Sustainable Façade Design and Virtue in Incarceration Architecture

The case of prison buildings in Abu Dhabi

Volume One

Nawal Khalifah Al-Hosany

A thesis submitted for the degree of
Doctor of Philosophy
in the
School of Architecture, Planning, and Landscape
at the
University of Newcastle upon Tyne

October, 2002

Abstract

The study reaches an understanding of the boundaries that a society can set, for the provision of comfort conditions using energy efficient building skins in prisons. The aim is to establish the role of façade design in attaining a possible balance between the provision of a humane environment for inmates that would help in rehabilitation efforts on one hand, and the penal system on the other. This study examines the factors that affect the balance between the costs to society of such comfort in energy terms, against rehabilitation. The study provides guidelines to establish this balance in design of prison facades in the United Arab Emirates (UAE). Emphasis will be on variables that have impact on the design and configurations of building skin.

In Western societies, the reform policy in the 18th century produced a new kind of architecture associated with it at that period (Evans, 1982). Prison architecture was part of the punishment regime. The effects of the indoor environment on the inmates and their physical and psychological comfort were not considered (Peters, 1995). The main role of the buildings was to operate as a punishment symbol not only to the offenders, but also to put fear into everyone passing by them (UNSDRI, 1975). The special configuration of the prison buildings of the 18th century was therefore manifested in the patterns of the indoor space as well as the façade design (Pearce, 1995).

Modern concepts of penal theories emphasise the rehabilitation of the prisoners (Lenci, 1977). It is believed that the contemporary institutions should focus more on the effect of the building environment on the individual (Christopher, 1990). Consequently, the contemporary design of prison buildings is to foster a more positive environment. This is mediated by the creation of an environment that is proactive rather than reactive (Spens, 1994). A positive and healthy environment is essential for the inmates' rehabilitation. In order to achieve this goal, comfort is a main concern.

The question of comfort in prisons is complex. Large numbers of quantitative and qualitative variables have been identified. This study traces and investigates the development of penal theories, in order to identify the importance of such variables for rehabilitation of inmates. A historical review was essential to fully understand the forces that shaped the development of prisons. The review includes development of prisons in different societies and discusses the penal systems in those societies. The analysis of the

historical development of prison buildings also revealed the importance of façade features that reflected the penal theories of certain times and of certain societies.

The thesis takes prisons in the United Arab Emirates (UAE) as a case study. The UAE prisons have moved through different phases of development. The new policy of the Ministry of Interior emphasises the need for rehabilitation and improving the conditions of the inmates. A prototype design has been developed as a model for all prisons in Abu Dhabi. The new design, with its improved environmental conditions, has significant implications on energy consumption with the increase in area per inmate and the introduction of air-conditioning. Emphasis on comfort as one of the main design factors will affect the layout of prisons, the design of the building skin, and the services provided.

The proposed prototype is simulated using thermal simulation modelling software in order to understand the thermal performance of the façades. Alternative scenarios, based on prison and design theories and new façade technologies, are developed and compared to the proposed prototype. The thesis concludes with a discussion on the role of façade design on the sustainability of prison buildings taking into account the social, environmental and technical related variables.

The thesis argues that the phrase sustainable façade design has always referred to the introduction of appropriate façade configuration in order to achieve energy efficiency. In prison buildings, however, a typology driven by cultural values and social theories, socio-economic factors have great impacts on the sustainable design of prisons' facades. Hence, achieving sustainable prison façade design is conditioned by coupling social aspects of prison buildings with technical energy saving measures.

Acknowledgments

"*Our task is to become good men, or to achieve the highest human good. That good is happiness.*" Typing these words means that the end of this stage of my life is getting closer. I am proud to say that I have enjoyed this course of study. The academic achievement from the time I spent doing this thesis, is a major part of my gain. On this road I found my real self. The experience of contacting different cultures and the valuable friendships I have built are priceless. Hence, a word of **"thank you"** is the minimum that I can give to everyone who helped me, one way or another in walking this road.

I would like to thank **Shiekh Saif Bin Zaid Al Nahyan** and my colleagues in the **General Directorate of Abu Dhabi Police,** for providing me with the opportunity to do this research and sponsoring my work

Words cannot describe my appreciation to **my supervisor, Dr.Hisham Elkadi,** who is talented in bringing the best out of his students. His faith and confidence in me made everything possible.

My parents. Although views of happiness differ, although you never totally understood my need to do this, you never tried to stop me and were always there with support. Walking this road would have been impossible without my father's support and my mother's prayers.

My friends in Newcastle and Plymouth. Thank you for being there. Thank you for sharing the good and the bad. I need to specify some, not to say that the friendship of the others is less important, but those helped in supporting my work. **Natasha** and **Sawsan,** you were both generous with your time and knowledge and I am very grateful. **Carolyne,** you taught me the two most important lessons; never to give up and the fact that sometimes we cannot win. Claremont birds, **Nassra and Slavica,** life became more pleasant with having you around; thank you.

Special thanks to **Prof. John Wiltshire,** who although retired to enjoy life, was there to give advice whenever needed.

Newcastle University staff. It has been pleasure being part of the team. Thank you **June, June, Catherine, Steph** and **Anne.** Thanks to the staff in **Newcastle Library** and to Mr. **Bill Foggo** who always helped me to present my work nicely. And special thanks to **Rita** who greeted me every morning with a nice warm smile.

I would like to address my deepest gratitude to the staff in **Tabreed** who were generous with their time and knowledge, specially **George Berbari** and **Sleiman Shakkour.**

Special thanks to **Mr. Leslie Fairweather, Dr. Audrey Lenox** and **Mr. Chris Perkins** for their time and the data they were very generous to provide.

Finally, I would like to thank the staff of the **UAE embassy** in London for their continuous assistance.

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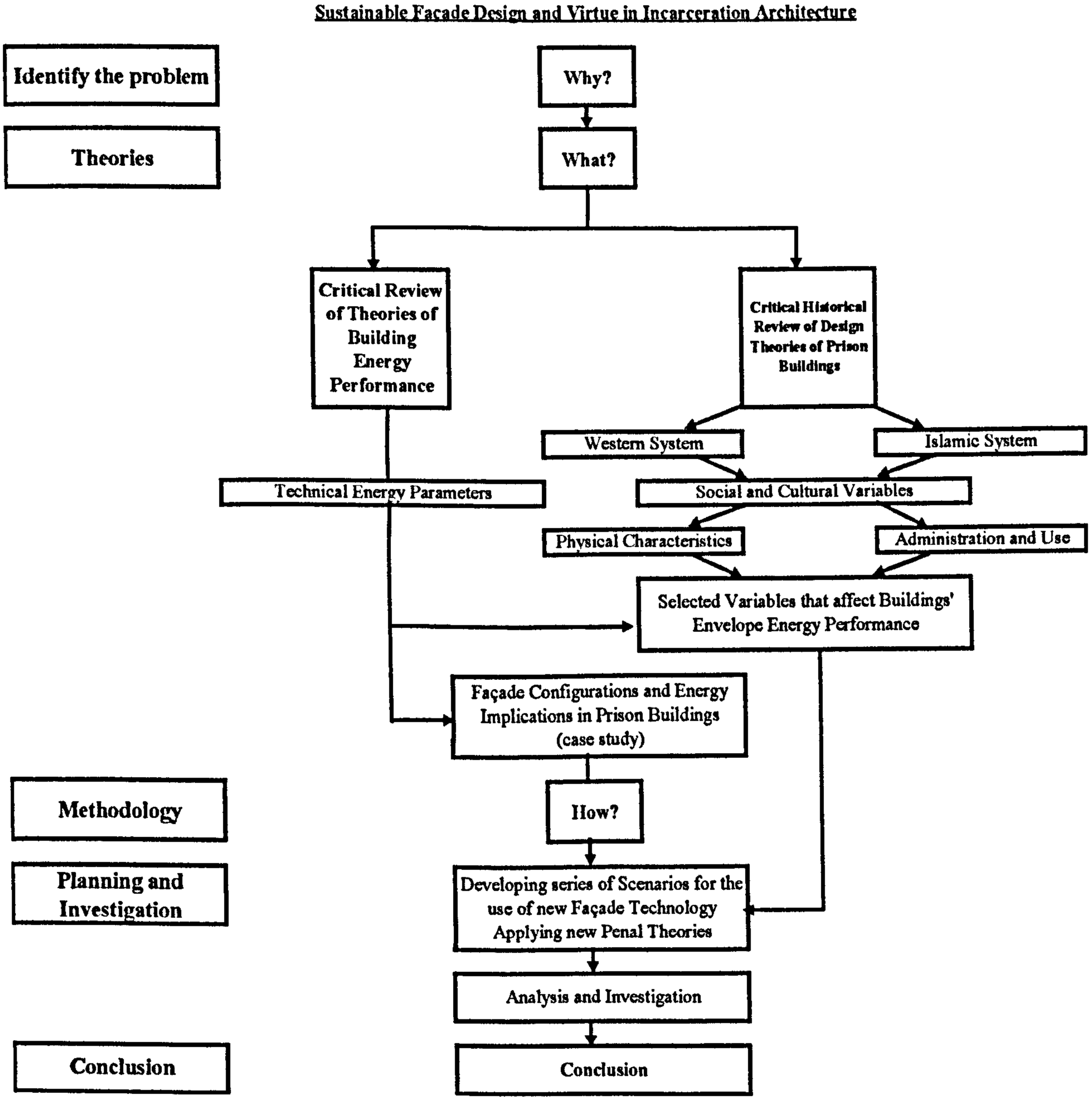

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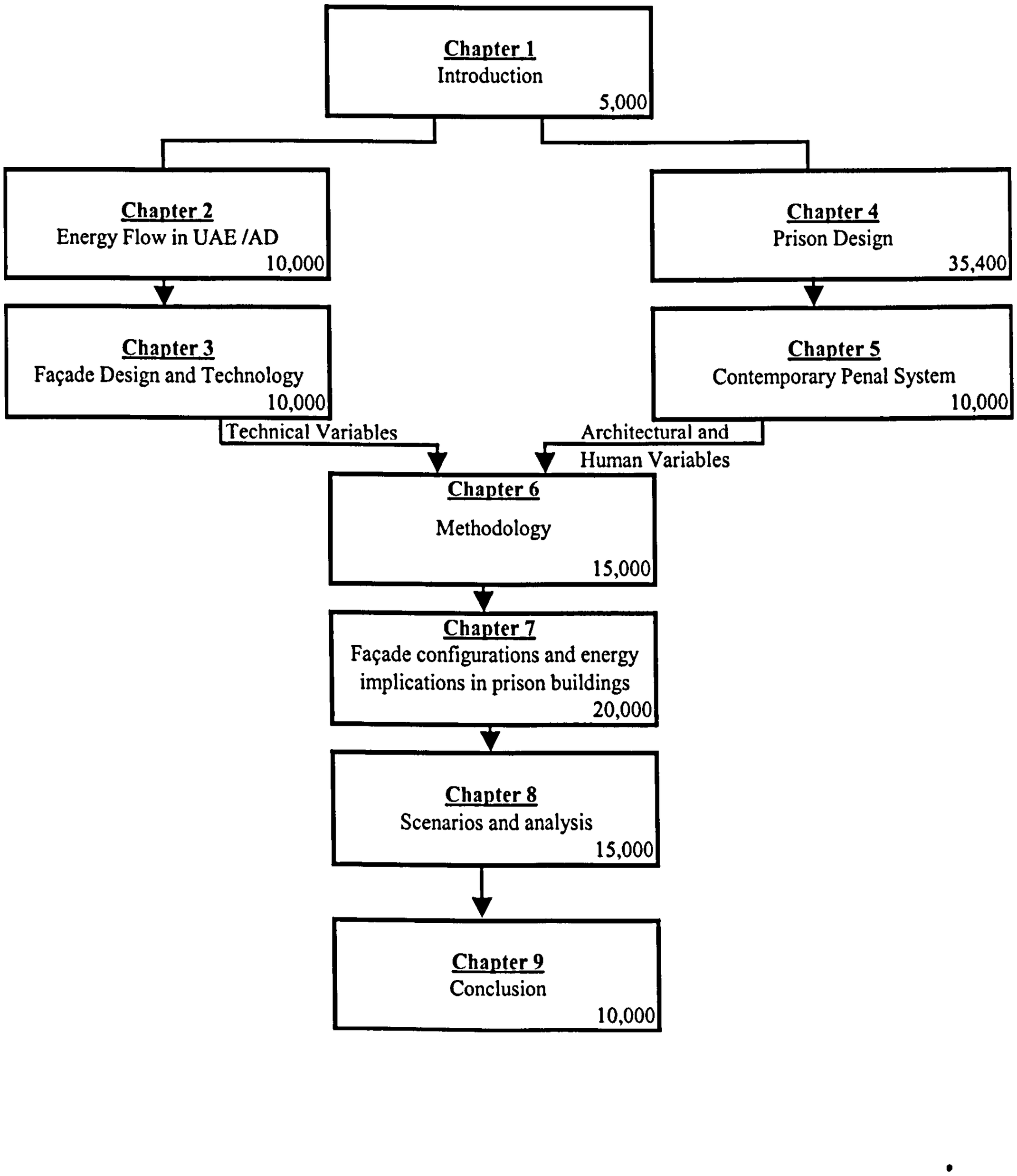

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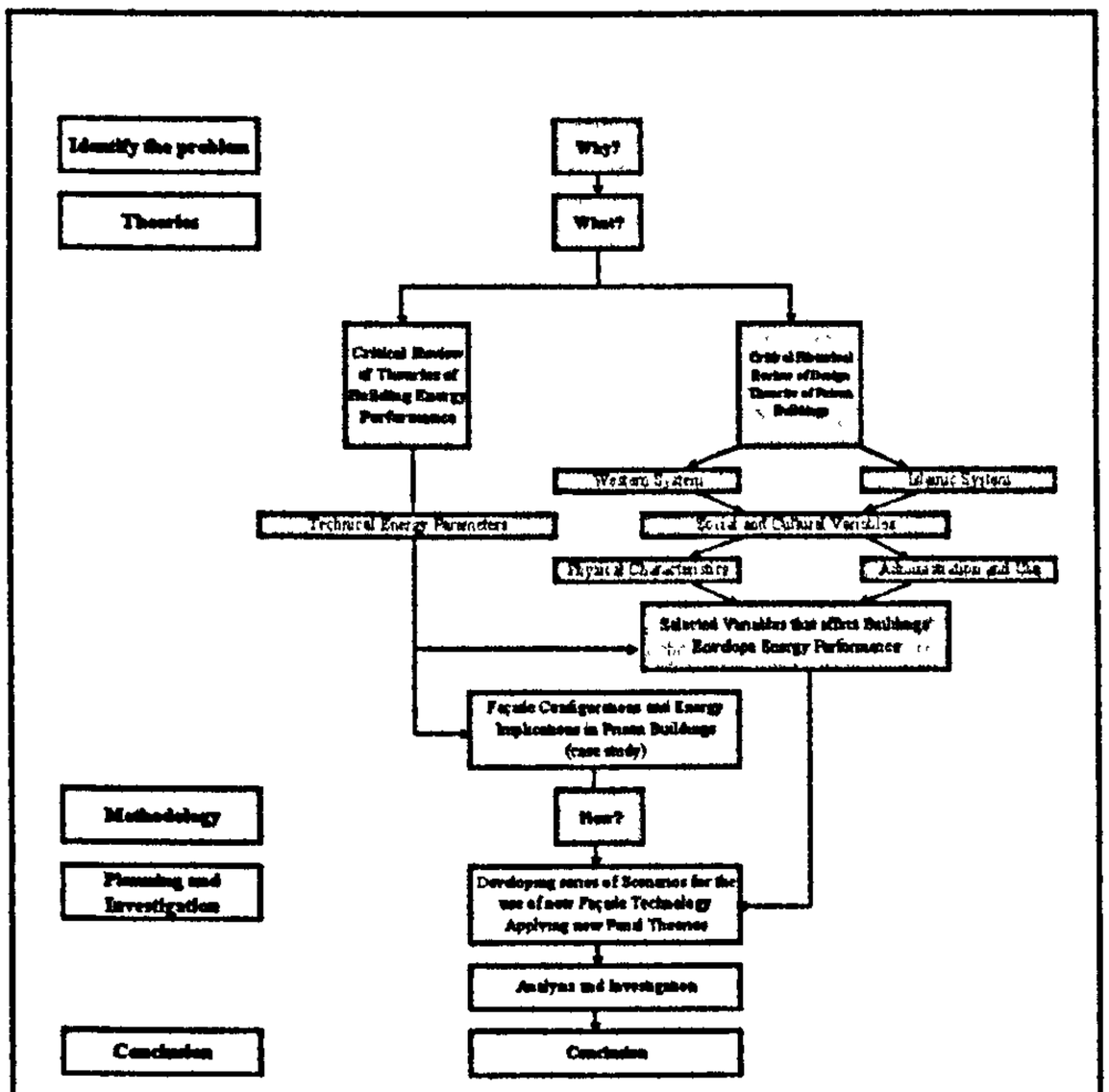

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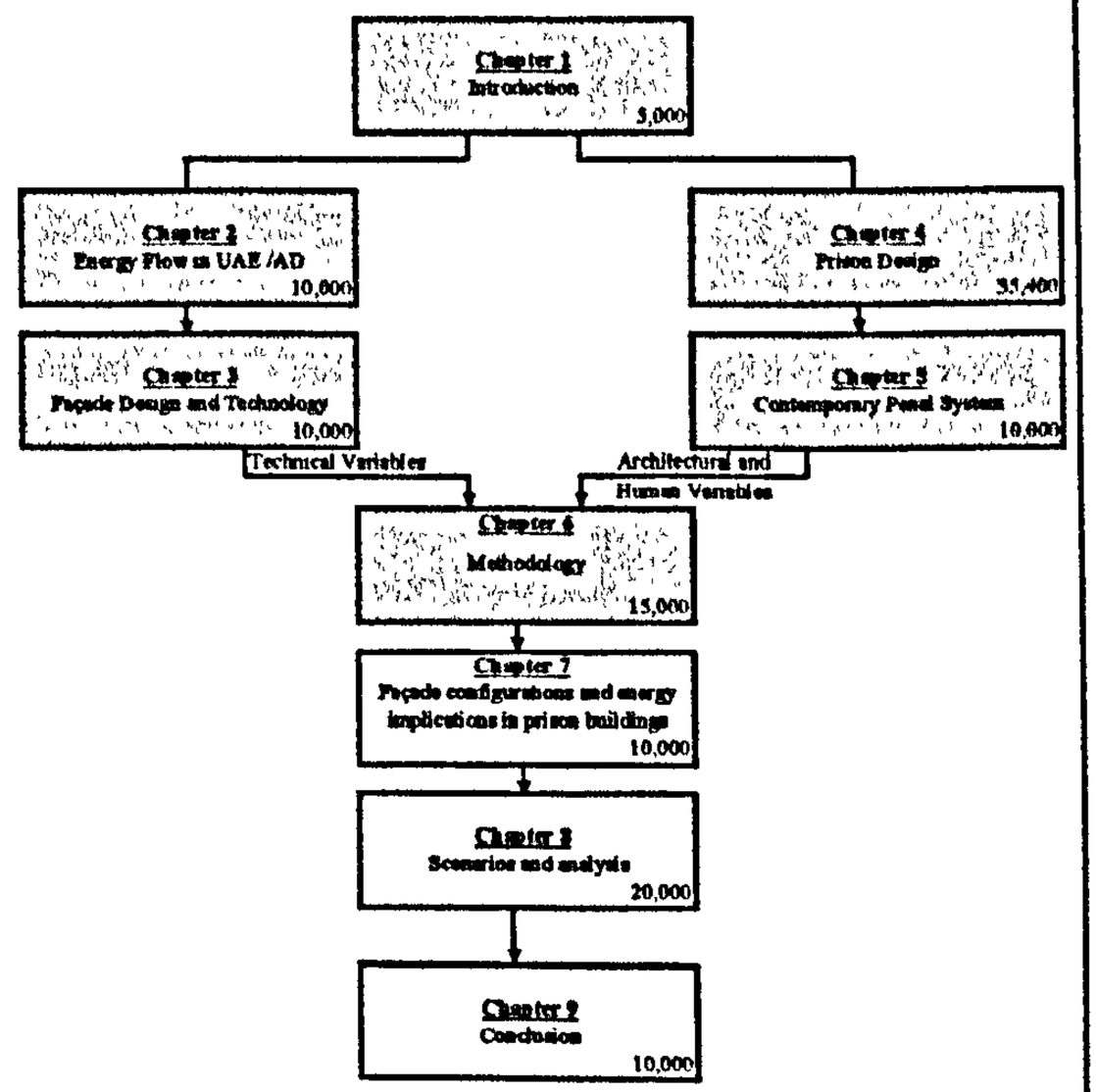

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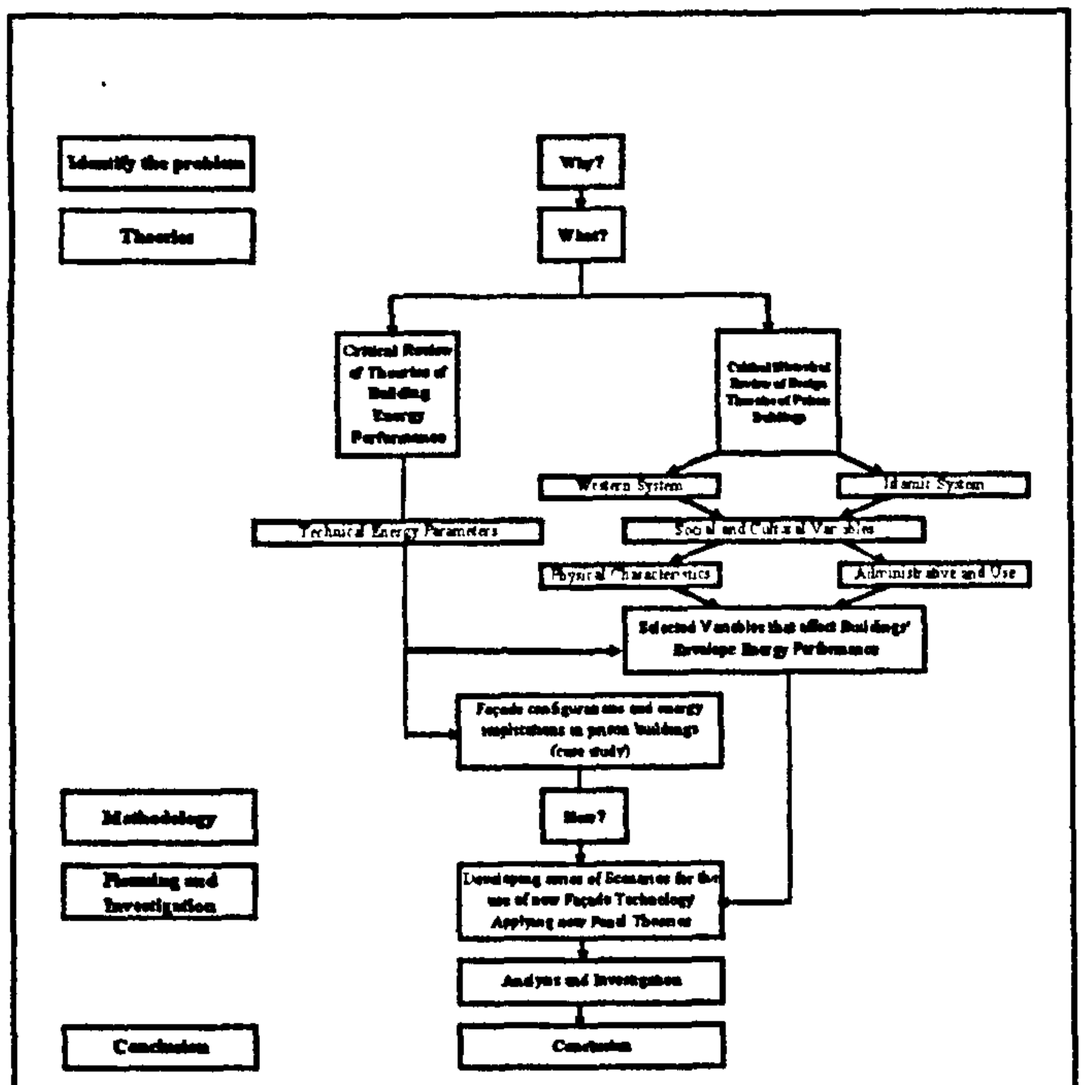
CHAPTER ONE

INTRODUCTION



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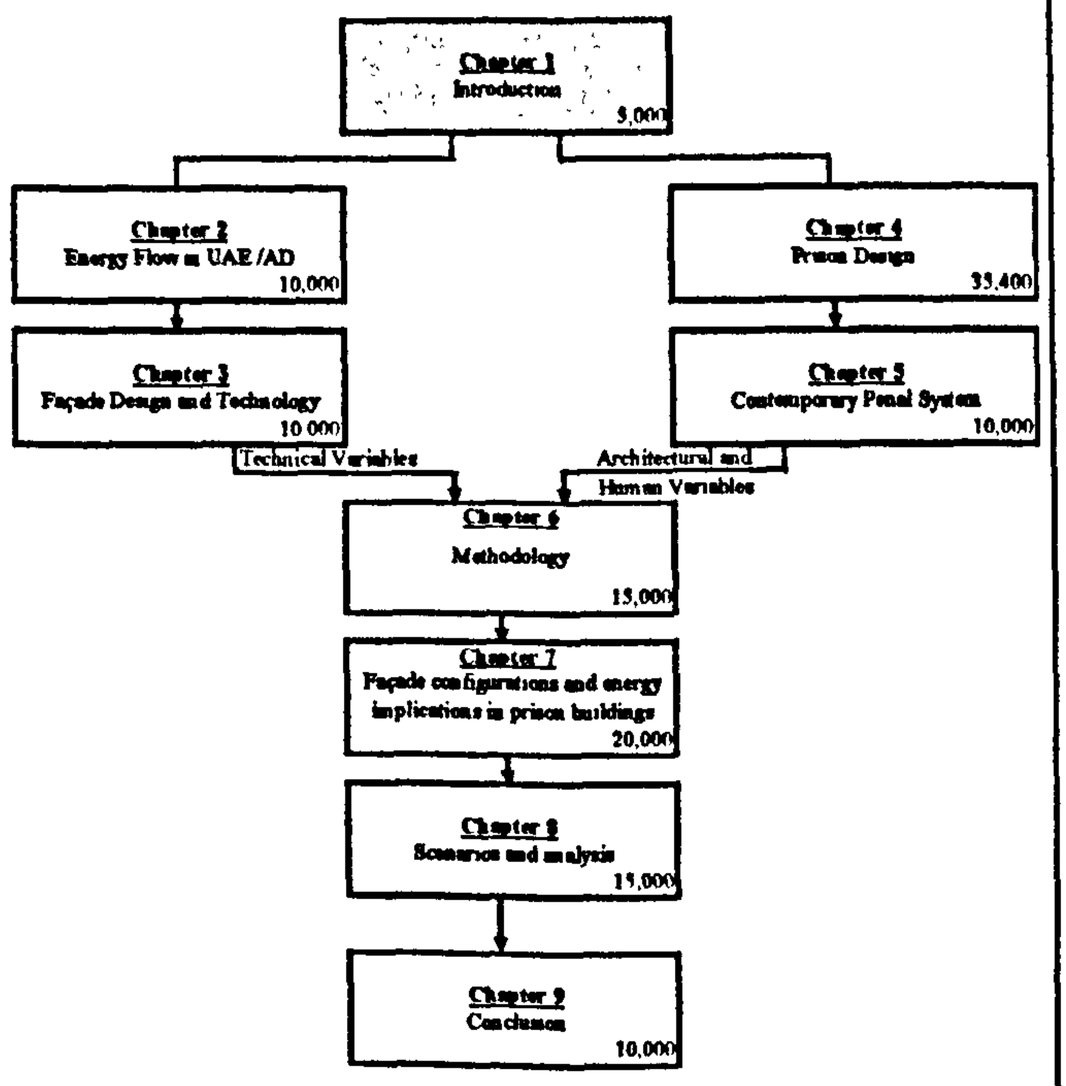


The Thesis Chapters Outline

1. Introduction

1.1 Overview

Thirty years after the recognition of the need for 'sustainable development' there is still no single, widely accepted definition. In the 1970s, the term basically referred to maintaining natural resources (Coomer and Howe, 1979). In the early 1980s sustainable development aimed to achieve lasting satisfaction of human needs and improvement of the quality of human life on one hand (Allen, 1980) and maintenance of essential ecological processes and life support systems on the other (IUCN, 1980). In the late 1980s, the approaches to sustainability emphasised social and economic aspects, which requires elimination of poverty and deprivation as well as the conservation and enhancement of the resources base. This was followed by the most common definition of sustainable development by the World Commission on Environment and Development (1987): *The ability of humanity to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.* Following the Earth Summit in the United Nations conference on Environment and Development (UNCED) in Rio in 1992 'sustainable development' has become the internationally accepted keywords for a political discourse committed to life, the conservation of natural resources and a sense of obligation to future generations. Definitions of sustainable development have been broadened to include the ability of a society, ecosystem or other ongoing system to continue functioning into the indefinite future, without being forced into decline through exhaustion or overloading of the key resources on which that system depends (Haviland, 1994).

Despite the wide acceptance of the UNCED's definition, 'sustainable development' remains controversial because of the cultural differences and North-South divide (Strong, 1990; Saunier, 1999). Saunier (1999) identified four different movements of sustainable development: human development, nature conservation, natural resources management and environmental protection. There are, however, several pending issues with relation to interests of different human groups. These include the viewing of sustainable development as a process of reconciliation of human groups separated from one another by different and conflicting demands they make on their shared surroundings.

The urban scene with its complex matrix of buildings, activities, services, and transportation consumes seventy five percent of the world's energy resources and produces the vast bulk of its pollution and climate-changing gases. Decisions made by architects are crucial to the achievement of a sustainable future (Edwards, 1999).

Despite the importance of architecture to the overall success of sustainable development, there is still no agreement on a definition that is applicable to architecture. There is a widespread belief among architects that the UNCED definition, for example, does not specify the ethical roles of humans for their everlasting existence on the planet (Kim, 98).

The term "sustainable architecture", used to describe the movement associated with environmentally conscious architectural design, has created ambivalence and confusion (Kremers, 1995). Emphasis has been therefore, on technical issues such as reducing energy consumption in the construction and maintenance of buildings. Very little attention is paid to the social and economic aspects.

The disarray of sustainable development approaches in architecture is evident. The attempts to include ethical dimensions as well as technical dimensions are seen as contradory to the profession of architecture itself (Levin, 1995). This is despite the fact that such values are accepted by human groups with conflicting demands on their shared surroundings. When human groups do not even have a shared context, conciliation for sustainable development became even more difficult. This is the case in incarceration architecture, where issues related to human comfort become debatable in themselves.

1.2 Sustainability of Incarceration Architecture

The disarray of a sustainability approach in prison buildings is rooted in the understanding of the role of architecture in the penal philosophy. A historical review of the development of the prison system, carried out in Chapter 4, showed that imprisonment is a philosophical and social problem before being a building problem. This contradiction is reflected in the difficulties of prison design. Contemporary architects feel social responsibilities in providing buildings whose purpose is neither totally accepted nor clearly defined. Prisons today are evaluated as social facilities with a similar importance to other social facilities (hospitals, schools, etc.), and part of the urban infrastructure (Lenci, 1977). Recent developments in prison buildings have also highlighted the new trends of sustainable architecture. More emphasis is placed on sustainable approaches not

only in technical terms, for example reducing energy consumption for maintaining comfort levels, but also relating to social issues. The contemporary design concepts for prisons should follow the changing ideals in penal institutions' containment philosophy and social structure on the one hand, and the changing ideals of use and design of a sustainable habitat in general of the architectural style that can express these new aspirations, on the other. New prison design policies emphasise the importance of providing more normalised environments to provide a more supportive setting for the normal behaviour. The human elements should be placed at the centre of the process of prison building design, in order to ensure that the squalid and haphazard prison conditions of the past do not return. The importance of providing a healthy indoor environment is also recognised in the new prison system. This includes light and view, thermal comfort, noise, interior design and ventilation (Fairweather, 2000). These technical factors are normally identified as the basis for sustainable architecture. The building envelope has major impacts on the performance of these factors. This thesis emphasises the role of the two factors, the social and the technical, in achieving sustainable incarceration architecture.

1.3 Development of a sustainable and humane environment in prisons of Abu Dhabi

Incarceration architecture by definition negates many aspects of sustainability. Natural and humane values embedded in the penal system can be ambiguous in many ways. Throughout history, it has been mainly the role of sociologists to advance theories and applications of incarceration architecture. Sustainability in this type of architecture, however, tends to rely heavily on technical solutions (Sala, 1998 and Billatos and Basali, 1997). There are many different definitions for sustainable architecture (Hui, 2000). The large programme introducing new prison buildings in UAE highlights the argument of technical versus social sustainability. There have been rapid changes in the prison population in the United Arab Emirates in both the types of crimes and profile of prisoners, as well as their numbers. This has resulted in a new design policy for prison buildings in Abu Dhabi. The prison design brief that was prepared by the Public Works Department in conjunction with the Ministry of Interior, stated the main objectives of the prison design. The principal goal of the design is to provide closed institutions for different categories of offenders. In order to ensure more effective classification of

prisoners, it was recommended to divide the accommodation into social units. The brief emphasised the importance of maintaining consistent control of the offenders to avoid unwanted contact with members of the community; to preserve a safe controlled environment and, at the same time, ease access to all parts of the prison. Ease of supervision and administration to minimise friction between prisoners and staff are important characteristics of prison buildings in Abu Dhabi. Correctional treatment aimed towards rehabilitation is a main issue in new prison policy there. Prisons should prepare inmates for their return to the community.

Climatic condition within prisons is considered one of the main variables that affect comfort and hence corrective actions. Taking into account the severe climate in Abu Dhabi, the importance of developing suitable interior spaces for programmes, activities and functions becomes critical. In order to present a sympathetic accommodation for the climatic conditions, there has been a need to provide air-conditioning in the prison buildings. A prototype design has been developed as a model for all prisons in Abu Dhabi.

This thesis argues and discusses the impacts of the decision to provide air conditioning on the sustainability and thermal performance of prison building. The study examines, in particular, the contribution of the envelope to the total energy performance in prisons in UAE environment. As previously discussed, this study argues that the sustainable features of natural and human values on the one hand, and the technical issues on the other are inseparable in this type of buildings

1.4 Aims and objectives

The aim is to establish the role of façade design in attaining a possible balance between the provision of a humane environment for inmates that would help in rehabilitation efforts and the penal system. This study examines the factors that affect the balance between the costs to society of such comfort in energy terms, against rehabilitation. The study takes the new development of prison buildings in Abu Dhabi, United Arab Emirates, as a case study.

The main objectives of the study can be divided into three main categories. The first group deals with understanding the energy performance in prison buildings, with particular reference to the role of the building façade. The second group of objectives deal

with the social aspects of the penal philosophies and the possible relationships to incarceration architecture. As this thesis attempts to break new ground in sustainable incarceration architecture linking social and technical aspects of façade design, the third group of objectives seek to develop a theoretical framework for the study. The problem to synthesise and integrate all the contending theories (penal theories, the empirical analysis of energy consumption, theories of prison architecture and thermal simulation models) into a coherent whole and assimilating the numerous variables that arose from examining the previous theories, necessitated developing a new methodological approach. The three sets of objectives can be summarised as follows:

1. Objectives related to energy consumption

i. To explore the impacts of the new policies and consequently the new prototype prison in Abu Dhabi on energy consumption, to maintain a humane environment in prison buildings.

ii. To examine the role of prison building façade in the development of sustainable prison architecture that takes into account both technical and social aspects.

iii. To study the thermal performance of the developed façades for the prototype of prison building in Abu Dhabi.

iv. To investigate the relative importance of different variables which constitute a prison building's façade, on energy consumption to maintain human comfort.

2. Objectives related to rehabilitation and social aspects of penal theories:

i. To critically review the relationships between rehabilitation and the environmental conditions of prison buildings.

ii. To discuss the development of penal theories in Western and Islamic societies and their impacts on the development and shaping of prison architecture, particularly façade design.

iii. To identify the main variables that have influenced the design of prison facades throughout history.

3. Objectives related to methodology and development of the theoretical framework:

i. To review the different methodological approaches that relate the social and technical aspects of energy studies.

ii. To explore the possibilities of bridging the gap between the two disparate fields of sustainable incarceration architecture, relate them and find the conceptual vocabulary to capture this relational process.

1.5 The structure of the thesis

The thesis follows the structural diagram shown in Figure 1. The diagram explains the different stages that the study follows and illustrates the two strands of sustainability in incarceration architecture. The thesis is also structured to the logical sequence of this diagram. Figure 2 explains the contents of different chapters of the thesis and the links between those chapters. **Chapter one** sets up and justifies the area in which the work will take place. The chapter provides an overview of the argument concerning the problem, and the disarray of sustainability in incarceration architecture. Chapter one also states the aims and objectives of the study. The structure of the thesis is explained and contents of the different chapters are summarised.

Chapter two discusses the energy flow in buildings in the United Arab Emirates and Abu Dhabi. Section 2.1 explains the building as an energy system, in the UAE context. The chapter proceeds to discuss, and provide a background on climatic conditions in Abu Dhabi and the requirement to provide comfort in such hostile climatic conditions. Section 2.3 investigates the generalised energy flow model (current technical solutions, energy sources, energy policies including pricing and comfort implications). The chapter will then proceed to review literature related to the role of the building's skin in the overall thermal performance of buildings in Abu Dhabi. Section 2.6 reviews the energy performance indicators that will guide the discussion in the following chapters. The driving forces (climate, comfort) in terms of peak load and consumption are reviewed in Section 2.7. Finally, the previous discussion and understanding of the context leads to the identification of architectural variables of building façades that influence the energy performance of buildings in Abu Dhabi.

Chapter three examines skin design and technology. The chapter defines the 'Skin' of the building (Section 3.2) in order to identify the factors and the elements of a building facade that constitute the skin of the building. Understanding the existing techniques (in UAE, regional, international) is one of the purposes of this chapter. The physical and optical properties of different skin materials are studied in a separate section. Section 3.3 reviews the development of the skin and the forces behind such development. This review examines literature related to the effects of building skin design on energy performance. Section 3.4 investigates the forces behind façade development in prison buildings. A historical review provides a chronological understanding of the development of façade design in prisons throughout history. The literature review in chapter two and three will form a theoretical and experimental background for the case studies analysis in chapter seven.

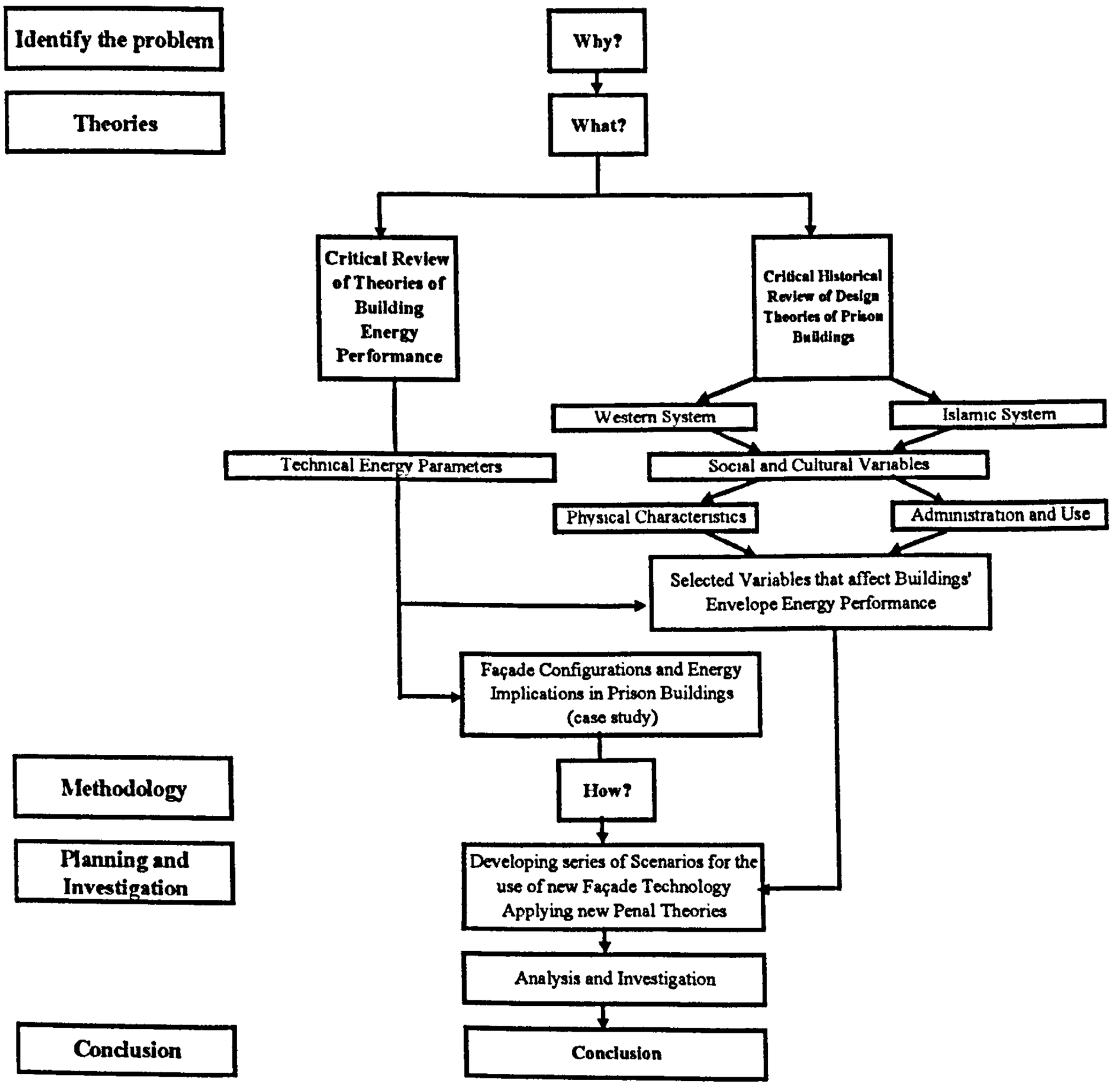


Figure 1: The Thesis Structure Diagram

Chapter four discusses the theories of prison design. Those theories will be discussed as a reflection of the society. The importance of indoor comfort on prisoners' behaviour is demonstrated in Section 4.3. This section will consider physical and psychological factors for indoor comfort in prisons. Section 4.3 also reviews visual and physical comfort and human behaviour. This chapter moves on to review the theoretical backgrounds on cultural diversity and visual perception in Section 4.4. Understanding the special characteristics of prisons as energy systems is one of the main purposes of this chapter. It also contains the development of prison design and theories of correction and

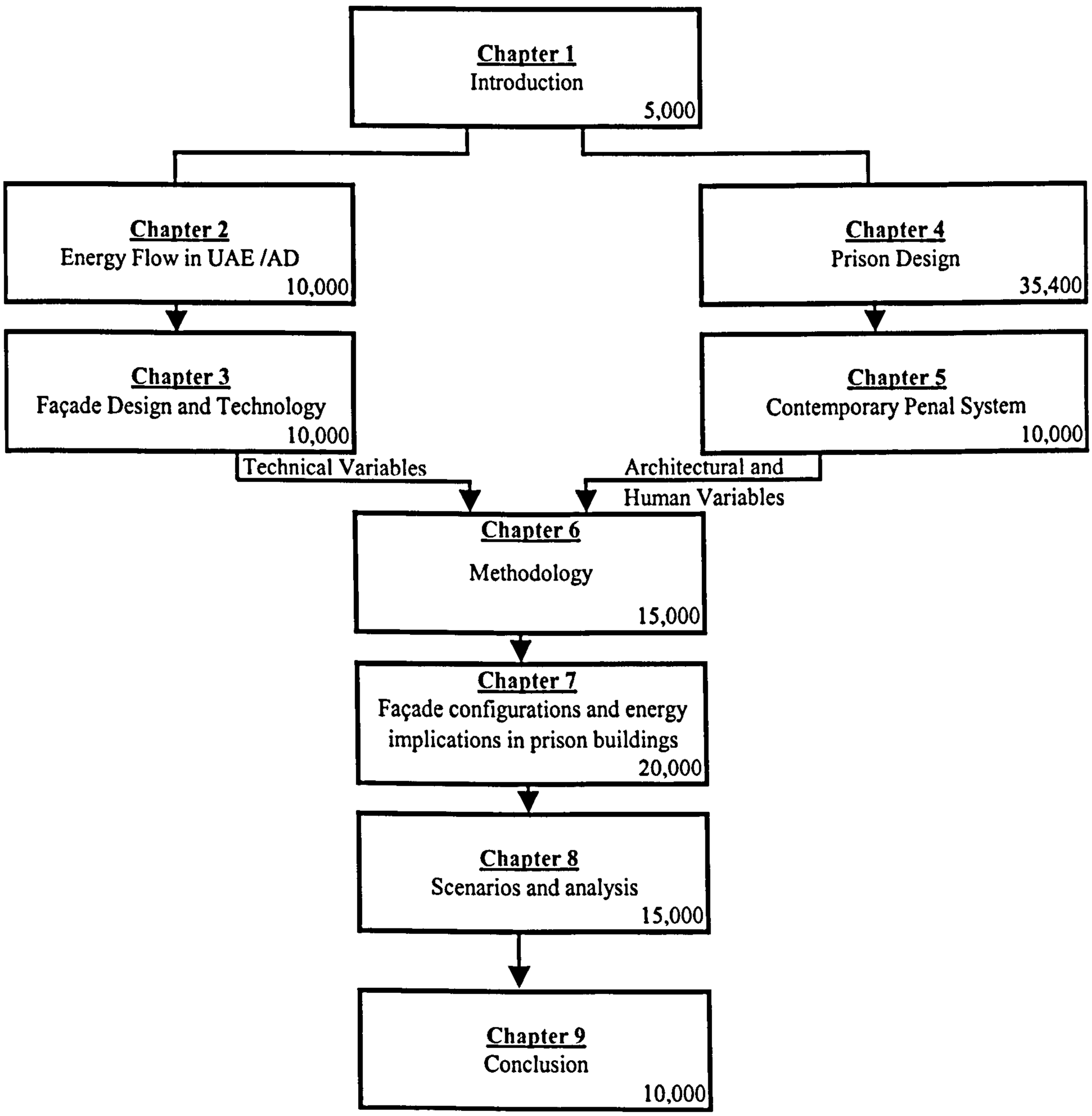


Figure 2: Outline of chapters of the thesis

provides the theoretical background to the discussion in Chapter six.

Chapter Five explores and discusses the evolution of penal theories and how they influence the form and environment of prison buildings. Section 5.2 focuses on the evolution of rehabilitation approaches in the twentieth century. The discussion in Section 5.3 sheds light on the social concerns of the contemporary approaches to imprisonment. Consequently, Section 5.4 examines the non-custodial penology and its interpretation in the UAE penal system. Finally, Section 5.5 provides an insight into recent trends and the future of imprisonment.

Chapter Six describes the methodology used in the thesis. Section 6.2 reviews the different research methods for sustainable prison design. The review covers research methods for energy-related built environment studies, research methods in prison design and rehabilitation and the sociology of energy in prison buildings. Investigation of the appropriate methods to analyse the energy flow patterns in buildings is included in this chapter. Section 6.3 discusses the opportunities and constraints of prison studies in the UAE. The following section (6.4) explains the adopted research methods. The structure of the different methods is described in Section 6.5. In this section the thesis's hypotheses are stated and explained. The section also assembles the theoretical framework of the thesis.

Attempts are made in **Chapter Seven** to identify the façade features that have energy implications in prison buildings. The Chapter relates both technical and social variables for sustainable prison façade design. Section 7.2 selects the architectural variables that have energy implications in prison façades, while the social variables are selected in Section 7.3. Section 7.4 reviews the literature concerning the simulation tools used for estimating the energy interactions within a building. This review will focus on computer software used for building energy simulation. This review will be a guide to set criteria for the selection of simulation models and to investigate case studies analysis. The simulation models will help to estimate the building energy performance, which is to be analysed in chapter eight.

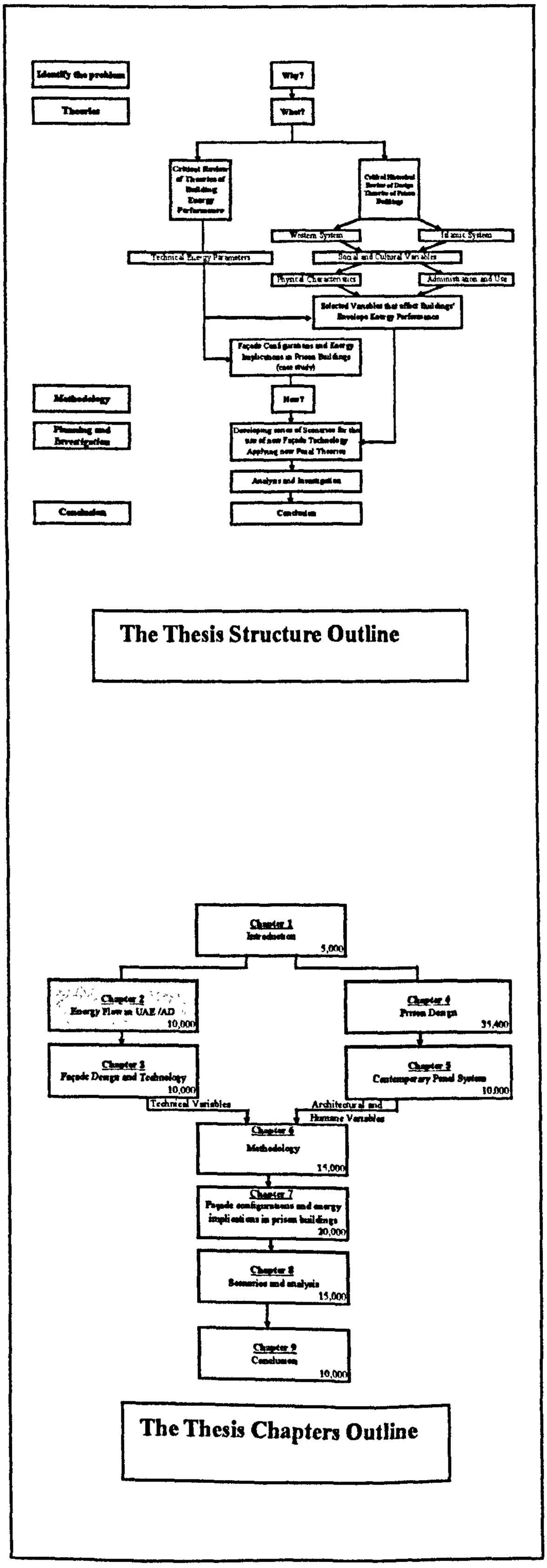
Chapter Eight analyses and investigates the results of the simulated base case as well as the developed scenarios. Section 8.2 sets the boundaries of the simulation, and states the base case input data. This section also identifies the variables that are to be tested. This includes variables related to façade configuration, materials, and activity and cooling profiles. Section 8.3 provides the basic analysis of the base case. The following sections

provide in-depth analysis of all the scenarios. A summary of the findings of such analysis is given in the last section.

Chapter Nine provides a summary of the thesis and the findings. The chapter also lists a set of recommendations for the design and configuration of prison façades in order to support development of viable sustainable prison buildings in the United Arab Emirates. At the end of the thesis, appendices and the list of references used will be presented.

CHAPTER TWO

Energy Flow in Buildings in the UAE/ Abu Dhabi



2 Energy Flow in buildings in the UAE/ Abu Dhabi

Prisons are microcosms of societies. In order to understand their behaviour and characteristics it is essential to understand the special characteristics of the society in which they are situated. This chapter discusses the demands of social and cultural factors and their impact on the development of prison buildings. This chapter aims to provide a general background of the context of this thesis, the United Arab Emirates and more specifically about the emirate of Abu Dhabi. This section also aims to explore the factors that influence the thermal performance of buildings in the UAE (section 2.6). It is, therefore, crucial to demonstrate the climatic features of the UAE generally and specifically Abu Dhabi, in order to assess the extent of the energy demands required to provide thermal comfort in buildings (sections 2.1.4 and 2.2.1).

An introduction to the general geographical, economical, demographical and climatic features of the UAE are carried out in section 2.1 which provides a general background to the discussion. The country's energy resources are also presented in this section.

2.1 General background of the UAE

It is widely agreed that sustainable architecture is the current term for environmental architecture (Hagan, 2001). Swept up in the concern for the environment however are the accompanying concerns for social and economic sustainability. In order to present a sustainable façade design it is, hence, inevitable to demonstrate the environmental, economic and socio-cultural characteristics of the case study location that is Abu Dhabi, which is the capital of the United Arab Emirates. This section briefly demonstrates these special characteristics of the UAE in general and Abu Dhabi specifically.

The United Arab Emirates (UAE) is a Federation established in the year 1971, between seven Emirates namely Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaima, Sharjah and Umm Al Quwain. The country is located in the area previously known as the Trucial Coast in the Gulf (Figure 3). The Emirates were, until World War I, under Ottoman rule and later became British protectorates.

Figure 3: The UAE location on the world map

2.1.1 The geography of the United Arab Emirates

The UAE lies between 22°50' and 26° north latitude and between 51° and 56°25' east longitude. It shares a 19 kilometres border with Qatar on the northwest, a 530 kilometres border with Saudi Arabia on the west, south, and southeast, and a 450 kilometres border with Oman on the southeast and northeast (Figure 4). The total area of the UAE is approximately 77,700 square kilometres.

Figure 4: A detailed map of the UAE

The UAE stretches for more than 650 kilometres along the southern shore of the Arabian Gulf. Most of the coast consists of saltpans that extend far inland. The largest natural harbour is at Dubai, although other ports have been dredged at Abu Dhabi, Sharjah and elsewhere.

The UAE also extends for about 90 kilometres along the Gulf of Oman, an area known as the Al Batinah coast. The Al Hajar al Gharbi (Western Al Hajar) Mountains, rising in places to 2,500 metres, separate the Al Batinah coast from the rest of the UAE. Beginning at the UAE-Oman border on the Arabian Gulf coast of the Musandam Peninsula (Ras Musandam), the Al Hajar al Gharbi Mountains extend southeastward for about 150 kilometres to the southernmost UAE-Oman frontier on the Gulf of Oman. The range continues as the Al Hajar ash Sharqi (Eastern Al Hajar) Mountains for more than 500 kilometres into Oman. The mountain slopes tend to run right to the shore. Nevertheless, there are small harbours at Diba al Hisn, Kalba and Khawr Fakkan on the Gulf of Oman. In the vicinity of Al Fujayrah, where the mountains do not approach the coast, there are sandy beaches.

South and west of Abu Dhabi, vast, rolling sand dunes merge into the Rub al Khali (Empty Quarter) of Saudi Arabia. The desert area of Abu Dhabi includes two important oases with adequate underground water for permanent settlements and cultivation. The extensive Al Liwa Oasis is in the south near the undefined border with Saudi Arabia. About 100 kilometres to the northeast of the Al Liwa Oasis is the Al Buraymi Oasis, which extends on both sides of the Abu Dhabi-Oman border.

2.1.2 The economic situation in the United Arab Emirates

During the last three decades enormous economic rapid changes have occurred in the Gulf area. These changes were produced by the discovery of oil in the region, and the economic wealth associated with it. In the UAE, as in all the Gulf Countries, this economic prosperity led to a major socio-cultural change. The construction and building sectors experienced the most noticeable change in the accelerated development of the UAE. The traditional architecture has disappeared under the stream of new technologies and sophisticated building systems. The impact of this change in energy terms is demonstrated in section 2.6.

Economic growth has, however, slowed sharply in the United Arab Emirates (UAE) over the last year (2001/2002), as oil prices have declined from the relatively high levels of 1999 and 2000. Real growth in gross domestic product (GDP) is 4.0% for 2001, after reaching 7.9% in 2000. The UAE economy is somewhat more diversified than most of the other Arabian Gulf oil exporters, which has mitigated some of the effects of the fall in oil prices.

2.1.3 The UAE population

It is very important for this thesis, to understand the population profile in the UAE. The cultural mix of the population is also reflected in the prison population. This is having a major impact on decision making regarding design, and management of prisons in the UAE.

The population of the UAE has increased more than fivefold in the past 25 years. According to the Central Statistics Department the population increased from 557,887 in 1975 to 3,108,000 in the middle of the year 2000. The number of expatriates living in the UAE continues to grow dramatically. The latest official figures show that the percentage of the expatriate population among the overall national population rose from 36 percent in the year 1968, to 75.6 percent in the year 1995. The expatriate population in the UAE vary in their nationalities, social, cultural, and political backgrounds. About 62.1 percent of the total population consists of ethnic Arabs. The largest non-Arab group consists of Asians from India and Pakistan, about 9.5 percent of the population. Some 2 percent are Iranians. Other groups, including Africans and Europeans, make up less than 2 percent of the population. This diversity of social, economic, and cultural background provides the UAE society with a very unique and complex pattern.

Table 1: The UAE population per Emirate

EMIRATE	1968	1975	1980	1985	1995	2000*[1]
Abu Dhabi	46,575	211,812	451,848	566,036	942,463	1,186,000
Dubai	59,271	183,187	276,301	370,788	689,420	913,000
Sharjah	31,968	78,790	159,317	228,317	402,792	520,000
Ajman	4,246	16,690	36,100	54,546	121,491	174,000
Umm Al-Quwain	3,744	6,908	12,426	19,285	35,361	46,000
Ras Al-Khaimah	24,687	43,845	73,918	96,578	143,334	171,000
Fujairah	9,735	16,655	32,189	43,753	76,180	98,000
UAE	**180,226**	**557,887**	**1,042,099**	**1,379,303**	**2,411,041**	**3,108,000**

Table 1 shows the desegregation of population data per Emirate. The table shows that Abu Dhabi Emirate has the largest population volume in the country.

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[1] 2000 figures are estimated figures and not calculated.

It is however, essential prior to consider in the energy scene in the UAE to demonstrate the climatic features of the country as the latter has major impact on the former. Hence, the following section provides a general understanding of the main climatic features of the UAE.

2.1.4 The climatic features of the UAE

Situated between 22 and 26 degrees north, the United Arab Emirates lie within a sub-region of the northern desert belt, characterised by scanty and erratic rainfall, and high levels of temperature, humidity and sunshine. Winter sunshine averages eight hours per day, while the summer figure reaches as high as eleven hours a day.

As the UAE is situated across the Tropic of Cancer it receives maximum solar radiation during the summer months which results in extreme hot and dry weather conditions. Average precipitation is roughly 8 cm (80 mm) per year. Most rain falls in the winter months, from November to April. Less frequent, but nevertheless important rainfall occurs in isolated summer showers, carried into the area by southwesterly monsoons, and often occurring at the eastern edge of the great Rub al Khali, along the borders between Abu Dhabi and Saudi Arabia.

2.1.5 The UAE energy and environmental situation

The expected increase in energy consumption and its consequent environmental impact following the introduction of air-conditioning in UAE prisons triggered this thesis project. It is, hence, beneficial to illustrate briefly the current energy and environment scene in the UAE.

2.1.5.1 Oil

The UAE contains proven crude oil reserves of 97.8 billion barrels, or slightly less than 10% of the world total. Abu Dhabi holds 94% of this amount, or about 92.2 billion barrels. Dubai contains an estimated 4.0 billion barrels, followed by Sharjah and Ras al-Khaimah, with 1.5 billion and 100 million barrels of oil respectively.

The UAE crude oil production is 2.15 million bbl/day. According to the US Department of Energy, the UAE Oil estimated consumption is 331,000 bbl/d and its net oil exports amount to 1.8 million bbl/d (EIA, 2001).

2.1.5.2 Natural gas

The UAE's natural gas reserves of 212 trillion cubic feet (Tcf) are the world's fifth largest after Russia, Iran, Qatar and Saudi Arabia. The largest reserves of 196.1 Tcf are located in Abu Dhabi. Sharjah, Dubai and Ras al-Khaimah contain smaller reserves of 10.7 Tcf, 4.1 Tcf and 1.1 Tcf, respectively. In Abu Dhabi, the non-associated Khuff natural gas reservoirs beneath the Umm Shaif and Abu al-Bukhush oil fields rank among the world's largest. Current natural gas reserves are projected to last for about 150-170 years.

Increased domestic consumption of electricity and growing demand from the petrochemical industry have provided incentives for the UAE to increase its use of natural gas. According to the EIA, over the last decade natural gas consumption in Abu Dhabi has doubled, and is projected to reach 4 billion cubic feet per day (bcf/d) by 2005 (EIA, 2001). The development of natural gas fields also results in increased production and exports of condensates, which are not subject to OPEC quotas ((Vine and Casey, 1992).

2.1.5.3 Renewable energy

Renewable energy has become an essential ingredient of social and economic development plans at the global level. However, the vast availability of fossil fuels in the Arab world has minimised efforts to invest in renewable energy sources. Recently, global sustainability and environmental concerns have initiated some efforts to develop renewable energy systems in the Arab world (Alnaser *et al.*, 1995). In the UAE several projects and systems have been proposed and applied (El-nashar and Samad, 1998; Kazim and Veziroglu, 2001). These systems however, are very limited and are not applied on a wide scale.

Solar energy as a clean energy source, for example, is abundant in the UAE and it has excellent prospects for future use in supplying energy demands especially in remote and isolated areas. The monthly average, daily total solar radiation varies from 2700 W h/m^2 in December to 8000 W h/m^2 in June, with an average clearness index of 0.65 (Khalil and Alnajjar, 1995). The use of photovoltaic and solar thermal devices is suitable for rural electrification, water pumping, seawater desalination etc. The Ministry of Interior, for example, uses photovoltaic devices in several police stations in rural areas (Figure 5).

Figure 5: Remote police station

2.1.5.4 Electricity

Electricity consumption in the UAE has been expanding with extraordinary rapidity during the past three decades. This strong demand is driven by buoyant economic activity, accelerated population growth due to a high fertility rate, international labour movement, technology advancement, greater penetration of highly intensive electricity appliances and relatively low electricity tariffs.

The UAE's soaring demand for electric power, coupled with volatile swings in peak loads, led the Emirates in 1997 to form a Privatisation Committee for the Water and Electricity Sector. In early 1998, the committee called for a comprehensive restructuring, including the elimination of the state-owned Abu Dhabi Water and Electricity Department (ADWED). ADWED was transformed into a regulatory body, the Abu Dhabi Water and Electricity Authority (ADWEA). The government plans to take a majority holding in the new ventures, with minority interests held by foreign firms. The government may gradually privatise its shares through initial public offerings (IPOs), allowing UAE nationals to become shareholders.

Electricity continues to displace other sources of energy in final consumption, most notably gas and kerosene in home use. As indicated by several previous studies (Al-Faris, 2002), residential demand in the form of air-conditioning, lighting, and use of appliances is the largest electricity user in these societies. Other users include the commercial (mainly for air conditioning and lighting) and industrial sectors.

2.1.5.5 Environmental overview

The UAE total energy consumption (of which Oil contributes 38.2% and Natural gas contributes 61.8%) is estimated to be 7216.61 quadrillion KWH that is 0.5% of world total energy consumption. The related energy carbon emissions are estimated at 32.2 million metric tons of carbon, which is 0.5% of world total carbon emissions. Figure 6 and 7 illustrate the energy consumption and related carbon emissions in the UAE by sector.

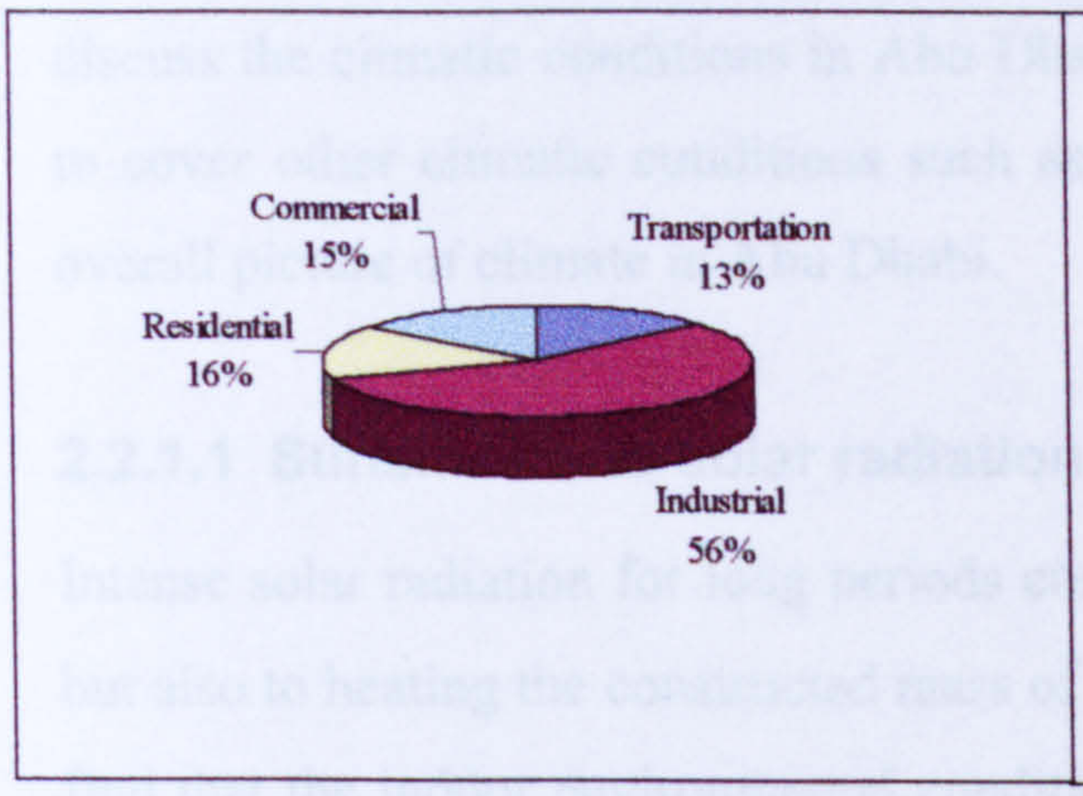


Figure 6: The UAE Sectoral Share of Carbon Emissions (1998E)

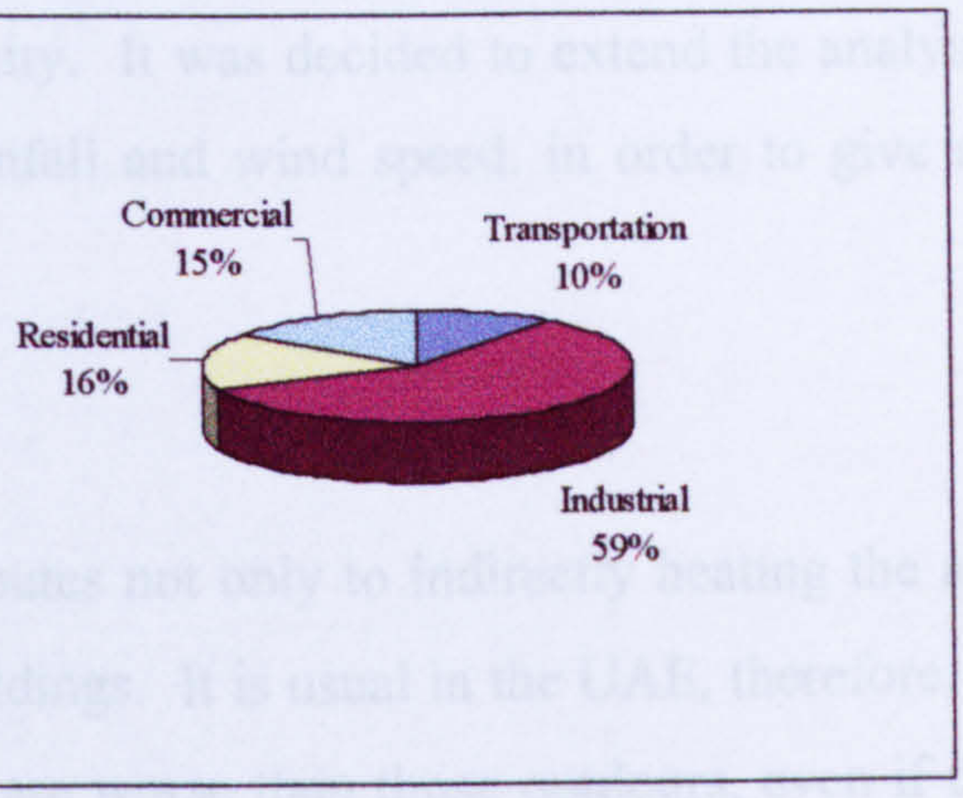


Figure 7: The UAE Sectoral Share of Energy Consumption (1998E)

2.2 General background of Abu Dhabi

Abu Dhabi city is the provisional capital of the UAE and the capital of Abu Dhabi Emirate. Abu Dhabi is situated between 24 and 29 North Latitude and 54 to 21 East Longitude, with 6m altitude.

The area of Abu Dhabi is 67340 km^2. More than 38% of the UAE population occupies Abu Dhabi, which makes the population density 16.74 person per square kilometre. In the following section the climatic features of Abu Dhabi are illustrated in detail.

2.2.1 Climatic features of Abu Dhabi

Climate is one of the prime factors in culture, and therefore built forms (Beng, 1994). It is hence essential to demonstrate the climatic features of Abu Dhabi in detail.

The problem of heat excess in hot climates is generally related to three main climatic factors, solar radiation, humidity and air temperature respectively (COCH and SERRA,

1996). It is believed that solar radiation is the main source of excess heat in hot arid zones, while the level of humidity can alter the impact of such excessive heat on comfort levels. A precise and linear relationship is found between the indoor comfort temperature and mean monthly outdoor temperature for both air-conditioned and naturally ventilated buildings (Humphreys, 1996). The climate can also be seen therefore, as a powerful influence on several aspects of living including clothing, furnishing, activities etc. Understanding the sensitivity of thermal comfort to outdoor temperatures can result in substantial savings, in extreme climatic cases such as the UAE. The following sections discuss the climatic conditions in Abu Dhabi city. It was decided to extend the analysis to cover other climatic conditions such as rainfall and wind speed, in order to give an overall picture of climate in Abu Dhabi.

2.2.1.1 Sunshine and solar radiation

Intense solar radiation for long periods contributes not only to indirectly heating the air, but also to heating the constructed mass of buildings. It is usual in the UAE, therefore, to find that the indoor environmental conditions are worse than those outdoors, even if the air temperature is not particularly high. This is the result of high mean radiant temperature.

Despite the dumping by air conditioning systems of large amounts of heat to the outside environment, the low built up area in most of the emirates makes the accumulation and development of heat islands very rare, apart from in Abu Dhabi city centre.

Abu Dhabi with its location on 24° 29' N and 54° 21' E, within the belt of the hot zone, is exposed to long hours of direct sun all the year round. The maximum sunshine duration is between 10 and 12.5 hr/day, while the minimum mean is between 7.9 hr/day and 10.3 hr/day. The annual average sunshine duration is 10 hours/day. Records show that the highest values are between May and September (Figure 8). Solar radiation intensity is very high through April until August. Measurements on the horizontal plane show that solar energy exceeds 60 KWH/m^2 (Figure 9) with an average of 73.6 KWh/m^2, while the mean maximum is 55.5 KWh/m^2. Additionally, Abu Dhabi city has clear skies most of the year. It is evident that Abu Dhabi displays a hot climate with a high relative humidity percentage (Figure 10).

