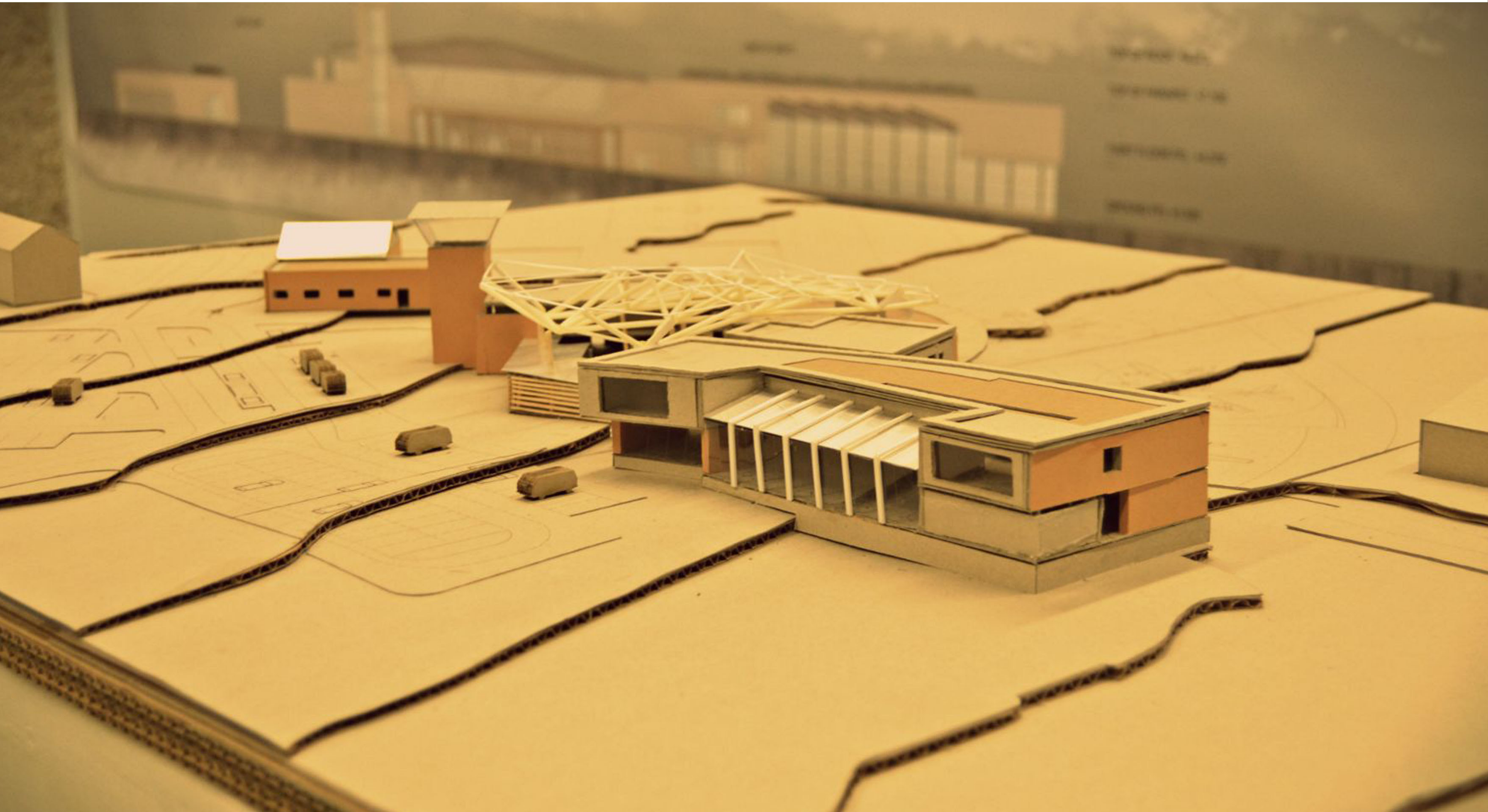
CONNECTING EARTH AND SKY

[The Design of an Aeronautical Terminal Facility for Somerset East]

K. KARIHINDI S214305058



AERONAUTICAL TERMINAL FACILITY

The Design of an Aeronautical Terminal Facility
For Somerset East

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Treatise (AA523)

Nelson Mandela Metropolitan University
Faculty of Arts
Architecture Department

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- **Andrew Palframan**
- **Rob Beach**
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- **Stephen Lear**
- **Blue Crane Route Municipality**
- **Blue Crane Development Agency**

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PREFACE

ABSTRACT

In addressing the stunted growth of the town of Somerset East, the treatise suggests that the model of an "Aerotropolis" (Kasarda and Lindsay, 2011) be used as a means to spur economic growth and development for the town. The treatise proposes the design of an air terminal facility, to act as the catalyst, for which growth of a mini-Aerotropolis will happen around as well as a northern gateway for tourism to two of South Africa's popular National Parks; Addo Elephant National Park and Mountain Zebra National Park.The challenge being the creation of a building type that incoorporates several would be segregated activities into one hybrid that generates public space within an interface or transcient space.

The chosen site is a heritage airfield site, with plans for development by the Blue Crane Development Agency, and certain infrastructure existing. The agency's master plan for the aerodrome is reconsidered, with the reworking of it done in order to fully exploit the potential of the aerodrome. From this reworked master plan, the design of the terminal building is developed, made to fit in with the constraints and informants of the carefully reworked master plan.

INTRODUCTION

This treatise design is concerned with: a redevelopment (where necessary) of the existing Blue Crane Development Agency's master plan for Somerset East Aerodrome; in order to fully utilize and exploit the potential to achieve maximum utility of the aerodrome for its current and future growth i.e. quality of service that the aerodrome will be providing.

The design of the terminal building will then be developed, derived from and made to fit in with the constraints and informants set out by the carefully reworked master plan.

AIMS AND OBJECTIVES

This treatise seeks is to: research the functional design requirements for a regional General Aviation terminal building for Somerset East Aerodrome that would comply and meet ICAO environment standards whilst acting as a hub for educational and recreational flight training, all the while acting as support for a light cargo despatch facility and support for an forecast cargo business.

The objectives are made up of the following components:

- To arrive at an understanding of the context; in terms of its geographical location and historical development.

- Outline how a rich aeronautical heritage has always been part of the town's history and how that heritage can be used to inform the town's future development.

- Establish an understanding of the airport environment, as well as architectural typology and expression of terminal.

- Augment the existing runway master plan layout of the aerodrome - to release the full potential of the site; for both current and future enhanced quality of use to be realised without one hampering the other.

- Define an appropriate building programme for activities to be accommodated.

- To maintain and preserve the pristine, natural context - using sustainable principles in the implementation of the design; where possible.

METHODOLOGY

This treatise will be conducted in two parts.
The first will follow a theoretical research of a pure nature - where primary and secondary sources will be consulted. It will explore issues associated with airports and flying in a rural context whilst acting as a catalyst for aviation related activities. A topological exploration will we conducted to assist define parameters to be implemented in the final design.
The second part will be conducted via the implementation of theoretical conclusions, principles and concepts drawn from the first part to arrive at an appropriate design response.

Primary sources will include:
Photographic surveys, Site Visits and Interviews with relevant professionals and aviation enthusiasts, management and developers of which;

- Rob Beach of the Blue Crane Development Agency
- Ibrahim Walid (Air Traffic Controller)

Secondary sources on the other hand will include;

- Municipal survey data
- Internet search engines
- Literature Survey from the NMMU library
- Media (relevant articles in journals, circulars, newspapers and manuals etc.)

DOCUMENTS STRUCTURE

This document will be divided into two parts:

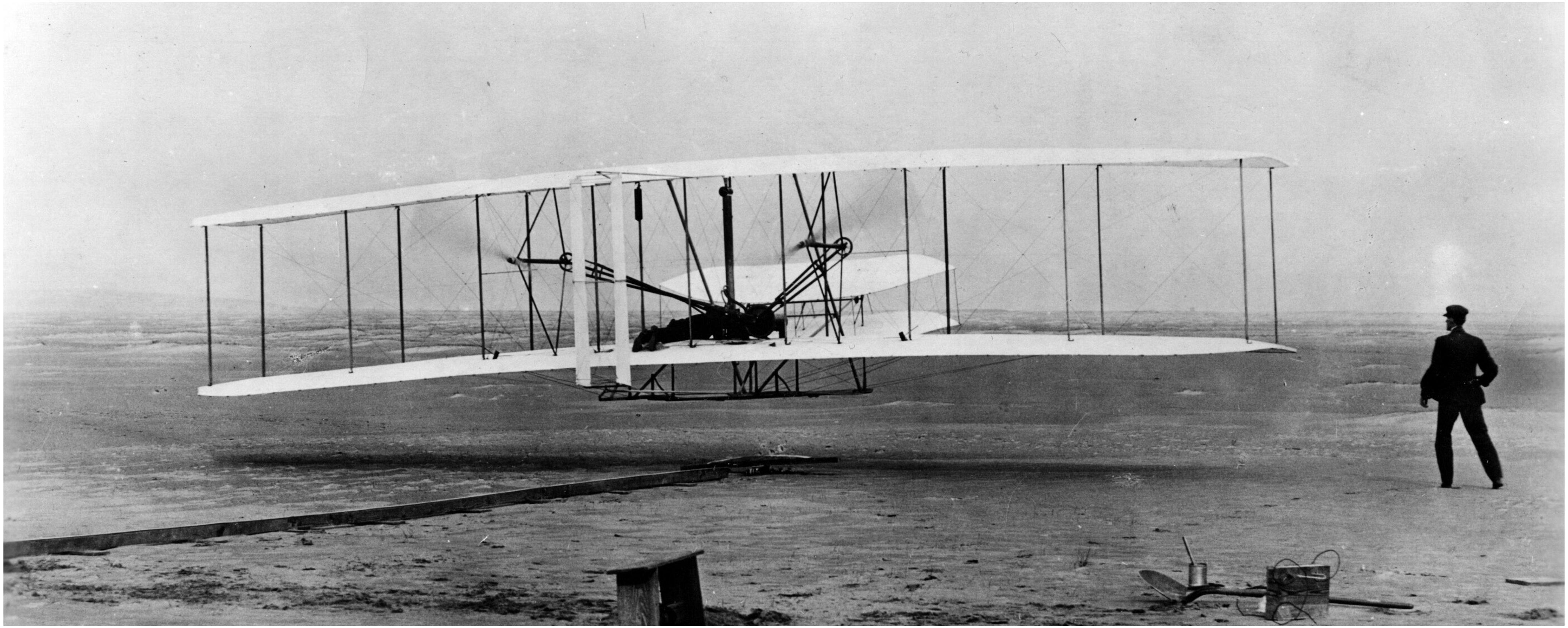
Part 1 will focuses on research into the issues of the airport and its typology; through research into the aspects of its technical functioning and programmatic requirements of an airport and analysing the constraints imposed on the site. A precedent analysis will be conducted in order for conclusions to be drawn to inform the design.

Part 2 focusses on the development of the brief and accommodation schedule, which will then lead into the eventual design response being generated- through site responses and conceptual interpretations.

PART ONE

RESEARCH

1



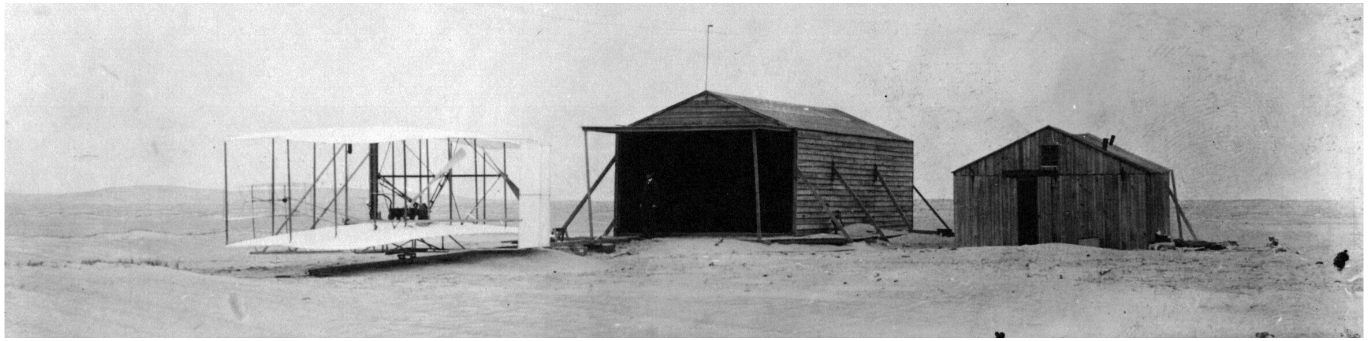


Figure 1.0 [Top] "Wright Brothers' 1904 Aeroplane ("Kitty Hawk") in first flight, December 17, 1903 at Kitty Hawk, N.C. Orville Wright at controls. Wilbur Wright standing at right. (first flight was 12 seconds)". (1904)

Figure 1.1 [Right] Photograph of the Wright Brothers' Camp in Kitty Hawk, North Carolina, 1903. (1903)

OVERVIEW

BACKGROUND TO THE PROBLEM

Ever since the first "controlled, powered and sustained heavier than air human flight" (Smithsonian Institution, 2003) by the Wright brothers in the early 20th century, which allowed man to take to the skies and furthermore paved the way for civilian aviation, much has evolved about the humble airstrip. New opportunities have emerged in and around airfield surroundings; which have led to the emergence of an altogether new urban typology the 'Aerotropolis', or Airport City. (Kasarda & Lindsay, 2011)

In the book, Aerotropolis: the way we will live next, Kasarda and Lindsay (2011) assert to have come to the understanding that; airports are becoming major urban centres around which hosts of other functions and activities are emerging - in as much a manner as how villages, towns and cities developed around major routes, rivers, harbours and railways etc. in the past. Kasarda's conclusions were arrived upon; after observing how airports are evolving from mere transportation zones into mixed-use commerce, business and manufacturing centres. In a nutshell, airports can be seen as evolving from simple rudimentary, mono-function transport terminal areas; into becoming hybrid functions areas - which are defining urban morphology.
Somerset East is a historical, agrarian, colonial settler town that has only developed up to about three times its original urban fabric size; since its inception nearly over 200 years ago in 1825.

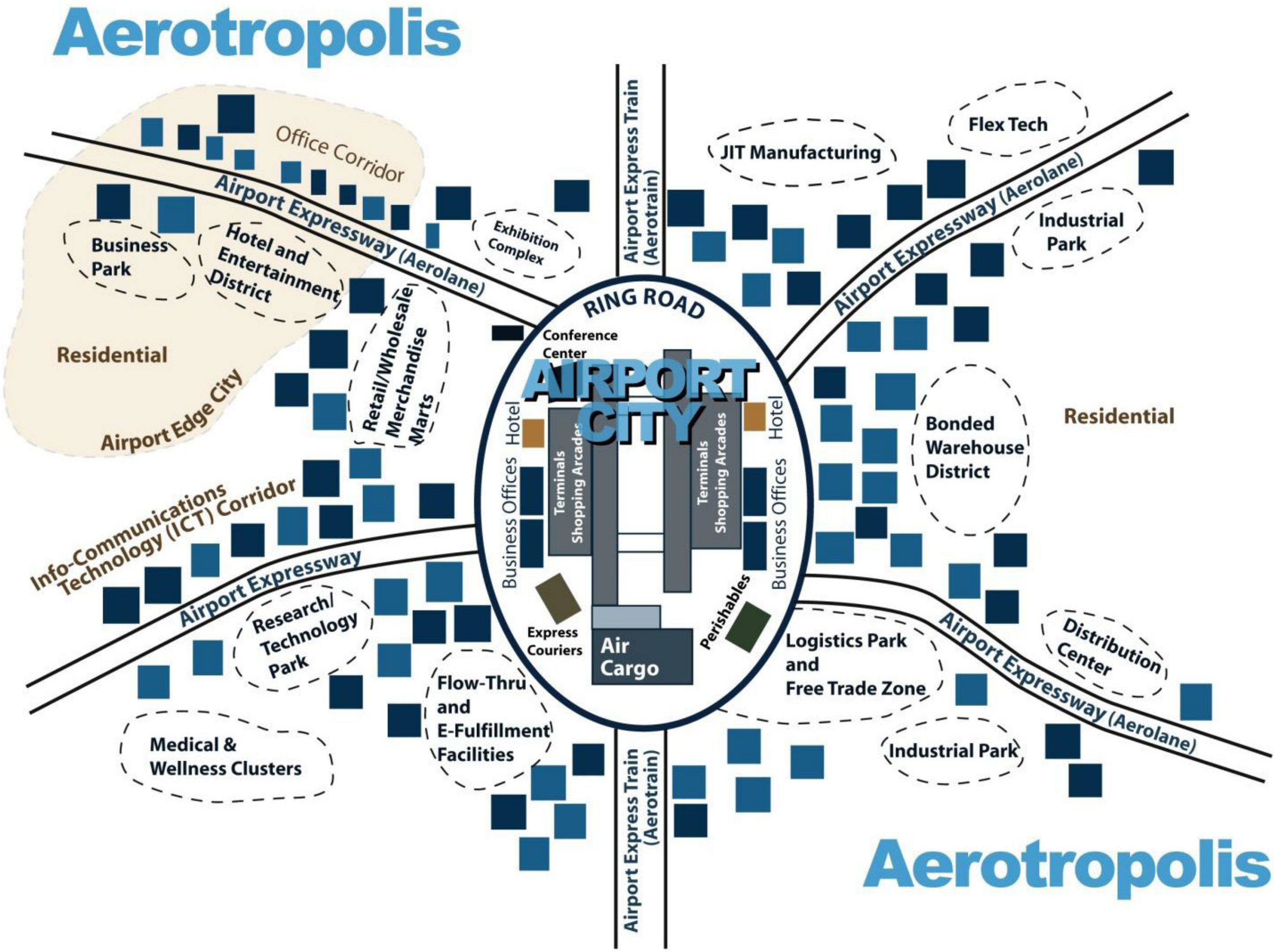


Figure 1.2 Aerotropolis Schematic. (Kasarda, 2011)

PROBLEM DEFINITION

Other towns that were established at roughly the same time have experienced relative successful economic growth as well as urban development in comparison; e.g. Port Elizabeth 1812, Graaff-Reinet 1786 and Cradock 1816. (Saunders, 2013, p. 49). The causes for this state of affairs can be inexhaustible, however, there are several which stand out; the town is situated away from major road networks, main railway lines and harbours etc. and is also subjected to the geo-morphological constraints of the region.

PROBLEM STATEMENT

Somerset East's failure to develop despite being a colonial white settler town has led to its isolation on the whole. As well as being isolated, the towns spatial modelling is one that is without a core activity to aid structure a cohesive town layout versus the currently sprawled and discontinuous developmental pattern. The historic core of the town which is the cultural centre and CBD is the "pulse of the town". However, it can be said that little thought has been given to the inclusion of subsequent modelling of the town to this historic core.
Existing roads and the currently disused railway infrastructure segregate communities and favour the motorised vehicles over the pedestrian and result in a lopsided and exclusive framework rather than one that is holistic and inclusive. The main road through the town is conceived as a dead thoroughfare; it neither enhances spatial quality nor

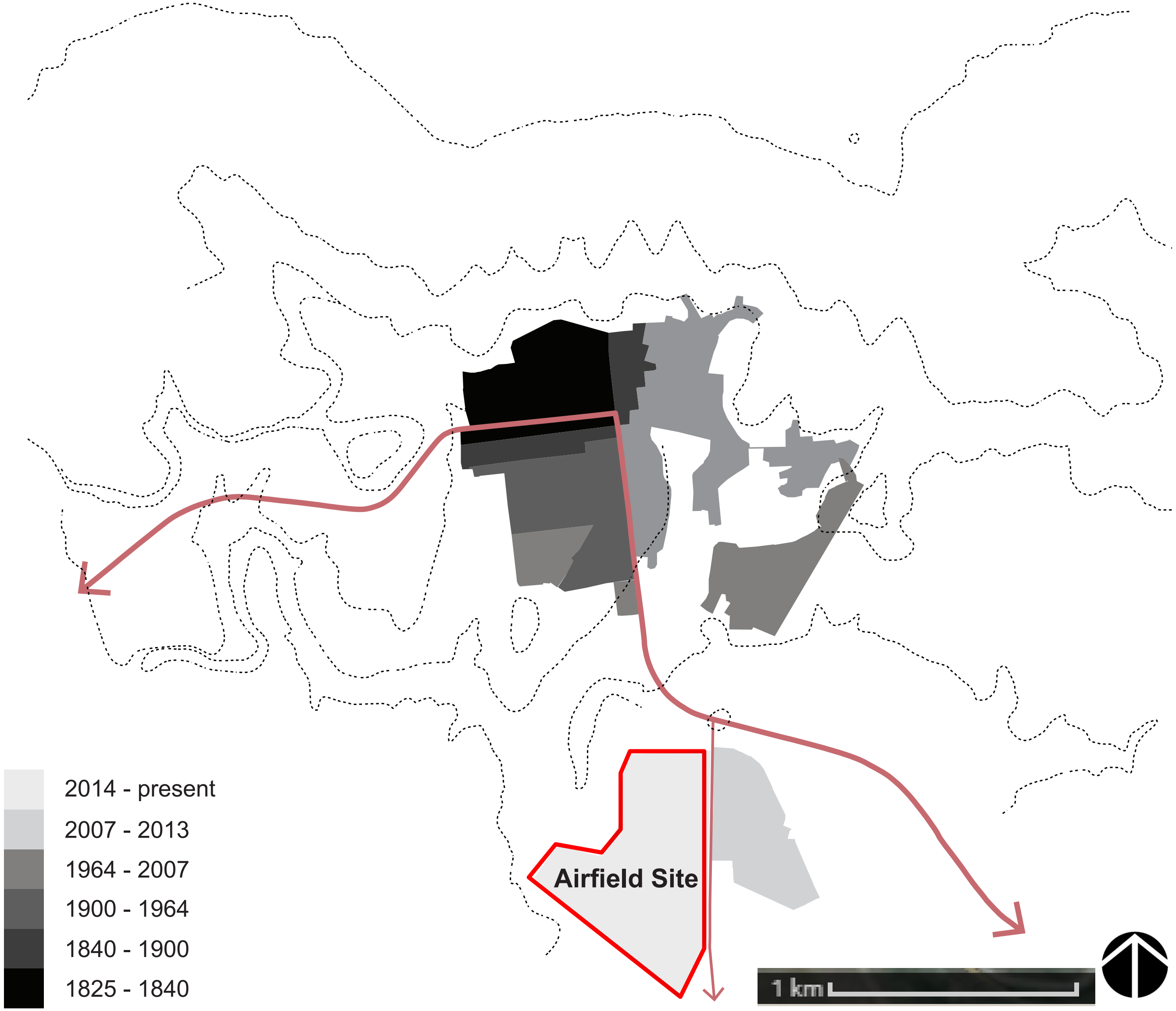


Figure 1.3 Historical development of Somerset East footprint over the years. Development & activity is concentrated only at the historic core leaving other communities isolated. (Karihindi, 2015)

propagates activity corridors by anchoring human occupation such that the entire town is tied together into a common spatial nucleus.

This urban scenario brings about a heightened demand for an architectural intervention that; as well as address the greater regional connectivity / isolation problem of Somerset East, by acting as a gateway to the region for the local tourism industry whilst itself becoming a catalyst to address the towns disjointed spatial morphology, would allthewhile tap into a rich aspect of the town's rich aeronautical heritage of Somerset East. The need to rectify this problem is therefore substantial.

BLUE CRANE ROUTE MUNICIPALITY

The Blue Crane Route Local Municipal area has a number of strategic environmental advantages. It is sparsely populated and contains 97% natural vegetation cover, is centrally located between three national parks: Addo Elephant National Park, Mountain Zebra National Park and Camdeboo National Park and contains a biodiversity of regional and national significance. It boasts incredible scenic beauty, and local conditions present a number of opportunities for Game Farming and Tourism. Recreational Game and Trophy hunting are some of the major income earners in the area. Higher population densities are primarily concentrated in the three urban centres of Somerset East, Cookhouse and Pearston.
(Statistics South Africa, 2011)

The remoteness of the urban centres around Somerset East and the environment provide an opportunity to tap into unrealized potential by the possibility of opening up an aerial Tourism gateway to the region.

Figure 1.4 The Boschberg Mountain and the Blue Crane region. (2013)

Figure 1.5 Site Location Somerset Aerodrome Industrial Park + Aerospace Cluster. (Wilken, 2014)

BLUE CRANE DEVELOPMENT AGENCY

The Blue Crane Development Agency (BCDA), is a local economic development (LED), agency that operated within the Blue Crane Route Municipality. Its mission was to conceptualise opportunities and facilitate sustainable developmental projects related to: Agriculture, Business and Tourism; to the benefit of all citizens with special emphasis on job creation and Black Economic Empowerment opportunities.

The Blue Crane Route Municipality (BCRM), is situated in the Western part of the Eastern Cape Province. The Western region (Sarah Baartman District Municipality, formerly Cacadu District Municipality) consists of nine local municipalities, of which the Blue Crane is the largest in size. It incorporates the towns of Somerset East, Cookhouse and Pearston, it covers an area of approximately 9914 square kilometres, with a population of approximately 40 000. Somerset East is the administrative seat. (South African Local Economic Development Network, n.d.)

The BCDA, was established in February 2004 but has since ceased to exist as a legal entity since 2008 (Beach, 2015). Even then, the work it was involved with is still active today.

THE BCDA'S VISION

The BCDA's vision, was that the development in and around the aerodrome precinct would function as a catalyst for the development of industry and commerce for Somerset East. The following projects are earmarked as part of the vision for the aerodrome:

- Pilot and UAV Training
- Green Aviation Industry
- Aircraft Assembly and Disassembly
- Components Manufacturing

This treatise research project will operate within the Blue Crane Development Agency's vision for the aerodrome but, will also seek opportunity for further improvement, where the opportunity exists, or has been left out for budgetary constraints etc. This is in order to achieve maximum utility potential of the aerodrome - both for the present time as well as future adaptability and upgrade of the entire airport.

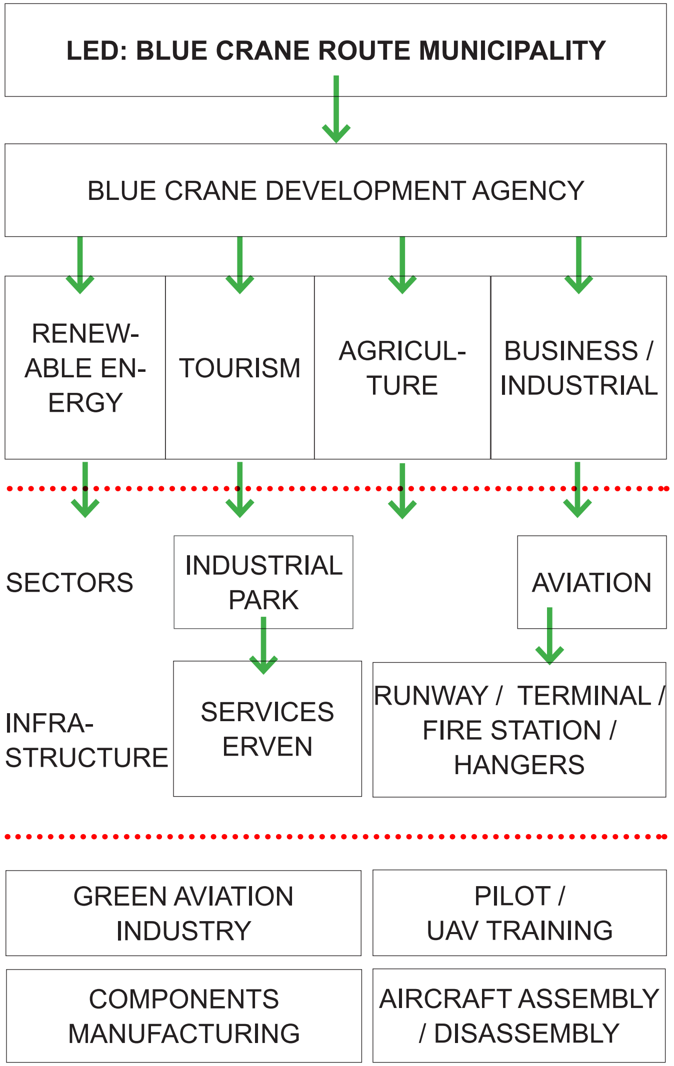


Figure 1.6 LED: Niche Industrial Development. (Wilken, 2014)

THE SITUATION

Amongst many projects that the agency has taken to task since its inception, in the different aforementioned fields, the one that is of relevance to this treatise research is the airfield at Somerset East.
Somerset aerodrome is managed by the members of the BCDA.

Somerset East Airfield (FAST) in the Eastern Cape is located at position 32° 45' 00" S 25° 36' 30"E, 1.5NM to the South of the Town of Somerset East, and has an elevation of 2345 feet above ground level (AGL), (approximately 275 m above sea level). It currently has two serviceable grass runways, 02-20, 1200x35m and 12/30, 1000x15m.

Bulk services: a control tower with a couple of offices, ablution facilities as well as two hangers are currently also available. The airfield currently has a perimeter security fence. A new fire station has recently been built next to the control tower and will be available for rescue/fire-fighting services at the airfield, it will also serve the town and district of Somerset East. (du Toit, 2015)

PROGRESS FLIGHT ACADEMY

Progress Flight academy (PFA) is an award winning flying school that specialises in providing premium flight training to clients who wish to achieve a genuine operational capability in multi-engine piston aeroplanes and attain the Commercial Pilot Licence with multi-engine Instrument Rating.

It is currently based in Port Elizabeth, Green Bushes where the majority of its training has been situated since 1981. The courses it offers are ICAO and SACAA compliant and range from Private Pilot Licence training right up to Professional Pilot and Instructor licence training. Thier Professional Pilot – Integrated Flight Training course alone offers up a total of includes a total of 80 Piper Seminole and other aircraft flying hours, including a solo flights. (Prosper Flight Academy, 2014)
The courses run for a periods of 6-8 weeks thoughout the year.

Due to several constraints that have evolved about the current training site, PFA and the BCDA have partnered to move the first stage of its “ab initio” training programme from PE to Somerset East Aerodrome.

Figure 1.7 Progress Flight Academy Vulcanair P68R. (Prosper Flight Academy, 2014)

NEED FOR DEVELOPMENT

The construction of a new fire station facility on the site has yielded an opportunity to expand the capacity of the airport to take on greater sizes of aircraft. The fire station is integral to the airport's emergency plan; in the event of any emergency that would arise. In addition, this coincides with the subsequent zoning of land within the boundaries of the aerodrome for industrial use.

RUNWAY ORGANIZATION PRINCIPLES

Somerset East Airport was originally planned around three short grass runways that crisscrossed the site; as can be seen in figure 1.10. Now the layout of the airport has been reconfigured; with the construction and upgrade of the southernmost runway from grass to an asphalt surfaced 1.2 Km runway, which in its future phase will be upgraded further to a 1.5km runway. (Beach, 2015)

The overall concept is shown in figure 1.8.

Figure 1.8 Somerset East Aerodrome Development Plan. (Karihindi, 2015)

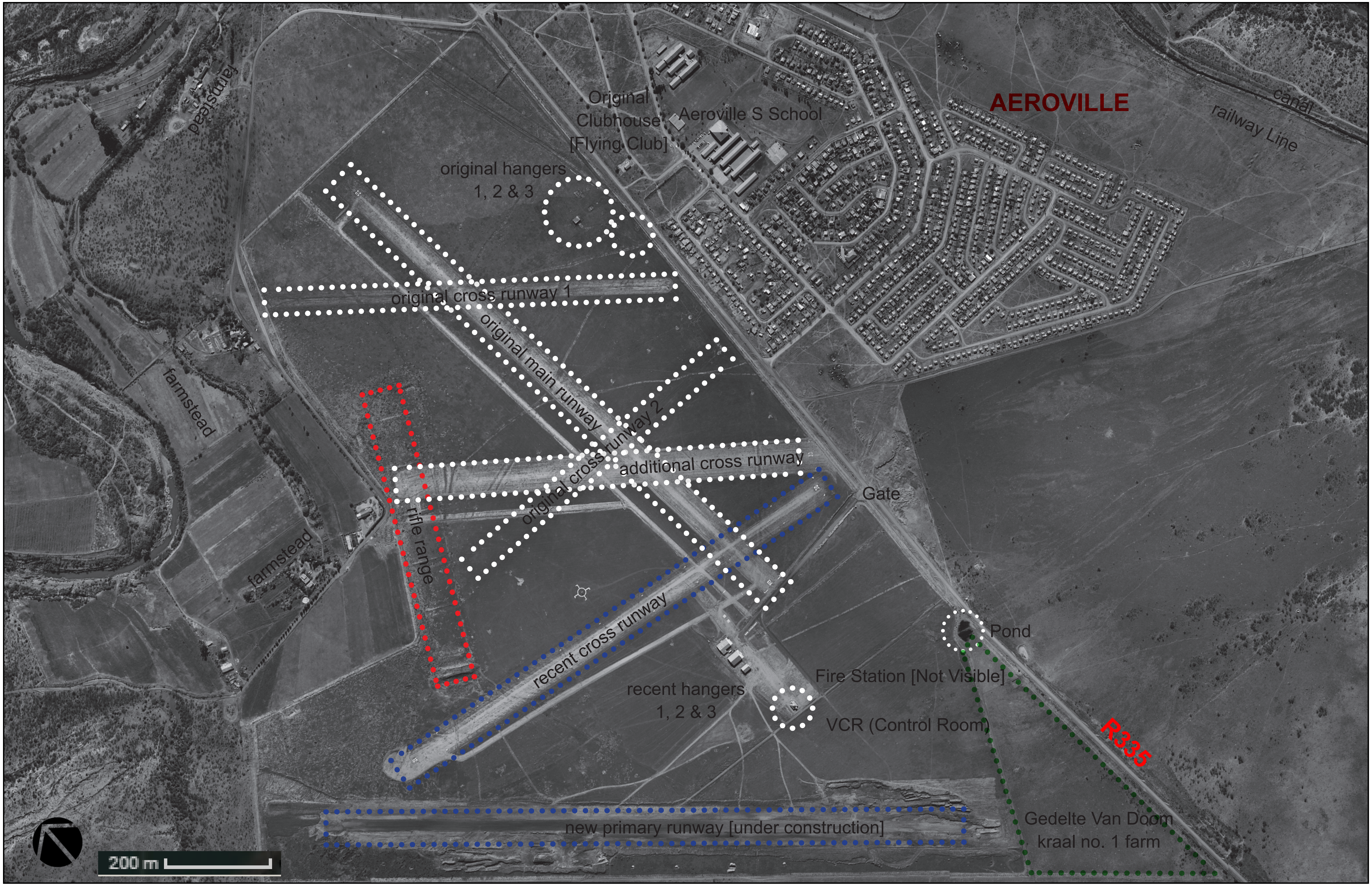


Figure 1.9 Aerial view of site depicting history of aerodrome in context. (Karihindi, 2015)

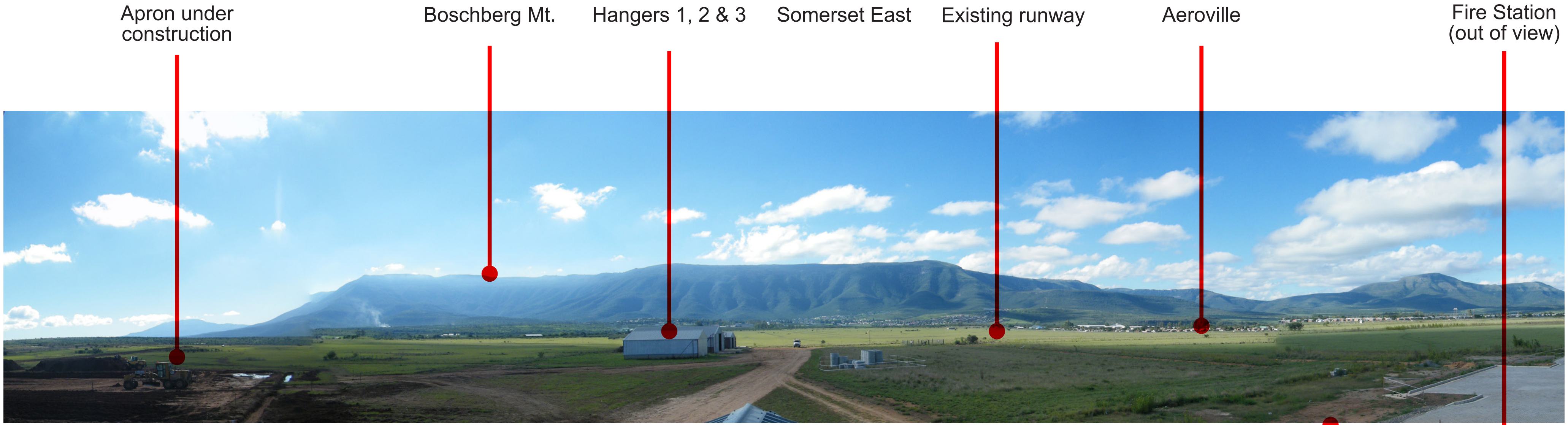


Figure 1.10 Site panoramic view towards the town from the control tower. (Karihindi, 2015)

CURRENT SITE CONDITIONS

On the east edge of the aerodrome, development and rationalisation has already begun - with the removal of a fourth runway, the subdivision of land into industrial plots and business plots, the construction of a fire station, a single storey control tower building; which also doubles as the airport terminal, a number of hangers on the precinct and the aforementioned 1.2 Km runway.

The 1.2 KM runway is being built as an all-weather, day and night runway which by orientation is an average of the two existing runways as a result of crosswind and prevailing wind directions layouts; hence it's functionality in all weather. (Beach, 2015)

Figure 1.11 New Fire Station. (Karihindi, 2015)

Figure 1.12 Air Traffic Control Tower. (Karihindi, 2015)

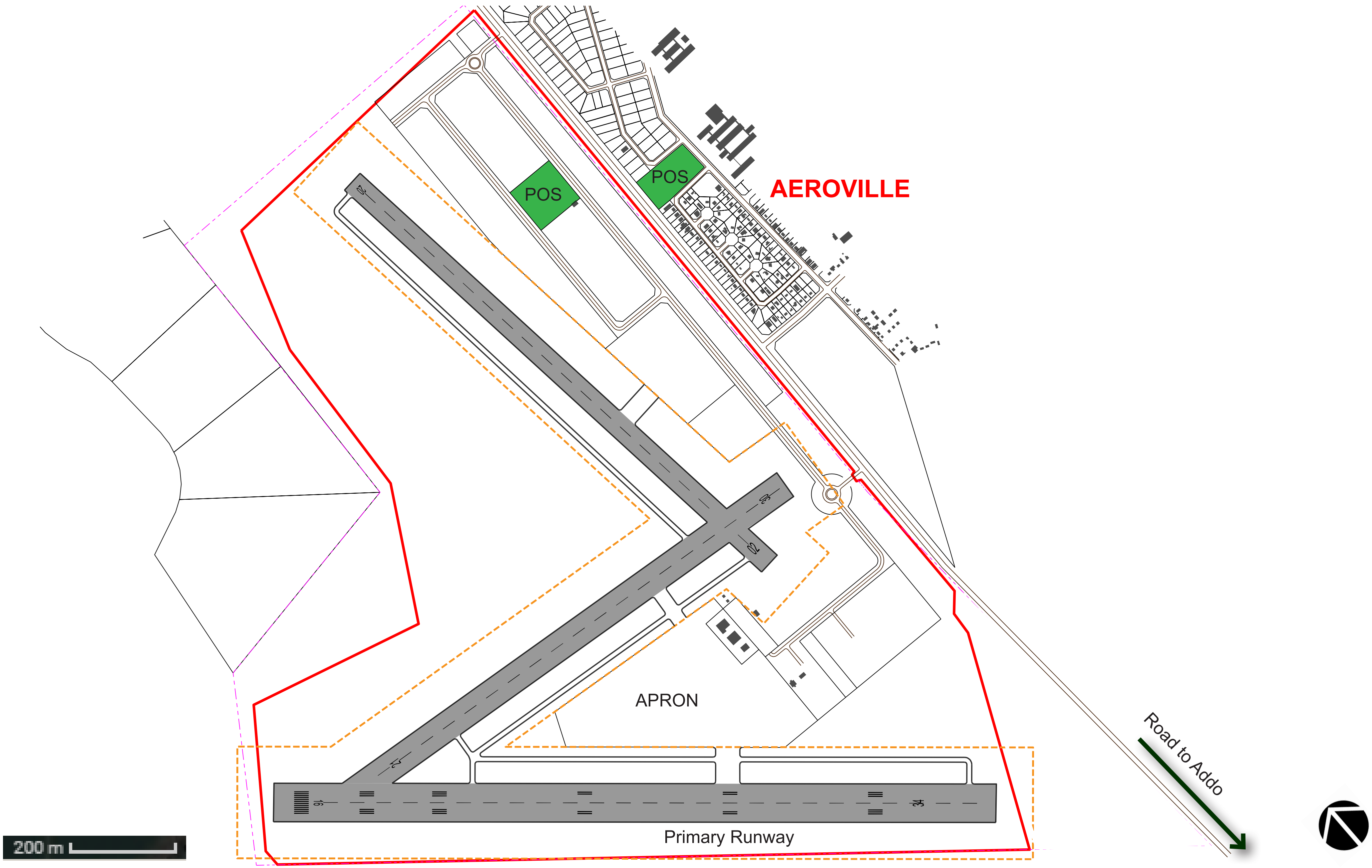


Figure 1.13 BCDA Airport - Draft Layout - Revision 3b. (Pretorius, 2010)

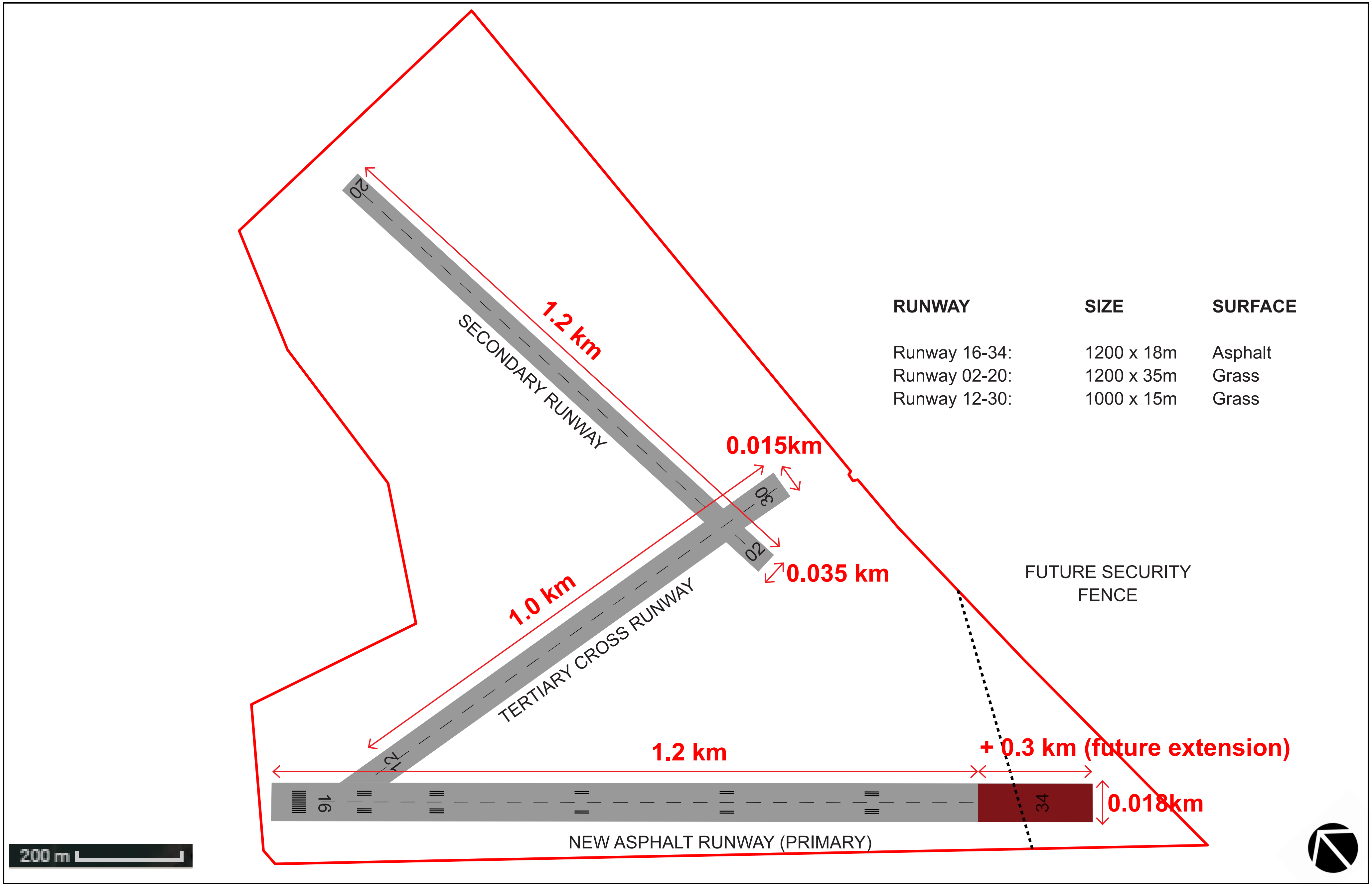


Figure 1.14 Existing and proposed runway sizes. (Karihindi, 2015)

CONTEXT

INTRODUCTION

In the following section the greater and immediate context of Somerset East will be examined. By investigating the natural and man-made structuring elements that influence the settlement typology it is expected that they will help to define the parameters of spatial and programmatic needs within Somerset East and as relating to the greater region which will substantiate the case for the treatise argument whilst in line with aspects of Blue Crane Development Agency's vision.

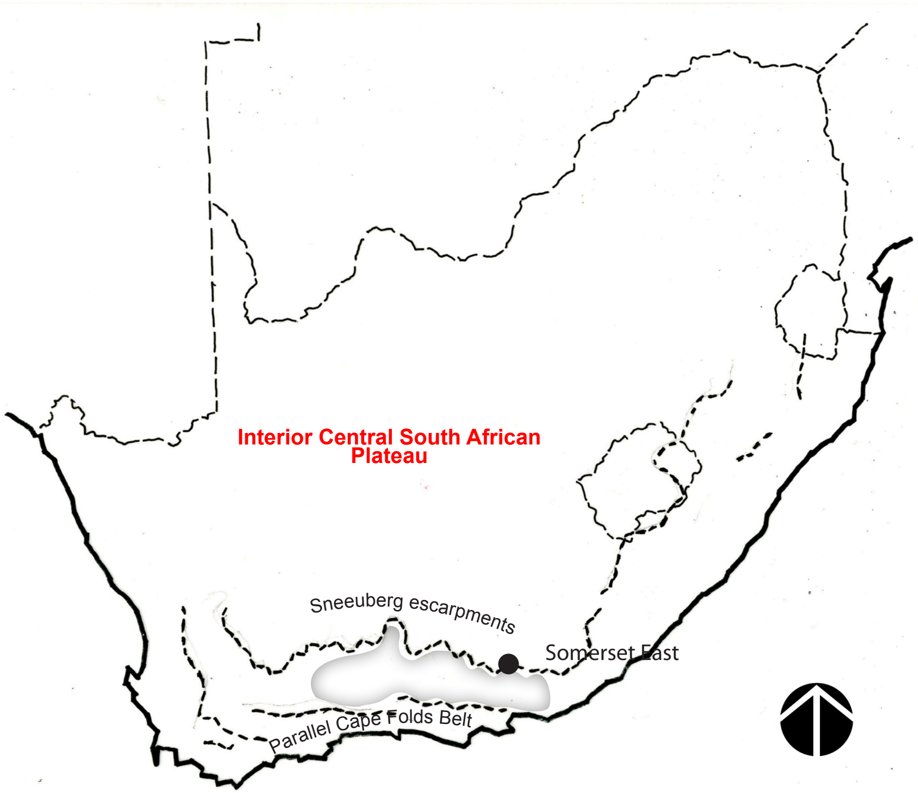
Starting at a national and regional scale to support the argument for the treatise, the study will go ahead to the town scale and lead to identifying constraints and informants which will close with an urban spatial framework of Somerset East.

Figure 2.0 Aerial view of Somerset East towards the North. View along the R63. (2013)

Figure 2.1 Westward view of Somerset East from the air with the historic town and high Street in the foreground. (2013)

UNDERSTANDING THE GREATER CONTEXT

Location of Somerset East is at a national scale.



Somerset East lies in a relatively low lying area of land that runs from east to west, it's sandwiched between two mountain ranges - these escarpments are indicated above. The thick interrupted line indicates the course of the Great Escarpment which delimits areas located on the

Figure 2.2 Natural Structuring elements. (Karihindi, 2015)

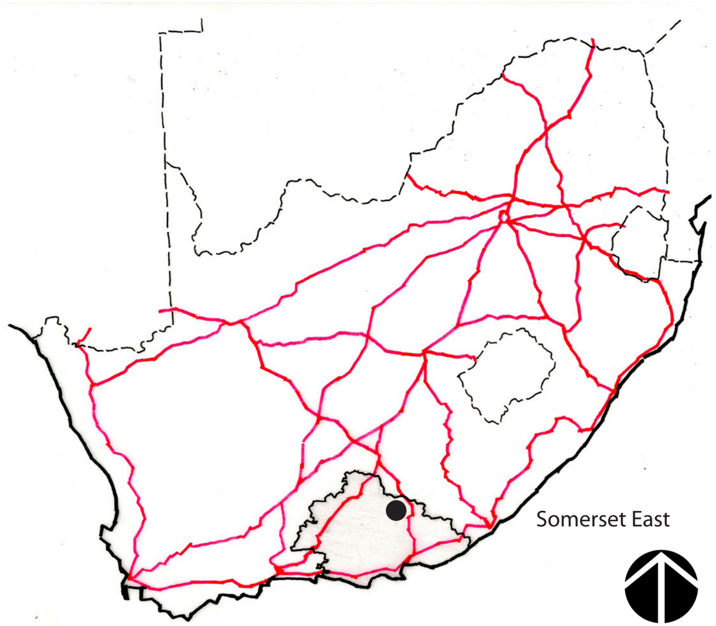


Figure 2.3 Connectivity: National road network. (Karihindi, 2015)

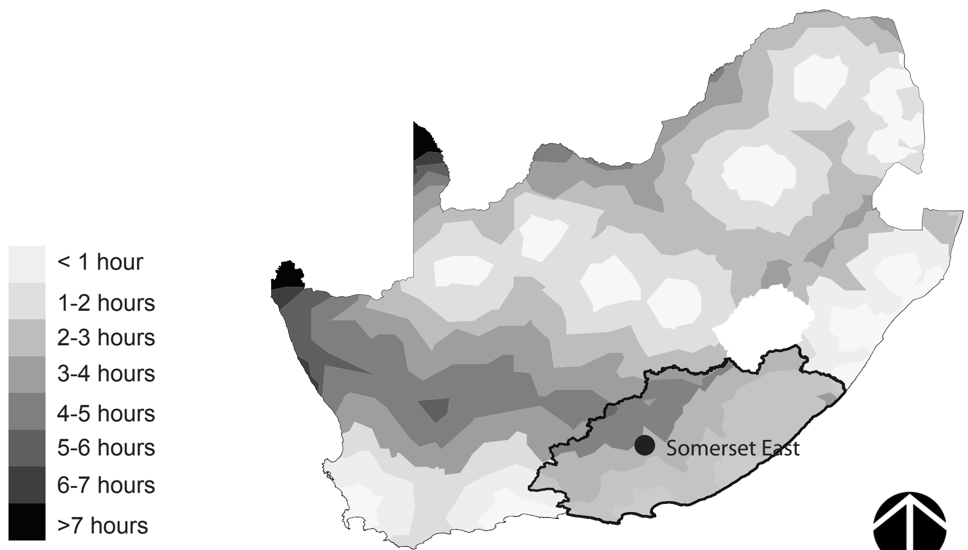
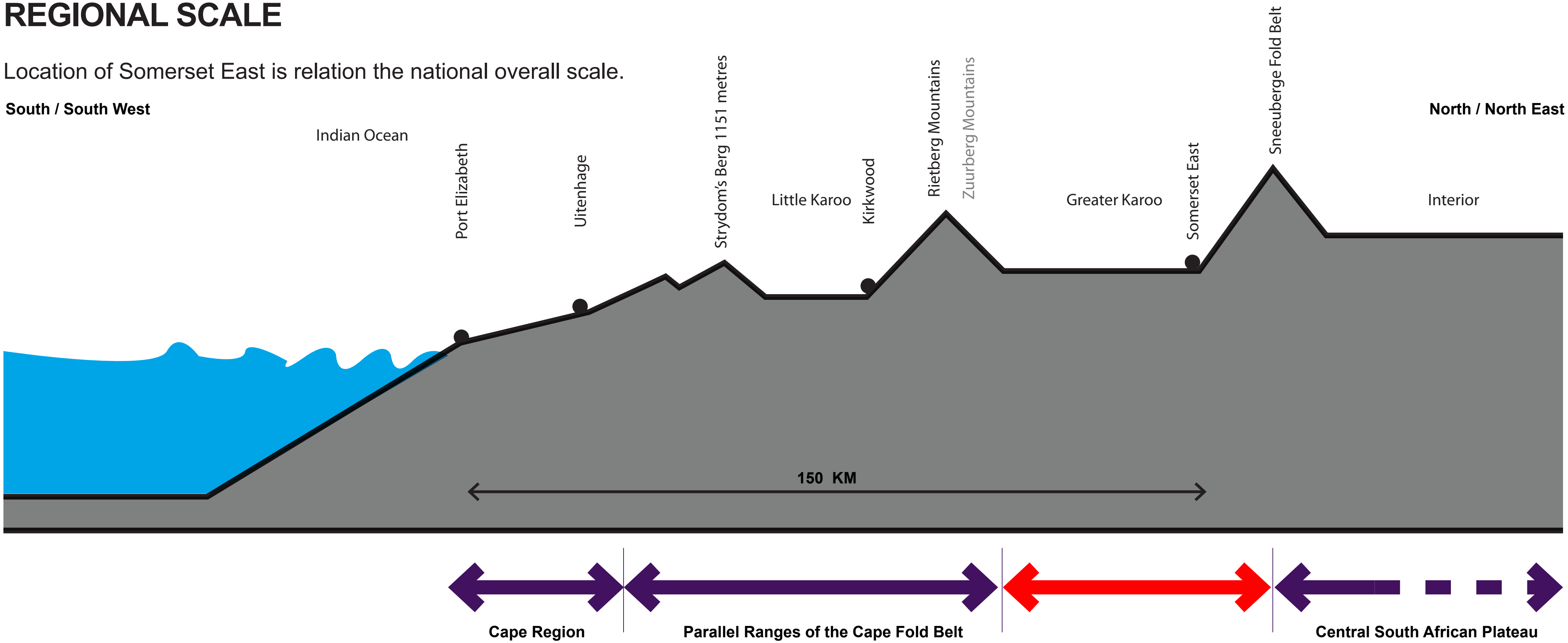


Figure 2.4 Connectivity: travel times by road to nearest airport with scheduled passenger service. (Ctnguy, 2015)

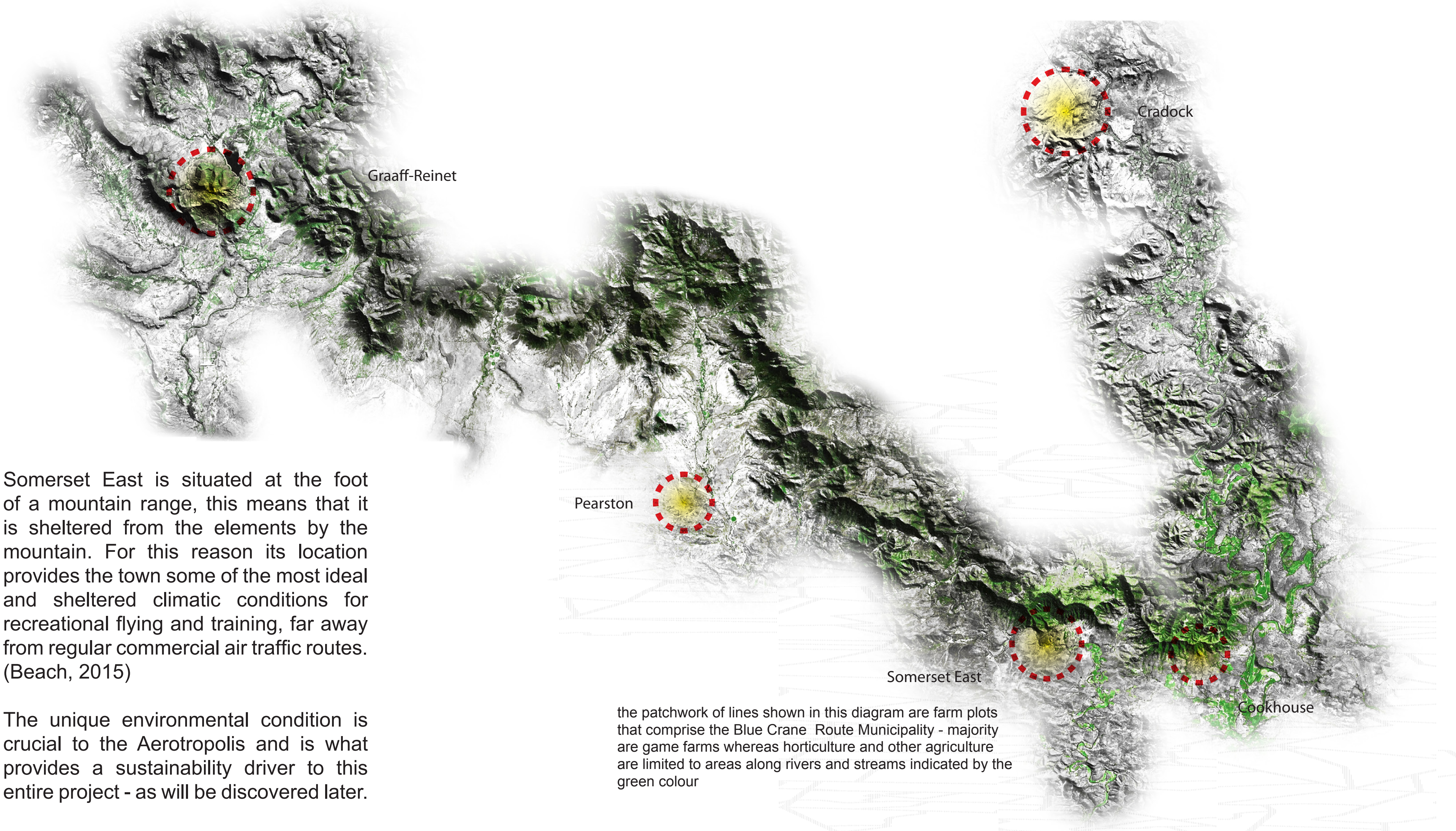
REGIONAL SCALE

Location of Somerset East is relation the national overall scale.



Central South African Plateau from areas located south of the parallel moutain reanges of the Cape Fold Belt. To the immediate south and south-west the solid lines trace the parallel ranges of the Cape Fold Belt. Parallel ranges of the Cape Fold Belt delimit this area of interest from the interior plateau and the coastal regions; thereby giving the area a unique and diverse character hence the concentration of National Parks. The region is lowly populated and enjoys a unique character uncommon to either the Cape or the interior. Consequently, this isolated nature also means that the area is left behind technologically and; thus a concerted effort needs to be made to bring it greater connectivity and inclusion along with the greater Port Elizabeth.

Figure 2.5 Cross-regional section depicting land structure. (Karihindi, 2015)



Somerset East is situated at the foot of a mountain range, this means that it is sheltered from the elements by the mountain. For this reason its location provides the town some of the most ideal and sheltered climatic conditions for recreational flying and training, far away from regular commercial air traffic routes. (Beach, 2015)

The unique environmental condition is crucial to the Aerotropolis and is what provides a sustainability driver to this entire project - as will be discovered later.

Figure 2.6 Natural structuring elements at regional scale. (Karihindi, 2015)

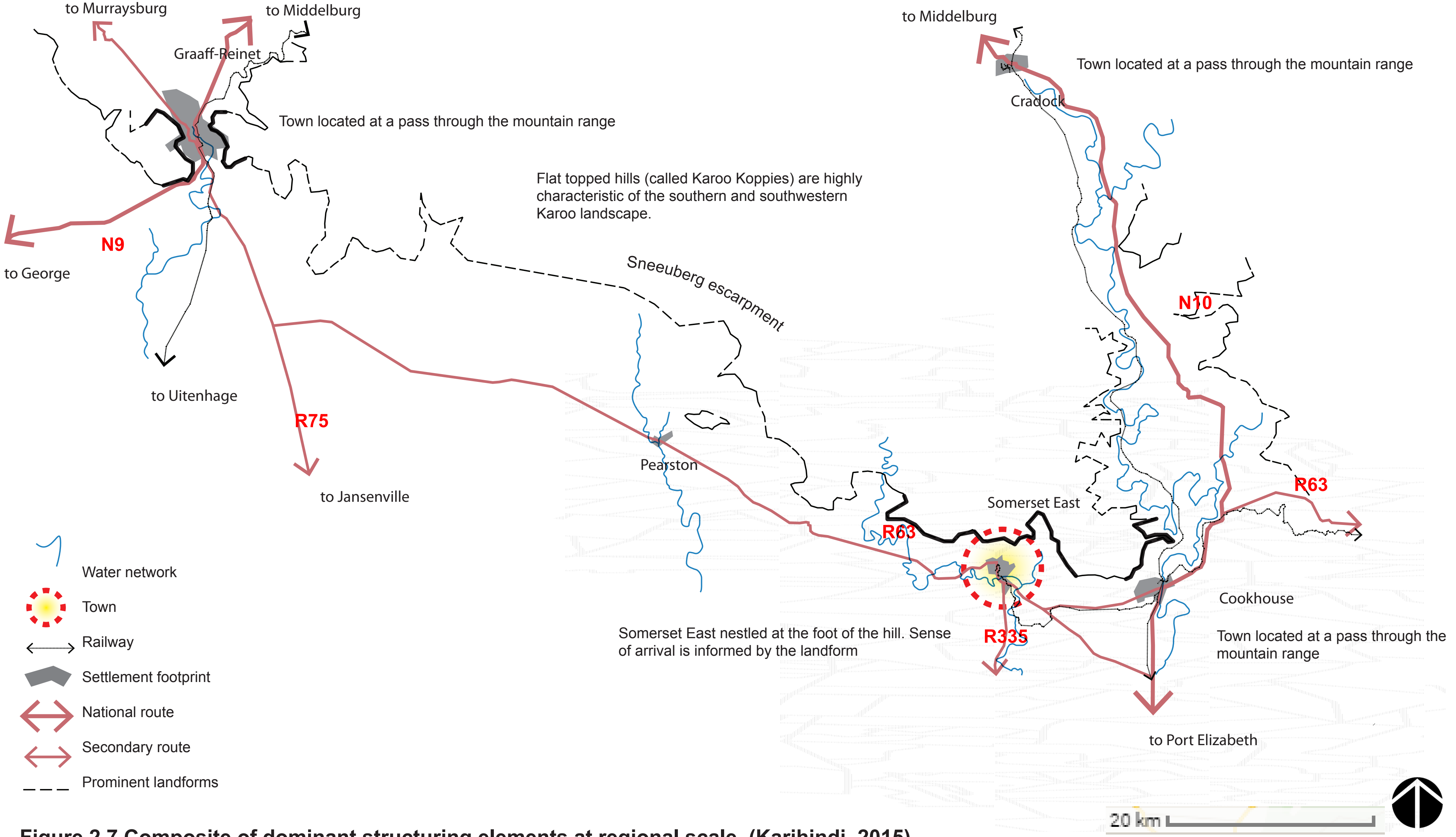


Figure 2.7 Composite of dominant structuring elements at regional scale. (Karihindi, 2015)

NATURE OF THE PROBLEM AT NATIONAL AND REGIONAL SCALE.

As previously realised in the goals of the town developmental agency it is clear to see that Somerset East is a very ambitious town that though being in one of South Africa's most pristine tourists environments of South Africa, it still remains relatively isolated from its main core of Port Elizabeth.

This creates the need for enabling architecture or an urban framework development plan that makes it a player in the economy for the Eastern Cape and that brings it more inclusion, connectivity and recognition as a pole town.

Scheduled flight routes bypass the region of Somerset East although it has more than the potential to be a major regional tourist destination because its locality.

Figure 2.8 Strategic Location and Connectivity Map: Somerset East's relationship to surrounding towns and it's strategic location close to several National Parks Areas which are attractive and highly frequented by the local and international tourists. (Karihindi, 2015)

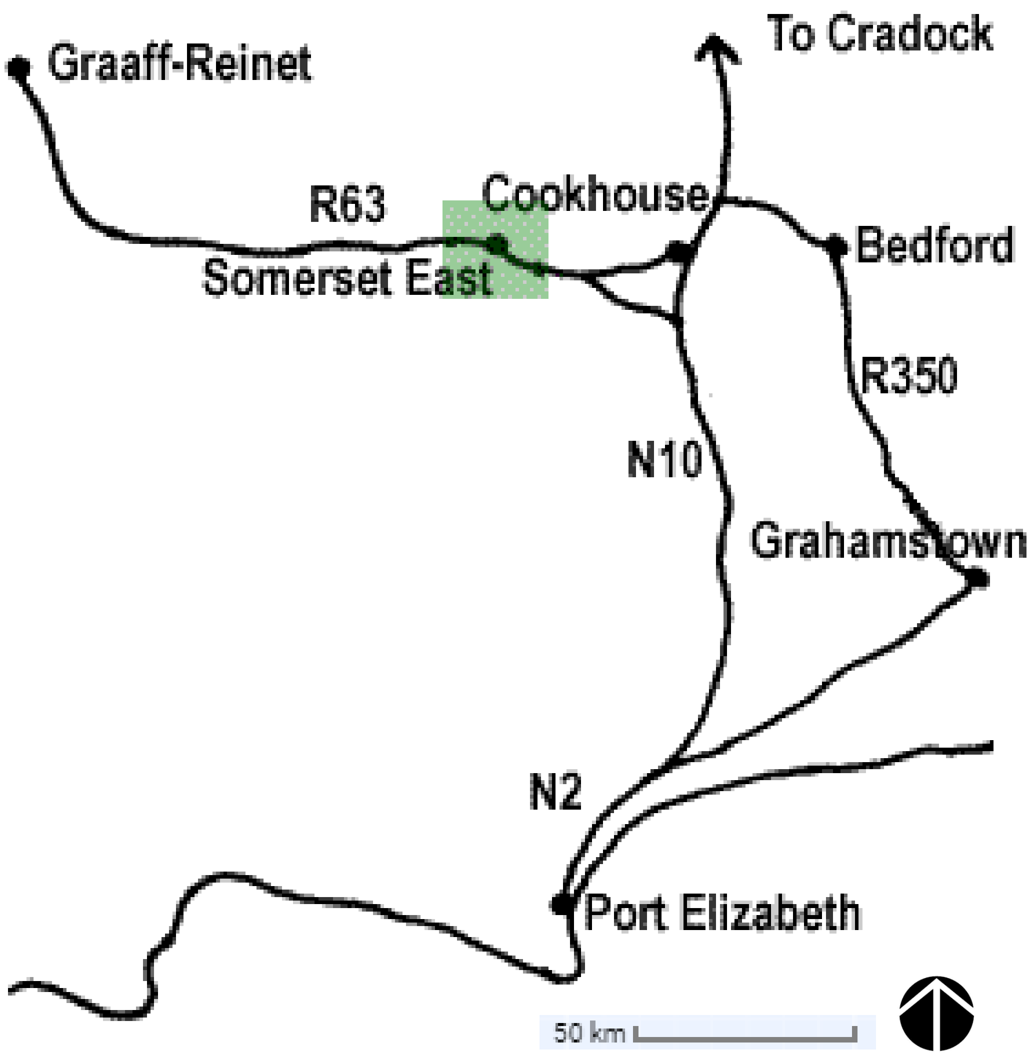


Figure 2.9 Connectivity Map: Somerset East's to Port Elizabeth. (Karihindi, 2015)

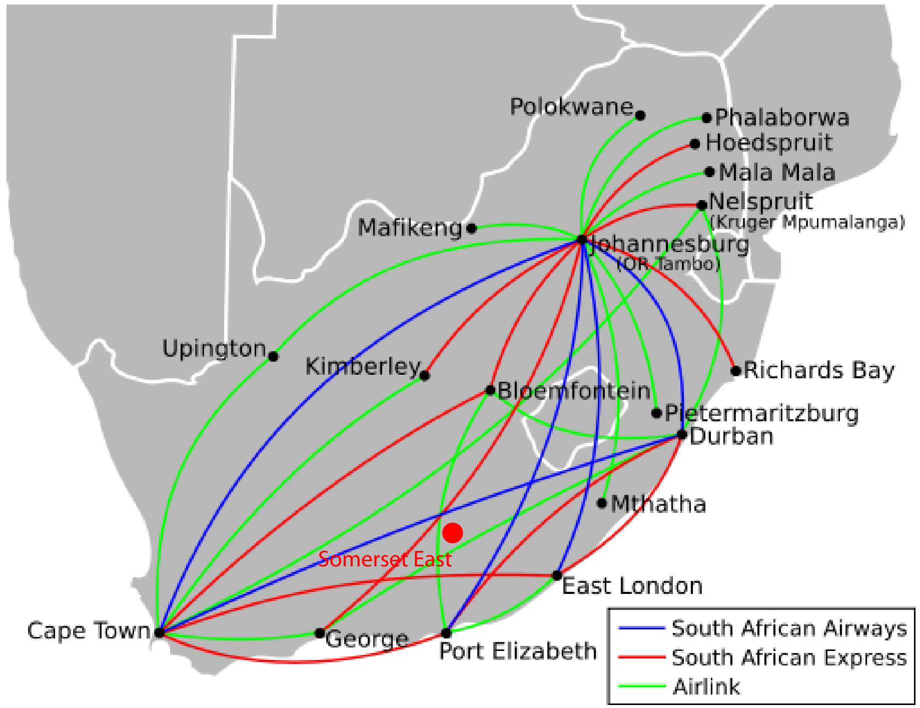


Figure 2.10 Somerset East In relation to scheduled commercial flight routes connections in South Africa. (2009)

CONCLUSIONS

Owing to accessibility as a major issue for the town, an aspect of the resultant building program (aeronautical terminal facility) ought to act as a 'gateway' to the region overcoming space and time because of it's would be first point of contact for any outsider to the region. Any architectural tectonic response to this context ought to respond sensitively to the environment and where possible aim be as sustainable as possible in respect of the natural environment.

