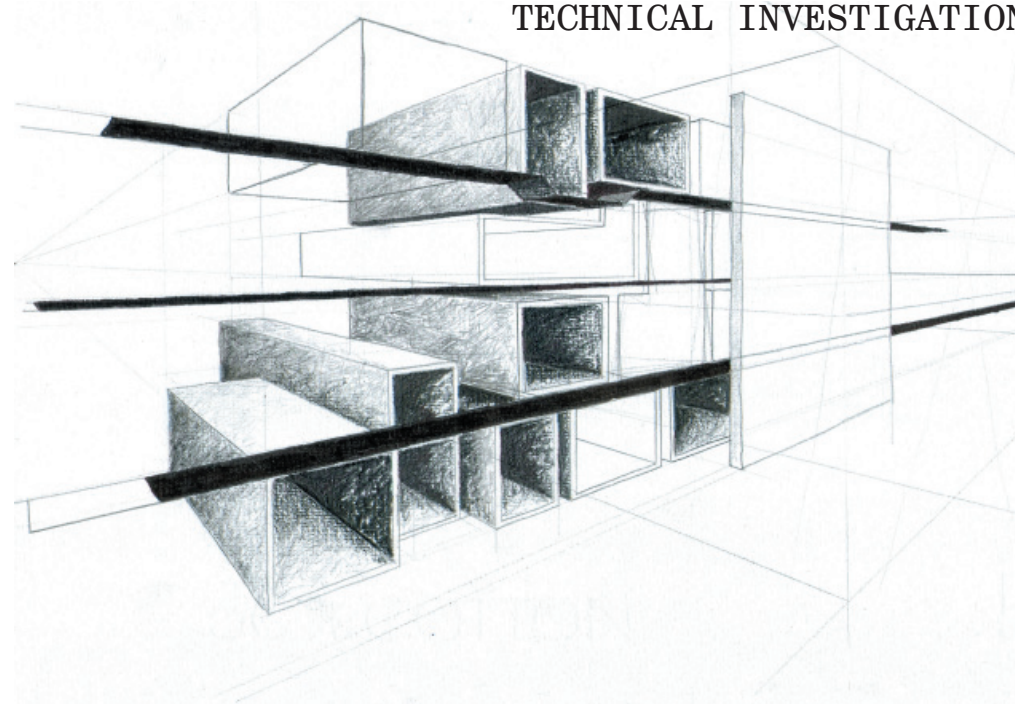


TECHNICAL INVESTIGATION



## DESIGN INFLUENCES

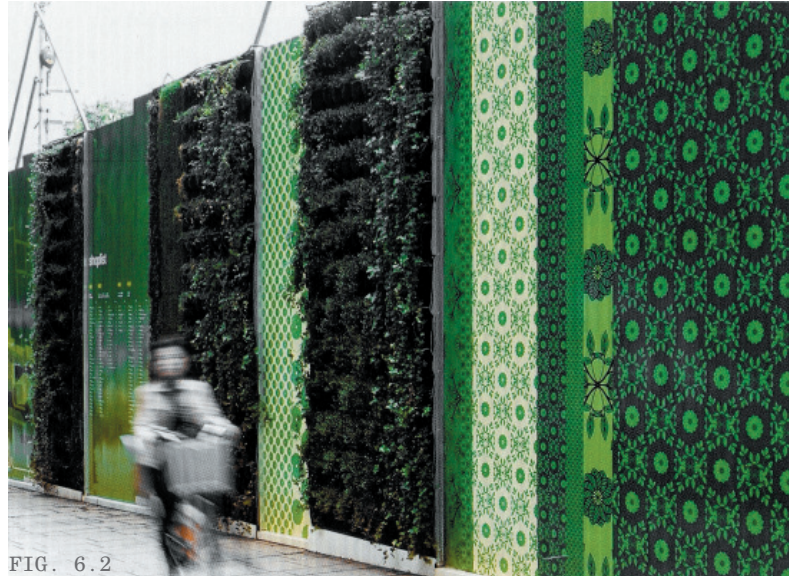


FIG. 6.2

Green Green Screen, Tokyo, Japan, 2003. Architect: Klein Dytham Architecture.

