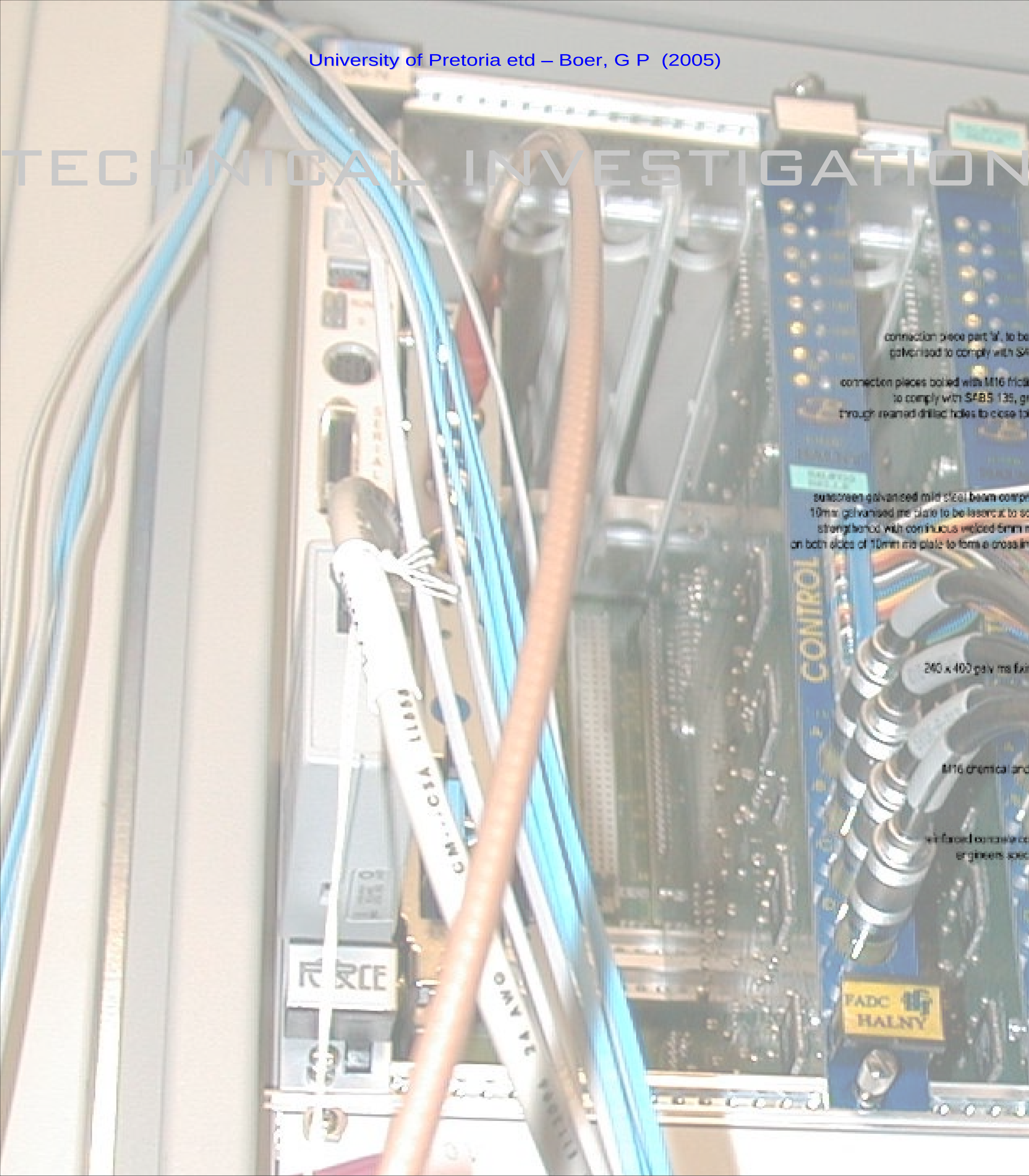
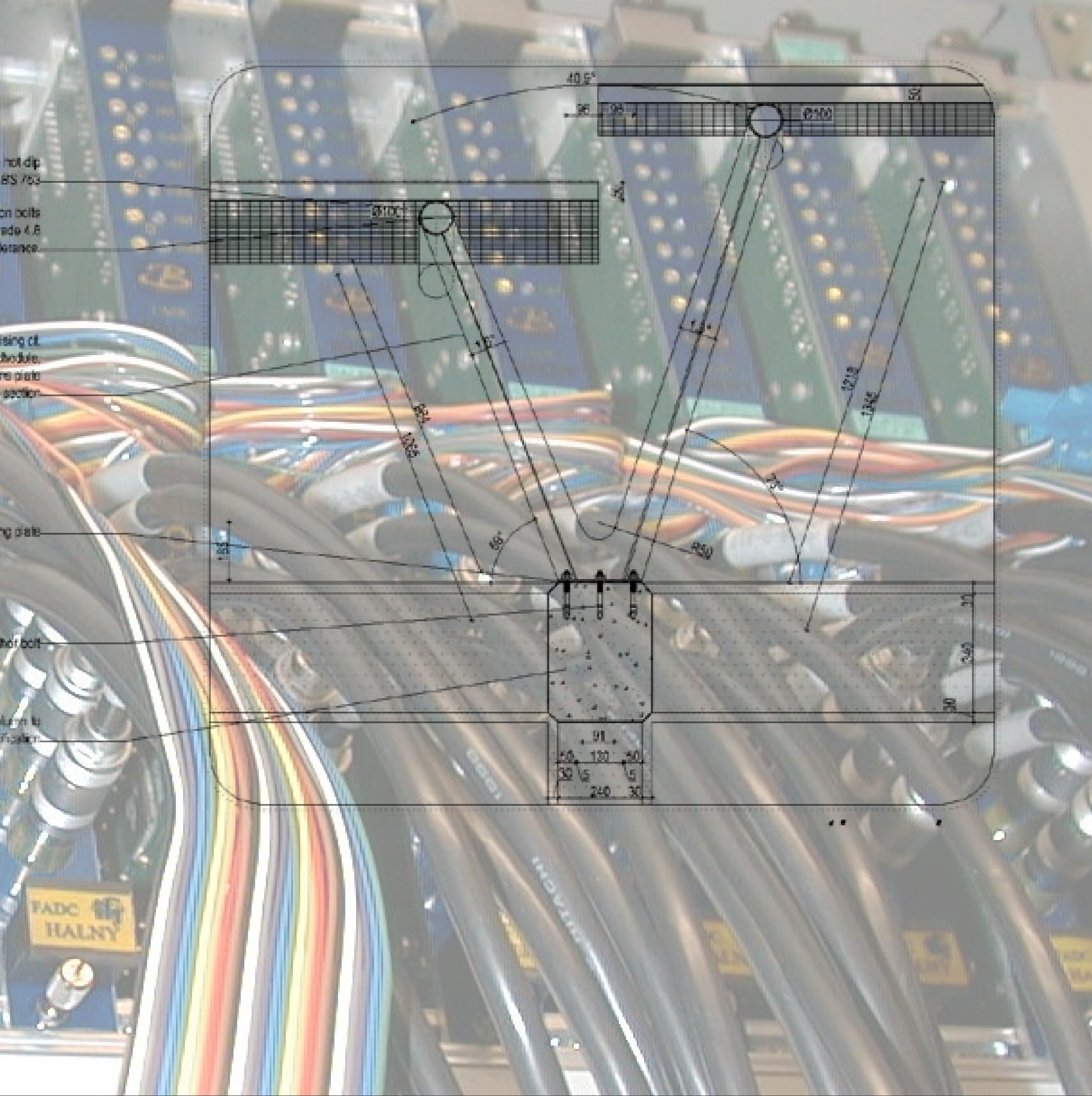
TECHNICAL INVESTIGATION



TECHNICAL INVESTIGATIO



8.1 Introduction

In the time frame of earth, even mankind, buildings have a limited life span of say 50 years. Considering the vast amount of materials that the construction sector consumes, designers should be cognizant of decisions that adversely impact the biosphere. Apart from the materials employed in a building, extensive maintenance and or replacement throughout the life cycle of a building is required.

In the design proposal for the School for the Built Environment, the manner in which the building may accommodate change is investigated. Continually evolving to adapt to its users' requirements, the level of adaptability will invariably determine its life-cycle, and ultimately its ruin.

A study of time presupposes a construct that dwells upon the transitory nature of both the pragmatic, as well as materials employed. The manner and ease of reconfiguration in the construct affects its adaptability. The design is therefore a study in the manner in which these changes can be accommodated.

The building consists of a definite beginning and end, symbolising the beginning and end of time for users moving in and along the construct.

The building is divided in a series alternating between the permanent and ephemeral.

Structure

The structural system is discussed in the design development chapter. The following is therefore an extract of the discussion.

The structural system used in the proposal is primarily of steel and concrete. The choice of concrete, as a permanent material that is only pliable during its construction, forms the static, internal mould around which the steel structural systems oscillate.

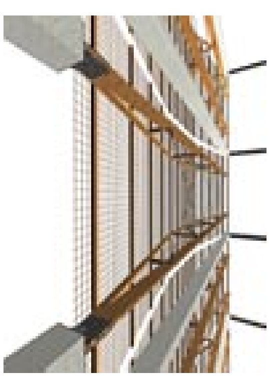
The three service cores along the length of the building is the permanent, non-programmeable spaces that will remain static in its configuration over the life span of the building.

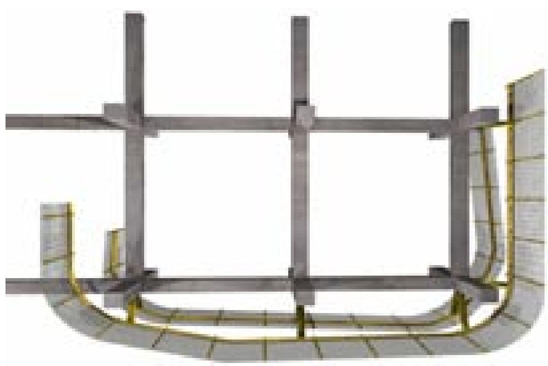
On the other hand, the infill between these vertical cores is the ephemeral component of the structure.