URBAN MAPPING AND SPATIAL FRAMEWORK DEVELOPMENT

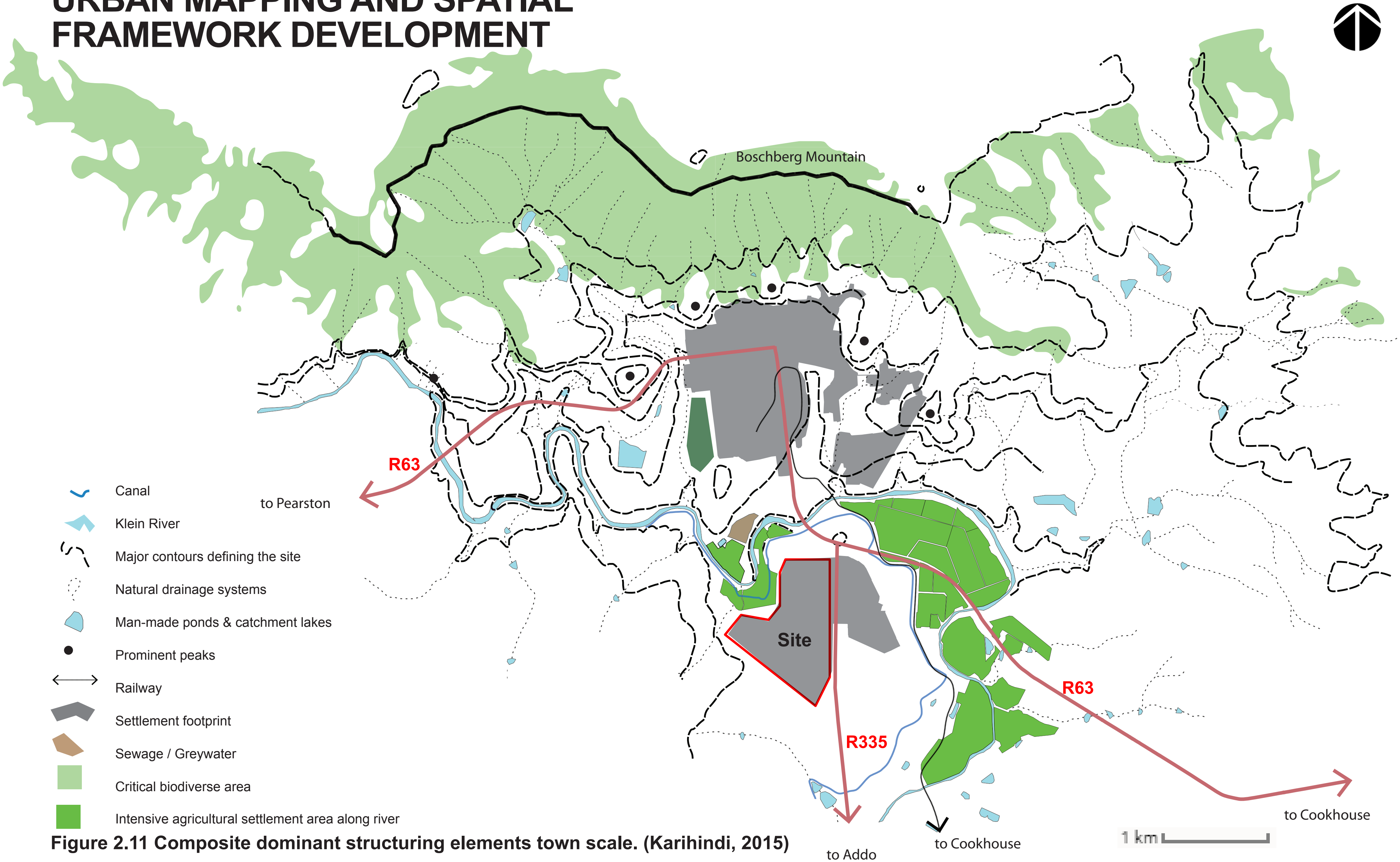


Figure 2.11 Composite dominant structuring elements town scale. (Karihindi, 2015)

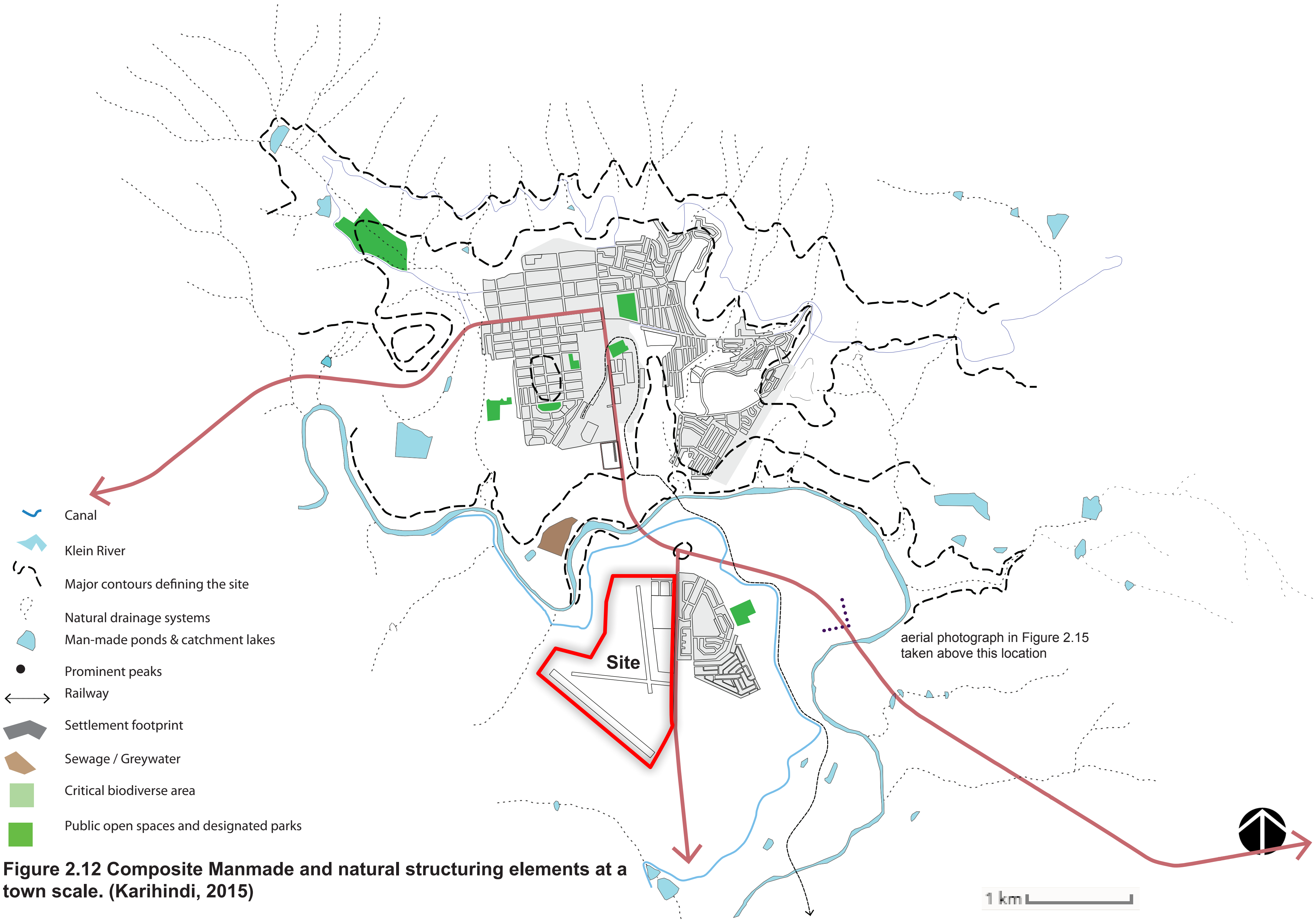
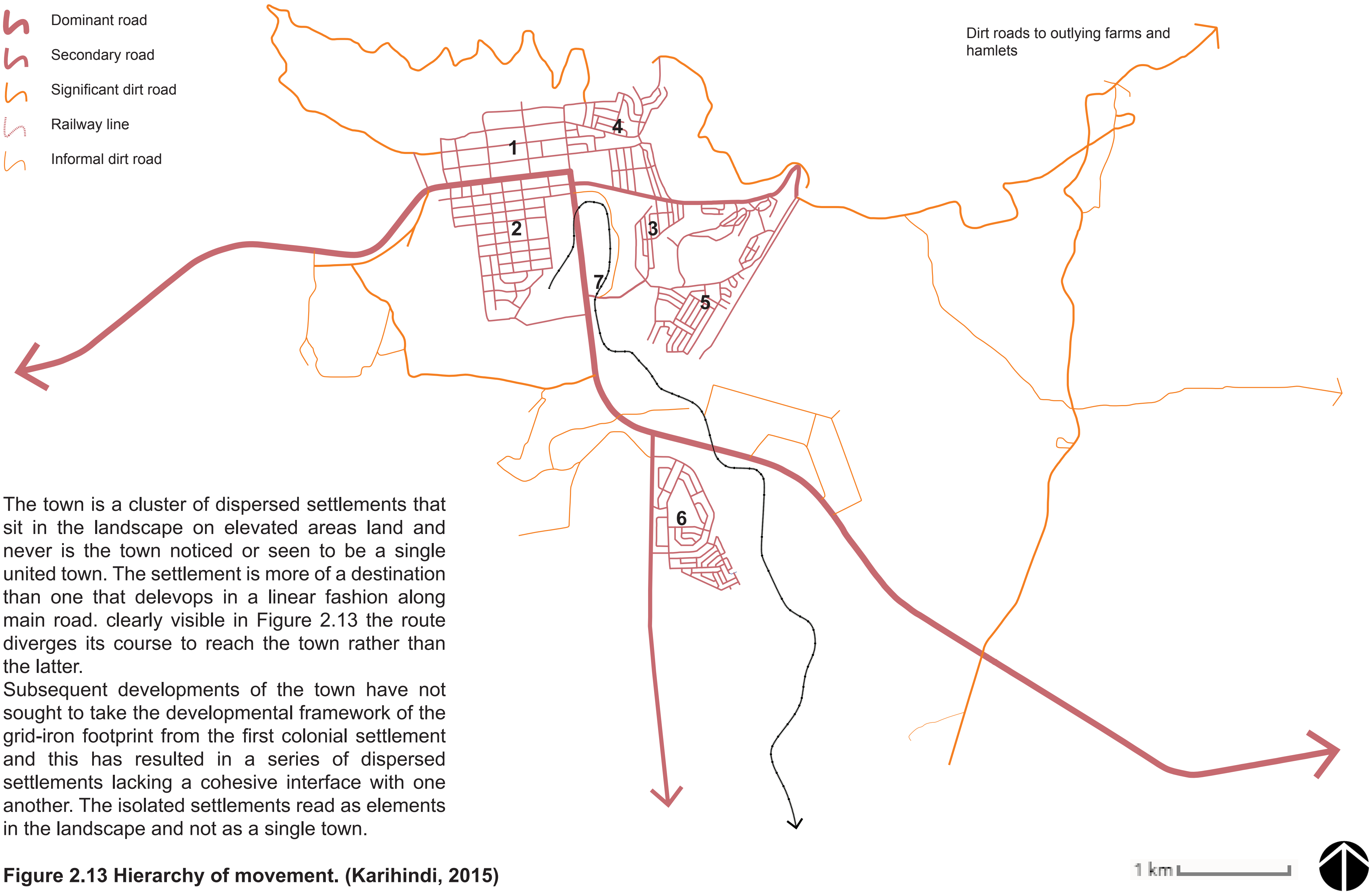
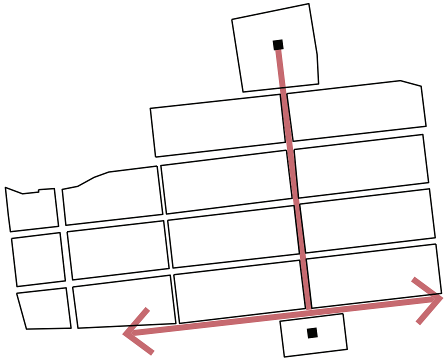


Figure 2.12 Composite Manmade and natural structuring elements at a town scale. (Karihindi, 2015)



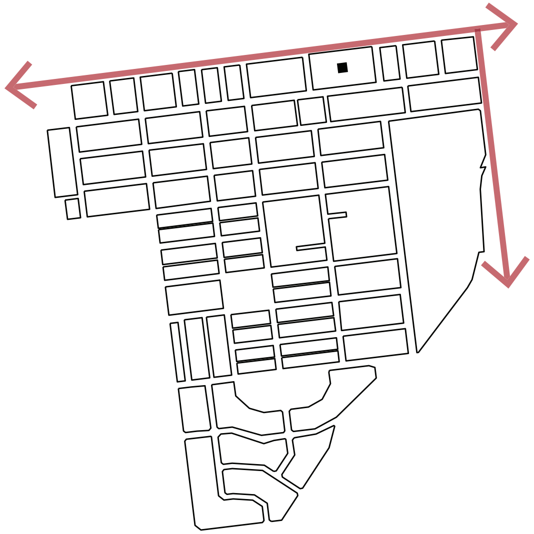
The town is a cluster of dispersed settlements that sit in the landscape on elevated areas land and never is the town noticed or seen to be a single united town. The settlement is more of a destination than one that delevops in a linear fashion along main road. clearly visible in Figure 2.13 the route diverges its course to reach the town rather than the latter.
Subsequent developments of the town have not sought to take the developmental framework of the grid-iron footprint from the first colonial settlement and this has resulted in a series of dispersed settlements lacking a cohesive interface with one another. The isolated settlements read as elements in the landscape and not as a single town.

Figure 2.13 Hierarchy of movement. (Karihindi, 2015)



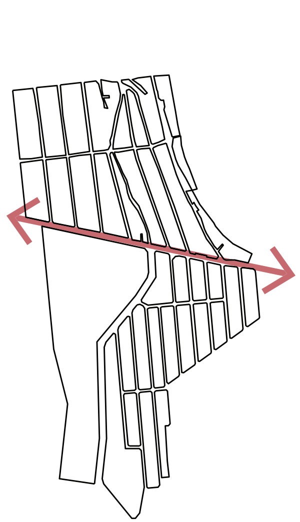
1. Strong sense of spatial hierarchy defined by main axis

Town planned as orthogonal grid layout.
No regard for topography.



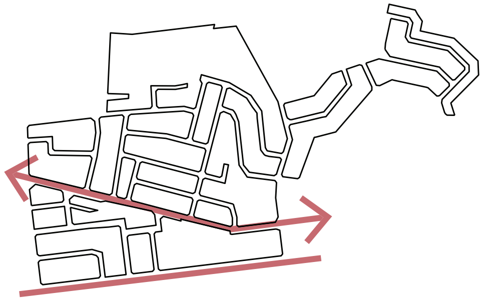
2. Propagation of grid iron on subsequent layout of town.

Low density

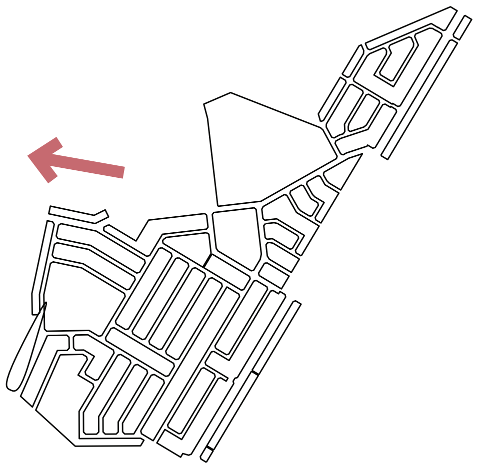


3. Grid-iron superimposed on topography with historic route running through.

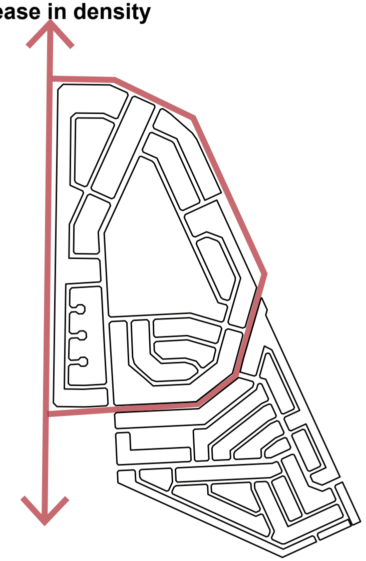
Increase in density



4. Layout generated by topography

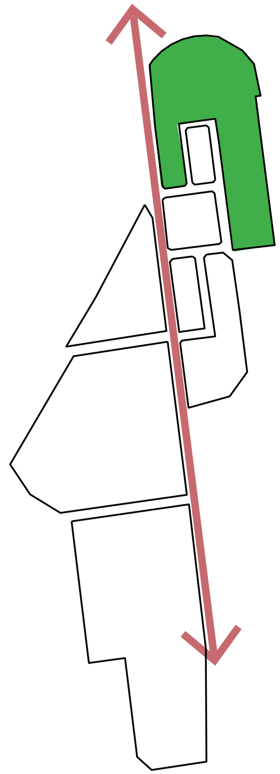


5. Enclave / nucleated and contain limited activities layout



6. Enclave / nucleated with limited activities

No sense of spatial hierarchy



7. The industrial precinct is planned as an area resultant and infill in nature of all other settlements.

this area is now the most average centre for the town that is located close to nearly all other settlement of Somerset East.

Figure 2.14 Settlement typology (not to scale). (Karihindi, 2015)


Figure 2.15 Aerial view of Somerset East from the air. (2014)

URBAN PROBLEM

In addition to being isolated from main transport networks and other urban settlements Somerset East is fragmented in its urban make up. The historic Core of Somerset East from which the town grew is of a generous grid-iron spatial layout. However, subsequent growth developments of the town have resulted in a sporadic and altogether different morphology of town layout of isolated enclaves with poor permeability and connectivity in stark contrast to the Historic Core. (See Figure 1.3 and Figure 2.12 -2.14)

This is realised in the outlying settlements that are disconnected, not only by lack of suitable developable land next to the historic core (a valley in this case), but also by poor town planning; an area resultant that accentuates the spatial divide is a spine of industrial zoned land situated between the historic town core and it's several outlying residential suburbs of an enclave nature. The area of land now sits as the average geographical centre for the entire town with its outlying settlements. It runs from North to South defined on either side by; 1) the R63 which is the main route into town from the South 2) a now disused railway track that snakes it's way into the old town cutting off the cohesiveness of the entire town, and 3) a valley.

Upon investigation a new Spatial Framework for Somerset East was arrived at which in essence did the following things:

1. Removed the existing disused railway system from the town centre and relocated it South of the Klein River towards the airport in light of promoting the 'Aerotropolis' (Kasarda, 2011) model for Somerset East Airport as mixed mode transport interchange. This step also involved relocating the heavy industries to the airport precinct.
2. Reconfigured the layout of the land with whilst maintaining as much of the built fabric as possible in order to improve access.
3. Concerted development efforts of the town into this narrow underutilised area of land with view of densifying the area; developing it as a modulated yet adaptable grid-iron Mixed Use Commercial and Medium Density Residential Zone with some Civic functions anchored at the South of the spine in a bid generate an activity corridor, with intermittent public spaces, along Route 63 into which other disconnected outlying settlements can be connected to; Thereby addressing the issue of Permeability and Connectivity suffered by the urban context.

Work supporting the urban proposal follows on from here till the end of this chapter.

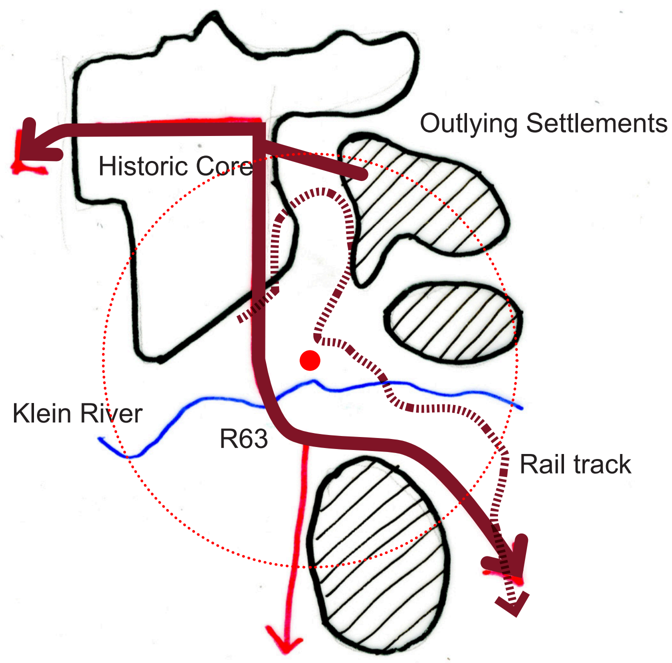


Figure 2.16 Historic Core and outlying enclave settlements systems. (Karihindi, 2015)

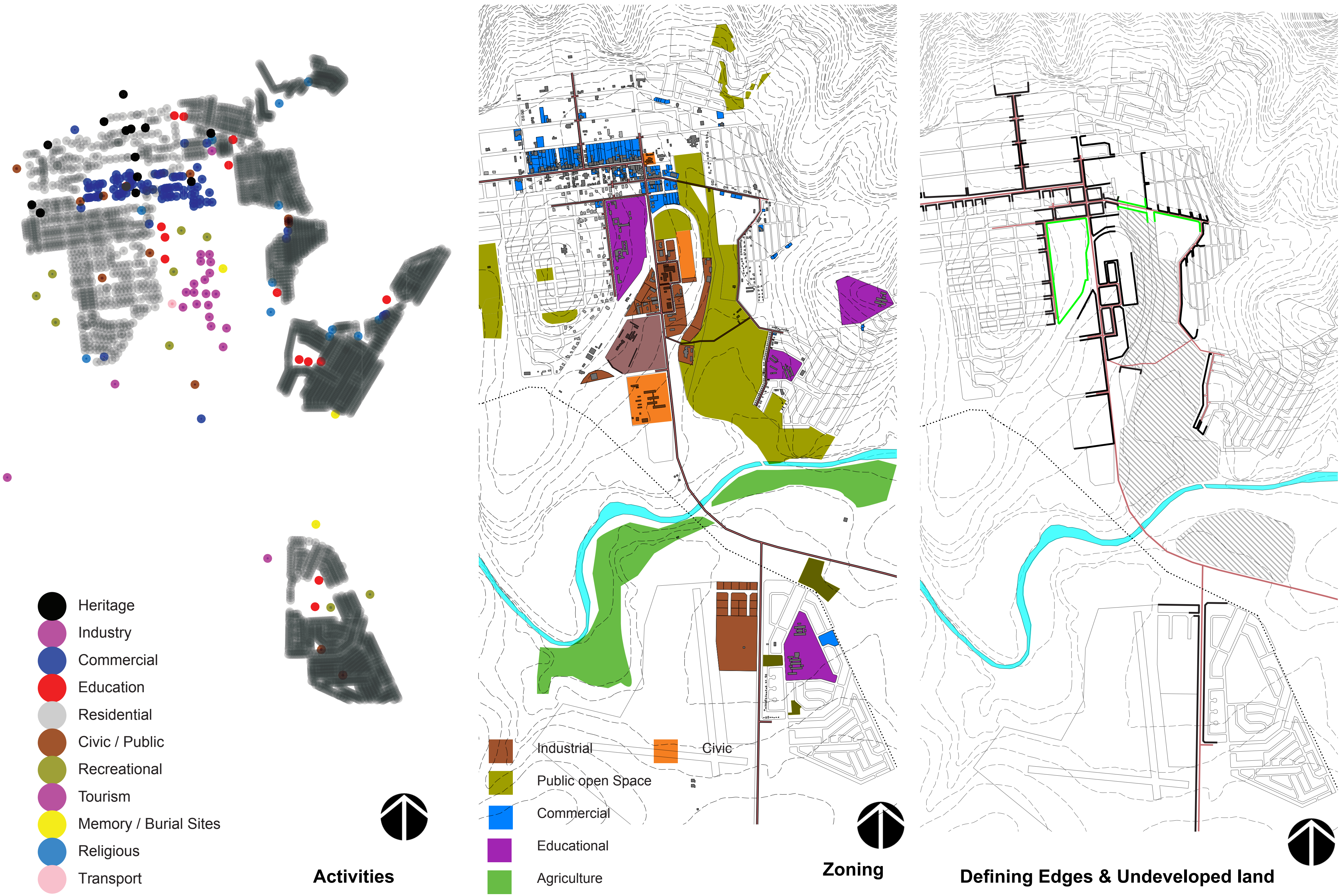
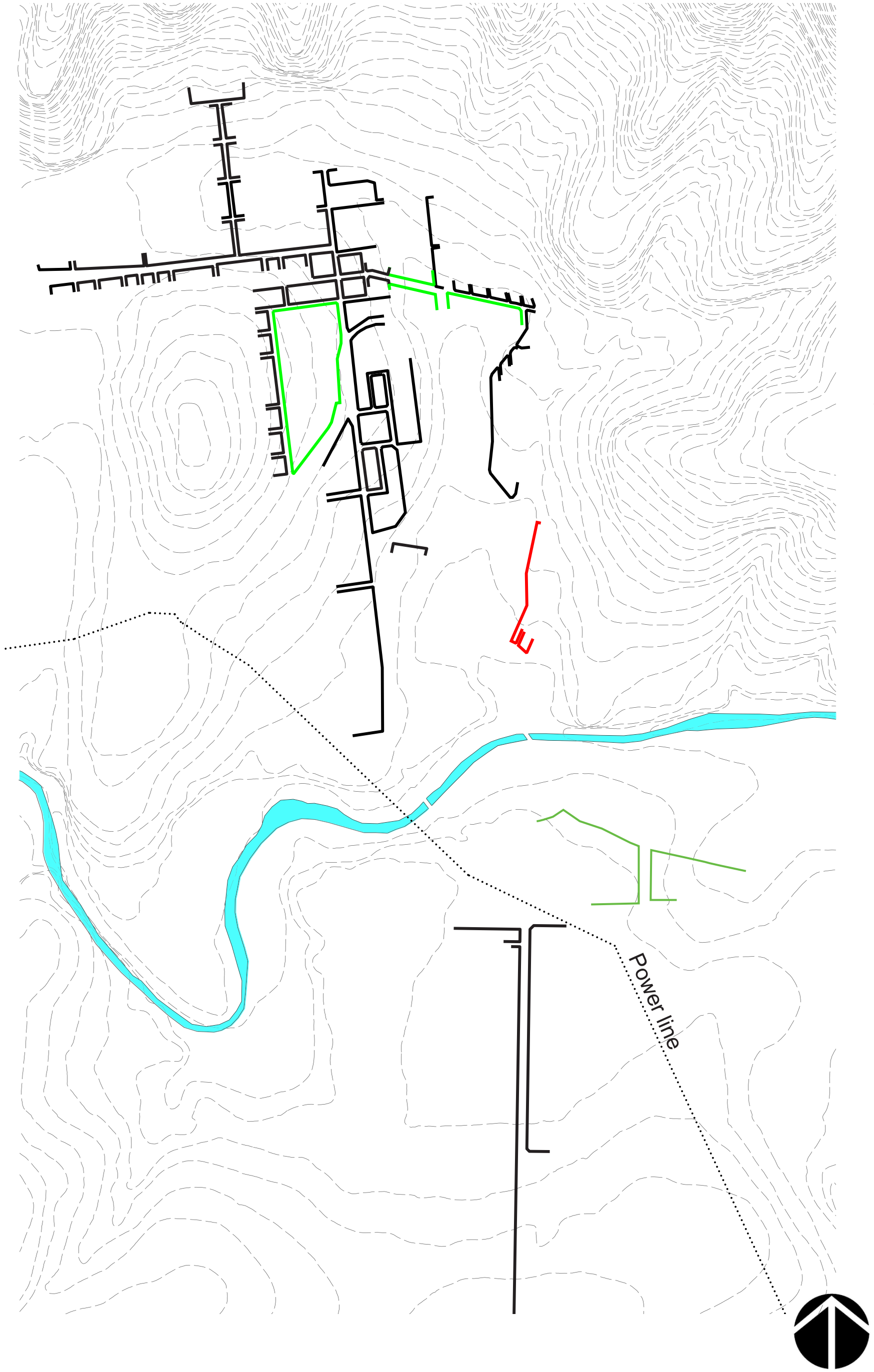


Figure 2.17 Interpretative mapping (not to scale). (Karihindi, 2015)



Built Edges

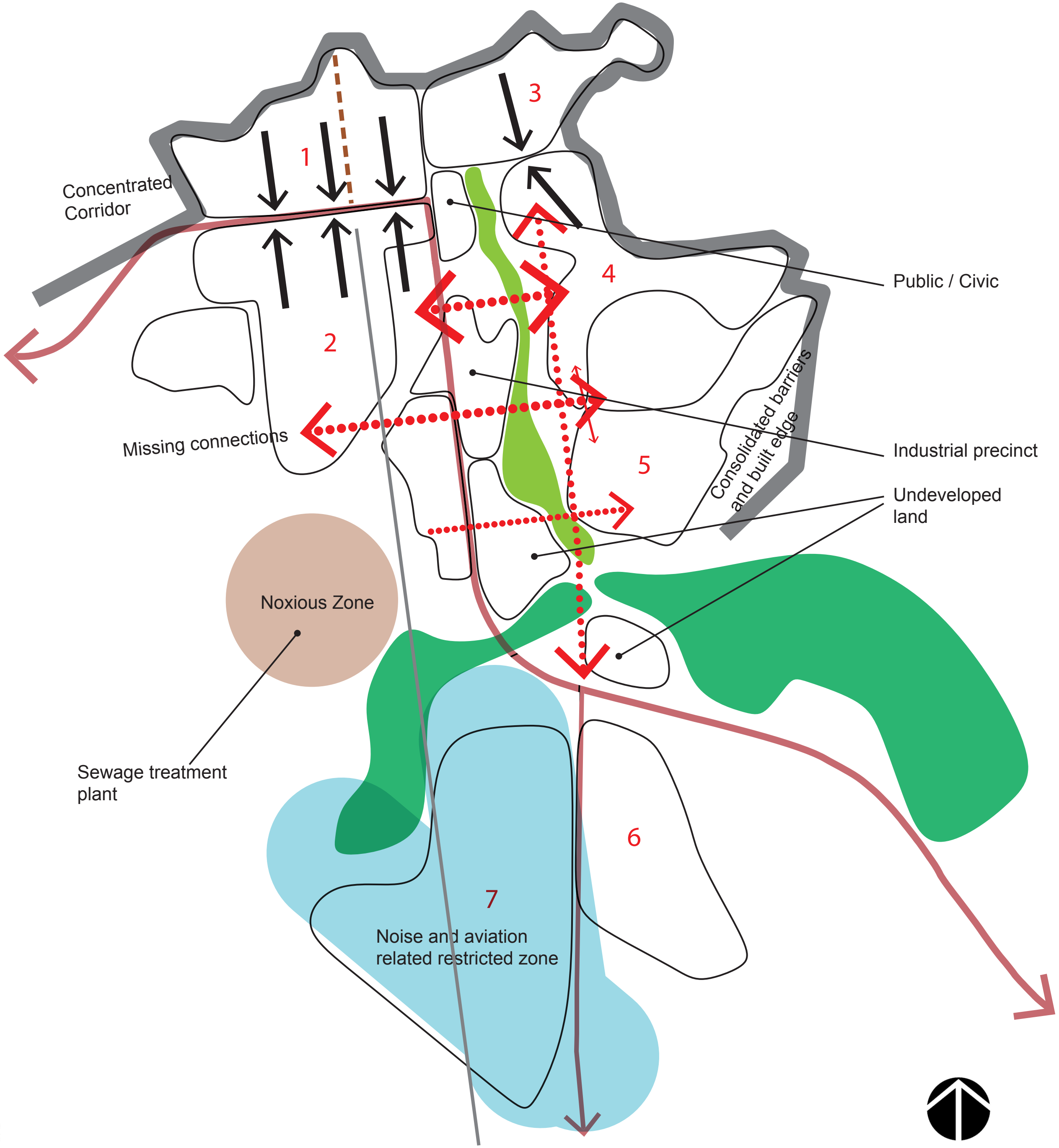


Figure 2.18 Diagrammatic interpretation structuring elements at town scale. (Karihindi, 2015)

Figure 2.19 Aerial photograph with central underutilised area indicated. (Google, 2015)

Figure 2.20 Close-up of precinct with built structures overlaid. (Google, 2015)

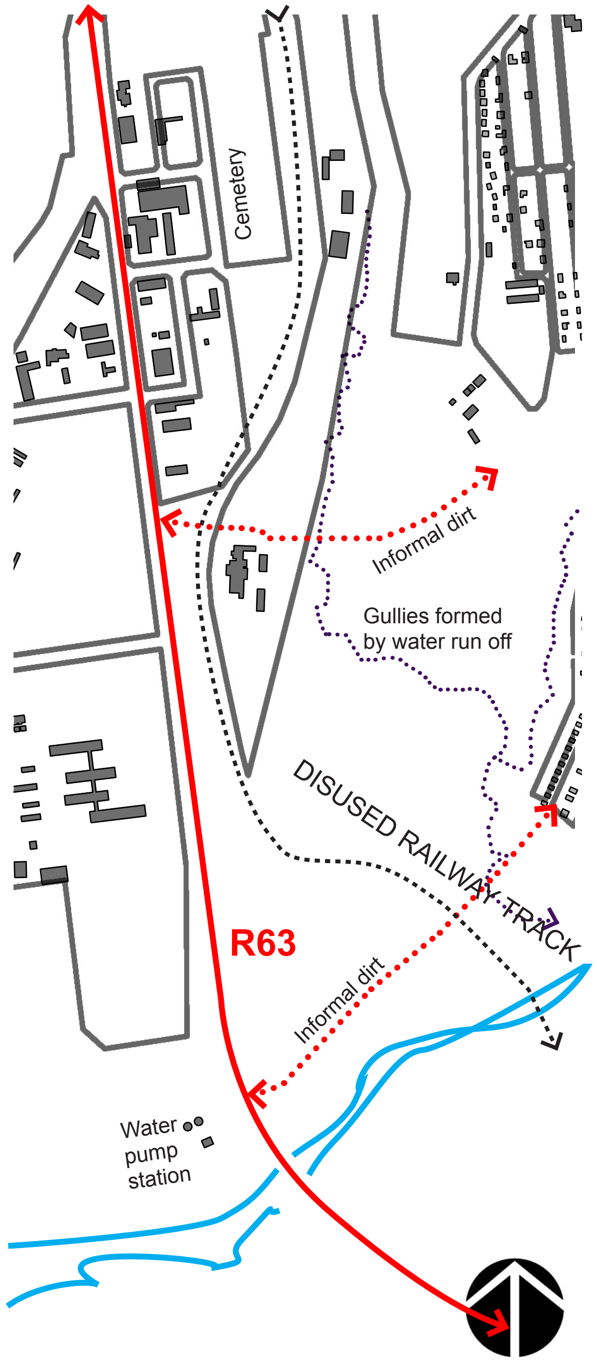
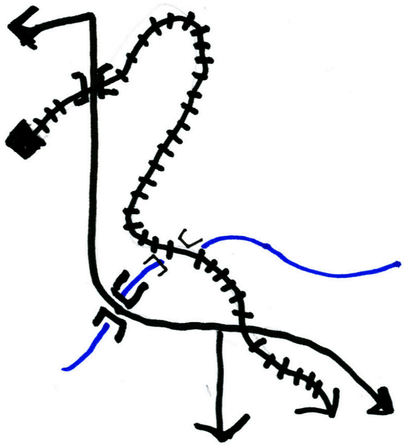
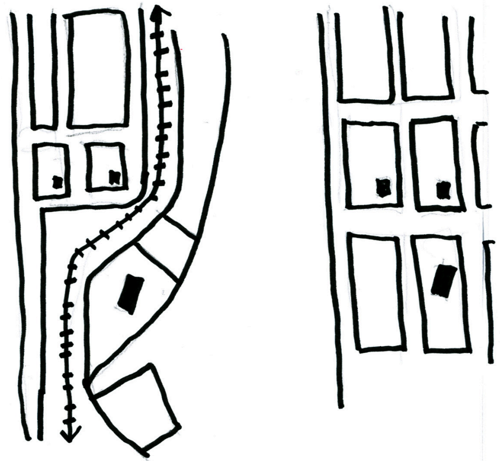


Figure 2.21 Diagram of the same. (Karihindi, 2015)

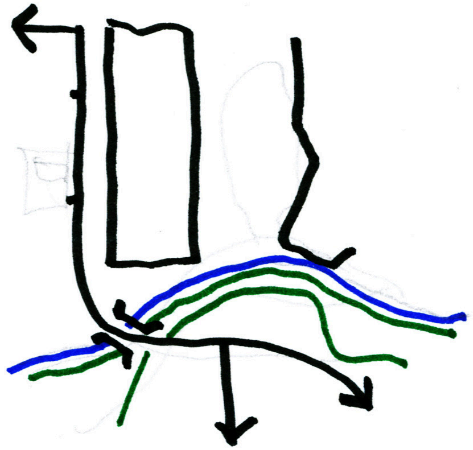
Disused railway infrastructure to be moved to free up land for development thereby integrating the disjointed town and creating a new equally accessible transportation node and gateway south of the river



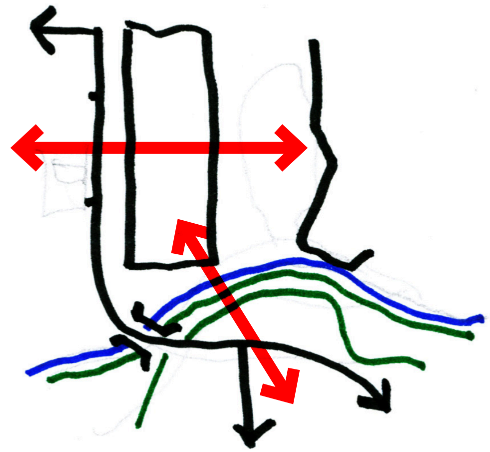
Redefine traditional industrial precinct layout into a more permeable configuration whilst retaining as much built fabric as possible

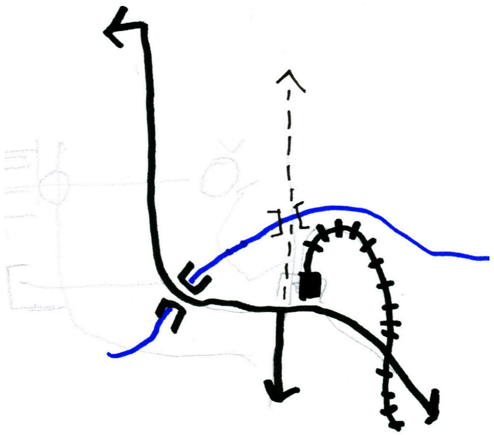


Extend the green system into the main urban centre of Somerset East. Potential for urban agriculture to be introduced to the low lying area valley of the town.

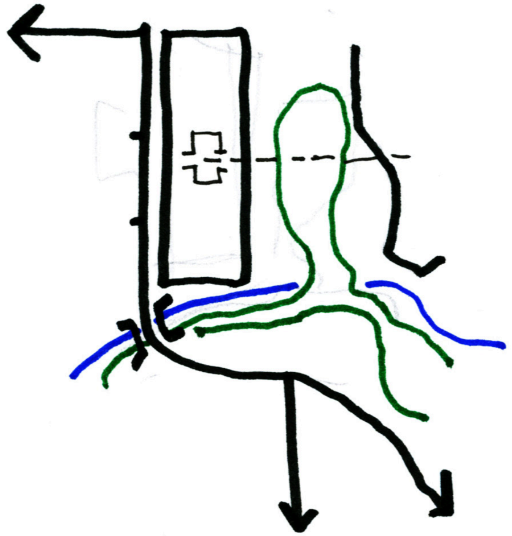


New East - West Transport corridors to link different communities and to act as an catalyst for activity along and a new alternative route across the river





Create squares for public space



Transport corridor to link and to act as an catalyst for activity

View corridor preservation (to and from the mountain)

Figure 2.22 Framework. (Karihindi, 2015)

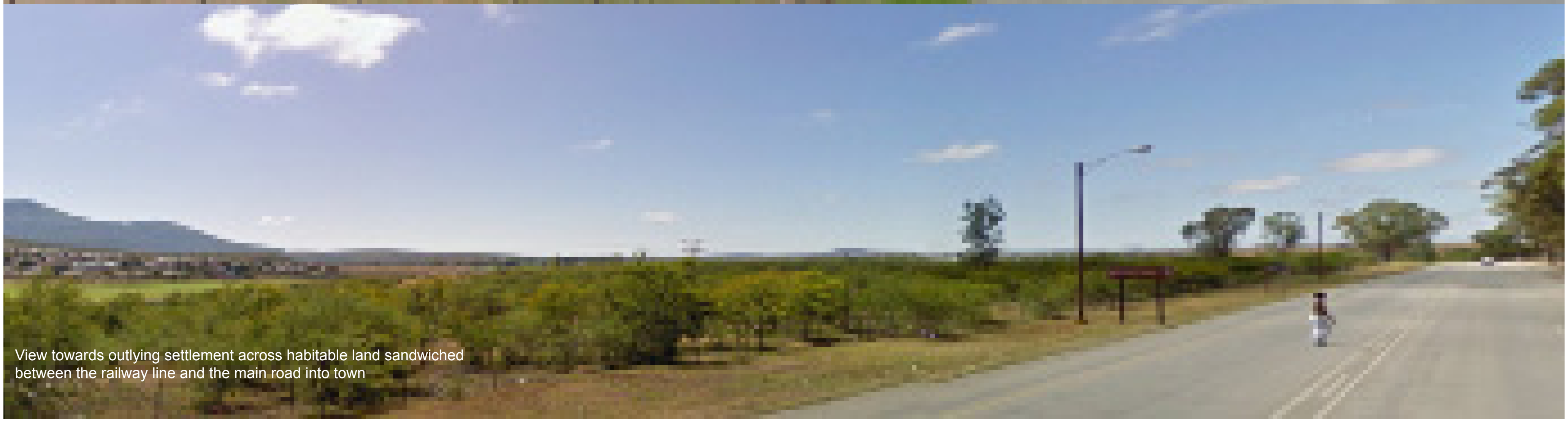
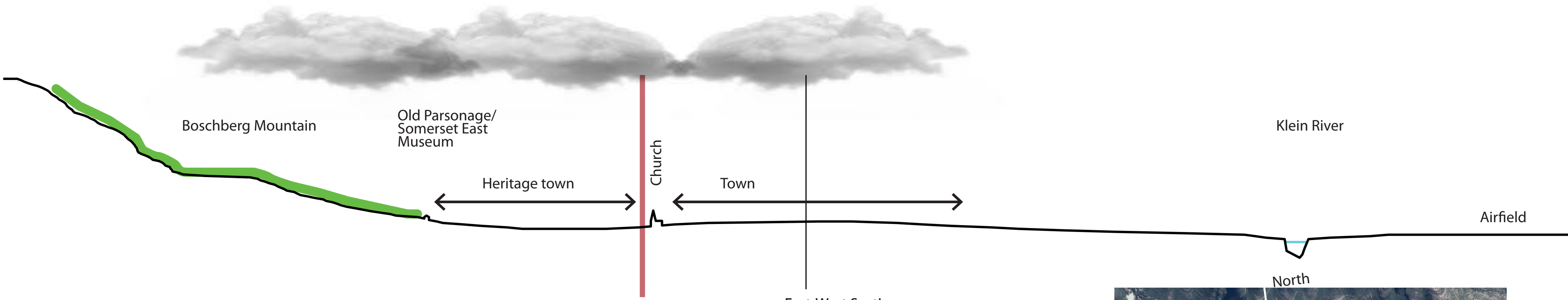
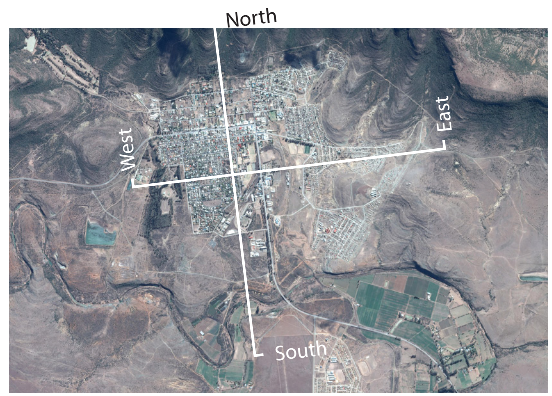


Figure 2.23 Precinct and immediate context - Looking south from R63. (Google, 2015)

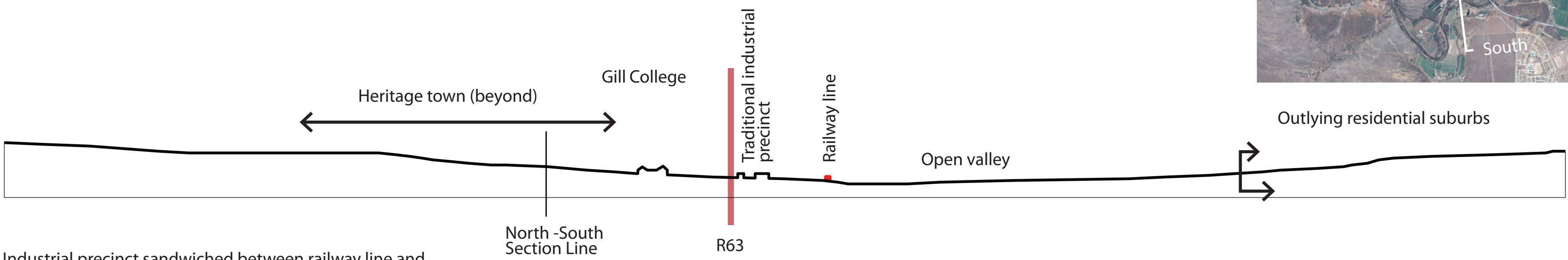


Section through town showing the lie of the land.

The historic town core situated at the foot of the hill in a shallow lying valley suitable for agriculture



North-South Section

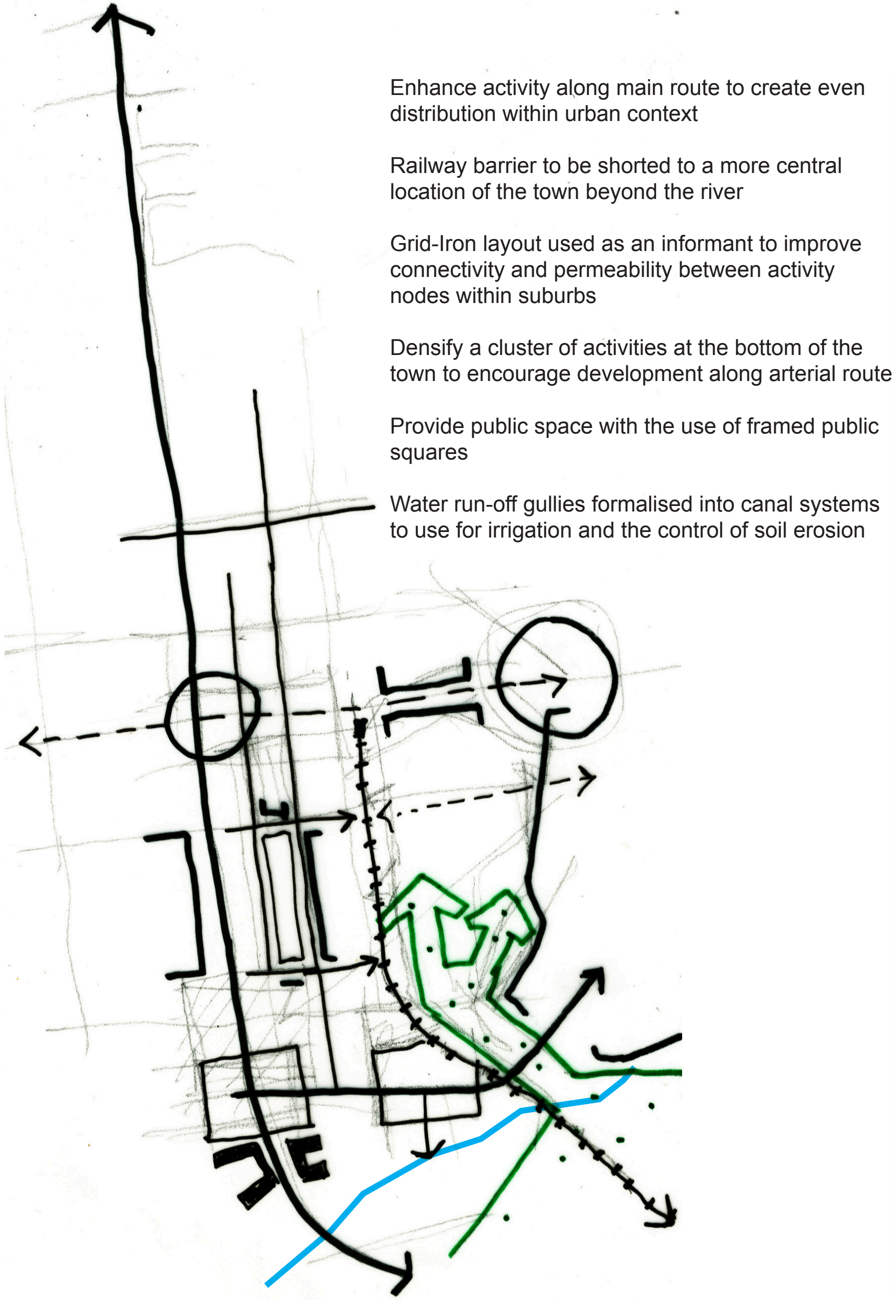


Industrial precinct sandwiched between railway line and main arterial route through Somerset East

East-West Section

Figure 2.24 Sectional Survey. (Karihindi, 2015)

URBAN CONCEPT



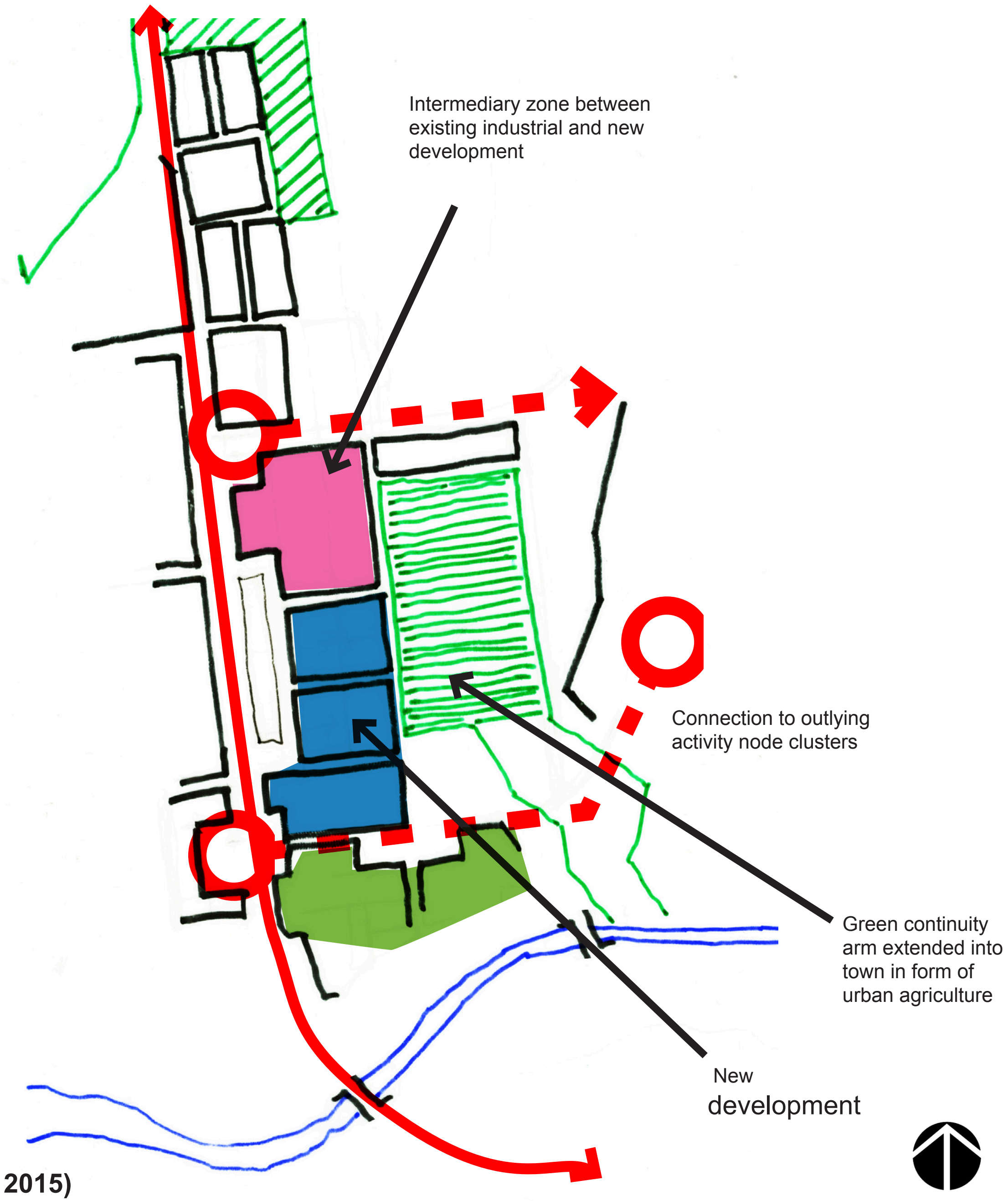


Figure 2.25 Diagrammatic representations of design ideas. (Karihindi, 2015)

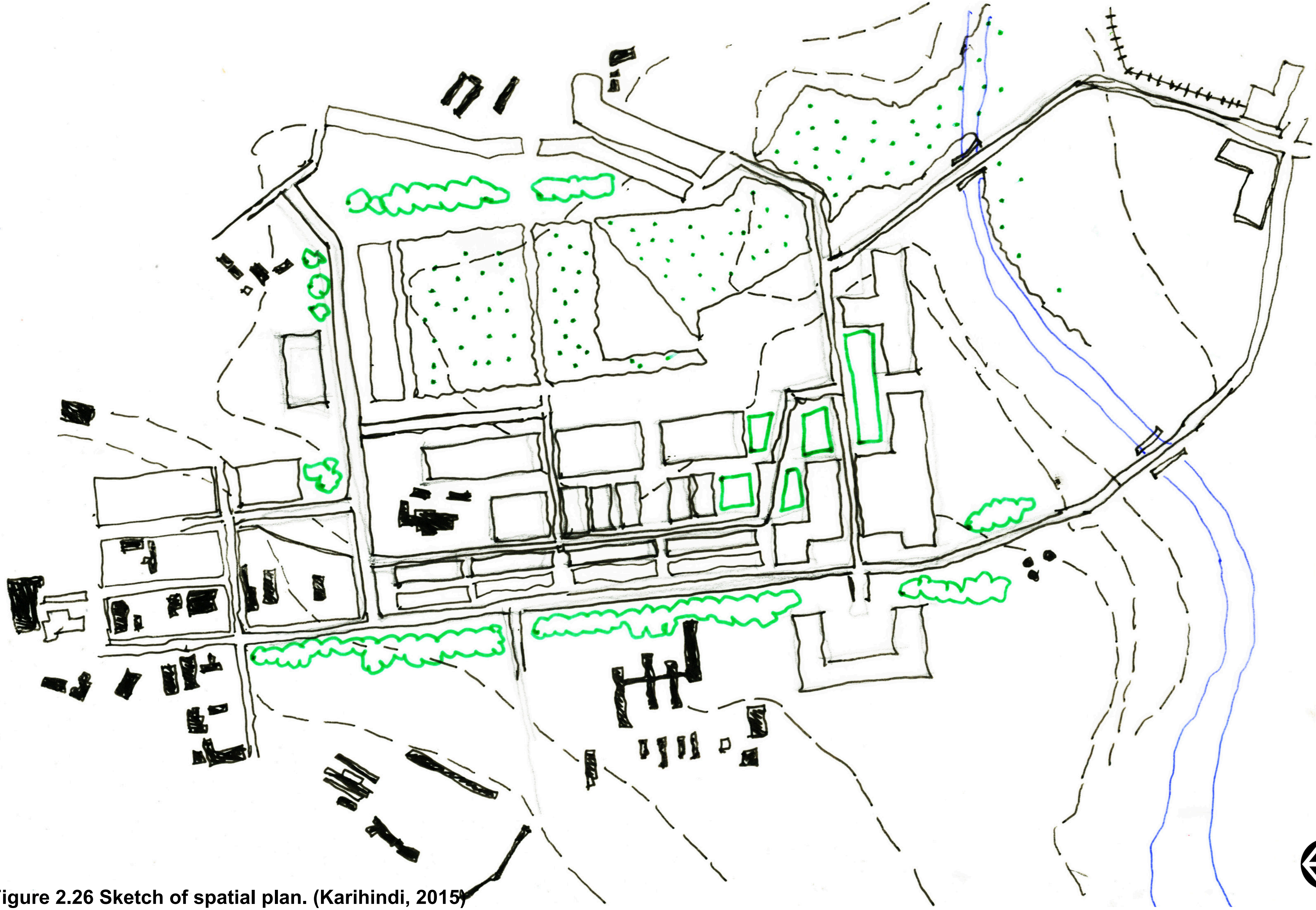


Figure 2.26 Sketch of spatial plan. (Karihindi, 2015)

VALUE STATEMENTS

Connectivity

Connecting disconnected and segregated communities is a priority in order to create a greater sense of inclusion and bringing wholesomeness to the town.

Activity Corridor Encouragement

Propagating activity along an arterial route into town by anchoring mixed, public and commercial functions at the beginning of the town such that they are strategically equidistant from all suburbs that make up Somerset East.

Permeability

Create opportunities where modernist inspired apartheid enclave systems of urban planning which have lead to economic, technical and social isolation can be corrected through new routes.

Economic Empowerment

Create opportunities for subsistence and commercial urban agriculture can be used to bolster impoverished communities

Public Space

Creating framed public space for public interaction.

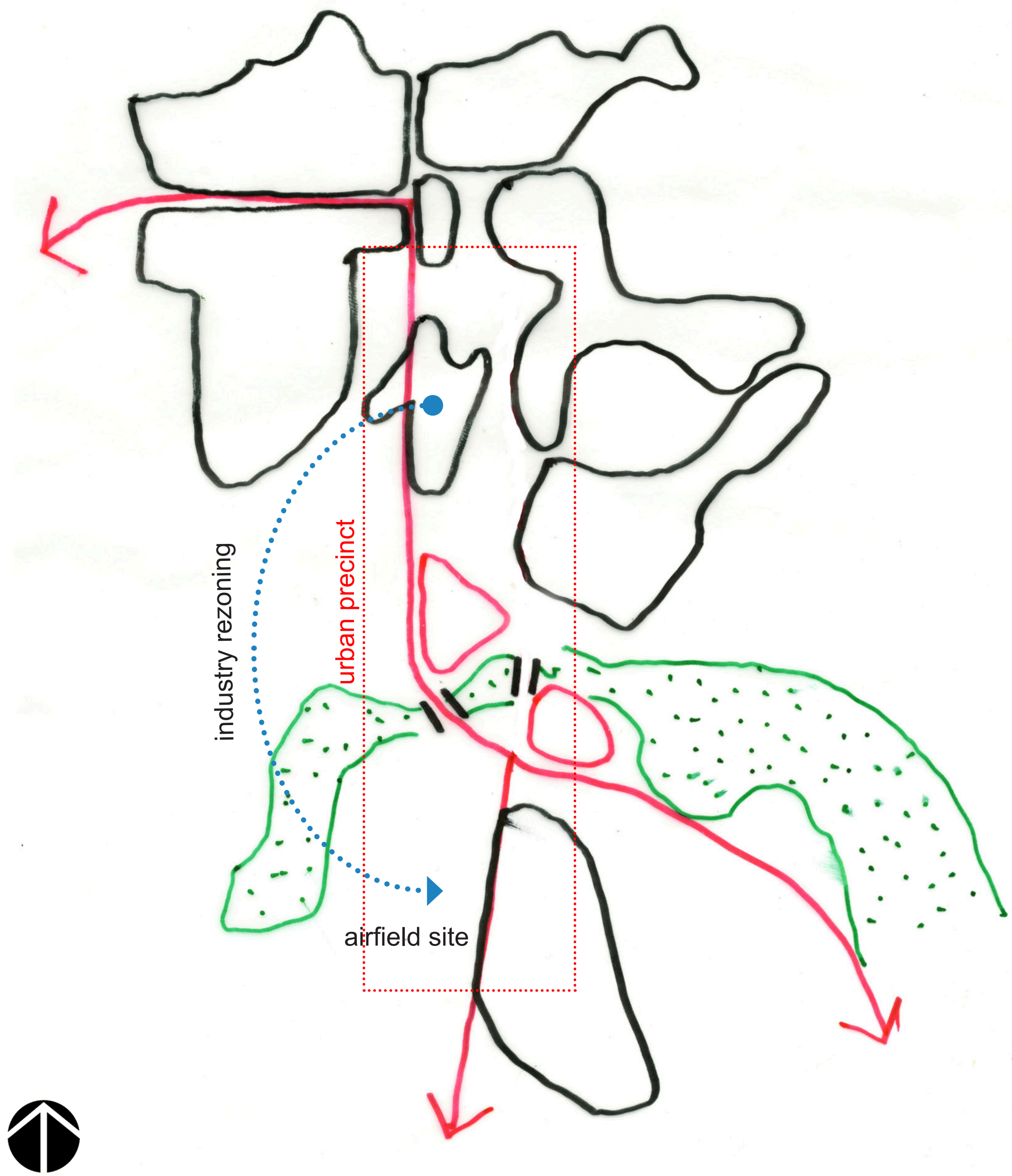
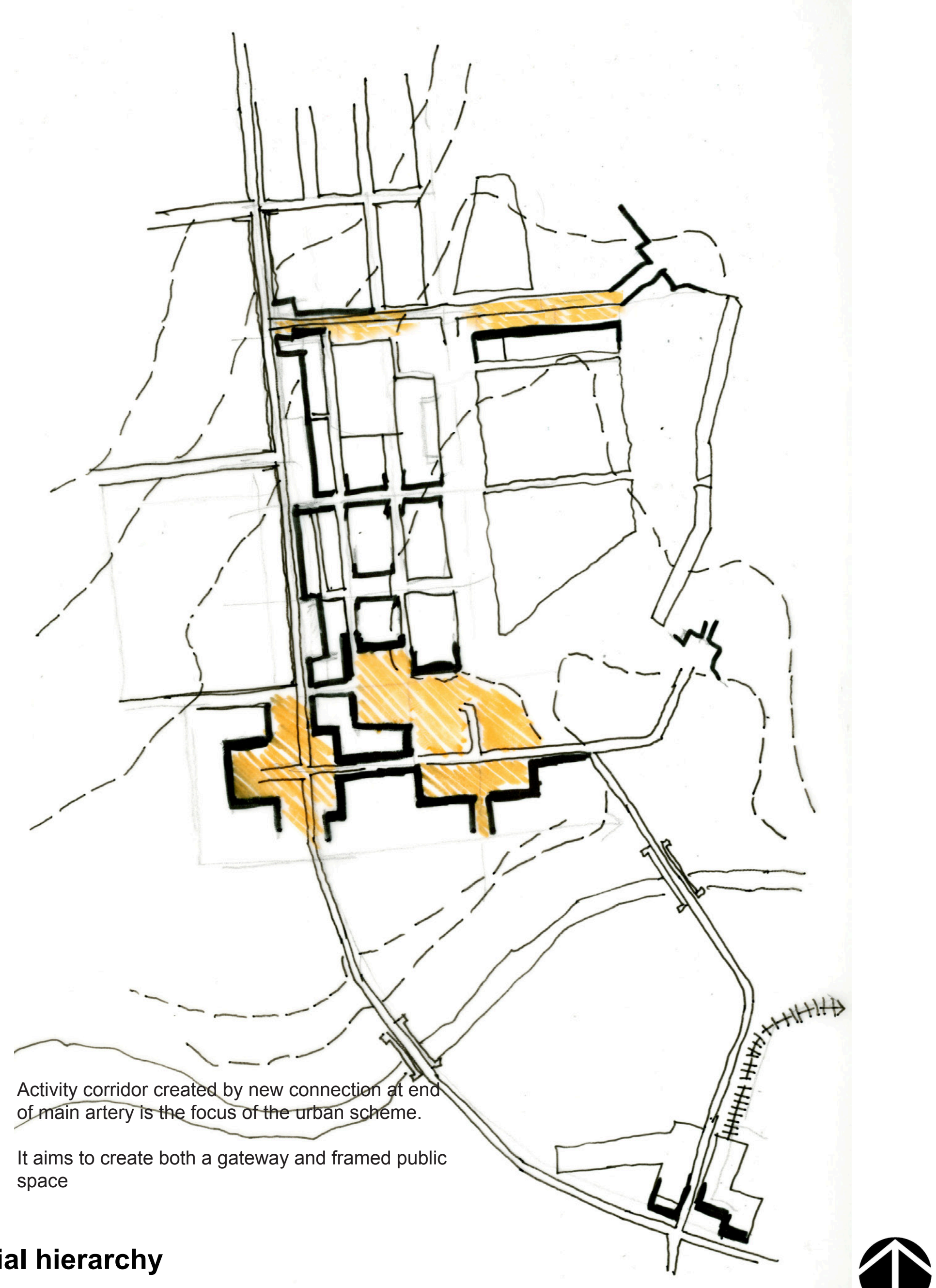
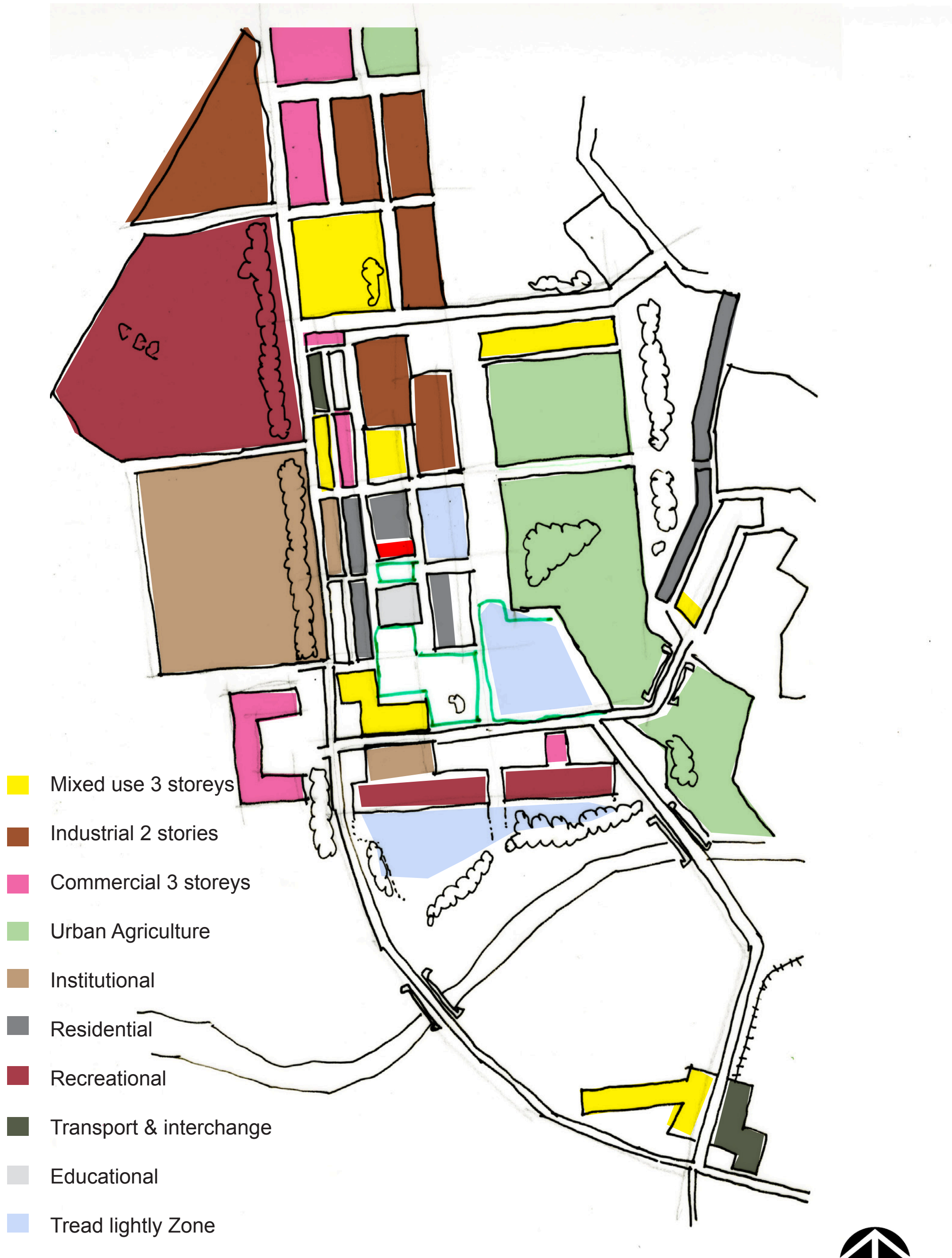


