

Determination of fire Resistivity of Door and Window Materials at Portharcourt Markets in Nigeria

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Abstract

The persistence of fire outbreaks in markets is a problem in Nigeria and the repetition of this problem is very frequent at Port Harcourt in Rivers State. To curtail this problem, research was made on the three major markets in Port Harcourt with the aim of determining the fire resistivity of their door and window materials, in order to generate guidelines for designing doors and windows of market buildings in Nigeria. The research made use of desktop study as the instrument for data collection. Then, the data were analyzed and checked by using content analysis technique, so as to validate the results. Among the findings are uses of ordinary windowpanes and their aluminium frames in the design of market buildings are not good practices against fires. Among the recommended guidelines are the design of all the window panes of market buildings must be metal type; the design of all the window frames of market buildings must be steel type, in order to ensure good practices against fires in Nigerian markets. Alternatively, the design of all the window panels of market buildings must be made up of any other fire-resistant material with a minimum of two hours resistance, in order to also ensure good practices against fires in Nigerian markets.

Keywords: Designing, doors and windows, fire, markets, windowpanes

INTRODUCTION

The derived benefits from markets are numerous in Nigeria and other places of the world. For example, marketplaces create employment and generate local revenue; supply household incomes and support the development of human resource via the provision and education of the family relatives or children of the traders (Baah-Ennumh and Adom-Asamoah, 2012 [1]; Owusu and Lund, 2004) [2]. Fire safety in markets in Nigeria and other places of the world is thus very crucial for the traders. Therefore, it is important that markets are free from fire outbreaks, in order to ensure continuous derivation of benefits from them. From the information obtained from the Federal Fire Service of Nigeria (2016) [3], the persistence of outbreaks of fire in several Nigerian markets is a problem. Frequent fire outbreaks in markets have been recorded in Rivers State of Nigeria. For example, it was reported by TVC News (2021) [4] that in February 2021 there was incident of fire at Mile 3 market in the city of Port Harcourt of Rivers State; likewise, in September 2018, there was incident of fire that razed a large section of Fruit garden market in Port Harcourt and the market was reportedly demolished after the incident; rebuilt and opened again for business transactions. TVC News (2021) [4] further reported that in December 2014, millions of Naira worth of goods were destroyed in a severe fire outbreak at the recent market complex in the aged Port Harcourt township; an incident of such similarity also happened in December 2013 during the time Mile 1 market that is situated along Ikwerre road was ruined by outbreak of fire in Port Harcourt.

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To curtail this problem of frequent fire outbreaks in Rivers State, research was conducted on the three major markets in Port Harcourt with the aim of

determining the fire resistivity of their door and window materials, in order to generate guidelines for designing doors and windows of market buildings in Nigeria. From the information obtained from Wikipedia (2022) [5], Port Harcourt of Rivers State is the center and largest city in the state; and it is documented as the 5th city in terms of popularity in Nigeria following Benin, Ibadan, Kano and Lagos. It is located at the axis of Bonny River at Niger Delta. In 2016, the urban area of Port Harcourt had a population that was estimated to be 1,865,000 inhabitants as increased from 1,382,592 in 2006. Port Harcourt was additionally developed via the influence of the petroleum industry in Nigeria with parts of modernization like overpasses, city blocks plus taller and substantial number of buildings. Shell and Chevron are among the oil firms that presently have offices in the city. (Figure 1) shows Nigeria revealing Rivers State as highlighted; its other 35 states and the Federal Capital Territory, Abuja.



Figure 1. Nigeria showing Rivers State as Highlighted; its other 35 States and the Federal Capital Territory, Abuja [Source: Africa Prime News, 2018 (<https://africaprinenews.com/2018/07/17/opinion/amaechi-wike-abe-dakuku-and-the-struggle-for-the-2019-rivers-apc-guber-ticket-critical-examination-of-the-forces-and-factors-at-play/>)], Retrieved on 07-12-2022].

METHODS AND PROCEDURES

This research employed descriptive survey method and produced qualitative data. According to the National Population Commission (2022) [6] and Nigeria High Commission (2022) [7], it was stated that Nigeria is comprised of 36 states and the Federal Capital Territory (FCT). The research considered determination of fire resistivity of door and window materials in Port Harcourt markets because it is the capital and largest city in Rivers State (Wikipedia, 2022) [5] with the cases of fire outbreaks in the time past. The information obtained from Pita Kwa Times (2016) [8] shows that seven main markets exist in Port Harcourt, and they are Oil mill market, Choba market, Mile 1/3 market, Rumuokoro market, Bori camp market, Ikoku spare parts market and Borokiri market. From these seven markets, three markets: Rumuokoro market, Mile 1 market and Bori camp market were randomly selected for this study.

According to Prashant and Supriya (2010) [9], Steve (2011) [10]; Suresh and Chandrashekara (2012) [11], in research, 20% size of the sample of a population is a good recommended sample size. The three

those markets that were researched in this case are above 20% of the size of the sample; these have in turn made the size of the sample to be adequate. The research data were obtained via desktop study; reviewed different literature, information from media and Internet search. The analyses of the research data were made and checked via content analysis technique by comparing the extracted data with the raw desktop (secondary) data, so as to validate the results. The analysis results were employed in creating the architectural guidelines of this study.

