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CIRCULATION AND FIRE SAFETY IN ULTRA MODERN MARKET DESIGN.

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Abstract

A busy place such as a market is one to consider circulation for as movement in a facility is continuous whenever it is in use. One would want to also want to pay attention to fire safety as well because it is part of the primary consideration to protect life and properties. Fire safety and movement in an ultra modern market is a quintessential priority as in the case of fire emergency, the means of circulation provided will aid egress and may determine a level of safety that will be attained. Data collections were achieved through studies from different publications and a case study. Ultra modern markets in Nigeria are still evolving as there are not many to lay hold on. The way to handle cases of circulation and fire safety are careful considerations from design standards and process which would be carefully implemented during construction. Proper measures should also be put in place to supervise the fire safety, ensuring that they are all in place. Keyword- Market, circulation, fire safety.

INTRODUCTION

Circulation is part of the key consideration in every architecture design, as careful consideration influences and controls how to appreciate a space. In cases such as a market place, circulation is a key factor to critically consider because, movement and circulation is a continuous process.

The market place is a public space that habits the buying and selling of products and goods both in large and small quantities. Congestion has become a reoccurring problem in market buildings as it serves as a public building that temporarily houses large numbers of people. (Adeyeye 2021).

It can also be seen as a physical venue for interaction between urban and rural cultures, markets also serve as a hub for socio-cultural, religious, and political activity (Balogun, 2011).

Considering these definitions, it implies that there may be some level of traffic which could lead to congestion and uneasy circulation. One of the major menaces of a market environment is circulation; this is because here, most persons come from different directions at every point which could lead to disorderliness if not checked.

LITERATURE REVIEW

A well circulated market needs little or no grids, mapping or even signage to regulate movement of people and vehicles. Therefore, circulation is of paramount importance in a market environment. In architecture, circulation is referred as the movement of people through and how they interact with a building.

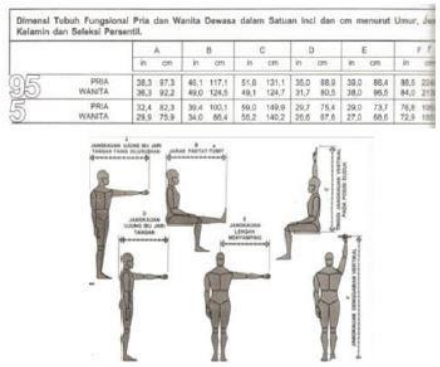


Figure 1. Standard Dimensions Body Functional [3] or Wheelchairs [3]

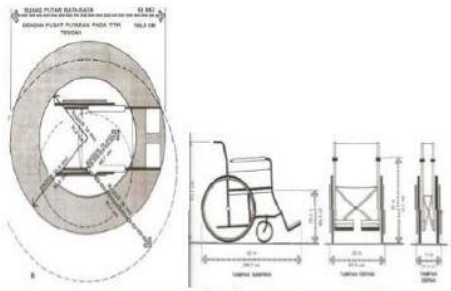
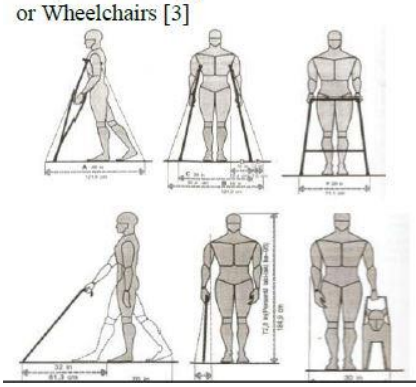


Figure 2. Standard User Space F



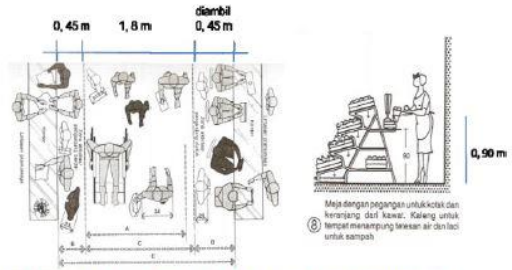


Figure 4. Standard Furniture and circulation in *the Display* Kiosk [3] [4]

