

**EFFECTIVENESS OF PASSIVE FIRE MEASURES IN THE DESIGN OF A
MARKET BUILDING, BENIN CITY**

EJALE EGHONGHON ANNE

(19PCA02008)

SEPTEMBER, 2021

**EFFECTIVENESS OF PASSIVE FIRE MEASURES IN THE DESIGN OF A
MARKET BUILDING, BENIN CITY**

BY

EJALE EGHONGHON ANNE

(19PCA02008)

B.Sc. Architecture, Ambrose Alli University, Ekpoma

**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE
STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
AWARD OF MASTER OF SCIENCE (M.Sc.) DEGREE IN ARCHITECTURE IN
THE DEPARTMENT OF ARCHITECTURE, COLLEGE OF SCIENCE AND
TECHNOLOGY, COVENANT UNIVERSITY OTA.**

SEPTEMBER, 2021

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirements for the award of the degree of Master of Science (M.Sc.) in Architecture in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Nigeria.

Mr. John A. Philip
(Secretary, School of Postgraduate Studies)

.....
Signature & date

Prof. Akan B. Williams
(Dean, School of Postgraduate Studies)

.....
Signature & date

DECLARATION

I, **EJALE, EGHONGHON ANNE (19PCA02008)** declare that this research was carried out by me under the supervision of Dr. Izobo-Martins Oladunni of the Department of Architecture, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

EJALE, EGHONGHON ANNE

.....

Signature & Date

CERTIFICATION

I certify that this dissertation titled “Effectiveness of Passive Fire Measures in the Design of Market, Benin-City” is an original research work carried out by EJALE Eghonghon Anne (19PCA02008), in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun state, Nigeria, under the supervision of Dr Oladunni Izobo-Martins.

Supervisor

Dr. Oladunni Izobo-Martins

Signature & date

Head of Department

Dr. Akunnaya Opoko

Signature & date

External Examiner

Dr. Ilesanmi Adetokunbo

Signature & date

Dean, School of Post-graduate Studies

Prof. Akan B. Williams

DEDICATION

This design thesis is dedicated to the glory of God, the people of Benin city and all those who give their time, talent and treasure towards community development.

ACKNOWLEDGEMENT

This thesis would not have been possible without the undeniable help of God and the assistance of my ever-supportive parents, Mr and Mrs Ejale. I want to especially thank my mother for her prayers and moral support throughout the two years of my Master's Program.

I will also like to thank my supervisor, Dr Izobo-Martins, for her guidance and insightful contributions to this work. Her zeal for perfection and the research process has greatly influenced me and this project.

Finally, I want to acknowledge the contributions made by Dr Alagbe, Dr Aduwo, Dr Aderomu, Dr Jegede and Dr Ediae for their constructive criticisms and motivating comments as my jurors and mentors.

TABLE OF CONTENT

ACCEPTANCE	iii
DECLARATION	iv
CERTIFICATION	v
DEDICATION	vi
ACKNOWLEDGEMENT	vii
TABLE OF CONTENT	viii
LIST OF FIGURES	xii
LIST OF TABLES	xiii
LIST OF PLATES	xiv
APPENDIXES	xvi
ABSTRACT	xvii
CHAPTER ONE1: INTRODUCTION	1
1.1 Background to the study	1
1.2 Problem statement	5
1.3 Research questions	7
1.4 Aim	7
1.5 Objectives	8
1.6 Justification	8
1.7 Significance of the study	9
1.8 Scope	10
1.9 Limitations of the study	10
1.10 Definition of terms	10
CHAPTER TWO: LITERATURE REVIEW	12
2.1 Market	12

2.1.1	Types of Market	13
2.1.2	Challenges of Market Complex Development	14
2.2	Inducement of Fire	15
2.3	Fire safety codes	17
2.3.1	Relevant Fire safety codes	18
2.4	Effectiveness of Fire safety in market buildings	20
2.5	Types of Fire safety measures	22
2.5.1	Active Fire Safety measures	23
2.5.2	Passive fire Safety measures	23
CHAPTER THREE: RESEARCH METHODOLOGY		34
3.1	Introduction	34
3.2	Research Philosophy Approach	34
3.3	Methods of Data Collection	35
3.4	Research Design	35
3.5	Study Population	36
3.6	Sampling methods	38
3.7	3.7 Design of Data Collection Instruments	39
3.7.1	Observation guide	39
3.8	Data Collection and Analysis	39
3.8.1	Data Collection and Treatment by Objectives	39
CHAPTER FOUR: RESULTS AND DISCUSSIONS		43
4.1	Introduction	43
4.2	Objective 1: To investigate the fire safety measures as it exists in selected markets	43
4.2.1	Tejuosho market	43

4.2.2 Oba market	51
4.2.3 Ekiosa market	56
4.2.4 Uselu market	63
4.3 Objective 2: To investigate the effectiveness of the existing fire safety measures in the selected markets.	72
4.4 Objective 3: To evaluate the extent to which passive fire safety measures have been adopted in selected markets	77
4.5 SITE AND ENVIRONMENTAL ANALYSIS	78
4.6 Background knowledge of Benin City	78
4.6.1 Socio-Cultural Character of Benin City Edo	79
4.6.2 The Criteria for Choosing Site	80
4.6.3 Importance of Passive Fire safety in the proposed market design	80
4.6.4 Accessibility to the site	81
CHAPTER FIVE: DESIGN CRITERIA AND OBJECTIVES	88
5.1 Project Goals and Objectives	88
5.2 Functional and Space Criteria	89
5.2.1 The commercial component	89
5.2.2 The Administrative component	91
5.2.3 The outdoor component	92
5.3 Design Considerations	93
5.4 Technological and environmental criteria	94
5.5 Legal and Planning Regulations	95
5.6 Behavioural and Aesthetics Criteria	96
5.6.1 Behavioural Criteria	96
5.6.2 Aesthetics Criteria	96