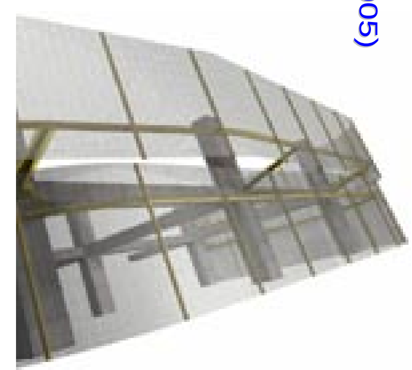
Concrete is used as the permanent 3-D grid material, as organisational architecture element, around which evolution of the building programme may take effect. Column and beam construction is used throughout the building, being stiffened by slabs as well as the various vertical service cores.

SERVICE SHAFTS, SLABS

SKIN







Ventilation

The purpose of any building is to create a manipulated climate, where man is protected from extreme fluctuations of the external climate. The type of ventilation system used in a building determines the amount of energy usage over its life-cycle.

A combination of both mechanical and passive ventilation systems are used in the School for the Built Environment.

Passive ventilation system:

Natural ventilation is only efficient if proper cross ventilation can occur. Cross ventilation, or rather the pressure differential, is dependant on the path of flowing air, as well as its distance. The proposed building is 20m wide, which is more than the critical distance for effective natural ventilation to occur. The adaptable floor and facade components should be configured with natural ventilation in mind. Limiting overall width to 3 modules of the three dimensional concrete column and beam structure, should allow for ample natural ventilation.

Birrer [1979] states that the most significant design considerations for creating an energy efficient building are form, fabric (materials), fenestration and orientation.

Form & orientation_

The School for the Built Environment is orientated at 15° east of north, allowing ample solar incidence. This orientation follows the existing campus grid, and accentuates 'filtered' eastern solar incidence during morning hours.

Fabric_

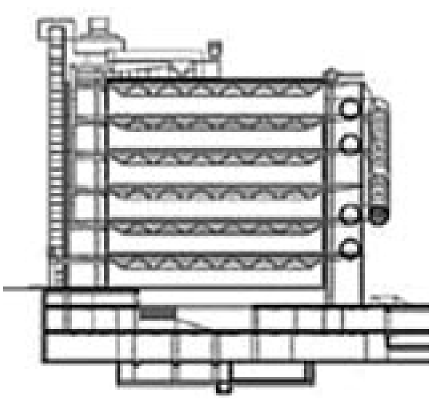
The use of concrete, with high thermal storing capacity aids in regulating internal ambient temperatures. The sunscreen 'skin' over the building proper generates a climatological transition zone between internal and external areas.

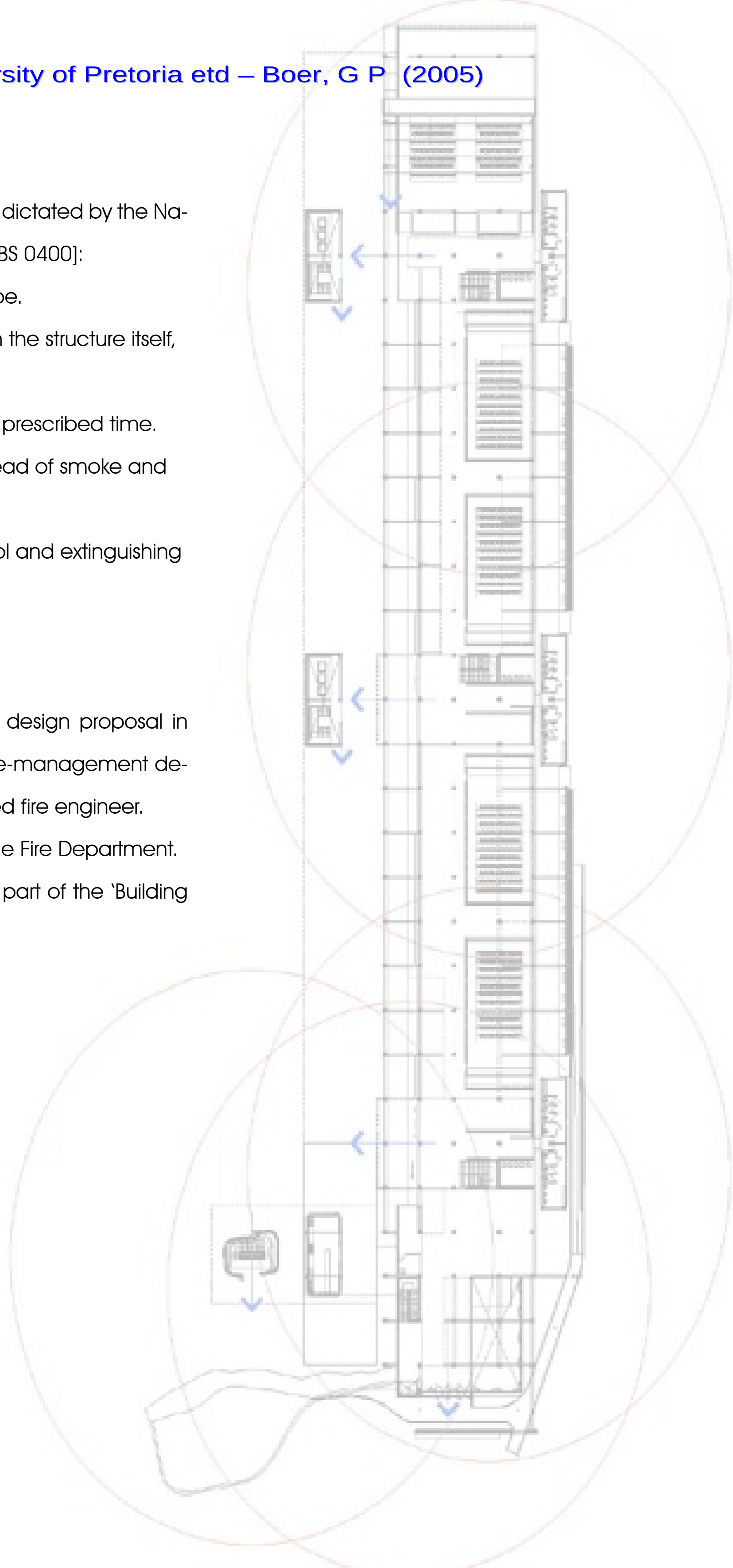
Fenestration_

Northern and southern façade fenestration are filtered by sunscreen components. The façades are adjustable in terms of openable windows; louvres and or sliding doors.

Mechanical ventilation system

The HVAC plant rooms are located on the roof adjacent to the vertical service core shafts. The shafts are open to the southern façade, allowing ease of access. Primary ducts are located in these vertical shafts with branching on different floor levels as required. Mechanical ventilation is required in areas such as the auditoriums, which use displacement ventilation from the floor upwards. A multi-zone constant air volume HVAC plant is proposed for required areas. According to Kohler [2004] the most adaptable mechanical HVAC system suitable for the proposed structure is the use of chilled-water fan-coil units which only require a 25mm pressurised galvanised mild steel circular hollow section pipe. These units can easily be incorporated into the ceilings recess. However, fan-coil units only regulate internal temperatures, and do not supply any displacement ventilation.





Fire management

The guidelines for fire management as dictated by the National Building Regulations [Part N of SABS 0400]:

- Life safety and the provision for escape.
- Minimize the spread of fire both within the structure itself, as well as from building to building.
- Provision for structural stability within a prescribed time.
- Detection, and prevention of the spread of smoke and heat.
- Provision for detection devices, control and extinguishing equipment.
- limiting the destruction of property.

Due to the vertical complexity of the design proposal in terms of vertical volumes, a rational fire-management design should be conducted by a certified fire engineer.
All building plans to be approved by the Fire Department.
Fire detection equipment should form part of the 'Building Management System'.

Vertical circulation

The School for the Built Environment is mainly a three storey building, with four storeys on its western extremity. Vertical circulation is concentrated at the non-programmeable service cores in the form of stairwells.

An elevator should be installed in the entrance lift lobby for disabled access requiring a high levelling accuracy. The elevator should have the minimum impact on the environment.