Source: Al Siti Mnawaroh 2017

Steven and Allen (2004) said that the flow of people and things between interior building spaces and to entrances and exits is known as circulation in architecture. This could happen both under normal and emergency circumstances, safe, practical, swift circulation is crucial for all buildings. Any of the many various sorts of passageways, including lobbies, hallways, ramps, stairs, and elevator hoist ways, may be used to direct this traffic. In commercial buildings such as ultra modern markets, circulation can be vertical and horizontal. In vertical circulation, the movement of people and merchandise are between multiple floors while in horizontal circulation, movement is across several spaces on a single floor.

Steven and Allen (2004) also added that Vertical circulation in a multi-storey building is important to achieving a successful functioning design in the use of emergencies.

One might want to think of a the different circulation media that could serve a modern market for different situations including safety and emergencies especially fire emergencies.

In vertical circulation for a multi-storey building, the application of stairs, ramps are introduced. Classes of vertical circulation system;

a) Class I systems, which include ramps, stairs, escalators, and elevators, are designed to convey both people and products.

b) Class II systems, such as vertical conveyors and dumb waiters, on the other hand, cannot be utilized to carry humans. (Steven and Allen 2004),

Horizontal circulation of goods and merchandise from one floor area to another on the same floor level is referred to as circulation in a building. Halls, corridors, elevators, staircases, lobbies, escalators, catwalks, and any other portions of a building that are designed to create access to a room or area within the building are examples of things included in circulation areas. For instance, portions of loading docks may be referred to as being in this area since they allow individuals access to and from the building and the loading dock. (Wise GEEK, 2003 – 2015).

However, a fire in such a place as a market causes may cause a dysfunction in movement circulation and flow of movement in the market place. Now, the impact of a fire at a market place may be either accidental or intentional.

Emmanuel et al (2020) stated that the frequent occurrence of disasters and emergencies in Nigeria has increased in frequency and intensity in the last decade and especially in recent times.

Fire safety is always a deep consideration from design thought process to ease and ensure minimal damage if it should ever occur. For a modern market, fire safety is not just considered for the safety of goods and services but also for the users of the different spaces.

Fire Safety Requirement

Emmnuel et al (2020) stated that for a market building to be rated safe in cases of fire outbreak, the following requirements/standards should be met. However, Prazeres (2013) asserts these requirements for fire safety measures, they include: Provide access and means of egress, Fire detecting operations, limit internal fire spread (linings), limit internal fire spread (structure), limit external fire spread

In design for fire safety, some factors should be considered, however, not to be limited to these:

- A clear emergency access route within the market for the Police/ Fire/ Ambulance to be maintained at all times, where there are no stalls obstructing the clear access, but not impede a safe evacuation for members of the public and staff.
- Provision of adequate exit routes is provided for the numbers of persons expected within the market area.
- Exit routes must remain unobstructed, and final exit gates must remain unlocked at all times when the market is in use.

- Suitable and sufficient directional signage must be provided, indicating the appropriate escape route.
- Suitable and sufficient directional signage must be provided, indicating the appropriate escape route.
- An adequate supply of fully tested firefighting equipment must be available in prominent and easy to access positions.
- All ignition sources must have been identified , and measures taken to ensure that they are kept away from all flammable materials (although this will be a post design measure). Croydon.gov.uk (2023)

In essence, while design considerations are done and finalized to be put in place, building designs should be done and constructed so that there are media of escape from the building, accessible to the building users, in case of fire to a place of safety outside the building. Hence, these accesses are classified into building users and firefighters. Richard (2011) gave the following means of egress that one can exit a building during fire crises; which includes the stairs, core arrangements, occupants egress elevator and fire service access elevators.

