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*centre for industrial and product design – pretoria, south africa*

By HAROLD PRESCOTT PERKS

Submitted in fulfilment of part of the requirements for the degree of MProf(ARCH) in the faculty of Engineering, the Built Environment and Information Technology, University of Pretoria, Pretoria, South Africa.

Mentor: Professor H.W. Wegelin

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The theme of this design discourse is to establish a centre for industrial and product design in Pretoria, by making use of an under-utilised site in the south western quadrant of Pretoria's CBD. This attempts to add to the urban domain and renewal of the specified area in the city.

Industrial and product design is currently being supported by government and the Council for Scientific and Industrial Research. Plans to extend the current training facilities are in place and Pretoria will need such a centre in the near future. This centre is created with traders in mind that have limited funds. The centre caters for individuals who wish to learn about design and manufacture through short courses that are offered at the facility. In addition, an official under-graduate programme is offered as well as postgraduate courses.

The centre forms part of the Museum Park precinct and contributes to the existing art and cultural activities that are part of the precinct.

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building conception

**Client:**

The client is the South African government in collaboration with the Council for Scientific and Industrial Research (CSIR).

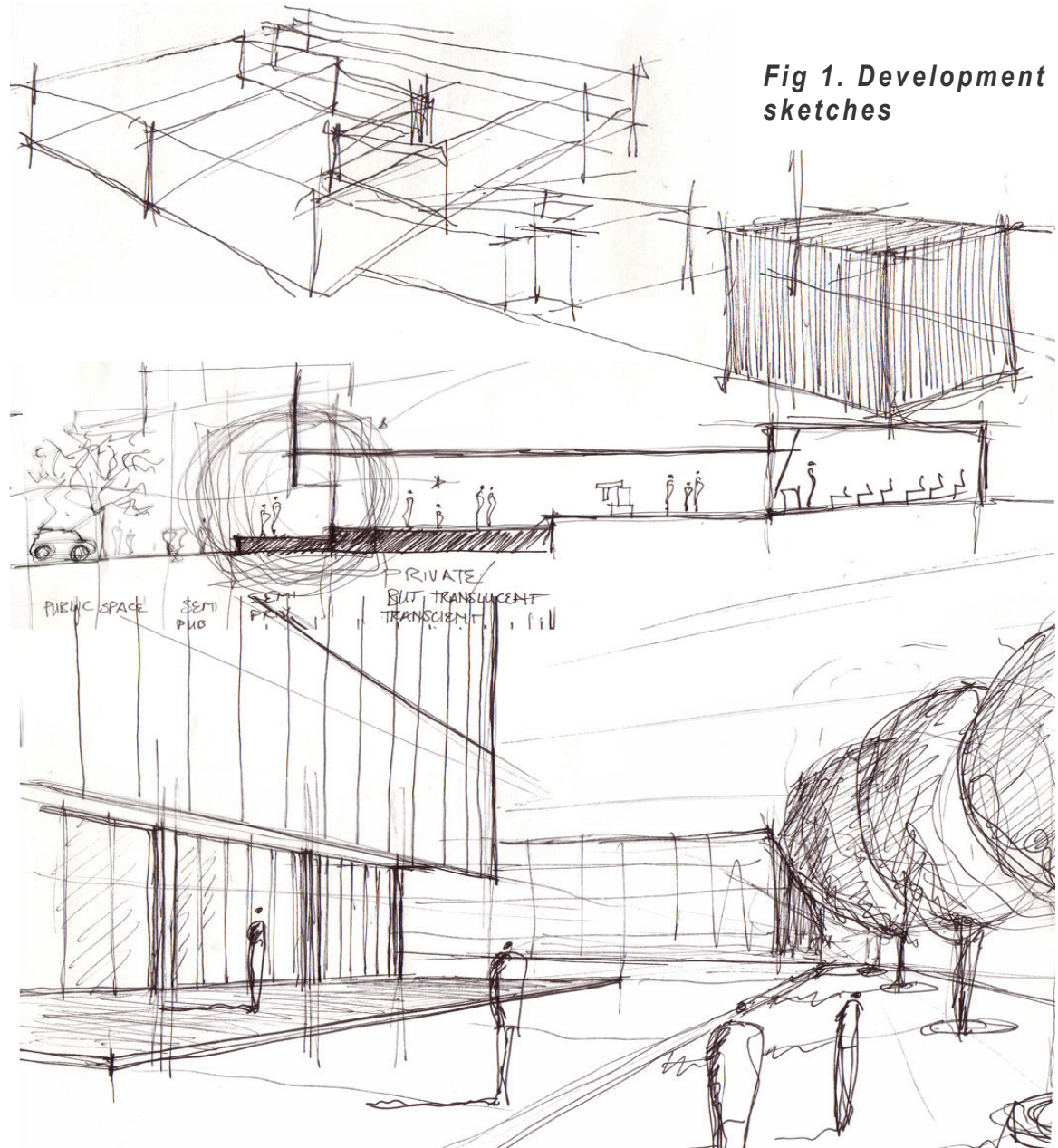
**Building:**

The building under investigation is a proposed design for a **centre for industrial design** for Pretoria.

Intentions for the building is to create a school of design that becomes a centre where professionals and the public can be invited to actively participate in a designer environment that benefits the quality of local product and industrial design.

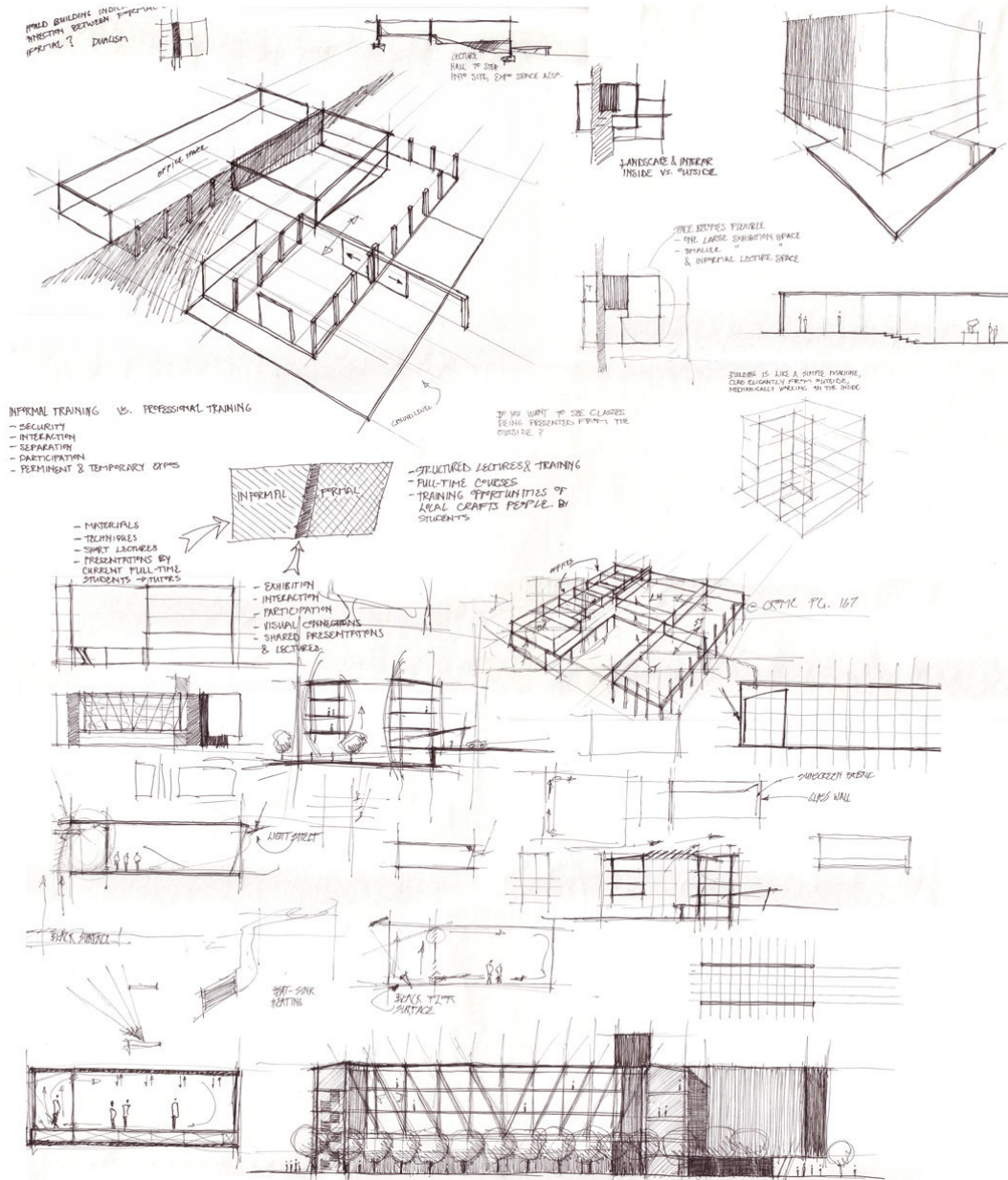
Spaces are intended to be used for the design school primarily, but certain spaces are designated for training workshops for non-permanent learners that attend short design courses. Other spaces can be rented by design professionals or firms for their own private business requirements. There is a commercial component and a restaurant space required by the client.

In addition, open green spaces are required for relaxation purposes.



**Fig 1. Development sketches**

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**Design school for permanent undergraduate students:**

Design studio for 300 permanent students:

- 5m<sup>2</sup> per student = 1500m<sup>2</sup>
- Space for 1 A1 drawing board and one lockable cupboard and desk

Workshop and machine shop  
750m<sup>2</sup>

Library space

1.15m<sup>2</sup> per student = 345m<sup>2</sup>

Lecture spaces = 450m<sup>2</sup>

Staff office space = 800m<sup>2</sup>

**Design centre spaces for training workshops:**

Training workshop space / seminar spaces  
1000m<sup>2</sup>

**Entrance foyer and reception**  
200m<sup>2</sup>

**Administrative office space**  
300m<sup>2</sup>

**Lecture spaces**  
1000m<sup>2</sup>

**Auditoriums**  
750m<sup>2</sup>

**Canteen area and restaurant space**  
300m<sup>2</sup>

**Service spaces:**

- Toilets and showers
- Kitchens
- 500m<sup>2</sup>

**Rentable offices for professional designers**

1000m<sup>2</sup>

**Rentable commercial space**

700m<sup>2</sup>

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**Parking bays (150)**

**Residential units**

500m<sup>2</sup>

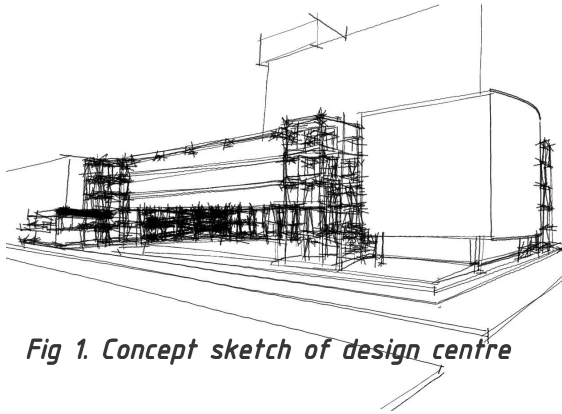
The building is to be no larger than 10,500m<sup>2</sup> and is to portray an industrial design language in its composition and aesthetics.

The centre houses 300 full-time students and must provide space for 150 part-time students per day in spaces other than the designated design studios. Thus, spaces for workshops and seminars are required.

Being in the Museum Park precinct allows the building to boast a display of product designs of the past. Contemporary exhibitions are to be housed within the building. In order to accommodate these aspects, the building needs circulation and display area, these spaces can be combined. An outdoor floor is also required for exhibitions and launches.

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## Introduction:



*Fig 1. Concept sketch of design centre*

### Aim:

The idea is not to simply create another industrial design school 50km from a well-established existing one. The design school shifts the focus from “industrial mass produced product development” as found in developed countries to product design indigenous to the South African context.

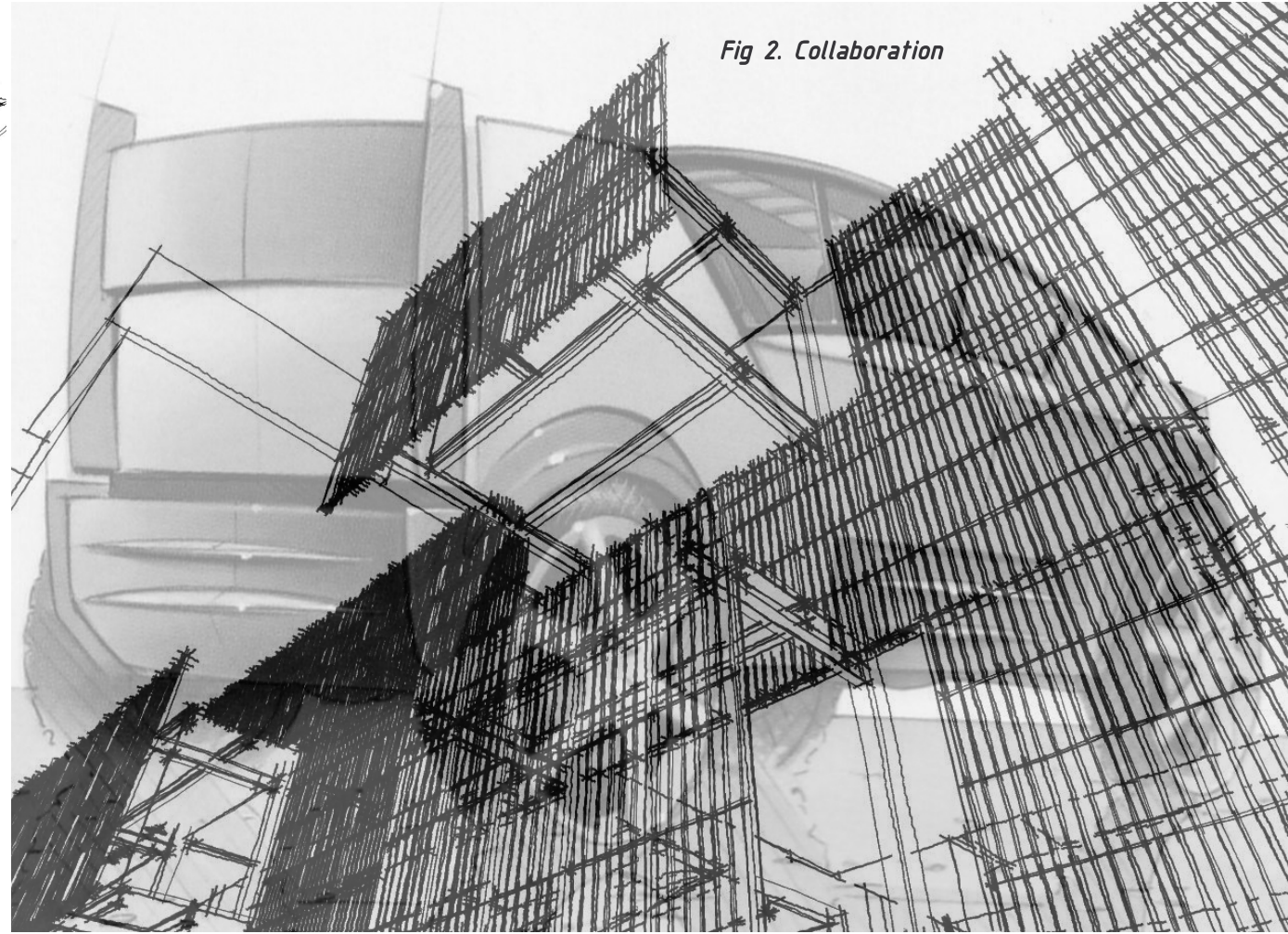
Pretoria is currently deprived of a designated institution of higher learning that is dedicated to the development of young talent in product development. The closest institution offering training in this type of design is the Wits Technikon in Johannesburg – school of industrial design. The other institution in the country is in

Cape Town. With the introduction of a facility of this nature, new talent may emerge thereby encouraging further development in design.

The development of a design school in Pretoria forms part of the Council for

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Scientific and Industrial Research’s (CSIR) development strategy to put in place fourteen design schools in South Africa that focus on product design and development.



*Fig 2. Collaboration*

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**Definition of objective:**

***Industrial Design: The conception and planning of products for multiple reproduction – is a creative and inventive process concerned with the synthesis of such instrumental factors as engineering, technology, materials and aesthetics into machine producible solutions that balance all user needs and desires within technical and social constraints.***

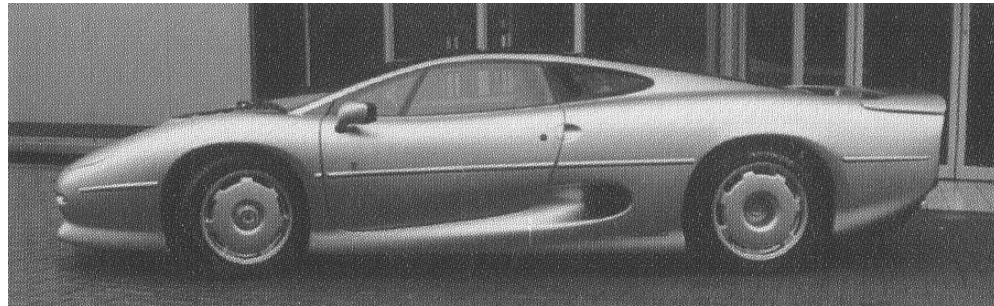
Fiell, 2000. p6.

It is important to understand the current trends and philosophies that are inherent in product development and industrial design respectively; and how these ideas relate to architecture. Ideas that are prominent in product and car design are of great value in the design and development of new buildings.

There are certain similarities that car and industrial designers share, paying great attention to specific details in order to make their designs more competitive and acceptable for the end user. Some of these issues need identification and analysis in order to understand how architects can benefit in terms of finer design elements.

Designers share design principles because of the scale of their design discipline. Whether designing a car, a chair or a hi-fi, the designer has a challenge to satisfy the end-user's

senses. Sensory perfection is what one may refer to as the design challenge. Each design is an attempt to improve and beat previous designs and products; designers are constantly battling against competition and have to keep corporate branding in mind as the designs evolve.



***Fig 3. Jaguar XJ220 designed by South African Keith Helfet***

Product development and industrial design share many design ideas. Some of the elements of design that exist in product development are in close association with those found in the realm of car design. Many of these design issues relate to the human user, relating to the five senses. Products on both ends of the scale must be acceptable to touch, sight, smell and in some instances even taste and sound. Designers are constantly challenging the past and lessons that are learned from it.

This paper allows an in depth investigation into designers and their products and how the products move in

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and through the development processes required. The theories and philosophies along with methods are documented to generate an understanding of the intricacies of design outside of architecture. The information and theories researched are compared to current architectural trends and later incorporated into a design to facilitate the development of product designers.

An extract from Perini, 1998 pg63:

*With the Design*

*Machine, BERTONE do not claim they have invented a means of making any type of design project materialise at the wave of a magic wand. The Design Machine is neither a company or a workshop; it is, instead, a system of companies, studios, workshops and technical and human resources, organised to provide everything it takes to design and develop from prototype to production.*

Above is an image of a Jaguar XJ220 designed by South African born industrial designer Keith Helfet. This is an example of what design training can achieve.

**Clients:**

The design school is supported by the CSIR and government. These two bodies in collaboration offer funds to establish schools and institutions for the development of design education.

A design school or design centre for Pretoria is of great importance; the CSIR's "DesignNation" initiative explains this concept well. The CSIR's idea is to upgrade facilities for the education of industrial and product design from where designers can be educated and trained at design schools distributed throughout the country. Fourteen schools are planned for the next 20 years and thus a design school or centre designed for Pretoria is viable and required in the "DesignNation" framework.

Government currently sponsors the Wits Technikon's industrial design school with machinery and tuition. This is important in understanding the government's input in the field of product and industrial design.

Sponsorship for the design school is ongoing in terms of operating after the construction phases.

Starting at school level the CSIR is promoting the understanding and education of people in terms of industrial design. This means that children are educated in design and CAD software to make them aware of the fact that they can have a career in product design in this country. When these children emerge from schools into tertiary education, they are prepared for training in industrial and product design.

Input into schools from the government affords people the opportunity to demand locally manufactured and designed goods because of their knowledge in design taught at school level. This is good for the economy because new markets and companies may emerge in the near future and uplift the current situation of few industrial and product design firms and companies. Government is putting in effort to speed up this process and the CSIR is

proposing that this process may take at least twenty years to have an effect on the local markets. Thus, an input of funding for proposed design schools is part of the proposal from the government and the CSIR.

An extract from the "DesignNation" website concerning Government participation in design education:

*"DesignNation is geared to synchronize with national strategies such as the Advanced Manufacturing Technology Strategy and the Research and Development strategy. It is imperative that these efforts culminate in the legislation of a 'design policy' for South Africa that will pave the way for increased competitiveness in the global market. The DesignNation 'system of design' will dovetail with the national 'system of innovation' to ensure an integrated approach to product development, and the creation of a modern knowledge economy."*

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**Site:**

The site for the proposed design school is located on the southern edge of the Pretoria CBD, directly south of the City Hall, on the corner of Minnaar and Bosman Streets. On the two remaining corners are the fire brigade and the historic ambulance building on the southwestern and northwestern corners respectively.

The site is within walking distance of the Pretoria station and main traffic and pedestrian routes.

Currently the site is owned by Spoornet and is used for undercover parking for the employees of Spoornet. An existing Spoornet building is found on the north-eastern corner of the site.

**Urban design:**

This site falls within the Paul Kruger Street development strategy and therefore has predetermined environmental impacts. Most of the design parameters that are understood from this development framework include constraints in terms of street spaces, façade relationships and proportions relevant to the Museum Park precinct and all the uses related to these factors.

The Museum Park precinct and the City Hall precinct actively informs the design and functions directly related to the site and its spaces.

The site falls within the City Hall precinct, which is discussed along with the Museum Park in the context study.