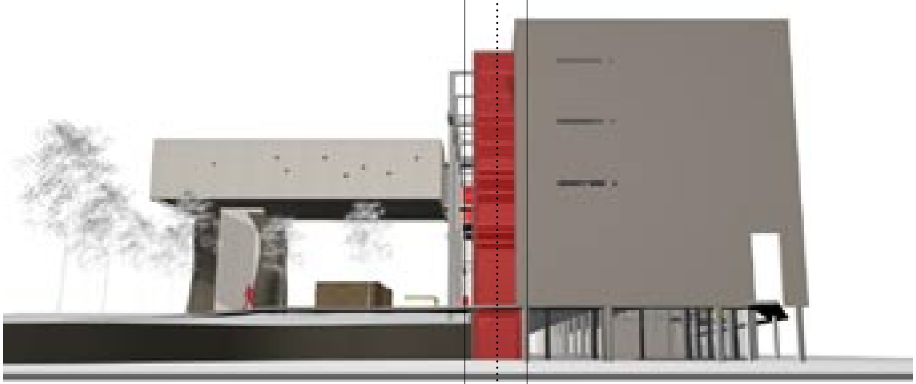
The 'Gen 2' machine-room-less elevator, manufactured by 'OTIS', has the advantages of:

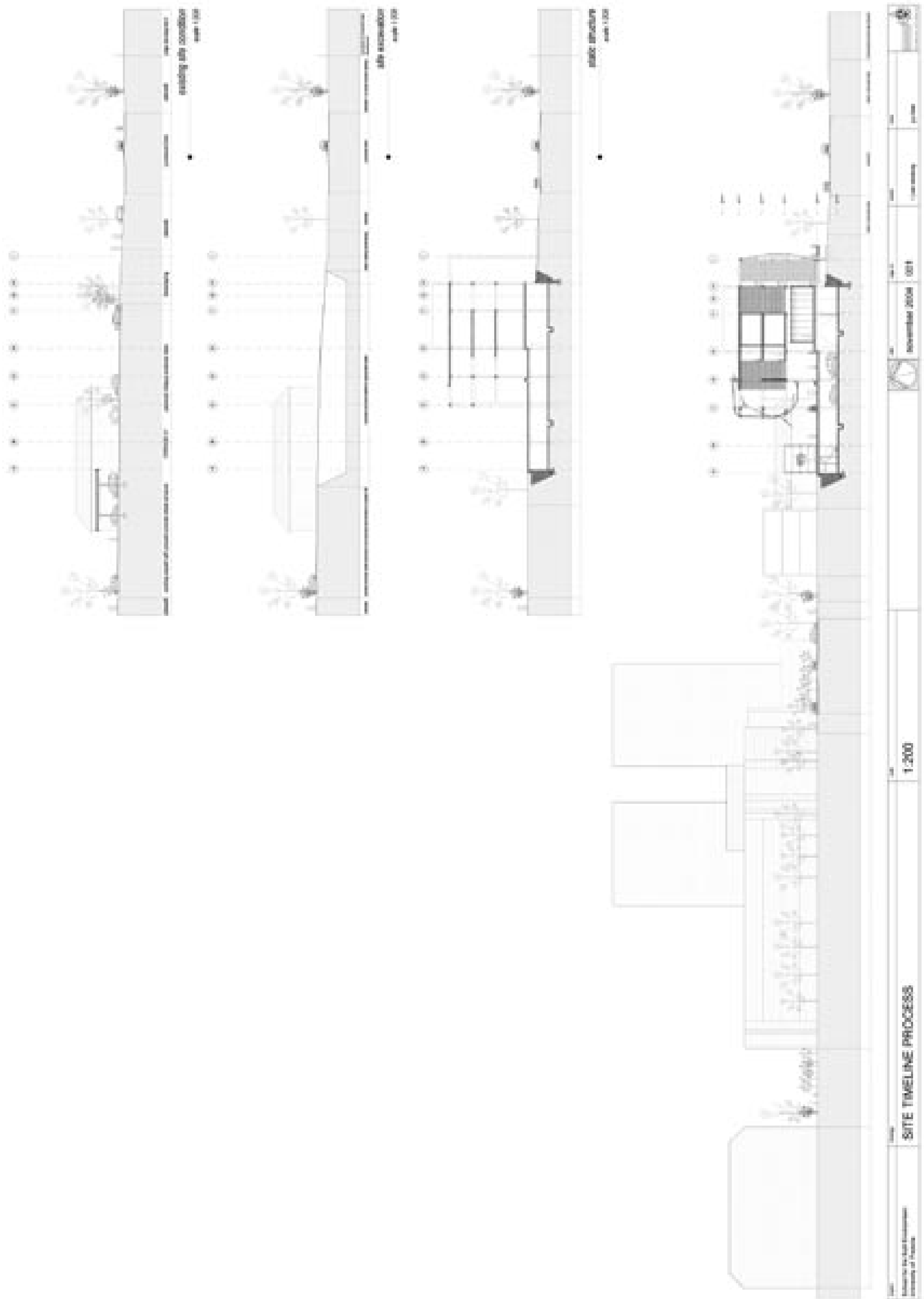
- Lower operating costs through the innovation of energy efficient machines and 'flat belt' technology. The flat belt wraps a flexible polyurethane skin around steel cords, that is lighter than conventional ropes, thereby reducing inertia.
- The flat belts have a larger surface area resulting in greater traction and also decreasing sheave wear. The belt requires no oil-based lubricants as it is gearless and is installed with sealed bearings.
- An electromagnetic filter eliminates interference with the buildings' electrical system.
- The machine room requires a small space, measuring 25 x 100 cm.

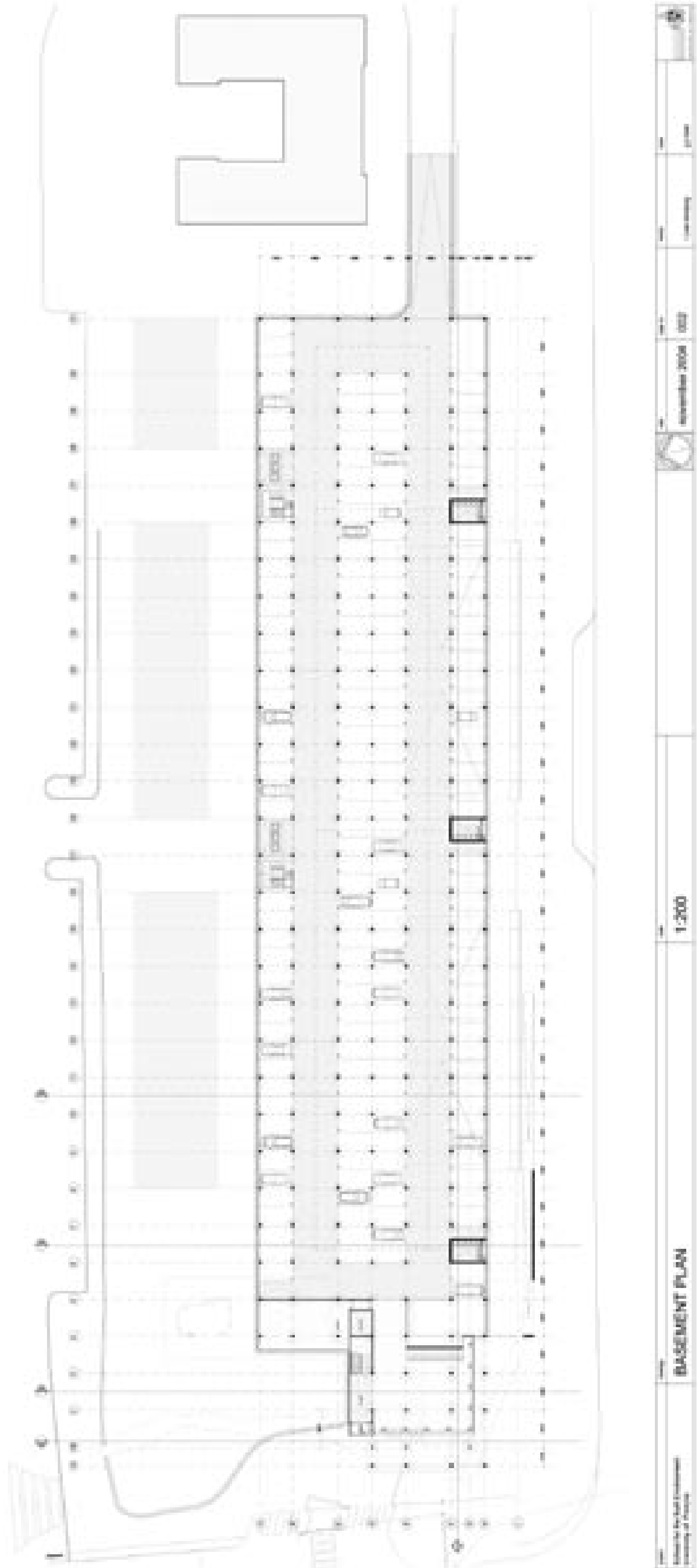
All mechanical components of the lift, as well as installation and maintenance to comply with SABS 1545.

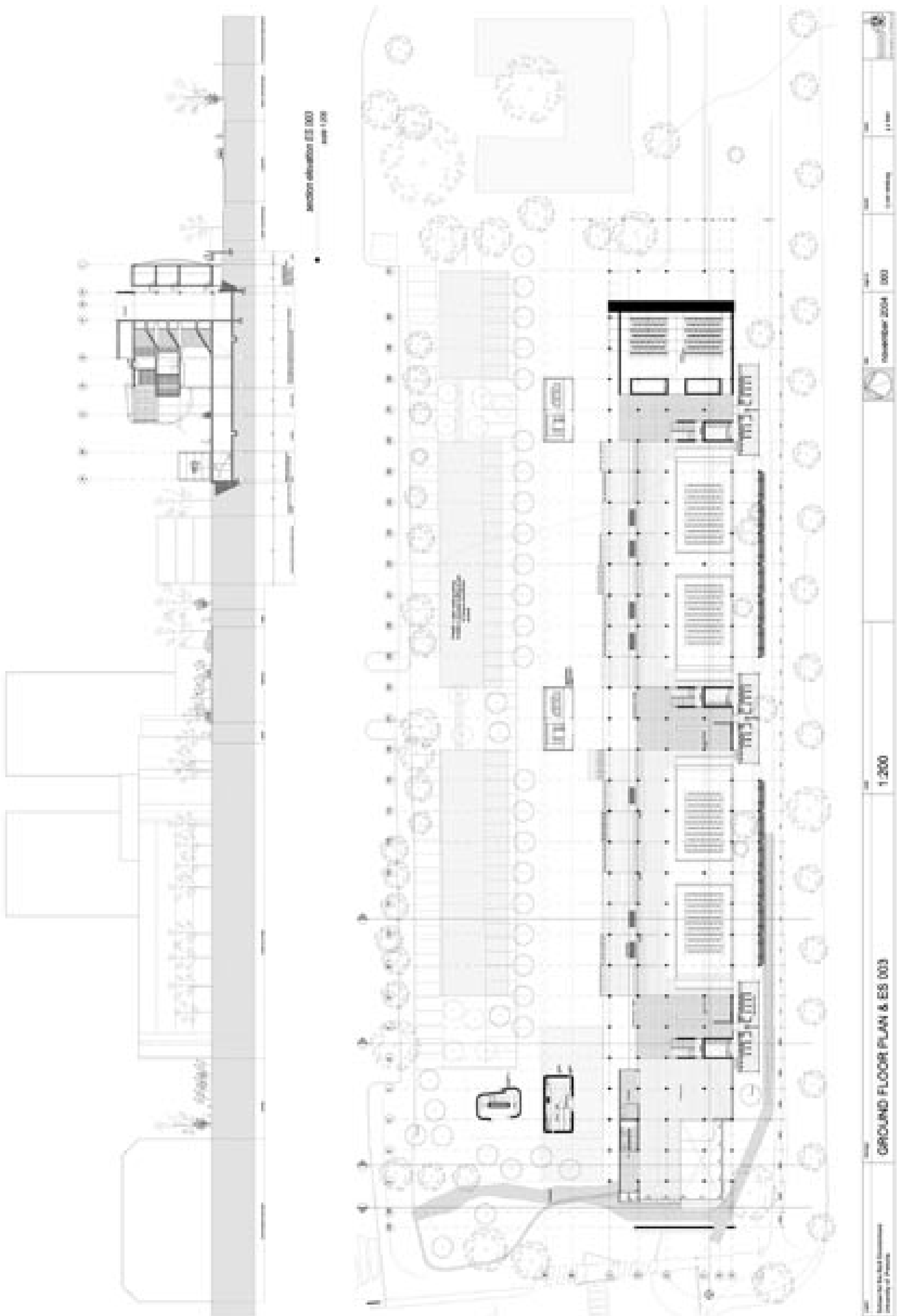
In the School for the Built Environment, the lift shaft is glazed with red structural glass. People moving along the main access ramp and vehicular traffic in the main entrance of the campus will see both the level and operation of the elevator housed inside. The lift shaft acts as a light well during night time, emitting filtered red light on the main access ramp. The daily usage of the elevator functions as a time modulator of its users' movement.

