

Assessment of High-Rise Buildings During the Operation Stage in Addis Ababa City

Amanuel Temesgen Mosie

Department of Construction Technology and Management, University of Gondar, Gondar, Ethiopia

Email address:

amanuelt509@gmail.com

To cite this article:

Amanuel Temesgen Mosie. Assessment of High-Rise Buildings During the Operation Stage in Addis Ababa City. *American Journal of Construction and Building Materials*. Vol. 6, No. 2, 2022, pp. 80-84. doi: 10.11648/j.ajcbm.20220602.11

Received: August 16, 2022; **Accepted:** September 13, 2022; **Published:** October 31, 2022

Abstract: To afford extra built-up space vertically both for working and living, high-rise buildings are constructed. Living in high-rise buildings has advantages as well as disadvantages. On the constructive side high-rise buildings can accommodate more people closer to work places, thus decreasing the length of work journeys and energy consumption. When we see the disadvantage side high-rise buildings needs extra equipments and facilities for vertical transportation, safety, and parking space. The construction of high-rise buildings in Addis Ababa is increasing rapidly nowadays. But during accommodation many problems affect the operation of the building while the construction is completed. The aim of this study is to identify the major challenges of high-rise buildings; to measure the satisfaction level of occupants of high-rise buildings; and to check the presence and functions of safety measures which are fixed in high-rise buildings. This research involves both qualitative and quantitative approaches for data collection and analysis. To gather quantitative data, survey questionnaires were administered to owners and occupants of high-rise buildings. For qualitative approach, in-depth interviews were carried out to purposefully selected respondents. In addition, observation was used. Lastly, data were collected from documents such as policy documents and reports of the Addis Ababa construction bureau. The data collected was analyzed using descriptive statistics. This study identified major challenges of high-rise buildings during the operation stage. The research result indicates that the key problems during the operation stage identified as lack of sufficient parking space, vertical transportation problems, and cleaning and maintenance problems. The outcome of the study helps the occupants of high-rise buildings and as a whole the construction industry to understand the actual factors during the operation of high-rise buildings.

Keywords: Cleaning, Maintenance, High Rise, Parking Space, Vertical Transportation

1. Introduction

High-rise buildings projects signify an element of the nation's economic influence and a symbol of benefit to the country. Therefore numerous countries have sought to realize their development through by the preparation of inclusive tactics to establish high rise investment projects to show their economic power & status [1]. If high-rise constructions were considered to contribute economic and innovative value, they are also responsible for many social and urban problems, changing the faces and atmosphere of cities and can have a negative impact on the public live, city infrastructure, the environment and living quality in cities [2]. According to Mike [3] problems of high-rise building are; problems with power supply, insufficient vehicle parking space, and cleaning of upper external walls of the structure. Like any

other structure, high-rise buildings are faced with several problems and experience accidents that endanger the lives of their occupants, destroy facilities and equipment within them, and affect other neighboring structures. The most feared hazards of tall buildings around the world are fire, terroristic attacks and building collapse [4]. The complex problems of designing and maintaining technical systems like communication, ventilation, technical operation, fire safety of high-rise building structures is also ambiguous [2]. High-rise buildings have a greater risk of fire according to its features such as great height, complex structure, and diverse functions, and so on. It is easy to cause more casualties and property losses once a high-rise building is on fire [5]. This research is therefore based on the belief that current problems in the high-rise building operation needs to be identified through a detailed study. The research tries to assess the

major challenges which affect the satisfaction of tenants of high-rise buildings in Addis Ababa city.

2. Literature Review

High-rise buildings have several advantages for one's country by occupying large people in a single building and saving land of a city [6]. Most of the advantages of high-rise buildings are mirror images of their potential drawbacks. High-rise buildings promote development, but may cause overcrowding and congestion [7].

Children suffer even more because they lose their direct contact with nature, and with other children. High-rise buildings work against society because they prevent the units of social importance the family, the neighborhood, etc., from functioning as naturally and as normally as before [6].