*Fig 5 Location map of Pretoria, South Africa*

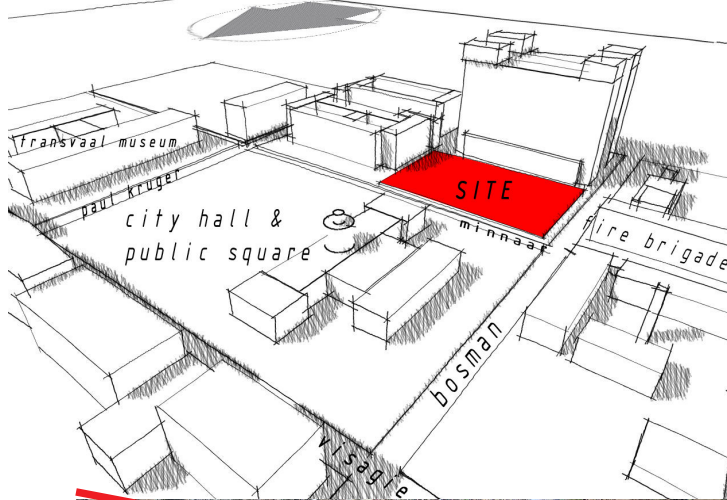


*Fig 4. Location map of the African continent*



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Fig 6. Aerial sketch of City Hall Precinct



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Fig 7. Aerial photo of site context

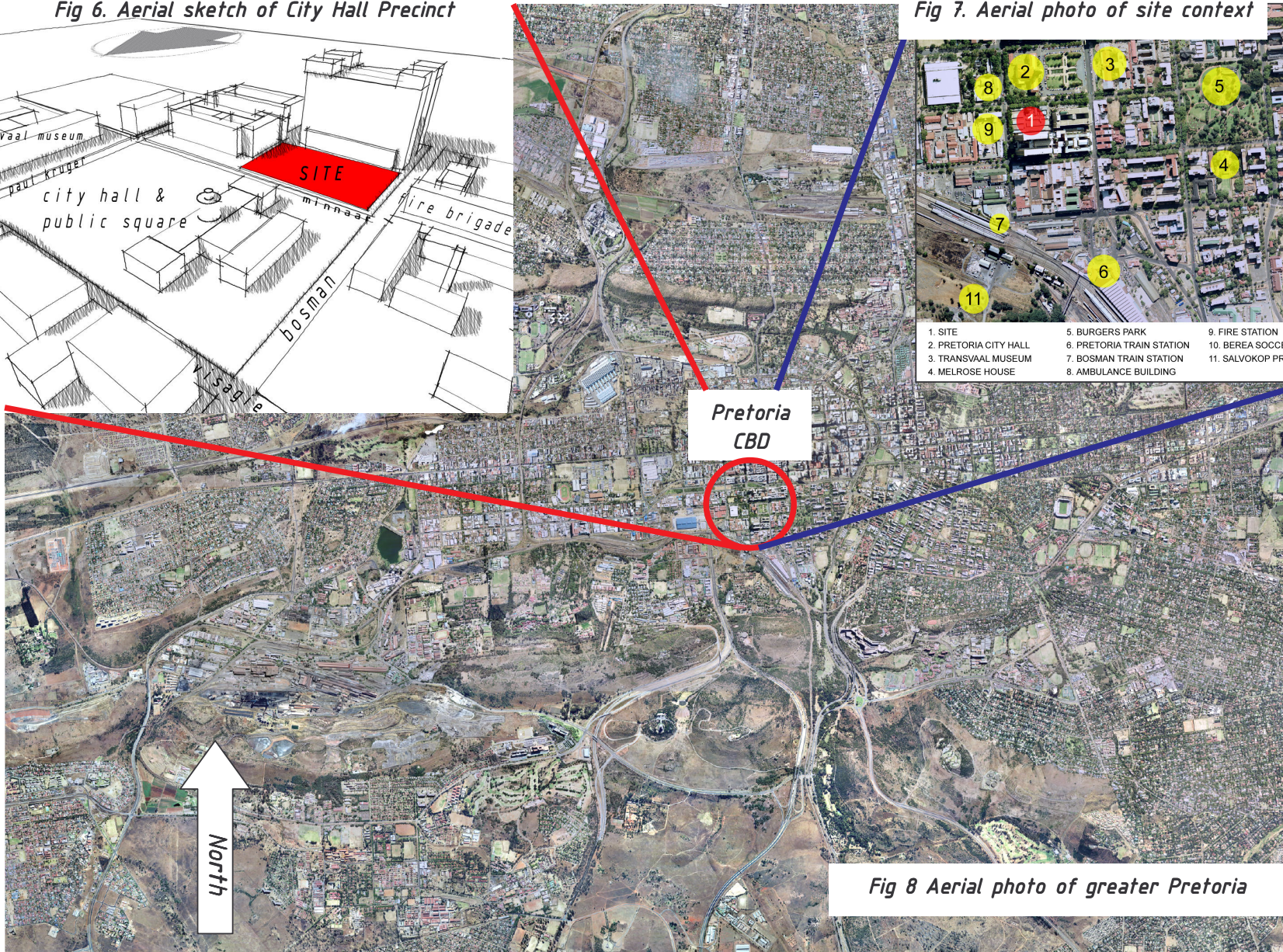
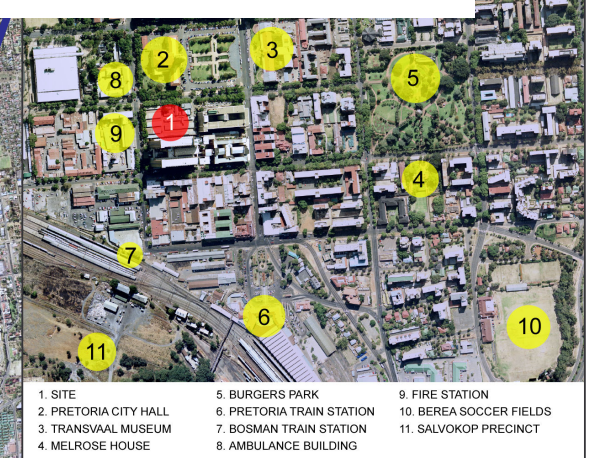


Fig 8 Aerial photo of greater Pretoria

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**Choice for site:**

Having looked at the location of the site and understanding the precinct wherein it belongs lends the site to creating an environment for tertiary type of learning:

- Well established human urban room
- Security provided on the street level
- Pedestrian-friendly
- Safe clean environment
- On the outskirts of the high-energy city CBD
- Within close proximity to housing
- Walking distance to transportation nodes, business infrastructure and retail

One of the main determining factors for choosing this site is security; to create an urban campus environment without the need to enclose the building with security barriers. The precinct is currently patrolled by security guards on foot and this ensures that homeless people and street crime is eradicated from this precinct.

The site belongs to the City Hall precinct and offers a large open square where people can visit and relax. It makes sense to create an urban campus kind of environment here because there are many benefits:

Learners will occupy the site and precinct at different times of the day, therefore making the urban space more

active with their presence. This precinct offers a safe environment in terms of noise and vehicular traffic within the city. Housing options are readily available within walking distance to the site as well as commercial facilities and retail stores. The site offers a heritage component because of the link with the greater Museum Park precinct.

Public transportation facilities are available within walking distance which eliminates the need to have personal transportation. This falls within the Inner-city Spatial Development Framework for Pretoria as the framework asks to eliminate personal transportation as far as possible within the near future.

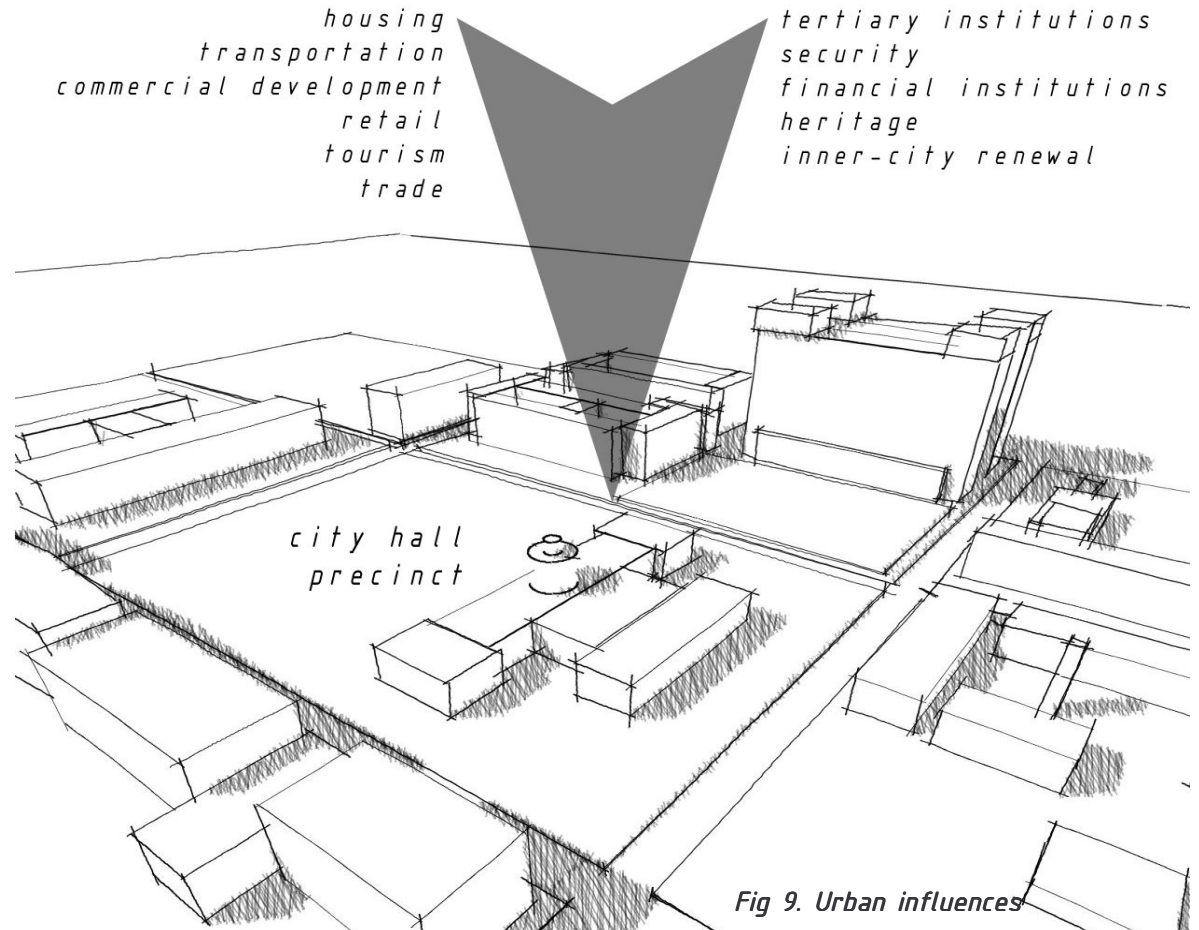


Fig 9. Urban influences

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Creating an urban campus within this precinct may lead to an upliftment of the use of surrounding buildings into uses adapted for other kinds of tertiary learning. This may create a movement back into the city for education facilities and housing (refer to Figure 9).

**Architectural objectives:**

To design a building that functions well in the circumstances that are required for product development needs the understanding of product design. This understanding goes further than the traditional history of such typical school buildings that are currently being used.

A study of the trends and philosophies in product design is undertaken in “Design Approach” to fully understand the functional requirements for such a school of design. The architectural requirement for the building relates to the direct functions undertaken within the school. The building reacts to environmental elements such as landscape, streetscape, urban spaces and rooms, building typologies in the immediate area and elements that are in direct influence of the design school.

**Design theory and development study**

**Product development school:**

Currently there are two industrial schools in South Africa: Wits Technikon and the Cape Technikon. Both were visited in order to complete this investigation.

The two schools have a strong “western” influence and are training students who, with little further studies required, can continue practicing in Europe, America and in the East. Both schools have sophisticated machine shops and these are geared to produce prototypes of outstanding quality. The Wits Technikon has more advanced modern-day machines aimed at rapid prototyping and this helps to keep the school up to date with the latest trends and technologies. This machinery helps train students in how to design products that can be manufactured by specific machines and products that can be mass-produced in factories.

**Learning in an industrial/product design school:**

The following information was gathered from visits to the Cape Technikon School of product design and the Wits school of industrial design:

The first year in the design school focuses on the development of presentations and presentation materials. Students are introduced to graphic materials and how to apply different presentation techniques. Design and art history is also introduced at first year level with design history being the most important. Later in the first year students are taught technical drawings and documentation of prototyping as well as how to work with drawing instruments and the technical specifications of assemblies. Prototyping is introduced and students start experiencing the challenge of designing objects and products.

The second year continues with design and art history and the focus shifts towards design and eventually becomes the main theoretical component of the course. Students are introduced to computer modelling programmes and rendering packages. Visual techniques are explored and the students are taught different modelling and prototyping materials that can be machined along with material properties and their uses. The students are trained to design and build their prototypes and how to make these simple enough for manufacture.

In the third year, the students learn more advanced computer design packages and rendering programmes, at this point design-history is still the main theory component. Prototypes and models become more important and

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presentations are of a professional standard while business orientated lectures are now introduced into the programme to allow students to become focussed on the entrepreneurial side of product design. Students are introduced to real-world problems by interaction with real clients who have association with the institutions.

The fourth and final year in industrial/product design is more entrepreneurial in format. Students are given the freedom to interact with businesses and they are encouraged to design objects as if in a private business situation. Students are given the option of designing objects from the first meeting with the client up to technical documentation and theoretical discourse.

Currently South African students are trained in this way. The focus is on training professionals who are able to produce rapid-prototypes and products of first-world standards. Students are given the tools to enter a global profession; this caters for the design of everyday products in order to make daily living easier and more comfortable.

**Design aim: not merely another design school.**

To design a school of product design that is only 50km away from an existing industrial design school does not make

much sense, especially as the market for industrial and product designers in South Africa is relatively small. There is a need to focus on the local product and craft markets. The problem is that local crafts people need to be trained to improve the quality of their products.

The Technikon of Cape Town is currently looking at starting a workshop during Technikon breaks to aid the local people with their crafts. Cape Town is a hive of tourist activity and craft markets are popular in and around the city.

The objective is to provide a school that not only offers training in industrial design but also helps in the development of fine art such as crafts and traditional artefacts manufactured by local people and bought by the public and tourists. The school will offer artists the opportunity to come in and better the quality of their products by introducing them to new materials and techniques of manufacture. At the same time, offering them the choice of further studies in industrial and product design. When an individual comes into an environment of further training, the person should be informed of other possibilities beyond their current situation through the institution itself. People who make use of this design facility will be exposed to “western” approaches in the design and manufacture of objects and artefacts.

A design institution offering this level of impact upon local designers influences

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people through other disciplines in design has to respond to the arts and crafts markets that exist in South Africa. The challenge would then be to design a facility that offers short courses in fundamental product improvement as well as an industrial design school that will allow students to further specialise in fields, for example: car, furniture and product design.

Why industrial design training and awareness?

**South Africa:**

The country is relatively new to the field of product and industrial design (this being most notable by the number of institutions offering courses for these practices today.) Currently few professional practices exist in the country and most of them are aimed at producing goods for the medium to high-income group.

Goods that are produced in South Africa are competing with products imported from all over the world and in a few cases are of inferior standard. Many of the products in homes are made in the East while the designs are designed in the United States, Europe or the East. Labour is relatively cost effective in the East and production time is short. People in the west have used this to their advantage and in so doing generate vast quantities of products in the shortest possible time whilst saving on costs.

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South Africa has the capability to produce objects of mass production in limited time, as in the case of vehicle assembly plants scattered over the country. Presently mother-companies such as Toyota and Nissan are using South African assembly plants to generate vehicles for export to South America and into Africa itself.

One of the biggest problems that South Africa has is that of exportation of raw materials. It is understood through interviews conducted at the Cape Technikon, that South Africa mines and exports raw materials and later buys back the material in fabricated forms and profiles at an enormous cost. This is normal practice, although we do manufacture a few products for our own use; unfortunately, South Africa does not have the monopoly in this practice. This is one reason why South Africa is not producing all of its own products and goods.

Another problem is the poor quality of South African products. It is bad enough that we are not producing the goods, but the few that are built are poorly executed, is quite another. This does not imply that all the goods are bad, merely that the more affordable goods are not of a suitable standard. South African designers are often criticised for the high prices of their products, this is because the quality of affordable products is relatively low.

Well-known designers of products in South Africa are producing top quality goods at a high price. Designer furniture in this country is carefully designed and built to last while the cheaper mass-produced equivalent is poorly assembled and is made of low-grade materials.

It is also important to note that a general trend found amongst some of the manufacturers is to become strongly competitive and to avoid partnerships in the product and industrial design sector. Ziggy Strohbach of the Cape Technikon (product design lecturer) explains that companies are 'killing' each other due to the independence of manufacture; people do not want to collaborate and share companies. He also points out that if the companies make alliances and partnerships to create larger firms it would lead to better products due to; less machinery costs, better design and idea sharing and stronger partnerships between manufacturer, suppliers and clients. In this way, companies can grow and become stronger instead of splitting up because of individual greed. Products at an affordable rate will improve the quality and design of goods and larger firms will compete for better manufactured and designed products in general.

It was noted through discussions that each person wants to execute his own design and run his own manufacturing processes, if this is the case, it will lead

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to poor quality products due to the limited capital of small companies.

A training facility to teach people to design good quality products is essential. People currently producing objects locally must be informed on some level of the importance of designing and manufacturing products to a high standard while keeping the objects affordable – this is possible through the collaboration of ideas through larger companies.

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An overview for the development of an industrial design centre for South Africa:

### Global:

Initially the establishment of industrial design schools in South Africa will have a relatively small impact on global economy. An idea that is being investigated at the CSIR is minimising the export of raw materials and increasing production of finished goods in South Africa. This would mean that the country saves costs on certain products that are presently being manufactured in other countries. The result would be that South Africans design and manufacture goods using local materials.

The impact of such a strategy would diminish the import market and improve the export of South African designed products. Presently, South Africa exports raw materials very cheaply but buys back manufactured products, from countries those importing the raw materials, at a hundred times the price of the raw material.

Another impact is the exporting of South African designed goods to international buyers. With the training of design professionals and the upgrading of manufacture, South Africa

could become a strong export country of high quality designed and manufactured goods.

### Local (South Africa):

The above argument defines the vision of product development and industrial design in South Africa over the next 15-20years. The government has shown great interest and strong investment in the education of design, from a scholarly level right through to industry

*baseline document*

– CSIR DesignNation initiative.

DesignNation (CSIR):

- *The upgrading of industrial design schools from 2 to 14*
- *Educating people in design understanding*
- *Introducing CAD education at school level*
- *The integration between Technikon and schools*
- *The full backing of the government*
- *Cooperation between industrial design education and industry*

The intention of the “DesignNation” initiative from the CSIR is to eliminate the necessity of importing products from abroad; these cost a lot more than if the same products were designed and manufactured in South Africa. Beginning at school level, students are made aware of product design. They are sensitised to the concept of ‘quality design and manufacture’. This empowers them as consumers.

Ultimately the goal is to minimise imports and to exploit local talent and industry to its full extent. Benefits to the country are plentiful. With design comes manufacture; the industrial sector will be boosted, along with industry comes job

Fig 1. DesignNation website page

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creation and more specialist requirements. This is more sustainable as there will be competition locally and greater collaboration between the public and private sectors.

Government is currently funding industrial design; the Wits Technikon receives sponsorship from government for machinery and development. Fortunately, government is aware of the fact that design is underdeveloped in the country. The CSIR is in constant discussion with government and have their approval to proceed with the development of design education.

*Benefits for schools* [CSIR Manufacturing and Materials Technology]:

- *School CAD centres can be run as a business or as a revenue-generating establishment*
- *Members of the corporate sector or local industry can be trained at school computer centres*
- *Teachers from the school who qualifies as Certified CAD Instructors can teach at other venues anywhere in the country*
- *The CAD centre can process contract drawing work from the Engineering or Architectural industry and have the senior CAD learners produce their first "Industry Standard drawings" whilst still at school*

This excerpt from the CSIR "CAD in schools initiative," illustrates some advantages for schools to implement CAD training. CAD is an important tool for the design field today as many products are finalised and built with the aid of computer models before production. The advantages to schools are similar to the advantages to the design school project. Many courses offered at the design school can be used in other industries.

Currently the success of CAD in schools is very positive. According to the CSIR, 24 schools in Gauteng have been introduced to two-dimensional and three-dimensional CAD training with phenomenal results.

### **Local Economy:**

This section focuses on the building and the direct influence it has on the local economy. To design a building that performs well at a regional level means that the building respects the local economy.

To be relatively economical the building process and the later use of the building must be within environmental restrictions and suitable to the success and use of the building and its programme. Locality of materials, passive climate control, emissions and

*baseline document*

waste production, for instance, must be clearly defined through limitations. Resources and materials are local and accessible within reasonable environmental limitations. Construction contractors are local and labourers in the area benefit from being employed close to their homes.

How the facility benefits the local economy:

- Local people have access to the facility, as there is training available for people off the street
- Training offered to people off the street will improve the quality of their products and so strengthen informal trade in the area
- If the products of local craftspeople are improved, these people can be offered courses in operating small businesses, at the institution
- The school offers courses in entrepreneurial studies to help craftspeople to get their own operations up and running
- The success of the school is not only promoted and determined by formal advertising and invitation, but also through word of mouth by people who have attended a few short courses.
- Local contractors are used to build the building
- Materials and components are of a local source

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- Furniture and fittings are preferably manufactured locally
- Maintenance and repairs are carried out by local contractors

Another component of local economy is the fact that training for a design career starts at school level, as mentioned in the previous section, local schools do benefit from the implementation of CAD in schools.

*Industrial collaboration:*

The local industry is influenced through the development of product and industrial design. Certain key industries and companies within the area may sponsor tuition at the institution in exchange for new design solutions. In this way, industry benefits directly, capital is injected into the school and so furthers the development of design students.

Awareness in design is increased through partnerships created between the design school and industry. This opens a new market in industrial design and promotes the importance of design in industry.

The most important aspect is the fact that through successful partnerships created between industry and design is the realisation that South Africans can design and produce goods for local and international use. Where design and

industry meet in local circumstances, the result can be an increase in the quality and design of products that meet international standards. This creates growth in the South African economy thus improving the import and export of raw and manufactured goods.

With proper interest generated through this school, the role of design increases the demand for quality in products and the improvement of standards. In turn, standards are maintained and raised by the interest and intervention of end users.

*Economic benefit:*

The impact at a later stage is that the import of internationally manufactured goods can be minimised and local design and manufacture could be fully exploited. The design and building of products in South Africa requires a strong industry and readily available materials, whether raw or fabricated.

Raw materials need to be fabricated and processed in close proximity to factories and product development industries. In order for this to happen, new facilities for fabrication, storage space and manufacture are required.

The requirement for facilities of this nature needs labour and skilled

*baseline document*

personnel to operate efficiently. Employment is created and an exceptionally high standard of workmanship is maintained in order to stay competitive at an international level.

The building makes use of a structural system designed for variation in envelope conditions. This means that the building can adapt and change the façade and envelope skin of the building during its life. Benefits arising from this system are that new materials can be regularly fitted and old materials can be replaced and recycled, thus empowering local contractors and manufacturers and ultimately pushes for new innovative designs.

*Social impact:*

As mentioned earlier, the social impact of a design school of this kind influences people from many different backgrounds and disciplines.

The intention of the school is to reach out to every person who is affected by industrial design. This means that everybody can be influenced and educated through design. From people who are directly involved with or at the institution right through to people who may own South African designed products. This is not to say that all products are directly related to the proposed institution, but rather that

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products designed by people who have been trained by such a facility in South Africa, display the qualities of production and design that the institution teaches.

*Benefits:*

Creates an environment where formal and informal training is offered to people who seek training in pure industrial design or simple courses in improving their own product and craft business. Corporate companies aid the institution with funding; hereby learners are afforded an opportunity to work with real problems and the funding companies benefit by receiving new ideas and prototype products in order to improve their brands and image. In this win-win situation, students are introduced to real-world problems and challenges and the companies are strengthened through local talent and ideas. This naturally beneficial association improves the trust in companies by the consumers through using locally trained design professionals.

Local economies can improve and businesses may save money and time through the employing of locally trained designers. Companies strengthen local contractors and manufacturers due to increased demand on locally designed and manufactured objects; consequently, labour demand will increase in the manufacturing sector.