This is a temporary work of architecture, which consists of a facade - a wall of plants. This temporary enclosure is a hybrid that integrates vegetation and printed graphics of abstract floral motifs. As result, a rich texture filled facade that communicates with pedestrians, which is somewhere between the naturalistic and the artificial.

(Aymonino 2006: 308)



FIG. 6.3

Extension in Marseille, Marseilles, France, 2001. Architect: Remy Marciano

The project provides an open-air patio for an existing building. It consists of one element, perforated sheet metal cladding which serves as an all-enveloping facing that provides an intimate setting for the existing enclosure within.

The project is set adjacent to a park and attempts to find a synthesis between the building and its natural surroundings, becoming the point where building and nature meets. The perforations are a repeated pattern that resembles something between the abstract and naturalistic.

(Aymonino 2006: 308)



FIG. 6.4



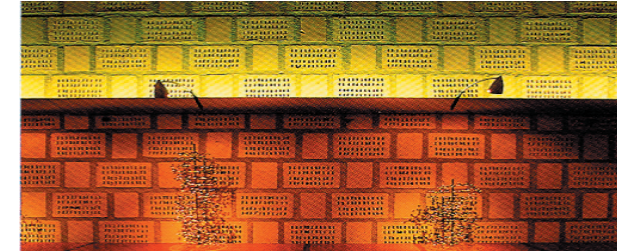
## MATERIAL SELECTION

### CONCRETE

The superstructure of the proposed development is a reinforced column and slab structure, including reinforced concrete shear walls, concrete roof and some exterior / interior walls.

The advantages of concrete construction is numerous and include:  
 Good thermal mass due to high density  
 It can achieve large spans.  
 Concrete is easily moulded and cast in-situ on site.  
 Concrete can have various finishes and textures, depending on the formwork and through adding iron oxide pigments.  
 New advances in technology allows for the production of translucent concrete, by adding crushed fibre optics, illustrated below (FIG. 6.6).

The proposed project requires the reinforced concrete walls to be cast with rough-sawn timber formwork shuttering on the exterior and plywood formwork shuttering on the interior. Furthermore, the project requires that dark blue-grey, iron oxide pigment be added to the concrete mix. Steven Holl beautifully illustrates the desired effect in the concrete finishes in the lobby of Simmons Hall (2002), MIT, above (FIG.6.5). The cost of pigmented concrete can be justified through robustness of the finish compared to plaster and paint.



### BRICK

Pretoria does have a brick aesthetic and many buildings in the CBD are characteristically concrete frame structures with brick infill, as is the case of the proposed development.

Brick has low embodied energy and is produced locally. The erection of brick structures in South Africa relies on cheap and intensive labour carried out by local bricklayers, empowering the local labour force. Brick has good thermal mass and load-bearing/structural properties. Furthermore, brick is recyclable and easily reused.

The proposed project requires two different types of bricks: stock brick that will be hidden by cladding and purely serve the function of adding thermal mass, and acoustic bricks to be used as face brick in the interior of the building. The aesthetic appeal of the acoustic bricks is illustrated by the interior of the Cambridge Crystallographic Data Centre in Cambridge, England (FIG. 6.6, above), designed by Eric Sorensen (1992). It serves the additional function of reducing traffic noise (Campbell & Pryce 2003: 285).

## STEEL

The proposed project use steel sparingly and only in places where the effect of lightness are to be communicated, for example the suspended floor of the library and as glazing support system. Steel is also utilised for its tensile qualities.

The advantages of steel include the following:  
Steel can be recycled and reused, has good structural properties and; requires very little maintenance. The project requires standard steel sections and will be assembled on site in order to decrease discrepancies.

Steel, on the other hand is a non-renewable resource.



Silk-screened glass (FIG. 6.7, above): the proposed project makes use of a silk-screened glass wall on the northern facade of the library. Silk-screen glass is produced by means of screen-printing a ceramic frit onto the surface of the glass. Jean Nouvel employs this technique of silk screening glass in the Quai Branly Museum (2006) in Paris, France. The effect gained transforms the interior space of the museum, allowing the visitor to experience the feeling of being enclosed by trees and foliage as if in a forest.

