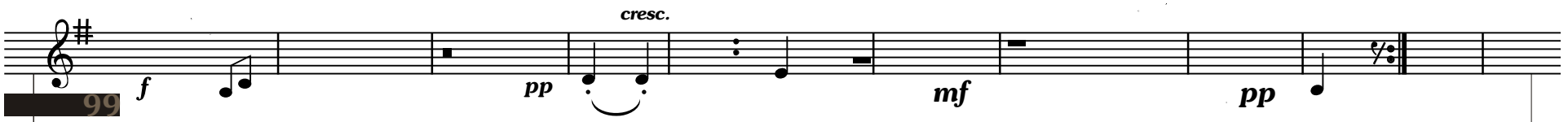
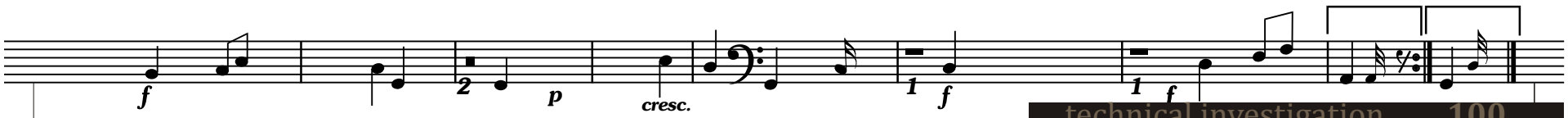
"Which is more musical, a truck passing by a factory or a truck passing by a music school?".

John Cage



TECHNICAL INVESTIGATION



STRUCTURAL COMPOSITION

The off-shutter reinforced concrete columns are 350 x 550mm at 5350mm centres with 20mm chamfered edges and are to be cast in storey heights. Reinforced concrete roof slabs are 340mm thick and can span a maximum of 8,6m. The thicknesses of these slabs have been determined due to the dead load requirements of the roof garden above the offices and recording studio as well as the live and dead loads requirements of the practice rooms. The reinforced concrete roof slab of the auditorium is 170mm thick and is supported by 330 x 1340mm primary and 220 x 255mm secondary reinforced concrete beams. All reinforced concrete shear walls are 230mm thick.

The structural steel columns have H-profile sections of 230 x 230 x 46. Lateral movement will be eliminated via cross-bracing and 203 x 133 x 25 I-beams as well as the massing of the buildings supporting the triple-volume steel structure in some sections.

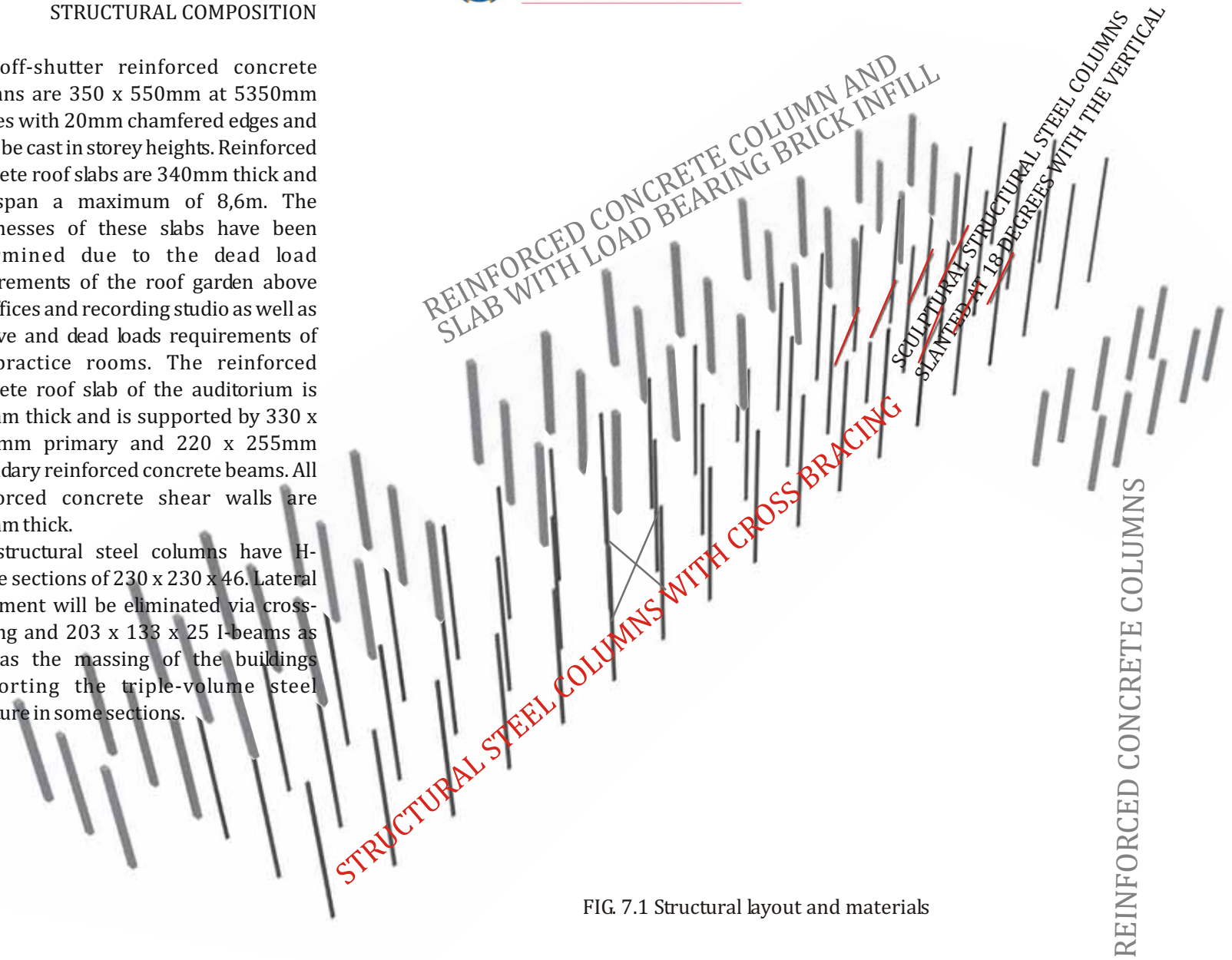
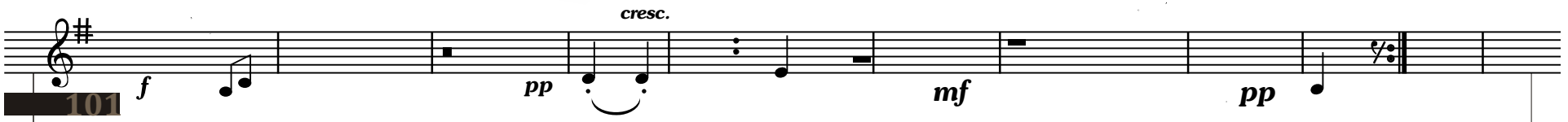