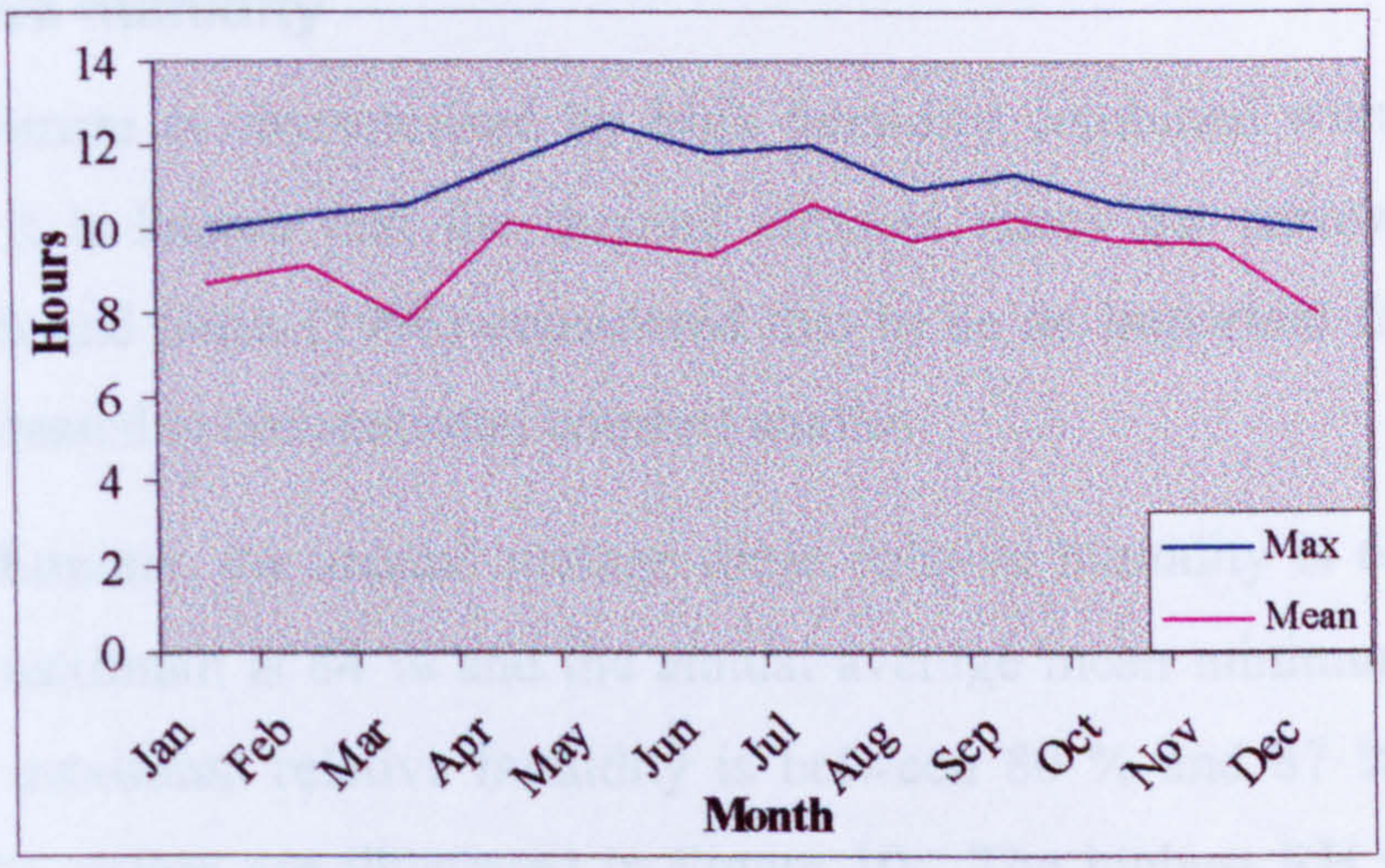


Figure 8: The monthly mean and maximum sunshine duration in Abu Dhabi

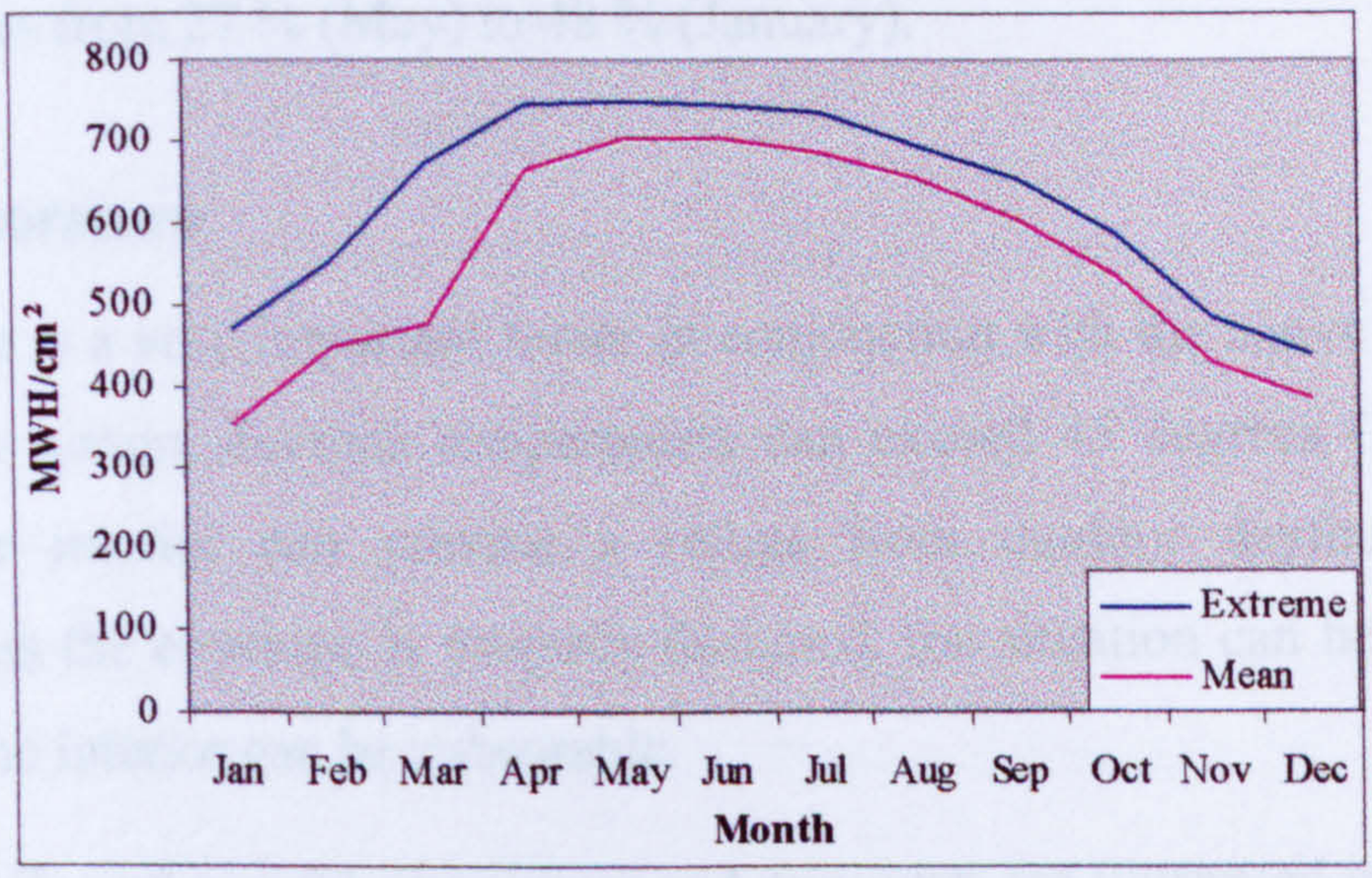


Figure 9: The monthly mean and extreme solar radiation in Abu Dhabi

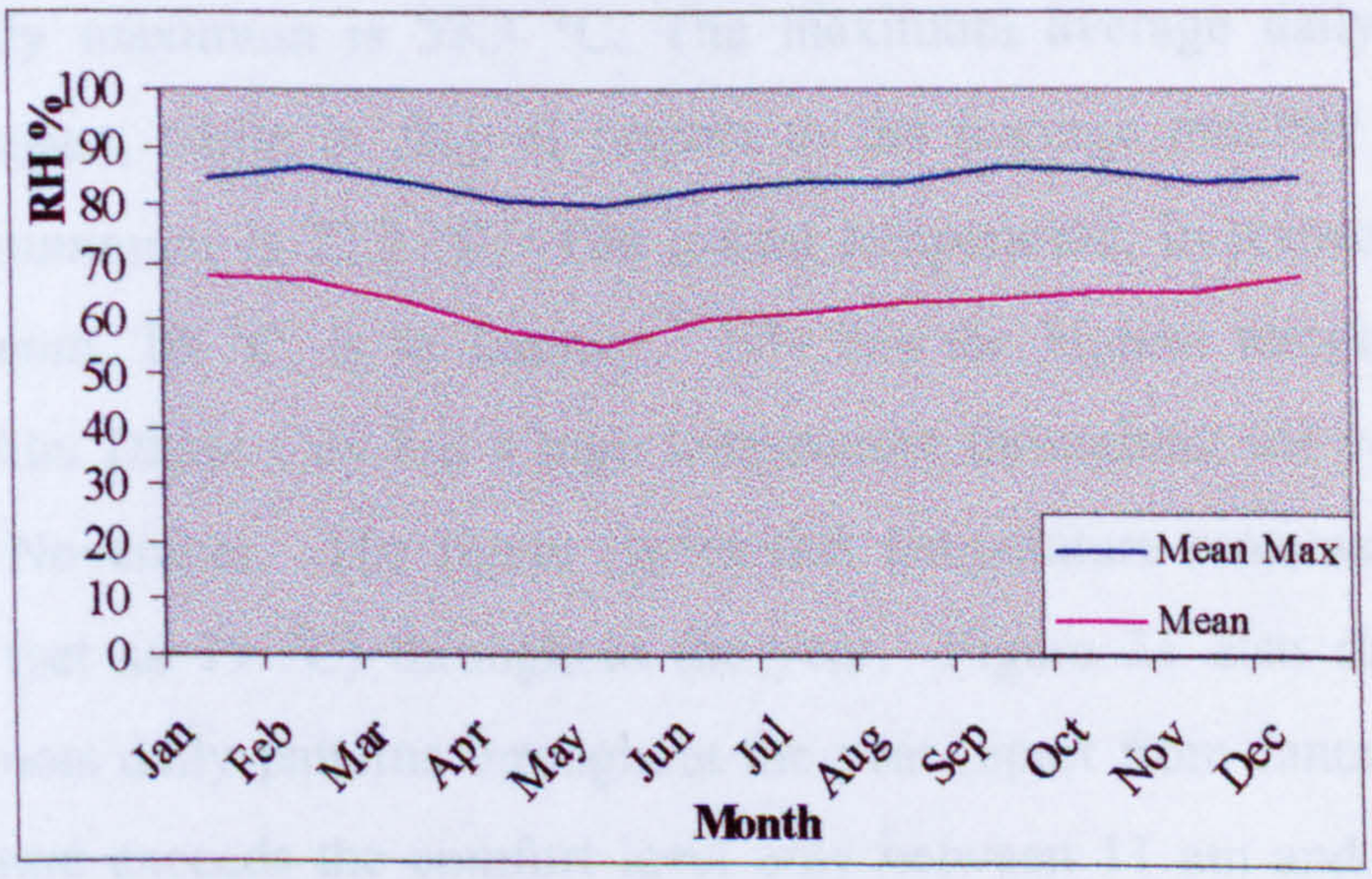


Figure 10: The monthly mean and mean extreme relative humidity in Abu Dhabi

2.2.1.2 Relative humidity

Abu Dhabi's climate is characterised by high humidity combined with relatively high temperatures. It is known that the thermal comfort zones get narrower as humidity increases. Coch and Serra (1996) considered this to be an important factor of comfort that is underestimated in conventional comfort studies.

In Abu Dhabi Emirate, the annual average mean relative humidity is 63 %, the annual average mean maximum is 84 % and the annual average mean minimum is 37 %. The monthly mean maximum relative humidity is between 80 % and 87 %. The monthly relative humidity values are illustrated in Figure 10. The highest RH in respect to the mean maximum, 87%, is in February, while the lowest, 80%, is in May. The mean maximum ranges from 27 % (May) to 48 % (January).

2.2.1.3 Temperature

Air temperature is a very important factor in conjunction with the above two parameters. During the hot season, daytime temperatures can exceed 45 degrees Celsius. In such conditions, the interior can provide a refuge from outdoor daytime temperatures. However, unless the envelope is properly designed, the situation can be reversed during the night and the interior can be unbearable.

The average daily and monthly maximum and minimum are illustrated in Figure 11. The annual average daily maximum temperature in Abu Dhabi Emirate is 32.3 °C. The average monthly maximum is 38.3 °C. The maximum average daily temperature is recorded in August, while in July of respect to the average monthly maximum. The average daily minimum is 22.3 °C. The lowest temperature, in respect to the average monthly minimum, 10 °C, is in January. July has the highest temperatures but it is apparent that Abu Dhabi City has a high temperature throughout the year, in particular from April to November. The figure shows that temperature remains higher than the comfort level (set as 19 °C) throughout the year. Figure 21 also shows that this is applicable to most daily patterns throughout the year (apart from January and February when temperature exceeds the comfort level only between 11 am and 7 pm). The dry bulb temperature set by ASHRAE for cooling design is 43.5 °C based on 2% probability, however CIBSE set the design dry bulb temperature at 46 °C (CIBSE, 1990).

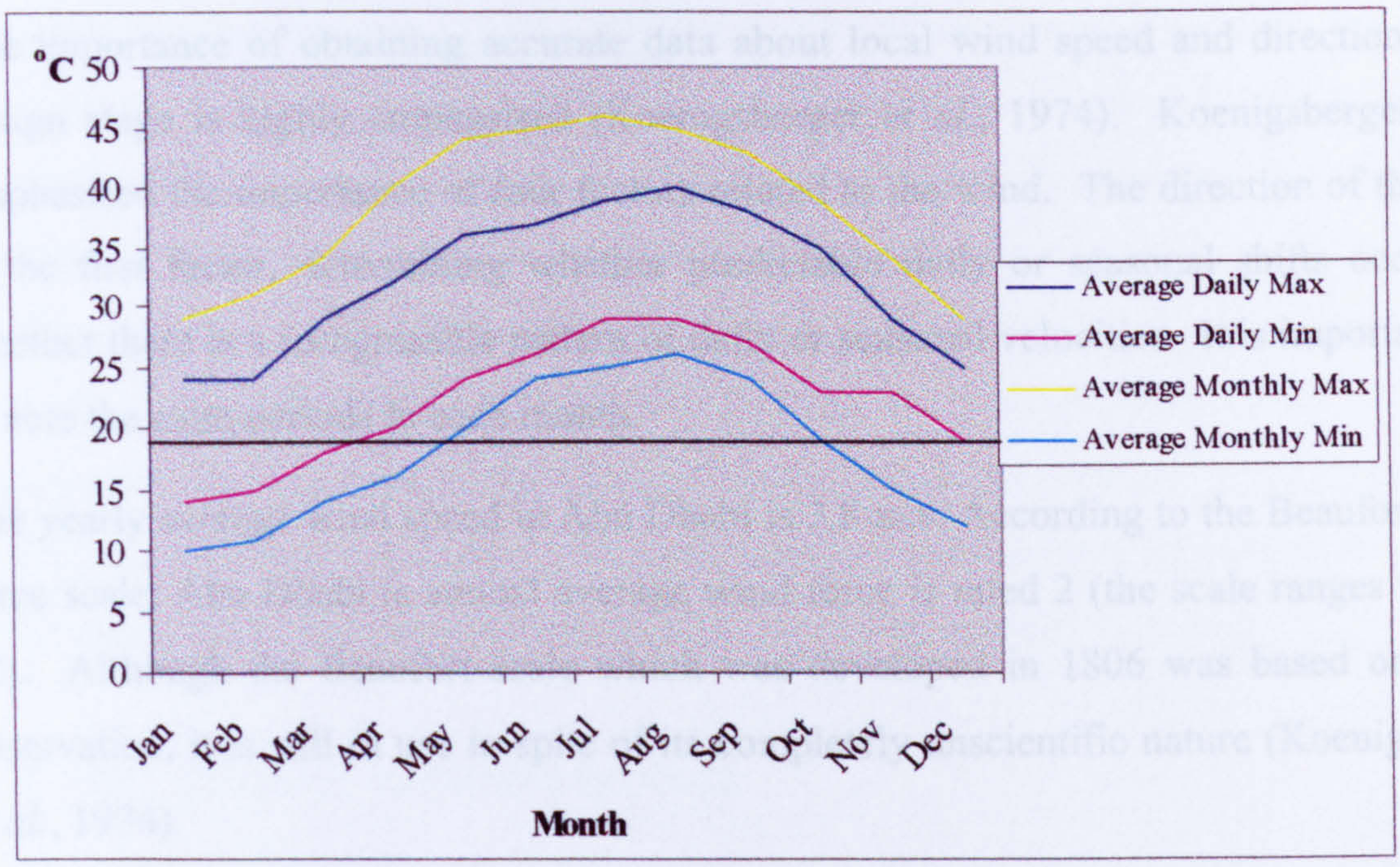


Figure 11: The annual temperature in Abu Dhabi

2.2.1.4 Rainfall

Abu Dhabi City is located in the hot zone belt, hence, rainfall is rare throughout the year. The maximum precipitation is usually in the cool season from December to April, with maximum precipitation in January and March. Figure 12 illustrates the monthly average rainfall.

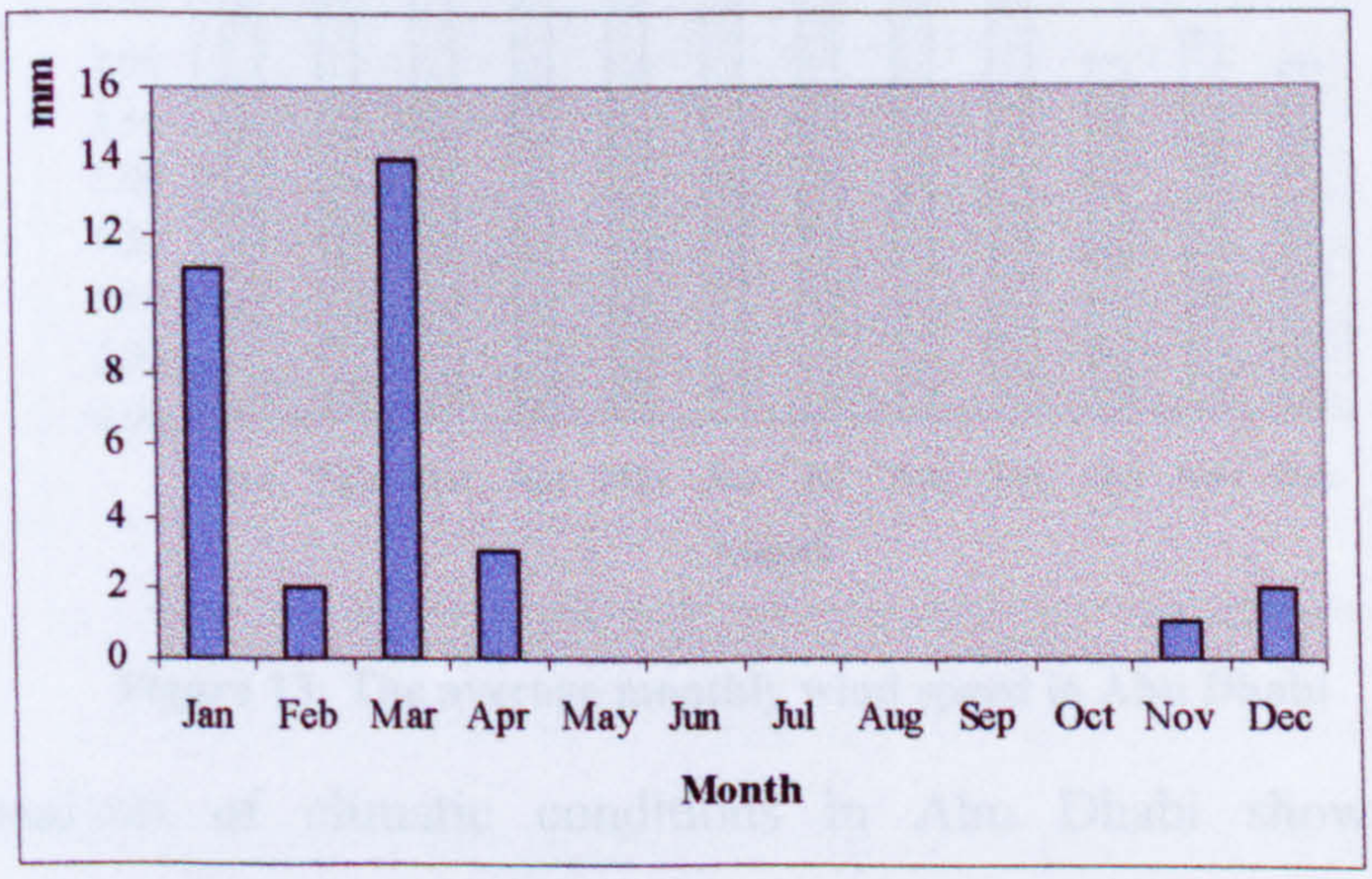


Figure 12: The monthly average rainfall in Abu Dhabi

2.2.1.5 Wind speed

The importance of obtaining accurate data about local wind speed and direction in the design stage is highly emphasised (Koenigsberger *et al.*, 1974). Koenigsberger *et al.* emphasised the importance of four factors related to the wind. The direction of the wind is the first factor, determining whether predictable daily or seasonal shifts occur and whether there is a recognisable pattern of daily or seasonal velocities. It is important also to note the calm periods in each month.

The yearly average wind speed in Abu Dhabi is 3.8 m/s. According to the Beaufort wind-force scale, Abu Dhabi is annual average wind force is rated 2 (the scale ranges from 0-12). Although the Beaufort scale which was developed in 1806 was based on visual observation, it is still in use in spite of its completely unscientific nature (Koenigsberger *et al.*, 1974).

Figure 13 shows the average monthly wind speed in Abu Dhabi. The maximum wind speed, 4.66 m/s, is recorded in August, while the minimum, which is 2.95, occurs in December. Both the maximum and the minimum average are considered force 2, according to Beaufort scale.

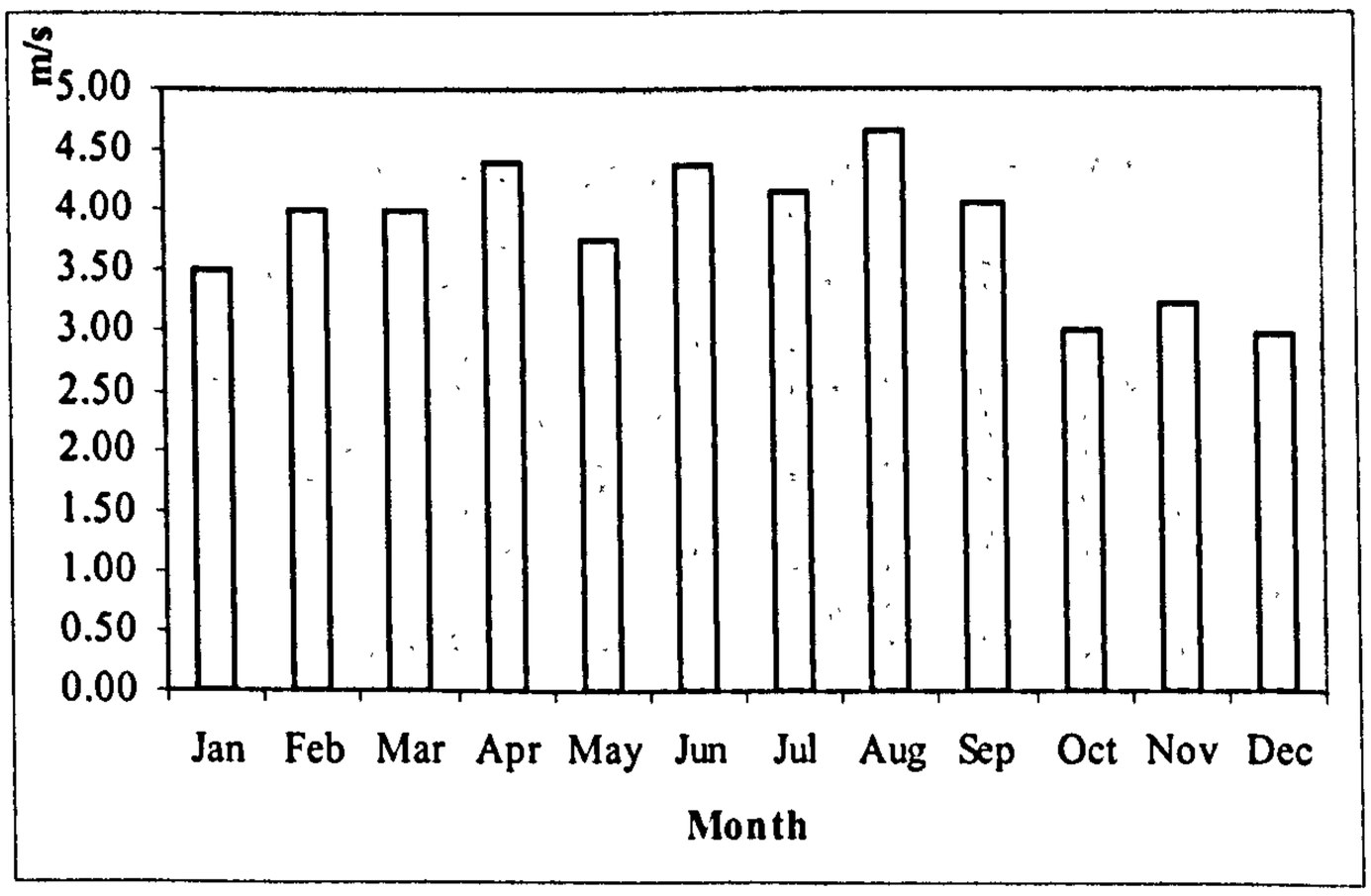


Figure 13: The average monthly wind speed in Abu Dhabi

The above analysis of climatic conditions in Abu Dhabi shows the extent of environmental stress in this region. Abu Dhabi city has a hostile climate classed as a "hot-dry maritime desert climate". This climate is considered to be one of the most unfavourable climates on the earth (Koenigsberger *et al.*, 1974). Long hours of direct sun can be as much as 12 hours per day, with a mean solar radiation of 55.5 KWh/m^2. Air

temperature (DBT) can reach a day-time mean maximum of about 40 °C, but in the cool season it remains around 24 °C. ASHRAE and CIBSE design conditions set the DB temperature to 43 and 47 respectively, for probability of 2%. Humidity is high, exceeding 85%, as solar radiation causes strong evaporation from the sea. Precipitation is very low. Despite this obvious indication of the extreme climatic conditions in Abu Dhabi, it would be difficult to assess the impact of these conditions on buildings and in particular on façade design, without investigating and understanding issues of thermal comfort in this part of the world. The following section will review the mechanism and definitions of thermal comfort. Thermal comfort indices will be reviewed, and the contribution of the façade to thermal comfort will be examined.

2.3 The thermal comfort factors

The hostile climate in the UAE urges the need to address questions of comfort and sustainability, design freedom and environmental responsibility. The discussion in the following chapters tries to establish where a balance might lie in such an affluent society. Exploring the facts of human thermal comfort will establish some boundaries for this study, within the UAE context. The following section provides basic elucidation of thermal comfort issues.

A dynamic equilibrium exists between people and their thermal environment. Changes in the environment tend to be compensated by changes in, for example, clothing or activity. Our daily life cycle comprises states of activity, fatigue and recovery. It is essential that the mind and body recover through recreation, rest and sleep to counter-balance the mental and physical fatigue resulting from activities of the day. This cycle can be, and is often impeded by unfavourable climatic conditions such as in the case of the UAE environment. The resulting stress on body and mind causes discomfort, loss of efficiency and may eventually lead to a breakdown of health. The effect of climate in UAE is therefore, a factor of considerable importance. As it is not feasible to regulate outdoor conditions, the task of the designer is to create the best possible indoor climate through appropriate design and construction of the building's envelope and its services.

Investigation of thermal comfort is a well-established line of research in building science. Markus and Morris (1980) reviewed the developments in this research field since the 18th Century. The authors discussed the variety of criteria that can be used to judge the

quality of a thermal environment in relation to human activity, health or well being. In order to understand thermal comfort indices in Abu Dhabi, a brief investigation of the mechanism of thermal comfort is necessary. The differences between adequate indoor environments for survival and for human comfort are also explored through the different definitions of thermal comfort in section 2.3.2.

2.3.1 Mechanisms of Thermal Comfort

In order to understand the human response to the thermal environment, it is necessary to examine briefly the basic thermal processes of the human body.

The body produces heat continuously. All energy and material requirements of the body are supplied from the consumption and digestion of food, in a process known as metabolism. Of all the energy produced in the body, only about 20% is utilised, the remaining 80% is 'surplus' heat which must be dissipated into the environment. The body can release heat to its environment by convection, radiation and evaporation and to a lesser extent, by conduction (Koenigsberger *et al.*, 1974). In order to achieve thermal balance the body heat gains needs to equal the body heat loss. Keonigsberger (1973) interpreted this in the following equation:

Metabolism minus **Evaporation** plus and minus **Conduction** plus and minus **Convection** plus and minus **Radiation** needs to sum to zero.

The environment has little effect on the metabolic rate. Nevertheless, human activities, weight, age and sex have a significant impact. The physiological basis of comfort was stated as the achievement of thermal equilibrium with a minimal amount of body regulation of metabolism, evaporation, radiation and conduction. To determine the optimum environmental conditions for comfort and health, one must ascertain the metabolic level during the course of routine physical activities, since body heat production increases in proportion to the level of exercise. When the activity level shifts from sleeping to heavy work, the metabolism varies accordingly (Vaughan, 1993).

2.3.2 Thermal comfort

The previous section shows that there is a wide range of conditions within which the deep body temperature can be maintained at or near 37 °C. There is however a narrower range of conditions within which people will feel comfortable. The heat flow rate from the

human body core to the thermal environment depends upon activity level, when the body performs work, the metabolic rate increases in order to provide the necessary energy.

Markus and Morris (1980) indicated that comfort should be defined within three physiological factors that affect the heat balance equation; skin temperature, sweat rate and metabolic rate. Thermal comfort or thermal neutrality, in this sense, may be defined as a condition in which a person would prefer neither warmer nor cooler surroundings. The human body is thermally comfortable when the heat constantly produced by bodily processes balances heat losses and gains to and from the environment. The achievement of such a balance depends upon the combined effect of many factors: personal variables such as activity and clothing, as well as physical variables. Markus and Morris (1980) distinguished between variables specific to individuals (i.e. activity and clothing) and physical variables. The physical variables are air temperature, radiant temperature, humidity, and air movement. These are considered to be the four main environmental factors affecting human comfort. The occupants of a building however, judge the quality of the design from an emotional as well as a physical point of view.

Elder and Martiz (1975) showed that accumulated sensations of well being or discomfort contribute to our total verdict on the house in which we live and the school, office or factory where we work. It is a challenge for the designer to strive towards the optimum of total comfort. In this sense, Elder and Maritx extend the definitions of thermal comfort *as the sensation of complete physical and mental well being.* Questions regarding occupants' background cultures have also influenced the comfort debate. Humphreys (1996) shows how different cultures shift the comfort zones in relation to outdoor temperature. If this holds true in the UAE, a slight change in the comfort environment can have major energy implications in the working environment. Humphreys (1996) shows that human comfort varies greatly in different parts of the globe. In his studies of adaptive approaches to thermal comfort, Humphreys (1996) found that indoor comfort temperatures from populations in different countries were as low as 17 °C (UK) and as high as 32 °C (Iraq). This difference was greater than could easily be explained by the differences in clothing insulation. It is very difficult therefore to formulate an absolute definition of thermal comfort, as a definition tends to describe *steady state* and *optimum* conditions, ignoring the effects of movement of people in space and differences in clothing and background cultures. This particular point is problematic in the UAE in

general and in prison buildings in particular, due to the large diversity of cultural backgrounds of the population.

2.3.3 Thermal comfort indices

The thermal environment within a room may be assessed by four measurements; *air temperature, mean radiant temperature, air velocity* and *wet bulb temperature* (for humidity and water vapour pressure in ambient air). Many thermal indices have been devised in an attempt to represent thermal comfort conditions by a single temperature. Examples of the available thermal indices are presented in this section.

The index temperature for comfort, which the CIBSE recommend for use in the UK, is the dry resultant temperature (t_{res}) and the Effective Temperature (ET) adopted by ASHRAE (first produced by Houghton and Yalgou in 1923 (Koenigsberger *et al.*, 1974)). Both temperatures combine temperature and humidity into a single index. The index is the temperature (in $^{\circ}$C) measured at the centre of a blackened globe 100-mm in diameter (CIBSE Guide, Section Al).

Fanger proposed measuring the degree of discomfort in terms of the thermal load placed on a person in a given environment (Fanger, 1970). Fanger predicted the thermal load; the difference between the internal heat production and the heat loss for a man at the comfort values. The Predicted Mean Vote (PMV) for a large group from experimental data was then computed, based on the relationship between the predicted vote, on a seven-point scale, and the load.

Givoni developed the "index of thermal stress", which is the calculated cooling rate produced by sweating. The calculation is based on a refined biophysical model of the man-environment thermal system. The index takes into account all the subjective and objective thermal factors. Its usefulness extends from comfortable to overheated conditions as far as the physiological adjustments are able to maintain thermal balance.

2.4 Energy audit and the importance of the skin

2.4.1 The energy scene in Abu Dhabi

Abu Dhabi has, along with the other emirates, witnessed a sudden and complete transformation in many areas. The construction and building sectors experienced the most noticeable changes in the accelerated development of the UAE (Figure 14 and Figure 15). The traditional architecture has disappeared under the stream of new technologies and sophisticated building systems. The whole city with its infrastructure was built between 1970 and 1985 following the new-fashioned trends in architecture. The building codes in Abu Dhabi have been updated three times in the last 30 years. Although the first code which was followed in the 70s and 80s laid strong emphasis on the regional characteristics and climatic features of Abu Dhabi, it was never completely applied in the expeditious expansion of Abu Dhabi. The rapid development came without a thorough study of the energy implications in such harsh climatic conditions. The totally

Figure 14: Abu Dhabi City in the 1950s

Figure 15: Abu Dhabi city in the 2000

glazed facade buildings that rise to more than 15 storeys were constructed in Abu Dhabi in the early 1980s. Figure 16 shows the increase in the built up area of Abu Dhabi.

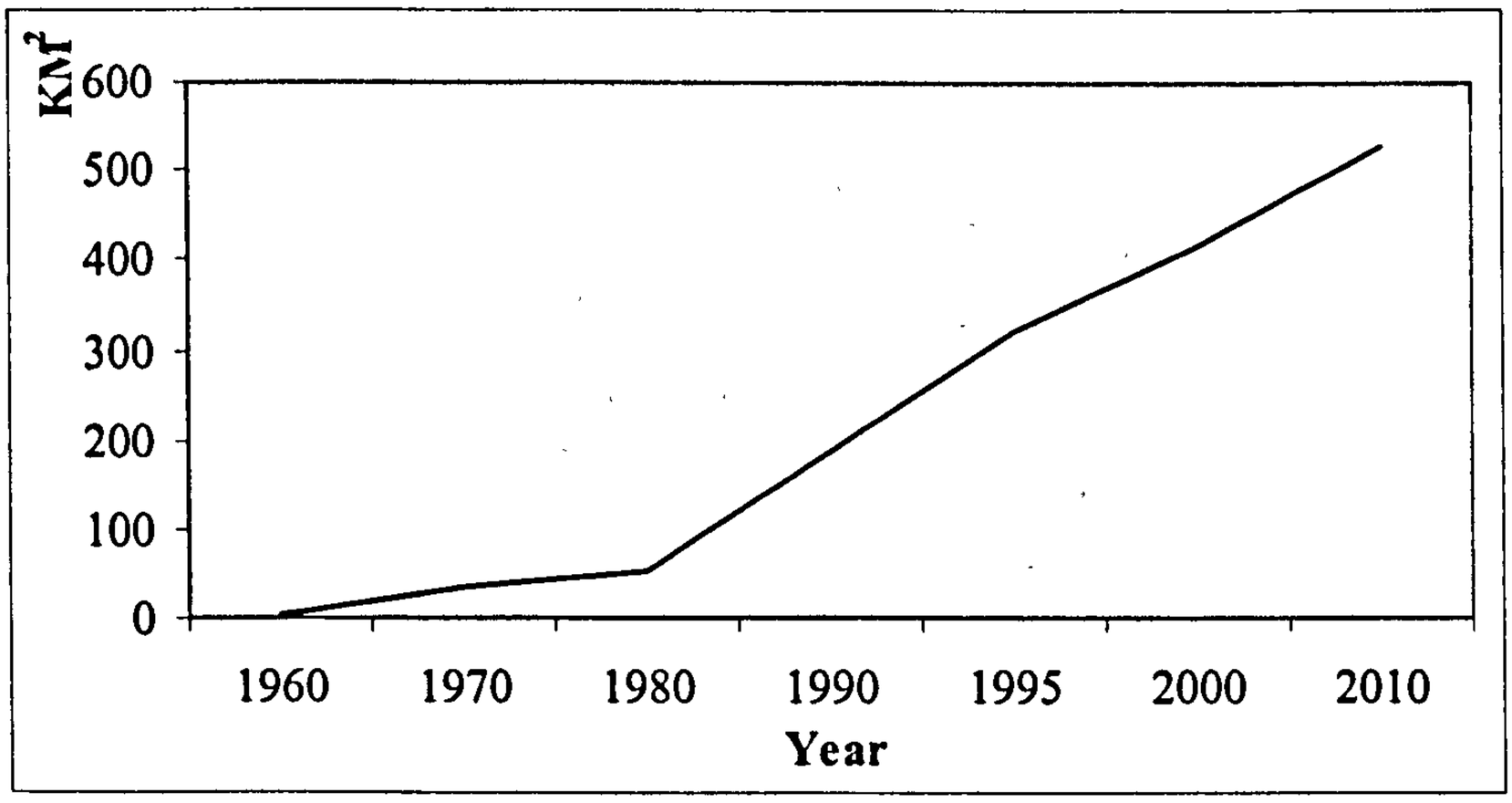


Figure 16: The increase in the built up area of Abu Dhabi

The most recent developed version of building codes and regulations was released in 1994, to be implemented in May 1998. Unfortunately, the energy issues and climatic factors were not properly addressed.

The new code included some general points about building size and ratio of the building area to the window openings. No serious guidelines for the envelope design and the façade elements have been suggested, nor any codes for skin material or glass specification indicated. It is interesting that in developed countries, for example the UK, building regulations, are becoming more restrictive. For example, with the new Part-L regulations the double glazed window with 12 mm cavity filled with Argon might not necessarily meet the requirements.

As a result of fast development without considering the energy implications, electric consumption increased from 540 GWH in 1975 to 7000 in 1997 (Water and Electricity Department, 1997) (Figure 17). This sharp increase after 1975 accompanied large population growth (Figure 18).

Interestingly, the per capita electric consumption is also increasing. Figure 17 shows that the per capita annual consumption had increased from 10,156 KWH in 1987 to 13,162 KWH by 1997. This is a result of many reasons: increase in quality of life, more use of electrical machines and indeed increase in air conditioning.

In order to identify the significance of air conditioning in the energy scene of Abu Dhabi, the following section reviews in detail the hourly and annual energy consumption.

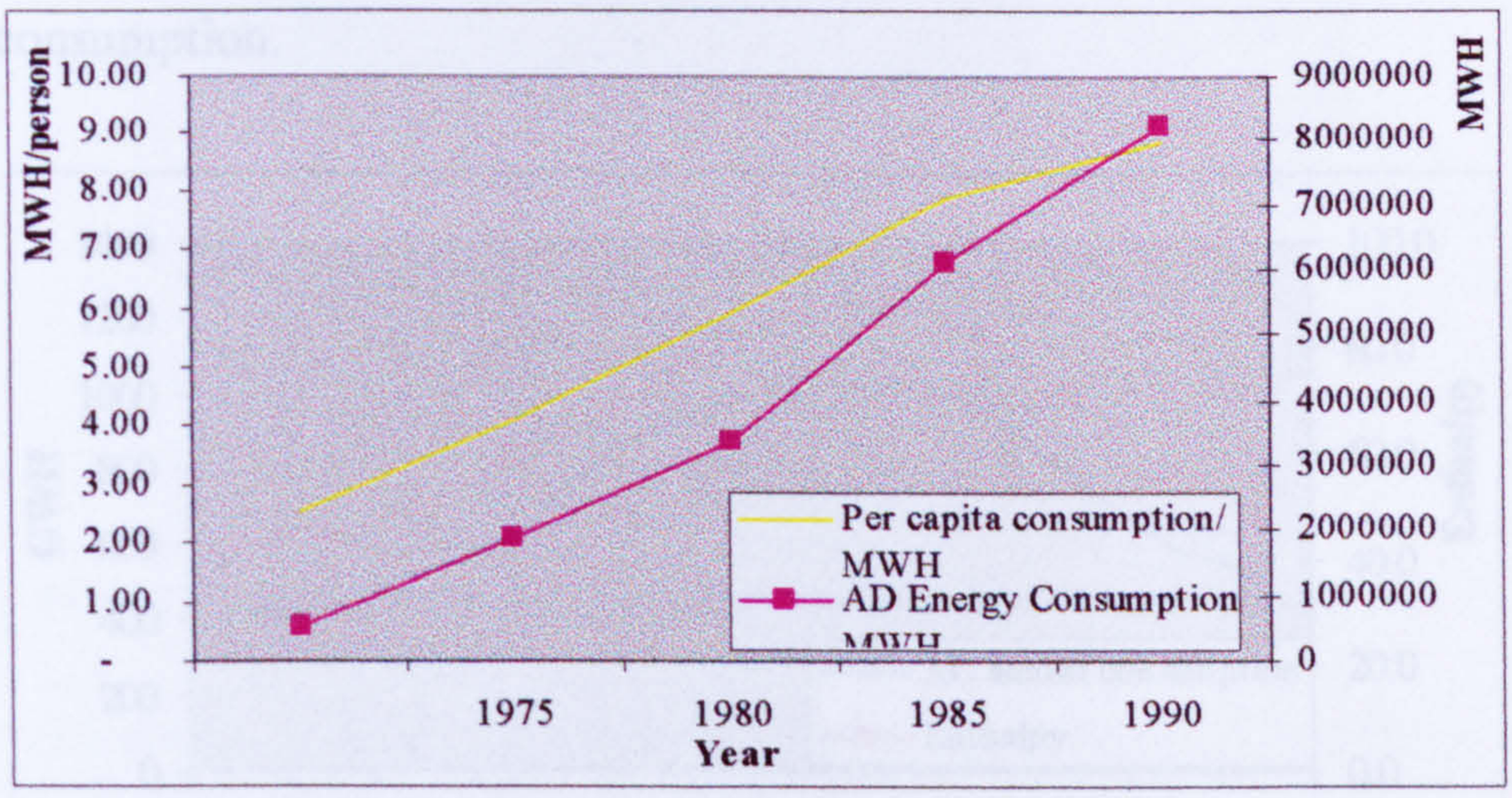


Figure 17: The increase in the total and per capita energy consumption in Abu Dhabi

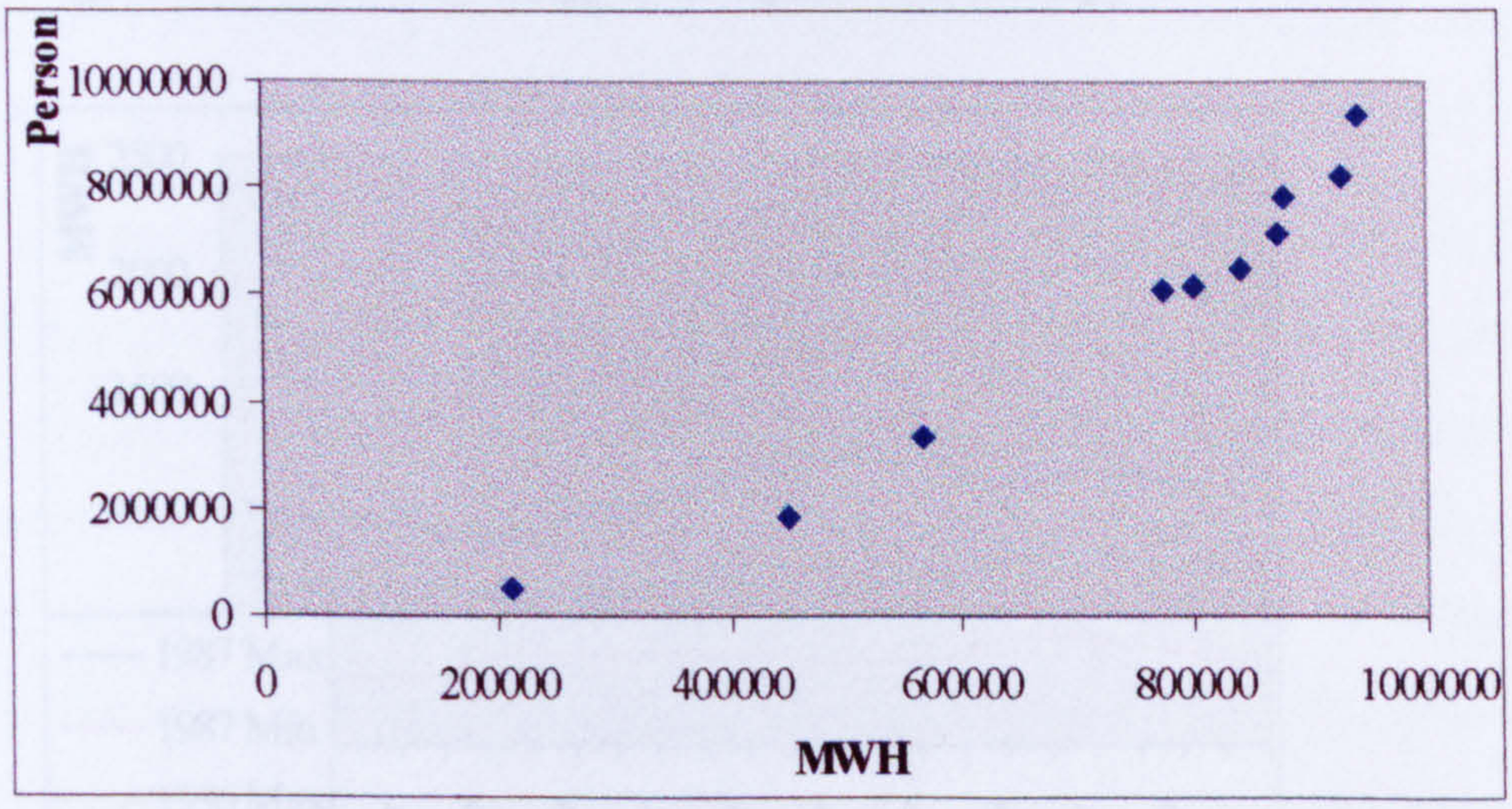


Figure 18: The increase in the population of Abu Dhabi

2.4.2 Abu Dhabi energy performance indicators review

The energy load in Abu Dhabi has increased dramatically in the last decades. Energy generation doubled between 1987 and 1997. Figure 19 shows the annual energy consumption in Abu Dhabi. Comparison between different years loads shows that the peak load is generally in the summer months (June- September, Figure 20).

The graph in Figure 19 shows that the sharp increase in electric use in June is not continued during July and August. This can be mainly related to the social pattern of the population in the UAE, since 75% of the population are foreigners who usually take their

holiday during these two months. Many nationals also escape the heat of these two months by taking a holiday abroad. As the total electric consumption in the city has a strong relationship to energy consumption in buildings, social pattern is highly significant to hourly consumption.

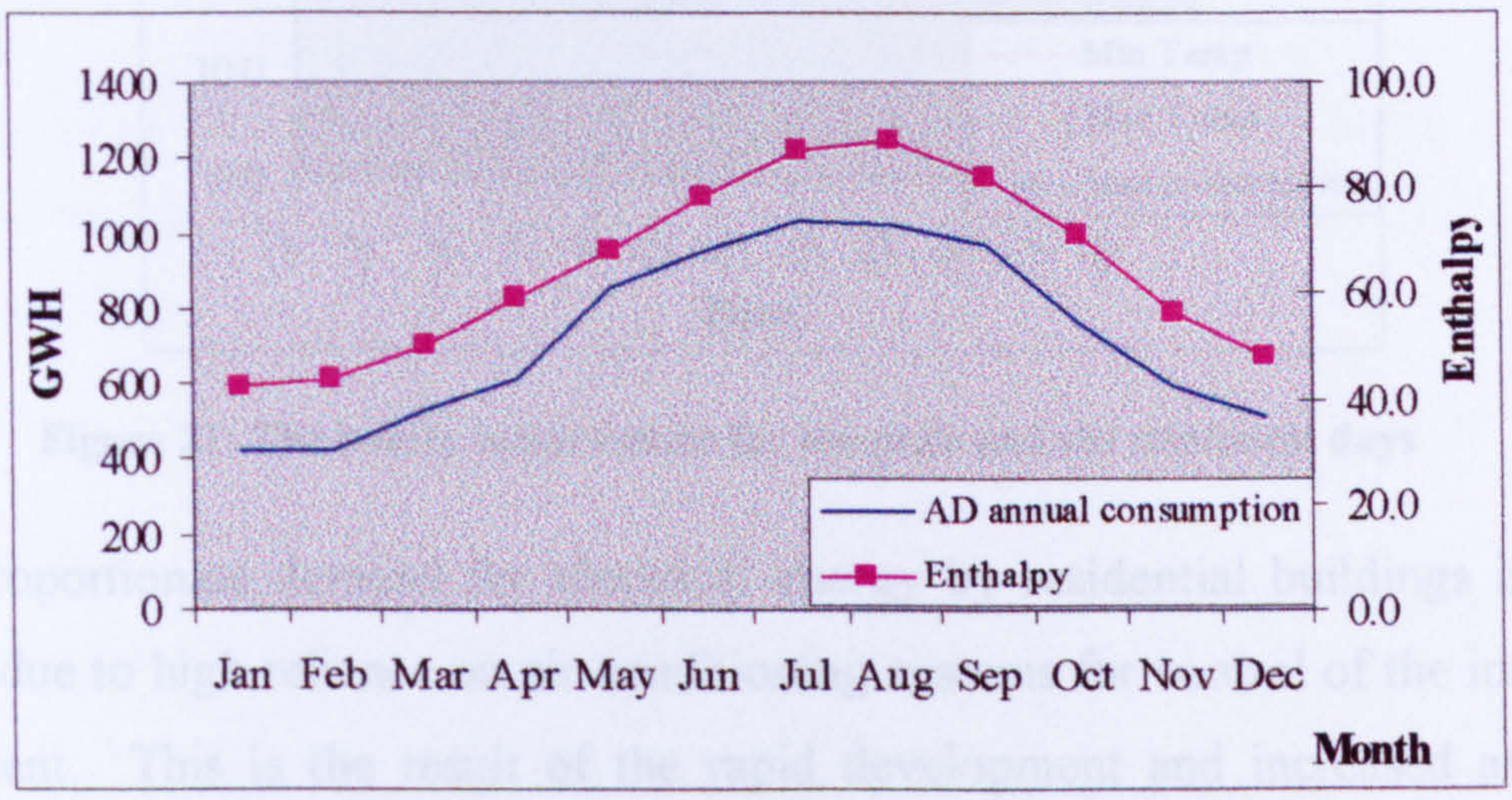


Figure 19: The annual energy consumption and enthalpy in Abu Dhabi

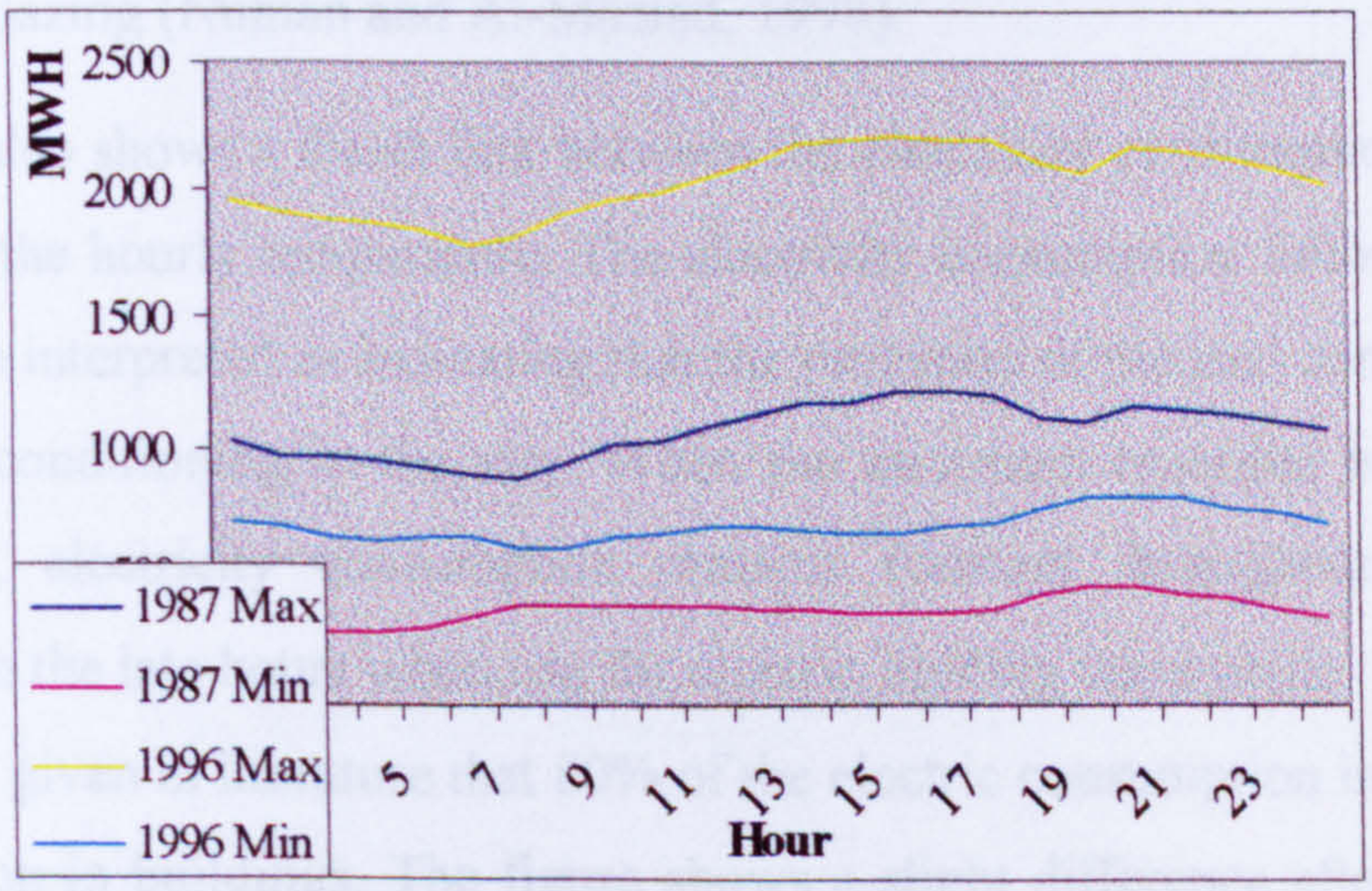


Figure 20: The hourly peak and minimum energy demand in Abu Dhabi in different years

The analysis of peak energy demand and electric loads during the years 1975 - 1997 shows a strong correlation between the increase in enthalpy (Figure 19) and the increase in electric consumption. Previous studies for buildings in Abu Dhabi have proved that the built up sector uses as much as 80.5% of the total electric consumption, with an average of 44% being used for air conditioning (Elkadi *et al.*, 1999).

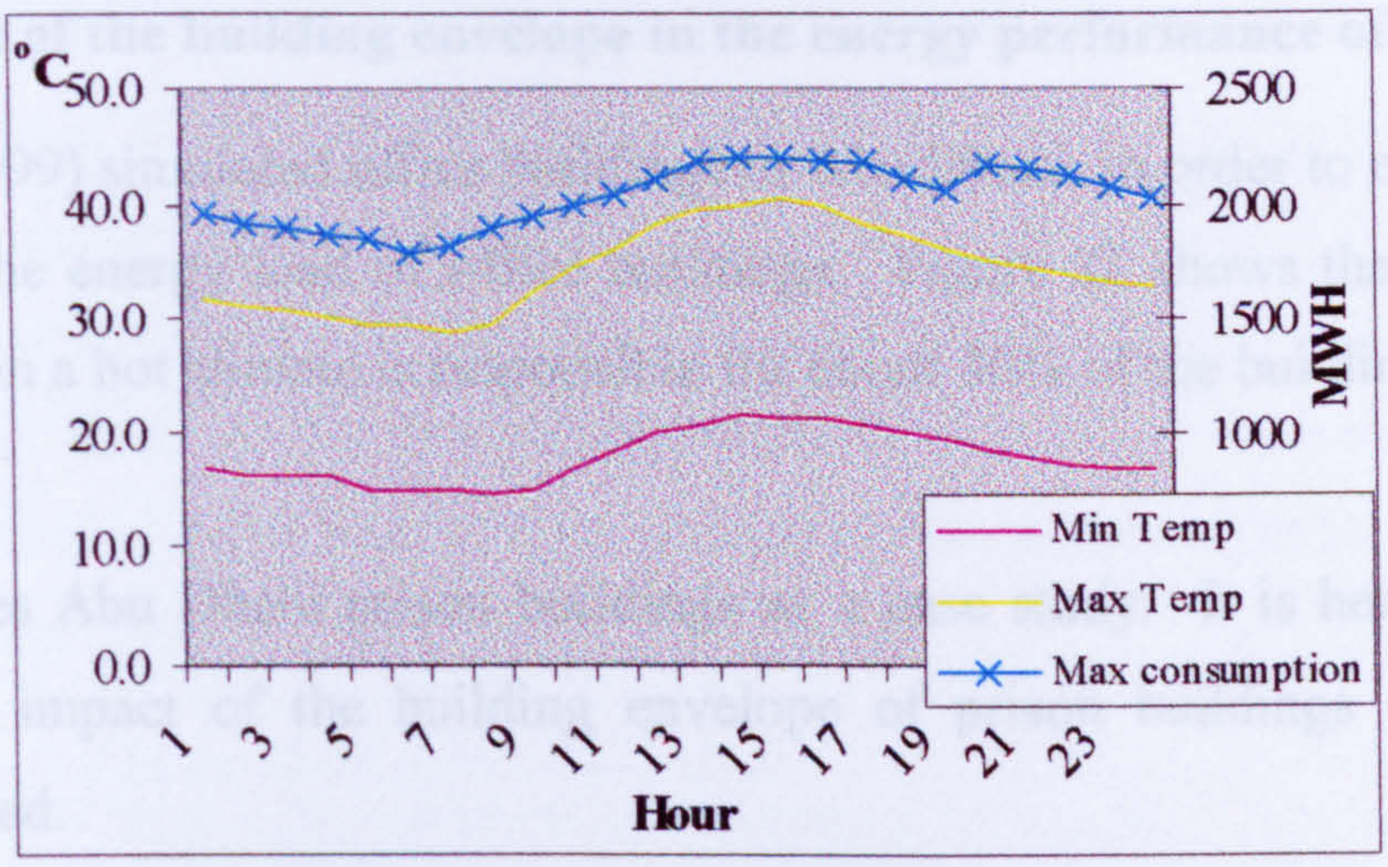


Figure 21: The hourly temperature for the peak and the minimum days

The disproportionate demand for electrical energy by residential buildings in the Gulf region is due to high reliance on air conditioning systems for control of the internal built environment. This is the result of the rapid development and increased affluence of recent last decades, which subsequently led to the adoption of insensitive designs for modern residential buildings and the use of inappropriate construction materials and excessive glazing (Numan and Al-Maziad, 1998).

Figure 21 also shows a direct link between the electricity consumption in the city of Abu Dhabi and the hourly temperature. The electricity consumption follows the same pattern. This can be interpreted as indicating that the provision of thermal comfort requires a wide use of air-conditioning in the city. When the minimum recorded hourly temperature is considered, electricity consumption remains constant throughout the day and only increases in the late hours when use for electric lighting takes place. This also stresses the conclusion given in literature that 80% of the electric consumption in the city is related to consumption in buildings. The figure shows a slight difference after 7:00 pm when use for buildings and street lighting differs slightly from the temperature profile.

Consequent to the strong relationship between the city electrical consumption and air-conditioning in the built environment, the expected increase in built-up area will result in a major increase in electricity consumption. It is important to find out the role of the skin which is this thesis particular interest in considering the energy consumption of buildings in the UAE.

2.4.3 The role of the building envelope in the energy performance of buildings

Elkadi *et al.* (1999) simulated office buildings in Abu Dhabi, in order to establish the role of the skin in the energy load of office buildings. Figure 22 shows that the skin of an office building in a hot climate is responsible for about 30% of the building's total energy consumption.

This thesis takes Abu Dhabi prison buildings as a case study. It is hence important to investigate the impact of the building envelope of prison buildings on their energy consumption load.

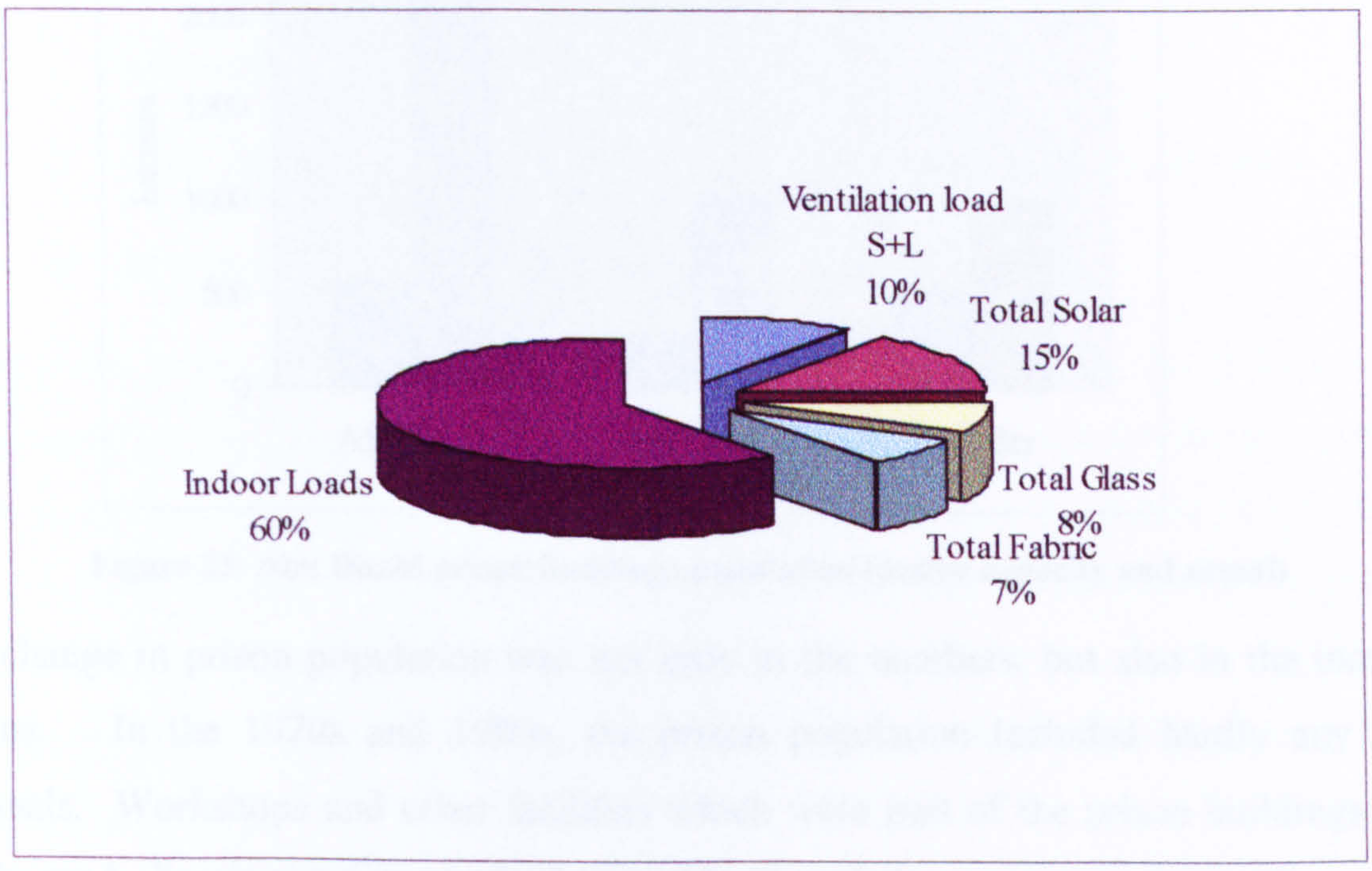


Figure 22: Different cooling load categories in office buildings

2.5 Thermal performance of façades in prison buildings

Currently, there are three main prisons in Abu Dhabi Emirate, namely Al Wathba, Al-Ain and Al Sader. With a design capacity of 570 inmates, Al Wathba aimed to host 500 male offenders and 70 female offenders. Al-Ain prison is designed to host 200 male and 70 female inmates. Finally, Al Sader is built to accommodate 520 inmates, which are divided into 460 male and 60 female inmates. It is worth noting that these prisons are not air-conditioned and located in remote areas in the middle of the desert. The exception is Al-Ain prison which is located in the town.

Unexpected increase in prisoner numbers has led to a major overcrowding problem in the prison population of all Abu Dhabi prisons. Figure 23 shows that the inmate population in Al Wathba increased by more than 300%. Al-Ain prison suffered a similar increase in numbers with more than 280%. The prisoner population in Al-Sader has also increased by 100 %. This boom in the inmate population of Abu Dhabi was recorded in 1995. Inmate population is expected to have increased since then. There is, however no available data after 1995.

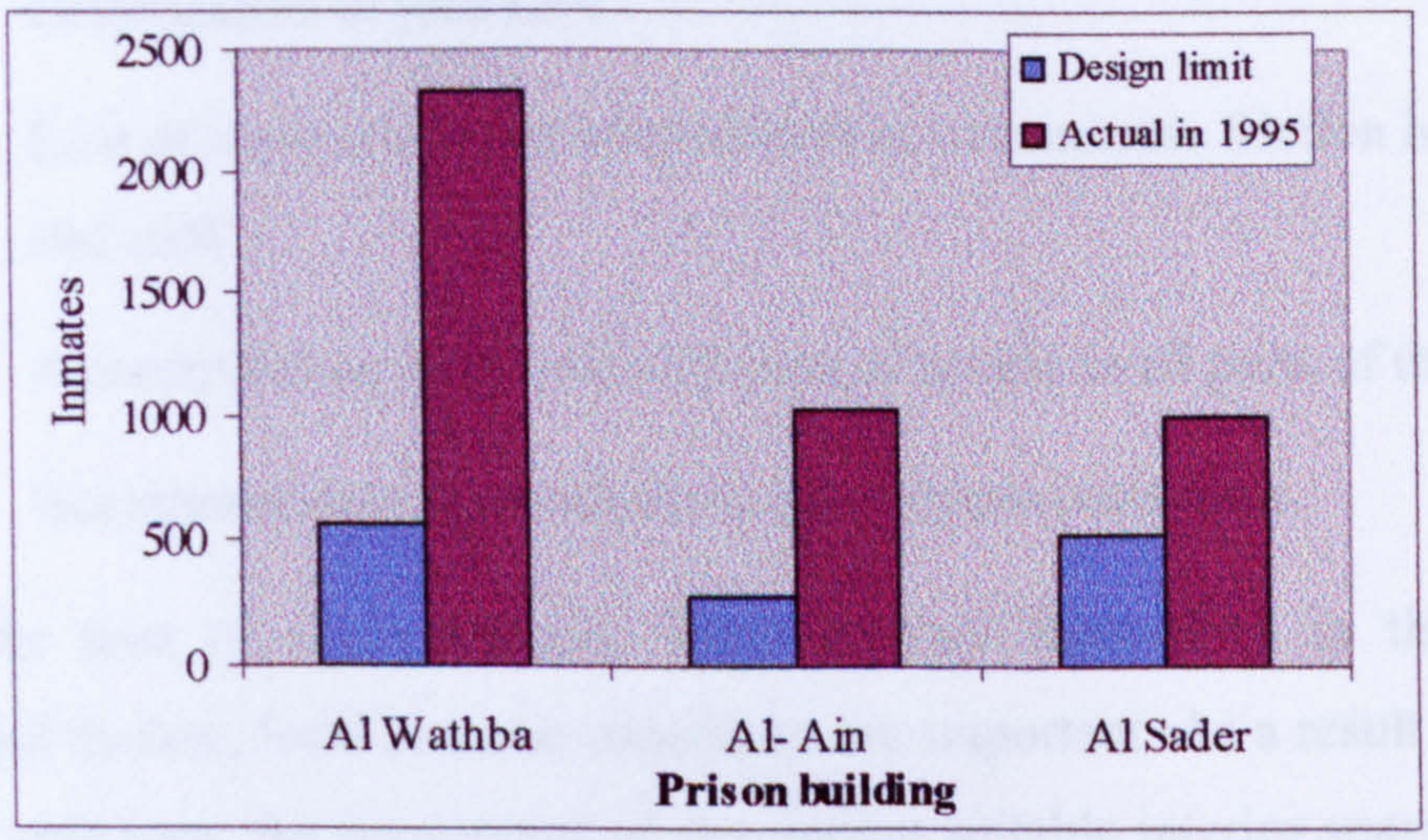


Figure 23: Abu Dhabi prison buildings population (design capacity and actual)

The change in prison population was not only in the numbers, but also in the inmates' origins. In the 1970s and 1980s, the prison population included hardly any UAE nationals. Workshops and other facilities which were part of the prison buildings were hardly used. Foreigners are usually deported back to their country of origins after serving their sentences. Prison governors found it useless to put efforts into rehabilitating the offenders, as they would not benefit the society in the UAE.

However the case has changed. The rapid changes in the prison population have been in the types of prisoners, as well as their numbers. The number of local inmates is increasing. Some fundamental new thinking has emerged about security and control measures. This has resulted in a new design policy for prison buildings in Abu Dhabi.

The prison design brief that was prepared by the "Public Works Departments" in conjunction with the "Ministry of Interior", stated the main objectives of the prison design as being:

1. To provide closed institutions for different categories of offenders.
2. Consistent control of the offenders to avoid unwanted contact with members of the community.
3. Standards of human decency.
4. Correctional treatment towards rehabilitation.
5. Division of accommodation into social units, thus ensuring a more effective classification of prisoners.
6. Ease of supervision and administration, to minimise friction between prisoners and staff.
7. A controlled environment with ease of access to all parts of the prison.
8. Accommodation sympathetic to the climatic conditions.

Among the host of considerations, which present themselves in the design of any correctional facility, local climatic conditions are important. As a result of the severity of climatic conditions, the importance of developing suitable interior spaces for programme activities and functions becomes critical. In order to present a sympathetic response to the climatic conditions, there is a need to provide air-conditioning. Achieving the third and the eighth objectives would be impossible without the introduction of air conditioning in prison buildings.

A prototype design has been developed in response to the previous objectives, which was chosen as a model for all prisons in Abu Dhabi. It is, however, important to provide a general background about the international prison design standards in relation to area per inmate.

2.5.1 Comparison analysis between the international and the UAE prison buildings

In order to investigate the average floor area that each inmate needs, the plans of 33 prisons throughout the world in terms of their floor areas related to number of inmates have been examined and analysed (Table 2). It is to be noted that the design and planning of Abu Dhabi prisons was based on United Kingdom standards, suitably adapted to local conditions. Therefore the UK prisons are treated individually and not included in the European analysis.

The area allocated for each inmate has a major impact on the overall energy requirements in prison buildings. Decisions regarding how many m^2 are allocated per inmate are not simple, and do not only depend on design requirements but rather on the penal philosophy adopted in different cultures and different societies. The allocated area also relates to the rehabilitation efforts, which will be discussed in chapter 5. The size of the institution also plays a role in deciding the area per inmate.

In theory, the prison building size is inversely related to the area per inmate. The larger the prison area is, the smaller the area per inmate would be. This is due to the presence of common facilities at all prisons. It appears in Table 3 that this theory does not apply accurately in the USA and Canada. Variations in standards between the respective geographical regions should be therefore taken into consideration.

Table 2: The International area per inmate analysis

Prison Name	Design Capacity	Building Floor Area m^2	Floor Area m^2/ inmate
USA and Canada			
USA Purdy, Washington/1969	144	7,565	52.53
USA, Diagnostic & Evaluation Centre/1979	160	7,088	44.3
USA, Montville Correctional Facility/1991	300	6,782	22.6
USA Butner	359	17,117	47.5
USA Foley Square, New York	390	20,242	52
USA. Niagara County Jail/1996	404	13,935	34.5
USA, Sullivan Max. security prison/1985	640	26,501	41.4
USA, Greenville County Jail/1994	805	17,329	21.5
USA, Carl Robinson correctional Inst./1990	900	23,225	25.8
USA, Federal Correctional Inst./ 1992	1588	51,528	32.4
USA, Greensville Correctional Centre/1990	1780	82,867	46.6
USA, Curran Fromhold Correctional. Facility/1995	2000	69,675	34.84
USA, Arizona State Prison/1981	2463	30,637	12.4
Canada Sainte Anne des Plaine/1970	74	4,960	67
Canada Cowansville/1968	432	19,205	44.5
Canada Millhaven/1967	447	20,814	46.5
Europe			
Denmark Ringe	92	8,060	87.5
Germany Aschaffenburg/1970	108	9,069	84
Finland Hameenlinna/1973	167	1,940	11.5
Holland Maastricht/1975	231	18,180	78.5
Germany Ergste/1971	304	15,970	52.5
Sweden Kumla/1965	320	37,760	118
France Chateauroux/1972	384	29,118	76
Germany Darstadt/1968	434	27,216	62.5
France Muret/1967	610	43,776	71.5
Germany Stuttgart-Stammheim/1965	693	28,360	41
Poland Bialoleka /1970	1112	22,200	20
Italy Rebibbia/1971	1363	54,991	40.5
France Fleury Merogis/1968	2886	133,500	46
United Kingdom			
UK Blundeston/ 1963	300	14,198	47.3
UK Low Newton/ 1978	447	31,033	69
UK Channings Wood/1982	484	26,656	55.1
UK Long Lartin/1972	500	27,810	55.6
United Arab Emirates			
Al Ain/1984	270	16,966	62.83
Al Sader	520	28,393	54.6
Al Wathba/1988	570	26,078	45.75
Central Prison/ Proposed	1200	166,368	138.64

Table 3: The average area per inmate in different countries

Country	*Small <500*	*Medium 500-1000*	*Large >10000*
USA & Canada	45.73	29.57	40.61
Europe	71.31	56.25	35.5
UK	56.75	-	-
Average	57.93	42.91	38.055
UAE	62.83	50.175	138.64

Table 4: Analysis of Abu Dhabi prison buildings

Prison Name	Design Capacity	Floor Area m^2	Floor Area per inmate m^2
Al Wathba /1988	570	26,078	45.75
Al Sader	520	28,393	54.6
Al Ain/ 1984	270	16,966	62.83
Central Prison/ Proposed	1200	166,368	138.64

Table 4 shows the three existing prisons in Abu Dhabi and the proposed Central Prison project. Al-Ain is considerably smaller than Al Wathba and Al Sadar; consequently its floor area per inmate is higher. However, the proposed prison building floor area per inmate shows a large difference between international standards and the proposed design (Table 2). Table 3 shows the dramatic increase of floor space per inmate, in the proposed UAE prison. The prototype will be thoroughly examined in chapter 8 but it is difficult to fully justify a three-fold increase on the average international standards. In Figure 24 the different areas per inmate for the different prisons in UAE are illustrated. The figure also shows the large difference between the floor area per inmate in existing prisons, and the proposed air-conditioned one.

The following section investigates the energy performance of the proposed prison building.