*Community involvement and upliftment:*  
Education through design enables people at street level to become involved in product design and development. In educating certain individuals others can be informed and educated, thus informally, people are made aware of design and the potential it has to improve their trade and financial lifestyles.

**Environmental impact:**

***“Shibui” derives from the specifically Zen-Buddhist concept of expressing spirituality through minimal aesthetic means. A good example of this is the highly rigorous Zen approach to garden design where two stones placed strategically can stand for the whole universe.***

Sparke 1987, p13

The building provides the opportunity to enhance and uplift the lives and circumstances of all who are involved either directly or indirectly with the design school. Not only can the people themselves benefit, but the precinct itself can also be uplifted. By educating the participants within the precinct, environmental awareness and responsibility is achieved. The building is designed in order to become an example for users and participants to understand how an urban building addresses environmental concerns.

The following are a few examples of how the building responds to environmental concerns and constraints:

**Water:**

Water consumption

- Consumption of water is designed for at all levels by introducing components that are specified to minimise water usage and the use from a primary source of water supply. Some components are:
- Dual flush water closets that are connected to a grey water supply and aerated showerheads.
- Automatically controlled taps in basins for all toilets and bathrooms from where this water is reintroduced into the grey water system for usage in irrigation or the like.

Plants and Landscape design

- Planting plants with relatively low maintenance that are found indigenous to the area.
- The design of the landscape adheres to the requirements of water saving, soil utilisation and definition of space.

The site slopes down to the north. This means that there is potential for a large loss of water off the site during storms. Utilising appropriate design techniques, the retention and use of this water is

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important for the functioning of the building.

## **Energy:**

### *Consumption*

The requirement for a saving in energy is important. The building has a responsibility in that the saving in energy usage comes from systems used in the building and components.

### *Sources*

Energy primarily sourced from Eskom and the building makes use of alternative sources as listed below:

- Solar heated water panels.
- Solar activated light switches and meters
- Windows are fitted in every space to maximise daylighting and thus minimise the need for artificial lighting

Passive heating systems allow the building to use natural heating and solar gain from the sun. This is maximised because the building is north orientated. The use of mass materials, such as concrete, allows heat gain during the day; the building radiates stored heat during nighttime, especially during winter. A louvre system is employed to minimise solar glare and allow heat into the building. The louvres allow the winter sun into the building to warm the building during

the day and minimises radiation from the sun during hot summer days. This system is important in the functioning of the building in terms of alternative energies; solar energy is renewable and important for the heating and lighting of the building spaces.

The massing and insulation of the building “shell” determines the use of solar heating and lighting. In order to save light energy, spaces that require maximum lighting are found on the southern side, like the studios, offices and training spaces, and those requiring maximum solar heat gain are on the northern façade of the building. Spaces benefiting are the design studios, offices, training spaces and residential units

### *Ventilation systems*

Passive ventilation systems minimise the need for mechanical ventilation. Users can access windows to adjust them according to the comfort of the space. Each space is specifically designed to offer an average temperature of between 20-22 degrees Celsius during occupation. A combination of mechanical ventilation and passive ventilation reduces the consumption of energy.

Specific spaces are designed primarily for mechanical ventilation for example: the design studios, auditorium spaces and the computer laboratories. A fan-coil mechanical system is used for the

building and runs on an ‘economic cycle’ to minimise the waste of energy. The entire building is supplied with chilled water from the air-conditioner chiller-plant placed on the roof of the building.

### *Appliances and fittings*

Appliances are of energy saving type and fittings are similar, thus reducing energy consumption and ensuring the longevity of components such as light fittings. Fittings for the building are predominantly polymer materials such as composite polymers and advanced composites, these materials offer great resistance to wear, they are flexible in design and can be well recycled. Appliances and fittings are also sourced locally and are manufactured from recycled materials or can be recycled after use.

### **Site:**

The site is discussed in “Site Context”; however, the developed site is not defined.

Being a brown-field site the design follows an urban design framework and communicates with neighbouring buildings, spaces and language. To improve the urban environment means that the design addresses problems and challenges related to the precinct and the spaces that exist in isolation from the design school.

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Landscape design reflects the desire to conserve water usage and the ongoing costs of maintenance. Plants used should require virtually no spraying of insecticides or any other artificial inputs.

#### **Economic Factors:**

Not only does the design centre offer educational facilities for students and crafts people, the building informs the precinct and surrounding urban spaces about product design. The building educates participators and passers by about how building design and product design can minimise the use of energy and improve the environment wherein it is found. This building benefits local talent and local contractors right through from design and construction to the education of design; this implies that local contractors are educated in building design, systems and construction.

Local people are employed and trained in building construction and building systems. These people are then skilled in order to improve their knowledge in building and construction. Contractors who have been trained during the construction of the design school can thus train other contractors in their fields thereby strengthening the profession and economy.

The design school trains professionals as well as people on the street such as local crafts people. When crafts people learn to apply what is learned at the design centre their crafts will improve in terms of quality and design.

#### *Local economy:*

A design centre in Pretoria is geared to creating wealth in the design and product sphere. Even though the design centre does not make a direct impression on local economies, the greater impact is distributed amongst professionals and products.

The building process and design is aimed at educating and upgrading local contractors. As mentioned earlier, the process of construction trains locally employed contractors in the processes of the building. In the process of educating these people, they are upgraded in the services that they may offer later in their careers.

Materials and suppliers are sourced locally within a 100km radius. Components are assembled on site and where specific components are difficult to assemble on site due to circumstances, the components are completed at the local workshops of contractors or suppliers.

The manufacture and supply of furniture and fittings is also sourced locally and made of locally supplied materials.

*baseline document*

These items are sourced with local raw materials and built by local contractors or specialists.

Repair and maintenance of the building and its systems is performed by locally trained specialists and professionals. The initiative to train local people in the construction phases of the building lends itself to the later maintenance and management of the building during the operational phases of the building. This strategy enables people to have understanding and knowledge in the building's systems and therefore afford them employment opportunities after completion of construction.

#### *Efficiency of use:*

Spaces in and around the building are designed to allow maximum usage and minimum wastage. This means that spaces are not monofunctional, but that they are multifunctional. Studio spaces are dedicated for the use of full-time students in the interest of safety. Lecture spaces are used for other functions during the evenings when there is no requirement for lectures for part-time students.

Design firms can utilise the facility during specific times for conferences and meetings with clients. By doing this companies are able to display their input into the school by products designed for them by the students. Clients are given the opportunity to

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*baseline document*

explore the school and its facilities as well as the process of design by the students.

A catering facility is incorporated into the school for meals and refreshments; this company can cater for functions that take place after hours. The catering company can offer business outside of the school, but their primary business is to offer a service to the school and all of the participants.

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Urban context:

*“The building of cities is one of man’s greatest achievements. The form of his city always has been and*

*always will be a pitiless indicator of the state of his civilisation. This form is determined by the multiplicity of decisions made by the people who live in it. In certain circumstances*

*urban study*

*these decisions have interacted to produce a force of such clarity and form that a noble city has been born”*

Bacon, 1978. p13



- |                       |                           |                         |
|-----------------------|---------------------------|-------------------------|
| 1. SITE               | 5. BURGERS PARK           | 9. FIRE STATION         |
| 2. PRETORIA CITY HALL | 6. PRETORIA TRAIN STATION | 10. BEREA SOCCER FIELDS |
| 3. TRANSVAAL MUSEUM   | 7. BOSMAN TRAIN STATION   | 11. SALVOKOP PRECINCT   |
| 4. MELROSE HOUSE      | 8. AMBULANCE BUILDING     | 12. CULTURAL ART MUSEUM |

The urban context wherein the project is found forms part of the Pretoria Inner City Integrated Spatial Development Framework or “ISDF.” Within the framework, a few principle guidelines are introduced and discussed for the further development of the inner city and surrounding urban pockets. These guidelines are addressed and used to inform certain decisions concerning the design school proposal.

The important principles pertaining directly to the project are mentioned as follows:

- Support the development of a spatial structure of urban areas that promote “walkability” – shorter block lengths, finer grain built form, mixed uses, etc.
- Enhance the visual quality of pedestrian networks.
- Create a legible, integrated and accessible public transport system and maximise the opportunities provided by having close access to public transport services.
- Structure the interface between the surrounding land uses and the function of the streets.
- Minimise the impact of various transport and movement modes.

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Fig 1. Aerial view of south-western quadrant of Pretoria CBD

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- Allow for the development of multi-functional land uses.
- Develop places that can be used for a variety of uses and purposes (robustness).
- Enhance and strengthen the existing character of precincts through labelling, theme development and the definition of precinct boundaries.
- Reinforce the inherent differences that distinguish one precinct from another.
- Promote the functioning and aesthetic connection between buildings by combining compatible uses, separating incompatible uses and strengthening the interfaces between precincts.

[ISDF -?]

These are a few principles identified from the ISDF, the basis from which certain design decisions were made using the knowledge and understanding gathered from this development framework.

Throughout the design investigation it is understood that the design of the building is not as important as the design of the spaces that inform the development of a building programme. What is meant is that the understanding of the present urban spaces and form in and around the City-Hall precinct is the driving force for the design of the design school proposal.

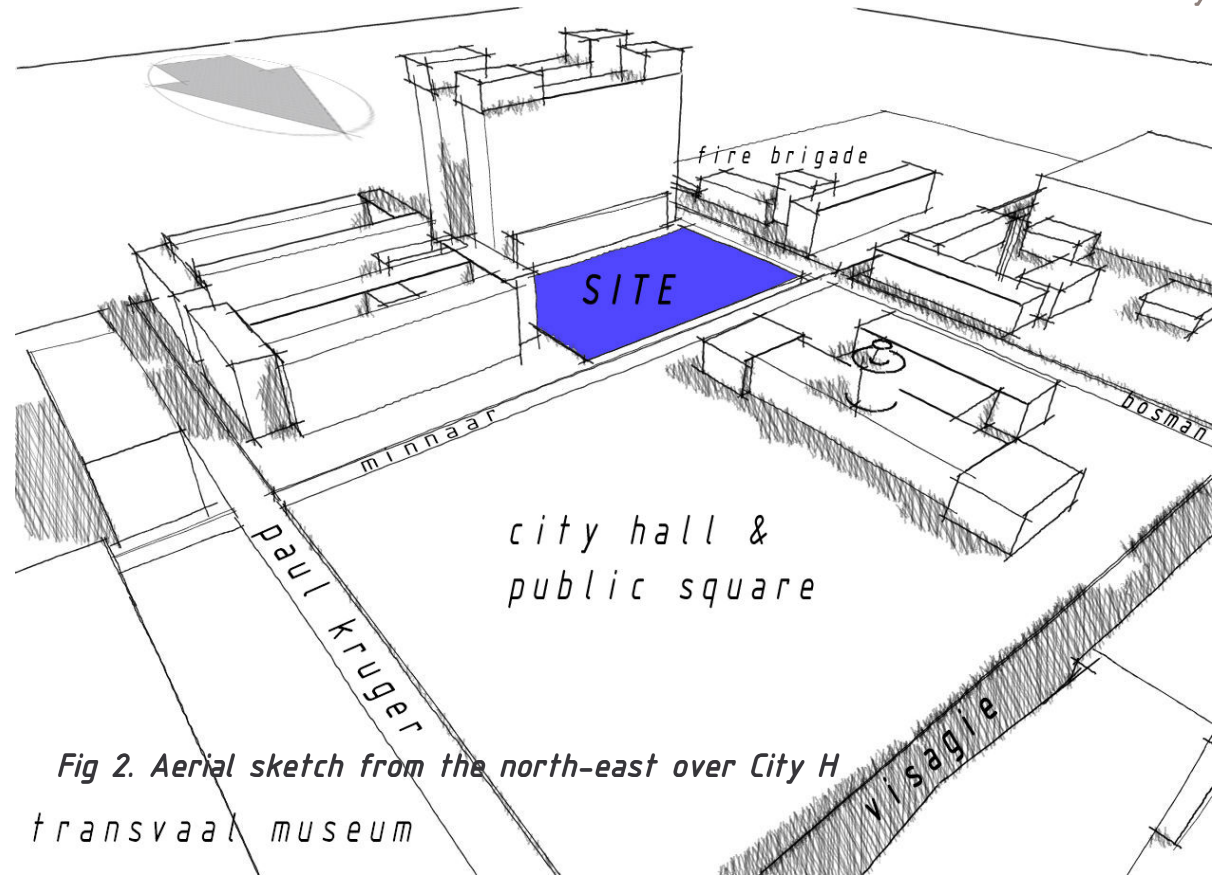


Fig 2. Aerial sketch from the north-east over City H

Several existing factors are of importance to the design of the school:

Firstly, the City Hall is an isolated building on a city block. Very stately, the building is preceded by a formal water feature and this is surrounded neatly kept grass and followed by vehicular parking. The presence of the City Hall is made visible by a boundary of building

facades that line all four sides adjacent to the City Hall building. The proposed site is lacking this very important feature to the City-Hall precinct.

Secondly, the buildings surrounding the precinct are of formality in that they share a prominence in verticality. A study shows that all the buildings have some form of vertical design element on the façade facing the City Hall.

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Thirdly, the City Hall precinct falls in a greater inner city precinct called the “Museum Park Precinct.” This precinct is tourist orientated and has been upgraded and designed to accommodate pedestrian traffic. Landscape furniture and the pedestrian walkways are identified through sameness in design theme; all furniture within this precinct is of the same design and language.

The importance of pedestrian movement is clearly visible through large walkways and pedestrian furniture. Large volumes of people move past the site daily.

Public transport is within walking distance of the site - train, bus and taxi facilities.

Presently people are using the City Hall lawns for relaxation and some individuals are trading informally in the

*urban study*

form of selling of food and photography.

This paper therefore aims to enhance the social architecture of the City Hall precinct by adding specific functions that relate to current activities on the City Hall precinct. The City Hall has a large urban green space in front of the building itself, this space is important to the precinct and therefore it is used to inform spatial development on the lower floors of the design school. The school becomes part of the urban room that extends into the CBD, the space within the precinct is important in the way that people experience the City Hall as well as the “Museum Park”. Socially the space can be divided into three pockets: public, private, and semi-private, and thus participators within the City Hall precinct are informed by the architecture as to what the space offers them.

Urban fabric in this precinct is relatively coarse as the buildings surrounding the City Hall are mainly tall with long continuous facades (refer to Figures 2, 3 & 4). The problem that arises from this grain is the interaction between urban fabric and user in this precinct, except for the Transvaal Museum, everyday pedestrians and users have specific destinations and do not interact directly with the built form that frames the City Hall. This is another reason for introducing a robust space close to the City Hall. A design

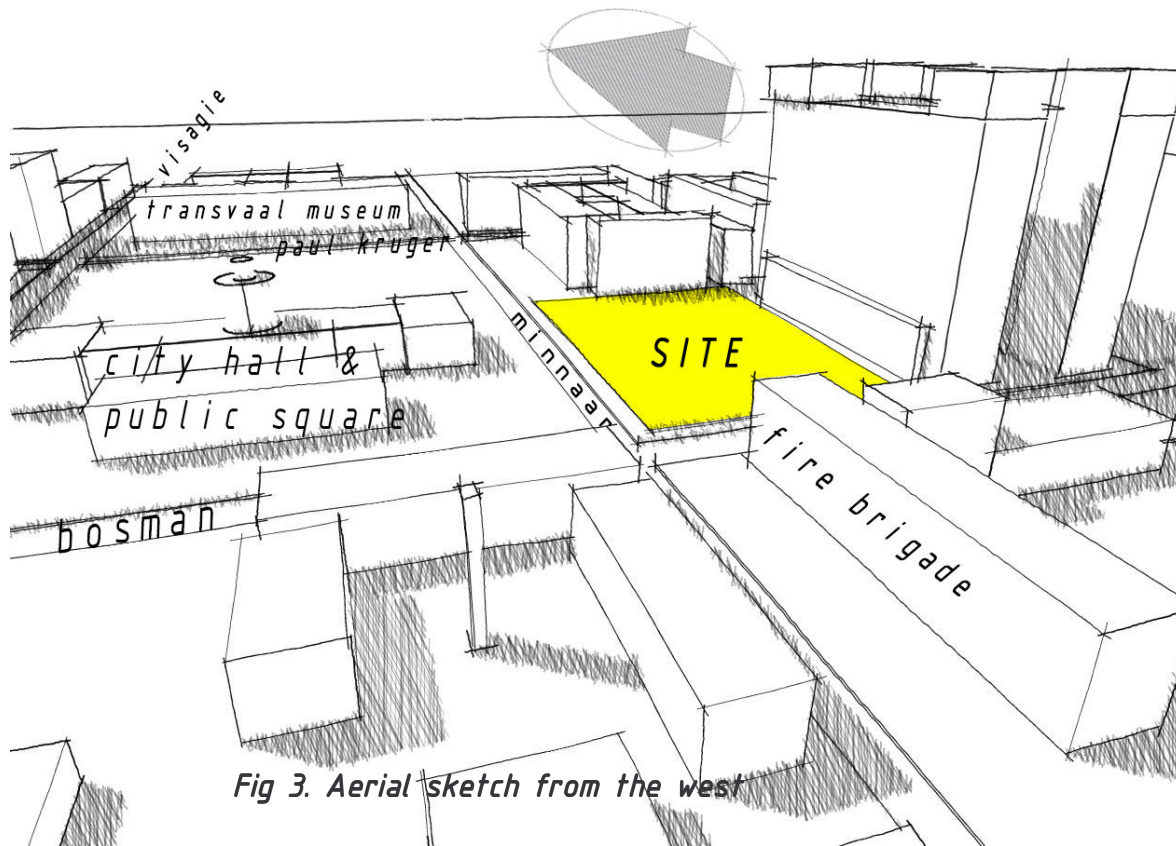


Fig 3. Aerial sketch from the west

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school with multi-functional spaces allows participators within the precinct the opportunity to explore more of this urban room. Focal points are established and the design of this space is articulated to prompt curiosity.

In order to integrate public open space and pedestrian movement, the functions within the building and that of the City Hall precinct are overlapped. A restaurant and sandwich bar spills over the walkway towards the City Hall and the “City Hall boundary” is broken in this way to create a tension between the formal language of the precinct and the informal elements of the design school. An exhibition space also steps out onto the sidewalk and becomes an exterior exhibition space. Both of these ground level spaces serve the public, one serves meals and refreshments the second educates visitors in the process of product design and development. The spatial integration is in response to present circulation past the site. High pedestrian traffic is present both on Minnaar street on the north and Bosman Street to the west, identifying this informs the type of space required to initiate interaction with the design school and the public space outside.

This design school is not merely an isolated institution but is a response to the immediate urban context. The building incorporates the open space in front of the City Hall as an informant

and responds to add use and users to this precinct. In this way, the precinct is more active at different times of the day and promotes passive safety and a greater mix of spaces and use in the area.



Fig 4. Figure-ground and ground-figure study



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**Site context:**

Current situation on the proposed site:

1. Form and Space

The proposed site is defined through existing buildings that neighbour the site to the east and to the south. On the southern side is a 19-storey office building (approximately 66 metres in height) and the building on the east is a seven-storey office block of 25 metres high. Each of these buildings have prominent horizontal facades that frame the proposed site, this is a prominent feature of the site that is important to the development of the building and to the development of spaces that are within and around the design school.

To the west is Bosman Street (refer to fig 1); this one-way road carries heavy traffic during morning and afternoon rush hours. Traffic moving towards the north on Bosman Street is high speed and dangerous for pedestrian usage. Because Bosman Street has four lanes and singular in direction, the road is seen as a strong pedestrian boundary towards the west.

On the northern boundary is Minnaar Street (refer to figure 2), a bi-directional inner-city street that connects all the busy routes entering and exiting the inner city. Minnaar is a relatively

*site context*

slow moving street that is not very busy during the day thus allowing for safe pedestrian movement. The street is narrow, this allows ease of use by pedestrians.

Minnaar and Bosman Streets are lined with large Jacaranda trees on both sides. This adds to the architecture and space of the streets acting as a



*Fig 2. View from site towards City Hall in the north*



*Fig 1. View towards site across Bosman Street from the west*

roof over Minnaar Street and thus enclosing the street from the top and framing it on each side. The trees create two spaces apart from the proposed site: a street room and a pedestrian corridor along the boundaries of buildings.



*Fig 3. View of Minnaar Street and Bosman Street intersection showing fire brigade to the left and the ambulance building to the right*

## 2. Flow of energy

Paul Kruger Street is a very important source of energy as it is a major axis within Pretoria along with Church Street. Paul Kruger provides access into the CBD and connects Church Square and the Pretoria train station, to the south east of the site. The street is always busy during the day and is bi-directional having two lanes southbound and two northbound. Paul Kruger Street is lined with commercial activity at street level providing services for pedestrians and people

moving from the station to the inner city and vice-versa.

Bosman Street is a high-energy street due to a high velocity traffic flow northerly in direction to the inner city, from the Bosman Street station in the south. Pedestrian movement is of high volume past the site particularly during early morning and late afternoon as commuters move to and from the city to the station. Lower down in Bosman Street commercial activity becomes prominent at street level. This function is addressed in the design as

commercial activity is introduced at street level on Bosman Street.

Minnaar Street has a positive flow of pedestrians in a friendly environment. The street has been developed to accommodate pedestrian movement and has features that promote pedestrian usage. This is a useful informant to the design of the design school in the precinct. Minnaar Street terminates in the east at Burgers Park. The park is currently used daily for relaxation and recreation. The park is a 700m walk from the design school along Minnaar Street.

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3. Space

There are a number of spaces accorded to the site directly, namely:

- The garden space in front of the city hall that leads into the entrance of the Transvaal Museum
- Minnaar Street and pedestrian space along both sides of the street
- Across Bosman Street is the fire station and the large open space in front of the garages



- |                       |                           |                         |
|-----------------------|---------------------------|-------------------------|
| 1. SITE               | 5. BURGERS PARK           | 9. FIRE STATION         |
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| 4. MELROSE HOUSE      | 8. AMBULANCE BUILDING     |                         |

**Fig 4. Aerial photo of south-west quadrant of Pretoria CBD**

- Lastly the framed space of the site itself being defined by the tall facades of the neighbouring buildings  
(Refer to figure 4)

These afore mentioned spaces are defined by their relationship to the proposed site, they continuously inform the design process. Important factors of spaces in and around the site are that they are each relative to their uses and participators. Each space has a linkage and this is maintained through the design of the school.

The site is encapsulated by the two tall buildings to the east and south respectively and this creates two walls that define the site as a room within the City Hall precinct. Being walled in by two buildings and a further wall of tree canopies make the space more intimate and separate the site from the rest of the precinct. This fact is addressed through the functions and uses of the building, the building is designed to bring the site space into the precinct and become actively involved with the precinct. The process of activating the site and building is

*site context*

generated through spaces that are used by participators in the precinct as well as by people who are directly involved in the design school. By making the building and all its users interact directly with the rest of the City Hall precinct, an active space can flow through the precinct during any time of the day. This is the biggest challenge for the design school.



