rows. Where a room or space has more than one use, the lowest calculated occupancy should be considered and used in the calculation.

The occupancy load of a room or space can be calculated using the handy information sheet provided by NFPA, however, the occupancy load to be complied, will be ultimately determined by the Competent Authority.

2.1. Occupancy load base calculation:

Occupancy Load = Room open floor area (ft2) ÷ User Load Factor (ft2/person)

But when calculating, the Occupancy Load Factor is based on the types of residences shown in accordance with NFPA 101, Table 7.3.1.2, and the regulation also calls for many more factors to be considered.

(1) Areas Without Fixed Seats

Fixed seating is classical grandstands, benches, or seats which cannot be moved since they are fixed in a place. The standard measurements used in the venues are written below,

- Church pews: One person for every 18 inches of length
- Stands (Restaurants): One person per 24-inch length
- Seats (typically with armrests): One person per seat

(2) Fixed Seated Areas

In places such as libraries, museums, restaurants, bars, places of worship, which do not have fixed seating;

- Table and chair seating: 15 square feet (net space) per person • Seating Chair (no desk): 7 sf per person (net space) • Areas for standing and dance floors: 7 sf (net space) per person
- Waiting, queue areas: 5 sf per person (net space)
- Exercise areas: 50 sf per person (gross area)

It is very critical to consider the net and gross area sizes during occupancy load calculation. There is slight difference in the measurement if spaces with the Fire and building codes. In most of the occupancy calculations, gross floor area is used. Gross floor area is the area bounded by the walls and it contains all areas except shafts or courtyards. As you can see in the below Figure 1, the X representing the shaft area and will not be considered during calculations, only the shaded areas to be calculated as gross floor area.

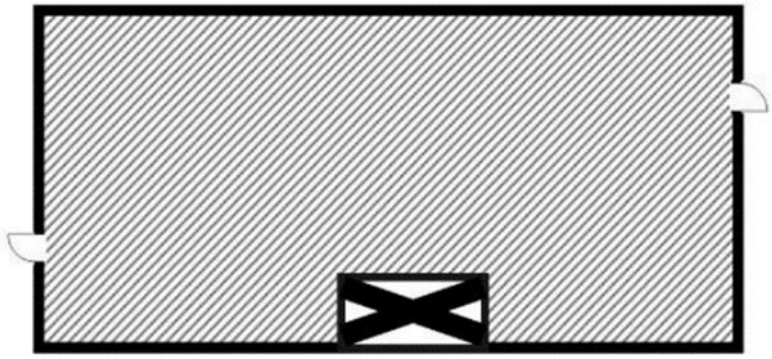

Figure 1. Gross area calculation

If there are larger numbers of people involves, that is where and when net floor space is typically used. The net area is the actual area occupied by the occupants of the building and it doesn't not consider stairs, corridors, toilets, mechanical rooms, etc. where occupants would not normally congregate. As you can see in the Figure 2, the white colored areas should not be included in the calculations and only the areas shaded should refer to the net floor area in the calculations.

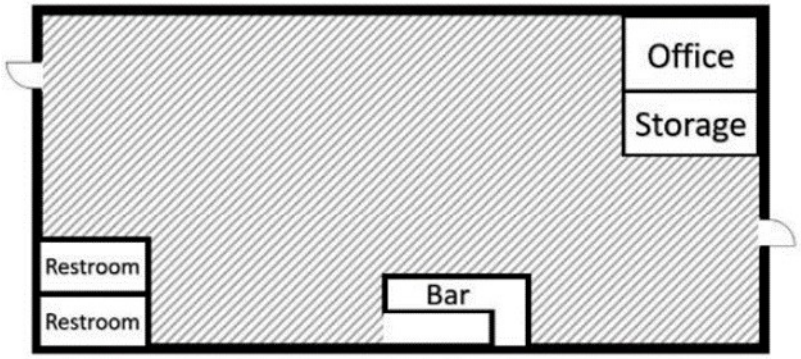

Figure 2. Net floor area

As we stated previously, different NFPA standards look the occupancy in different ways, for example NFPA1 defines occupancy according to the intended use of a building against the hazards (hazard classification) it may contain. However, there are 31 different occupancy types listed in Table 7.3.1.2 in the original NFPA 101 standards. All these occupancy types have their own specific requirements and occupancy load factors. These are given in Table 3.