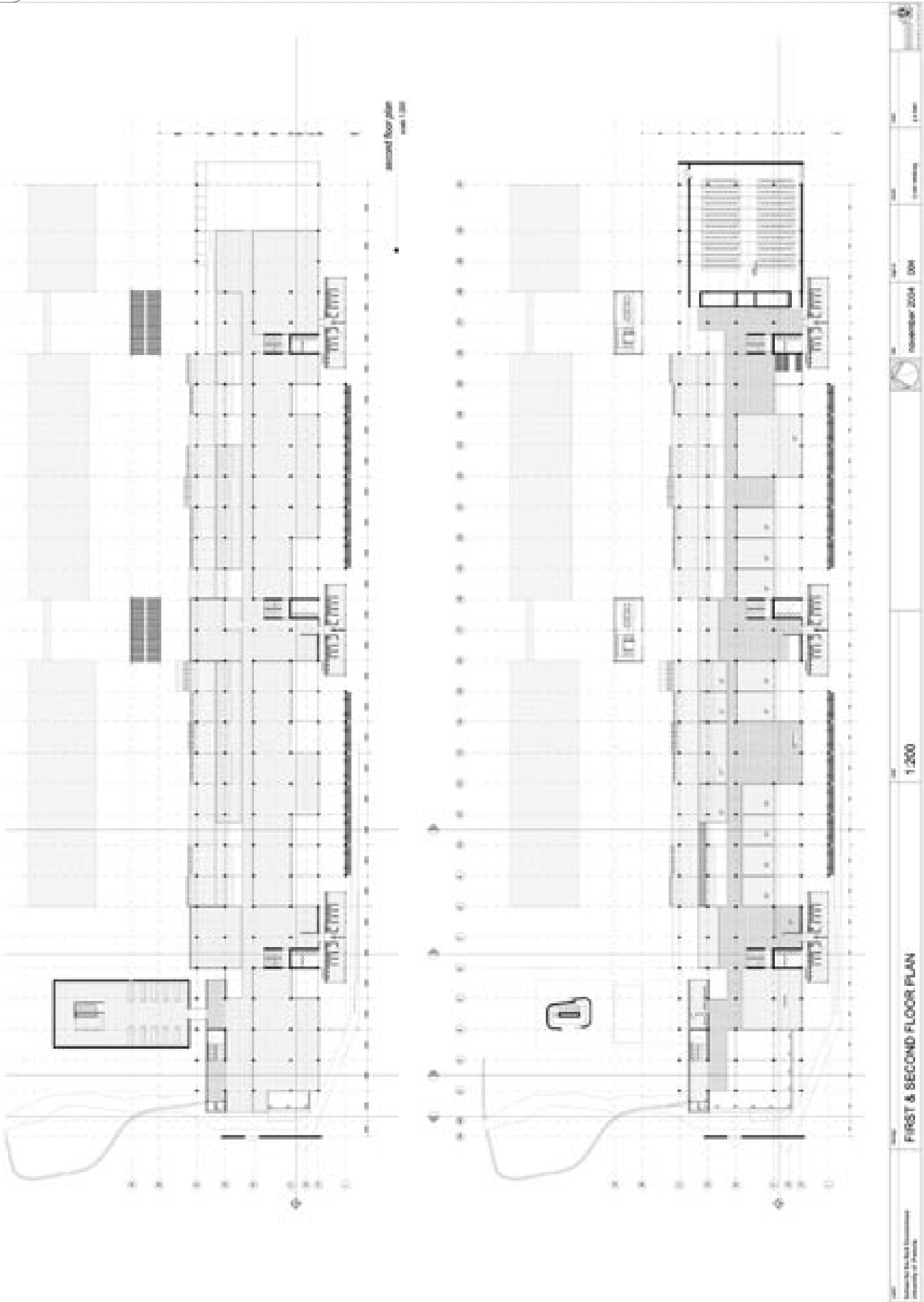
Gen 2 machine-room-less elevator. 'OTIS'

