

**INTEGRATED ULTRA-MODERN ABATTOIR AND
RESEARCH FACILITY, KARA, OGUN STATE, NIGERIA.**

**ACHIEVING HYGIENIC ENVIRONMENT FOR MEAT PRODUCTION THROUGH
ARCHITECTURAL DESIGN AND PLANNING**

OYENUGA, TEMILOLA ANUOLUWAPO

(12CA014079)

MAY, 2018

**INTEGRATED ULTRA-MODERN ABATTOIR AND
RESEARCH FACILITY, KARA, OGUN STATE, NIGERIA.**

**ACHIEVING HYGIENIC ENVIRONMENT FOR MEAT PRODUCTION THROUGH
ARCHITECTURAL DESIGN AND PLANNING**

BY

OYENUGA, TEMILOLA ANUOLUWAPO

(12CA014079)

B.Sc Architecture, Covenant University, Ota

**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.**

MAY, 2018

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Sciences 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, **OYENUGA, TEMILOLA ANUOLUWAPO (12CA014079)**, declares that this research was carried out by me under the supervision of Prof. E. O. Ibe at the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State. 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.

OYENUGA TEMILOLA ANUOLUWAPO

Signature / Date

CERTIFICATION

We certify that this dissertation titled “Integrated Ultra-Modern Abattoir And Research Facility, Kara, Ogun State, Nigeria” is an original research work carried out by Oyenuga, Temilola Anuoluwapo (12CA014079) in the Department of Architecture, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. E. O. Ibem. We have examined and found this work acceptable as part of the requirements for the award of Master of Science in Architecture.

Prof. Eziyi O. Ibem

(Supervisor)

Signature / Date

Prof. Akunnaya P. Opoko

(Head of Department)

Signature / Date

Prof. Olatunde Arayela

(External Examiner)

Signature / Date

Prof. Akan B. Williams

(Dean, School of Postgraduate Studies)

Signature / Date

DEDICATION

I dedicate this research to GOD ALMIGHTY who has been my rock and my strong hold. I also dedicate it to my loving parents, Mr. and Mrs. Oyenuga for their unrelenting support.

ACKNOWLEDGEMENTS

My acknowledgement goes to God Almighty who has given me the grace to start and finish this research well. He deserves all the glory and praise.

I also sincerely appreciate my loving parents, **Mr and Mrs Oyenuga**, for their wonderful support and seeing me through this project from its start to finish. I love you and may God reward you in all areas of your life.

To my supervisors, **Prof. Ibem E. O., Dr A. A. Oluwatayo and Dr. O. O. Izobo-Martins**, I am sincerely grateful for the time, concern and effort shown in the becoming and realization of this project. Thank you very much and may Almighty God reward you immensely.

I sincerely appreciate my siblings, **Temitope Oyenuga and Oyindamola Oyenuga**, for their love, concern and support shown towards achieving this research. God bless you both.

I also appreciate my friends and classmates for encouraging and supporting me. God bless you all.

TABLE OF CONTENTS

ACCEPTANCE	i
DECLARATION	ii
CERTIFICATION	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
LIST OF FIGURES	ix
LIST OF PLATES	xi
LIST OF TABLES	xv
ABSTRACT	xvi
CHAPTER ONE	1
INTRODUCTION	1
1.1 BACKGROUND OF STUDY	1
1.2 PROBLEM STATEMENT	3
1.2.1 RESEARCH QUESTIONS	5
1.3 AIM AND OBJECTIVES	6
1.4 JUSTIFICATION FOR THE STUDY	6
1.5 THE CLIENT/ USERS	7
1.6 SCOPE OF STUDY	7
1.7 LOCATION	8
1.8 METHODOLOGY	9
1.9 DEFINITION OF TERMS	9
CHAPTER TWO	11
LITERATURE REVIEW	11
2.0 INTRODUCTION.....	11
2.1 DEFINITION AND DESCRIPTIONS OF ABATTOIRS.....	11
2.2 BRIEF HISTORY OF ABATTOIRS.....	12
2.3 CLASSIFICATIONS, CATEGORIES AND TYPES OF ABATTOIRS	19
2.4 OVERVIEW OF ABATTOIR PROCESSES AND OPERATIONS.....	23
2.5 FUNCTIONS, SPACES AND RELATIONSHIPS BETWEEN SPACES IN AN ABATTOIR.....	26
2.6 SPECIFIC PROBLEMS IN AN ABATTOIR	48
2.7 SUMMARY	54
CHAPTER THREE	55

