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## SECURITY STRATEGIES IN AIRPORT TERMINALS.

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KEMBOI BRIAN KIPLETING.

BO2/O894/2013.

## DECLARATION

This thesis is my original work and has not been presented in any other university or institution for the purpose of awarding a degree to the best of my knowledge.

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This thesis is submitted in partial fulfillment of the examination requirements for the award of the Bachelor of Architecture degree, in the Department of Architecture and Building Science at the University of Nairobi.

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## DEDICATION.

This is for you, Mike Maraba.

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## ABSTRACT.

A review of the potential security threats to airport terminals shows that new techniques are required that will solve the problem of insecurity. Security strategies that will physically and spatially protect the airport terminal for instance from of a bomb explosion are been adopted. These strategies employ the concept of hardening building components and proper spatial definition of security areas. Several methods of implementing these remediation strategies have been described. These methods include facade and perimeter protection, column reinforcement, sufficient lighting and surveillance. An important element in protecting the airport terminal is providing the adequate standoff distance from access roads and parking areas where vehicles loaded with explosives might be used. The analysis showed that physical reinforcements increases the blast resistance of the building components. However, the physical reinforcements especially use of materials such as Kevlar and steel jackets limits the design. The analysis is presented in such that they can be used as an aid to the design of airport terminals. This study was conducted by analyzing two airport terminals ; Terminal 1A at Jomo Kenyatta International Airport and Terminal 4 at Adolfo Suarez Madrid-Barajas Airport. The security strategies used in these two terminals were critically analyzed and conclusions drawn up. Concluding from that, it is recommended that for an airport terminal to have an effective security design, it needs to have an efficient surveillance system, a good space syntax and well defined territoriality.

# CHAPTER 1 : INTRODUCTION.

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**Figure 1.01 :** The TWA Flight Center at John F. Kennedy International Airport, New York.

**Source :** [www.modernterminal.com](http://www.modernterminal.com). Accessed September 2018.



**Figure 1.02 :** The terminal building at Stansted Airport, United Kingdom.

**Source :** [www.modernterminal.com](http://www.modernterminal.com). Accessed on September 2018.

### 1.1 Introductory background.

Air transport has been described as the defining mode of transportation of the 21st century. There is no other means of travel that can compare to the speed, scale and glamor of contemporary air travel. The flight has opened continents and allowed mass accessibility, like railroads on a smaller scale, a century earlier. In the process, air travel has altered our experience of place and time: it has expanded our sense of geography and human experience (Edwards, 2015).

The airport terminal has taken the place as the central building of the air transport system. Its architecture reflects the glamor, scale and technological prowess of this fast-growing industry. As air travel becomes more popular and accessible, the airport has assumed greater importance as a fundamentally new and challenging building typology. Something like the train station and the combined theater, the modern airport terminal is a highly charged and symbolic building. It is a miniature city that reflects the values and aspirations of society in general (Cox, 2012).

In the scenario of world architecture, the airport occupies an important place. The airport authorities have been, through century, one of the most adventurous patterns of modern architecture. From the Eero Saarinen Terminal TWA of 1959 in Kennedy Airport as illustrated in Figure 1.01 to Stansted Airport by Norman Foster in 2000 as illustrated in Figure 1.02 airport developers have been consistent in their support for innovative design, whether expressed in formal terms or in technological terms. The airport will continue push the boundaries of architectural design, creating images and structural solutions that are adopted in other types of construction (Horonjeff, 2010).





Figure 1.03 : 9/11 attacks on New York's World Trade center.

Source : [www.reuters.com](http://www.reuters.com). Accessed on September 2018.



Figure 1.04 : 9/11 attacks on Pentagon building.

Source : [www.reuters.com](http://www.reuters.com). Accessed on September 2018.

However, regardless with the growth of technological developments in airport design still in the early days of civil aviation, the greatest concerns were related to the safety of flight and there was little concern over airport or aviation security. However, one of the most significant issues facing airports today is that of airport security. Most users of commercial service airports are subjected to security infrastructure, policies, and procedures within the terminal area; however, airport security concerns all areas and users of the airport (Redhead, 2016).

Aviation security first became an issue in 1930 when Peruvian revolutionaries seized a Pan American mail plane with the aim of dropping propaganda leaflets over Lima. The most significant event in our generation was the hijacking and crashing of aircrafts into the World Trade Center as illustrated in Figure 1.03 and Pentagon Building as seen in Figure 1.04 on September 11, 2001. In response to this event, the Aviation industry made several radical changes to airport security. Authorities were formed to develop and enforce new security guidelines for aviation (Grammich, 2007).