The major difficulties or challenges of high-rise buildings during operation of high-rise buildings includes fire safety problems, vertical transportation problems, parking space problems, heat ventilation and air conditioning problems, and maintenance related problems [5, 8-12]. Problems like aerodynamics, big ventilation shaft areas per floor, complicated heating and control systems inevitably arise during construction and operation and require high planning and construction effort [2].

3. Methodology

The strategy that has been followed for this research work was first to formulate a research problem and then the research design i.e. the data and information sources determined to solve the problem based on the formulated research design. On the basis of the data and information sources the research instruments were decided. Then the required data collected and analyzed. Finally, available document sources were review for cross-checking the validity of the information obtained through the overall research work. A descriptive survey design attempted to collect data from the relevant population (tenants

of buildings and owners of the buildings) to assess the challenges of high-rise building operation.

4. Results and Discussion

4.1. Key Problems During Operation of High-Rise Buildings in Addis Ababa City

Figure 1 shows the challenges of high-rise buildings after occupancy of the tenants of the buildings. From the questionnaire survey the key problems includes lack of sufficient parking space, vertical transportation problems, and maintenance problems.

Lack of sufficient parking space: - From site observation and interview high-rise buildings in Addis Ababa didn't have sufficient parking facilities. The number of peoples who are living, working, and customers in high-rise buildings is too large due to this it is difficult to get sufficient parking spaces. Parking spaces within the area are used by shoppers, cinema house customers, café, bar and restaurant users, bank customers and government and private office workers.

Vertical transportation problems: - Based on site observation elevators of high-rise buildings in Addis Ababa city didn't work fully. The non-functionality of vertical transportation facilities in most high-rise buildings leads the customers to move up to above 15 floors by using stairs which minimizes the quality and suitability of the buildings. Based on the customer satisfaction survey most of the tenants of high-rise buildings are not satisfied with the vertical transportation facilities i.e. the continuous function and speed of elevators.

Maintenance problems: - Based on site observation facilities of most of high-rise buildings didn't work or function due to lack of continuous supervision and maintenance such as the elevators are not working consistently, most of toilets are non-functional, exterior aluminum finishes of walls and windows are not cleaned, and heat ventilation and air conditioning systems are not working well.

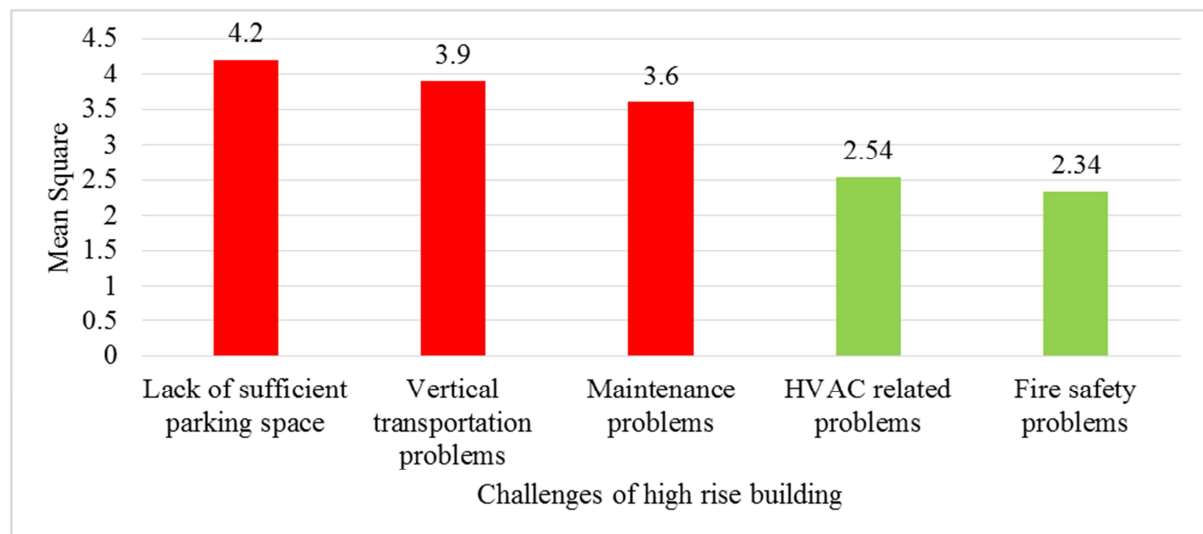


Figure 1. Challenges of high rise buildings during operation.