Figure 2.27 Diagrammatic representations of urban precinct. (Karihindi, 2015)

DESIGN STRUCTURE PRINCIPLES

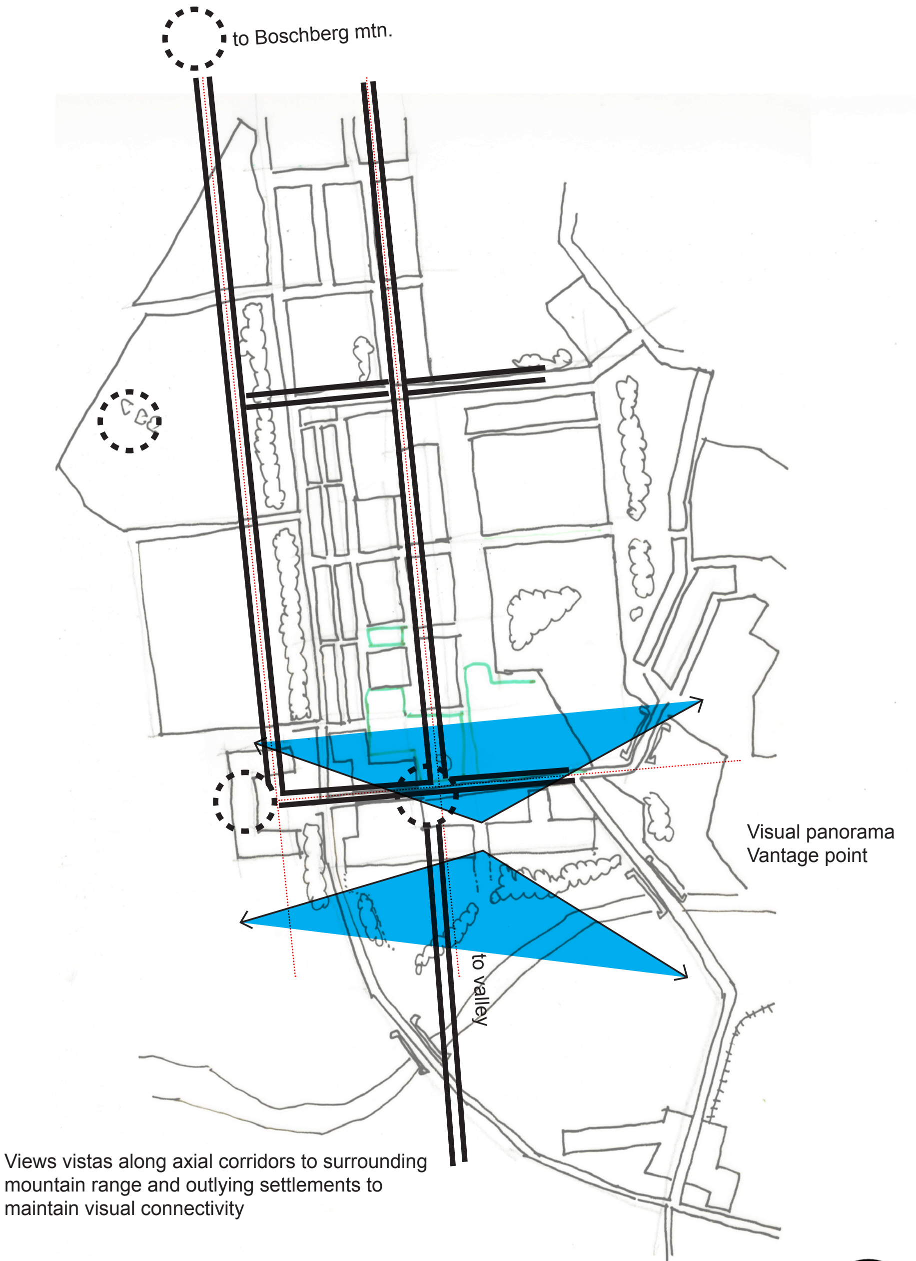


Spatial hierarchy

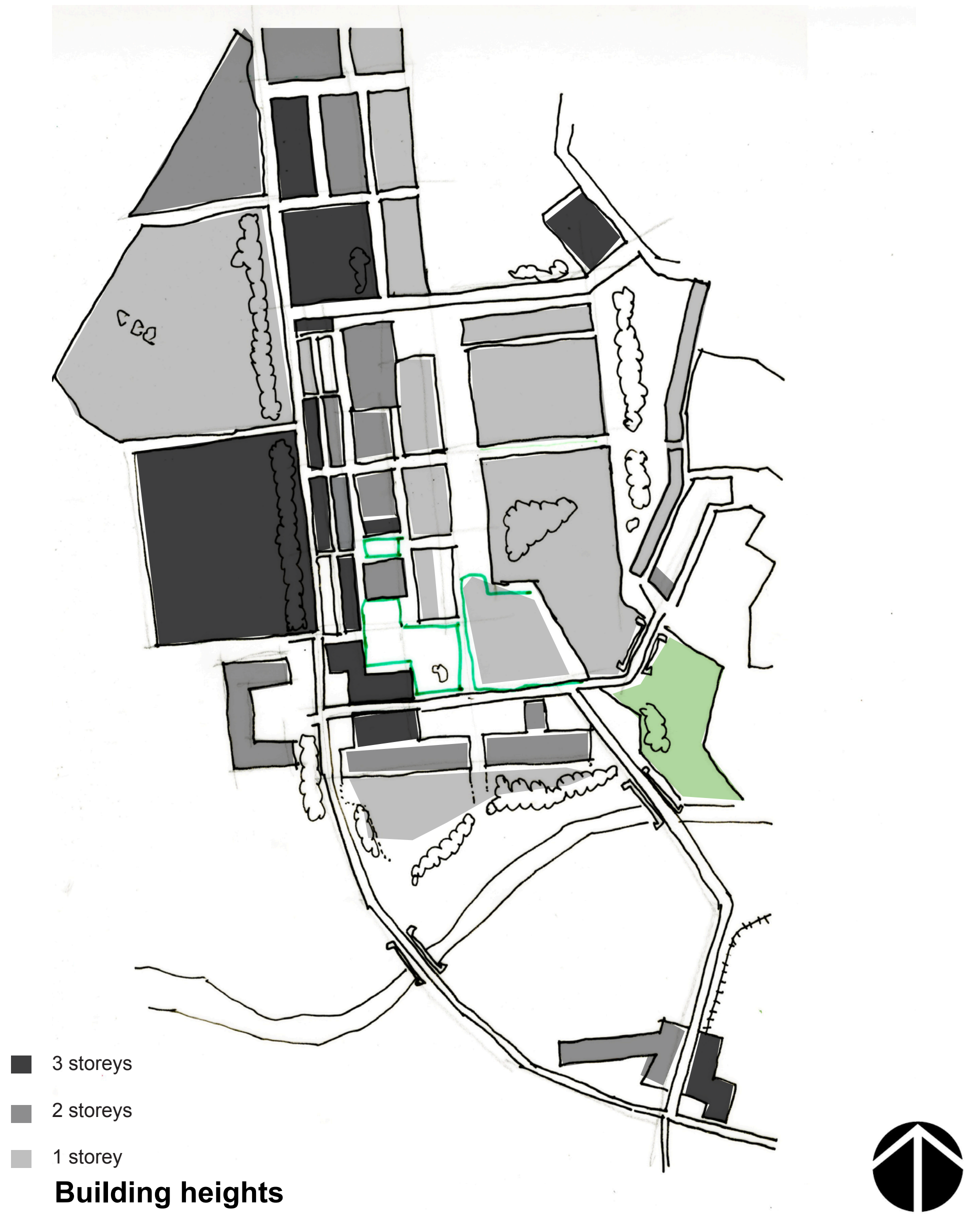


Land use programme

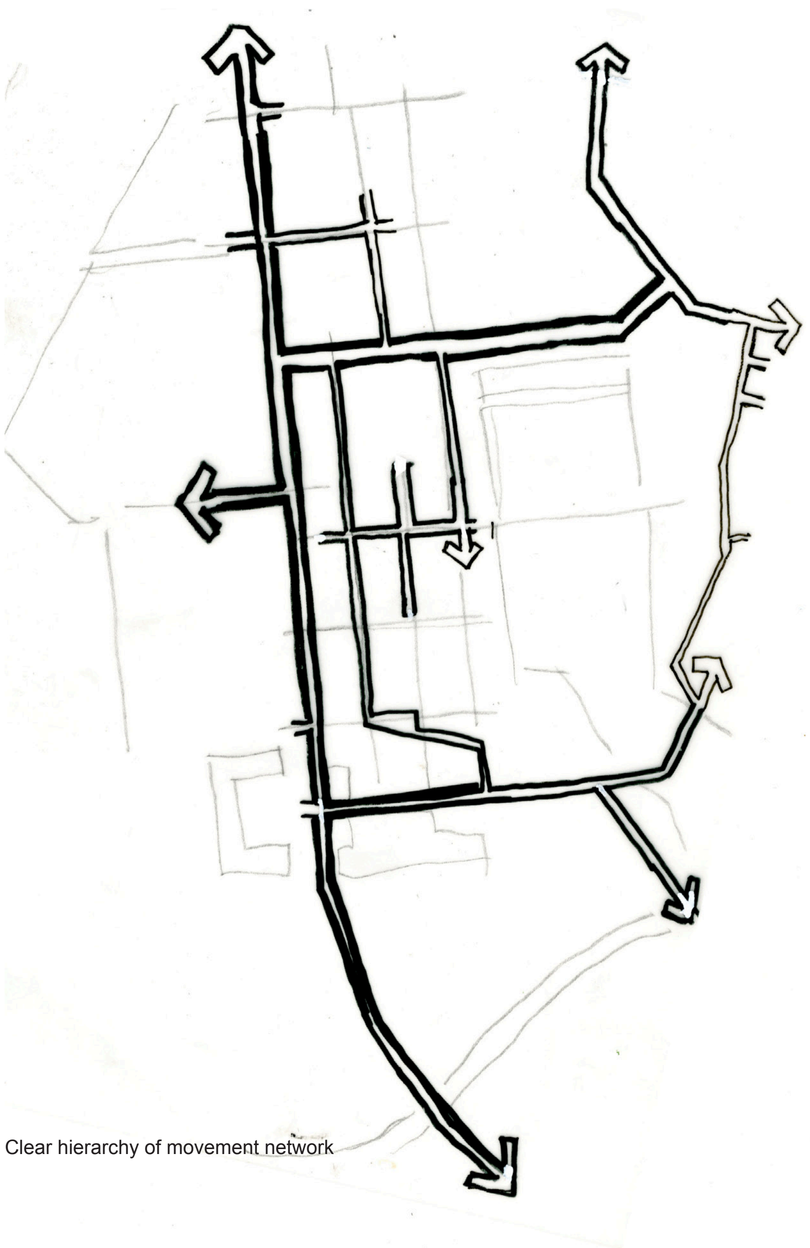
Figure 2.28 Design structure principles. (Karihindi, 2015)



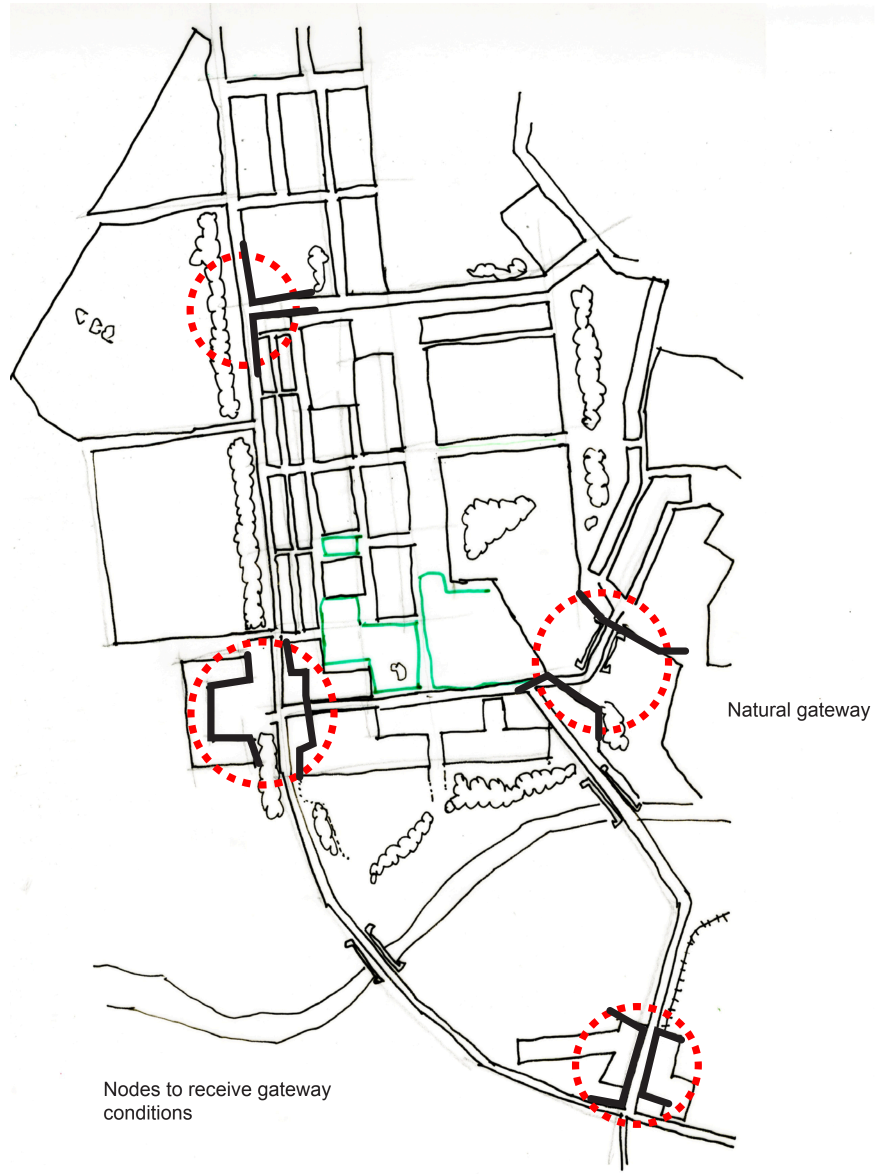
Axial alignment and focal points



Building heights



Movement hierarchy



Gateways and gateway conditions

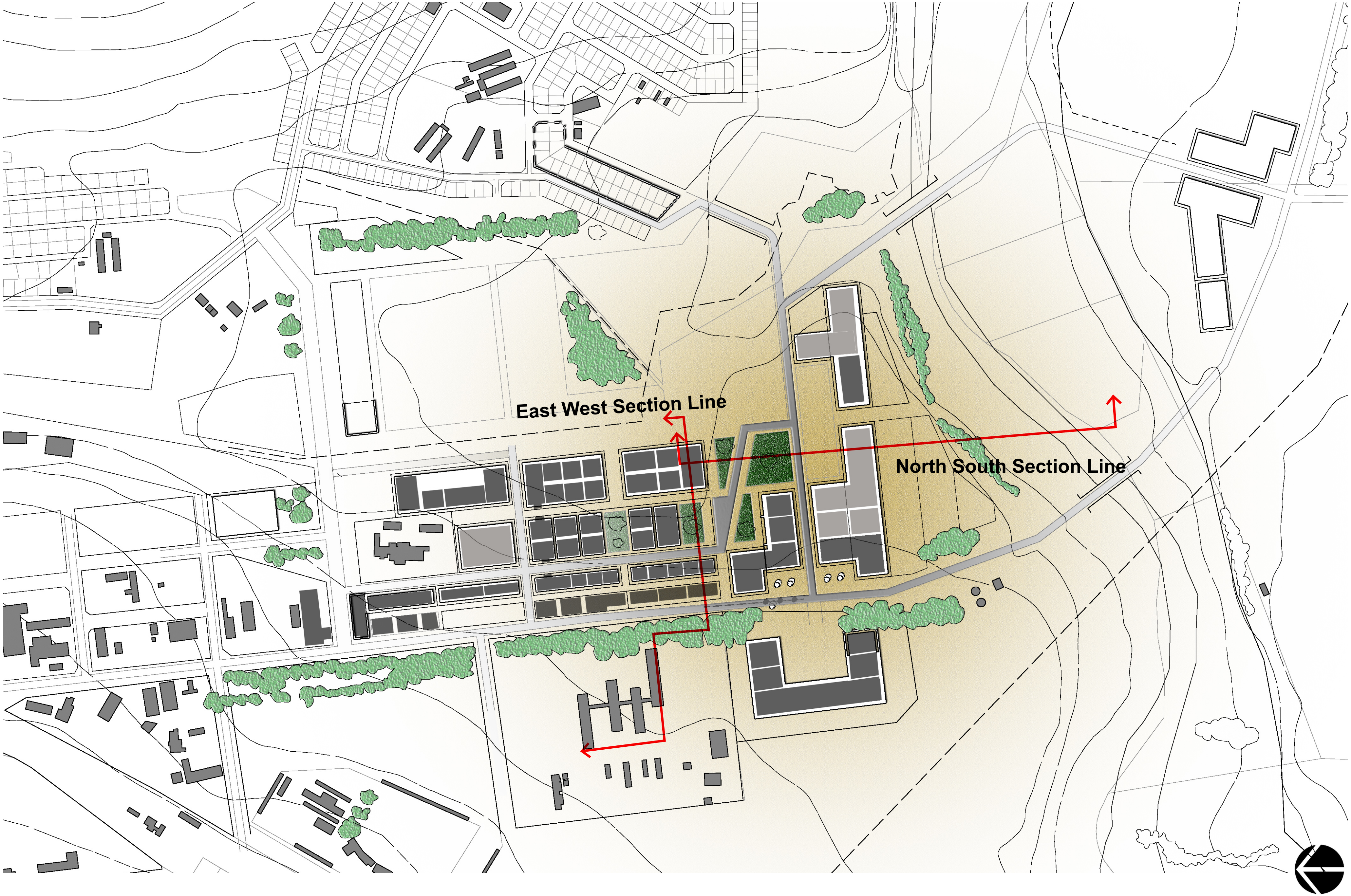


Figure 2.29 Resulting General Spatial Layout Concept for town. (Karihindi, 2015)

RELEVANCE TO TREATISE

Developing the model for an Aerotropolis at a town scale relies on focusing or situating the town's development in and about the airport. Such facilities as industries, businesses and transportation interchange facilities, etc. For the Somerset East the urban model depends on transplanting the industries from current traditional location to the new industrial zone located within the confines of the aerodrome - rezoning that land for more public oriented and mixed uses, including higher density residential use.

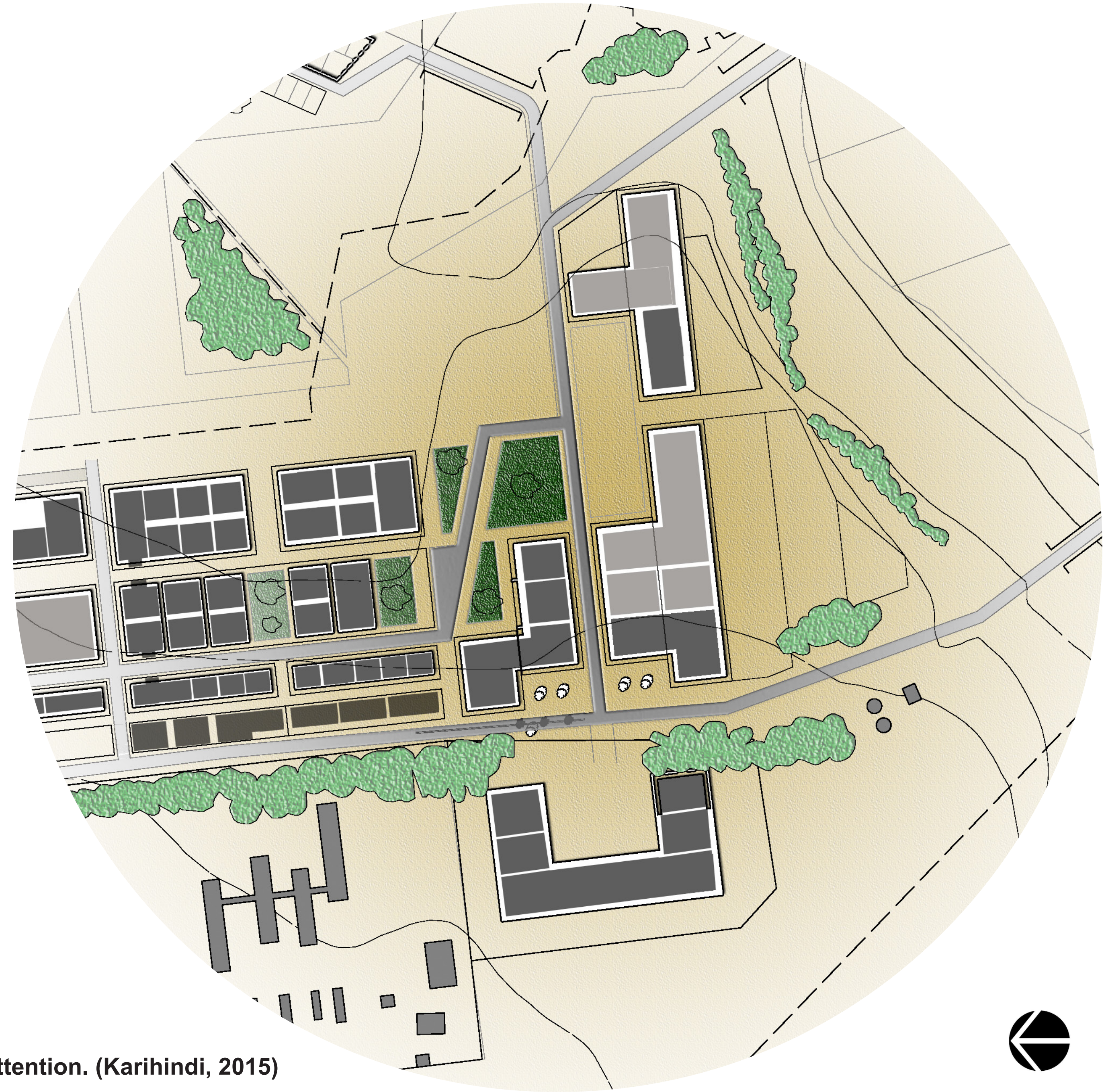
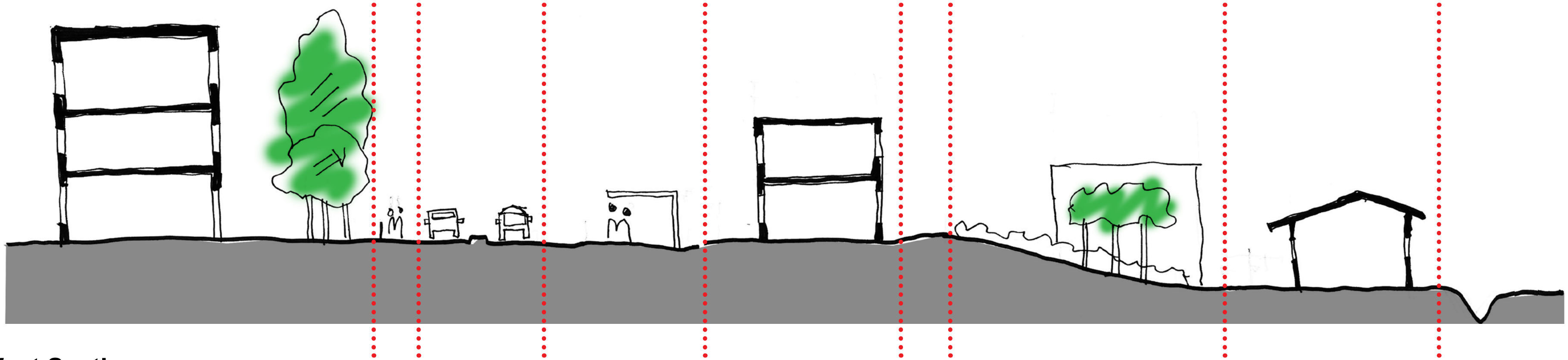
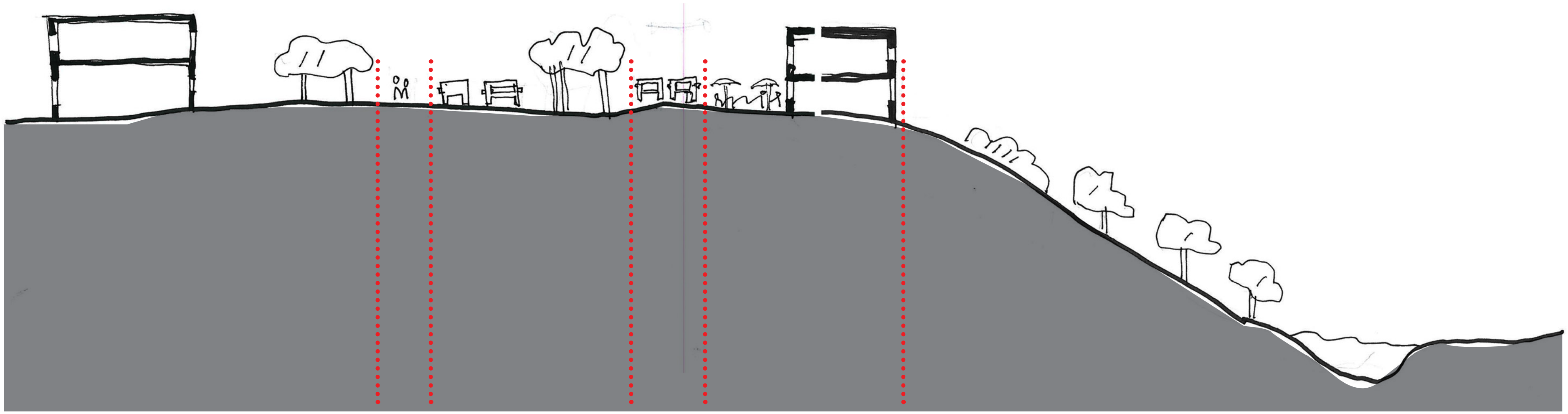


Figure 2.30 Precinct identified for further detail attention. (Karihindi, 2015)



East West Section



North South Section

Figure 2.31 Schematic sections. (Karihindi, 2015)

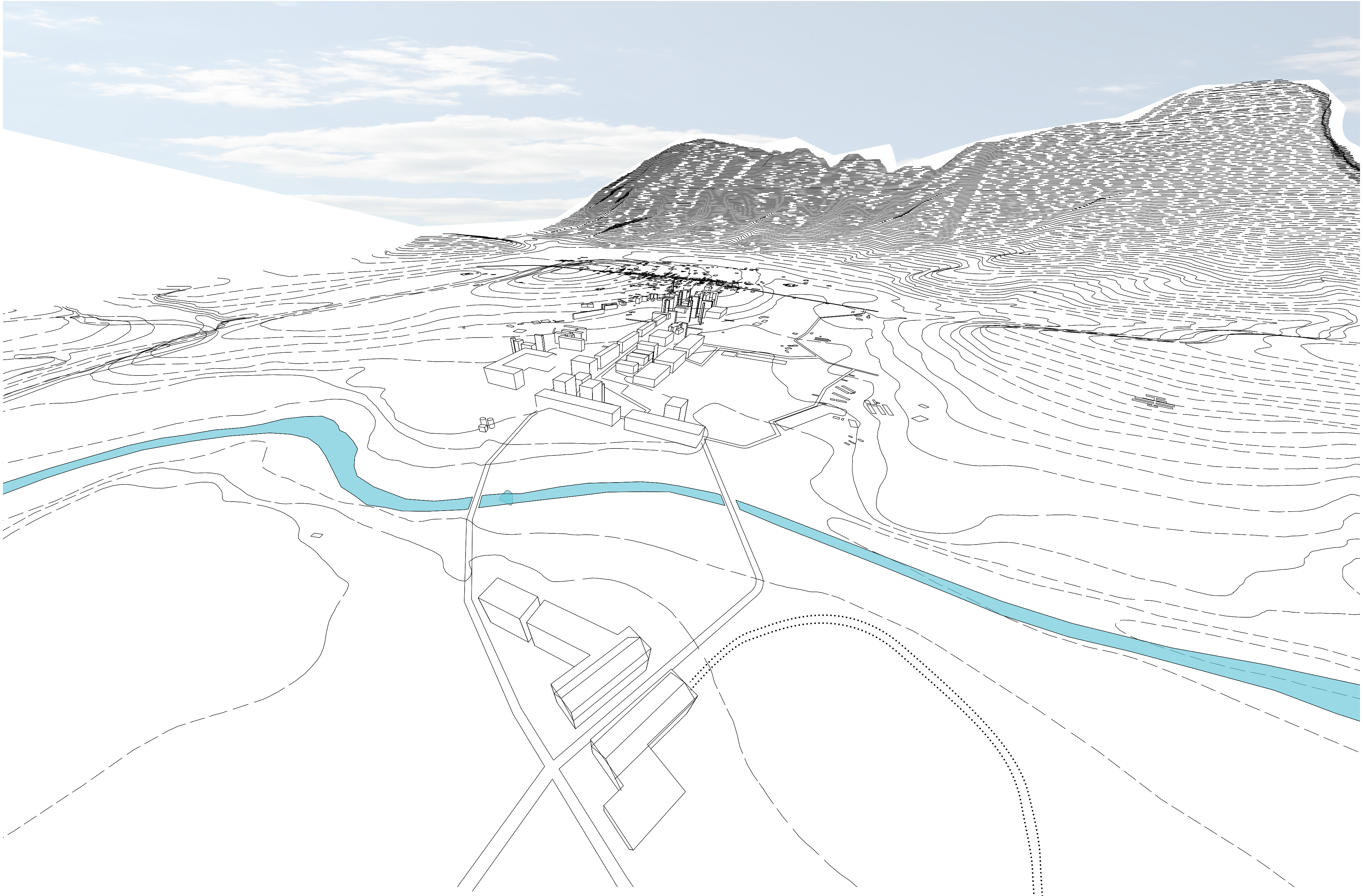


Figure 2.32 Super Block Massing Perspective : New Mixed Use Commercial and Medium Density Residential Area. (Karihindi, 2015)

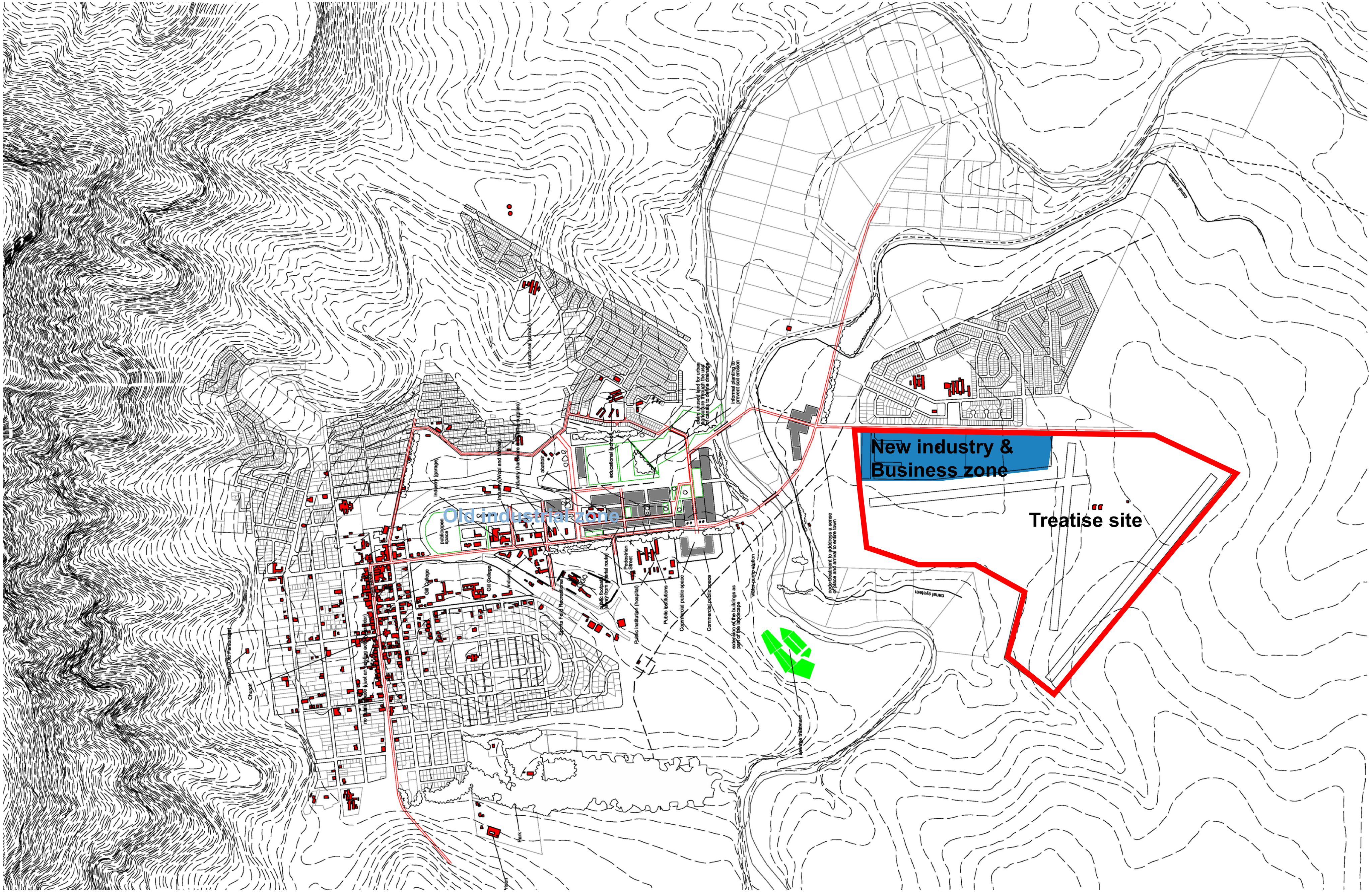


Figure 2.33 Urban scheme shown in greater context. (Karihindi, 2015)

CAPTURING THE ESSENCE OF SOMERSET EAST

WALTER BATTISS

In order to get a better understanding on reading the context and landscape of Somerset East, a look at the work by Walter Battiss in figure 2.34 is observed.
It is expected, to this end, that being from the town, his artistic interpretation of landscape will provide a foundation for expression to be employed when responding to the context at a later stage during the design implementation process.

Walter Battiss was born in Somerset East, South Africa in 1906. The Goodman Gallery (2015) regards him as “one of South Africa’s first and most outstanding modernist artists”. Modernism in art and architecture is a paradigm that advocated the departure from classical or idealised notions of perfect. (Eysteinsson,1990). In the work to the right, Battiss encapsulates the essence of the indigenous landscape and the actualisation is in the use of lucid lines and shapes; which represent forms with a clear departure from the perfect and ideal representational quality in his artwork. This can be said to be “abstraction”, which according to architect Peter Eisenmann (1976) is merely a “stylistic manifestations” of the modernist paradigm.

Figure 2.34 ***Untitled (mountain landscape),*** **Pen and ink on paper 28 x 43 cm. (Batiss, 1941-45)**

The airport has an influence on land development patterns. Airports are beginning to play an important role in the determining land development patterns. In the vicinity of major airports can be found an assortment of hotels and motels offering complete convention facilities including sleeping and meeting rooms as well as restaurants and entertainment establishments.

Manufacturing plants and offices have found a location near an airport desirable because it offers fast delivery of personnel and goods. Some airports have developed "fly-in" industrial parks offering direct taxiway access to individual plants.

(American Society of Planning Officials, 1968)

AERONAUTICAL HERITAGE OF SOMERSET EAST

INTRODUCTION

This part of the document will discuss the aeronautical heritage of Somerset East, it will also delve into, in chronological order, several noteworthy pioneers from Somerset East who have been instrumental in the development of the South African aviation industry; both internationally and nationally.
This heritage aspect is a crucial informant to the design and development of the treatise program, because it has not been captured in the fabric of the town. The project by the Blue Crane Development Agency to upgrade the aerodrome facilities is the first effort at cementing the aeronautical heritage into the building fabric of the town.

In 2009, a developmental assessment for the land on which the aerodrome is sited, discovered that the original main runway - indicated in Figure 3.0 - was more than 75 years old and therefore qualified it for heritage status. (du Raan, 2009). The South African National Heritage Resources Act (SAHRA) heritage Act No.15 of 1994 stipulates that; any manmade structures, features and artefacts associated with military history older than 75 years and the sites on which they are found are liable for conservation or heritage status, for this reason the town found itself stuck with an airfiled with which it had to consider. because the airfield had once been used by the South African Air Force. Although the military use of the site was brief, the aerodrome played host to many aeronautical feats in South Africa.

Figure 3.0 Original main runway over 60 years old. (Beach, 2015)

THE PIONEERS

In 1930, Christo Erasmus and his brother founded, ‘The Erasmus Aircraft Company of South Africa’. The aim of this company, was to build aircrafts in Somerset East; under licence to the Heath Parasol company. Due to the Great Depression, there was however no market for the product. Also the then government was not in favour of the plan and they alleged that all aircraft should rather be imported from England. So Erasmus did not obtain a licence to start his factory. (Somerset Budget and Pearston Advocate, 16 August 1957).

Note: The majority of the information contained in this section, if not all, is taken from;

- Interview with Rob Beach
- Somerset East: Blue Crane Development Agency. Erdogan, S., 1998. Airport Design - A Thesis in City and Regional Planning.

Further description can be found in the bibliography.

CHRISTO ERASMUS

He grew up on the farm, Charlton on the Boschberg
Took Keen interest in cars and Aeroplanes

1925 Left for the U.S.A
Became an engineer and was involved with the design of the Heath Parasol aeroplane.
1928 Became the chief testing pilot. In the same year they built a propeller engine. This aircraft engine was ten years ahead of its time.
Christo Erasmus was also involved in the design of the Baby Bullet used for pylon racing
1930 Returned to South Africa after accident
'The Erasmus Aircraft Company of South Africa', in an effort to enable them to build aircrafts in Somerset East licenced under the Heath Parasol company, requested the local council to hire 900² yards of the aerodrome for a period of 99 years. According to his calculations it would cost £1 000 to prepare the ground surface. He also had plans to build hangars and fuel-pumps.

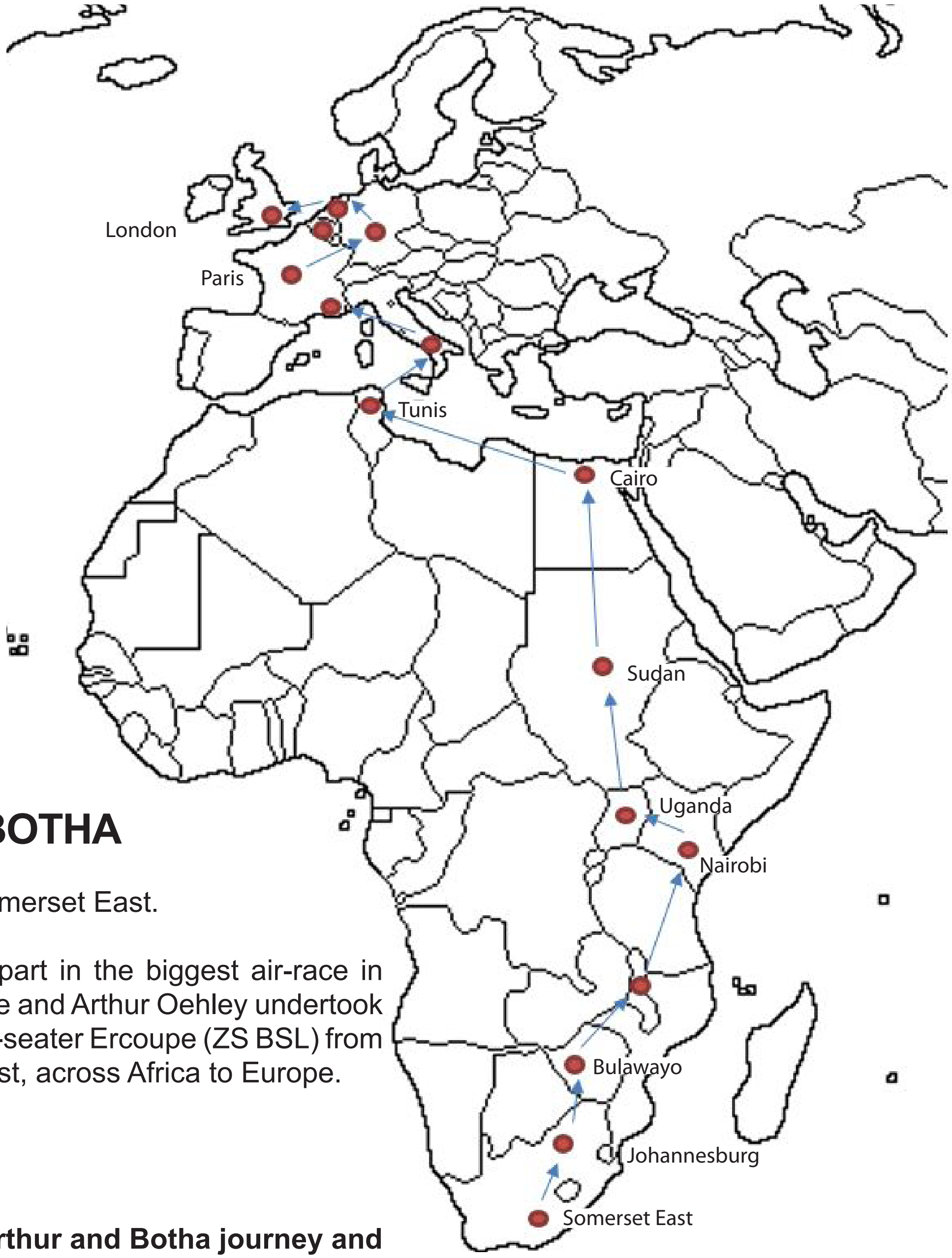
Figure 3.2 Mr. J.C. Erasmus (n.d.)

CHRIS TROSKIE

1938 Born in the Somerset East area
1956 Commenced flying lessons at the 'Somerset East Flying Club'.
1958 Received his Private Pilot licence (PP).

Chris was once the only flight instructor in the Somerset East area and as a result spent many long hours training beginner pilots - du Raan (2009) outlines, "there were many days when he started as early as three in the morning and only finished at ten in the evening". Many pilots who are captains in the various airlines in South Africa were trained by him.
At the time of writing of this document Chris was said to be alive doing advanced flying instruction totalling 3013 flight hours.

Figure 3.1 Christo Erasmas and the Model Ercoupe old. (n.d.) **Figure 3.3 SNA-40. (n.d.)**



WILLIE BOTHA

Farmer in Somerset East.

1954 Took part in the biggest air-race in the country he and Arthur Oehley undertook a trip in a two-seater Ercoupe (ZS BSL) from Somerset East, across Africa to Europe.

Figure 3.4 Arthur and Botha journey and destinations on the Ercoupe. (Karihindi, 2015)

Figure 3.5 Willie Botha and Arthur Oehley arrived from London. (n.d.)

Figure 3.6 Willie Botha and the Ercoupe. (n.d.)

CONCLUSIONS

From this chapter it is thus clear to see that Somerset East has got a rich aeronautical past. Herein, begins the model for a mini Aerotropolis realised by the BCDA.
Looking at the master plan scale, it is clearly visible that the subsequent subdivision and layout of the land was influenced by retaining the historic runway.

Due to the would be scale of the task, the treatise document will only be concerned with investigating the aspects that are concerned with flying for travel, for commerce, for tourism, for recreation and as an educational/learning process.

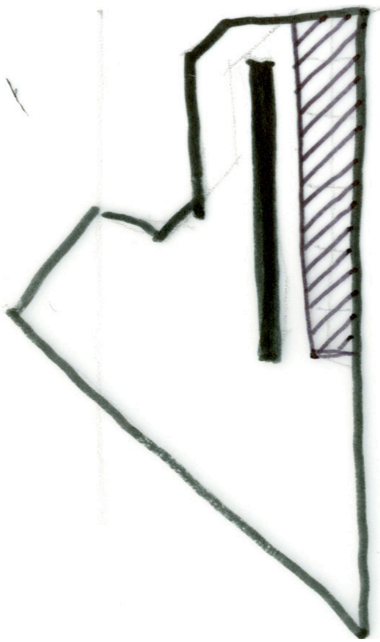


Figure 3.7 Site with main original runway. (Karihindi, 2015)

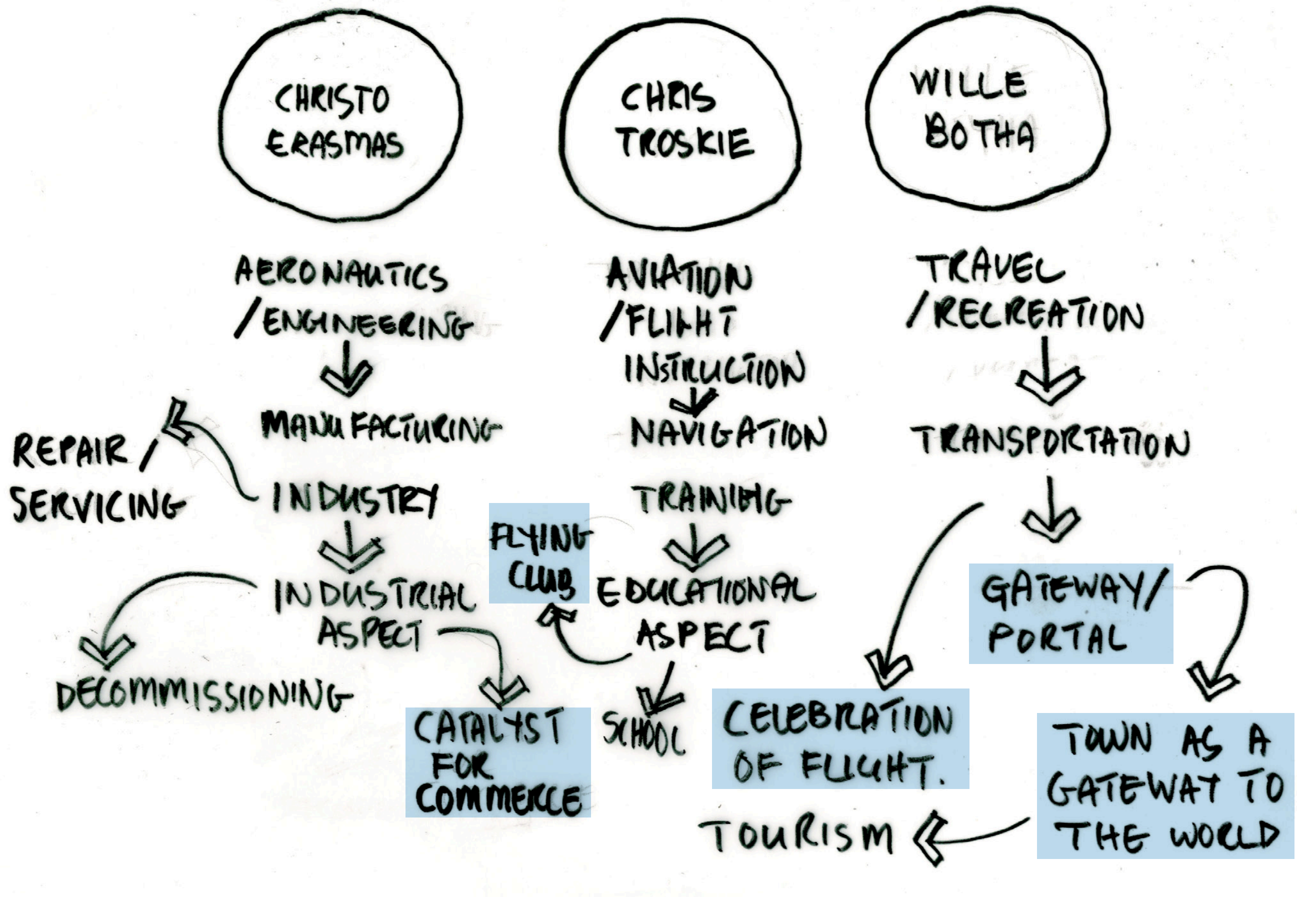


Figure 3.8 Activities that emerge at a master plan scale for the aerodrome according to the heritage. (Karihindi, 2015)

UNDERSTANDING THE AIRPORT ENVIRONMENT

INTRODUCTION

This section of the document will deal mostly with statutory technical aspects entailed in airport master-planning. By testing the site layout against the statutory safety requirements- as set out by the relevant regulatory bodies- information gathered from current and proposed use requirements for the aerodrome, together with realised and unused potential opportunities; a pertinent sizing and understanding will be arrived at and will be used to inform the master plan design process as well as the technical aspects.

This information will then be used to further inform the design for the terminal requirements capacities. This information will also help to situate functions in the aerodrome precinct.

Note: Most of the information is obtained from numerous sources but mostly:

- Federal Aviation Administration. (1989). Airport Design Advisory Circular

Further description can be found in the bibliography.

Figure 4.0 Aerial view of Cambridge Airport environment. (n.d.)

DEFINITION AND FUNCTIONS

Airports are conceived as airfields, with amenities that facilitate for the departure and landing of aircrafts. (Wragg, 2008)

Airports are altogether varied and vast in their purpose and function; some provide training for pilots- which keeps a steady supply of pilots for the military and commercial airlines- others provide community based services such as: fire-fighting, search and rescue, pest control for agriculture, time related medical transportation services, some even provide state and municipal access to the airspace etc. (Federal Aviation Administration, 2012)

All these services offered by airports are varied and do infer slight differences in airport type, one from the next; however, one overarching principle dictates the layout and design of all aircrafts; safety.

International bodies that deal with regulations pertaining to safety, aerodrome planning and design layout are the ICAO and the FAA.
The South African counterpart to these bodies is the South African Civil Aviation Authority (SACAA) and most of the established codes are global and transferable except for some extreme context specific case.

INTERNATIONAL CIVIL AVIATION ORGANISATION [ICAO]

Many countries have regulators that oversee civil aviation to ensure adherence to international standards provided by ICAO. ICAO is a specialised agency of the United Nations, it's responsible for codifying the principles and techniques of international air navigation and fostering the planning and development of international air transport- to ensure safe and orderly growth. (Höhne, 2013)

FEDERAL AVIATION ADMINISTRATION

The FAA is chiefly responsible for; the advancement, safety and regulation of civil aviation, as well as overseeing the development of the air traffic control system and commercial aerospace travel in America. (Federal Aviation Administration, 2015)

Note: For the sake of the abundance of information FAA manuals will be employed. Manuals and design advisory circulars about aerodrome design will be used to define the design for the apron arrangement, runway sizes and safety area requirements.
Please refer to the bibliography for more information.

MAKE UP

The airport environment is comprised of airside and landside areas. The airside is the most technical section, driven by various statutory and safety clearance requirements that are denoted by the aforementioned bodies; ICAO and FAA.

The spatial aspect of an airport design is realised on landside. The human scale is more or less the yardstick to airside design.

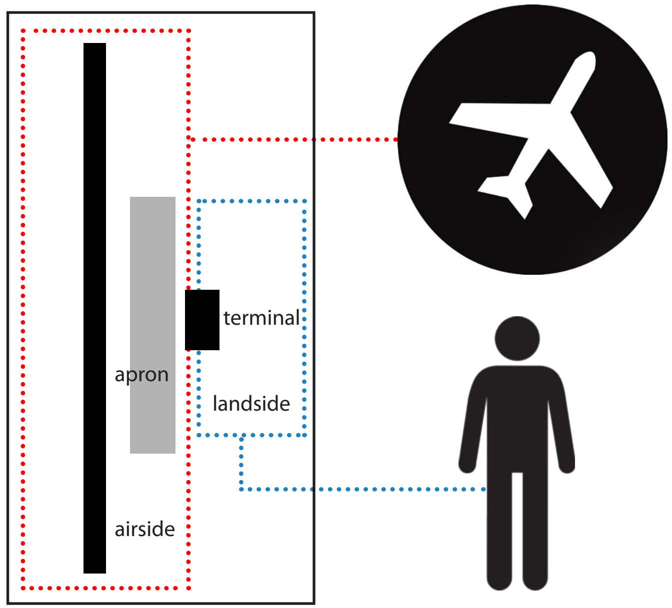


Figure 4.1 Airside and landside; with terminal as the go-between space. (Karihindi, 2015)

AIRSIDE

The air-side portion of an airport encompasses all facilities that support aircraft and aircraft-related activities such as; runways, taxiways, aprons and hangers. In addition to the ground facilities, the airspace surrounding an airport is also included in airside discussions; this includes runway and taxiway safety areas and federal Aviation Regulation (Far) Part 77 surfaces. These airside facilities provide the airport, and those who use it, with the necessary infrastructure to operate an aircraft. (American Planning Association, 2006, p. 295)
These airside facilities include the following: Runway areas, Taxiway areas, Aircraft parking areas and Airspace.

Figure 4.2 The Northern Rockies Regional Airport airside and landside. (2010)

LANDSIDE

The landside area of an airport has traditionally encompassed the land areas within an airport that support its operations, but are not dedicated to aircraft operations.
Such functions as: the preparation of passengers before flights, sorting them, preparing them and alighting them etc. Barajas Airport Terminal is a landside facility.

Figure 4.3 Adolfo Suarez Madrid-Barajas Airport – Madrid, Spain. (Thomas, 2015)

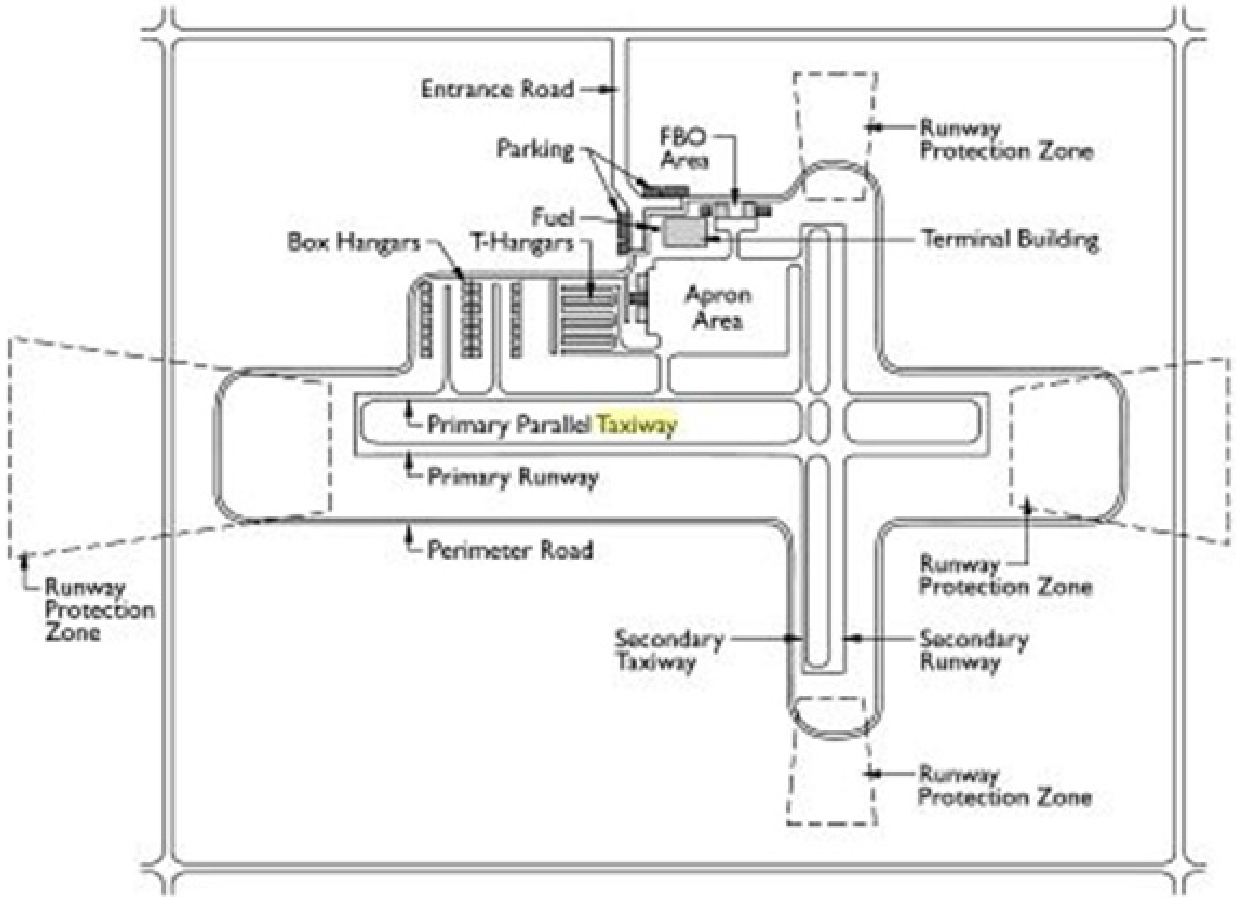


Figure 4.4 Basic Layout of an airport; Airport Layout plan. (American Planning Association, 2006)

CRITICAL AIRCRAFT

The length of an aircraft is used to determine the length of an aircraft's parking area and hangars. In addition, for commercial service airports, the length of the largest aircraft to perform at least five departures per day; determines the required amount of aircraft rescue and fire-fighting equipment on the airfield. (Sproule, et al., 2010, p. 57).

The critical or design aircraft is best defined by Rock Hill/York County (2003) as "the most demanding aircraft that is currently using or is projected to use the airport facility on a regular basis". Therefore, the design of a terminal building in the precinct of Somerset East Aerodrome ought to be designed to the specifications that would allow such an aircraft to operate with ease.

The weight, wingspan, and performance characteristics of these aircrafts, in conjunction with site-specific conditions, determine an airport's geometry- in terms of runway/taxiway configurations, lengths and separations. (Rock Hill/ York County, 2003)
Figure 4.4 and 4.5 indicate the current classes of critical aircraft using the facility and future critical aircraft forecast to use the airport upon completion of 1.5Km runway give or take. Most of these aircraft have STOL capability, which allows them to take off and land on relatively short runways. Another class, not indicated, is the class that contains medium, small freight aircrafts which will also use the airfield.

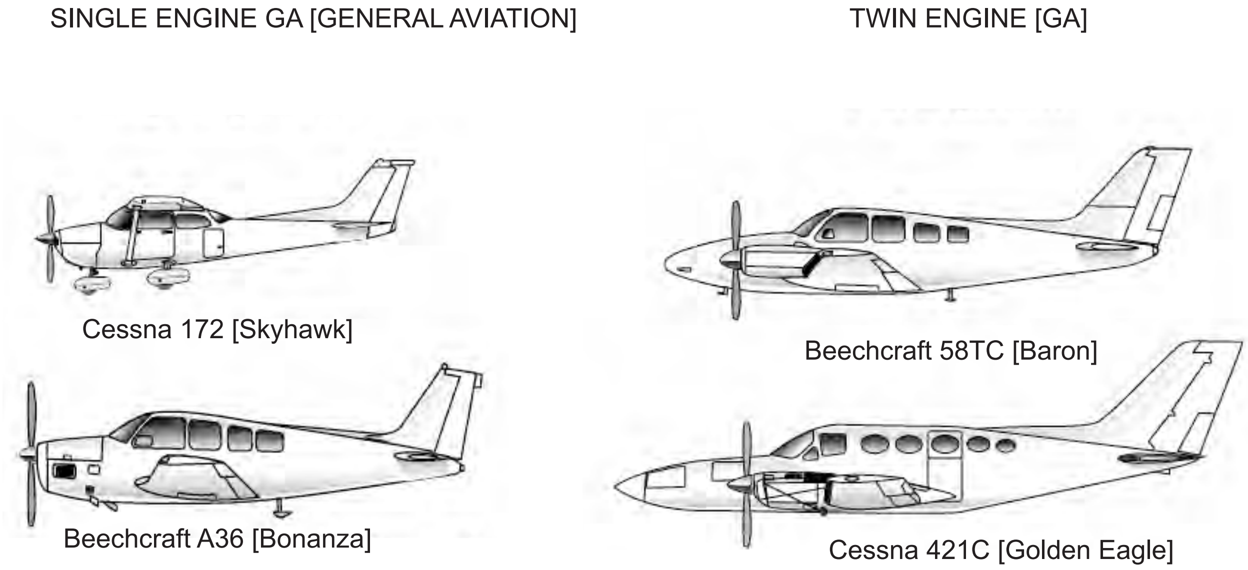


Figure 4.5 General Aviation Aircraft. Have one or two engines. (Trani, 2015)

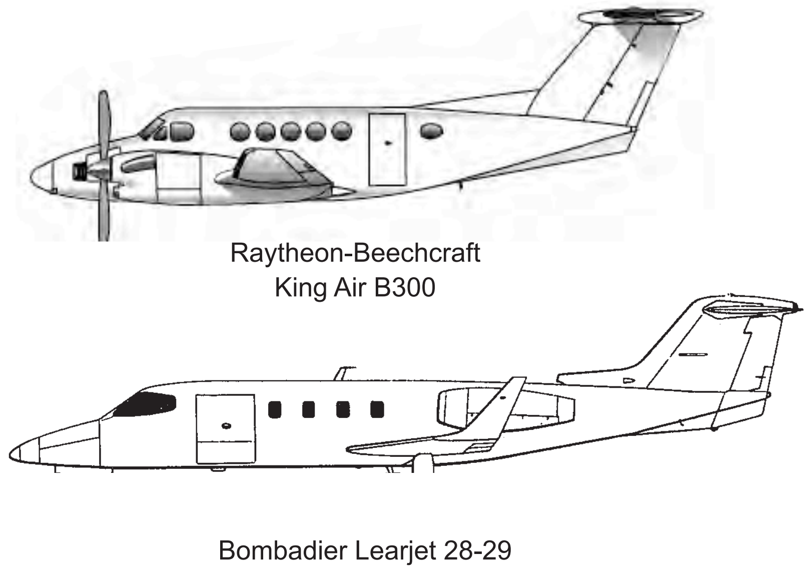


Figure 4.6 Corporate Aircraft with one or two turbo propeller or jet driven engines. (Trani, 2015)

By understanding the airside safety requirements it allows for a better position to critique an airport environment; especially one with little built fabric.

The following tables and diagrams (Figure 4.6 - figure 4.14) act as though a formula through which the information, in figure 1.12 will be will be added as part of a pre-plan and going towards the master plan for the 1.5Km runway and not the 1.2m.

Note: Unless otherwise indicated, the majority of this information is taken from:

U.S. Department of Transportation, Federal Aviation Administration. (1989). *Airport Design Advisory Circular.* Circular distributed 29th September.

Code element 1		Code element 2	
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wing span (4)
1	Less than 800 m	A	Up to but not including 15 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m
4	1 800 m and over	D	36 m up to but not including 52 m
		E	52 m up to but not including 65 m
		F	65m up to but not including 80m

Figure 4.7 Aerodrome Reference Code, (International Civil Aviation Organization, 1999, p. 17)

ITEM	DIM 1/	AIRPLANE DESIGN GROUP				
		I 2/	I	II	III	IV
Runway Length	A	- Refer to paragraph 301 -				
Runway Width	B	60 ft 18 m	60 ft 18 m	75 ft 23 m	100 ft 30 m	150 ft 45 m
Runway Shoulder Width		10 ft 3 m	10 ft 3 m	10 ft 3 m	20 ft 6 m	25 ft 7.5 m
Runway Blast Pad Width		80 ft 24 m	80 ft 24 m	95 ft 29 m	140 ft 42 m	200 ft 60 m
Runway Blast Pad Length		60 ft 18 m	100 ft 30 m	150 ft 45 m	200 ft 60 m	200 ft 60 m
Runway Safety Area Width	C	120 ft 36 m	120 ft 36 m	150 ft 45 m	300 ft 90 m	500 ft 150 m
Runway Safety Area Length Prior to Landing Threshold 3/, 4/		240 ft 72 m	240 ft 72 m	300 ft 90 m	600 ft 180 m	600 ft 180 m
Runway Safety Area Length Beyond RW End 3/, 4/	P	240 ft 72 m	240 ft 72 m	300 ft 90 m	600 ft 180 m	1,000 ft 300 m
Obstacle Free Zone Width and Length		- Refer to paragraph 306 -				
Runway Object Free Area Width	Q	250 ft 75 m	400 ft 120 m	500 ft 150 m	800 ft 240 m	800 ft 240 m
Runway Object Free Area Length Beyond RW End 5/	R	240 ft 72 m	240 ft 72 m	300 ft 90 m	600 ft 180 m	1,000 ft 300 m

Figure 4.8 Runway Separation Standards for aircraft approach categories A & B (1989)

ITEM	DIM 1/	AIRPLANE DESIGN GROUP					
		I	II	III	IV	V	VI
Taxiway Centerline to: Parallel Taxiway/ Taxilane Centerline	J	69 ft 21 m	105 ft 32 m	152 ft 46.5 m	215 ft 65.5 m	267 ft 81 m	324ft 99 m
Fixed or Movable Object 2/ and 3/	K	44.5 ft 13.5 m	65.5 ft 20 m	93 ft 28.5 m	129.5 ft 39.5 m	160 ft 485 m	193 ft 59 m
Taxilane Centerline to: Parallel Taxilane Centerline		64 ft 19.5 m	97 ft 29.5 m	140 ft 42.5 m	198 ft 60 m	245 ft 74.5 m	298 ft 91 m
Fixed or Movable Object 2/ and 3/		39.5 ft 12 m	57.5 ft 17.5 m	81 ft 24.5 m	112.5 ft 34 m	138 ft 42 m	167 ft 51 m

Figure 4.9 Taxiway and taxilane separation standards (1989)

	Code letter				
Code number	A	B	C	D	E
1[a]	*18 m*	*18 m*	*23 m*	B	B
2[a]	*23 m*	*23 m*	*30 m*	B	B
3	*30 m*	*30 m*	*30 m*	*45 m*	B
4	B	B	*45 m*	*45 m*	*45 m*

Figure 4.10 Width of Runways (International Civil Aviation Organization, 1999, p. 28)

ITEM	DIM 1/	AIRPLANE DESIGN GROUP (ADG)				
		I	II	III 2/	IV	V
Radius of Taxiway Turn 3/	R	75 ft 22.5 m	75 ft 22.5 m	100 ft 30 m	150 ft 30 m	150 ft 45 m
Length of Lead-in to Fillet	L	50 ft 15 m	50 ft 15 m	150 ft 45 m	250 ft 75 m	250 ft 75 m
Fillet Radius for Tracking Centerline 4/ 5/	F	60 ft 18 m	55 ft 16.5 m	55 ft 16.5 m	85 ft 25.5 m	85 ft 25.5 m

Figure 4.11 Taxiway fillet dimensions. (1989)

THE AIRPORT REFERENCE CODE (ARC)

The Airport Reference Code (ARC) is a coding system developed by the Federal Aviation Administration (FAA), to relate airport design criteria to the operational and physical characteristics of the airplane types that will operate at a particular airport/aerodrome and/or runway. (The ARC is part of design standards established in the FAA Advisory Circular 150/5300-13, Airport Design, June 2008.) (San Lorenzo Citizens, 2009)

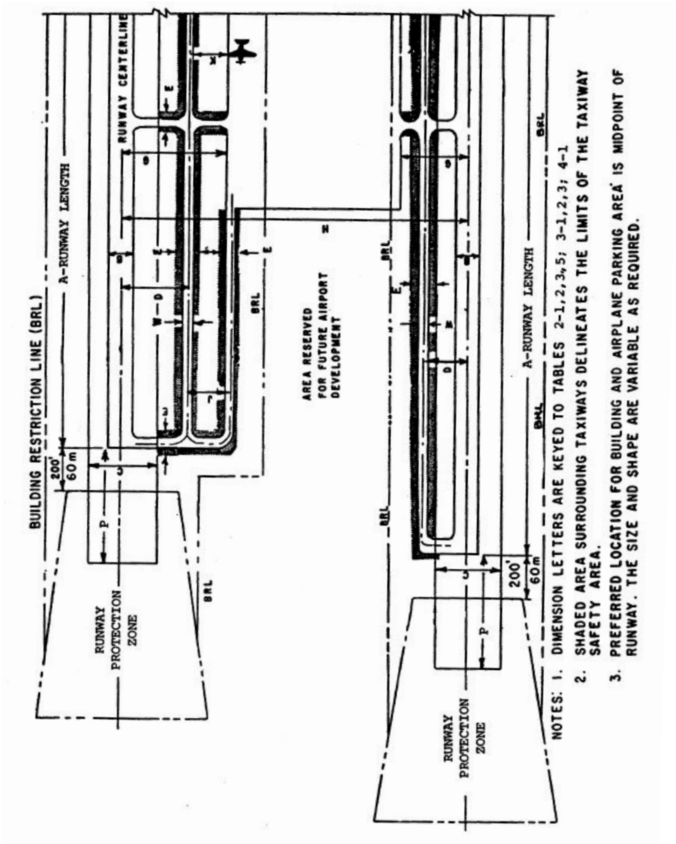


Figure 4.12 Typical airport layout. (1989)

Each runway has its unique ARC code. Once one is able to ascertain the ARC of an airfield; one then becomes able to understand the category or type of aircraft that is able to operate on such an airstrip, from the ARC number. We thus have the capacity, the load and a fair understanding of what to plan

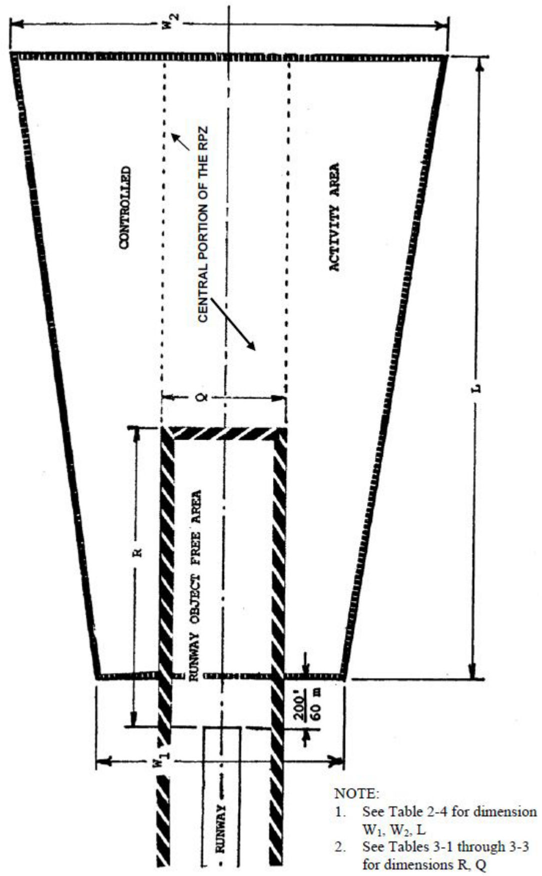


Figure 4.13 Runway protection zone. (1989)

for- in relation to that aerodrome requirements.
Taxiway
The taxiway system should be designed in such a way to allow aircraft to maintain a safe and comfortable on-ground manoeuvring speed. Each runway typically has its own parallel

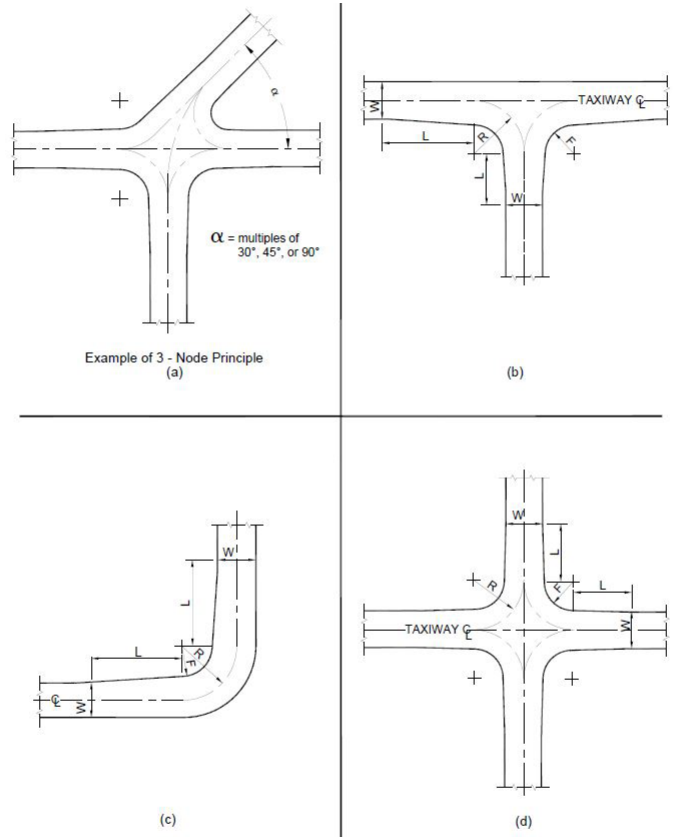
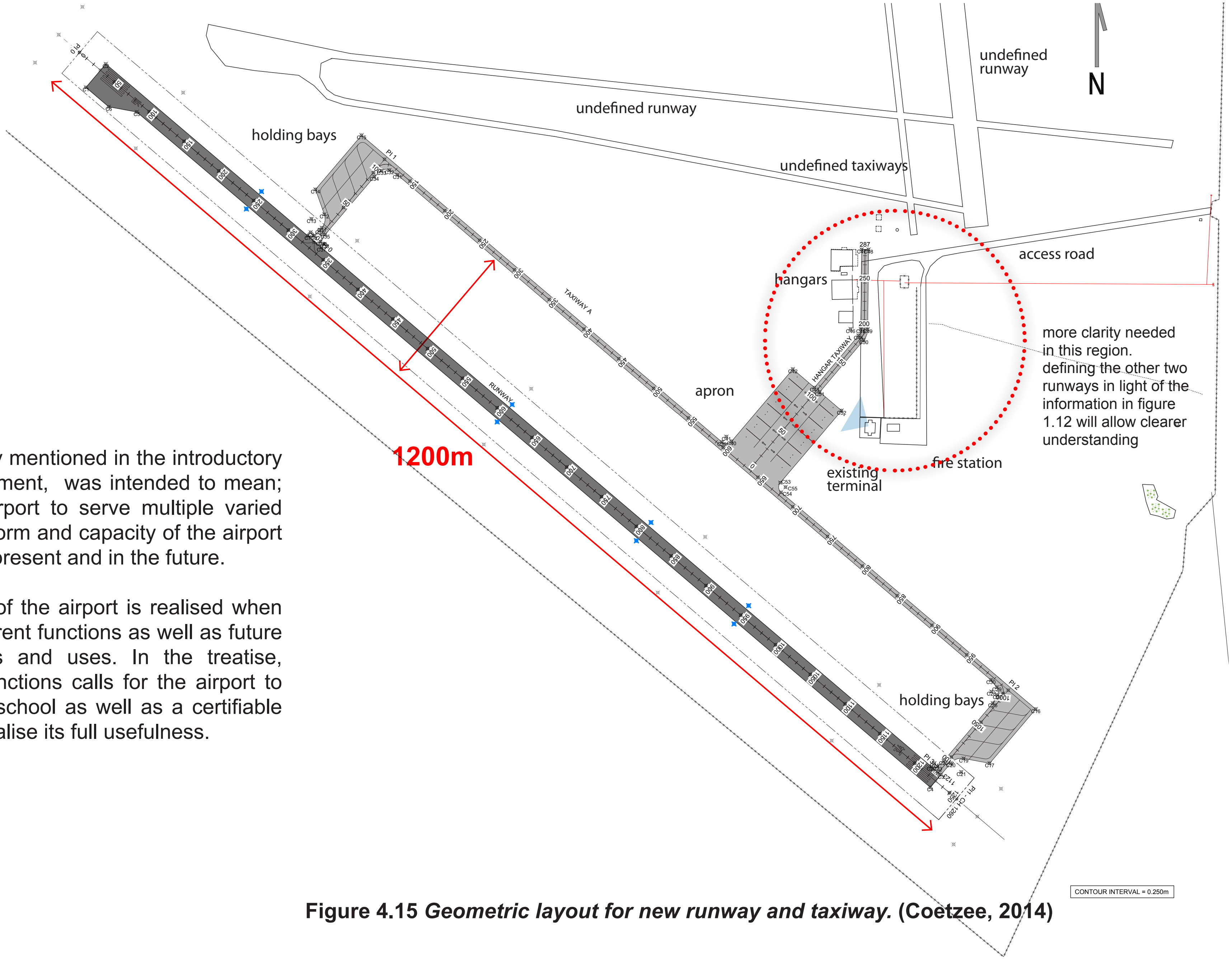


Figure 4.14 Taxiway to taxiway intersection details. (1989)

taxiway and the taxiway must be located far enough from the runway so that aircraft wing tips or tail tips do not extend into the airspace along the runway to cause safety issues (American Planning Association, 2006, p. 295)



UTILITY

'Utility', as previously mentioned in the introductory chapter of this document, was intended to mean; the ability of the airport to serve multiple varied activities whilst the form and capacity of the airport remains relevant at present and in the future.