Fire and its components

Fire starts when a flammable and/or a combustible material, in combination with a sufficient quantity of an oxidizer such as oxygen gas or another oxygen rich compound (though non-oxygen oxidizers exist that can replace oxygen), is exposed to a source of heat or ambient temperature above the flash point for the fuel/oxidizer mix, and is able to sustain a rate of rapid oxidation that produces a chain reaction (John, 2014).

Fire suppression Mechanism in Public Buildings

Suppression mechanism are triggered into action after detection by the detection operators in place. Van Raalte (2010) gives the wet and dry sprinkler systems as the major suppression

mechanisms. Wet systems are the simplest and most common type of sprinkler system installation, with relatively few components. The system provides fixed fire protection using piping filled with pressurized water supplied from a dependable source at all times. Water is continually discharged through sprinklers that have activated over or near the fire, thereby minimizing water damage Closed heat-sensitive automatic sprinklers spaced and located in accordance with recognized installation standards are used to detect fire upon operation, the sprinklers distribute the water over a specific area to control or extinguish the fire (Vikings, 2008).

Design Standards Against Fire

Adamu, (2013) opines various design standards have been developed as a guide for the development of public buildings in respect to fire, these standards cut across fire safety, non-combustible building and fire prevention and control amongst others. Standards here refer to design strategies and specifications by the qualities required for fire prevention and control maybe achieved at a certain degree. The national building code (2006) defines anon-combustible construction as that type of construction in which a degree of fire safety is attained by the use of non-combustible materials for structural members and other building assemblies. It further states the fire-resistive time periods may be reduced by one hour for interior load bearing walls, exterior load bearing and non-load bearing walls, roofs and the beams supporting roofs, provided they do not frame into columns.

Stairways Designed For Emergency Egress

These are sometimes called escape stairways; they are used for emergency cases like fire outbreak in the building, and others. To stop the spread of smoke and flames, interior exit stairways frequently need to be enclosed with walls that have a fire resistance grade. The design and grading of walls must adhere to local building codes. Self-closing fire doors that have been approved should be used to seal off any wall openings. In buildings that must be

constructed in accordance with the fire code, stairs must be entirely made of non-combustible materials. There shouldn't be any other use for the open space under stairs that is intended to be utilized as a means of egress, not even closets. **(**Steven et al, 2004).