ACHIEVING HYGIENIC ENVIRONMENT THROUGH ARCHITECTURAL DESIGN AND PLANNING	55
3.1 INTRODUCTION.....	55
3.2 HYGIENE OF FOOD ESTABLISHMENTS	55
3.3 ABATTOIR DESIGN AND HYGIENIC ENVIRONMENT.....	61
3.4 MAJOR DESIGN PROBLEMS IN ABATTOIRS	62
3.5 KEY ISSUES CONSIDERED IN DESIGNING AND PLANNING MODERN ABATTOIRS FOR HYGIENIC ENVIRONMENT	64
3.6 MODERN APPROACHES AND PRACTICES IN DESIGN FOR HYGIENIC ENVIRONMENT IN ABATTOIRS	65
3.7 ARCHITECTURAL SOLUTIONS/ STRATEGIES TO ABATTOIR DESIGN FOR HYGIENIC ENVIRONMENT	67
3.8 COMMON TECHNOLOGICAL AND ENVIRONMENTAL SOLUTIONS IN ABATTOIR DESIGN FOR HYGIENIC ENVIRONMENT	72
3.9 SUMMARY	80
CHAPTER FOUR.....	81
CASE STUDIES.....	81
4.0 INTRODUCTION.....	81
4.1 CASE STUDY 1: KARA MARKET ABATTOIR, OJODU BERGER, OGUN STATE	82
4.2 CASE STUDY 2: OKO OBA ABATTOIR, AGEGE, LAGOS STATE.....	96
4.3 CASE STUDY 3: MATORI ABATTOIR, MUSHIN, LAGOS STATE.....	114
4.4 CASE STUDY 4: ILAJE ABATTOIR, BARIGA, LAGOS STATE	127
4.5 CASE STUDY 5: DANISH CROWN SLAUGHTERHOUSE, HORSSENS, AND DANISH MEAT RESEARCH INSTITUTE (DMRI), TAASTRUP, DENMARK	141
4.6 SUMMARY	157
CHAPTER FIVE	158
SITE AND ENVIRONMENTAL ANALYSIS	158
5.0 INTRODUCTION.....	158
5.1 THE CRITERIA FOR CHOOSING A SITE.....	158
5.2 THE CHOICE OF SITE, LOCATION, VISIBILITY	161
5.3 FEATURES OF THE SITE	163
5.4 SITE ANALYSIS.....	167
CHAPTER SIX	175
DESIGN CRITERIA	175

6.0	INTRODUCTION.....	175
6.1	PROJECT GOALS AND OBJECTIVES	175
6.2	FUNCTIONAL AND SPACE CRITERIA.....	176
6.3	TECHNOLOGICAL AND ENVIRONMENTAL CRITERIA	195
6.4	LEGAL AND PLANNING REGULATIONS.....	198
6.5	BEHAVIOURAL AND AESTHETICS CRITERIA.....	200
CHAPTER SEVEN.....		201
APPROACH TO THE DESIGN		201
7.0	INTRODUCTION.....	201
7.1	DESIGN PHILOSOPHY, CONCEPTS AND ITS JUSTIFICATION	201
7.2	DESIGN DEVELOPMENT PROCESS	202
REFERENCES AND BIBLIOGRAPHY.....		205