FIG. 7.1 Structural layout and materials



FLOORING MATERIALS

The external landscape paving of the proposed public square consists of different flooring materials which will be continued throughout the ground floor level of the proposed project. This supports the design philosophy of activities and musical performances within the music/arcade area spilling out into the square and vice versa blurring the concept of inside with outside. This also ties in with the proposed arcade through the city block to the west of the site.

Flooring materials for external paving will consist of grass, concrete blocks and interlocking paving for heavy traffic. Pedestrian movement and flow as well as sun angles will determine where each of the selected materials is to be utilized.

Floor surfaces of the buildings will consist of floor screeds in spaces with high pedestrian movement and carpets in spaces with controlled acoustic requirements. The pedestrian bridges floor finishes consists of timber floor boards to give a feeling of a lightweight appearance as well as a feeling of warmth. The timber floor boards will also contribute the acoustics of the space.


FIG. 7.2


FIG. 7.3


FIG. 7.4

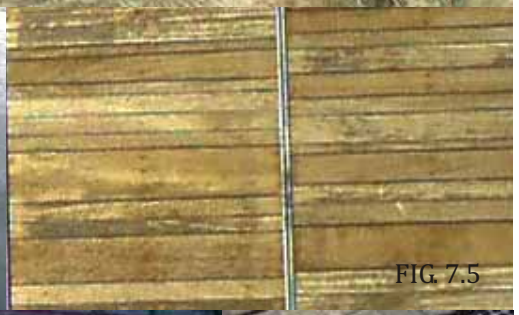


FIG. 7.5


FIG. 7.6


FIG. 7.7


FIG. 7.8

ROOF SYSTEMS

The roofing systems of the proposed projects consists of cast-in-situ reinforced concrete roofs as well as lightweight roof sheeting.

The coverage of the reinforced concrete roofs will either consist of simple concrete construction, a planted concrete roof or loose gravel. Waterproofing will be placed directly over the slabs on a screed of 1:70 gradient. 100 diameter PVC rain water pipes is cast into the reinforced concrete columns at 10,7m intervals

The coverage of the triple volume steel structure will consist of 0,6mm S-Profile mild steel sheets at 1 degree slope with patent Chromadek finish on roof purlins. 100 diameter PVC rain water down pipes is concealed withing the 203 x 203 x 46 mild steel H-section column by means of panels.

The planted concrete roof consists of cement screed with a minimum thickness of 25mm and a maximum of 250mm. The water proofing is covered with a 50mm, galvanised steel mesh reinforced cement screed; a 50mm layer of stone wrapped in a geotextile and 250mm topsoil.

FIG. 7.9 Roof systems

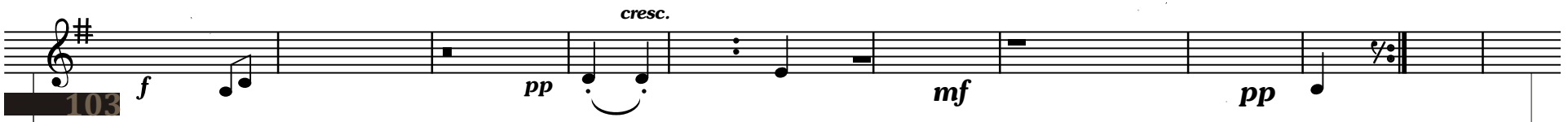


FIG. 7.10 Planted roof

Massing

Thermal mass is achieved via concrete work that absorbs direct solar radiation during the day and radiates it into the interior during the night. This will be beneficial to spaces that are used at night such the auditorium, offices, practice rooms, kitchen and recording studio. Wall and slab thicknesses ranging between 230 to 500mm usually result in sufficient time delays and thus walls and roof slab thicknesses fall in this category.