**Fig 5. Cooperation building on southern boundary of site**



**Fig 6. Photo of NZASM building on the Eastern boundary of site**

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#### 4. Articulation

Texture, light and shade, colour, form and materials:

The buildings to the east and south are concrete high-rise structures. Each different in their own right, but possessing similarity in articulation: The buildings are of concrete and have windows at each level being evenly spaced. The building to the south has horizontal steel louvers covering the first six levels where after the windows continue as stated above. An element of articulation found on each building is vertical concrete strips between every window; this is repeated on both buildings from the ground floor to the top of the building. Both buildings are coloured in an off-white painted finish. Most noticeable is the lack of interior-exterior exploration on each façade respectively, the fact that there are no balconies or other elements that spill from the interior of each building.

The site is well lit by the sun during the day, but is shaded by the eastern building in the first few hours after sunrise. Presently the site is used as parking for the building to the east (NZASM office building) and has a sand texture with no vegetation. On the northern and western boundaries are large jacaranda trees that line each side of Minnaar and Bosman Streets.



*Fig 7. View of existing Minnaar Street pedestrian landscape*

Minnaar Street has been designed and developed for pedestrian movement (refer to figure 7); usage is currently in good condition and being used responsibly by pedestrians. The northern side of the street has benches and drinking fountains but this is not the case on the southern side, the side directly adjacent to the site. The lighting on Minnaar Street is purpose built for pedestrian movement as at night, it is well lit and it is bright.

Bosman Street is under developed in terms of pedestrian landscaping and does not have lighting as Minnaar Street offers for pedestrians. The western side of Bosman Street, where

*site context*

the fire station is located, is paved and in good condition. The eastern side, directly part of the site, has a concrete walkway that is in bad condition.



*Fig 8. View of Bosman Street on the western boundary of the site*

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site context

5. Surrounding Buildings:



*Fig 9. NZASM building on the east boundary of the site*



*Fig 11. View from gardens at City Hall towards site in the south west*



*Fig 10. Cooperation building to the south of the site*



*Fig 12. View down Minnaar Street towards East with City Hall on the left*



*Fig 13. View of fire brigade to the west of the site across Bosman Street*

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6. Conclusion:

With information gathered at site level and all influences related directly to the site and its immediate environment, the design is informed of all influencing factors and present participators. Herewith informed decisions are made and a successful study is achieved at the completion of the project.

On reflection, the operation of the building can be taken back to these few factors made mention of above and the appropriateness of certain design ideas can be made. Apart from the well defined and used City Hall precinct, the influence of an urban school is made prevalent of through this dissertation.

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**Design precedents:**

Precedents selected are informant to the process of designing a centre that reacts to a visual quality that can appropriately form part of the Museum Park and City Hall precinct. The chosen precedents are then subjectively chosen for visual qualities.

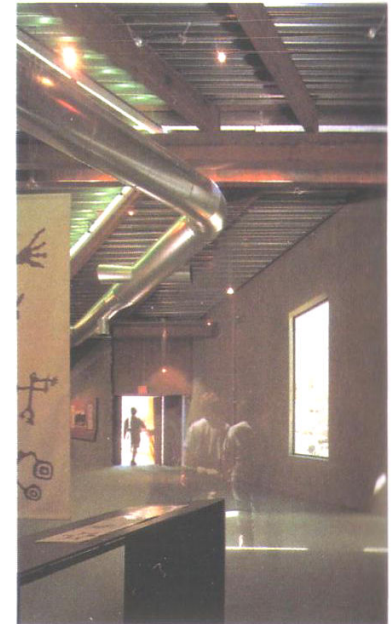
***Museum of Rock Art, Arizona USA. 1995 – William Bruder:***

This building reacts immediately to the surrounding context, being located at the entrance from the parking lot, leading visitors into the museum and then out into the mountain where the engravings are. Natural colours create a respectful reaction to the environment.

A cue taken from this design was the exposure of materials and services in the building. Air-conditioner ducts are exposed and the underside of the roof structure is visible. This idea is useful in a centre where the architecture should educate visitors and users about how the building is constructed as a working product.

In the museum, exhibition spaces and circulation is combined as in the illustrations. One of the requirements for the design centre is to combine exhibition and circulation spaces.

*design precedents*



*Fig 1. Museum of Rock Art, Arizona USA*

006

**Department of Geosciences,  
University of Aveiro. Portugal 1991 –  
Eduardo Souto de Moura:**

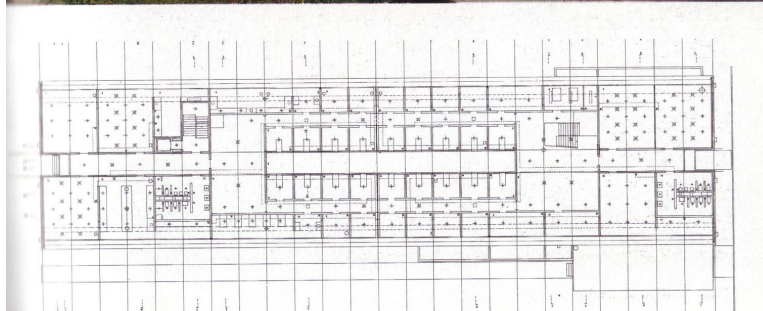
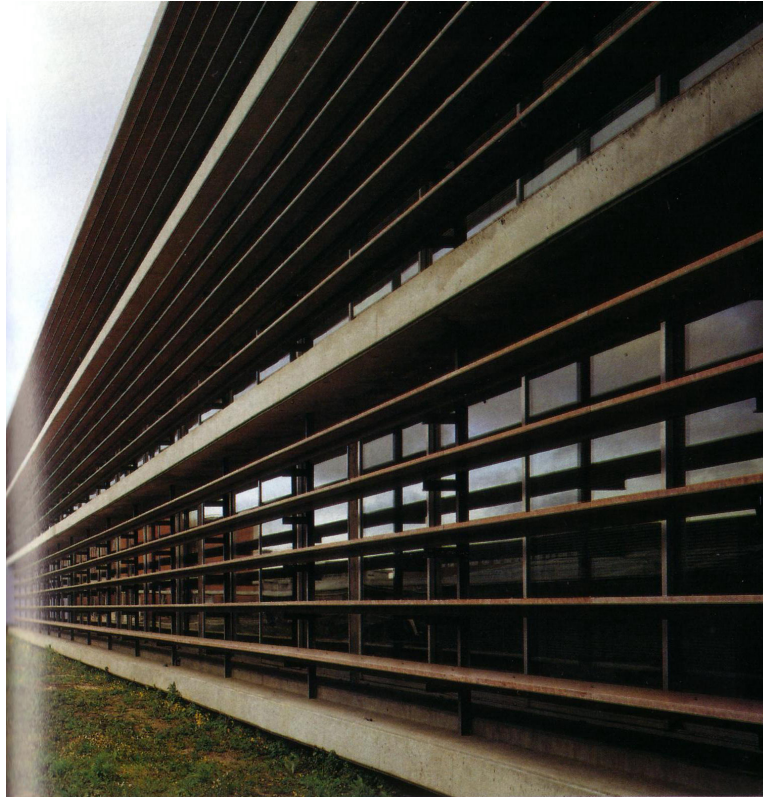
In this project, a play of different materials was the criterion for selection. The contrast between heavy concrete and lightweight steel and glass plays an important role in the success of the visual quality of the building. In addition, the colours that are achieved are in contrast, the light grey of concrete and the dark finish of the steel.

In the proposed design centre, the choice to use steel and concrete as the structural system allows the building to show elementary details that are robust and simplistic in order to give the building the impression that it is a building which can be created through local contractors and builders due to non-complex joints and finishes.

The minimalist visual quality of the building is achieved through attention to detail and reaction to buildings in the immediate surrounding.

This building reacts to neighbouring buildings which are three storeys high with symmetrical box layouts and very plain. "All you have to do was glance at the other buildings on the campus: straight blocks of brick, all with three floors, parallel and equidistant, the only difference being whether the windows were oblong or square, or the

blinds being white or dark" – Francisco Asensio Cerver, pg 338.



*design precedents*

**Fig 2. Dept. of  
Geosciences, University of  
Aveiro**

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*design precedents*



*Fig 3. Dept. of Geosciences, University of Aveiro*



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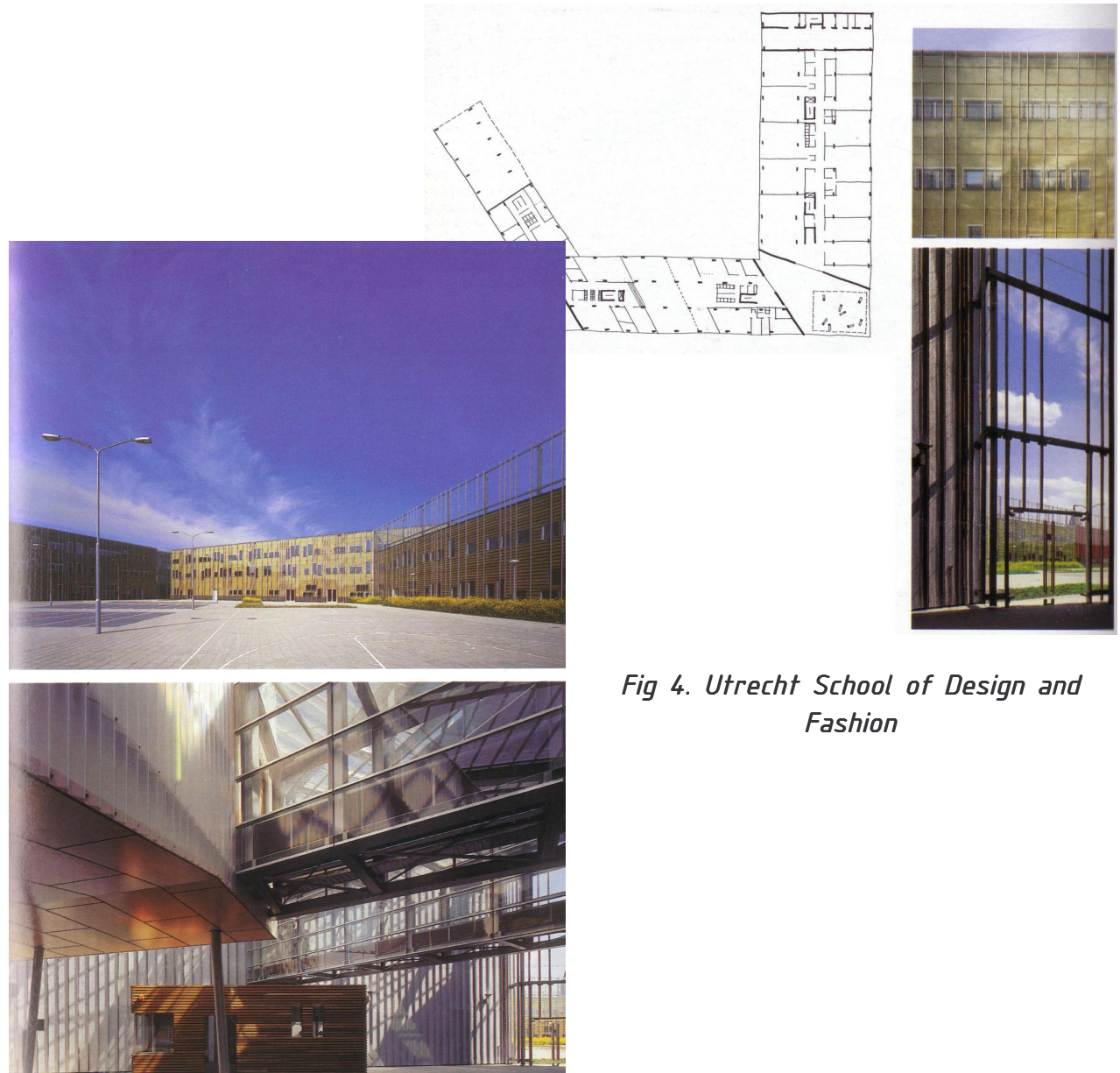
**Utrecht School of Design and Fashion, Utrecht, The Netherlands, 1997. – Erick van Egeraat:**

Chosen as an example where alternative materials are used and where there is a distinct simplistic resolution for a school for design. This building becomes formal and is neutral in design. I believe that perhaps design schools should be neutral and minimalistic in order to allow creative thinking. By constraining the architecture to a specified point, freedom in design may be provoked. This is the theoretical point of departure for generating the design centre.

Polycarbonate sheeting and s-rib profiles are used as cladding and for façade treatment in this building. Materials such as these are investigated and used in the centre. In relation to the previous precedent, this building has a dialogue between materials, in this case, steel and glass. The lightweight steel shell is translated into the interior where this becomes the structural system to which internal corridors and spaces are attached.

A simple rationalist plan form is given for the building, this adds to the simplistic nature of the building.

*design precedents*



*Fig 4. Utrecht School of Design and Fashion*

006

**Wozocos, Amsterdam, The Netherlands, 1997. – MVRDV:**

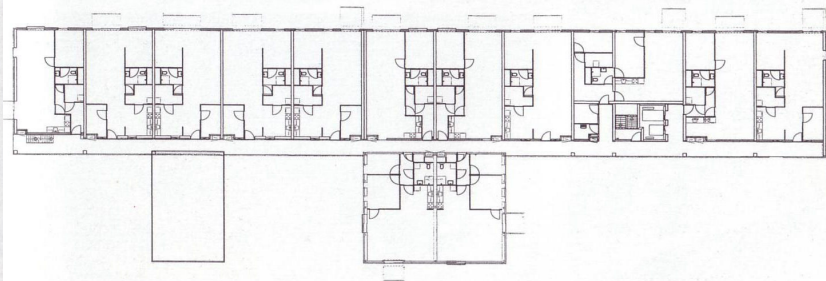
Although this project is purely a housing project, the merits for choice are material selection and innovation in construction. A concrete super-structure to which individual apartment structures are hung creates an interesting urban fabric for the region. The overhanging apartments were designed in reaction to height restrictions and the need for more space.

Timber clad overhanging apartments oppose the traditional concrete apartment block structure. This concept is used to create exhibition spaces on the circulation wings in the design centre.

*design precedents*



*Fig 5 & 6. Wozocos, The Netherlands*



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## Design Approach:

The design of products is a reciprocal continuous development of idea and object. Designers are developing a balance between function, practicality and beauty through processes of solving problems and creating objects for use. As soon as the problem or challenge is identified, a solution is designed, whether it is an object or not. No defined process or recipe for design exists and this is the challenge in design. There is also no perfect solution or absolute in design and this gives rise to creative design and beauty in a certain sense, without a differentiated opinion about beauty and design no great designs can evolve.

A building dedicated to the development of product and industrial design in South Africa is just such a design challenge. This is not the pinnacle of industrial design school buildings, but is rather a discussion with the participator about what a design school could become through spatial design.

An approach used in the design of the building relates to the design of cars. Rather than merely concentrating on the external envelope of a car, designers and engineers are developing the interior and mechanics that are found within. In car design it is important to have a good understanding of the mechanics of cars before the design of the shell can be attempted.

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Herein lies a contradiction, without the understanding of exterior space, the designer may have difficulty in visualising the envelope and all the features composing it. In car design there is little room for error and this constraint allows the designer to explore new developments and

*design approach*  
solutions to save machining costs and create new aesthetics.

The final car viewed by the public is the product of a lengthy process initiated by either a designer or mechanical engineer, whether it is a design sketch or a new mechanical platform layout.

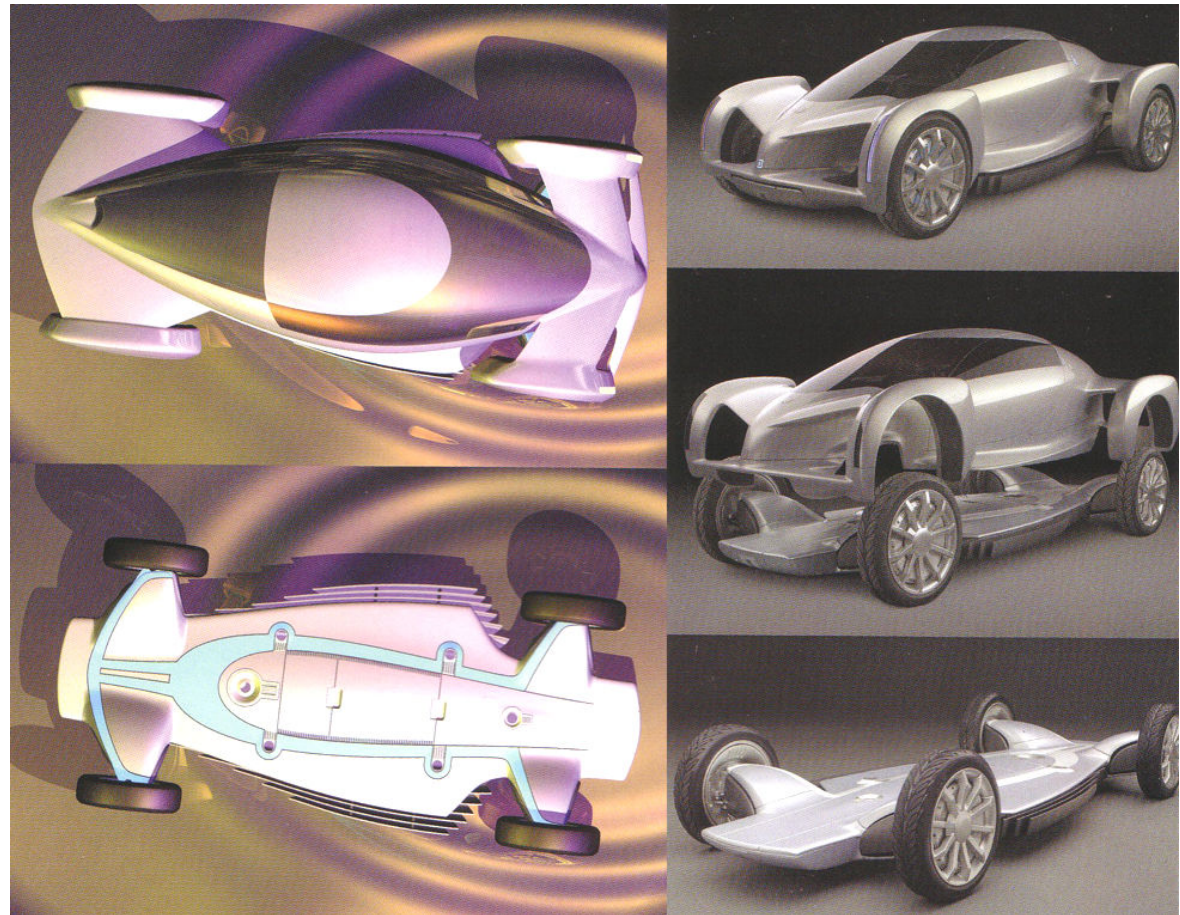


Fig 1. G.M. Autonomy concept 2002

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The previous illustrates (Figure 1) shows how a design is developed around the mechanical layout of a Hydrogen Fuel-Cell Platform:

The Autonomy from G.M. (General Motors) is a good example of how design can help to define the image of a new car for the future.

In another scenario, a designer may be required to design a car before a platform is developed, however, the designer must know that the design must be able to accommodate some form of power plant in order to work; if the designer does not respect this constraint, the design is merely sculptural and will remain as a paper design. The Alfa Romeo Kamal (Figure

*design approach* 2), launched at the 73<sup>rd</sup> Geneva International Motor Show in March 2003, is a practical illustration of how the designer applied knowledge of current the SUV (sports utility vehicle) platform to generate a new sculptural design for a popular market:

As explained, the design of a car can follow numerous approaches or processes. This enables designers to explore new trends and solutions at different stages and thus allows for innovative solutions and products.

Designing a school follows the same direction as car design in many instances. There is no obsolete design for such a building programme that allows the functions of the building to be the main driving force. Car design is a constant quest to find the perfect solution to match aesthetics and mechanics without great compromise to performance or function.



Fig 2. Alfa Romeo Kamal concept 2003

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*Fig 3. Isuzu Zen concept 2001*

### *design approach*

The main aim in car design is to encapsulate a mode of transport in a shell that appeals to the intended market. Some designs are products that relate directly to transport and movement where as others are objects of sheer delight or pleasure. Cars not aimed at mass production are sometimes designed to fulfil other functions in the interest of developing vehicular transportation into more interesting dynamic spaces that can travel from place to place. An example of this kind of design approach is the Isuzu Zen designed by Isuzu's European Design Studio in 2001 (Figure 3), launched as concept at the Tokyo Motor Show in November 2001. The Zen is an inspired spatial experience that goes beyond automotive transportation. Zen is designed to be experienced as an architectural space in a dynamic surrounding. In any space, the Zen can be adapted to experience the exterior space and can be adapted internally to create a dialogue with the external space wherein it is parked. This car is not designed for the mass market, but rather as an illustration of how car design is influenced by nature and spaces that surround the car. A highway or even a rural road is a space wherein a car is actively part, this is the driving force for car designs such as the Zen and others that are designed as unusual cars or vehicles.

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In designing a school for professional industrial design, an approach following car design is appropriate. The school has a specific function and requires certain key elements, these are designed for and the development relates to these in respect of spatial design and analysis.

Firstly, the building is resolved in detail and many of these technical details explore simple yet effective solutions indigenous to a South African context. In the refinement of the building envelope, details become more human in scale and relate to the human participator in the built environment. Specifically designed articulation creates human comfortable space and allows the participator the opportunity to experience the building as a complete product, mirroring the purpose for the building.

The building is adaptable in terms of spatial design and allows the use of spaces to become adapted to specific needs. Because of the flexibility in design education (different types of courses offered) offered at this institution, the building relates to this identity through spaces that can be arranged to accommodate specific training programmes.