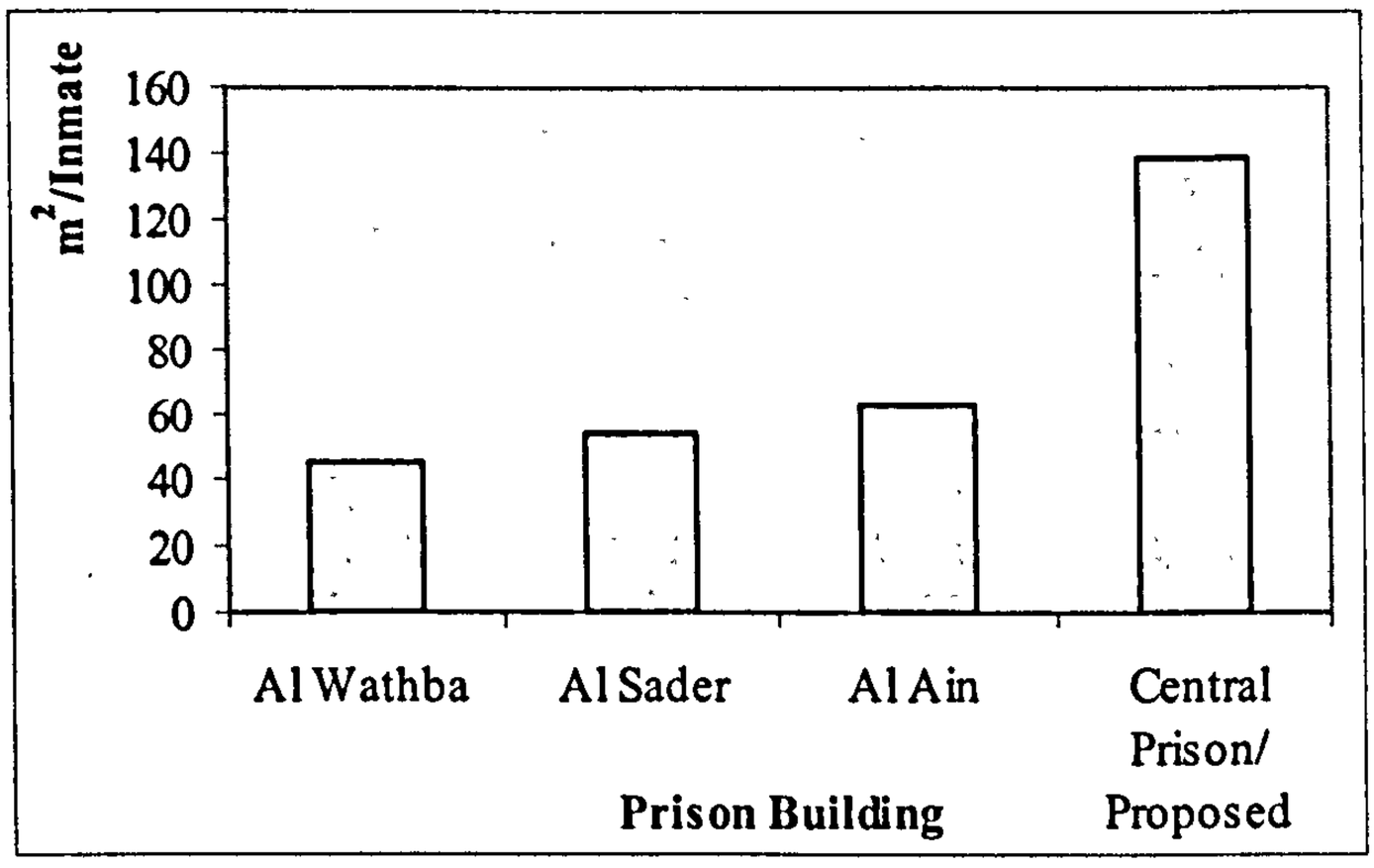


Figure 24: The area per inmate in Abu Dhabi prisons

2.5.2 Energy performance of the proposed Central Prison in Abu Dhabi

This section investigates the implications that the introduction of comfort as a main design factor will have for the design of the prison and the design of its façade, in turn.

The feasibility study that was conducted for the Central Prison project indicates that the building was designed for 1200 inmates. The design is meant to be a prototype, to be replicated in different Emirates. Thorough examination of the literature of the proposed study showed that heating at night as well as cooling load during the day have been considered and calculated in the new proposal. This leads to the conclusion that there was no or little, attempt to use passive energy means such as the use of thermal mass, or night cooling.

The cooling loads for the proposed central prison are assumed to be 4 MW, with 2 MW for heating load. This will add up to a total of 230 KWH/m^2. Table 5 shows the energy per square metre needed for maintaining thermal comfort in different types of building, in hot climates. It is clear from the table that the proposed prison cooling load is double the load in a residential building and 33% higher than the annual load/m^2 in a hotel.

Table 5: Electrical use to maintain thermal comfort in different typology of buildings

Type of Building	AC Electrical use KWH/m^2
Residential Villa	114.6
Hotel	154.2
Office Building	153
Prison	230

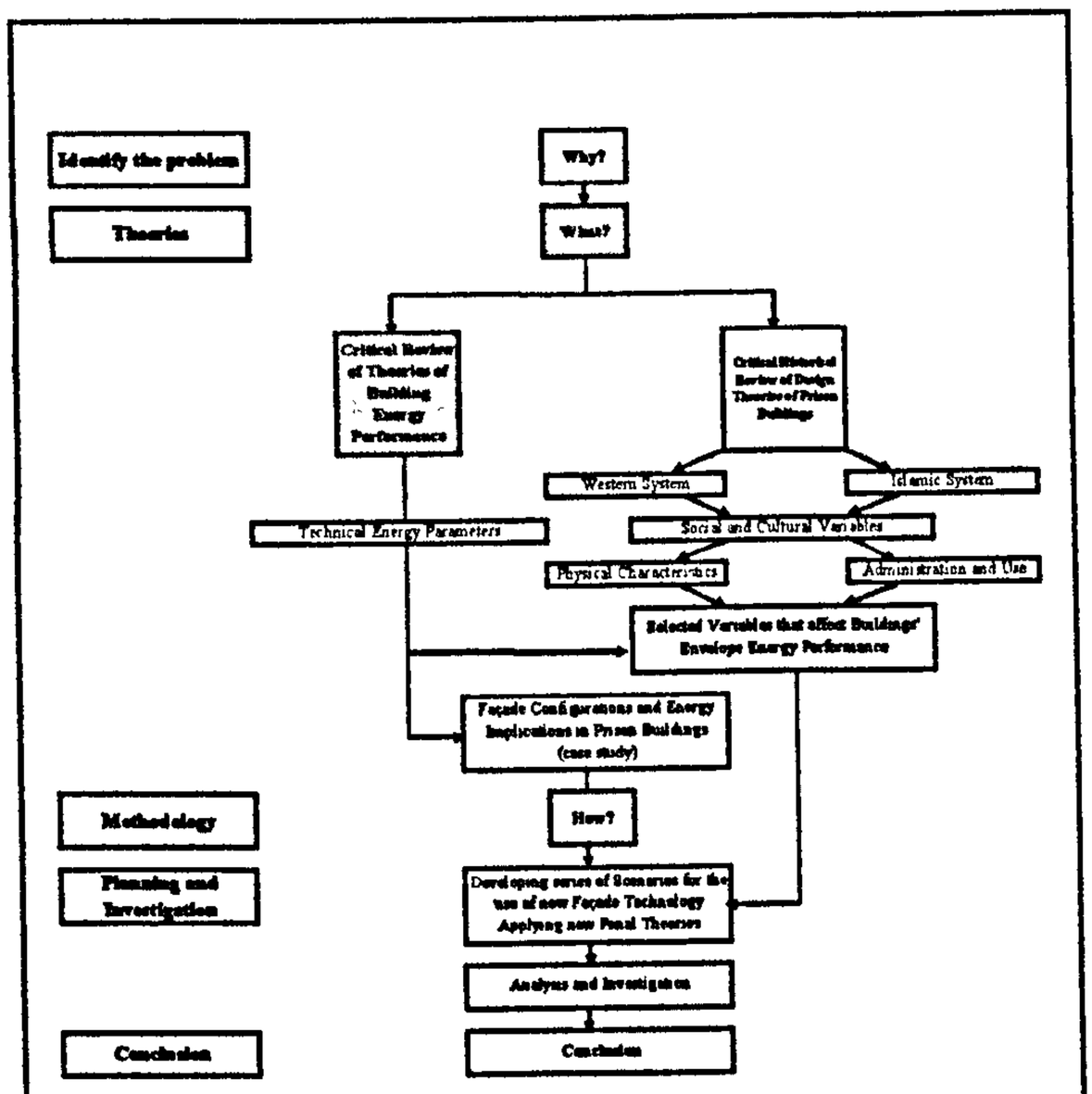
The estimated prison population in the Emirates of Abu Dhabi is approximately 5000 prisoners. Table 3 shows that the international standard for average floor area per inmate is 38 m^2. According to the proposed design, the total energy required to provide air-conditioning to all prisoners in the Emirates of Abu Dhabi should therefore be 43.7 GWH, approximately 0.6% of the total energy consumption in the Emirate of Abu Dhabi. If the proposed 138 m^2 is to be adapted, this amount would escalate to 158.7 GWH, 2.6% of the total consumption in the Emirate. As previously indicated, the building envelope in a hot climate can be responsible for 30% of such energy consumption (Figure 22). For prisons, this could be as much as 0.78 % of the total electricity consumption in Abu Dhabi.

2.6 Chapter conclusion

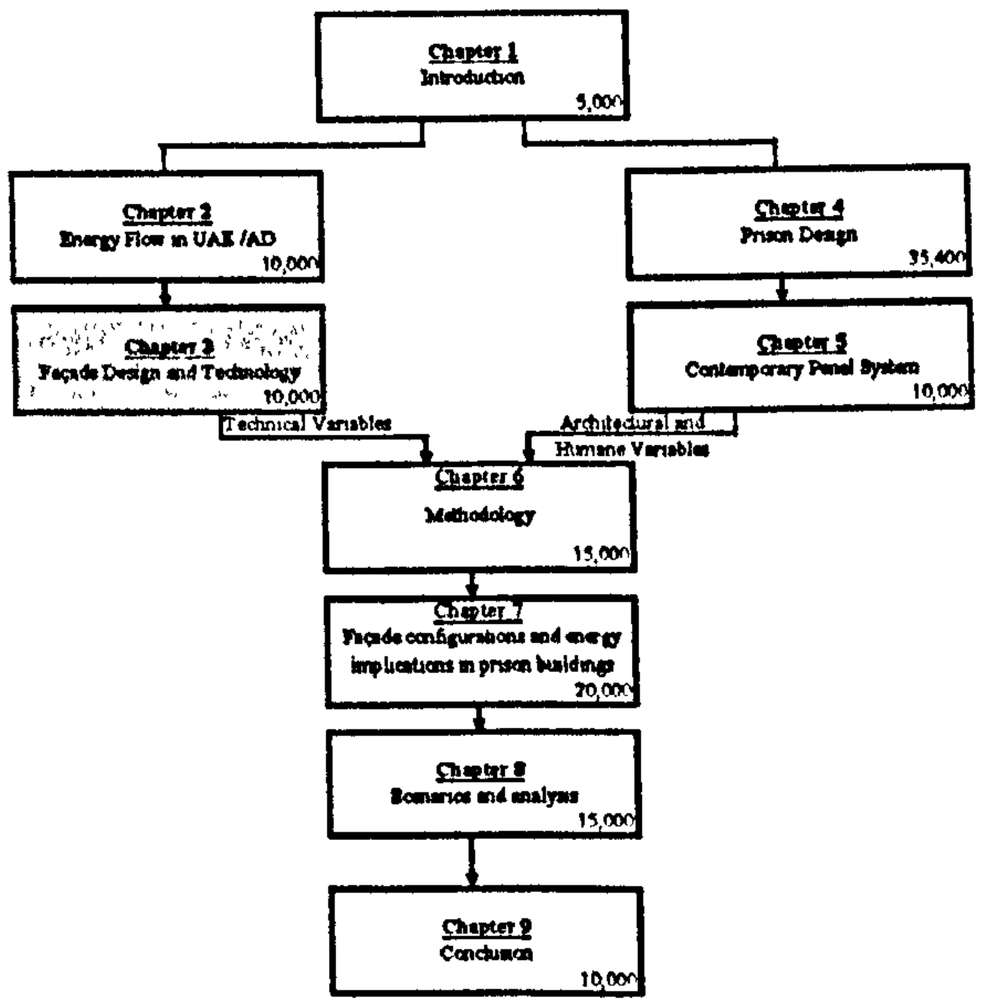
The building industry is a major sector for energy consumption in the Emirates of Abu Dhabi. The energy consumption is not only limited to the direct cost of air conditioning but also to the indirect cost and infrastructure required. In the developed world, buildings are responsible for as much as 50% of the total energy consumption (Harris *et al.*, 1998). In the Emirates, this ratio can be much higher. Elkadi *et al.* proved that in the UAE the building sector contribution is 80.5% of the total electric consumption, with 44% a direct result of air-conditioning. As a result of the hostile climatic conditions in the Gulf area, the building envelope has a major contribution to the energy requirement for air conditioning. Elkadi *et al.* (1999) showed that the building's envelope contributes to as much as 30% of the energy required in buildings. In the light of the new policy to increase the thermal comfort of the prison population, the role of the skin can be crucial to the total energy consumption. The design of a prison façade has specific characteristics. The development of prison façade design and its relation to environmental conditions is reviewed in chapter 4. Using expected energy consumption per inmate, and the expected increase in floor area in relation to increasing prison population and increase in comfort conditions, the expected total energy requirements for air conditioning has been calculated. An amount of 43.7 GWH is expected, if the policy of providing air-conditioning to all prison buildings to be implemented. This constitutes 0.6 percent of the total annual electric consumption in Abu Dhabi. The role of the prison's envelope can therefore be as much as 0.24%. Yik *et al.* (1998) shows that appropriate design of the façade can reduce this amount by as much as 30%. An approximate figure between 1.75 and 5.24 GWH could be saved if the thermal efficiency of façade were to be increased by 10 – 30% respectively. Such reduction could have serious implications, not only for the Ministry of Interior's budget for implementing this policy but also on the total Abu Dhabi electricity production and infrastructure. The savings could also positively contribute to a substantial reduction in CO2 emissions.

CHAPTER THREE

Façade Design and Technology



The Thesis Structure Outline



The Thesis Chapters Outline

3 Facade design and technology

3.1 Introduction

The aim of this chapter is to investigate the evolving configuration of façade design in the architecture of prisons. A deeper understanding of the historical background of this development will help in identifying the variables that are more sensitive to environmental forces, which manipulated and shaped such evolution.

The building envelope or skin comprises the outer elements of a building, including the foundation, walls, roof, windows, doors and floors (ASHRAE, 1999a). The envelope of a building, like the skin of a human body, is called upon to perform a multitude of simultaneous functions in a relatively thin dimension. These can be divided into energy related and non-energy related functions. In its role as a **building façade,** the building envelope often communicates important cultural and social information such as a sense of grandeur or permanence. The façade is the face of a building (Oxford, 1999). Hence, the development of architectural movements has in many instances been manifested in façade design. Some have gone so far as to state that the history of architecture is virtually the history of the skin of buildings (Tombazis, 1996). This chapter traces the development of façade design of prisons through history. The changing roles of façades are investigated and related to the various design movements.

The idiosyncratic character of prison buildings, which as illustrated in chapter four is visible in façade design, varies from the more general façade design. When ancient man searched for a shelter, façades were perceived as shields from the evil represented in natural forces. However when the use of prison buildings emerged, their façades had a reverse role. They shielded the outside from the evil inside, which is the human evil. It is hence essential to trace the development of prison buildings façade design in order to identify the distinguished façade variables of prison buildings.

A building envelope is not only a physical boundary between the indoor and the outdoor environments, but also communicates important cultural and social information. Providing clear definition of building envelope and façade is an essential prerequisite to the discussion to be carried out in this chapter. In literature, there are many different definitions of building envelope, building façade, and biological metaphors of building skin. The first section of this chapter illustrates the different known definitions of the

building envelope, skin and façade. The development of prison façade design with links to the increasing environmental awareness through history, is demonstrated in the second section. The third section focuses the discussion on reviewing the development of prison buildings façade design in relation to sustainability and rehabilitation issues. The chapter is summarised and its conclusion presented in the last section.

3.2 Façade definitions

Building skin, building envelope and building façades are different terms used to label the exterior elements of a building. This section illustrates the different definitions of these terms. Firstly, it is important to highlight the differences, if there are any, between the building's envelope, skin and façade.

3.2.1 Definitions

The Oxford dictionary of architecture offers two definitions for the **envelope**. The first describes it as the "Outer part of a building enclosing the interior volumes". The second presents it as "light waterproof protective cladding, e.g. glass and metal frames, protecting the structure, as in curtain-walling" (Curl, 1999). Powler and Kelbaugh (1990) defined a "building envelope" to be any surface that separates the thermally conditioned interior of a building from its environment. According to this definition, building envelope includes roofs, exterior walls, floors, ceiling slabs and foundation walls.

In order to determine building requirements, the American Society of Heating, Refrigerating and Air-Conditioning Engineers classified the building envelope into two parts: the exterior plus the semi-exterior portions of a building. These classifications are defined as:

"The **Building envelope, exterior** is defined as: the elements of a building that separate conditioned spaces from the exterior. **Building envelope, semi-exterior** defined as: the elements of a building that separate conditioned space from unconditioned space or that enclose semi-heated spaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from conditioned spaces" (ASHRAE, 1999b).

Among the various building envelope definitions, the discussion by Stein and Reynolds (2000) brought a new perspective to the subject. The authors rejected the general

tendency to label the building envelope as a set of two-dimensional exterior surfaces. According to the authors, the building envelope is more like a transitional space, 'a theatre where the interaction between outdoor forces and indoor conditions can be experienced'. The most important point that the authors highlighted is the envelope's "fourth dimension", that is **time.** Seasonal changes have a marked effect on the transition space, which consequently have an effect on the environmental aspects of indoor spaces. This dimension has a specific importance to the discussion of this thesis, which is illustrated in chapter nine.

The recent introduction of "**responsive**" materials into the building envelope construction, which is illustrated in detail in section 3.3.1.6, has encouraged using the term "**Skin**" when discussing the building envelope and sometimes the building façade. In support of this approach Tombazis (1996) compared the skin of buildings to different kinds of skins; of plants, animals and human beings. Tombazis stated four points that relate animal skins to those of buildings. These points are: adaptation to the natural environment and climatic conditions, variety and refinements related to different conditions, adaptation to changing conditions of temperature and the resulting aesthetic beauty.

In relation to human skin, Tombazis presented nine points of similarity to building skin. Building skin like human skin is perceived as a dynamic and multi-functional enclosure. They are both multi-layered. External factors, such as orientation, result in dissimilarity between the different parts of a building skin. Like human skin, special features are incorporated in building skins as a consequence of different needs. Building skin regulates the amount of water and air penetrating or escaping the building, to maintain the indoor air quality. The similarities exist in the tendency of building skin to shed its outer part and in its self-healing process. The eighth point is seen in the ability of building skin to perform as a generator of solar energy and other resources (e.g. water). The tendency of the building skin to act as a seasonal and diurnal regulator of energy to be reflected or absorbed as needed, is the last point of similarity between the building and the human skins (Tombazis, 1996).

In the recent two decades, the concept of the "intelligent building" has emerged. The term intelligent building was employed as early as the 1980s. Since then several definitions for the term have surfaced. Wigginton and Harris (2002) stated thirty-four definitions of "intelligent buildings" and thirteen definitions of "intelligent skin/ façade".

In the context of these definitions, it is apparent that "intelligent skins" and "intelligent façades" are sometimes treated as two faces for the same coin. For example Wigginton and Harris (2002) described the intelligent façade as an intrinsic part of the intelligent building, which performs the function of enveloping the inhabited interior. The authors used biological metaphors to confirm that it was more appropriate to describe the intelligent façade as the "intelligent skin", "emphasising its affinity with the human epidermis" (Wigginton and Harris, 2002). More discussion of the definitions of intelligent building and intelligent façade is carried out in section 3.3.1.6.

3.2.2 Envelope, skin or façade

The previous brief review of building envelope, skin and façade definitions shows that there is no clear distinction between the uses of these terms. Building skin has, however, become more dominant when referring to the exterior elements of a building. This may be related to the introduction of advanced technologies to building materials that made construction bio-climatically conscious. Building envelopes resemble to human body skin (Powler and Kelbaugh, 1990) and the skins of plants and animals (Tombazis, 1996). In this thesis both terms (building **envelope**, and building **skin**) are used with no distinction when discussing the outer part of a building. However, the term "**façade**" is used specifically to label the external walls of a building, which are comprised of opaque and glazed materials.

The previous definitions provide a preliminary understanding of building façade elements and functions. However, "the merit of any definition depends upon the soundness of the theory that results; by itself, a definition cannot settle any fundamental question" (Rawls, 1999: 130). Deeper investigation, hence, is essential to fully comprehend the role of building façades in general use, and more specifically in the prison-buildings context. Investigating the forces behind building façade development is the first step towards identifying sustainability related variables, which is the aim of this chapter.

3.3 Forces behind façade development

The basic human **need** for **protection** from natural forces has been the main driver of the development of façade design in buildings. **Traditionally,** local environmental factors shaped building faces and restricted the building envelope's role to mere functionality. That is to **secure** and **protect** the indoor environment and its occupants. Section 3.3.1.1 illustrates the traditional façade design and highlights its functions.

The invention of glass or more precisely utilising glass in architecture, marks the second and some argue the most important force behind building skin development. **Glass** has provided architects with power to **challenge** and **manipulate** environmental forces. The need to create enclosure for shelter, protection and privacy for the first time did not conflict with the need to transmit light, to provide illumination and view. Section 3.3.1.2 demonstrates how the façade's role shifted from being a shield from natural environmental forces, into being a manipulator of these forces.

The recent improvement in glass **technologies** in the twentieth century has dramatically extended this power and enabled architects to **ignore** environmental forces. The "**glass culture**" marked a beginning of an era, a new social age. Entirely glazed facades sealed the mechanically controlled indoor environment. Section 3.3.1.3 shows how glass has given mankind a false feeling of self-prominence and enabled them to disregard the local environment.

Nature, however, proved once more to be stronger. The human body rejected total isolation from the natural environment, and symptoms like **sick buildings syndromes** began to surface. Indoor **comfort** equations needed to be modified, and building skin design had to be the first to respond to the new movement. On the other hand, the energy crisis of the 1970s put more pressure on architects and engineers to create buildings that were more **energy conscious**. Details of how facades started to be perceived as **energy systems** are illustrated in section 3.3.1.4.

New agenda emerged in built environment research motivated by enhanced **information technology** in the 1980s. A paradigm shift occurred. Energy conservation was no longer the main priority. **Energy efficiency** has become the keyword. Rather than cutting back, the goal is to maintain expected levels of service, for example, in terms of comfort or lighting, but to do so using more efficient systems and technologies. Global warming and the need to reduce carbon dioxide emissions, in the 1990s, promoted a new round of

technical and scientific activity. Although the potential for nemesis in energy use and resources depletion was brought to light very clearly in 1972, in the Club of Rome's Report (Meadows, 1972), **sustainable development** as a concept in the built environment did not flourish until the early 1990s. Building envelope turned into a theatre for development of **technical fixes** that integrate different sustainability and energy efficiency measures. This final development is demonstrated in section 3.3.1.5.

3.3.1 Historical development of façade design

The brief discussion in the previous section illustrates the different forces that stimulated the development of façade design through history. Following the forces that shaped façade design, five main design approaches can be identified. These are traditional, climate responsive façades, the glass box, energy conscious façades and intelligent façades.

The traditional phase represents façades of pre-sixties buildings when building envelopes were held responsible for most building services: e.g. ventilation, cooling and lighting. However, by the 1960s the situation had changed dramatically and it had become widely accepted in the developed Western world that heating, cooling, and lighting of buildings could mainly be accomplished mechanically. The attempts to manipulate environmental forces in the early sixties, by using structural shading devices, developed into a total separation between indoor and outdoor environments in attempt to conquer the environmental forces. However, a major change in attitude took place following an increase of environmental awareness, which resulted from both an energy and environmental crisis. Façades were perceived as energy systems, and more recently with the advances of information technology to be treated as a theatre of interaction of different forces. The following sections illustrate in detail the different phases of façade design.

3.3.1.1 Traditional façades

Facades, traditionally, had very distinct regional characteristics. This resulted from being environmentally responsive. Some claim that climate sensitivity is the main force behind these regional differences in façade design (Lechner, 1991). This, however, is only partially accurate. Culture too has great influence on façade design. The availability of

materials in the local context is another major factor of envelope design. Hence, the term environmentally responsive is more accurate in describing traditional façades.

This section does not intend to present an extensive review of the different regional façades. A review of a few different examples will be sufficient to indicate how the environment has traditionally shaped buildings. However, before giving some examples it is essential to state the main approaches to environmentally responsive envelope design.

One can identify two opposing concepts of design in traditional building envelopes. These are the **open frame**, and the **closed shell** (Stein and Reynolds, 2000). The latter concept is mainly used in harsh environments. Environmental conditions can be undesirable, especially if the climatic conditions are severe or where unwanted external influences such as noise or intrusive activities abound. Building envelopes in this case act as a barrier and so this approach might be called "**barrier-dominated**" (Stein and Reynolds, 2000). Windows are no more than carefully selected punch holes, to make very limited contact with the outdoor environment.

On the other hand, the open frame is usually applied when external conditions are very close to the desired internal ones. The envelope begins as an open structural frame, with pieces of building skin selectively added to modify only a few out-door forces. The building envelope in this case acts more like a connector with the external environment. In contrast to the barrier-dominated approach where no, or only minimal contact between the external and the internal environments is required, the "**connector-dominated**" approach allows direct contact between the two environments (Stein and Reynolds, 2000). The closed shell concept has been widely applied in hot, arid and cold climates. The open frame structure has been functional in both hot, humid climates and temperate climates.

The igloo in the Eskimo's built environment is an example of a closed shell of ice (Figure 25). The envelope functions as a filter for light and heat, and as a barrier to wind. There is a cautious allowance for entry and smoke holes. Closed shells of mud blocks are utilised in arid environments, e.g. the Pueblo (Figure 26). The envelope operates as a barrier to wind and sunlight and as a filter for heat, by delaying and reducing its impact on the interior. Small windows and doors are usually south facing to admit some light and desirable heat. In hot and dry climates one usually finds massive walls, used for their time lag effect. Windows are very small to avoid admitting intensive solar radiation.

Another element employed to control solar radiation is the envelope colour. Light colours are usually applied to the exterior to minimise absorption of solar radiation, and to the interior to help in diffusing the sunlight entering through the small windows (Figure 27). The façades situated in regions with cold climates demonstrated similar characteristics, however for a different function. Heat retention was the role of the envelope here. Buildings tended to be very compact in order to curtail the surface area to volume ratio. Windows were minimised, as they were perceived as weak points in the thermally resistant envelope. Although this resulted in sacrificing views and daylight, the need to conserve heat was overpowering. Because hot air rises, ceilings were kept very low (Lechner, 1991).

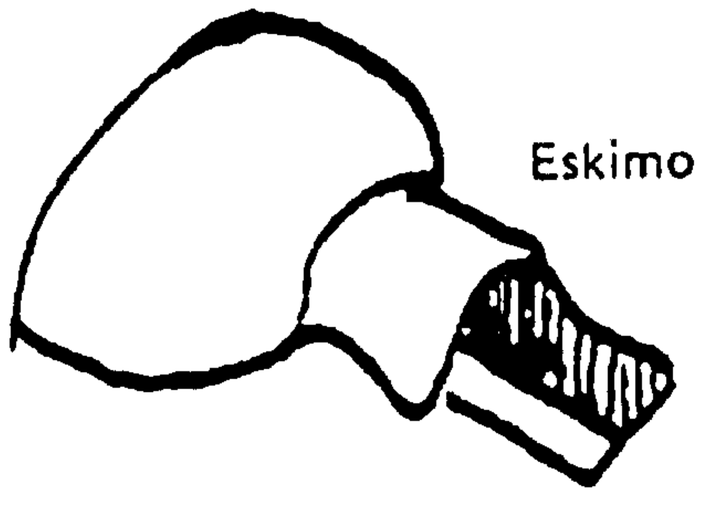


Figure 25: The igloo's closed shell of ice

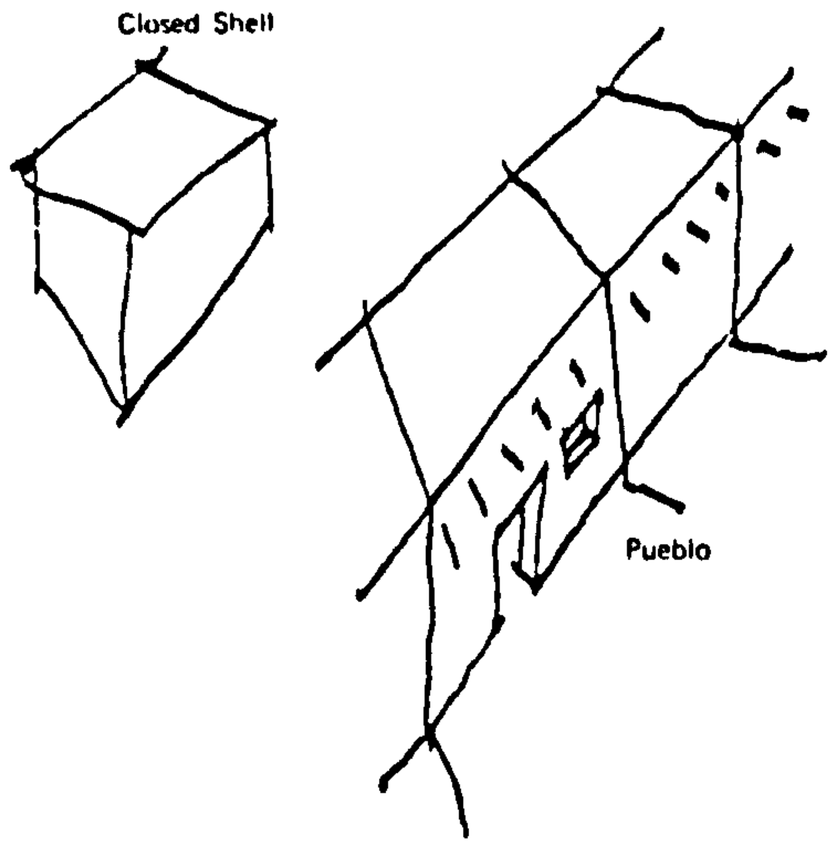


Figure 26: The closed shell of mud blocks

Figure 27: The heavy closed urban fabric in Saudi village

A different kind of design is found in hot, humid climates. Although temperatures are lower, the high humidity creates great discomfort (Koenigsberger *et al.*, 1973). The main relief comes from air movement across the skin to increase the rate of evaporative cooling. The native buildings of Sumatra in Indonesia provide a good example of an envelope design solution to this environmental problem (Figure 28). To the open frame, a barrier roof of local plant materials is added to resist rain and sun. A raised floor permits the occupants to avoid damp earth and its creatures and allow for maximum natural ventilation.

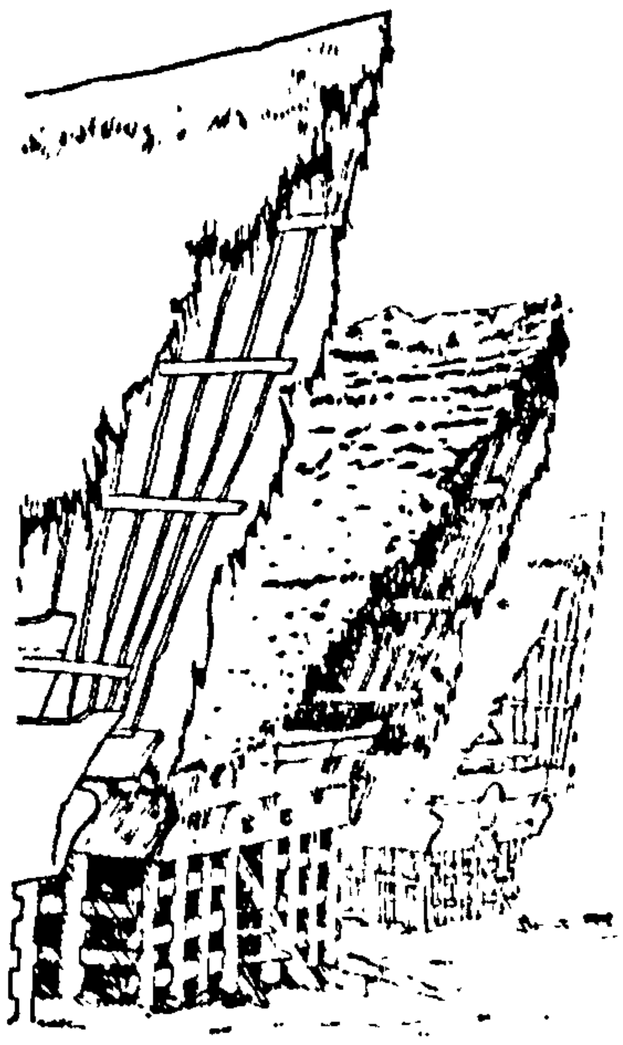


Figure 28: Traditional housing in Sumatra, Indonesia

In summary, in traditional architecture the role of building envelope ranged between being barrier-dominated and connector-dominated, following the influence of

environmental forces. However, with a wide range of energy sources, building materials, and mechanical equipment available, architects and engineers became armed with tools to manipulate the environment. As the next section points out, the structural shading devices approach marked a new era in façade design.

3.3.1.2 Climate responsive façades

Western architecture pioneered the world in abandoning traditional architecture and searching for a new architectural identity, following the Industrial Revolution. The essence of this new philosophy was set out clearly by Paul Scheerbart in 1914: " We live for the most part in closed rooms. These form the environment from which our culture grows. Our culture is to a certain extent the product of our architecture. If we want our culture to rise to a higher level, we are obliged, for better or worse, to change our architecture. And this only becomes possible if we take away the closed character from the rooms in which we live. We can only do that by introducing glass in architecture". He goes on to emphasise the relationship between architecture and culture by saying: "the new environment, which we thus create, must bring us a new culture". Cited by Wigginton (1996: 52-53).

The development of glass, iron and steel facilitated the implementation of this modern philosophy. Throughout most of the history of Western architecture, the exterior wall has been the predominant load-bearing element. Thus, the envelope of a building was also its structure. Hence the design of a building's façade could only respond readily to changes in style and technology when steel and concrete frames gradually replaced the exterior wall as structural supports, as it was no longer necessary for the envelope to accommodate a restrictive set of structural requirements. The skin became a "curtain wall" a largely autonomous subsystem with surface continuity in an overall building assembly. At the same time, the rationalisation of mechanical systems made interior planning more regimented and systematic. Increasingly, the distinctions between types of commercial could be read only in the aesthetic interpretation of the facade and not in the articulation of plan and section (Powler and Kelbaugh, 1990).

Parallel to the rapid development in building materials technologies, there has been increased interest in the effect of climate on humans, on one hand, and in the relationship between climate and architecture on the other. This interest is reflected in numerous publications as well as the growing research activity in these subjects. The relationship

between climate, man, and architecture has three inseparable aspects. These are physiological, physical and the architectural (Givoni, 1972).

Understanding the climatic elements and the elements of heat exchange between human and their thermal environment, has gained priority in the research agenda. Thermal comfort became the main concern of many researchers, such as Fanger and Olgyay. Controlled experiments were the main method used to produce single scales that combine the effects of the four environmental factors (air temperature, humidity, radiation, and air movement) on the human body's heat dissipation process. Such scales are collectively referred to as "thermal indices" or "comfort scales". The first known of these is the effective temperature (ET) produced by Houghton and Yalgou in 1923.

With modern science and technology, the role of façades shifted from shielding inhabitants from the exterior environment. They are expected to be waterproof and water-vapour resistant, to provide thermal comfort and good interior air quality, and to control the transmission of ambient noise and the fragile human "comfort zone" inside. The façade's new function is as "**environmental filter**" (Figure 29).

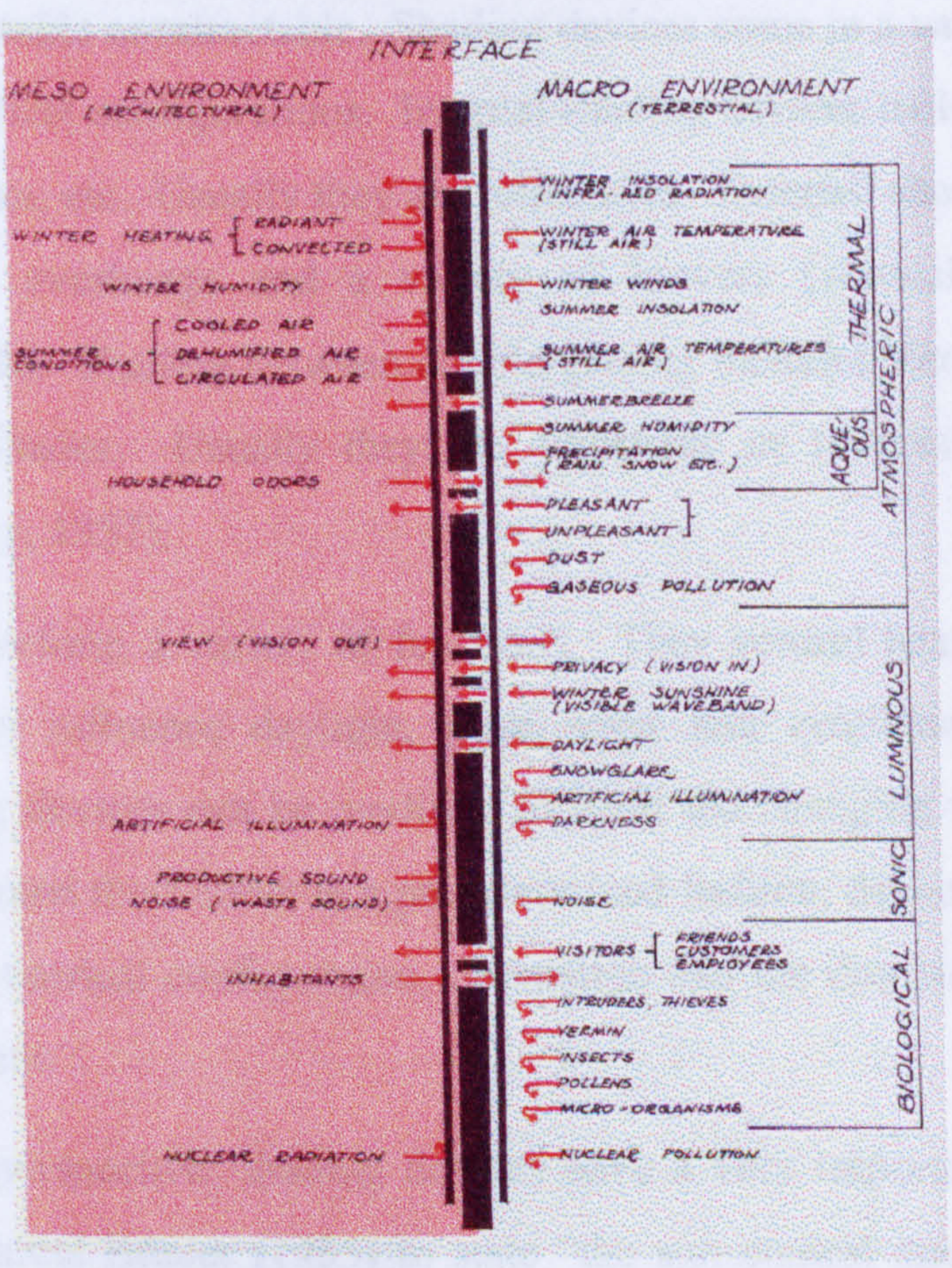


Figure 29: The building envelope as environmental filter (Fitch, 1972)

Orientation, window elements, building materials, etc. were utilised to manipulate natural forces and filter the external environment. The choice of orientation is subject to several considerations including the view, the location of the building, the topography of the site, the location of the source of the noise and the nature of the climate. Orientation can affect indoor environment in two aspects. It can regulate the influences of solar radiation, and ventilation problems associated with the relationship between the direction of prevailing winds and the orientation of the building (Givoni, 1972).

Extensive studies of the thermal effect of windows and efficiency of shading devices (Olgyay and Olgyay, 1957; Olgyay, 1963; Givoni, 1972) provided wide understanding of the control potential that window elements can have on the external environment. The use of special glasses or glass treatments can to a certain limit control the thermal effect of windows, however, when shading devices are applied in combination with glass, they can modify to a very great extent the window's thermal effect. The use of shading devices dominated façade design in hot climates.

Shading devices can be applied externally, internally or between double-glazing. They may be fixed, adjustable or retractable. Shading devices come in a variety of architectural shapes and geometrical configurations. Internal shading devices include Venetian blinds, roller blinds, curtains, etc. Usually they are retractable. External shading devices include shutters, awnings, overhangs and a variety of louvers (vertical, horizontal and a combination of both). Shading between double-glazing includes Venetian blinds, pleated paper and roller shades. Usually they are adjustable or retractable from the inside (Olgyay and Olgyay, 1957).

Shading devices perform a variety of functions. They control heat gain (constantly or selectively). They influence daylight, glare, view and ventilation. Adjustable and retractable shading devices can be modified to fulfil the changing requirements at will, but fixed devices exert their effect in a predetermined fashion, depending on the interplay between their geometrical configuration, orientation and the diurnal and annual patterns of the sun movement.

From a different perspective, shading devices have a very important role aesthetically. This provoked Marcel Breuer (1955) to state "the sun control device has to be on the outside of the building, an element of the façade, an element of architecture. And because

this device is so important a part of our open architecture, it may develop into as characteristic a form as the Doric column". Cited by Lechner (1991:133).

The rapid industrial development of building material technologies, glass in particular, changed once more the face of buildings. A new era emerged and glass plays a major role in the new design movement, which is illustrated in the following section.

3.3.1.3 Technology driven façades

Glass developed rapidly between the two World Wars. In the 1920s and 1930s toughened glass appeared. In the same era, the technique of heat-strengthening glass was introduced. However, it was not until 1928 that glass was developed to be the material that is in use at present (Wigginton, 1996). This provided the basis for all the developments in structural glazing, which took place after World War II. High-quality glass, the product of new technologies, became a key material in the development of simple, good street building; glass architecture was poised to move into a new and larger role.

The development of the curtain wall in the 1950s and 1960s rendered a different image than pre-war architecture. This was a result of the congruence of interest between commercial developers and commercial curtain wall installation contractors. The universal objective of these developers was the construction of buildings, which maximised rental return against capital outlay. The brief for these buildings, a new typology namely office buildings, was simple and straightforward. The production of maximum office floor area, flexibility for office use, greater window area and lowest possible cost were the main keywords.

From view point of aesthetics, commercial buildings of that era were generally designed as abstract, non-figurative compositions lacking orientation differentiation and in poorer examples, lacking human scale (Powler and Kelbaugh, 1990). Building façades became anonymous glass panels. The façade function shifted once more. The building envelope was now to seal the indoor environment against natural forces. Mechanical solutions enabled architects to ignore those natural forces creating totally independent indoor environments.

These commercial buildings were labelled as a sort of "international style" but without the style. Others called it "instant architecture" (Wigginton, 1996). The 1972 energy

crisis was the determining factor in the existence of this design movement. The low cost of energy made this typology of buildings desirable, however, the shock of discovering that energy is a limited resource led to a new attitude.

From a different perspective, the notion that this International Style had encouraged too much uniformity in building façades, which resulted in climate-insensitive designs, provoked a different kind of concern. For some, the main concern was less about excess energy consumption than over the lack of architectural "honesty". Others argued that buildings should respond to their context, and that an important part of this context was the climate. In the light of the monotonous of skyscrapers of the 1960s, the message that orientation should affect fenestration was a welcome idea in many quarters. Nevertheless architectural expression was more the goal than energy efficiency (Powler and Kelbaugh, 1990).

The notion of "totally" sealed facades failed aesthetically and functionally. Their energy consumption was huge, and their occupants were not happy. Syndromes such as "sick building syndrome" emerged and occupants requested more contact with the external environment and more control over their indoor environment. A new solution was required and hence a new attitude in façade design emerged.

3.3.1.4 Energy conscious façades

The price the world had to pay for ignoring environmental forces was enormous. A lesson had to be learnt. Building envelopes were now called upon to perform a multitude of simultaneous functions, in a relatively thin dimension. These functions can be divided into energy related and non-energy related.

The non-energy functions are mainly to provide shelter for occupants and to control indoor air quality. The envelope has construction functions that are strength and rigidity, stability and durability, control of heat, air and moisture vapour flows, control of liquid water movement cost-effectiveness and fire resistance. The envelope is responsible for the building's acoustical performance and of course should respond to aesthetic considerations (ASHRAE, 1999a).

To understand the full complexity of the influence of the envelope on building energy performance, Powler and Kelbaugh (1990) isolated seven energy-related functions.

These functions are performing as a thermal valve; a radiant filter; an air infiltration barrier; a moisture membrane; an energy collection or distribution device; a thermal, electrical, or chemical store and as a dynamic filter.

1. Function as a thermal valve: the building envelope, through its thermal resistance (R value) regulates the flow of thermal energy from the interior to the exterior environment (or visa versa).

2. Function as a radiant filter: the envelope transmits, absorbs or reflects radiant energy.

3. Function as air infiltration barrier: the envelope breathes by allowing exterior air to seep through cracks and openings or by intentionally introducing air through vents and fans. The design of the envelope is one of the principal factors that determine the level of air infiltration into a building. The envelope also acts as a barrier to airborne substances, such as pollutants and odours.

4. Function as a moisture membrane: the envelope controls moisture content within the building.

5. Function as energy collection or distribution device: many solar thermal systems collect radiant energy at the building envelope to enhance the building's thermal performance. Designers have also begun to regard building envelopes as plenums or chases that distribute essential building services.

6. Function as a thermal, electrical, or chemical store: the building envelope can store energy. For example by using mass walls, the skin is utilised to provide thermal capacity in which heat can be stored for later use.

7. Function as a dynamic filter: buildings envelopes have been able to change their faces in the past using shutters, awnings and other movable devices.

The post-energy crisis era witnessed the application of considerable resources into research and development, not only in envelope energy performance, but also in human thermal comfort. Four main specific research themes can be recognised within the general theme of thermal comfort (Markus, 1980):

1. **Thermal Index:** these studies aimed to produce a family of predictive tools which gives a designer a thermal index which can accurately predict the consequences of any unique combination of the four environmental variables (air temperature, humidity, radiation, and air movement), and the two personal ones of clothing and activity. These studies were mainly clinical experiments. The methods used were similar to the ones explained above: controlled laboratory experiments.

2. **Assessment of Discomfort:** the aim of these studies is to find a method to assess discomfort. Such assessment will clearly have to express not only the degree of discomfort (warm or cold) felt, but also its duration and the number of people in a group who are affected by it. Several approaches have been used; the two main ones are semantic and behavioural. In the semantic approach, people are asked to express their impressions of the environment on a linear scale in which numbers are fitted to phrases using questionnaires (e.g. ASHRAE, 1972; Fanger, 1970). The behavioural approach includes measures such as those of sweat rate, oxygen consumption, activity adjustment, analysis of clothing worn and observation of peoples' choices in setting thermal controls, opening windows, etc. These methods are complex. The observation of physiological behaviour, which is outside conscious control, is especially suited to the laboratory. Observation of the other types of behaviour is ideally suited to field studies, and involves no interference with the normal routines of life. However, most laboratory and field results are based on the simpler semantic techniques, in which people are asked to express their feelings about an environment in words. These expressions are quantified by scaling and then correlated to variations in the environment and in clothing and activity levels. The analysis may be based on open-ended interviews or questionnaires. Humphreys' (1975) field studies are one example of this approach. It was emphasised, however, that semantic approaches are more reliable for their clarity and accuracy.

3. **General Index of the Environment:** There is a need for a practical general index of the environment itself, adequately accounting for activity and clothing, to give the designer a measure of the general quality of the environment. This need was transformed into the development of the DISC index, which has been developed following the experimental methods described in the sections above.

4. **Special Factors:** there has been a considerable amount of research investigating what were known as the special factors that may influence comfort assessments: age, sex, state of health, sleep transients, subjective judgments such as "freshness" and "stuffiness" and others. These studies were mainly laboratory-controlled experiments. However, several field studies started to appear. Humphreys (1975) carried out a comparative analysis study, where he compared laboratory-controlled experiments with field studies. One of the most important results of his study was that while laboratory work carried out in different centres and over a long period of time shows reasonable agreement, field studies show a much greater variation. Following this conclusion the importance of qualitative approaches was recognised. A new term emerged, "Field Laboratory", where thermal comfort research was conducted using systematic observation, measurement and recording of data (Markus, 1980).

Before 1972, the envelope's influence on building energy consumption was not a major issue in architectural design. In this context, envelope performance was measured in terms of instantaneous heat gain or heat loss. There was no organised comprehensive database for energy consumption patterns nor understanding of the impact of the envelope on the energy performance of whole buildings.

The best-known and most accessible literature directed toward architects on building design and energy consumption tended to stress "climate-responsive design", and not specifically "energy efficient design". The perspective of most of these authors was to optimise building envelope design before mechanical systems intervened. The primary envelope strategy discussed was solar control, typically by shading, in warm climates. Mathematical modelling in this literature was rudimentary, and severely hampered by tedious hand calculation procedures.

In 1972, the average design practitioner perceived two strategies for affecting the climate responsiveness of a façade: altering the U value and controlling solar radiation. Altering the U value is generally translated into increasing the insulation levels in the building's envelope. Sun control implied solutions ranging from reflective glass to reduce shading coefficients to the use of explicit exterior shading devices like overhangs, louvers or fins.

With respect to solar design, the basic design philosophy was defensive. Usually, the goal was to protect the building envelope from climatic extremes rather than to employ solar radiation for heating on lighting.

In 1972 a building was perceived as a kind of appliance that required energy to operate. However, energy-sensitive envelope strategies provided a wide variety of consequences on a building's overall design. Sometimes an envelope design idea has formal implications (the shape of the building responds); sometimes only components need to vary (such as a shading device on a façade); a change in materials may be required with little impact on appearance (such as in the application of low-emissivity glass or films to windows); while at other times, only a variation in the building's use may be required (such as a change in occupancy schedule).

The energy conservation design strategies based on highly insulated fabric and efficient service measures brought back the complicated problem of the building façade. The need for light, view and contact with the external world still existed. In design language this meant more glass. Hence, instead of giving up on glass, the industry came up with more efficient solutions. Façades once more faced a change in function. The following section gives a brief review of the façade's role in the present.

3.3.1.5 Intelligent façades

The energy and environmental crisis placed architects and engineers in a critical situation. The ancient conflict between natural forces and indoor comfort is surfacing once more, with calls to minimise the use of glass to reduce energy consumption. However, most architects and engineers are reluctant to abandon glass. After all glass on one hand is impermeable, long-lived and transmissive; on the other it is characterised with quality modulators of heat, light and sound transfer, which are needed for a total performance.

The expectations of building envelope have not changed much, however, the factors that have radically changed are: the increasing understanding of man's experiential requirements; the increasing technical ability to manipulate environmental forces and the increasingly complex institutions and processes required to sustain social life under these new circumstances (Fitch, 1972). Together, these new factors have at once required and made possible a whole new order of building performance.

A new solution for the old-new conflict of building façade is inevitable. In 1981 Davis and Rogers described what was perceived then as a radical new proposal for the way to design building façades (Davies and Rogers, 1981). "We need to develop a new integrated window wall, where all these elements are one where multiple performance is integrated in one single element. What is needed is an environmental diode, a progressive thermal and spectral switching device, a dynamic interactive multi-capability processor acting as a building skin". They add "This environmental diode, a polyvalent wall as the envelope of a building will remove the distinction between solid and transparent, as it will be capable of replacing both conditions and will dynamically regulate energy flow in either direction depending upon external and internal conditions, monitor and control light levels and constant ratios as necessary at all points in the envelope. The wall would be capable of energy transfer along its surface adding to or removing energy from building zones which are too hot or cold, trading energy surplus for energy need" (Davis and Rogers, 1981:56).

The concept that Davis and Rogers presented has been has labelled as the "intelligent façade" and become widely implemented. Hence, the building envelope is no longer perceived as a two dimensional exterior surfaces, it is a transition space. A theatre where the interaction between outdoors forces and indoors conditions can be experienced. It is argued that the building envelope has a fourth dimension, that is **time** (Stein and Reynolds, 2000). The façade's energy and social performance changes throughout the day and the year. In the course of the discussion, it will be proved that such quality can be utilised to achieve sustainability in prison buildings. However, this section aims only to illustrate the definitions of the intelligent façades and the technical variables that distinguish this type of façade.

3.3.1.5.1 Definition

There have been a considerable number of attempts to define the intelligent facades. However, this section does not attempt to describe all of them. Two examples are presented here. Wigginton and Harris (2002) presented a comprehensive list of definitions. Intelligent façade is defined as a façade incorporating variable technology, which would amend itself to provide comfort conditions inside the building whatever the external environmental conditions might be, in any particular building location (Wigginton and Harris, 2002). Others argue that in order for a glass façade to be

described as "intelligent", it has to make use of natural, renewable energy sources, such as solar energy (Compagno, 1999). In his definition of intelligent façade Compagno stated "the word intelligent" indicates the dynamic, almost living capability of a façade to adapt to changing daily or seasonal conditions in order to achieve a reduction in a building's consumption of primary energy" (Compagno, 1999:129).

3.3.1.5.2 Intelligent façade features

In a survey carried out by Wigginton and Harris (2002) which covered twenty-two case studies, twelve intelligent features were identified. These are: building management systems, learning ability, environmental data, responsive artificial lighting, daylight controllers, sun controllers, occupant control, electricity generators, ventilation controllers, heating and temperature controllers, cooling devices and the double skin.

Compagno (1999) illustrated six examples of intelligent glass façade features. These are single-skin façade, double-skin façade, storey-high double-skin façade, building-high double-skin façade, shaft façade, and climate halls.

3.3.1.5.3 Energy performance of intelligent façades

A large number of research studies have recently revolved around the evaluation of 'intelligent buildings'; less attention, however, has been given to the evaluation of the performance of the skin. The main reason is the difficulty in evaluating a building's skin without the performance of its building as a whole. The definition of the skin boundaries is not yet clear (Elkadi, 2000). It is debatable whether intelligent buildings can save energy. It has been claimed that many intelligent buildings use a lot of energy (Matsunawa and Nohara, 1994). The sustainability of intelligent skin features has been questioned; for example there have been demands to clarify the biophysical and psycho-cultural advantages of the double skin in order to describe it as a configuration element of sustainable architecture (Diprose and Robertson, 1996).

There are no definite criteria to evaluate intelligent skins, however there have been several attempts. For example an ecological approach for the evaluation of intelligent energy features in a building's skin was proposed by Elkadi (2000).

3.3.1.5.4 The future

The future of façade design is ambiguous. However, what is clear is that a "building façade should no longer be regarded as a static and inert barrier, but a dynamic environmental filter, with the energy passing through it ripe for exploitation. Such a façade can make a significant contribution to the highly evolved building of the future, designed and equipped to take advantage of the new nanometric technologies, and deliver a new aesthetic for architecture, bio-climatically devised, regionally based, technically competent, with new forms of beauty" (Wigginton and Harris, 2002:44).

3.3.2 Sustainability related façade variables

There was an early recognition of the building impact on the environment dating back to the writings of Vitruvius (Vitruvius, 1999). The pace of urbanisation and industrialisation in the late nineteenth century triggered concerns about environmental damage. documented in the writings of William Morris (Morris, 1972; Morris, 1910-15). These concerns, however, were not acted upon until as late as the 1990s when climate change and greenhouse emissions shook the world. Sustainability took priority in the built environment research agenda. Energy conservation and energy efficiency themes that surfaced in the 1970s and 1980s, respectively, became part of the bigger picture. The new goal of architecture was summarised in the 1993 UIA/AIA declaration of interdependence for a sustainable future: "Buildings and the built environment play a major role in the human impact on the natural environment and on the quality of life; a sustainable design integrates consideration of resource and energy efficiency, healthy buildings and materials, ecologically and socially sensitive land use, and an aesthetic sensitivity that inspires, affirms, and ennobles; a sustainable design can significantly reduce adverse human impacts on the nature environment while simultaneously improving quality of life and economic well-being" quoted in Wigginton and Harris (2002: 14).

There is an increasing wide acknowledgment of the need for interdisciplinary approaches in energy studies, and in particular façade design. Efforts are being made to bridge the gap between social and technical variables in order to help address sustainability issues. Social scientists are demanding a more leading role in the sustainability of incarceration and penal systems that targets social, economic and technological needs, to guide innovation in prison philosophy. Architects and building engineers usually investigate sustainability of the built environment from a technological point of view, with introduction of technical fixes that will improve façade performance. The brief history of energy-related building research shows that it has been dominated by a view of the building as an essentially physical entity, with uniform physical and technical properties. A new discipline of the 'sociology of energy and buildings' has emerged. This concept and other similar methodologies are discussed in more detail in Chapter 6. It is however important to refer to these new trends here while attempting to gather together the main variables that influence sustainability efforts in prison design.

A summary of the technical variables is provided in this section while social and cultural issues will be addressed in the following chapters. The previous discussion shows that the design of prison buildings can be strongly related to the institution's mission and goals. Discussion of the UAE case shows how such mission and goals has changed dramatically with the increase of the local prison population. The rehabilitation strategies have gained more momentum, and the purpose of the prison building altered. The institutional mission and goals are in three parts; the purpose, the responsibility and the philosophical direction. The three parts can directly influence the design of the building and are likely (as discussed in Chapter 7) to have direct links to the architectural variables of prison design. Design guides for prison buildings have identified nine elements that should be considered in their design. Previous discussion showed that there are three categories that have influenced the development of facades, **Design, configuration, and material.** The three categories are thought to provide a good basis to investigate the technical factors that influence the sustainability of prison façades. Chapter 7 examines the link(s) between the institution's mission and goals, and the technical variables and indicators that have links with these three categories.

3.4 Forces behind façade development in prison buildings

Prisons are a very distinct building typology. The special characteristics of prisons are explained in chapter four. This section, hence, does not intend to provide a detailed demonstration of the different movements in prison design. A brief demonstration is, however, essential to illustrate the different forces that shaped prison buildings façades.

Section 3.3 demonstrated how the development of general façade design was mainly linked to environmental forces. The occupant's well-being has been a major influence on facades design throughout history. The case in prisons, however, might be different. Prisons façades contrary to other typology of façades, aimed to protect the outside from the inside. Inmates were perceived as source of evil that society needed to be shielded against.

The different prison façade design movements reflected different **penal** systems. Prison began its existence as **confinement** spaces, a function that survived for centuries and still exists. Prisons acted as symbols of **power,** as they were located in castles and forts in medieval Europe. Between the 16th and the 18th centuries the efforts of prison **reformers** showed some success and prison buildings began to gain an individual identity. Houses of correction were purposely built as **reformatories.**

The decline in public punishment between the 17th and 18th centuries, following the development of new attitudes towards the human body, transformed the prison into being the centre of the penal system. This transformation resulted in the emergence of **incarceration architecture** (Foucault, 1977). The fundamental issue in the newly established prison was still reform. The main characteristics of the reformed prisons were: security, salubrity and reformation. Façades had to help fulfil these functions.

Two new penal systems emerged in the early 19th century, which influenced prison architecture until the first half of the 20th century. Incarceration architecture had a new role to fulfil. Architecture was utilised to prevent communication in order to achieve treatment. Inmates were considered to be patients who needed reform. Contact with the "outside" in any form had to be restricted, in order to achieve rehabilitation. Façades had symbolic and ideological statements to present. Façades made important statements about external social relations, concerning how the prison was to be seen by society as an instrument of social policy (Markus, 1994).

Prisons in the later 20th century to the present day however, present a different attitude. The new of generation prisons pioneered in the US found international acceptance and wide implementation. The façade design of the new institutions shifted radically. In contrast to the prisons of the 1950s and earlier eras, glass façades emerged in the design of contemporary prisons. The austere functional style and lightness that characterised civilian and residential structures became applicable to prison façades (Johnston, 2000).

The following sections illustrate in more detail these different façade design movements.

3.4.1 Historical development of façade design in prisons

The evolution of prison buildings architecture is intimately bound up with the development of penal theories over the centuries. Architecture was not only a reflection of the institution; it was a vital instrument in carrying out its goals. The change in social, political, economical and cultural characteristics of Western societies had important influence on the development of both the architectural configuration of the prison and the institutional management and administrative regimes.

The aim of this section is to investigate the development of façade design in prison buildings through history.

3.4.1.1 Ancient prison building façades

Before the 18th century prison had marginal role in the system of punishment. It was mainly an interlude between court appearance and ultimate, usually physical, punishment. Confinement places tended, therefore, to be "opportunistic" occupying structures built for different purposes (Johnston, 2000).

As a result of the absence of architectural identity for prisons, there was no façade design movement to be traced. The envelopes of the "spaces" used to confine the offenders, acted as a shield to protect the outside environment from the human evil that occupied it.

3.4.1.2 Fortified prisons

In the second half of the 12th century the concept of political enemies emerged in England following the requirements of William I, who gave orders to build the first royal prison in order to contain his enemies. The common response was to modify existing castles, fortresses, and city gates to accommodate the prisoners. In some cases prison chambers were specifically constructed. Prison rooms in castles, whether newly built or adopted, were commonly located on one of the lower levels of the keep, the outer wall on the towers (Evans, 1982).

It was believed that the walls around the edges of towns marked the boundary between human, artificial creation and the natural world of the gods. Thus, placing offenders in the city walls and gates was a way to protect the society from foreign elements and the impurity of the offenders (Markus, 1994).

It is difficult to define any special characteristics or configuration that distinguish these prisons, which can barely be termed prisons as they were hardly ever built with the purpose of functioning as such. The effective measurements of a good prison at that time meant two things only: maximum security and brutal treatment. The design of façades reflected the same message. The image that such forts represented was uninviting and cavern-like, with frightful inscriptions to inspire darkness, threat, ruin and terror. The façade here was utilised as a deterrent tool (Figure 30).

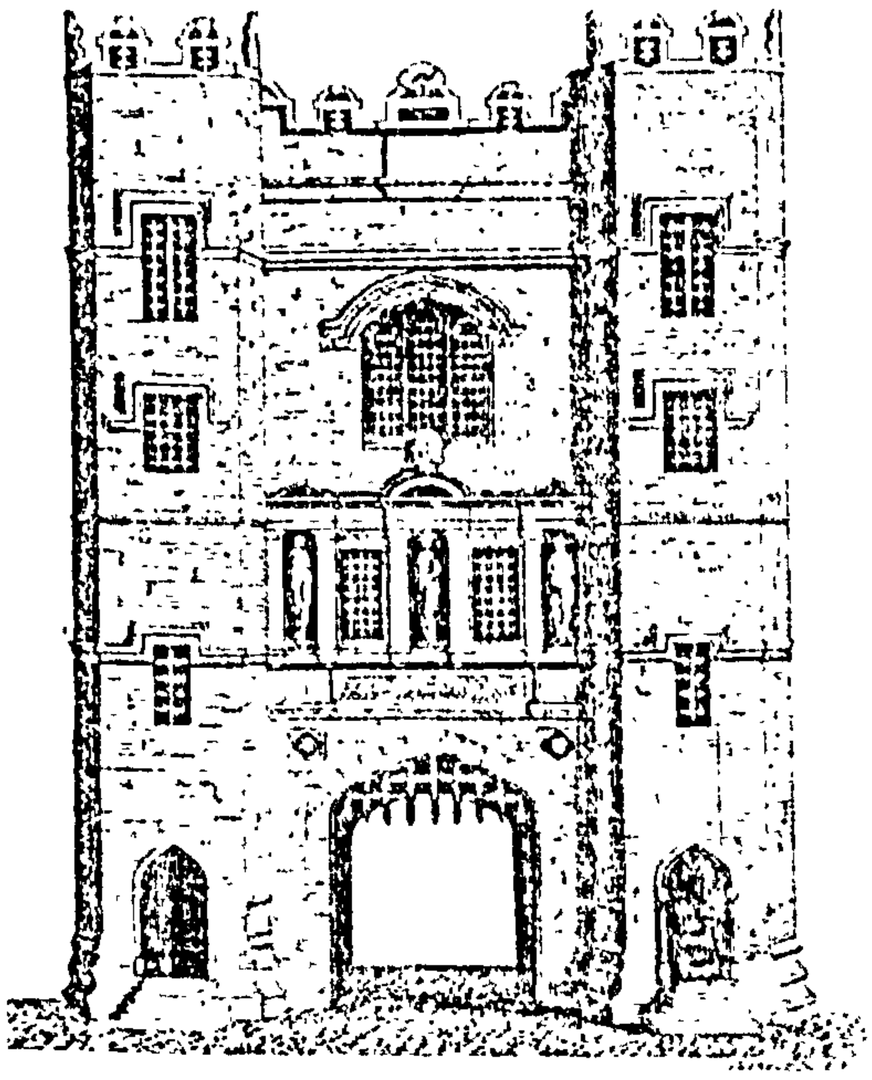


Figure 30: Prison in the fort

3.4.1.3 Facades for correction

The concept of house of correction, or the workhouse, emerged in Europe in the 16th century. The workhouse was built on the idea of the rehabilitative value of regular work and the formation of habits of industry. Although the workhouse was a result of a new humanitarian spirit of the times which demanded less harsh treatment for minor offenders, the prisoners' *comfort* was not an issue in designing the workhouse (Fairweather, 1975).

Inmates were confined in a sealed environment. The small windows were grill barred. Inmates had no contact with the outside environment (Figure 31).

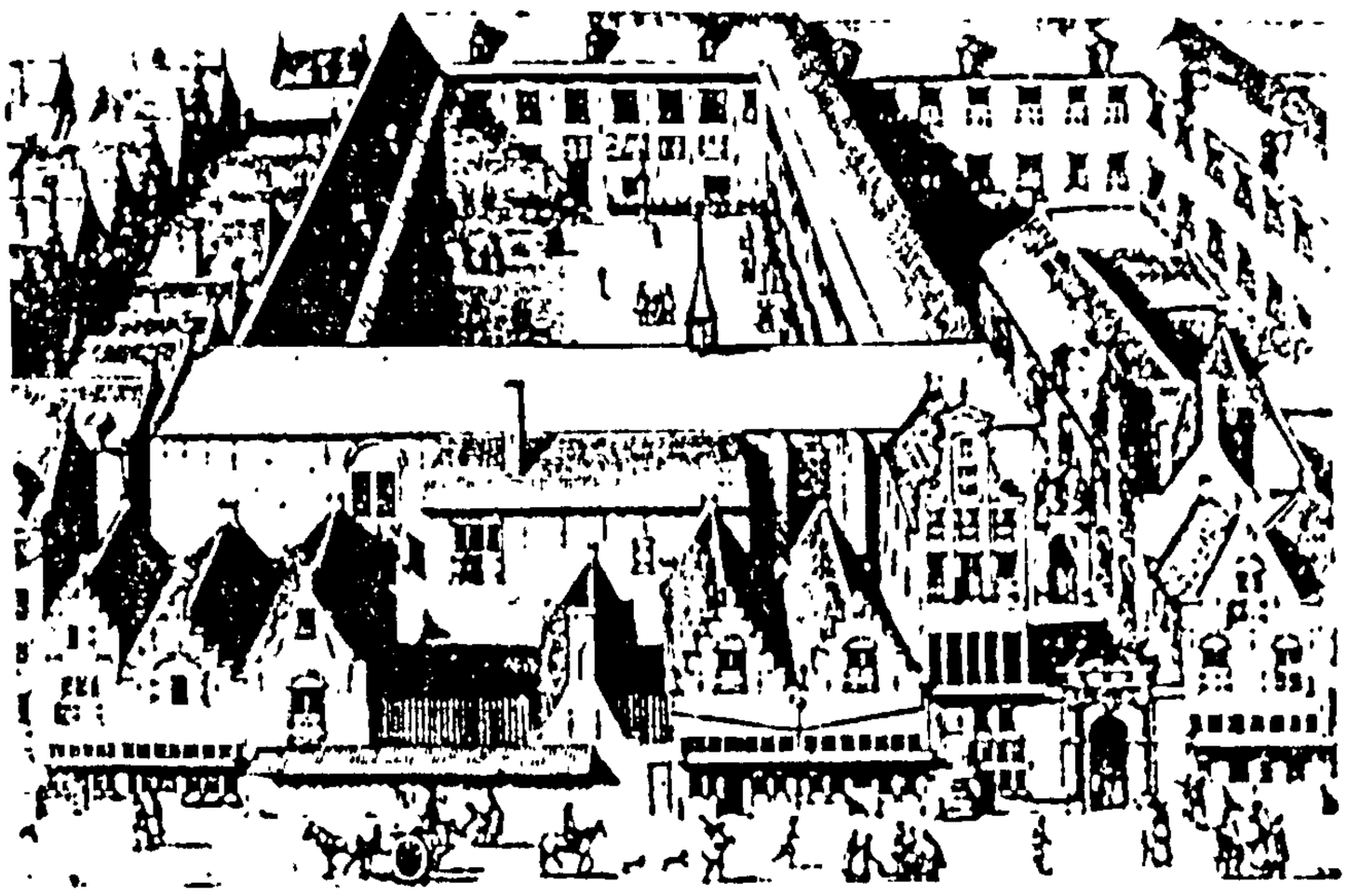


Figure 31: Example of house of correction façade

3.4.1.4 Façades for reform

By the end of the 18th century and the beginning of the 19th century distinctive forms of penal architecture had developed. Consequently, definite ideas concerning the prison façade design materialised. There was a tacit agreement that prisons should have a 'general appearance' and 'appropriate style' (Evans, 1982). That was interpreted as avoiding any ornate styles. However, design of the façade was not merely a matter of economy and security. It carried out a significant part of the purposes of a prison, and played an active role in implementing the functions of imprisonment itself, namely, that of deterrence of the inmates and the general public (Johnston, 1973). Johnston (2000:65) quoted an "Encyclopedia Londinensis" (1826) article that expresses this façade design philosophy in highly enthusiastic terms: "the style of architecture of a prison ... offers an effectual method of exciting the imagination to a most desirable point of abhorrence ...

the exterior of a prison should, therefore, be formed in the heavy and sombre style, which most forcibly impresses the spectator with gloom and terror. Massive cornices, the absence of windows or other ornaments, small low doors and the whole structure comparatively low, seem to include nearly all the points necessary to produce the desired effect".

However the real milestone in penal architecture was the development of the silent and separate systems, in America in the early 19th century. The architectural and environmental characteristics of these systems are explained in detail in chapter four.

In the silent system rectangular long cellblocks formed the outside boundary wall (Figure 32). The concept of the silent system envelope can be considered to include the double-skin (Figure 33). The aim of implementing such a system was however not related to comfort or sustainability. Security and visual discomfort were what motivated this system. Small windows were located in the outer wall facing the cell door. The distance between the two walls was 2.7 m. Hence, the amount of light penetrating the cell was very limited.