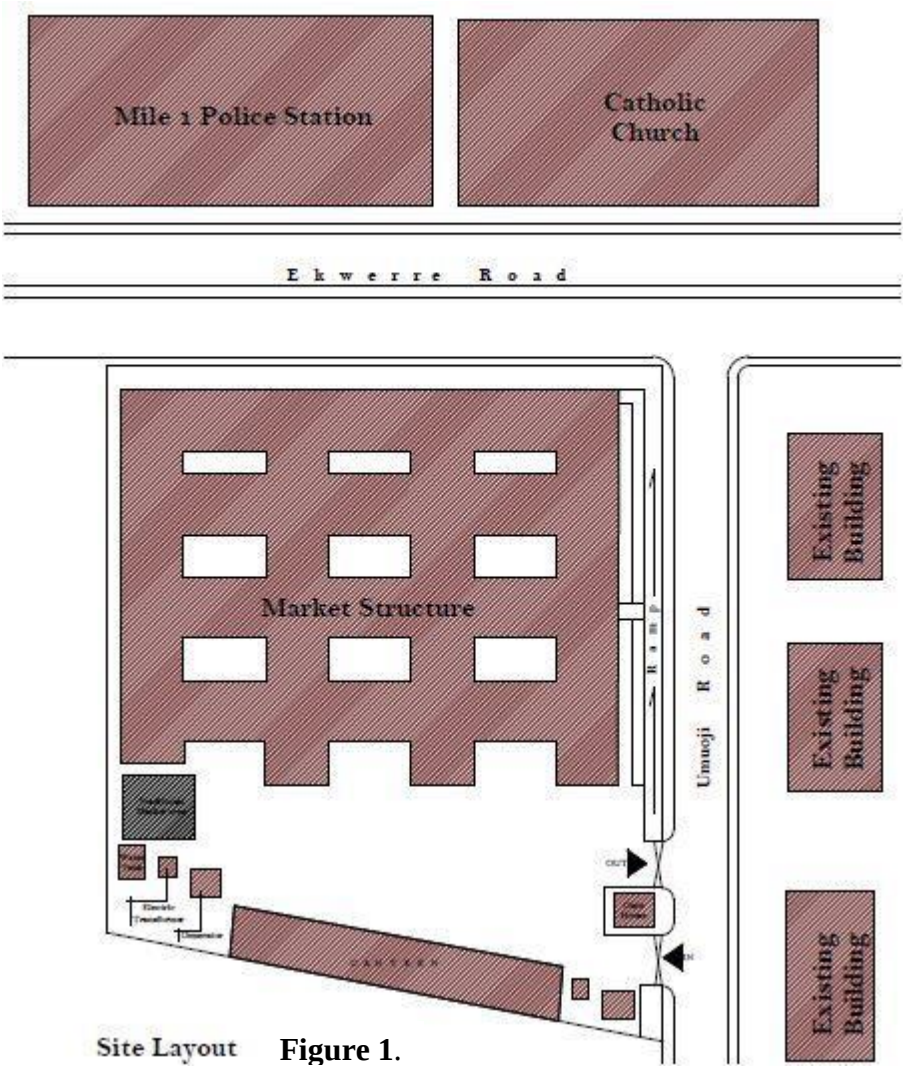
For stair widths in public buildings or theatres, the amount of time needed for a full evacuation must be estimated. For a more progressive ascent, such stairs or front entry steps are climbed carefully. An emergency stair should make a rapid descent easy. Every area of the building must be at least 35 meters from an emergency exit. Self-closing fire doors with a fire rating of 30munites are used instead when many staircases are required and must be positioned to provide the quickest escape route possible. (Neufert, 2001).

Fire disasters have become so continuous that one can almost say that it occurs daily. However, the risk of fire outbreaks is at its peak during the dry season; it is of great concern the number of fire incidents that has happened in quick succession across the nation; the statistics for the year 2012 coming from various states in the federation are equally frightening (Emmanuel et al, 2020). He also stated in his article *"Assessment of Fire Safety Measures in Some Markets in Kaduna State, Nigeria"* that in Rivers State, the government has announced that 73 persons suffered different degrees of injuries and that no fewer than 230 persons lost their lives in 222 fire incidents in the state in 2012 alone.

METHODOLOGY

In order to achieve this study, the case study approach was adopted. This study intends to analyze ultra modern markets using Rumuwoji Modern Market**.** The Rumuwoji Modern market is located in the city of Port Harcourt along Ikwerre road, Mlie 1, Rumuwoji town near the mile 1 flyover in the Port Harcourt Local Government Area of Rivers State. The fly over which is a major vehicle terminal point in the city of Port Harcourt, the market is surrounded by the Police Station in Diobu division Rumuwoji in direct opposite and of course the host community of Rumuwoji and the Mile1 fly over park. The site has two access roads, the major access is the Ikwerre road linked by the minor access road called the Umuoju road

which is the main entrance to the market, and there is also a proposed site at the western side of the market for further development especially for fruits and vegetable market which is not part of the existing Rumuwoji Modern Market.