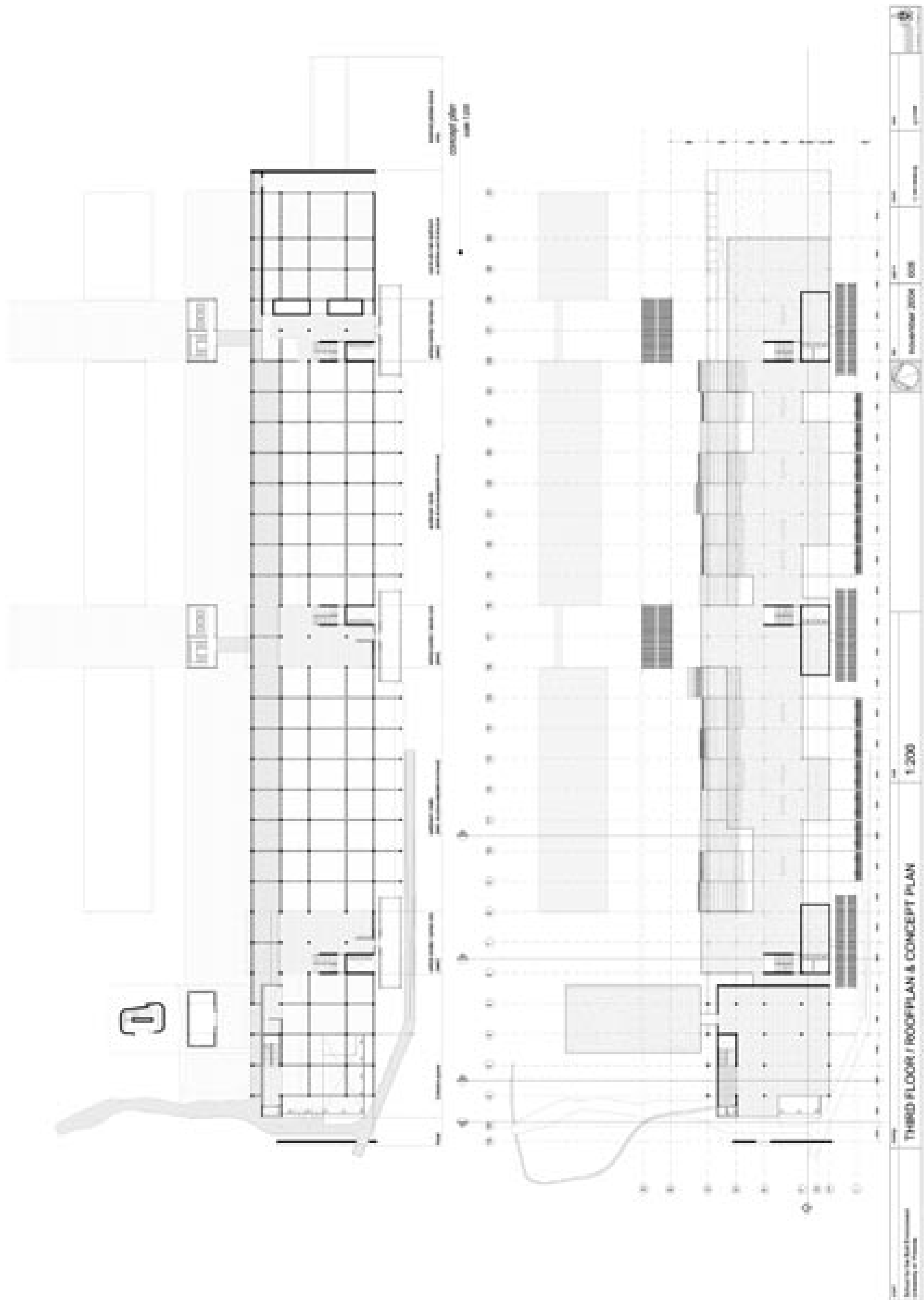


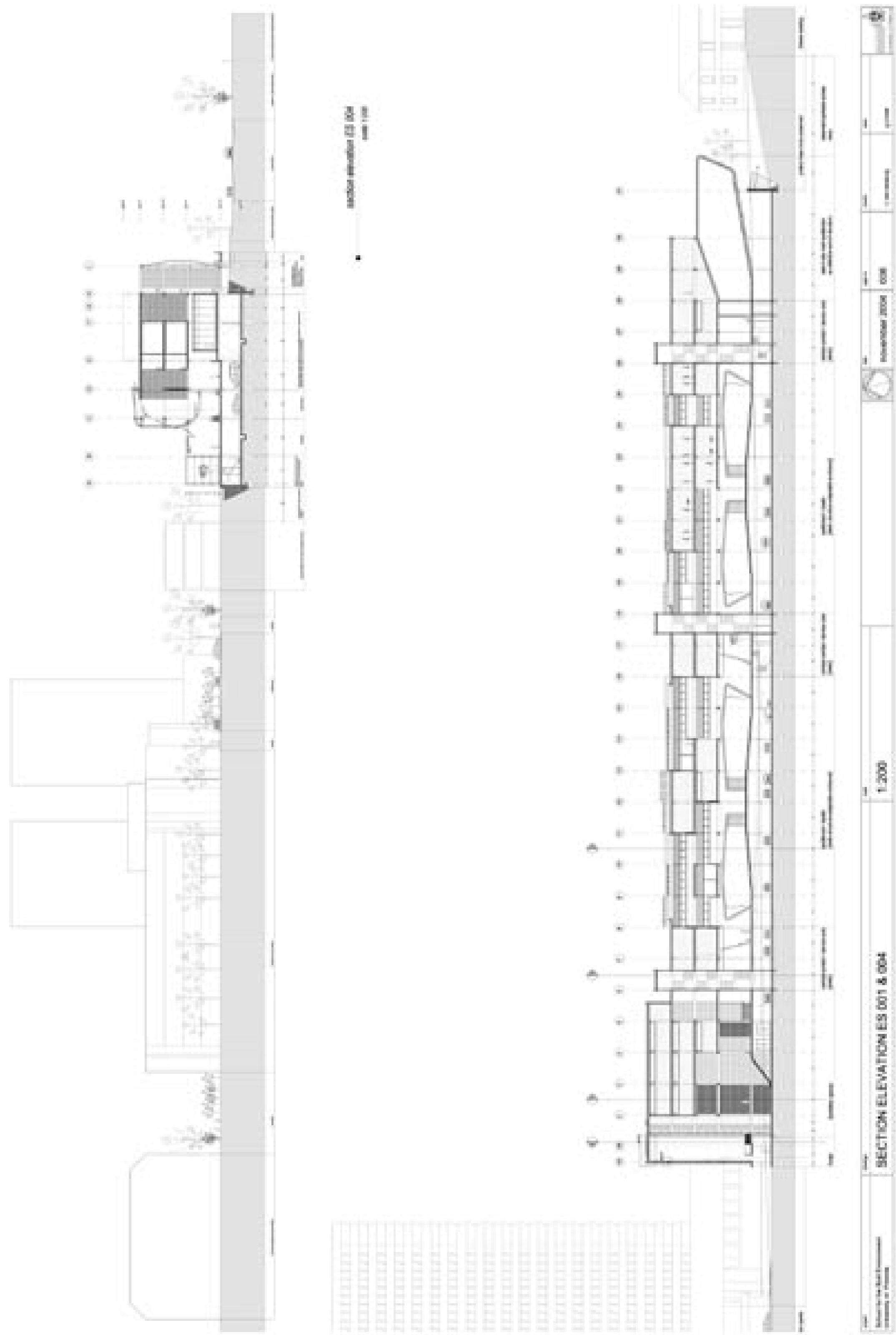

SITE TIMELINE PROCESS
1:200
November 2004


BASEMENT PLAN
1:200

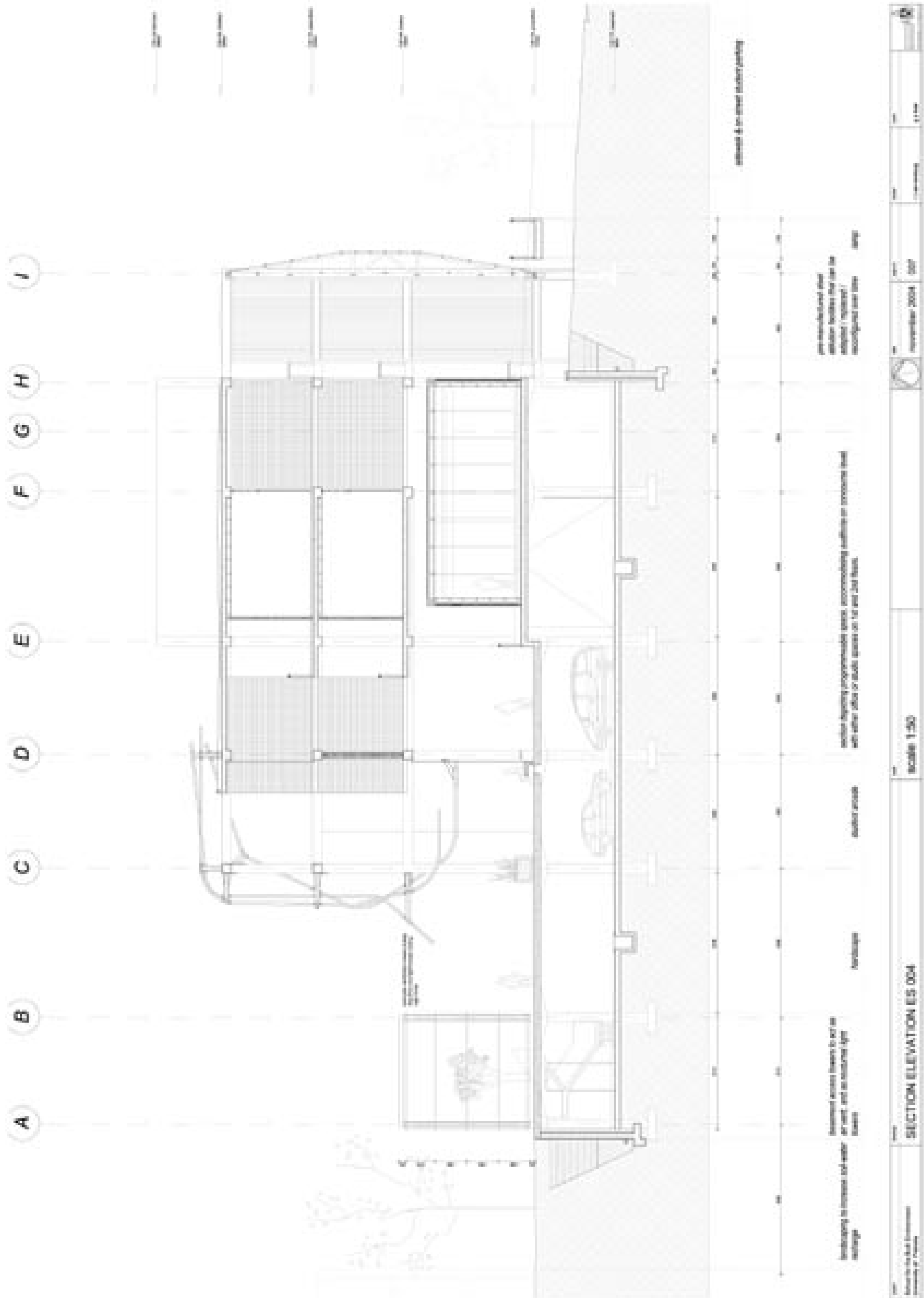