## GLASS

Glass introduces natural light into the building, merging interior and exterior space. The proposed project utilizes glass in order to communicate a feeling of weightlessness, institutional transparency and illuminating the courtyard at night from within the interior of the building.

The advantages of glass include the following:  
Allows natural light into the building's interior.  
Glass can be recycled and reused.  
Glass establishes a visual connection between the interior and exterior adding to occupant comfort.

The proposed project uses 19mm insulvue glass with a low emissivity outer layer in order to reduce heat loss at night, due to the low thermal insulation value of glass. The proposed project relies on shading devices on the northern and western facades of the building, reducing the most disadvantages associated with glass.

## COPPER

Copper develops a blue-green patina in ordinary atmosphere and is very resistant to most corrosion agents, making it suitable as a cladding or roofing material. Annealed copper is a relatively strong and ductile material and can be joined by welding, brazing or soldering. Copper can be recycled relatively cheaply and 40 percent of all production is from recycled metal.

The proposed project employs perforated copper sheets as a shading screen. The perforations are an abstract pattern between the abstract and naturalistic. The wished

effect communicates a merging of the building with its natural surroundings.

Remy Marciano employs perforated sheet metal cladding (FIG. 6.9, bottom middle) to the same effect in his design for the extension in Marseille (2001), France.

The perforations in the copper cladding used in the proposed project will be weld-cut on site according to a designed pattern, but allowing for variations to occur.

## PERFORATED PLYWOOD

Perforated plywood ceilings and wall panels are employed in the proposed project in order to improve the legibility of interior spaces, announcing the threshold, as well as for acoustic purposes. Lacy grille-work ceiling and wall panels are installed in the exhibition space to hide and vent service ducts.

FIG. 6.8 (bottom left) Paisley perforated ceiling of the Walker Art Centre (2005), Herzog & de Meuron.

FIG. 6.10 (bottom right). Wrapped perforated plywood music hall of the Casa da Musica (2005), OMA.





## STRUCTURE

The off-shutter reinforced concrete columns are 260 x 300mm and 260 x 400mm (bigger column dimensions to support the auditorium, between the Gallery and the vehicular ramp leading down to the basement level. All columns to have 20mm chamfered edges and cast in storey heights. Concrete to be cast with vertical movement joints at 10,6 m intervals and must be a clean break through the entire structure. Vertical movement joints in the reinforced concrete walls of 10mm bitumen-impregnated soft board. The reinforced concrete slabs are 340mm thick with a maximum span of 8,6 meters. All reinforced concrete shear walls are 200mm thick.