4.2. Satisfaction Survey of the Occupants of High-Rise Buildings

Table 1 shows that satisfaction of occupants of high-rise buildings. The survey was conducted mainly on commercial, office and mixed use high-rise buildings. From the questionnaire survey the occupants of high-rise buildings in Addis Ababa are not satisfied with, related to; automobile parking space, adequacy of escape routes in case of fire, central heating system, and the maintenance and repair service.

Satisfaction with automobile parking space: - The higher the building the bigger the parking demands among the building users. Hence, it is important to provide sufficient parking lots for the tenants and users of the building. The reason of the dissatisfaction of the users would be the limitation of parking lots that are provided and the demand of it are too much higher than the lots that are provided. The data above indicate that many high rise buildings in the Addis Ababa city have not enough space for parking of automobiles.

Satisfaction with the adequacy of escape routes in case of fire: - The principal objective of the provision of an escape route in occupancies is to ensure that people can get to a place of relative safety within the shortest period of time

without travelling excessive distances. The route should at all points, be wide enough to allow the persons using such route to move rapidly along it and it must not, at any time, be obstructed in any way [13]. From site observation escape routes are provided, but they are not open and difficult to access if any fire accident happened in the building.

Satisfaction with central heating system: - A central heating system provides warmth to the whole interior of a building or portion of a building from one point to multiple rooms. When the height of a building becomes increasing the temperature of the rooms will decrease. Therefore, this central heating system must be fixed to the building. When we see the buildings in Addis Ababa most of the buildings have this device, but it is not fully functional.

Satisfaction with the maintenance and repair service: - The key concern of maintenance is to ensure a building and its services can perform its designed functions for the desired period of time with a high degree of reliability. Maintenance and repair in high-rise building include; elevators, windows, exterior walls, and firefighting devices. The response of respondents indicates that there is no an appropriate maintenance and repair with the defective parts of buildings which are under operation.

Table 1. Satisfaction survey of tenants of high-rise buildings in Addis Ababa city.

No.	Services or condition of the building	Mean	R
1	Are you satisfied with distribution of adequate day light your residence?	3.76	12
2	Are you satisfied with sanitary fixtures?	3.46	11
3	Are you satisfied with the security inside the lift?	3.16	10
4	Are you satisfied with the acoustic quality of the building?	3.12	9
5	Are you satisfied with the security in the corridors?	3.09	8
6	Are you satisfied with the lift speed?	3.08	7
7	Are there adequate number and quality of fire extinguishers?	3.06	6
8	Are you satisfied with the disposal service?	3.02	5
9	Are you satisfied with the maintenance and repair service?	2.62	4
10	Are you satisfied with the central heating system?	2.60	3
11	Adequacy of escape routes in case of fire?	2.46	2
12	Are you satisfied with an automobile parking space?	2.44	1

4.3. Checklist of Safety Measures Which Are Fixed in High-Rise Buildings During Operation

Table 2 shows the presence and functionality of different safety measures which must be fixed in high-rise buildings. The checklist was collected by visiting high-rise buildings that are occupied and asking the building management.