GROUND FLOOR PLAN & ES 003
1:200
November 2004

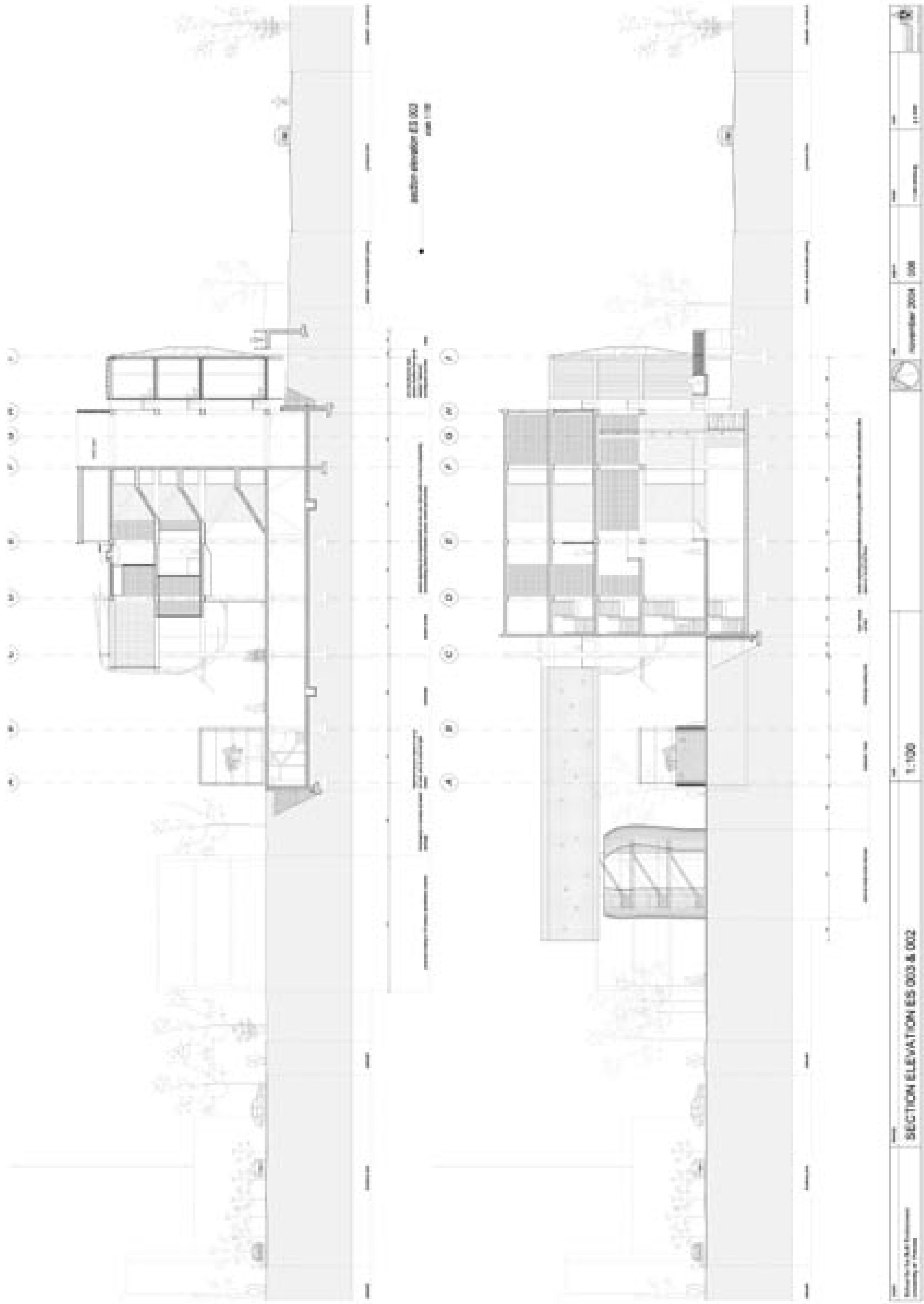

second floor plan
FIRST & SECOND FLOOR PLAN
1:200
November 2004

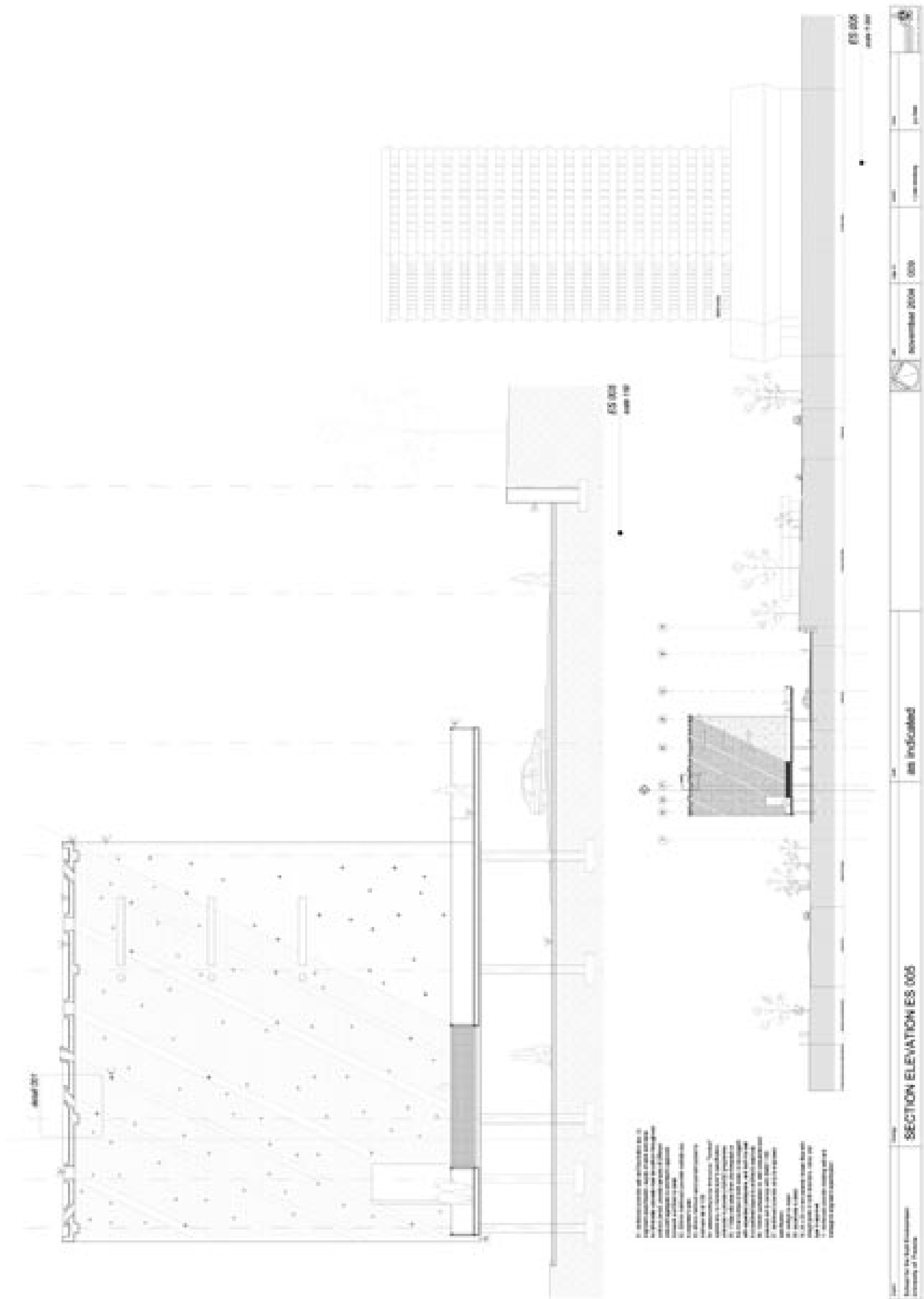