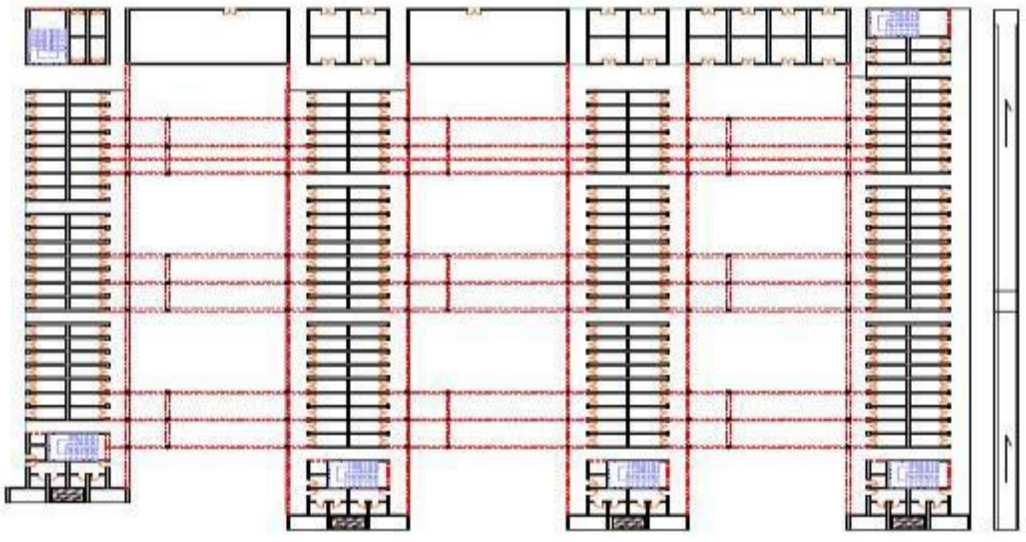
Site Layout **Figure 1**.

In time past, the market of study used to not be an ultra modern market as it was a 'local market' and as such it suffered the common deficiencies of most markets of its kind which was the issue of circulation also adding to the fact that the materials used in construction were prone to fire. But having been destroyed by an inferno On 6th January, 2004. The market had to be rebuilt up to the standard of an ultra modern market for efficient use.

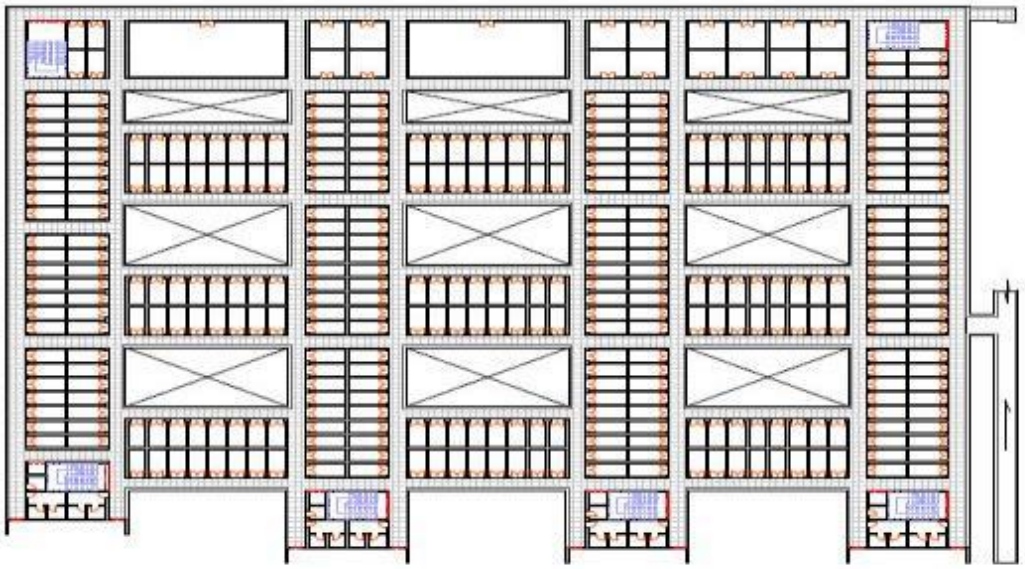
A ramp for disables and wheelbarrows was situated on the building's eastern flank for easy access through the main access road. This building service was put in place to ensure that circulation is at its best and it within the market premise.