LIST OF FIGURES

Figure 2. 1: Process Flow Diagram of Large Animal Slaughtering	24
Figure 2. 2: A modern abattoir layout example	28
Figure 2. 3: Diagram illustrating by-products.....	37
Figure 2. 4:Diagram illustrating basic flows and spatial relationships in a meat research institute.....	43
Figure 3. 1: Diagram illustrating procedure for putting on protective clothing in a food establishment	59
Figure 4. 1: Aerial view of the entire Kara Market and the adjoining properties.....	82
Figure 4. 2: Drawing of the layout of Kara Market Abattoir.....	89
Figure 4. 3: Aerial View of the entire Oko Oba Abattoir and the adjoining properties	97
Figure 4. 4: Drawing of the layout of Oko Oba Abattoir.....	100
Figure 4. 5: Drawing of the current layout of the Mechanized Line in Oko Oba Abattoir ...	102
Figure 4. 6: Aerial view of the Matori Abattoir and the adjoining properties	114
Figure 4. 7: Drawing of the layout of Matori Abattoir	116
Figure 4. 8: Aerial view of the entire Ilaje Abattoir and the adjoining properties.....	128
Figure 4. 9: Drawing showing the layout of Ilaje Abattoir.....	129
Figure 4. 10: Drawing showing the layout of the new semi-mechanized Ilaje Abattoir	132
Figure 4. 11: Aerial view of the Danish Technology Institute Campus in Taastrup, Denmark	150
Figure 4. 12: Drawing of a section through the Danish Meat Research Institute Building ...	152
Figure 4. 13: Drawing of one of the floor plans of the Danish Meat Research Institute building	153
Figure 5. 1: Satellite Picture of Selected Site	161
Figure 5. 2: Map showing contour lines	163
Figure 5. 3: Map showing location of water body	164
Figure 5. 4: Map showing existing structures on site	166
Figure 5. 5: Chart showing average temperatures and precipitation for Isheri-Oke, Ogun State.....	167
Figure 5. 6: Bar chart showing maximum temperatures at Isheri-Oke, Ogun State.....	168
Figure 5. 7: Bar chart showing precipitation amounts for Isheri-Oke, Ogun State.	169
Figure 5. 8: Bar chart showing wind speeds in Isheri-Oke, Ogun State.....	169

Figure 5. 9: Chart showing wind rose blowing from South-West and North-East in Isheri-Oke, Ogun State.....	170
Figure 5. 10: Bar chart and graph showing cloudy, sunny and precipitation days in Isheri-Oke, Ogun State.....	171
Figure 6. 1: Drawing showing the basic dimension of a large animal (a) and small animal (b) chute respectively.....	180
Figure 6. 2: Cattle Abattoir Operation Procedure Flow-Chart	188
Figure 6. 3: Sheep/goat Abattoir Operation Procedure Flow-Chart	189
Figure 7. 1: Drawing showing the land-use of the entire premises.....	202
Figure 7. 2: Diagram showing the site zoning of the entire premises.....	203
Figure 7. 3: Diagram showing the zoning of the Abattoir	203
Figure 7. 4: Chart showing the functional spatial flow of the Abattoir	204

LIST OF PLATES

Plate 4. 1: Picture showing the entrance into the Kara Market premises	82
Plate 4. 2: Picture showing the Lairage of the Abattoir	86
Plate 4. 3: Picture showing the entire Slaughter Floor.....	86
Plate 4. 4: Picture showing the Meat Cutting and Deboning Area	87
Plate 4. 5: Picture of the interior of veterinary office, Plate 4. 6: Picture showing the Head Processing Shed	87
Plate 4. 7: Pictures of the Goat/sheep Slaughter and Processing Area	87
Plate 4. 8: Pictures of the Blood Processing Area and Blood Drying Ground	88
Plate 4. 9: Pictures showing the livestock Truck Park.....	88
Plate 4. 10: Picture of the mosque in the abattoir, Plate 4. 11: Picture of the manager's office (Asorock)	90
Plate 4. 12: Pictures of the exterior and interior look of the Horn Storage Room.....	90
Plate 4. 13: Picture of the abattoir toilet facility, Plate 4. 14: Picture of the pit latrine toilet..	91
Plate 4. 15: Picture of the surface storage tanks, Plate 4. 16: Picture of the overhead storage tank.....	92
Plate 4. 17: Picture showing the vertical circulation system used for the only multi-story building	92
Plate 4. 18: Pictures of the waste disposal area of the abattoir	95
Plate 4. 19: Pictures of the drainage system of the abattoir	95
Plate 4. 20: Picture of the main entrance to the abattoir	97
Plate 4. 21: Picture of a model of the designed layout of Oko Oba Abattoir	99
Plate 4. 22: Picture of one of the Lairages, Plate 4. 23: Picture of the Slaughter Slab	104
Plate 4. 24: Picture of the Cattle Mechanized Line A's V race and Lairage	104
Plate 4. 25: Picture of the Cattle Mechanized Line A building and Car Park Area.....	104
Plate 4. 26: Picture of Stunning Box and Blood drain, Plate 4. 27: Picture of the Offal Processing Room	104
Plate 4. 28: Pictures of the Slaughter Hall	105
Plate 4. 29: Picture of the Project Office, Plate 4. 30: Picture showing the Waste Treatment Plant	105
Plate 4. 31: Picture of the Management Building	105
Plate 4. 32: Picture of Skye Bank, Plate 4. 33: Picture of one of the vehicle wash bays	105
Plate 4. 34: Picture of the lairage and its materials.....	107