DATA PRESENTATION AND DISCUSSIONS

The Door and window materials that were found in Port Harcourt markets include glasses, aluminium and steel. (Table1) shows the distribution of different door and window materials that were observed in Port Harcourt markets. The use of glasses and aluminium were found in Rumuokoro market and Mile 1 market, while the use of steel was found in all the three markets (Rumuokoro market, Mile 1 market and Ikoku spare parts market).

Table 1. Distribution of Different Door and Window Materials in Port Harcourt Markets.

S/N	Market	Door and Window Material
1	Rumuokoro Market	Glass, Aluminium and Steel/Metal
2	Mile 1 Market	Glass, Aluminium and Steel/Metal
3	Ikoku Spare Parts Market	Steel/Metal

Source: Reviewed Work, 2022.

Rumuokoro Market

Scholars have stated that the use of steel in building design is a good practice against fires (Buxton, 2011 [12]; Health and Safety Executive, 2010 [13]; Merritt and Ricketts, 2001 [14]; Neufert and Neufert, 2000 [15]; Wald, Kallerova and Chlouba, 2009) [16]. The use of steel/metal in the design and construction of the doors of buildings in Rumuokoro market is a good practice against fires. However, it was observed that glasses were used as window shutters and aluminium was used in the design and construction of their frames



Figure 2. Rumuokoro Market showing Steel Doors; Windowpanes and their Aluminium Frames in its Construction.

Source: Twitter, 2018 (<https://twitter.com/AskPHPeople/status/1050743414185189383>), Retrieved on 08-12-2022.

in this market. Contrarily, most of the glasses that are non-fire resistant provide little or no fire protection; for example, window glass of a standard quality will break by the time the temperature is approximately up to 250° F and there is a possibility of a tempered glass to last up to around 500°F (Jerry, 2008) [17]. In opposite also, structures that are made up of aluminium possess low fire resistance due to the alloy melting temperature that is low (Davor, Ivan and Marija, 2015) [18]. (Figure 2) shows the use of steel doors; windowpanes and their aluminium frames in the construction of Rumuokoro market.

Mile 1 Market

The use of steel/metal panel doors in the design and construction of Mile 1 market is a good practice against fires. However, it was observed that glasses were used as window shutters and aluminium was used in the design and construction of their frames in this market; contrarily, Building and Construction Authority (2017) [19]; Neufert and Neufert (2000) [15] and Quarles (2013) [20] pointed out that the materials that can be used to design buildings against the incidents of fire should have the enablement of resisting surface flame spread. (Figure 3) shows the use of steel panel doors; window panes and their aluminium frames in the construction of Mile 1 market.



Figure 3. Mile 1 Market showing the Use of Steel Panel Doors; Window Panes and their Aluminium Frames in its Construction.

Source: Twitter, 2018 (<https://twitter.com/AskPHPeople/status/1050743414185189383>), Retrieved on 08-12-2022.

Ikoku Spare Parts Market

The use of steel in building design is a good practice against fires (Buxton, 2011 [12]; Health and Safety Executive, 2010 [13]; Merritt and Ricketts, 2001 [14]; Neufert and Neufert, 2000 [15]; Wald *et al.*, 2009) [16]. The use of steel/metal panel doors in the design and construction of Ikoku spare parts market is a good practice against fires. (Figure 4) shows the use of steel panel doors in the construction of Ikoku spare parts market.



Figure 4. Ikoku Spare Parts Market showing the Use of Steel Panel Doors in its Construction.
Source: Twitter, 2018 (<https://twitter.com/AskPHPeople/status/1050743414185189383>), Retrieved on 08-12-2022.

CONCLUSION AND RECOMMENDATIONS

This research determined the fire resistivity of door and window materials in PortHarcourt markets in Rivers State of Nigeria due to the problem of persistence of fire outbreaks in Nigerian markets and it served as an avenue to generate guidelines for designing doors and windows of market buildings in Nigeria. The research findings showed that the use of steel panel doors in the design and construction of the doors of all the market buildings that were studied is a good practice against fires but the use of ordinary windowpanes and their aluminium frames is not a good practice against fires in Rumuokoro market and Mile 1 market. Having considered these findings, the following guidelines are therefore recommended for designing doors and windows of market buildings in Nigeria:

Guidelines for Designing Doors and Windows of Market Buildings in Nigeria

- i. The design of all the door panels of Nigerian market buildings must be steel/metal type as being practiced against market fires at Port Harcourt in Rivers State of Nigeria.
- ii. The design of all the window shutters of market buildings must be metal type, in order to ensure a good practice against fires in Nigerian markets.
- iii. The design of all the window frames of market buildings must be steel type, in order to also ensure a good practice against fires in Nigerian markets.
- iv. Alternatively, the design of all the window panels of market buildings must be made up of any other fire resistant material with a minimum of two hours resistance, in order to similarly ensure a good practice against fires in Nigerian markets.

This research only considered the door and window designs of market buildings without considering the design of other parts of the market buildings in Port Harcourt and this is a research gap. Therefore, in any similar research like this, addressing this gap should not be neglected.

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