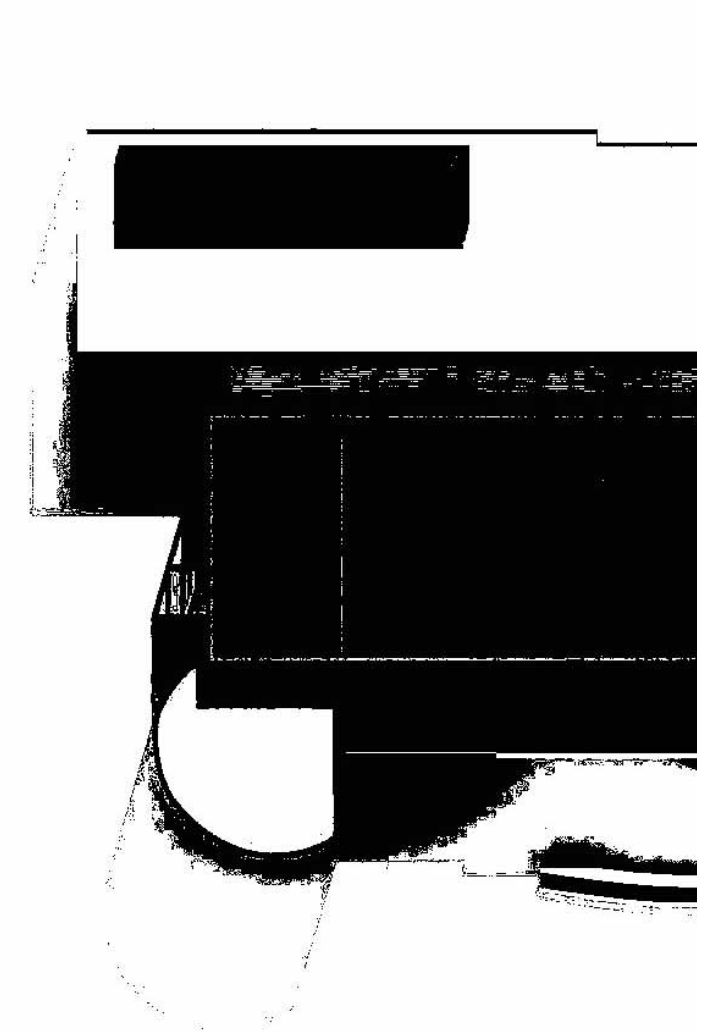
Orientation

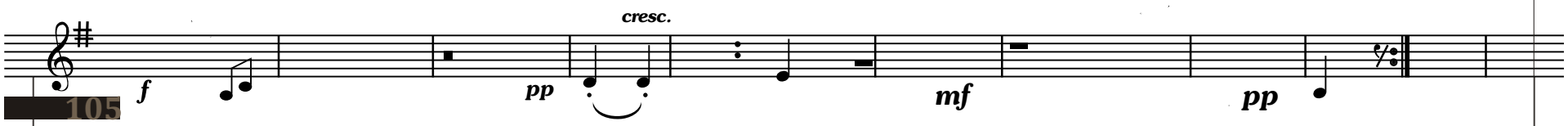
The site is of a rectangular shape that runs along an east-west axis perpendicular to Paul Kruger Street minimizing western facades and maximizing northern facades. The east-west axis is of utmost importance as it forms part of a proposed activity spine starting in the city block west of the site and ending at the main entrance of the proposed art museum to the east of the site.

The massing of the proposed project is broken up along the east-west axis making the use of passive systems more achievable. Public and private spaces are arranged in such a way that all the public activities are able to spill out onto the public square and public areas of the proposed tram station and along the south facades of the proposed project.

Ventilation

All windows are able to be manually opened and closed to control the comfort of interior spaces as required by the occupant. Openings along the triple-volume steel structure make provisions for the prevailing winds blowing from a north-east direction during the morning and a north-west direction in the afternoon as well as the venting of rising hot air.





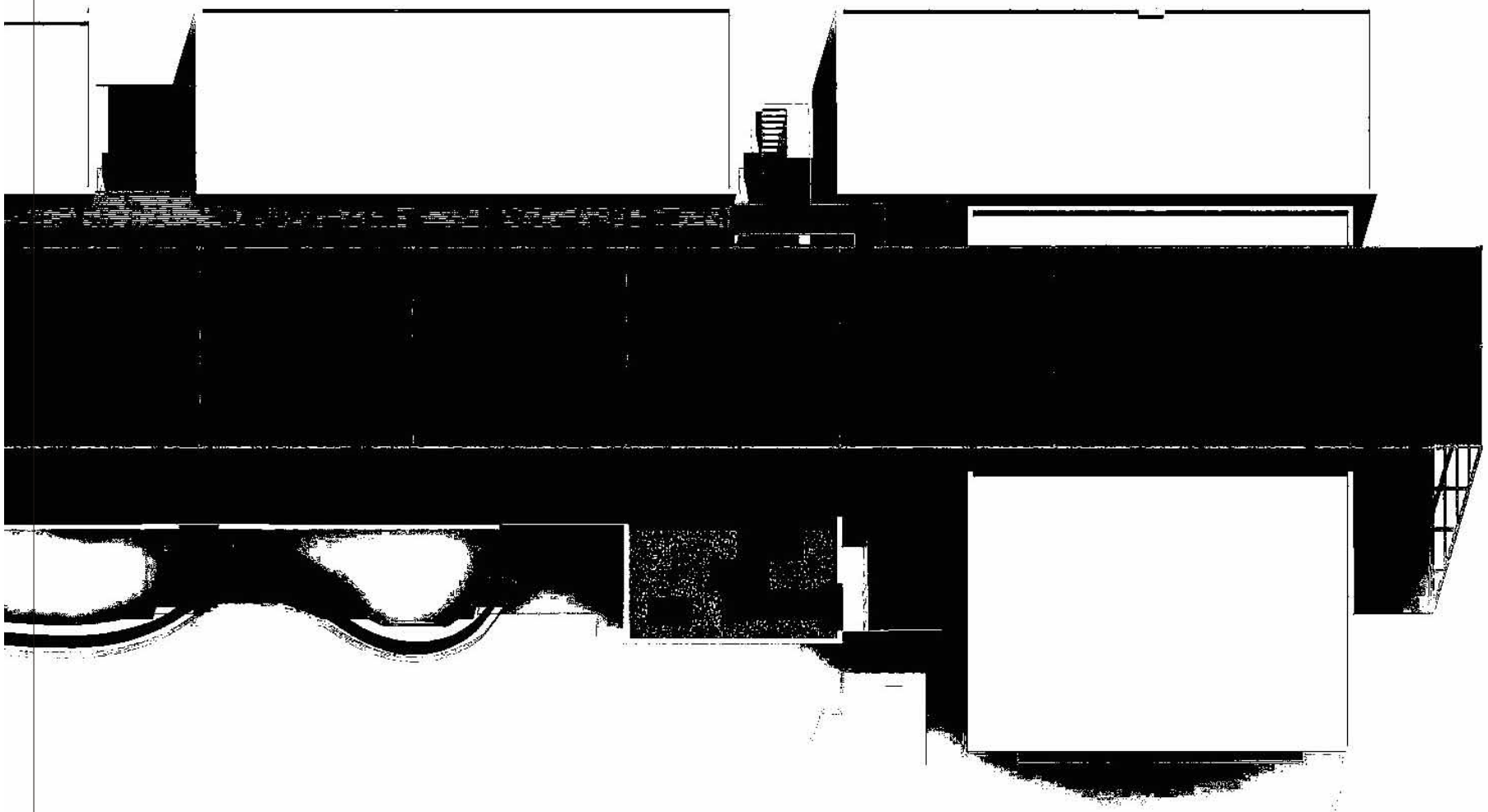
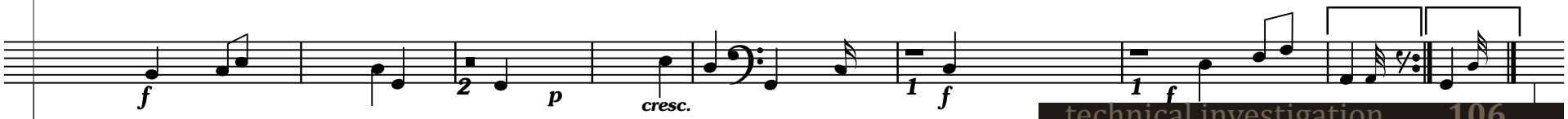