The full usefulness of the airport is realised when it caters for both current functions as well as future forecasted functions and uses. In the treatise, a varied array of functions calls for the airport to house both a flight school as well as a certifiable airport terminal to realise its full usefulness.

Figure 4.15 ***Geometric layout for new runway and taxiway.*** **(Coetzee, 2014)**

CONCLUSIONS

For Somerset East Aerodrome, we know the following:

- The existing structures
- The size and make-up of the three runways that the municipality has envisioned for the airport.
- The 1.2Km runway under construction; which in future will be extended to a 1.5Km runway.
- We have an idea of the type of aircraft to occupy the airside space.

At this instance; the departure point for the treatise is thus to forgo the 1.2Km runway (in a sense) and plan for a 1.5Km runway, understand the constraints placed on the airfield by the two 'undefined' grass runways; in terms of ICAO and FAA aerodrome standards of the overall site.

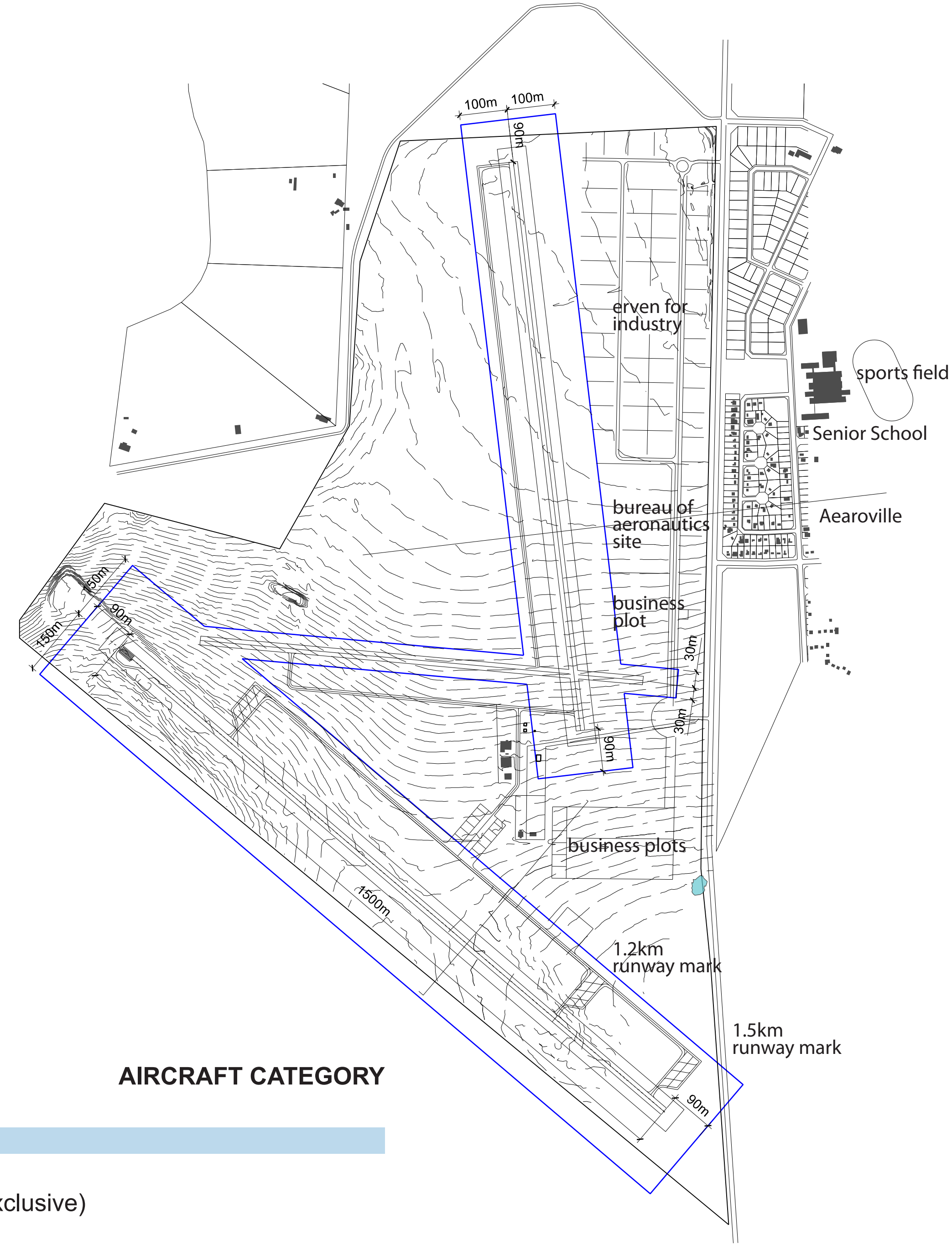


Figure 4.15 Assumed safety area requirements in light of 1.5 Km runway. (Karihindi, 2015)

RUNWAY	SIZE	SURFACE	ARC(Aerodrome Ref. Code)	AIRCRAFT CATEGORY
Runway 16-34:	1200 x 18m	Asphalt	ARC:	3B Corporate Aircraft
Runway 02-20:	1200 x 35m	Grass	ARC:	2B Corporate
Runway 12-30:	1000 x 15m	Grass	ARC:	1B (Small Airplane Exclusive)

SUMMARY OF SITE CONSTRAINTS AND INFORMANTS

OBSTACLE IDENTIFICATION SURFACES

The Obstacle Limitation Surfaces (OLS) are a series of surfaces that define the limits to which objects may project into the airspace on an aerodrome. Eight Obstacle Limitation Surfaces:

- Conical Surface
- Inner Horizontal Surface
- Approach Surface
- Inner Approach Surface
- Transitional Surface
- Inner Transitional Surface
- Balked Landing Surface
- Take-off Climb

In order for an airport to offer civil services, it must observe these outlined imaginary surfaces.

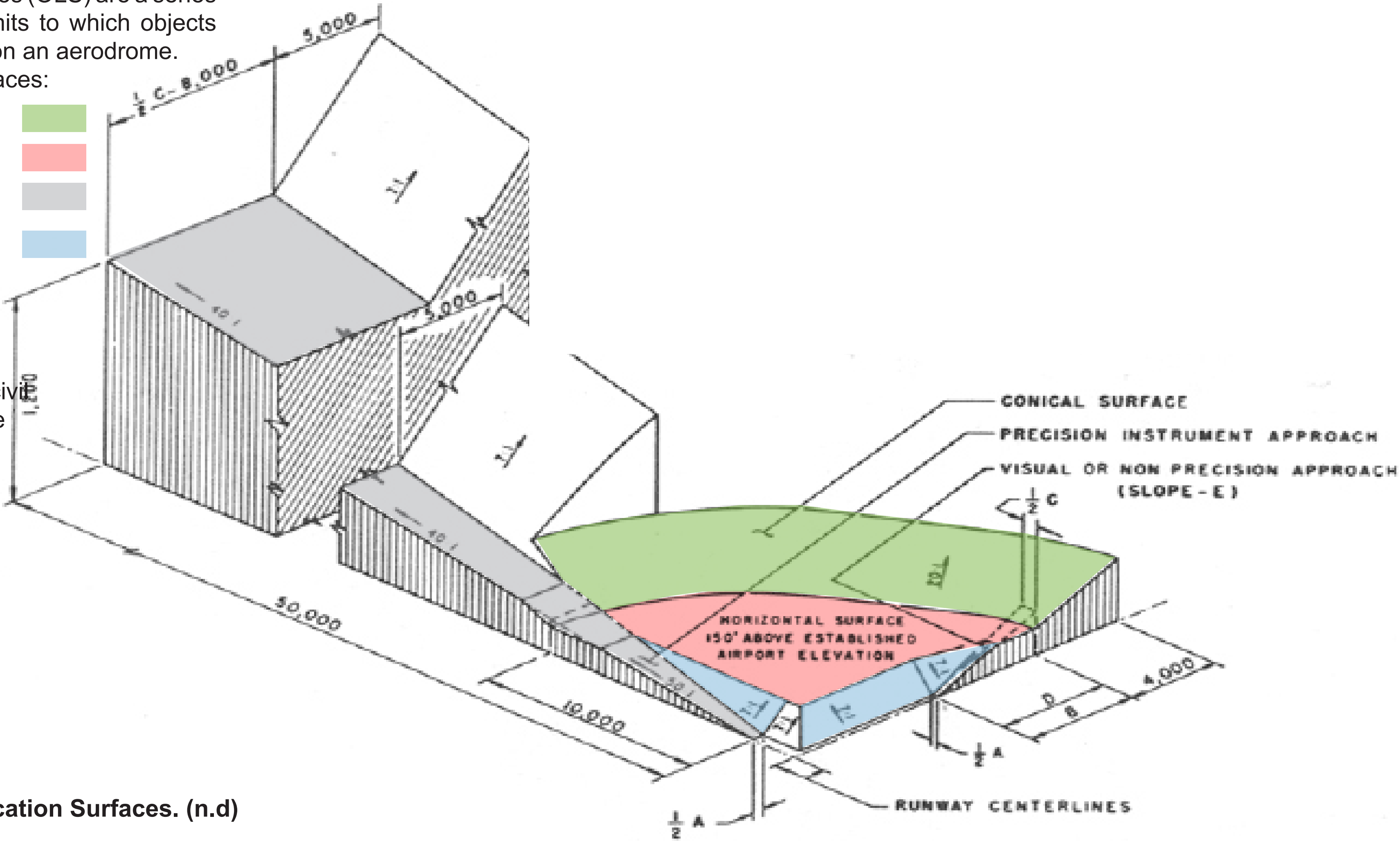


Figure 5.0 Obstacle Identification Surfaces. (n.d)

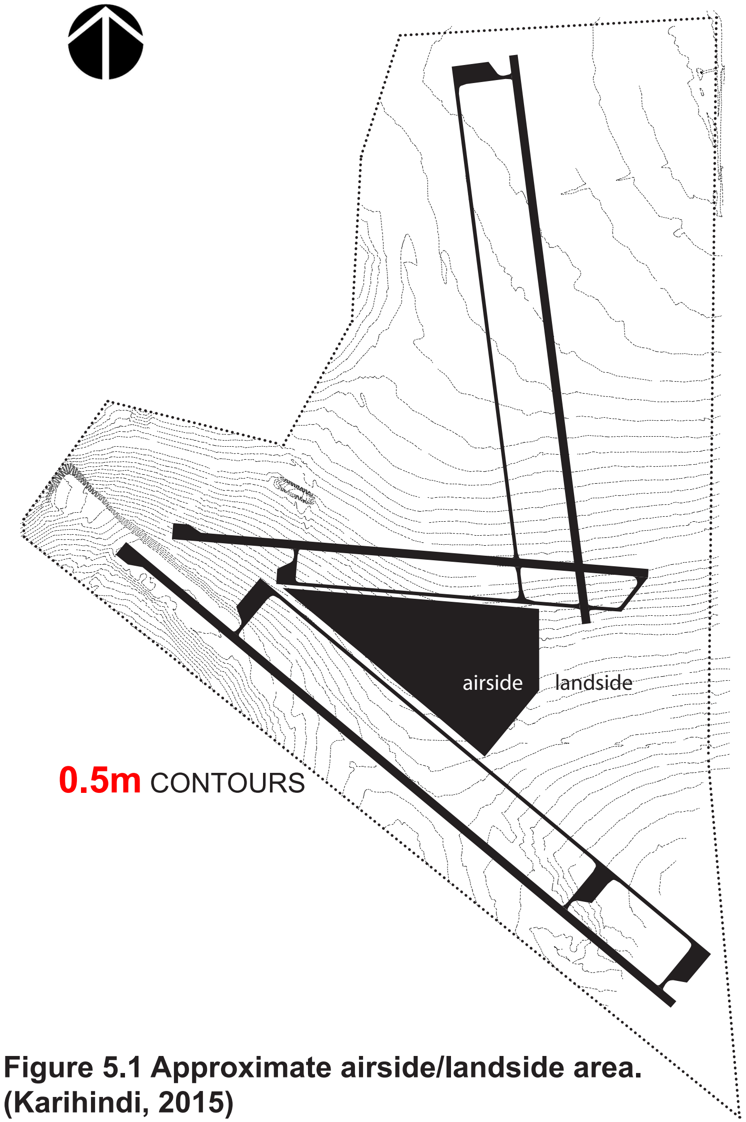


Figure 5.1 Approximate airside/landside area. (Karihindi, 2015)

Existing and proposed runways and proposed parallel taxiway system together with Apron.

VISUAL CONTROL ROOM

Visual Control Room (VCR) sight lines place a vertical constraint on the aerodrome area; between Runway 16-34 and Runway 12-30.
VCR sight lines are vistas, or lines of sight, that ought to remain unobstructed between the control room and taxiways- in order to maintain constant monitoring and viewing of aircrafts that are on the taxiway; as a traffic control measure and a safety precaution at hot spot areas.

The height of the VCR determines the maximum buildable height within and below the Inner Horizontal Surface over the aerodrome.

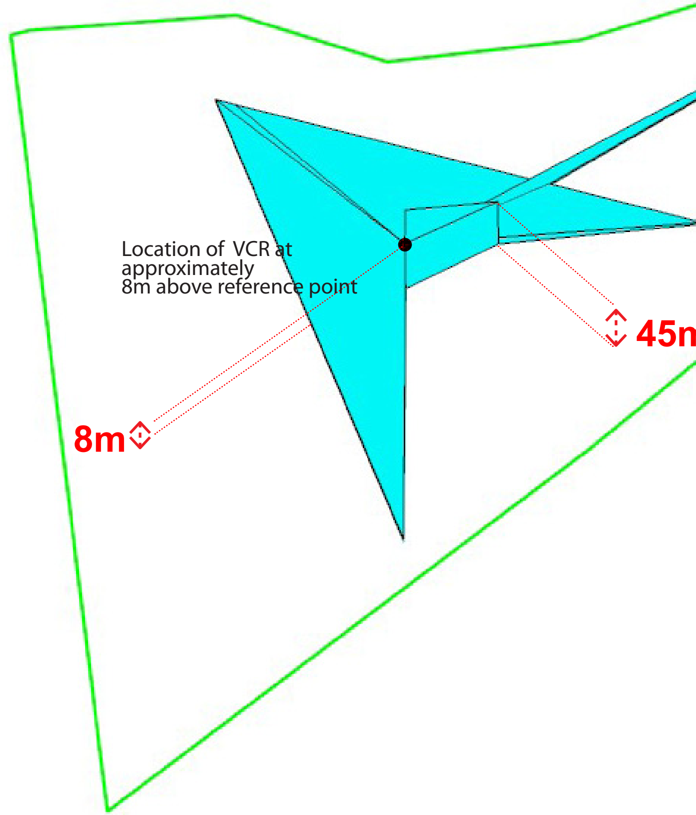
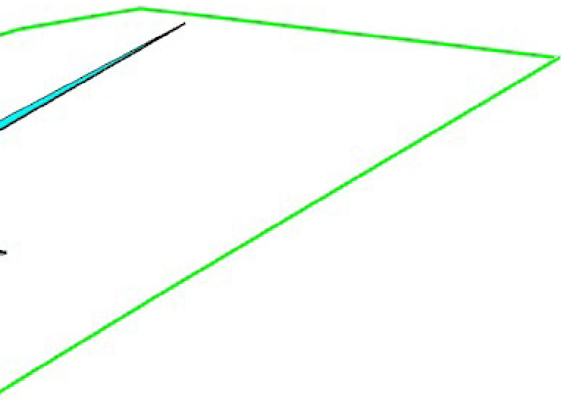


Figure 5.2 Resultant 3D Volume extruded up to VCR; the proposed visual sight lines. (Karihindi, 2015)



The maximum buildable volume within and around the apron and resultant unconstrained area is vertically delimited by the Visual Control Room (VCR) sight lines.
These lines of sight, in principle, exist between the VCR and the centre line above each taxiway on the aerodrome precinct to enable constant visual identification monitoring of aircraft during taxying operations; under visual flight rules.

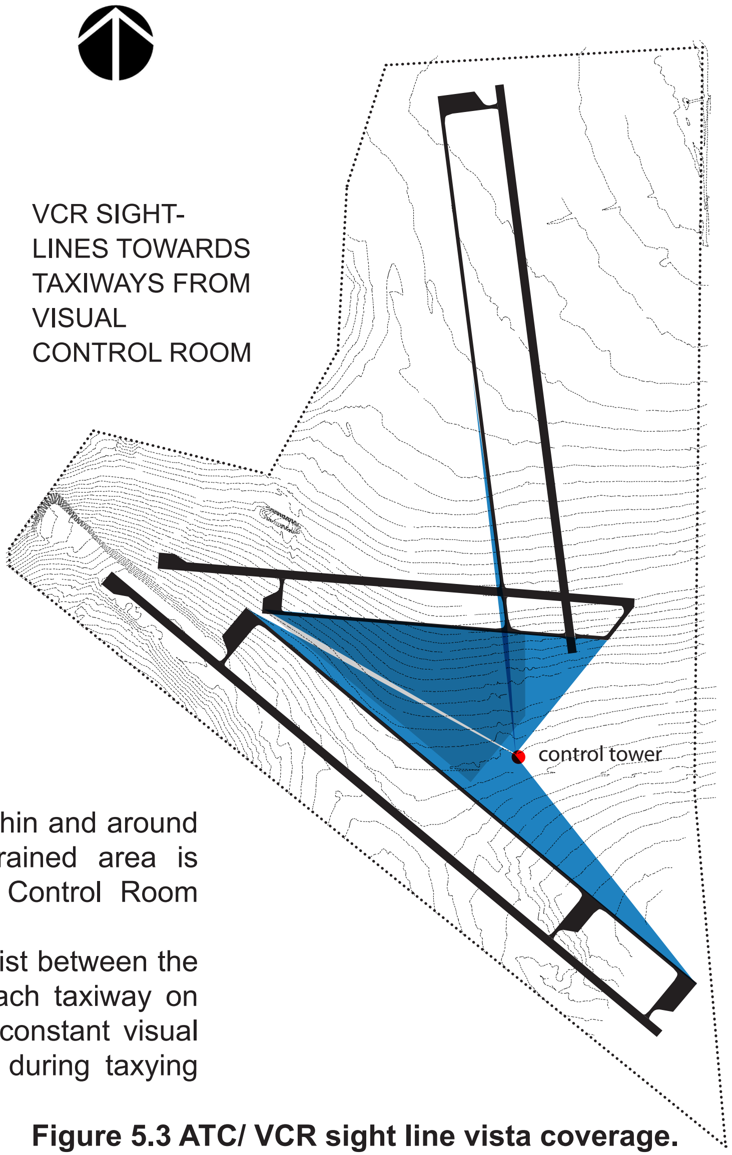


Figure 5.3 ATC/ VCR sight line vista coverage. (Karihindi, 2015)

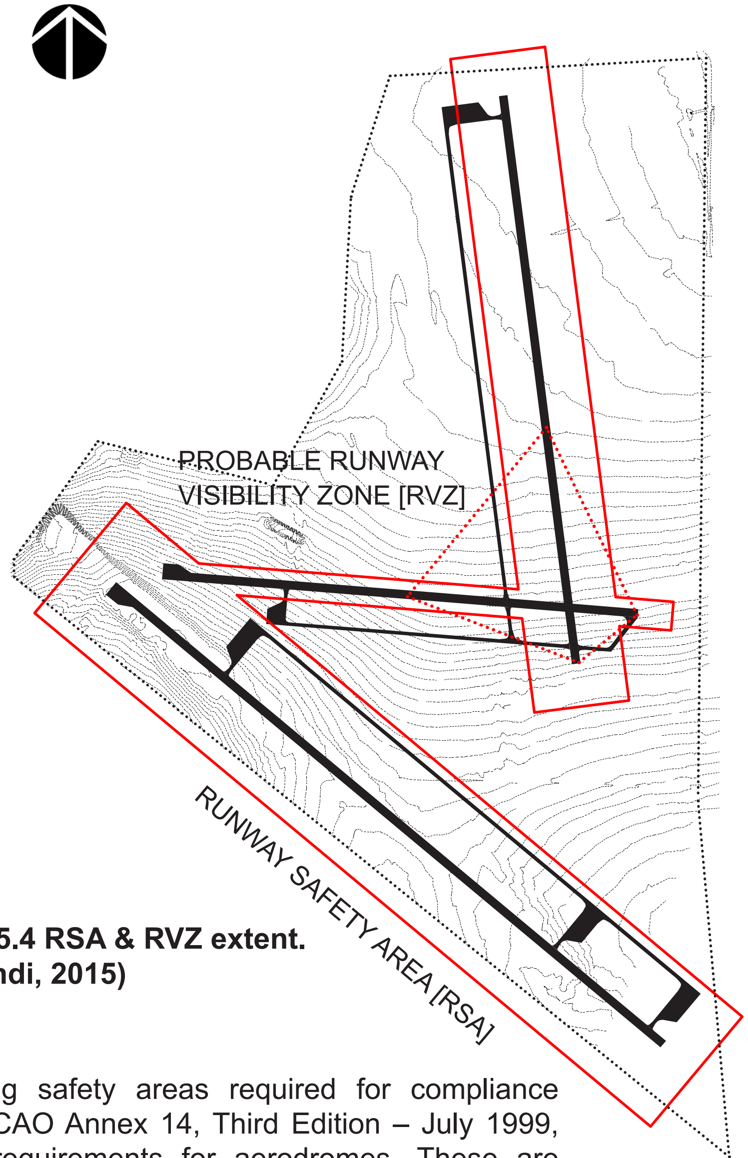


Figure 5.4 RSA & RVZ extent. (Karihindi, 2015)

Resulting safety areas required for compliance within ICAO Annex 14, Third Edition – July 1999, safety requirements for aerodromes. These are influenced by airplane category requirements; in relation to the size of the runway.

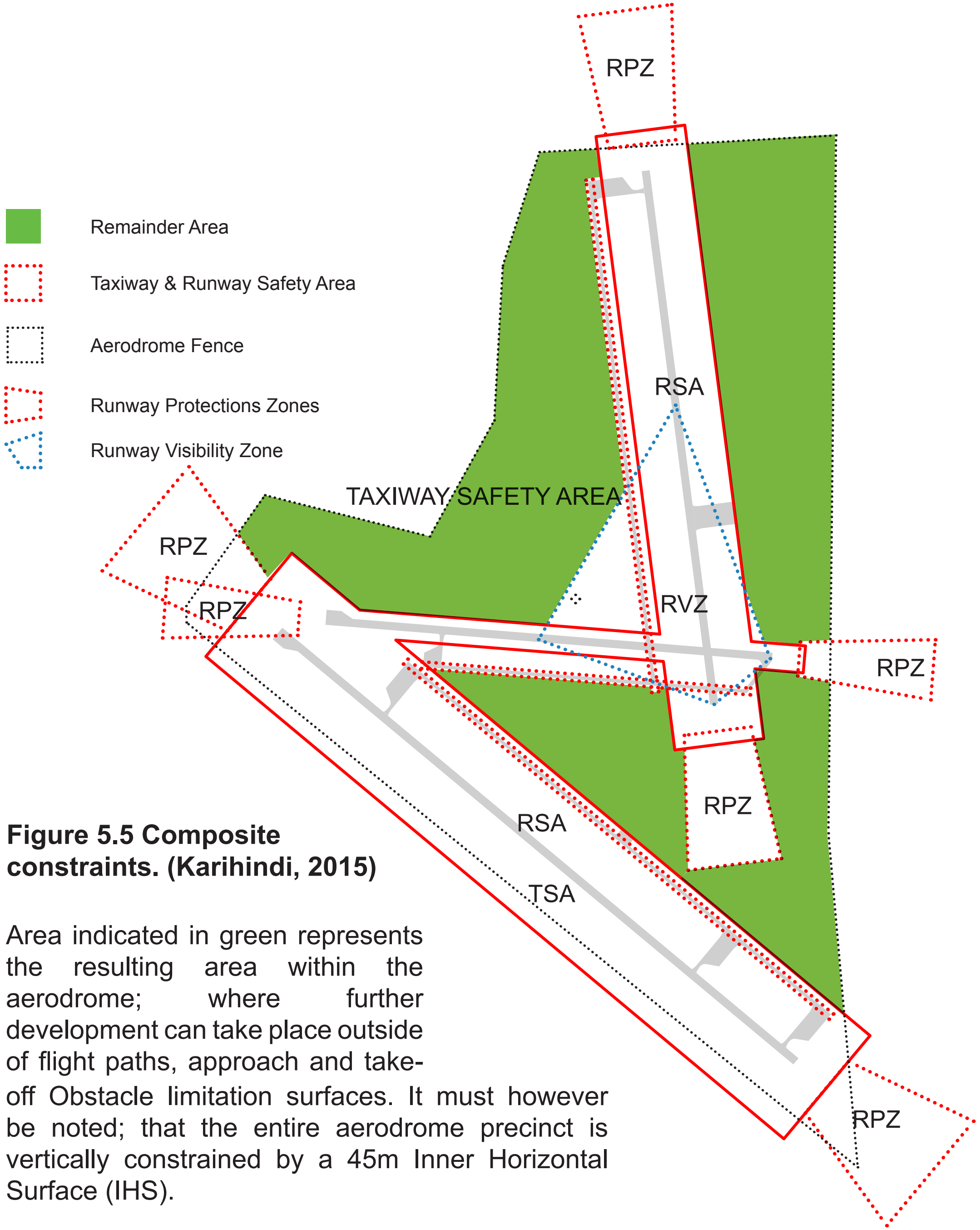


Figure 5.5 Composite constraints. (Karihindi, 2015)

Area indicated in green represents the resulting area within the aerodrome; where further development can take place outside of flight paths, approach and take-off Obstacle limitation surfaces. It must however be noted; that the entire aerodrome precinct is vertically constrained by a 45m Inner Horizontal Surface (IHS).

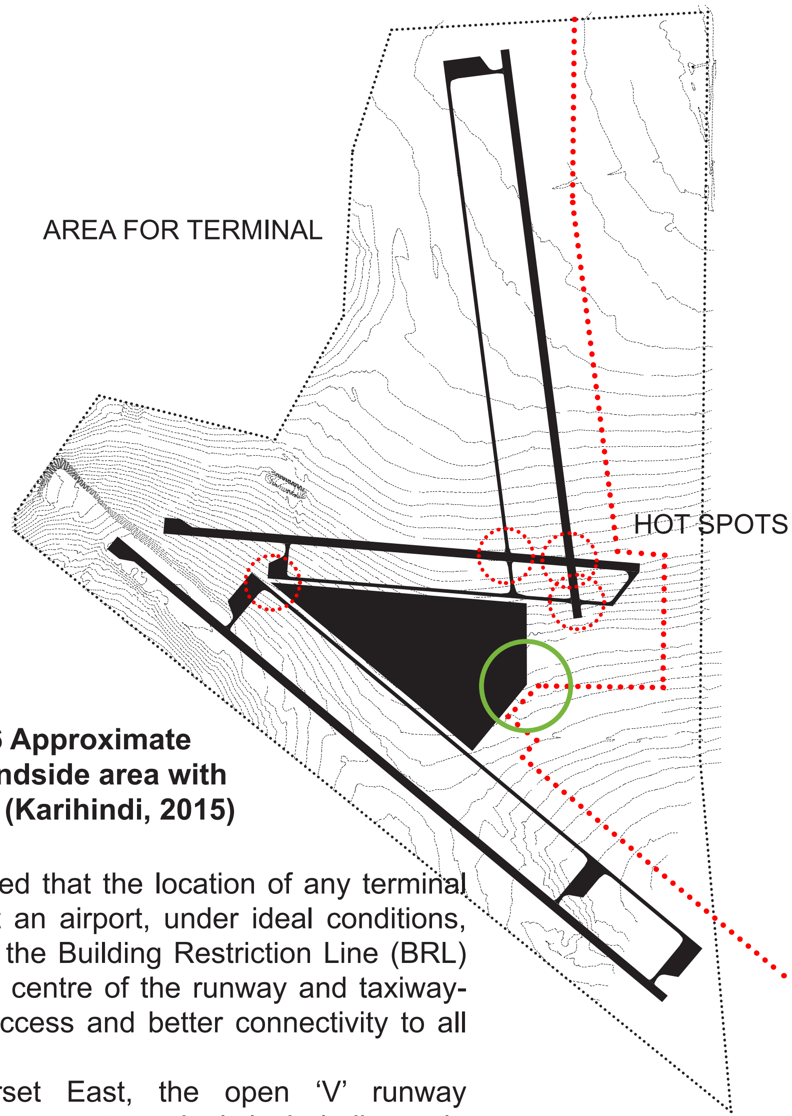


Figure 5.6 Approximate apron / landside area with hotspots. (Karihindi, 2015)

It is required that the location of any terminal building at an airport, under ideal conditions, be behind the Building Restriction Line (BRL) and at the centre of the runway and taxiway-for easy access and better connectivity to all runways.
At Somerset East, the open ‘V’ runway configuration creates a logistical challenge in this respect.
Area in green found to be most ideal.

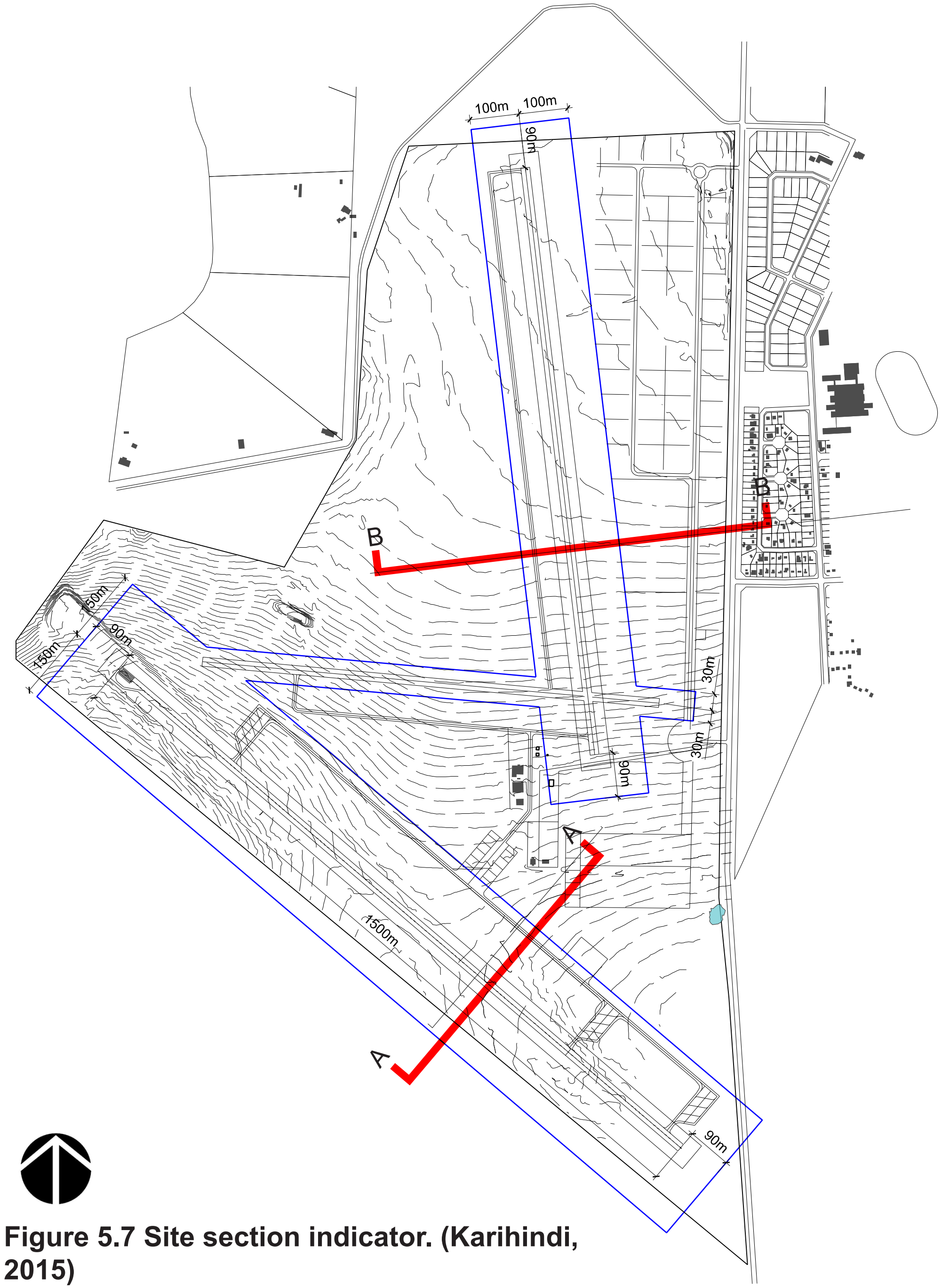


Figure 5.7 Site section indicator. (Karihindi, 2015)

The building restriction line (BRL) defines the limits of development of all on-airport structures, except facilities required by their function to be located near runways and taxiways. Although FAA offers only limited guidance on defining the appropriate location for building restriction lines, most airports use Part 77 surfaces.

In the case of Somerset East Airport, both taxiway-to-object separation standards and Part 77 surfaces are considered.

SUMMARY OF CONSTRAINTS

The height and volume of the terminal building are limited by:

Vertical

- Visual Control Room (VCR) sight line - the view required from the Visual Control Tower; as it shows towards the taxiways and Runways.
- 45m Inner horizontal surface (IHS)
- Transitional Surfaces

There are at present no constraints that exist below ground.

Horizontal

- Runway Safety Areas
- Runway Visibility Zones
- Runway Protection Zones

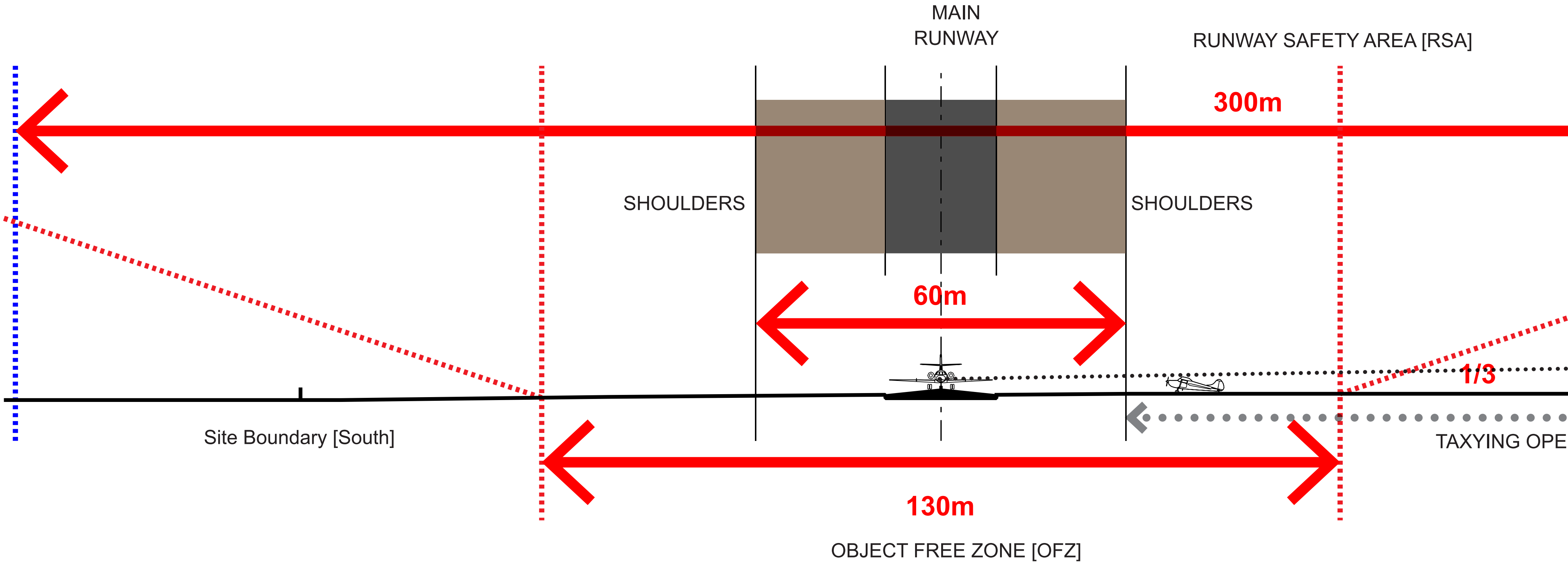
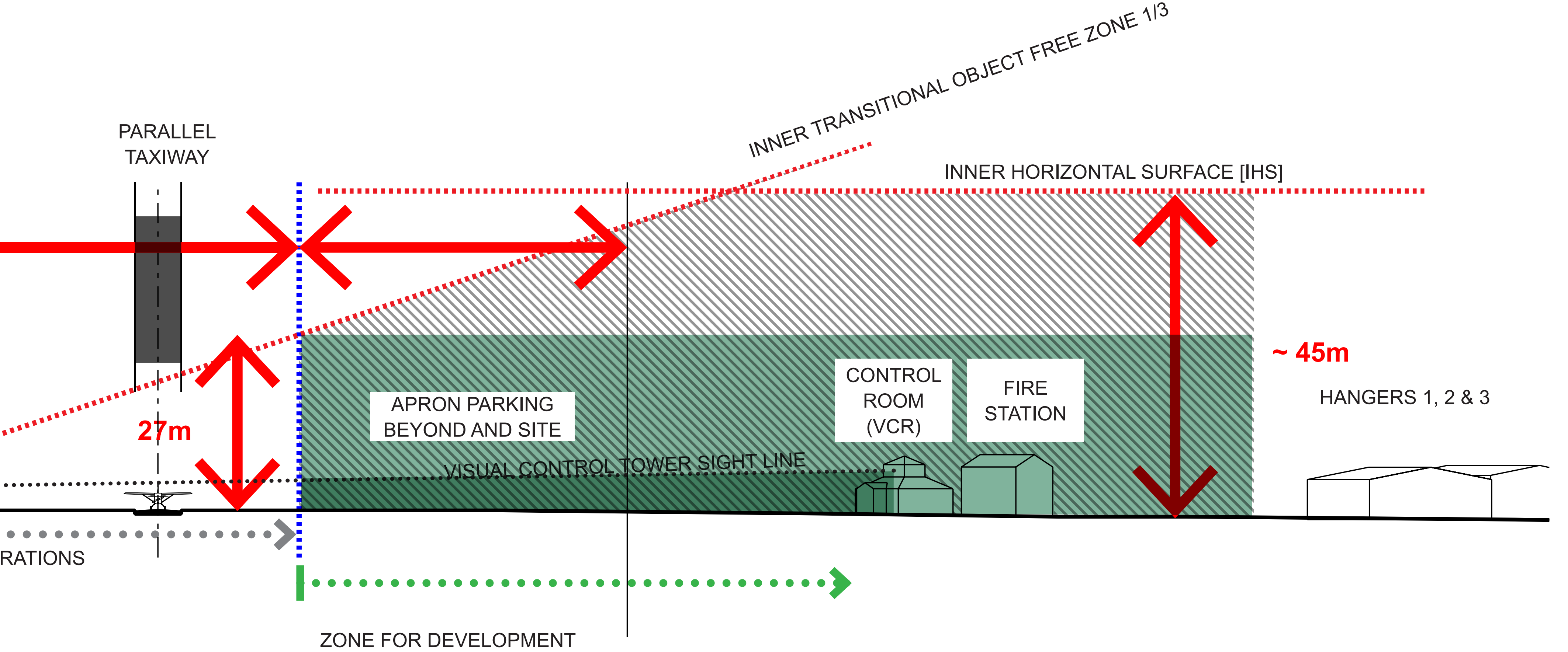
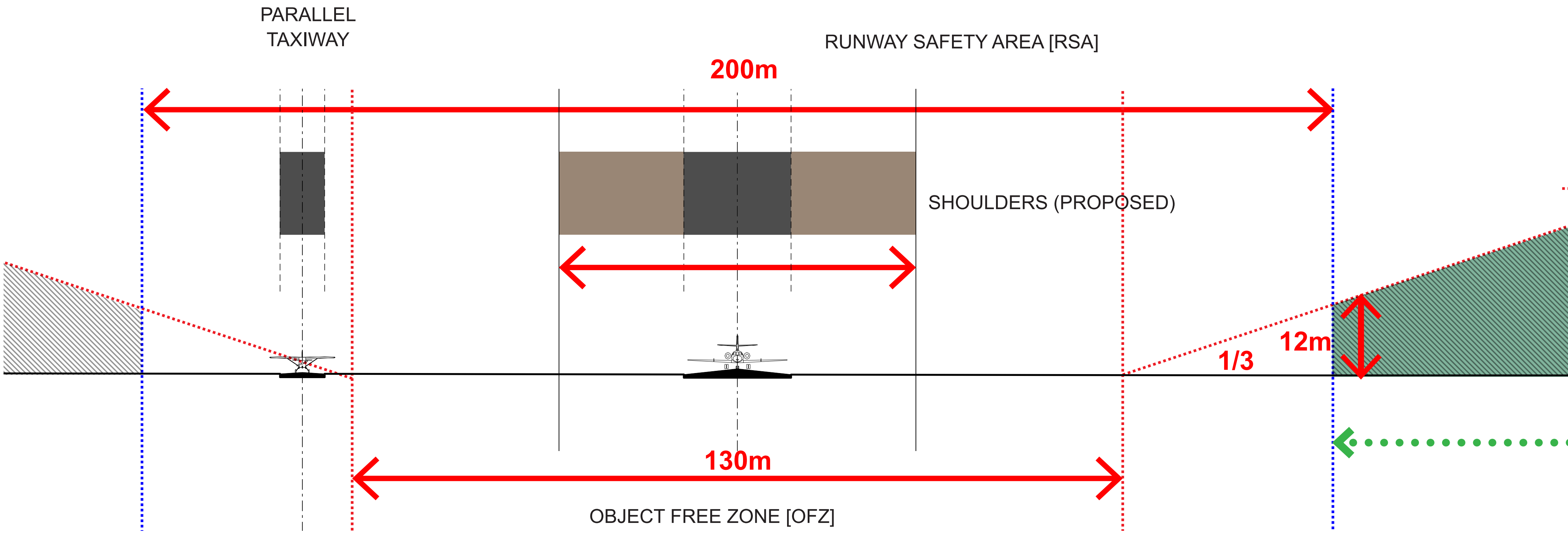


Figure 5.8 Constraints and Informants. Site Section A-A. All constraints and informants designed according to ICAO Standards and Regulations. (Karihindi, 2015)

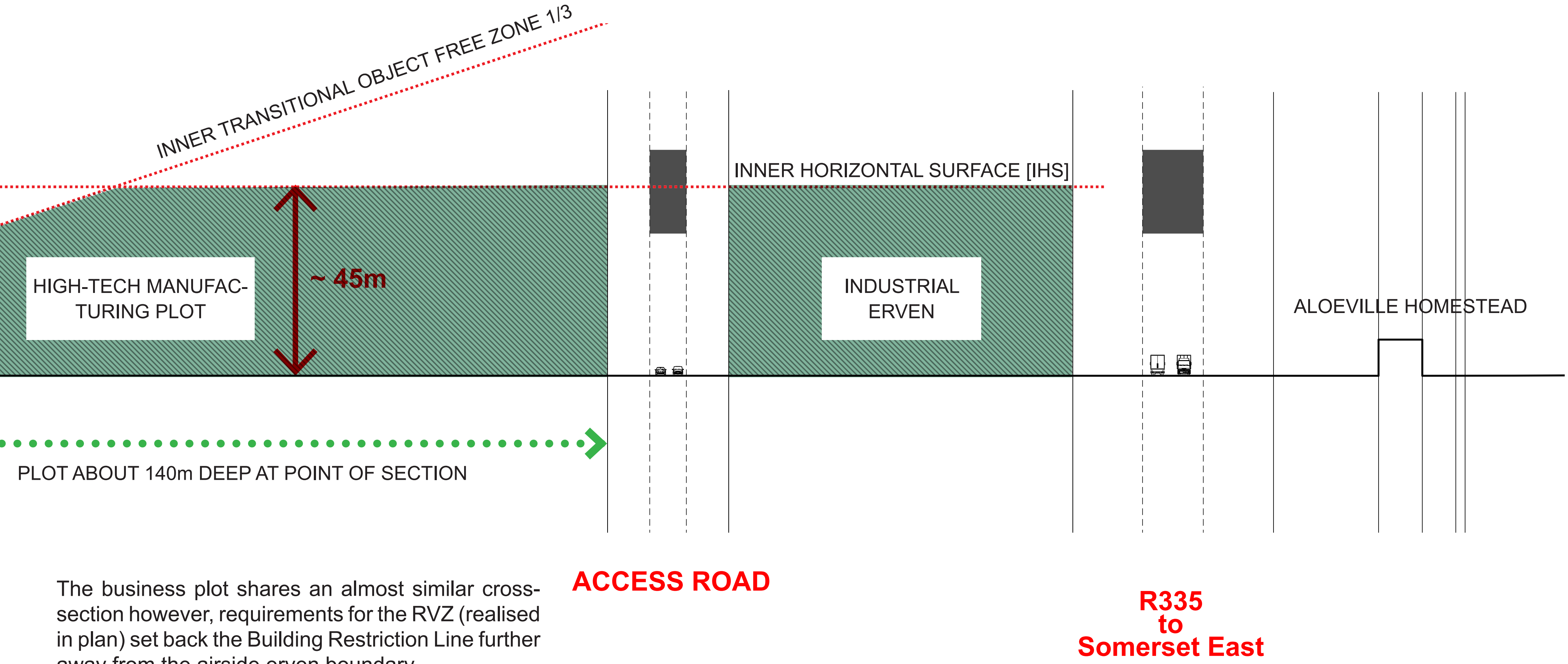


The Building Restriction Line (in plan) rests somewhere within this zone. It is not fixed and FAA and ICAO guidelines on its location are only in principle, but must observe the following: The Runway Protection Zones, the Runway Object Free areas and the Runway Visibility Zone, i.e. RPZ, OFZ and the RVZ.



High-tech manufacturing plot has direct access to the runway.

Figure 5.9 Constraints and Informants. Site Section B-B. All constraints and informants designed according to ICAO Standards and Regulations. (Karihindi, 2015)



The business plot shares an almost similar cross-section however, requirements for the RVZ (realised in plan) set back the Building Restriction Line further away from the airside erven boundary.

CONCLUSIONS

The area under investigation for siting the terminal building and hangers is severely hampered by the existing control towers lines of sight. This will prove challenging in the future; when demand for the facility and increased traffic create the need for additional hanger and parking space.
In light of this, the current layout does not meet the increased demand and should therefore either be upgraded or relocated to another more suitable location.

The initial plan by the Blue Crane Development Agency to provide business facilities within the aerodrome area close to the terminal is a step in the right direction towards creating greater inclusion for public and community viable space; in contrast to creating an elitist environment socially secluded from the immediate community.

Some areas which have been set aside and zoned for business activity have been located with or under a Runway Protection Zone, this creates major security flaws in the master plan of the airport and will limit any upgrade of Runway 02-20.

Figure 5.10 Three hangers on airfield at FAST. (n.d.)

PROGRAMME DEVELOPMENT

INTRODUCTION

This section explores the general programmatic requirements of the functions to be housed in the treatise airport proposal.

This section begins with a discussion on the general overview of activities which will be located on the airfield site. This then leads into the programmatic exploration of the components of the general program, housing: Terminal activities, Flight school, and Airside activities.

ACTIVITIES TO BE LOCATED ON THE AIRFIELD

The discussion with Rob Beach (2015) of 'BCDA', revealed that a number of activities are forecast to be located on the airfield in the future and for this reason need to be taken into account now rather than later. All activities will be in some way or the other related to the airport city model of the Aerotropolis.

Fire Station
The fire station needs to have constant and uninterrupted access ways to all runways in the event of an emergency and for fire rescue operations.
As well as having access to the air-side of the building, there also needs to be a clearway out of the aerodrome in order to service the aforementioned towns of Somerset East, Pearston and Cookhouse

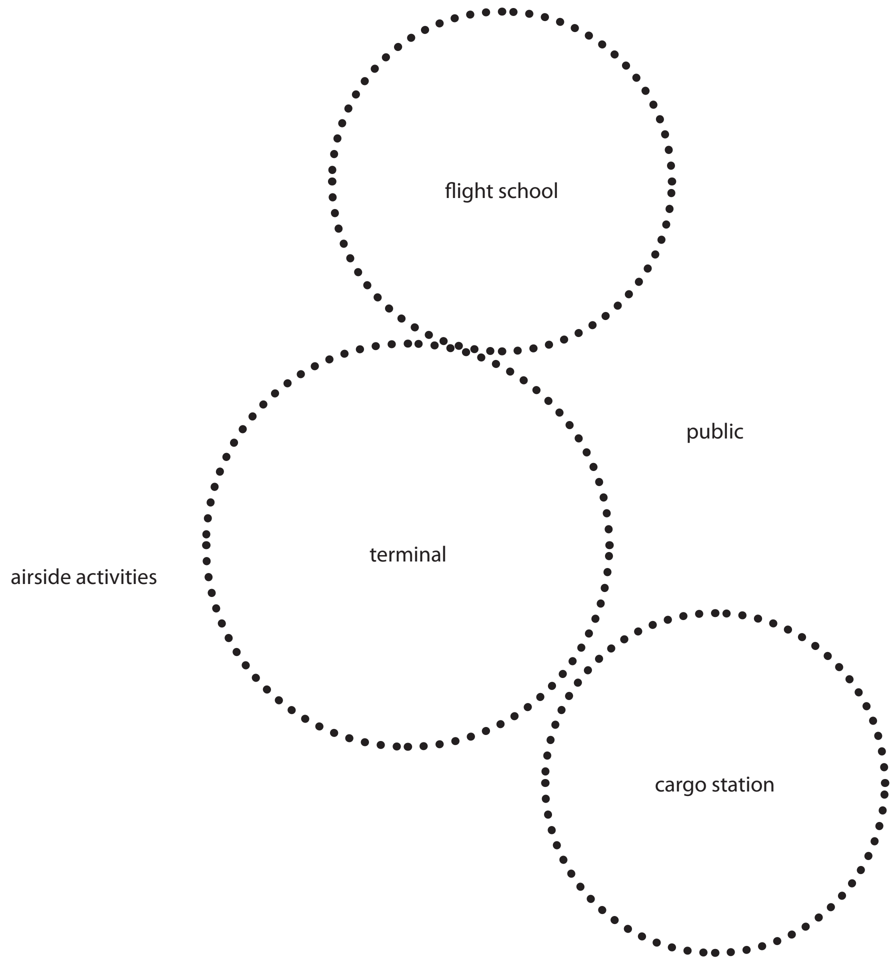


Figure 6.0 Activities to be investigated. (Karihindi, 2015)

‘Bureau of Aeronautics’
The bureau of aeronautics is that arm of the BCDA that will comprise of a joint venture between Albasera Aircrafts cc (a small dynamic SA company with offices and primary workshop assembly facility that deals in the assembly and manufacture of light sport Aircrafts) and the Wits University’s Skywake Aircraft Project.

The SkyWake project is a partnership between the Blue Crane Development Agency (BCDA) and the University of the Witwatersrand to manufacture the first two-seater light sports aircraft to be designed and intended for production in South Africa. The aircraft has a 100hp Rotax 912S engine giving a top speed of about 120kt and a field length requirement of less than 200m. It has been designed specifically for the South African environment, particularly to cater for the hot-and-high conditions encountered in much of the country.
Design of the aircraft is led by one of the university’s lecturers and the project is built by a core team of six or seven with at least 40 students have participating on the project. (Garc64, 2010)
This will comprise of a commercial production, with warehousing, activity with an aeronautical research/learning activity and like-wise will need to be catered for.

Light Industrial Park
Aside from all the aviation related activities on the aerodrome, The industrial park will comprise the majority of land that is not utilised by strict aviation related functions. It would however employ the services of a fast and readily available air cargo opportunity opened up by the airport’s, 1.5 KM asphalt runway for such uses as ferrying time sensitive goods to and from other destinations out of Somerset East.
The majority of the local workforce in Somerset East will be employed here to realise the Local Economic Development goals that the project sought to create.

Air Cargo
Some of the light industry zoned erfs and will serve as remote warehousing for companies and franchises from all over South Africa. For this there needs to be effective access created to serve this function.

Decommissioning of Airbus aircrafts
Such activities as aircraft parking, maintenance, aeroplane dismantling, aircraft disposal and recycling will comprise this task. The vision is that this will be a sustainable process where waste generation will be kept to a mimimum. which would need to be effectively tackled and disposed off, reused or recycled, and for that aircrafts

trains and trucks for waste removal etc hence access to be looked at.(Beach, 2015)

Flight School
As mentioned earlier at PFA.

Business Park
The business park is to offer such activities as office space, conference venues and marketing suites from in and out of town with particular quick and traffic free access to terminal and charter flight services from he terminal.

Flight Club (Currently operating)
Although the flight club is operating it will need to be observed as an independent process from flight school and as such should cater uninhibited access to airfield and hangers for resident and local private pilots.

Airshow
A public event at which aviators display their flying skills and the capabilities of their aircraft to spectators, usually by means of aerobatics. Air shows without aerobatic displays, having only aircraft displayed parked on the ground, are called “static air shows”. This involves a large gathering of persons and would require enough parking space and interaction public open space to realise.

Tourism
Somerset East’s revenue is largely dependent on tourism - game farms are located around Somerset East as well as the Addo National Park to the South and the Mountain Zebra National Park to the North. With the annual visitor number forecast to be growing at a rate of 10 % PA this facility should cater for the .clientele to arrive

Figure 6.1 RAF Red Arrows aerobatic display team display at Farnborough International Air Show (Karihindi, 2010)


ounge luxury
Lounges

PASSENGER TERMINAL ACTIVITIES

As it will be discovered throughout this document; an airport terminal is a relatively new kind of building that prepares people for pre-flight and post-flight activities. In essence an airport is an interface building.

For the sake of this section the word ‘airport’ will be sparingly used interchangeably with the word ‘terminal’.

An overview of the various types of terminal buildings (airports) are shown briefly below:

International Airports

International airports (and/or terminals) provide for travel between countries, at times even continents and they typically provide for larger heavier aircraft and large traffic volumes. They typically have the following functions associated with them;

- Ticket stalls
- Security
- Customs and immigration.

Regional/Local Airports

Regional Airports on the other hand are much smaller in nature and provide for much lesser traffic and do not have customs and immigration services. In the past they did not have security and scanner services but ever since the September 2001 attacks on the New York Trade Centre, there has been a large push to have scanners and security devices in place at small and regional airports as well. (Pearman, 2004).

Most terminals of this type operate on a common-use facility basis whereby functions and facilities for use are shared interchangeable between the different users, service providers and operations. These uses are assigned based upon the needs at the given time, such as ticket stalls and concourse gates and check-in stalls. (Cho & Illia, 2003)

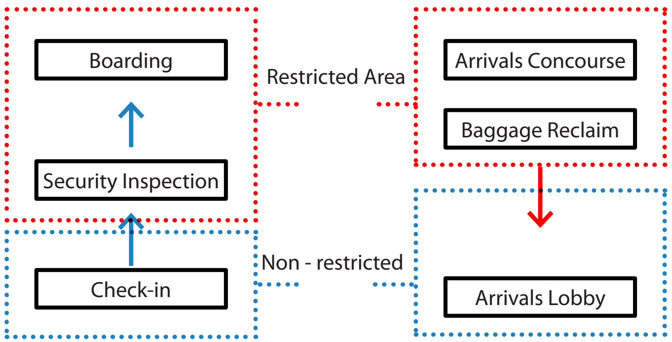


Figure 6.2 Local /regional airport departure and arrivals activities process. (Karihindi, 2015)

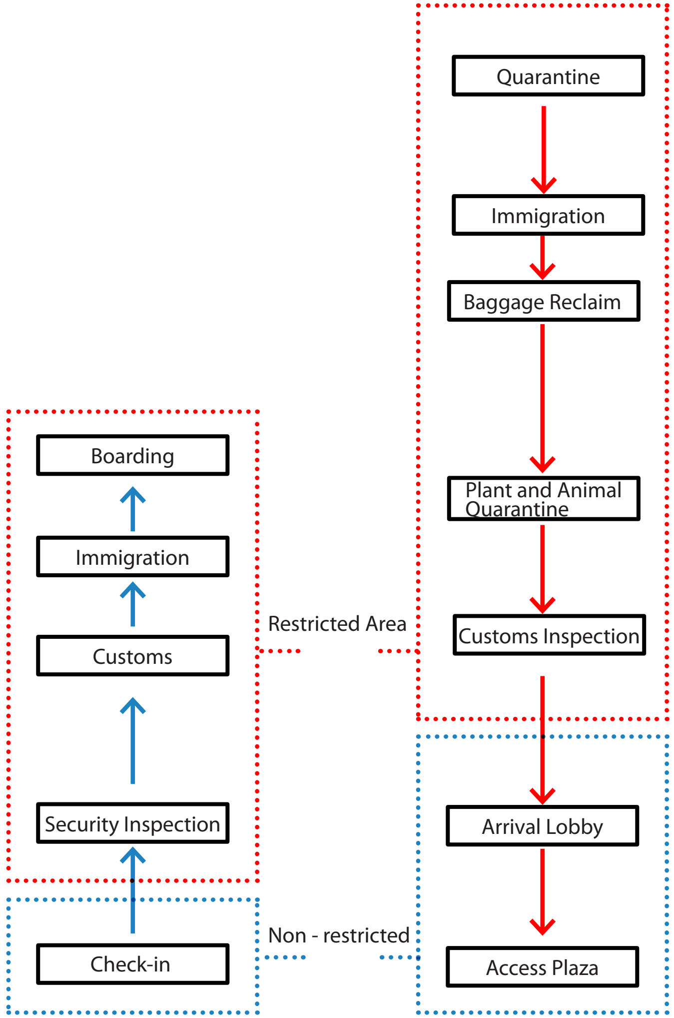


Figure 6.3 International airport departure and arrivals activities process. (Karihindi, 2015)

General Aviation Terminal

General Aviation terminals on the other hand offer support to a wide variety of services ranging anything from gliders and powered parachuting to corporate business jet flights, flying clubs flight/ schools etc.

Most of the world's air traffic falls into this category, and most of the world's airports serve general aviation exclusively. (Federal Aviation Administration, 2012; Crane , 2001).

The proposed terminal building for Somerset East falls into the category of a General Aviation Terminal, operating at the size of a Local Airport, due to its small town location, and proposed light air traffic activity.

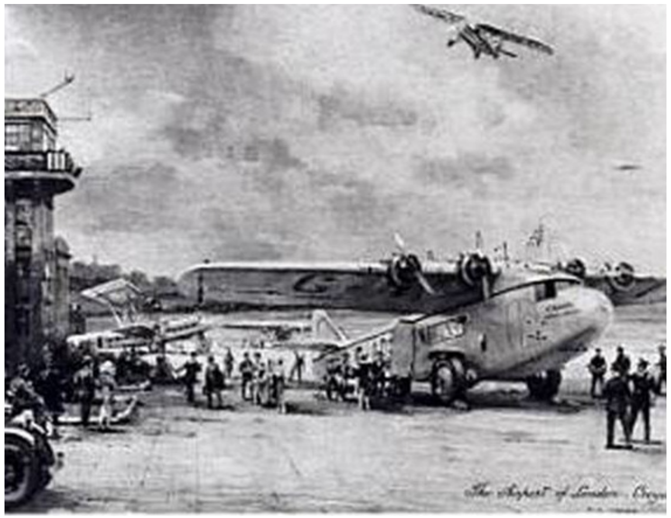


Figure 6.4 Flying from Croydon in the 1930s. (Pearman, 2004, p. 12)

Nature of Terminal space

Due to the large volumes of passenger traffic, and sometimes time constraints placed on passengers by departing aircrafts, terminals, for the most part, are conceived as sheds under which a whole variety of activities happen; rather than compartmentalised spaces. Therefore clear navigation and orientation should be achieved at all times within the terminal environment.
In contrast to the current times, progression from landside to airside was always simple and straightforward with the aircraft in view, nowadays with regulations and multiple level changes the modern terminal is compounded. (Shaw, 2007)

Terminal Activities

As previously discussed in the preceding chapter, the passenger terminal has a number of activities that it needs to accommodate for departures and arrivals; some open to the public whilst others restricted from public access.

The passenger Terminal has to provide enough room for.
- processing
- secondary services
- and gathering

Departure Concourse

ICAO requirements stipulate that the terminal should accommodate:
- Seating for 80% of airplane maximum capacity
- Space for airline processing (gate control) passenger queuing space circulation space
- Space per person: approx. 3m2

Security and Check-in

After passengers have shown their boarding passes to security and issued their checked luggage for inspection, the standard procedure is such that they are required to;
- Place hand luggage onto an X-ray conveyor belt to be scanned
- Place the contents of your pockets in the trays provided to be passed through the X-ray machine.
- Passengers then proceed through metal detector
- Manual search by security may be required by security guards.

Conclusion

A terminal Building is determined by three activities that a passenger takes before boarding an aircraft. The entire programme for the building; The Check-In, Security and Departure. The spaces are different in nature and technicalities allow for unique spatial conditions at each stage.

Outbound Baggage Check-in and Processing

The outbound journey comprises of a Check-In step where luggage is subjected to a security scan before it is allowed onto the journey. This process requires special machinery that can detect explosives and harmful chemicals.

The outbound baggage procedure is to comprise of a front end check-in and weigh-in station, and a back-of-house baggage screening process for harmful items, which requires an explosives detection system. For this, a mini in-line Checked Baggage Inspection System (CBIS) is to be employed. A certified explosives detection system (EDS) which has a capacity of 210-230 bags per hour is the ideal model for a low capacity airport, such as the proposed Somerset East Terminal.