Table 3. Occupancy Load Factors (NFPA 101, Table 7.3.1.2) (NFPA 101, 2018)

Table 7.3.1.2 Occupant Load Factors Use		
Use	ft2 (per person)	m2 (per person)
A occupancy or occupancy of 50 or more people used for gathering, worship, entertainment, eating and similar purposes. (2) It is used as a private entertainment building regardless of the person load [101:6.1.2.1])		
Intensive use, without fixed seating	7 net	0.65 net
Non-intensive use areas without fixed seating	15 net	1.4 net
Bench-type seating	455 linear mm for each person	455 linear mm for each person
Bench-type seating	Fixed number of seats	Fixed number of seats
Waiting areas	It's written 13.1.7.2 and 12.1.7.2	It's written 13.1.7.2 and 12.1.7.2
Kitchens	100	9.3
Library storage areas	100	9.3
Library reading areas	50 net	4.6 net
Swimming pools	50 (water surface)	4.6 (water surface)
Swimming pool decks	30	2.8
Rooms for exercising with equipment	50	4.6

Rooms for exercising without equipment	15	1.4 net
Stages	15	1.4 net
Gridirons, galleries, access catwalks and lighting	100 net	9.3 net
Gaming areas. for example casinos and etc.	11	1
Skating rinks	50	4.6
Educational use (Occupancy used for places where education is more than 12 hours a week or 4 hours a day until the twelfth grade[101:6.1.3.1])		
Classrooms	20 net	1.9 net
Vocational areas, laboratories and shops	50 net	4.6 net
Use for Day Care (Occupancy in places where four or more people are cared for less than 24 hours a day, except for their relatives [101: 6.1.4.1])	35 net	3.3 net
Use in places where health care is provided (occupancy where required treatment or care is administered to four or more inpatients at the same time[101: 6.1.5.1]		
Inpatient treatment department	240	22.3
Sleeping departments	120	11.1
For places where outpatient health care is provided (Occupancy used for places that can serve four or more patients at the same time during outpatient treatment	100	9.3
Locations of detainees (Occupancy in places where one or more people need to be detained for different reasons[101:6.1.7.1]	120	11.1
Residential Use (An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional. [101:6.1.8.1])		
Hotels (Buildings with or without meals for more than 16 people [101:6.1.8.1.3]	200	18.6
Dormitory buildings (buildings that provide common use for more than 16 people who are not from the same family[101:6.1.8.1.4])	200	18.6
Apartments (3 or more residences with bathroom and kitchen. [101:6.1.8.1.5])	200	18.6
Places for care and hostel use, (Places where		

there are 4 or more people who do not have any kinship for personal care purposes [101:6.1.9.1])	200	18.6
Industrial buildings (structures where activities such as production, packaging and assembly are carried out [101:6.1.12.1]).		
General and high hazard industrial	100	9.3
Special-purpose industrial	NA	NA
Occupancy for buildings where non-commercial business transactions take place [*101*:6.1.11.1])	100	9.3
Tower where air traffic is controlled	40	3.7
Buildings used for storage (occupancy where commercial goods, vehicles or goods are stored)		
In storage occupancies	NA	NA
In mercantile occupancies	300	27,.9
In other than storage and mercantile occupancies	500	46.5
Commercial Use (Occupancy in places where products are sold and promoted)[101:6.1.10.1])		
Sales area on street floor (b), (c)	30	27.9
Sales area on two or more street floors (c)	40	3.7
Sales area on floor below street floor (c)	30	2.8
Sales area on floors above street floor (c)	60	5.6
Office-only floors or ground floors	See Business Use	See Business use
Floor sections or ground floors used as warehouses that are not open to public use	300	27.9
Mall buildings (d)	Per factors applicable to use of space (e)	
NA: Not applicable. User load is the number of users likely to be found at any given time.		
(a) All factors are defined as gross area if they are not shown as "net".		
(b) Due to the different ground levels of the streets, the gross floor area for one person is 40 ft2 (3.7 m2) for calculating the occupant load of commercial buildings with 2 or more floors that can be directly reached from streets		
(c) As explained in 3.3.253, the ground floor of the commercial area is accepted as the ground floor of the street in order to calculate the user load on the commercial floors that do not have a direct floor entrance from the street		
(d) The user load of a dining area that is not included as the gross leasable area of the shopping mall		

is calculated according to Table 7.3.1.2 (e) The user load number of the parts used by the pedestrians inside the shopping center should not be calculated according to Table 7.3.1.2. All anchor stores within the shopping center must have independent exit doors.

In addition to the above table, there are other occupancy types listed below;

2.1.1. Multiple occupancies

Structures or buildings with two or more occupancy classes shall be classified according to Section 6.1.

2.1.2. Mixed occupancy

A multiple occupancy where occupancies mingle.

2.1.3. Separated occupancy

A multiple occupancy, where occupancy is divided according to the fire resistance level of the buildings

Table 4 below gives an idea of the effect of occupancy type on the installation of fire alarm systems in a facility/building.