FIG. 7.11 Massing



BRICK

Many of the buildings in the CBD are concrete frame structures with brick infill. Brick is a recyclable and reusable material which is locally manufactured. Brick has a low embodied energy and relatively good thermal mass with good load-bearing and structural properties.

The level of skilled labour required for bricklaying is such that local non specialized labour will be made use of which would as a result empower the local community. The proposed project will make use of bricks as infill in the concrete frame structures. Brick will also be used aesthetically to respond to the CBD brick context and to add to the colour and texture palette of the proposed design.

FIG. 7.12

CONCRETE

Concrete is a robust material that has many different finishes and textures depending on the way it is cast and formed. The quality of the concrete mix could prolong the life expectancy and it is therefore imperative that proper supervision on site is carried out when concrete is poured in-situ. Due to the high density of concrete it has a good thermal mass. Structurally speaking, concrete is able to achieve long spans.

The proposed project will make use of a reinforced concrete column and slab structure. All concrete work will be cast with rough-sawn timber framework shuttering on the exterior and plywood form shuttering on the interior. Colour pigments will be added to the concrete mix to ensure a consistent finish.

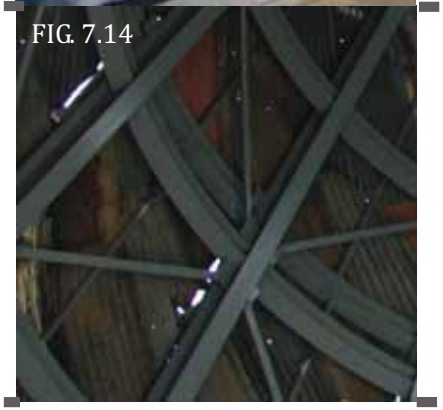
FIG. 7.13

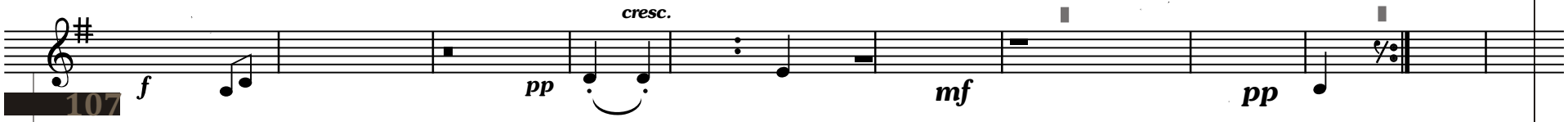
STEEL

Steel is used as a lightweight material in contrast to the robust and permanent nature of concrete. The finish of steelwork is important to further emphasis it's character as a lightweight material.

The proposed project will make use of standard steel profiles which will be assembled on site to avoid any discrepancies between the design proposal and construction team. The use of steel in the proposed project is justified by the fact that steel is recyclable and reusable. Also due to the fact that steel has good structural properties and requires very little maintenance. Therefore if the lifetime of the building expires in the future, the steel members can be removed and reused elsewhere.

FIG. 7.14





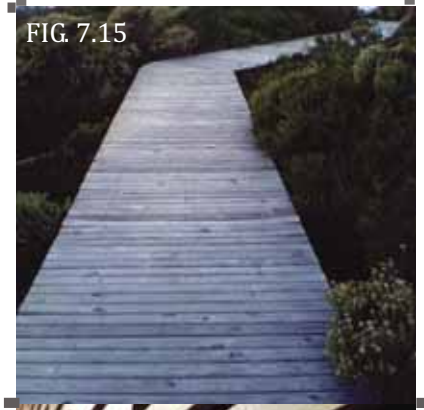


FIG. 7.15

TIMBER

Of the materials considered, timber requires the most maintenance and will be kept to a minimum considering the climatic properties of the Pretoria/Tshwane area. The proposed project will make use of timber indoors thus limiting exposure to the elements. Timber will be used as a flooring material for the pedestrian bridges located within the main steel arcade area providing a contrast to the steel structure and contributing a "warm", lightweight appearance to the particular space. Timber will also be used as a cladding material to improve the acoustic quality of certain spaces.

FIG. 7.16

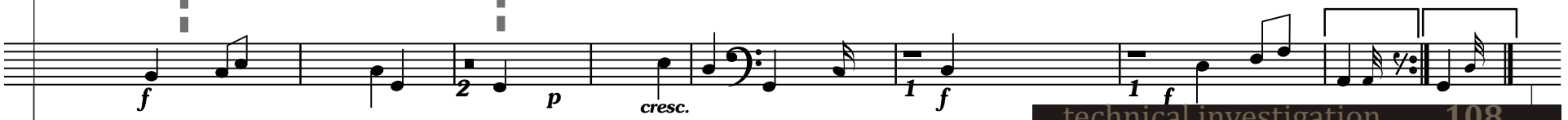
PERFORATED PLYWOOD

Perforated plywood ceiling and wall panels are employed within spaces that require acoustic control such as the auditorium and recording studio. Perforated plywood is also employed within the steel arcade structure providing a contrast to the polished finish of the steelwork.