*design approach*



Fig 4. Renault Talisman 2001

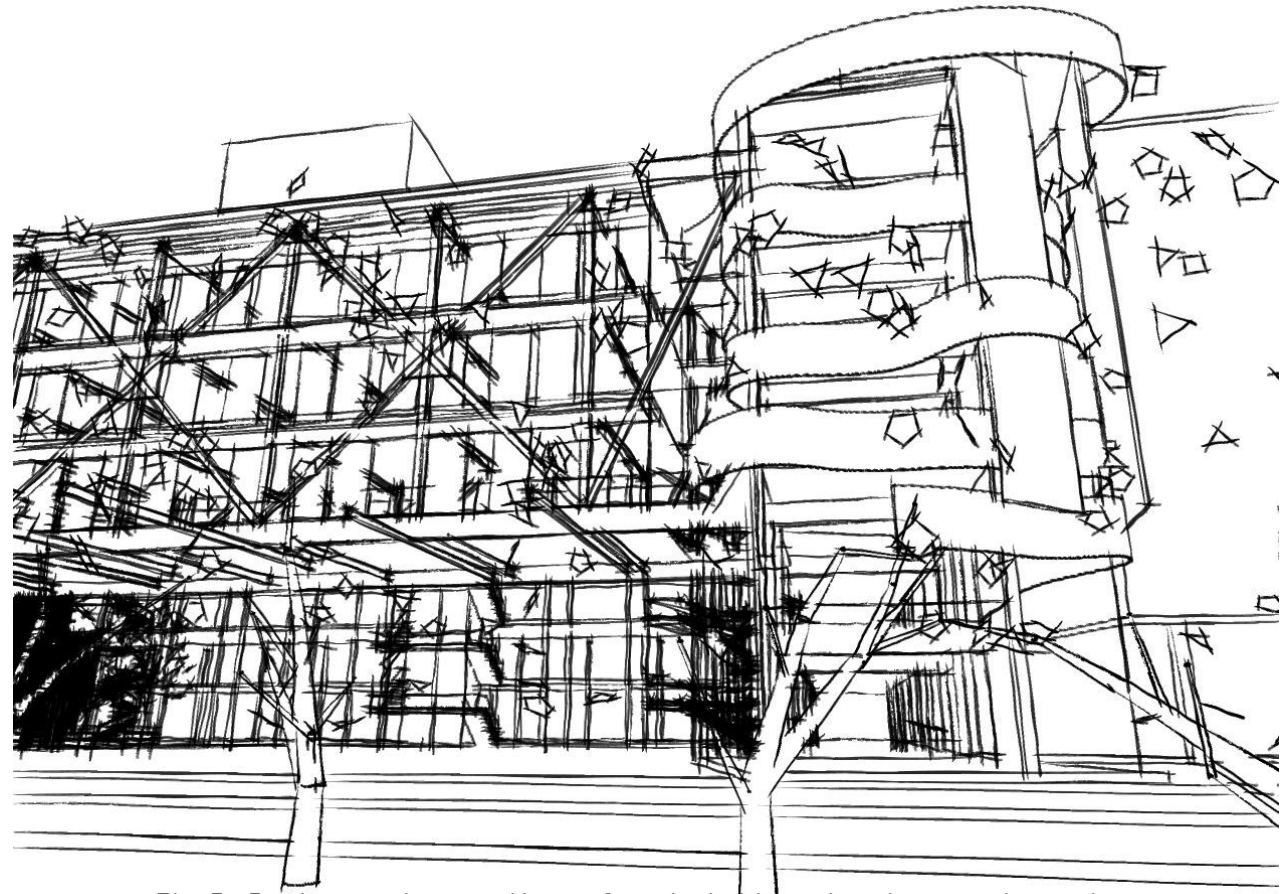
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*design approach*

A relatively rigid structural system communicates identically to car design where a car requires an automotive platform to operate. The building has a designed structural system that enables spaces to adapt without the need to modify the structure to accommodate such spatial requirements. The envelope of the building becomes a muscular skin that relates to the interior spaces, these interior spaces are in constant dialogue with the exterior and vice-versa. In having this structured skeleton for a design school, the envelope may evolve as time moves on. This idea follows the car design notion of upgrading and improving: new envelope skins can replace the present design system. Renault developed successful engine layouts in the 1970's that are still used in the new generation cars today. This relevant practice relates to the static structural system incorporated in the school. With a structural system clearly calculated and optimised the building offers flexibility for future façade and envelope design.

Renault chief designer, Patrick le Quément, designed the Talisman (Figure 4) launched as a concept car at the September 2001 Frankfurt Motor Show. Talisman is a concept that emphasises the importance of uncluttered interior space and minimalist design. The large gull-wing door eliminates the obstruction of an open door at the side of the car and makes the need for a centre pillar

redundant. By simply designing doors that operate in this manner, the interior is freed and the threshold between inside and outside is unobstructed. Furthermore, the interior features an unorthodox seat design following a theme of slick lines running through the cars interior panel work.



*Fig 5. Design centre northern façade bridge structure and envelope*

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The interior emphasises simplistic design with the use of composite materials and advanced polymers in the design of furniture and the instrumentation. This car covers up the intricate working of the car as a complicated machine of mechanical engineering and exposes the simple detailing of the interior and exterior finishes. There is no cluttered centre panel and driving instrumentation, the instruments are simplified and designed to give the driver all information required for driving.

In the Talisman, the beauty lies in the fact that all components of the car whether inside or out are resolved in a manner that meets the goal of simplifying car design without the cluttered or complicated finishing details that are sometimes found on car designs.

This illustration of design refinement needs to be illustrated to understand that the design centre building does recognise this design approach and reacts to it directly in its refinement. The building reacts in that none of the structural systems are hidden inside slick shells or envelopes. Structurally the design centre is exposed and defined to illuminate the making of such a structure and allow participators the opportunity to understand the building on an elementary level. This makes the use of a replaceable envelope for the building more feasible because the skin

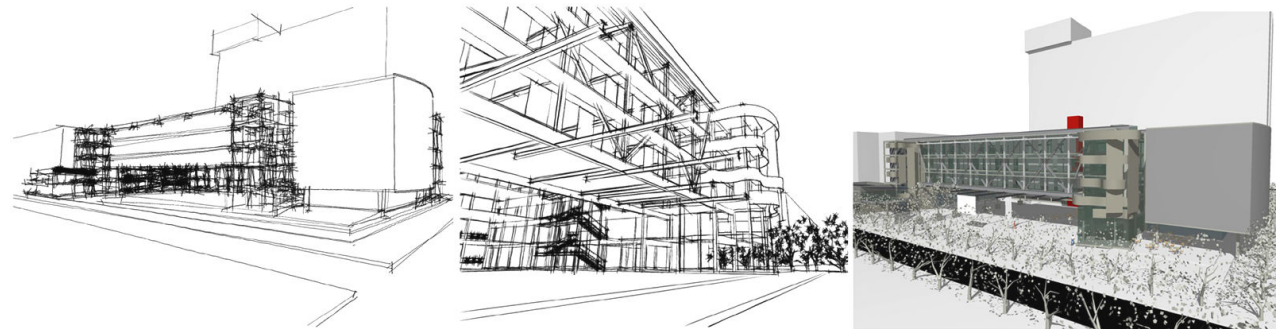
of the building adds to the appearance and articulation of the facades and spaces. Figure 5 illustrates the possible façade design used in one proposal on the right showing how a screen system can wrap around the western circulation wing. This design theory is visual in sketch design how car design influences architecture.

*design approach*

Car design is a very competitive, specialist form of product design and gives reason to understanding the process of design that can underpin the formulation for designing a centre. This is the reason for choosing to compare car design, as an industrial art to building design; designing a car is



*Honda Unibox design and interior exposing structure and materials*



*Sketches for design centre exposing structure, form and materials*

**Figure 6. Comparison of the building design to the Honda Unibox**

*007*

complicated and mathematical with large constraints and physical boundaries, yet designers make it look simple and very elegant. Car design goes deeper than this and through this chapter; the art of car design has been illustrated with different approaches and aspects.

When the design of the building moves into formality, the theory of design as understood through current car design trends is applied, the design becomes a symbol of architecture that has its roots in the design of a product or car.

Much like car design philosophy, the building takes on many issues and is dealt with similarly to the way that car designers and other design professionals deal with their products. This investigation creates a platform for design and allows the functional aspect of the design school to explore many ways of solving building design problems. The resolution in designing the centre is illustrated in Figure 6 where the design centre is compared to the compact Honda Unibox; the Unibox is refined in detail and exposes these and its materials as part of the design.

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**Design decisions:**

The initial concept arrived through an investigation into the existing urban fabric and form. Massing and volumes were studied in the precinct and these led to the exploration of forms and mass that may enhance a building on the chosen location.

Simple diagrammatic sketches aided in finding an optimum solution for the site. These diagrams are crucial in the illustration of how the spaces and forms were chosen for the project. These exploration sketches are shown in Figures 2, 3 & 4.

On an *urban design level*, a few constraints need addressing, namely:

- The fact that this is a stately precinct due to the City Hall and museum buildings, there is an urban frame that surrounds the City Hall building and this line has to be respected in the precinct, refer to Figure 1, the image defines the frame surrounding the public space in front of City Hall and also Figures 9 & 10.
- All neighbouring buildings to the City Hall are formal and do not compete with the image of the City Hall. This gives reason to adopt the same strategy in the

*design decisions*

a featured building part of the design. The function of the building follows under the heading – Precinct considerations.

concept for the design centre. An explanation of the surrounding buildings is dealt with in chapter 4, a discussion follows in “Precinct considerations”

- The old Spoornet building located on the premises becomes

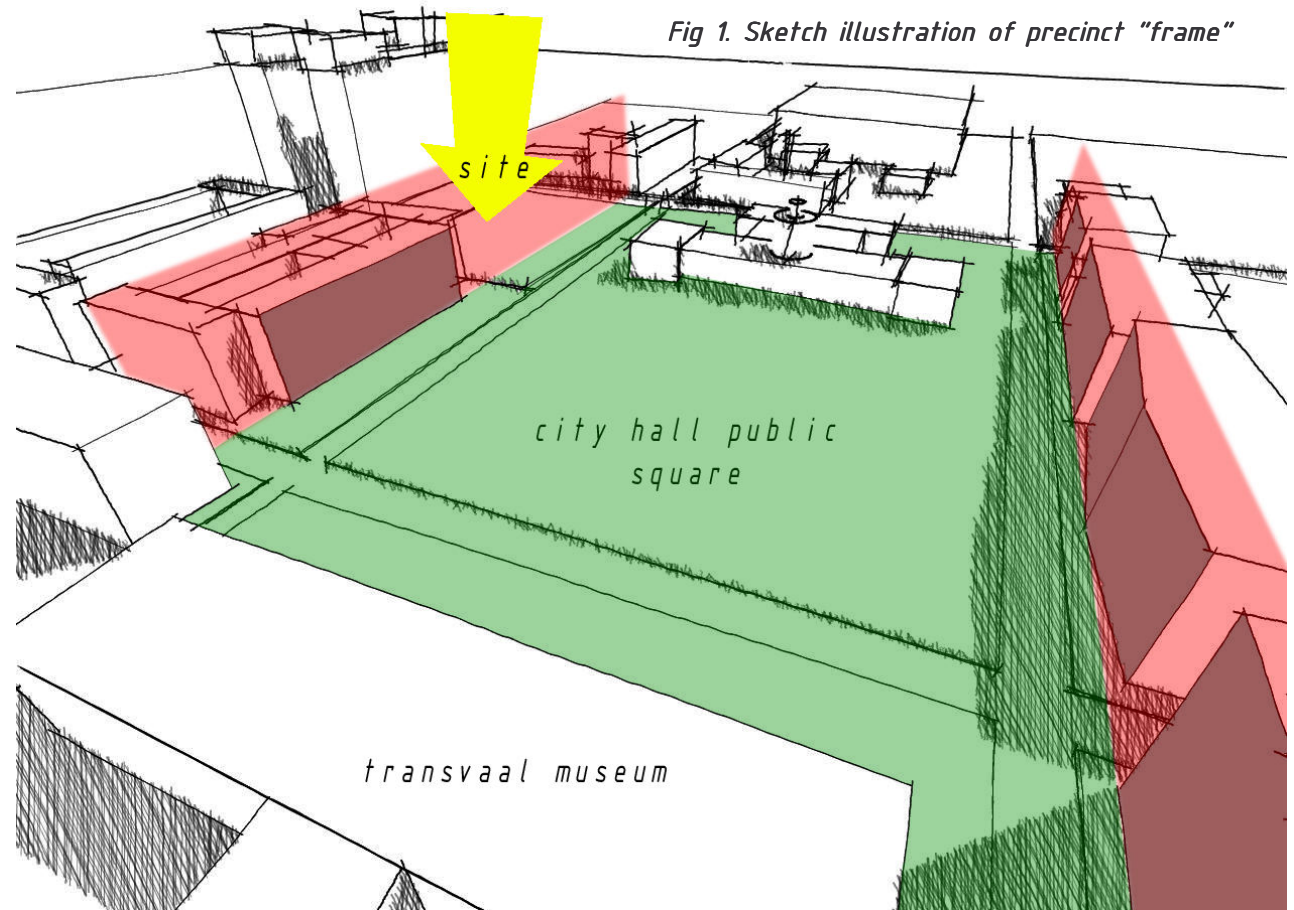


Fig 1. Sketch illustration of precinct “frame”

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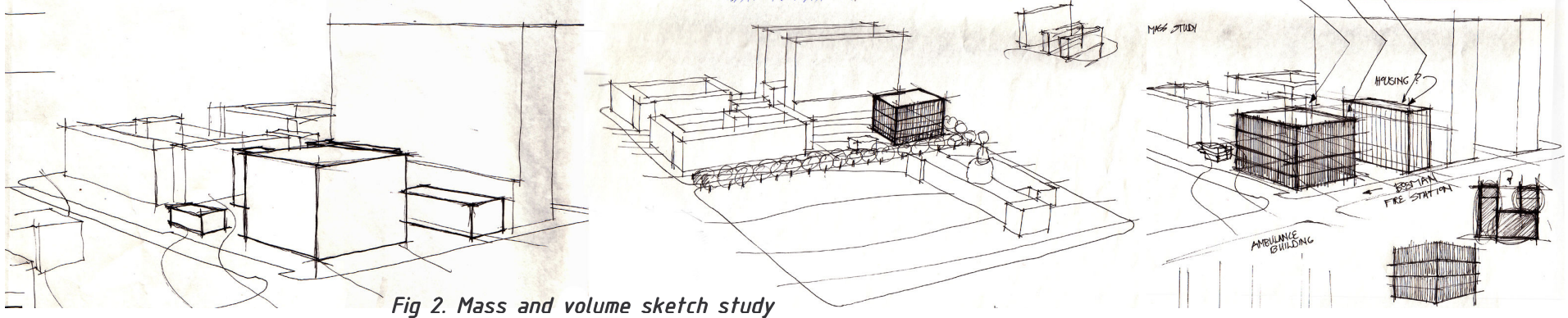


Fig 2. Mass and volume sketch study

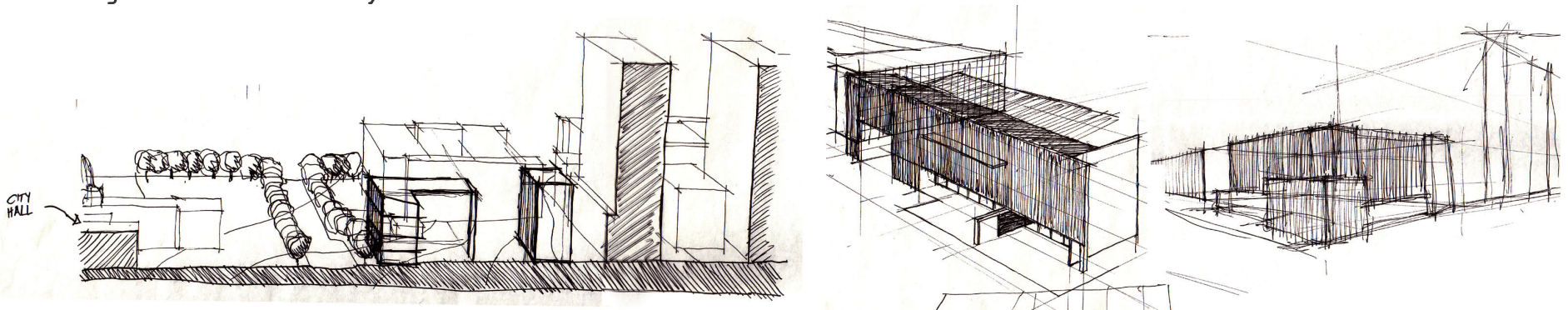
The exploration brought about an understanding of the way that buildings are massed in the area. Diagrams in Figures 2, 3 and 4 clearly define the route followed to finalise an urban scale and mass suitable for the precinct.

If the design proposal is to become an icon within the precinct, the location would be incorrect to a certain degree because the site is hidden behind the City Hall. The most important driving factor in proposing a volume for this urban room within the precinct is to create a link between the City Hall

gardens public space and the campus environment of the design centre.

The final resolution for the building became visible in sketch form in Figure 4. This sketch is very elementary and makes a clear illustration of the mass and volume of the design centre.

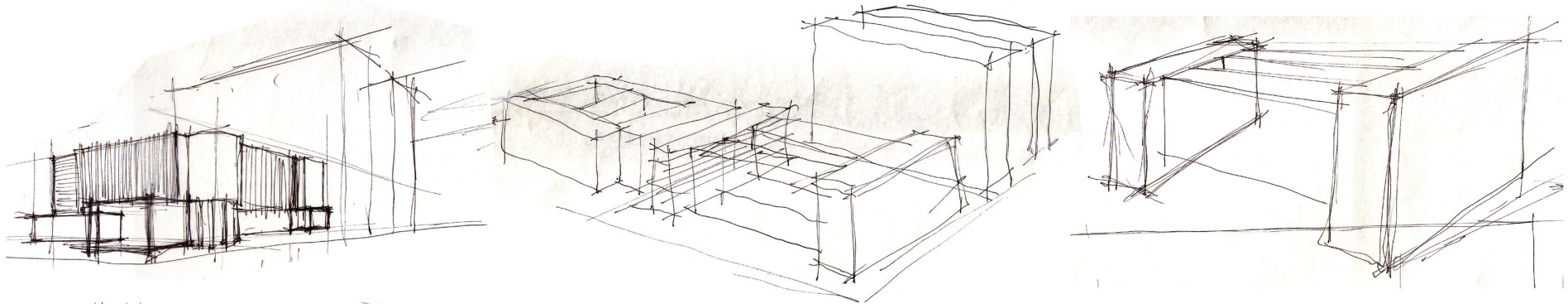
Fig 3. Further sketch study



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Fig 4. Progress sketches of final building resolution

design decisions



Having looked at car design as an example of product design, the building follows certain principles named

previously to fulfil form and function. The final appearance and working of the building becomes symbolic of car

and product design in that it resembles a working machine adaptable to the fourth dimension, namely: time. With time, the building is adaptable and can take on new appearances and forms outside of the main structural system and layout.

**Envelope of a building:**

Time is very important in the framework of the city of Pretoria, leading to the decision to design a design centre that may not necessarily change functionality, but may remain as a design school perhaps in different disciplines in the future. Designed to adapt purely to improved technologies, the structure of the building lends itself to different envelope conditions. It is possible to accept that future improvements and modifications may comprise lighter and more effective solutions to the current and near-future envelope skins that are designed.

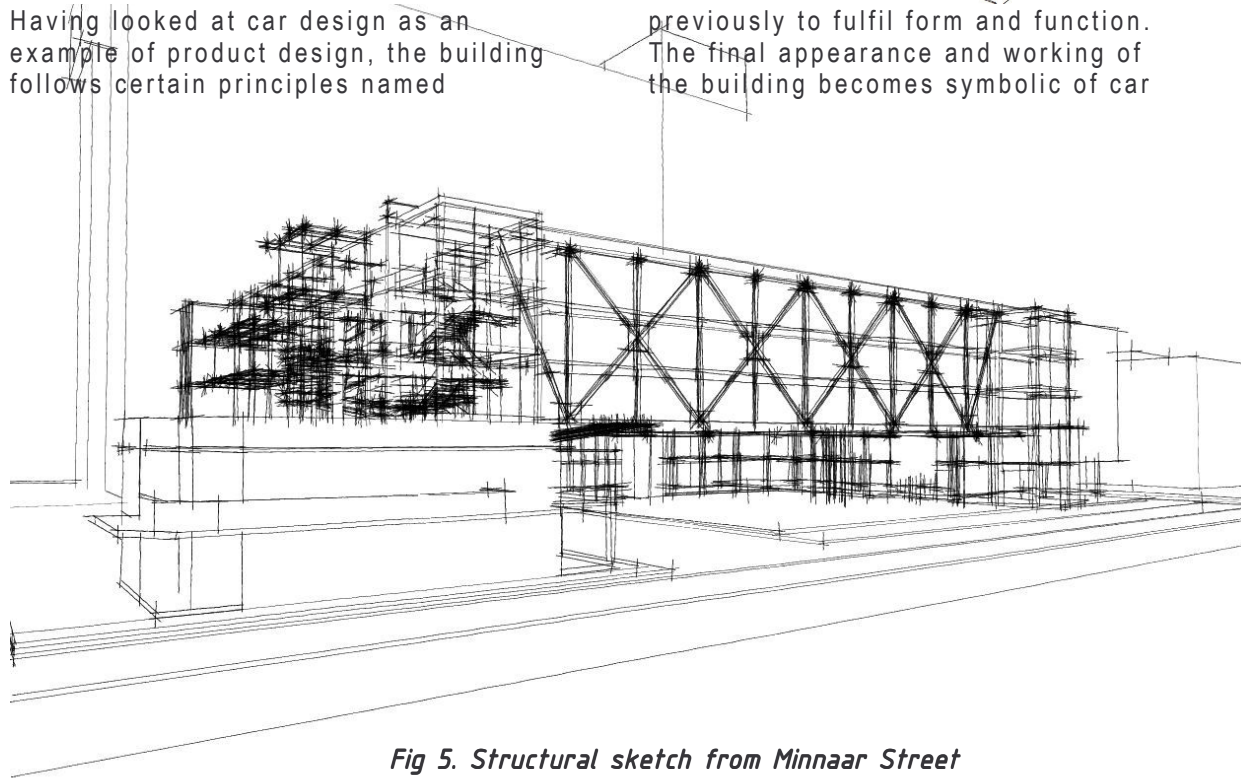


Fig 5. Structural sketch from Minnaar Street

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This makes the design of the building adaptable for the use of in-house designed products and therefore inspires the use of the building as a design school and centre for young people.

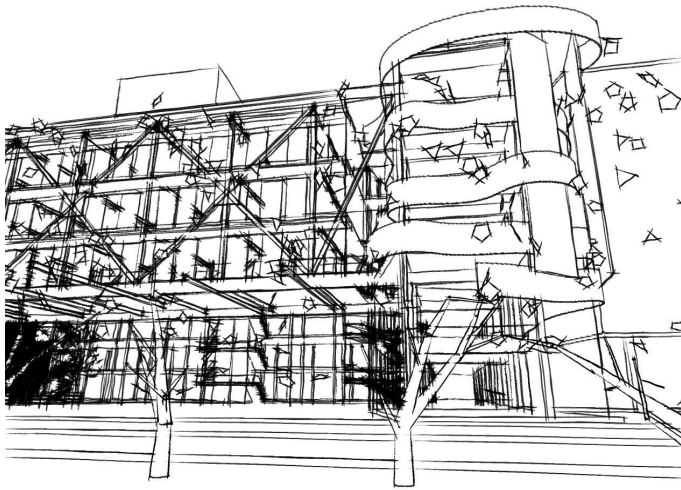


Fig 6. View of possible envelope

A structural system designed to accommodate change on the surface of the building exists with flexibility in mind, the structure offers flexible spatial layouts and arrangements. This is created by using masonry infill work. The infill panels are composite panels of polyurethane bonded to either steel or aluminium. This material is dealt with in the technical investigation.

### Suspended Studios:

The suspended floors (Figures 5 & 7) of the main design studios are a product of creating an uninterrupted linkage between the design centre's courtyard and the public square in front of the City Hall. It uses a space-frame truss structure that supports the floors of the



Fig 7. View from north

studios and hangs between two circulation wings. This structure consists of steel and concrete; the steel frame structure is external to the studios and visible from the outside. With this exposed structural system, the working forces in suspension are illustrated and this allows people to view the structure as a product of design and engineering.

### design decisions

Fusion between design and purpose is crucial to the success of the building. A design centre does not necessarily have to be a creative building but may require simplicity to stimulate creative minds.