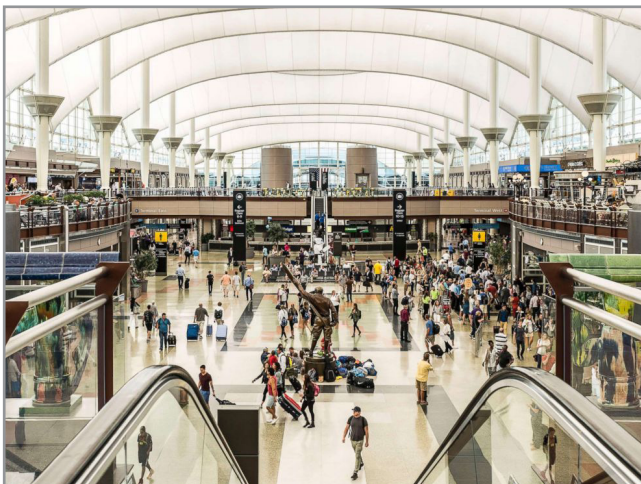
According to the Database of Worldwide Terrorism Incidents, it lists 225 attacks on civilian aircraft or airports worldwide since 1980. Of these, two-thirds, or 150, were attacks on civilian aircraft and one-third, or 75, were attacks on or at airports (Terry, 2017).

The database states that 150 attacks on aircraft have resulted in 4,280 fatalities and 76 fatalities resulting from attacks on airports, since 1980. The casualties of the September 2001 are about 1,400 fatalities. For sure, attacks on airports have produced significant damage, of the 75 attacks on airports:



**Figure 1.05 :** A car bomb attack on Glasgow Airport.

**Source :** [www.internationalairportreview.com](http://www.internationalairportreview.com). Accessed on October 2018.



**Figure 1.06 :** Interior layout of the terminal building at Denver airport.

**Source :** [www.flightglobal.com](http://www.flightglobal.com). Accessed on October 2018.

- i) 49 used portable explosives (mostly in luggage but also including 3 mail bombs), resulting in 58 fatalities.
- ii) 9 used vehicle bombs, resulting in 4 fatalities. For instance, the attack on Glasgow Airport Terminal by terrorists in 2007 as illustrated in Figure 1.05.
- iii) 8 used missiles, rocket-propelled grenades, or mortars, resulting in 1 fatality.
- iv) 7 used firearms, resulting in 13 fatalities.

### 1.2 Problem statement.

Large numbers of people pass through airports every day as captured in Figure 1.06. This presents potential targets for terrorism and other forms of crime because of the number of people located in one place. Similarly, the high concentration of people on large airliners increases the potentially high death rate with attacks on aircraft, and the ability to use a hijacked airplane as a lethal weapon may provide an alluring target for terrorism. Hence, there is need to put in place a security oriented airport design that attempts to prevent any threats or potentially dangerous situations from arising or entering the country.

### 1.3 Research objectives.

- i) To investigate and understand the basic functioning and workings of design strategies employed to enhance airport security.
- ii) To assess the current state of security in airport terminals.
- iii) To propose better ways of designing for safety and security in airport terminals.





Figure 1.07: An aerial view of Heydar Aliyev International airport in Azerbaijan.

Source : [www.hi-tech.com](http://www.hi-tech.com). Accessed on October 2018.



Figure 1.08 : Carrasco International Airport in Montevideo, Uruguay.

Source : [www.rafaelvinoly.com](http://www.rafaelvinoly.com). Accessed on October 2018.

### 1.4 Research questions.

- i) How does the design strategies employed to enhance airport security work and function?
- ii) Are the current airport terminals designed to sustain potential security threats?
- iii) Can architects come up with better ways of tackling security through design?

### 1.5 Study justification.

There has been a paradigm shift with regard to the design of airport terminal as time has advanced. In recent times, designers have begun to focus more on meeting the aesthetic for instance the form of the terminal building at Heydar Aliyev International Airport as illustrated in Figure 1.07 , functional needs of their clients and security of the users and physical structures as shown in Figure 1.08. This could be described as the third level of design, with the first two being functionality and aesthetic value. (Chow, 2015) The third level is hence the security design and its inclusion in the design process has been proven to lead to a more wholesome final product especially in the design of airport facilities. This study therefore seeks to establish exactly how security in the afore-mentioned facility can be achieved successfully.

### 1.6 Scope and limitation.

The time allocated for the study is 8-10 weeks, however it may not be sufficient for a detailed and in-depth documentation of airport terminal facilities both locally and internationally. Resources available will not allow for conduction of



**Figure 1.09 :** The main entrance to Cape Town International Airport, South Africa.

**Source :** [www.airportsecurity.com](http://www.airportsecurity.com). Accessed on October 2018.



**Figure 1.10 :** Brussels Zaventem airport following the explosions in 2016.

The attack affected airport operations for three months.