Table 4. The occupancy type affects the fire alarm installations required in a building

Occupancy Classification	Building Configuration		Fire Alarm System Requirements							
	Floor Area	Habitable	Automatic- Manual Control	Zone Chart / Fire	Graphic Annunciator	Detectors (Smoke/Hea)	Manual Call Point /	Audible (Sounder/ Bell) / Visible	MASS NOTIFICATION SYSTEM	FIRE TELEPHONE (TWO-WAY
Assembly With Less Than 300 Occupants (Auditoriums, Theater As Per NFPA 101)	NA	NA	Required	Required	Not Required	Required	Require d	Required	Not Required	Not Required
Assembly With More Than 300 Occupants (Auditoriums, Theater As Per NFPA 101)	NA	NA	Required	Required	Permit ted	Required	Require d	Required	Required	Required
Residential Dwellings & Villas	NA	NA	Not Required	Not Required	Not Required	Required	Permitted	Permitted	Not Required	Not Required

Residential (Class A - Low Rise Apartment Buildings (Up To 4 Flats Only))	<500	<12M	Required	Required	Not Required	Required (Carbon Monoxide (CO) alarm and detectors required in accordance with NFPA 101 and 72)	Required	Required	Not Required	Not Required
Business Class A - Low Rise Building	≤500 m2	≤15 m	Required	Required	Not Required	Required	Require d	Required	Not Required	Not Required
Business Class B - Medium Rise Building, Type A	>500 m2 - ≤1000 m2	>15m-≤18 m	Required	Required	Permit ted	Required	Require d	Required	Permitted	Permitted
Hotel (Class A - Low Rise Building)	≤500	≤15	Required	Required	Not Required	Required CO detectors are required in guest rooms/suit es with communica ting attached garage for the fit-out shall be provided for monitoring of(except for open garage) or rooms/suit es permanentl y containing installed fuel-burning appliance. The CO sensitivity shall meet the requiremen ts of UL std. 2043	Required	Required	Not Required	Not Required
Dormitory And Accommodat ion (Low Rise)	≤500	≤15	Required	Required	Not Required	Required	Require d	Required	Not Required	Not Required
Educational (Secondary)	Unlimited	G+2	Required	Required	Not Required	Required	Required	Required	Required	Required (R-HIGH RISE & COMPLEX)
Healthcare (Type A - High Rise)	Unlimited	>28 M	Required	Required	Required	Required	Required	Required	Required	Required

CONCLUSION:

This study shows that "Regulation on the Protection of Buildings from Fire" and "Norms of the American National Fire Protection Association (NFPA 101)" also took into account the human load on the building during a fire and made the necessary guidance. Although NFPA has examined the issue in more detail, it has been observed that detailed information is given in the ROPBF.

Determining the correct occupancy classification is the most critical and essential part of implementing the NFPA 101, Life Safety Code to an area in a building or a facility. Occupancy classification stipulates designing of many different fire and life safety features which is an essential part of a life safety. These requirements are unique for each building and facility, also reflects the future characteristics of the expected inhabitants of that area, such as the ability to protect themselves, familiarity with the location, age and alertness. Improper classification of a building/facility, over or under estimating the application of the required code requirements, may cause buildings to lack fire and life safety features or have additional fire and life safety features not required by the Code.

Implementing and applying occupancy classification within different codes and different standards may not be always as simple as it seems. Therefore, when working with more than one code, the specific building and user characteristics of that area should be considered. Because different organizations' codes and standards use different user thresholds and user attributes, it is not always possible to generalize how occupancy classifications are aligned.

NFPA provides codes, standards, recommended practices, and guides ("NFPA Standards"), however Turkey's Regulation on the Protection of Buildings from Fire is the applicable law. NFPA 101 is a 570-page document and brings a more holistic approach not only to Occupancy load factors but also other factors that may affect the life safety of the occupants for different types of buildings and facilities. The 2018 edition expands the Code's scope to include hazardous materials emergencies, injuries from falls, and emergency communications. In addition, NFPA has other standards that covers variety of Fire Safety related subjects. It would be wise to support Turkey's Regulation on the Protection of Buildings law with different standards and guidance's in order to increase the effectiveness not only for occupancy/user loads but also other important fire and life safety items.

Consequently, occupancy load requirements have a very important effect in fire and life safety. Effectively determining the occupant load of a building is the most critical step in designing a safe building. The recommended user load directly affects the safety of the building occupants. All life saving features of a building such as exit routes, permitted types of construction, necessary fire protection systems, etc. depends on the occupancy load.

Compliance with the Ethical Standard

Conflict of Interest: The authors declare that there is no conflict of interest.

Ethics Committee Permission: Ethics committee approval is not required for this study.

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