The detailing and finishing of the building and its systems are relatively

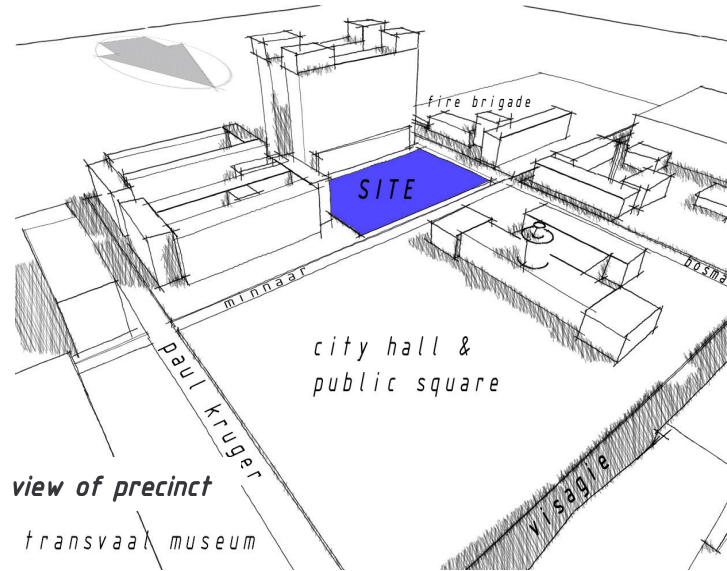
simple and remain visible. A bicycle consists of many working parts; these are exposed but refined in detail to appear simple and aerodynamic. Thus, this building too has details and parts that are not clad or hidden, but refined and calculated to fulfil their functions and attract interest.

The suspended studio section appears to float and in so doing, may lure the

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attention of passers by and users of the building. This is an important decision for the design of the building, to create a structure that visually communicates its function in the city. When approaching or passing the building a sense of inquisitiveness must be invoked and the final design in its completion achieves this goal without seeming to be an icon within the precinct.

*design decisions*

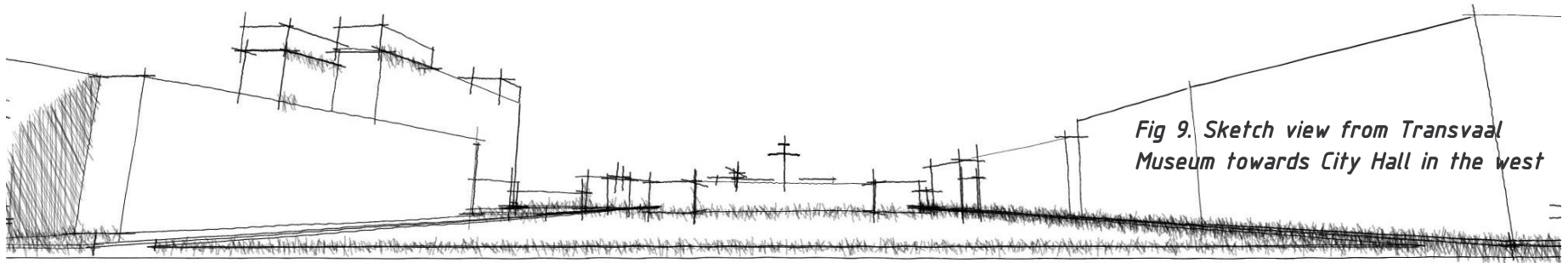


**Fig 8. Aerial view of precinct**

**Precinct considerations:**

City Hall is a stately icon in the precinct and one of the main constraints was to not disregard the status of the City Hall building (refer to Figures 4 & 5). To create a building that fits within the precinct, does not become an icon, and does not dissolve into the existing buildings is an important contradiction to consider.

Removing the existing railway building on the premises (refer to Figure 6) was considered, but due to



**Fig 9. Sketch view from Transvaal Museum towards City Hall in the west**



**Fig 10. View from Transvaal Museum towards City Hall in the west**

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numerous discussions and decisions, the conservation of the building became an integral part of the design and its theories. This railway building (architect and date of construction unknown) was built as part of the NZASM railway infrastructure and remains part of the history of Pretoria as a good example of modernism in the earlier part of the 20<sup>th</sup> century in South Africa. Trains are a product of the Industrial Revolution and an important example of mass-produced artefacts and how design evolution has transformed them into the high-speed passenger land bound transportation system, as we know them today.

To make the railway building an integral part of the design project became important as a reminder of the history of design and its influences. Adding



Fig 11. Old railway building on premises

this building into the design programme also allows the design to enhance the tourist route that exists on the precinct by creating a museum for industrial design.

Another important building within the museum park precinct is the Museum of Cultural History. This building has a permanent exhibition of product design

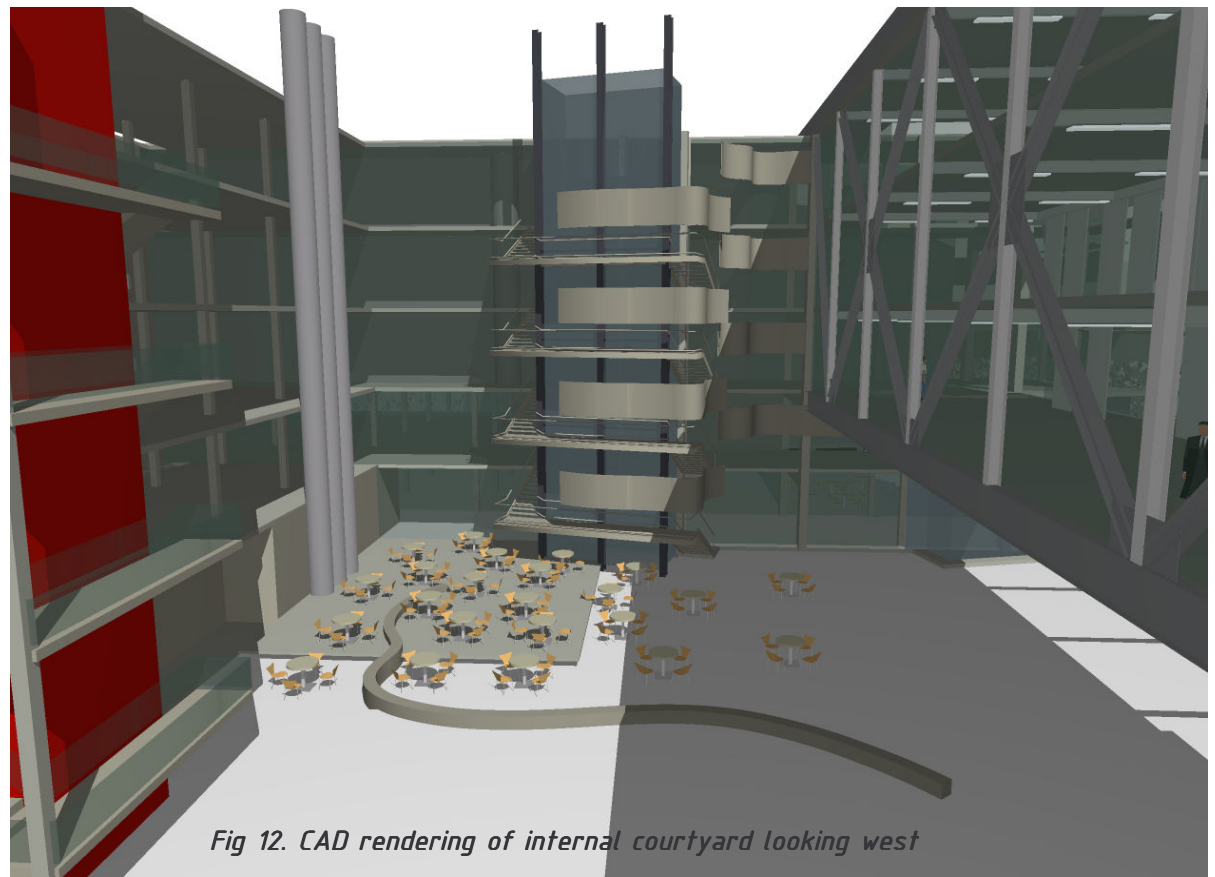


Fig 12. CAD rendering of internal courtyard looking west

*design decisions*

and can form an integral part of the design centre

### **Courtyard:**

A link has been established between the City Hall public open space and the internal space of the design centre. This courtyard becomes a focal point

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within the structure of the design centre, with all the functions and activities within the centre spilling over into the courtyard. The space is articulated with many functions and activities.

Safety is of primary concern and the open courtyard design comes as a result of policing found within the precinct as discussed in the

introduction

### Circulation:

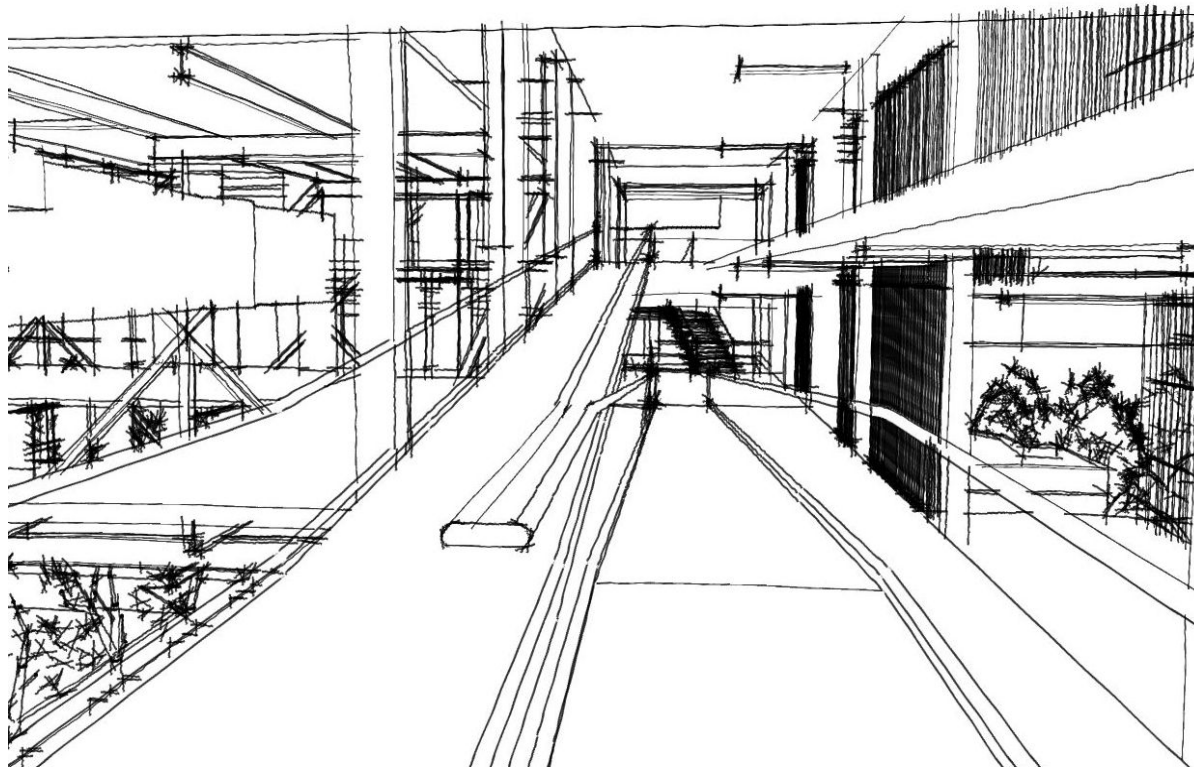
Two vertical circulation routes (refer to Figure 12) are designed within the courtyard space which in turn animate the space with vertical movement. These circulation cores exist in

*design decisions*

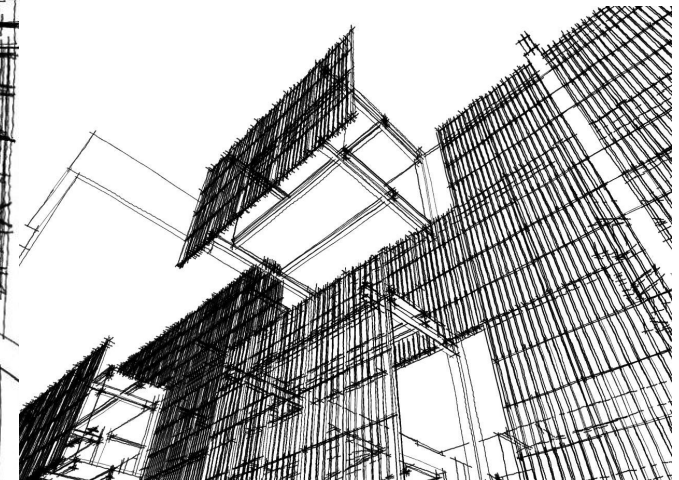
collaboration with two large horizontal circulation stacks. A west and an east circulation stack provide the two wings on opposite sides to the studio bridge. Doubling in use (Figure 13), the circulation wings function as exhibition space for the centre.

On the western side of the building are spaces provided for numerous functions, all multi-functional to accommodate various activities and spaces. The main functions of the western wing are machine workshops, training spaces and wet services. These spaces are dedicated spaces and are adaptable if space needs revising.

*Fig 13. Interior sketch of eastern circulation and exposition wing*



*Fig 14. Sketch impression of exhibition pods with sun shade device attached on eastern side of eastern wing*



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### Exhibition pods:

A further decision to create exhibition pods on each side of the eastern wing was introduced. These pods act as “clip-on” boxes that are attached to the main structural frame of the building. Each exhibition pod (Figure 14) can accommodate various exhibitions that can be arranged to the exhibitor’s requirements.

### Auditorium design:

An auditorium is crucial for the design centre as presentations and conferences are often hosted and the space must be available at all times. The design of the auditorium follows standard practice and the exterior responds to the immediate context:

Across Bosman Street on the west of the site is the fire station and the building that is placed on the concerned corner resembles modern architecture as in Figure 15. The auditorium responds to the fire station’s

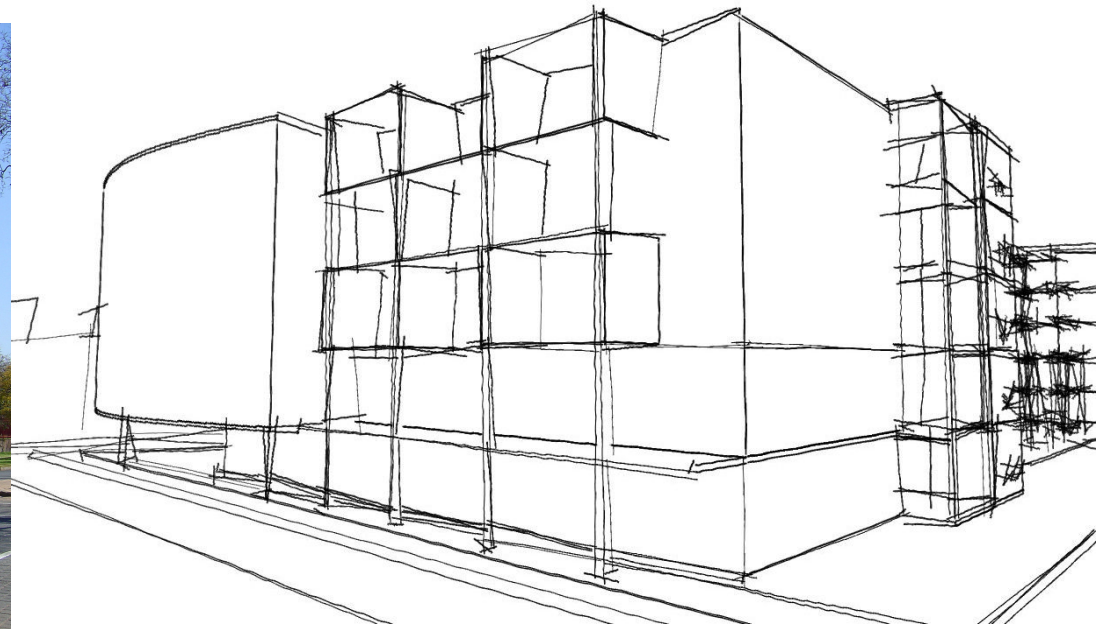
### *design decisions*

form and articulation to create a responsive dialogue across the street in terms of design, this leads to the solid façade of the auditorium with no openings (figure 16).

*Fig 15. View of fire station across Bosman Street*



*Fig 16. Sketch of the western façade showing auditorium form*



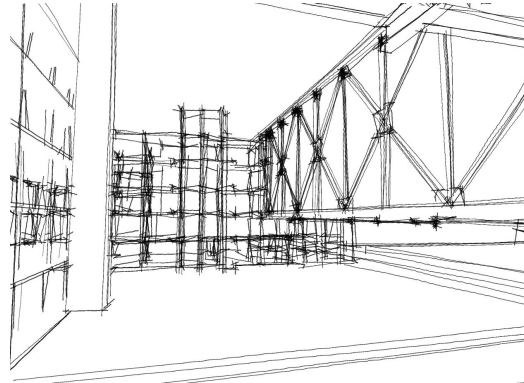
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**Design studio interior:**

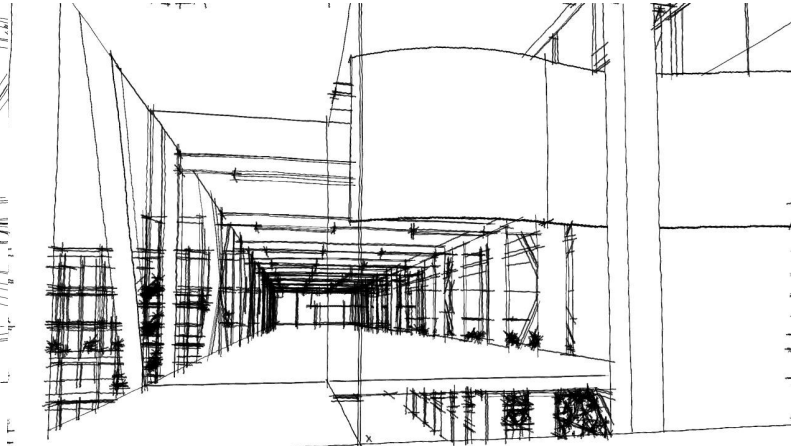
Being the most important space within the building, the design studios need to be designed to maximise occupational comfort. The studios are already an important feature within the design of the building because it is suspended over the internal courtyard (Figure 17).

Creating design studios for a young group of individuals means that the spaces have to be as flexible and adaptable as possible. The spaces are clear and uncluttered from the structural system thus allowing the space to be arranged and occupied in any possible manner that is suitable for design studios.

The northern side of the studios have been designed as a dedicated movement and display space allowing this space to heat up in winter and circulate through the rest of the studios with the aid of mechanical ventilation (figure 19). There are sliding presentation panels that define the movement passage on the northern side, these panels can be moved sideways and act as a visual buffer for excessive glare coming from the windows on the northern side of the design studios.

*design decisions*

*Fig 17. View of design studio bridge over courtyard*



*Fig 18. Sketch impression of entrance into the design studios*



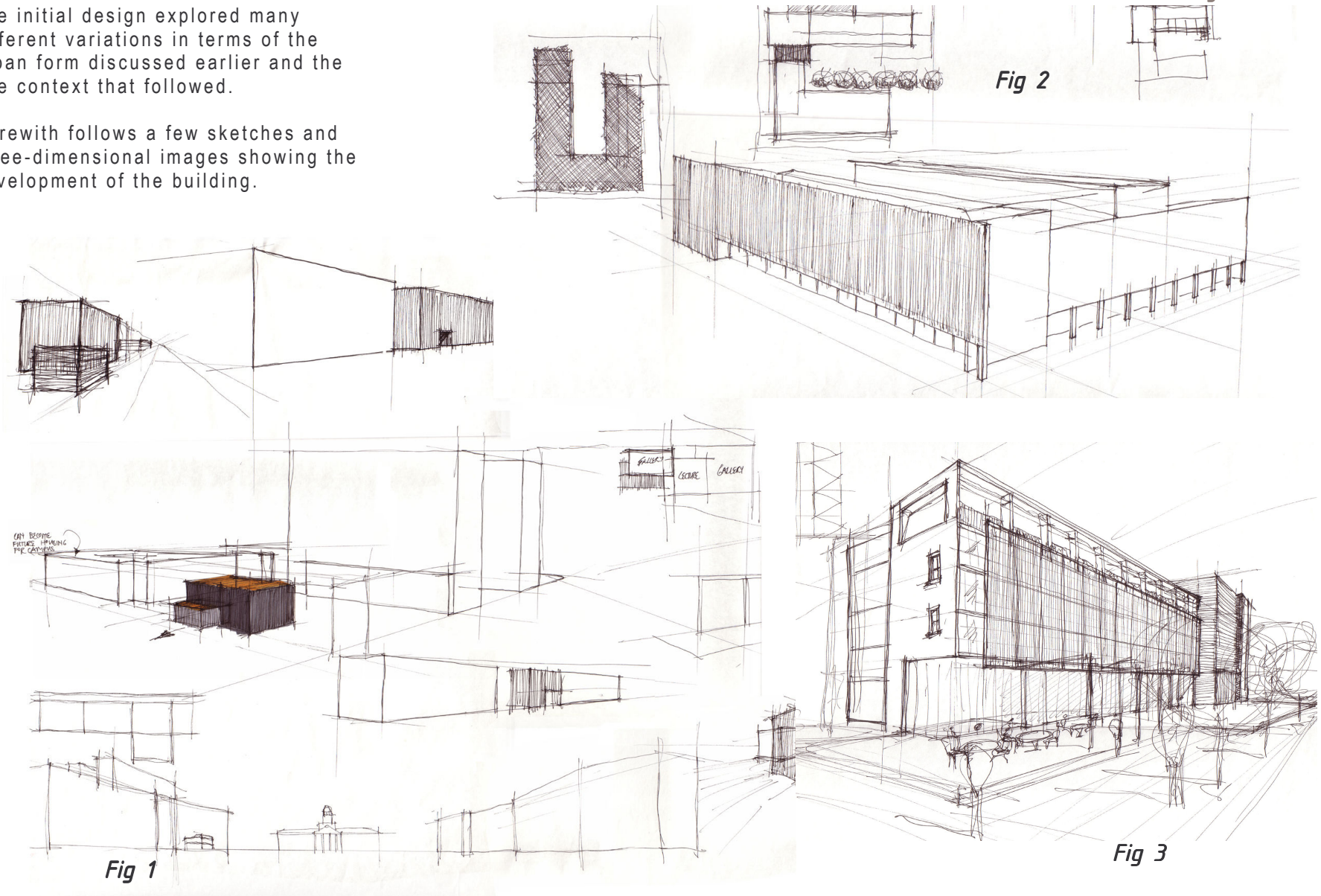
*Fig 19. Sketch perspective of design studio with display panels defining movement and display space on the northern side of the studio space*

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The initial design explored many different variations in terms of the urban form discussed earlier and the site context that followed.

Herewith follows a few sketches and three-dimensional images showing the development of the building.