Overall Dimensions

- 2413 mm x 2223 mm x 4759 mm

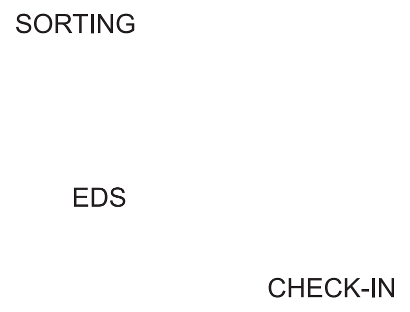


Figure 6.5 Schematic visualization of a mini in-line system (U.S. Department of Homeland Security, 2007)

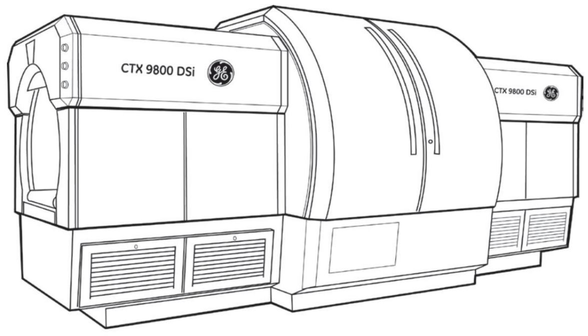


Figure 6.6 CTX 9800 DSi Explosives Detection System. (GE Homeland Protection, 2009)

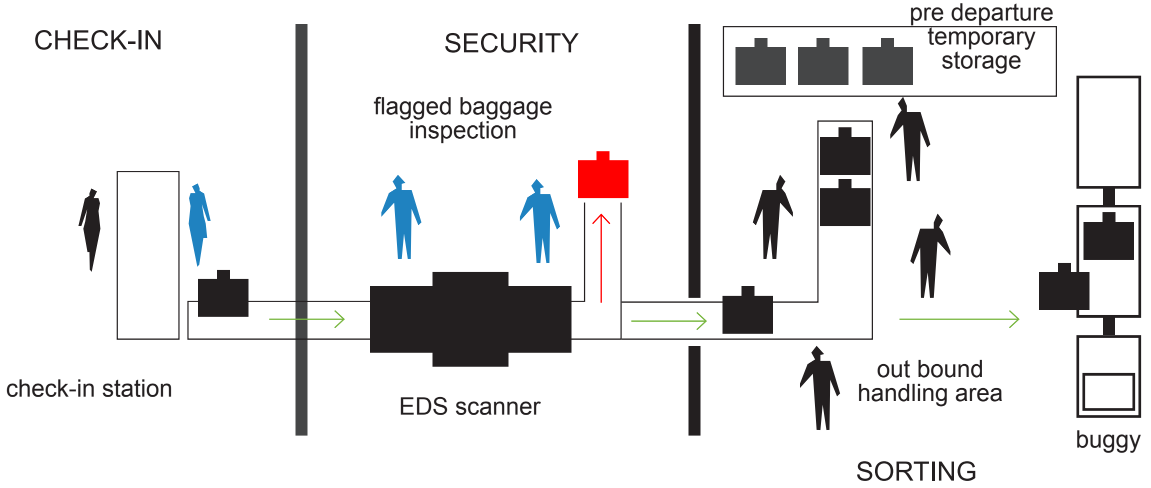


Figure 6.7 Outbound baggage handling procedure showing degrees of access. (Karihindi, 2015)

Inbound Baggage Reclaim and Handling

The passenger arrivals process consists of those facilities and functions which reunite the arriving passengers with their checked baggage.(Coffman Associates, 2014).
The baggage reclaim area is to consist of a frontage, passenger floor area and circulation. The baggage claim frontage area is where baggage is passed from the baggage handlers to awaiting passengers upon a conveyor belt. Floor area is the space in which passengers wait to collect their baggage, and the circulation area is the area through which passengers move to/from the baggage claim area.
For reuniting passengers with their baggage, an elegant baggage carousel design is chosen to create a focal point for the space upon arrival. Although adaptable and variable, the carousel is based on the 8000 series Uni-Plate Flat Plate Carousel model shown in the figure above.

Overall Dimensions

- 2844mm x 6000mm x 300mm

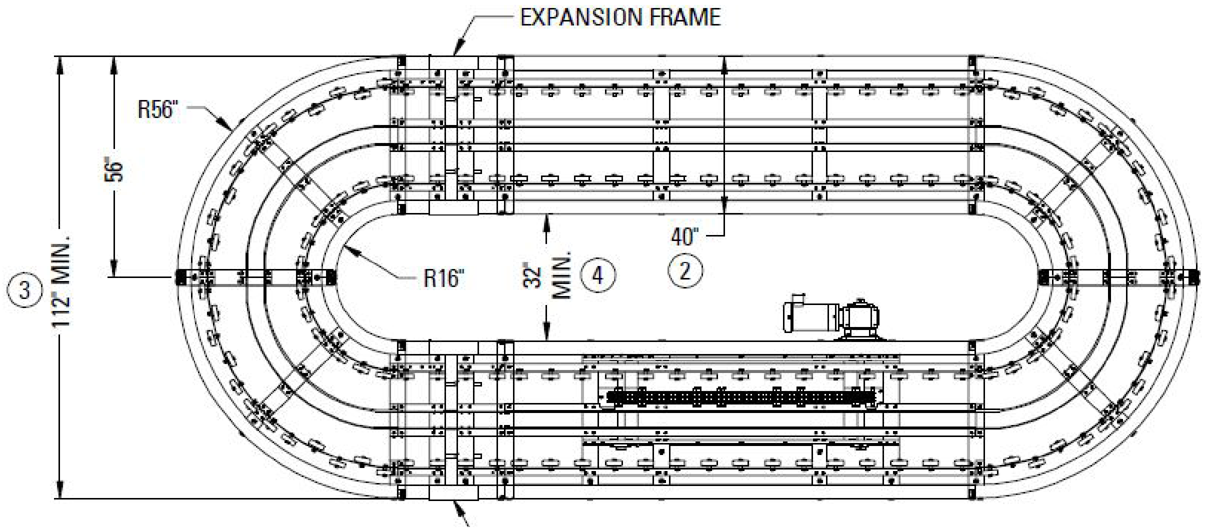


Figure 6.9 8000 Series Uni-Plate™ Carousel Layout with Dimensions. (Unified Supply, 2015)

Figure 6.8 8000 [Right] Series Uni-Plate™ Carousel. (Pallets Shown Transparent Red for Illustration Purposes.) (Unified Supply, 2015)

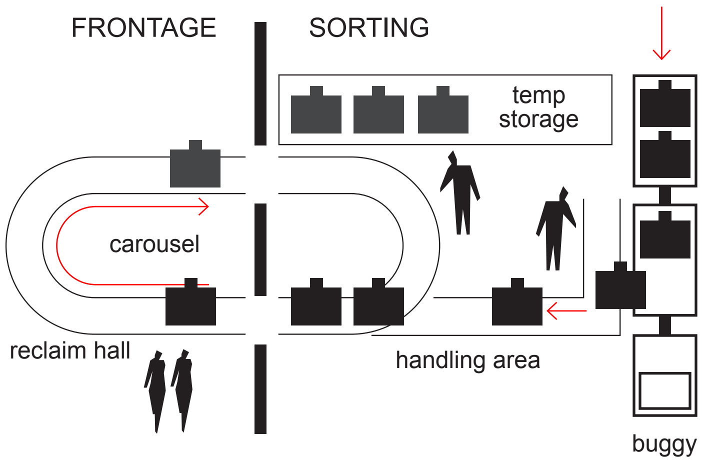


Figure 6.10 Inbound baggage handling procedure. (Karihindi, 2015)

Figure 6.11 Trainee pilots receiving instruction in a classroom. (n.d.)

FLIGHT SCHOOL ACTIVITIES

A flight academy offers an environment which is conducive for trainee pilots to obtain their training license.

The size of each activity to be accommodated at a training institution depends on the average number of students that are to use the facility, as well as the equipment required to facilitate for such an endeavour such as; aircraft parking space and training equipment etc.
All in all the PFA envisions that the training facility will cater for 50 students.

The main functions include the following:

1-Educational
- Aircrafts
- Lecture Rooms
- Briefing & Debriefing Rooms
- Meeting Rooms
- Flight Simulator Rooms

2-Maintenance
- Aircraft Maintenance Areas
- Workshop
- Workstation
- Tool Storage Room

3-Communal
- Communal areas such as Cafeteria & bar [Cold Food / no hot food]

Flight Simulators

Flight simulators are devices that recreate the actual flying environment to allow for training and instruction without the practical dangers.

Research has revealed that the Frasca 131 and the Frasca 142, used for pilot training by Progress Flight academy, are a variant of the fixed wing aircraft flight simulators produced by Frasca International Inc. They are licensed by SACAA, ICAO as well as the FAA.
Seen here to the right is a rudimentary setup of two Frasca 142 simulators and beside them their instructors and monitor stations respectively.
This is undoubtedly the state of affairs at Prosper Flight Academy's simulation rooms. Nevertheless, in order to add to the whole experience of 'flying' for students and also as a matter of image and branding for PFA, the flight simulators can be fitted into a full flight simulator (FFS) system which can emulate the experience via integrated motion, surround sound and three dimensional visual effects created during the flight training session. This better engages the trainees as well as the trainer - in contrast to what is achieved by two computer monitors side by side as seen in the picture to the immediate right.

Overall dimensions for FFS system

- 2844mm x 5000mm x 5500mm

Figure 6.12 Frasca 141 FTD – simulator. (Simulator Broker, 2010)

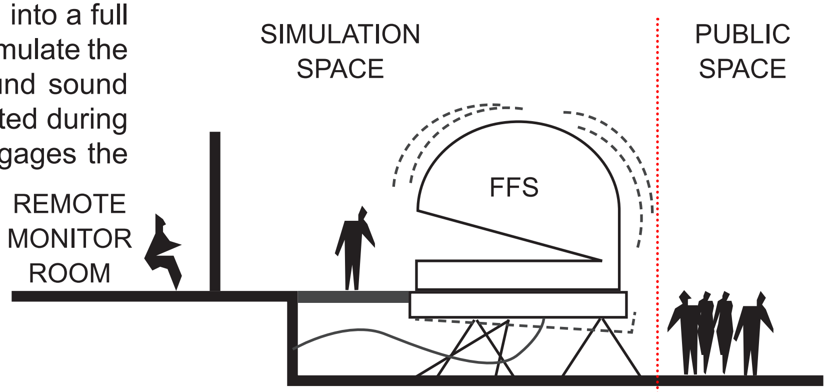


Figure 6.13 Diagrammatic understanding of flight simulator spatial requirements. (Karihindi, 2015)

Figure 6.14 CJ1+ Level D Full Flight Simulator with electric motion base. (Frasca International, 2014)

AIRSIDE ACTIVITIES

Airspace

According to the BCDA it is envisaged that as much as up to 10 aircrafts would be in the General Flying Area to the South West of Somerset East. The amount of aircrafts in the airspace will be determined by the Progress Flight Academy's flight training programme which according to du Toit, (2015) is due to relocate in "ab-initio" from the already busy airspace area of Port Elizabeth to Somerset East In October 2015.

Aside from General Aviation flights, any combination of the two aircrafts shown to the right amounting to 10 (for the meantime), can be in operation on the airport at a single time for training purposes. The twin-engine Seminole for advanced pilot training and the single-engine Warrior type Piper for rudimentary training. Each of these aircrafts have a capacity of 2 to approximately 4 passengers but for the sake of training purposes it is assumed that only an experienced instructor and a trainee pilot would be accommodated.

This inevitably leads to the conclusion that the Terminal facilities as well as apron arrangements and hangers, need to be designed in such a manner as to accommodate this activity and the projected number of people at any given instance.

Apron

The apron currently needs to be able to accommodate the following types of aircraft in respect of Progress Flight Academy

- 7 Piper Warrior IIIs
- 7 PA28-161
- 2 Piper Seminoles,
- 2 PA44-180.

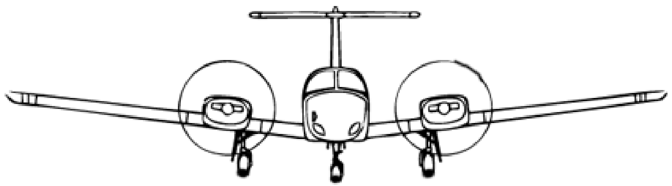


Figure 6.15 Piper Seminole. (Piper, 1995)

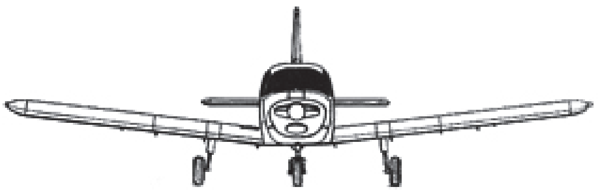


Figure 6.16 Piper Warrior Aircraft Type. (Piper, 1995)

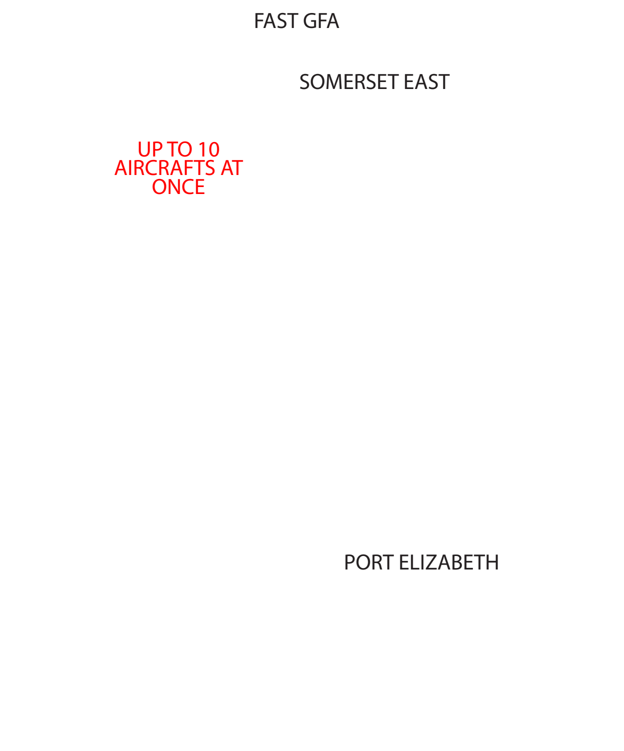


Figure 6.17 Aeronautical Chart showing proposed General Flying Area for Somerset East [FAST], outside of Port Elizabeth Airspace. (du Toit, 2015)

As mentioned before, aside from the PFA flight school activities the airport also needs to cater for a host of other services including: offering a full range of aircraft services, an on-demand charter operation and maintenance facility, fuelling station and cargo.

With respect to the commercial flight operations of the terminal, the future apron size requirements are not currently known. However, it is forecasted that Somerset East will receive a 10 % annual visitor increase. (Blue Crane Route Municipality, 2015). As such, a precautionary measure providing holding bays instead of bypass taxiways, enhances capacity. Holding bays provide a standing space for airplanes awaiting final air traffic control (ATC) clearance and to permit those airplanes already cleared by ATC to move to their runway take-off position. By virtue of their size, holding bays enhance manoeuvrability for holding airplanes whilst also permitting bypass operations indicated by *FAA AC 150/5300-13 Airport Design Advisory Circular.*

Terminal and Apron Interface Requirements

Terminal apron requirements are determined by the number of gates, the size of the gates, the manoeuvring area required for aircrafts at gates, and their aircrafts parking layout in the gate area. The aircrafts parking layout of the gate area requires the aircraft to park nose-in by manoeuvring into a parking position under its own power and manoeuvring out of the position with the aid of towing equipment for non-training aircrafts i.e. Citation jets.

Aerodrome Traffic

According to ICAO, the traffic on an Aeordrome can be classified in three ways, as either being : Light, Medium, or Heavy. (International Civil Aviation Organization, 1999, p.11)

- Light: “Where the number of movements in the mean busy hour is not greater than 15 per runway or typically less than 20 total aerodrome movements”
- Medium: “Where the number of movements in the mean busy hour is of the order of 16 to 25 per runway or typically between 20 to 35 total aerodrome movements.’
- Heavy: “Where the number of movements in the mean busy hour is of the order of 26 or more per runway or typically more than 35 total aerodrome movements.”

It is conceived for this treatise, that the aerodrome traffic falls under the category of Light.

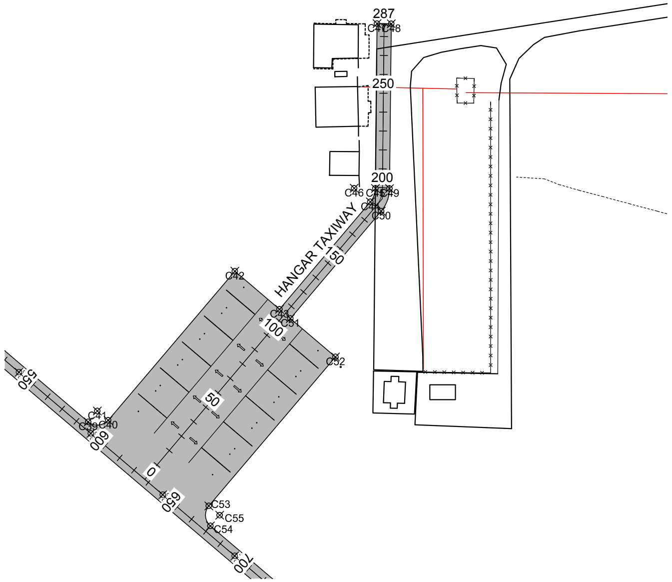


Figure 6.18 ***Geometric layout for new runway and taxiway.*** **(Coetzee, 2014)**

Aircraft Servicing

These activities indicated in Figure 6.19 to the right is an indication of the activities that happen to a parked aircraft on the apron. It is such that the parking bay space is required to take into consideration all the following space needs. The model(critical) aircraft indicated to the left is a Boeing aircraft .

For Somerset East the service road requirements is 5m on the apron.

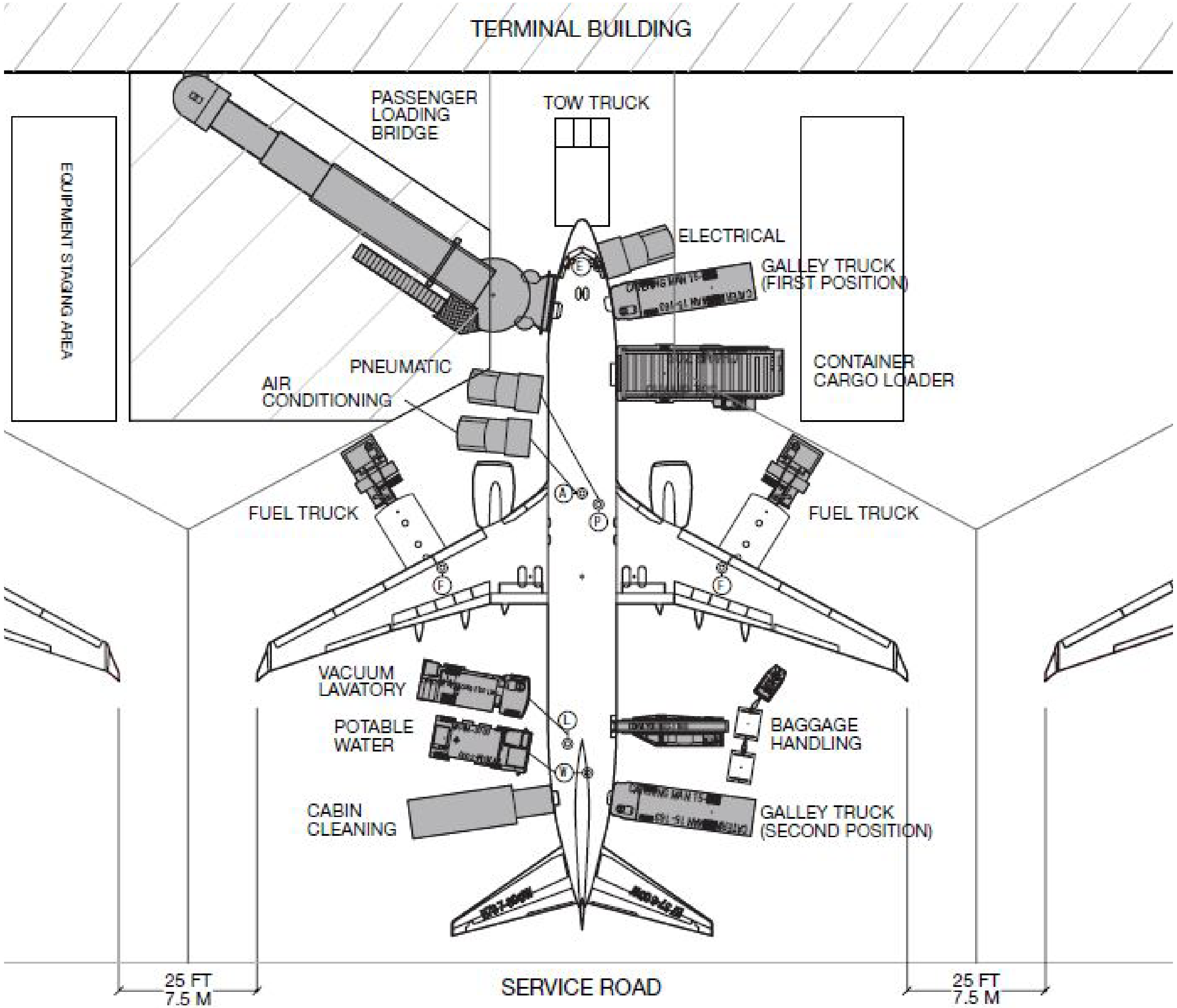


Figure 6.19 Typical aircraft servicing equipment referencing the Boeing 737/BBJ Document D6-58325-6, Section 5.0 Terminal Servicing. (Landrum & Brown, 2010)

AIR FREIGHT HANDLING

The cargo handling process is a largely back-of-house activity; it involves the reception, preparation, sorting and despatch of goods. The task is labour intensive and is largely confined to large open plan industrial sheds. The process happens in a similar manner to the b
The cargo despatch process also entails the use of scanners for the detection of explosives and drugs as can be seen in Figure 6.20.

The operations also requires unrestricted access to the apron for loading and off loading of goods

The cargo terminal is highly specialised in it's operations and therefore need not be directly connected to the passenger terminal. Access is controlled.
The treatise document is not focus on the cargo terminal however it's significance lies in being part of implementing facilities to support a budding Aerotropolis.

Figure 6.20 Dortmond Airpot Cargo Terminal activities (2015)

PRECEDENT STUDY

INTRODUCTION

In this section, international precedents as well as local precedents for airports will be analysed, so as to formulate relevant design strategies for later implementation at a later stage of the design response.
The manner in which these precedents handle passenger progression through a terminal building is of importance to this treatise.

Elements that will be looked at in this chapter comprise of the following;

- Tectonic
- Programme / Functions
- Circulation
- Master plan
- Sustainability

STANSTED AIRPORT

Architect: Foster and Partners
Location: Stansted Mountfitchet, Essex UK

Built: 1981 - 1991

Stansted Airport is a judicious reaction to the necessities of air travel. Be that as it may, the structure rises above the just utilitarian. Without a doubt the 'basic trees' which bolster the rooftop and convey administrations make an effective, sentimental space with their arms stretching up inside of an inside showered with diffused light (Fletcher, 1996).

Figure 7.0 Aerial photograph showing terminal with adjacent apron. (Foster and Partners, 2009)

Architectural Expression

The overall determining feature is functionality above all else.
Stansted airport celebrates the romance of air travel by challenging the used archetypes of that time, Gatwick and Heathrow. Many have found this scheme by Foster and Partners to verge on "form follows function" (Sullivan, 1924) formula, because of its simple response to program and spatial needs. It further suggests that "functionalism is really no more than a late phase of humanism, rather than an alternative to it," (237). In other words, in humanism, the form of buildings and structures was largely inspired by the human body, making man the centre of all things.

Figure 7.1 Baggage reclaim Hall. (Foster and Partners, 1991)

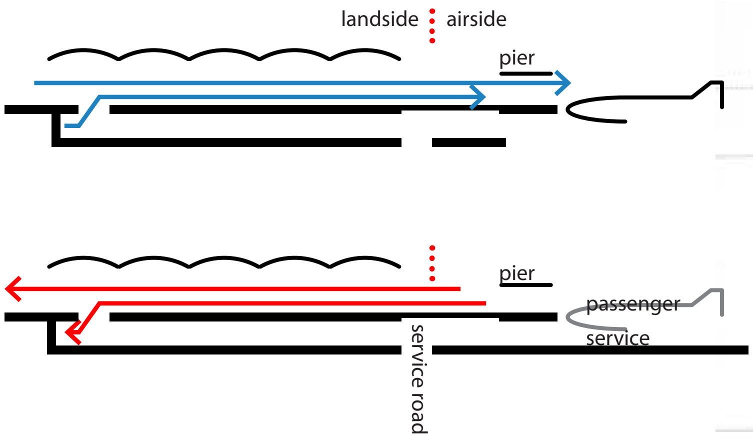


Figure 7.2 All PAX flows are located on one level. (Karihindi, 2015)

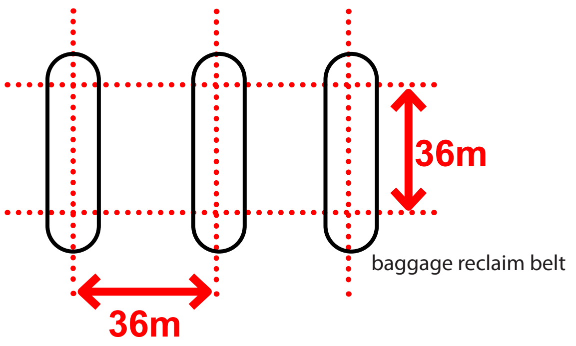


Figure 7.3 36mx36m grid dictates the spatial layout of the entire building. Grid is determined by space requirements for baggage handling system on level below. (Karihindi, 2015)

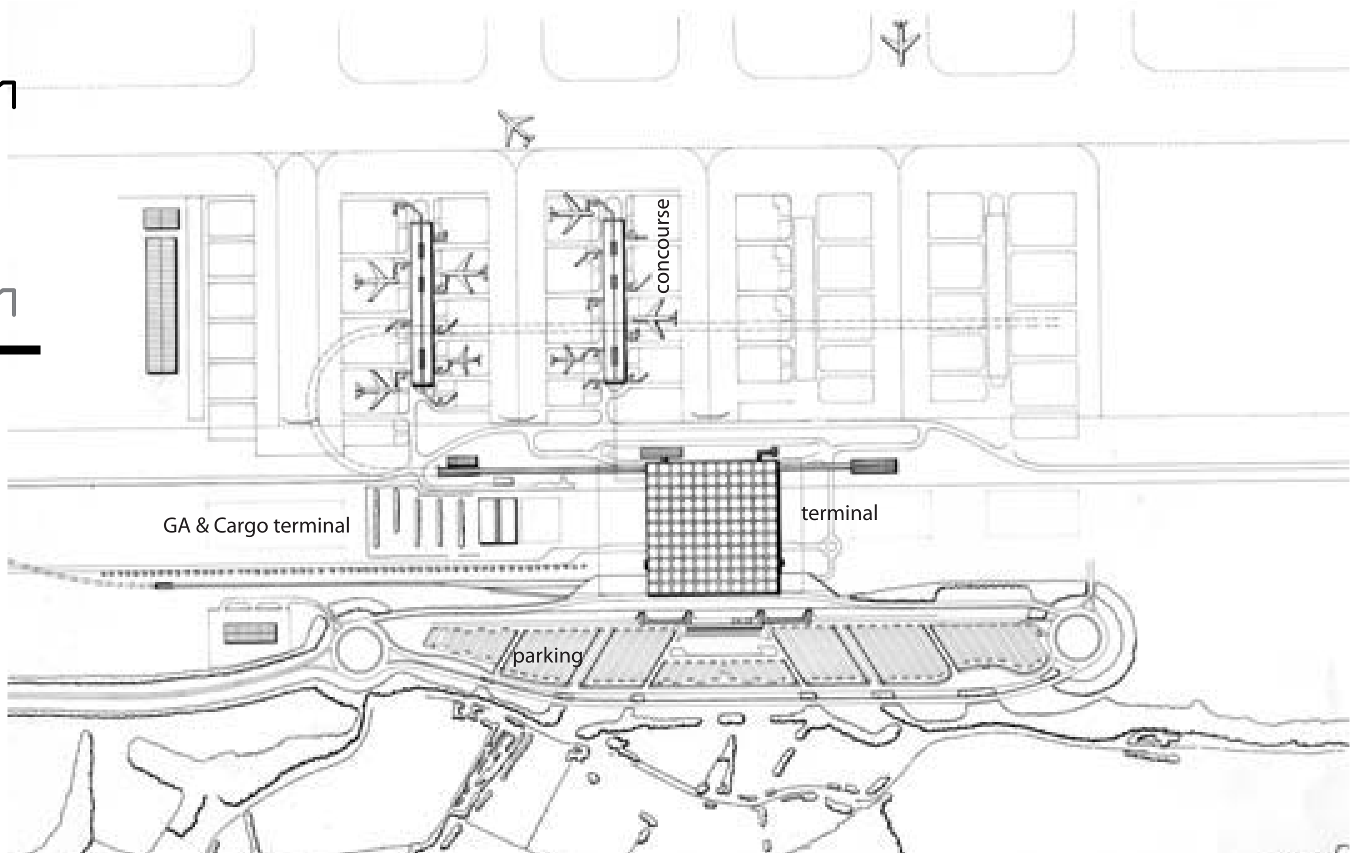


Figure 7.4 Aerial photograph showing terminal with adjacent apron. (Foster and Partners, 1991)

Stansted Airport can be said to be a simple and straight forward design that meets the intended need quite precisely without much effort. This clever design approach often referred to as “High-Tech” manages to set the terminal apart, by manner of “solving problems in obvious ways”. (Davies, 1988).

Work by creating smart solutions to what would otherwise be mundane design responses.

Spatial

The spatial quality of the internal environment is achieved through the play with light. The 15m high floating roof design challenges the notion of compartmentalised spaces. The result is an open plan arrangement that has the advantage of being able to adapt to any function should the need arise in future.

The terminal’s flexible interior space divides arrivals and departures laterally. The progression from landside to airside is a simple walk through the terminal to your plane, which was always in view. (Shaw, 2007, pp. 2-7)

Materiality

Apart from the PVC module roof supported by structural steel trees on a rigid 36x36m grid, the overall building material is glass- which creates an ambient internal environment.

Master plan

The passenger boarding bridges (PBB) are not physically attached to the main terminal building; except by footbridge tunnel walkways that link the gates to departure concourses, which stand within the apron where ramps are located in the apron area. These piers act as an extension of the terminal space onto the airspace. (Shaw, 2007, pp. 2-7)

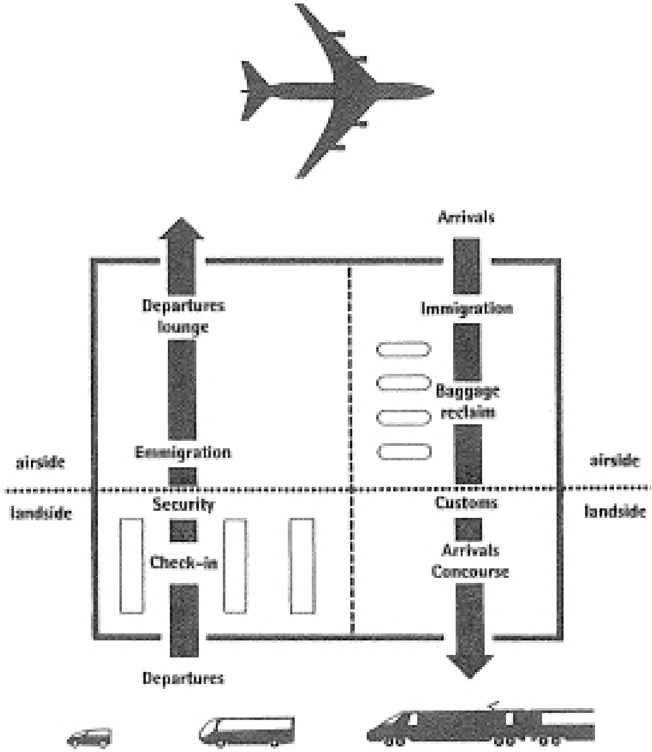


Figure 7.5 Simplicity of the plan. (Edwards, 1998:115)

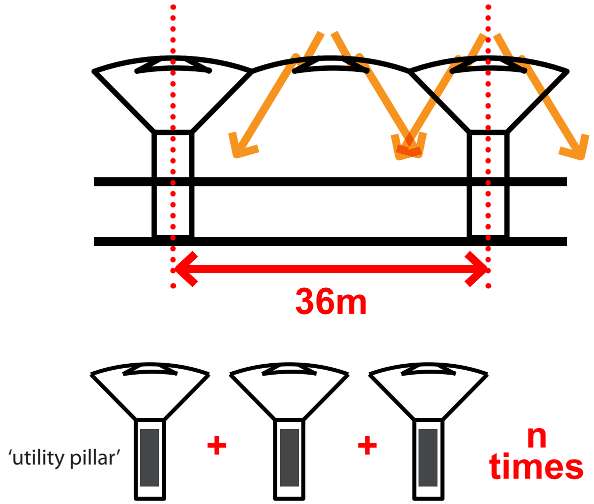


Figure 7.6 Utility Pillars with services and roof canopy with light reflectors and diffusers. (Karihindi, 2015)

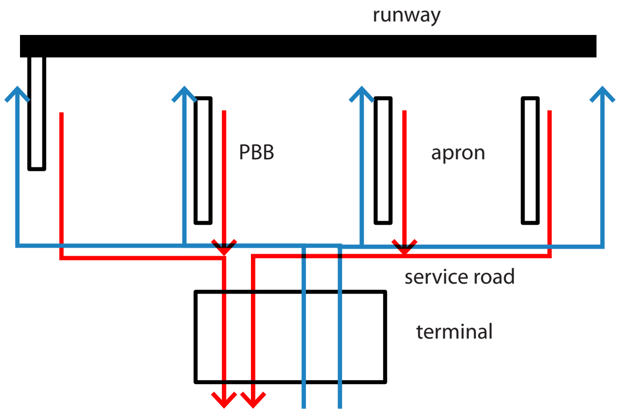


Figure 7.7 Overall composition of terminal and concourses. (Karihindi, 2015)

Form

Apart from the modular expandability of the building model, the overall form of the terminal has little to do with symbolism or metaphorical gestures that are usually related to the act of 'flying', but rather the effect is achieved though the use of light reflectors and diffusers on the underside of the roof.

Structural trees used to prop up the roof are dramatic as well as elegant and the sheer height dwarfs the human scale.

Sustainability

The use of light reflectors and diffusers as a passive sustainability design ethos can be credited to the terminal design, with its ability to mitigate the daylighting energy load requirements. Solar heat gain caused by direct solar radiation from the South Sun is also resolved in the same manner.

The modular construction model is also cheap and saves costs and allows ease of expansion.

Conclusions

Stansted Airport is a terminal that uses light in a manner so as to create ambience for the passenger. Both outbound and inbound experiences are given equal spatial treatment.

Figure 7.8 Stansted Airport skylight with reflector / diffuser in detail. (n.d.)

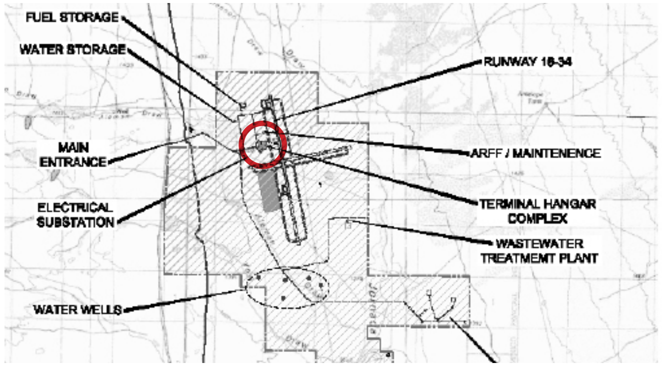


Figure 7.9 Site plan. (Jefts & Paz, 2012)

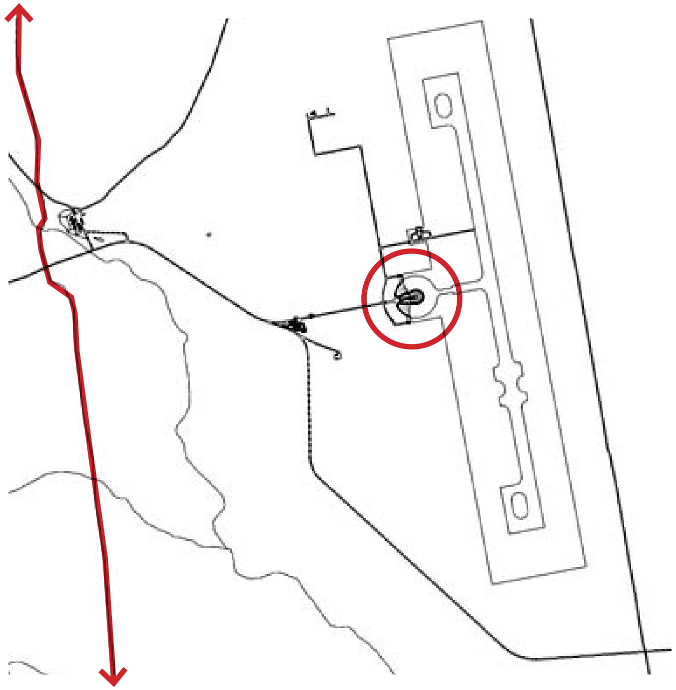


Figure 7.10 Site plan. (Jefts & Paz, 2012)

SPACEPORT AMERICA

Architect: Foster and Partners
Location: New Mexico, USA
Built: 2006-2014

Space Port America is a relatively new typology of building. It is a terminal / hanger style type building conceived as a “gateway to space” (2006) by the architects . It lies on 17,000 acres within the Jornada del Muerto Desert (Figure 1), or Journey of Death, It is largely isolated from the rest of the public domain. (Jefts & Paz, 2012).

Architectural Expression

The building sits as an element that is neither on nor under the landscape, but within it. The effective play with form allows it to blends seamlessly with the landscape, maintaining minimal impact on its context. Part of the external envelope devolves into the landscape; which strengthens the connection between a building and its surroundings.

Spatial

Terminal and hanger are one element and this extends the notion and experience of flight right up to the building. This is in contrast with the most common layout of terminals in most airports whereby the apron and terminal are separate. The passenger is given a three dimensional view of the aircraft by virtue of the way the space is arranged internally; terminal concourse and preparatory spaces are situated above the aircraft space.

Materiality

Local materials and regional construction techniques are used to lower the overall embodied energy of the building.

Master plan

Runway is directly connected to the apron and the terminal building and the taxiway is not commanding much hierarchy.
Apron extends up to the building envelope in a radial fashion as opposed to away from it, which is common in most airports. Little other activity exists on the airfield.

Figure 7.11 Spaceport America views from the air. (Foster and Partners, 2014)

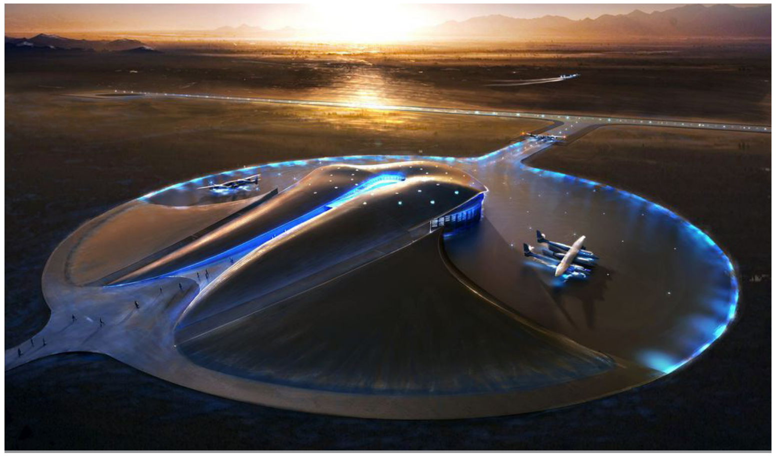


Figure 7.12 Spaceport America Artist's impression. (Foster and Partners, 2014)

Figure 7.13 Main landside approach. (Foster and Partners, 2014)

Figure 7.14 Hanger. (Foster and Partners 2014)

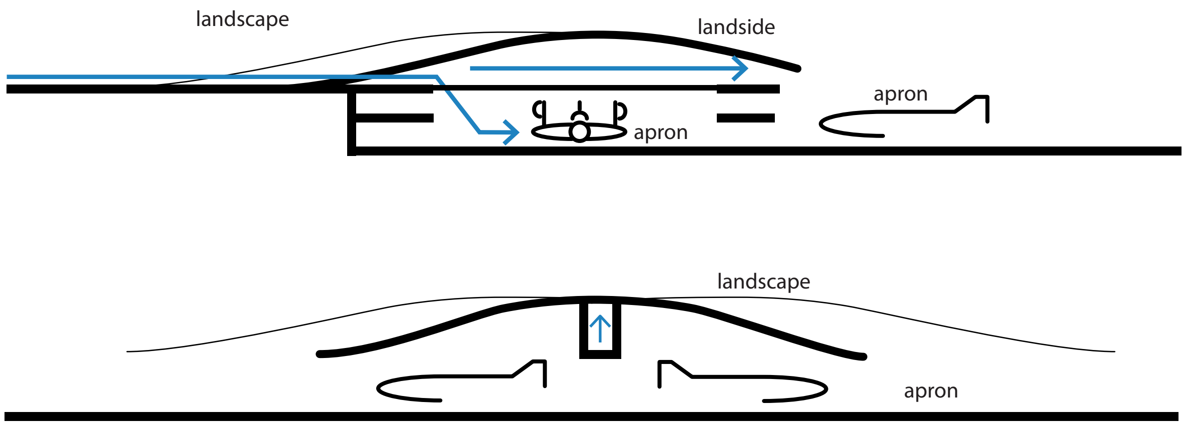


Figure 7.15 Relationship to the landscape. (Karihindi, 2015)

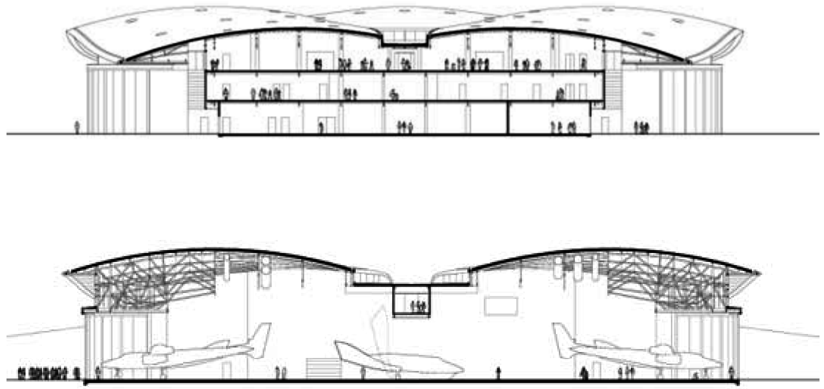
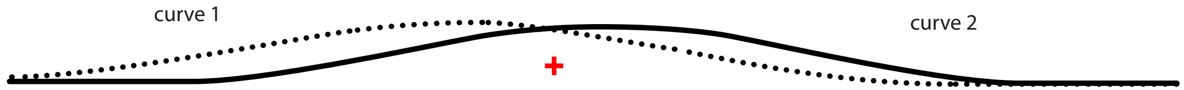


Figure 7.17 Typical Transverse Sections across terminal. (Foster and Partners, 2014)



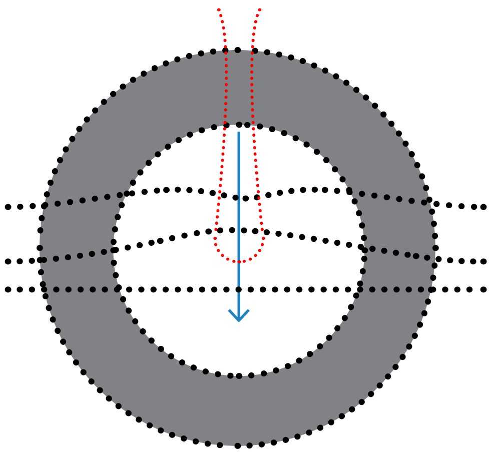


Figure 7.16 Overall derivations of building form. Alternating curves are lofted together and then sliced in plan. (Karihindi, 2015)

Form

Alternating sinusoidal waves are used to define the roof geometry. They mimic the morphology of desert dunes or the mountainous region surrounding the space port.

Sustainability

In other to achieve sustainability ratings the building actively engages with its context rather than working against it. To reduce energy consumption; “the facility uses Earth Tubes embedded within the western earthen berms to draw air into earth for pre-conditioning before it enters the chillers. Underfloor radiant cooling and heating and the use of chilled beams both reduce the energy footprint as well.” (Jefts & Paz, 2012).

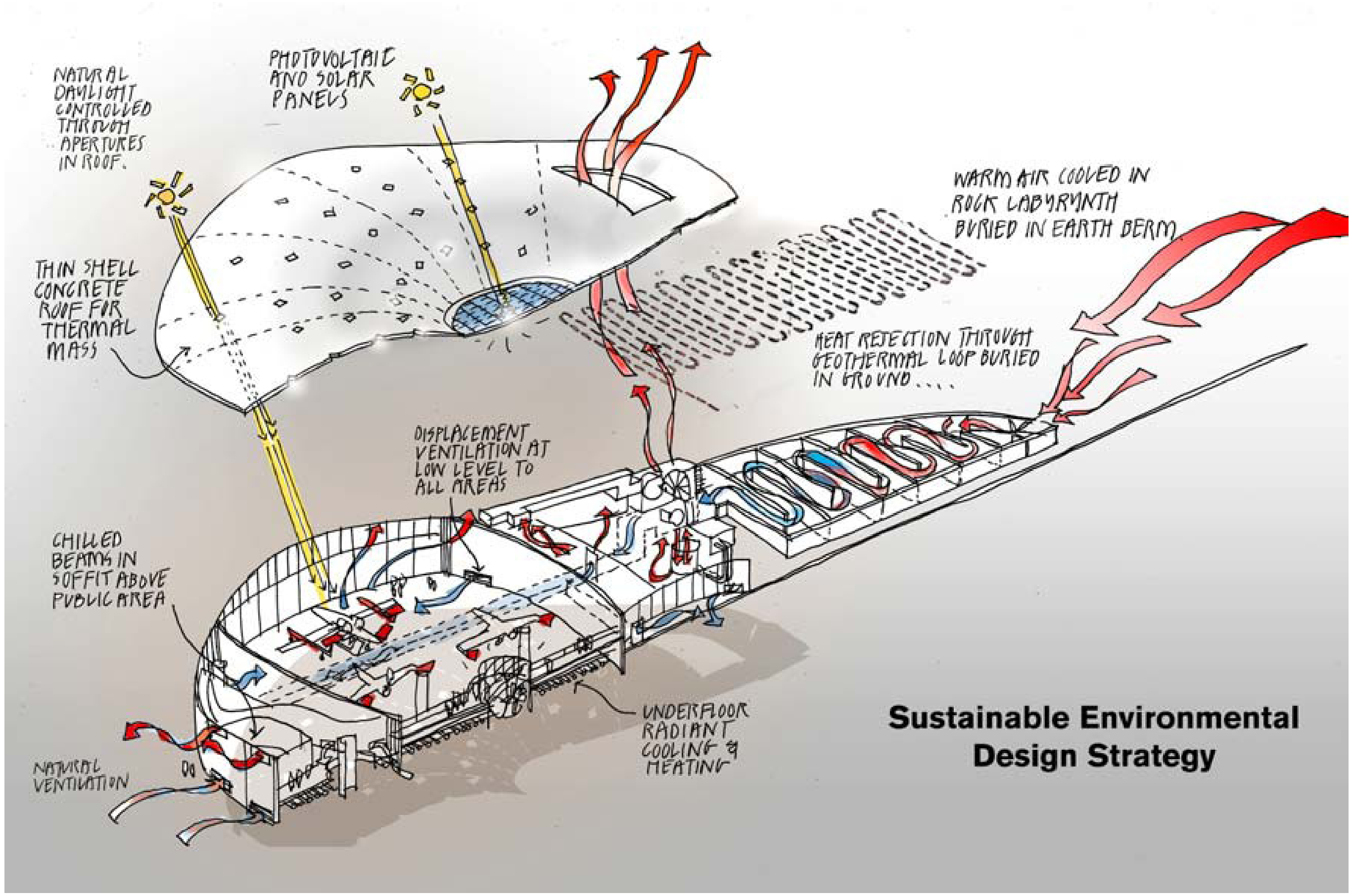


Figure 7.18 Spaceport America Sustainability Design Concept. (Foster and Partners, 2014)

Conclusions

Spaceport America has succeeded greatly in challenging the nominal typology of the terminal building. Where traditionally hangers, aprons and terminal buildings were separate from passenger terminals, which comprise the public realm, buildings; the Spaceport brings all the three spatial entities together.

Spaceport America is more about the form rather than the space making qualities. Actively engaging with the landscape, its circular envelope allows for maximum panoramic views into the landscape.

CAPE TOWN INTERNATIONAL AIRPORT
(CENTRAL TERMINAL BUILDING)

Architects: Kritzinger Architects
Location: Cape Town International Airport, Western Cape, South Africa
Built: 2010

The airport was developed to process up to 15 million passengers per annum by the year 2015 in the run up to the FIFA world cup that was held in 2010. The roof above the elevated drop-off and pick up road is a metaphorical reference to the process of flying. (Uffelen, 2012, p. 206)

Spatial

The new terminal design roof is seemingly a cap on a previously ad hoc agglomeration of spaces designed and added through the ages as the need occurred. Although the new roof does not extend over the international departure and arrival gates wing, as well as the domestic and arrival gates and wing; the new roof has seemingly enhanced the

Figure 7.19 [Top Right] Airside facade. (Gleich, 2012)
Figure 7.20 [Top Left] Central terminal building, transport plaza. (Gleich, 2012)
Figure 7.21 [Right] Check-in hall view, from food court. (Gleich, 2012)

spatial qualities of the check-in hall whilst for the latter, activities are housed under low profile roofs in comparison.

Despite the overall linear organisation of the building in the plan, the check-in hall is developed as U-plan in layout; with the check-in at the centre of the space and food and beverages court directly overlooking the check-in hall on the next mezzanine level. The arrival gates are situated on the same level as the check-in hall, found towards the airside end of the building, maintaining no visual connection between the two activities- owing to airport security requirements.

The departures gates concourse is also located on the mezzanine level above both the check-in and arrivals level (the same level as the food and beverages court).
Airport administration and management activities are situated on an additional mezzanine level above both the check-in/arrivals concourse ,and the departures gates/Food and beverages court.

Interfaces to expedite the boarding and disembarking of passengers from aircrafts is carried out through a number of fixed contact stands located at each gate and aircraft ramp parking position. Thereby eliminating any need for shuttles to ferry passengers to and fro on the airside area.

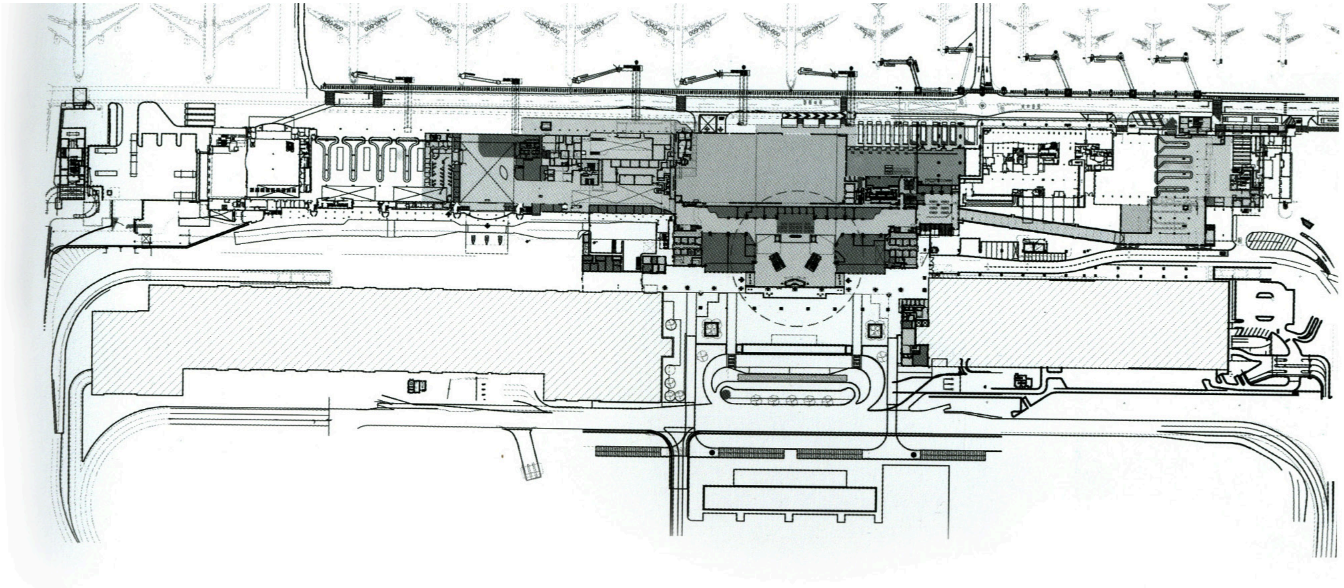


Figure 7.22 Ground floor plan. (Gleich, 2012)

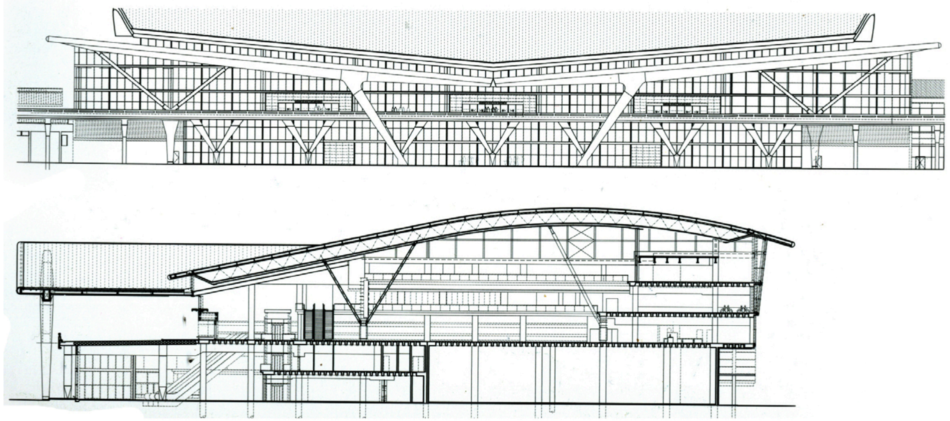


Figure 7.23 Landside elevation and cross section. (Gleich, 2012)

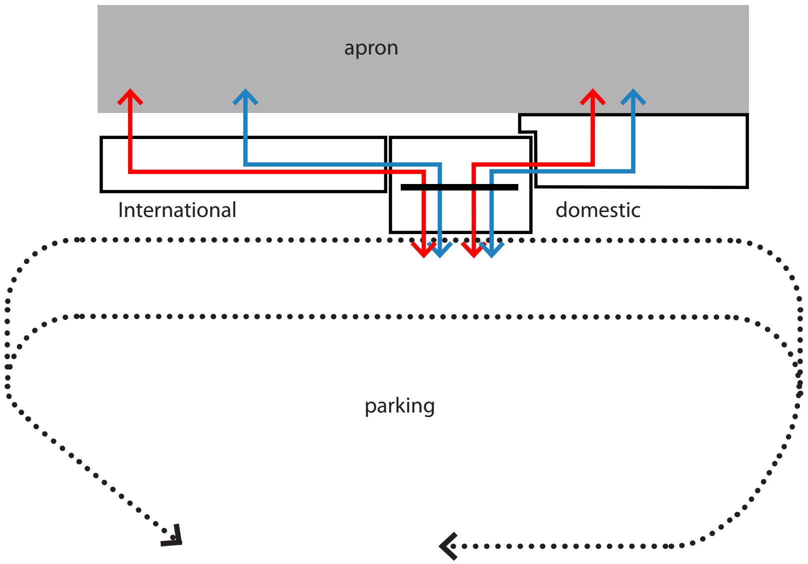


Figure 7.24 Site plan access and spatial configuration. (Karihindi, 2015)

Conclusions

It is apparent that airport terminal design places more emphasis on celebrating the departure passenger experience versus the arrivals experience. It goes without saying; when one arrives say from a very long flight one is least interested in remaining at an airport longer than need be.
Elevated drop off road enhances the notion of interchange associated with airport buildings.

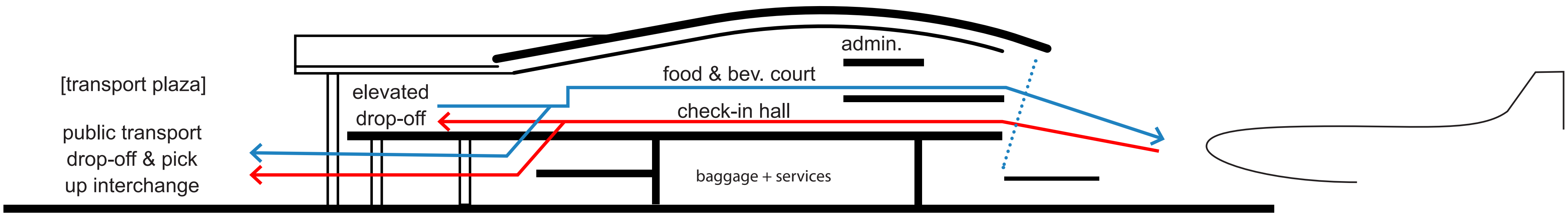


Figure 7.25 Sectional Profile Passenger flows. (Karihindi, 2015)

FARNBOROUGH AIRPORT TERMINAL

Architect: 3DReid [Peter Farmer]
Location: Farnborough, Hampshire, UK
Built: 1981 - 2000

Farnborough Airport is considered one of few elitist General Aviation sites in the world, a trend that is rapidly taking ground in aviation architecture. The terminal offers passengers the experience of an unparalleled world of air travel that is free from traffic, discreet, private and greatly removed from the nominal air travel experience as we know it. (Gibberd & Hill, 2014).
The terminal building, officially referred to as an 'operations building' by the architects, serves a dual purpose in that it is both the headquarters of the TAG Farnborough's establishment as well as a high class business elite passenger terminal.
One half the building serves TAG Farnborough's HQ and the other half provides the passenger processing, security and lounge facilities. (3Dreid, 2006)

Spatial

The two separate activities are connected by a triple height atrium volume space through which the vertical circulation runs by means of an elaborate spiral staircase at the centre and a lift to one side of the flanks.

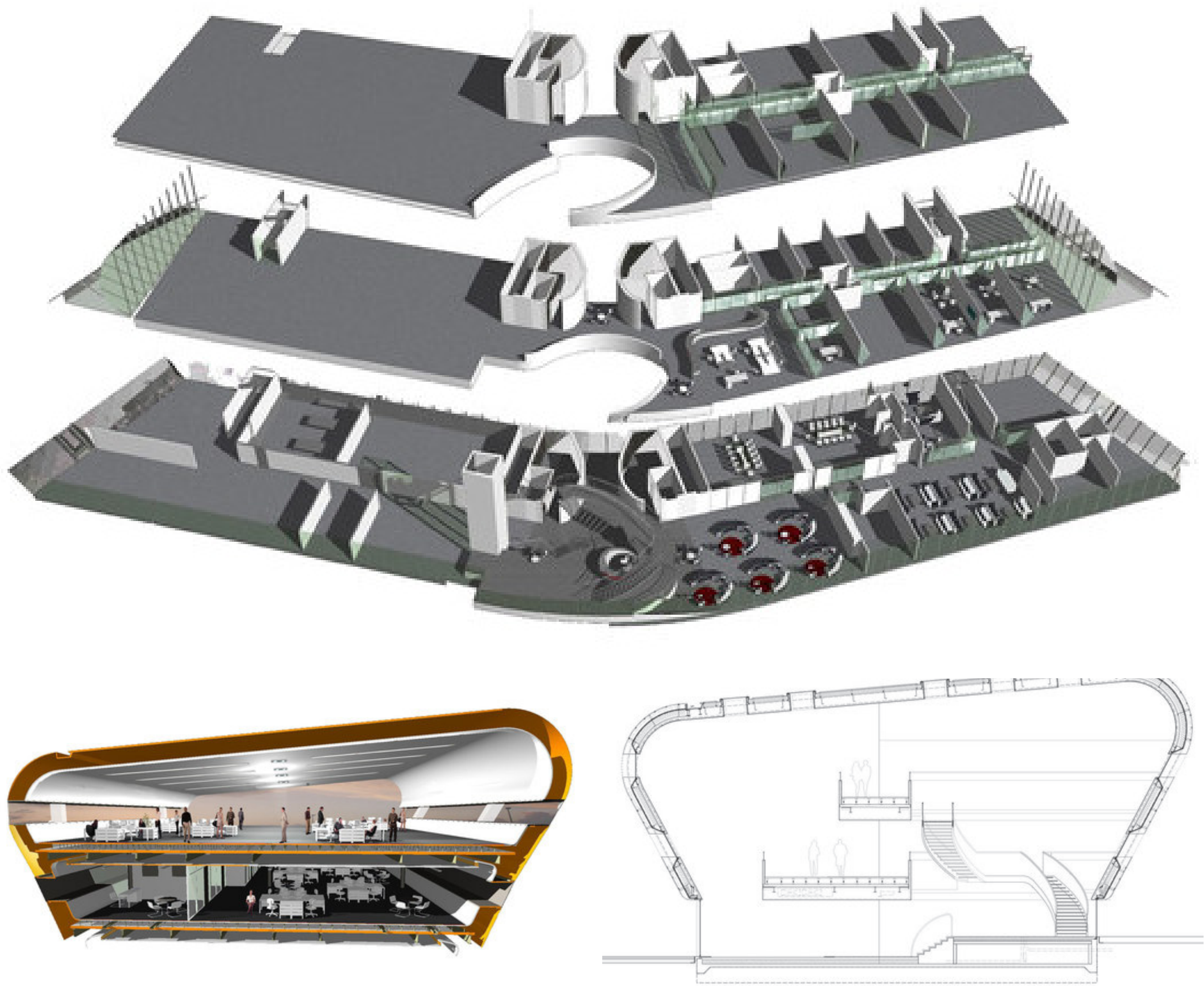


Figure 7.26 Exploded axonometric layout, 3D internal perspective & Section. (3DReid, 2000)

Figure 7.27 Airside perspective from the apron Ramp. (3DReid, 2000)

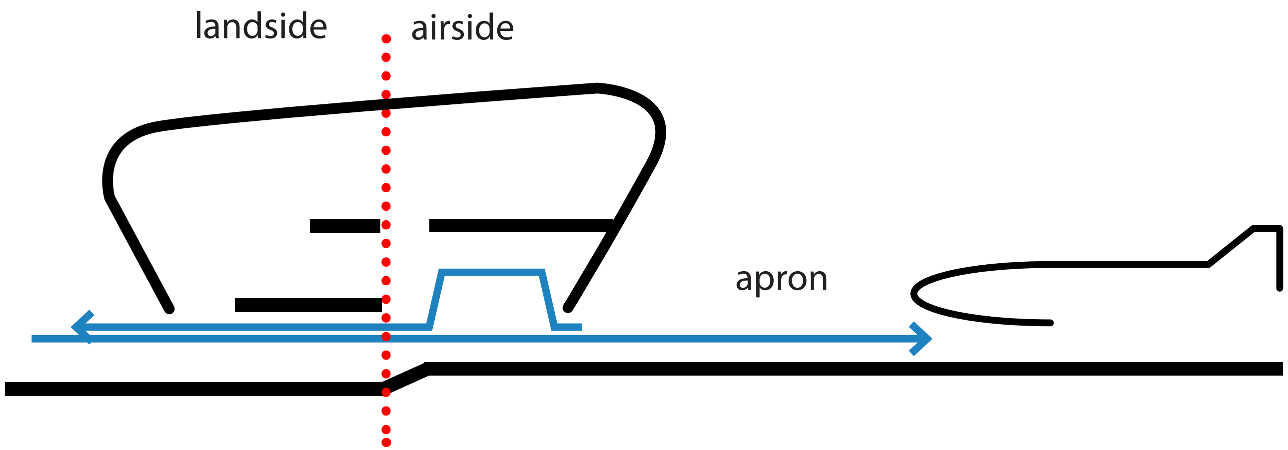


Figure 7.28 PAX flows through terminal. (Karihindi, 2015)

Two service cores are located on the landside edge of the building on either side of the main entrance, one serving the office wing and the other serving the terminal end of the building.

Materiality

The operations building is a steel frame building clad with aluminium tiles with concrete floor slabs. Owing to the type of client expected to use the terminal the choice of aluminium as a cladding material creates both a clean and elegant look for the terminal. As well as being an innovative building design delivered under budget; 25,000 aluminium shingles used on the terminal are 100% recyclable.

Expression

The building tectonic creates a clinical internal environment that in the true sense could be said, doesn't seems really concerned or interested about its immediate surroundings but rather what it is. Windows are horizontal uninterrupted slits, except where the structure passes in the facade offering a full panorama of the airfield. Passengers do not engage with the surroundings, they just observe from within.

Form

The overall building tectonic and gesture of it, can be said to resemble the body of an aircraft or the elements of aerodynamic design.
The 3-dimensional curve form, that is the envelope,

Figure 7.29 Air traffic control tower. (Hufton & Crow, 2011)

Figure 1.30 Atrium space(Hufton & Crow, 2011)

seems a flight of fancy from the architect's pencil to the naked eye, however looking a little deeper reveals the clever problem solving capabilities of the form and material; creating a one envelope building without hard edges or corners mitigates radar and ILS impact and reflections, by shaping the airside façade of the building with an incline. Radar and ILS signals emitted from the airfield communications beacon are directed to the ground and away from the landing aircrafts thereby reducing interference.

There is more; the outward incline of the south facing façade (also airside façade) also embodies a passive design trick up its sleeve in that it reduces solar heat gain by stopping direct sunlight from entering the terminal by simply using its shape avoiding the employment of cumbersome shades or louvers on the exterior.

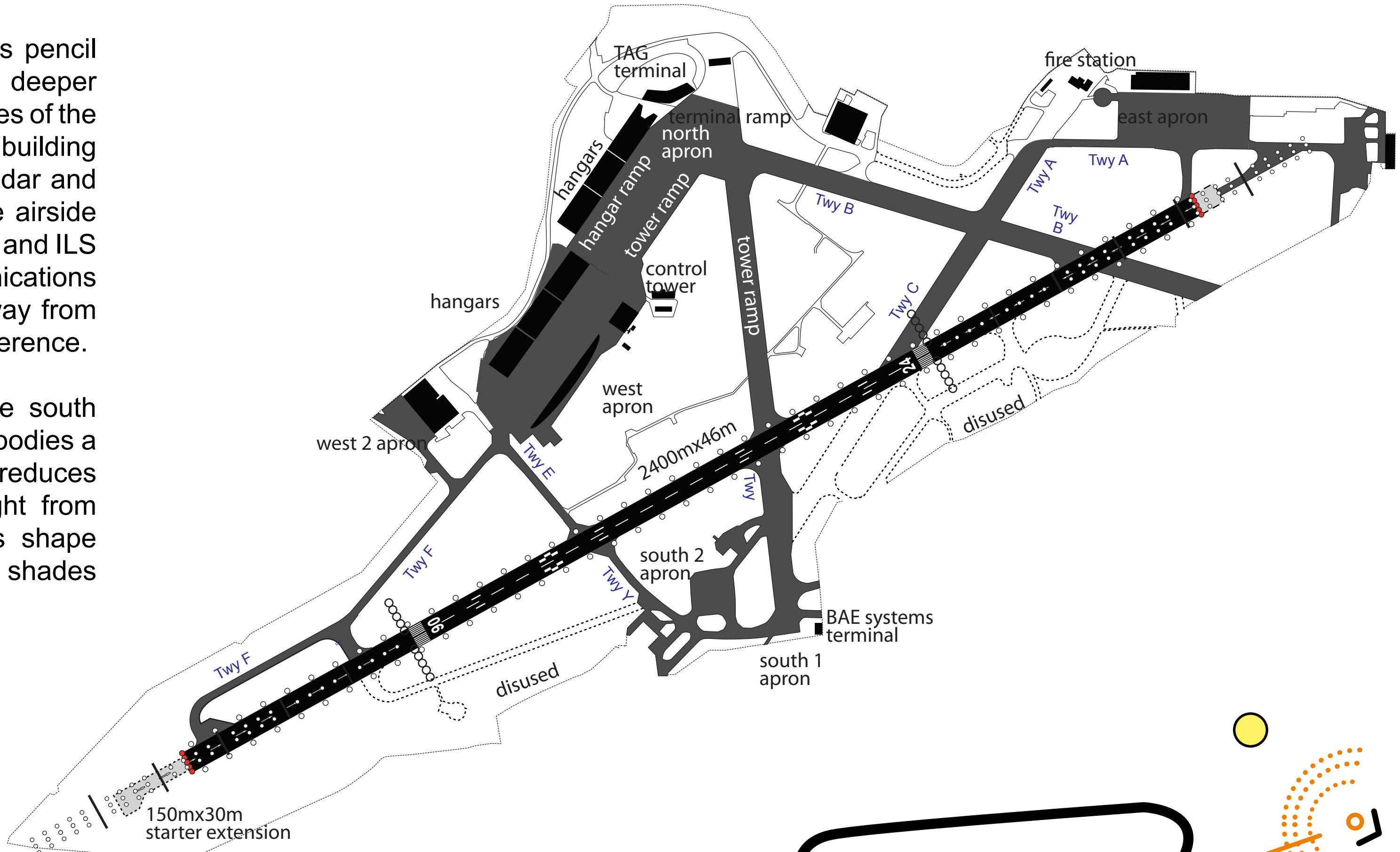


Figure 7.31 Farnborough Aerodrome Chart. (n.d.)

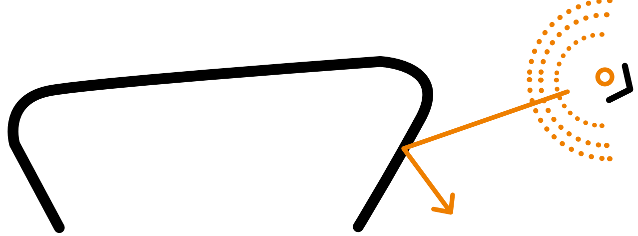


Figure 7.32 Direct Solar Radiation prevention and ILS / Radar interference solution. (Karihindi, 2015)

Master plan

The landing strip is the home of the Farnborough Airshow which is held in even numbered years. It is likewise home to the Air Accidents Investigation Branch, a piece of the Department for Transport in Britain. The many activities located on the airfield are made possible by the-upgraded Air Traffic Control Tower.
When all-round visual connection achieved it is possible to manage a number of airline traffic without having to rely on the a rational layout of the apron.

Conclusions

The terminal building is not particularly responsive to context but ist w

LANSERIA AIRPORT

Architect: Honiball Architects
Location: Johannesburg, South Africa
Built:2013

"Lanseria International Airport has developed from a small rural airport into a fully-fledged airport facility with a high service levels". (ShowMe South Africa, 2013).