FIG. 7.17

GLASS

Considering the acoustic properties of glass, it will be used sparingly throughout the proposed project. Glass will be used to create visual links as well as to allow natural light into spaces. Currently the northern facades of the building is well shaded due to neighbouring buildings and so shading devices is not required to eliminate the buildup of heat gain.



Screens used in the proposed project consists of perforated copper, stainless steel mesh and woven steel screens.

Perforated copper screens is used as shading devices in eastern and western facades. The perforations of the copper screens will be weld-cut on site and will allow for variations in the predetermined design of the screens. Copper can be joined by welding, brazing or soldering. Copper is also recycled relatively easily and 40% of all production is from recycled materials. (Lotz; 2006)

Stainless steel mesh is used to clad the music market arcade along the northern and southern facades. This allows for visual access both in and out of the space but with enough opacity to define inside and outside as well as reveal the silhouettes of the building's inhabitants. The reverberation time of stainless steel mesh also best represents the environment that a street musician is accustomed to.

Woven steel screens is used as means of concealing service doors and ducts. Due to the transparent nature of woven steel, service ducts and all plumbing pipes will be painted black to avoid unwanted visual

PERFORATED COPPER

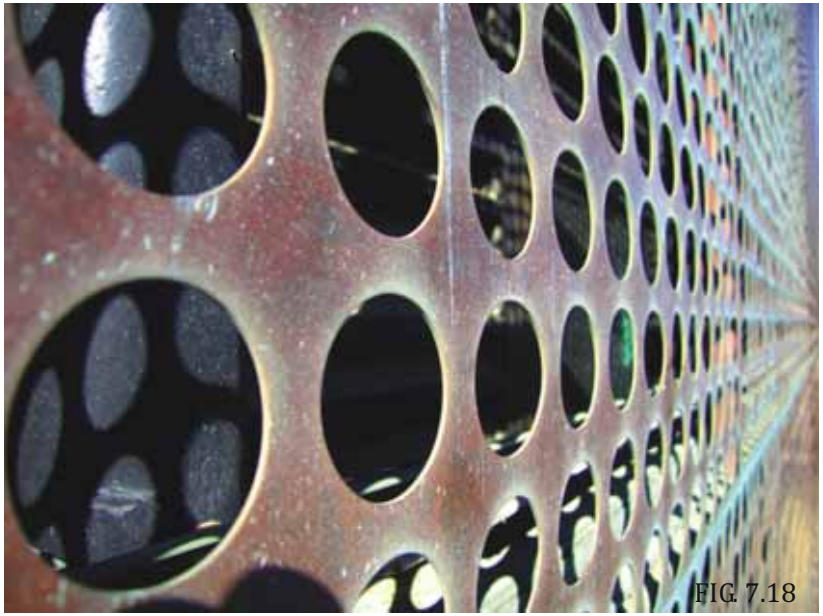
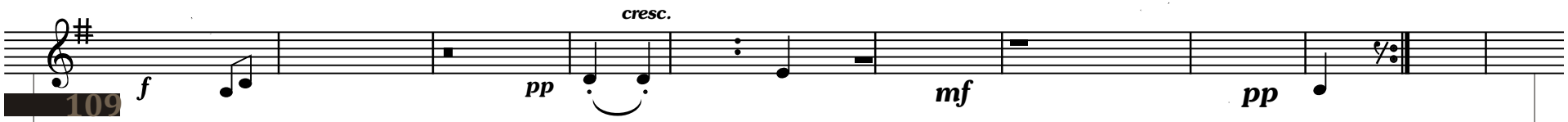


FIG. 7.18

WOVEN STEEL

FIG. 7.19



LESS STEEL MESH

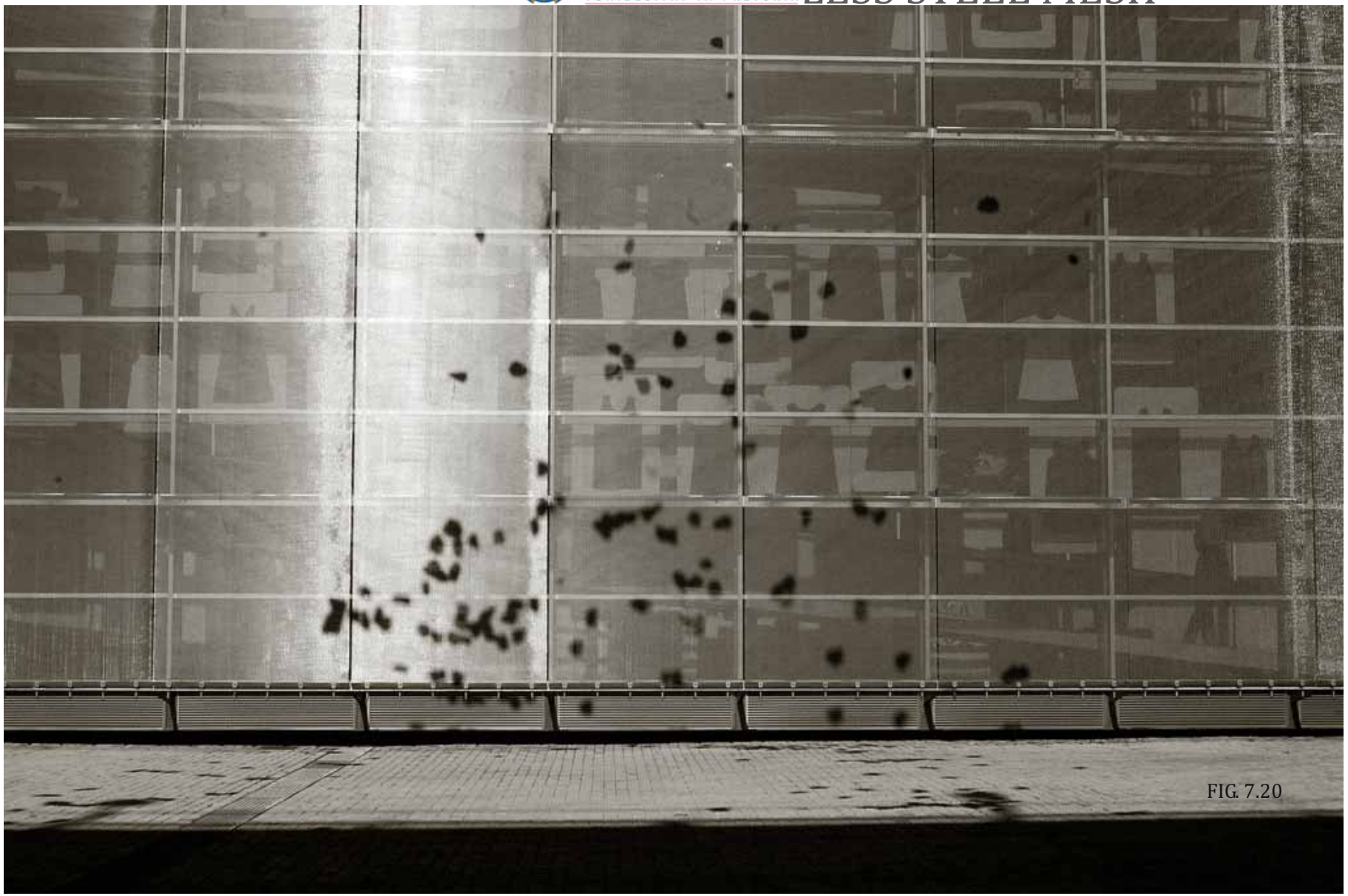
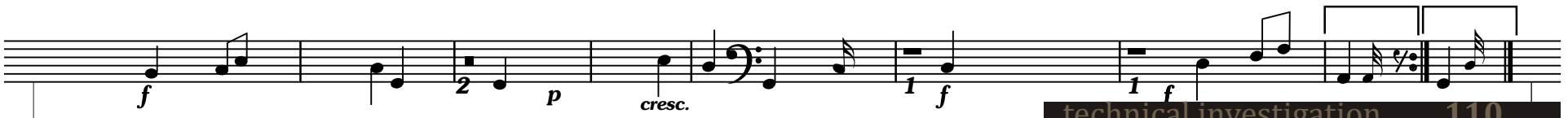