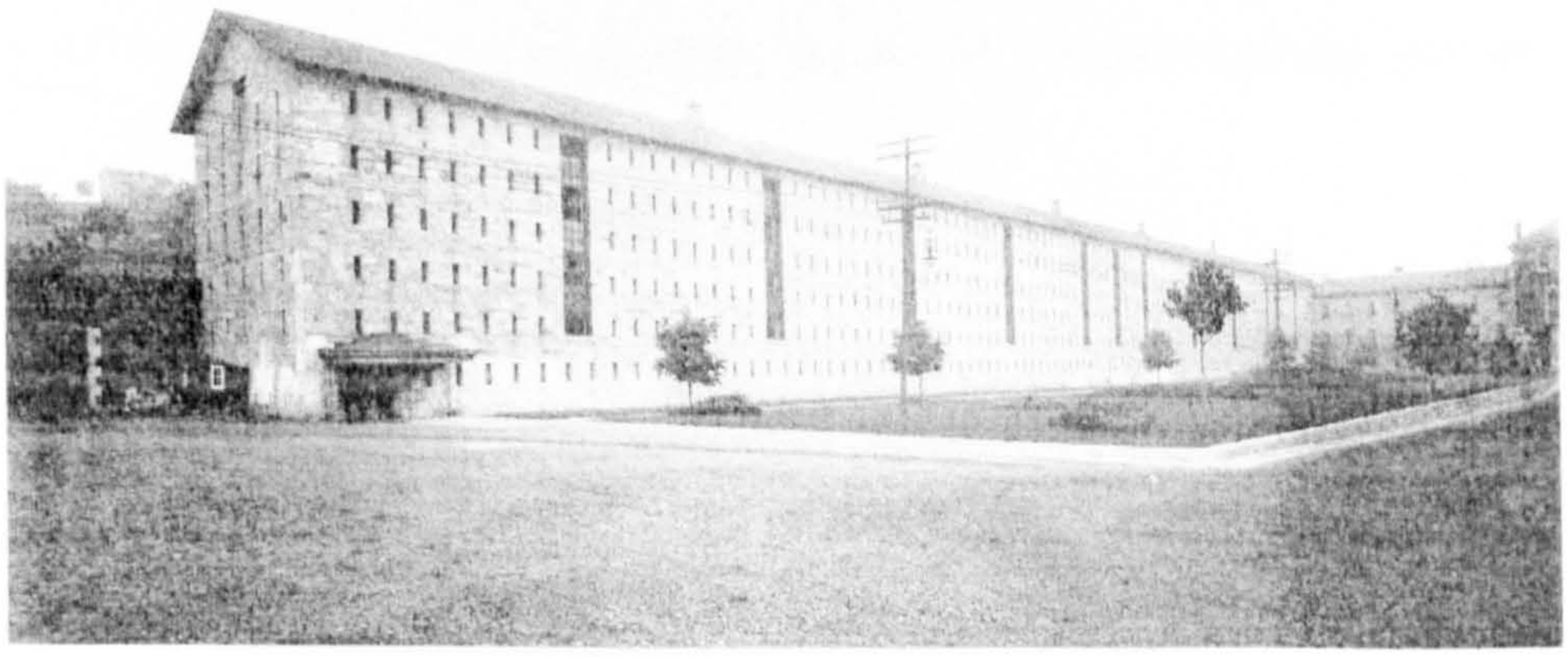


Figure 32: The facade in the silent system

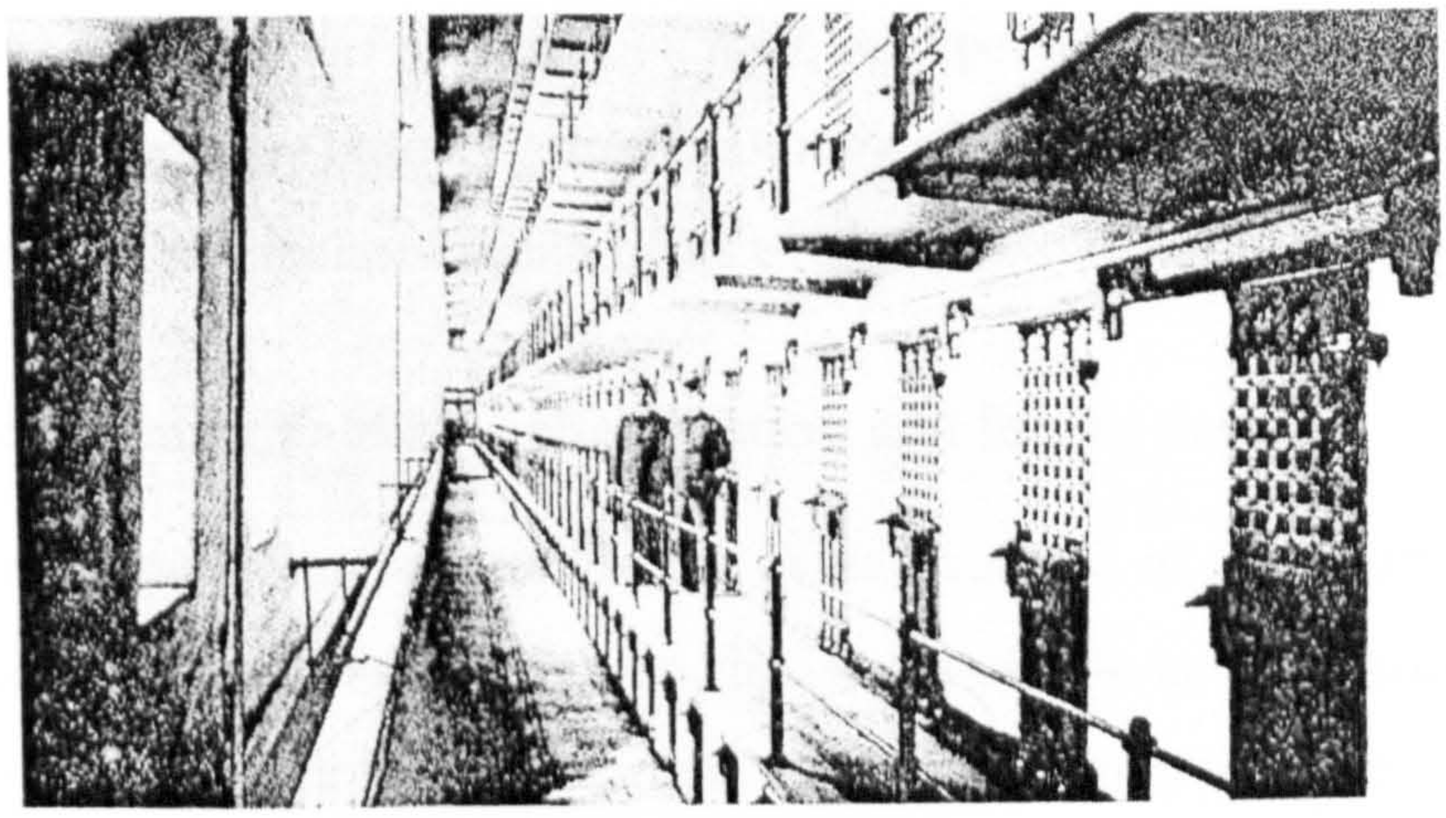


Figure 33: The double skin in the silent system

The radial separate system, however, was surrounded by an outer wall that incorporated a two-storey building at its entrance and a guard tower at each end (Figure 34). The façade of the two story front building, incorporated in the outer prison wall, was in Gothic revival style. On the other hand the façades of the cellblocks were functional and, hence, universally recognisable. The lined cellblocks with squinting windows left architects feeling the danger of losing their last claim on the prison, its imagery, which now belonged to the separate system (Evans, 1982). The outer wall became the only element that architects would devote their attention to. Hence, the appearance of the outside façade and the entrance became increasingly medieval, ornamental and meretricious.

Figure 34: The façade in the separate system

3.4.1.5 Façades for rehabilitation

The prison system has been exposed to continuous criticism as it has failed in its reform purpose. From the late twentieth century until the present several attitudes have been proposed. However, the widely accepted one is direct supervision, or the "new generation" prisons. The keywords to this epoch are community and normality.

This community emphasis has resulted in a new, unexpected kind of institution. Smaller, group-oriented, community based, normal buildings aim to achieve more than the socially and often geographically isolated monuments ever could.

3.4.2 Summary: Sustainability, rehabilitation and façade design

Despite the importance of architecture to the overall success of sustainable development, there is still no agreement on a definition that is applicable to architecture. There is a widespread belief among architects that the UNCED definition, for example, does not specify the ethical roles of humans in their everlasting existence on the planet (Kim and Rigdon, 1998). The term "sustainable architecture", used to describe the movement associated with environmentally conscious architectural design, has created ambivalence and confusion (Kremers, 1995). Emphasis has been therefore on technical issues, such as reducing energy consumption or efficiency in the construction and maintenance of buildings. Very little attention has been paid to the social and economic aspects.

Chronological examination of the development of façade design showed several stages of movement from traditional configuration towards more technical fixes in the 1970s. The result was widening the gap between façades as a two dimensional shield and the four dimensional (including time dimension) environment where different environmental and technical forces interact. The later provided the basis for a move towards more energy conscious façades, including intelligent façades.

The historical development of prison façade design has followed a different theme. The role of façade in prison buildings aimed at being deterrent rather than for environmental, pleasing or aesthetic reasons. Contemporary approaches to rehabilitation had dramatically changed this view. Prison façades have been more recently seen as not only having an environmental role but also a social and cultural one. Sustainability of façades in prison buildings is, therefore, strongly related to the social and cultural dimensions of prisons as rehabilitation centres.

This view is, however, fully appreciated by neither architects nor social scientists. In its role as **building façade**, the building envelope often communicates important cultural and social information. When energy requirements conflict with architectural expression, for many architects decisions become more difficult. The disarray of sustainable development approaches in architecture then becomes evident. The attempts to include

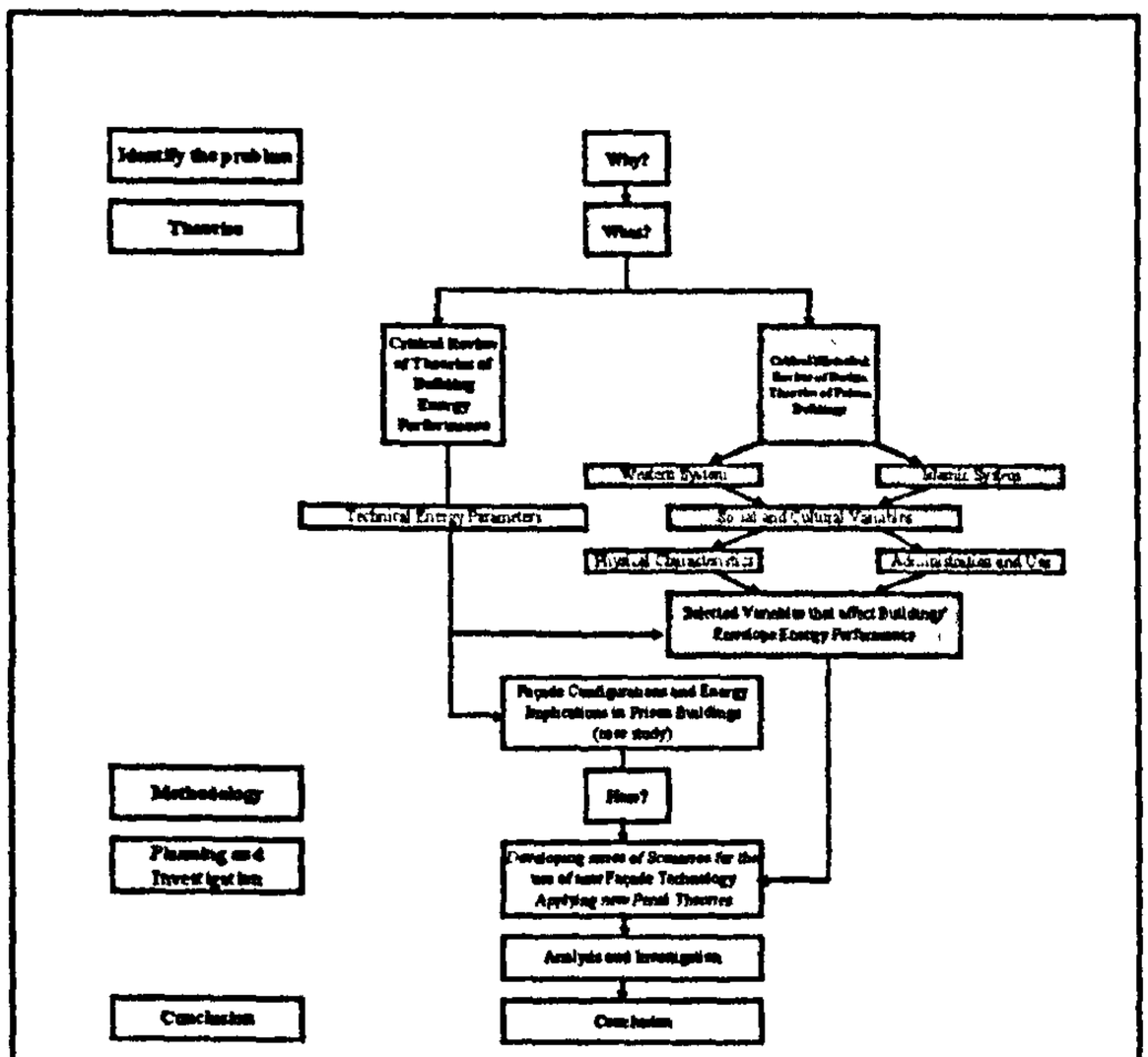
ethical dimensions as well as technical dimensions are seen as contradicting the profession of architecture itself (Levine, 1995). This is despite the fact that such values are accepted by human groups with conflicting demands on their shared surroundings. When human groups do not even have a shared context, conciliation for sustainable development becomes even more difficult. This is the case in incarceration architecture, where issues related to human comfort become debatable in themselves.

The review of the historical development of penal systems has shown that prison buildings design moved from being a tool for physical restraint of inmates, into introducing human values in order to achieve rehabilitation. In its wider context, prison design should consider social and economic aspects. Most recently, the concept of imprisonment has been questioned and the current rehabilitation approaches are subject to serious criticism. Prison buildings are problematic in attempting to achieve sustainable architecture. Attempts to introduce comfort within prison buildings will lead to extensive use of resources and greater energy consumption. More appropriate façade configuration, for example, can be particularly helpful to achieve sustainable architecture within such a controversial building typology. It has been argued however that this is not enough (Al-Hosany and Elkadi, 2001). The success of sustainability depends on achieving social and economic goals as well as technical ones.

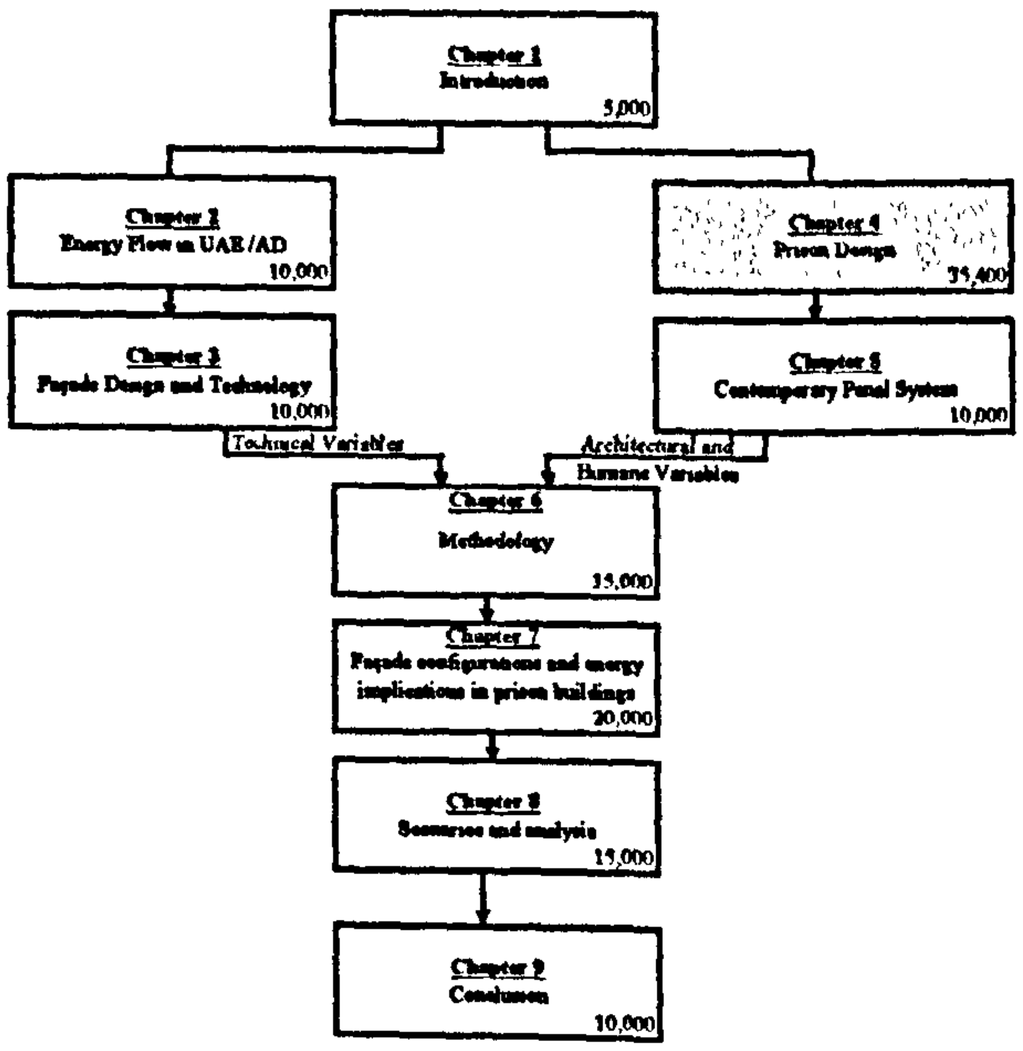
Al-Hosany and Elkadi (2001) emphasised the importance of social aspects in conjunction with technical energy saving measures, to achieve real sustainable incarceration architecture. Rehabilitative approaches and contemporary penal theories should also be factors towards sustainable incarceration architecture. The paper shows that adequate and comfortable provision of ventilation, for example, can help in achieving both technical and ethical objectives in sustainable incarceration architecture. Mobility of inmates is well recommended in social theory and can also, if properly designed, lead to energy conservation. In the light of the previous discussion it has been suggested that the conflict between incarceration architecture and sustainable architecture can be resolved (Al-Hosany and Elkadi, 2002).

CHAPTER FOUR

Prison Design



The Thesis Structure Outline



The Thesis Chapters Outline

4 Prison Design

4.1 Introduction

Chapter four discusses theories of prison design in both Western and Islamic societies. The discussion is divided into two main parts. The first part examines the influence of socio-economic patterns of a society on prison systems, while the second part reviews the architectural (technical) design theories of prison buildings. The aim is to identify the social and cultural factors that affect both the administration of prisons and the physical characteristics (the design parameters) of such institutions. Identifying these factors will consequently lead to recognition of the architectural and human variables that are to be considered in the design process for the envelope of the prison building, and subsequently its energy performance. In order to achieve this aim, the chapter is divided into six sections.

Section 4.2 reviews the historical development of prison buildings in Western societies. The evolution of prison building architecture is intimately bound up with the development of penal theories over the centuries. Architecture was not only a reflection of the institution; it was a vital instrument in carrying out its goals. The changes in social, political, economical and cultural characteristics of Western societies had an important influence on the development of both the architectural configuration of the prison, and the management and administration of the institution. The aim of this part is to critically review the design theories of prison buildings. The architectural elements and space configuration of prison buildings are traced through history in the process of secluding the role of building envelope or façade features on offender reform and /or rehabilitation.

In the second section, the physical and physiological factors for indoor comfort in prisons are discussed. The hypothesis of this section is that prison buildings' indoor environment has important impact on the inmates' behaviour and consequently influences the rehabilitation of prisoners. Historical review of the evolution of human and environmental considerations in prison buildings show that the human elements should be placed at the centre of the process of prison buildings design in order to ensure a progressive paradigm towards institutional rehabilitation.

It is important to analyse and review the relevance of traditional values and the local penal system, in the case study. Section four explains the Islamic penal system. A historical review of the traditional Islamic penal system, the *Shari'a,* is carried out to identify the role of imprisonment in Islamic societies. The historical review demonstrates that several contemporary (Western) social approaches towards offenders' rehabilitation such as domestic confinement, effective classification, gender issues, can be traced in Islamic law. The economic, military, political, and cultural dominance of the West in the 19th century influenced change in penal theories and led to marginalisation of the *Shari'a* in Islamic Societies. Imprisonment, being the centrepiece of the Western penal system, replaced in many Islamic countries the *Quesas* and *Hudud* punishments. The contemporary penal system of many countries in the Islamic world and the Middle East are presented in this section. The survey shows that although a set of common historical sources and methods exists, the modern expressions of Islamic law vary immensely from country to country. The prison buildings in most contemporary Islamic societies follow standard designs that reflect a philosophy developed in the Western environment.

This philosophy of physical confinement as an ultimate punishment failed to reduce the crime level in both the Western and the Islamic societies. Finally, this section investigates the current penal system in the United Arab Emirates (the UAE). A survey of the prison population in Abu Dhabi is carried out. The complex and unique pattern of the UAE society is mirrored in the prison population. The latest official figures show that the percentage of the expatriate population among the overall national population was 75.6 percent in the year 1995. This is reflected in the prison population as well. The diversity in UAE prisoners in terms of their nationalities, social, cultural, political backgrounds and economic make up coupled with issues of race and gender, represents an uncommon population problem in prisons there. The survey indicates a dramatic increase in the prison population of the UAE. This transformation of the inmates' population in the UAE prisons is in number as well as pattern of offenders and types of offences. The prison crisis led to the emergence of new design guidance for prison buildings in the UAE. This section reviews the new guidelines and the ensuing prototype design. Finally, this section investigates the sustainability of the existing incarceration architecture in the United Arab Emirates (UAE), and whether it can be improved by adopting both Islamic and contemporary approaches towards offenders' rehabilitation.

The chapter is summarised and its conclusions are drawn in the final section.

It can be detected from the review that there is special emphasis on the historical and contemporary development of incarceration architecture in both the United States of America and the United Kingdom. The motivations behind this, however, can be justified. The main leading incarceration architecture movements originated in the US; it was therefore inescapable to study the development of prison design there. The case study of this research is situated in the United Arab Emirates, which uses the United Kingdom prison design standards.

4.2 The Historical Development of Prison Design

4.2.1 Introduction

The system of imprisonment is, currently, dominated by contradictory cultural values and a historically unstable sense of purpose. Contemporary Western incarceration architecture has been influenced by many extraneous forces, which are mainly historical, bureaucratic, and socio-political factors (Lennox, 1997). In order to understand these forces, the history of incarceration architecture has to be studied. However, reviewing the history of prison architecture would be impossible without studying the changing penal philosophy over the centuries, which was triggered by social forces. This section reviews the development of penal systems through history and the philosophical and social problems that affected the evolution of prison buildings.

The 18th century prisons had a marginal role in the system of punishment. It was mainly an interlude between the court appearance and ultimate, usually physical, punishment. Confinement places tended, therefore, to be "opportunistic", occupying structures built for different purposes (Johnston, 2000). Section 4.2.3 illustrates that once invented and implemented, prisons underwent fundamental alterations in appearance and organisation. The evolution of incarceration architecture reflected the rapid change in the philosophies of punishment. Diverse penal philosophies each required a distinctive layout that was thought capable of accomplishing its goals. Each time an ideogram took a form that was more complex (e.g. articulated around a central core or central open space), it represented advanced research into the quality of the architectural environment for the inmates, and the organisation of their lives (Lenci, 1977). The special configurations of the prison buildings in the 18th and the 19th centuries were, therefore, manifested in the patterns of the indoor space as well as the façade design (Pearce, 1995). The analysis of the historical development of prison buildings carried out in section 4.2.3 identifies the main variables in facade configurations that reflected penal theories and influenced the indoor and the outdoor environments.

The end of the 19th century witnessed the uncoupling of architecture and reform (Evans, 1982). It was admitted that the prison system had failed to live up to its original ideals but the failure did not have any impact on its longevity. The reform impulse faded however, without uprooting the prison from the criminal justice system (McGowen, 1998). Non-custodial sentences started to emerge slowly in the Western penal system,

with different proportion in different countries (Chapter 5 examines such alternatives). However as we come into the 21st century, imprisonment is in spite of everything, the key component of Western and global penal systems. Section 4.2.4 reviews the architectural elements and space configurations of contemporary prison buildings. The aim is to identify the architectural variables that have affected the development of the design of prison buildings generally, and the configurations of their façades specifically.

This section is concluded and its findings are summarised in part 4.2.5.

4.2.2 The birth of prison

4.2.2.1 Ancient prisons

Several historians of the prison institution stated that prisons scarcely had any punitive role before the late 18th century (e.g. Foucault, 1977 and Fairweather, 1975). They were places for confinement and detention of those awaiting trail or corporal punishment and in some cases for containing personal and political enemies. Debtors were also confined until they, or their families, paid their debts. However, more recent research shows that secular and religious writings provide strong evidence of the existence of imprisonment as part of a wide category of physical punishment for convicted individuals in almost all ancient civilisations, although early laws speak little of prisons (Peters, 1998; Johnston, 2000).

The earliest record of prisons in Ancient Egypt dated from the period of the Middle Kingdom (2050- 1786 B.C.). Such institutions together with forced labour survived in Egypt long after the age of the Pharaohs. In China the building of prisons in 2000 B.C. was noted in a collection of Chinese literature (Johnston, 2000). Among the Hebrews, prisons first appeared during the monarchy in imitation of the practices of neighbouring states, such as Egypt to the west or the great empires of the east. In Ancient Athens prison was called *desmoterion*: "the place of chains". The recorded use of imprisonment in the Roman Empire was for debt and for the practice of domestic *ergastulum*, a cell located in the Roman houses that the male heads households used to discipline members of the household. Although imprisonment did not play the largest punitive role in Athenian penology, it was possibly legitimate in 399 B.C. Exile, fines and capital punishment were more frequent (Peters, 1998).

In the 5th century B.C. *Plato* foresaw for the modern correctional system by envisaging three types of prison in each city. These types are divided as one to keep those waiting for trial, and anther which he called a *Sophronesterion* (house of correction) for those who were mentally ill, vagrants or committed minor offences. The third prison, Plato recommended, should be away from residential areas. This was for those who had committed serious crimes (Fairweather 1975).

The insignificant role of imprisonment in these ancient penal systems minimised the efforts made in designing or building prisons. The historical prison buildings in the ancient world have disappeared, but historical literature had left some descriptions. For example, it is claimed that prison buildings in ancient Egypt resembled fortresses with cells and dungeons (Peters, 1998).

To examine the architectural and space configurations of the early prisons the *Tullianum,* later called the *Mamertine* in Rome, can be taken as an example. It is claimed that the *Mamertine* was positioned almost four metres under the ground (Fairweather 1975; Peters, 1998). It consisted of a conical and dark underground chamber which appeared to function as both confinement place and execution chamber. The chamber was surrounded with solid walls, accessible only from the top and had no door or window. It had a diameter of approximately 6m and was less than 1.8m high. Its smell was enough to bring fear and horror to the heart (Peters, 1998). Another room was added above the original chamber, in the late second century B.C. The upper room measured approximately 6.7m x 9m and was 5m high (Johnston, 2000). Figure 35 illustrates a reconstruction of the prison by Ancus Martius in 640 B.C. (Fairweather 1975). It is worth

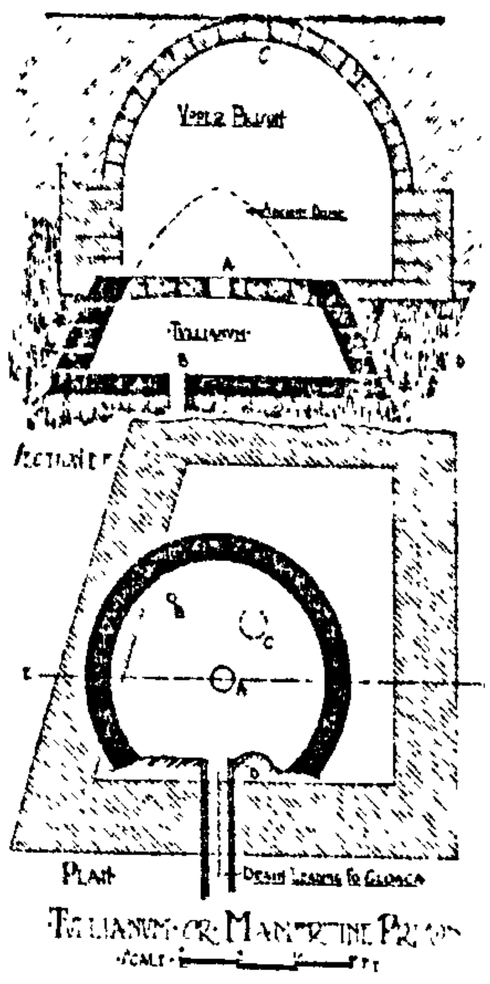


Figure 35: the Mamertine in Rome

noting that not all historians agreed on the reconstructed version of the prison. The prison was described as neglected, dark, over crowded and stinking; qualities which characterised the whole concept of the prison buildings in that era. However, in spite of the horrendous conditions of prisons, they were certainly not the harshest punishments known to imperial whim.

4.2.2.2 Monastic prisons

The prison emerged in a new function with the development of canon (Church) law. Any punishment that could result in the death of the offender was rejected, in order to prevent the penance that would lead to salvation and restoration of the Christian community. That was the earliest articulation of an institutionalised system based on the idea of sin and its correction, "*penitential expiation*". This system was recognised as Monastic prisons (Johnston, 2000). Although the Roman judicial doctrine specified that prisons should serve as places of confinement, not punishment, Pope Boniface VIII (Rome) in 1298 permitted bishops and abbots to punish offenders by prison either for periods of time, or for life. By doing so he became the first sovereign authority in the Western tradition to determine that imprisonment as punishment was a legitimate instrument of a universal legal system.

4.2.2.3 Medieval Europe

Historians have long regarded the social, political, economic and intellectual changes in the 12th century as a turning point in European history. European societies varied in the time, the pace, and the way they changed. The universal claims of learned Roman law and canon law often made little impression on areas not prepared to receive or use them (Peters, 1998).

The second half of the 12th century witnessed the erection of the first royal prison in England by William I. It was built to contain the King's enemies. This was implemented more intensively in 1166, when Henry II issued orders to his sheriffs to build jails in each county. However, existing castles, fortresses, and city gates were modified to accommodate the prisoners. In some cases prison chambers were specifically constructed. Prison rooms in castles, whether newly built or adopted, were commonly located on one of the lower levels of the keep, the outer walls, or the towers. Locating the prison chambers, which were sometimes referred to as "pits", in the lowest level of the

tower or castle was mainly for security reasons. However, deprivation from light and view was part of the punishment procedure. The second part of section 4.3 illustrates this in detail. Figure 36 shows the prison rooms that were located in the lower level of *Mont-Saint-Michel,* built under Robert de Thorigny (1154-86). The first cells added to the castle were "the Twins", which were two small cells with no access to light. The air was provided by a passage to the outside (Johnston, 2000).

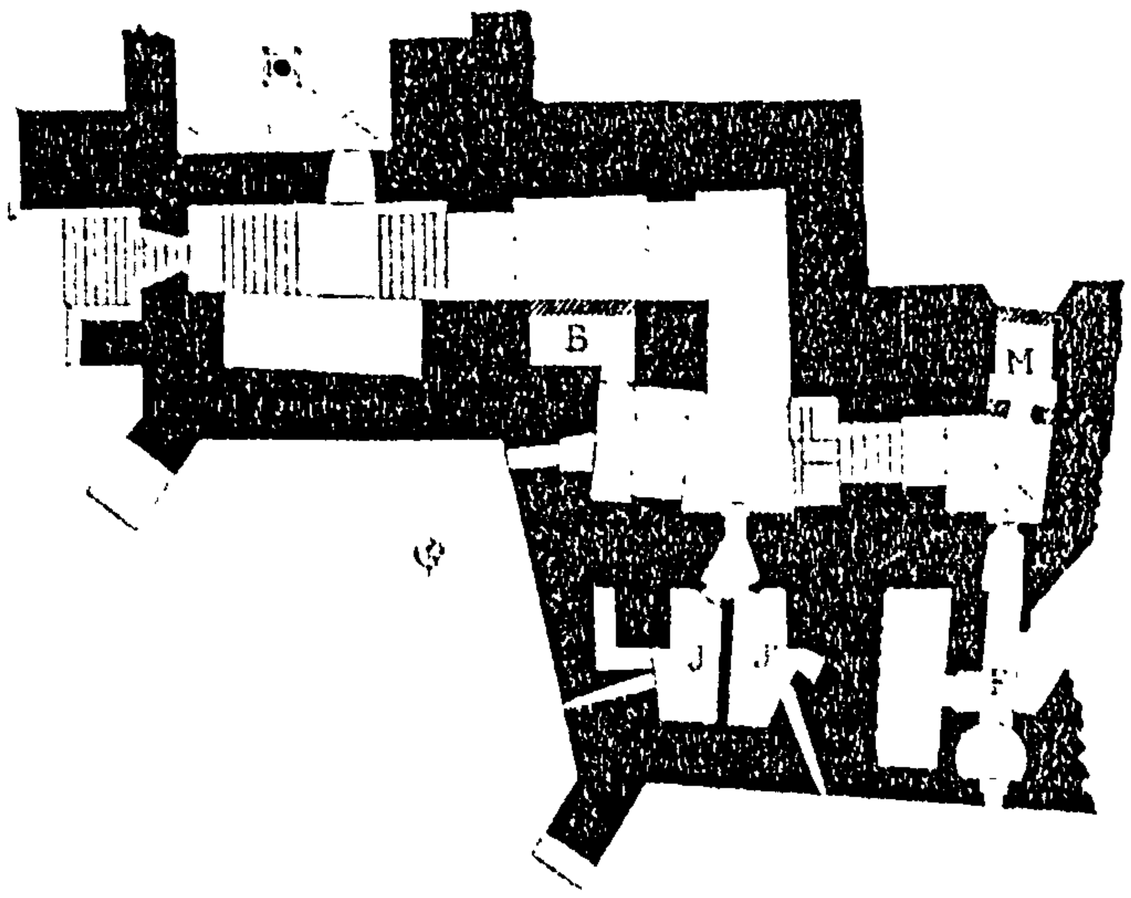


Figure 36 Prison rooms, Mont-Saint-Michel. The Twins are indicated as J and J

From the 1270s, the number of prisons in castles, and of imprisonable offences, increased rapidly in Europe. The space configurations of the prison chambers in these castles were similar throughout Europe. Each chamber was about 4.6m in diameter and had a vaulted stone ceiling about 6m high. The upper level room had a tiny slit window about 2m above floor level, but the great thickness of the walls restricted the access of light and air. The lower-level room had no ventilation or natural light access. It was reached by a circular staircase from the upper floors of each tower. All the prison rooms were located below the surface of the inner courtyard of the castle and above the ground level outside (Johnston, 2000).

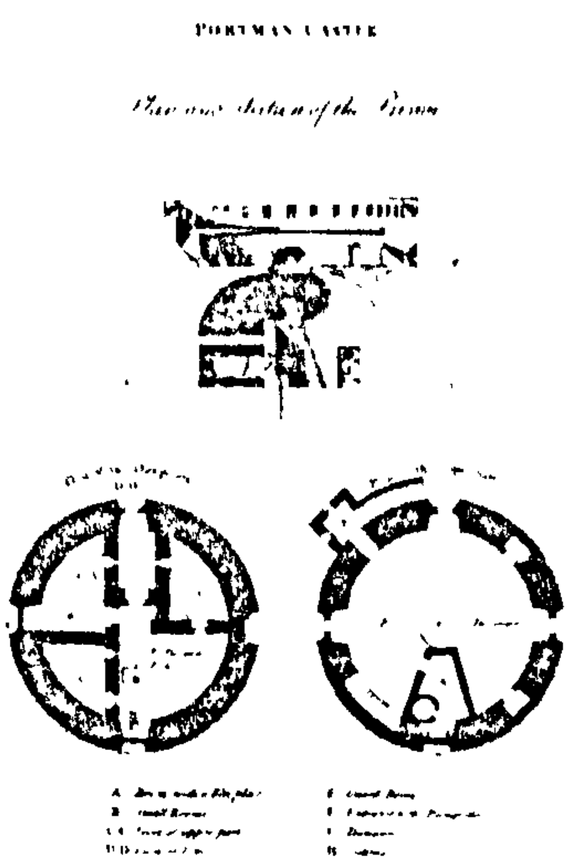


Figure 37: Upper-level tower prison, Portman Castle

There were some exceptions to this general layout of prisons within castles. Portman Castle represented one. As shown in Figure 37, the chamber was located at the top of the round tower. It was around 6.7m in diameter and was divided into four rooms.

The prisoners occupied three, while the fourth was used as an anteroom and had small windows to provide light and ventilation.

No progress was recorded during the next four centuries for this rudimentary penal system. The functions of prisons remained restricted to confinement and detention. During the later 12th and 13th centuries, coercive imprisonment in the Fleet or the Tower of debtors of the Crown became more common. The 15th and 16th centuries were the golden years for the use of such prisons in Europe. The Seven Towers of Constantinople, the Castle of Spielberg, the Pozzi of the Venetian Ducal Place, and the Conciergerie were examples of such prisons which meant death inside ten feet thick stonewalls (Fairweather, 1975).

Penal options during the pre-industrial Europe ranged from aggravated forms of the death penalty (breaking on the wheel) to minor sanctions (a warning not to repeat the offence). In between lay more and less serious forms of bondage (galley servitude or confinement in a prison workhouse), banishment, fines and a host of minor obligations or prohibitions. Prison was used rarely and served either as a mitigation of capital punishment or as an alternative to a fine if the offender was insolvent (Spierenburg, 1998).

For the most part, prisons in German lands consisted of rooms or holes in the foundations of local fortifications. Prisons in Germany remained local and unreformed, until well into the early modern period. Needles to say the conditions in these spaces were no better than those in the rest of Europe.

The Scandinavian countries favoured punishments that entailed property loss, death or mutilation. Prison use was restricted to temporary confinement, until the 16th century when confinement for forced labour was introduced gradually.

Until Napoleon, civil and criminal law in France remained largely regionally based, although royally supervised. Custodial imprisonment existed in France. Imprisonment as a punishment had also developed in 13th century France, in both royal justice and the regional customary law, nevertheless, its use was infrequent. The *Chatelet* (fortress) is the best known of the early French prisons.

Royal prisons began to increase in number during the reigon of Louis XI (1461-83), including the most famous royal prison, the Bastille (Figure 38), which was originally a gate. It reflected the magnitude of the 16th century architectural theories in its reputation; uninviting and cavern-like entrances with frightful inscription to inspire darkness, threat,

ruin and terror (Johnston, 1973). The system of prisons that emerged from French customary regional royal law lasted until the French Revolution in 1789. In the late 17th and 18th centuries penal reformers insisted that prison conditions should be improved, and prison practices reformed. By the 18th century new forms of punishment had been introduced- including the galley and the workhouse.

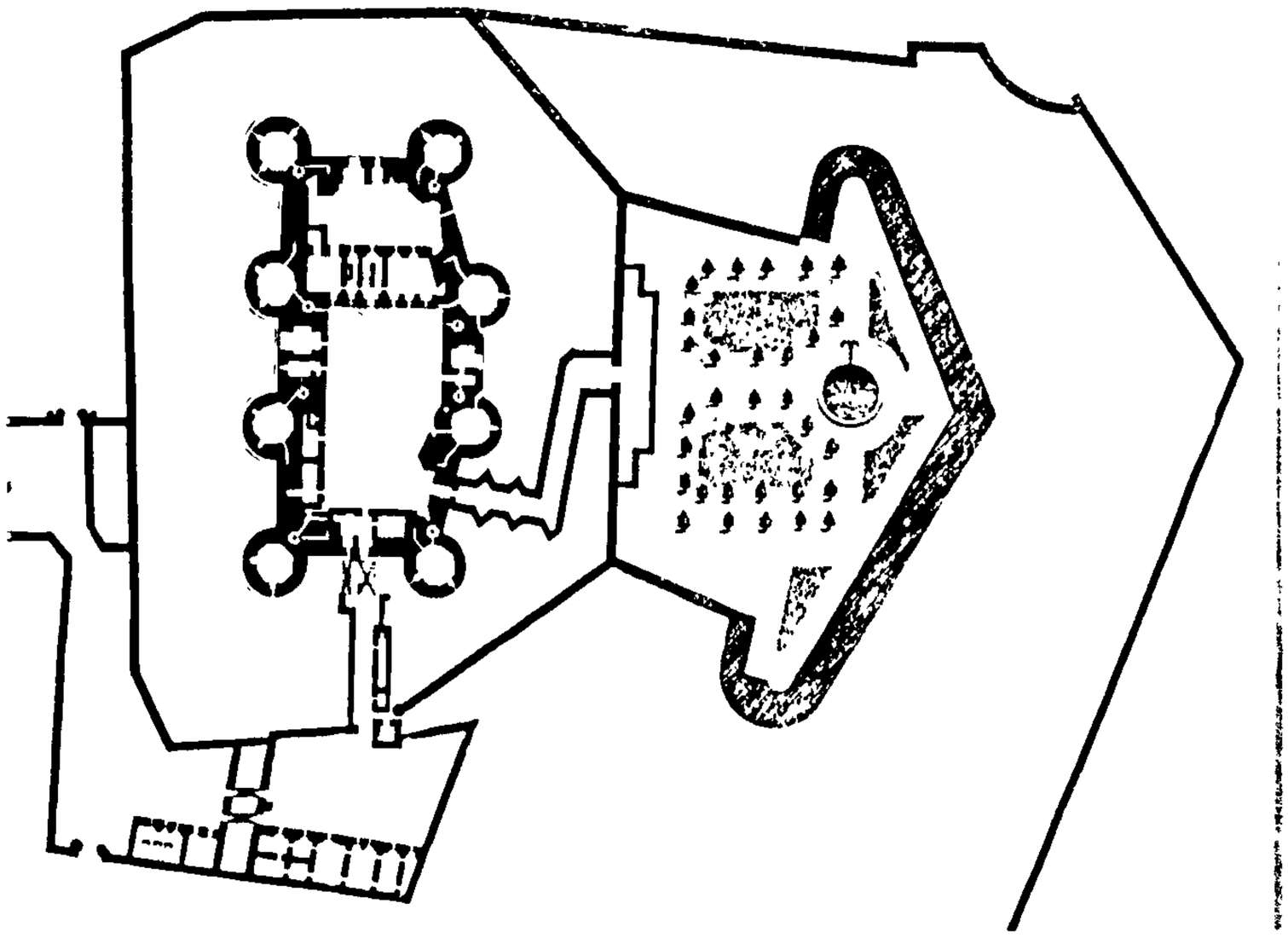


Figure 38: The Bastille

The numerous societies in Italy displayed a very different pattern. A broad spectrum of legal innovations in the 12th and 13th centuries was evident in Italy. The kingdom of Sicily, the Papal States and the powerful city-republics of the north offered an astonishingly ambitious address to the problem of crime and criminal law. This approach, at its most developed comes closest to later developments in criminal law and modes of punishment (Peters, 1998).

Some historians have identified a sequence in styles of public punishment from the 12th to the 16th centuries. According to this, fines initially succeeded harsh physical punishments. Fines were often combined with imprisonment, during the 14th and 15th centuries (Foucault, 1977). In both Venice and Florence, the increased use of punitive imprisonment suggests that imprisonment represented a major aspect of the legal revolution that had begun in the 12th and 13th centuries (Peters, 1998).

Generally speaking, punitive use of imprisonment was infrequent all over Europe. Physical, and generally public, punishments were more popular. Two types held the greatest interest for the people of early modern Europe. Execution on the scaffold or at a similar public spot, most clearly embodied contemporary attitudes. The other punishment involving bondage and labour, suggested the direction criminal justice would take in the future. The scaffold was the most forceful means of exerting social control for the authorities (Spierenburg, 1998).

4.2.2.4 Workhouse movement

The mid 16th century marked the emergence of "The House of Correction" or "The Workhouse", called the "Bridewell" in England, as a solution for the increasing unemployment and vagrancy. The use of those institutions became very widespread in Europe, but Germany and Holland led the way in fully developing the model of the prison workhouse in the 17th century (Fairweather, 1975).

The improved version of the houses of correction in Holland, the Rasp house in Amsterdam (1595) (Figure 39), the first and most famous house of work, had an important influence on prison development. Nine rooms (bedrooms as well as workrooms) were to be found in this institution. The early houses of correction appear to have been the first true "reformatories". For the first time, religious instruction and regular work were utilised in the aim of reforming of the criminal. The first women's prison was also built in Amsterdam by the Protestants, in the year 1593. This was followed by examples in other parts of Europe.

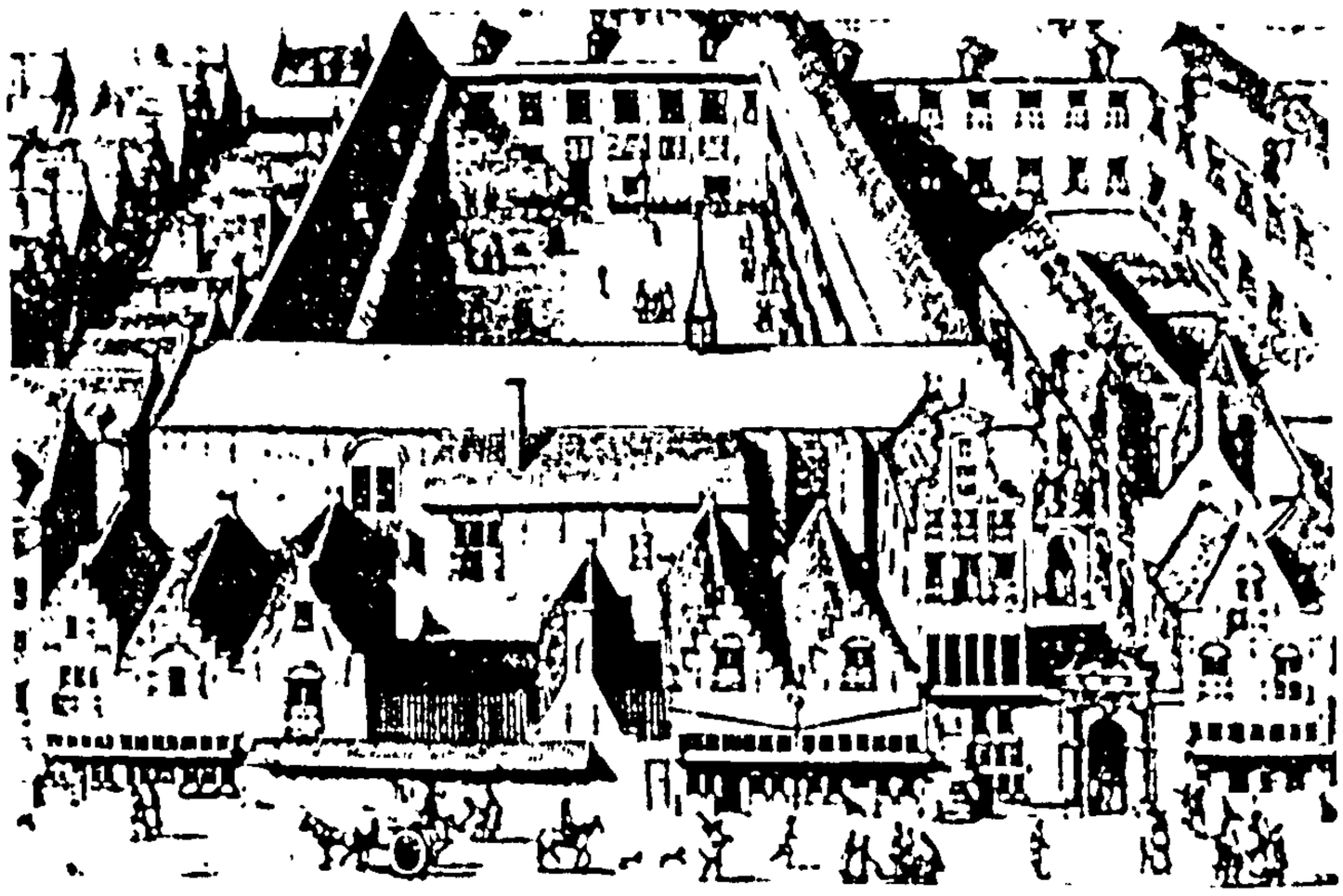


Figure 39: The Rasp house in Amsterdam

By the closing years of the 16th century the vague outlines of a new rationale of treatment were beginning to emerge. On the other hand, however, neither a coherent penal program nor a distinctive prison architecture had been formed. Most prisons remained relatively crude structures with only one or two chambers. In some cases, larger prisons were designed with a façade reflecting current ideas for any grand public buildings, such as hospitals. In other cases, prison facades were similar to those of palaces and governmental buildings. Behind the facades, however, there were no distinguishable elements or special space configurations. The layout of the gaols generally consisted of a group of cells, often arranged at random, or simply disposed around the interior courtyard (Johnston, 2000). Basic surveillance needs were not considered. Sanitation was rarely provided.

By the beginning of the 17th century two different institutions can be recognised in Europe, which were the Houses of Correction and the county goals. However, historians reported that any difference between the two institutions diminished, to be in the title only. They housed, indiscriminately, every type of offender (Fairweather, 1975). The gaol keepers had ultimate authority over the prison and inmates. Disorder and neglect were dominant features of the prison. Only the presence of irons differentiated felons from visitors, or from debtors and their families. Some inhabitants lived in ease, while others suffered in squalor. Punitive imprisonment was, up till now, not part of the penal system. Transportation, exile, physical punishments and public capital punishment were the devices for retribution.

Between the early 17th and the mid 18th centuries the penal system changed greatly. At the centre of this transformation was the emergence of the prison as the chief institution for combating crime. To understand the rise of prison, one must examine changing social attitudes towards offenders, the family, and the human body itself. This thesis does not intend to investigate such values in detail; however, this subject has been a territory for extended analysis by many historians and sociologist (e.g. Foucault, 1977; Spierenburg, 1998). Yet, in the following part, the development of the various penal theories and its reflection on incarceration architecture will be investigated in order to disaffiliate the architectural elements and human values that marked prison building in its early instigation.

4.2.3 Development of prison design theories

4.2.3.1 The rise of reform

Historians today no longer describe the evolution of criminal justice in simple terms, such as a gradual progress away from cruelty. Several major social and cultural processes come into play, including privatisation, the development of new attitudes towards the body, and the changing character of the family (Foucault, 1977; Spierenburg, 1998). Among the many changes that occurred in Europe between the 17th and 18th centuries was the disappearance of torture as a public spectacle. "In its time, it gave rise to too much inflated rhetoric; perhaps it attributed too readily and too emphatically to a process of humanisation" (Foucault, 1977: 7).

Quantitative data substantiate the gradual decline in public punishment, particularly capital punishment (Spierenburg, 1998). The use of transportation and hulks[2] became the solution for the increasing rate of crime. Discussions about the urgent need for more adequate forms of punishment started surfacing gradually. Consequently, a period of large-scale prison building started in Europe in the 17th century.

However, the chaos in prison conditions, functions and systems did not witness any progress until the beginning of the 18th century. Reform movements started to emerge all over Europe. The first recognised one owed its existence to the Roman Catholic Church, and more specifically to one priest. That was Filippo Franci who, in 1677, introduced reform through a regime of solitude and religious instruction in the Workhouse for Recalcitrant and Vagrant Boys in Florence (Johnston, 2000). Another important influence came from the Quakers[3] in America. In 1682 William Penn[4] (1644- 1718) established the 'Great Law' in which he stated that most crimes should be punished by

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[2] Hulk is an old ship stripped of fittings and permanently moored especially for use as prison (definition by Oxford Dictionary, the 10th edition).

[3] Members of the Religious Society of Friends, a Christian movement devoted to peaceful principles and rejecting both formal ministry and all set forms of worship (definition by Oxford Dictionary, the 10th edition)

4 English Quaker leader and advocate of religious freedom, who oversaw the founding of the American Commonwealth of Pennsylvania as a refuge for Quakers and other religious minorities of Europe (Encyclopaedia Britannica).

hard labour in a house of correction that resembled the English workhouse (Fairweather, 1975). The British, however, compelled them to resort to fines and corporal punishment by the year 1718, and this continued to be the case until after the Declaration of the Independence in 1776.

Twenty-four hours' segregation, a concept that was introduced and advocated by the Roman Catholic Church, was the first practical attempt to use treatment for the avowed purpose of correction and reform (Johnston, 2000). In 1704 this concept led to the erection of the first purposely built reformatory prison. This was St. Michael's prison in Rome, the first cellular prison in the world, designed by Carlo Fontano (Figure 40) (Pevsner, 1976; Fletcher's, 1987). The importance of this building stemmed from the fact that architecture was for the first time utilised to embrace a reform system. The reformatory regime followed in St. Michael's prison introduced the separation concept in

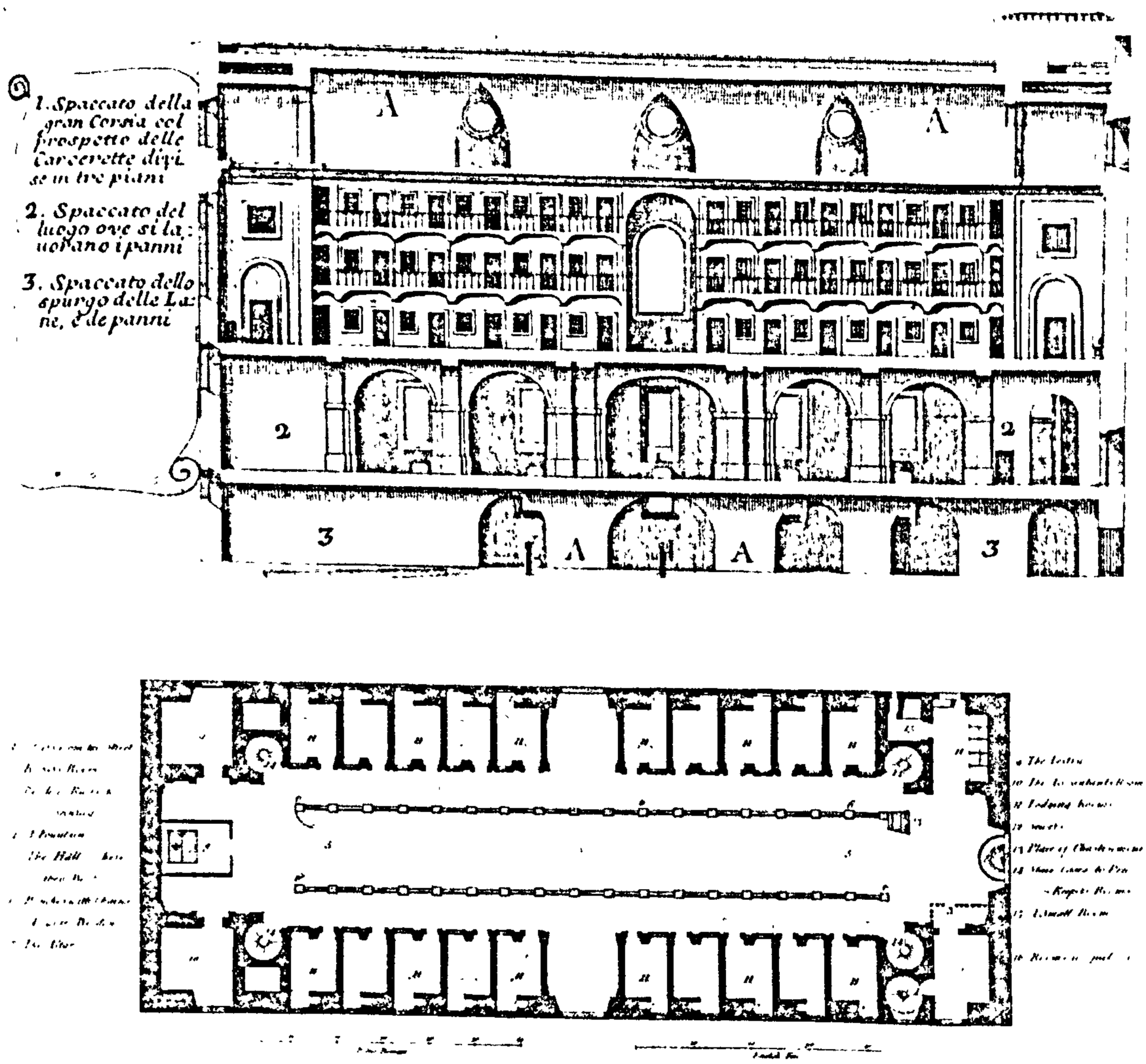

Figure 40: Plan and Elevation of St Michael's Prison

order to allow offenders to reflect on their misdeeds in solitude, and to prevent moral

contamination resulting from placing different kinds of offenders together. This was done by a rectangular structure with thirty outside cells arranged on three tiers, with balconies or galleries on each level. Each cell contained a latrine, exterior and interior windows, a mattress, a solid door and a small aperture opening onto the balcony that could be closed off by a small door. Glass was used for the outside windows, which was unusual practice at the time. From the inner window of the cell, the inmate had a view of the large well-lit hall containing the altar. The sleeping rooms faced a large central hall that was used as a workroom, dinning room and for Mass. The work was carried out in total silence. Discipline was severe if any sign of breaking the rules was perceived (Johnston, 2000). With his design, Carlo Fontano satisfied on important function of prison that is ease of supervision. St. Michael is considered the first prison designed with a definite and recognisable architectural expression of its own. With its simplicity and functionality it influenced prison architecture for the next 200 years, and led to the complicated radial plans which emerged later (Fairweather, 1975).

In the following 70 years several houses of correction were built, however; none had an important structure architecturally. The Milanese house of correction, by Francesco Croce (Figure 41) was the only exception. Work on the prison commenced in the late 1750s. The design of the prison was based on St. Michael's prison, and combined elements of it with some of the conventional cross plans found in hospitals and churches. A T-Shaped cellular section was flanked by buildings containing workrooms and other services. The flanking structures were arranged around two courts one on either side of

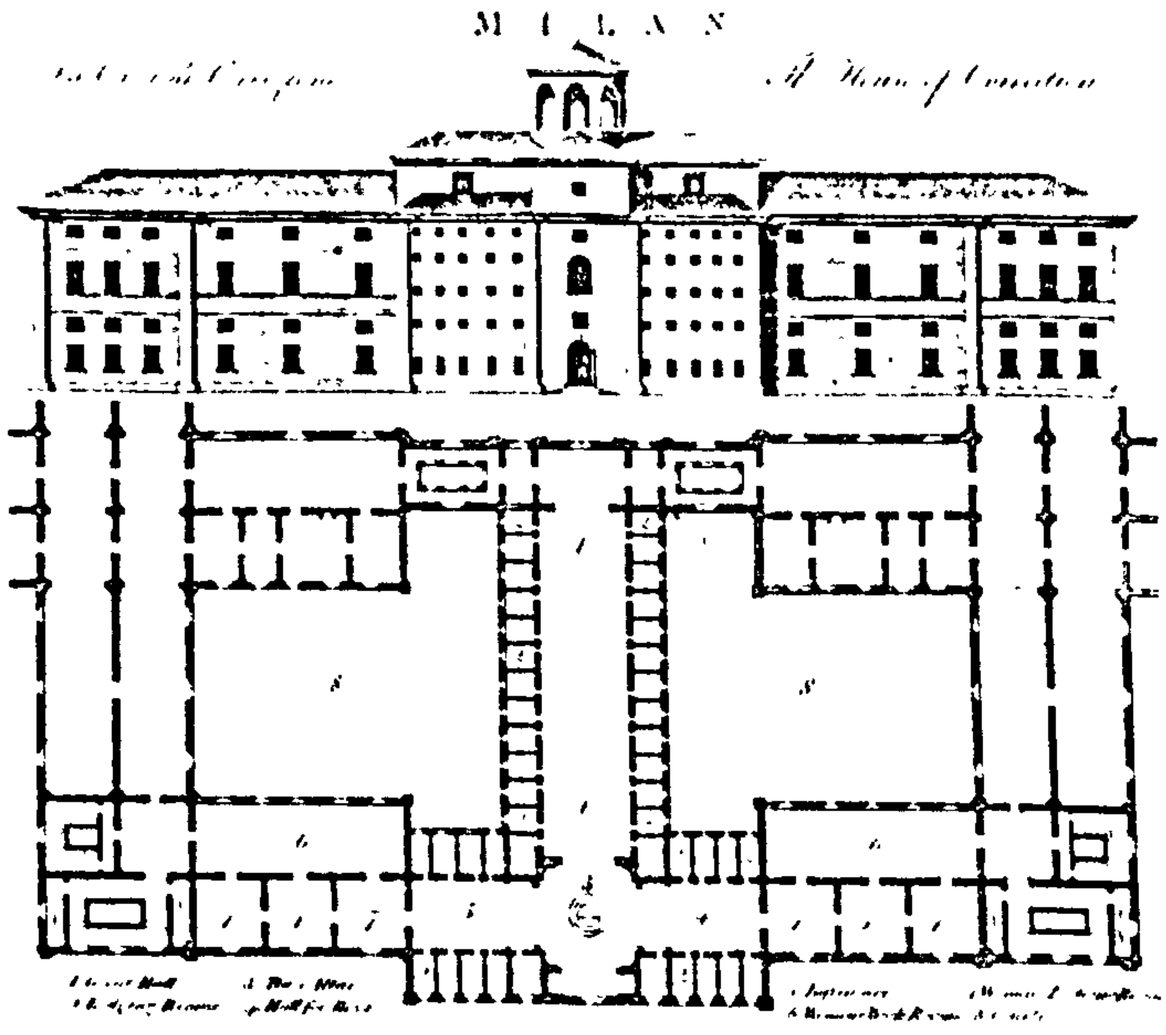

Figure 41: Part plan and section of the House of Correction, Milan

the main portion. The T-shaped main building contained 120 sleeping rooms; each was 2.5m x 2.8m, arranged along the outer walls on three levels and connected by stone galleries with iron railings. Each cell had a bed, a stool and a toilet. Similar to St. Michael, there were windows on both the outside wall and the inner wall opening to balconies. A workroom, which was called the 'Great Room' and measured 9.4m x 37.8m, was located in the long wing. An altar was situated at the crossing of the T-shaped structure (Johnston, 1973). Milan's workhouse played an important role in the working out of an architectural solution to the prison design problem (Fairweather, 1975). However, it had little effect on later prison structures (Johnston, 2000).

Another milestone in penal theories and prison architecture is Ghent prison (1773) designed by Maison de Force in Belgium (Figure 42) Ghent prison was the first large-scale adult penal institution in which a conscious attempt was made to bring architecture to the aid of the penological philosophy of treatment, in a sophisticated and skilful manner. The novel penal regime which was introduced in Ghent combined silence with forced labour, a labour that inmates were paid for carrying out. The Ghent regime, also, introduced several measures of classification. Inmates were categorised according to their gender, their age, the degree of their criminality and the length of their sentence (Johnston, 2000). Instead of the simple rectangular court that was portrayed in St. Michael, Ghent prison cells were laid out in eight trapezium-shaped courts that surrounded a central octagonal court, which was flanked by service facilities. Ghent was

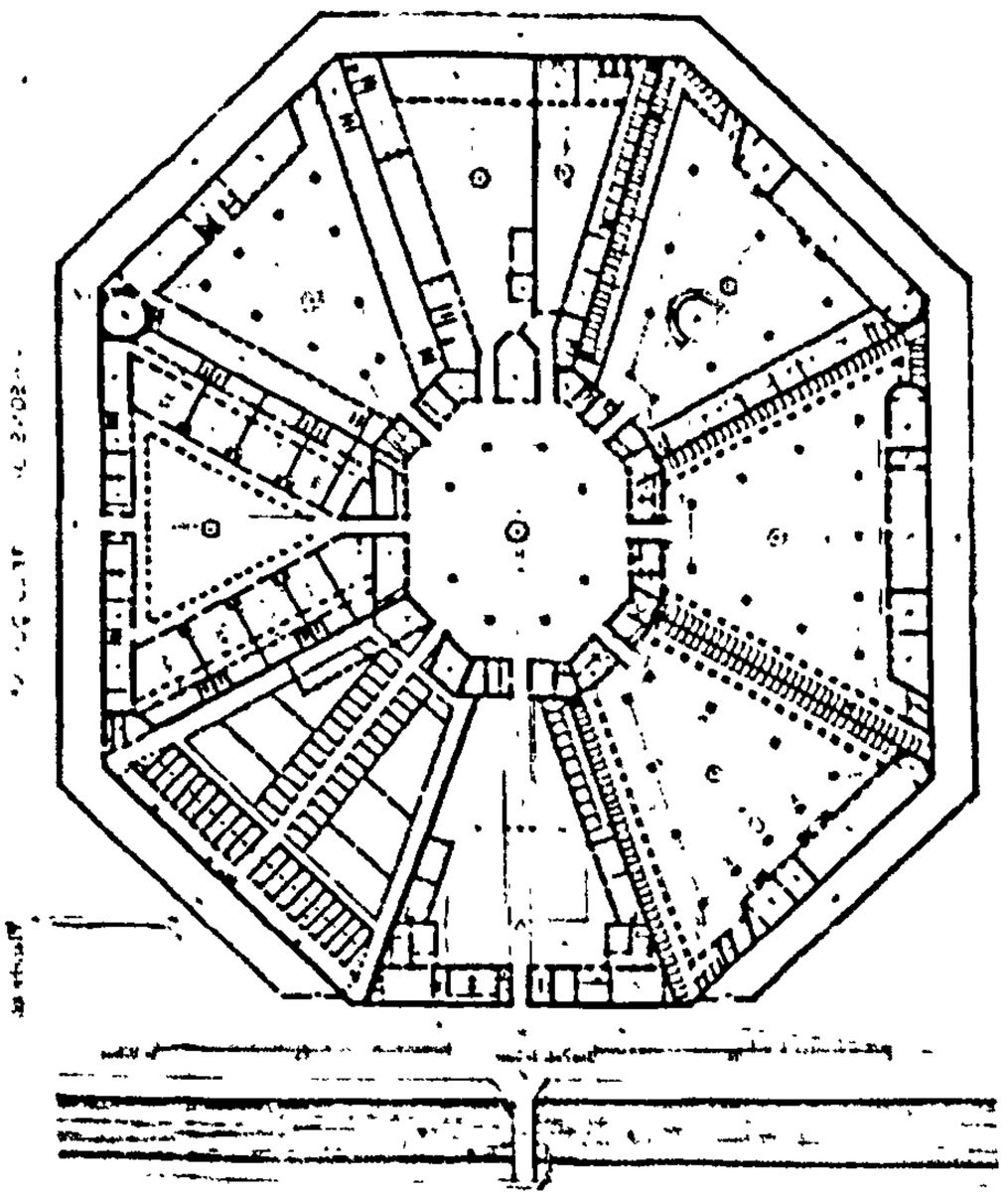

Figure 42: Cellular prison at Ghent

a rudimentary phase of the later radial prisons. Each cellblock was a separate unit to allow effective supervision as well as effective classification. An important element in the Ghent design is the two external corridors, which surrounded the building for extra security (Fairweather, 1975). Initially, Ghent was considered a model prison. However, over time its condition deteriorated and it became overcrowded. Its concept of classification with silence was, however, followed all over Europe.

4.2.3.2 Architecture utilised in reform

By the end of the 18th century crime rates were increasing dramatically. Social thinkers and commentators speculated about the causes of crime. External conditions were now perceived to be responsible for causing the offenders misconduct. Criminal law reforms were effected throughout Europe, to various degrees. However, in England the reform of the law and of penal treatment reached its greatest development (Johnston, 2000). Evans (1982), though, argues that the reform movement was not triggered solely by the appalling conditions in prisons, which reformers such as Howard (1773-1790) published and endeavoured to change. He insists that penal reform was more a cause than a reaction. "It issued not just from observation, but from an implicit contrast between the way of the world as it stood and another possibility, another way of making and using prisons, that gave to the murky facts of common practice a far sharper silhouette" (Evans, 1982: 47). A fundamental tenet of penal reform then, was that under certain circumstances the character of an offender would inevitably shift from vice towards virtue. It was believed that prison buildings had a major responsibility in the transfiguring of evil consciences.

The various English reform movements were incorporated into two main ones: the *Evangelical* supported by Howard, William Blackburn (Architect) and Sir William Eden, and the *Utilitarian* principles of Jeremy Bentham. By means of religious and education instructions along with solitude the evangelicals hoped to achieve reform (Tomlinson, 1980). Utilitarian principles, on the other hand, emphasised submitting criminals to the discipline of an industrial and self-supporting prison, in order to create honest and industrial citizens (Bentham, 1970; Lyons, 1991). There was, however, a wide range of consensus between the two groups. Both agreed that deterrence was a primary aim of punishment, and both aimed for reformation. Reformation of the character was the main concern. Houses of correction focused attention on the tangible reality of productiveness,

turning the useless into the useful, and the reforming prisons aimed to concentrate on the moral transformation of their inmates, turning evil into good.

The debate on the virtues of these two competing approaches continued unresolved until the first half of the 19th century. Yet new prison buildings were essential, and new gaols, and houses of correction were built intensively, mainly following the guidelines of Howard and Blackburn the architect. Blackburn (1750-1790) dominated English prison architecture during the 1780s and long after his death. He was the first to turn prison deign into a kind of technology, translating the doctrine of reform into the practicalities of construction. The importance of Blackburn's and his contemporaries' prison designs stemmed from the point that they featured a critical change in architecture, as it was applied to a new class of building (Evans, 1982).

The composition of 'Blackstone's Act' in 1778 marks the beginning of the modern English prison system. The act established penitentiary houses, where separate confinement with labour should take place. Moral and religious instruction was emphasised. Some basic guidelines for cell dimensions were given: a maximum of 3.7m x 2.4m x 3.4m high, and minimum of 3m x 2.1m x 2.7m high. The act stressed the regular inspection of prisons by Justices. Solitary confinement accompanied by well-regulated labour and religious instruction was stated in the 1779 Penitentiary Act, which was brought into local gaols and houses of correction by Acts of 1781 and 1784. In 1782 the first general prison Act highlighted the importance of classifying prisoners on a gender basis and crime type. No guidelines for human consideration or rehabilitation regimes were indicated. It was assumed that solitary labour and religious instruction were the way to reform offenders.

Although no effort was made to enforce those Acts, some progress was noticed in new prison buildings. However, the major revolution in prison building was caused by the outbreak of 'gaol fever'. Gaol fever was the other precipitant of reform, which did alter prisons, leaving an indelible print on their architecture (Evans, 1982). Numerous prisons were entirely or partially constructed following the solitary confinement principle, and influenced by the classification system. Hygiene and ventilation were the main concerns in the prison design process. Health and religion became the two main aspects of prison administration (McGowen, 1998).

In one sense, the history of prison design from this point onwards is, as Evans (1982: 46) defines, "the history of the removal of power from those who worked and lived within to those who ruled the prison from the outside, and the unnoticed role of architecture in this usurpation". The prison institution, in the following years, witnessed a major transformation in both physical (architectural) characteristics and administration. Order and control regulated not only the life of the inmates, but the behaviour of the staff as well. The following paragraphs analytically trace this development in both Europe and America.

Evidently, reform by building prisons was initiated by local magistrates more than by central government. Abandoning transportation as a punishment procedure led to a dramatic increase in the prison population that was estimated to be 84% between 1776 and 1787/8 in England alone (Evans, 1982). The fundamental issue was still the reform of the prison system, but it was the immediate necessity for expansion that promoted new building. Architects collaborating with magistrates began to develop prison design into a kind of moral geography. The reformed prison, reformers agreed, required three main characteristics which were: Security, Salubrity and Reformation. As a matter of fact, security needed enclosure, salubrity needed exposure and fragmentation, reformation required compartmentalisation; however, the reformed prison had to reconcile these contradictory needs (Evans, 1982).

Architects started competing to provide a prison model. New techniques were invented to facilitate implementation of the controversial prison needs. From the several layouts that dominated the prison design in that era one can identify three varieties of plan, that are: a hub with attached radial wings; a hub facing onto a polygonal range of buildings, and a hybrid of polygonal and radial types. Concern for security and the maintenance of discipline and order were the main motivation for the development of such layouts. The different proposals analogised in introducing the concept of the centralisation of authority. The governor's or the keeper's parlour was always located at the focal point of the prison, with windows facing out onto every facet of the prison. In 1787 Jeremy Bentham developed this principle of central observation even more and allowed it to penetrate the interior of the cell in his design for the panopticon (the all-seeing eye), the circular prison (Figure 43).. The following paragraph explains how this led to a dramatic change of the purpose of this principle.

The panopticon layout was described as the logical development of cellular prisons arranged around a central point (Fairweather, 1975). The idea behind the circular prison was ease of supervision, as using the circular plan means maximum supervision with a minimum of skilled overseers. The panopticon reflects utilitarian penal philosophy, but more it manifests Bentham's search for a method to create a design that could control

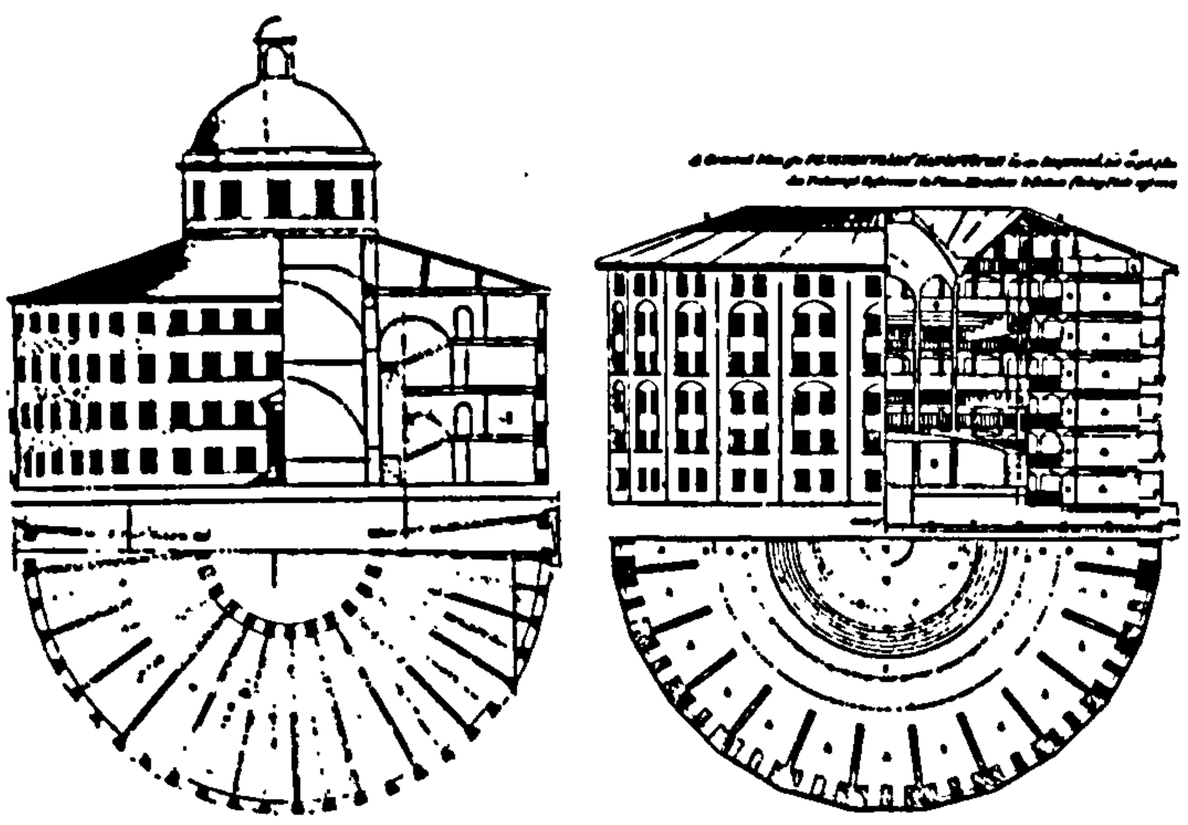

Figure 43: The Panopticon

human behaviour, and through behaviour the human condition as a whole (Lyons, 1991; Semple, 1993). The governor's or the inspector's office was placed in the centre of the building, instead of the chapel or the church. Careful control over geometry and light aimed to enhance surveillance and vision. "The inmates instead of gaining solidarity by being drawn centripetally to a symbolic centre, were fragmented and dispersed centrifugally from the centre by a powerful and invisible eye" (Markus, 1994:14). Foucault (1975) emphasised that Bentham in the panopticon, laid down the principle that power should be visible and unverifiable. He described it as: "a marvellous machine which, whatever use one may wish to put it to, produces homogeneous effects of power" (Foucault, 1977: 202). The difference between the prison buildings designed by Blackburn and Benthams' panopticon, reflects the differences between the two competing movements (the Evangelical and the Utilitarian). The use of architecture was partly needed in Blackburn prison designs, Bentham, on the other hand, used it to generate and stabilize a complete social system. Technology was not simply an aid to morality; it was a necessary precondition to the morality it created (Evans, 1982). The panopticon was never built. The failure of the scheme was the result of many personal, political, social and economical matters. This is not the place to investigate such causes, however, many researchers have examined this subject (e.g. Evans, 1982; Semple, 1993). The failure of

the panopticon to become the model prison did not affect the respect that the design earned. The proposal was closely studied in both Europe and America. The definite penological principles of the panopticon drew prison designers into centric designs and established the principle of the radial prison plan that emerged later (Fairweather, 1975). However, several circular prisons were later erected, for example in France (1792), in Spain (1852), and in Holland (1880) (Johnston, 1973; Fairweather, 1975).