Automatic sprinkler system: - An automatic sprinkler system is designed to detect a fire and extinguish it with water in its early stages or hold the fire in check so that extinguishment can be complete by other means. The automatic sprinkler system is an effective means to control fires in enclosed areas. A sprinkler system consists of a water supply and one or more sprinkler installations; each installation consists of a set of installation main control valves and a pipe array fitted with sprinkler heads. The sprinkler heads are fitted at specified locations on the roof or ceiling, and where necessary between racks, below the

shelves, and in ovens or stoves. [14]. Based on the checklist in 26.6% of high-rise buildings is available, but deficient in number, 26.6% is not available, 26.6% are available and functional, and 20% available, but not functional, this indicates that in most of high-rise buildings an automatic sprinkler system is fixed on but not sufficient in number.

Emergency voice: - Some fire alarm systems utilize emergency voice alarm communication systems to provide pre-recorded and manual voice messages. Voice-based systems provide response personnel with the ability to conduct orderly evacuation and notify building occupants of changing event circumstances [15]. Based on the checklist in 40% of the buildings is not available, 33.3% available, but deficient in number, 20% available and functioning and 6.6% are available but not functioning. This indicates that most of high-rise buildings in Addis Ababa have not an emergency voice.

Synchronized power system: - consistent electric power for elevators and facilities must be provided for high-rise

buildings in order to keep the safety of the tenants of buildings. Based on the checklist in 46.6% of the buildings is available and functioning and 53.3% not available. This indicates that in most of high-rise buildings in Addis Ababa synchronized power system is not available.

Smoke proof stair wall: - In a high-rise building, the stairs typically represent the sole means of egress during a fire. It is imperative for the exit stairs are free of smoke and to incorporate design features that improve the speed of occupant egress. Most building codes require the fire stairwells in a high-rise building to be pressurized to keep smoke out. Based on the checklist in 66.6 available and functioning and in 33.4 available but deficient in number. This indicates that most of high-rise buildings in Addis Ababa have smoke proof stair wall.

Modern fire department: - The need for a fire department

is to supervise and manage the firefighting facilities in the building. The responsibility may include supervision, maintenance, and control of the building fire safety system. Based on the checklist in 80% of the buildings is not available and in 10% available and functioning.

Functional elevator system: - Vertical transportation of people and material in high-rise buildings, mainly by using an elevator system. This machine is basically powered by electrical motors which drive power cables [16]. These elevators are the basic needs for high-rise buildings which is difficult to transport people without them. From the checklist in 53.3% of buildings is available and functioning, 33.4% available, but not functioning, and 13.3% are available but deficient in number. This indicates that most of high-rise buildings have an appropriate elevator system and some of them are not functional.

Table 2. Checklist of safety measures which fixed in high rise buildings.

No	Safety Measures	Available & Functional		Available & deficient in no.		Available & not functional		Not Available	
		N	%	N	%	N	%	N	%
1	Automatic Sprinkler System	4	26.6	4	26.6	3	20	4	26.6
2	Emergency Voice	3	20	5	33.3	1	6.6	6	40
3	Synchronized power system	7	46.6	-	-	-	-	8	53.3
4	Smoke Proof Stairwell	10	66.6	5	33.4	-	-	-	-
5	Modern Fire Department	3	20	-	-	-	-	12	80
7	Functional Elevator system	8	53.3	2	13.3	5	33.4	-	-
8	Fire Extinguishers	10	66.6	4	26.6	1	6.8	-	-

Fire extinguisher: - Fire extinguishers are extremely important as they are the most commonly used for of fire protection. In many cases, they are a first line of defense and often contain or extinguish a fire, preventing expensive damage. Based on the checklist in 66.6% of buildings available and functioning, 26.6% available, but deficient in number, and 6.8% available but not functioning. This indicates that high-rise building in Addis Ababa has fire extinguishers, but some of them have not efficient in number.

training for the users of the building about the operation of lifts and also hire an operator who is responsible for the operation and maintenance of the lifts; arrange a manager who has responsibility for a periodical maintenance of the building and also must plan an appropriate finance for maintenance activities.