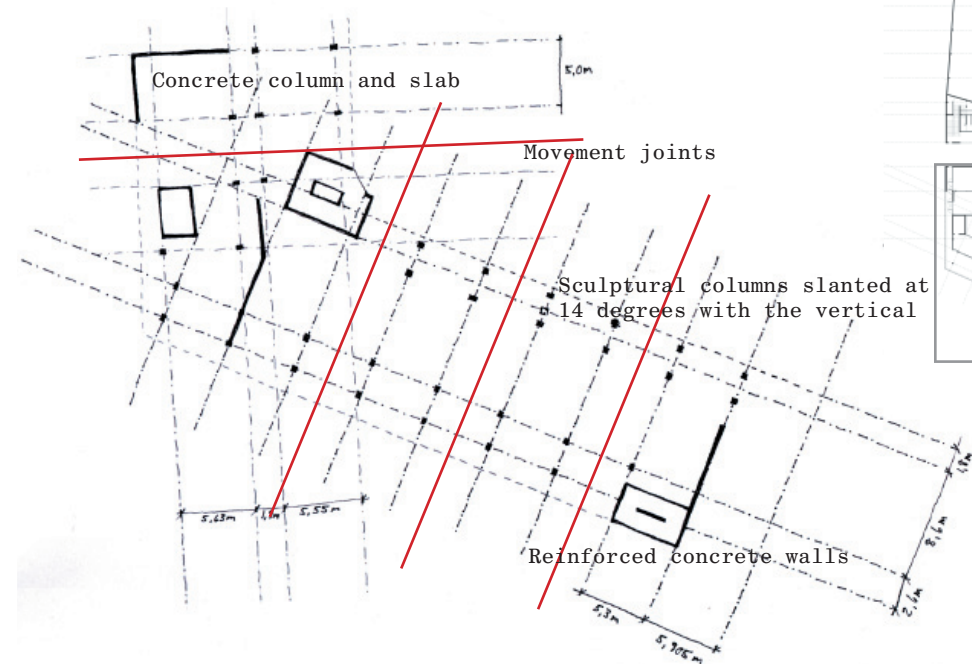


FIG. 6.11 (bottom) Structural layout and materials  
FIG. 6.12 (top) First floor plan.



FIG. 6.11 (bottom) Structural layout and materials  
FIG. 6.12 (top) First floor plan.

## ROOF CONSTRUCTION

### ROOF CONSTRUCTION

The roof construction of the proposed project consists of a reinforced concrete roof, either a simple concrete construction or a planted concrete roof (FIG. 6.13).

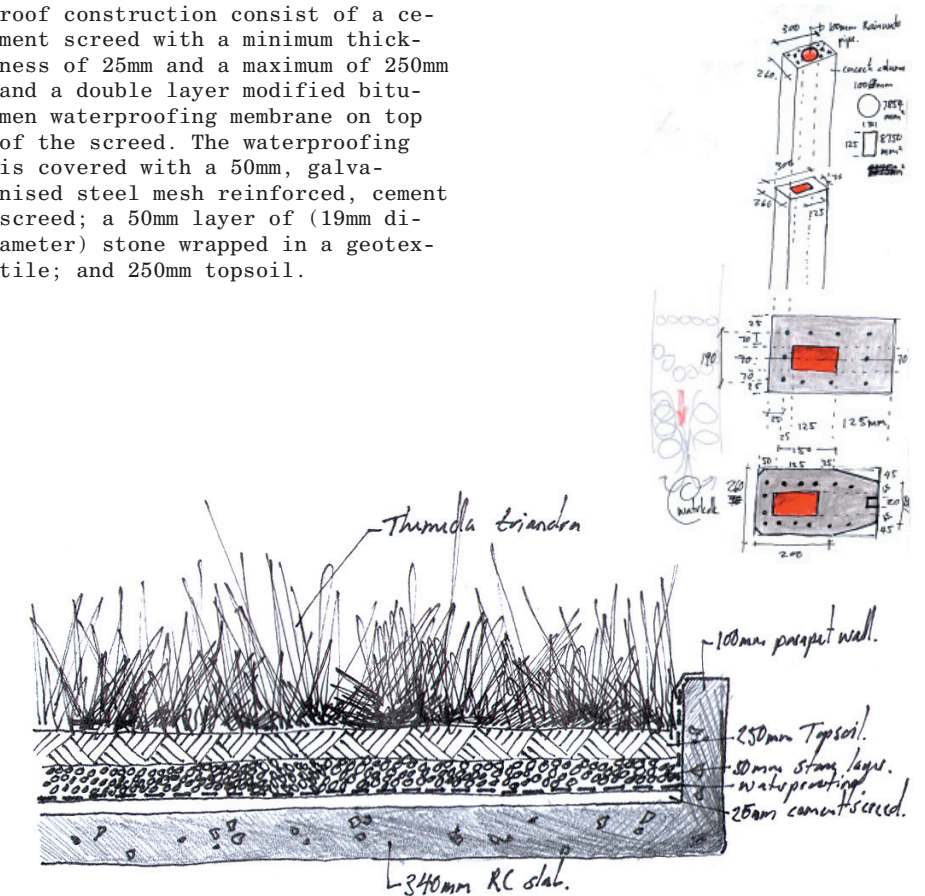
The concrete roof construction requires a minimum screed thickness of 40mm along with a minimum gradient of 1:50 according to the NBR L5.3. The reinforced concrete roof slabs are 255mm / 340mm thick, with 255mm to 510mm high parapet walls.