Before the fire disaster in 2004, the materials used for the construction of the market structure was just wood and trampolines, which was part of what aided the inferno to spread fast and due to the poor circulation grid causing severe traffic during the fire emergency it was difficult to rescue as much goods as possible which led to the failure of the structure.

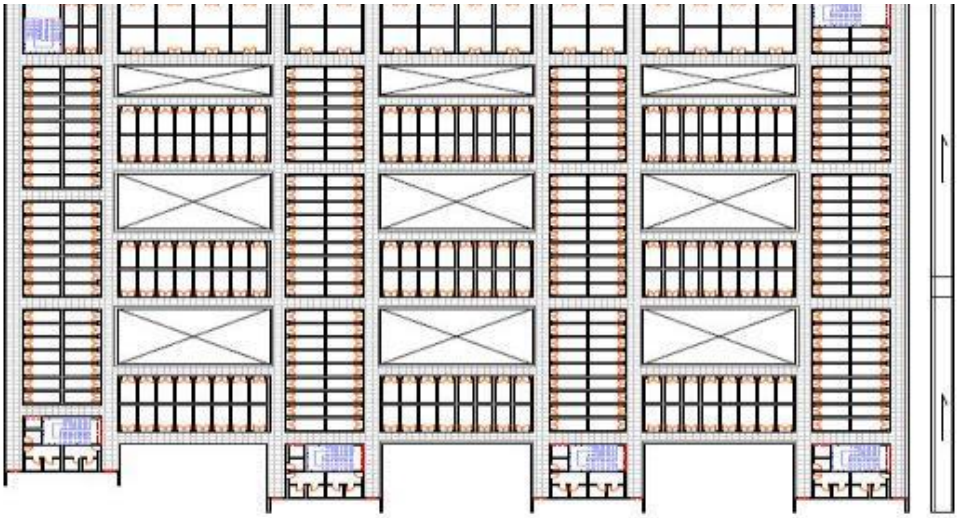
However, when it was reconstructed to modern standard, materials such as steel, concrete and aluminium was adopted to resist the quick spread of fire. Also, some safety services such as fire extinguishers were put in strategic places to fight fire. In the previous structure, the market contained less occupants as it was just on ground floor level, but after reconstruction, three extra floors were added, making room for more occupants, and as well introducing vertical means of circulation such as stairs and ramp.



Ground Floor Plan **Figure 2**.



First Floor Plan **Figure 3**



Second Floor Plan **Figure 4**

Passage ways of 1.5m was provided on each side of the carefully gridded layout also making provision on each side, aiding the visual continuity. The detail of material used in construction were, sand screed 225mm hollowed blocks for all the walls, with a modular grid system of reinforced concrete columns of about 1.5m spacing which is 96 used as the standard lock up shop space the structure. Long span aluminium roofing sheets are used on a steel structural roofing system of about 150 sloppy conventional roofs; walls are finished with sand screed plastering, painted with the same colour of emulsion paint, floor is finished with sand screed German flooring

Figure 4. Exterior view showing ramp provided

Figure 5. Exterior view showing balcony

CONCLUSION

Now when consideration for fire safety and circulation is to be considered, it goes beyond pedestrian consideration but also one would also have to look at vehicular consideration for easy vehicular movement within and around the environment as this might also be a cause of fire disaster. Measures would have to be taken to manage its movement. Also, considerations for fire safety trucks for them to be able to circulate around the structure and manage fire disasters, if for any reason. Fire extinguishers should be placed at strategic positions so as it could serve in times of need.

Fire emergency is not an everyday occurrence, but however, proper precautions towards it should be done carefully especially from design process. This entails from the design of the of spaces to the design of the environment, the services to be provided to the to the materials to be built with and as well the end users.

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