Seeing that new prisons were essential, Blackburn's designs and Howard's recommendations dominated prison architecture in England and Europe, however, the improvement of hygiene and ventilation seemed to be their main concern and no particular philosophy was instituted. In 1823 the new Gaol Act was approved and a new penal philosophy was established. The classification system was introduced, and the new prisons (1820s-1830s) reflected it. The system was built on the belief that different kinds of criminals corrupted each other and hence should be kept apart (Tomlinson, 1980; McGowen, 1998). The degree of criminality became the basis of classification, along with age and gender. The implementation of such schemes necessitated the provision of a complex series of wards, classes, workrooms, dayrooms, exercise yards and sleeping cells. Classification as an imprisonment system was not uniformly implemented. The Act did not provide for any means of enforcement.

The previous review shown that by the end of the 18th century and the beginning of the 19th century, distinctive forms of penal architecture were developed. These forms were of three main types: the rectangular (non-radial) based upon the older forms of 18th century jails; the circular, including polygonal layouts; and the radial. The technological advancements of the industrial and scientific revolutions of the period gave considerable impetus to innovation and experimentation by architects and builders. On the services side, new developments in central heating, ventilation and plumbing of large buildings found some of their earliest applications in the prisons of the early 19th century (Johnston, 2000). There were, as well, definite ideas concerning prison façade design. There was a tacit agreement that prisons should have a 'general appearance' and 'appropriate style'. That was interpreted by avoiding ornate styles; however there were exceptions. Certain prison facades were elaborate and consequently highly criticised by both reformers and the public, for example, Newgate prison, 1770 (Figure 44). It was described as having a forbidding rusticated façade that fitted its function. Three enclosures lay behind the façade; the central element with blind window recesses in the side projections of the

wings, was closely modelled on Florentine palaces (Fletcher, 1987). However, the design of the facades was not merely a matter of economy and security. It carried out a significant part of the purposes of a prison, and played an active role in implementing the functions of imprisonment itself, namely that of deterrence of the inmates and the general public (Johnston, 1973). Johnston (2000:65) quoted an "Encyclopedia Londinensis" (1826) article that expresses this design philosophy in highly enthusiastic terms: "the style of architecture of a prison ... offers an effectual method of exciting the imagination to a most desirable point of abhorrence ... the exterior of a prison should, therefore, be formed in the heavy and sombre style, which most forcibly impresses the spectator with gloom and terror. Massive cornices, the absence of windows or other ornaments, small low doors and the whole structure comparatively low, seem to include nearly all the points necessary to produce the desired effect. Our own Newgate perhaps embodies these as perfectly as can be desired". In spite of the criticism, the Gothic style started finding its way into prison design and soon stony excrescence was established all over the world as the style of prisons (Johnston, 1973).

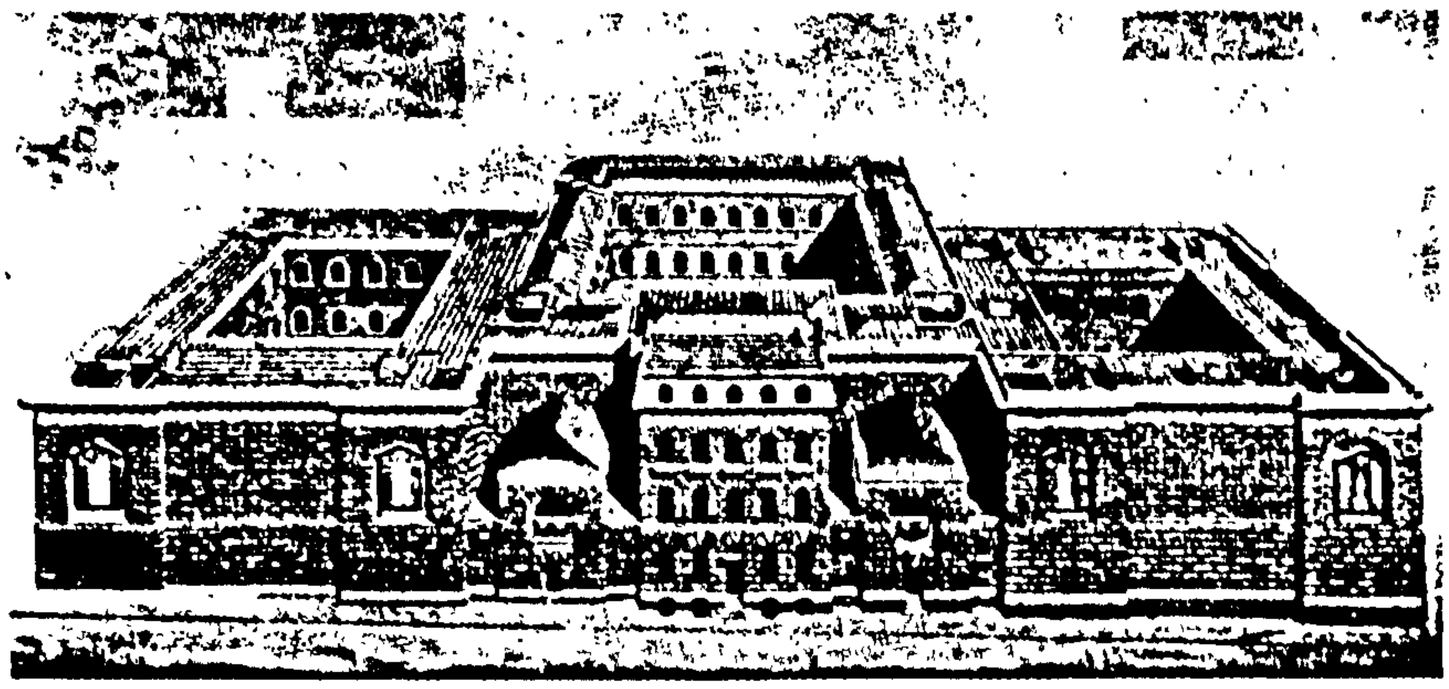

Figure 44: Model of Newgate Prison

In tracing innovation in prison architecture thus far, it can be concluded that prisons evolved out of the awareness of prison conditions in the last decades of the 18th century. This was an architecture of surveillance. Prisons after 1780 were increasingly erected in semicircular or radial layouts, to discourage contact among prisoners and to control the behaviour of both the keepers and their charges. The goals of the ideal prison structure, however, remained disappointingly unfulfilled. If truth be told, despite the shortcomings of the early prison designs and programmes, the efforts of reformers and architects represent the first serious attempts to fashion a specific architecture for prisons and to deal with problems such as mingling of different types of inmate, corruption, undisciplined behaviour of the keepers and matters of health and sanitation. Pointing out

the problems is half way to identifying the solution, and reformers identified the bad things about old prison designs and hoped architecture could solve these problems. In matters of health and orderliness of the prisoners, the new prisons of the period met with modest success. Nevertheless, reformers realised that the magic formula was still missing. A new source of inspiration for both penal architecture and the regimen would come from North America, this time.

4.2.3.3 The American influence

Although the development of prison architecture and humanising of imprisonment conditions before 1830 mainly originated in Europe, and especially in England, the Americans took the lead and developed a coherent strategy for reforming prisoners. They introduced a new prison architecture. In the early 19th century, the Americans created two rival penal regimes, namely the silent (the Auburn) and the separate (the Pennsylvania) systems. Incarceration architecture at this stage was not only utilised for reform, but also to prevent communication as a formula for correction (Johnston, 1994a). It was believed that the silent (non-communication) system known as the Auburn system would be an effective way of preventing the spread of moral contagion (McGowen, 1998; Fairweather, 1975). The separate system owed much to the thinking of Quaker (the Religious Society of Friends) reformers. The intention of this system was the reformation and rehabilitation of its inmates, and it was based on the idea of virtually unrestricted solitary confinement (Moyer, 1977). The Americans embarked upon a new venture. Reform in prison was an experiment; Americans had no model prisons to visit, no pioneers in the march of reform to warn them of errors or guide them to truth.

The space was used in the separate system as a way to separate and isolate each prisoner, so that they did not see or hear the one another. The philosophy behind this system was enforcing the principle of individual reform through penitence and labour, which would rehabilitate the prisoner. The plan and the symbolic and ideological forms with which these buildings were invested have a vital role in explaining the internal power relations of the regimes. They also make important statements about external social relations, concerning how the prison is to be seen by society as an instrument of social policy (Markus, 1994).

The Pennsylvania system (Figure 45) copied St. Michael prison's outside cells along with the Ghent prison radiating cellblocks. The Auburn system architecture (Figure 46) on the

other hand, was inspired from the inside cells of Ghent prison, along with the single rectangular cellblock concept from St. Michael prison. Another distinguishing element in the Auburn prison design is the entrance. It was planned to be in the centre of a long cell house, which formed most of the outside boundary wall. The toughness of steel and the construction strength were the only improvements applied to those systems throughout the following century (Fairweather; 1975).

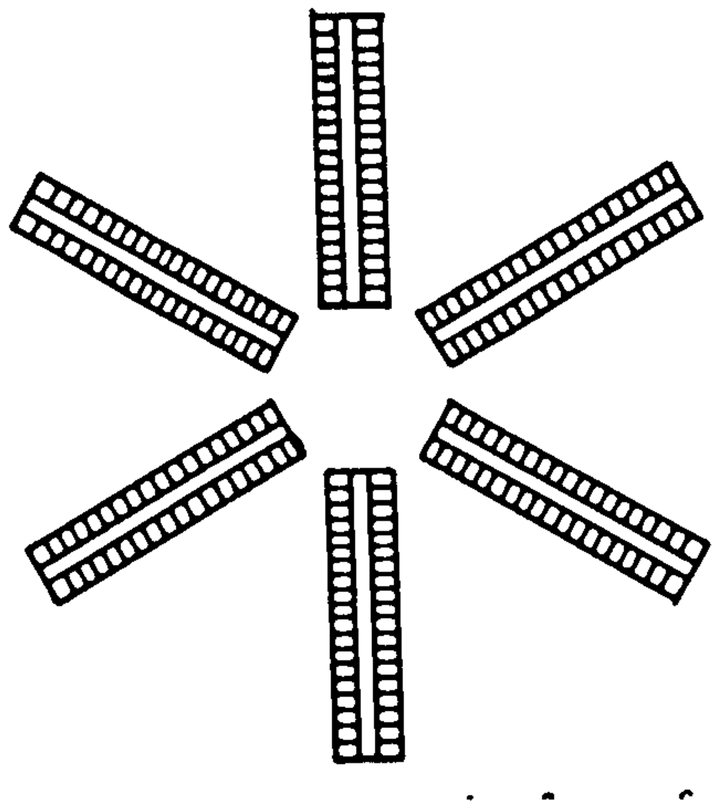

Figure 45: The radial plan of the Pennsylvania system

A developed example of the Pennsylvania System, the Eastern Penitentiary of Pennsylvania (Figure 47) known as Cherry Hill, was built in Philadelphia in 1829 by John Haviland (1782-1852). The importance of this prison arises from its being the first fully developed radial plan, where all the cells can be watched from a central position (Fairweather; 1975). The penitentiary contained 252 cells situated in seven spokes. Four spokes were one tier high, while the rest were two tiers. In order to allow the prisoners to work in the cells, they were designed to be exceptionally large: 3.6m x 2.3m x 4.9m high. Each cell had access to a roofless high-walled exercise yard 6m x 2.4m. Cells were made larger later, 4.3m x 2.3m. On top of each cell a sloping skylight measuring 310 mm x 100 mm was fitted, in order to allow light into the cells. The Haviland design addressed

Figure 46: The stick form of the Auburn system

the concerns for heating and sanitation. Heated air was conducted by flues under the

corridor. Floors were wooden on set stone sub-floors and a water closet was provided for

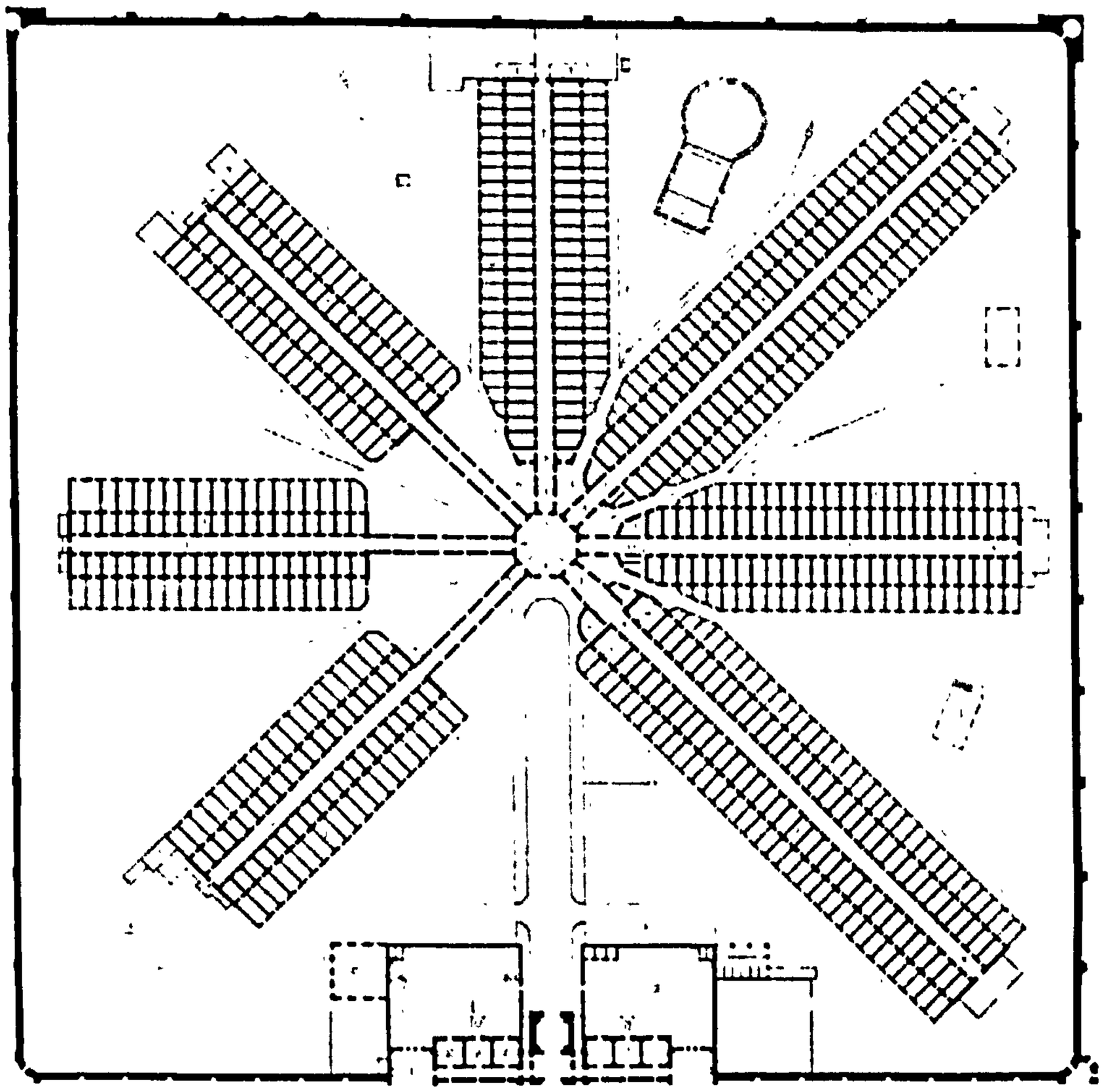

Figure 47: The Eastern State Penitentiary

each cell. Each cell was provided in with a specially designed flush toilet; however, the toilet was externally flushed several times daily. Ventilation was another priority, and each cell was provided with a vent for fresh air and heating. Anxiety about escapes resulted in the penitentiary having only one main entrance. The central gateway was 4.6m wide and 8.2m high, and the gates were oak with an iron portcullis. The façade of the two storey front building, incorporated in the outer prison wall, was in Gothic revival style and included a guard tower on each end. In order to avoid any unplanned contact between inmates and staff, the service facilities were located in the basement (Johnston, 1994b). The details of the distinctive regime that the Pennsylvania System introduced are discussed in section 4.3.2, where its impact on the inmates is also considered.

Sing-Sing, opened in 1828 (Figure 48), on the other hand, set the characteristic pattern for Auburn system institutions. The north wing of the prison was built by inmate labour. The three people who influenced its design were William Brittin, a local carpenter, John Cray, a local architect and a member of the Boards of Inspectors and Louis Dwight, a

member of the Prison Discipline Society of Boston. The building contained 550 small sleeping cells, each 2.1m x 1.0m x 2.0m high, arranged back to back on five tiers. The middle wall separating the ranges of cells was 0.6m and the partitions between the cells were 0.03m. Cell doors were of oak, with an iron grating in the upper portion to admit light and heat. Far from the designers' intention, the ventilation ducts which were 6.35 cm in diameter enabled inmates surreptitiously to communicate with one another while the thick cells doors prevented the guards from hearing them. The cells were accessed through 0.9m wide balconies on each tier. The balconies faced the exterior cellblock wall across a 2.7m wide-open space, from ground floor to roof. The five levels were connected by flights of stone stairs, which were not provided with railings, on each end of the building. The workshop contained a gallery that was 610m long and 0.9 wide, in order to allow the guards to observe the inmate workers via slits without being seen by the latter.

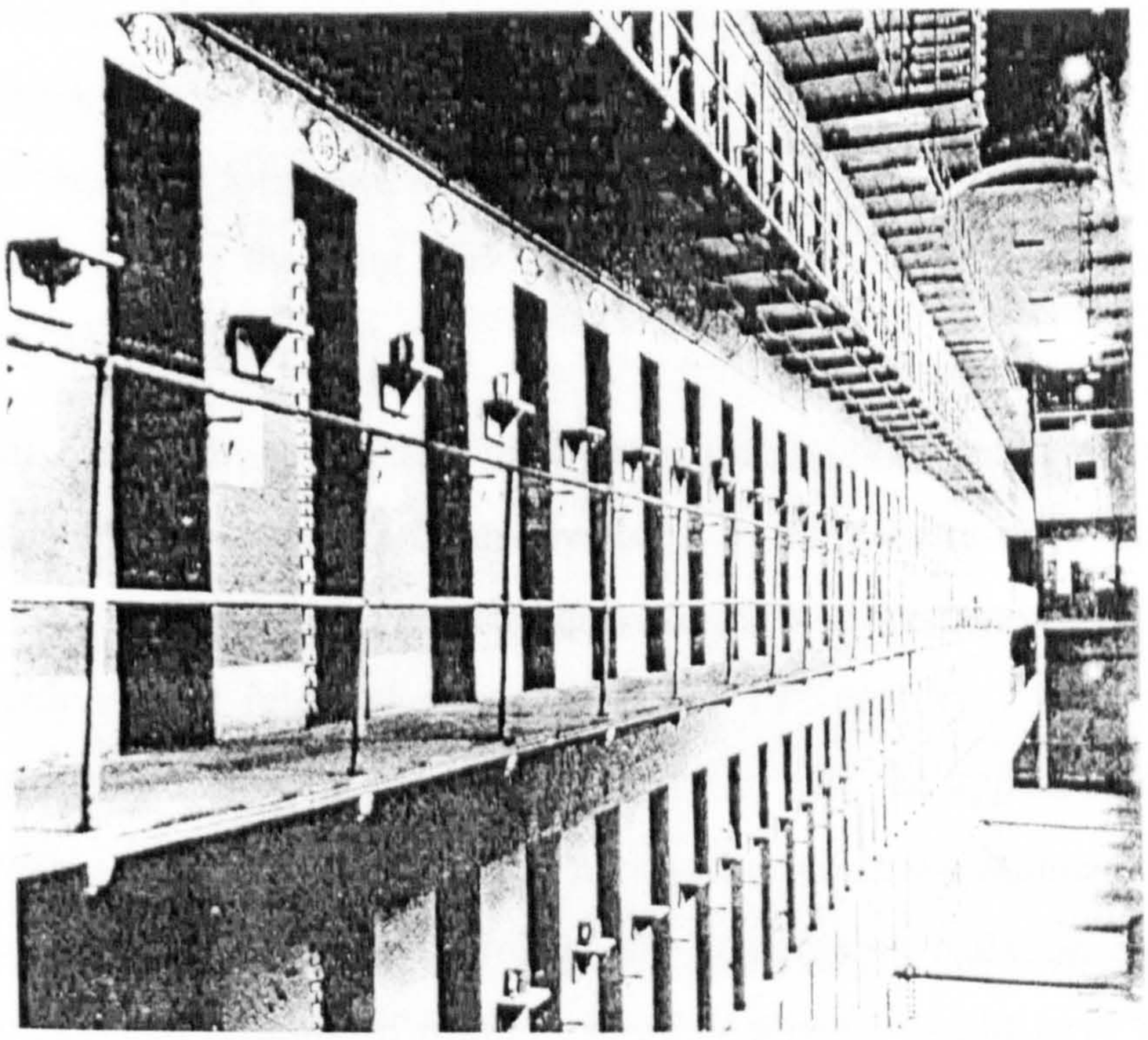

Figure 48: Sing-Sing Prison

All through the century the proponents of the two competing systems fiercely defended their views on imprisonment. Neither side ever admitted publicly that they might not have been on the right track, and neither acknowledged the considerable flaws in the everyday working of their respective prisons. The unusual architectural and sociological difficulties that faced the Eastern State Penitentiary made it impossible for the

penitentiary to fulfil the goals of its designer and the reform ideology which supported it. While the philosophy of the system required continual solitary confinement that excluded communication with fellow prisoners and offered minimal contact with staff, the need to provide healthy accommodation for the incarcerated men allowed inmates to find devious ways of communicating. In the early 19th century building technology did not provide ready solutions for large-scale heating, ventilating, and waste disposal. The problems of providing a healthy physical and mental environment in the solitude of a damp and under-heated cell were not completely solved (Johnston, 1994c; Johnston, 2000). The Auburn system, on the other hand, suffered problems with ventilation, heating and lighting from the beginning. Heating was provided by stoves in the corners of the building, but they never kept the cells warm in wintertime. Steam heat was tried briefly in 1839 but proved inadequate. The cells were damp and infested with vermin. The light was too meagre to allow the prisoners to read. Toilet buckets in the cells produced noxious odour in the cells and corridors. Harsh physical punishments were inflicted on the inmates; the temptation to break the rule of silence was always there, with inmates working, eating and moving around together (Johnston, 2000). Fairweather (1975: 20) blamed Sing-Sing for providing "the model for the long dark cell corridors which were the curse of prison construction for the following century".

It is challenging, however, to identify the system that worked better between the silent (the Auburn) and the separate (the Pennsylvania). In the present-day, recidivism would be a revealing index of successful reform; however, it is almost impossible to determine the rate of recidivism of released prisoners in the 19th century. As a matter of fact, accusations were most commonly made in connection with the appearance of insanity in the separate system prisons. Other sorts of harm occurred in the Auburn system prisons. Therefore, the choice between the corrosiveness of enforced isolation and the physical violence and calculated tyranny of routines in other prisons would have been a difficult one, had inmates been given the opportunity to make it. In financial terms, neither system fulfilled the dream of its founders, although Cherry Hill was always more expensive to run. Consequently, the Americans chose the Auburn system for their institutions. This was more economical to build, on one hand, while workshop industry was more productive and lucrative than individual work done in a cell, on the other. The other element causing the Americans to prefer the silent system was the increasing of prison population. This jeopardised the penitentiary philosophy with more than one man

needing to be placed in one cell, and within a few years the only vestige of its original idealistic purpose was its architecture (Johnston, 1994c).

However, the case was different in Europe and the rest of the world. The great experiment in the modification of criminal behaviour attracted reformers' attention, and the American institutions started to attract visitors from all over the world. In its early days, and before the theory's promise had been eroded by contact with reality, penologists around the world regarded Eastern State Penitentiary as the perfect prison (Johnston, 1994d). Reformers from England and Europe preferred the Pennsylvania system for several reasons. It was believed that the Auburn system did not provide adequate treatment for the offenders, and hence had no impact on the repression of crime. The Pennsylvania system on the other hand was perceived to give equity of justice and a chance of reformation. Solitary reflection was thought a reformative influence as well as a good punishment, and there was no chance of contamination by other prisoners (Fairweather, 1975; Tomlinson, 1980).

Cherry Hill was a model for the world and variations on Haviland's plans were built in several countries. Johnston (1994c) gave some examples of prisons influenced by Haviland design, in France 1843-50, Belgium 1856-60, Italy 1867-79, Germany 1869-79, Russia 1884-90; in the 20th century Haviland influence is obvious in the design of the Beijing First Prison in China (1909-12) and the design of Hakodate prison in Japan

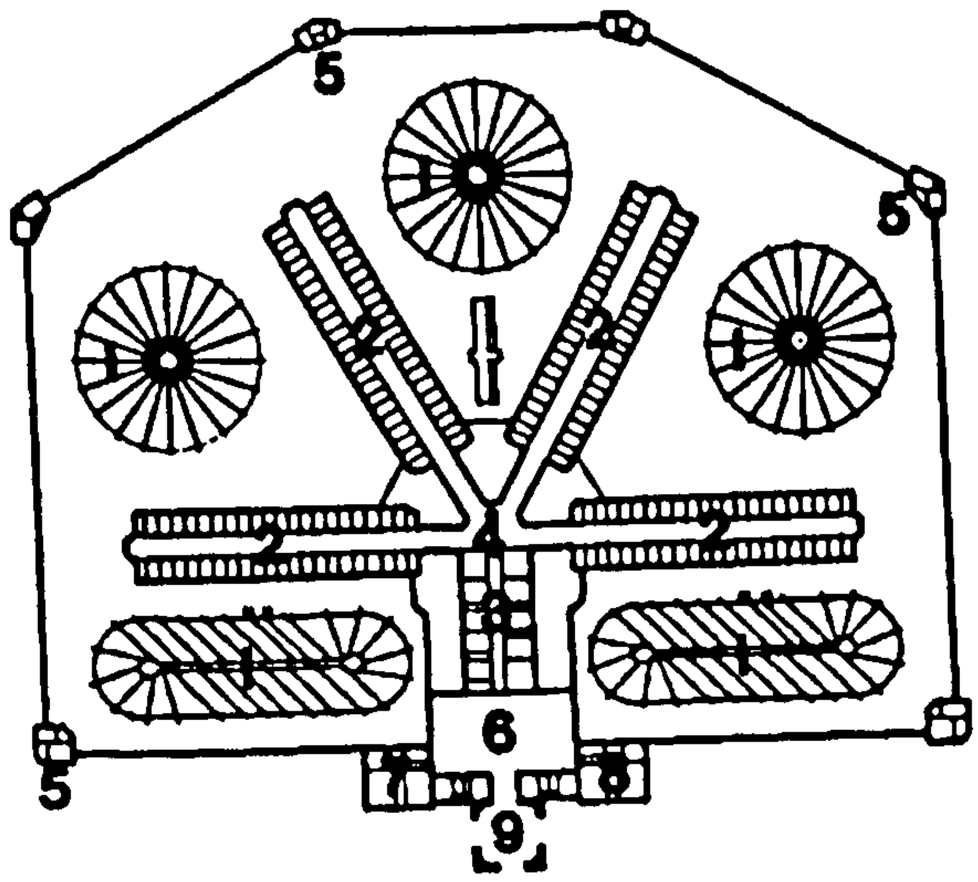

Figure 49: The Pentonville Prison, London

(1931). However, the most important prison modelled upon the Eastern State

Penitentiary was the Model Prison at Pentonville (Figure 49) built in London, England during 1840-42, designed by Joshua Jebb.

It is worth mentioning that as Johnston (1994d: 70) described "in one of those strange twists of history and cultural diffusion, the radial plan originally developed in British and Continental prisons was not widely accepted for large prisons in Europe until after it had been transplanted to the United States by Haviland". It was, therefore, Haviland's reinforcement of those plans that provided the model for subsequent British prisons.

Jebb, although he took the Eastern State Penitentiary as a model, did not adopt it wholesale. He analysed every aspect of prison life, and found new solutions. Everything from the beginning to end was chosen with scrupulous care, and detailed with infinitesimal precision. He recognised, for example, the importance of the indoor air quality and warmth as having a direct influence on health of prisoners, and devised an ingenious method of providing a flow of fresh air to each cell. He designed the cells in particular with great care. The cell to him was the key to the whole institution and everything was utilised, sometimes created, to increase the power of the cell over the mind of the prisoner (Evans, 1982; Fairweather, 2000b). Jebb had brought the art of designing the solitary cell to a new perfection, as he believed that the cell was responsible for the transmutation of the criminal mind. In order for this to be carried out successfully the crucial connections that linked the cell with the rest of the building and the world at large, had to be carefully engineered. Pentonville was his attempt to construct an entirely predictable, synthetic, reforming environment. In a way this can be seen as an early experiment in what is now called environmental control. Section 4.3.2 investigates these efforts in more detail. Jebb had also been wielding the razor of economy wherever the aims of the institution were not being furthered by the design. Pentonville "as a piece of engineering, the construction was economical in the abstract sense that no part of it was without its utility" (Evans, 1982: 349).

The boundary of the Model Prison was defined by a chain of six wardens linked together with long stretches of plain wall. The four large converging wings that formed the body of the prison and housed the inmates were contained within. Each wing was made up of a nave-like, barrel vaulted space 5m wide and 12m high, lined on either side with three storeys of cells reached from a network of light iron galleries and catwalks. Where the four wings met was an ample central hall commanding a sequence of panoramic views down each of the succeeding galleries. Every door to every cell could be seen from this

one point. Glazed bays jutted out from the Commissioner's and governor's office into the central hall, allowing them this all-encompassing view of the rest of the prison interior (Fairweather, 1975; Evans, 1982).

Pentonville was more impressive for its complexity and perfection than for its originality. No one can compete with Evans (1982) in his analysis of the Model Prison originality, and a lengthy quote is therefore essential. "It was the outcome of a process of historical development, the end of an evolutionary chain, which it is perhaps worth attempting to define. In terms of its architecture the Model prison represented a rather specialised form of eclecticism. Each of its components can be traced back: the radial plan, the galleries, the cellular compartmentalisation, the ventilation and servicing, the observatory, the chapel; all had emerged from the recent practice of prison building, serving many different systems of discipline. Elements brought together to define a second genotype of the prison more perfectly adapted than Bullar's generic radial plans in the 1820s. Yet this says very little, and makes it sound as if the history of the prison was the history of accumulation of parts. More than this had been involved. The fundamental aim of these institutions had been to reform corrupted character. Prison architecture was developed quite consciously as a means to this end. Increasing technical sophistication was a consequence of successive failures to achieve reformation, which were frequently seen as failures of performance in the prison building. The critical link, then, was the link between reformation and character, which held out a possibility, and the technology of the prison through which that possibility was to be realised" (Evans, 1982: 363).

By 1847 fifty-one prisons following the Model Prison had been erected or were under construction, in England alone. Never in English history have so many prisons been built or rebuilt as during Victoria's reign. Prison architects had too little to do, with a pre-ordained prison design. All the architects could do was to fit Jebb wings onto a site, and then devote their attention to the appearance of the façade and entrance. Consequently, façades became increasingly mediaeval, ornamental, and meretricious (Evans, 1982).

In France, and more specifically at Fresnes near Paris in 1898, however, one new prison layout was introduced. The 'telephone pole' (Figure 50) designed by Francisque-Henri Poussin was one of the chief innovations in modern prison design (Fairweather, 1975). The plan of the prison was set as a series of rectangular cell houses arranged at right angles, on each side of a corridor which links them. The cells (3.9m x 2.4m x 3.0m high) were planned around the outside walls; many of them contained a water closet and

lavatory basin. The concept of classifying the prisoners was probably served in this plan. Contrary to the central control point in the radial plan, separate control was used in each block with general supervision from the central corridor. Fairweather (1975) stressed that Poussin's design was instrumented in changing the course of prison architecture mainly in America, during the following 50 years.

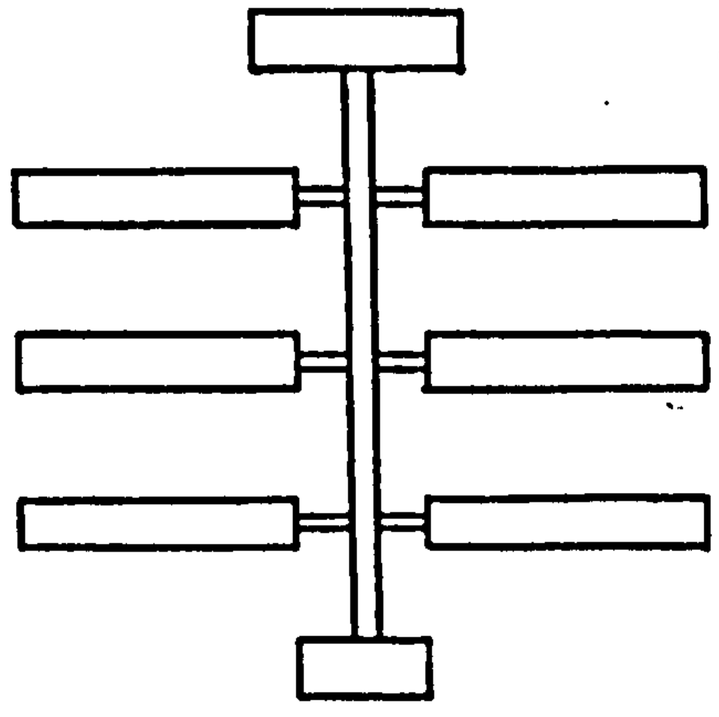

Figure 50: The telephone pole layout

4.2.3.4 The uncoupling of architecture and reform

Pentonville, nevertheless, was the ultimate prison building that attempted technical perfection. Historians and social reformists agree that it was a decisive point for the notion that imprisonment could redeem criminals (Foucault, 1977; Ignatieff, 1980). The system failed, and the prison was deprived of its power to transform. The prison was reassessed and redefined as a tried and convenient method of exacting punishment and deterring from crime. However, its form and substance were preserved, while its original purpose as an institution was lost to view. It was at that point that, as Evans (1982) described it, the uncoupling of architecture and reform took place.

Separate systems as well as silence systems were abandoned in America after 1965, and in many places decades before that. However, the contemporary world inherited the buildings that carried out their specific goals.

4.2.3.5 Summary

The review of the historical development of prison design has shown that although imprisonment was rooted in the ancient world, a self-conscious architecture of incarceration emerged as late as the 18th century. Early places of confinement were crude structures and rarely built for the purpose they were used for. They were generally strong cages within a fortress or castle enclosure, or subterranean parts of public buildings. The only characteristic that these structures held in common was their substantial secure nature. The 16th century workhouse represented a significant departure from older methods of treatment. Its architecture, however, revealed no break from the past. The first distinct architectural form that was coupled with a specific penal function can be traced to St Michele cellular prison (Figure 40). Satisfying the function of ease of supervision was the most distinguishable element in the prison. Later, Ghent prison (Figure 42) gained more importance. It was regarded as the first large penal institution in which a conscious attempt was made to bring architecture to the aid of the treatment philosophy (Johnston, 1973). In more complex prisons, the layout went further than facilitating ease of supervision, into assisting the introduction of effective measures of classification. Another interesting architectural element that characterised the building is the two external corridors that provided extra security. These two examples along with the Milan house of correction (Figure 41) are exceptions to the common prison buildings of that era. Generally, in design terms prisons of that time had no characteristic form. Although there was some agreement on the general quality of prison facades, in reality incarceration architecture, in the essence of a distinctive external appearance and original interior arrangement that differentiated it from other types of buildings, had not esteemed yet.

The truly original and characteristic forms of prison design developed in the late 18th and 19th centuries. Circular, polygonal, and radial plans replaced the simple rectangle shape to accommodate the new prison functions, which are: security, healthy environment, classification and ease of supervision. At the beginning of the reform stage, prison buildings were located away from urban areas, where very few civilians could see them. Security fences concealed the building away from the public. Behind the high fence, the façade of the building had little difference from those of other civil structures. Architects made no effort to tie external appearance with the special functions of the interior. Later, large-scale erection of purpose-built prisons, a self-conscious architecture, evolved.

There was general agreement among architects and the public on how the exterior of a prison should look and the message that it should send. The prison envelope was not only expected to offer maximum security but also to achieve crime deterrence. Following this concept, excessively elaborate façade design started to emerge in prison buildings (e.g. Newgate prison, Figure 44).

The search for a magic architectural formula for reform was believed to end with the foundation of the two penal systems that appeared in America; the silent (the Auburn) and the separate (the Pennsylvania) systems. The prototype of the former had controlled prison architecture in America, and the latter had dominated prison design in the rest of the world. Johnston (1973) ironically compared the cells of the Auburn-type prison with the iron and wooden cages placed in the interior of medieval castles. This similarity occurred after technology facilitated the excessive use of steel in the cell elements (doors, bars, etc.). The façade design, however, in both regimes aimed to impress both onlookers and the architect's colleagues. The division between the façade and plan designs in prisons, which has been evident for so long, was finally broken into two unconnected tasks presided over by different interests. A technology of moral purpose prescribed and enforced by the reformers, and an architecture of external appearances within the competence of the individual architect to decide (Evans, 1982). The rise of the gothic form in prisons was at its peak. New prisons resembled palaces (Johnston, 2000), and hence triggered a lot of criticism. The 20th century world inherited 19th century prison buildings that had survived the diminishing of the penal system behind them. In the following section the contemporary architectural configurations and the penal system of prison buildings are reviewed.

4.2.4 Architectural elements and space configuration of prison buildings

From the end of the 18th century until the present, penal thinking has progressed and evolved in many countries. The ideas of humanising penalties and recognising the human dignity of the prisoner have decisively influenced legislation, at least formally. The review carried out in 4.2.3 shows how prison buildings evolved from being "opportunistic spaces" that carried out the function of confinement, into distinguished purpose-built reform prisons. The later typology of prison buildings was applied worldwide in the period between 1850- 1950. Although the architecture of such buildings represents a penal philosophy that had become redundant by the first half of the 20th century, its physical existence resulted in the continuity of using such prisons in many countries. As described in section 4.2.3 such buildings were designed to perfectly fit the separate and the silent systems, hence, their construction obstinately prevents any contemporary penal adaptation.

Collision between the reformers' noble ideas and the reality of the prison institute eliminated gradually the role of architecture in the reform procedure. By the end of the 19th century and the beginning of the 20th century, most countries had shifted away from the cellular isolation penal system; however, several countries developed a mixed stage system in their prisons. Inmates were to spend only the initial stage of their confinement in isolation (Johnston, 2000). Prison however, in its simple function of depriving liberty, remained the centrepiece of penal philosophy. Prison was and still is the clearest, simplest and most equitable of penalties. Historians explained the continuity of the existence of the prison system by defining it as an economico-moral self-evidence of a penalty that measures punishment in days, months, and years and draws up quantitative equivalences between offences and durations (Foucault, 1977).

Between 1900 and 1935 prisons became human warehouses. No specific penal system evolved to replace the separate and the silent systems. The role of prisons retreated to the stage of providing custody, punishment and sometimes hard labour. Prison architecture consequently was idle. Modification to prison structure aimed only to reduce the cost of the construction. Utilising less-expensive materials and using prison labour in constructing prisons were the general changes in the prison architecture. Contradictory to the monolithic, uniform, and intimidating former prison buildings, in this era almost any sort of building was dragged into service and designated as a prison. Old convict prisons existed alongside converted country mansions, public buildings and hutted camps

(Dunbar and Fairweather, 2000). The economic and social dislocations that followed World War II led to an international deceleration in resuming prison construction except in the United States, which recommenced building prisons almost immediately.

After 1945 prison retained its basic functions, which are punishment, the provision of secure custody, reform, deterrence and ensuring the health and safety of prisoners. However, some of these functions gained more emphasis and consequently, architectural forms were modified to include the changes in penal attitude. Contemporary prison architecture also, hinged more intensively on the use of high technology. Researchers such as Fairweather, 1975, Lenci, 1977 and Johnston, 2000 relate such changes to the increasingly conservative attitudes of the public and official policy makers, as well as the changing nature of inmate populations. The following part reviews the contemporary layout of prison buildings. The review identifies two main streams in contemporary incarceration architecture. The first is the old forms of prison layouts, which were significantly modified. The second is the new forms of prison designs that emerged in the last three decades of the 20th century. However, before presenting the architectural configurations of these forms, it is worth noting that contemporary penal treatments are illustrated in Chapter 5.

The prison system in the 20th century became more complicated and diverse than it had been in the 18th and 19th centuries. While prisons in early times were built only for maximum security, they began to specialise over the course of the 19th century; so that juveniles would enter one type of institution, women another and mentally ill people still another. The process continued into the 20th century, with inmates categorised into different degrees of security according to the severity of their offence and the extent of their criminal record. Consequently, new prisons were built either to a specific degree of security (maximum, medium or minimum), or with different security zones within one prison. New (higher) security categories appeared, mainly in the US, to solve increasing control problems, hence "super-security" or "maxi-maxi security" prisons started to emerge. In some cases specific new zones were designated for this purpose such as "control unit" or "security housing unit". Very specific and expensive materials are usually utilised in the building of high security prisons. Prisons now are called "correctional institutions" and the federal prison system in the US divided its facilities into "penitentiaries" and "correctional institutions".

Although, as will be explained later, new prison layouts have emerged, some of the traditional prison layouts survived and have been modified in response to contemporary conditions. There are five main categories into which the traditional layouts can be divided. These are the rectangular layouts, courtyard or self enclosed prisons, radial plans, modified telephone-pole layouts, and high-rise prisons (sky scrapers). The latter however are mainly used as temporary detention centres (Miller, 1975). Fairweather (1975) and more recently Johnston (2000) provided very detailed examples of prison layout worldwide. It is, however, evident that the façade design of the new institutions has shifted radically. In contrast to the prisons of the 1950s and earlier, glass façades emerged in the design of contemporary prisons. The austere functional style and lightness that characterised civilian and residential structures also became applicable to prison façades (Johnston, 2000).

There were, however, several novel architectural solutions in prison design initiated in the United States in the 20th century. The 'treatment prototype' or the 'medical model' prison emerged. The advocates of this system believed that inmates needed to be encouraged to live and work in communities that were, as far as possible, similar to the ones in the outside world. This philosophy led to the creation of the current popular prison layouts in North America, which has been copied in the rest of the world, the Open Campus Plan or the Unit Plan. The layout is a combination of a series of pods or small housing units, and other facilities connected by secure passageways or open walkways (Johnston, 2000). The main purpose of the new prison was the provision of treatment and training. The concept was first introduced for minimum-security facilities, juvenile and women's institutions. However, modern penal philosophies emphasised that efforts to treat offenders classified as maximum security risk would be more efficient if they were situated in more normal open conditions, with a consequent improvement in living, training and recreational facilities. In order to achieve maximum-security in a facility whose layout and construction turned it into a minimum-security institution, an escape-proof system of walls and fences had to be established. The liberal treatment within a secure perimeter concept did not lack its critics, especially with the high rate of recidivism. There was general scepticism of the possibility about achieving the noble aim of the institution while the prison was constantly under the surveillance of armed guards. It was argued that the prison failed to satisfy both the demands of maximum security and the requirements of a minimum-security institution (Fairweather, 1975). Overcrowding

in prisons globally steadily grew worse, and there was still no sign of any obvious relationship between penal policies and the design of penal establishments that they should have generated. The need for a change was essential and the solution came again from the United States.

The direct supervision prisons, or what is known internationally as the new generation prisons is considered the real milestone in contemporary penal architecture. The main design requirements of the new penal philosophy were to provide single cells for inmates, direct staff supervision and functional inmate living units (Zupan, 1991). Inmates were to be divided into small groups of 40 to 50 for housing purposes. The interior features of the facilities were to be designed to reduce the trauma of incarceration and to ensure efficient use of space. Sections 4.3.3 and 4.3.4 investigate these features and the arguments around them, in detail. The living units were to be arranged to ensure that correction officers could observe all areas within the unit. These concerns about security and the search for designs to minimise if not nullify the "blind spots" in the prison units led to the triangular layout prison (Figure 51). The idea was first used experimentally and then widely adopted in the USA. The success of the design motivated the American Correctional Association to favour it in their design guide for secure adult correctional facilities (ACA, 1983). The proposed UAE central prison, which is the case study of this thesis follows this triangular layout. A modified version of the triangle the "bow-tie",

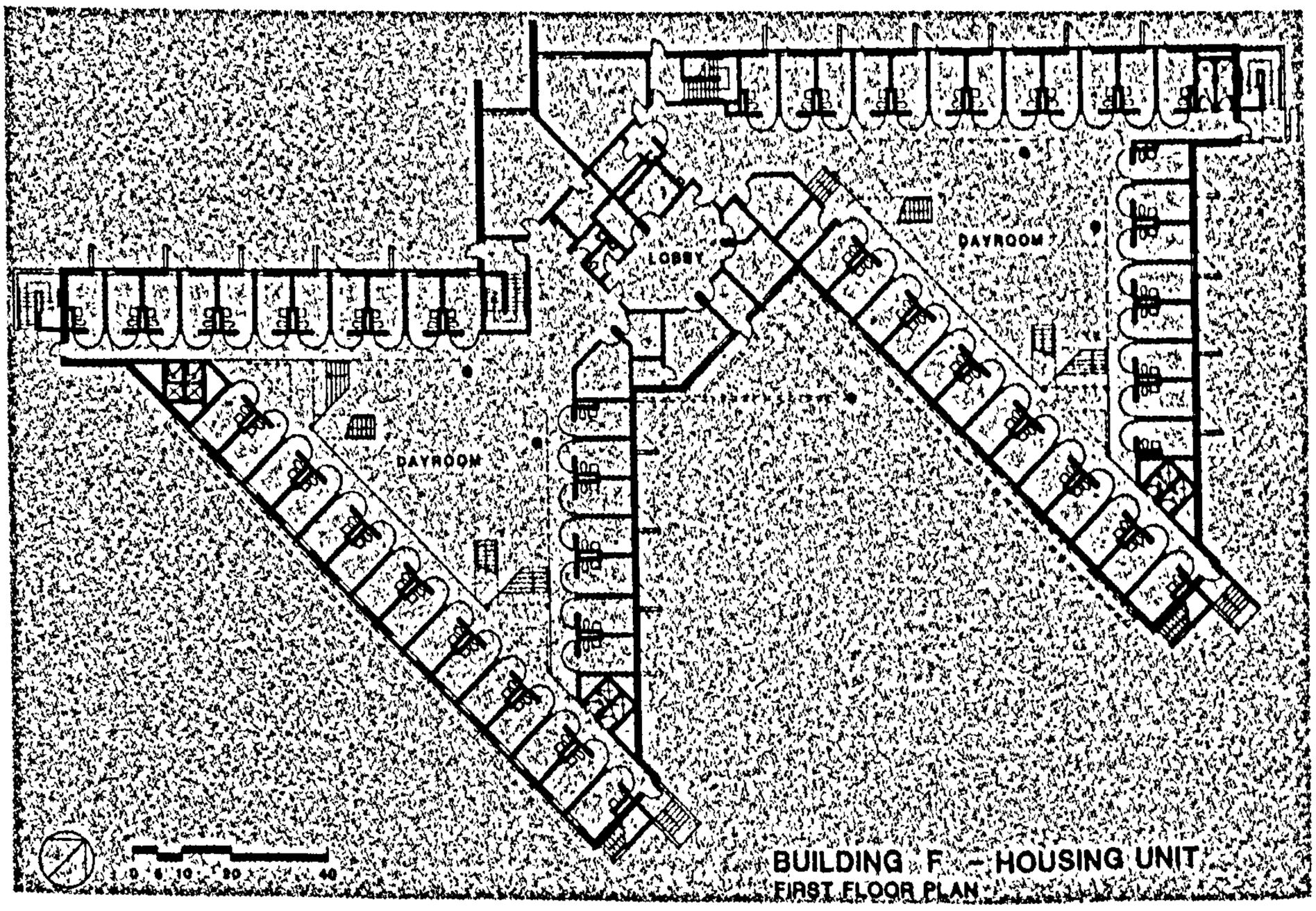

Figure 51: The Triangular prison layout

was adopted in the design of several institutions in the USA in the 1980s (Figure 52).

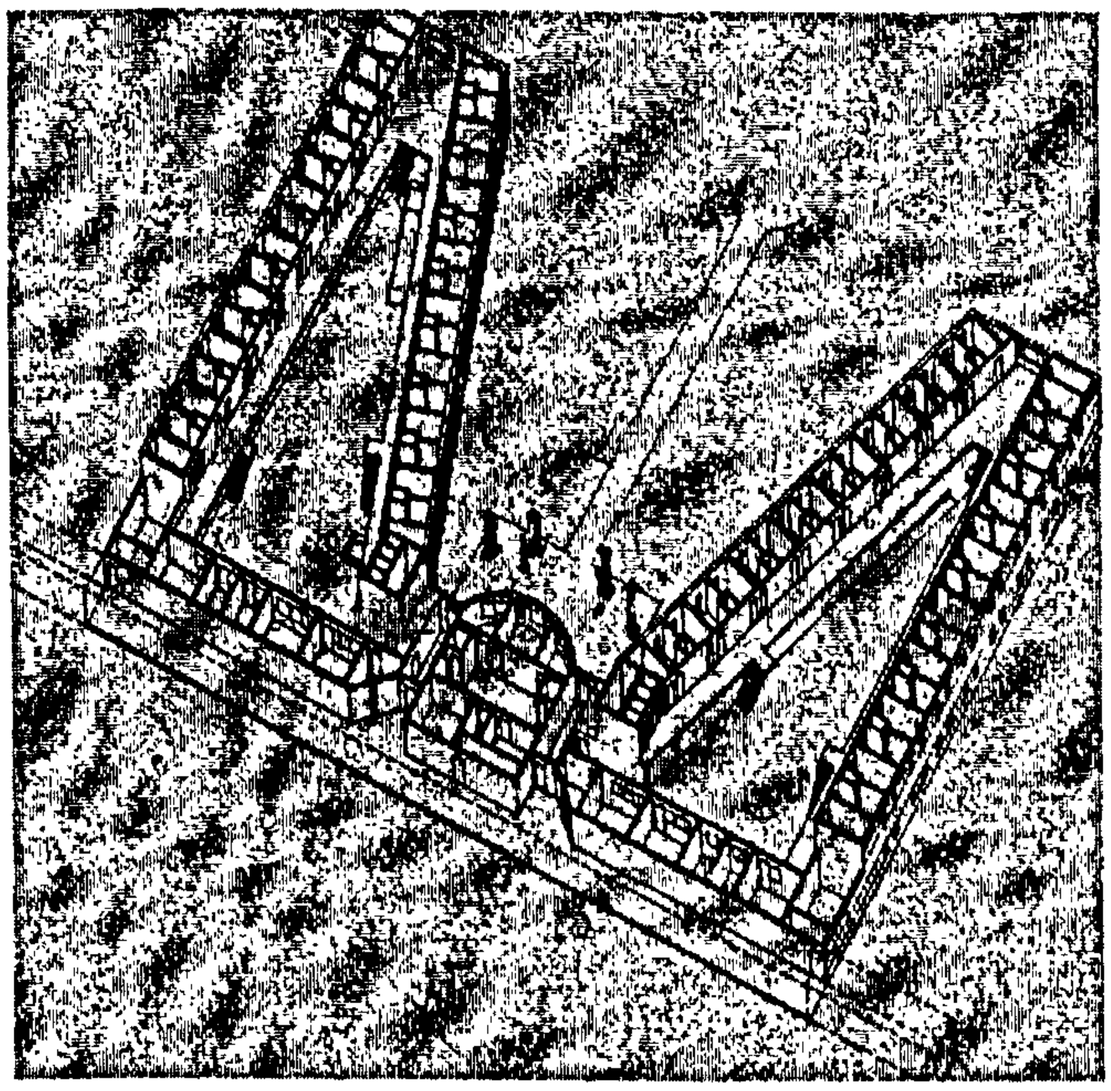

Figure 52: The Bow-tie layout

In a step similar to that carried out in the 19th century, in 1984 the British Home Office sent a delegation to visit the new prison buildings in the US and to hold discussions with officials there. Following this visit, the Home Office published the report that introduced the direct supervision system into Britain: "New Directions in Prison Design" (Home Office, 1985). The aim of the report was to familiarise the Home Office architects and policy makers with direct supervision, carried out in new triangular housing units in a campus setting and with new standards of interior and exterior finishes and equipment. Another publication that had changed the direction of prison architecture and regimes in the UK was "A Sense of Direction" (Dunbar, 1985). Dunbar's report looked at the importance of activity, individualism, relationships and the implications of architecture. He highlighted the need for discrete living units to facilitate the relationships between staff and prisoners, and good facilities for regime and industrial activities. However, the first manifestation of the new prison design approach in the UK was the preparation and publication of the 27 booklets that made up the Prison Design Briefing System (PDBS) in 1989 (HMPS, 1989). The PDBS was perceived as an achievement in understanding the operational and human requirements of the new generation prisons, and expressing them in design terms (Figure 53) (Fairweather, 2000b). The PDBS did not intend to impose standard solutions, it mainly aimed to identify and incorporate the relevant features of the

"new generation" American designs. It illustrated new concepts and principles. It provided clearer understanding of the "client" requirements. The PDBS formed the basis for assessing typical inmate occupation profiles and staffing requirements and cost management system. It was additionally perceived to enable detailed designs to be developed quickly when speed was a primary objective (HMPS, 1989). The advent of the privatisation of prison funding and building, which emerged in the UK the last decade in of the 20th century, has restricted the implementation of the PDBS principles and after more than a decade since publication no complete model solution has yet been built (Fairweather, 2000b).

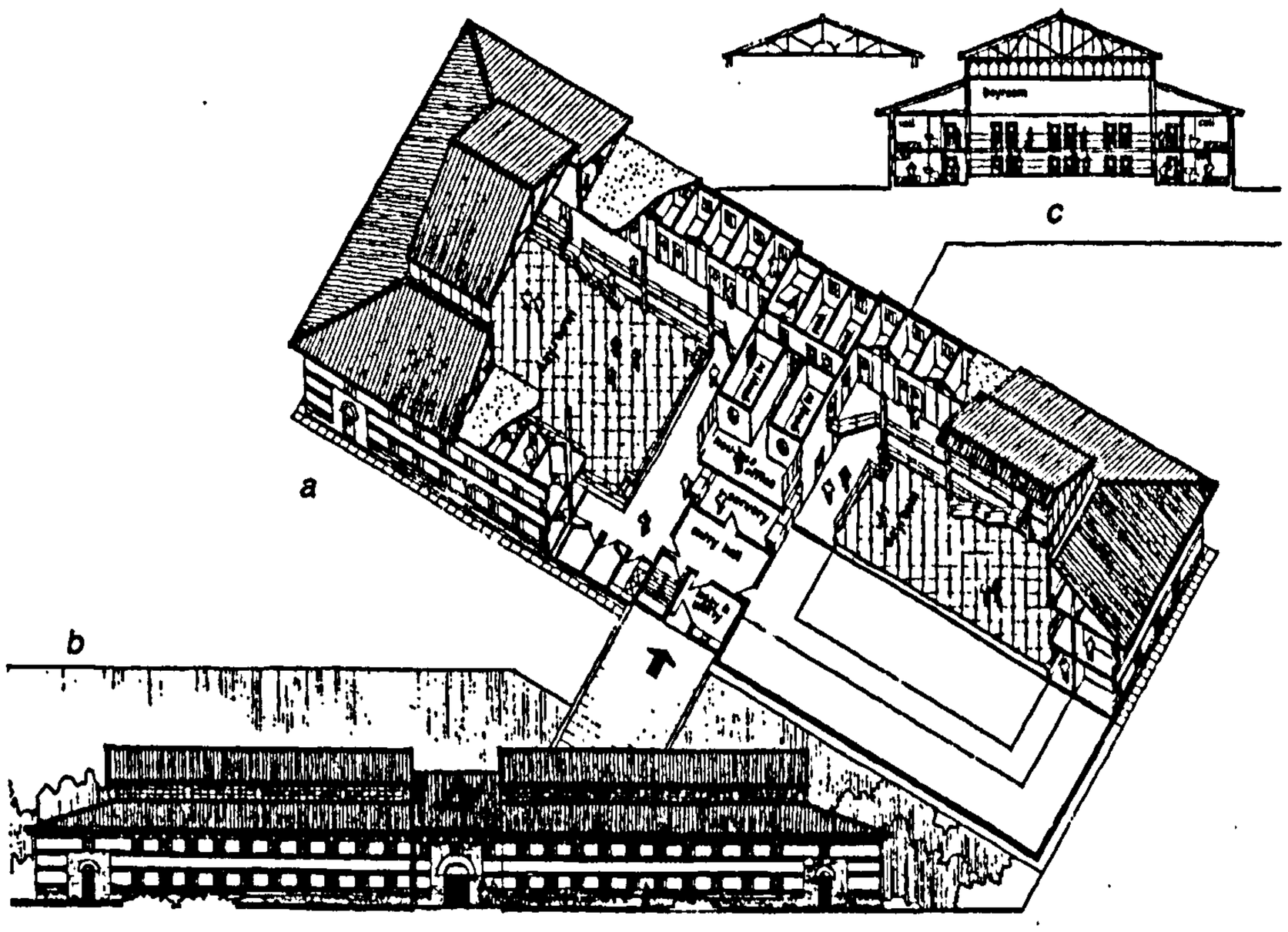

Figure 53: Prison Design Briefing System, suggested design

Following the rapid increase in prison population in the 1980s and 1990s, extensive new prison construction was required and some standardisation was inevitable. Using standard plans, particularly for living units, was perceived as a cost-saving strategy. Two "footprints" of cellular housing units have been developed. Almost all the prisons erected in this stage adopted a combination of direct and indirect supervision and used a modified square unit with cells on three sides and on two levels (Figure 54). In the centre of the square structure are a sallyport and offices on the lower level, and a control room on the upper level with an unobstructed view of all one hundred cells, the showers and the dayrooms. The second standard plan, used for general inmate housing consists of two trapezoidal units divided into three sections, each with about 24 cells on two levels and

sharing a dayroom. A second-level control room overlooks dayrooms and cells. Dining and kitchen facilities link the two units. The common element of the two modules was the tendency to being large, as they were designed for the occupancy of 2000 inmates (Johnston, 2000).

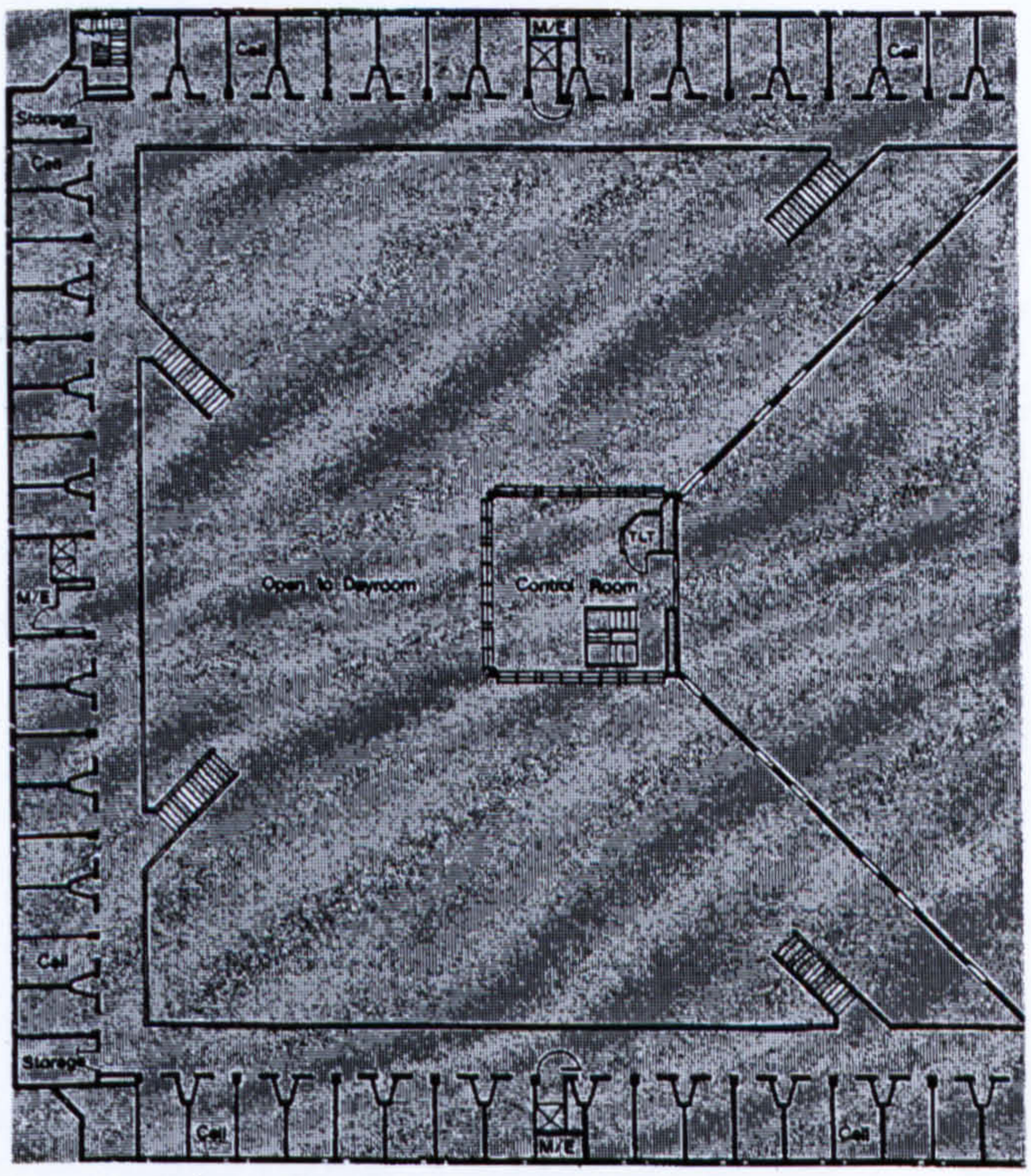

Figure 54: Footprint of California's standard living unit

In the United Kingdom, similar circumstances along with political reasons led the Construction Unit in the Prison Service to adapt standardisation of design and modularisation of construction. This approach has been construed into two main types of accommodation, namely the Houseblocks and prefabricated ready-to-use Units (RTUs) (Bailey, 2000). Another 20th century American-British solution to over crowded inmate accommodation is ship prisons. The Weare (Figure 55) in the United Kingdom is one example. A floating barracks during the Falklands war was used by the New York Department of Corrections as a rehabilitation centre for those involved in drug crimes. In 1997 it arrived in Portland Harbour in the UK and was utilised as prison accommodation for "category C offenders[5]". The Weare is a flat-bottomed barge, and its superstructure consists of steel containers stacked on top of one another to provide five levels of accommodation (Bailey, 2000). The RTUs provided a prefabricated solution for

[5] Offenders who are unlikely to escape.

"category C" offenders while the Houseblocks were used to house the "category B[6]" inmates.

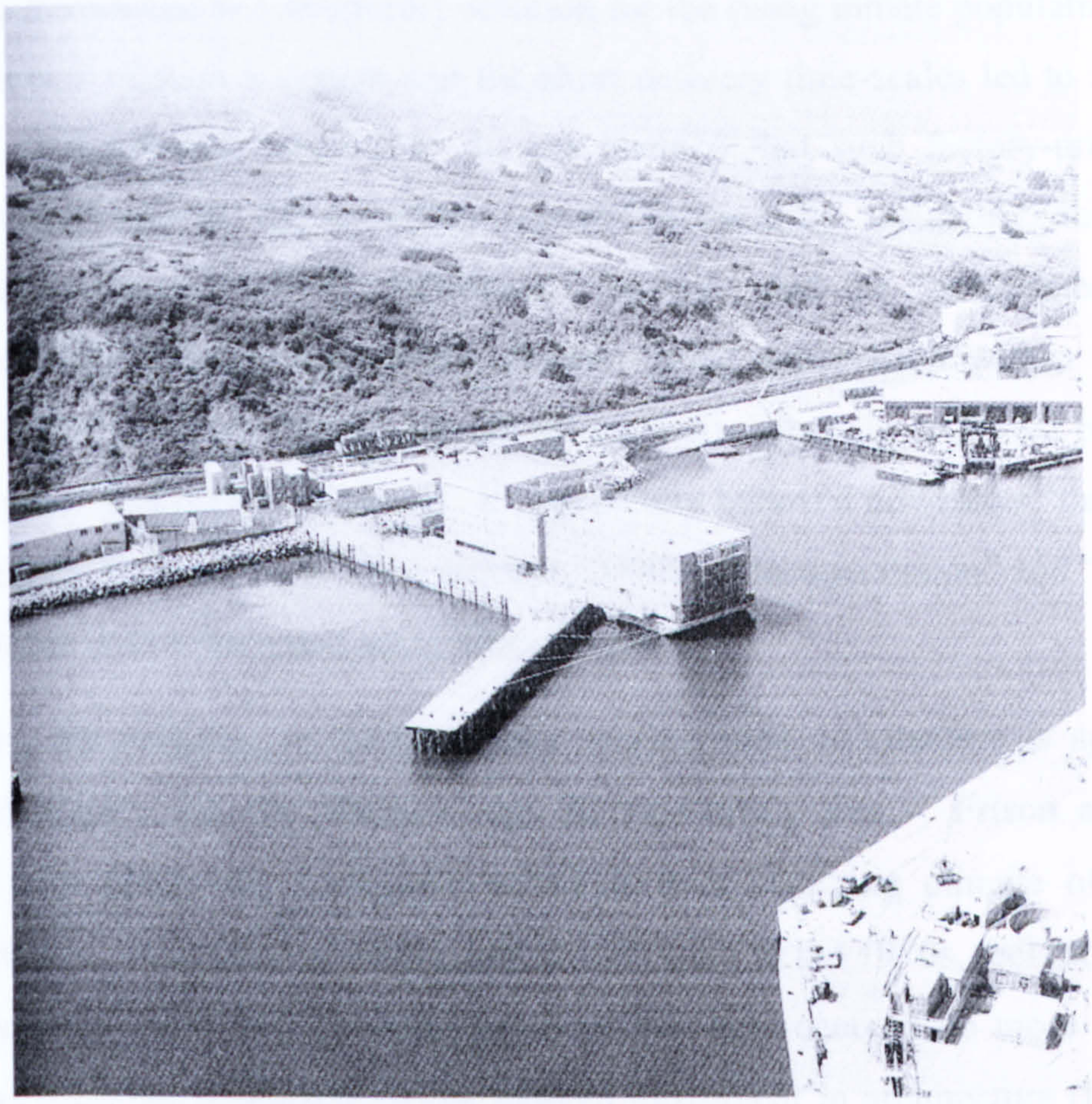

Figure 55: The Weare, moored at Weymouth

The historical review in the previous section 4.2.3 showed how incarceration architecture emerged and grew with the penal system, most obviously in the Victorian and American radial prisons. The design then precisely matched their purpose of strict isolation, and moral introspection as a mean for reform and salvation, combined with total ease of supervision and control by a minimum of staff. This bond, however, was broken by the end of the 19th century and the beginning of the 20th century. It was not until the evolution of the "new generation" prisons that architecture again matched aspiration. Nevertheless the recent overcrowding problems on one hand, and the idea of privatisation on the other, have put this approach in the risk of being abandoned. Concerns about security and cost jeopardised treatment and rehabilitation efforts. Architects were pressed

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[6] Offenders for whom the very highest conditions of security are not necessary but for whom escape must still be very difficult.

to modify their designs either to reinforce the notion of security or to reduce the cost of the building (Russell, 1998). The standardisation and modularisation of prison buildings was initially introduced as a temporary solution for the rising inmate population. The low construction cost of such a system and the short delivery time-scales led to its extensive application in correctional facilities. It was claimed that such factory-produced wall systems could include all the necessary features for security, insulating, and aesthetics. Management's is assured of the institution's security, and the "normalised" approach could be adopted which consequently allowed direct supervision within the building perimeter (Dewitt, 1987). This approach has been continuously criticised by reformers, prison governors and prison architects. It is generally believed nowadays "that prisons do not get designed, they get built" (Fairweather, 2000b). "Incapacitation" and "just deserts" swapped places with reform and rehabilitation efforts.

In summary, the situation in contemporary incarceration architecture is split into two streams, the theory and the practice, and the two rarely join. Prison architects are struggling with producing acceptable solutions in a changing climate of public and political opinion. Architects of today, just as they were in the 1970s, feel more perplexed by the complexity of a still evolving problem that has received no more than a weak contribution from the revolution of the modern movement in architecture (Lenci, 1977). The main challenge that faces prison architects currently is to balance functional and environmental needs against the demands of security, and the increasingly changing social and political aspects (Figure 56).

In section 4.3.3 the "ideal" incarceration architecture elements are explained and the impact of the prison environment on the inmates is discussed.

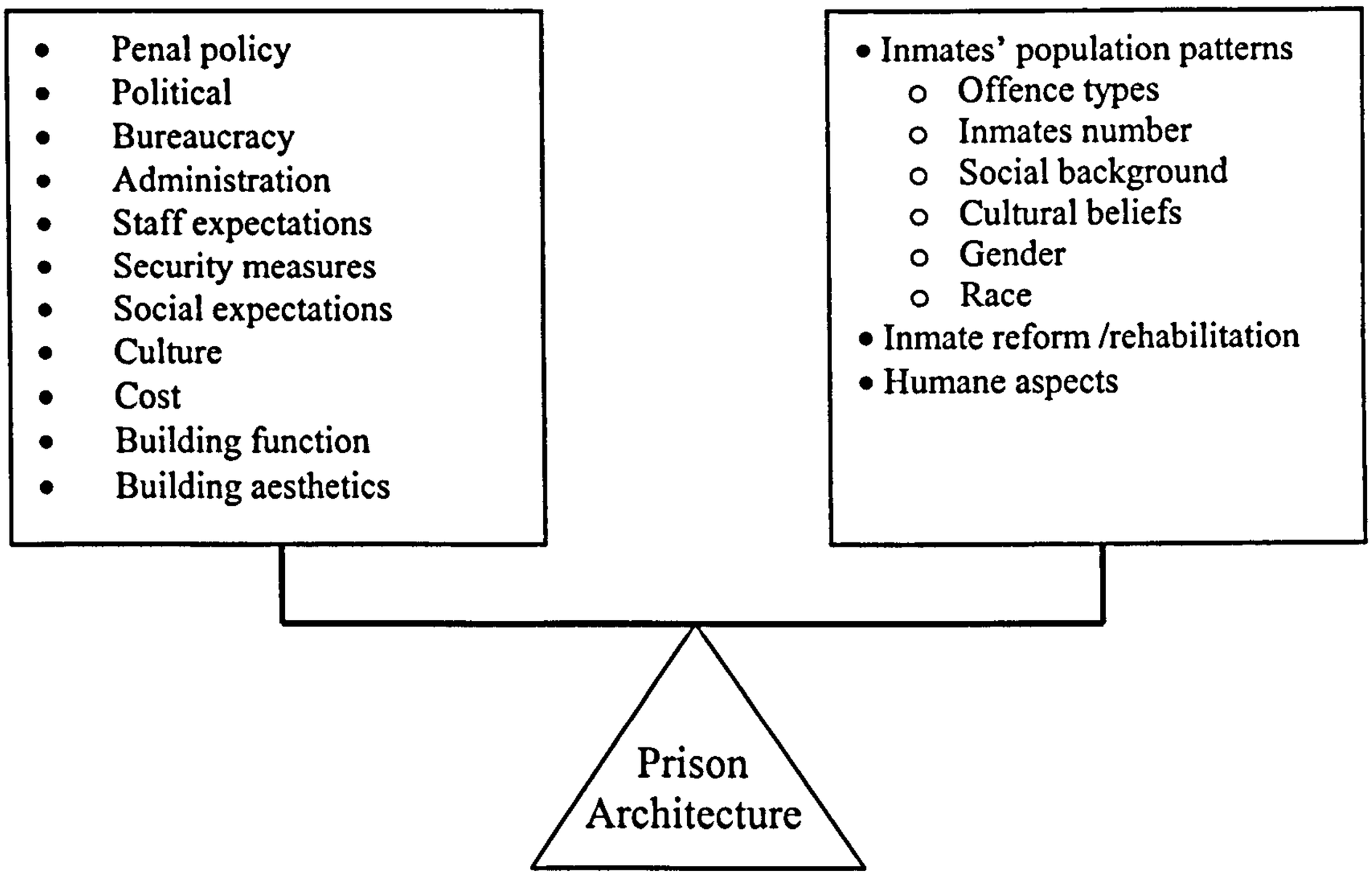


Figure 56: The challenge that meets Architects in the process of prison buildings design

4.2.5 Conclusion

The exhaustive summary of the development of prison in the Western world carried out in this section shows that the history of incarceration has been marked by extraordinary changes.

Before the 18th century, imprisonment had a marginal role in the penal system. Prison use was limited to offenders' detention and it had scarcely any penological role. Severe physical and corporal punishments were more widespread. As the review indicated, in an era when corporal punishment has became uncivilised and open violence unconscionable, prison supplies a subtle, situational form of violence against the person which enables retribution to be inflicted in a way which is sufficiently discreet and "deniable" to be culturally acceptable to most of the population (Garland, 1990).

The use of imprisonment started to be seen as one among other penalties. In England the use of transportation and the hulks composed the major part of the penal system. Imprisonment was also envisaged as a condition to enable certain punishments to be carried out, such as forced labour. The regime in Ghent prison (Figure 42) is an example where corporal punishment was replaced by the deprivation of liberty, augmented by forced labour that helped not only to support the institution but the inmates who were able to accumulate money that they could take when they were released.

In 1775 transportation was interrupted by America declaring independence. The use of hulks, despite the criticism of being expensive and unhealthy, survived well into the 19th century.

In the 18th century imprisonment became the main penal system, and incarceration architecture evolved to carry out the function of the "new" building typology. At this stage prison became a complete and austere institution. The prison architecture that had evolved by the end of the 18th century was described as the architecture of surveillance. In the 19th century, prison architecture was made responsible for reforming the inmates. Prison buildings were empowered to transform the offenders' character from vice to virtue. Incarceration architecture with its technological programme represented the two main penal theories that dominated that era, silence and separation. It was however, the separation system represented in the penitentiary that directed incarceration architecture all over the world. In terms of large-scale application of a correction philosophy having generative force in architecture, the development of the penitentiary is without precedent.