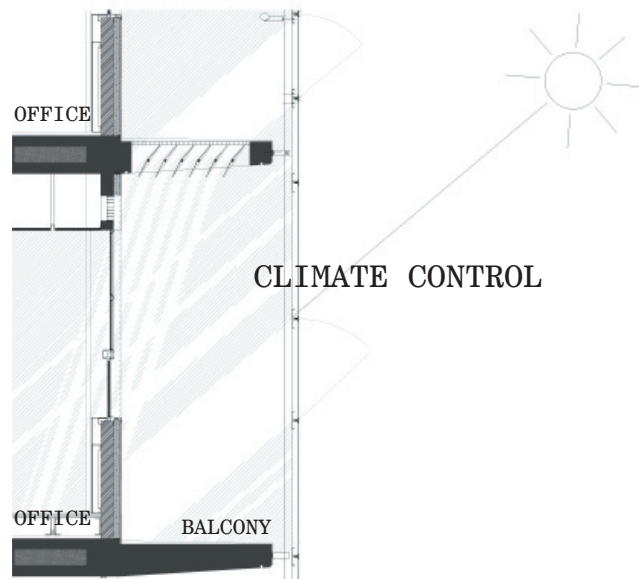
Waterproofing of the concrete roof consist of a cement screed with a minimum thickness of 40mm with a 1:50 gradient; a double layer 4mm modified bitumen membrane with 100mm side laps and 150mm end laps, sealed by means of torch-on fusion; The waterproofing membrane is then covered with dry stacked 500 x 500 x 80mm precast concrete cover tile. The waterproofing membrane are taken up 200mm against parapet walls and protected with galvanised steel flashing.

100mm diameter PVC down pipes is cast into the reinforced concrete end columns at 5.3m & 5m intervals.

The planted reinforced concrete

roof construction consist of a cement screed with a minimum thickness of 25mm and a maximum of 250mm and a double layer modified bitumen waterproofing membrane on top of the screed. The waterproofing is covered with a 50mm, galvanised steel mesh reinforced, cement screed; a 50mm layer of (19mm diameter) stone wrapped in a geotextile; and 250mm topsoil.





CLIMATE CONTROL

## ORIENTATION, SOLAR CONTROL AND NATURAL LIGHT (FIG. 6.14).

The site is long (280m) and thin (64m) with the long edges being the eastern and western boundaries. As result the design, being informed by the site and its context, has long east and west facing facades.

Making use of natural daylight was an important objective during the design process and incorporates many roof-lights and light-wells in order to let natural daylight into the building. Northern facade preference was given to office space and studios of which sufficient natural lighting levels are a minimum requirement. The 1.8m roof overhang, The perforated copper screen, louver system and the 6m recessed silk screened glass facade of the library prevents direct solar radiation into the north facing rooms during summer. Adjustable screen windows in the perforated copper screen allow light into the building during winter.

The long western facade is protected from the late afternoon sun by means of the perforated copper screen, small openings with shading screens that reflect northern light into the archive and by employing air-brick with glass-block glazing on the western wall of the southern wheelchair ramp.

The glazed eastern facade is protected from low-level eastern sun by the large and dense existing tree growth along the Apies River. The southern facade's has large glazed openings in order to make full use of southern light.

## THERMAL MASS

Thermal mass is provided by the flat concrete roofs, exterior concrete walls on the western facade of the auditorium and the archive - the two spaces that will be used at night. These facades absorb direct and indirect solar radiation during the day and radiate the heat at night. This delay period is determined by the density and thickness of the materials. The thickness of the concrete walls and roofs, which range between 200mm and 340mm, provides a sufficient delay to ensure that interior temperatures are effectively cool during the day and cool at night.

STUDIO

FIG. 6.14

## VENTILATION

Passive ventilation was an important consideration from the outset of the design process, in order to reduce the amount of energy used. The design incorporates thermal towers to vent rising hot air out of the building. All windows, except for the glass curtain wall of the eastern elevation, can be manually opened and closed to maximise occupant comfort.

FIG. 6.15 illustrates passive air-flow through the building.