**Source :** [www.aviationbelgium.com](http://www.aviationbelgium.com). Accessed on October 2018.

thorough research, especially where trips need to be conducted frequently, for example trips abroad to observe how terminal security is tackled in various airport.

### 1.7 Study significance.

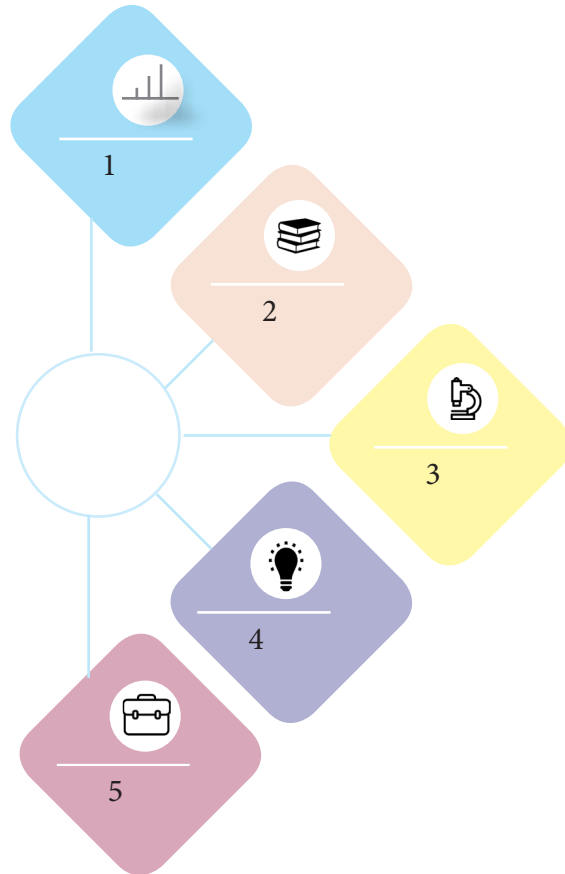
This study will illustrate the principles of security design that lead to a more secure airport terminal. Any airport design for improved security can be evaluated for its effect on three security outcomes variables (Schell, 2014) :

- i) Deterrence or detection of an attack before it occurs. A case in point is the off airport security checks at Cape Town International Airport as seen in Figure 1.09.
- ii) The number of casualties an attack would cause.
- iii) The extent to which airport operations would be interrupted by an attack. For instance the attack on Brussels airport interrupted airport operations for nearly three months. The extent of the damage is illustrated in Figure 1.10.

For each means of likely attack, we examine how the airport configuration might help in deterring or detecting such an attack as well as how it might limit the casualties and effects on operations. This knowledge can hence be used to inform future designs. This document may then serve as a prototype or a baseline for the achievement of successful incorporation of security into terminal design.

### 1.8 Study organization.

**Chapter 1** of this study gives a brief introductory background to the aspect of terminal design and security considerations , this is to give the reader a better grounding as to what exactly the author intends to research on.



**Figure 1.11 :** An infographic illustrating the study organization.

The study will be broken down into five separate chapters as illustrated and colour coded above. This will hence enhance the reader's further understanding.

**Source :** [www.designboom.com](http://www.designboom.com). Accessed on October 2018.

**Chapter 2** consists of the review of both published and unpublished works on the topic of study. It examines on the history and evolution of airport security, what exactly is meant by the term terminal security architecture, and the factors that pertain to its acquisition in the terminal facility. This is achieved via studying the works of authors of different times in order to give a more informed understanding as to how design is used to enhance security in a terminal facility and how it was done in the past, and how it is done today. The authors focused on are researchers Bryan Edwards, Terry L. Schell, Brian G. Chow, and Clifford Grammich, Horonjeff, Robert and Mckelvey, The parameters obtained from this chapter will hence govern the 4th chapter study as it will entail documenting the presence or lack thereof of said parameters.

**Chapter 3** delineates the techniques that will be used in the conduction of this research. It also indicates the methods of data collection, analysis and presentation that shall be utilized in order to further deepen the understanding of the topic of study.

**Chapter 4** of this study entails the critical analysis of the chosen case studies i.e. . It is however important to note that the case studies selected will not be studied in their entirety. Rather, the specific point of focus will be their response to security. This shall then be corresponded with the parameters outlined in Chapter 2 of this study.

**Chapter 5** will summarize lessons learnt from the case studies and how they can be utilized, or added onto, in order to derive conclusions of the study for recommendations to the way forward on the study topic . The study organization is illustrated in Figure 1.11.