Plate 4. 35: Picture of toilets in the Management building, Plate 4. 36: Picture of Male Changing Room	108
Plate 4. 37: Picture of facilities in the Male Changing Room	108
Plate 4. 38: Picture showing windows in the Slaughter Hall and the Changing Room.....	110
Plate 4. 39: Picture of facilities for cleaning and washing of hands	112
Plate 4. 40: Picture showing site drainage, Plate 4. 41: Picture of canal carrying waste from the abattoir	113
Plate 4. 42: Picture showing slaughter hall drainage, Plate 4. 43: Picture showing abattoir road surface.....	113
Plate 4. 44: Picture of the entrance of the Matori Abattoir.....	114
Plate 4. 45: Pictures of the Cattle Lairages in Matori Abattoir.....	118
Plate 4. 46: Picture of the Goat Lairage section, Plate 4. 47: Picture of the Cattle Slaughter Hall.....	118
Plate 4. 48: Picture of the Cattle entrance and foot bath, Plate 4. 49: Picture of workers entrance and foot bath.....	119
Plate 4. 50: Picture of the Small Ruminant Slaughter Hall, Plate 4. 51: Picture of the Car Park	119
Plate 4. 52: Picture of the Administrative building, Plate 4. 53: Picture of the Residential building	119
Plate 4. 54: Picture of the Waste Collection Areas on site in the Abattoir	119
Plate 4. 55: Pictures of the exterior and interior wall of the Cattle Slaughter Hall respectively	121
Plate 4. 56: Pictures showing the exterior wall of the Small Ruminant Slaughter Hall	121
Plate 4. 57: Pictures showing the five Water Storage Tanks in the Matori Abattoir.....	122
Plate 4. 58: Pictures showing the Interior of the Toilet facility in Matori abattoir.....	123
Plate 4. 59: Picture of the Meat Market	124
Plate 4. 60: Pictures showing the lighting in the Cattle and Goat/sheep Slaughter Hall	125
Plate 4. 61: Pictures showing the Drainage near the Processing and Deboning section in the Matori Abattoir	126
Plate 4. 62: Picture of the entrance of the Ilaje Abattoir.....	127
Plate 4. 63: Picture of the Lairage, Plate 4. 64: Picture of the cows about to be off-loaded .	131
Plate 4. 65: Pictures showing the Slaughter Slab.....	131
Plate 4. 66: Picture of the Processing Area, Plate 4. 67: Picture of the Cutting and Deboning Area.....	131