According to the architects; "the ground level comprises private and business class departure lounges, world-class check-in counters, superior retail outlets and workshops. On the first floor area are new restaurants, modern general departure lounges, office space and a terrace used for corporate entertainment. The mezzanine area provides additional lounges and offices". (Honiball Architects, 2013)
The VCR room is incorporated into the terminal rather away from it.

Figure 7.33 Landside exterior showing main terminal for scheduled flights.

Architectural Expression and Form

The terminal comprises of a one-dimensional curve sinusoidal waveform roof, supported underside by expressed space truss structural system. "Strong shapes with reference to aerodynamic elements, featuring large glazed panels for maximum natural light penetration and visibility." (Honiball Architects, 2013)

Figure 7.34 Lanseria airfield composition. (Google Maps, 2015)

Materiality

Apart from the overall use of tinted glazing to allow maximum daylight penetration whilst reducing internal solar heat gain the building is clad in a porcelain tile cladding and roofed by a zincalum sheet covering. Little else can be said to be of sustainable merit.

Conclusions

Although starting out from two grass runways Lanseria is a testament to the requirement for adequate airport fore-planning. The roof profile expresses the overall direction of the passenger flow process.

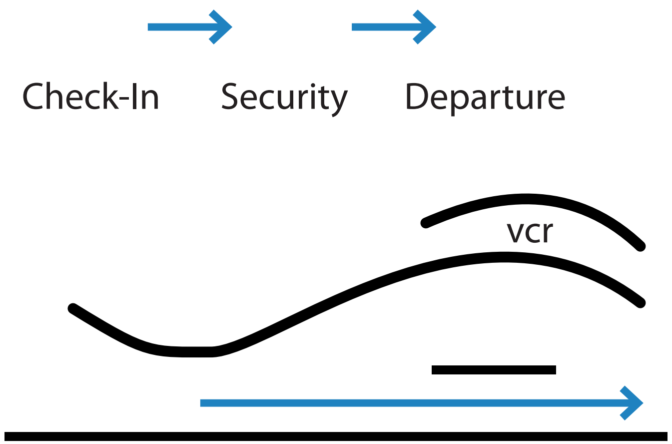


Figure 7.35 PAX flow is expressed by the overall roof geometry roof. (Karihindi, 2015)

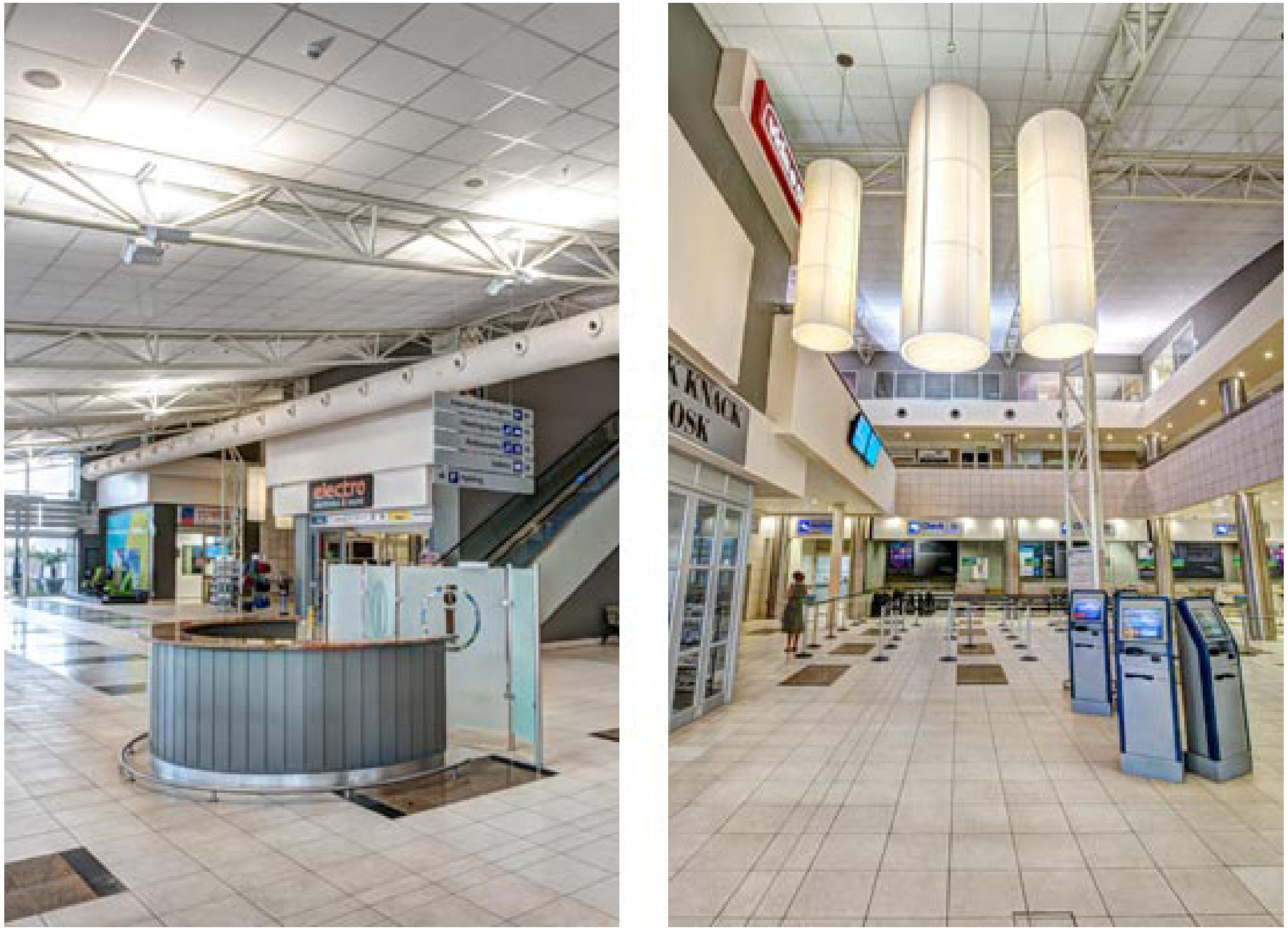


Figure 7.36 Lanseria Airport International spatial quality (2013)

SOMERSET AIRPORT [SMQ]

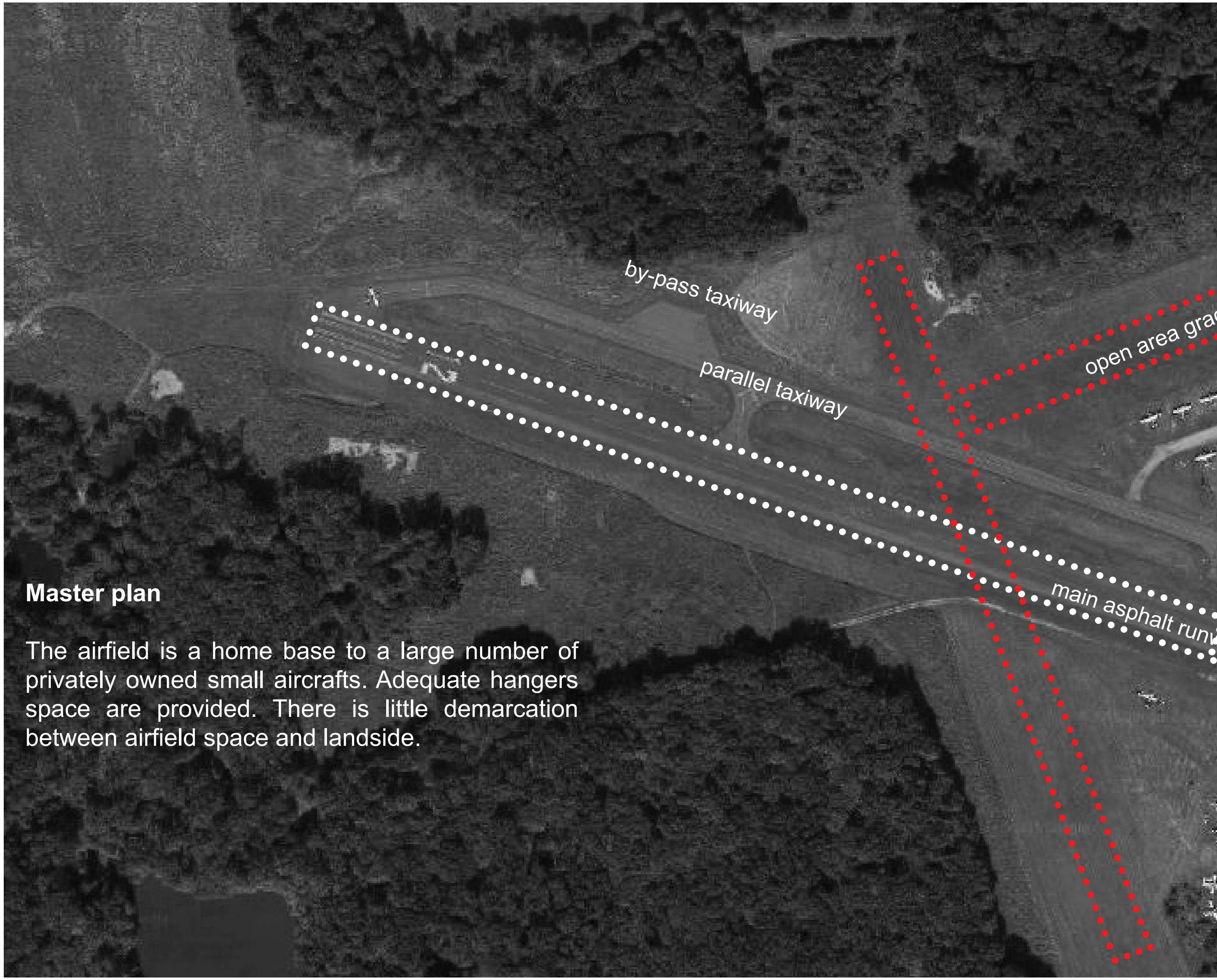
Location: Bedminster Township, New Jersey, USA
Built: 1946

About SMQ

- There are 8 hangers and it serves as a home base for over 150 aircrafts.
- No control tower at aerodrome.
- Hangars and Tie downs – Somerset Airport has individual “T-hangars,” open bay hangars, and individual tie downs available for temporary and permanent basing of aircraft
- Hangers H1-H5 are T-Hangers whereas hangars H6-H7 are open bay hangars.

Main Runway
- Dimensions: 833 x 20m
- Surface: asphalt, in good condition
- Runway Edge Lights: medium intensity

The use of T-Hangars allows the AMP to take on more aircrafts on the aerodrome precinct and thus caters for a high number of resident aircrafts.
To the east of the apron are situated a number of offices and office spaces said to include a doctors surgery that operates by air.



Master plan

The airfield is a home base to a large number of privately owned small aircrafts. Adequate hangers space are provided. There is little demarcation between airfield space and landside.

Figure 7.37 Somerset Airport aerial view. (Google Maps, 2015)

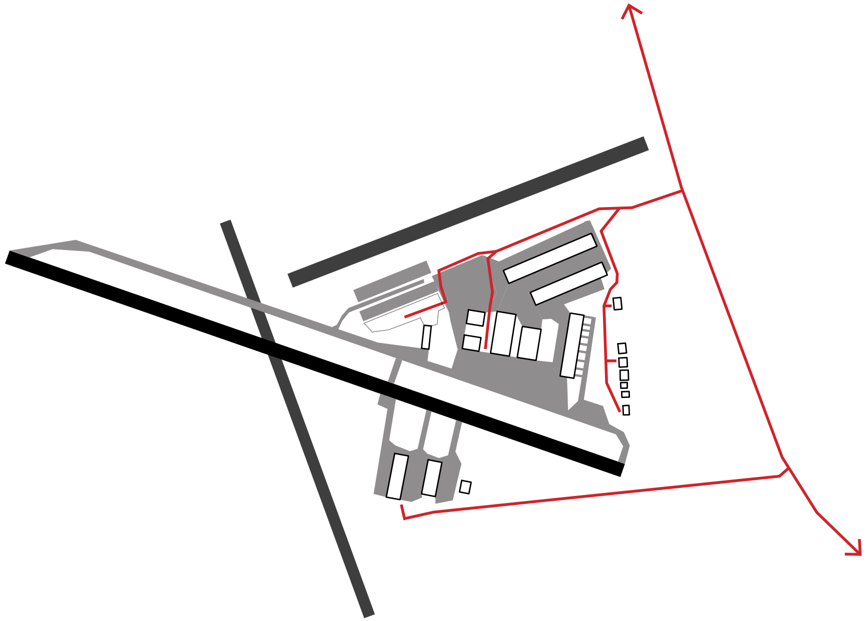


Figure 7.38 Diagrammatic understanding of airport master plan. (Karihindi, 2015)

Conclusions

The airport lacks an overall cohesive master plan to organise space on the

CONCLUSIONS

The departure experience is the major terminal space of focus. The ability for passengers to find their way through the terminal is a crucial aspect of terminal design.

- Passenger flows influence the overall layout/ planning of the terminal building.

The constant use of a metaphor is prevalent in airport architecture - in architecture, buildings are not only playing with the visual image of the form, but it also plays with the hidden messages and meanings of it. (Jencks, 1977)

- The use of form can be used to enhance the spatial experience of the passenger, before one has even reached the aircraft.

- Most of the airport terminal designs are largely comprised of a large monolithic envelopes or roofs that observe several functions under it; with little or lack of pertinent attention to the differing and spatial needs and qualities required thereof.

- Most terminal environments have got little to no greenery which is a failure where sustainability is concerned.

The majority of airports looked at have shown poor vision or difficulty in handling the Airside Terminal Connection as well as Landside Terminal Connection. These terminals buildings are hemmed in by service roads(between apron and terminal) and drop off zones on the latter(between terminal and the public front of the building)

Due to the vast scale of an airport and the numerous types of activities that are contained therein, although not directly but indirectly related to aviation, most airport building designs have sought to develop a uniform language of expression that attempts to create an identity for the entire airport to read as one cohesive unit, rather than different building tectonics.

This is seen in the use of symmetry for terminal buildings.

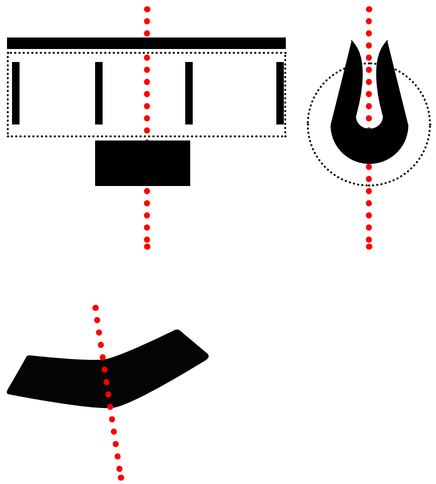


Figure 7.39 Use of symmetry in airport design. (Karihindi, 2015)

Many of the design responses in South Africa are cumbersome, weighty and lack clear intelligibility and essence to capture 'the thing' or say the spirit of transient space which leads one from being on the grounded to being airborne.

PART TWO

DESIGN PRINCIPLES & IMPLEMENTATIONS

2

“Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return.”
— Leonardo da Vinci

DESIGN BRIEF

This treatise project proposes a new light traffic aeronautical terminal facility for Somerset East Airport. The design will revolve around the careful planning for movement and arrangement of aeroplanes within the aerodrome on the airside in relation to function on landside.

Figure 8.0 ***'The awe of flying.'*** **(Karihindi, 2015)**

ACCOMMODATION SCHEDULE

PASSENGER TERMINAL

Administration	**123 Sqm**
Airport Lobby	300 Sqm
Departure Lounge	
Private Departure Lounge	26 Sqm.
Baggage reclaim hall	
Ticket Stall/Counters	56 Sqm
2 Reception desk	24 Sqm
2 Offices	32 Sqm
Rental Car Counter	
Tourism / Info Desk	**16 Sqm**
Exhibition space	
Security	**30Sqm**
Security room	
Scanner Room	12 Sqm.
Security Checkpoint	
Security Support / holding Room	
Baggage handling	
Reclaim Belt	30 Sqm.
Outbound handling	12 Sqm.
Inbound handling	12 Sqm.
Temporary storage	10 Sqm.
Staff room	10 Sqm.
Trolleys	8 Sqm.
Public Ablutions	**46 Sqm**
Men	20 Sqm
Women	20 Sqm
Disabled	6 Sqm

MAINTENANCE AND TECHNICAL

Baggage handling	
Reclaim Belt	30 Sqm.
Outbound handling	12 Sqm
Inbound handling	12 Sqm
Manoeuvring of baggage carts	120 Sqm
Storage	
Baggage carts & airplane stairs	45 Sqm
Other equipment	25 Sqm
Maintenance / cleaning facilities	12 Sqm
Airport Operations	36 Sqm.
Administration Office	46 Sqm.

FLIGHT SCHOOL AND FLIGHT CLUB

Administration	
3 Office Space	40 Sqm.
4 Staff Room / Instructors Offices	30 Sqm.
Director’s office	20 Sqm.
Secretary	12 Sqm
Reception	20 Sqm
Boardroom	24 Sqm.
2 Lecture Rooms	160 Sqm.
4Flight Simulator Rooms:	60 Sqm.

WFrasca 131
Frasca 142
2 Vulcanair P68R FNTPs Simulators

Parking Bays for Fleet:
Vulcanair P68R 412 Sqm./P
Piper Warrior IIIs
7 PA28-161
2 Piper Seminoles,
2 PA44-180.

Note: Some areas are incorporated in the courtyard space such as the Airport Lobby and Cart Storage.

DESIGN PRINCIPLES

Some of the design ethos that this treatise design solution seeks to achieve are:

- minimal environmental impact and disturbance as possible.

Appearance

Taking cues from the surrounding moutaineous context, Somerset East terminal building will be conceived as an open free standing structure with a unique and dramatic form echoing the surrounding mountainous context. It will aim to achieve visual lightness despite the large scale of the programme and technicalities involved, where possible utilising natural light.

The tectonic expression of the operations building should create a unique and memorable visual identity for the town of Somerset East. Being that it aims to promote the local tourist economy, strives to promote Somerset East as a tourist gateway and destination in the region and also as a business hub for the Blue Crane Municipality.

Sustainability

The terminal building envelope will incorporate a range of passive environmental design concepts such as: south orientated facade as opposed to allowing direct sunlight into the building from the north. Aimed at reducing lighting costs as well as regulating heat gain. Where possible rammed earth will be used as a building material.

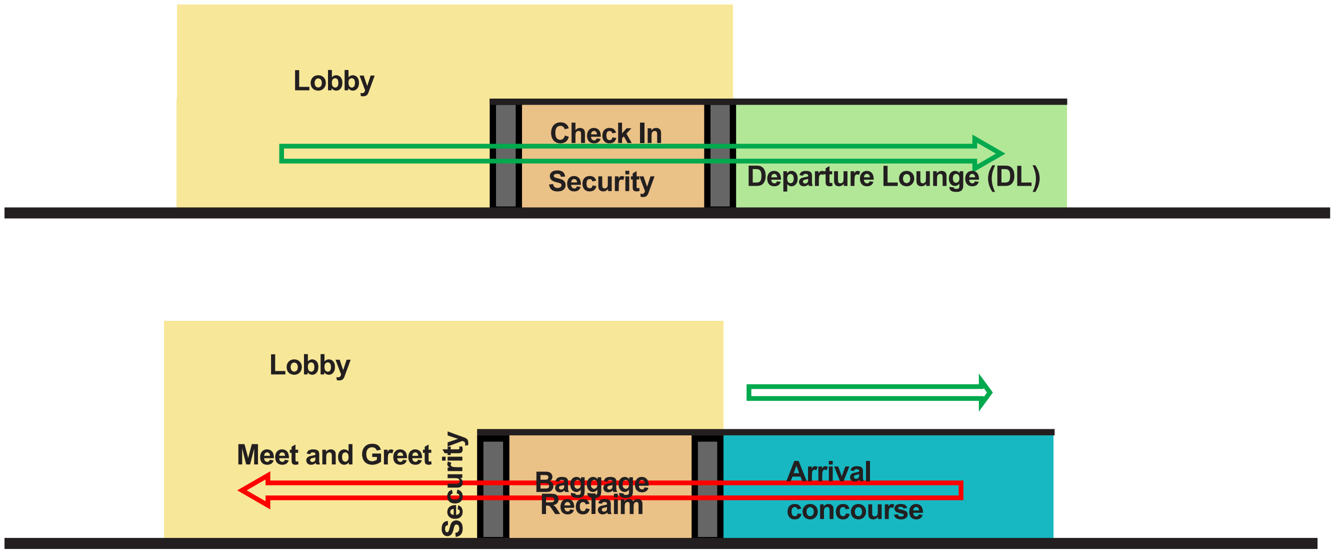


Figure 8.1 Programme as a Section. (Karihindi, 2015)

Challenges for Terminal Building

More than one type of activity is to be accommodated within the terminal building.

- General aviation chartered flights to and from the terminal.
- Flight training for up to 50 students over a six week period.
- Recreational Flying support space for resident pilots who are also part of the the flight school.

In order to create a common interaction area for passengers, students and enthusiasts, with the aim of creating an aeronautical hub; the terminal building and flight school are to be organised around a central courtyard space that serves as a departure and arrival hall as well as an orientation space.

Materiality

Most terminal buildings seen are steel frame buildings with a lot of glass and concrete. For Somerset East; a tectonic that attempts to be contextual without totally being taken over by 'regionalism' will be attempted.

Throughout Somerset East locally sourced stone has been the predominant building material. In order to obtain a design response that it sensitive to its surroundings the following materials are employed. Natural timber is a material that ages gracefully when exposed to the elements and can become part of the landscape. Therefore it would be used as a finish to material create a contemporary rustications - mimicking the rusticated stone walls. Still on this note; copper is to be used as a roofing material to give the terminal building an 'aged' look over time.

In order to achieve greater spatial quality in the Departure Hall; a combination of steel and laminated wood will be used to achieve the structural strength of steel whilst softening the hardness of steel and responding to the context.
Note: We are trying to achieve a building tectonic that is not alien to its surrounding but is part and parcel of it by using materials that are sustainable and downright locally available and/or renewable.

Figure 8.2 Angler & Antelope Guesthouse a former Roman Catholic Church. Somerset East. (Marais, 2014)

Figure 8.3 Recycled pallet wood used as siding to create a Contemporary rusticated finish. (Bradley, 2015)

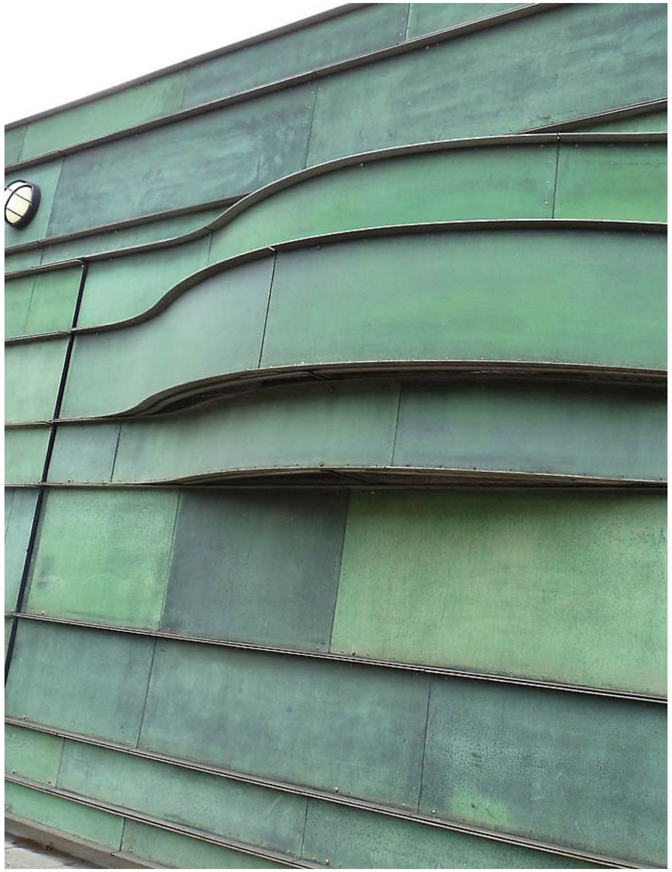


Figure 8.4 Standing Seam Copper Cladding weathered a lovely shade of green. (n.d.)

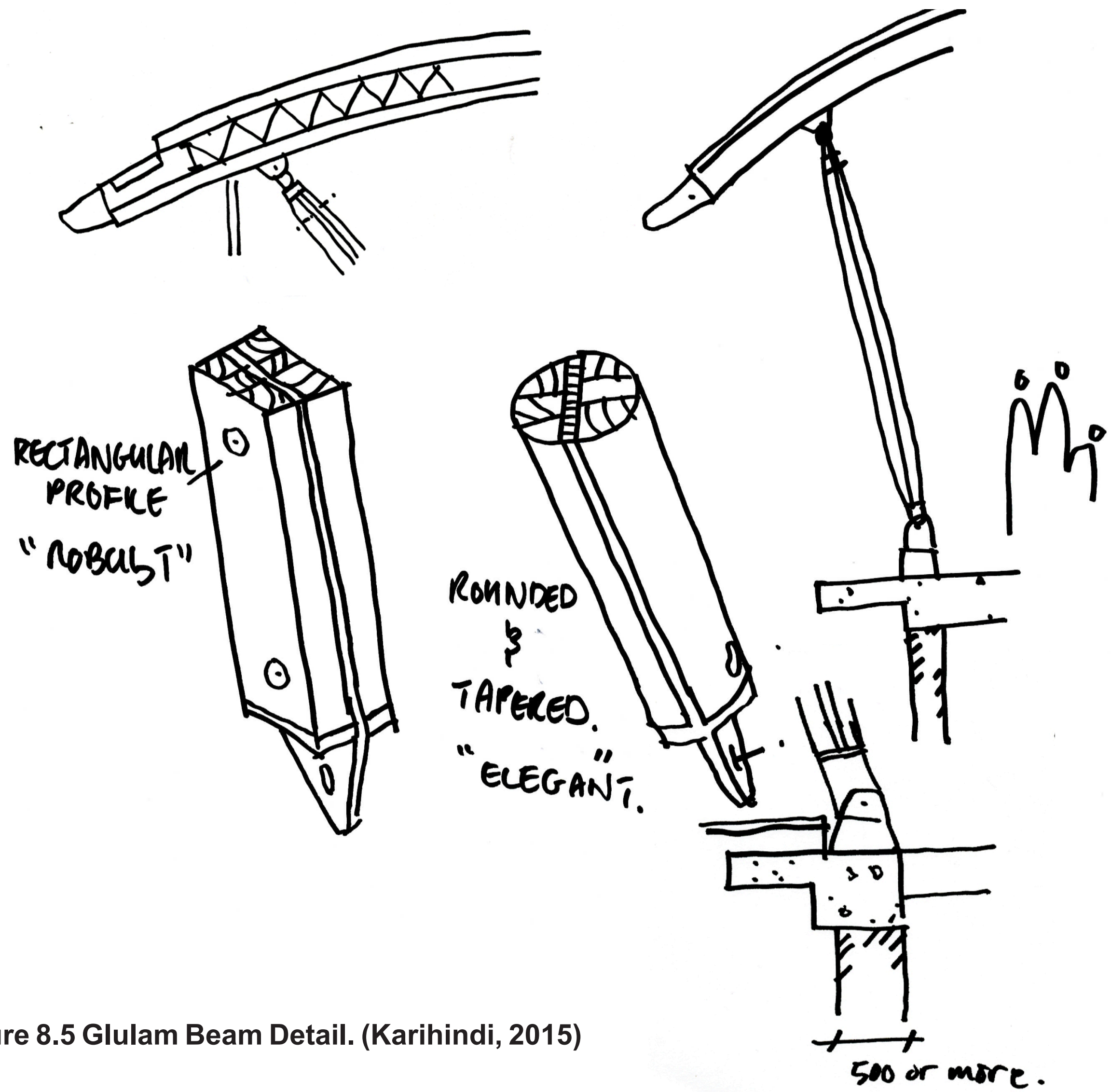


Figure 8.5 Glulam Beam Detail. (Karihindi, 2015)

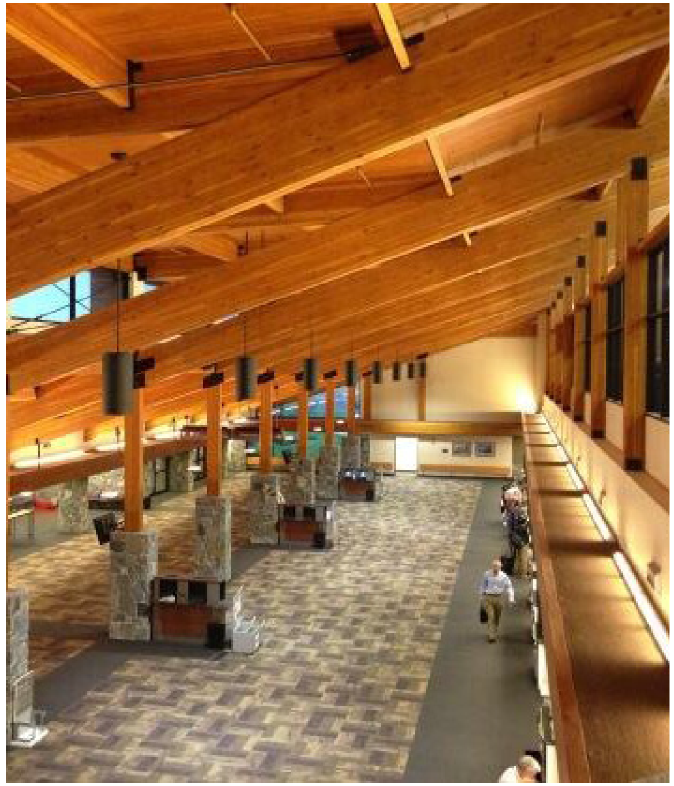


Figure 8.6 Glulam Beams at Bozeman Airport in the US. (Farley, 2012)

Using Glulam in this manner is an attempt to increase the tactile nature of the structural members and give them elegance of would-be (in a contemporay buiding) steel sections.

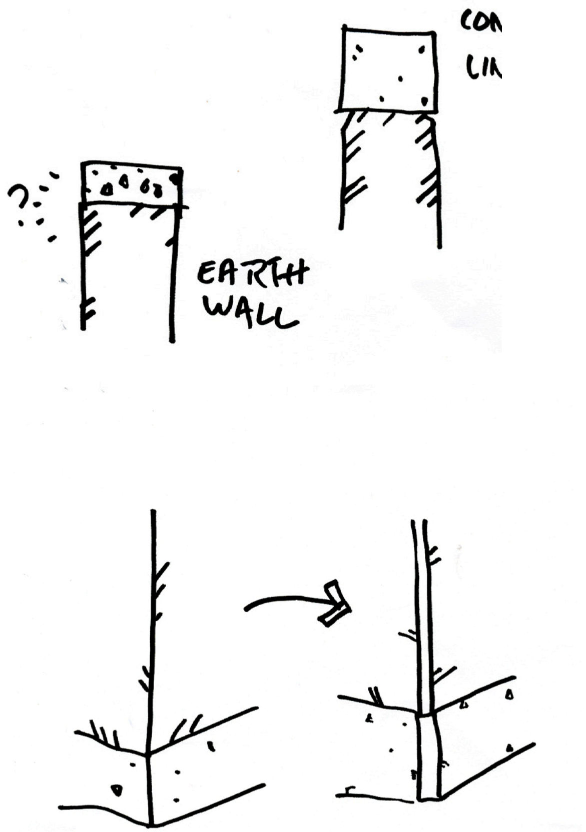


Figure 8.7 Structural Insulted Rammed Earth. (Karihindi, 2015)

Figure 8.8 Structural Insulated Rammed Earth. (n.d.)

Rammed earth is an interesting material - above all materials encountered throughout this treatise research, none seems more an appropriate material to 'cement' a building in its context than rammed earth appears to!

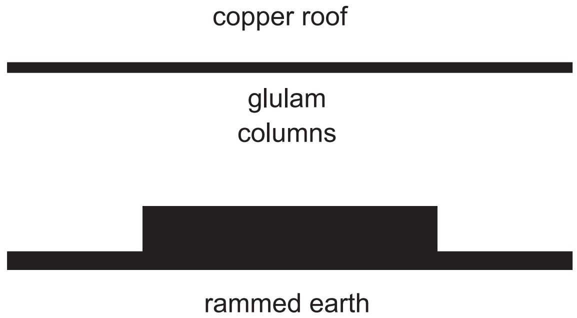


Figure 8.9 Make up of the building. (Karihindi, 2015)

FORECOURT

Performance Requirements

The facility will cater for up to 50 students during the day and staff members:

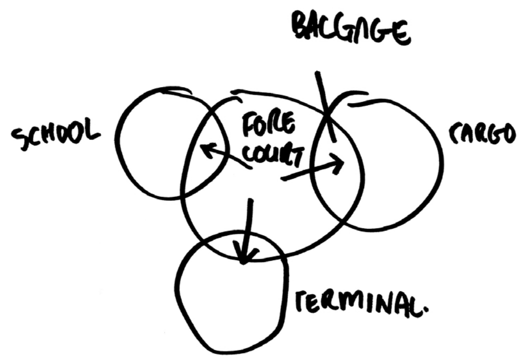
- Controlled environment for trainee instruction is required on site.
- The overall terminal atmosphere is to serve a more tourist gateway facility for with the majority of the General Aviations flights focusing on the tourist market.
- Provide a social space where various players in aviation interact with one another and the public in order to create awareness about aviation as both recreational and economical.

Transport, Access and Movement

A key design objective for Somerset East Terminal precinct is to provide an interchange space that provides both public transport and private vehicles a good service. The design principle is to build upon the existing road to create an effective interface between air and other modes of transport - Coach, Bus, Taxi and private car drop off catering for the varying user types as well as providing clear service access routes that are unobstructed and away from general public areas without compromising public space quality.

The interface zone will be defined as a piazza which would be sized to create orientation space for flight school / club and terminal. The piazza design will be developed to arriving and departing passengers, students(trainee pilots) and club members.

Principles
- Well lit environment
- Convenient and easy movement for passengers
- Priority for pedestrian movement over vehicles next to terminal.
- The forecourt layout is to keep private car drop off segregated from other users. and keep public transport drop off further away from terminal.



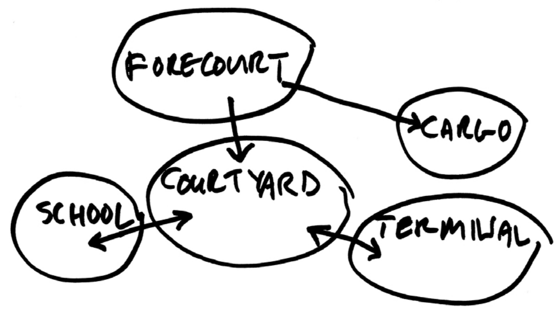
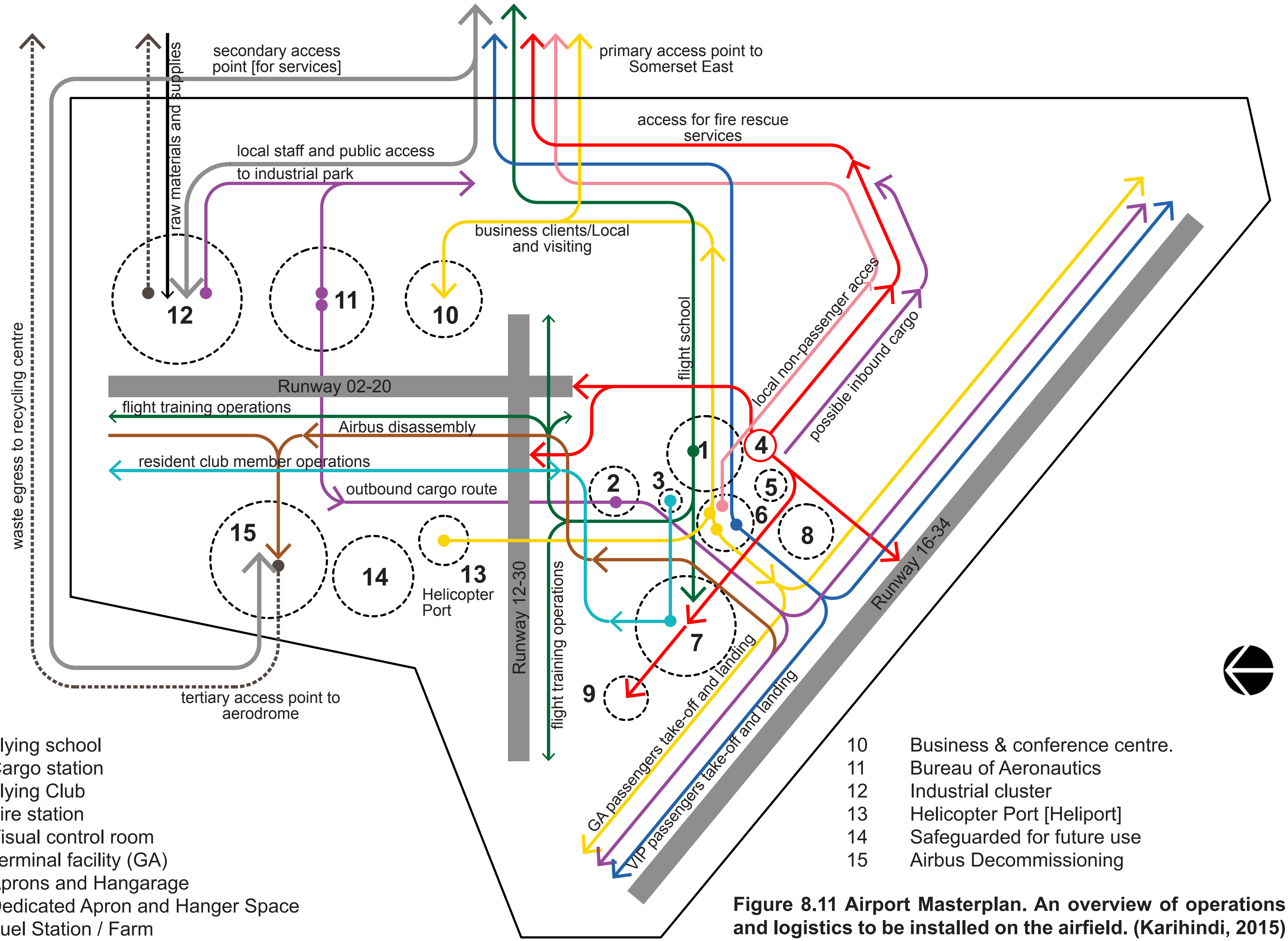
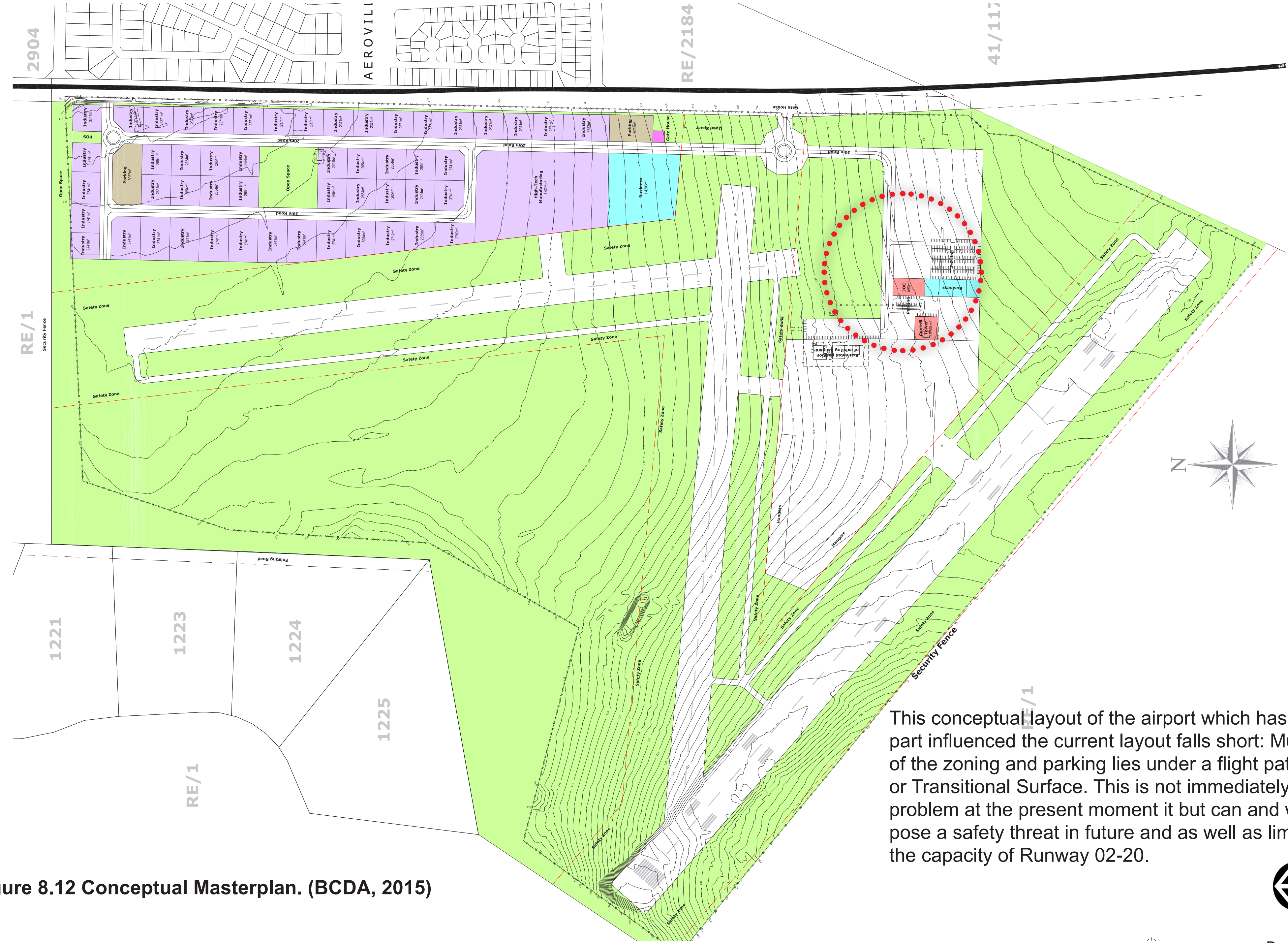


Figure 8.10 Forecourt Concept. Forecourt is first point of arrival. (Karihindi, 2015)



1	Flying school
2	Cargo station
3	Flying Club
4	Fire station
5	Visual control room
6	Terminal facility (GA)
7	Aprons and Hangarage
8	Dedicated Apron and Hanger Space
9	Fuel Station / Farm
10	Business & conference centre.
11	Bureau of Aeronautics
12	Industrial cluster
13	Helicopter Port [Heliport]
14	Safeguarded for future use
15	Airbus Decommissioning

Figure 8.11 Airport Masterplan. An overview of operations and logistics to be installed on the airfield. (Karihindi, 2015)



This conceptual layout of the airport which has in part influenced the current layout falls short: Much of the zoning and parking lies under a flight path or Transitional Surface. This is not immediately a problem at the present moment it but can and will pose a safety threat in future and as well as limit the capacity of Runway 02-20.

Figure 8.12 Conceptual Masterplan. (BCDA, 2015)

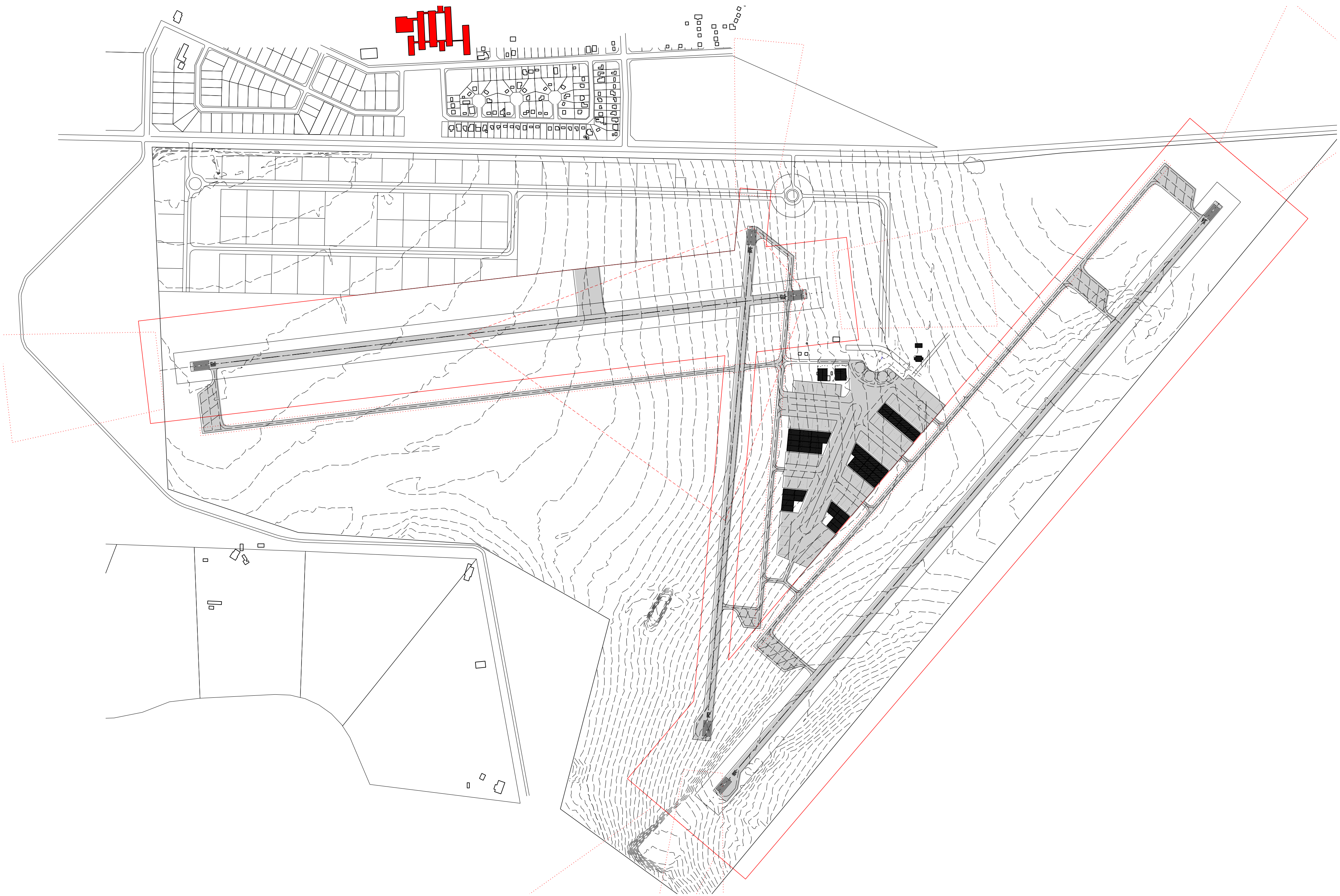


Figure 8.13 Derived conclusive master plan with hangars. (Karihindi, 2015)

THE SITE

The site of a terminal building ought to be situated at a central location to all runways that it would service.
It should be easily accessible from airside as well as from landside. As a sustainability measure to reduce the fuel consumption when taxying; the apron allows multiple direct access routes to all runways at all times whilst observing the safety clearance requirements for the Critical Aircraft from the ramp area.

For the aforementioned reasons; the site was chosen as shown in the diagram to the far right.

Apart from allowing for a greater number of aircraft parking bays at the terminal / apron interface; the convex ramp plan arrangement allows for building morphology to extend out onto the apron providing a greater vantage and experience for passengers, in contrast to the linear arrangement. The convex ramp arrangement also allows the terminal building to have a deeper plan whilst the linear does not.

Figure 8.14 Radial (Convex) and linear ramp arrangement options at terminal ramp interface. (Karihindi, 2015)

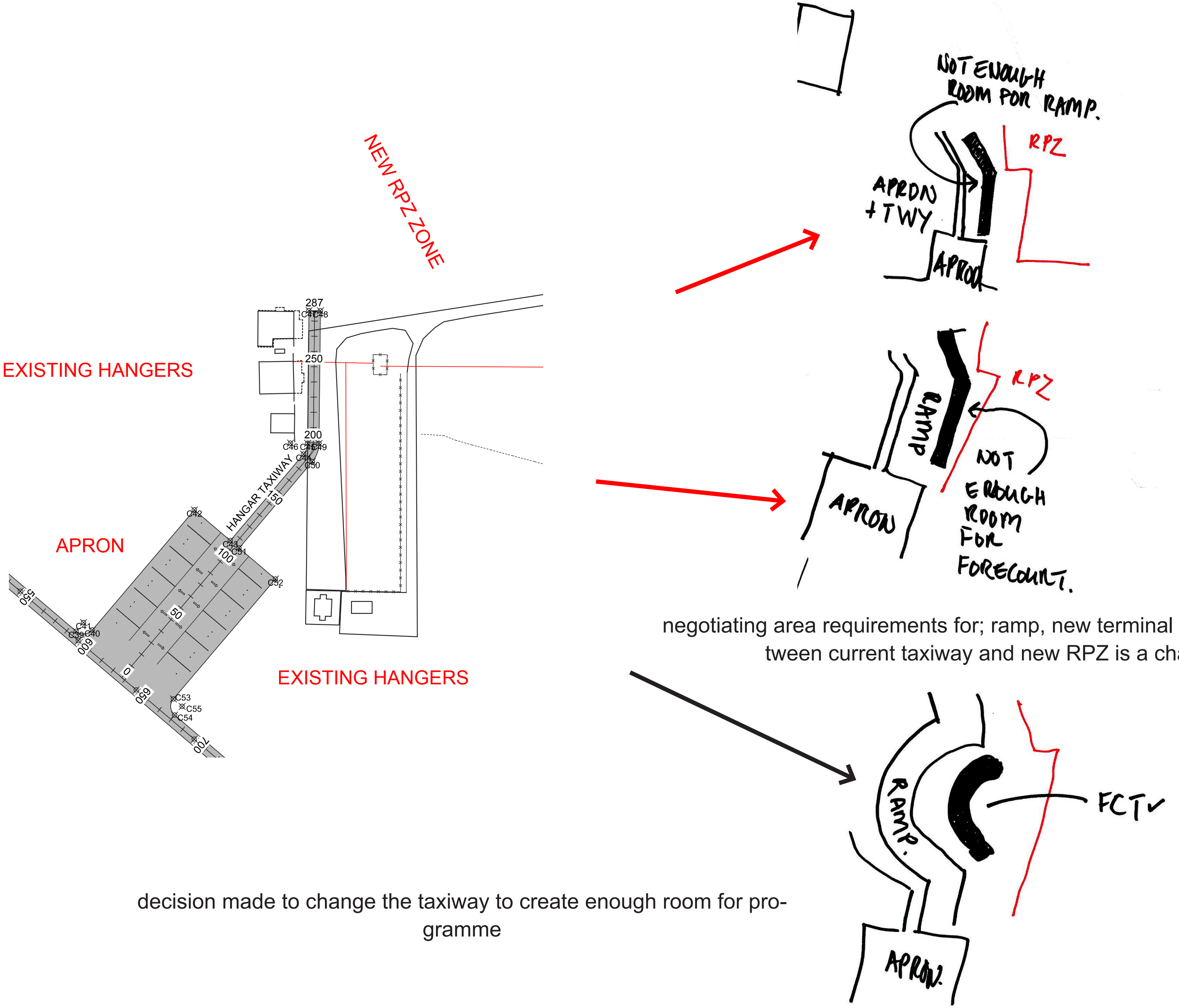


Figure 8.15 The problem with current apron layout in relation to terminal area requirements and the imposed RPZ - with options. (Karihindi, 2015)

CONCEPTUAL DEVELOPMENT AND INTERPRETATION

CONCEPT

Abstraction of the Landscape

The notion of abstraction is used to inform the initial design concept. An abstraction of the landscape is a contextual design response to context. In as similar a manner as Somerset East Is nestled by the Boshberg Mountain Range, similarly an array of aeronautical functions are nestled together under the envelope.
Note that for the sake of abstracting, there is no desire to adhere to traditional form and identification , rather a simple stoke and line captures the essence of place.

Figure 9.0 Abstraction of the Landscape. (Karihindi, 2015)

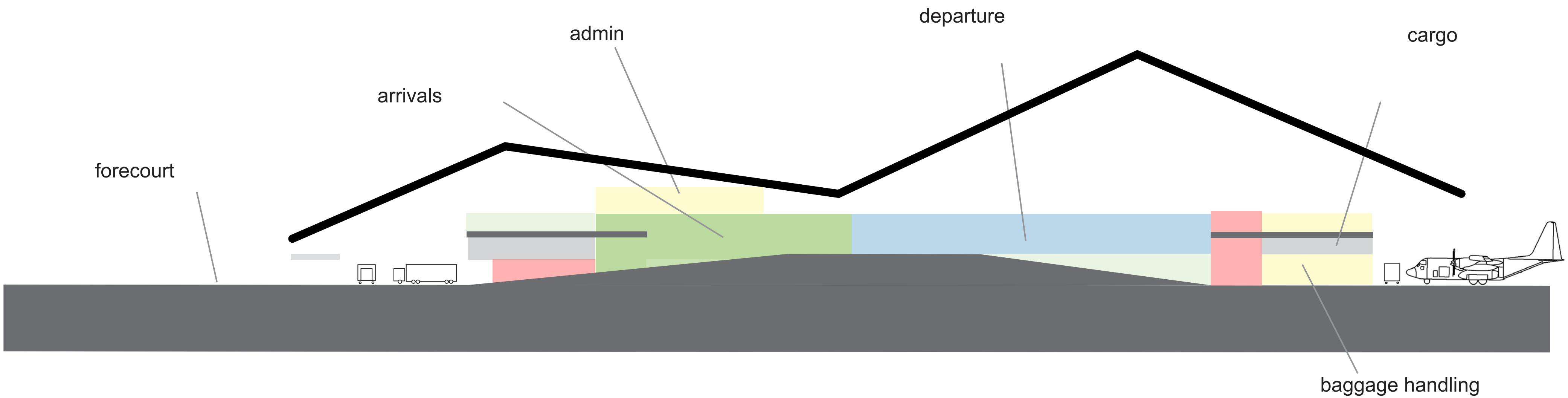


Figure 9.1 Diagrammatic interpretation of concept. (Karihindi, 2015)

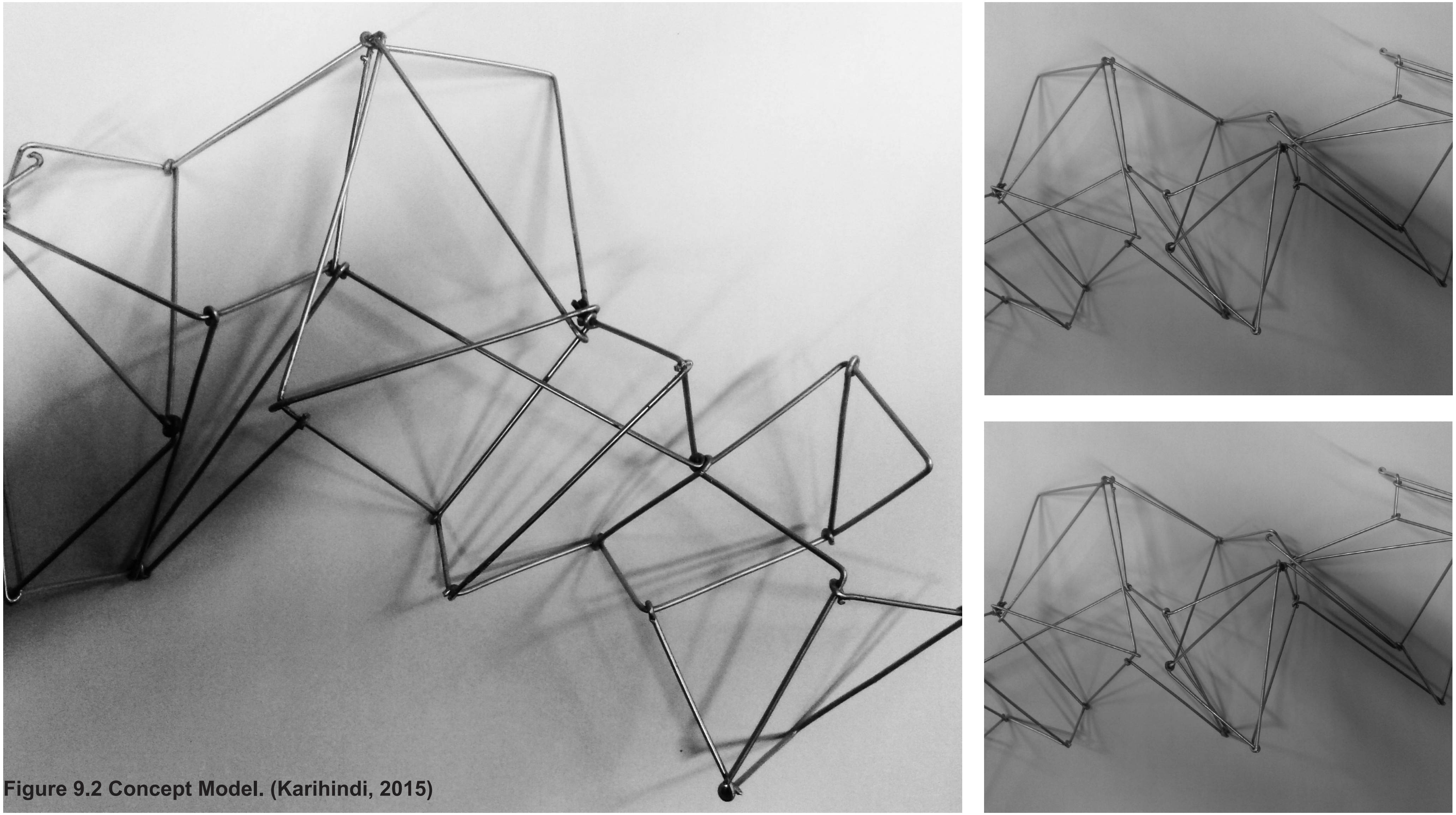


Figure 9.2 Concept Model. (Karihindi, 2015)

The activities on the airside will inform the form and spatial arrangement of the building.
It will be assumed that Runway 02-20 and Runway 12-30 will primarily serve the Flight School Training Programme whereas Runway 16-34 will serve the more commercial aviation aspects of Travel, Tourism, and Cargo Operations e.t.c
The result is the 'Wing Concept'; which has the terminal at the centre, the flight school and cargo on either side of it. Each wing is sited such that it is close to its runway and apron where possible.
The aircraft parking bays in front of the terminal are transient spaces and as such offer great flexibility of use: they can serve commercial jets as well as small category aircraft used by the flight school.

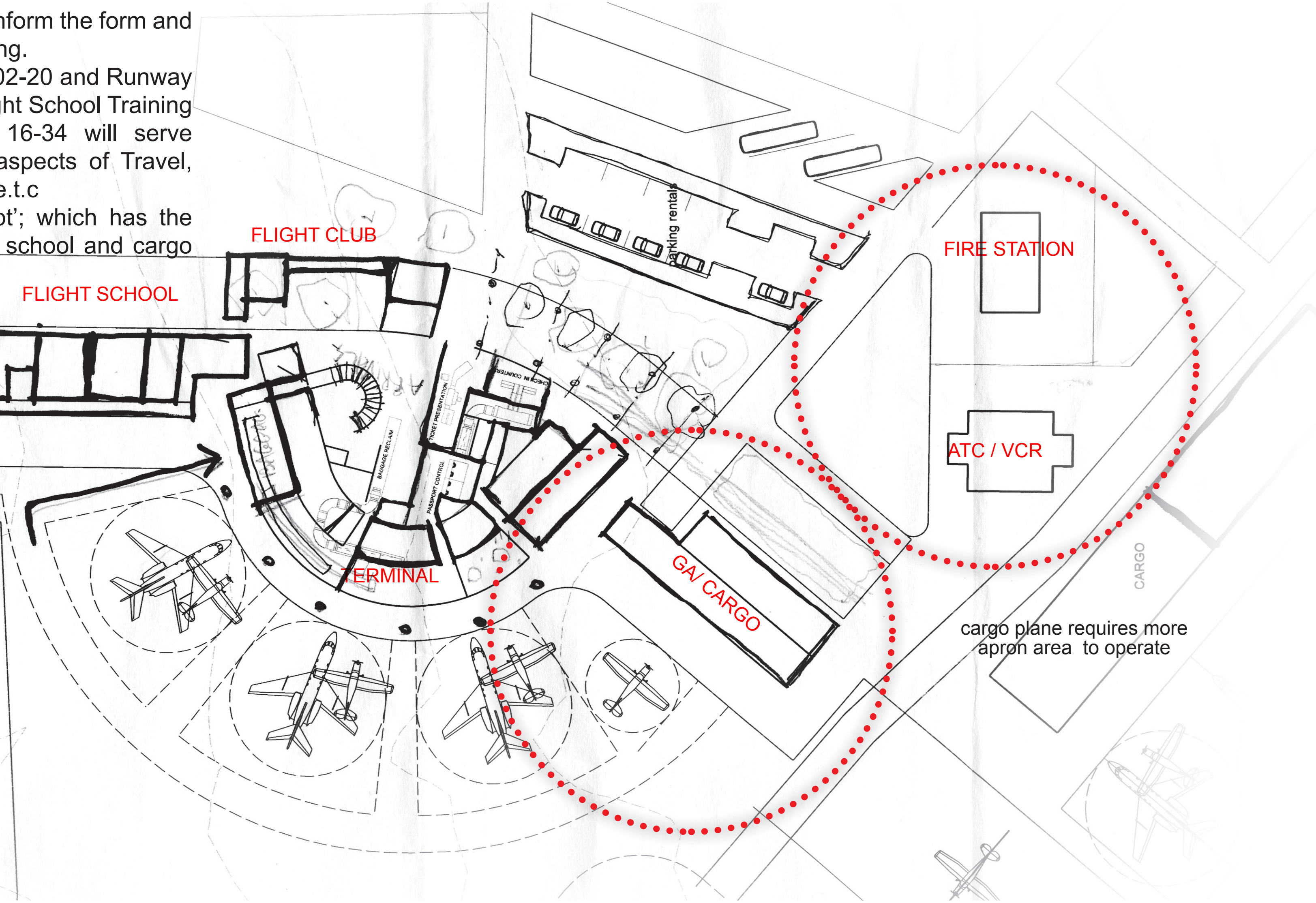


Figure 9.3 Development of plan. (Karihindi, 2015)

DESIGN DEVELOPMENT

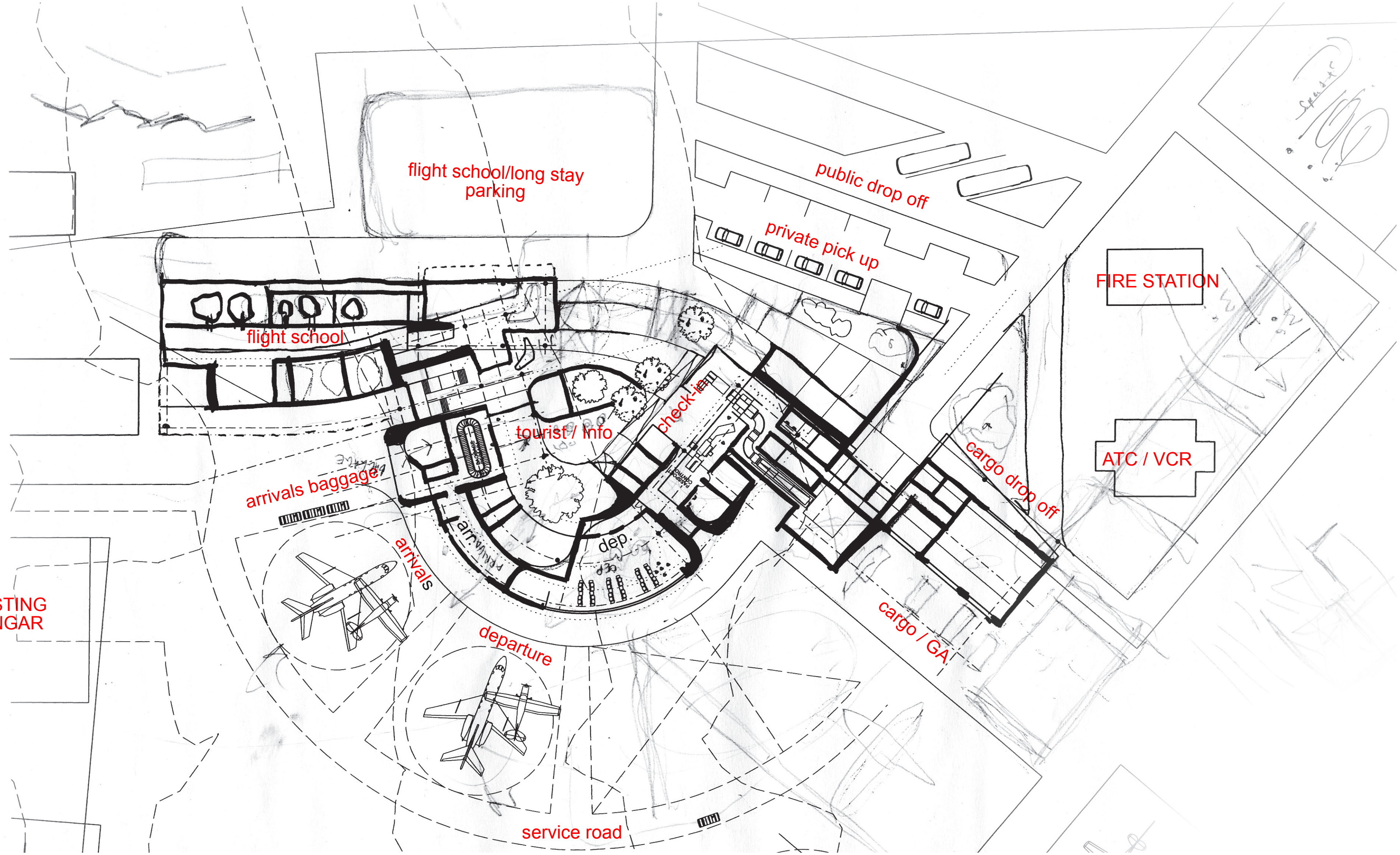
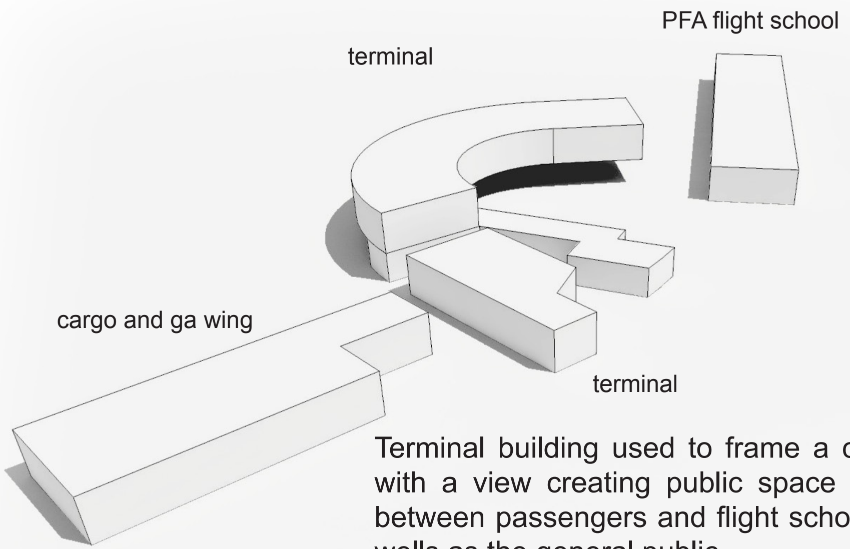
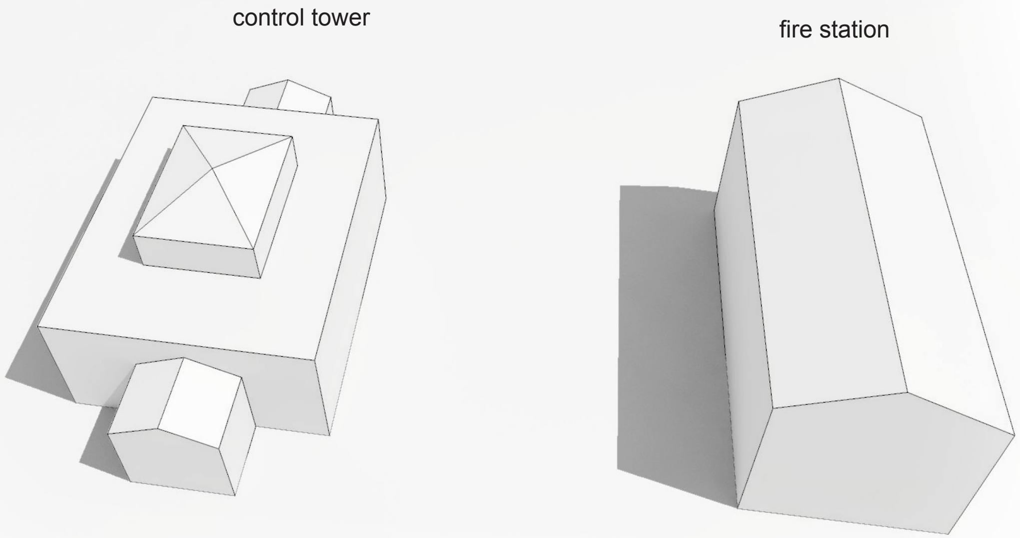
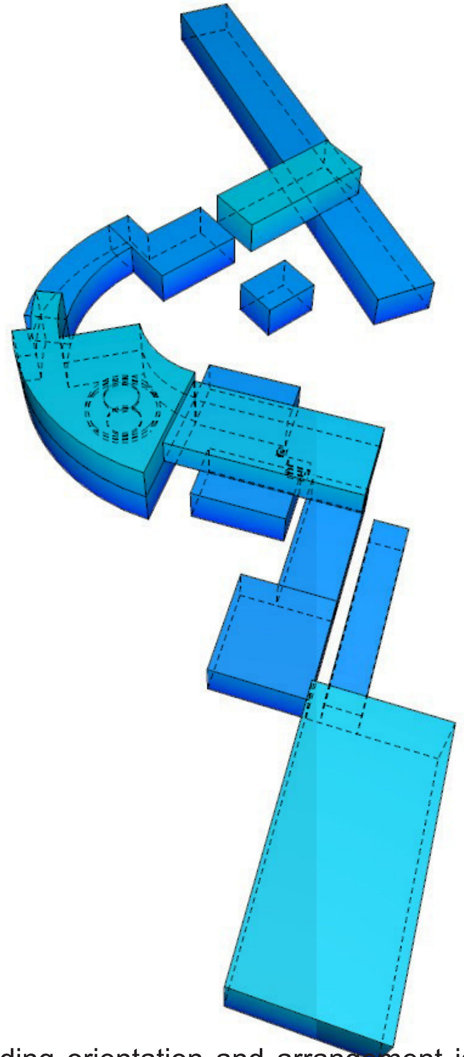


Figure 9.4 Development of plan. Courtyard as focus of activities. Karihindi, 2015)



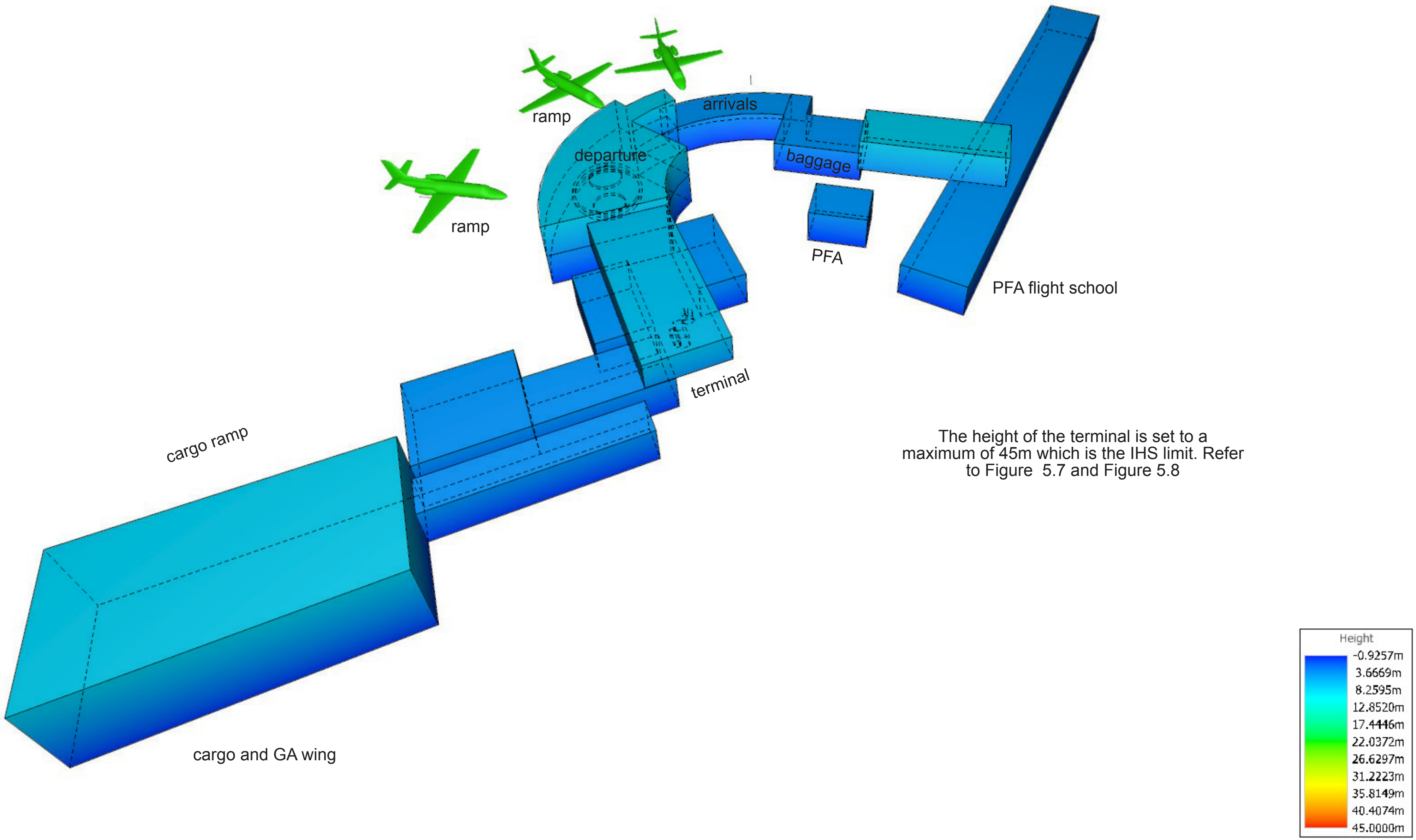
Terminal building used to frame a courtyard area with a view creating public space for interaction between passengers and flight school students as wells as the general public





Building orientation and arrangement is such that there is little area of the facade facing north. The more translucent faces of the building are relatively oriented away from receiving direct solar radiation.