Typology of prison building was applied world wide in the period between 1850- 1950. Most of those prisons are still in use which means that many countries are using prisons which do not reflect the penal ideology in evolution, simply because they still exist. The construction of those prisons does not allow using them in order to meet the needs of the present, without very expensive changes. In some cases the form of the building controls the kind of treatment. Often the location of those buildings has become the centre of the city, because of the city expanding (Lenci, 1977).

The prison architecture in the 20th and 21st centuries is divided into three main streams. The first is the traditional prison design that is still in use. Such buildings are generally large institutions, enough to house at least 1000 inmates. The regime in such institution emphasises minimising movement of the prisoners and therefore the range of activities provided is limited. Inmates are housed in large numbers, in each section. The building size symbolises the power of the institution. The furniture and the facilities are basic and essential, as the intention is to link discomfort with punishment. Another disadvantage of this attitude is the limited number of buildings, which leads to the lack of flexibility.

The other type of prisons represents contemporary penal policy that combine architecture and a management approach, known as "new generation facilities". The main distinguishing characteristic of the new institution is its small size (500 inmates or less).

The new philosophy behind the design is to emphasise the feeling of domestic life as each cell block is divided into sections for small groups, of 12 persons maximum. A variety of different premises are generally provided in order to give space for different activities. The concept of low density in land use is adopted. Good materials and good architecture are employed in prison design, along with comfort and good furniture. Decorations and furnishings are cheerful and attractive. Interiors are light and airy and noise levels are kept low. Flexibility in the use of the building is one of the main qualities of the new generation of prison buildings.

The third stet, which has emerged as a result of the increasing inmate population, is standardisation or modularisation. The advantages of this system are minimising both the cost and the time of construction. The disadvantages are the loss of the individualisation treatment, and the withdrawal of prison role into incapacitation. Although such solutions were intended to be temporary, the most recent penal approaches "getting tough" and "just deserts" led to the increased implementation of such systems.

What it appears to be a major step back in prison accommodation is the use of ship prisons. Such solutions, although highly modified, conjure up images of the squalid hulks of the 17th century. Fortunately, there is apparently no plan neither in the UK nor the USA to adopt more prison ships. However, there are many existing examples, which are likely to remain in use for the foreseeable future.

In the following section the physical and psychological factors for indoor comfort in prison are studied. The section aims to trace the development of human considerations in prison building through history. The contemporary environmental considerations in prison buildings are presented and the role of architecture in contemporary reforming approaches is analysed.

4.3 Physical and psychological factors for indoor comfort in prisons

The penal reforms of the late 18th century regularised imprisonment in Western countries and gave it a moral purpose (Evans, 1982). Prisons at that stage became the centrepiece of the penal system. The use of imprisonment subsequently became the most widespread penal system in the world, replacing severe physical punishments. A new kind of architecture consequently emerged, and prison buildings became a proper subject for architects. Prison buildings, through their three centuries of existence, have been proposed to achieve five goals: Punishment, Protection, Reform, Cure, and Exemplary Righteousness (Markus, 1994).

The 20th century witnessed an enormous surge in the inmates' population all over the world. 8.6 million person are held in penal institutions globally (Walmsley, 2000). The increase in the recidivism rates also resulted in subjecting the idea of imprisonment to strong criticism (Lenci, 1977). In the 1970s, the stark statement that "nothing works" in treatment of offenders and reduction of recidivism was widely accepted (Martinson, 1974; Brody, 1976). It was proved, however, that most of the arguments against rehabilitation were tenuous and based on myths. As soon as rehabilitation was seriously attempted in practice, such arguments were rejected (Kolstad, 1996; Blackburn, 1980). In spite of all the counter-arguments, offenders are still incarcerated in every country (Kuhn, 1998) and new prison buildings and facilities are erected every year (BOP, 2000; McConville, 2000).

Although there is little existing evidence that specific indoor features of prison buildings directly impact upon inmates' behaviour, it is known that architecture can play a major role. Built environment can be used to manipulate people, and surroundings can be used to influence people's actions (Christopher, 1990). Rehabilitation and reform are still the main purposes of incarceration. Prison buildings have a major role acting as a tool for rehabilitation just as they were used for punishment and retribution. Rehabilitation in prison can be achieved by providing the right environment for it, as people behave differently in different environments.

Architectural theories of prison buildings reflect the changes in social systems and consequently, the penal philosophy through history. Unfortunately, there is a lack of

academic research and professional debate on the issues of prison architecture and the philosophies that they reflect.

This section attempts to partially meet this lack and to point out the physical and psychological factors for indoor comfort in prisons that have direct impact on rehabilitation.

4.3.1 Human considerations in prison buildings through history

The historical review of the development of prison buildings design and penal system in section 4.2, demonstrated that prisons have a rich history with a beginning that cannot be dated accurately. However, before the 18th century physical confinement had a marginal role in the system of punishment. Following their invention and wide implementation, prisons underwent fundamental alterations in appearance and organisation. This section is an attempt to relate the indoor comfort factors to the development of both penal systems and prison buildings design theories through history.

4.3.1.1 Ancient prisons

Despite the fact that early laws speak little of prisons, there is strong evidence for the presence of imprisonment as part of a wide category of physical punishment for convicted individuals in almost all ancient civilisations (Peters, 1998). However recent excavation in Xian province in China unearthed a stone tablet dated 723 C. E. which stated that Buddhist temples were to be set up near prisons, so that prisoners could be helped to a better way of life (Johnston, 2000). This indicates an early recognition of the role of imprisonment in rehabilitating offenders.

Ancient prison buildings have disappeared. However, literature illustrated that the conditions and the characteristics of such spaces were far from accommodating any elements of comfort or basic human needs (Chalklin, 1983; McGowen, 1998; Peters, 1998; Wayne, 1994).

As the prisons or jails in ancient history were not purposely built to serve a long-term function, no special characteristics could be traced. Physical and psychological comfort for the offenders was not considered. It was not until the early 4th century when some slight sympathy for the physical and the well-being of the inmates became apparent. Costantine Edict in the Theodosian Code revealed some recommendations for 'relatively'

more humane treatment to the inmates. He indicated that being in custody should not mean to be tortured. Costantine advised using loose chains instead of tight iron manacles in chaining the inmates. In a simple way, he presented a daily routine for the inmates. Costantine particularly mentioned daylight. He related good health with enjoying the daylight. The inmates were to be kept in healthful cells during the night, and allowed into a common area to enjoy the light during the day (Peters, 1998). It is worth noting that in spite of the horrendous conditions of prisons, they were certainly not the harshest punishment known to the Imperial whim at that time. Interesting in the Roman prisons was that the degree of severity reflected the degree of security. It is recorded that the Roman prisons had different sections. One was an inner (deeper) more obscure chamber. The offender was deprived from fundamental human needs such as food, clothing, bedding, light, view and human treatment. Lack of light and view were again major tools for punishment. Offenders were locked into stocks or tightly chained, abused and tortured by the guards. Conditions in other sections were relatively enhanced. Some had windows. Enjoying light and view was a privilege. This indicates the early recognition of the importance of daylight to comfort of inmates, a knowledge that was utilised to increase the severity of the punishment.

4.3.1.2 The rise of Islam

In other parts of the world, specifically in the Arabian Peninsula, the 7th century witnessed the surfacing of the Islamic era founded by the prophet Mohammed, who was also a social reformer. Islamic penal theories recognised and stressed the importance of a more comprehensive attitude towards punishment. Section 4.5.2 demonstrates the principles of Islamic penal theories in the 7th century. Although imprisonment had a marginal role in the Islamic punishment procedure, it was introduced for the specific function of rehabilitation (Bassiouni, 1982; Benmelha, 1982). Its use was restricted to dangerous and incorrigible criminals who were held in prison until they showed signs of repentance and only then were released. Literature indicates that offenders were placed in domestic environments for the period of their confinement in the Prophet's day, as well as those of the four early Caliphs. The offenders were kept in the Prophet's and his assistants' houses. This had a high impact on the offenders' physical and psychological well-being. The offender enjoyed the high quality indoor environment which characterised the houses of that period. High natural lighting, good ventilation, concerns

for hygiene and generous spaces, are examples of the Islamic house characteristics from which the prisoners benefited while they were confined. The Prophet and his successors were very careful in choosing the people who attended to prisoners. It was the company and the environment that mattered, in the Islamic reform procedure. The Mosque, which was used as a meeting place as well as a place for prayer, was also used for confining offenders. Confinement in the Islamic house and the Mosque had a positive impact on the offenders' psychology. They were not excluded from society. The offenders' reform was the responsibility of the society of which they were part. Social issues such as gender segregation were implemented in imprisonment once the system was utilised. The prophet Mohammed and his successors, the Caliphs, emphasised the importance of human treatment of the prisoners. It is forbidden in Islam to cause any unnecessary pain or humiliation to the offender while executing the punishment (Abu-Ghudah, 1987). The traditional Islamic view of imprisonment is expressed in terms of restricting the right of the convict to move freely about (Al-Alfi, 1982; Awad, 1982). The Prophet referred to the prisoner as *asir*, a designation indicating that the imprisoned convicts are in the custody of the state, which in turn is responsible for them.

The historical review of the Islamic penal systems, which will be discussed in detail in 4.5.2, shows that as soon as the function of prison changed by the introduction of political imprisonment in the end of the 7th century, characteristics of the prison buildings were transformed dramatically. Political imprisonment was introduced to support the Caliphs leadership by confining political enemies. The rulers shifted away from the classical Islamic guidelines in treating their prisoners. It was claimed that prisoners were tortured and denied their rights. Literature indicates that prisons were overcrowded, dark and some claim that women were confined in the same places as men (Al-Samad, 1995). Prisons were located in the city walls, fortresses and in the rulers' palaces (Abu-Ghudah 1987; Grabar, 1978). However, in the early 8th century, the Ummayyade Caliph Omar Ibn Abd Al-Aziz outlined the minimum standards for treating offenders and for prison conditions. The guidelines he produced were distributed among the rulers and the governors of the different Islamic cities. Omar's guidelines covered the same principles that were adopted by the United Nations in the 20th century, the Standard Minimum Rules for the Treatment of Prisoners, which will be discussed in detail in section 4.3.4. The 8th century guidelines established conditions against violating any of the rights of the prisoner, particularly the integrity of his beliefs, mind, body and dignity. Two types of

segregation were introduced, gender segregation and segregation according to the offence type. Rules for the accommodation conditions, clothing, food, medical treatment and the critical choice of guards and prison governors were established in the guidelines (Al-Laheib, 1984). Later in the same century, another list was introduced by the Abbasid Caliph Haron Al-Rashid. The new recommendations followed the same principles as those founded by Omar but went further by calling for a salary to be paid to the deprived prisoner's family, as while confined they would not be able to earn to support them. The state was responsible for the provision of the inmate's needs and welfare. Prisoners were part of the society, their reform and rehabilitation was the responsibility of the system.

4.3.1.3 Medieval Europe

In the same era, prisons in the west were still no more than places for confining those awaiting trial or execution of physical punishment. The concept of political imprisonment began in the second half of the 12th century in England. In 1166, Henry II issued orders to sheriffs to build jails in each county to hold the political offenders until they could be tried. Although his orders were followed and some spaces were allocated for prisons, it would be hard to describe those gaols as suitable. None was built as a prison, and other buildings were transformed into prisons without measuring their suitability for that purpose. Many city gates were used as prisons; some of them were modified to provide the necessary accommodation (Evans, 1982). It was believed that the walls around the edges of towns marked the boundary between human, artificial creation and the natural world of the gods. Thus, placing offenders in the city walls and gates was a way to protect the society from the foreign elements and the impurity of the offenders (Markus, 1994).

From the 1270s onwards the number of prisons in England increased rapidly. In royal prisons the types of accommodation varied from foul to comfortable, the latter usually reserved for high-ranking prisoners. Items of comfort such as food, fuel, bedding etc. needed to be purchased from the jailers. Below the relatively comfortable rooms were common chambers for groups of prisoners, and below these were the cells of harshest confinement. Inmates paid for their time in the prison. The standards of living in the royal prisons were not to cause death or injury, they were to be reasonable and airy, and were regularly inspected for physical and supervisory conditions. While in England the only classification of prisoners was by the wealth factor, in French prisons signs of

gender segregation were reported. The degree of dangerousness of the prisoners was sometimes the basis for separation (Markus, 1994). It is difficult to define any special characteristics or configurations that distinguish these prisons, which can barely be termed prisons as they were hardly ever built with the purpose of functioning as one. The effective measurements of a good prison at that time meant two things only: maximum security and brutal treatment. No progress was recorded during the next four centuries in this rudimentary penal system. Prison usage as punishment, was not valued yet. Punitive imprisonment was infrequent in all Europe until the 16th century, when confinement with forced labour was introduced gradually.

4.3.1.4 Workhouse movement

For various reasons explained in 4.2.2 the concept of "The House of Correction" or "The Workhouse" emerged in the 16th century. The workhouse was built on the idea of the rehabilitative value of regular work, and the formation of habits of industry. The RASP House in Amsterdam (Figure 39) will be taken as an example for this concept. Although the workhouse was a result of the new humanitarian spirit of the times which demanded less harsh treatment for minor offenders than had been in force, the prisoners' *comfort* was not an issue in designing the workhouse. Four to twelve prisoners were accommodated in 5.2m x 3.2m and 8m x 5m x 2.4m rooms respectively. A toilet bucket was provided in the same room. Lack of privacy and suitable sanitary facilities was humiliating and degrading. Materials like timber and cement were used for the floors of each room while the walls were boarded. Heavy double doors were used to enter the rooms. Inmates' thermal comfort was not among the designers' main concerns. Windows were not glazed and no heating was provided. Instead they were protected by iron grilles. The openings to the court were covered with iron grilles as well.

Two kinds of institution were to be found in England and other parts of Europe, in this era. Those were the county gaols and the houses of correction. The differences between the two categories were insignificant and were almost in name only. Life conditions in both types were obnoxious. The size of the rooms was too small in relation to their occupation rate. Chimneys, courts, water, shutters and glass to the windows were considered luxuries no one made an effort to provide (Evans, 1982). The conditions of such buildings caused the death of many of their inhabitants (Howard, 1977).

4.3.1.5 The rise of prison reform

The appalling conditions prevailing in the prisons provoked the movement for prison reform engendered by many thinkers of the 'Age of Enlightenment' such as John Howard and Sir William Eden, who examined the structure and principles of English criminal law in order to find a comprehensive plan for its reform (Tomlinson, 1980). The end of the 18th century witnessed the evolution of the ideas of humanising penalties and recognising the human dignity of the prisoner, which have positively influenced legislation and introduced new penal thinking in all Western countries. Imprisonment developed into being the centrepiece of the Western penal system. Offenders at this stage were imprisoned as punishment for a certain period of time, according to their crimes. A new typology of prison emerged in 1776. It was called the convict prisons. Local prisons were expected to carry out the role of confining convicts. Nevertheless, this role was restricted to the confinement of the inmates had been sentenced to a short period, only up to two years. Yet still the main function of local prisons was detention for the following three types offenders: those awaiting trial, offenders awaiting capital punishment and for debtors. The local prison buildings were mainly old and made up of the two historically distinct components, the jail and the house of correction. On the other hand, the convict prison buildings were purposely built following the various reform movement systems.

Reformers believed that under certain circumstances the character of an offender would inevitably shift from vice towards virtue. In England there were two main movements for reform: the *Evangelical* supported by Howard, William Blackburn (architect) and Sir William Eden, and the *Utilitarian* principles of Jeremy Bentham. As illustrated in 4.2.3 inmates' reformation was the aim of the two interwoven strands of thought, however different approaches were pursued. The evangelicals stressed solitude, reflection and prayer to convert those they saw as sinners (Tomlinson, 1980). Honest and industrial citizens, on the other hand, were expected to be created by submitting criminals to the discipline of an industrial and self-supporting prison in the utilitarian principle (Lyons, 1991).

Incarceration architecture was made responsible for the transfiguring of evil consciences. The prison environment became highly important. Guidelines for prison regimes and physical characteristics started to appear. The importance of gender and offence type classification was highlighted. Improving hygiene and ventilation in prison buildings

came prior to the instituting of any particular philosophy (Tomlinson, 1980). However, no guidelines for human consideration or rehabilitation regimes were apparent.

The previous review illustrated that when confinement and physical and psychological humiliation were the only aims of imprisonment, prison indoor environment was used to increase the suffering of the inmates. However, when reform and correction became part of the imprisonment functions, prison buildings started to have definite and recognisable architectural expression. The milestone of this era can be traced to the erection of St. Michael's prison in Rome in 1704 (Figure 40) under the influence of the Roman Catholic Church, to contain the youthful offenders. Solitude, hard labour and religious instruction aimed to allow offenders to reflect on their misdeeds in solitude. Carlo Fontano, while designing St. Michael, was aware of the importance of natural light in the reform procedure. Every cell had two windows, one looking to the outside and the other looking into the court, which was completely open from floor to roof and used as a workroom. His idea of the court was copied in most of the succeeding prisons, until the 20th century (Markus, 1994). Reform and deterrence became the main functions of the imprisonment penalty. Physical punishment addressed to the body of the convict was no longer a constituent element of the penalty. The body was instead instrumented or intermediated in the reform procedure. The indoor environment in the purpose-built prison buildings of the late 18th and the early 19th centuries became highly important to support their functions. Adequate light and ventilation gradually came forward in the conceptual priorities of prison design. For example, in Ghent prison (Belgium, 1770) "Maison de Force", the main characteristics of the design were ease of supervision and provision of light and air in the accommodation cells. Concerns for improvements of hygiene and ventilation preceded even instituting any particular design philosophy, in the prison buildings designed by the architect Blackburn which supported the evangelical movement towards reform (the details of the different reform movements are specified in section 4.2.3) (Tomlinson, 1980). The design and the regime that were tried in Gloucester prison, opened in 1792 (Figure 57), represented a penal ideology implemented all over England and many parts of Europe. It was claimed that the inmates' physical and spiritual needs were provided by the prison administrators. However, the prison administrators' concerns were limited to the provision of the convicts' basic needs. The clothing that was assigned to them was described as comfortable but humiliating. Food was prepared to be the minimum sufficient for maintaining life and health. Reading materials were restricted

to the Bible only. Every means of partial indulgence or luxury were prevented via the denial of money. Such denial aimed, as well, at the prevention of corruption among jailers and prison officers. The inmates' mental and bodily welfare were attended to by prison inspectors, who retained the only visiting rights to the inmates (McGowen, 1998). Similar conditions with some variations, characterised both the local and the convict (governmental) prisons (McConville, 1998).

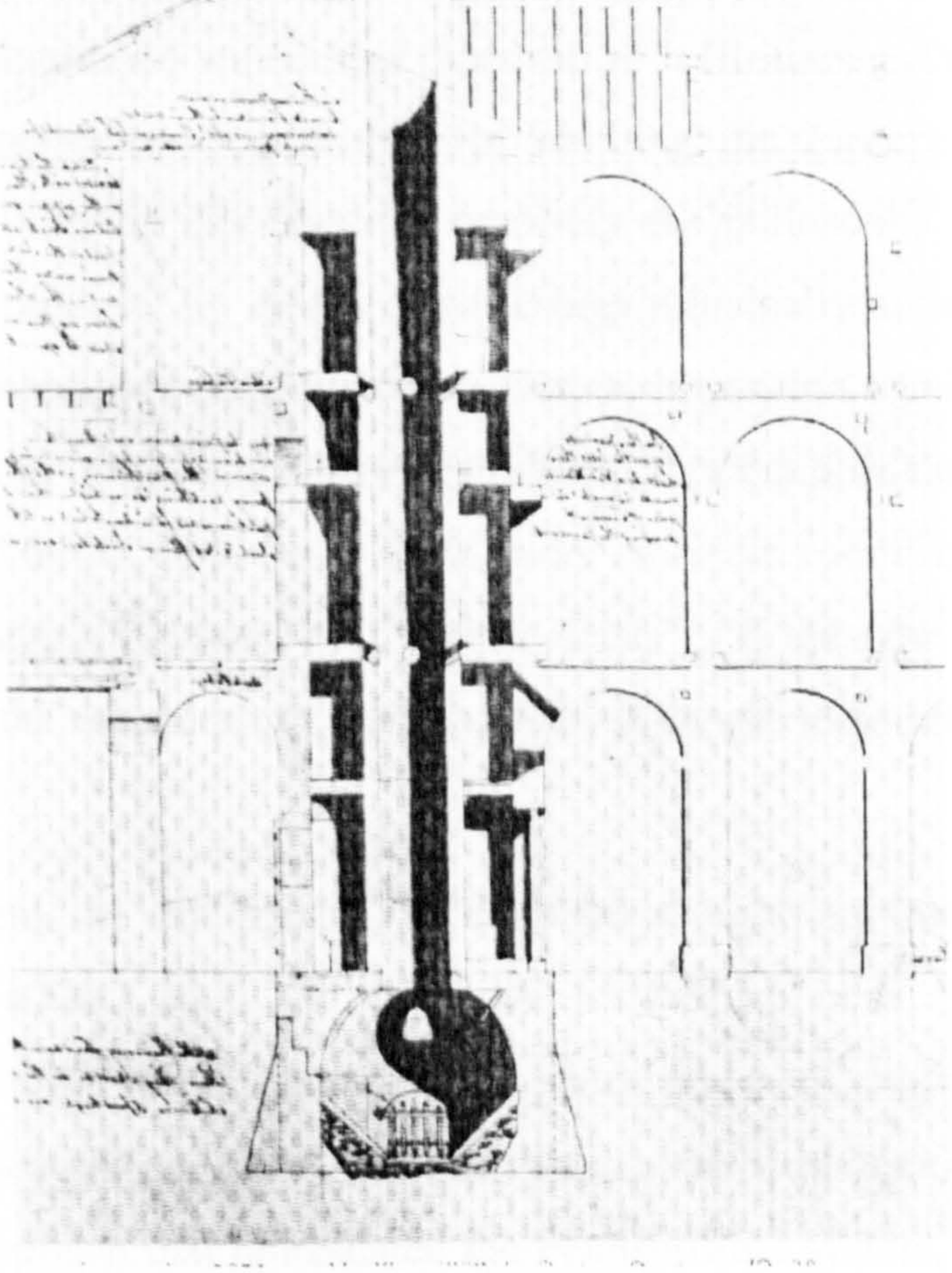


Figure 57: Gloucester prison

4.3.1.6 The American influence

In the early 19th century new and more fundamental changes in the reform ideology were in the air. The two most powerful and competing penal regimes, the silent (the Auburn) and the separate (the Pennsylvania) systems, appeared in America. The layout and the architectural configurations of these systems are explained in detail in section 4.2.4. Under the Auburn plan prisoners slept alone, one to a cell. They came together to eat and to work in the prison shops, but the rules prohibited all talking and even exchanges of glances. The Pennsylvania system, on the other hand, confined prisoners to individual

cells for the entire period of their confinement. They worked, ate and slept in solitary confinement and were allowed to see only selected visitors (Johnston, 1994b). For all their opposing views, the advocates of Pennsylvania and Auburn were both committed to the rehabilitative potential of the prison and were both convinced that the routines imposed on inmates would transform them into law-abiding citizens. Reform, as well as deterrence, was now the aim of incarceration. It was believed that the penitentiary would succeed precisely where other community institutions had failed. Just as defects in the social environment had led inmates into crime, the disciplined and disciplining environment of the institution would lead them out of it (Rothman, 1998). The words of the Building Commissioners responsible for building the Eastern State Penitentiary quoted by Johnston (1994b: 32) illustrate precisely the philosophy behind the system: "Good design is to produce, by means of sufferings principally acting on the mind and accompanied with moral and religious instruction, a disposition to virtuous conduct, the only sure preventive of crime, and where this beneficial effect does not follow, to impress so great a dread and terror, as to deter the offender from the commission of crime in the state where the system of solitary confinement exists". If the new experiment did not result in reforming the offenders, at least the fear of complete solitude was expected to achieve deterrence.

In the separate system, the new inmate was admitted at night, put into a bath and dressed in prison garb; then a black hood was drawn over his face and head, and he was led to the cell from which he never stirred again until his whole period of confinement has expired. The cell dimensions were generous. In Cherry Hill, the most famous American prison (Figure 47) and the prison that represented the Pennsylvania system, the cell size ranged between 2.3m x 3.7 to 2.3m x 4.9m. The measurement of the exercise room, which was attached to the cell, was 2.4m x 5.5m x 3.7m high. Spartan furnishings were provided by the prison: an iron bedstead, a clothes rack, a stool, a tin cup, a food pan, a spoon, knife, and fork, a water can, a brush for cleaning, a fine-tooth comb, a "wash-hand basin" and a clean towel, supplied weekly. A workbench, loom, or other equipment would sometimes be provided in the cell. Toilet and a cold-water tap were provided as well. The inmates were well fed in their cells. Personal hygiene was probably better than in the homes of most of the city's poor, who lacked bathroom tubs and running hot water. Adequate ventilation and provision of heating were among the main priorities in the Cherry Hill design, and prisons followed its style (Johnston, 1994e).

On the other hand, in the prisons that modelled their facilities and regimes after the Auburn system in New York, a concerted effort was made to subdue the prisoner's will from the time they entered a facility. There, as nearly everywhere, prisoners were dressed in black-and-white-striped uniforms and they were subjected to a routine calculated to control them at all times. The cells were invariably small, as inmates went to the cells to sleep only as indicated previously. The cells at Sing-Sing (Figure 48) were 1.0m wide and 2.1m long, and those at Kingston Penitentiary in Ontario were 0.8m by 2m. Cells everywhere were poorly ventilated and cold, with damp walls or floors. The only sources of heat were a few stoves located at the ends of the cellblocks. Plumbing in the cell, whether water tap or a toilet, was rare; inmates usually had a bucket for a sink and another for a toilet. At Auburn the only natural light in a cell was that penetrating a heavy iron latticework door set in a deeply recessed doorway. Another example which followed the silent system was the Virginia Penitentiary in Richmond. Designed by Benjamin Henry Latrobe, it had windowless oak doors to the cells. These cells had no heating or plumbing. In the Maine State Prison at Thomaston, opened in the 1820s, which also followed the silent system, the cells were below ground and inmates entered by a ladder through a narrow opening; the hatch was locked after the ladder was pulled up (Johnston, 2000).

The rehabilitative ideal helped to legitimize the severity of the correctional schemes in the silent system. The prisons enforced not only rules of silence but also regular labour, and harsh discipline was implemented if the inmate was seen bungling with his task. Most facilities compelled the men to work eight to ten hours a day, a routine that was to serve to inculcate habits of diligence even as it brought the state a financial return on its prison investment. The only limitations on the length of the workweek were a respect for a Christian Sunday and the absence of artificial light. Breaking the silence was a serious offence requiring harsh punishment. The atmosphere of congregate institutions was saturated with cruelty and corruption. The separate system, in contrast, was perceived by its supportive as humane, secure, ordered and ultimately, successful (Rothman, 1998).

Both regimes inflicted physical punishments on the inmates if they violated the rules of the system. Punishments in the separate system ranged from confinement in one's cell without work, or denial of time in the exercise yard. Work and enjoying the natural light in the yard were considered privilege that inmates could retain only by good behaviour. Diet was also utilised in the punishment procedure, a reduction in diet for one or more

weeks, or being given no meat for three days might be applied if discipline was necessary. However, if more serious punishment was required, time in the "dungeon" could be applied. Inmates there were denied all elements of comfort. The dungeon was one of the dark cells with blocked skylights. The cell was stripped of the normal furnishings, not even having a bed. Here the inmate might be placed in irons and restricted to half a pound of bread and water, for up to seven days. Inmates were provided with a single blanket in these punishment cells even in the coldest weather, and sometimes even this was taken away (Johnston, 1994c). However, other more cruel punishments in the 19th century were the "Iron Gag" (Figure 58), the "Tranquillising Chair" or the "Mad Chair" (Figure 59), and the "Straitjacket" (Figure 60). These severe punishments were abandoned after 1835.

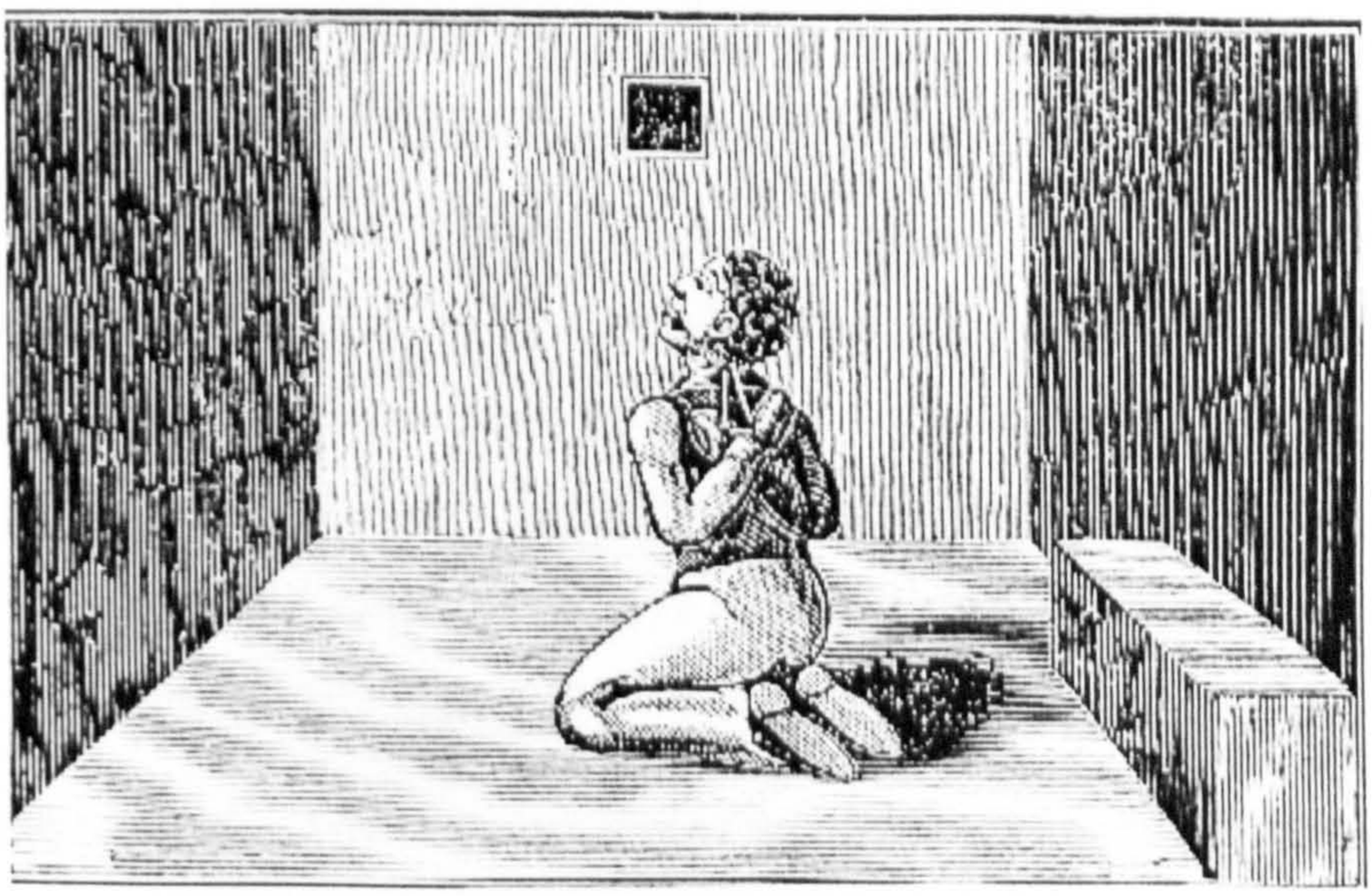


Figure 58: the Iron gag

Figure 59: The Tranquilizing chair

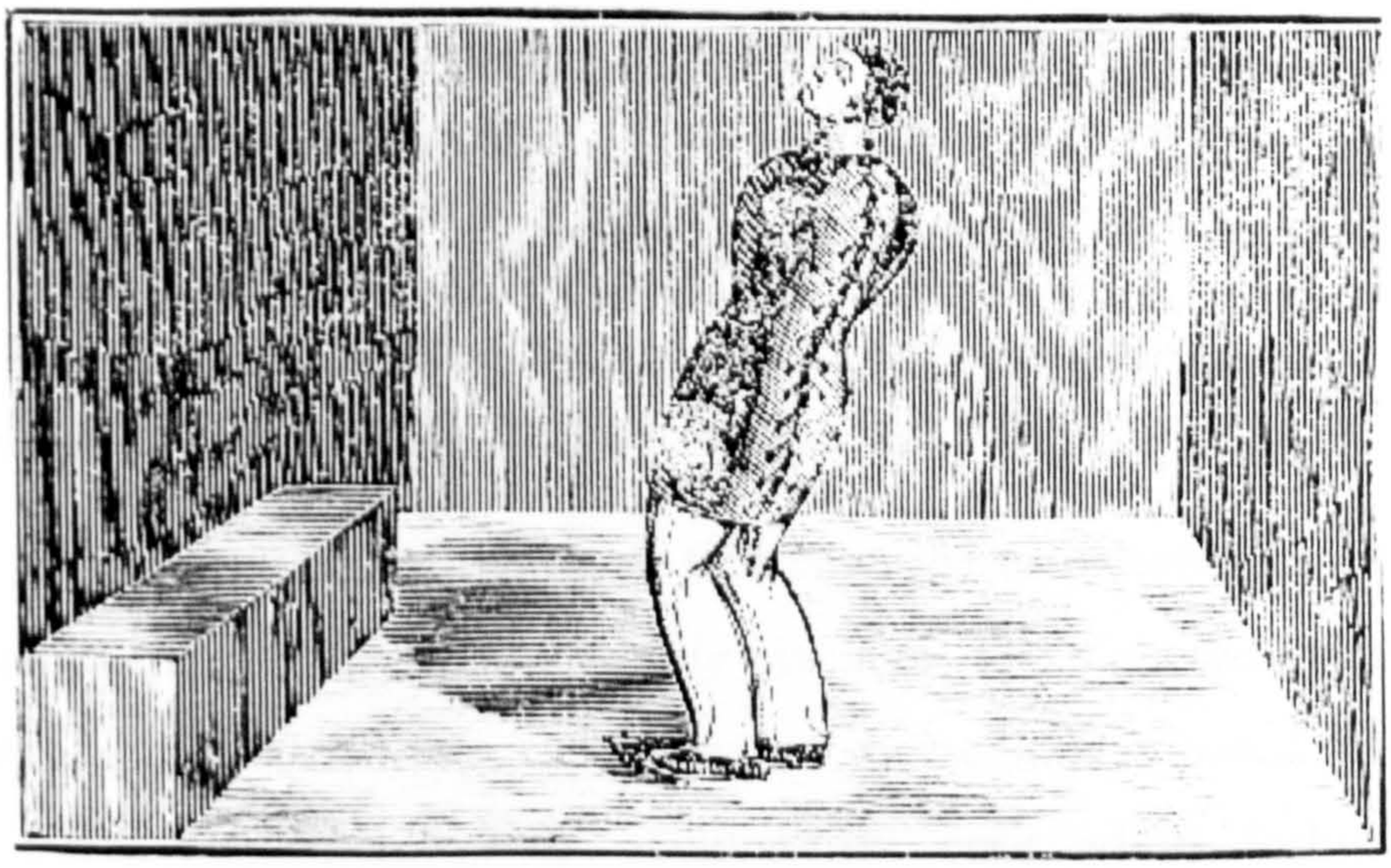


Figure 60: the Straitjacket

The Auburn system, with inmates out of their cells during the daytime, offered more opportunities to violate rules. Punishment was swift and severe. One Auburn prison warden stated that: "I consider it impossible to govern a large prison without a whip" (quoted by Johnston, 1994c: 66). The general attitude among the prison officers was that in order to balance between the welfare of the society and the reform of the offenders, the latter needed to feel "that they were in reality, the slaves of the state..... That they should most deeply feel the awful degradation and misery, to which their vicious courses had reduced them" (quoted by Johnston, 1994c: 66).

However, in the main, the American prisons of this era were characterised by being clean, orderly, and silent. Dickens, who visited the USA in January 1842, stated: "In an American state prison or house of correction, I found it difficult at first to persuade myself that I was really in a jail: a place of ignominious punishment and endurance" (quoted by Marcus, 1997: 92). It might seem that inmates were surrounded by all reasonable means of comfort and happiness that their condition would admit. On the other hand, reality rendered a different account. The systems were rigid and strict. Although they were established with good intentions and meant for reformation, their implementation was characterised by inefficiency and inhumanity. Dickens, while he was visiting Cherry Hill, wrote about the inmates: "I looked at some of them with the same awe as I should have looked at men who have been buried alive, and dug up again" (Marcus, 1997: 95). The punishment of the spirit of the subject, was immensely worse than physical punishment. The 19th century penologists were every bit as aware of the

separate confinement's capacity to break the spirit, even though they were ignorant of the psychological mechanisms involved (McConville, 1998).

On the whole American institutions followed the silent model, mainly on economical grounds, while England and Europe adopted the separate system with some variations for various reasons which have been explained in detail in 4.2.3.

In Victorian England the prison buildings that emerged to incorporate the ideas of the separate system were carefully and intricately planned. The Victorian prison design was the embodiment and the concrete expression of the regime imposed within its walls (Tomlinson, 1977; Tomlinson, 1980). Pentonville, designed by Joshua Jebb (1838) following the design of Eastern State Penitentiary (Figure 49) was the Model Prison where all the theories of reform through the separate system were put into practice. It was an attempt to construct an entirely predictable, synthetic, reforming environment (Evans, 1982). The details of the construction, architectural configuration and the technology employed in Pentonville are investigated in 4.2.4. In this part the measures that were employed to maintain the physical and mental health of the inmates are explored.

The four main elements that were considered crucial in keeping the prisoners healthy and sane were: the cell dimensions, the air quality, the thermal comfort and sufficient light (Tomlinson, 1980; Evans, 1982). Great emphasis was placed on the provision of sufficient cell space. Cell space was believed to be related directly to the inmates' physical and psychological comfort, and consequently affected the reform procedure. The individual cells were designed with the twin aims of the institution, as far as humanly possible, and the total separation of one prisoner from the next. The dimensions of the standard cell, where the inmates were suppose to spend the majority time of their sentence, were set to be 3.9m x 2.1m x 2.7 high (Fairweather, 1975). Provision of light was highly emphasised, and all cells were standardised to have a 1.5m x 0.28m high fixed window. Through careful orientation of the building all cells, during some part of the day, were to receive sunlight. On the other hand, windows were located high enough (1.82m) to restrict any view outside the cell. "The cell was blind: the form and content of the exterior world were obliterated" (Evans, 1982: 354). For the long winter nights a light, supplied from a gas factory within the prison, was installed to enable the convicts to read; however the light, as everything else in the cell environment, was controlled from outside the cell. It is not very clear if the light was installed on grounds of humanity or

with the object of keeping the prisoners at work for longer hours. Each cell contained tap, basin and lavatory. Hence, ventilation was a necessity to keep the cell air clean and healthy. As indicated previously, sound as well as vision was to be blocked by the window; thus, scientific and philosophical principles of ventilation had to be adopted. This was known as the descending principle of ventilation (Tomlinson, 1977). Ventilation was integrated with a system of air heating. A system of combined warming and ventilation known as thermo-ventilation was fed into the cells using a web of invisible lifelines. All services and transactions in the Pentonville prison were "depersonalised, mechanised, centralised, and integrated within a from of building which seemed designed to inhibit this very process" (Evans, 1982: 360).

Convicts were to leave their cells for two reasons only. The first was to exercise in outdoor yard to sustain a healthy physical condition. The second was to the chapel in order to maintain their moral condition. During these activities inmates' personal identity had to be abolished. Inmates were stripped of their names, and were given numbers inscribed on their uniforms and their cells door. The inmates' face was to be covered with a mask of brown cloth with slots only for the eyes when it was essential for him to leave the cell (Tomlinson, 1980). Everything in the building and the regime carried out the mission of applying total separation.

Evans (1982: 4) stated that "Pentonville was not only an agency of reformation, it was a vast and complex piece of engineering aimed not at the conquest of nature, but at the conquest of human nature". The concert of architecture and engineering at Pentonville had nothing whatever to do with the provision of comfort or with convenience. Instead it was a necessary part of the war against communication. Pentonville represented the apotheosis of the idea that a totally controlled environment could produce a reformed and autonomous individual (McGowen, 1998).

The Pentonville design dominated prison architecture in England and Europe. In contrast to the disorder and neglect, which were dominant in the 18th century, the late 19th century prisons were quiet and orderly, as well as drab and functional. Everything in the new system was carefully and intricately planned. Reformers focused on two aspects of prison administration: health and religion. The latter was a source of critical worry, being seen as the relaxation of a necessary severity of the regime. Prisoners were confined in identical cells and subjected to a similar diet. Their lives were carefully regulated. The ghostly forms of convicts in uniforms and masks exaggerated the eeriness of the building.

Conversation and pleasure had been outlawed, but the prison was healthy and clean (Tomlinson, 1980; McGowen, 1998). Reformers wanted to achieve greater control over punishment, to regulate its operation and effect. The reformed prison sought to reduce the autonomy of the convict. Prisons did not inflict needless and excessive pain; they merely employed a minimal level of severity in order to secure the proclaimed goal of reforming the individual. What began in the 1780s as an attempt to defeat prisoner culture now climaxed in the effort to gain the total elimination of that culture, by imposing a regime of silence. Nearly every author during these years had favourable words for some kind of solitary confinement to frustrate vice and promote virtue among prisoners (McGowen, 1998).

The historical review of the development of prison buildings carried out in 4.2 illustrated that the fundamental aim of these institutions had been to reform corrupted character. Prison architecture was developed quite consciously as a means to this end. Increasing technical sophistication was a consequence of successive failures to achieve reformation, which were frequently seen as failures of performance in the prison building. The critical link, then, was the link between reformation and character, which held out a possibility and the technology of the prison through which that possibility was to be realised. At Pentonville Jebb finally turned an issue of psychology into an issue of mechanics, and in this respect the Model Prison was not only the most advanced prison, but the most advanced building of its time (Evans, 1982).

The rituals of prison life, however, often worked differently than had been desired. Reformers introduced a regime whose ambition was to erase the old identity of the offender and to destroy the immoral sociability that was thought to sustain bad habits. Imprisonment was supposed to create this change by the combined action of stone, routine, labour, and religion. The initiation into prison life symbolised this quest. New prisoners were given a bath and a haircut. They were clothed in uniforms and their names were replaced with numbers. These measures were intended to facilitate the creation of a new identity, but numerous prisoners testified to a different outcome. They felt demeaned and humiliated. The bathwater was foul. The uniforms were coarse and ill fitting. The shoes were cheap and uncomfortable. The physical inspection of the prisoner's body established from the outset that he had no right of privacy, a lesson reinforced everyday by the spy hole in the cell door (McGowen, 1998; Tomlinson, 1980). One of the main aims of the reformed penal regime was to render prisoners passive, so

that their characters could be reshaped. But the evidence offered by prison memories tells a different story. Prisoners were inventive in discovering ways to subvert penal disciplines (Evans, 1982).

Another miscalculated limitation in the prison system was (and still is) the use that prison building administrators and authorities make of the design and the regime of the building. Reformers introduced exact uniformity into every prison irrespective of the character of its administrators. The actual use of the prisons however rendered different scenarios. In some cases prison authorities put the health of the inmates before the integrity of the system by introducing fresh air into the cells via the windows (Tomlinson, 1977). In other cases the high-minded goals which inspired the regime tended to become lost, in the multiplication of rules and rituals that governed prison life. The threat of punishment hung over every proceeding. The lighting was turned off early by some prison authorities, to cut down on the gas bill. The ex-military men who staffed prisons were far better at detecting infractions than at contributing to moral reform. Inmates performed their wheel labour for six hours a day on a diet of oatmeal, bread and water, after nights and days of extreme discomfort. Other body vulnerabilities were diligently exploited. A "progressive" dietary regime was established. This provided for an allowance of food so meagre in the early stages, as to constitute scientific starvation. This was implemented in both convict and local prisons. Since local prison sentences were so short, few prisoners stayed long enough to get beyond the first or second stage of their marginally improved allowance. Imprisonment was believed to be perceived as deterrent as was consistent with the maintenance of health and strength. To give more than minimum diet, it was cautioned, would assist in the manufacture of the habitual criminal. Near-starvation was justified as unavoidable when punishing those already hungry, to deter them from committing crime and from using the prison as a boarding house. Yet the effects of diet were considered in relation to a well-fed person, to whom, indeed, partial abstinence is not only safe but also frequently beneficial. The dietary management was indicative of the temper and penal methods of those years. Consist with their crude utilitarianism, the scientists and officials were not satisfied with meals that provided minimum nutriment. They issued detailed instructions on how to cook the food in such a way and from such ingredients that it had a smell, taste, and consistency so repulsive that it made some prisoners nauseous and even diarrheic. Denying sleep too, was sometimes perceived as part of the penal procedure. For the tiny minority of prisoners whose sentences were long

enough to allow them to win promotion to the highest (fourth) class, the promotions were insignificant. At this disciplinary summit, they were allowed to work together and to receive some improvement in dietary and in reading material. They had also earned, by this time, mattresses instead of boards. In the local prisons inmates in this position could have a half-hour visit and a letter each month, and on their release they were given a slightly larger discharge gratuity (McConville, 1998; Tomlinson, 1980).

As a principle of penal policy, separation survived into the third decade of the 20th century. However, the system never lacked critics. While its supporters portrayed it as a work of humanity that is tempered with a reasonable dose of severity, the critics viewed the system as being "too well-appointed to deter, and too dreadful to reform" (Evans, 1982: 386). The softness of the model was said to pamper the body, and its severity was said to attack the mind (Evans, 1982).

Many prisoners at Pentonville were reported unable to stand up to the mental strains of separate confinement. Several succumbed to madness. Reports of prisoners declared insane, or suffered from delusions were heard all over Europe. Many cases of successful suicide were recorded (Fairweather, 1975; Evans, 1982). The same criticisms were applied to the American separate system. The system was characterised as "maniac-making" (Johnston, 1994c). However, the advocates of the separate system argued that offenders entered the prison in poor health or bearing inherited tendencies toward specific diseases. It was also known that in the 19th century those who were mentally unstable or ill were often confined in prisons because of the absence of specified mental institutions. However, some reformers believed that the good effect of separation stemmed from its influence on the mind. It was argued that some violence had to be done to the mental faculty, if reformation was to succeed. The reformers' main concern was not whether the separate system produced madness and dementia, but whether the risk was excessive (Evans, 1982). Officials from both Pentonville prison, the model for the English and Europe separate system prisons, and Cherry Hill the American model made public statements of reassurance that the system had no deleterious effects on the inmates. It was claimed that investigation showed that inmates incarcerated for long periods had no higher mortality rates than those serving shorter periods (Evans, 1982; Johnston, 1994e).

However, it is worth noting that long before American clinicians became interested in the link between solitary confinement and mental illness, its use in Eastern State Penitentiary had been discontinued except as punishment for rule infractions. Reports were indicating

that the prison violated its own rules from the beginning; inmates were used for various housekeeping tasks around the prison and, without their masks, served at dinner parties given by the warden. The picture of the sparsely furnished cell and the bare exercise enclosure was as misleading as the usual impression of solitary confinement. Some prisoners were reported to have small gardens in their yards for vegetables, flowers, or fruit. In winter some of these plants were brought into the cells. Some prisoners were allowed to keep small pets. Inmates were sometimes permitted to decorate the walls of their cells and engage in hobbies, although no materials were officially provided for this. On the other hand, in most prisons the case was different. Inmates were strictly prohibited from keeping pets, decorating their cells or accumulating homelike possessions. Nevertheless, it is evident that during the 19th century the regimen at Cherry Hill was milder than it was acknowledged to be (Johnston, 1994c). It is not clear if this resulted from humane gestures on the part of guards showing favouritism toward some prisoners, or if it represented official policy.

4.3.1.7 Noble ideas collide with reality

By the year 1866 and after the Civil War American Prisons were, unfortunately, characterised by overcrowding, brutality, and disorder. Not only were cruel punishments pervasive throughout the state prisons, but so also was corruption. Overcrowding was everywhere the rule of the day. Maintaining separation was no longer possible and inmates were kept two or sometimes three to a cell. In some cases four inmates were reported to be accommodated a cell purposely designed for one person (Rothman, 1998).

Many European countries, which endorsed the principle of solitary confinement, faced the same problems in the growing prison population on one hand. The efficiency of the solitary confinement had been called into question, on the other. Statistics everywhere revealed higher rates of death, suicide and madness among the isolated inmates, and consequently, the separate system came under frequent attack for its cruelty and harshness. Economic reasons led to the abandonment of the separate system and adaptation of prisons constructed with common dormitories and common workrooms in many European countries, thereby reflecting what O'Brien (1998: 181) called "a kind of institutional schizophrenia between articulated goals and economic realities".

By the end of the 19th century there was a universal scepticism about the possibility of reformation through imprisonment. The notion that imprisonment could reform,

evaporated from penal theory with astonishing speed. The change however was a change in opinion only, with no significant correlative change in practice. The prison itself hardly witnessed any change. However, a notion of uniformity of administrative procedures, management, regulation, construction and detailing were ossified (Evans, 1982). New prisons continued to be designed according to principles once considered enlightened, even though there was an obvious call for a replacement penal system. Punishment, deterrence and shutting criminals away became again the aim of prisons. Reformation efforts were perceived to be a privilege accorded only to the juveniles. Henceforth, the living standards in prisons deteriorated. It was not until after the end of the Second World War that the gulf between the new concepts of criminal training and the 19th century establishments in which they had to be carried out became apparent. However, it was not possible in the immediate post-war economic situation to establish a new prison system at a stroke. Existing prison buildings were modified to accommodate workshops, classrooms, gymnasiums, libraries, etc, within their existing high walls. It was not until the end of the 1950s that a new prison building programme emerged.

4.3.1.8 Summary

The review of prisons in the ancient world indicates very early knowledge of the impact of sensory deprivation on human well being. Denial of thermal comfort, ventilation, light and view was directly related to the degree of punishment. However, when imprisonment aimed to achieve rehabilitation in the 7th century Islamic world, the indoor environment of the confinement spaces became highly important. When confinement and punishment became the main role of imprisonment such measures were reversed. Comfort achieved through providing light and warmth was reduced.

The 16th century workhouses that resulted from social and economical problems of unemployment, vagrancy and idleness represent the first European institution that addressed rehabilitation. Regular work and the formation of habits of industry were believed to reform the confined. Efforts to provide physiological and psychological comfort for the inmates were minor. The unglazed buildings did not provide comfort, but increased the suffering of the inmates in the cold winter days.

The use of imprisonment as punishment started to emerge in the 17th century. Confinement and punishment were by now the only functions of the institution. Hence, the conditions of prisons were worse than ever before. The deterioration of prison

conditions triggered the reform movement that climaxed with the two developed and competing American systems: the silent (Auburn) and the separate (Pennsylvania) systems. Although they offered different approaches they both aimed to influence the inmates' behaviour and to divert them into the right path. Religion and work along with solitude in the separate system, and silence in the Auburn system aimed to rehabilitate offenders. In both systems efforts were made to enhance the indoor environment of the housing cells where inmates spent most of their time. The impact the separate system had on the world was enormous. The Eastern State Penitentiary that represented the Pennsylvania philosophy became a model for the world. The Pentonville in England, which was based on the Pennsylvania regime, was the ultimate comprehensive expression of the penal institutions. The aim of the institute was to stop communication among inmates, in order to achieve maximum control over them. Provision of comfort and convenience were not among the aims of the institution.

In a totally controlled environment, offenders were expected to reform. The physical needs of the inmates were addressed with care. However, no efforts were made to understand the psychological impact of the environment on the inmate. Although windows were installed in all the cells, they were located high enough to be out of reach. The prisoner was totally isolated from the outside world and was deprived from any glimmer of a view. The inmate did not have any control on any item in their environment. The light, the heating, their privacy was all controlled from the outside. Although the system was perceived as a work of humanity, its impact on the mind and soul of the incarcerated was immeasurable. The failure of the model prison to reform led to the loss of any arguments supporting reformation through imprisonment. Chapter 5 explains how penologist and criminologist were driven more into extreme opposite direction believing that rehabilitation could mainly be treated psychologically. The 20th century prison system, as is explained in sections 4.2.4 and 4.3.3 is a compound of heritage of incarceration architecture that reflects an ideology that does not exist any more, and conflicting penal systems.

In the following section the contemporary environmental concerns in 20th century prison buildings are discussed.

4.3.2 Environmental perception in prison building

The review carried in section 4.2.4 illustrated the various architectural solutions to the inmates' accommodation. It is, however, the aim of this section to highlight the main prison buildings design elements and their impact on inmate behaviour. The recent development of the behavioural sciences resulted in the creation of a positive theoretical basis for architectural design (Lang, 1987). The impact of the indoor and the outdoor environment of several building typologies, such as office buildings on the occupants' productivity have been well researched (e.g. Vischer, 1996; Roulet, 2001). The case is, however, different in prison buildings. The empirical research about the impact of the indoor environment on the inmate's behaviour is very limited. Generally speaking, the studies that have been carried out show conflicting results. It was not possible to establish a clear relationship between behaviour and design. Too many other variables exist to challenge the results. Changes in behaviour may be as much a result of management procedures and the personal characteristics of inmates and staff, as of their environment. Architectural design is only one of several variables, and it is not always easy to identify its effects separately. Other research is strongly suggestive but unproven. Some of these uncertainties arise from the difficulty of providing appropriate methodologies to test relationships; others undoubtedly reflect weak or uncertain design effects (Fairweather, 2000a).

Wright and Goodstein (1989) reviewed the major ways that prison environments have been viewed, and concluded that such studies can be divided into three groups. The first group focuses on the physical characteristics of the prison. Such research describes the design, space and other structural features of the prison setting. The second in prison environment research attempts to conceptualise what it is to live in prison, by identifying those social characteristics that press on individuals and represent what is imprisonment to them within the unique context of prison. The final group describes what happens when change disrupts traditional social structure. This section will follow the theme of the first group in studying the physical characteristics of the prison buildings, however emphasis will be put on the relationship of the provision of physical and psychological comfort with the inmates' behaviour.

There are no obvious design formulas for any building typology and no certainty that what works in one location will work in another, with different cultures or in other countries. In penal institutions, however, some elements are common and some broad

conclusions can be drawn. These include the importance of the operational philosophy, the location and size of the institution, the building environment, violence and the fear of violence, the satisfaction and perceived safety of the staff, and the relation of all these to design and construction. This section investigates these relationships, and highlights the different design considerations in the prison building. More emphasis will be put on indoor features and the housing accommodation, and its impact on the façade design.

4.3.2.1 Penal philosophy

Several operational philosophies emerged after the failure of the separate and silence systems in the late 19th century. However, the most fundamental penal change of the last 30 years has been the switch from indirect into direct supervision. In design terms this was interpreted in the shift between radial layouts to "new generation" designs, where a greater degree of staff-inmate contact has been encouraged. This has had far-reaching psychological and security implications for both inmates and staff. Proponents of the philosophy argue that when appropriate architecture and inmate management practices provide for the inmates' critical human needs (safety, privacy, personal space, activity, familial contact, social relations and dignity) the need for the inmates to manipulate and control their environment will be minimised (Zupan, 1991). The new system aimed to normalise the prison buildings as much as possible. Several empirical studies assured that the new system affected the inmates' behaviour positively, and reduced the inmates' violence against each other and against staff (e.g. Senese, 1997). Applegate *et al.* (1999) suggested that direct supervision might have a positive influence on recidivism. On the other hand, several inmates were entirely uncomfortable with the new relationship. Fairweather (2000a) stated that some inmates at one British prison asked to be moved back to the bleaker prisons to which they were accustomed, because staff were "too friendly" in the new ones. They preferred the certainty of the mutual antipathy that they claimed existed in the older radial or corridor prisons; they could understand and handle that better.

This contradiction in the results of the research conducted emphasise the importance of moving towards individual programmes for prisoners, and incorporating diverse activities. Hence, effective classification of inmates' accommodation is essential. It has been established both theoretically and empirically that classification which relates

human and environmental variables can improve prisoner adjustment and prison management, sometimes substantially (Johnson, 1996).

4.3.2.2 Classification

The history of inmate classification closely parallels the evolution of the development of penal philosophy. Historically, prison classification has moved from merely separating types of offenders to complex, empirically derived systems focusing on a variety of issues. Risk predictions, needs assessments, aetiologies of criminal behaviour and optimising treatment are just some goals of recently developed classification systems.

Prior to 1870, when corrections focused on retribution and punishment, classification was based primarily on type of offence. Inmates were classified for the purpose of determining the "appropriate" form of punishment. There was no need to extend the process further, since all inmates were housed in comparable settings and occupied their time in a similar manner.

In the latter part of the 19th century, however, penology changed direction, introducing reform and rehabilitation as important goals. As these goals gained prominence and acceptance, classification began to ground itself in clinical diagnostic and treatment categories that stressed the "personal pathologies" of offenders.

Inmates, by virtue of their arrest and conviction, were assumed to be deficient in personal growth and survival skills. The task of classification was to identify such deficiencies so that they could be corrected. Use of this medical model of classification proliferated during the 20th century, as the psychological and sociological causes of crime were explored and methods for assessing offenders grew more sophisticated. This trend continued into the early 1970s. It started to lose favour due to public frustration with rising crime rates, gratuitous violence and the perceived failure of treatment-oriented programmes (Flynn, 1978; MacKenzie, 1989). It is however worth noting that some prison systems still follow the rehabilitative or progressive classification approach, as in Scottish prisons (McNeill, 1988).

Today, correctional philosophy in many countries is increasingly based upon a retributive (punishment) or "just deserts" view of handling offenders. Previous assumptions regarding the efficacy of rehabilitation have been increasingly challenged. There has also been an increase in litigation regarding inappropriate use of criteria for determining how

inmates are housed, and when and whether they are permitted to participate in correctional programmes. Both developments, along with the well-publicised prison-crowding crisis, have affected traditional classification strategies governing the management of inmates (Austin, 1998).

Specifically, correctional classification systems have moved away from so-called "subjective" (previously known as psychological) models to "objective" (previously known as management) systems. Supportive of the objective models argue that the subjective models tend to rely upon informal criteria that often lead to inconsistency and error in staff decision-making. Conversely, objective systems depend upon a narrow set of well-defined legal (e.g., severity of current offence, prior arrests, etc.) and personal (e.g., age, marital status, etc.) characteristics. These items are then weighted and assigned differential values (points) within a well-defined instrument that is then used to assess an inmate's level of risk or programme needs. Objective systems place greater emphasis on fairness, consistency and openness in the decision-making process. The objectivity of a classification system, however, is a matter of degree, for the creation of these systems involves subjective judgments, and all the systems currently in existence incorporate at least some subjective staff judgment (Alexander and Austin, 1992; NIC, 1992). The advocates of the psychological approach, although admitting the advantages of the objective approach, emphasise the need to incorporate the theoretical issues in order to understand the criminal behaviour and the aetiology of such behaviour. There is an increasing fear that the psychological issues will become separated from the prison environment (MacKenzie, 1989).

As a result of the increasing emphasis on classification as a management tool and the growing pressure to improve classification, considerable attention has been focused on the process of classification. Many individuals and organisations have provided guidance in structuring effective procedures. In the United States the National Institute of Corrections (NIC) issued the following principles for effective classification system (NIC, 1992):

1. There must be a clear definition of goals and objectives of the total correctional system.

2. There must be detailed written procedures and policies governing the classification process.

3. The classification process must provide for the collection of complete, high quality, verified, standardised data.

4. Measurement and testing instruments used in the classification decision-making process must be valid, reliable, and objective.

5. There must be explicit policy statements structuring and checking the discretionary decision-making powers of classification team staff.

6. There must be provision for screening and further evaluating prisoners who are management problems, and those who have special needs.

7. There must be provisions to match offenders with programmes; these provisions must be consistent with custody classification.

8. There must be provisions to classify prisoners at the least restrictive custody level.

9. There must be provisions to involve prisoners in the classification process.

10. There must be provisions for systematic, periodic reclassification hearings.

11. The classification process must be efficient and economically sound.

12. There must be provisions to continuously evaluate and improve the classification process.

13. Classification procedures must be consistent with constitutional requisites.

14. There must be opportunity to gain input from administration and line staff when undertaking development of a classification system.

However, Austin (2000a) defined four key components of the comprehensive classification process namely: External classification, Internal classification, Needs assessment and Community risk assessment. External classification is designed to determine an inmate's custody level, which in turn will influence the facility at which the inmate will be housed. Needs classification identifies the mental health treatment, educational and training needs of an individual inmate. This information is used to determine in which programmes or special services the inmate should participate while incarcerated, to enhance adjustment to the facility and to reduce the risk of recidivism. When combined with the inmate's custody level, it further refines the decisions surrounding to which facility an inmate will be assigned. Internal classification is

facility-based and requires structured decisions on issues such as: housing, programmes, and work assignments. Community risk is the focus of the next classification phase in which inmates are considered for release from the secure facility on work details, for pre-release preparation or parole. Community risk assessment is linked with needs associated with educational achievements, vocational skills, substance abuse, and relationships.

Several methods have been invented and followed in various countries. In countries such the USA, Canada, Holland, Sweden, New Zealand and Australia, prisoners are routinely assigned to functional units that differ according to prisoners' types, management styles, social norms, and the programme offered. The functional unit management offers a flexible approach to the classification and management of different groups. With a functional unit management structure in place, special-risk or special-needs inmates can be readily offered a coherent routine that at once addresses their situation and also integrates them, in varying degrees, into the life of the larger prison (Gerard, 1991). Levinson (1991) argues that when prisons are "unitised", the results are impressive. Social climate ratings improve; this proves true both for tougher and for more vulnerable inmates. It is worth noting that, at least as of 1991, no system that has adopted unit management has subsequently abandoned it (Levinson, 1991). It has also been proved that there are indications that small but consistent drops in recidivism rates may be a consequence of this organisational reform, independent of the specific correctional programmes offered to inmates (Johnson, 1996).

In the United States, different jurisdictions follow different approaches. For example the Pennsylvania Department of Correction (PA DOC) has developed the "Pennsylvania Additive Classification Tool" (PACT). Harrison (2000) claims that PACT is a fully-automated classification system that is reliable, easy to administer, and incorporates all relevant data to establish an inmate's custody level, housing unit assignment, work detail, treatment and programming needs. The system sorts inmates, channels resources to inmates according to their risk and needs, rewards positive behaviour and enables both inmates and staff to fully understand the factors on which a specific classification decision is based. It is based upon the "just deserts" model in which an inmate's classification level is based on his/her commitment, crime and institutional behaviour.

The South Carolina Department of Correction has developed personal computer software to simulate the interactive dynamics of prison classification policies, sentence structure, inmate behaviour, and prison bed type requirements. Lee (2000) illustrates how the

Dynamic Simulation Model (DSM) applies classification scenarios to the current and projected future inmate attributes, manages "heads and beds, " predicts future bed-type mix and generates a cost-effective classification model. Neubauer, 2000; Ligtenberg, 2000; Ludwick, 2000; and Roesel, 2000 present other examples from other states.

The architecture of the prison building, however, plays a major role in the success or the failure of the various classification systems. Correctional officials are in uniform agreement that architecture has a very important impact. Some believe that it "makes or breaks" the operation (DiIulio, 1987:294). The architecture of these diverse institutions varies greatly, from traditional concrete and brick behemoths, filled with tiers and ranks of steel-barred cages with vast congregate dining halls, to campus-like facilities with scattered houses, holding inmates in home-like conditions. Architecture tends to dominate much of the texture of life in prison. There is an obvious unevenness in suffering in such a classificatory system, but it is not an inequity that the prison authorities can or should avoid. The essential pain of imprisonment, of minimum security level offenders lies in the prisoners' banishment from society and their loss of autonomy; Morris (1998) suggested that it would serve no social purpose to increase suffering for criminals in open institutions

Fewer dispositions in the correctional life of most prison systems in the USA and the UK are based on effective classifications. Among the reasons for this trend are shrinking resources, which narrow the spectrum of the clientele that can be set a side for differential dispositions. With some exceptions, prison systems today assign inmates on the basis of the space that has just became available. In theory, nevertheless, "classification is not a thing unto itself. It is a means for matching people and services, people and settings, people and people. This makes classification the science and practice of arranging decent, meaningful and effective person-environment transactions" (Toch, 1997:112). There is however, an increase concern for providing separate classification instruments for female inmates, which is explained in the next chapter.

4.3.2.3 Cell classification

Configuration of cells has direct impact on the composition of façades as well as occupants' comfort levels. Very limited empirical or theoretical research has been conducted concerning the relationships between prison cell classification and inmate behaviour. It is essential in this era of increased prison population and prison

construction to examine the impact that the housing cell arrangements have on the inmates' conduct.

Farbstein (1982) suggests that inmate misconduct is suppressed by single cell housing. This commentator argues that compared with multiple cells and dormitories, single cells are easier to monitor and require fewer security staff and less observation time. From another angle, Fairweather (2000) argues that the amount of space in single and double cells does not appear to be an important factor in inmates' reaction to their housing, but space may become a more serious problem in multiple occupancy cells or dormitories. While limited space in a single cell has an impact on how cramped the space feels, in multiple housing there are the additional effects of decreased interpersonal distance, reduced privacy and increased potential interference.

Another risk that dormitory and double-bunked cells may involve is raising tension levels, which can lead to increased levels of assault. Sharing may also increase the number of unpredictable and unwanted interactions, including threatening behaviour (Fairweather, 2000). Other factors also influence whether assaultive behaviour will occur in heavily double-bunked institutions: e.g., the level of crowding, the spatial constraints in cell or dormitory design, and the amount of out-of-cell activity allowed to each inmate. Single-bunked cells also enhance opportunities for staff to differentiate inmates and become more familiar with them. As a result, single cell housing lessens pressure on intake and classification staff to correctly assess or predict inmate behaviour. In essence, it leaves staff with a little more margin for error when classifying inmates. However, Wener (2000) argues that with the new generation designs operate reasonably well; facilities that were designed with single-bed cell have survived large-scale double bunking without major outbreaks of violence. Nevertheless, if double bunking is used, then accurate classification becomes more essential to successful inmate management. Multiple-celling for medium security inmates has recently been adopted by the Standards Committee of the American Correctional Association (Miller, 1991; ACA, 1991). This does not say that crowding is without consequences, on the contrary, an extensive amount of empirical research has related inmates psychological problems to the over-crowding which produces stress and anxiety, resulting in violent or destructive behaviour (e.g. Paulus, 1992).

4.3.2.4 Interior design

The cell classification is a major component of the living accommodation in prisons, and the previous section clarified its impact on the inmates' behaviour. However, recent research has demonstrated the high impact of the interior design and environment of buildings upon its occupants (SCFBR, 1996; Vischer, 1996; Heerwagen, 1998). Christopher (1990) argued that we breathe our surroundings in. He stated that they have human, social, biological and ecological implications. The environment, most of the time, works upon its occupants without any conscious resistance. Inmates spent the majority of their confinement period indoors. It is therefore essential to pay specific attention to the design of indoor features in the different parts of prison building, and particularly to the design of the inmates' housing units. Generally people spend 90% of their lives within buildings; when incarcerated, inmates spend 100% of their time indoors which proliferates the impact of the ambient environmental conditions on their health. There is increasing research that relates the characteristics of the built environment to human health (Rayner, 1997). However, such research is limited in the prison environment. It is however, evident that stress factors are the main concern in prison environment as it influences the inmate behaviour, which impacts upon rehabilitation and correctional efforts. In recent research carried out by Evans *et al.* (1998) interior design elements that may influence stress are identified (Table 1).

Table 6: Interior design elements that may influence stress (Evans *et al.*, 1998)

Stimulation	*Affordances*
intensity	ambiguity
complexity	sudden perceptual changes
mystery	perceptual cue conflict
novelty	feedback
noise	
light	*Control*
odor	crowding
color	boundaries
crowding	climatic & light controls
visual exposure	spatial hierarchy
proximity to circulation	territoriality
adjacencies	symbolism
	flexibility
Coherence	responsiveness
legibility	privacy
organization	depth
thematic structure	interconnectedness
predictability	functional distances
landmark	focal point
signage	sociofugal furniture
pathway configuration	arrangement
distinctiveness	
floorplan complexity	*Restorative*
circulation alignment	minimal distraction
exterior vistas	stimulus shelter
	fascination
	solitude

In this section four elements of the stimulation factors are illustrated within the prison environment; colour, thermal comfort, noise, light and view. This is not to be misapprehended; other factors and elements are not less important. They will be however, discussed in detail in Chapters 5 and 7.

4.3.2.4.1 Thermal comfort

According to Lechner, (1991) thermal comfort is certain combinations of air temperature, relative humidity, air motion, and mean radiant temperature. Achieving comfort is the ultimate objective of calculations and resulting architectural manipulation (Stein, 2000). Recent research proved that several individual psychological factors have as much influence on comfort as temperature, humidity, or air motion (Butera, 1998). Such factors are more complicated in prison life. Although there was early recognition of temperature as a characteristic of the physical environment of prisons that affects inmate behaviour (Gould, 1980), a limited number of studies has examined its effects. A review carried out by Wright and Goodstein (1989) suggested that "uncomfortably hot days" bore no relationship to the incidence of disruptive behaviour among inmates. Recent research, however, related thermal discomfort, especially that related to the increase in temperature, to irritability and aggressive behaviour (Fairweather, 2000a). Fairweather also indicated that indoor air quality is also of importance. It has been found that relative to a no-odour group, the presence of even a moderately offensive smell increased aggression.

4.3.2.4.2 Colour

One of the main characteristics of contemporary prison design, specifically the paradigm that follows the new generation prison, is the "softening" of the prison environment. In design terms this has been interpreted by replacing intimidating bars with cell windows, with doors and walls substituting the bars that separate corridors from cells. The efforts in shifting the ambience of the prison into a more civilian and domestic mood have been perceptible in contemporary prison buildings all over the world (Johnston, 2000).

The impact of colour on occupants' behaviour and mood has been established and become general knowledge, however, there has been little empirical research on the impact of colour on inmate behaviour in the correctional field. One of the few exceptions is the work carried out by Bennett *et al.* (1991). Bennett and his colleagues examined the benefit of using Baker-Miller Pink paint in prison cells to reduce the aggressive and antisocial behaviour of prisoners. Their experiment was divided into two stages. The first was carried out in a prison cell in a police station. A simulated cell was constructed in the Department of Architecture and Design at Leeds Polytechnic University, for the second stage. Subjects were divided into two groups. One was placed in the pink cell

and the other was placed in a standard magnolia-coloured cell. The results of both trials were coherent and analogous. The experiment results indicated that faster average time for behavioural improvements was perceived among subjects placed in the pink cell.

The importance of the previous experiment is obvious. The colour can play a major role in the transformation of inmates' behaviour, and hence can be utilised in the rehabilitation procedures.

Several systems have been aware of such an important factor and utilised it in their institutions. Fairweather (2000a) reported an important case of "psychedelic torture" using colour. An isolation cell in a jail at Rockingham, North Carolina was painted from floor to ceiling in vivid yellow, broken up with purple dots of varying sizes. Colour in this case was utilised in the punishment and the deterrence procedures. However, there are several cases where colour has been utilised positively and has sent out a different message to the inmates. Colour in Dutch prisons, for example, is a very important ingredient in all new prison interiors (Christiaanse, 1994; Neutelings, 1994; Hulten, 2000). In France many prisons are famous for their interesting use of colour which reflects high consideration for the psychological quality of the inmates' life. In Maison d'Arret de Brest prison in Brest for example, bright colours are applied to surfaces thoughout the building, for example in activity areas, service facilities, columns and doors. The cell interiors on the other hand are of lighter, softer tone that is accentuated by colour features (Butler, 1994).

Colour has influence on inmates, and when they are given the chance they object to it. In 1985 a design group was assigned to design a new correctional facility in Orlando, in the US. The firm interviewed the inmates, without officers present. Inmates agreed on three main subjects: that they were innocent, their dislike of the steel feeling it sapped their strength, and that they hated the "damn" colours. Following this feedback the company carried out research on colour preferences and the psychological effects of colour, and designed the Orlando jail with chromatic emphasis. A simple colour approach was employed. Blue, believed to have a calming effect, is used in inmate day rooms. Red, which increases brain wave activity and prolongs the perception of time, is used in visitation spaces. Shades of light orange are found in the dining areas, as it was argued that it enhances appetite. Yellow, which makes building elements seem less massive, tints the heavy window mullions (Freeman, 1985).

Colour as well as change in materials can assist in the management of open spaces, allowing safe movement and control and helping eliminate the use of corridors and additional gates. That was the main intention of the colouring schemes that are used in Belmarsh prison in London, to define different spaces. The brief that was given to the architect by the Property Services Agency (PSA) required the use of "autumnal" colours in the housing units, in order to provide a comfortable and warm feeling. Hence, the basic wall tone for accommodation is speckled yellow while all metal work in the cell is oxidised orange. The architect wanted to make inmates aware of moving into different parts of the institution and to affect their moods accordingly (Designer's Journal, 1991).

The importance of colour is closely bound with light. Knowledge of light effects on humans has traditionally been based on visual perception research, on the whole, addressing issues of visual task performance and discomfort in different light settings (e.g. Boyce, 1981). Recent research has, however, attempted to establish the non-visual influence of light on basic biological and psychological mechanisms (e.g. Drahonovska, 1997). Visible light has major impact on the occupants' mood and behaviour based on cognitive perceptions and possibly unconscious perceptions (Zilber, 1993). In the field of incarceration Bennett *et al.* (1991) are pioneers in studying the impact of light colour filters on the inmates behaviour. Their research concluded that different colours affect the estimation of time to change behaviour. A very interesting conclusion that these authors reached was that a filter system indicated improvements in the care and custody of prisoners at an individual level of need. This is emphasised by the results of a very recent research investigated which the interaction effects between colour of light and gender on long-term memory. The study showed that males performed best in `warm' and `cool' white lighting, and that women performed better than men in artificial `daylight' white lighting (Knez, 2001). It is worth noting that there has been little research on the effects of ambient colour used in indoor environments. It is however, an area ripe for research.