*design resolution*



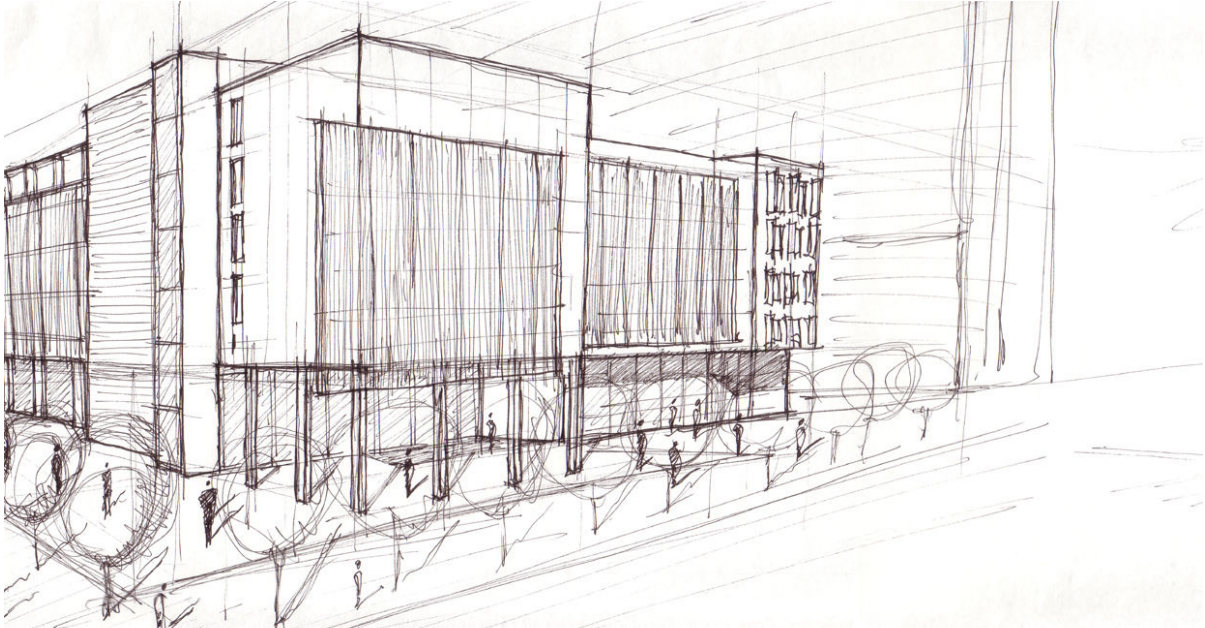
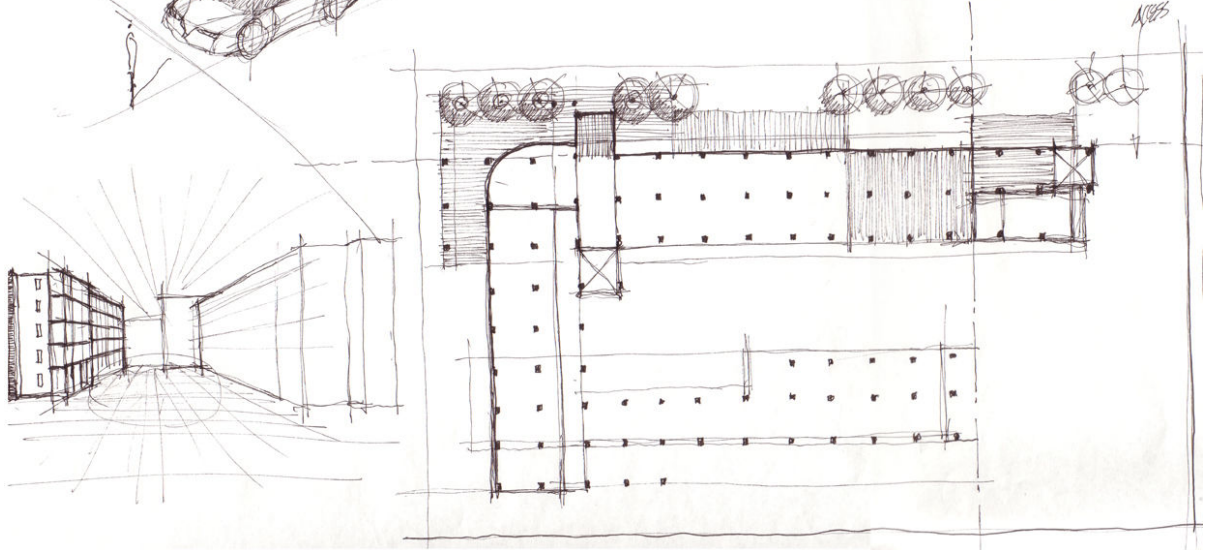


Fig 4



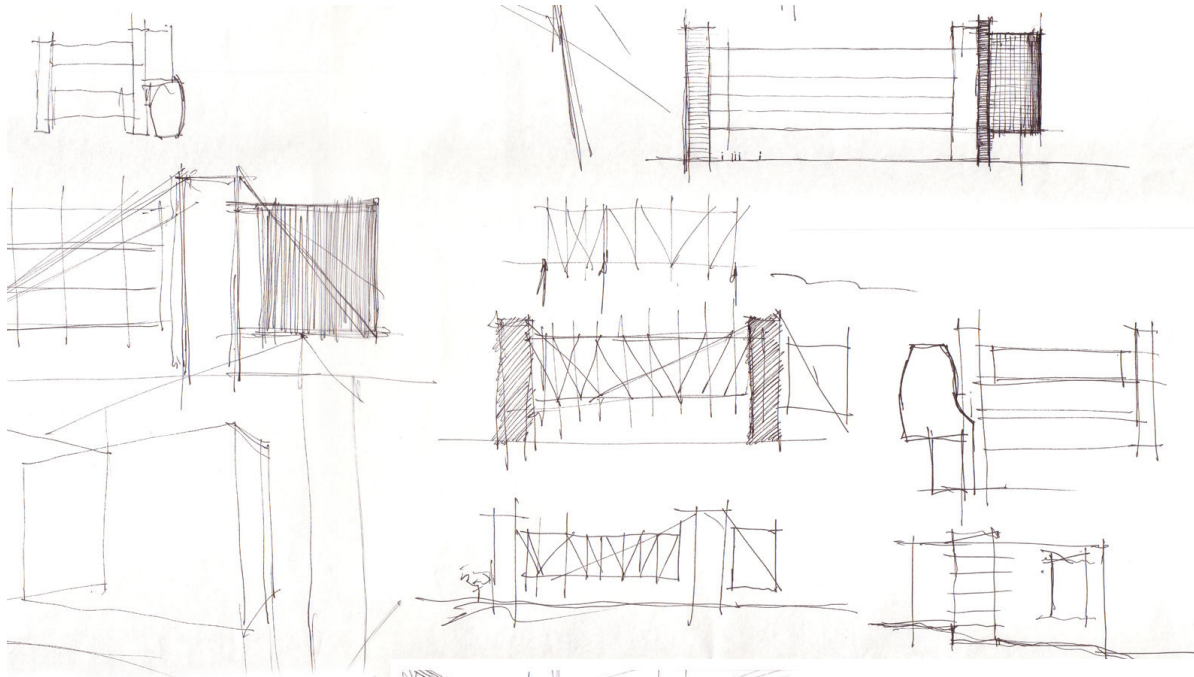


Fig 5

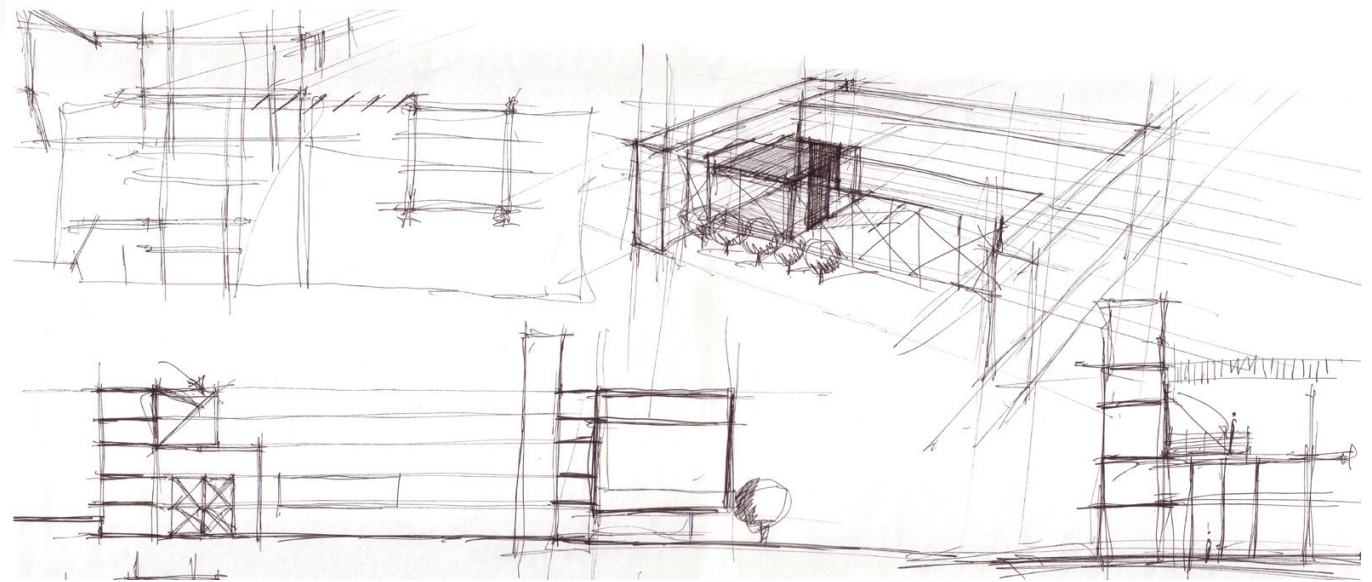


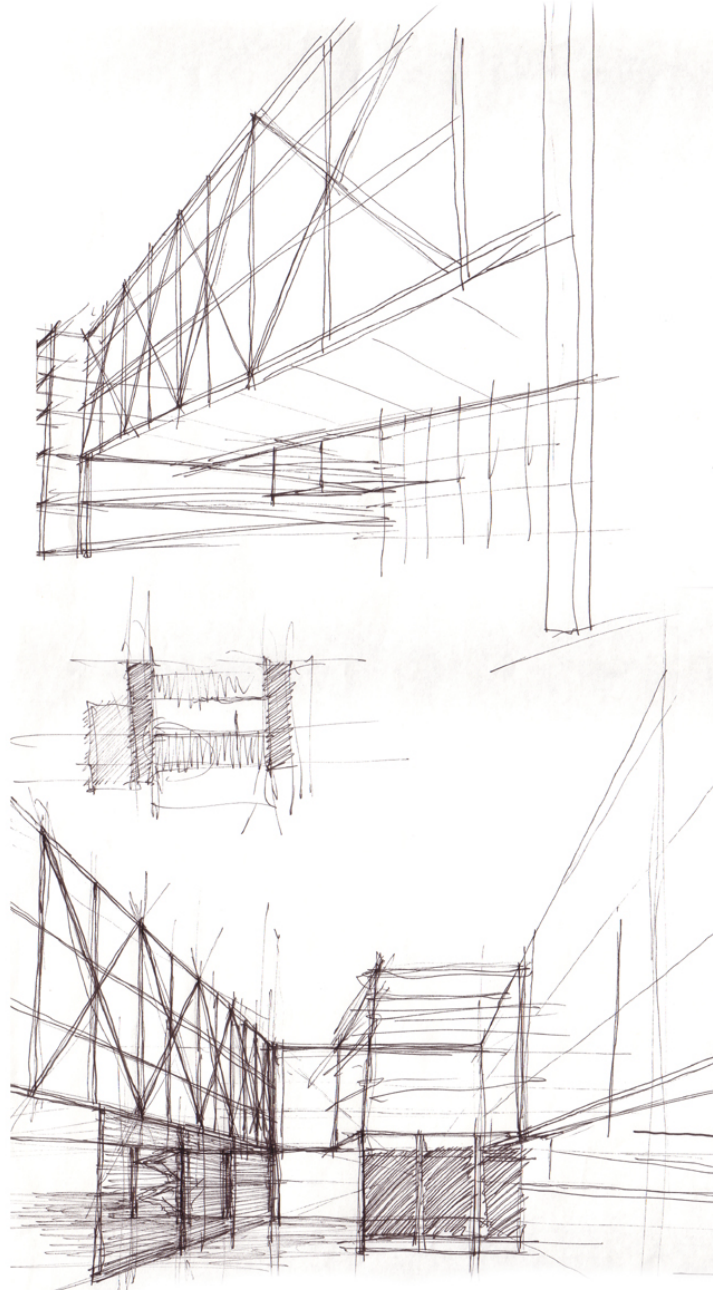
Fig 6

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Figures 1 to 5 are early sketches illustrating the design process that lead to the final design. Initially the design was based on an isolated inner courtyard, Figures 1-4. Becoming too conservative in design resolution, it was decided to readdress the design.

This design did not react appropriately enough to the neighbouring buildings and the building was altered to offer a courtyard that relates to the public open space in front of City Hall. Opening the courtyard meant that the studio spaces on the northern side of the building were to suspend.

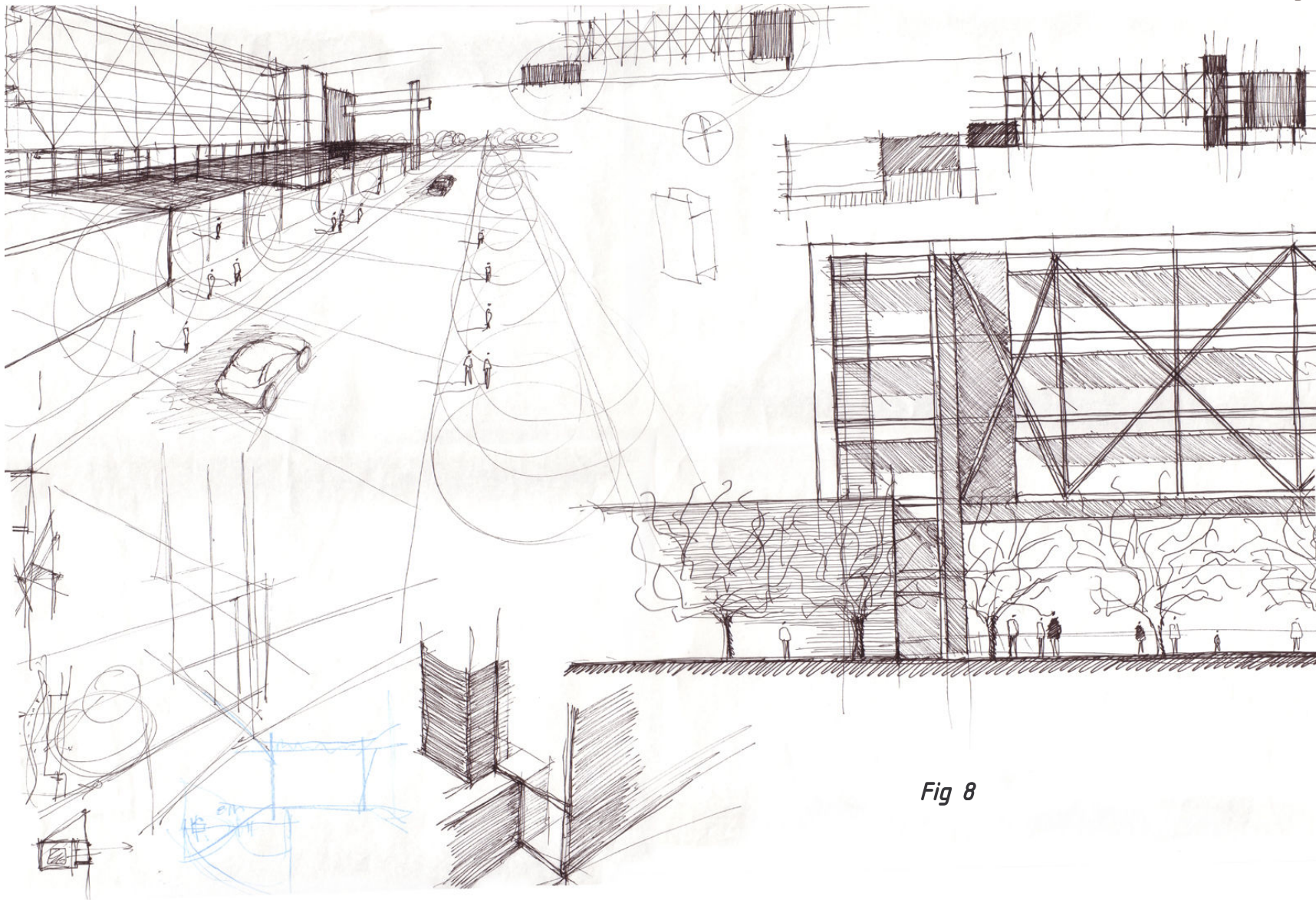
*design resolution*



*Fig 7*

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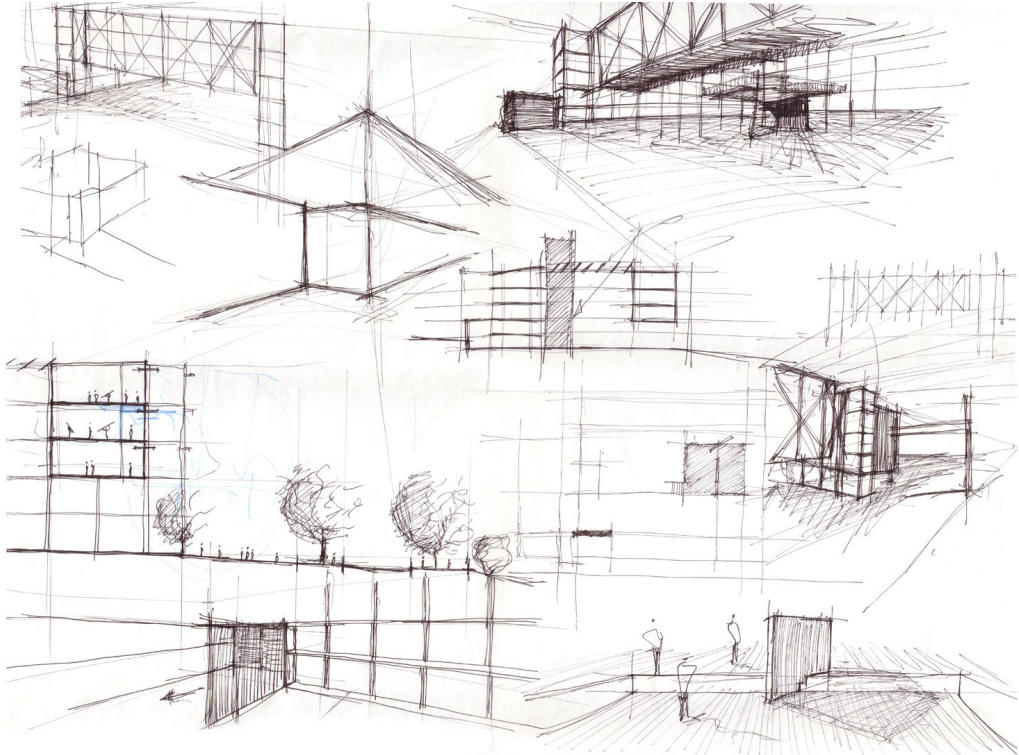
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**Fig 8**

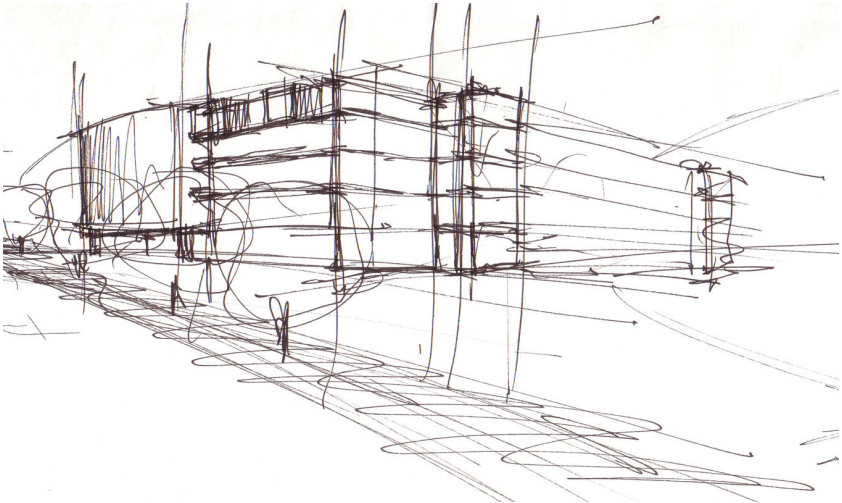
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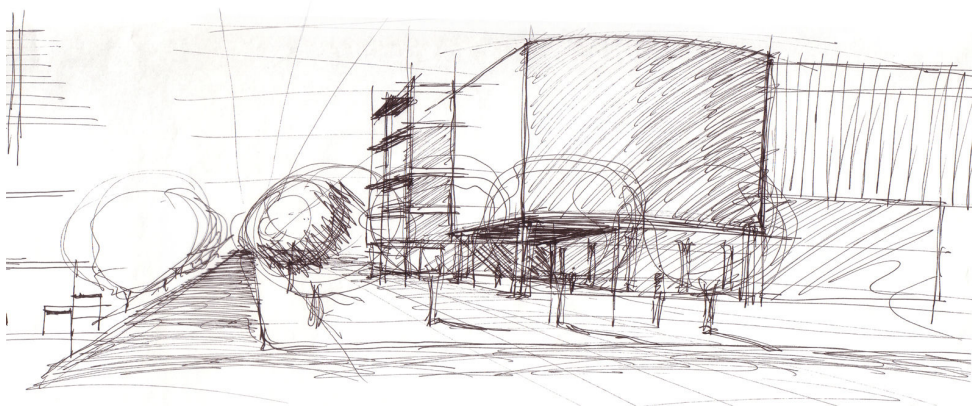
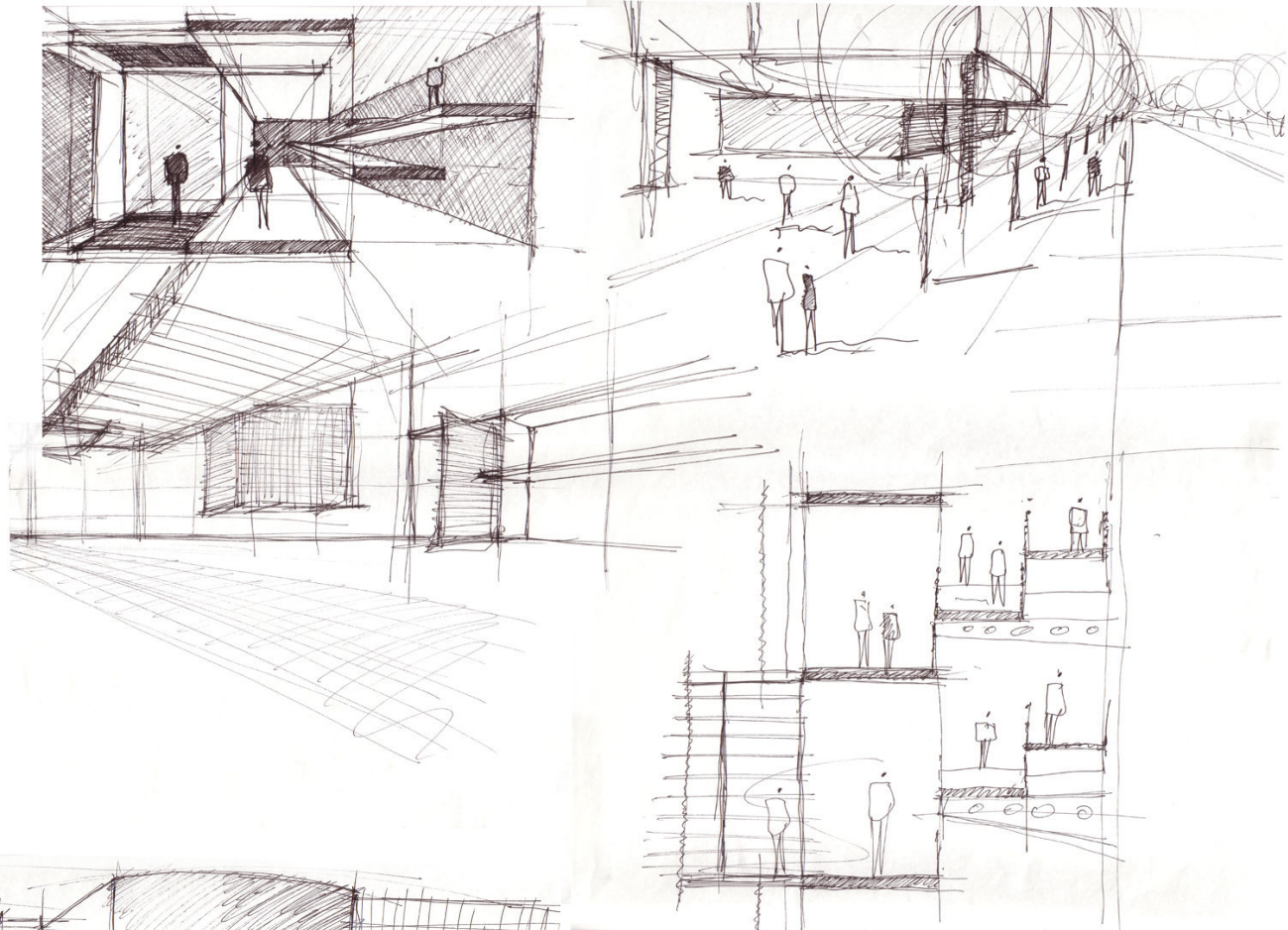