Plate 4. 68: Picture of the Butchers' & Vet's. Building, Plate 4. 69: Picture of the Veterinarian's Office	131
Plate 4. 70: Picture of changing/relaxing and toilet building, Plate 4. 71: Picture of the waste dump area.....	132
Plate 4. 72: Picture of the new Ilaje Abattoir Building, Plate 4. 73: Picture of the new Lairage	134
Plate 4. 74: Pictures of the Cattle Slaughter Section from the front and back entrances, respectively	134
Plate 4. 75: Pictures showing the Cattle Offal Processing Sections	134
Plate 4. 76: Pictures showing the Cattle Cutting and Deboning Section	134
Plate 4. 77: Picture of the Small Ruminant Slaughter Area, Plate 4. 78: Picture of the Processing Section	135
Plate 4. 79: Picture of the three Surface Storage Water Tanks, and also the Guts-Content Disposal Area.....	137
Plate 4. 80: Picture of the red steel staircase, Plate 4. 81: Picture of the reinforced concrete staircase.....	137
Plate 4. 82: Picture of the Meat Sales Sheds, Plate 4. 83: Picture of the Market	138
Plate 4. 84: Picture of the fenestrations, Plate 4. 85: Picture of the roof lights	139
Plate 4. 86: Pictures showing the drainage design within the Abattoir building	141
Plate 4. 87: Aerial view of the Danish Crown Slaughterhouse in Horsens	143
Plate 4. 88: Aerial view of the Danish Meat Research Institute in Taastrup	143
Plate 4. 89: Picture showing pigs off-loading from a truck, Plate 4. 90: Picture of the Lairage	148
Plate 4. 91: Picture Chilling Room	149
Plate 4. 92: Picture of the Cutting Section, Plate 4. 93: Picture of the Loading Section.....	149
Plate 4. 94: Picture showing meat pieces on Christmas trees, Plate 4. 95: Picture of the Deboning Section.....	149
Plate 4. 96: Picture of the Loading Bay, Plate 4. 97: Picture showing boxes being loaded in trucks.....	150
Plate 4. 98: Pictures of the Danish Meat Research Institute Building	154
Plate 4. 99: Pictures of the Atrium in Danish Meat Research Institute Building	154
Plate 4. 100: Picture of a Laboratory in DMRI, Plate 4. 101: Picture of a Meeting Room in DMRI	154

Plate 5. 1: Picture of Lagos-Ibadan Express Road and Kara bus stop adjacent to the site	164
Plate 5. 2: Picture showing the various existing structures on site in Kara Market, Ogun State	166
Plate 5. 3: Picture of the various existing structures on site in Kara Market, Ogun State.....	166
Plate 5. 4: Picture showing the various soil types found on site in Kara Market, Ogun State	172
Plate 5. 5: Picture showing presence of electricity on site.....	172
Plate 5. 6: Picture showing presence of electricity on site.....	173

LIST OF TABLES

Table 2. 1: Abattoirs, Slaughterhouses, Slaughterslabs and Annual Slaughter of Animals in Nigeria.....	18
Table 6. 1: Table showing spaces with their sizes in the Slaughtering and Processing Unit, Abattoir Facility.....	177
Table 6. 2: Table showing the height and length of overhead rails for bleeding and dressing	180
Table 6. 3: Table showing space requirement per carcass and the distance between the rails in the chilling rooms	180
Table 6. 4: Table showing spaces with their sizes in the Personnel Unit, Abattoir Facility..	181
Table 6. 5: Table showing spaces with their sizes in the Administrative Unit, Abattoir Facility	182
Table 6. 6: Table showing spaces with their sizes in the Administrative Unit, Research Institute	185
Table 6. 7: Table showing spaces with their sizes in the General Unit, Research Institute ..	185
Table 6. 8: Table showing spaces with their sizes in the Research Unit, Research Institute	186
Table 6. 9: Table of major equipment and their sizes used in an Abattoir Facility	190

ABSTRACT

An abattoir is a facility where slaughtering, butchering and processing of animals to produce meat and meat products fit for human consumption take place. Achieving hygienic environment in an abattoir is one of the major challenges facing abattoirs in Nigeria and there is a need to improve their condition. There has been very little attempt at identifying how this can be done through the design of abattoirs in this country. This study was an attempt to fill this gap. This research thus focuses on how to achieve a hygienic environment in Abattoirs through architectural planning and design. Therefore, the main aim of this study is to investigate and develop architectural design and planning solutions for achieving hygienic environment for meat production and processing in the Kara Market Abattoir, Ogun State, Nigeria. To achieve this aim, the following objectives were identified: (i) to study the historical development of abattoirs globally and in Nigeria; (ii) to identify the major problems encountered with abattoirs; (iii) to examine specific solutions and strategies towards achieving and maintaining a hygienic environment in a modern abattoir; and (iv) to investigate the existing facilities and services in the Kara market abattoir in Ogun State and other abattoirs within and outside Nigeria. To do this, existing literature have been reviewed and data has been gotten from assessment and examination of existing case studies. Subsequently, for this reason, this thesis has created an architectural design proposal redesigning and planning the Kara Market Abattoir to meet current needs and global best practices in meat production and processing.

Keywords: Abattoir, Research facility, Hygienic environment, Architectural design and planning.