FIG. 7.20



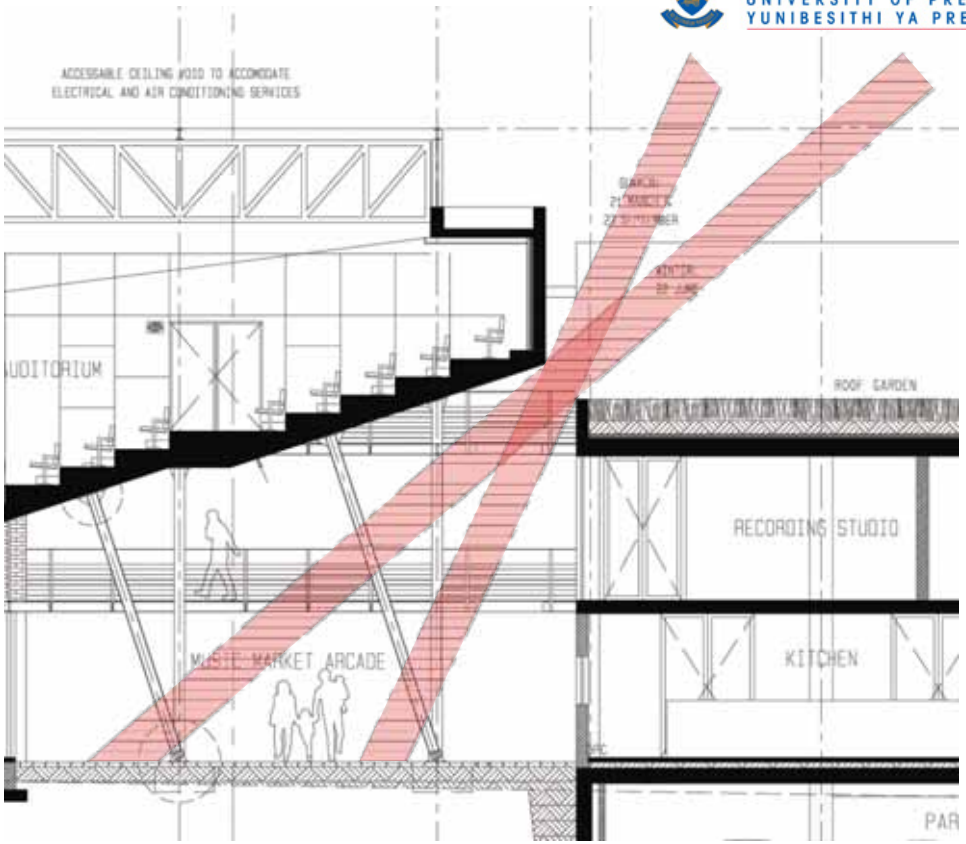


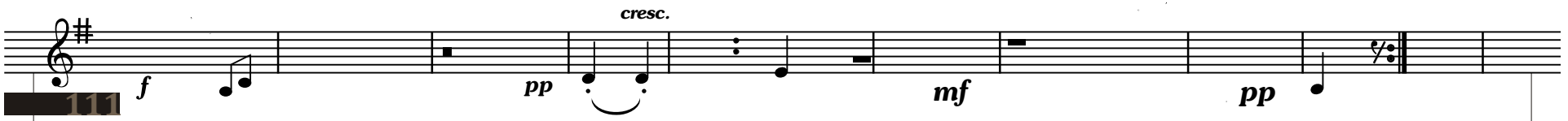
FIG. 7.21 Sun angles

SOLAR CONTROL AND LIGHTING REQUIREMENTS

The northern orientation of the building allows for maximum day-lighting potential. The offices, library and retail stores are located along the northern façade to ensure sufficient day-lighting. Skylights are also utilized in the offices to further enhance day-lighting.

There are no glazed openings along the western and eastern elevations eliminating a build-up of unwanted solar radiation into the building. The southern façade opened up towards the public square and makes full use of southern light.