Figure 9.5 Composition study. (Karihindi, 2015)



The height of the terminal is set to a maximum of 45m which is the IHS limit. Refer to Figure 5.7 and Figure 5.8

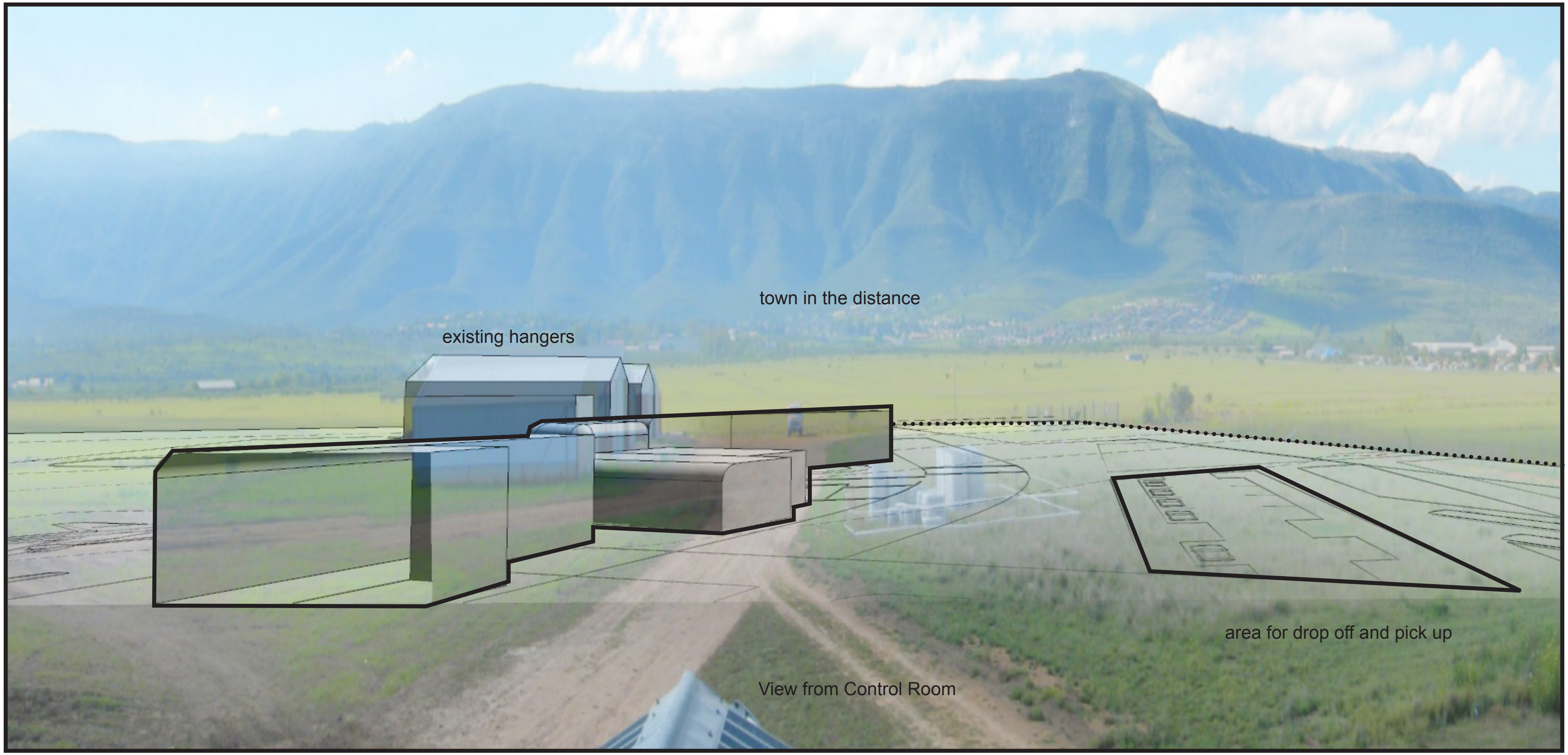


Figure 9.6 Evaluating the mass in its would-be real location and context. Seen from the VCR. (Karihindi, 2015)

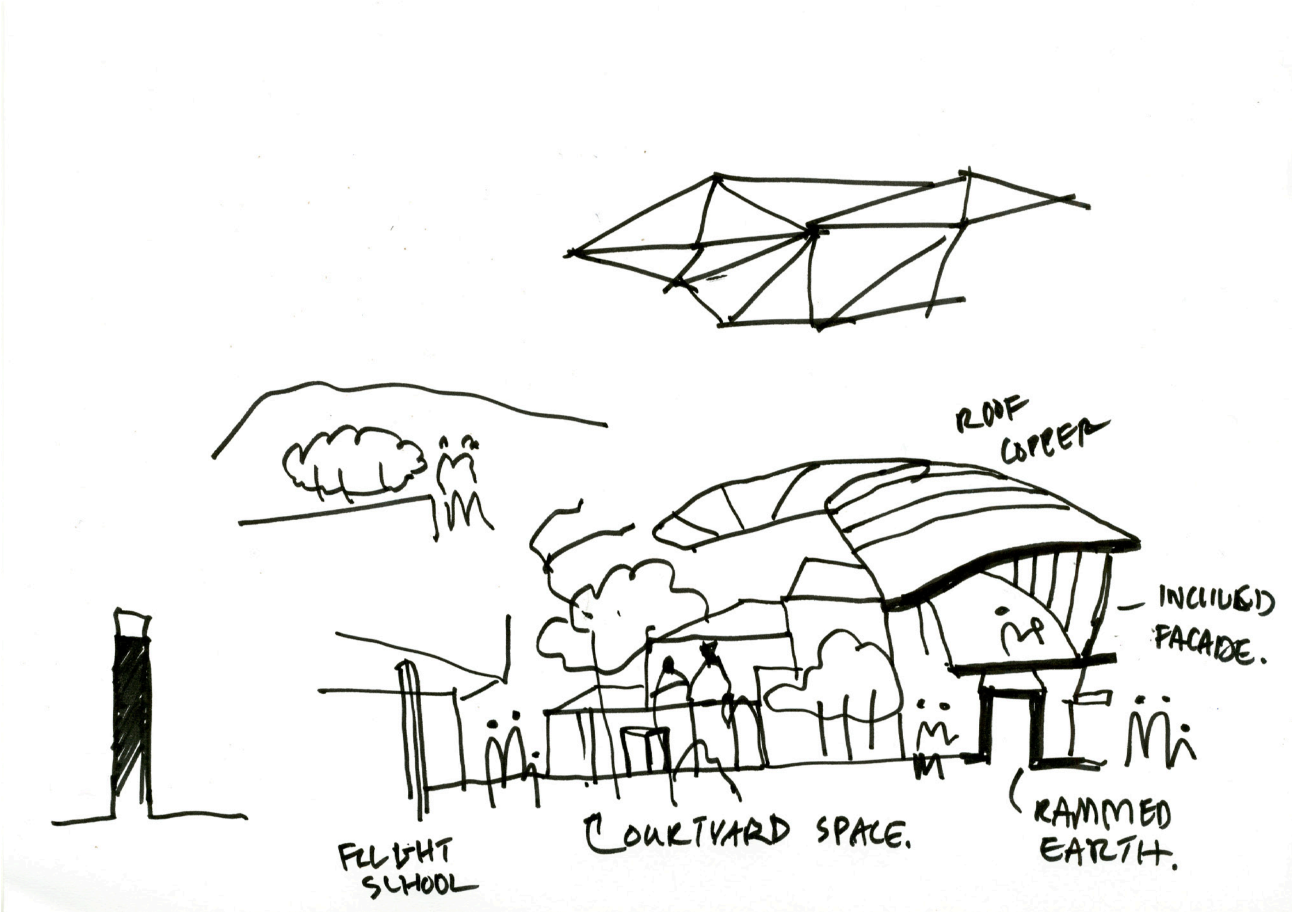


Figure 9.7 All Ideas into one. (Karihindi, 2015)

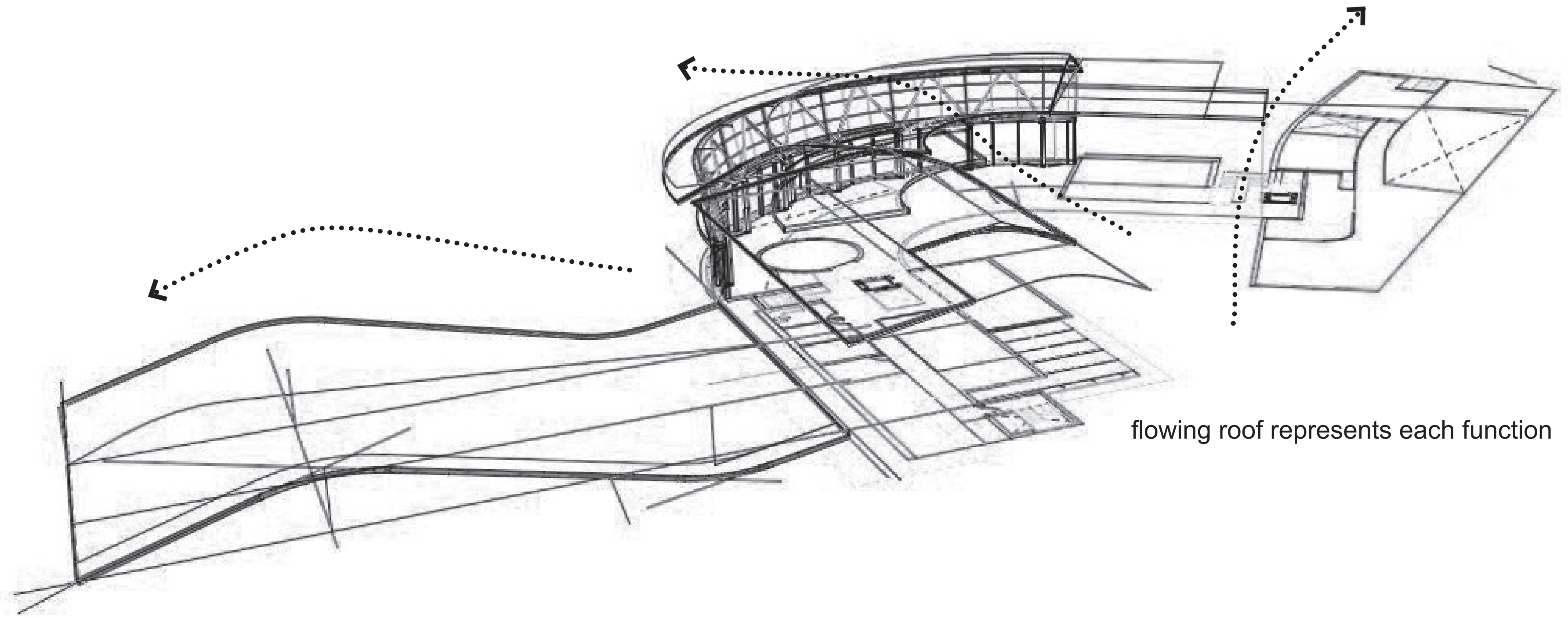
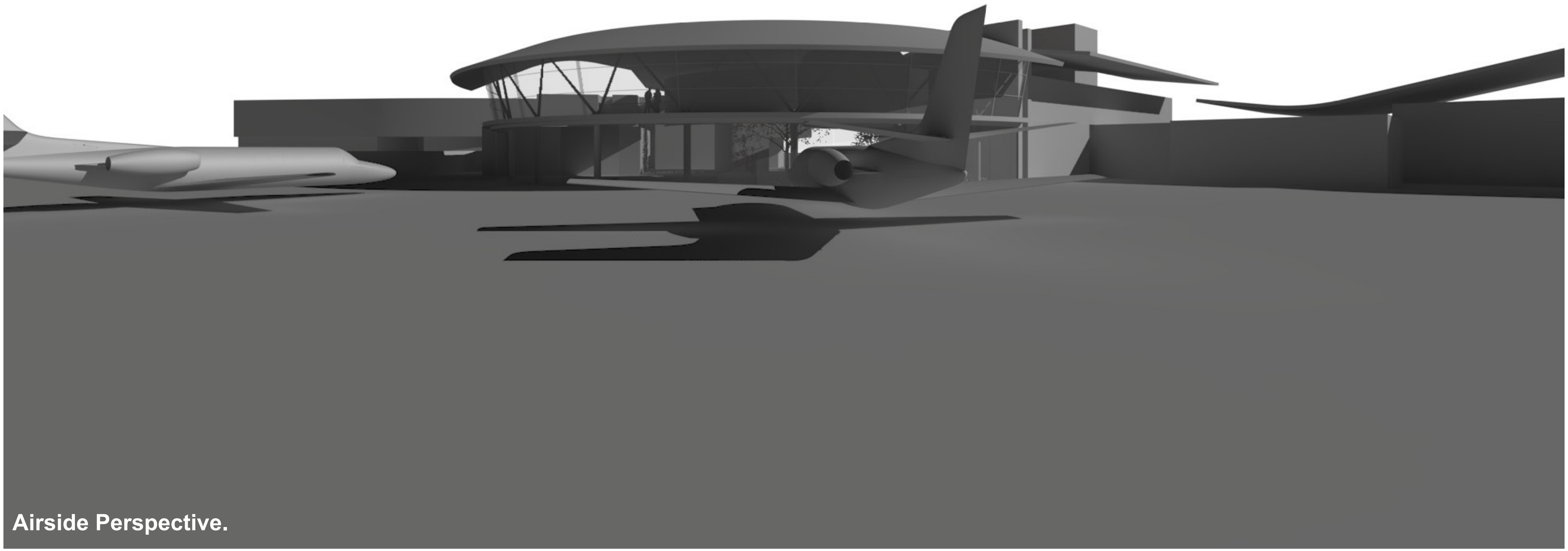
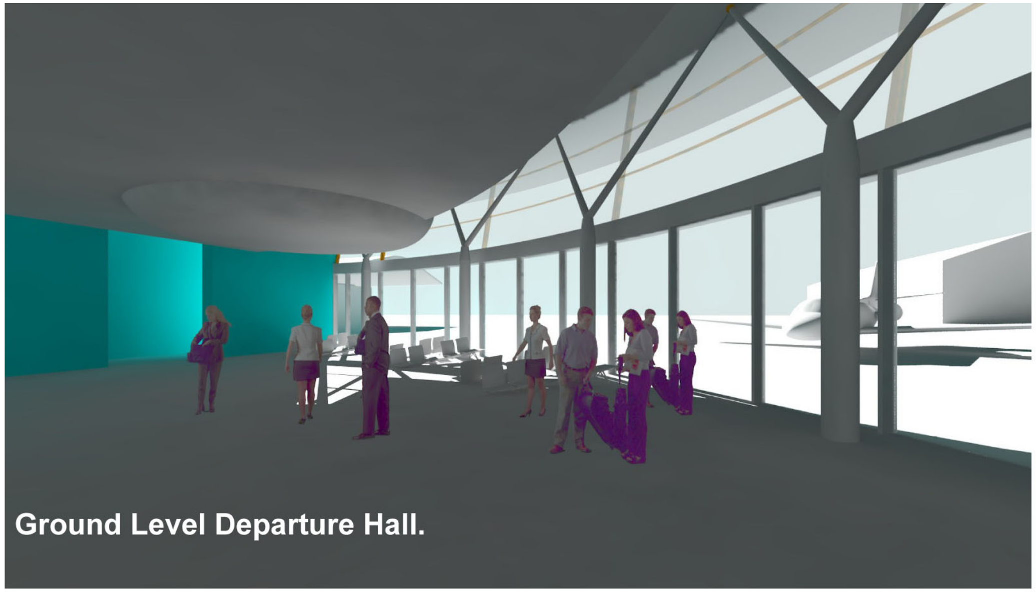


Figure 9.8 Development of Flowing Roof. (Karihindi, 2015)

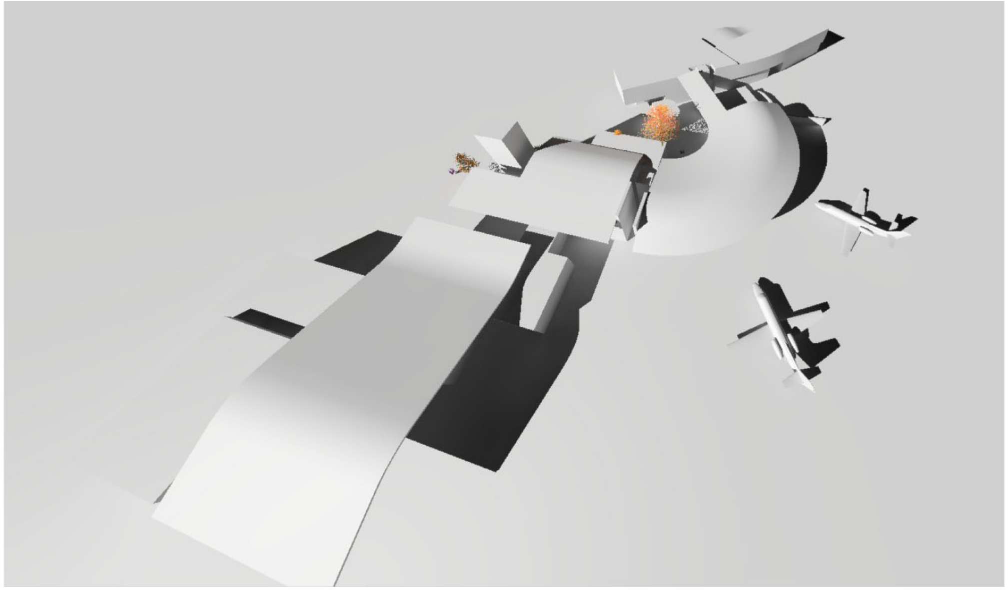
INITIAL CONCEPT

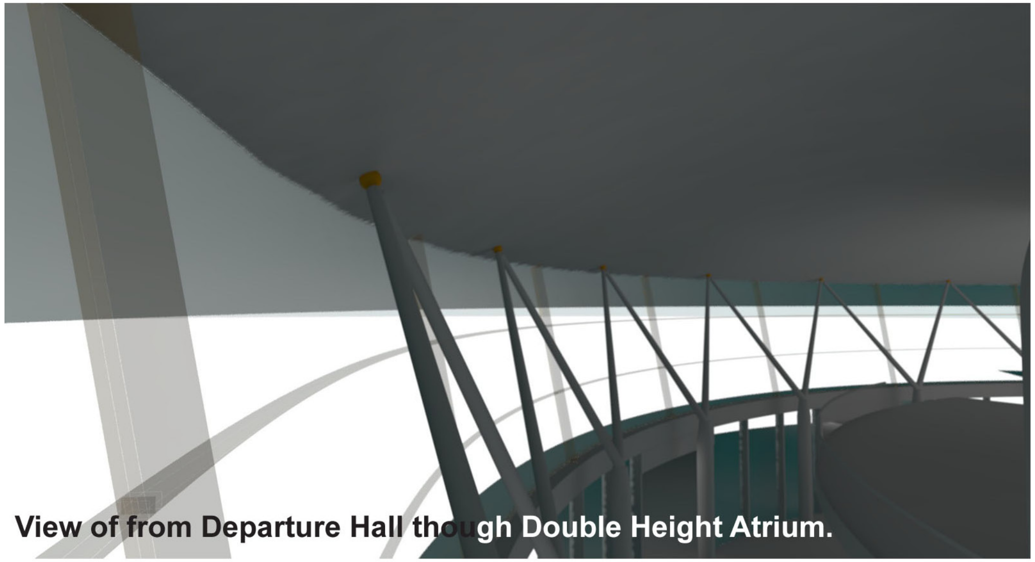


Airside Perspective.

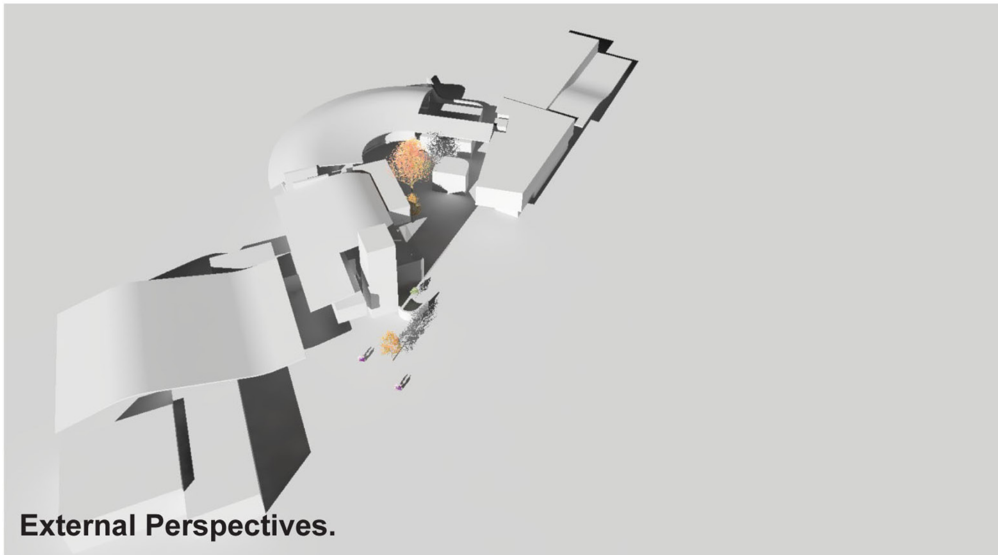


Ground Level Departure Hall.

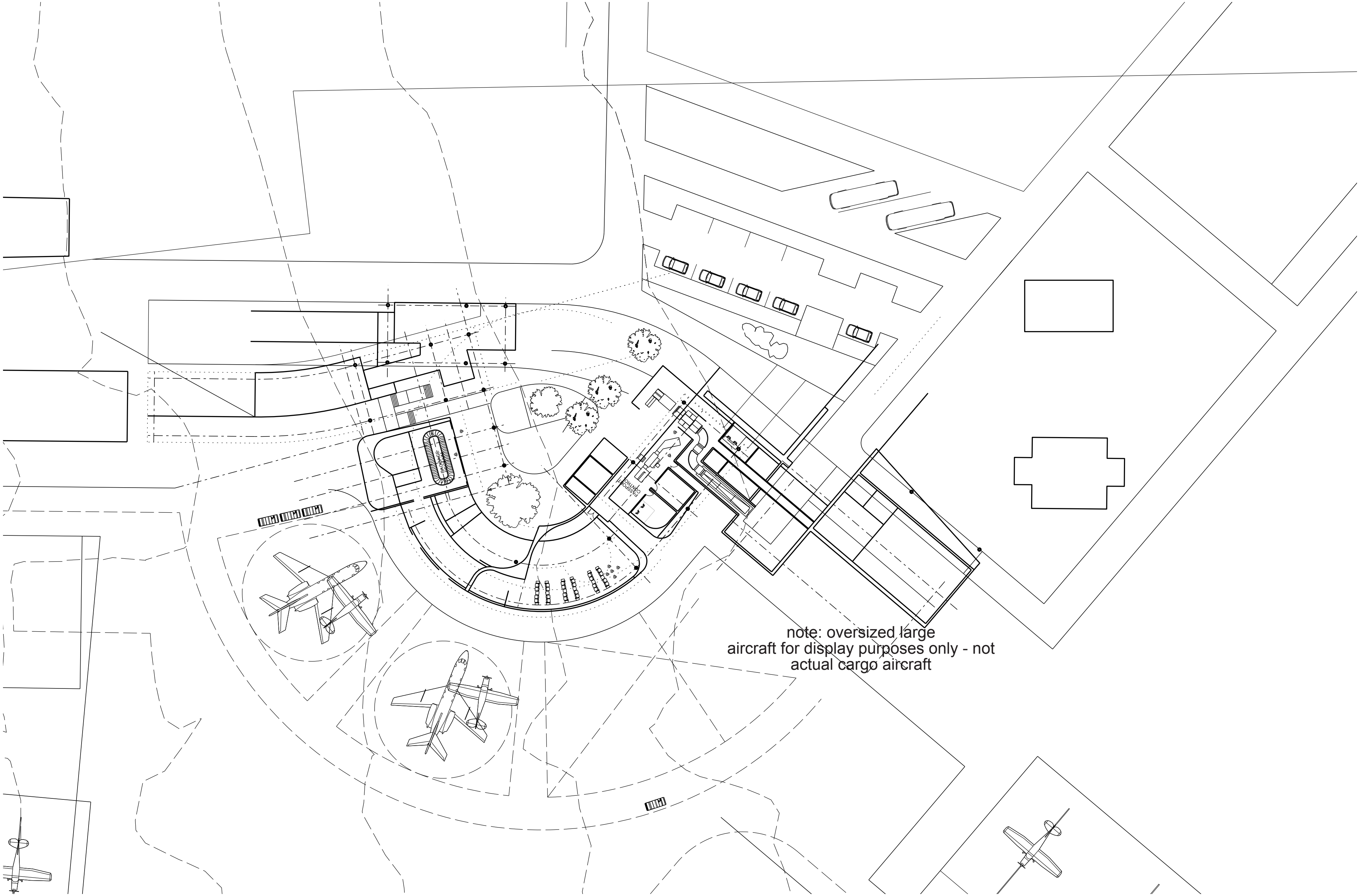




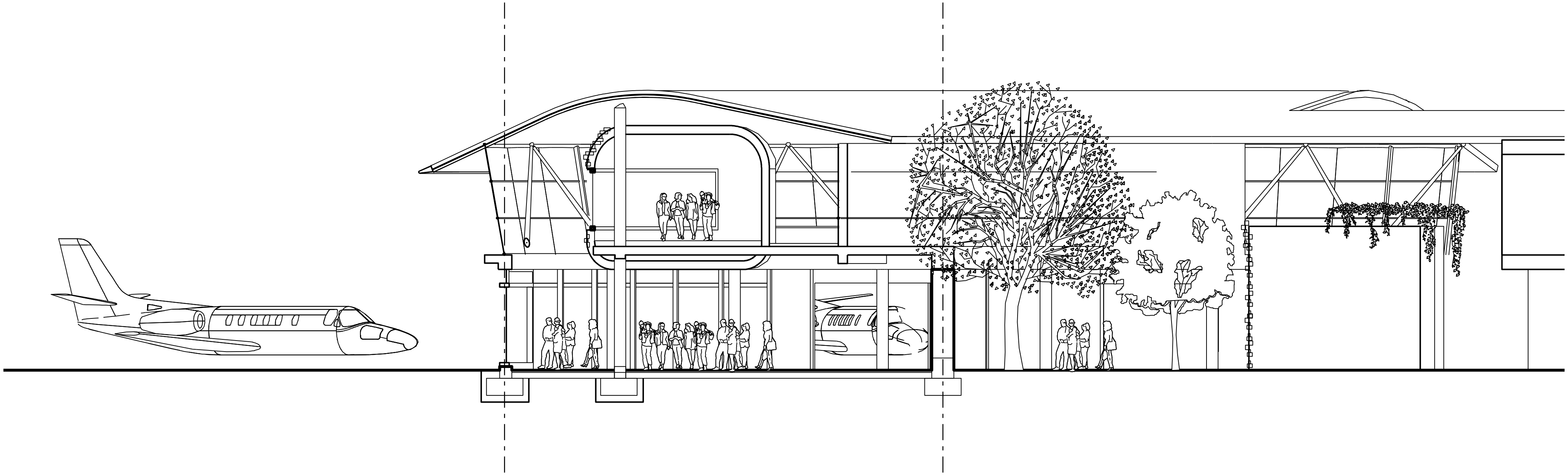
View of from Departure Hall though Double Height Atrium.



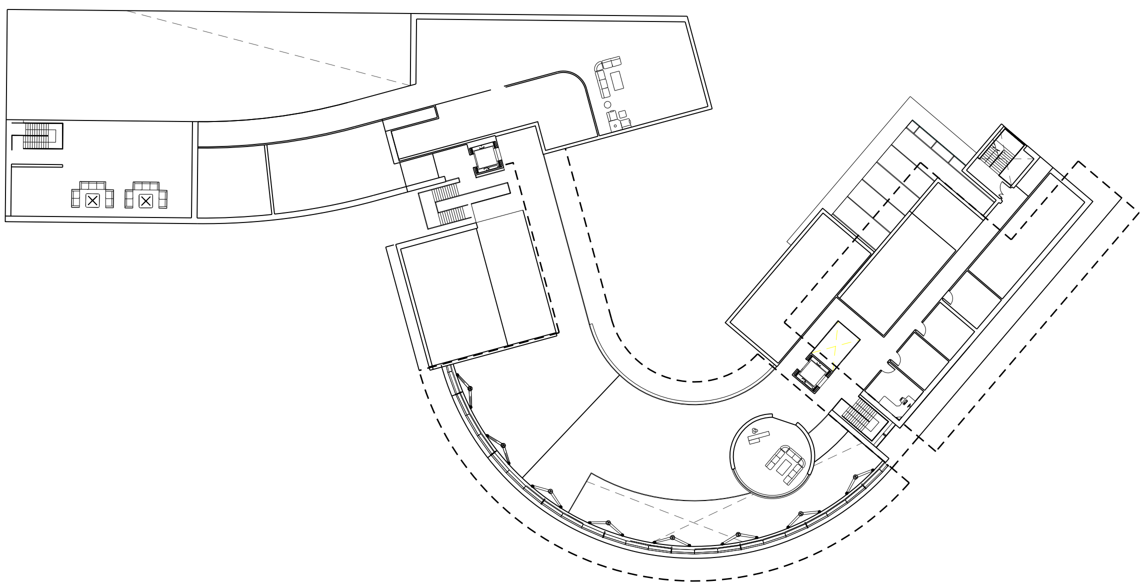
External Perspectives.



Ground Floor Level with Context.

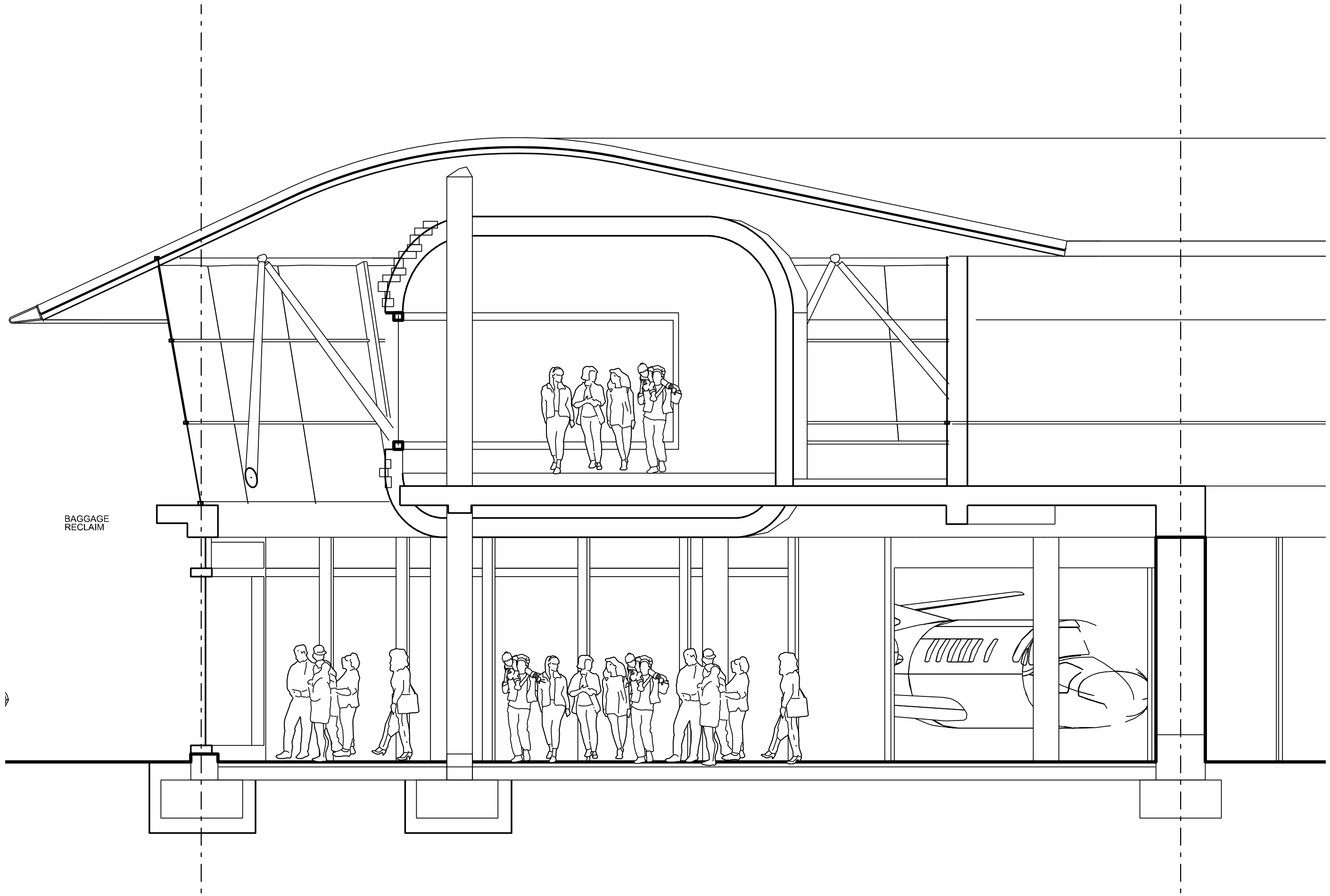


Generic Sectional Composition Through Departure Hall.



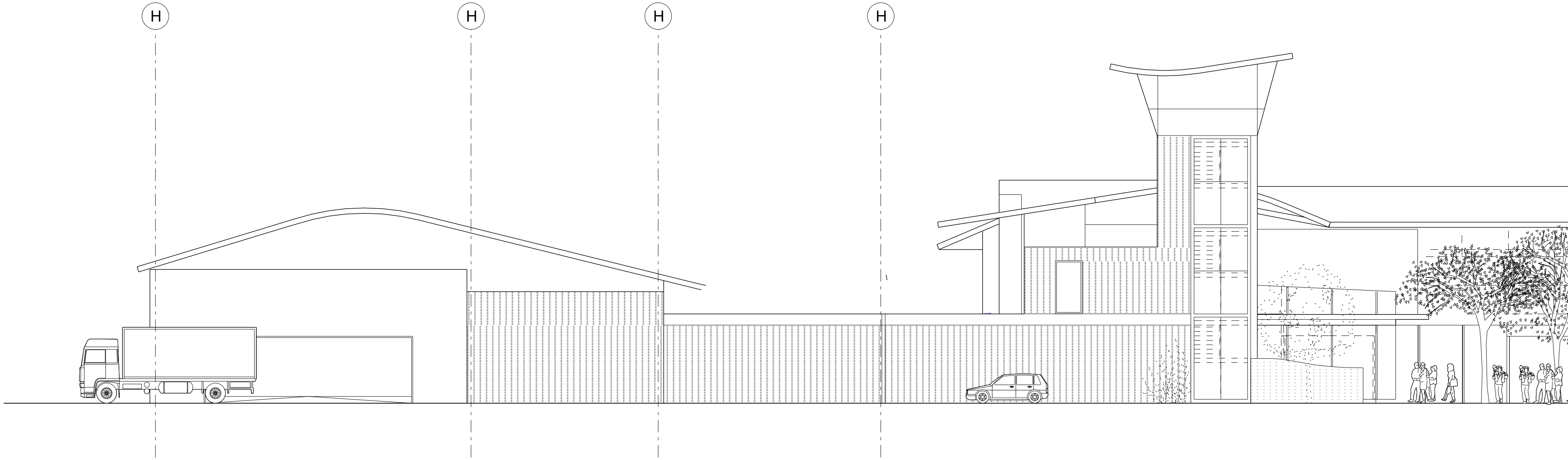
Passenger flows and airport operations extend to the first floor which convolutes the program.

First Floor Level without Context.

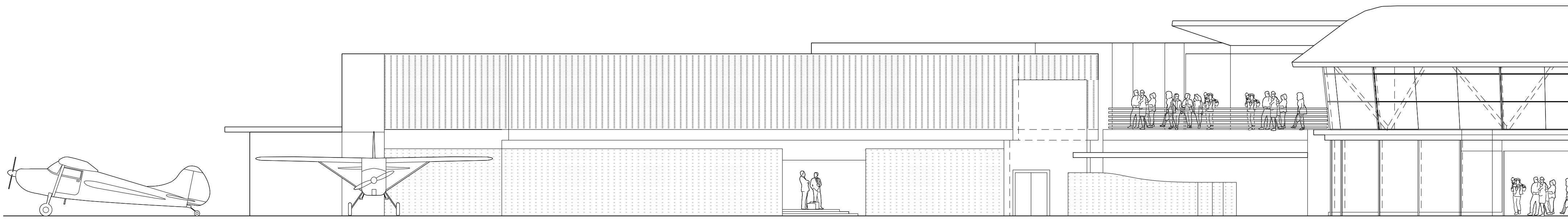


Generic Sectional Composition Through Departure Hall and Courtyard

Typical Section Though Departure Hall

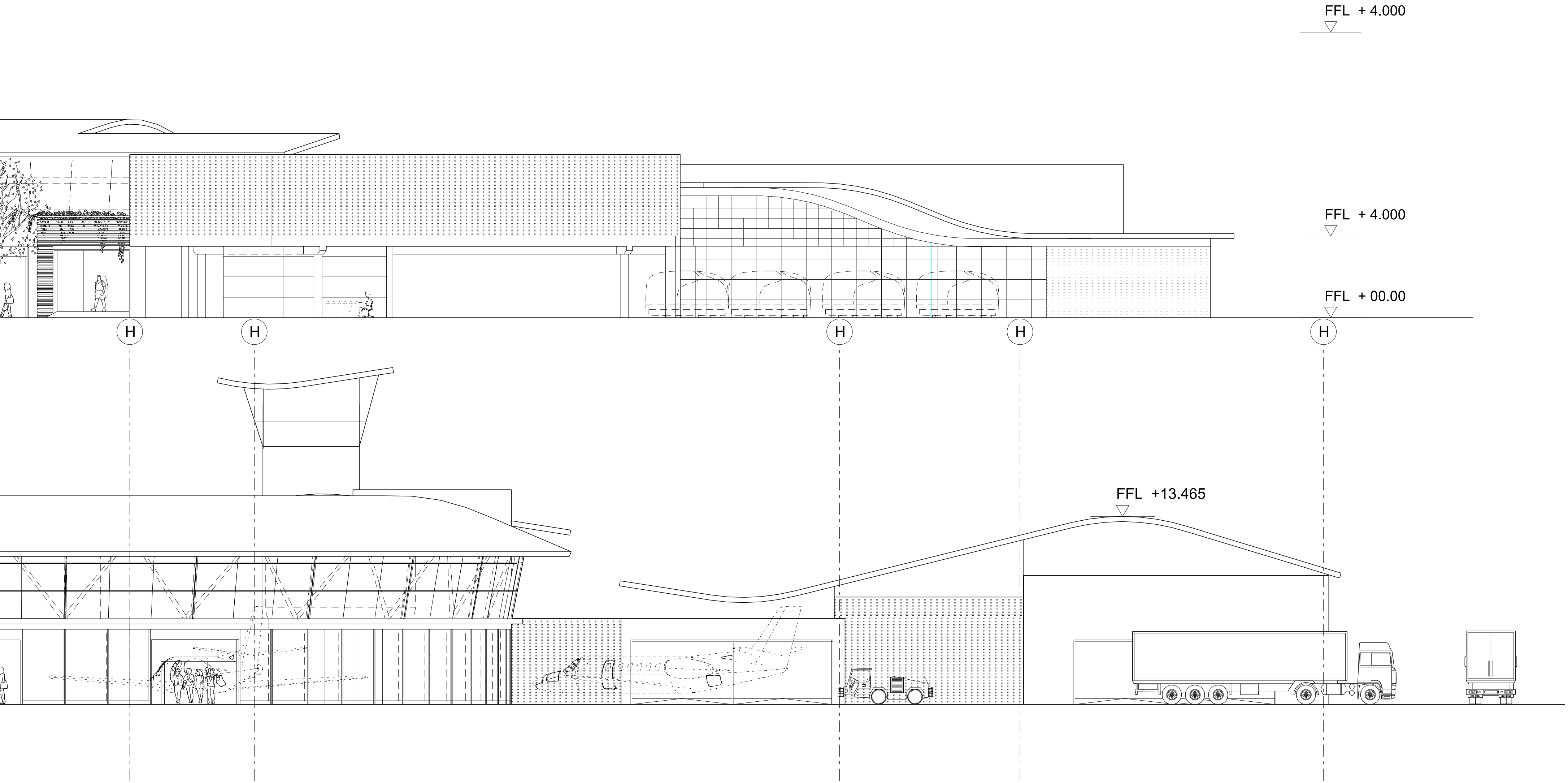


01 Landside Elevation
1:200



02 Airside Elevation
1:200

General Arrangement Drawings: Airside and Landsde Elevation.


FFL + 4.000
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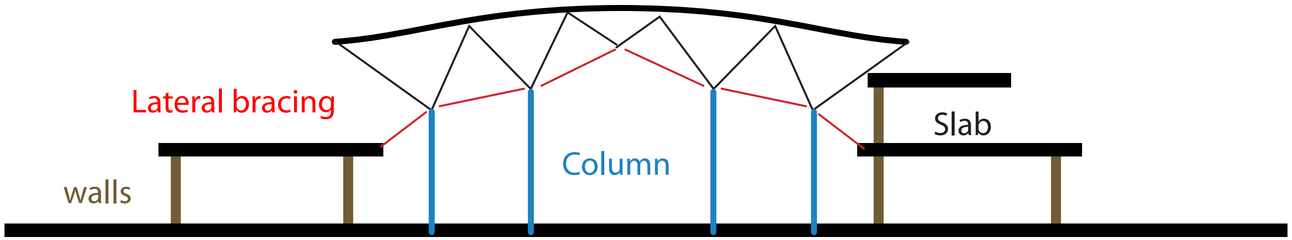
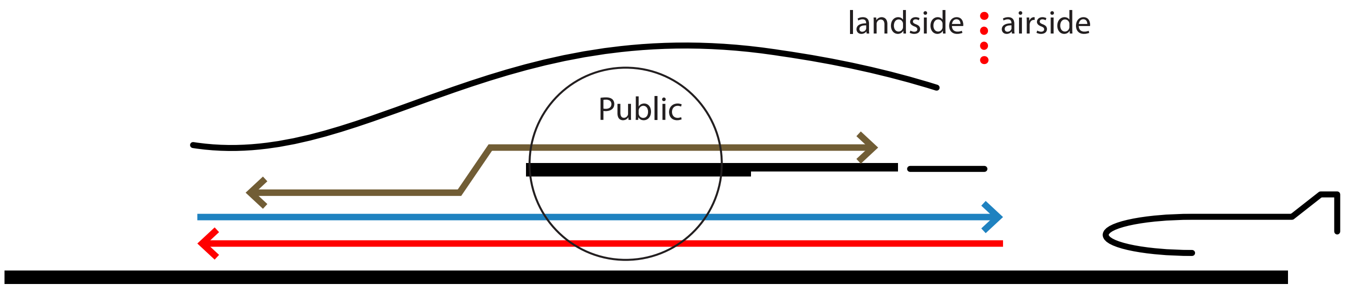
DESIGN RESPONSE PRINCIPLES AND STRATEGIES

The roof is a spaceframe that is augmented and deformed in the horizontal plane and the vertical so that node centres fall on top of the column centres supporting it. In section the result is a sinusoidal roof profile that is low at the entrance and higher as one progresses into the terminal - this helps with directing the direction of flow as well as wayfinding



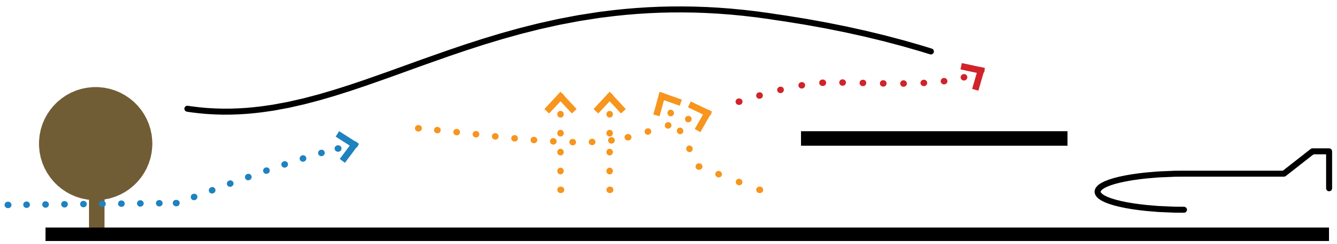
Structure principle

The public realm of the airport terminal(Lobby) is extended onto the 1st floor level in order to take advantage of the views into the surrounding landscape.
All movements of passengers is remains on the ground level to ensure simple and direct access to the apron for both passengers and student pilots.



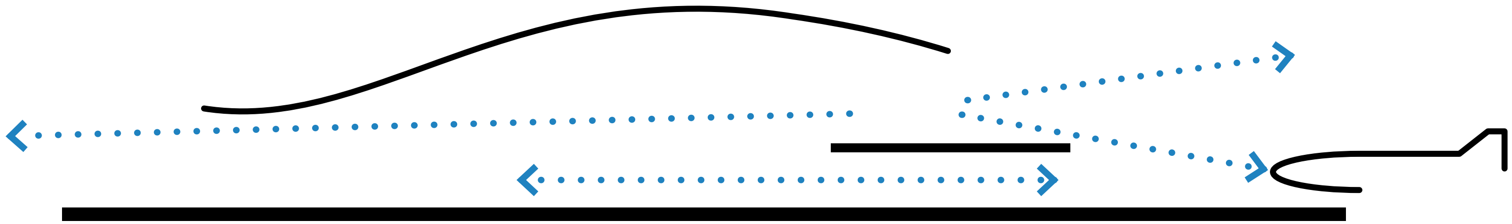
Passenger flows(PAX) and public realm

The double height volume created by the roof which is open at the eaves helps to induce a cross and stack ventilation effect versus mechanised heating and cooling - reduces the energy footprint.



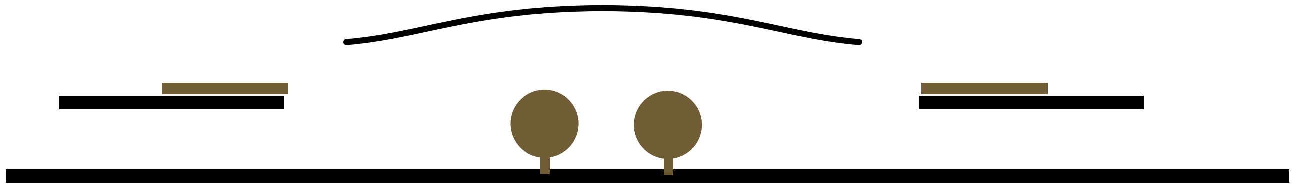
Stack and cross ventilation effect

The first floor acts as a vantage point and a viewing platform. It is open to the public and students as well as passengers can use this space to interact.



Views out

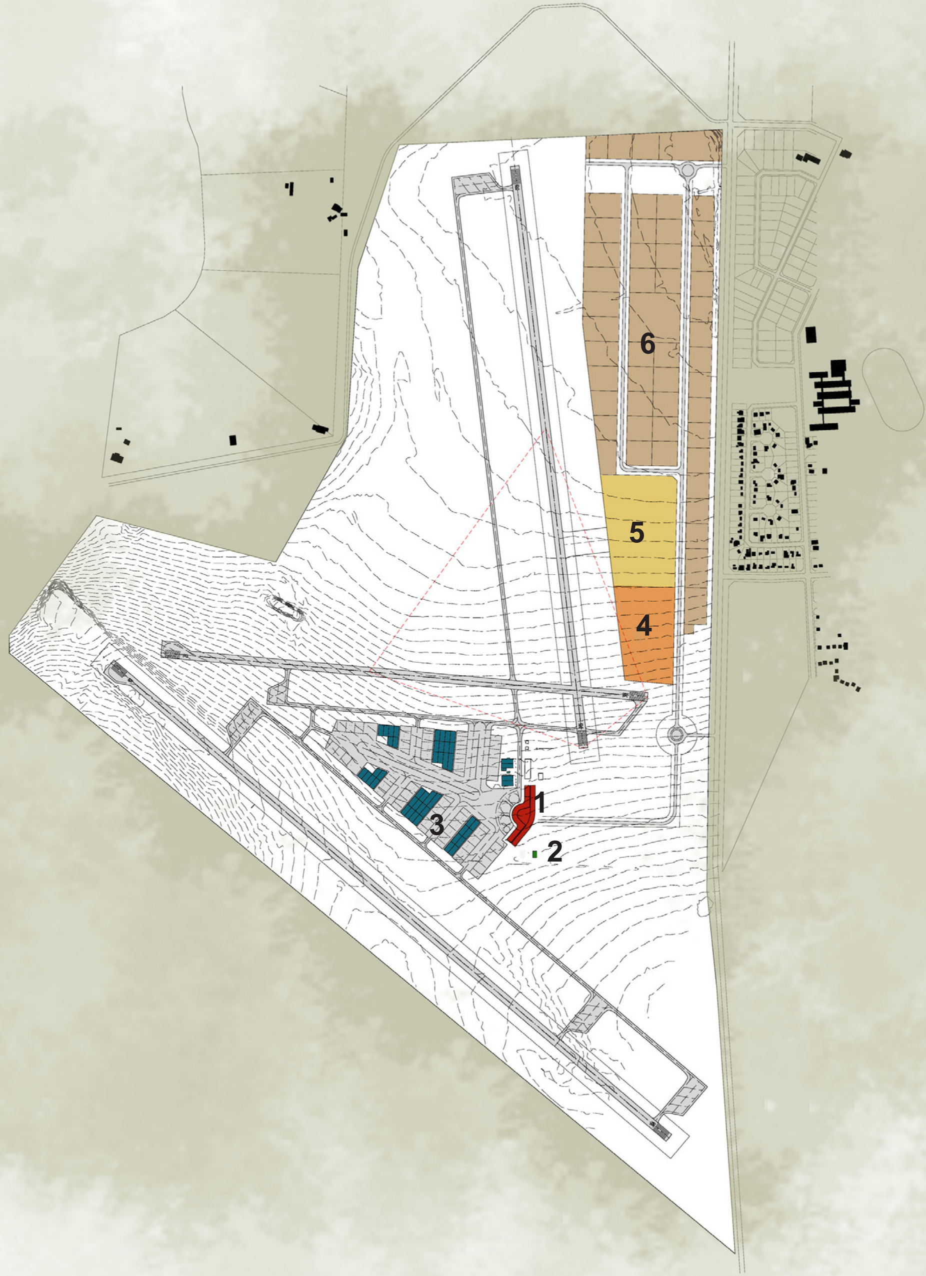
The use of vegetation aims at creating a much more habitable interior. This is to blur the boundary between outside and inside and also in connecting the building to its surroundings. The use of green roof also passively acts as a natural air conditioner - warm air entering at the eaves is cooled as it passes through the vegetation.



Covered courtyard as organising space

FINAL DESIGN RESPONSE

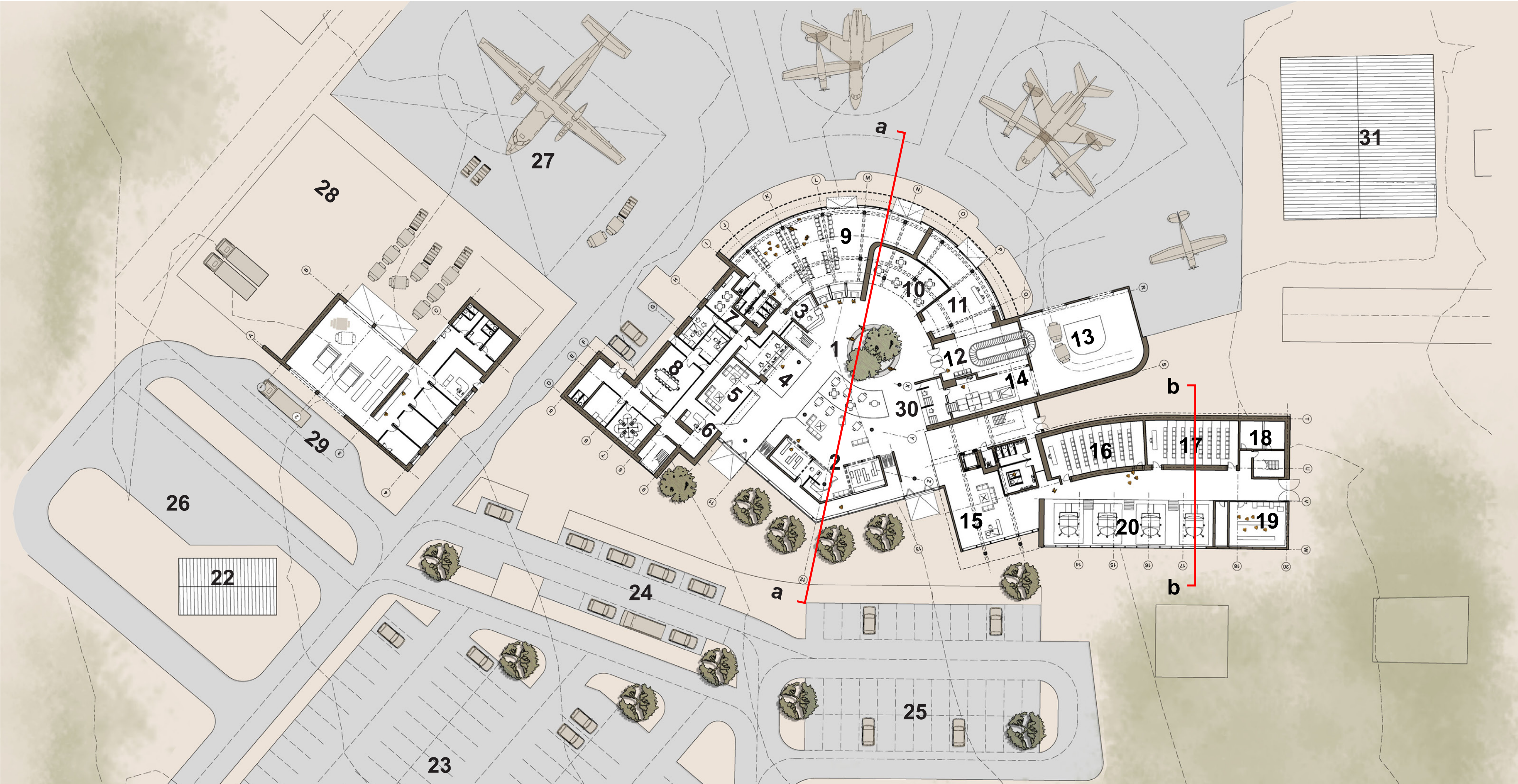
Landside Perspective



1. Proposed site
2. Fire Station
3. Hangars
4. Business Plot
5. Bureau of Aeronautics
6. Industrial Plots

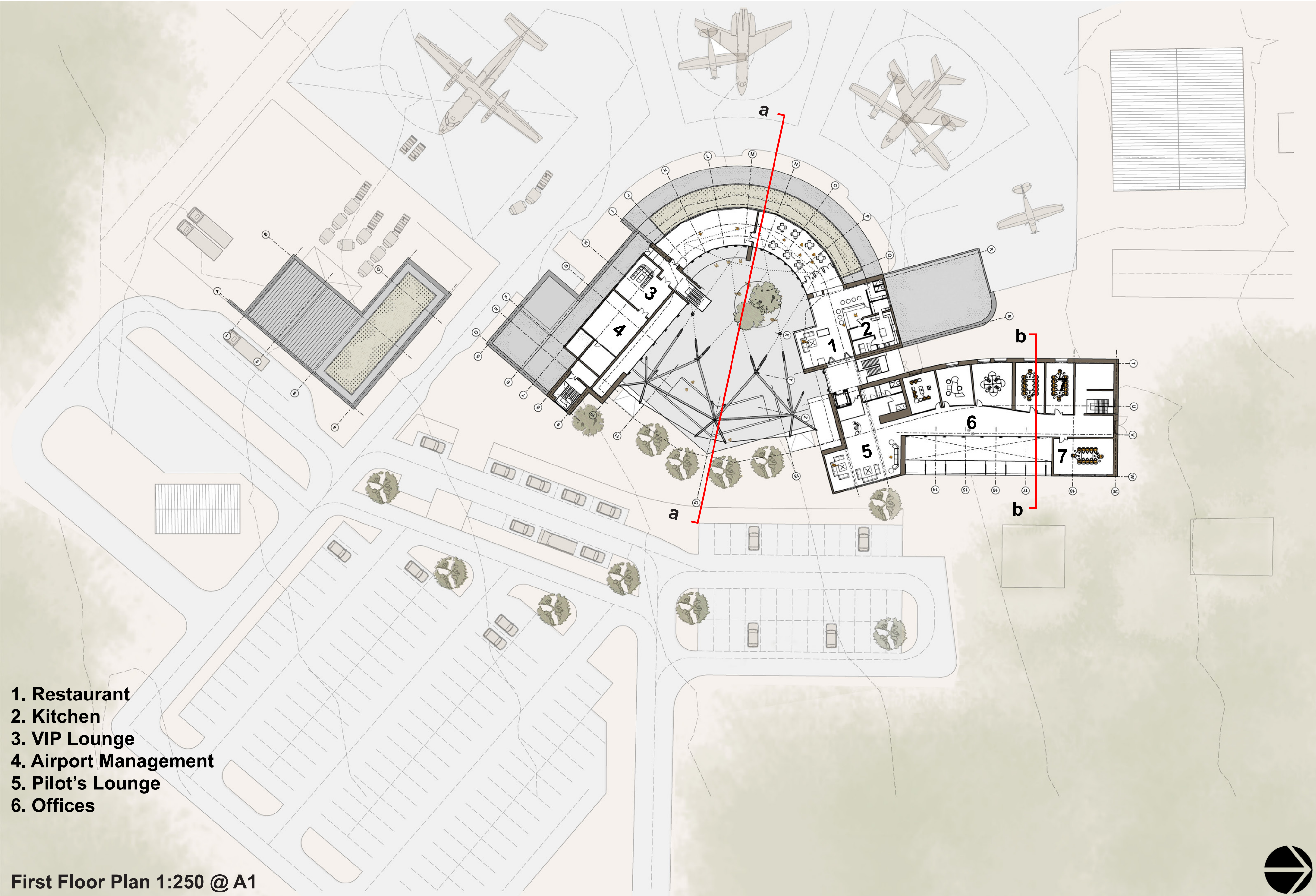
Airport Masterplan 1: 5000 @ A1

Site Plan 1:500 @ A1



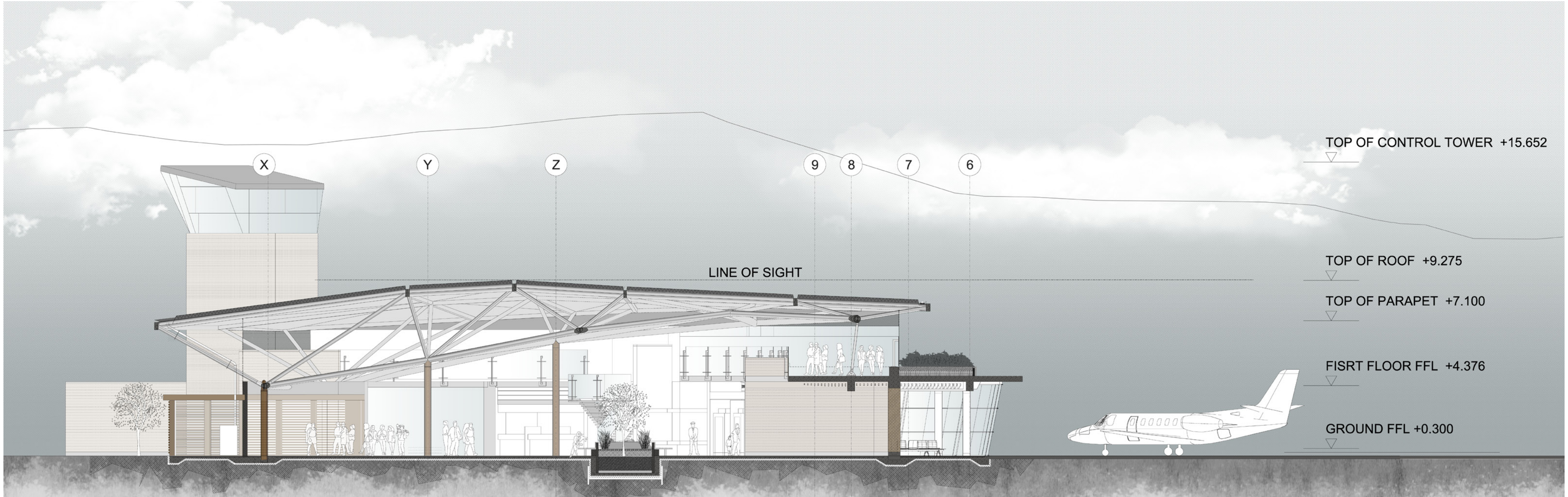
1. Airport Lobby
2. Ticket & Tourism info & gift shop
3. Security Office
4. Ticket & booking stalls
5. Airport Lounge
6. Reception
7. Security Support
8. Boardroom
9. Departure Hall
10. Meet & Greet Waiting
11. Arrivals Concourse
12. Baggage Reclaim
13. Baggage Handling
14. EDS Room
15. Flight school reception lobby
16. Lecture room 01
17. Lecture room 02
18. Storage
19. Engineer's Workshop
20. Simulator Hall
21. Cargo Terminal Handling
22. Fire Station
23. Public Parking
24. Drop Off & Pick Up
25. Airport Staff & School Parking
26. Fire Truck Parking Bay
27. Cargo Apron & Ramp
28. Goods Yard
29. Delivery Bay
30. Baggage Check-In Counter
31. Existing Hangar