THIRD FLOOR / ROOFPLAN & CONCEPT PLAN
1:200

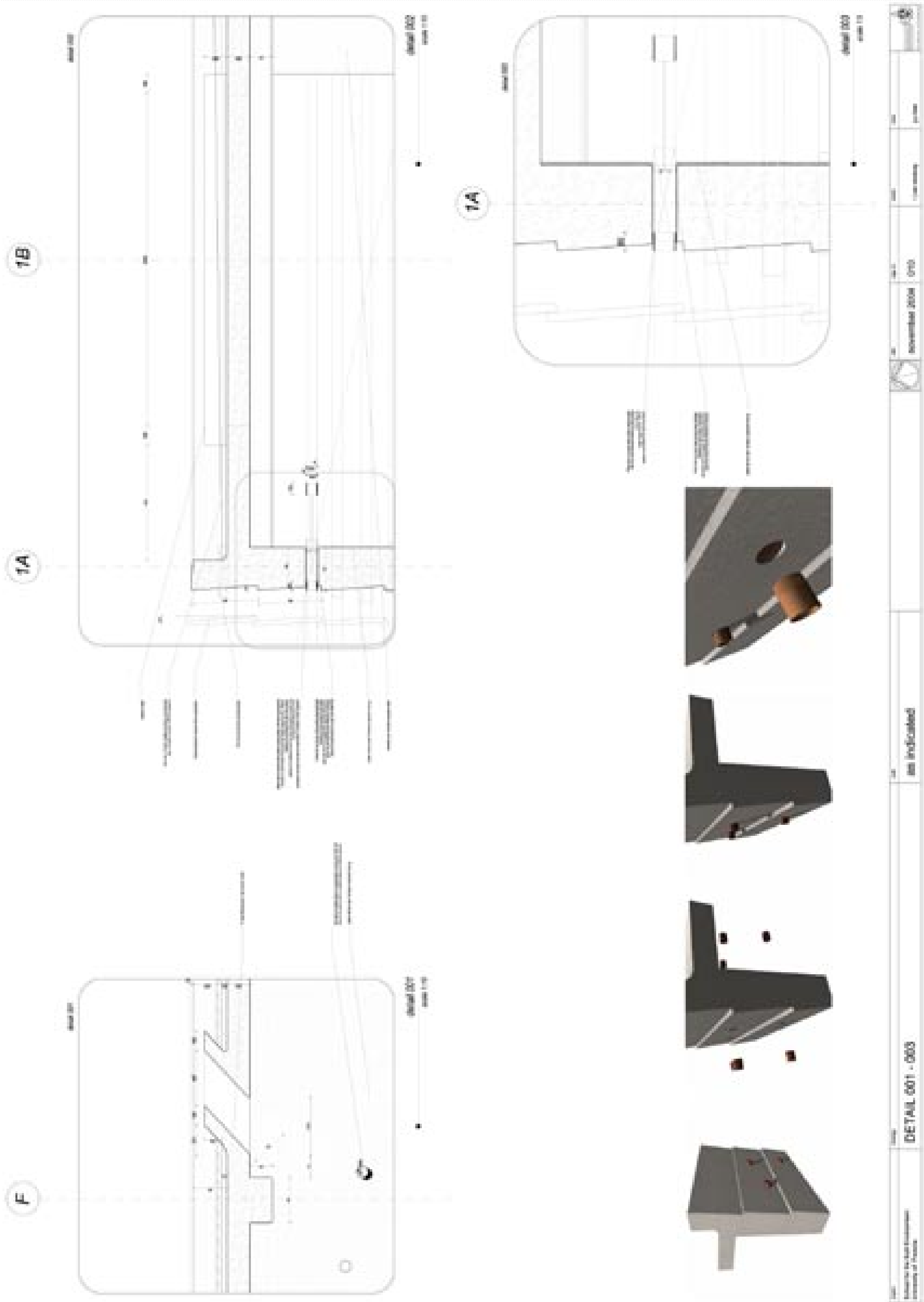


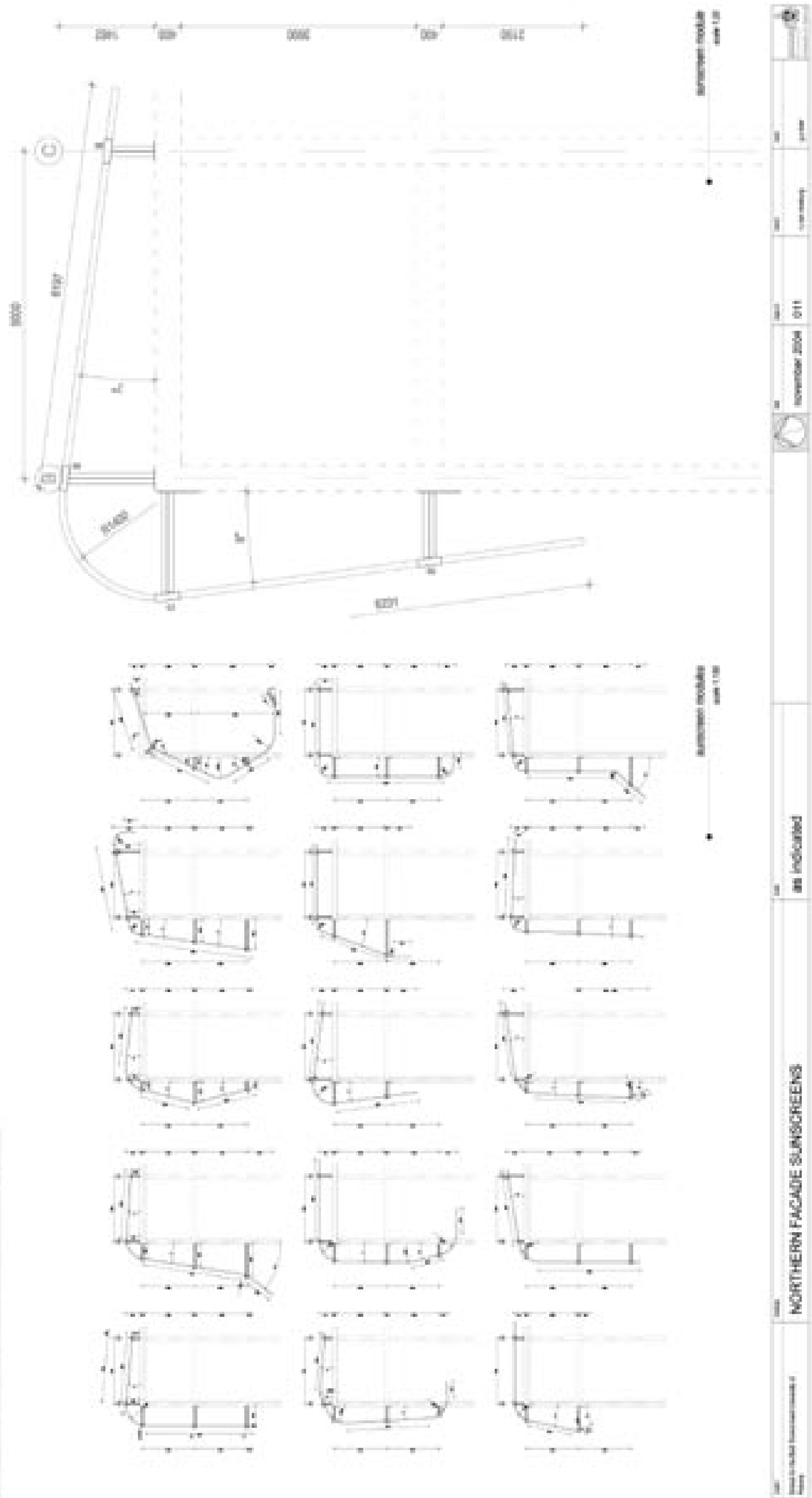
section elevation ES 004
1:200
SECTION ELEVATION ES 001 & 004