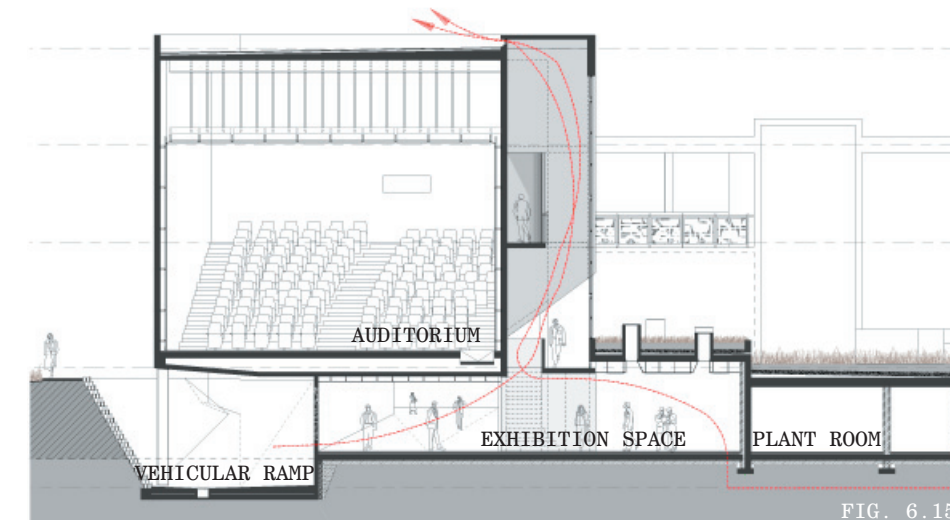
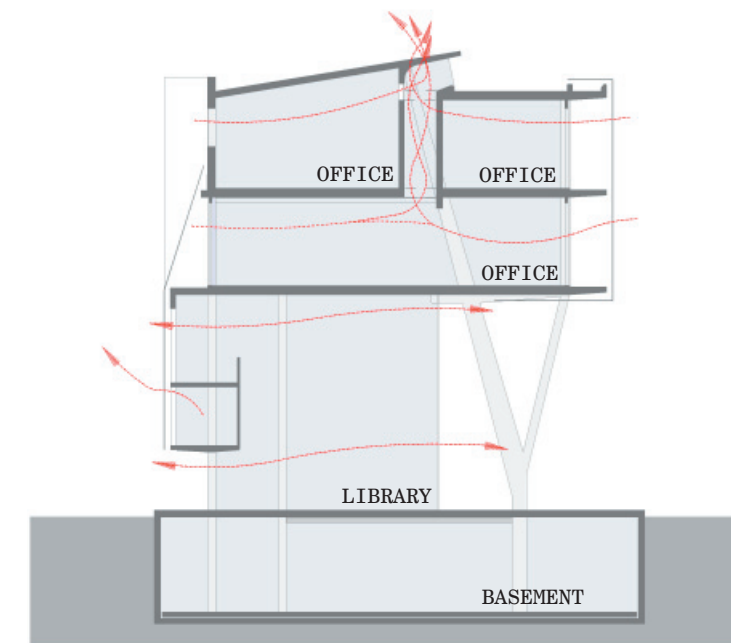
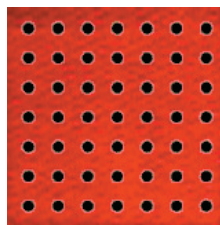


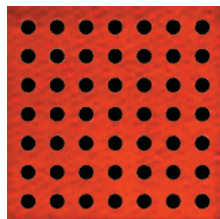
FIG. 6.15



## ACOUSTICS



The auditorium (FIG. 6.16) is a concrete box overhanging the vehicular ramp leading down into the basement. The shape of the auditorium was designed to prevent the occurrence of standing waves (standing waves occur when sound waves are trapped between two parallel walls). No walls are parallel to one another and the floor and ceiling differ in gradient. The walls are 200mm thick reinforced concrete.



Both access points to the auditorium have double wooden doors with a cavity between them and the doorjamb sealed with a 25mm neoprene seal. All glazed openings to

be double-glazed and not parallel to one another. The cavity is supplied with copper sulphite in order to absorb moisture between the two laminated glass panes.

