

**KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS**  
**COLLEGE OF ENVIRONMENTAL DESIGN**  
**DEPARTMENT OF CITY AND REGIONAL PLANNING**

**FINAL PLANNING PROJECT (CRP- 601)**

**GIS-BASED URBAN SUSTAINABILTY ASSESSMENT: THE  
CASE OF DAMMAM CITY, SAUDI ARABIA**

**BY**  
**YUSUF ADEDOYIN AINA**  
**(STUDENT ID: 210285)**



**INSTRUCTOR: DR. HABIB AL-SHUWAIKHAT**

**MAY 2004**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

## **ACKNOWLEDGEMENTS**

I wish to express my profound gratitude to Allah (Subhana Wa Ta'ala) for granting me the privilege of completing this study successfully. I acknowledge with thanks the support and advice from my research advisor, Dr. Habib Alshuwaikhhat, in supervising the research. My appreciation is also due to Dr. Abdulgader Amir, Dr. Baqer AlRamadan and all the faculty and staff of the Department of City and Regional Planning and the College of Environmental Design for their invaluable support. I appreciate the opportunity granted to me by the University through its Research Assistantship program. I am also grateful to my fellow Research Assistants and the Nigerian community for their support and assistance. My warm appreciation also goes to Dr. Muhammad Awad and Mr. AbdulAziz Buhullaigah who are working on the update of Dammam Master Plan for their assistance and cooperation. My appreciation is due to my Dad, Mom, in-laws and others at home for their encouraging words. My appreciation is also due to my wife and child for their patience and endurance. May Allah (Subhana Wa Ta'ala) grant us his mercy, the good of this world and the hereafter. Amin.

## **ABSTRACT**

The concept of sustainable development has been widely accepted as a laudable goal to be achieved by different nations. Countries and municipalities especially in developing countries still find it difficult to operationalize the principles of sustainability. Those communities that are able to apply it do not have adequate means of evaluating how successful the application is. This study discusses the assessment of the application of the principles of sustainability especially with regards to city planning. The vast opportunities of spatial analysis made available by the advances in GIS technology and their utilization in sustainability assessment are also discussed. Based on the discussion, a framework of indicators is developed to assess the sustainability of Dammam city, Saudi Arabia. The study concluded that some aspects of sustainability are not addressed by the planning process and the plan document. The planning process and the plan document addressed economic sustainability issues more than social and environmental issues. The result of the GIS-based sustainability assessment of the study area produced similar findings. The study developed a sustainable planning guidance and made some recommendations based on the findings.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
ABSTRACT.....	iv
LIST OF TABLES.....	vii
LIST OF FIGURES.....	vii
<b>CHAPTER ONE</b>	
INTRODUCTION.....	1
1.0 Background to the study.....	1
1.1 Statement of Problem.....	3
1.2 Research Objectives.....	4
1.3 Scope of the Study.....	4
1.4 Study Area.....	4
<b>CHAPTER TWO</b>	
LITERATURE REVIEW.....	7
2.0 Introduction.....	7
2.1 Sustainable Planning and Sustainability.....	7
2.2 Urban Sustainability Appraisal.....	11
2.3 GIS technology and Urban Sustainability.....	16
2.4 Modeling Urban Dynamics for Sustainable Cities.....	22
<b>CHAPTER THREE</b>	
METHODOLOGY.....	24
3.0 Data Collection and Study Tasks.....	24
3.1 Planning Process Survey.....	24
3.2 Sustainability Appraisal of Dammam Master Plan.....	25
3.3 GIS-Based Urban Sustainability Assessment.....	28
<b>CHAPTER FOUR</b>	
RESULTS AND DISCUSSION.....	32
4.0 Sustainable Planning Process in Dammam.....	32

4.1 Evaluation of the Dammam Master Plan.....	34
4.2 Sustainability Assessment of Dammam City Core.....	38
 <b>CHAPTER FIVE</b>	
GUIDELINES FOR SUSTAINABLE PLANNING.....	45
5.0 Introduction.....	45
5.1 Guidance for Sustainable Development Plan.....	46
 <b>CHAPTER SIX</b>	
CONCLUSIONS AND RECOMMENDATIONS	
6.0 Conclusions.....	49
6.1 Recommendations.....	50
 <b>REFERENCES</b> .....	 53
 <b>APPENDIX</b> .....	 61

## LIST OF TABLES

2.1 Principles of Sustainable Development and Master Plan Elements.....	15
2.2 Factors for assessing Sustainable Development in a Master Plan.....	15
3.1 Plan Elements and Sustainability Principles/Indicators.....	26
3.2 Sustainable Indicators Standard Values.....	30
4.1 Evaluation of Dammam Master Plan.....	34
4.2 Values of Sustainable Indicators in the Study Area.....	42

## LIST OF FIGURES

1.1 Map Showing the Location of Dammam.....	5
1.2 Land-use Map of the Study Area.....	6
2.1 Potential Use of GIS in Impact Assessment.....	19
2.2 Analytical Framework for Evaluating Urban Sustainability.....	20
4.1 Accessibility to Health Facilities in the Study Area.....	38
4.2 Accessibility to Open Space in the Study Area.....	39
4.3 Accessibility to Educational Facilities in the Study Area.....	39
4.4 Exposure of the Populace to Unacceptable Traffic Noise Level.....	40
4.5 Exposure of the Populace to Harmful Traffic Emissions.....	41
4.6 Sites for Location of Health Facilities to Improve Accessibility.....	41
5.1 Procedure for Making Strategic Sustainability Plan.....	4