4.3.2.4.3 Noise

Noise is the term used for any unwanted sound, thus the definition of noise is subjective. Individuals react to noise differently; someone's sound is another's noise. However, various levels of noise may produce both psychological and physiological effects. The physiological effects such as mental and bodily fatigue accrue if the noise was above 65 dBA. Stress and other nervous effect can result from unwanted noise up to 65 dBA. Major physical damage can be caused by exposure to noise levels that are 90 dBA or higher (Koenigsberger *et al.*, 1974).

Acoustics is the science of sound, and can be broadly divided into two major areas (Flynn *et al.*, 1992):

- Handling of wanted sound, room acoustics.
- Handling of unwanted sound, the control of noise.

Architectural acoustics is defined as the technology of designing spaces, structures and mechanical systems to meet hearing needs. Achieving good acoustics is very difficult (Stein *et al.*, 2000). Several studies have been carried out on the impact of noise in residential environments and work places. The impact of noise on individual productivity was measured in several empirical studies (e.g. Belojevic *et al.*, 2001). In a complex space such as a prison building noise is even more problematical.

Noise in the prison environment is one of the most persistent problems. Recent research related noise to stress and discomfort among inmates (Fairweather, 2000a). Fairweather divided the noise in prisons into two main issues. Those are the source of noise, and the material used in the prison. The first issue covers multiple conversations, shouted orders, and radios and televisions. The second one is the hard, reflective quality of most prison buildings. The new generation prisons are one step forward in dealing with both issues. The unitising of prisons and dividing inmates into small groups, can lead to major reduction in noise. Several prison managements insist on inmates using earphones when listening to television or radio. The use of soft and absorbent materials is the solution for the other factor.

4.3.2.4.4 Light and view

Recent research in the built environment emphasised the importance of daylight and windows for human well-being (e.g. Guzowski, 2000). Research proved that daylight has

direct impact on the physiological and more recently, psychological human well-being (Cawthorne, 1995). Rickets, a debilitating bone disease that causes physical deformities, was one of the first illnesses associated with sunlight. Exposure to sunlight sets off an elegant cycle that causes the skin to produce vitamin D, which increases the absorption of calcium in the intestine, which is then released to the skeleton to strengthen bones. Osteoporosis, or porous bones, is another disease directly associated with vitamin D deficiency and, indirectly, with sunlight. It has become increasingly evident that humans also have a psychological need for light (which is integrally related to and influenced by physiological needs). Seasonal affective disorder (SAD) has received much attention since the 1980s. Studies on SAD have had a profound impact on the understanding of the human biological response to light. SAD is characterised as a seasonal recurrence of depression that is frequently (but not always) associated with the fall and winter months. Contrary to clinical depression, which may result in weight loss and insomnia, the symptoms of SAD can include fatigue, lack of energy, increased sleep, carbohydrate craving and weight gain (Drahonovska, 1997).

The impact of daylight and windows in commercial and residential buildings has been studied extensively (HSE, 1987; Wong, 1994). It is very ironic that such an important element lacks any empirical research in an environment that is used to influence people and modify their behaviour, i.e. the prison environment. Several studies related sensory deprivation resulted from the minimising of windows, and access to a view to high rates of stress and consequently cases of suicide among inmates (e.g. Boys, 1982). However, the recent emphasis on the importance of providing daylight in prison buildings is related to theoretical research founded upon general knowledge, with no significant empirical research which addresses the complicated prison environment. One example of the extensive use of daylighting in prison buildings is illustrated by Autran (1994). In the design of the Maison d'Arret d'Epinal, light and colour were integrated and utilised to emphasise the key factor of the contemporary incarceration process; that is, preparing the inmate for reintegration into society (Autran, 1994).

However, in prison building it is essential to specify a balanced judgment over how much natural light can be provided and where. The concerns of window size and location should be addressed. The window size does not only impact upon daylighting, but other considerations are involved. Privacy and transparency for example are two issues that need to be taken into account when deciding window dimensions in prison buildings.

Fairweather (2000a) presents very important questions which need to be addressed in such judgment. "Does the public want to see quite so blatantly what happens inside? And do those inside want to become a public spectacle?" (Fairweather, 2000a: 43).

The previous general demonstration of some of the indoor factors of the prison indicates clearly that design of the prison building and its indoor environment is crucial to its operation, and to the impact it has on the achievement of correctional goals for inmates, staff and public users. The design of prison environment is vital to the reform procedure and the "uncoupling between architecture and penal system" that occurred at the end of the 19th century has to be amended. Reform groups need to appreciate the fundamental importance of the envelope within which prisoners are incarcerated, and correctional regimes are enforced. The following section discusses this argument in detail.

4.3.3 Architecture as investigator of virtue

One of the most influential of the reform associations, the Boston Prison Discipline Society, deemed architecture as one of the most important moral sciences. "There are", the society observed, "principles in architecture, by the observance of which great moral changes can be more easily produced among the most abandoned of our race... other things being equal, the prospect of improvement in morals depends, in some degree, upon the construction of buildings" (Rothman, 1998: 106). Previously, architecture's role in prison design aimed to enhance the surveillance of prisoners and guards, provide better ventilation, and improve sanitation. The role then evolved providing total environmental control in order to reform the offenders' characters. Incarceration architecture modelled on the design of the Panopticon added the functions of pure control and power to the prison institution. The separate system prison type was the test of this belief. In terms of such large-scale application of a correction philosophy that has generative force in architecture, the development of the penitentiary is without precedent. The application was directly followed by uncoupling of reform and architecture as a result of the failure of the separate system. The reasons for the incongruity between penal theory and prison architecture cannot be stated accurately; it is, however, apparently related to the persistent existence of crime. When punishment, deterrence, surveillance and security were the goals of imprisonment, architecture achieved those aims with great success. When rehabilitation and reform were the aims of the institution, architecture failed dramatically.

Architecture is a social art. Traditionally, architecture was concerned with light, form, mass, space, line, and edge and technology of buildings. Contemporary social problems made the expansion of this traditional scope essential. The continuation of past practices in planning and design creates disparity between needs and solutions, at an accelerating rate. Therefore, in order to provide appropriate design responses, improved strategies are required to address more complex systems and subsystems that characterise the functions of society (Moyer, 1975a). The understanding of the need for this expanded architecture is essential in penal institutions. The design of the Model Prison in the 19th century was based on extensive research in building technology and mechanics. The inmates were rendered passive, and expected to respond equally to standardised accommodation. The design decisions were based on practical thinking which had no psychological knowledge to support its aims. However, the situation is reversed in the contemporary world.

The large number of studies and research on prison and prisoners has been mainly carried out by sociologists and penologists. The vast amount of research that asserted the importance of the built environment on the occupants rarely reached the field of prison. This can be a result of the complexity of the institution, or socio-economic factors. The factors behind the limited interest in the research of the prison environment are a ripe area for further discussion. The need for such research is essential.

The failure of the separate system aborted all the enthusiasm for institutional treatments. Although the failure of the system had huge influence on the design of prisons up until the present day, there has been very little analysis of the reasons for its failure. The thesis argues that ignorance of the indoor environmental impact on the occupants has largely contributed to this fate. Mere functionalism is never enough to design a space that aims to influence its occupants' behaviour. The psychology of the space is essential here. A link should be made between sociological and scientific approaches in the research that involves prison buildings, if the latter are to be successful in their function. Design does matter in the penal institution. To achieve the ultimate goal of the prison, there needs to be a more comprehensive approach towards rehabilitation.

4.4 Islamic penal theories and contemporary rehabilitation approaches

It is claimed that the history of the prison as an institution and a building type has been well researched in the last fifty years. This can be only accurate for the Western world. The prison systems in other parts of the world, and particularly in the traditional Islamic world, have been overlooked. Despite the fact that Islamic law (the *Shari'a*) is one of the major non-Western legal systems in the world today, literature about the beginnings of prison disregards a system that evolved in the 7th century. The importance of the *Shari'a* is that it actually aims to order the lives and social conditions, in a limited or general form, of the many hundreds of millions of Muslims that comprise one-sixth of the world's population.

The development of the Western penal system is related to social, political, economical and cultural conditions (McConville, 2000). In sharp contrast, Islamic discussion about punishment brings theology and jurisprudence together as a single enterprise, since the punishments of this life are closely bound up with punishments in the hereafter and God is involved in both categories of punishment (Peters, 1997). Whilst it was not until the late 18th century that imprisonment was regularised and became part of the penal system in Western countries, in the Islamic nations imprisonment was introduced in the 7th century. The claims that female segregation in prison buildings, for instance, dates back to the late 16th century are false, as the literature review of this thesis showed that it was introduced in Islamic society as early as the 7th century.

Overlooking such an important penal system in recording the history of prisons is striking. This section attempts to fill this gap and to explore the aspects of resemblance between current approaches to offenders' rehabilitation in the contemporary world, and the 7th century traditional Islamic penal theories. It also reviews contemporary penal systems in different parts of the Islamic world.

4.4.1 Principles of Islamic penal theories in the 7th century

The historical review of the development of prison buildings in the West, which is carried out in the previous section, revealed strong links to local social and economic values. The influence of these values on prison buildings façade design was presented. Is this influence global? Is it possible to apply façade design variables that resulted from

centuries of social, political, and economical development in one society to another one? The case in Islamic culture is even more complicated. It is not only a different society, but the penal philosophy is different as well. These differences will result in different design considerations. Hence, it is essential to study the principles of Islamic penal philosophy in order to identify the specific design needs for prison buildings in Islamic societies.

The seventh century A.D. witnessed the beginning of the Islamic era founded by the prophet Mohammed, who performed also as a social reformer (Roberts, 1971). Islam introduced a social revolution. Its cornerstone was individual and collective morality. These principles of morality, which provide the basis for a society's spiritual values, are enunciated (among others) in terms of equality, justice, freedom, brotherhood, mercy and compassion (Mcknight, 1997). Islam is perceived as an integrated concept of life in this world and hereafter. It regulates the conduct of the state and of the individual in all aspects of human concern, linking the worldly and past-life aspects in an inseparable whole in which the will of the creator is part of the interrelationship of men, and of man with his creator (Hassan, 1981). This concept of morality, based upon belief in Allah, is the basis of individual responsibility and accountability and is at the root of all subjective and objective human values and relations, irrespective of their extent (Bassiouni, 1982).

The most distinctive element in Islam is its religious law, the *Shair'a* or the *Shari'a*. It is a phenomenon different from all other forms of law (Schacht, 1964, 1974). All jurists agree that the *Shair'a* (literally 'the path') comprises the entire corpus of divinely revealed law (Bannerman, 1988). The *Shari'a* covers every aspect of life and every field, which would not be regarded as law at all in any modern classification. It is rooted not only in social ideals but also in social reality (Anderson, 1996a; Humphreys, 1991). Divine law (*Shari'a)* is concerned with the preservation of five things: the person, the faculty of reason, progeny, property and the worship of God. The penal laws relate to these in specific ways. The person is protected by those laws, which grant individuals the right to retaliation or compensation, thus giving them the capacity to deter aggression against their persons (McKnight, 1997).

There are two categories of crime and punishment in Islamic legislation: determined and discretionary. Determined crimes and penalties are those provided for by the *Qu'ran* or the *Sunna* (the tradition of the Prophet Muhammad) where both the form of criminalised conduct and its assigned punishment are specified. A crime or a penalty is discretionary

when neither *Qu'ranic* nor *Sunna* text render the act in question criminal. Crimes of the first category are of two kinds: crimes of *Hudud,* offences against God, and crimes of retribution (*Quesas*) and compensation (*Diyya*). The function of *Hudud* crimes and punishments is to protect public interest in Muslim society, public property and security (theft and banditry), family structure, conjugal and familial relations (adultery), and personal reputation (defamation or false accusation of unchasteity). Furthermore, the prevailing tendency in Islamic penal law is to consider crimes related to the protection of psychological welfare and moral conduct of individuals, such as the prohibition against drinking alcohol (Al-'Awwa, 1982; Bassiouni, 1982). The *Hudud* punishments may not be waived, since the command of God requires that they be applied without exception. Their severity is obvious. On the other hand, they are all circumscribed by procedural constraints which are so rigorous as to make many of them virtually impossible to implement (Mcknight, 1997; Al-Alfi, 1982). Crimes of retribution and compensation (*Diyya*) involve homicide, bodily injury or other forms of harm committed against the physical security of the person. They are labelled as such because the punishment imposed is either a retributive penalty, or takes the form of pecuniary compensation (ransom).

Discretionary offences, commonly known as crimes of *Ta'azir* (corrective or rehabilitative punishment), are numerous in Muslim states. All criminal acts and corresponding penalties outside the framework of crimes and penalties of *Hudud* and retribution are considered discretionary (Al-'Awwa, 1982). Such penalty could be imprisonment, the infliction of physical punishment or the imposition of compensation in accordance with the principle of rehabilitation, as rehabilitation is the overall purpose of *Ta'azir* (Bassiouni, 1982; Benmelha, 1982). Muslim jurists have, with reservations, accepted fines (compensation) as punishment in matters of *Ta'azir*. It is believed that the availability of this penalty may lead judges to employ it to excess, thereby permitting them to plunder the people. Consequently, fines were only cautiously introduced within the range of *Ta'azir* penalties. In any event, Islamic law does not seem to require fines other than for exceptional and supplementary reasons. A fine is imposed by deducting or setting apart a portion of the criminal's wealth or possessions in lieu of corporal punishment. This fine is not to be kept or added to the public treasury, but to be returned to the offenders as soon as they show signs of repentance (Bassiouni, 1982). Corporal punishments such as flagellation are sometimes applicable in *Ta'azir* crimes. Flagellation

is recommended most often on grounds that it can be readily imposed, and thereby causes a minimal deprivation of liberty for the accused. Offenders may thereafter attend to their businesses and serve the interest of their families. It is a cost-effective system for the state and the community, and saves the offender from being corrupted by the influence of incorrigible prisoners (Benmelha, 1982).

4.4.1.1 Imprisonment in the early 7th Century Islamic state

Imprisonment is a *Ta'azir* penalty, whose main objectives are discipline and correction. Islamic jurists have long recognised the serious consequences of imprisonment. Some argue that it is as serious as *Hudud* penalties and should, therefore, be nullified in case of doubt. Resorting to imprisonment becomes imperative only when flagellation is ineffective. They would restrict its use to dangerous and incorrigible criminals who are held in prison until they show signs of repentance, and only then are released. Literature indicates that offenders were placed in domestic environments for the period of their confinement in the Prophet's time, as well as that of the four early Caliphs.

Early Muslims were aware of the importance of society's role in the offender's rehabilitation. This knowledge was implemented through confining offenders in the most holy spaces in Islamic society, the mosque and the house. The Mosque in the 7th century functioned not only as a place for prayer, but also as a meeting place. The Mosque operated as a reform and rehabilitation institute. Literature indicated that offenders were kept in the Prophet's and his assistants' houses. This had a high impact on the offenders' physical and psychological well-being. The offender enjoyed the high quality indoor environment which characterised the houses of that period: high natural lighting, good ventilation, concerns for hygiene and generous spaces. It is reported that the Prophet and his successors were very careful in selecting the people who looked after the inmates, which reflects early awareness of the importance of righteous companionship in the reform process.

During Omar's rule, the third Caliph, prisons became a governmental institution, paid for and maintained by the state. Public treasury money was used to fund the new institutions for the benefit of society. A residential house was assigned to function as a prison. This house had a courtyard, and rooms surrounded it. Offenders enjoyed the freedom to move between rooms and the courtyard during the day and early evening (Al-Laheib, 1984).

The first purpose-built prison building was *Nafe'a,* commissioned by Ali ibn Abi Talib the fourth Caliph. The poor security standards of the building led to its failure and the erection of *Al-Mekhias,* with more secure materials. There are no detailed data about the space configuration of the building, but literature indicates that it followed the design of residential houses. Ali paid surprise visits to the jail to hear complaints from prisoners and to ensure that they were not mistreated (Al-Samad, 1995).

Gender segregation was implemented in the prison system from the Prophet's time. Women were imprisoned in the same way (in houses and mosques), but in special cases women would be confined in their own houses (Abu-Ghdah, 1987; Al-Samad, 1995).

The Prophet Mohammed and his successors, the Caliphs, emphasised the importance of humane treatment of prisoners. The Islamic state was responsible for providing the basic needs of the inmates. It was forbidden in Islam to cause any unnecessary pain or humiliation to the offender while rehabilitating him (Abu-Ghudah 1987). The *Sunna* contains examples of caring for prisoners, and the Prophet's exhortations that the man to whom he had entrusted a prisoner care for him and treat him deferentially (Al-Alfi, 1982; Awad, 1982).

4.4.1.2 Political Imprisonment

In the year 661 the period of the Caliphs of Medina ended, and the Ummayyads led the Islamic world. The rule of the Umayyads, the first dynasty in Islam (661-750), represented in many respects the consummation of tendencies which were inherent in the nature of the community of Muslims under the Prophet. During their rule the framework of a new Arab Muslim society was created, in this society a new administration of justice and Islamic jurisprudence, and through it, Islamic law itself came into being (Schacht, 1974). The use of imprisonment became more consistent. Prison buildings became more organised, and the state assigned prison guards.

Narrative literature records the emergence of a new function for prison buildings in this period. Prisons had a political role, being used to support the Caliph's leadership by confining political enemies. The rulers shifted away from the classical Islamic guidelines in treating their prisoners. Signs of inmate torture and degrading treatment can be traced in the literature (Al-Samad, 1995). The healthy and human characteristics of confinement

places during the early Islamic era were replaced by dark and overcrowded places. The Islamic principle of gender segregation was reported to be neglected, in some cases.

4.4.1.3 Glimmers of hope

It was not until the rule of Omar ibn Abd Al-Aziz (who died in 720) that things began to improve. Omar ruled using the principles of the Prophet and the early Caliphs. He produced guidelines for the minimum standards for treating offenders, which all rulers and the governors of the different Islamic cities were to follow. The guidelines, which were produced in the early 8th century, covered many principles that were adopted by the United Nations in the 20th century, in the Standard Minimum Rules for the Treatment of Prisoners. The 8th century list aimed at the protection of the rights of prisoners, particularly the integrity of their beliefs, mind, body and dignity. The guidelines introduced two types of classification gender segregation, and classification following the type of offence. Omar's instructions governed accommodation conditions. It outlined the inmate's rights for clothing, food and medical treatment. The critical choice of guards and governors was also included in the guidelines (Al-Laheib, 1984).

The Umayyads were overthrown by the Abbasids. The early 'Abbasids attempted to make Islamic law, which was then still in its formative period, the only law of the state. They were successful in so far as the *qadis* (judges) were henceforth bound to the sacred law, but they did not succeed in achieving a permanent fusion of theory and practice, of political power and sacred law (Schacht, 1964).

In the period of the Caliph Haron Al-Rashid (who died in 809), and under the recommendations of the jurist Abu Yousef, new guidelines for prisoners' treatment were founded. The new recommendations, although they contained several similarities to Omar's guidelines, contained more detail and several additions. The most important point in the new guidelines was providing a salary to the deprived prisoners' family. Abu Yousef emphasised the importance of implementing the *Hudud* and *Quesas* punishments for deterrence, and to avoid overcrowding in prisons.

The previous discussion has shown that the religious character of Islamic criminal law must be considered one of its most remarkable attributes, distinguishing it from other contemporary penal systems (Al-'Awwa, 1982). The nature of the Islamic criminal justice process is justice-fairness oriented. The purposes and goals of the Islamic criminal

justice system are the ascertainment of the truth, the determination of the responsibility of the accused, the remedy to the victim, and the social remedy (Bassiouni, 1982). Several fundamental guarantees provided by Muslim law in penal procedure in the 7th and 8th centuries can be found in contemporary penal procedures. The presumption of innocence, the protection of privacy and the inviolability of the home, the protection of physical integrity and the prohibition of torture, the equality of parties in penal procedure and the duty of judges to be neutral and fair are examples of such procedures.

Shari'a jurists hold that in principle, one is guaranteed the freedom to move as he/she pleases. Jurists have condemned the violation of this principle by forbidding arrest except when necessary. Imprisonment has been a tool used in the process of rehabilitating offenders since the middle of the first century, in the Islamic world (Al-Alfi 1982). Many of the most forward-looking concepts in today's criminal justice have been the mainstays of Islamic approaches for centuries. For example, the ideas of victim compensation, restitution and diversions, work release, periodic imprisonment, conditional release and others have been part of Islamic criminal justice practice. It is noteworthy that the traditional Islamic practice went beyond most modern penal systems in confronting the sexual problems of prison life. Some demanded that the wives of married prisoners be allowed to visit them occasionally for conjugal privileges (Al-Alfi 1982). The concept of the open prison, which was implemented in many European countries in the late 20th century, was introduced in the Islamic society from the 7th century through keeping offenders in the Mosque. The Islamic penal system did not believe in forgetting about offenders after "locking them up". The offenders' reform was not only the responsibility of the state but of all society. It can be concluded that if a Muslim state or even the ideal Islamic state wishes to adhere to the contemporary penal system and human rights conventions, it may do so without any legal or philosophical impediment.

Islamic penal theories recognised and stressed the importance of a more comprehensive attitude towards punishment, and the diminishing role of buildings and confinement spaces for rehabilitation. This would imply that when buildings are designed to reside inmates, the building's envelope should resemble as much as possible a normal residential block of the context in which they are built.

4.4.2 Current punishment approaches in the Islamic societies

The Islamic world forms an arc of continuous population stretching from the west coast of Africa and going as far East as the Northern shores of Australia. This arc, therefore, stretches across the three continents of Africa, Europe, and Asia. Although a set of common historical sources and methods exists, the modern expressions of Islamic law vary immensely from one country to another. Islamic law in Saudi Arabia today differs significantly in detail and application from Islamic law in modern Morocco. Islamic law in its modern expression is a truly separate legal family: unique, comprising ancient and timeless texts and offering a wealth of legal concepts, ideas and interpretations. Islamic law has been subject to tremendous changes since the beginning of the 19th century and in many areas has been replaced totally by secular Western-based legal rules. It was in this epoch that the economic, military, political and cultural dominance of the West began to influence most aspects of Islamic life. The effect of importing the new European sciences, literary as much as technical, was to displace jurisprudence to the margins of intellectual life (Imber, 1997). In particular, in areas that Europeans colonised directly, the new administrators regarded the *Shari'a* not as God's law but as native customs and, from this starting point, developed legal systems based on the pattern of metropolitan practice. The trend is to harmonise secular laws with Islamic law as far as possible. In reality, outside the areas of personal status, the result has been a marginalisation of Islamic law (Anderson, 1996b). The use of *Hudud* and *Quesas* penalties was minimised in most cases and imprisonment became the main penal system in most Islamic countries.

The importance of the traditional Islamic law, the *Shari'a*, is not affected by these changes. It still influences the laws of contemporary Islamic states; in states of traditional orientation, such as Saudi Arabia, as the law of the land; and in the states of modernist orientation as an ideal, influencing and even inspiring their secular legislation.

The following section demonstrates some examples of the status of the penal system in different parts of Islamic society and the limits of the contribution of *Shari'a* laws.

4.4.2.1 The Shari's law in non Arabic Islamic societies

At present, Islamic countries differ greatly in their political, social and economic settings. The margins of the application of the traditional Islamic law, the *Shari'a,* vary from one country to another. While Turkey totally abandoned the *Shari'a* in 1927 (Coulson, 1964),

the Taliban in Afghanistan imposed what seems to many a distorted, strictly religious regime. Turkey provides the only example where a traditionally Islamic community was able to change by force of law not only its Islamic constitutional and legal provisions, but also some of the fundamental "mannerisms" of its people, matters relating to their social, cultural and civic life (Hassan, 1981). Conversely, the law in Afghanistan aimed to create an extreme Islamic State. Turkey and Afghanistan symbolise the two ends of the spectrum. Most Islamic societies apply more moderate systems. However, movements to reinstall traditional Islamic law are found in countries such as Indonesia, which has agreed to allow its troubled Aceh province to introduce Islamic law, or *Shari'a.* Most of the Islamic fundamentalists have a hidden political agenda. Politically motivated leaders have sought and used the flexibility of Islamic thought to suit their self-serving purposes.

In most Islamic countries one can trace two penal systems. The civil laws based on the Western penal codes, and the *Shari'a* courts continued to function but with their jurisdiction confined, in general, to family law.

Imprisonment, being the main Western penal system, was implemented intensively as a punishment paradigm in contemporary Islamic societies and the use of *Hudud* and *Quesas* diminished. The prison buildings in many Islamic countries follow the pattern of the international prison crisis. Similar to the prison situation in many developed and developing countries, overcrowding, poor physical environmental conditions, filth, corruption, poor medical care and violence characterise prisons in Islamic countries. The Human Rights Watch (1993) reported that the physical conditions of many prison buildings in several Islamic countries are below any acceptable standards. Prisoners in many cases are tortured and denied of all their rights. Reports about corruption among guards, abuse and rape of women offenders are stated frequently.

The prison standards and the prisoners' treatment in most contemporary Islamic societies conflict with both international human standards and traditional Islamic guidelines.

4.4.2.2 The Shari'a law in the Middle East

During the last two centuries the *Shari'a* has been substantially displaced, in most Middle Eastern countries, in the courts at least, by codes of law largely of European origin; and even in the sphere of family law, which is still regarded as basically Islamic, many modifications have been introduced. In Saudi Arabia, the Yemen, and Oman, the *Shari'a* still, in theory, reigns supreme, although even in Saudi Arabia royal decrees are today assuming ever-increasing importance (Anderson, 1996b). The Ottoman reforms were paralleled in Egypt, which had attained juridical independence under the Khedive Ismail in 1874. Mixed courts were set up in 1875 and Native courts in 1883, and civil codes (as well as a Penal Code) were promulgated for their use, all based predominantly on French models, although both these civil codes did include among their provisions a certain number of sections derived from the *Shari'a*. Thus in Egypt, the enforcement of the pure *Shari'a* was thenceforth restricted to the assigned *Shari'a* courts and the sphere of personal or family law; and the dichotomy was almost complete. In 1955 Egypt abolished the *Shari'a* courts entirely and the *Shari'a* family law, along with civil and criminal law, is now administrated by a unified system of national courts. In 1956 Tunisia did the same (Coulson, 1964). The reshaping of Islamic law by modernist legislation has evoked much interest and inspired similar movements in other countries of the near East, in the Sudan, Jordan, Lebanon, Syria, Iraq and Libya. The laws enacted in those countries went even further than their Egyptian prototypes (Schacht, 1964). Civil codes were established in most of the Middle Eastern countries following the Egyptian Civil Code of 1949.

Despite the major differences in the penal theories of the two categories, both systems share the same construction of prison buildings and prison institutions.

There can be no doubt that these reforms did not stem initially from any popular demand, but were imposed on the people from above, in the interests of administrative efficiency and in deference to foreign opinion. It was not very long before they began to gain considerable support among those elements in the population, which had received Western education.

The Arabian Peninsula remained, generally, resistant to the influence of European laws. In Saudi Arabia, Yemen and some of the Arabian Gulf countries, traditional Islamic law

has remained the fundamental law up to the present day and, with the introduction of but a few superficial modifications, still governs every aspect of legal relationships.

Imprisonment, thus, gained an important role in the contemporary penal system in Middle Eastern countries. The role of imprisonment in suppressing political enemies, which has been an active function of prisons since the late 7th century, is still extensively used in the Islamic world. The International Amnesty organisation (2000) reported widespread and serious human rights violations - including large-scale executions, routine use of torture and unfair trials, often before special courts, taking place throughout much of the Middle East. Torture and cruel, inhuman, or degrading treatment is described in many Middle Eastern countries. Political prisoners are reported to be physically and psychologically tortured in countries such Egypt, Syria, Iraq and Iran (Amnesty, 2000). Historical castles and towers have been used for confinement, with little enhancement. Inmates in many cases suffer filthy environments with appalling sanitary conditions (Human Rights Watch, 1993). It is worth mentioning that data about the conditions of prisons in countries, which apply Shari'a (e.g. Saudi Arabia), was not found.

The prisoner-to-population rate differs from country to country in the Middle East (Table 7). The efforts made by Amnesty International to find accurate data on prison populations in countries like Saudi Arabia for example, have been futile. The prison population shown in Table 7 for Saudi Arabia, represents sentenced prisoners only. The Yemeni prison population illustrates the government-managed facilities only. The present prison population is much higher than the actual prison buildings' capacity in almost all Middle Eastern countries. In Egypt, for example, the capacity of the prisons, many of which were constructed in the late 19th century, is 20,000 and in 1992 the thirty prisons held 35,392 inmates. Many Middle Eastern countries consider prison buildings as a highly classified matter. There are little or no data on the conditions of the prison environments and regimes, or sometimes even the prison population. The human right watch report about Egypt in the year 1993 is the only exception found. There are no data about prison layout or the regimes applied in the facilities in any country in the Middle East.

Country	Total Prison Population	Date	Estimated National Population	Prison Population rate (per 100,000 of national population)
Tunisia	23,165	31/12/96	9.2m	250
United Arab Emirates	c.6,000	12/1/98	2.4m	250
Morocco	48,600	/97	27.5m	175
Lebanon	5,000	/97	3.1m	160
Iran	101,801	31/12/93	65.0m	155
Libya	c.6,750	/98	5.3m	125
Algeria	35,737	/96	28.6m	125
Egypt	c.80,000	/98	66.0m	120
Sudan	32,000	/97	27.9m	115
Kuwait	1,735	/97	1.7m	100
Qatar	527	31/12/93	540,000	100
Syria	14,000	/97	15.0m	95
Yemen	14,000*	/98	16.9m	85
Jordan	3,749	31/12/93	5.1m	75
Bahrain	305	31/12/93	549,000	55
Saudi Arabia	7,939**	31/12/93	17.2m	45

Table 7: Prison Population in the Middle Eastern Countries (Walmsley, 2000)
* Government Managed prisons only
** Sentenced prisoners only

4.4.2.3 The Shari's law in the United Arab Emirates

To maintain harmony between them, the seven Emirates were given the constitutional right to opt for joining the Federal judicial system or to maintain their own independent system (UAE Constitution, Chapter 5). Except for Dubai and Ras Al-Khaima who maintain their own judicial systems, the other Emirates joined the Federal system.

The constitution designates the *Shari'a* as the basis of all legislation. The Federal UAE courts, similar to the courts in most countries in the area, are organised to form two main divisions, civil and criminal, and are also generally divided into three stages of litigation namely courts of First Instance, Appeal and the Federal Supreme Court (colloquially referred to as Court of Cassation). The jurisdiction of the third division, namely the *Shari'a* courts, which initially were to review matters of personal status, was expanded in certain Emirates such as Abu Dhabi to include serious criminal cases, labour and other commercial matters. Important cases with a security aspect are referred to special courts.

The use of imprisonment is widely implemented in the different UAE Emirates, along with the *Hudud* and *Quesas* punishments. Deportation, which is a contemporary penal system, frequently follows the sentences on the expatriates.

The population of the UAE has increased more than five fold in the past 25 years. According to the Central Statistics Department at the Ministry of Planning, the population

increased from 557,887 in 1975 to 3,108,000 by the middle of the year 2000. The number of expatriates living in the UAE continues to grow dramatically. The latest official figures show that the percentage of the expatriate population among the overall national population has risen from 36 % in 1968, to 75.6 % in 1995. As indicated in chapter 2, the expatriate population in the UAE varies in their nationalities, social, cultural, and political backgrounds. About 62.1 % of the total foreign population consists of ethnic Arabs. The largest non-Arab group consists of Asians from India and Pakistan, who constitute about 9.5 % of the population. Some two percent are Iranians. Other groups, including Africans and Europeans, make up less than two percent of the population. This diversity of the social, economic and cultural backgrounds provides the UAE society with very unique and complex patterns. The UAE has one of the highest prison populations in the Middle East (250 per 100,000, Table 7). The inmates' population structure mirrors the national pattern. The low percentage of UAE nationals in relation to the total national population (24.4 % of the total population) is reflected in the prison population as well. The diversity in the UAE prisoners in terms of their social, political and economic make up coupled with issues of race and gender represent a rare case of population problem in prisons. Design for such complicated patterns is problematic and cannot follow any standardised system. Rehabilitation approaches within this pattern need to be tailored for the various inmates' groups. The unforeseen rapid transformation in prison population in both numbers and types has led to major overcrowding in most UAE prison buildings. This has resulted in the emergence of fundamental new thinking about security and control measures. Consequently, a new design policy of prison buildings has been implemented. The prison design brief prepared by "Public Works Departments" in conjunction with the "Ministry of Interior", stated the main objectives of prison design.

The principal goal of the design is to provide closed institutions for different categories of offenders. In order to ensure more effective classification of prisoners, it is recommended to divide the accommodation into social units to accommodate the various prison groups following the offence typology and the inmates' backgrounds. To preserve a safe controlled environment and at the same time, ease access to all parts of the prison is emphasised. Correctional treatment towards rehabilitation is a central issue in new prison policy in the UAE. Prisons should prepare inmates for their return to the community.

Prison building accommodation is expected to maintain the standards of human decency and to be sympathetic to the UAE's severe climatic conditions.

In Dubai the new *central* prison is described as having five star luxury (BBC, 1998). Inmates - or rather 'guests', as the Dubai prison chief has insisted they should be called - are housed in double rooms with "televisions, proper toilets, central air conditioning and other top class facilities". The Dubai central prison's general manager believes that the deterrent role of prison buildings is accomplished simply by the deprivation of freedom. The offenders are entitled to humane treatment in pleasant conditions during their confinement period (Sediq, 2001).

In Abu Dhabi the Ministry of Interior intends to provide all prisons with air conditioning. A prototype is suggested as a model for all prison designs in Abu Dhabi. The new policy represented in the proposed prototype will have a large impact on the energy consumption in Abu Dhabi, through the increase of area per inmate and the introduction of air conditioning.

The hostile climatic environment instigates the importance of environmental design. There is a need to find a balance between the provisions of comfort conditions to achieve rehabilitation in prisons against its costs to society, in our case in energy terms.

Anticipating the future is an uncertain but nevertheless necessary activity, since the direction and pace of change is never inevitable but rather a consequence of choices and decisions that are made in the present. In respect to imprisonment in the United Arab Emirates a reappraisal of possible future options seems to be particularly appropriate, since even in the last decade the nature of imprisonment appears to have undergone a relatively radical transformation in terms of its functions, organisation and the size and make up of prison populations.

The real task which confronts contemporary Islamic jurists, beyond their immediate aim of adapting traditional Islamic law to modern conditions, is to evaluate modern social life and modern legal thought from an Islamic angle, to determine which elements in traditional Islamic doctrine represent essential Islamic standards. Islam is characterised by its potential for freedom of movement and a capacity for evolution (Goldziher, 1981).

As illustrated in section 4.2.4 the recent trend in prison building standardisation and applying the same typology proved a failure internationally. There are no universal penal polices which can be applied to the prison population as a whole. In a conservative

Islamic society like that of the United Arab Emirates, there is a need to build on both Islamic and contemporary theories to improve the sustainability of incarceration architecture.

The penal system in an Islamic society has to take into account the socio-economic aspects of punishment. Islamic jurists have long recognised the serious consequences of imprisonment. Some argue that it is as serious as *Hudud* penalties, and should therefore be nullified in case of doubt. They would restrict its use to dangerous and incorrigible criminals who are held in prison until they show signs of repentance and only then are released (Al-Alfi 1982). Prison buildings should be designed for confinement where rehabilitation should be the aim, that should lead to "repentance" and consequently reunion with society. Design of such buildings should therefore provide adequate indoor comfort. As an Islamic society pays for the inmates' "family allowance", the same society should pay an adequate price for the rehabilitation of inmates. This should be the cost of providing an adequate and humane environment for confinement. The question should not therefore be the balance between inmates' comfort and their punishment; the question should address the ways to achieve maximum comfort that would support rehabilitation, with minimum resource use. Architecture strategies should therefore lead toward these technical and social solutions.

4.4.3 Conclusion

The historical review of the Islamic penal system showed that despite the changes imposed on Islamic society to adopt a more Westernised penal system, the inherited values for punishment which are built in Islamic law reject the principle of physical confinement and imprisonment as the main punishment and/ or rehabilitation approach. This has resulted in the dismissal of prison buildings as institution for rehabilitation.

People in Islamic societies still believe in the values of Islamic penal theories. This is apparent in their belief in the differentiation between determination (*Hudud and Quesas*) and discretionary crimes (*Ta'azir*).

The marginal role of prison buildings in Islamic societies becomes evident, when the importance of prisons in Western and Middle Eastern societies is compared. While prison buildings have been emphasised and in many cases glorified in Western society, they are almost overlooked as a building typology in Islamic society.

The recent emphasis on prison designs and construction in the United Arab Emirates is an unconscious attempt to combine Western and Islamic values. Increasing comfort in domestic layout facilities and rehabilitative programs, which have considerable costs for society, is an interesting model. This model should be carefully examined to provide an appropriate balance between punishment, social values and cost.

4.5 Summary and Conclusion

The historical investigation carried out in this chapter shows that the Enlightenment rationality, the political upheavals of the French revolution and the social upheavals of the Industrial revolution created a reaction of control and discipline. Prison was but the clearest case of the general shift, based on fear, towards rational and rigid order. The enormous 19th century elaboration of theories and practices in prison discipline and management were, in microcosm, theories and practices of social order (Markus, 1994; McGowen, 1998; Verhulst, 1999).

In comparison to earlier prisons, the 19th century prison building designs aimed to provide a healthy environment for the inmates. Inmates' comfort was measured by providing appropriate sanitary and ventilation systems, thermal comfort, natural light and daily exercise. However, the damage the system inflicted to the inmates psychological well-being was enormous and beyond the imagination of the inventors of the system. Despite their differences, reformers and their opponents agreed that comfort and pleasure had no place in prison, but that privation was a necessary element of any penal scheme.

Prisons at the beginning of the 19th century were pushed into two similar but distinct architectural forms, the radial and the polygonal. Prison architecture depended on two things: the devising of new techniques and the understanding of penal principles (Evans, 1982). Incarceration architecture emerged in the 18th century, and was fully developed in the 19th century. The importance of architecture by the end of the 19th century has declined dramatically and become marginalised by the 20th century. That case is still the same in the 21st century. The American innovation of "new generation" prisons is the only exception. Again architecture has been utilised to carry out a specific penal system.

Several international conferences have been held to emphasis the need for a change. Aims were stated and guidelines offered. The reality of prison life, however, renders a different scenario. Fairweather (1977) in his introduction to the Penal Policy and Prison Architecture conference stated: "the difficulty is not so much in defining aims, as in getting them carried through. The tactics of *how* to implement strategic decisions are as important as deciding what decisions should be made". Today after nearly a quarter of a century since he made this comment, the situation remains still more or less the same.

The contemporary penal system "just deserts" had a major impact on prison design. Prisons are now categorised on the base of their security. The new prisons are minimum,

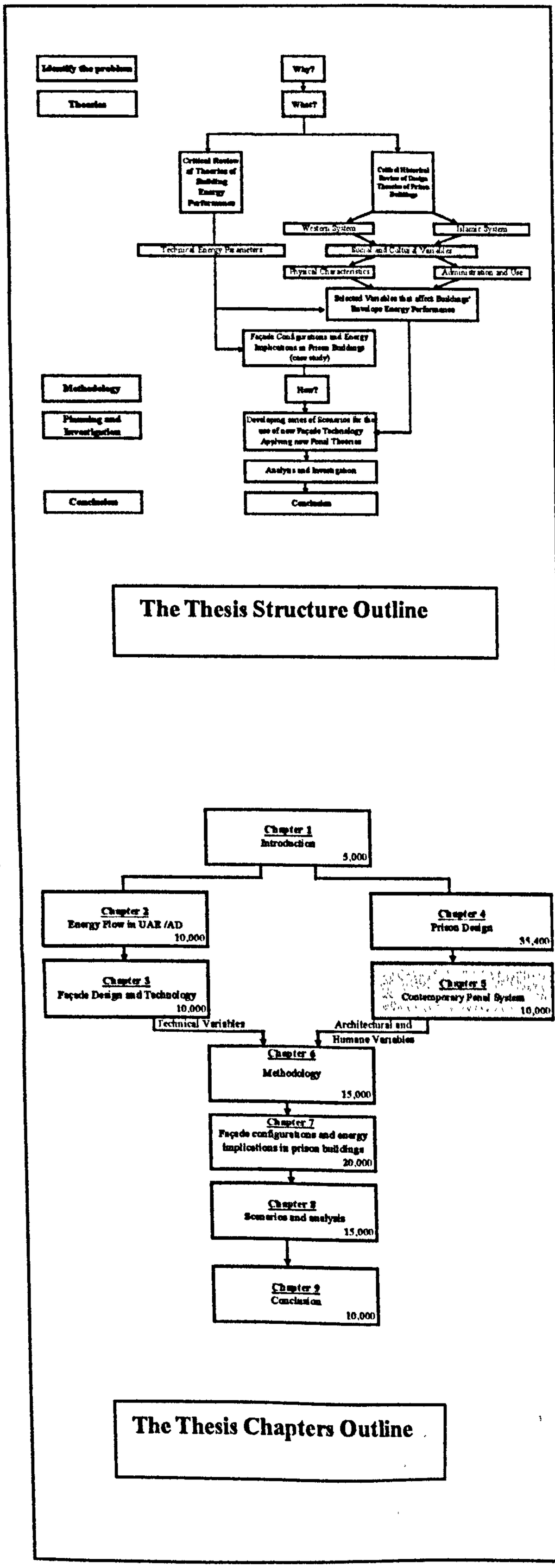
medium, or maximum security, and more recently "super-maximum" prisons appeared. "Security" and "Humanity" are to some extent incompatible, perhaps even contradictory, but putting opposites together often brings issues into greater focus. However, there should be a balance. The gap between theoretical and empirical research in prison design should be bridged. Prison as a building is not apart from but in continuity with the urban space, the human habitat. Consequently the design concepts for prisons should follow on one hand the changing ideals in penal institutions' containment philosophy and social structure, and on the other, the changing ideals of use and design of habitat in general, and of the architectural style that can express these new aspirations.

The contemporary trend in the globalisation of architecture is doomed to failure in a complex building typology like prisons. Different people act differently. Hence the cultural and environmental elements are very influential parts in the prison design process. Reviewing the development of imprisonment in the Islamic world is therefore essential.

The review proves that physical confinement had a marginal role in Islamic penology. Imprisonment in a domestic environment was used for rehabilitation rather than punishment. The diminishing role of the prisons as a building typology in Islamic architecture confirms this argument. Islamic penal theories recognised and stressed the importance of more comprehensive attitudes towards punishment. However, the importance of prison in the Islamic penal system stems out of its function. Imprisonment had one main function in the 7th century traditional Islamic society; that is rehabilitation.

CHAPTER FIVE

Contemporary Penal System



The Thesis Structure Outline

The Thesis Chapters Outline

5 Contemporary penal system

5.1 Introduction

This chapter aims to identify the social and cultural variables that influence prison buildings design. These variables together with the architectural variables identified in the previous chapter (Chapter 4) are essential to set the boundaries for building developed scenarios. This section explores the contemporary approaches of a more comprehensive attitude towards rehabilitation. Social and human aspects such as gender and racial issues are strongly emphasised in contemporary approaches to incarceration architecture. The contemporary penal system is, firstly, discussed and the role of imprisonment during the current post-modernity and post-industrialisation period is highlighted. The new, alternative approaches to imprisonment are surveyed and illustrated in section 5.4.

5.2 Evolution of rehabilitation approaches in the 20th Century

Immediately after World War II the rehabilitation of prisoners became more important. This led to an expansion of ancillary areas of prisons that were devoted to schooling, vocational training, recreation and the clinical services of social workers, psychiatrists and psychologists (Johnson, 1996; Morris, 1998). However, this movement to humanise and soften the experience of imprisonment was slowed and sometimes reversed by new circumstances. The pattern of inmates and the overcrowding problem led to compromise in the rehabilitation efforts. Many of the idealistic rehabilitative goals of the 1950s were abandoned (Martinson, 1974). The 1970s saw increasing disillusionment with the effectiveness of specific measures taken to modify criminal behaviour (Kolstad, 1996). The public begun to mistrust the reform efforts and advocated an increasingly hard line toward offenders. However, this pessimistic attitude, which was dominant in the 1970s, has recently shifted into a renewed enthusiasm for constructive approaches to working with offenders to achieve rehabilitation and, hence, prevent crime. This section demonstrates the shift in the general attitudes towards rehabilitation in the 20th and the 21st centuries.

Prisoners in a civilised society retain their entire human rights. They are entitled to most of their civic rights, which can be abridged only to a certain point by custodial imperatives (PRI, 1997). The United Nations has established that prison conditions are

human rights issues and the International Covenant on Civil and Political Rights affirms the proposition that human rights extend to those who are incarcerated. In 1955 the U.N. adopted the 'Standard Minimum Rules for the Treatment of Prisoners'. These rules are the most comprehensive international agreement designed to establish standards for prison conditions, and to monitor and enforce adherence to those standards. They set out what is accepted as being good principle and practice in the treatment of prisoners and the management of institutions. The rules emphasise the importance of equality in treatment and effective classification of the inmates. Accommodation conditions, personal hygiene, clothing and bedding, food, exercise and sport, and medical services are covered in the standards. The document contains some guidelines for maintaining discipline and punishment and restricts the use of physical restraint instruments. Social issues like contact with the outside world, education, religion, etc. are addressed in the rules. Contemporary prison buildings design is guided and ruled by these standards.

The enormous surge in the inmate population of the world, in the 20th and the beginning of the 21st centuries (8.6 million people are held in penal institutions throughout the world (Walmsley, 2000)) and the increase in the recidivism (re-offending) rates resulted in the idea of imprisonment being subjected to strong criticism (Lenci, 1977). In the 1970s, the stark statement that "Nothing Works" in treatment of offenders and reduction of recidivism was widely accepted (Brody, 1976). It was proved, however, that most of the arguments against rehabilitation were tenuous and based on myths. As soon as rehabilitation was seriously attempted in practice, such arguments were rejected (Blackburn, 1980). In spite of all the counter-arguments, offenders are still incarcerated in most societies and different cultures. The prison population in England and Wales is expected to range between 70,400 and 80,300 inmates in the year 2007 (White and Cullen, 2000). New prison buildings and facilities are, therefore, erected every year (BOP, 2000). The prison population in the United Arab Emirates has doubled since 1980.

The efforts to balance security measures and treatment in prisons vanished with the rise in the prison population. Security dominated the prison design elements, and the central penal policy following the 1970s was a strict 'just deserts' policy. In design terms this was interpreted in increasing security measures, with more control gates and zoning of the prison. The use of large dinning rooms was no longer acceptable, and in many cases inmates used their cells to eat. Physical barriers replaced dynamic personal interaction. Staff members were put into control rooms, stationed behind gates. Generally the

resources which were utilised to improve security, were taken away from improving regimes and improvements in lower category establishments such as women's prisons. In the moral vacuum that ensued custodianship, security, and human warehousing became the norms of imprisonment (Blumstein, 1989; Dunbar and Fairweather, 2000).

The failure of the traditional institutional reform approaches has resulted in the recognition of the importance of therapeutic use of the community, which has been adopted by Islamic penal theory since the 7th century as explained in Chapter four, (Dickens, 1977). This has been interpreted in three approaches. First, the call for non-custodial measures, which was widely accepted and introduced in different forms such as parole, suspended sentences, fines and service to the community (Killias, *et al.* 2000). This approach is illustrated in section 5.3. The second is a plea to reduce the barriers between prisons and the community. It is believed that to achieve rehabilitation it is important to develop methods to provide maximum opportunities for the prisoners to interact with the public (Dickens, 1977; Lenci, 1977). The third attitude emphasises the importance of conceiving prisons as communities, and that the building physical design should reflect humanitarian concerns with the improvement of social inter-relationships between inmates, and between inmates and staff (Priestley, *et. al*, 1984). This approach highlighted the importance of education, domesticity and therapy in order to achieve the goals of imprisonment. Recent research (Fairweather, 2000a) confirmed the crucial role of the prison environment in the achievement of correctional goals for inmates, staff, and public users when it is strengthened by the support of the administration, staffing, operation and activities, as well as the community.

This importance of prison design is evident in this brief review of the contemporary penal systems. The success of contemporary attitudes related to institutional rehabilitation (the integration between prisons and society and the normalisation of prisons) relies heavily upon appropriate architectural solutions. Architectural variables in the interior and the exterior of a prison building have a major contribution to either the success or the failure of the prison regime. It is, however, evident that there are very limited contemporary theories in penal architecture despite the continuous shift in penal system from one position to another.

The following section demonstrates how social issues such as race, age and gender can have major impacts on the design of prisons. It is hence, essential to highlight some of

the major social concerns in the prison environment to recognise the social variables that influence prison buildings design.

5.3 Social concerns in the contemporary prison environment

The contemporary prison environment is challenged by complicated social issues that surfaced in the second half of the 20th century. The social fabric in most contemporary societies renders an entirely different picture to those same societies before the 20th century. The ease of transportation between the different continents and the tendency of the developed countries to attract immigrants from various parts of the world has resulted in a racial mixture in contemporary societies. This is evident in the UAE societies where 60% of the population are foreigners. Prison populations, consequently, are now composed from a racial mixture that brings to the prison environment a variety of cultural and religious backgrounds.

Female as well as juvenile imprisonment is not new phenomena in the penal system. The unexpected sharp increase in these categories' population, however, highlighted the importance of addressing, if not constructing facilities that tackle the needs of these groups.

Health care and the policy of harsh sentencing led to a new phenomenon in the contemporary penal system, an ageing prison population. In the United Kingdom the number of inmates aged over 60 has trebled in the past decade. Ohio State (US) predicted in 1995 that it would need 3,000 beds for elderly convicts by 2003. It reached that within two years. Although special facilities were assigned to house elderly offenders, research and studies of the prison design for this category do not exist.

Although the previous inmate categories (juveniles, women and the elderly) has benefited from some thoughtful social research, there is a limited accompanying exploration of design. This thesis' case study is a medium security, male offenders prison building. Hence, although volumes could be written on the implications of psychological, social and environmental research in designing for these three specific offender categories, this thesis does not intend to investigate this issue in depth. However, in order to set the social theoretical framework for the thesis scenarios, it is important to identify how social issues like gender and age lead to specific design solutions for prison buildings. Gender

issues are taken as an example to highlight the overall impact of social issues on the prison building design.

5.3.1 Gender issues

The historical review carried out in Chapter 4, shows that female imprisonment goes back to the ancients. However, the first women's prison was built in Amsterdam in the year 1593. In the second half of the 20th century concerns about female imprisonment have increased, following pressures from feminist groups and the rapid growth of the incarcerated women population. Although the number of female prisoners is very minor in comparison to male offenders, the rate of women offenders is increasing dramatically every year. For example in the United States of America the numbers of females incarcerated has increased from 410,300 in 1987 to 895,300 in 1997 (Figure 61 (Bureau of Justice Statistics, 2000)).

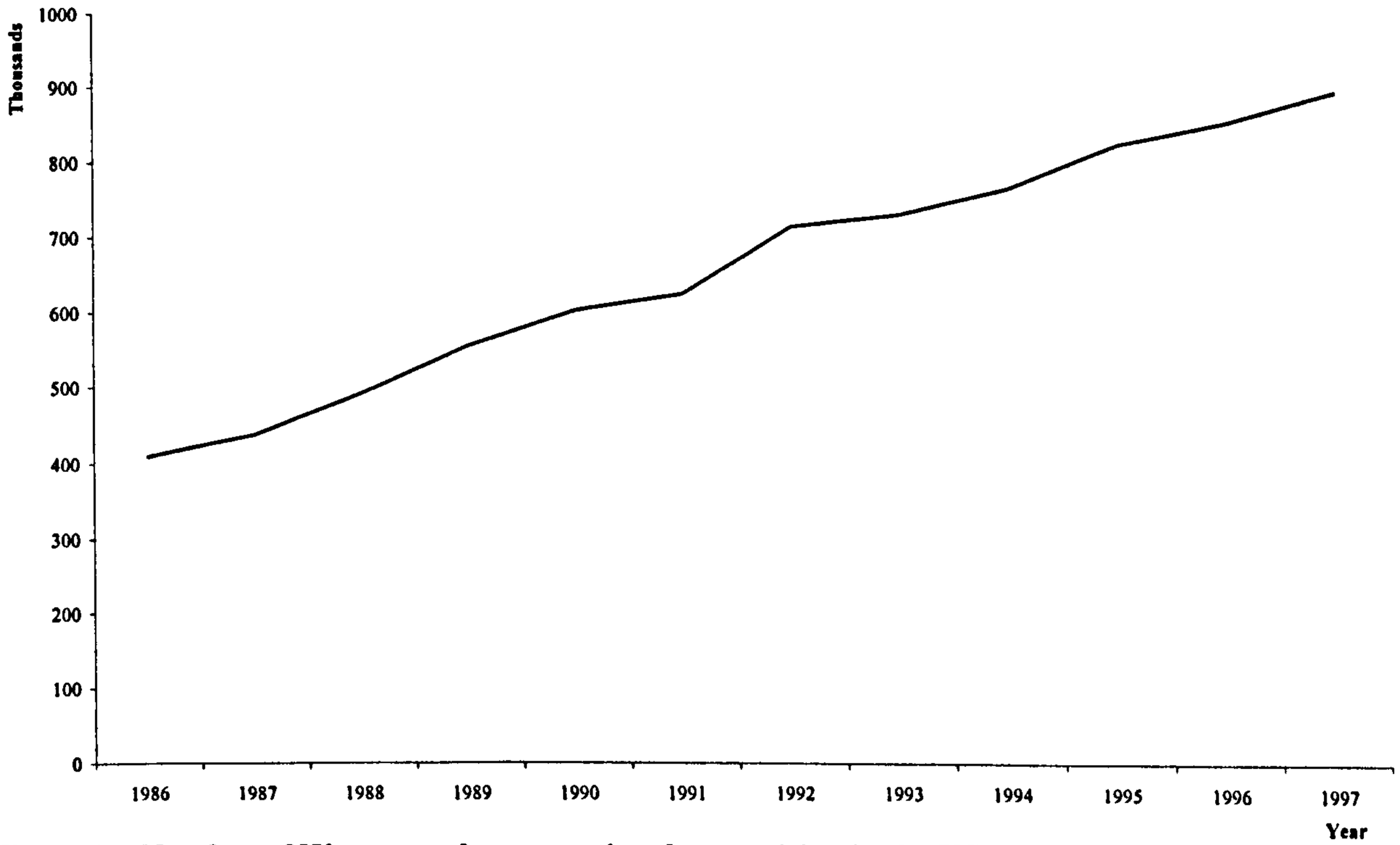


Figure 61: Number of Women under correctional supervision in the USA (Bureau of Justice Statistics, 2000)

Another example is the United Kingdom. The UK is suffering a sharp rise in the female prison population that led to a conversion of three men jails into women prisons by the end of the year 2001. The numbers of women incarcerated increased from 1,561 in 1993 to 4,045 in November 2001 (Figure 62, HM Prison Service, 2001). The dramatic increase in the incarcerated women population in the two examples is better presented if compared to the total prison population. In 1986, women comprised 12.7 % of the USA

prison population, rising to 27.6% in 1997 (the latest statistical data available). In the United Kingdom the women comprised 3.5% of the prison population in 1993 rising to 5.2% in 2000 and to 5.9% in 2001. This unexpected population growth has been a major factor intensifying the need for improved purpose designed female correctional facilities.

Figure 62: The sharp increase in incarcerated women population in the UK (HM Prison Service, 2001)

The surge in the incarcerated women population is not the only factor that influenced design and building of women's correctional facilities; reformers mainly feminists made a great contribution. Feminist approaches helped to shape public enquiries into female imprisonment in most developed countries, in the second half of the 20th century. Canada is a leading example of embracing feminist ideas in practice. One of the most important papers influenced by feminist principles is Creating Choices (TFOFSW, 1990). The report recommended extensive changes to the imprisonment of the federal population. However, the impact of feminist principles in Canada is not limited to the **recommended strategies**, there are an increasing number of **active programmes** which are based on these principles. The government funded several active programmes, based on feminist principles (Kendall, 1993; Scarth and Mclean, 1994; Atkinson and Mclean, 1994). These principles include a range of feminist therapeutic programmes. Kendall (1993: 5) claimed "feminist therapy is essentially a philosophy of treatment, rather than a technique of treatment". Feminist therapy sees people within their social, economic and political

environment, and attempts to reduce the power of the professional, and to help individuals take control over their own lives (Shaw, 1996).

In their paper Carlen and Tckaikovsky (1996) described, analysed and assessed the relationship between some of the developments in the British penal system and some of the difficulties confronting prison 'reformers', 'reductionists', and 'abolitionists' during the first ten years of the "Women in Prison Campaign"[7]. In opposition to the pessimists who argue that nothing can be done or that reforms will inevitably be incorporated into the 'repressive apparatuses of the state', the authors argue from a 'utopian-realist' position that there have been significant reforms in recent years, although many initiatives remain experimental and are often short lived.

The social research which examines issues related to female incarceration resulted in issues and ideas that focused attention on the unique characteristics of incarcerated women that influence design choices. Although it has been established that designing for incarcerated women is different than designing for incarcerated men, there is no vital foundation of research that assures more effective and responsive solutions (Carter, 1997). The studies carried out by Carp and Davis (1989), Carter (1997), and Elias and Ricci (1997) are examples of the few exceptions.

Literature review has shown that although both genders are capable of aberrant behaviour that requires special security measures and design features, the percentage of women that require these special and expensive measures is minor. The profile differences for women require a thoughtful design process that goes beyond painting a men's facility a pastel colour. In order to achieve anything more than punishment in women's prisons it is essential to exploit the social, physiological, emotional, and psychological differences in a positive manner that creates environments that reinforce constructive behaviour and change.

Carter (1997) identified **offender profile** and **custody classification** as the key indicators of women's behaviour that impact upon design choices. He claims that if properly addressed, they will define a design basis that is more cost effective in construction and more normative in management than a male prison retrofit. Designing a prototype

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[7] Women in Prison (WIP) was founded in 1983 by C. Tchaikovsky. From its conception, the group had to consider what is special about women's imprisonment.

environment is emerging as the current trend in many parts of the world, for example the USA and the UK. Obviously, prototyping has some economic benefits in a system where many inmates can be categorised into a single custody classification, however, environmental variation have a very positive impact upon behaviour.

If the experience of incarceration is to mean anything more than punishment and incapacitation, both the facilities and the activities that go on within them must respond to those who will use them, **the inmates.** Hence, prison design should be gender sensitive.

One of the great difficulties facing the designer of a women's institution is the desire of many departments of correction to create "flexibility" that permits the ultimate use of women's facilities for male inmates. Many of the decentralised service benefits for women also apply to men (Carp, 1989). However, if the initial and long-term planned use of the facility is for women offenders, then the historical, physiological and biological differences between men and women should be recognised and design solutions that maximise the opportunities associated with these differences should be developed. This can mean less emphasis on expensive barriers, hardware, and institutionalised spaces and a greater degree of commitment to a more normative and residential environment (Elias, 1997).

Designing a women's facility for the 21st century offers a great opportunity to make the totality of the environment support a treatment-oriented programme. One might expect that the more traditional double-tiered open dayroom concept (found in men's facilities constructed during the 1970s and 1980s) will be replaced by a single-story, smaller living unit of a more residential scale. Such changes will have dramatic impacts on the façade designs and hence comfort levels. In addition, the use of open space for circulation, colours to support different types of environmental conditions and furnishings that reflect the generally accepted behavioural characteristics of women might not only foster the opportunity for self-improvement but also result in institutions that are less expensive to construct and maintain, with a better chance of achieving offenders' rehabilitation.

The previous discussion highlights several spatial as well as a-spatial variables that would improve the sensitivity of prison design towards gender. These variables can be summarised as follows:

1. Facility size.
2. Housing unit size.
3. Building materials
4. Cells (size, fixtures /furniture, light, number of occupants)
5. Dayrooms (size, fixtures/furniture, light)
6. Support areas (exercise/recreation, education, programming, medical, visiting, work)
7. Environmental conditions (light, temperature, noise, ventilation, plumbing).
8. Security (internal, external, equipment)
9. Privacy and control.

5.3.2 Classification

The recent change in correctional theory and practice has been argued to represent a revolutionary paradigm shift. As has happened in all areas of correction, the philosophical change has had some impact on correctional classification. Historically, prison classification has moved from merely separating types of offenders to complex, empirically derived systems focusing on a variety of issues. Risk predictions, needs assessments, aetiologies of criminal behaviour and optimising treatment are just some of the goals of recently developed classification system. This section aims to illustrate briefly the development of the classification systems. Classification is a very complicated issue. Different countries follow different techniques. However, it is not the aim of this thesis to examine or demonstrate all the classification systems that exist in the contemporary penal system. A general demonstration of the most common classification system will be sufficient to illustrate the importance of prison design in the success of classification systems.

5.3.2.1 The History of Inmate Classification

The history of inmate classification closely parallels the evolution of penal philosophy. Prior to 1870, when correction focused on retribution and punishment, classification was based primarily on type of offence. Inmates were classified for the purpose of determining the "appropriate" form of punishment. There was no need to extend the process further, since all inmates were housed in comparable settings and occupied their time in a similar manner.

In the latter part of the nineteenth century, however, correction changed direction, introducing reform and rehabilitation as important goals. As these goals gained prominence and acceptance, classification began to ground itself in clinical diagnostic and treatment categories that stressed the "personal pathologies" of offenders (MacKenzie, 1989).

Inmates, by virtue of their arrest and conviction, were assumed to be deficient in personal growth and survival skills. The task of classification was to identify such deficiencies so that they could be corrected. Use of this medical model of classification proliferated during the twentieth century, as the psychological and sociological causes of crime were explored and methods for assessing offenders grew more sophisticated. This trend continued into the early 1970s. It started to lose favour due to public frustration with rising crime rates, gratuitous violence, and the perceived failure of treatment-oriented programmes (NIC, 1992).

5.3.2.2 A theoretical revolution in corrections

Correctional philosophy in the last decade has been increasingly based upon a retributive (punishment) or "just deserts" view of handling offenders. Previous assumptions regarding the efficacy of rehabilitation have been increasingly challenged. There has also been an increase in litigation regarding inappropriate use of criteria for determining how inmates are housed, and when and whether they are permitted to participate in correctional programmes. Both developments, along with the well-publicised national prison overcrowding crisis, have affected traditional classification strategies governing the management of inmates.

Specifically, correctional classification systems have moved away from so-called "subjective" models to "objective" systems. Subjective models tend to rely upon

informal criteria, which often lead to inconsistency and error in staff decision-making. Conversely, objective systems depend upon a narrow set of well-defined legal (e.g., severity of current offence, prior arrests, etc.) and personal characteristics (e.g., age, marital status, etc.). These items are then weighted and assigned differential values (points) within a well-defined instrument that is then used to assess an inmate's level of risk, or programme needs. Objective systems are claimed to place greater emphasis on fairness, consistency, and openness in the decision-making process (Austin *et. al*, 1990).

5.3.2.3 Classification of women offenders

Burke and Adams (1991) found that many correctional staff were dissatisfied with current classification methods for women. One of the major reasons for this dissatisfaction is that classification systems tend to be designed and tested for male inmates. A so-called "gender-neutral" classification system would use the same classification factors and scoring for both males and females. However, such a system would be appropriate only if it were true that the classification risk factors and decision thresholds had the same predictive attributes for both males and females. For a number of reasons this assumption may not be correct. Incarcerated women differ from male inmates in their behaviour and special needs, especially with regard to medical and mental health needs and family attributes (Nesbitt and Argento 1984). For these reasons, many practitioners feel that current systems over-classify and incorrectly house female inmates (Burke and Adams 1991; Hardyman, 2000b).

Brennan and Austin (1997) examined the status of classification procedures for female inmates and produced five options that can be considered in selecting a new or revised classification system for female inmates. These options are:

1. Implement a separate classification system for male and female inmates.
2. Implement a behaviour-based classification system.
3. Modify a gender-neutral system.
4. Implement a descriptive classification system that uses criminal involvement and sophistication as the organizing principle.
5. Implement a predictive classification system with public risk (recidivism) as the organising principle.

5.3.2.4 Prison design and classification

The one single factor that most determines the architectural response of a prison is the custody requirement to maintain a safe and secure environment for community, staff, and prisoners. To reflect the classification system implemented in a facility, varying the **design requirements** to carefully reflect the security and support needs of different categories of inmates is one major step.

Another advantage of using classification to direct design responses is in the potential for using **building materials** that more closely reflect the behavioural risk of the inmates assigned to a particular custody level. Not only does the selection of material indicate a range of housing types to meet varying custody levels, but the zoning of support facilities reinforces the degree of freedom of movement that the inmates earn through good behaviour.

To capture the ultimate benefit of any classification model it is essential for architects to be involved in the process of facility planning from the beginning, and to understand the system to be applied in the prison. Design and construction methods can only be appropriate if they are based on total understanding of the different categories of offenders.

5.4 Examination of non-custodial penology

The literature review carried out in section 4.2 showed that the prison was the product of pressure to reform existing methods of punishment and to find more enlightened, humane and effective answers to punishing the crime. However, towards the end of the 19th century, imprisonment became the subject of increasing criticism and gradually lost the absolute position it had gained as the dominant form of punishment. In its place, many European countries invented new, non-custodial punishments such as the suspended sentence and supervised parole. In some countries these new non-custodial punishments produced only minor changes in penal practice; in others, they substantially replaced imprisonment. This section aims to review the non-incarcerative sentences that are in use in the contemporary penal system globally.

5.4.1 Alternative, intermediate or community sanctions

Choosing the title of this section was not easy. There is wide disagreement over how to label the non-custodial sentences. The most common word is "alternatives", however, most criminologists argue against using that (e.g. Morris and Tonry, 1990 and Pease, 1995). Their argument is based on the fact that the word "alternative" assumes that the norm of punishment is imprisonment, against which all other punishments are to be measured. Other words such as "community" and "intermediate sanctions" have been suggested.

It is not within the scope of this thesis to suggest or decide on a definite label for non-custodial punishments, and hence as they are most commonly referred to as "alternative" punishments, this term will be used in this thesis. It is important to examine these "alternative" measures in order to set the boundaries of possible punishments within the social realm. This examination will highlight the positive and negative aspects of imprisonment and possible improvements in the design of prison buildings.

5.4.2 Non-custodial sanctions available

There are several alternative punishments available in different countries. These punishments are, generally, divided into two types: they are **supervision sanctions** and **monetary payments and penal warnings.** Supervision sanctions include[8]:

1. Probation
2. Suspended or conditional sanction, with supervision or condition of treatment
3. Community services
4. Open, ambulant or contract treatment
5. Suspension of driving or other licences
6. Deprivation of rights
7. Removal of professional status
8. Local banishment /exclusion order

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[8] The lists are adapted from Joutsen and Bishop (1994).

The monetary payments and penal warnings are mainly:

1. Fines.
2. Compensatory payments.
3. Confiscation of personal property.
4. Finding of guilt but no sanction imposed.
5. Finding of guilt but no sanction imposed providing that no further offence is committed during some stated period.
6. Conditional or suspended sentence; no supervision of the offender ordered.
7. Admonition.
8. Acceptance of offender's undertaking to be of good behaviour in the future.
9. Decision on sanction deferred for some stated period.

The following section illustrates the counter arguments that examine the benefits of alternative punishments.

5.4.3 Custodial or non-custodial

In recent years there has been a spate of meta-analysis of the effectiveness of non-custodial sanctions in preventing recidivism (e.g. Lipsey, 1992). The more recent work in this tradition (Jackson, *et al.*, 1994) concludes that overall, the effects are modest. However, much greater success attends some interventions. They conclude that the effectiveness of programmes lies in their details, with specific approaches not captured in meta-analyses.

Killias *et al.* (2000) in a controlled experiment, tried to assess the comparative effects of community service and short prison sentences. In terms of recidivism their findings were in favour of community service. The results of a controlled experiment by Killias *et al.* (2000) emphasised Pease's statement (1995), that the conclusion that "Nothing Works" is unsustainable. Yet the active ingredient is not community service or probation or monetary penalty, but something about the way in which these are sometimes applied to offenders.

5.4.4 Non-custodial punishments in the UAE

As indicated in Chapter 4, the contemporary penal system in the UAE is based on the *Shari'a*, and hence, non-custodial punishments have been applied in the country for centuries, long before the country's birth. The non-custodial sanctions range from the death penalty at one end, to the "name and shame" trend at the other. This very recent trend (which is not part of the *Shari'a* law) is to publish the picture of offenders that have committed minor offences, mainly related to moral issues, in the official newspaper.

Other punishments such as fines, referred to in Shari'a as "*Diyya*", are also applied intensively in the country. The use of physical punishment following *Hudud* is declining, although it still exists especially flagellation. The use of imprisonment however, is the main penal system in the UAE and appears likely to keep its position for the foreseeable future.

5.5 Future of imprisonment

At the beginning of the 21st century, imprisonment is still the centrepiece of the contemporary penal system just as it was in the 18th century. Imprisonment within its three-centuries of existence, has been expected to serve the same functions. New approaches did, however, evolve in the 20th century. The main functions of prison buildings today are assumed to be rehabilitation, deterrence, protection, retribution and "exemplary righteousness" (Markus, 1994). The hard board, hard fare, hard labour, and retributive religion which characterised reform approaches in the 18th century, were replaced by physical and vocational training, mental and physical medicine, productive work, and spiritual welfare support (Dickens, 1977).

Chapter 4 illustrated the conditions of historical prison buildings. It showed the development of the penal system, which was intimately bound up with prison architecture, in order to help understand the contemporary prison system. In the previous sections, the contemporary rehabilitation approaches are illustrated and the social elements that influence prison design theories are highlighted. It is, however, important to illustrate present prison conditions in order to be able to predict the future.

5.5.1 Prison buildings conditions today

Existing prison conditions, policies and practices worldwide, despite international declarations, treaties and standards, are below the level of decency (Human Rights Watch, 1993). Overcrowding and inadequate physical circumstances are reported in prisons worldwide, even in countries that are more or less respectful of human rights such as the United Kingdom (Lord Woolf, 2001), and the United States of America.

Classification systems are often primitive or nonexistent, and expose vulnerable or weak prisoners to violent offenders (Human Rights Watch, 1993). Ethnic minorities are still subject to discrimination in many prisons (NACRO, 2000). Inmates are still subject to poor health care (BBC, 2000a). Women are mistreated in many prisons (CBC, 1999). In spite of the high level of analysis and discussion and some significant theoretical contributions to the understanding of women's imprisonment, this does not appear to have had much impact on policies relating to women offenders (Burke and Adams, 1991) or in the process of designing women's prisons (Thigpen and Hunter, 1998).

Prisons were invented as a tool for human reform. Shifting from cruel physical punishments to imprisonment was perceived as humane a movement. Prisons in the 18th and the 19th century were no longer confinement places for those awaiting physical punishment; they were purposely designed and built buildings to carry out a specific function, which is reform. However, prisons today are mainly bricks of shame. It is feared now that the public physical punishment which was carried out in the Middle Ages has been replaced by torture behind high walls and wire fences. The total isolation that drove inmates crazy in the *separate system,* is carried out in all USA super-maximum security prisons. 20,000 inmates spend 23 hours a day alone and idle in a three m^2 sealed metal cell, with one hour alone in an exercise room (Maghan, 1999 and Borger, 2002).

One might wonder if the claimed failure of imprisonment in offenders' rehabilitation might not be related more to the poor physical prisons environment, administrative policies, and practices in the prison buildings, than to the failure of the imprisonment approach.

5.5.2 Is there a future?

The future of imprisonment is ambiguous. However, as the 21st century begins there are three broad choices with regards to the future of imprisonment. First, the '**punishment paradigm**' with its emphasis upon increased use of prison and greater penal austerity, on the premise that a combination of incapacitation and the deterrent functions of imprisonment will reduce crime and increase public safety. Secondly, the '**administrative paradigm**' which is based on risk analysis claims to be a cost-effective way of managing aggregate populations through a greater reliance on technology. The third option is the '**progressive paradigm**', which is concerned with maintaining custodial standards and recognising the needs of different types of offenders. At the same time it is concerned with the defence of prisoners' rights, attacking discriminatory policies and where possible re-establishing the links between prisons and the wider community. This involves developing prison regimes which promote meaningful opportunities for prisoners to improve themselves and to confront their anti-social behaviour (Matthews and Francis 1996). Architects and designers are still excluded from the discussions and counter-arguments about prison and the future of imprisonment.

The arguments about prison and imprisonment are an on going process. New theories are being developed, and conferences held everywhere. The practice is, however, different. There is still a wide gap between theory and practice. Protecting society by locking up offenders for a period of time is perceived to be the only benefit of prisons. However, recent findings question such benefit. According to the former UK Chief Inspector of Prisons, Sir David Ramsbotham, the public is being put at risk because of the appalling state of the prison health care service (BBC, 2002c). He has warned that the physical and mental health of prisoners is often worse when they return to society.

5.5.3 The past and the future

At present, penologists and criminologists have doubts about institutional rehabilitation efforts. Sociologists are calling for more non-custodial punishments rather than the use of minimum and medium security prisons. Prisons are to hold violent and serious offenders by which society benefits from locking them away.

In the United Arab Emirates, a country that is trying to provide a balance between the *Shari'a* and the contemporary penal system, the future of imprisonment is even more

ambiguous. However, prisons will not be abandoned in the foreseeable future, not globally nor specifically in the United Arab Emirates. Nevertheless, a more comprehensive attitude upon the rehabilitation with emphasis towards social aspects being represented in incarceration architecture, is the only way forward.

Figure 63 shows the effort of this study to summarise how the role of imprisonment has shifted dramatically through history. The question is, whether prison would go back to its primary role as confinement only for those who are awaiting trial or "alternative punishment".