5. Conclusions

This study assessed the condition of high-rise buildings in Addis Ababa City. It identified the major challenges which minimize the suitability high-rise buildings for the tenants, customers, and owners of the buildings. The result of the study indicates that the key problems of high-rise buildings at the occupancy or during the operation stage include; lack of sufficient parking space, vertical transportation problems, and maintenance problems. The occupants of high-rise buildings in Addis Ababa are not satisfied with, related to; automobile parking space, adequacy of escape routes in case of fire, central heating system, and the maintenance and repair service. Therefore in order to make high-rise buildings suitable for the tenants and customers the owner of the project must consider highly the space for parking of automobiles during the design of the structure; shall use smart car parking technologies which minimize and save space; prepare a

References

- [1] A. Farouk, "High Rise Buildings and How They Affect Countries Progression," International journal of high rise buildings, pp. 1-14, 2011.
- [2] Eichner, M and Ivanova, Z, "Socioecological Aspects of High-rise Construction," in E3S Web of Conferences, Moscow, 2018.
- [3] A. A. Mike, "The problems/possible solutions of managing a high rise multi-tenanted office complex in Abuja metropolis - A case study of the Industrial Training Fund (ITF) house, No 6 Adetokunbo Ademola Crescent, Wuse II, Abuja," International journal of Environmental sciences, vol. 5, no. 5, pp. 1043-1051, 2015.
- [4] A. N. Ede, "Challenges Affecting the Development and Optimal Use of Tall Buildings in Nigeria," The International Journal Of Engineering And Science, vol. 3, no. 4, pp. 12-20, 2014.
- [5] Nimlyat, P. S, Audu, A. U., Ola-Adisa, E. O., Gwatau, D., "An evaluation of fire safety measures in high-rise buildings in Nigeria," Sustainable Cities and Society, pp. 776-785, 2017.

- [6] Bhatija, K. K., Chinmayi, H. K., and Shweta, B., "Sustainable high rise buildings- design and material perspective," National Conference on Emerging Trends in Construction Technology and Sustainability, pp. 1-6, 2018.
- [7] Garg, R. and Sharma, K. A., "Advantages, disadvantages and challenges of sustainable vertical cities," International Research Journal of Engineering and Technology, vol. 05, no. 01, pp. 339-342, 2018.
- [8] Hernelind, J. and Roivainen, G., "High rise elevators – challenges and solutions in ride comfort simulations," in Science in the Age of Experience, 2017.
- [9] Aliyu, A. A., Funtua, H. A., Mammadi, A., Bukar, B. G., Garkuwa, A. I., and Abubakar, M. M., "Management Problems Associated with Multi-Tenanted HighRise Commercial Buildings in Kaduna Metropolis, Nigeria," Civil and Environmental Research, vol. 8, no. 1, pp. 114-123, 2016.
- [10] Duванov et al., "Optimize the use of a parking space in a residential area," in 15th International scientific conference "Underground Urbanisation as a Prerequisite for Sustainable Development", St. Petersburg, 2016.
- [11] Cowlard, "Fire Safety design for tall buildings," 2013.
- [12] E. Mensah, "Challenges of maintenance management of commercial buildings in Ghana: a case study of social security and national insurance trust properties in Accra," Thesis, pp. 1-68, 2015.
- [13] M. Kironji, "Evaluation of Fire Protection Systems in Commercial Highrise Buildings for Fire Safety Optimization A Case of Nairobi Central Business District," International Journal of Scientific and Research Publications, vol. 5, no. 10, pp. 1-8, 2015.
- [14] Ahmed, A., Mansor, A., and Albagul, A., "Design and Fabrication of an Automatic," in Lecture Notes in Mechanical Engineering, Switzerland, 2015.
- [15] Wikipedia Contributors, "Fire alarm system," 18 November 2019. [Online]. Available: https://en.wikipedia.org/w/index.php?title=Fire_alarm_system&oldid=926731316.
- [16] Wikipedia contributors, "Elevator," 21 November 2019. [Online]. Available: <https://en.wikipedia.org/w/index.php?title=Elevator&oldid=926009923>.