Expanded metal screens along the triple-volume steel structure prevent direct solar radiation into the music/market area, particularly on the western façade.



Due to the semi-pedestrianisation of Paul Kruger Street, vehicle traffic will be greatly reduced resulting in the lowering of noise pollution. Overall sound insulation is improved as the massing of proposed project is broken up, eliminating the possibility of overlapping noise pollution between spaces.

Although the acoustic environment of the music/market area is fairly open such as the environment typically encountered by a street musician, provisions have been made through wooden panels, wooden pedestrian bridges and hanging ceilings forming part of the triple-volume steel structure.
The auditorium is a reinforced concrete box consisting of 230mm thick walls, 170mm roof slab and a 340mm racked seat floor slab. There are no parallel walls within the auditorium to eliminate standing waves. Perforated plywood panels are fixed to a mild steel frame leaving a 130m cavity between concrete wall and panel for rockwool insulation material. The main access point to the auditorium consists of two double wooden doors with a cavity between them.

The recording studio is situated north of the auditorium. It consists of three spaces namely the live room, control room and vocals booth. None of the walls within the recording studio is parallel to one another to eliminate standing waves. The construction of the walls consists of 510mm brickwork with a 50mm cavity filled with insulating material. A raised 32mm tongue in groove timber floor is supported on 94 x 44mm timber battens to eliminate structural noise. All glazed opening are double glazed not parallel to one another. Access to the recording studio is via hollow core timber double doors.

The practice rooms are located along the southern elevation of the proposed project. The massing of the practice rooms consists of 230mm reinforced concrete walls and 340mm roof slabs. There are no parallel walls in the practice rooms to eliminate standing waves. Perforated plywood panels are fixed to a mild steel frame leaving a 130m cavity between concrete wall and panel for rockwool insulation material. Acoustic glass (45dB sound proof) is employed to the northern facades of practice rooms to ensure a visual link between general public and musician.

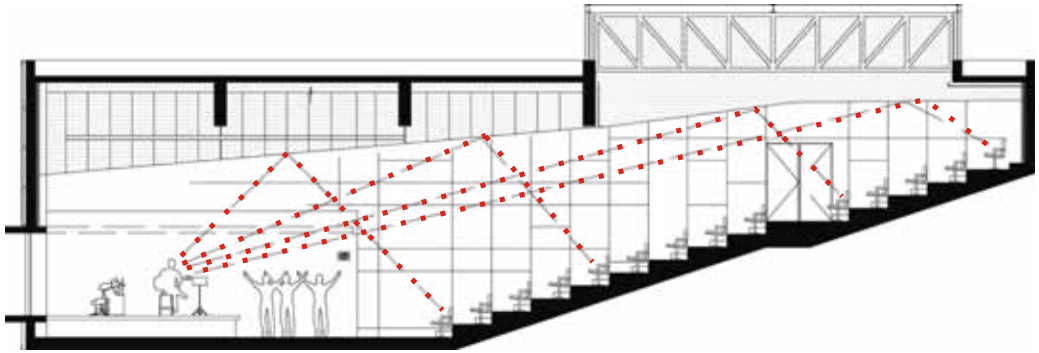
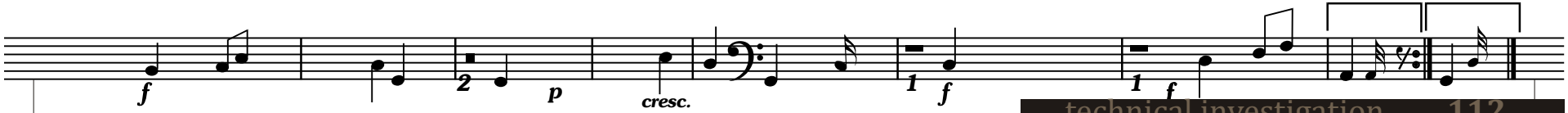
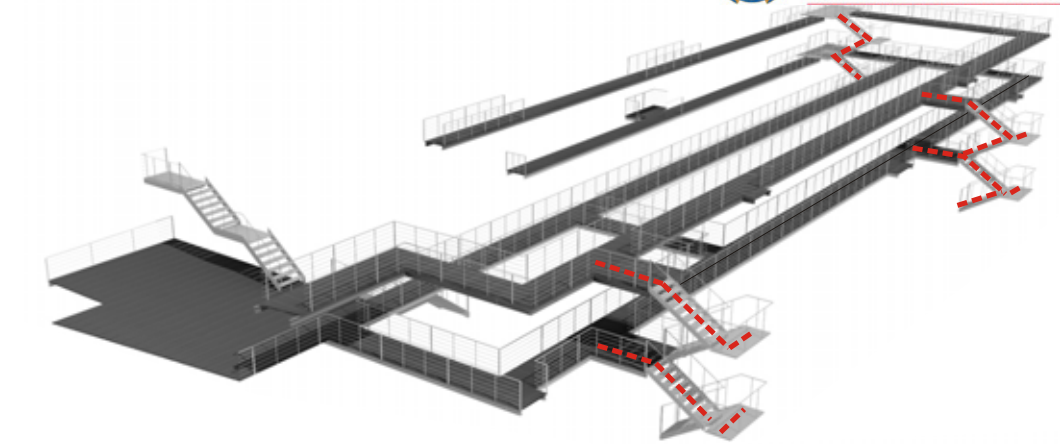