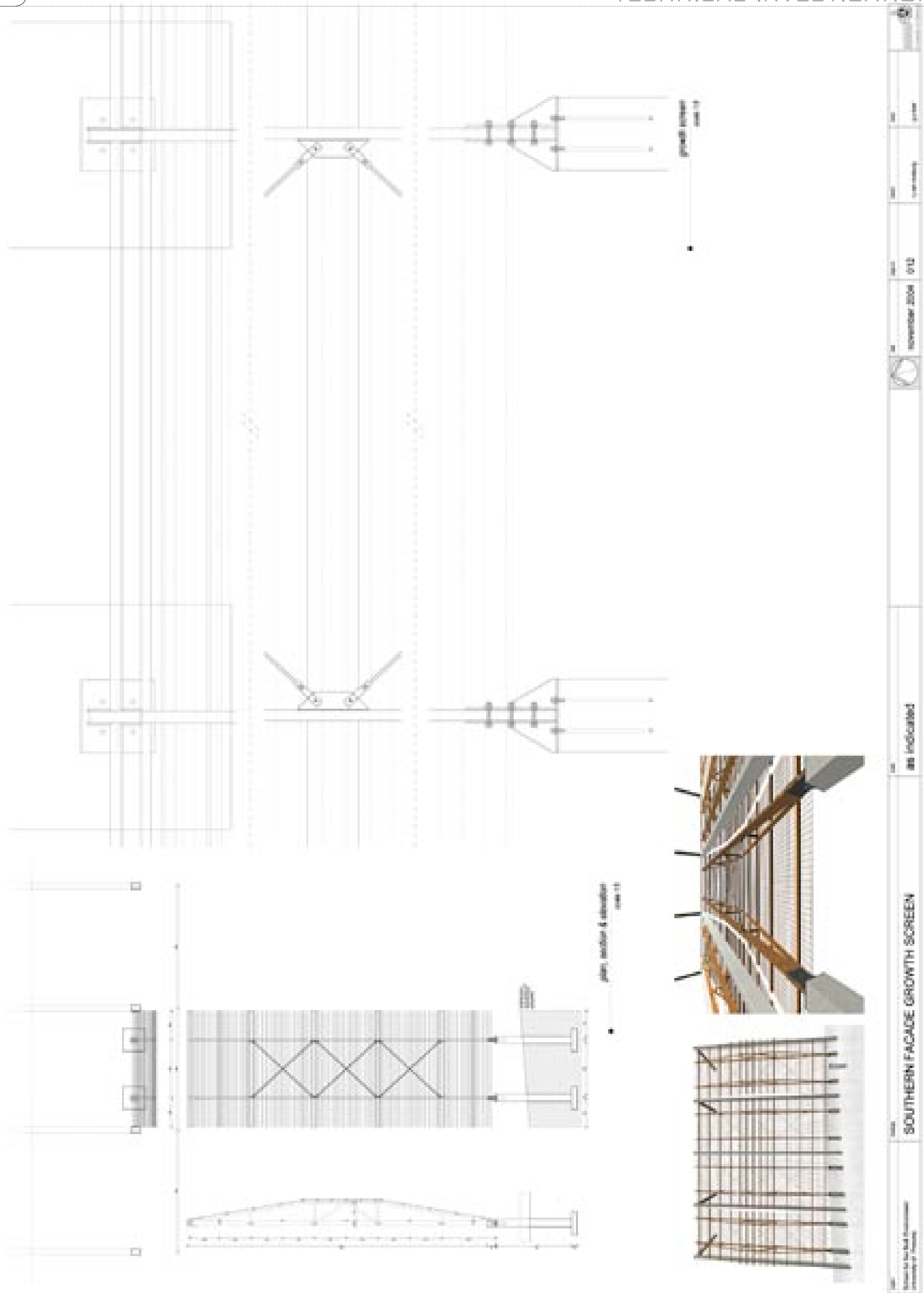

A
B
C
D
E
F
G
H
I
SECTION ELEVATION ES 004
scale 1:50
november 2004

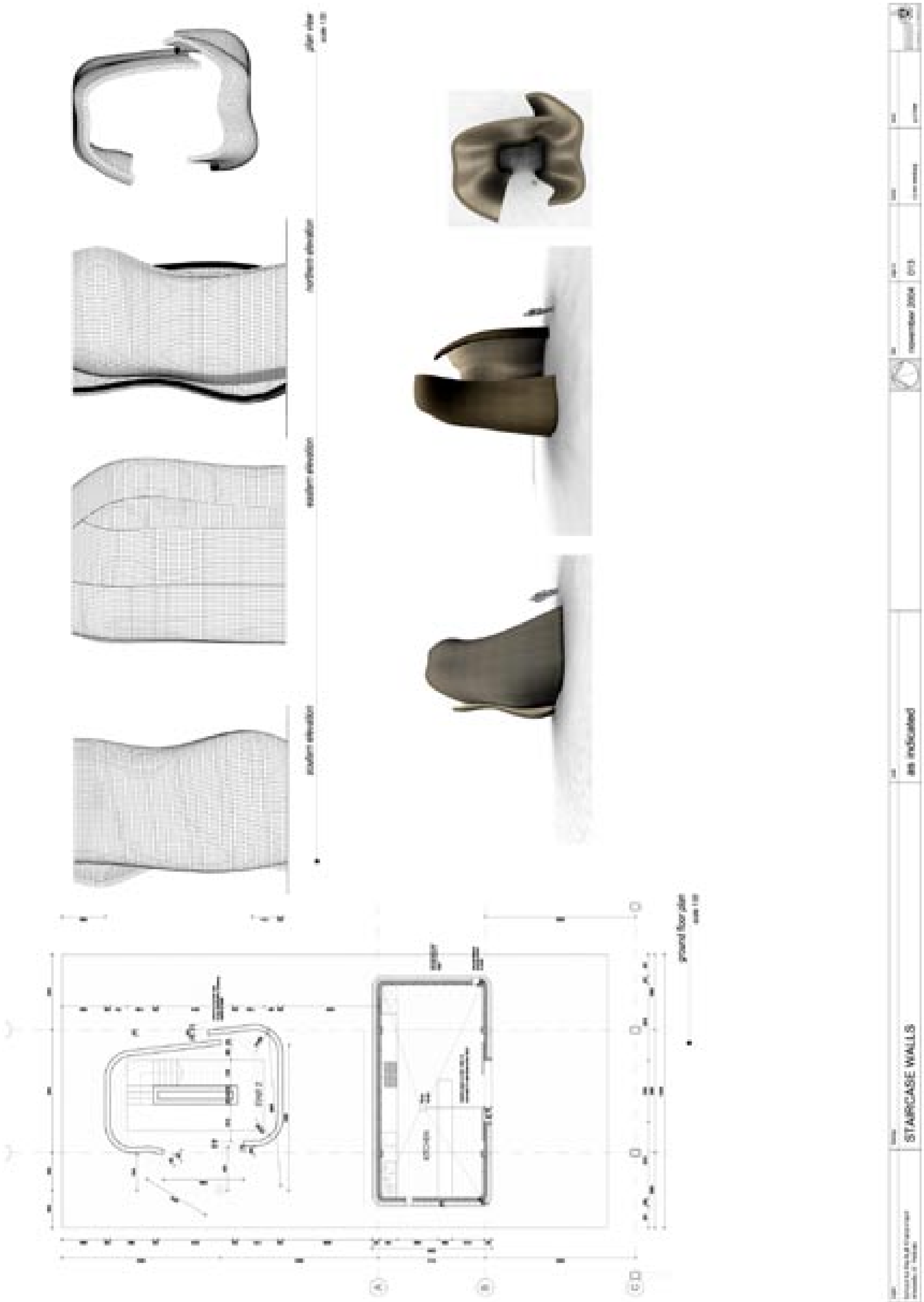

SECTION ELEVATION ES 003 & 002
1:100

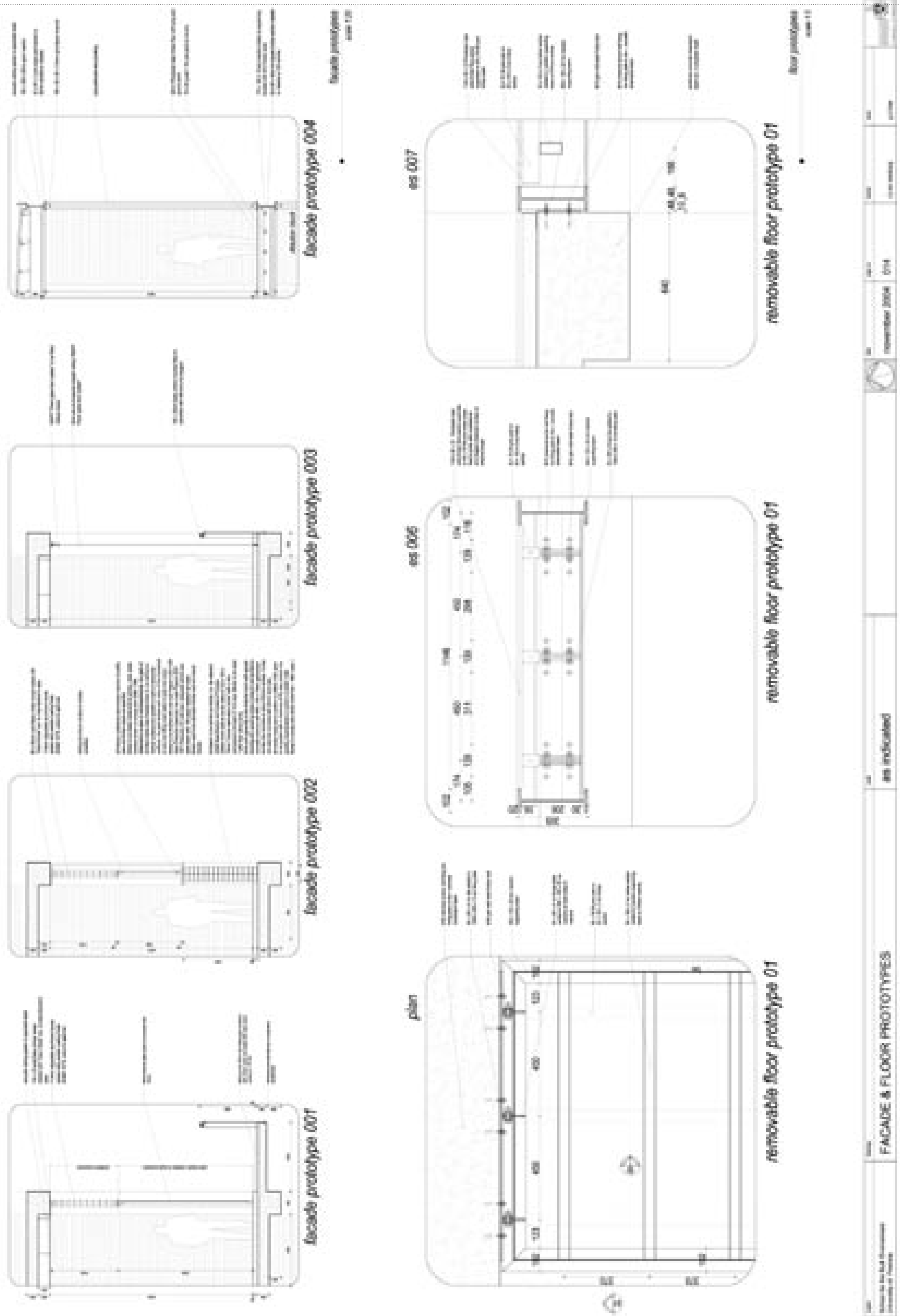

SECTION ELEVATION ES 005
as indicated

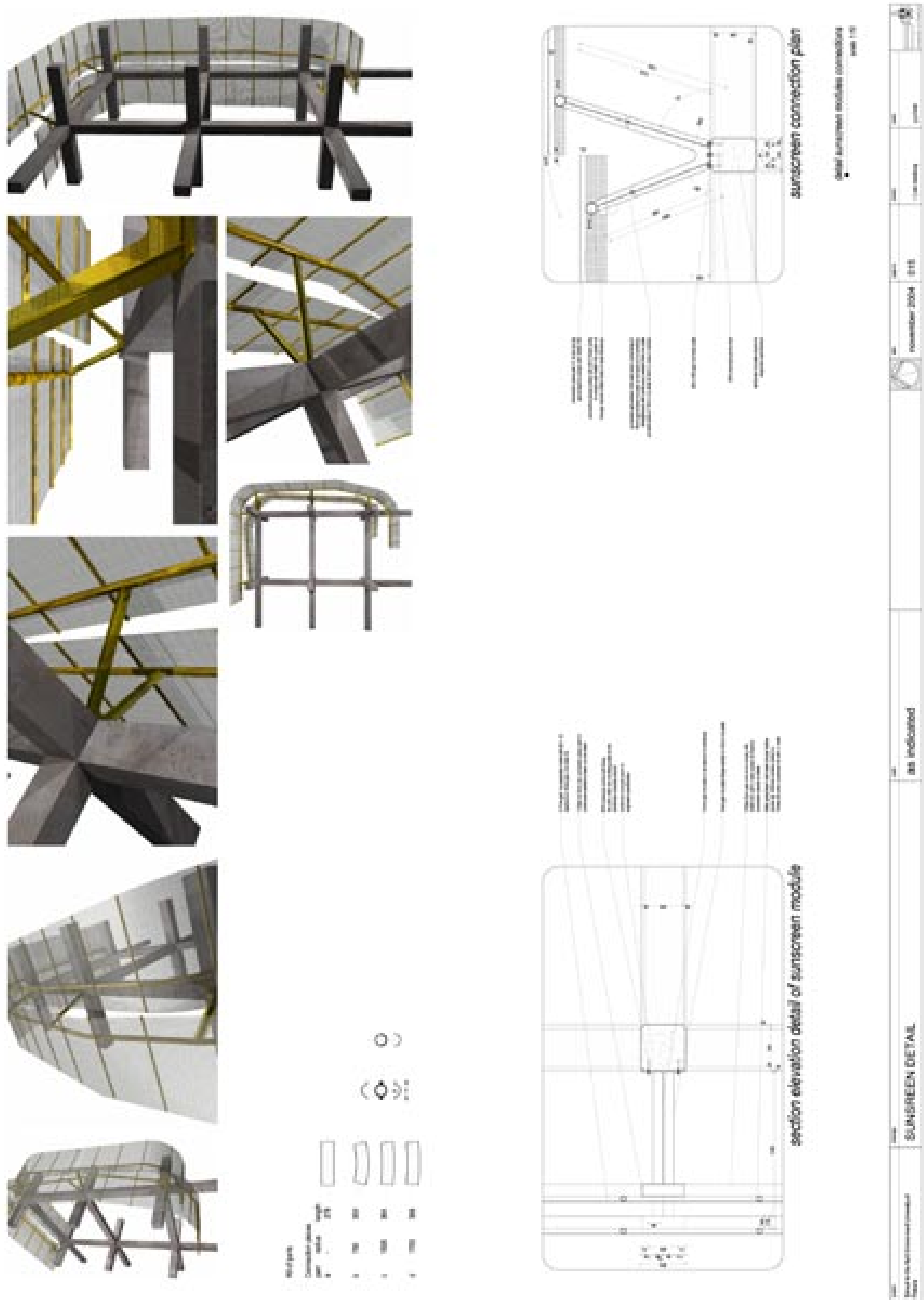

1B
1A
F
as indicated
DETAIL 001 - 003


NORTHERN FACADE SUNSCREENS
as indicated
november 2004
011


SOUTHERN FACADE GROWTH SCREEN
as indicated
november 2004
012
plan, section & elevation
growth screen


STAIRCASE WALLS
as indicated
november 2004


facade prototype 004
facade prototype 003
facade prototype 002
facade prototype 001
as 007
as 006
plan
removable floor prototype 01
removable floor prototype 01
removable floor prototype 01
as indicated
FACADE & FLOOR PROTOTYPES


sunscreen connection plan
section elevation detail of sunscreen module
as indicated
SUNSCREEN DETAIL
November 2004


1:1000
SITE PLAN