CHAPTER SIX: DESIGN PHILOSOPHY, CONCEPTUALIZATION AND PROPOSAL	98
6.1 Design Philosophy	98
6.2 Bubble diagram	99
6.3 Design Concept	100
6.4 Conclusion	103
REFERENCE	105
APPENDIXES	111

LIST OF FIGURES

Figure 1 Showing the Local Government areas in Benin city	37
Figure 2 Showing the socio-cultural Character of Residents in Benin city	80

LIST OF TABLES

Table 3.1 List of Major markets in Oredo, Ikpoba-Okha, Egor Local Government area in Benin city that have experienced fire outbreaks within the last three years	37
Table 3.2 Showing the distribution of markets with fire incidence in Oredo, Ikpoba-Okha, Egor Local Government areas in Benin city	38
Table 4.1 Showing the presence or absence of specific criteria in the Tejuosho market that can affect fire safety in the market	45
Table 4.2 Showing the presence or absence of specific criteria in the Oba market that can affect fire safety in the market	52
Table 4.3 Showing the presence or absence of specific criteria in the Uselu market that can affect fire safety in the market	65
Table 4.4 Showing the ranking of Passive fire Protection amongst other Criteria	75
Table 4.4 Showing the ranking of Passive fire Protection amongst other Criteria	77

LIST OF PLATES

Plate 4.1 Showing Phase II of Tejuosho market from the street level	44
Plate 4.2 Entrance into Phase I through Tejuosho Road	46
Plate 4.3 Showing Entrance into Phase II through Tejuosho Road	47
Plate 4.4 Entrance into Phase I through Tejuosho Avenue	47
Plate 4.5 Entrance into Phase I and Phase II through Ojuelegba Road	47
Plate 4.6 Showing a typical circulation corridor on the first floor of Tejuosho market Phase I	49
Plate 4.7 Showing the modular arrangement of shops in a typical suspended floor plan of one of the market blocks.	49
Plate 4.8 Showing the pipes for the wet-riser system	50
Plate 4.9 Showing satellite imagery of Oba market and its proximity to Ring road	51
Plate 4.10 Showing the front of the market from Siluko road	53
Plate 4.11 Showing the burnt section of the market	54
Plate 4.12 Showing an Aisle in Oba market	55
Plate 4.13 Showing the front of Ekiosa market from the Second-east-circular road	58
Plate 4.14 Showing the ruins of the old fence of Ekiosa market by Evbarunegbeifo street	59
Plate 4.15 Showing the structure used for the stalls Ekiosa market	60
Plate 4.16 Showing the ruins of the shops at Ekiosa market	60
Plate 4.17 Showing the size of the effect of fire of the steel doors used for shops at Ekiosa market	61
Plate 4.18 Showing the size of the space between shops at Ekiosa market before the fire	61
Plate 4.19 Showing the remains of the shops at Ekiosa market	62
Plate 4.20 Showing temporary structures reconstructed after the fire	63

Plate 4.21 Showing the Circulation space for the open-air market	66
Plate 4.22 Showing the Exits and Stairs on the left-wing of the market	67
Plate 4.23 Atrium showing narrow space in between rolls of lock-up shops	68
Plate 4.24 Major access road – Ugbowo –Lagos road in front of the site	68
Plate 4.25 Showing temporary shades in front of Uselu market	69
Plate 4.26 Showing the use of Mild steel doors	69
Plate 4.27 Showing the material used for covering the Atrium	70
Plate 4.28 Showing the Corridor leading to shops	70
Plate 4.29 Showing a row of shops and a narrow atrium	71
Plate 4.30 Showing the building with rows of stalls	71
Plate 4.31 Showing open-air market within the market premises	72
Plate 4.32 Showing ruins of old Ekiosa market	82

APPENDIXES

Appendix 1: Observation Guide	111
Appendix 2: Site Location Plan	112
Appendix 3: Concept Evolution	112
Appendix 4: Bubble Diagram	113
Appendix 5: Site Plan	114
Appendix 6: Ground Floor Plan	115
Appendix 7: First Floor Plan	116
Appendix 8: Roof Plan	117
Appendix 9: Section	118
Appendix 10: Elevation	119
Appendix 11: 3D presentation	119

ABSTRACT

Markets offer social, cultural and economic character to a society. Hence, frequent fire outbreaks act as a major disruption to the lives of many people, especially traders. This research recognises the importance of a sustainable solution to the fire outbreaks and poor fire safety management associated with Nigerian markets. Therefore, the study aims to investigate the existing fire safety measures in some selected markets and adopt passive fire safety strategies in designing a modern market in Benin city. The research employs observation guides to examine selected case studies with a history of fire incidences, and the results are analysed using measures of central tendency. The findings indicated that most markets in Nigeria do not have adequate passive fire safety measures making their building structures susceptible to grave damages in the event of a fire outbreak. Based on these results, a new market design was developed. This new market conforms with the principles of passive fire safety strategies for a sustainable solution to fire hazards in markets.

Keywords: Market, Fire safety, Benin City, Passive fire safety measures