FIG. 7.22 Auditorium





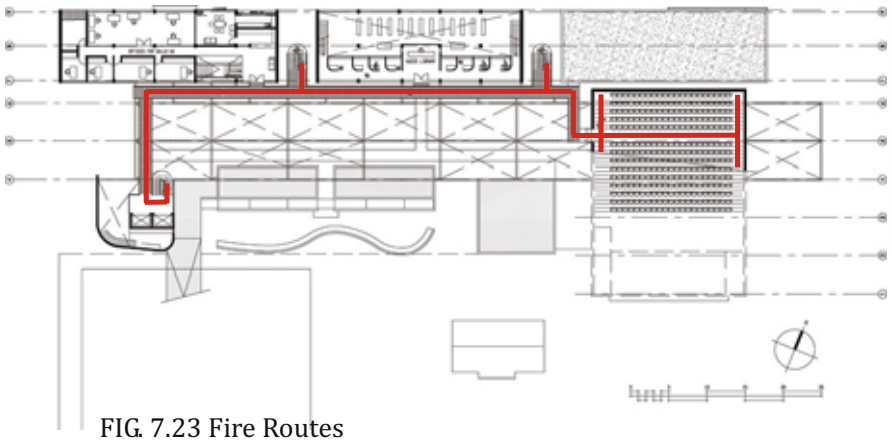


FIG. 7.23 Fire Routes

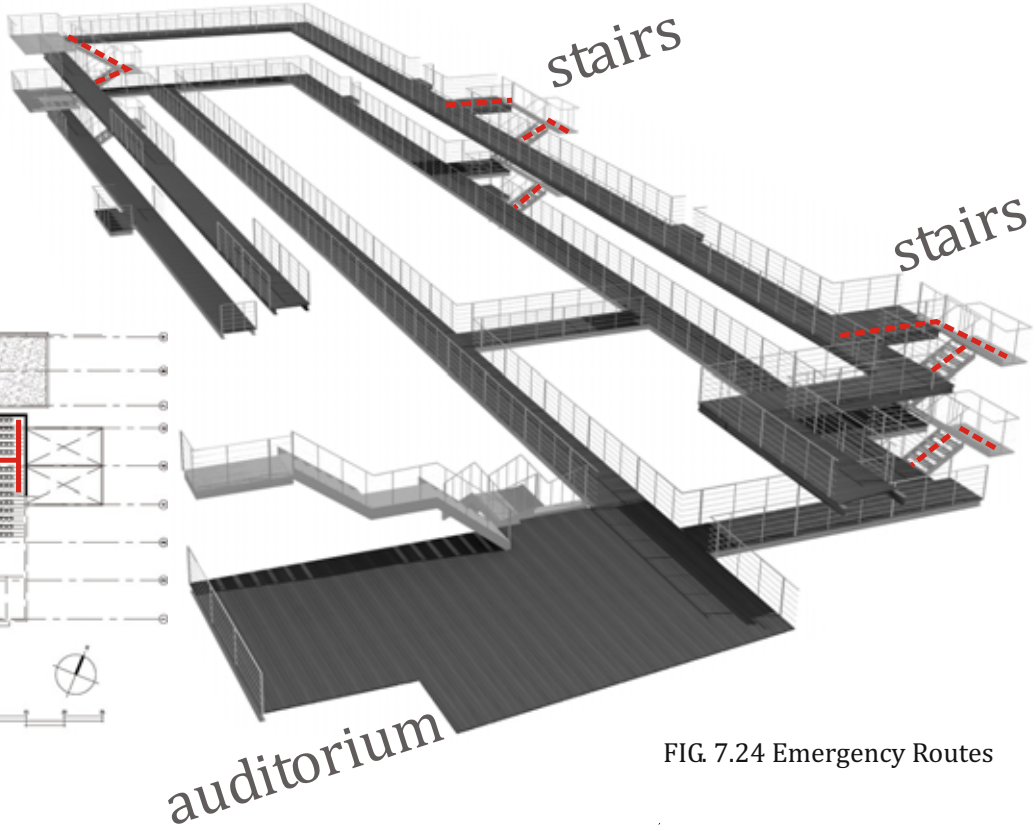
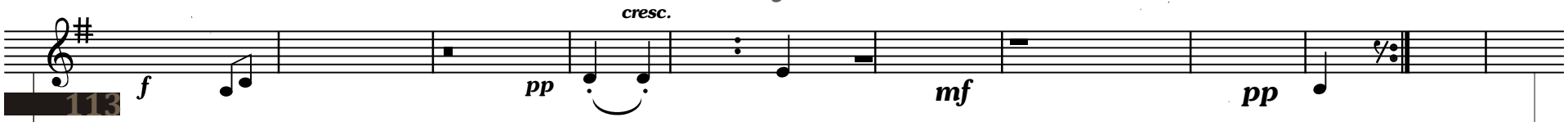


FIG. 7.24 Emergency Routes



FIRE CONTROL

The National Building Regulations stipulates that escape routes should not be further than 45m (SABS 0400 TT 16.2). This is however only applicable to buildings that exceed three storeys. The proposed project is three storeys high and is therefore not required to provide emergency escape routes. However, a conservative approach was taken by locating three vertical circulation areas that can each function as emergency escape routes if need be.

Lifts: TT 54.1 Stipulates that no platform be made of flammable materials such as timber. Also, a fire lobby should be provided.

All the structural steel components of the triple-volume music/market arcade area will be coated with a thin layer of mastic intumescent for fire protection. Concrete has a high fire resistance and requires no treatment. Fire hose reels should be provided for every 500m2 (SABS 0400 TT 34.1) bringing the total to seven hose reels. The NBR further requires that the amount of fire extinguishers be located within the following spaces according to classification: (Table 10 TT 37.4).

Auditorium - A2 - 1 per 200m^2.
Offices - G1 - 1 per 200m^2.
Library - A3 - 1 per 200m^2.
Practice rooms - A3 - 1 per 200m^2.
Recording studio - B3 - 1 per 400m^2.
Restaurant - A1 - 1 per 200m^2.

INCLUSIVE DESIGN

The design philosophy and public nature of the proposed project embraces people of all backgrounds and people with disabilities of any sort are no exception. Therefore people in wheelchairs will have access to any part of the building via two lifts located in the main vertical circulation area and parking basement. Pedestrian bridges are wide enough to accommodate both wheelchair and pedestrian with ample passing distance. The pedestrian bridges floor finish is timber floor boards making it possible for it to be flush with the finished floor levels of the buildings making access to buildings effortless.
The auditorium has a designated area for wheelchair users with no obstructions in view. Ablution facilities are provided on ground floor level as well as first floor level for disabled people and fall well within Section S as stipulated by the National Building Regulations regarding travelling distances. The pedestrian ramp link on third floor level has a maximum gradient of 1:12 with resting platforms every two meters rise.