Ground Floor Plan 1:250 @ A1

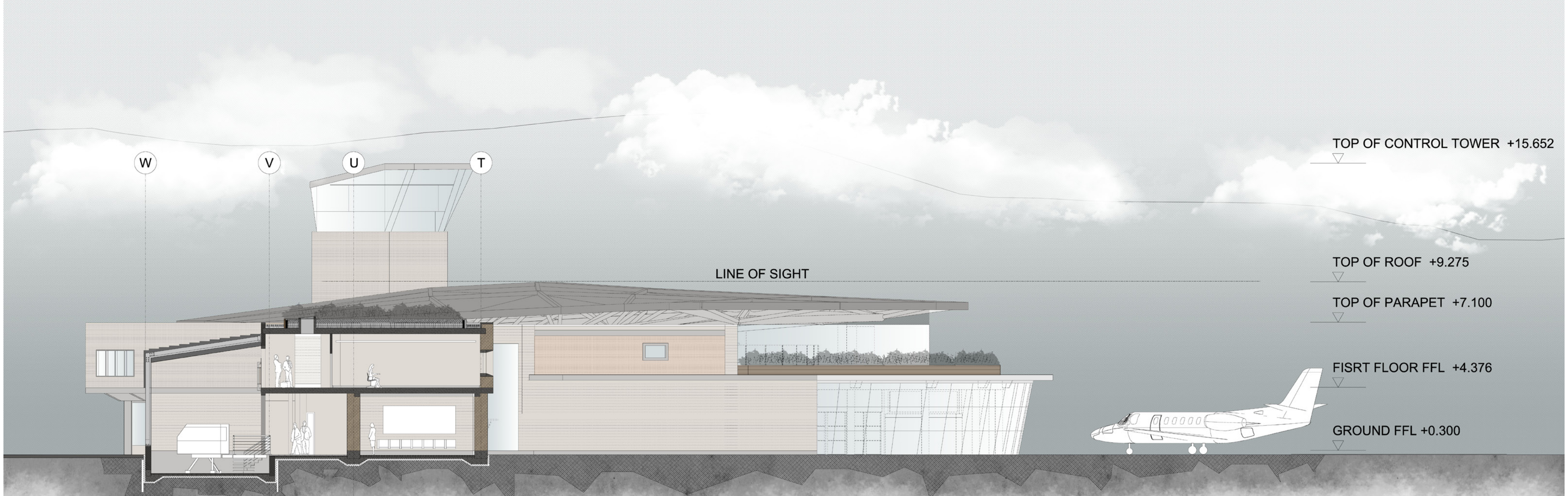


1. Restaurant
2. Kitchen
3. VIP Lounge
4. Airport Management
5. Pilot's Lounge
6. Offices

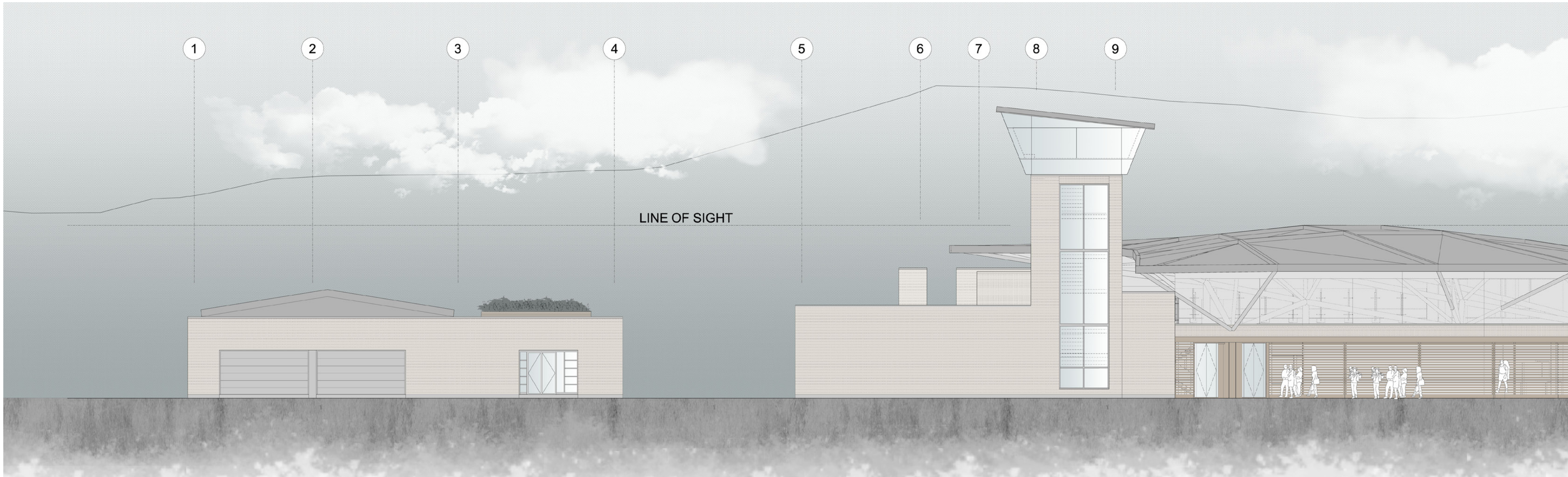
First Floor Plan 1:250 @ A1



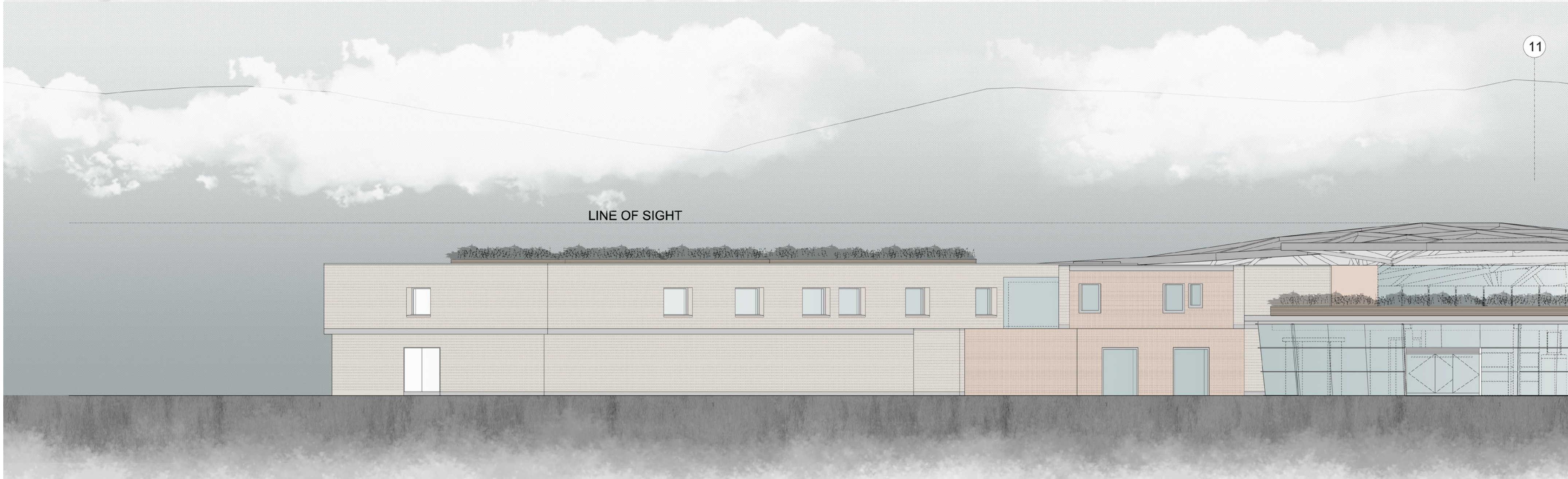
Section A-A 1:50 @ A1 Landscape Height



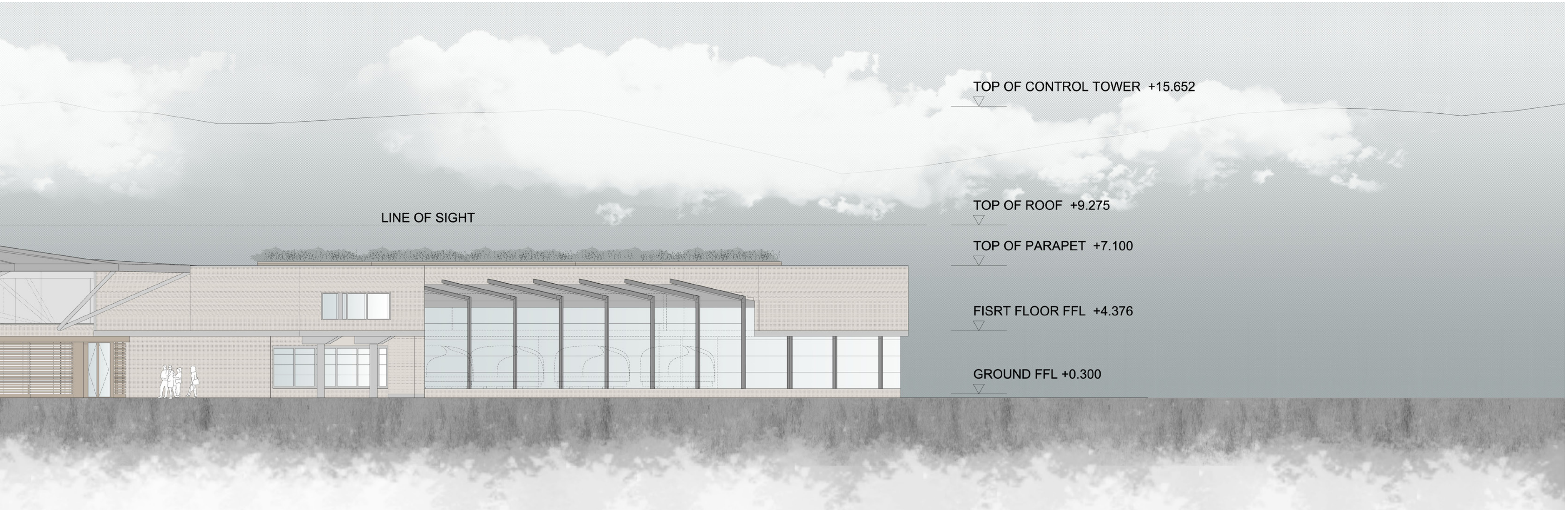
Section B-B 1:50 @ A1 Landscape Height

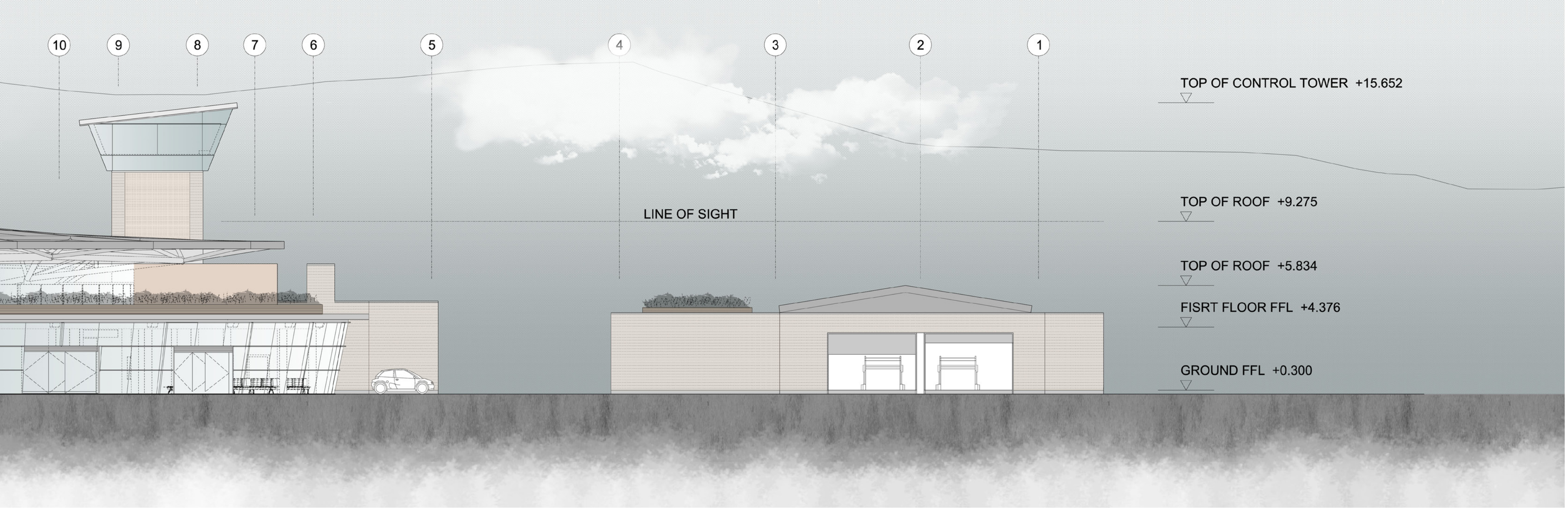


Landside Elevation 1:50 @ A1 Landscape Height



Airside Elevation 1:50 @ A1 Landscape Height


TOP OF CONTROL TOWER +15.652
LINE OF SIGHT
TOP OF ROOF +9.275
TOP OF PARAPET +7.100
FISRT FLOOR FFL +4.376
GROUND FFL +0.300


10
9
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1
TOP OF CONTROL TOWER +15.652
LINE OF SIGHT
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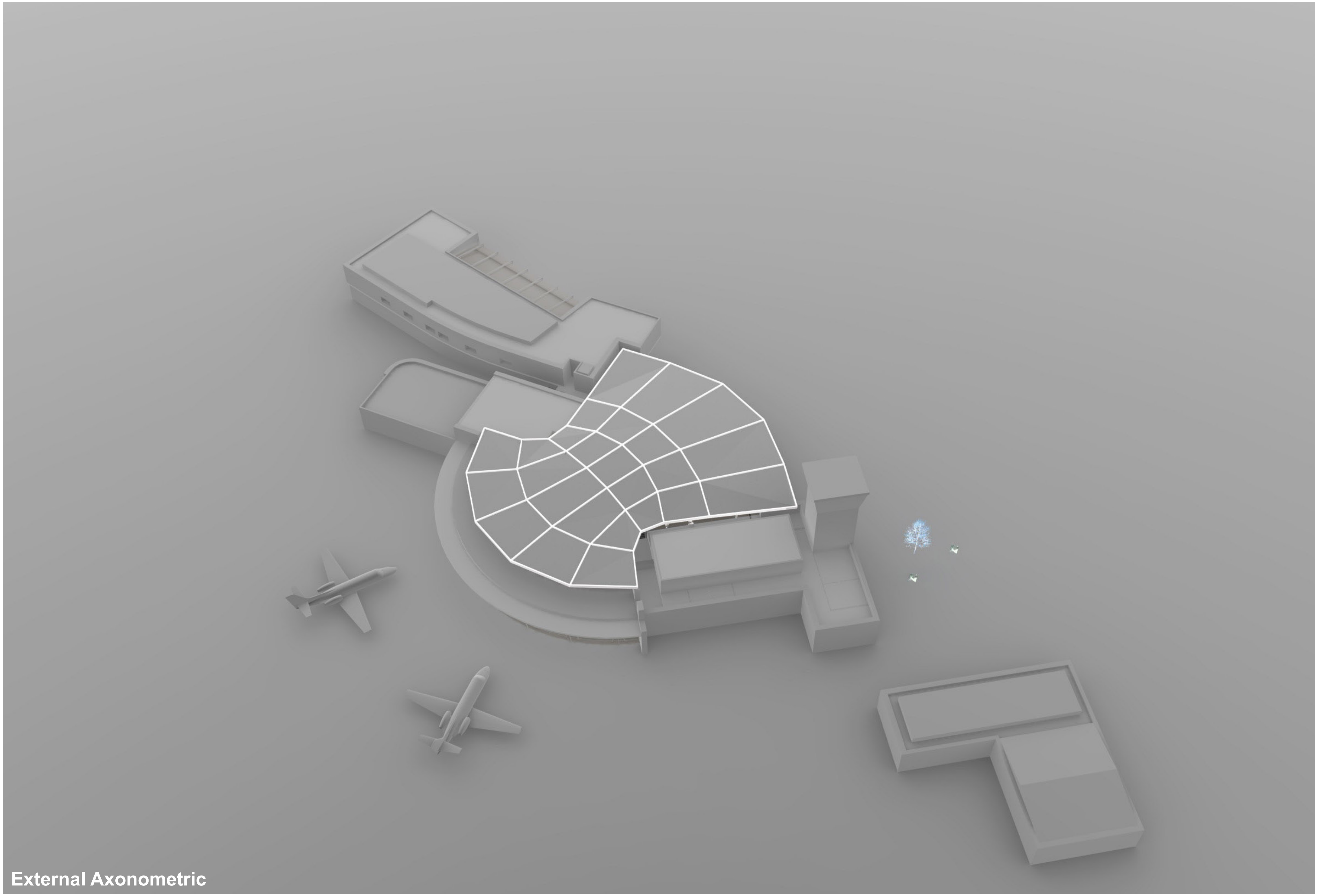
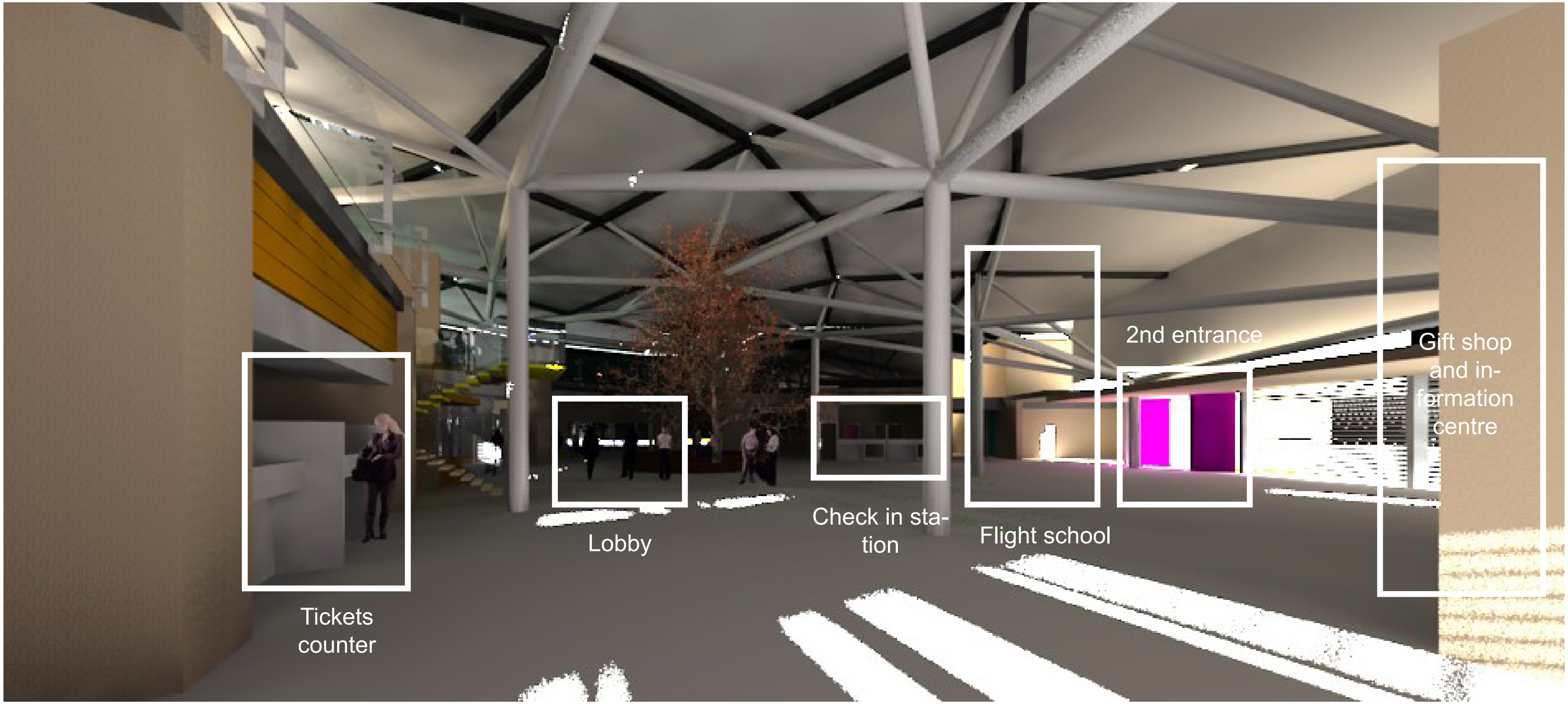
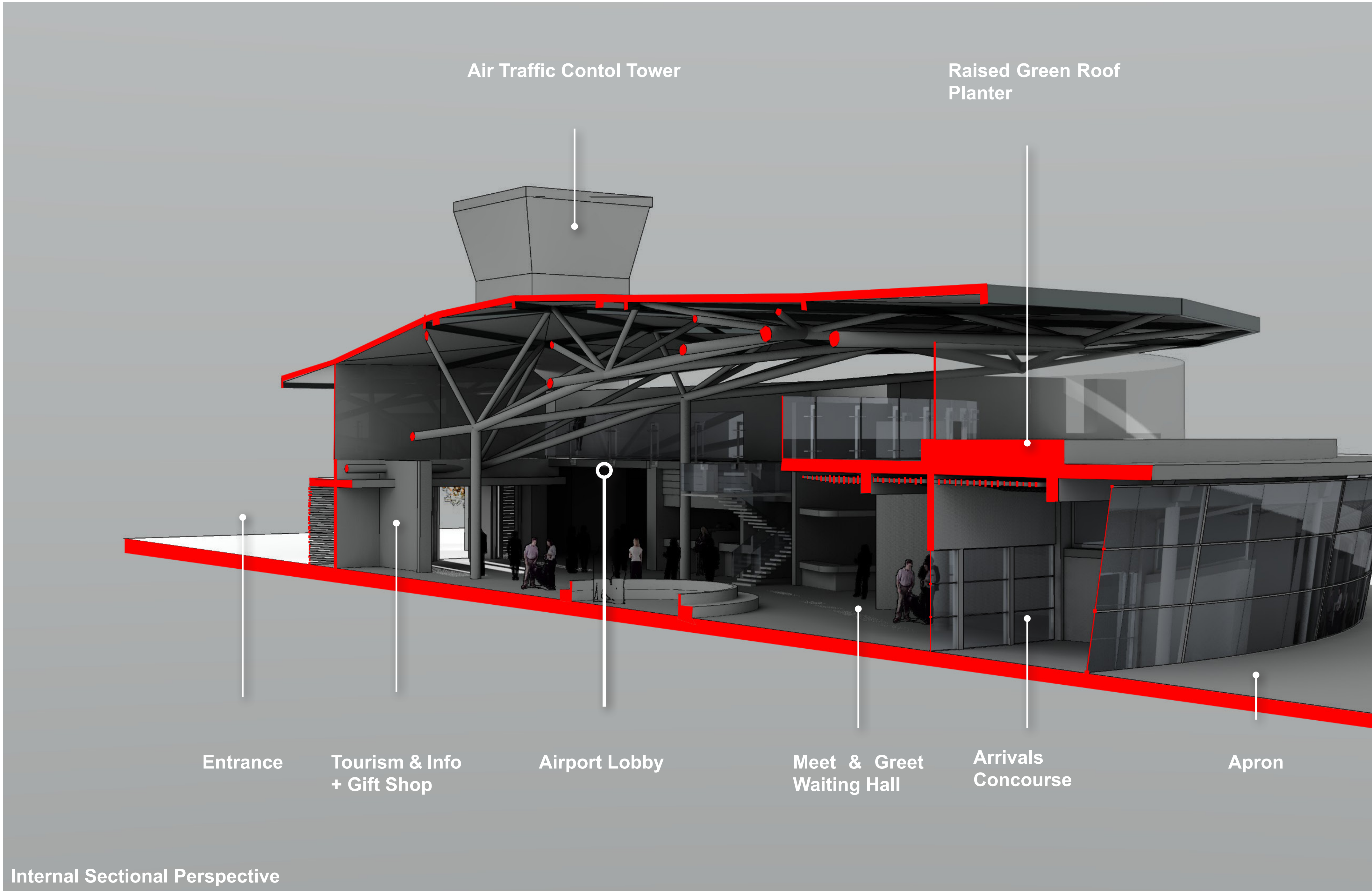
TOP OF ROOF +5.834
FISRT FLOOR FFL +4.376
GROUND FFL +0.300

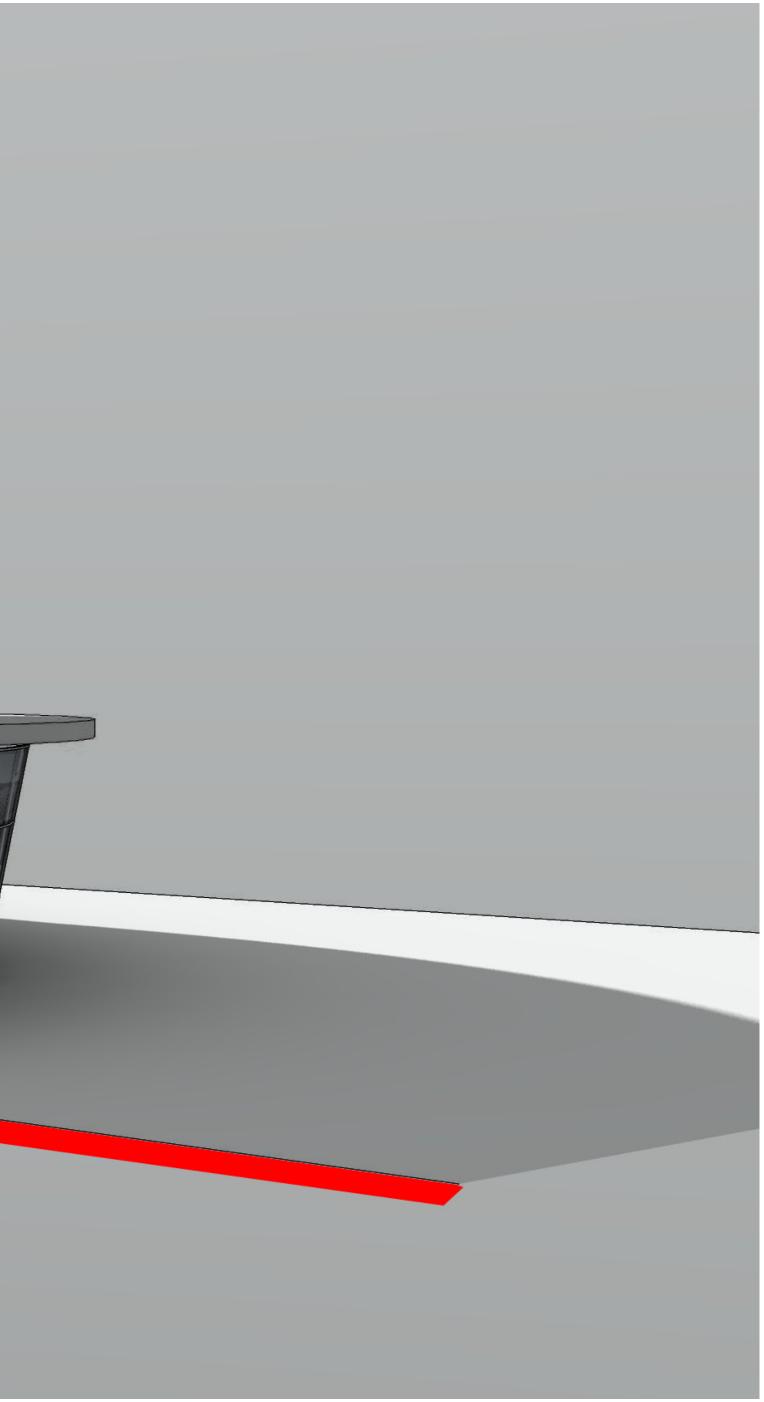


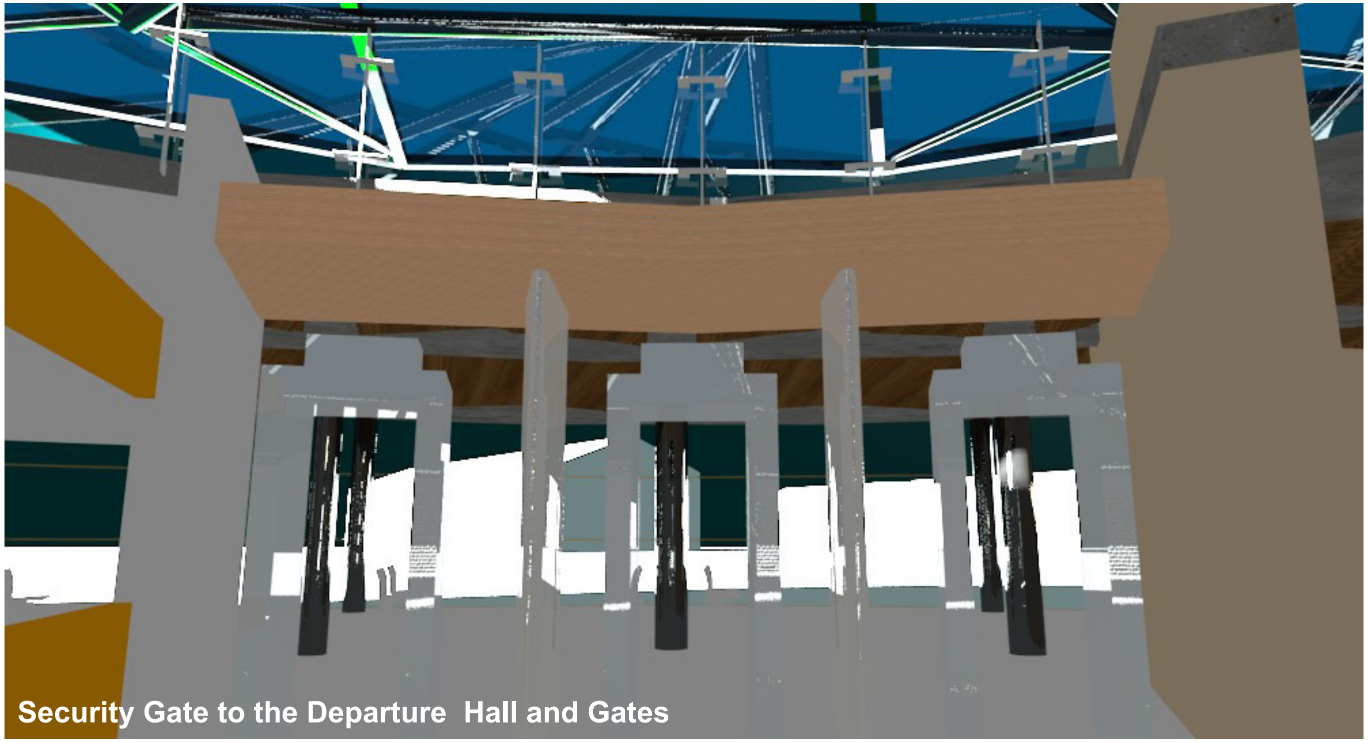
External Axonometric



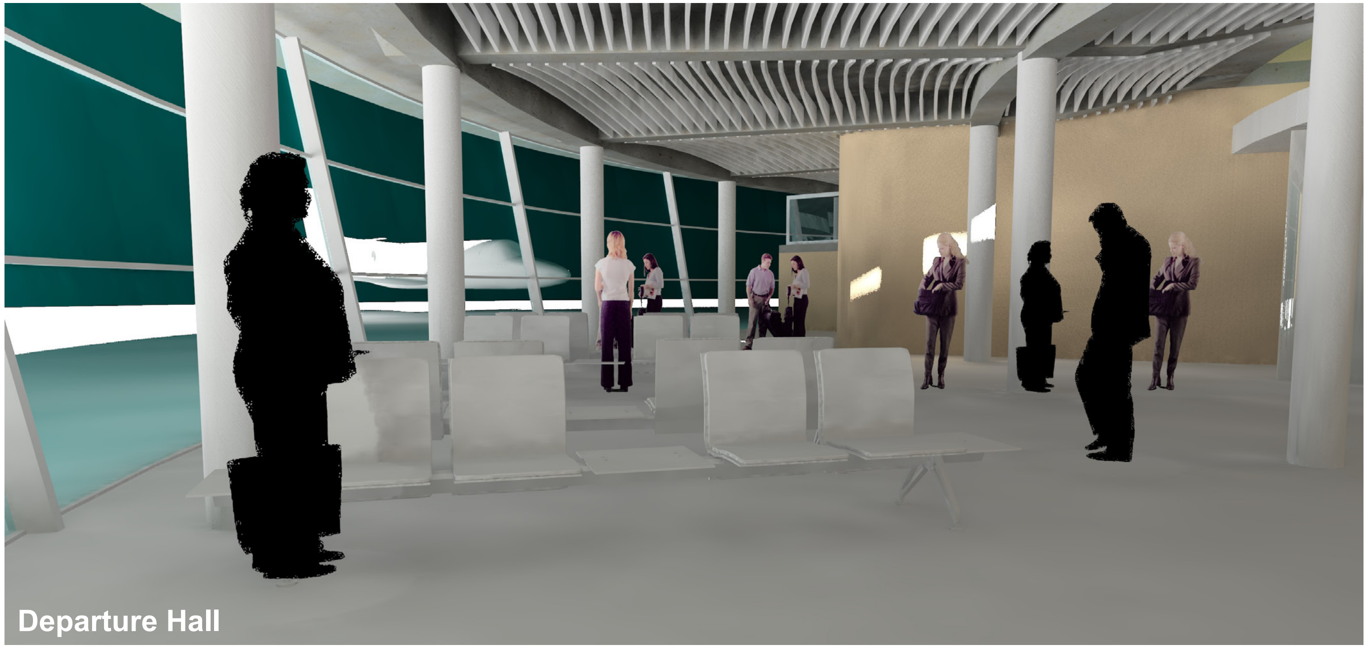
Internal ‘panorama’


Air Traffic Contol Tower
Raised Green Roof Planter
Entrance
Tourism & Info + Gift Shop
Airport Lobby
Meet & Greet Waiting Hall
Arrivals Concourse
Apron
Internal Sectional Perspective





Security Gate to the Departure Hall and Gates

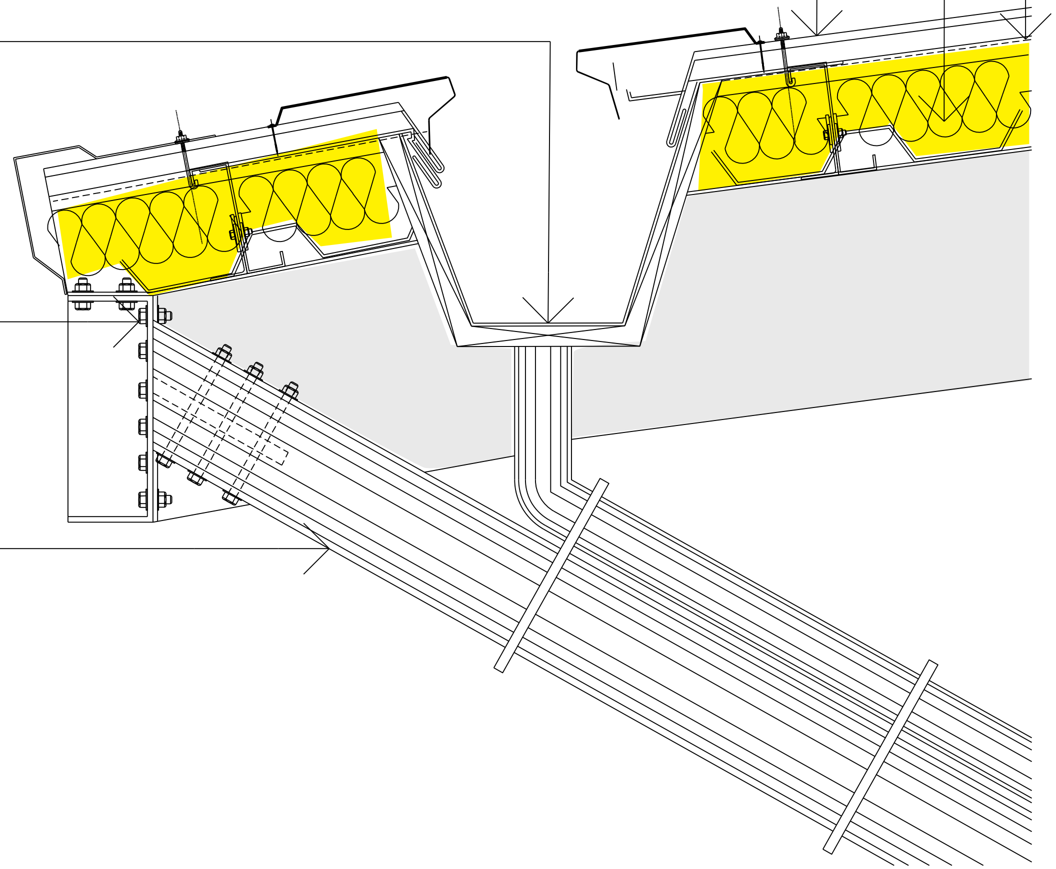


Departure Hall

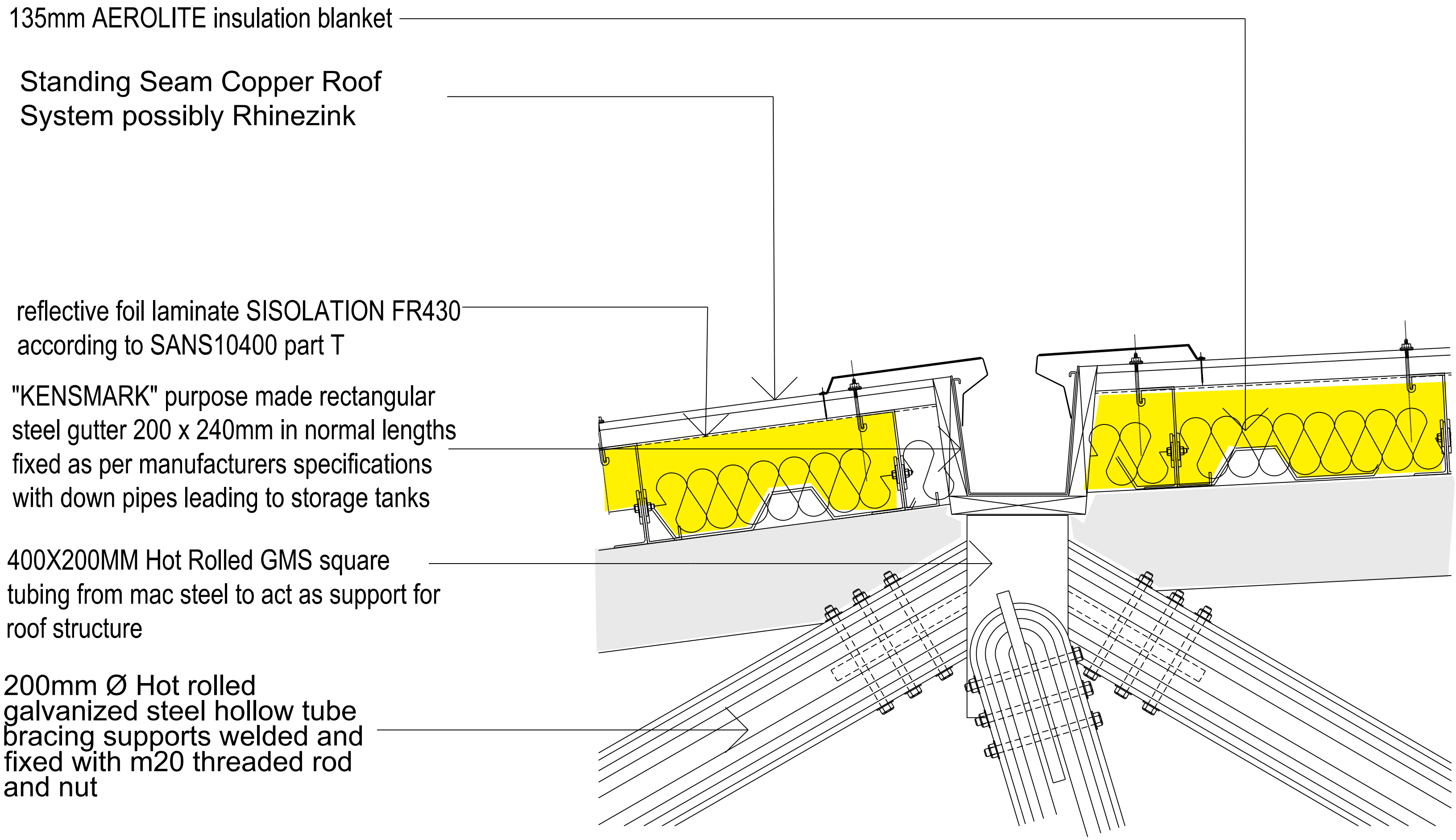

Airport Lobby seen from entrance

Lobby

Airport Lobby from Roof Level



Eaves Detail @ 1:13.5



Gutter Detail @ 1:13.5

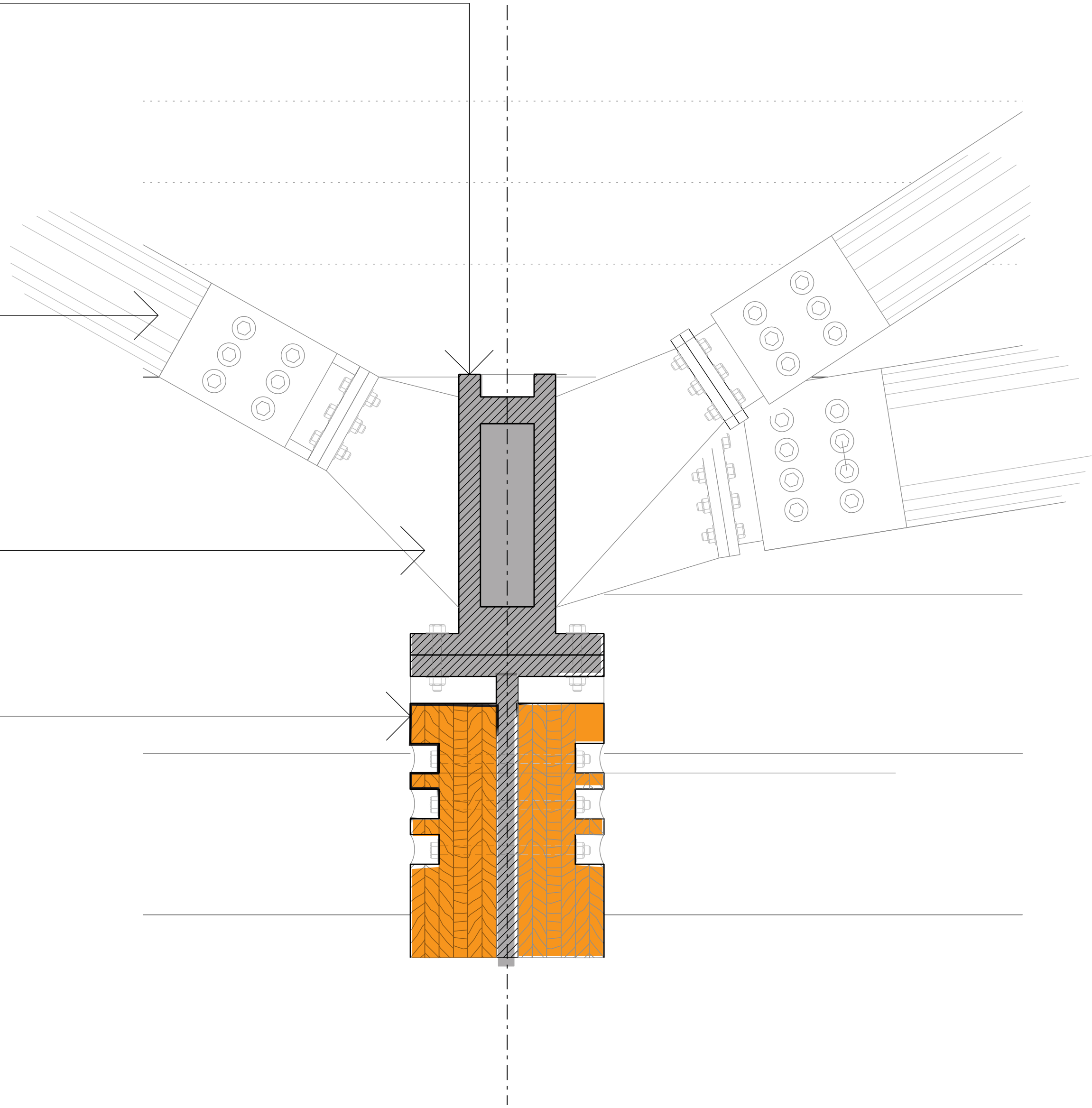
TYPICAL - NODE DETAIL

Glulam timber members with steel nodes
1. S. Steel 'T' member fitted to the end of the Glulam Timber column

Steel hot rolled beams with welded end plate, fastened with M20 bolts and nuts

Angled vertical steel plate , connectors welded to 'T' node to which Steel Beams are afixed

Round Polish finished Glulam Column to which Top node is attached



Column Node Detail @ 1:13.5

Waterproof concrete infill with round
stainless steel cap around column base

Round Polish finished Glulam Column to
which Top node is attached

finished floor tile

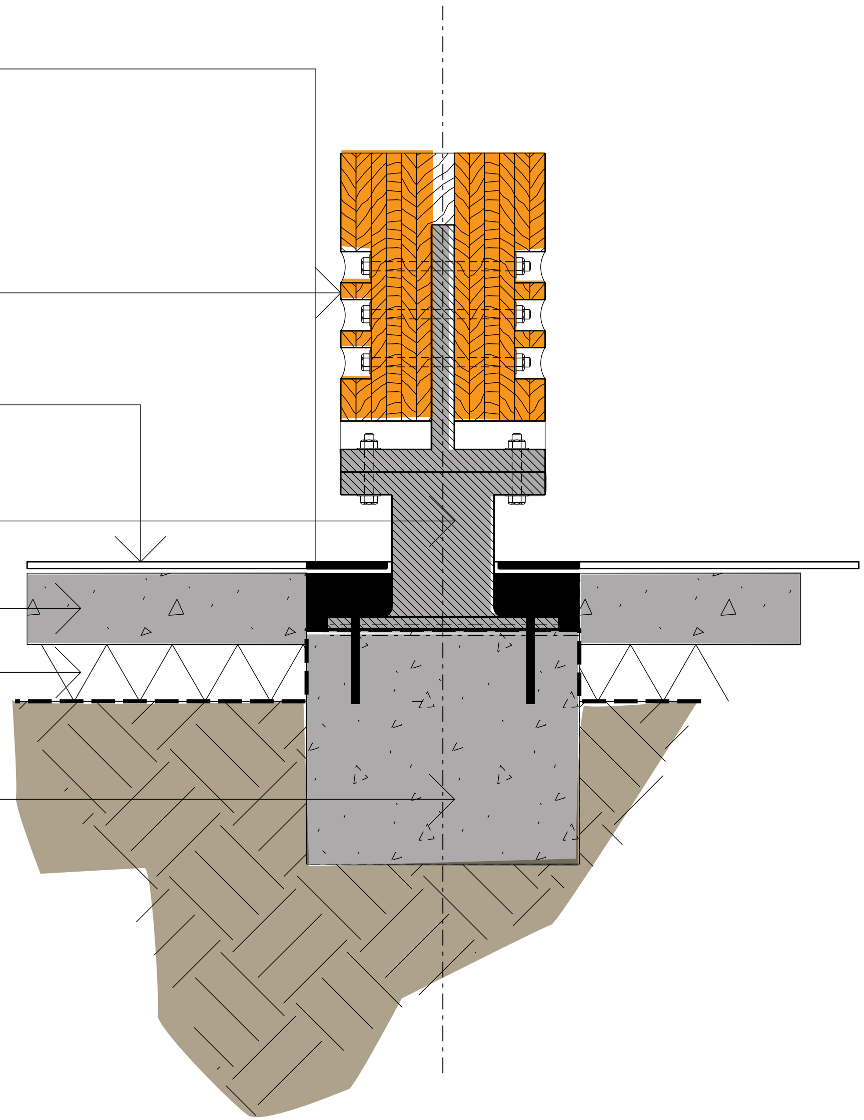
Machined steel Section bolted and achored
directly onto top of fountation pile

90 mm Thick Self Leveling Screed

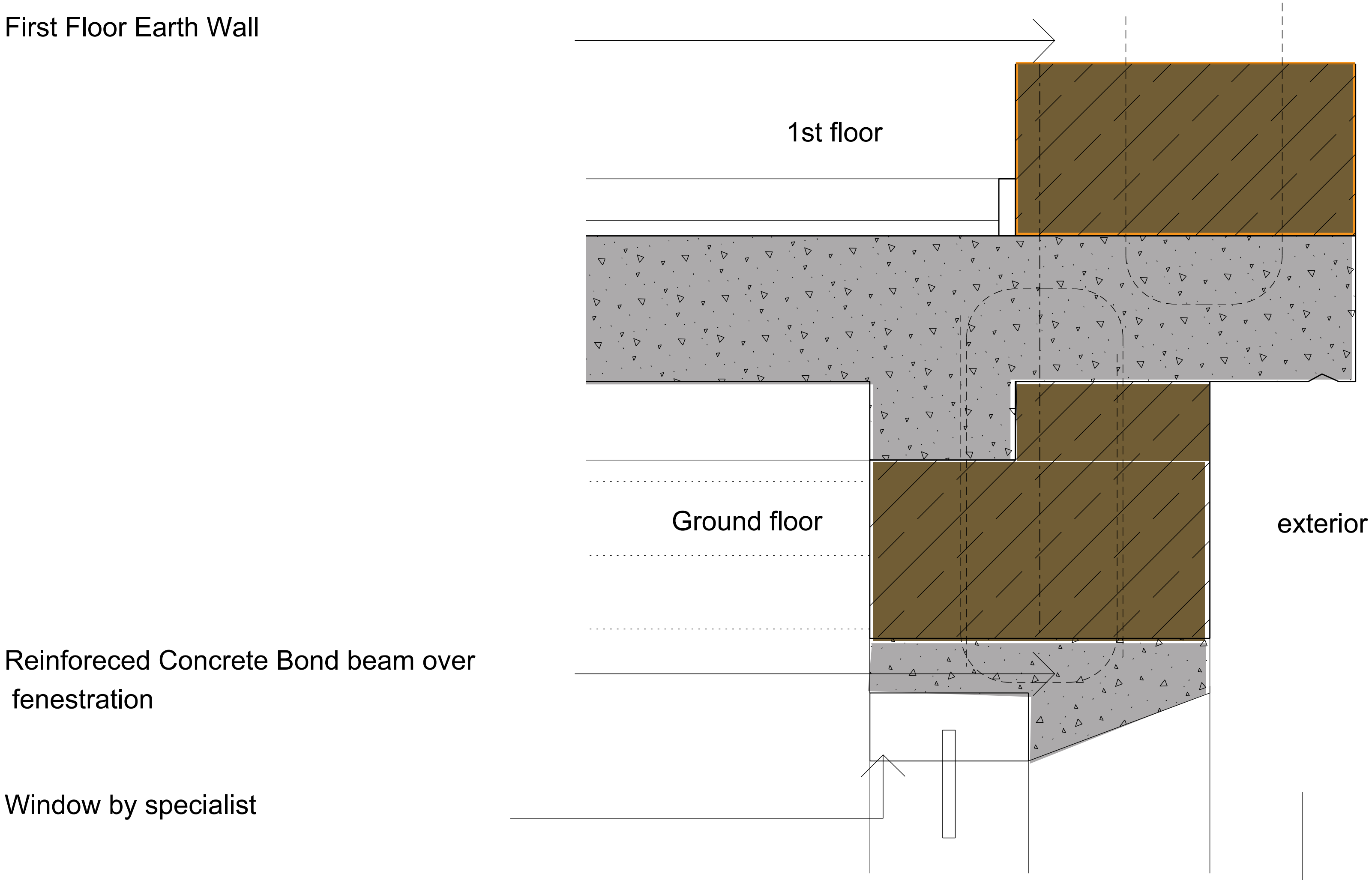
with electrowelded mesh reinforcement

100 mm thick Rigid Board Insulation

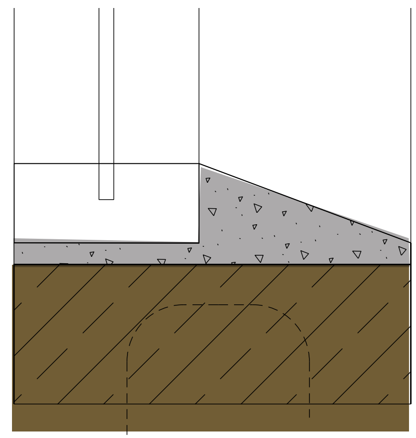
Weight Tranfer to Pile



Column Base Detail @ 1:13.5



1st floor and ground floor
Wall detail



Sill Detail @ 1:13.5

RAMMED EARTH FOOTING DETAIL

Eerth Wall section Starts 20mm above ground level for rain water splash off clearance

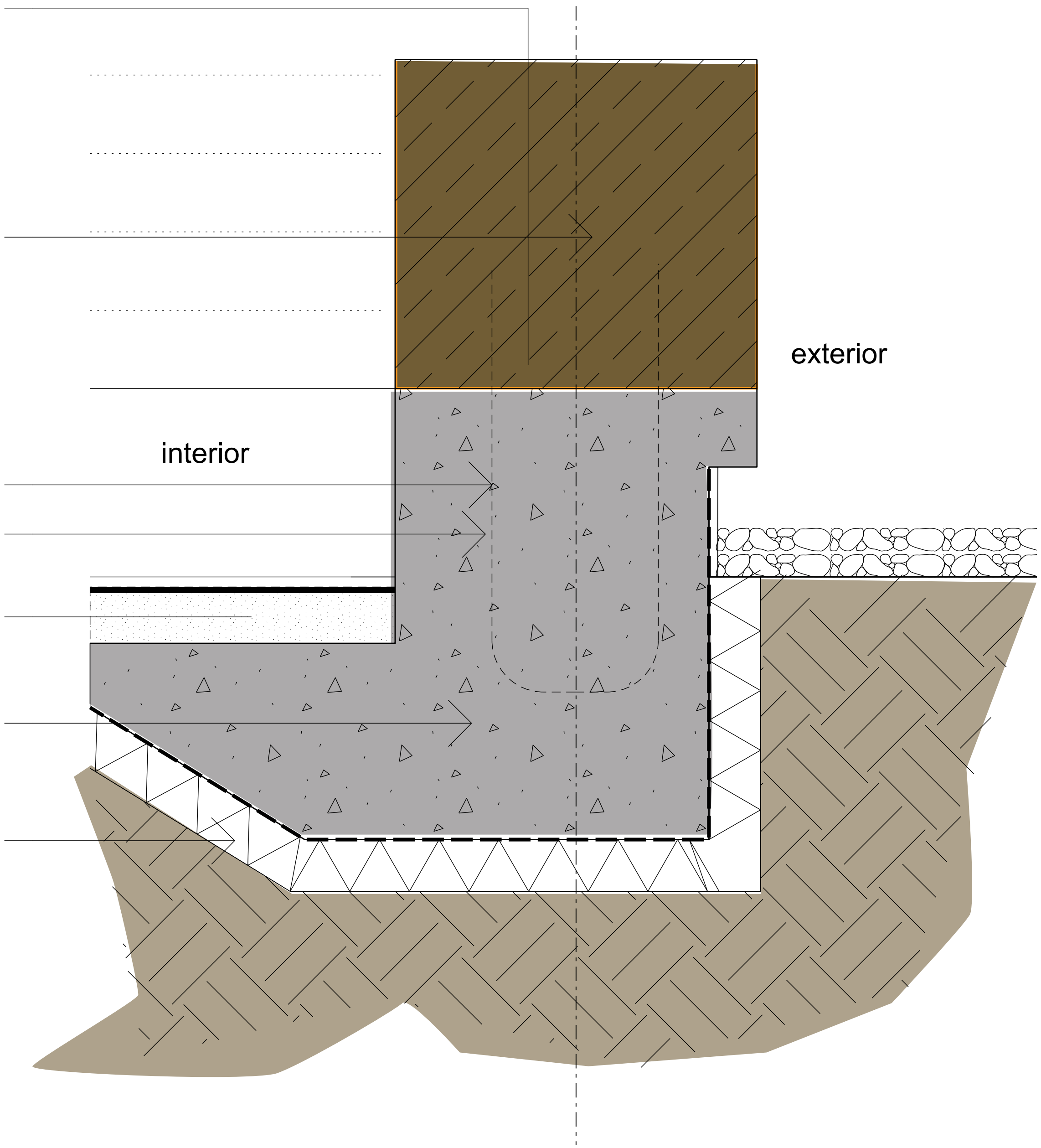
700 mm Rammed Earth wall

Steel renforcement through wall and footing

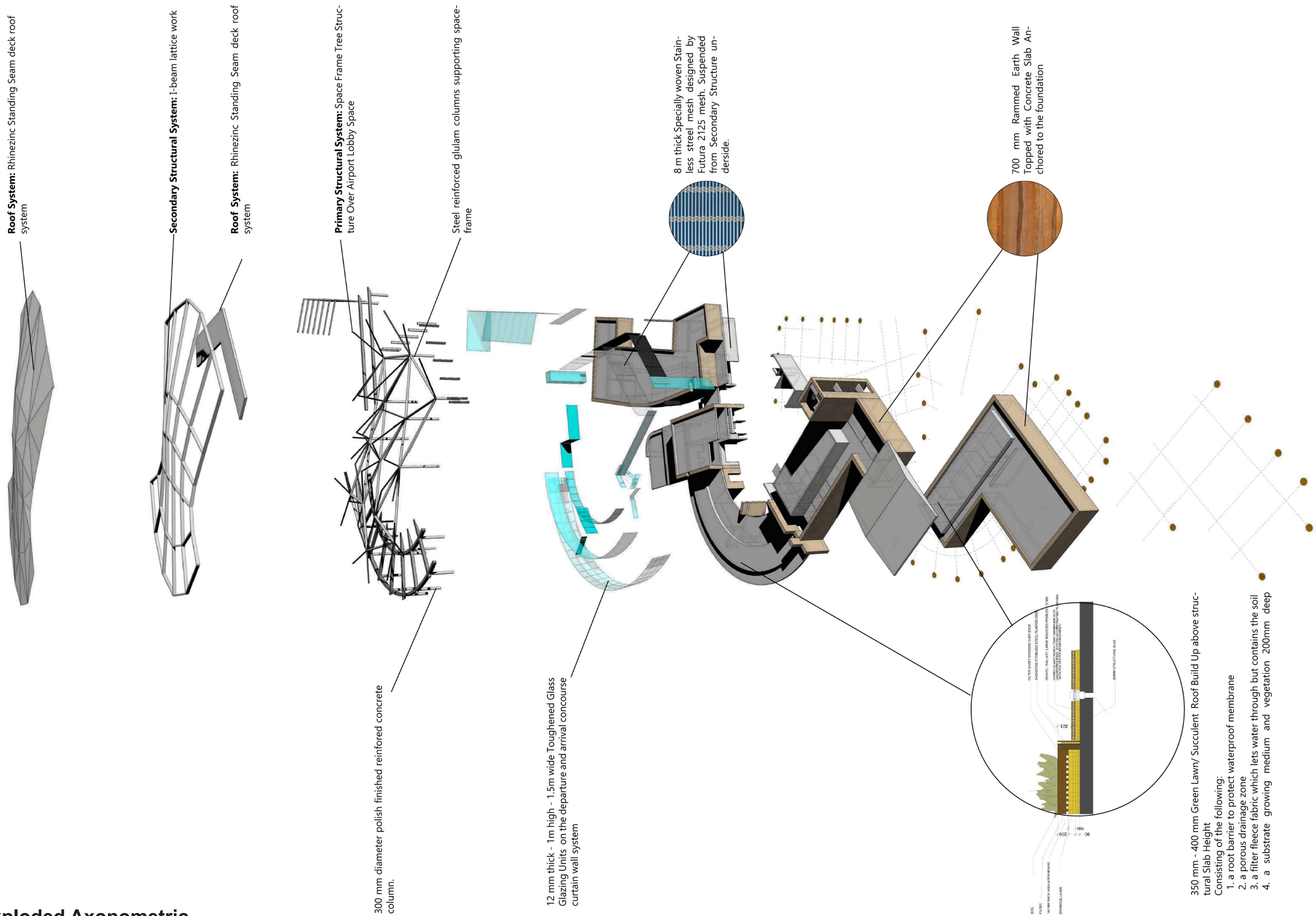
90 mm Thick Self Leveling Screed with electrowelded mesh reinforcement

Reinforced concrete footing 700 mm wide

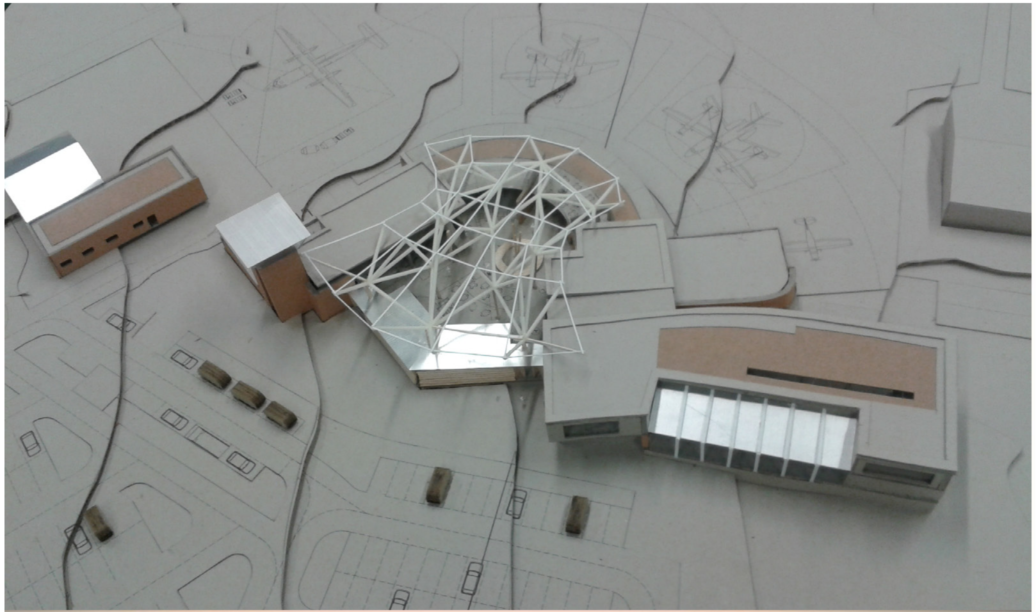
100 mm thick Rigid Board Insulation

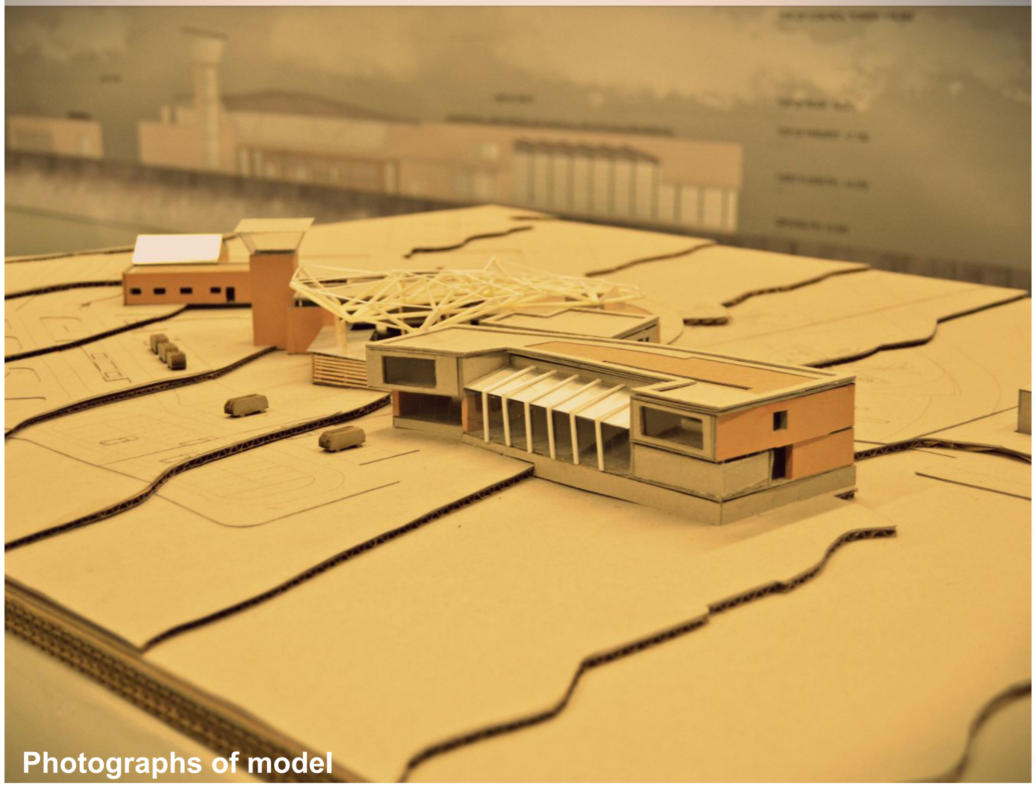


Rammed Earth Wall Build up and Footing Detail @ 1:13.5



Exploded Axonometric





Photographs of model

DEFINITION OF TERMS

The following are comprehensive definitions of terms which will be used throughout the document.

Ab-initio
According to the South African Civil Aviation Act, 2009 (Act no 13 of 2009) Civil aviation regulations, 2011,"ab initio", refers to the practical training required towards the first issue of a national or PPL, issued in terms of part 61 or part 62, or for the endorsement of such a licence with an additional category of aircraft, and for the purpose of regulation 91.02.3 excludes cross-country flight training.

Air Traffic Control (ATC)
The service provides separation of services to participating airborne traffic as well as clearances to land, take off or taxi at airports via a control tower.

Airside
An area of land (including buildings, runways and control towers) for the arrival and departure of aircrafts.

Apron
A specified portion of the airfield used for passenger, cargo or freight loading and unloading, aircraft parking, and the refuelling, maintenance and servicing of aircraft. (Coffman Associates, 2014)

Arrivals
Passengers arriving at terminal by air

Building Restriction Line (BRL)
A line which identifies suitable building area locations on airports.

Gate
The point of access for the passenger to the aircraft, ramp or apron.

Hot Spots
A location on an aerodrome movement area with a history or potential risk of collision or runway incursion, and where heightened attention by pilots/drivers is necessary. (ICAO Doc 9870, Manual on the Prevention of Runway Incursions).

General Aviation [GA]
General aviation refers to all civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire.

Gate Lounge
Waiting area adjacent to the gate for assembling departing passengers.

Landside
The area of the terminal to which the public has access (both travelling and non-travelling)

Obstacle Identification Surfaces [OLS]
The Obstacle Limitation Surfaces (OLS) are a series of imaginary surfaces that define the limits to which objects may project into the airspace on an aerodrome.

Meeting Point
Defined area for rendezvous, normally in arrival concourse.

Obstacle Free Zone [OFZ]
ICAO International Civil Aviation Organization (1999) cited in (Caves & Kazda, 2007, p. 56) defines the Obstacle Free Zone (OFZ) as the "airspace above the inner approach surface, inner transitional surfaces, and baulked landing surfaces and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted obstacle required for air transportation purposes". It is further imputed by (Caves & Kazda, 2007, p. 56) that during Category II or III operations, taxiing or aircraft holding for take-off must also be kept out of the OFZ.

Object
All fixed (temporary or permanent) and mobile objects or parts thereof that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in fight.

Precision-Approach Path Indicator [PAPI]
A navigational aid system for airplanes landing provided via a system of lights, the proper approach slope to the runway.

Taxiway
Taxiways are paved or turf areas constructed between airport areas such as runways, aprons, and hanger areas - they allow aircrafts to traverse freely on the ground.

Bypass Taxiway
A bay provided along the taxiway to provide flexibility in runway use by permitting ground manoeuvring of steady streams of departing aeroplanes. When a preceding aircraft is not ready for take-off, and blocks the entrance taxiway, other aircrafts in queue can use the bypass taxiway.

Ramp (Terminal)
Area on airside where pre-flight activities are carried out such as: boarding and disembarking of passengers.

Runway Visibility Zone [RVZ]
An area on the airport to be kept clear of permanent objects; so that there is an unobstructed line of site from any 1.5m above the runway centre line to any point 1.5m above an intersecting runway centre line. (Coffman Associates, 2014)

Visual Control ROOM (VCR)
A room with a vantage of viewpoint of the aerodrome from where ATC operations are conducted.

Visual Flight Rules (VFR)
Rules that govern the procedures for conducting flight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

Types of landing systems

In order for an aircraft to land in an area with limited visibility, e.g. at night, there are a number of systems which are employed to allow this to take place; these place a constraint on the airport precinct.

Instrument Landing System (ILS)
An ILS is a ground-based instrument approach system that provides precision lateral and vertical guidance to an aircraft approaching and landing on a runway, using a combination of radio signals and, in many cases, high-intensity lighting arrays to enable a safe landing

Global Positioning System (GPS) based Landing Systems
Local Area Augmentation Systems, LAAS
LAAS is a ground based augmentation system for use in the terminal area. It consists of four reference receivers located virtually on airport property. The four are redundant and are used to eliminate multipath problems and insure unobstructed signal paths to as many satellites as possible. (Helfrick, 2000: p.175)

ABBREVIATIONS

ATC: Air Traffic Control
ARC: Airport Reference Code
BCDA: Blue Crane Development Agency
BCRM: Blue Crane Route Municipality
BRL: Building Restriction Line
CBIS: Checked Baggage Inspection System
EDS: Explosives Detection System
FAA: Federal Aviation Administration
FNPT: Flight and Navigation Procedures Trainer
FFS: Full Flight Simulators
GA: General Aviation
ICAO: International Civil Aviation Authority
ILS: Instrument Landing System
LED: Local Economic Development
PAX: Passengers
PAPI: Precision-Approach Path Indicator
PFA: Progress Flight Academy
SACAA: South African Civil Aviation Authority
STOL: Short Take Off and Landing
VIP: Very Important Person

The words aerodrome, airport and airfield will be used interchangeably throughout the course of the document - all will have the same meaning.

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ILLUSTRATIONS

Figure 1.0 “Wright Brothers’ 1904 Aeroplane (“Kitty Hawk”) in first flight, December 17, 1903 at Kitty Hawk, N.C. Orville Wright at controls. Wilbur Wright standing at right. (first flight was 12 seconds)” (1904) [Photograph] At: https://theunwrittenrecord.files.wordpress.com/2013/12/165-ww-7b-6.jpg [Accessed 15 September 2015]

Figure 1.1 Photograph of the Wright Brothers’ Camp in Kitty Hawk, North Carolina, 1903 (1903) [Photograph] At: https://theunwrittenrecord.files.wordpress.com/2013/12/18-wp-48625.jpg [Accessed 15 September 2015]

Figure 1.2 Kasarda, John D, Aerotropolis Schematic, (2011-13) [Diagram] At: http://www.aerotropolis.com/files/AerotropolisSchematic.jpg [Accessed 15 September 2015]

Figure 1.3 Karihindi, (2015) Historical development of Somerset East footprint over the years

Figure 1.4 The Boschberg Mountain and the Blue Crane region, (2013), [Photograph] At: http://www.somerset-east.co.za/listing/bird_watching_in_the_blue_crane_route [Accessed 15 September 2015]

Figure 1.5 Wilken, (2014), Site Location Somerset Aerodrome Industrial Park + Aerospace Cluster. [Illustration] At: http://www.karoofoundation.co.za/images/Parliament%202014/5Nov/Blue%20Crane%20Development%20Agency%20.pdf . [Accessed 12 September 2015]

Figure 1.6 Wilken, Chris, LED: Niche Industrial Development, (2014) [Diagram] At: http://www.karoofoundation.co.za/images/Parliament%202014/5Nov/Blue%20Crane%20Development%20Agency%20.pdf [Accessed 18 June 2015]

Figure 1.7 Prosper Flight Academy, 2014 Progrss Flight Academy Vulcanair P68R. [Photograph] At: http://www.flightacademy.co.za/images/VulcanairP68R.jpg [Accessed 11 September 2015].

Figure 1.8 Karihindi, (2015), Somerset East Aerodrome Development Plan

Figure 1.9 Karihindi, (2015), Aerial view of site depicting history of aerodrome in context

Figure 1.10 Karihindi, (2015), Site panoramic view towards the town from the control tower

Figure 1.11 Karihindi, (2015), New Fire Station

Figure 1.12 Karihindi, (2015), Air Traffic Control Tower

Figure 1.13 Pretorius, (2010), BCDA Airport - Draft Layout - Revision 3b

Figure 1.14 Karihindi, (2015), Existing and proposed runway sizes

Figure 2.0 Aerial view of Somerset East towards the North-View along the R63, (2013) [Photograph] At: http://www.somerset-east.co.za/ [Accessed 16 March 2015]

Figure 2.1 Westward view of Somerset East from the air with the historic town and high Street in the foreground, (2013) [Photograph] At: http://www.somerset-east.co.za/ [Accessed 16 March 2015]

Figure 2.2 Karihindi, (2015), Natural Structuring elements,

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