The wall construction consists of a 200mm reinforced concrete wall; 50mm mineral wool blanket with a black fabric covering fixed to the wall; a

76 x 38 x 2.0 mild steel RHS frame fixed to the concrete columns (with 5000mm centres) but isolated from the concrete structure with 10mm neoprene seals in order to prevent structural noise; 8mm x 1750 x 1080 red stained perforated plywood panels fixed to steel structure. The cavity between the concrete wall and the plywood panels is 130mm.

The front third of the side walls and ceiling are covered by red stained plywood with  $\phi 3$  holes at a 13.5mm pitch which allows for a 21.1% open area and functions as a sound reflector (Fig.) The remaining two thirds of the side walls, ceiling and rear wall are covered by perforated plywood with  $\phi 7$  hole @13.5mm pitch which allows for a 11% open area and functions as absorber of low frequencies and prevent echoes (Fig.). The front wall serves as a acoustic reflector and has a fairfaced concrete finish.

The success of a recording studio depends solely on its acoustic efficiency. The recording studio consists of three important spaces: The live room, the control booth and the piano room. The recording studio is situated right next (north) to the auditorium.

None of the live room's walls are parallel to one another as is the case with the floor and ceiling to prevent the occurrence of standing waves. The construction consists of 510mm thick cavity walls with a 50mm cavity. The floating timber floor's construction consist of 32mm thick tongue and groove timber floor planks nailed to 94 x 44mm timber battens, which is isolated from the concrete floor with 10mm neoprene seals (alternating between RC floor - timber batten and Timber floor plank - timber batten) in order to prevent structural

noise. The live room has a 12mm plywood veneer hanging ceiling hiding HVAC ducts (with incorporated acoustic absorbers).

The access doors to the live room from the control room and to the equipment storage are double timber doors with a cavity between them, sealed with 25mm Sondor neoprene seals all along the doorjamb. All glazed openings (view panel between the live- and control room) are double-glazed and not parallel to one another. The bigger the cavity between the two laminate glass panels, the better the acoustic isolation. Copper sulphate should be inserted into the cavity to absorb any moisture.

The glass sliding door of the piano room is a 45dB sound proof door and consist of two sliding doors.

The piano room wall construction consist of 510mm cavity walls with a 50mm cavity; 32 x 69mm timber battens fixed to brick wall with 50mm mineral wool blanket with fabric covering in the cavity and fixed to the wall, perforated plywood veneer panels screwed to the timber battens. A similar wall construction will be employed for the control room.

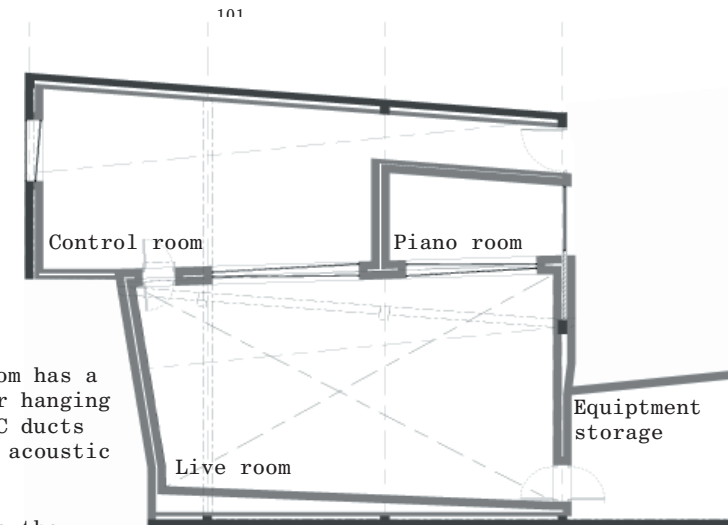


FIG. 6.16 Auditorium

## INCLUSIVITY

The Communication Research Centre as well as the public amenities provide for the old and infirm. Wheelchair ramps, to provide disabled access to the first floor from ground floor level, are provided in the library, exhibition space and the southern wing of the design school that links the school administration with the studios on ground and first floor levels. The entrance to the archive, which is two levels high, is on the first floor level with a wheelchair ramp giving access to the upper level. The auditorium has wheelchair access on ground level as well as on the first floor level. The courtyard can be accessed by ramps leading up from the Apies River level, down from the library and the entrance foyer respectively.