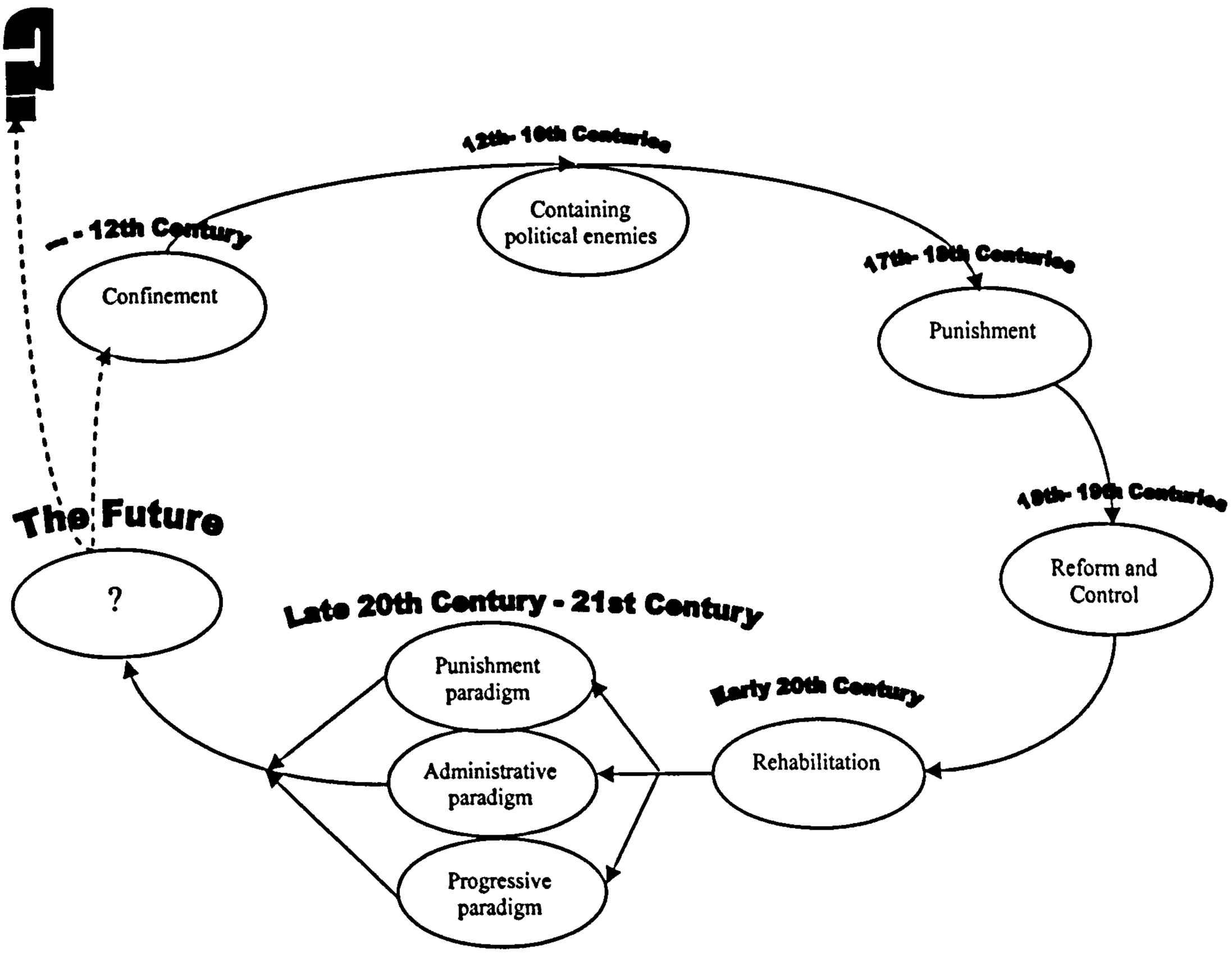

Figure 63: the changing role of imprisonment through history

6 Methodology

6.1 Research Methods for Sustainable Prison Design

The aim of this thesis is establish the role of façade design in attaining a possible balance between the provision of a humane environment for inmates that would help in rehabilitation efforts on one hand and be a penal system on the other. In order to decide on the methodology to be conducted in the thesis it is essential to underpin research methods and practices in the two parts of the thesis: energy and rehabilitation both related to architecture and built environment.

Section 6.2.1 reviews the research methods that are employed in energy studies in the built environment. This section highlights the thermal modelling techniques and reviews the new trends of research methods in this field. Section 6.2.2 discusses different research efforts that attempted to link design of prisons with rehabilitation of inmates. The section provides a historical review of various research approaches in incarceration architecture. Finally, section 6.2.3 demonstrates the importance of understanding the social organisation of energy-conserving measures.

6.1.1 Research methods for energy-related built environment studies

Although energy had a place on the building research agenda prior to the 1970s, the combination of the sudden escalation of energy prices and political anxiety positioned energy (its availability, use, cost, and environmental impact) in research and policy priorities. This section aims to review the research methods that have been widely utilised in building energy studies since the 1970s.

Since the 1970s, many studies have focused on energy conservation in the built environment. Over the last 30 years, energy as a "problem" has been continuously re-defined. The ever evolving definitions of the "problem" are reflected in the series of "energy campaigns" to raise public awareness in order to meet certain governments' targets in different parts of the Western world. In the United Kingdom, for example, the political agenda has called for a curtailment in the rate of fossil-fuel consumption. The 'Save It' campaign of the 1970s, concentrated on energy "conservation". This was about cutting back on demand through turning off lights, lowering thermostats, etc. Energy 'efficiency' was exhorted by "Get more for your Monergy" in the 1980s. The new wave

was about the promotion of efficiency, not conservation *per se*. The goal was to maintain expected levels of service, in terms of comfort and lighting for example, by using more efficient systems and technologies instead of cutting back consumption. A new concept was introduced with the "Helping the Earth Begins at Home" campaign of 1992. Global warming and the need to reduce carbon dioxide emissions provided a new round of technical and scientific activity. The emphasis was on conservation as in the 1970s, but for environmental rather than political or economical reasons. The 1999/2000 campaign: "Are you doing your bit?" includes an energy-saving element along with the environmental message (Bennett and Newborough, 2001).

Emphasis on energy research and the related sustainable debate has emerged from the different nature of these campaigns. The previous paragraph shows that the purpose and importance of energy efficiency has been continuously redefined in the last three decades. Consequently, this has been translated into new research methods and techniques, and accordingly into the design of the built environment.

Guy and Shove (2000) examined energy research in six countries. They detected a number of predictable patterns. In the selected countries energy research increased dramatically in the 1970s, dropping in the 1980s and gradually escalating in response to environmental concerns in the 1990s. The study provided a bird's-eye view of research priorities that showed a "maturing" of the field and its adaptation to new pressures and interpretations. Energy research in the 1970s was dominated by interest in **quantification** and **measurements** of energy usage, and technical diagrams showing the proportion of energy "escaping" through walls, floor, roof, and windows. The evidence of such **input-output models** helped to establish priorities for further research.

The next stage, in the 1980s, energy research focused on initiatives to develop new building materials and more efficient heating and cooling systems. Extensive interest in the thermal performance of buildings as a whole can also be recognised at this time. Complex exercises in **modelling** building performance became highly fashionable. Environmental issues, including sustainability in the 1990s inspired new energy research directions. For instance it promoted studies of **embodied energy**. Energy has become one of the main services in the studies of **life cycle assessments, whole-life costing, designing for durability,** etc. The UK Building Research Establishment's Energy and Environmental Assessment Model (BREEAM) and the development of databases cataloguing the green credentials of building materials are examples of energy studies in

this period. The following sections illustrate details of the different energy research patterns during the last three decades.

6.1.1.1 Research methods for energy-related built environment studies in the 1970s

One can recognise four main research themes in the 1970s. These are thermal comfort (e.g. Fanger, 1970), climate (e.g. Givoni, 1976), thermal response of buildings (e.g. Day and Burberry, 1976), and alternative energy sources for electricity and air-conditioning (e.g. Brinkworth, 1972). Some of these themes are from long before the 70s, such as work on thermal comfort. Interests in establishing thermal comfort criteria dated back in Europe, to the beginning of the 19th century. For example, in 1733 Arbuthnot pointed out the chilling effects of wind by dispersing the layer of warm, moist air around the body. In 1804 Sir John Leslie used an alcohol thermometer to measure air velocity by observing the cooling of the heated instrument (a review carried out by Bedford in 1961 and summarised by Markus, 1980).

Literature reviews of the studies during this period showed that laboratory controlled experiments were the main research methods. **Special rooms** were **built**. Sets of **independent variables**, for indoor and/or outdoor climatic conditions, were produced and manipulated at will. A number of experimental subjects (**dependent variables**) were located in the room and their reactions were recorded. The following section discusses the research methods related to thermal comfort.

In the case of investigating the thermal comfort studies two approaches can be identified: the **semantic** and **behavioural approaches**. In the semantic approach, subjects are asked to express their impressions of the environment on a **linear scale** in which numbers are fitted to phrases using **questionnaires** (e.g. ASHRAE, 1972; Fanger, 1970). The behavioural approach includes **measures** such as those of sweat rate, oxygen consumption, activity adjustment, **analysis** of clothing worn and **observation** of subject choices in setting thermal controls, opening windows, etc. These methods are complex. The **observation** of physiological behaviour, which is outside conscious control, is suited especially to the laboratory. Observation of the other types of behaviour is ideally suited to field studies, and involves no interference with the normal routines of life. However, most of the laboratory and field results are based on the simpler **semantic techniques**, in which people are asked to express their feelings about an environment in words. These

expressions are **quantified** by scaling and then **correlated** to variations in the environment and in clothing and activity levels. The analysis may be based on **open-ended interviews or questionnaires.** Humphreys' (1975) field studies are an example of this approach. It has been claimed that **semantic** approaches are more **reliable** for their **clarity** and **accuracy.** However, a **comparative analysis** study carried out by Humphreys (1975) showed that while laboratory work carried out in different centres and over a long period of time shows reasonable agreement; field studies show a much greater variation. Following this conclusion the importance of **qualitative approaches** was recognised. Social variables such as age, gender, health, etc. and subjective judgments such as "freshness" and "stuffiness" started to surface. A new term emerged: "Field Laboratory" where thermal comfort research was carried out using **systematic observation, measurement,** and **recording of data** (e.g. Markus, 1980).

Outputs of the energy-related building studies were integrated in a vast amount of design guides (e.g. ASHRAE, 1972; CIBS, 1977a; CIBS, 1977b; CIBS, 1977c; CIBS, 1977d; Directorate of Building Development, 1975; Great Britain Dept. of the Environment, 1979) and textbooks (e.g. Koenigsberger *et al.*, 1973; Steadman, 1975; Burberry, 1978; O'Callaghan, 1978; Markus, 1980; Fisk, 1981).

The economic factors of energy conservation motivated several research projects. For example, Marshall's (1980) study attempted to apply traditional microeconomic theory to building science. He introduced five tools of economic analysis to facilitate measuring economic efficiency in building. These are **Life-Cycle Cost** (LCC), **Net Benefits or Savings** (B-C), **Savings-to-Investment Ratio** (SIR), **Internal Rate of Return** (IRR), and **Discounted Payback** (DPB).

In summary, the quantitative approaches were dominant in nearly all energy research themes related to the built environment in the 1970s. It is however worth noting that the importance of social variables and, hence, the qualitative approaches also started to emerge at the end of this period. However, this knowledge did not generate any well established new research methods or theoretical debate.

6.1.1.2 Research methods for energy-related built environment studies in the 1980s

In the early 1980s, research and studies of sustainable development aimed to achieve lasting satisfaction of human needs and improvement of the quality of human life on one hand (Allen, 1980) and maintenance of essential ecological processes and life support systems on the other (IUCN, WWF and UNEP, 1980). In architecture, this was interpreted using a new language in the energy related research agenda. Efficiency and development of new materials and building services were the immediate concerns (e.g. Burberry, 1982).

A new generation of **computer simulation** and building performance **modelling** emerged and became the dominant methods of **quantifying** and **assessing** building performance (Clarke, 2001). The "new" programs had a **field problem** approach, and utilised **numerical methods.** With these programs the only **independent variables** were **space** and **time** dimensions. All other system parameters are **dependent** so that no single energy transfer process can be solved in isolation. This signalled the beginning of integrated modelling whereby the thermal, visual, and acoustic aspects of performance were considered together. Consequently, the developed models increased their integrity vis-à-vis the real world. The descriptive study of Dupagne and Renson (1987) presents an example of the use of the 1980s simulation programs.

On the whole, research approaches in the 1980s were dominated by scientific, quantitative methods carried out mainly by computer simulations. Field studies, case studies, questionnaires and structured interviews are among the research methods that were utilised in obtaining data used in laboratory qualitative research.

6.1.1.3 Research methods for energy-related built environment studies in the 1990s

In the early 1990s 'sustainable development' became internationally accepted keywords for a political discourse committed to life, the conservation of natural resources and a sense of obligation to future generations (Strong, 1990). The triangular relationship between environment, health, and development emerged as one of the most important global issues in the 1990s. In the built environment, as well as other disciplines, this meant integrating and internalising environmental consideration into policies covering building design and energy management. Various directive and research funding

programmes surfaces, that sought to improve the quality of life by ensuring that environmental matters were taken into account. The term "sustainable architecture" emerged to describe the movement associated with environmentally conscious architectural design.

The needs of establishing a methodology of environmental measurement, of life cycle assessment, of thinking holistically about design motivated the 1990s research studies. Computer simulations and laboratory experiments were still major components of energy-related building studies, however, the importance of integration with the "real world" led to vast development in these methods. Other qualitative methods such as "case studies" became more important and when possible preferred over simulation of building performance. A number of apparent advantages explain this preference. For example, case studies provide evidence of **actual** rather than **predicted** levels of energy use. Communication (via observation, interview, questionnaires, etc.) with occupants in order to gauge their experience on comfort and energy consumption has become possible. On the other hand, although a vast amount of data can be obtained from case studies, the possibility of isolating the main cause of an action is limited. This is evident in cases when buildings are retrofitted. It is possible to make "before" and "after" measurements, however, if energy savings were proved, the reasons might not be entirely clear (e.g. BPP, 1993; BPP, 1996). The case is, however, totally different in computer simulation modelling.

Several techniques, e.g. **sensitivity tests**, are used in building simulation modelling to assess the significance and impact of input design parameters. Sensitivity tests aim to compare quantitatively the changes in output with the changes in input. Sensitivity theory has been generally used for assessing the thermal response of buildings and their energy and load characteristics. The general techniques for sensitivity analysis in building simulation are (Spitler *et al.* 1989):

- Formulating a base case reference and describing it.
- Studying and breaking down the factors into basic parameters (parameterisation)
- Identifying parameters of interest recognising their base case values.
- Determining what simulation outputs are to be investigated and their practical implications.

- Introducing perturbations to the selected parameters about their base case values, one at a time.
- Studying the corresponding effects of the perturbations on simulation outputs.
- Determining the sensitivity coefficients for each parameter if appropriate.

For example, Lam and Hui (1996) carried out a study to analyse the energy performance of office buildings in Hong Kong using the basic principles of sensitivity methods. A detailed building energy simulation program was used on a generic model of an office building, to generate simulation data for the study. Important input design parameters of the building system were identified and analysed from the view point of annual building energy usege, the peak design loads, and the building load profiles.

Case studies in energy-related building research follow a typical style. They outline the designers' goals and intentions and offer recorded data on energy consumption, comfort, users' satisfaction and environmental performance. The Good Practice case studies, which are carried out by the Best Practice Programme (BPP) in the Energy Efficiency Office (UK Department of The Environment) present a good example of these studies (e.g. BPP, 1991; BPP, 1995a; BPP, 1995b). Along with the Good Practice case studies, a series of "Good Practice Guides" were developed by the Best Practice Programme (BPP, 1994; BPP, 1996a; BPP, 1996b; BPP, 1996c; BPP, 1998)

Generally, although differing in the detail of their methodologies, most building scientists are committed to the production of generalisable and universally applicable knowledge. They have sought to generate science-based understanding of building technology that would transcend localised forms of practical knowledge and experience.

6.1.1.4 New trends in the research methods for energy-related built environment studies

Recently, there has been a wide acknowledgment of the need for interdisciplinary approaches to cope with sustainability issues. Research projects strive to provide an integrated theoretical and methodological framework of the concept of sustainability. Recent efforts have been made to bridge the gap between social science and natural science, and develop joint research and policy agendas for problem solving on sustainability issues. Social scientists are demanding a more leading role in the sustainability debate. They advocate their demand with the fact that social science

provides policy-makers with concepts, methods and tools enabling them to adopt the institutional set-up to new situations, to target specific social, economic, and technological needs, to guide innovation in society, to transform science and technology into beneficial elements for societal development and individual well-being (Becker, *et al.* 1999). The debates have also extended to address some specific social agendas. The contribution of gender theories, for example, is argued to be beneficial in both the scientific appraisal of sustainability, and the social and political implementation of the term (Braidotti, 1999; Eichler, 1999).

Under the assumption that sustainability will not be achieved until humans accept more responsibility for the environmental consequences of their reproductive and consumptive behaviours, the psychological argument over sustainability surfaced. Environmental psychology is defined as the study of human environment relationships, where 'environment' includes both the built environment and nature. Research by psychologists on the general subject of environmental sustainability is related to conservation of resources, conservation of ecosystems and concerns about quality of life for humans and other species (Werner, 1999). Traditionally, psychological research is descriptive of how the situation is. Case studies, cross-cultural analysis, in-depth interviews and other survey methods have all been frequently utilised. Recently, however, psychologists have been required to take more active roles in devising strategies for determining and implementing environmental policies. Hence, **'action-oriented'** research that measures actual behaviours, and shows how to affect positive changes in behaviours, is perceived as the way forward in psychological research on sustainability (Werner, 1999).

From the relatively new sub-discipline 'sociology of the environment', the 'sociology of energy and buildings' has emerged. Sociologists are calling for a more influential role in the built environment energy related research. Guy and Shove (2000), for example, using case studies and survey methods sought to develop a broadly sociological approach to the everyday practicalities of energy-efficient design. Goodacre *et al.* (2002) attempt to integrate energy efficiency with the social agenda in sustainability. The authors used a cost-benefit analysis framework to assess the potential scale of some of the energy efficiency benefits in the English housing stock. Their paper argues that energy efficiency upgrading of housing produces environmental, social, and macro-economic benefits in addition to lower fuel bills for the householder. Social benefits can include increasing social inclusion and equity as well as improving human health. Economic

benefits can include increasing employment and the creation of wealth. Environmental benefits, also, include a less polluted global and local environment and the saving of scarce natural resources.

The recent trends in holistic approach in research are not restricted to the general sustainability debate or the built environment energy related research. More specific elements in built environment issues have been approached using an integrated holistic method. For example, Citherlet *et al.* (2001) describe the development of a multiple-domain approach in building simulation programs. The authors argue that a holistic approach to building design requires a method to estimate the performance that will result from the interactions between the different technical domains. Real scale experimentation and numerical simulation are suitable methods, because they each can integrate the complex physical processes. Their study argued that computer simulation is the preferred option for the holistic appraisal of design options, because the experimental approach is time consuming and expensive.

The need to set "benchmarks" or standards to evaluate the energy efficiency of a building resulted in some research studies. For example, Elkadi (2000) suggested an ecological approach for the evaluation of intelligence energy features in a building's skin. Elkadi set criteria based on the energy flow principles in integral natural systems to evaluate the energy performance in an intelligent skin, drawing a list of features that can reflect this definition. A list of 23 carefully chosen buildings was prepared as case studies to validate the developed criteria. Different weights for different criteria were calculated for various features based on ecological energy principles. In a different case, Wittchen and Brandt (2002) developed a methodology for selecting office building upgrading solutions based on a test survey in European buildings. Their developed methodology "TOBUS" includes a survey of the physical condition of the building's structure, facilities and installations performed during an on-site visit, and an IEQ assessment based on a questionnaire to the employees supplemented by a few interviews. The survey is modular and allows for different levels of investigation. The initial quick inspection may reveal potential sources of problems and may consequently be followed by supplementary and more detailed surveys. The scope of any supplementary survey is defined as a result of the first investigation.

It is worth noting that some alternative research methods, such as **auditing**, have been reintroduced recently in a different context. Auditing has been used to describe

techniques for obtaining a snapshot of current events in areas other than business and finance, especially energy usage. In the period after the first 'oil crisis', an urgent requirement existed for better understanding of when, where, and how much energy was being used by homes, businesses and the transport sector. Through knowing this information future consumption could be predicted, and conservation strategies devised to reduce consumption. Thus, the term 'Energy Audit' came into being and in the 1970s and 1980s various schemes, aimed at both industrial and domestic activities, were developed. These used the auditing technique to produce data specific to an activity, process, or building. Recently, in the context of identifying how to achieve national targets for emissions abatement (and verifying that, in due course, such achievements have been realised) there has been an increasing need to understand when, where and how much energy is being consumed, and identifying areas of significant consumption. The energy audit provides the tool for achieving this understanding. Bennett and Newborough (2001) carried out a study to present an audit methodology for major cities. A hybrid approach is proposed as a practicable method for providing a sufficiently detailed output. The first stage of such an approach is to divide the city into a series of sectors and sub-sectors in order to structure the breakdown of the city into a series of logical groups and sub-groups to produce a set of smaller, more manageable tasks. Once the structure has been defined, the detailed data can be collected, analysed and extrapolated to provide the required estimate. Surveys are likely to be required in order to obtain industrial and commercial consumption data, domestic equipment usage and appliance ownership patterns. Modelling can be used to predict the consumption for a large end-use activity that contains many variables (such as predicting the total domestic dwelling heat loss value across the range of dwelling types and conditions). Field monitoring can be used to provide local consumption data for a number of representative end-uses.

The brief history of energy-related building research shows that it has been dominated by a view of the building as an essentially physical entity, with uniform physical and technical properties. Research methods applied in the field are mainly quantitative based on comparing empirical data with output of computer modelling. It is however evident that sociologists and psychologists are demanding more involvement in the general sustainable issues and in, what the thesis is more concerned with, built environment energy related studies. This thesis is adopting the new trends of linking social and

technical variables to provide an overall understanding of applicability of energy savings measures to the function of the building type under study, i.e. Rehabilitation.

As indicated in the introduction, this thesis is divided into two main parts, which are energy and prison design. The following section illustrates the research methods carried out in the second part of the thesis, that is concerning prison design and rehabilitation.

6.1.2 Research Methods in Prison Design and Rehabilitation

The conviction that prison design directly influences inmates' behaviour is not a new concept. The literature review, which is carried out in chapter 4, shows that this direct relationship has been a long-standing feature of the penal system. It can be confidently argued that the birth of the prison system emerged from this belief. The failure of the silent and the separate systems in achieving reform led to a general doubt concerning the reliability of the prison system in achieving such reform (Chapter 4). The design aspect of incarceration architecture was, consequently, marginalized and efforts to recoil the penal system with prison building design are scarce. The only exception to the previous statement is the development of the New Generation Prisons in the United States in the early 1970s. Today, as it was in the past, the prison system remains a mysterious complex institution that, stubbornly, remains reluctant to achieve its creators' aims. It comes as no surprise that this problem was perceived as a social challenge. The prison is, after all, a philosophical and social issue before being a building problem.

Architects, as many others, feel perplexed by the complexity of a still evolving problem. When it comes to prison design, architects feel enormous social responsibilities whose purpose is neither totally accepted nor clearly defined, opposite to other typology, such as office buildings (Lenci, 1977). Hence, science and building technology have a very marginal role in all the prison "*themes or issues*" research. Prisons, however, have always captured the attention of social experts.

The thesis argues that the indoor prison environment also has a major impact on the inmates' behaviour and hence affects the rehabilitation efforts. The number of technical papers that examine the relation between inmates' behaviour and the built environment are extremely limited. On the other hand, there is a large amount of research that investigates the impact of social factors such as gender and race on the inmates' behaviour. The balance between discussion of the impacts of technical and social

variables was impossible to establish. It is, therefore, safe to state that the research into prison issues has been dominated by sociologists and criminologists and mainly approached by qualitative methods.

The literature review that is carried in Chapter 4 showed that the empirical studies that relate architecture to the various goals of the prison buildings, are very limited. The analysis of incarceration architecture has been conducted at a fairly general, non-empirical level by historical research, considering particular case studies. This is generally related to the difficulty of 'regimes and prison populations' remaining constant while architecture layouts are changed, or conversely, holding designs constant while regimes are manipulated. Consequently, the relatively few empirical investigations that exist are limited to examining the more measurable aspects of prison environments, such as cell size and type of accommodation. Such empirical studies addressed, mainly, the relationship between the prison built environment and control, safety, and security measures.

The following sections illustrate in detail the main research approaches in incarceration architecture studies, namely:

1. Historical research.
2. Case studies.
3. Survey methods.
4. Feminist approaches.
5. Empirical approaches.

6.1.2.1 Historical research approaches in incarceration architecture

It is evident from the literature review that prisons captured the attention of historians for several centuries (e.g. Durkheim, 1986; Durkheim, 1983). Sociologists have studied the history of the prison to illuminate the history of various social institutions. The historians' engagement with prison development also builds on the fact that social history has joined with political history to explore how societies and governments maintain social order (Foucault, 1977; Spierenburg, 1998). Historical research is intended to help understand, explain or predict through the systematic collection and objective evaluation of data relating past occurrences, in order to explore research questions or test hypotheses

concerning causes, effects or trends that may help to explain present or anticipate future events (Burns, 2000). The history of prison architecture is not a simple list of chronological events; it is an integrated account of the relationships between social, economical and political factors. There are several types of historical research recognised in various disciplines, which is also the case in incarceration architecture historical research. The most prevalent type of historical research is the **biography of a particular penal system and prison design.** For example, Tomlinson (1980) examined the separate system prison and the process by which it was institutionalised in 19th century England. Semple (1993) studied Bentham's prison "the Panopticon", and Rothman (1998) studied the prison system in the US during the period between 1789 and 1865.

The second approach of historical research which can be identified in prison design is **synthesising or comparing old design approaches with new ones, to illuminate trends** in incarceration architecture. This can be identified in several studies; the work of Fairweather (2000b) can be taken as an example. Fairweather (2000b) compared the design of Pentonville in the 19th century with the Prison Design Briefing System (PDBS) that was established in 1988, in order to illustrate the importance of the contribution of architects to the success of the prison system.

The third approach in the historical research which is utilised in prison architecture, is **revisionist history.** For example, Markus (1994) examined the history of prison design in order to identify the significance of certain architectural historical elements that might guide contemporary prison design.

The literature review of research methods used in incarceration architecture highlighted the importance of historical research in the development of prison architecture. Five points have been identified:

1. It relates contemporary prison problems to past experiences,
2. It allows re-evaluation of penal theories, hypotheses, and generalisations held about the past, and how and why penal theories and practices developed,
3. It stresses the importance of complex interactions in the actions and situations that determine the past and present; particularly how the contemporary penal system came about,

4. It highlights present and future trends, particularly the guises in which progressive ideas in penal system emerged, and
5. It contributes to the understanding of the relationships between politics and penal system, between prison and society, and between inmate and prison governor.

6.1.2.2 Case studies and incarceration architecture

Case studies are the other major approach utilised in incarceration architecture. This can be explained by the fact that case studies allow an investigation to retain the holistic and meaningful characteristics of real life events. In a case study the focus of attention is on the case in its idiosyncratic complexity, not on the whole population of cases (Burns, 2000). This quality is essential in research related to prison design. The significance of the case studies approach in research is related to several elements, which are illustrated in research methods literature (Travers, 2001; Yin, 1994; Hamel, 1993; Yin, 1993). The following section highlights the purposes of case studies in penal architecture research.

Case studies are very valuable as preliminaries to major investigations. They are **intensive and generate rich subjective data** which can bring to light variables, phenomena, processes and relationships that deserve more intensive investigation. This purpose is found in the work of Fairweather (1989) and Johnston (2000). When observation of case studies is applied, it serves the aim of **probing deeply and analysing intensively** the multifarious phenomena that constitute the life cycle of the unit, with a view to establishing generalisations about the wider population to which the unit belongs. Evershed's (1987) study of the Special Unit, 'C' wing, in HMP Parkhurst represents an example of this purpose. In many studies, a case study has **provided anecdotal evidence that illustrated more general findings**; Coyle's (1987) studied the Scottish experience with small units and provided an example of such case. Another major reason for using case study is that it may **refute a universal generalisation**; Morris' (2000) study of the Tamms Correctional Centre in the USA can be taken as an example. In the prison environment several relevant variables cannot be identified and/ or manipulated, and hence the use of the case study method might be in certain cases be the only relevant research method.

Three types of case studies can be identified in research methods concerning incarceration architecture. The first type is **historical case studies.** These studies trace the

development of an organisation/system over time. Examples of such cases can be recognised in the work of Fairweather (1975), McConville (1998), Johnston, (2000), and several others who traced the development of incarceration architecture through history. The second type is **observational case studies,** which focus on a specific group using a variety of observation and interview methods as their major tools. Paulus and Dzindolet (1992), for example examined the effect of confinement on the inmates. The **multi-case studies** approach is the third type that can be found in incarceration architecture literature. This type is not based on the sampling logic of multiple subjects in one experiment. If the cases are not aggregated it is convenient to apply the term "case study" to such an investigation. It is a form of replication. A good example of this type is Johnston's (1994d) work that followed the design of Cherry Hill prison.

The review showed that the use of case studies is one of the most relevant research methods in incarceration architecture. The case study research method provides a descriptive real-life holistic account that offers insights and illuminates meanings, which may in turn become tentative hypotheses for further research. Case studies in prison design are usually qualitative and involve devising ethnographic techniques, particularly participant observation.

6.1.2.3 Survey methods in incarceration architecture

Survey methods, usually employing a range of interview, questionnaire and attitude scale procedures are methods of data generation and analysis that span qualitative and quantitative approaches. They are capable of adoption, modification, and translation. Research in incarceration architecture is no exception. Survey methods have been used intensively in most qualitative research and in triangulation processes.

The survey is the most commonly used descriptive method in prison research, and gathers data at a particular point in time. The **descriptive** survey aims to estimate as precisely as possible, the nature of existing conditions. Brodie *et al.* (1999) for example, designed a survey aimed to record the current appearance of prisons in England and Wales. The other type of survey, which has been used extensively in prison research, is the **explanatory** survey. This survey seeks to establish the "cause and effect" relationships but without experimental manipulation. The Home Office (1985) "New directions in prison design" report is a good example of this approach.

Flynn (1976) is an early example of using survey methods in prison environment. Flynn described a study undertaken by a team of researchers from the university of Illinois into prison and jail security. Identifying the environmental variables that appeared to affect staff and inmates' safety was the main aim of the study. A **survey** of twenty institutions representing a spread of purpose, security classification, and population size was carried out. The sample was studied in detail by **observation, personal interviews,** and **questionnaires.** Another **standardised survey** of 98 state-operated correctional institutes was also conducted. Canter's (1987) study was based on data from sixteen institutions, representing the full range of prison design then is use, and **in-depth case studies** of six establishments.

Attitude measurement is one of the best known survey methods. Attitudes are evaluated beliefs that predispose the individual to respond in a preferential way. That is, attitudes are predispositions to react positively or negatively to some social object. Attitude scales involve the application of standardised questionnaires, to enable individuals to be placed on a dimension indicating degree of favourability towards the object in question (Burns, 2000). Among the considerable amount of prison building research that has utilised this approach, the study carried out by Applegate *et al.* (1999) can be taken as a good representation of this particular survey method.

6.1.2.4 Feminism approach to incarceration architecture research

"Once women are inserted into the picture, be it as objects of social-scientific research or as subjects conducting such enquiry, established paradigms are unsettled. The definition of *the object domain* of a research paradigm, its unit of measurement, its method of verification, the alleged neutrality of its theoretical terminology, and the claims to universality of its models and metaphors are all thrown into questions" (Benhabib, 1992: 178).

Imprisonment of women has become an area of growing concern internationally. It is a fact that the actual numbers of women incarcerated remains relatively low, however it is increasing dramatically and the number of woman incarcerated in the UK had increased two fold by 2001. Nevertheless, the lack of attention given to the needs of female prisoners and the punitive disciplinary regimes that have been developed for women have attracted a substantial amount of critical commentary (Carlen, 1990; Eaton, 1993). Feminists have challenged the andocentric nature of imprisonment. In a number of

countries such as the United Kingdom, the United States, Australia and Canada, feminists have influenced penal policies and have lobbied for new programmes for women in prison (Carlen, 1996; Shaw, 1996).

Shaw (1996) showed that the women-centred proposals for penal reform are based on a series of five feminist principles. These include: **empowerment, the provision of meaningful choices, treating women with respect and dignity, providing a physically and emotionally supportive environment** and the **sharing of responsibility for women's welfare** between institutional staff, community members and with the women themselves. A very good example of such proposals is the report of the Task Force On Federally Sentenced Women "Creating Choices" (1990). The members of the task force worked from a feminist perspective. The report was an outcome of five research projects. The research methods that were followed in these projects throw light on the qualitative techniques that are commonly utilised in the feminist approach of prison research. It is, therefore, essential briefly to discuss these research methods.

The first project, coordinated by Margaret Shaw (Shaw, 1989a) involved **individual interviews** with federally sentenced women in prison, and on parole or mandatory supervision in the community. The purpose of this project was to gather information from as many women as possible, on their experiences of imprisonment parole and mandatory supervision, their needs for programs and services and their views on where and under what conditions they would like to serve their sentences.

Subsequent to this project, a similar **survey** was conducted with federally sentenced Aboriginal women in Canada (Sugar, 1990). This survey was a unique attempt to gather information about federally sentenced Aboriginal women which could only be understood within the context of being female, Aboriginal and imprisoned. **Interviews** with Aboriginal women were conducted by Aboriginal women who had also been through the Canadian prison system. The researchers asked the women to tell their life stories, and made an effort to be as non-directive as possible so that the stories would speak for themselves.

The third report completed by Margaret Shaw offered an **historical overview** of the imprisonment of women, particularly in Canada, although experiences in other countries are also discussed (Shaw, 1989b). This study also provides a current account of the

issues surrounding the imprisonment of women in Canada, as well as a **comparison** of responses to such issues in various countries.

The fourth study, by Lee Axon (1989), was commissioned to gain an up to date report and analysis of exemplary programs, services and opportunities which were designed to address the special needs of women serving long sentences throughout the United States. Her report summarised the findings of a **literature survey, telephone interviews** and **on-site visits** to a number of facilities in that country.

The fifth report (Evans, 1989) provided an **inventory** of institutional programs available to federally sentenced women, throughout provincial/territorial and federal institutions. The report included information about the range and types of programs provided, as well as the distinctions and gaps in programming among various institutions.

The need to be responsive to the inmates' needs is especially important with women's institutions, and must be reflected in the management techniques and programming chosen for a women's facility, as well as in the facility's design and features. Hence, the design of prison buildings or correctional facilities for women has also gained special attention. The intention to identify and attempt to meet the needs of female inmates, motivated the development of design guides that address planning and design women prisons. Carp's (1989) study presents an example of the design considerations in the building of women's prisons. This study includes data collected in a **survey** of seven women's correctional facilities located throughout the United States. The primary focus of the survey was to identify design inadequacies in these facilities, and to obtain information about the planning process that should be used for a women's facility. The survey contained many **open-ended questions**, inviting **unstructured participant responses**. It was conducted through a **telephone interview** with one respondent at each facility, usually the warden.

More recently Elias and Ricci (1997) produced a report which addressed the planning issues of women's jails. Three simple statistical analyses were carried out, in order to produce **historical trends**, which described recent patterns of average daily populations, a **population forecast**, which identified the number of beds that the local jurisdiction would need, and a **profile of inmates** held at the jail, including demographic information, criminal history, and arrest and release information.

The review showed that the prison researches carried out from a feminism perspective were mainly theoretically motivated, approached by qualitative techniques and in few cases the qualitative variables were analysed using statistical methods. The outcomes of the research projects were mainly **strategic recommendations, active programmes,** and, in research related to the built environment, **technical design guides,** with economical and social insights.

6.1.2.5 Empirical research in incarceration architecture

Quantitative research methods are employed in scientific research in order to establish general laws or principles. Such a scientific approach is often termed *nomothetic,* and assumes that social reality is objective and external to the individual (Burns, 2000). The scientific method has specific characteristics. The four most important characteristics of science research are **control, operational definition, replication** and **hypothesis testing.** Control is the most important element in scientific methodology because it enables the researchers to identify the causes of their observations. Experiments are conducted in an attempt to answer certain questions. To answer questions concerning prison environment, it is essential to eliminate the simultaneous influence of many variables to isolate the cause of an effect. Controlled inquiry is an essential process because without it the cause of an effect could not be isolated. Therefore, by definition, it is virtually impossible to apply a scientific approach in prison research. For example there is no experimental way in which regimes and inmate populations can be held constant, while security levels are varied. Hence, the limited empirical research that is found in literature is related to measurable aspects of prison environment such as the cell size, examined with control, security and safety. The most important of these studies are: Canter (1987), D'Atri (1981), Farbstein and Wener (1982), Flynn (1976), Suedfeld (1980), and Wener and Olsen (1980).

D'Atri (1981) reported the results of two empirical studies into the relationship of certain features of **prison environment** with **inmates' blood pressure levels.** The first study was a **cross-sectional study** of 412 men in three Massachusetts institutions. In all three institutions, the only variable that significantly affected blood pressure levels was the type of accommodation, blood pressure levels being significantly higher for inmates housed in dormitory accommodation than for inmates in single cells. In the second, a **longitudinal study** conducted at a single institution, a sample of inmates was given a **detailed**

questionnaire when they first arrived at the establishment and they were **interviewed at regular intervals** during their sentence.

Bennett *et al.* (1991)'s study is another example of empirical research examines features of the prison environment and inmates' behaviour. In their study the team conducted two experiments to determine the benefit of using Baker-Miller Pink paint in prison cells to reduce the aggressive and antisocial behaviour of prisoners. In the first trial, a single cell at a police station was repainted **Pink.** The ceiling and walls were painted with eggshell finish and the door and window frame were painted in gloss pink. The floor was painted a neutral grey. The door was solid and the window consisted of thick opaque glass. Artificial lighting was provided by a standard incandescent light bulb behind security glass over the door. For this study, the incandescent wattage was increased to 200 watts from 100 watts to improve vision. Unchanged cells at the facility remained magnolia in colour. Every other prisoner was remanded to the pink cell for 30 minutes. Those not assigned to the pink cell were placed in the magnolia coloured cells. Both cells were monitored by custodial staff at 10 minute intervals to record behaviour. Behavioural criteria excluded generalities, using instead specific behavioural categories such as abusiveness, unruliness and violence.

For the second experiment, an experimental cell was constructed in a university architectural department using timber and chipboard materials, with all joints taped to reduce shadowing effects. Illumination was similar to that in the police cell, and the 'prison cell' dimensions were identical to that in the first experiment. Volunteer subjects were randomly assigned to either the pink or magnolia cell. Behavioural change was recorded by means of a semantic questionnaire. These forms were completed by each subject both immediately before and after each exposure in the cell. To evaluate any change in physical strength, a kinesiological muscle test was performed on each subject before entering the cell and after departure.

Statistical analysis has been widely used to test quantifiable variables in prisons and to explore how strongly variables are related to each other. Chi-square, a simple non-parametric test of significance, is used for nominal data where observations can be classified into discrete categories and treated as frequencies. Senese (1997), for example, used comparative chi-square difference tests and logit modelling to evaluate the similarities and differences in inmate rule infractions, in both a traditional jail and a podular/direct supervision jail.

To sum up, very little empirical research has been conducted concerning the relationships between prison built environment and inmate rehabilitation. It is a matter of fact that rehabilitation is difficult to measure. However, no real attempts have been established to quantify the different environmental factors that affect rehabilitation. Qualitative measures, which are recognised as the more humanistic paradigm, are dominant in the prison research field. Research methods for appraisal and evaluation of qualitative measures are well established and widely utilised in prison related-research. However, quantitative or scientific research has been marginalized and limited to the measurable elements of the built environment.

6.1.2.6 A Sociology of Energy in Prison Buildings

Whichever way we look at it, prison building is a difficult case. Even in "technical" terms, building performance is strongly marked by such idiosyncratic features as location and orientation. In addition the relative impact of one measure, for instance the addition of further insulation, depends upon the properties and qualities of the rest of the structure. Isolating and thereby understanding the performance of individual elements may yield comparable and generalisable results. However, this does not necessarily help when it comes to anticipating their combined effect, even though that is what counts in practice. A further confounding problem is that building science is in any event not the only factor that architects and designers take into account. When dealing with the complex problem of a prison building, they are not simply dealing with optimisation of a set of fixed parameters. To some extend they are involved in creating those parameters in the first place. There are also other priorities at stake, like the cost, style, image and appearance of the end result. With functional, social and architectural problems, prison buildings present a challenging problem. Rather than sequentially peeling away layers of intervening factors in the hope of getting at the underlying essence of energy performance in prison buildings, another route is to make a concerted effort to understand how buildings perform in practice.

The review of the disparate research methods for both energy studies and prison studies of this thesis shows that while built environment energy related research is dominated by scientific approaches, sociologists and criminologists concerned with different subsets are leading the prison buildings research agenda (Table 8). Experience has shown that although anchored in social and economic policies prison related regimes and policies

have failed dramatically as a result of technical problems. The results of laboratory based energy studies failed in comparison to real life applications. Hence, achieving sustainability in energy terms in prison buildings requires developing common tools and metaphors between scientists and socialists.

Table 8: Research volume of different disciplines related to the study of energy in prison buildings

	Sociologists	*Architects/ Scientists*
Energy Studies	Small	Vast
Prison Studies	Vast	Small
Energy in Prisons	?	?

The historical review of the development of prison buildings design carried out in chapter four, shows three different approaches to the process of designing a prison building. The early prisons were a simple confinement spaces that were assigned following the orders of a landlord or a king. Architects and engineers following technical and scientific knowledge developed architectural schemes for 18th century prison buildings. The failure of such systems marginalized the role of architects in the penal system. The contemporary prison system is dominated by sociologists and criminologists, who set the prison system and develop the regimes that architects are requested to supply a building to fit. The later approach, however, proved a failure as shown in Chapter 4. This thesis emphasises the need for a closer collaboration between architects and sociologists, in the early stages of development of a new imprisonment regime or philosophy. The need is also essential for adding the social dimension to technical energy data, in order to achieve a sustainable prison design. Figure 64 shows the influence of different players in the development of prison buildings design and the future vision proposed by this thesis.

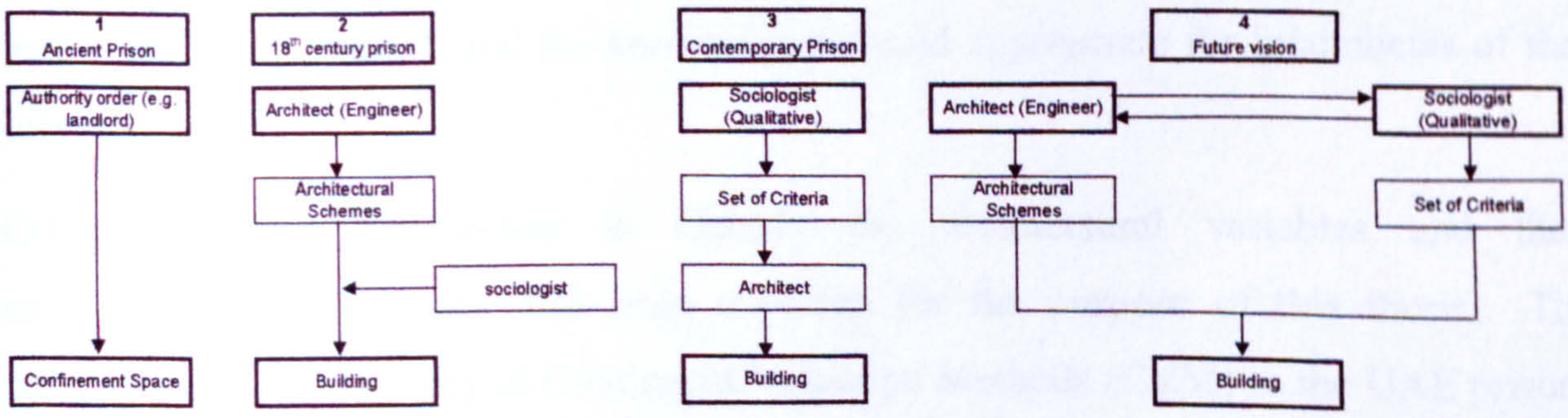

Figure 64: Influence of different players in the development of prison buildings design

6.2 Opportunities and Constraints of Prison Studies in the UAE

Prisons offer a difficult case for both social and technical studies. Qualitative approaches like **ethnographic research** and **unstructured interviewing** are very difficult to conduct in a closed institution like a prison, where interaction is often distorted, and where honesty and openness are not guaranteed. Both the researcher and the research participants may experience alienation or hostility as a result of misinformation. In United Arab Emirates prisons, the case is even more complicated.

The cultural composition of the United Arab Emirates society is very complex. It is estimated that approximately 80% of the population are expatriates. This population pattern is also reflected in the cultural structure of prisoners, and hence reliability and validity of ethnographic and unstructured interviewing studies in such a complicated setting are highly questionable. Reliability of a research study is based on two assumptions. The first is that the study can be replicable. The second is that two or more people can have similar interpretations by using the same categories and procedures (Burns, 2000). Ethnographic research in a UAE prison building is especially vulnerable to replication difficulties. A study of a racial incident at a UAE prison building cannot be replicated exactly because the event cannot be reproduced. The problems of uniqueness and idiosyncrasy in the UAE prison environment can lead to the claim that no ethnographic study can be assessed for reliability. Achieving the second assumption for reliability is even more challenging. In ethnographic research, generally, it is difficult for an ethnographer to replicate the findings of another. The case is more complex in a UAE prison building because the flow of information is dependent on the social roles held within the group studied, and the knowledge deemed appropriate for incumbents of that roles to possess.

Other qualitative approaches to identify the architectural variables and their environmental values have also been explored for the purpose of this thesis. The suitability and applicability of Contingent Valuation Methods (CVM) in the UAE prisons have been examined. The aim of testing this method was an attempt to quantify social and environmental values within prison buildings, similar to those techniques used in office buildings (Jakobsson and Dragun, 1996).

The problem of the large estimated increase in the energy consumption in prison buildings in Abu Dhabi following the introduction of air-conditioning, initiated this

research project. There are no fully air-conditioned prisons in Abu Dhabi. Consequently, field studies to collect measured and real life data were not viable. Several constraints were also noted in this study. The United Arab Emirates is a very conservative society where prisons are treated as a top classified issue. Although the study was carried out by an employee in the General Directorate of the Abu Dhabi Police, which is funding the project, access has been limited to administration data from the existing UAE prisons. Personal communications and non-structured interviews were the main route for collecting vital data for the research. The researcher's occupation in the General Directorate allowed her direct contact with the conditions in prison buildings and gave her a chance to observe the effects of the indoor conditions of the existing prisons on the inmates' physical comfort and as consequence their psychological affects. This experience was very useful in the validation of the research finding. The following section illustrates the selection of the appropriate research method that is utilised in this thesis.

6.3 Selection of Appropriate Research Methods

The peculiarity of prison studies in the UAE is explained in section 6.2. The selection of appropriate research methods added another dimension to the thesis. Two operational sets of hypotheses are formulated from the thesis general hypothesis, as illustrated in section 6.4.1, a technical set of hypotheses and a social one. Hence, there is a need to a variety of research theories and multiple conceptual frameworks. However, these theories are not competitive since they are seeking to explain different phenomena. The following sections illustrate the different methods that are utilised in this thesis, literature review, historical review, computer simulation, and comparative analysis.

6.3.1 Literature review

Hart (1998: 13) defined a literature review as "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data, and evidence written from a particular standpoint to fulfil certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed".

Literature review is an essential method to answer questions critical to both the social and the technical parts of this thesis. The literature review is decisive in identifying the key

sources of literature related to the research topic. It is important to distinguish the key theories, concepts and ideas in both energy and prison fields. Appropriate literature review illustrates the major issues and debates about the thesis topic and the related political standpoints. The origins and definitions of energy and prison related topics could only be identified by a literature review. Recognising the main questions and problems that have been addressed to date in energy and prison debates is essential, in order to achieve a general understanding and knowledge of the research topic. Literature review is the only method to fulfil this purpose. Understanding the way that knowledge of energy and prison related issues are structured and organised is another important prerequisite to a successful research study. Literature review serves this purpose.

6.3.2 Historical review

The selection of the historical review method is associated with its importance in prison architecture studies, as illustrated in section 7.2.2.1. Historical research is an integrated account of people, places, events, and times, invoking both qualitative and quantitative methods and data. It involves a wide range of studies from individual biographies and architectural movements through to trend analysis, all undertaken in idiosyncratic ways. In this thesis both primary and secondary sources of data related to development of prison buildings and the environmental, cultural and socio-economical contexts are used. It is often difficult to assess reliability and validity, as a past event cannot be replicated, data are often fragmentary and authenticity may be difficult to assess. Internal and external criticism, however, can be used to overcome this.

Section 7.5.5 demonstrates in detail the historical review approach that was utilised in the thesis.

6.3.3 Case Studies and comparative analysis

The review carried out in sections 6.2.1 and 6.2.2.2 shows that the case study has had a long history in both prison and energy research, and been used extensively in areas such as rehabilitation efforts, and the built environment energy performance. Hence, the use of case studies is inevitable in this thesis. The case in the thesis is a proposed air-conditioned prison building in Abu-Dhabi. The fact that the prison has not been built yet necessitated modelling the case using appropriate computer modelling software. The variables that were identified from the literature and the historical reviews were then

utilised to build different scenarios, that are varied in their architectural and social settings. Comparative analysis using quantitative technique that was computer simulation are carried out in Chapter 8. Building energy simulation is known to be a powerful and analytical method for building energy research and evaluation of architectural design (Hui, 1998).

6.4 Thesis Methodology Structure

This section aims to illustrate the structure of the methodology used in this thesis. The following section spells out the hypothesis, followed by detailed illustration of the methods that are utilised to test the hypothesis.

6.4.1 Hypothesis

The Ministry of Interior in the United Arab Emirates intends to implement a new policy in prison buildings. The main goal of this new policy is to increase thermal comfort in the indoor prison environment. The element of 'effective classification' of prisoners has priority in the new design policy and will lead to a certain level of segregation. A prototype design has been developed as a model for all prisons in Abu Dhabi. The thermal performance of the envelope of this prototype has not been thoroughly examined and might lead to a substantial increase in energy consumption to maintain comfort. This problem initiated this research project.

The main hypothesis of this thesis is that "*prison buildings façade design has a role to improve the balance between cost to society and environment in energy terms and **rehabilitation***". This hypothesis has two theoretical bases, social and technical. The main hypothesis is divided into two general hypotheses: a social hypothesis and a technical one. The social hypothesis is "*façade design has an important role in determining prison form, composition, and configuration that have major impact on rehabilitation efforts*". The technical hypothesis is "*appropriate façade design can significantly improve energy consumption in prisons and provide comfort*". Several operational hypotheses were developed to test the social and the technical hypothesises and consequently the main hypothesis of the thesis.

Two operational hypotheses are developed out of the technical hypothesis:

- Façade configuration has direct impact on energy consumption.

- Composition and configuration of glazed areas has direct impact on energy consumption.

Three operational hypotheses arise from the social hypothesis:

- Configuration of façade design controls cell volumetric proportions and hence impact upon rehabilitation efforts.
- Selection of window size and geometry is a reflection of cell arrangements (single or compound).
- Orientation of façade and relevant environmental variables can constraint view and light, and has rehabilitation impact.

The thesis' general hypothesis and consequently its operational ones are looking to confirm the relationship between sustainable prison buildings façade design, and rehabilitation efforts. Figure 65 shows the thesis hypotheses in relation to the thesis layout. The aim is to test the hypotheses as rigorously and objectively as possible. However, objectivity can only be achieved if the theoretical framework of the thesis reinforced first. It is essential, nevertheless, to provide explicit definitions of the main terms involved in the thesis before demonstrating how the theoretical framework of the thesis is assembled.

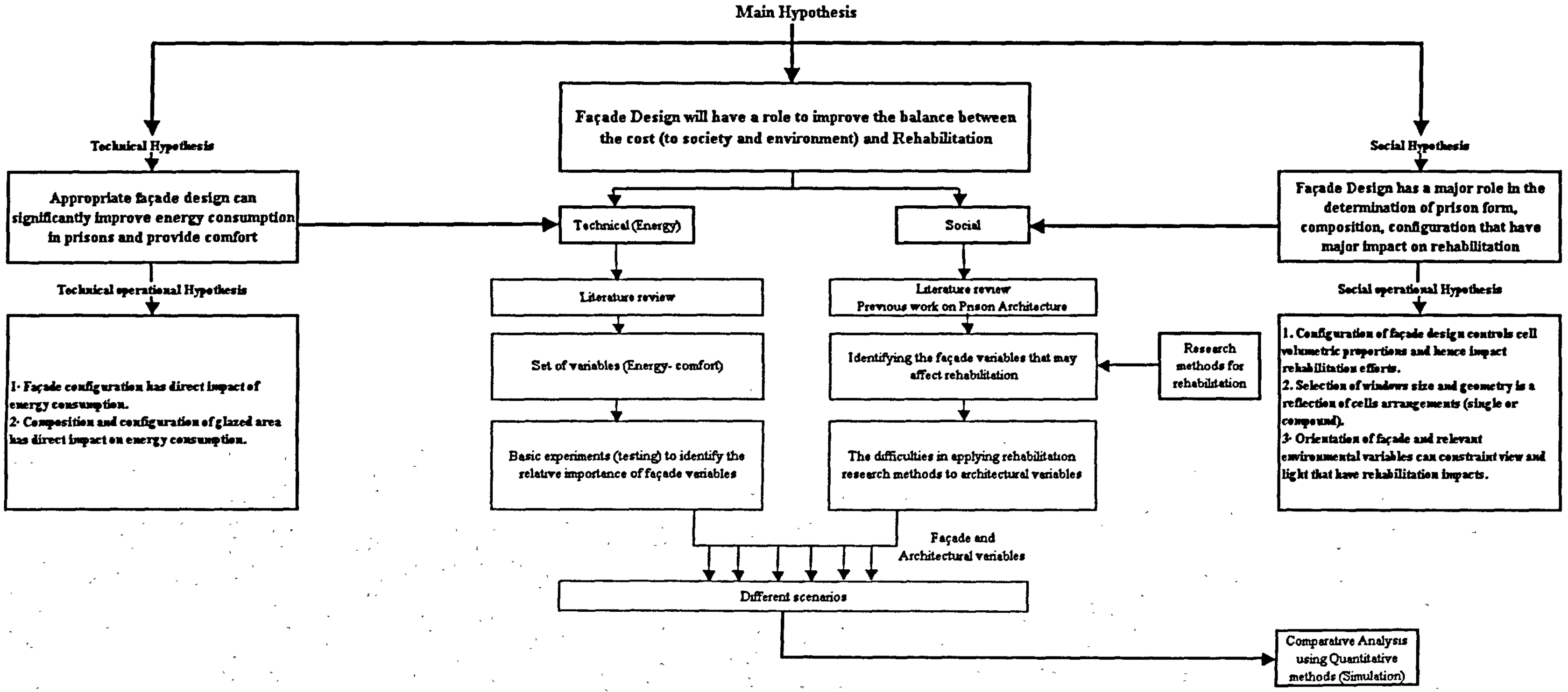

Figure 65: The Thesis General and Operational Hypothesises in Relation to the Thesis Layout

6.4.2 Definitions

The thesis title is: "*Sustainable façade design and virtue in incarceration architecture*". Hence, the two main aspects of the thesis are **sustainable façade design** and **incarceration architecture.** Incarceration architecture is used to describe the ideas that emerged in the late 18th and early 19th centuries, when the prison became a proper subject for architecture.

It is essential to specifically define *sustainable architecture* on one hand, and *façade* on the other, in order to define sustainable façade design. Despite the importance of architecture in the overall success of a sustainable development, there is still no agreement on a definition that is applicable to architecture. The term "sustainable architecture" is generally used to describe the movement associated with environmentally conscious architectural design. Emphasis has therefore been on technical issues, such as reducing energy consumption in the construction and maintenance of buildings. Very little attention is paid to the social and economic aspects.

Façade is defined as the external face or elevation of a building, especially the principal front (Curl, 1999). The phrase sustainable façade design has always referred to the introduction of appropriate façade configuration in order to achieve energy efficiency. In prison buildings, however, a typology driven by cultural values and social theories, socio-economic factors have great impact on the sustainable design of prison facades. Hence, achieving sustainable prison façade design is conditioned by coupling social aspects of prison buildings with technical energy saving measures.

6.4.3 Assembling the theoretical framework of the thesis

The theoretical framework is a key in shaping any research activities. Fellows and Liu (1997) compared it with the structural steel or reinforced concrete frame that is used in a building. The approach to this study, interestingly enough, comes not from one but many theoretical perspectives. This thesis' conceptual framework not only triangulates, but also incorporates many different angles and theories in approaching its subject (Figure 66 shows the thesis methodology structure). Evaluating the relationships between design, space, inmates, rehabilitation and sustainability cannot be achieved by applying the method or ideas of a particular theorist, one among several reasons for that being, for example, that the variables are far too complex and diverse. Whilst the most prominent

issues can be neatly divided into sections – for example, prison, inmates, comfort, facade, energy and technology – these themes overlap and impact on each other, time and time again. Similarly, they each contain numerous theoretical perspectives to explore the concepts involved, each of which may be applied and used.

This is not to say that this thesis does not critically evaluate the work of authors whose ideas are helpful in tackling the areas which the study examines. But it is impossible to

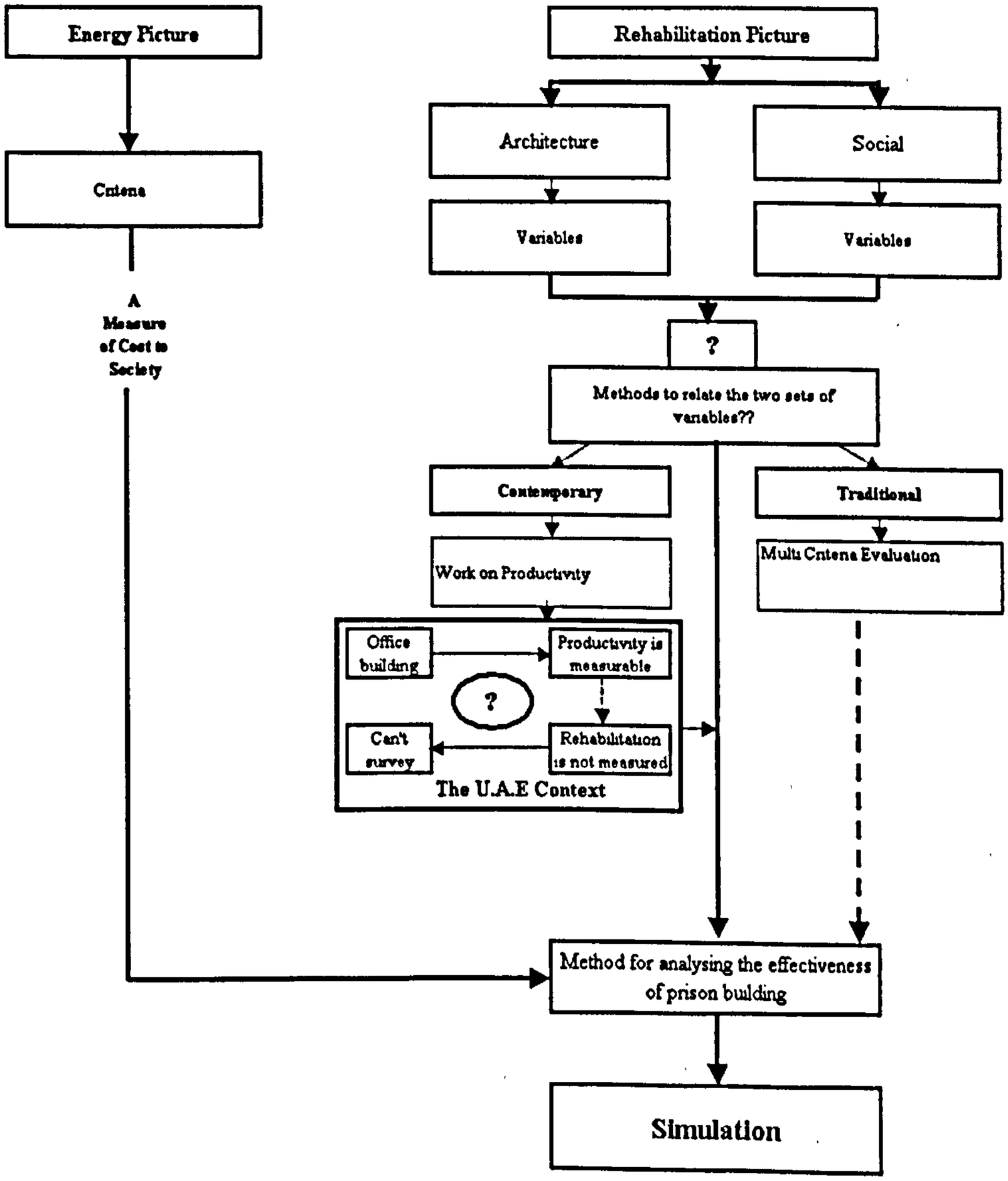

Figure 66: The Thesis Methodology Structure

pin down the thesis to a theorist or a combination of theorists. Rather, certain ideas of certain theorists combined with the researcher's thinking provide a conceptual framework for this thesis.

This thesis triangulates and incorporates two main theoretical standpoints. One is the "*broadly sociological approach*" in prison and rehabilitation studies. The second is the

"*Techno-economic approach*" in energy research. The problem of synthesising and integrating all those contending theories (the penal theories, the empirical analysis and the simulation models) into a coherent whole and assimilating the numerous variables that are surfaced from examining the previous theories, necessitated **developing** a third methodological approach. This third approach is essential to bridge the gap between the two and, hence, relate them together and find the conceptual vocabulary to capture this relational process. The later perspective is proposed by this study, as there is no "*ready-made*" theoretical approach to this thesis' specific case. However, the "*sociology of technology*" (Guy and Shove, 2000) and the "*environmental psychology*" (Lang, 1987) perspectives have been the basis for the proposed theoretical approach. The "*theory of space as an aspect of social life*" (Hillier, B. and J. Hanson, 1984) has been also influential in the development of the proposed framework. The proposed approach can be referred to as the "***sociology of energy in prison buildings***". Features of this approach are mirrored in the methods adopted. It is worth noting that the thesis theoretical framework developed, and was modified, through the period of the study and, hence, it is essential to demonstrate this development.

6.4.3.1 The beginning: loose and chaotic

The research hypothesis, which is illustrated in section 6.5.1, was triggered by a problem that is briefly; *an extensive increase in energy consumption is expected as a result of inefficient prison building design.* Hence, in the beginning it was believed that this thesis would be essentially a technical study following the energy paradigm in Section 6.2.1. The thesis then evolved to include the social aspects and hence involve both *cognitive* (knowledge, comprehension, application, analysis, synthesis and evaluation) and *affective objectives* (receiving, responding, value, organisation and characterisation). The aim was to produce a policy that could be implemented in the prison buildings design sector in the United Arab Emirates; hence, the research was guided into *normative criteria.* The *positivism approach* seemed to lead the thesis in evaluating the particular occupation patterns and the configuration of space, of the prison buildings. It was anticipated, as well, that within this approach the special energy flow characteristics of prison buildings and their facades would be identified. However, measurement is an essential component of this approach, leading to a 'natural' emphasis on formal statistical analysis and modelling of cause and effect relationships between these observed and measured

'realities'. Although the social context of the case study is real, the case study itself is a modelled feasibility study and obtaining empirical data is hence unfeasible.

At one point, the need to focus on 'relations' between 'actors' (inmates, staff, architect, the construction engineers, etc.) with a distinction between internal relations and external contingent relations seemed essential to this research. Therefore, another important approach that appeared to be a good starting point is *Realism*. Realism views causality as stemming from intrinsic interactions between people, which depend on the unobservable internal structures, mechanisms, properties and processes at work during their interaction with each other in different contexts. Prisons, however, are not easily accessible. Even if physical access is permitted by central bureaucracy, it may not be possible to penetrate the attitudes and relationships inside.

Empirical approach using computer simulation modelling for investigating the thermal performance of building envelope appeared to be the norm. The notion was that computer simulation could accurately reflect the thermal behaviour of walls. This was supported with *empirical observation*. This universal approach dominated this research field. However, further investigation in the field showed that human and cultural factors became important ingredients of the understanding of thermal performance. For example, it is understood that no time-dependent simulation model can accurately predict the impacts of occupancy within the building. The study of thermal performance needs to examine also gender, social and cultural factors, and computer analysis became a small tool in the overall understanding. In the case of prison design the reliability of computer simulation modelling in providing an accurate representation of the real life situation, seemed even more vulnerable. At this stage it was clear that there is not one specific approach that can solely lead this inquiry, and hence there is a need to triangulate several approaches in order to test the complicated hypothesis which integrates diverse issues.

6.4.3.2 Moving towards solid ground

The thesis aims to introduce a sustainable façade design for prison buildings. The meaning of sustainable here is not only energy efficient, but also providing a positive environment for inmates' rehabilitation. Hence, technical and social operational hypothesises were developed. The hypotheses are explained in detail in section 6.5.1. A critical review of building energy performance theories was carried out to provide the technical energy parameters that are needed to test the technical part. A set of variables

related to energy and human well-being (comfort) were identified. Consequently, some pilot experiments were used to identify the relative importance of façade variables illustrated in chapter 7 and published in two academic papers included in the index (Al-Hosany and Elkadi, 2000a; Al-Hosany and Elkadi, 2000b).

However, the first step to understand the energy performance in prison buildings is to understand the sociology of the prison system. A literature review, thus, was carried out to investigate all the aspects related to the prison built environment and the major penal movements related to institutional rehabilitation. The aim was to investigate *shallowly* the social aspects of prison buildings, in order to understand the social logic of the prison environment. However, this shallow investigation ended up becoming a deep analytical exploration of penal theories and the development of the prison system through history. The review showed that prison is an inherently theoretical subject. Prison buildings raise issues about the relations of the form of the material world and the way in which the inmates live in them, that are unavoidably both **philosophical** and **scientific.** A survey of incarceration architecture theories seemed to be meaningless without a deep understanding of the roots of the institution of the prison through history. A critical historical review, hence, was unavoidable to review the development of penal and incarceration architecture theories in both the Islamic and the Western worlds in order to verify the sustainable factors that affected the development of prison design.

A vast number of both **social** and **architectural** variables were identified from the historical review. Using a basic statistical analysis method (MS excel spreadsheets), which is illustrated in detail in chapter 7, these variables were narrowed down into a smaller list of façade variables that are sought, on one hand, to be influential in the efforts of rehabilitation and to affect the energy performance of the building, on the other. These variables were challenged using research methods that are common in rehabilitation studies. At this stage difficulties arose. Although the common qualitative approaches were effective in evaluating the social variables, applying them to architectural variables rendered technical difficulties. The search began to locate a certain method that could relate the two sets of variables.

6.4.3.3 Is there a way out?

Literature review on research methodology and techniques showed two solutions to link social and technical variables together. The **traditional way** is represented by

approaches such as **Multi Criteria Evaluations**, which can be traced in the work of Voogd (1983) and more recently Janssen (1996). The **contemporary approach** is more evident in office buildings research, which is mainly concerned about productivity. Experts have explored this field using various techniques. The work of Derek Clements-Croome[9] and his colleagues on creating the productive workplace is the one with which this thesis is mainly concerned. They developed a methodology to assess the link between indoor environment and productivity, using scientific principles and the experience of occupational psychologists (Clements-Croome and Kaluarachchi, 2000).

Prisons at different historical stages were compared to hospitals, mental institutions and factories but one cannot perceive any similarities between prisons and office buildings. There is hardly any basis for comparison between them (maybe only in humorous way, see **Appendix 2).** The differences are major. One could argue that the only similarity between the two buildings typology is that both are purposely built to serve a certain function. Productivity is a key issue for individual companies as well as the national economy as a whole. There is a vast amount of research that investigates the impact of the office environment on the employees' physical and psychological well-being, and methods to improve the workplace in order to enhance productivity. On the other hand, rehabilitation is the main purpose of prison buildings. There are no studies investigating the chances of improving the built environment in prison buildings to improve rehabilitation.

Clements-Croome (2000) stated that productivity can be **measured** in **absolute** or **direct** terms, by measuring speed of working and the accuracy of outputs by designing highly controlled experiments with well-focused tests. He proposed **comparative** measures, using scales and questionnaires to assess the individual opinions of people concerning their work and environment. In some cases, employing combined measures using some physiological measure such as brain rhythms to test the correlation between the brain responses with the responses assessed by questionnaires, was recommended. At this point, it was clear that literally applying Clements-Croome *et al.* contemporary approach

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[9] Derek Clements-Croome is Professor of Construction Engineering in the Department of Construction Management and Engineering at the University of Reading, UK.

http://www.construct.rdg.ac.uk/People_contacts/Staff/Staff/Derek_Croome.htm

on productivity to rehabilitation in prison buildings was not viable. Rehabilitation is **not** measurable. Efforts to use survey techniques to quantify rehabilitation are ineffectual. The external factors that influence rehabilitation are very complicated and producing a controlled environment is hence, impossible.

The picture, however, is now clearer. The contemporary work on productivity is one step in understanding the holistic environmental factors that impact upon human well-being and in the case of office buildings impact on productivity, but if applied in the prison environment influences the rehabilitation process. It is, however, worth noting that the "**System Theory**" which is represented in the work of T. A. Markus and his colleagues in the Building Performance Research Unit, inspired this contemporary approach. Figure 67 shows the descriptive model of the system that helped in the specification and the development of the Units work.

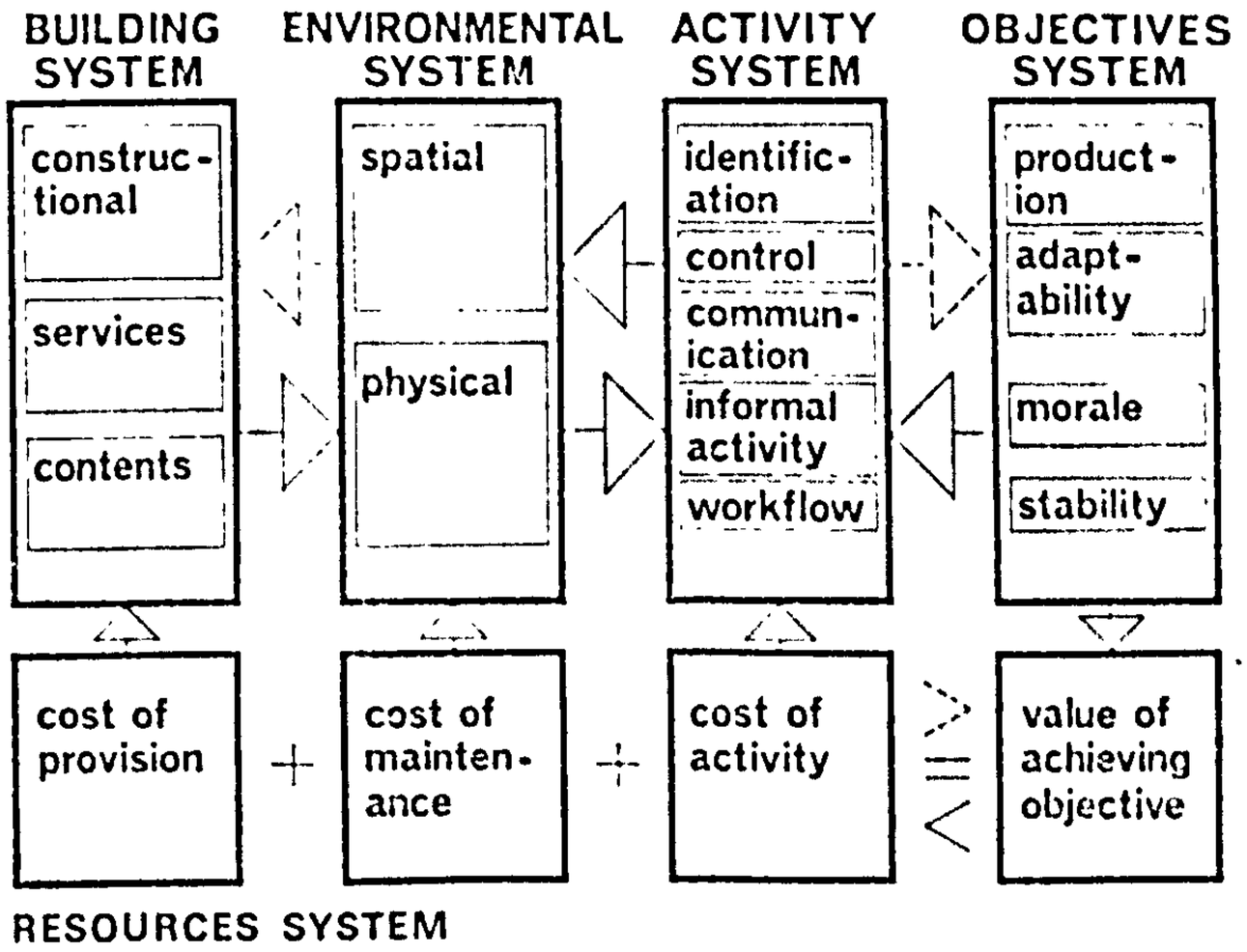

Figure 67: Conceptual Model of the System of Building and People (Markus *et al.*, 1972: 4)

In this thesis case study, rehabilitation is considered the main objective of the prison building that would lead to its sustainable development. The cost is in this case interoperated in energy terms, and thus the balance is critical. Criteria of energy efficient façade design are aimed out of the empirical approach, which also measures the cost to society. On the other hand the qualitative approach is intended to provide the social boundaries for effective prison building design in order to produce a precisely tailored scenario for prison buildings in the United Arab Emirates. This was the most difficult part of the thesis: the development of different scenarios that are based on both prison and

design theories on one hand, and new façade technologies on the other. The development of these scenarios is explained in the following section. Comparative analysis using quantitative methods (that is, computer simulation) is carried out to identify the best-case scenario for a prison building in the United Arab Emirates.

This thesis is not another energy efficiency study. The work of Hillier *et al.* on the social logic of space, provided a starting point to this research framework. The social aspects of prison buildings have great impact on energy performance. In prison buildings, an area dominated by social scientists and almost ignored by scientific researchers, the need for an integrated conceptual research approach is essential. This thesis attempts to instigate a more comprehensive approach to prison design studies. An approach that is called the "*sociology of energy in prison buildings*" which attempts to offer a more qualitative energy and a more quantitative prison approach in order to achieve a sustainable prison building design.