All ramps have a maximum gradient of 1:12 with resting platforms every two meters of vertical rise.

The ground floor level as well as the first floor level has toilets for use by disabled persons that comply with the requirements set by section S of the National building regulations.

## FIRE STRATEGY

The National building regulations stipulates in section TT 16.2 that a building with three or less storeys in height is not required to include an emergency escape route.

The NBR further specifies that the travel distance, measured to the nearest escape door, must not exceed 45m. The corporate wing of the proposed project is four storeys high and requires two emergency escape routes (FIG. 6.17).

The NBR further requires, section TT 7, that structural elements are to have a fire resistance as follows:

The restaurant, recording studio, auditorium and workshop – 60 minutes

The exhibition space – 90 minutes  
Offices and art studios – 60 minutes

The concrete structure will provide sufficient fire resistance. The structural steel members of glass curtain wall on the eastern façade requires an intumescent mastic fire resistant coating thinly painted on the members after a coat of steel primer has been applied.

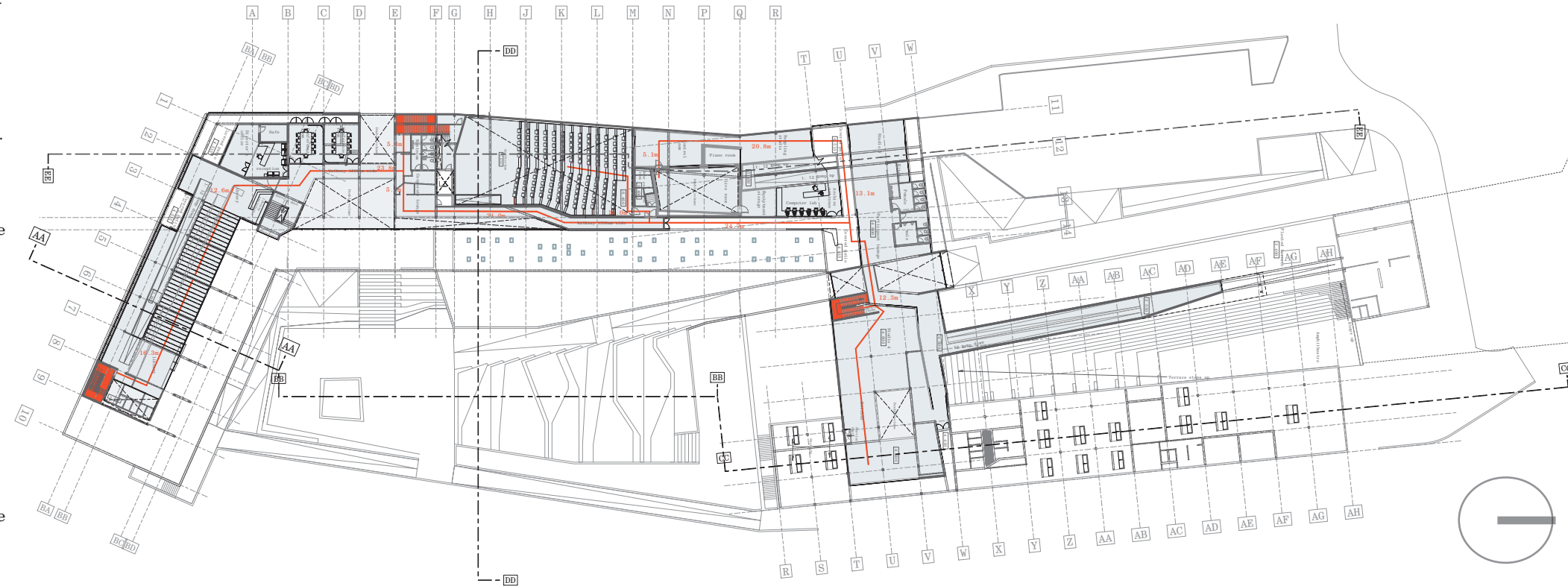


FIG. 6.17 Second floor plan. NTS