*Fig 9*

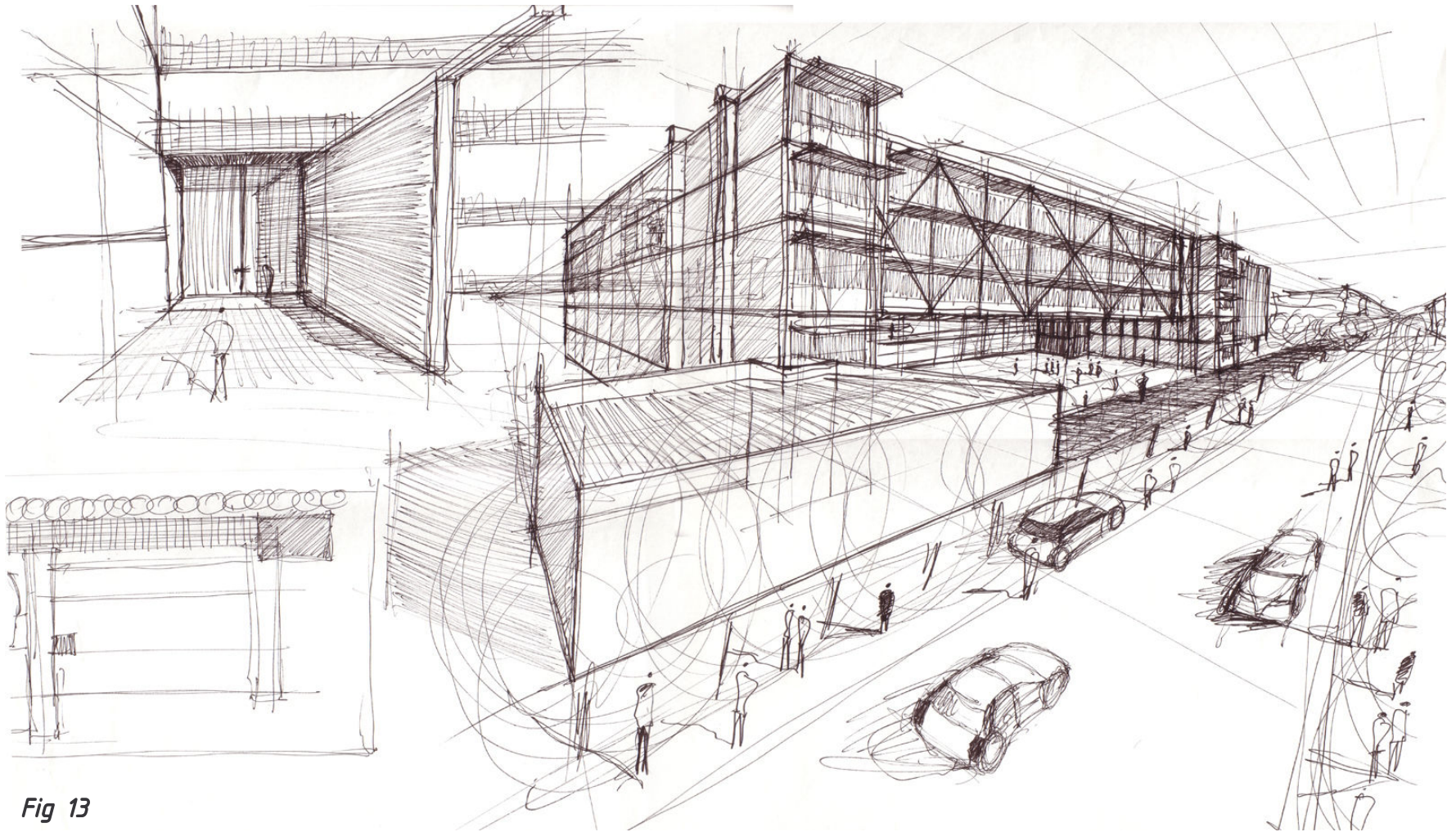
*Fig 10*



**Fig 11**



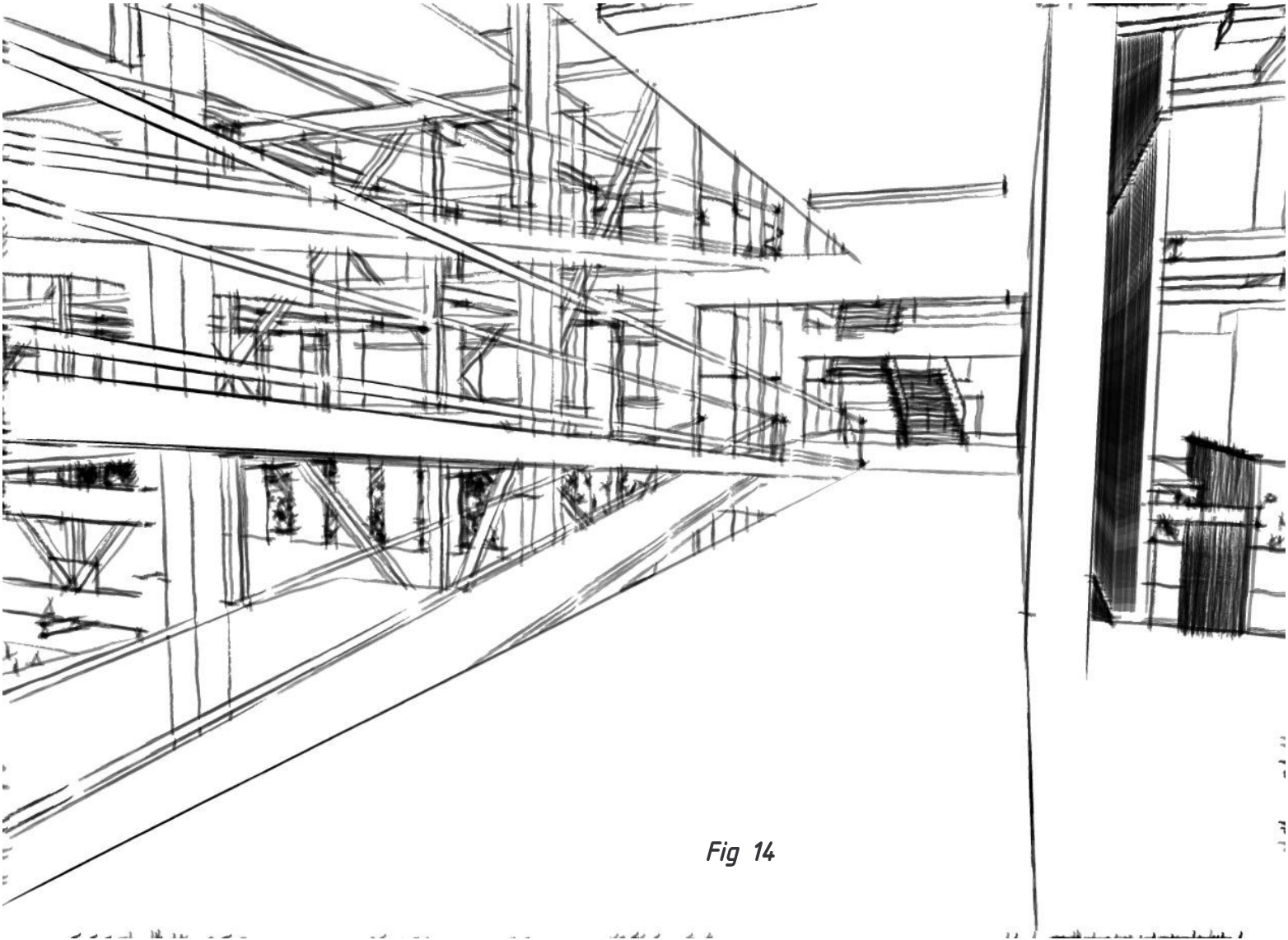
**Fig 12**



**Fig 13**

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*design resolution*



*Fig 14*

1. Eastern circulation wing
2. Residential units (southern wing)
3. Western circulation wing
4. Entrance foyer
5. Exposed hydraulic lift shaft steel structure and stairs
6. Second concrete lift shaft and staircase
7. Retained railway building
8. Expo pod structure
9. Existing Jacaranda trees

10. Office spaces
11. Double volume entrance into workshop and machine shop
12. Deciduous creeper in northern facade of southern wing
13. Light timber shade structure above canteen
14. Planted landscape with shade grass and Coast silver oak trees
15. Galvanised steel basement ventilators
16. Minnaar Street

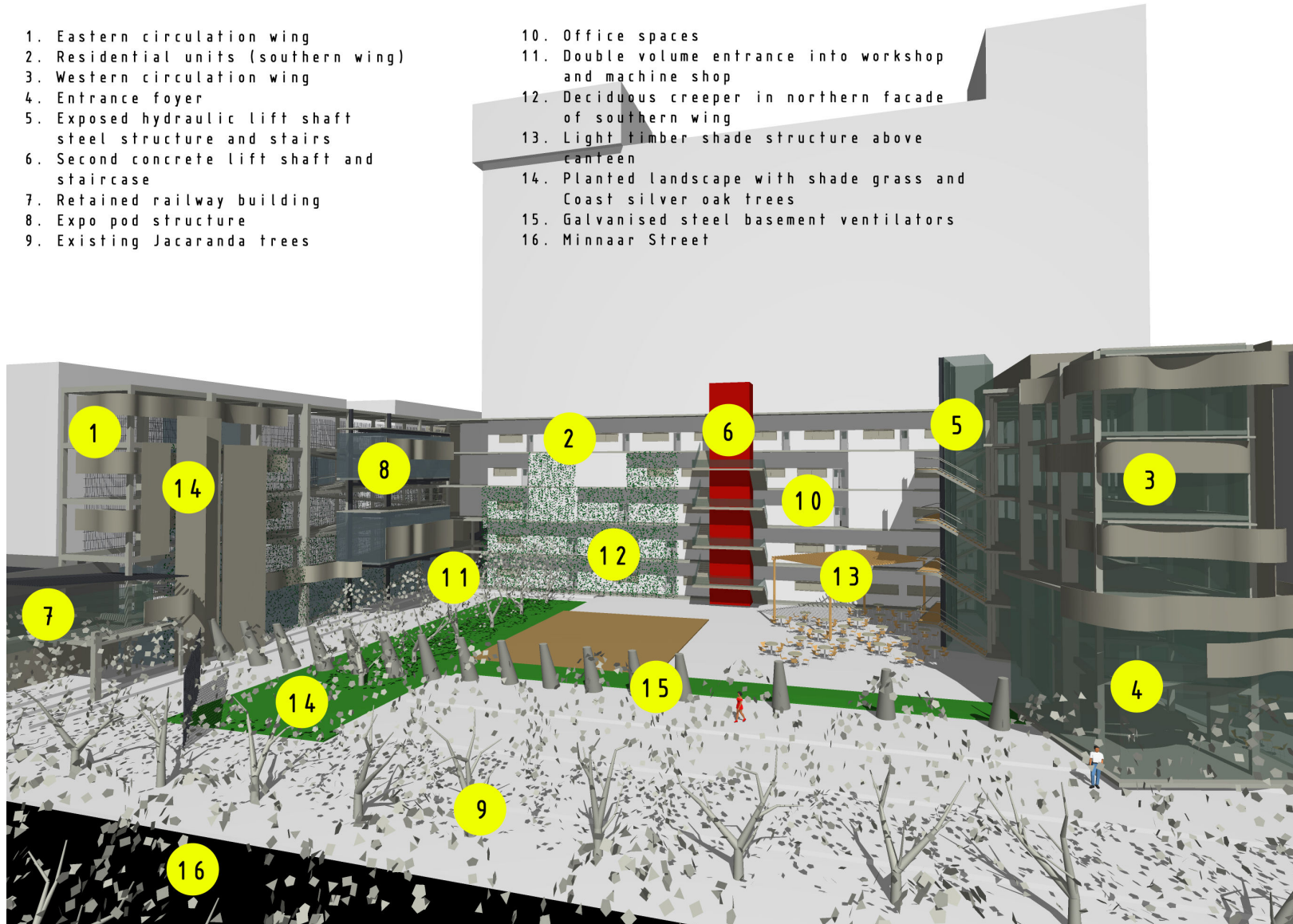


Fig 15

- 1. Steel studio bridge structure
- 2. Plywood Sunscreens on light steel structure

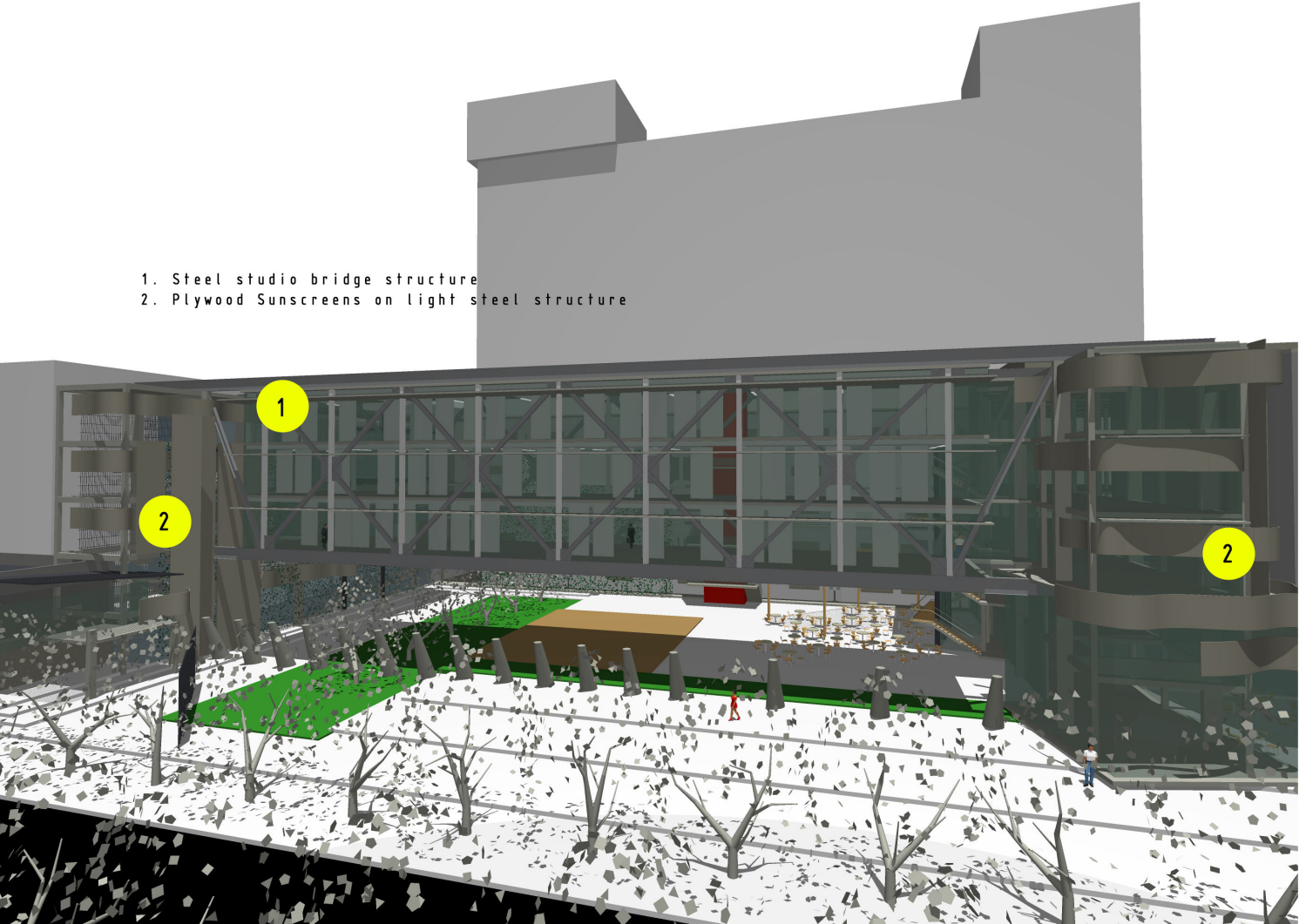


Fig 16

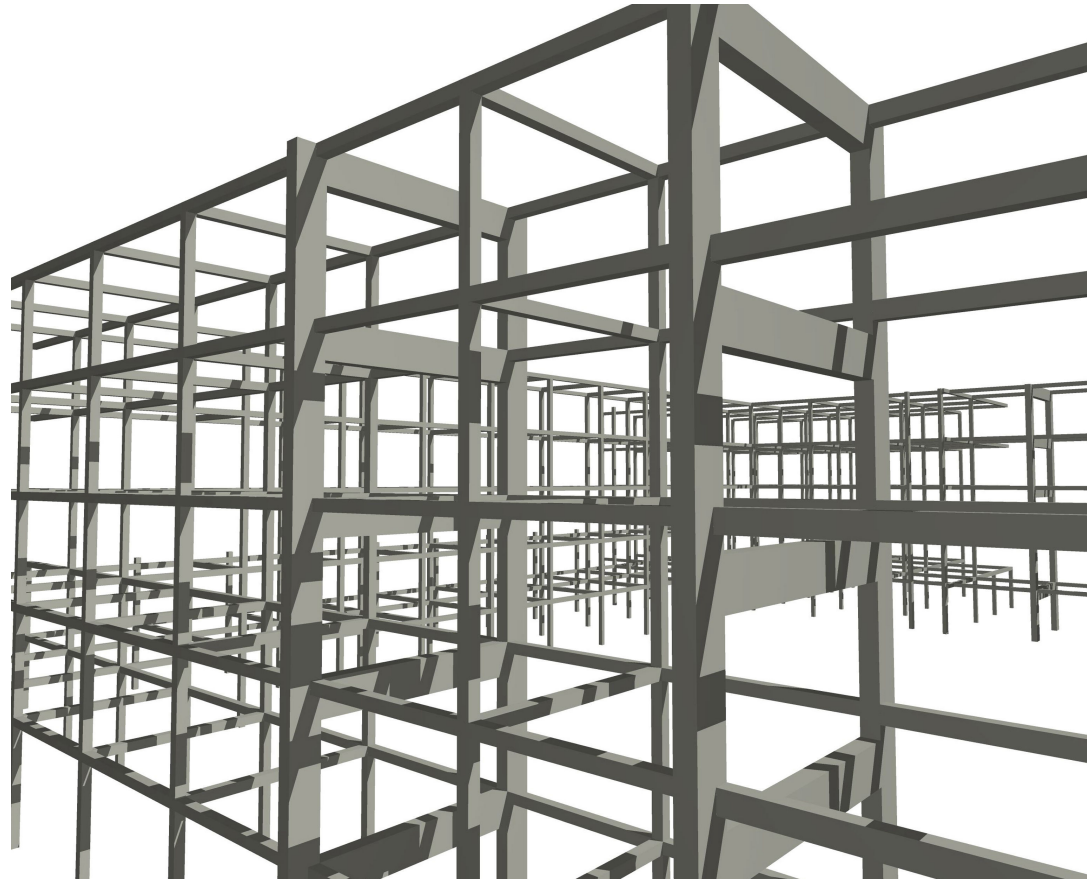
## Technical evolution:

This chapter explores the use of concrete, steel and other materials pertaining to the main super-structure, the steel bridge structure (studio space) including a steel frame for the hydraulic lift shaft, and the eastern circulation wing with its 'clip-on' steel structure exhibition pods. In addition, the general performance of the building is briefly explained.

### Main Structure:

The building comprises of two main structural systems, namely, reinforced concrete column and beam structure with concrete floors (main super-structure), and a steel structural system. The investigation concentrates on these two systems and explores the versatility of 'clip-on' steel structures versus the rather static concrete skeleton-like super-structure. To understand that these two systems can merge to create space relates to the dualism in design between design and production. One forms the basis for a product and the other creates the object.

*Fig 1. Concrete super-structure*



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The **concrete super-structure** is laid out on a plan grid layout of 6X6 metres (Figure 1). This layout is based on parking bay spaces in the basement level below ground in conjunction with an optimum span for concrete floor spans. A six metre span eliminates the need for heavy reinforcement within the floor slabs and allows cast-in-situ concrete floors a minimal thickness of 170mm with the aid of pre-tensioning.

The **floor system** used throughout the building varies from cast-in-situ floor slabs to Bondek designed spans and hollow block floor slabs.

In the south and west wings of the building cast-in-situ slabs and beams are used because of the requirement for stiff floors and reduction of structural vibration that may arise from footsteps and activities on the above floor slabs, furthermore, these floors offer bracing to prevent any lateral movement within the structure.

Using Bondek flooring in the eastern circulation wing allows the use of permanent shuttering and a thinner slab for the upper level. Vibration, caused by footsteps and activities above, within this floor is greater but allowable in such a space. The exposed underside of the permanent shuttering gives an industrial finish to the space

The last floor type is a hollow-block system used in the bridge structure. Purely to decrease weight, this system was chosen to fulfil the requirement for use inside a suspended steel bridge structure.

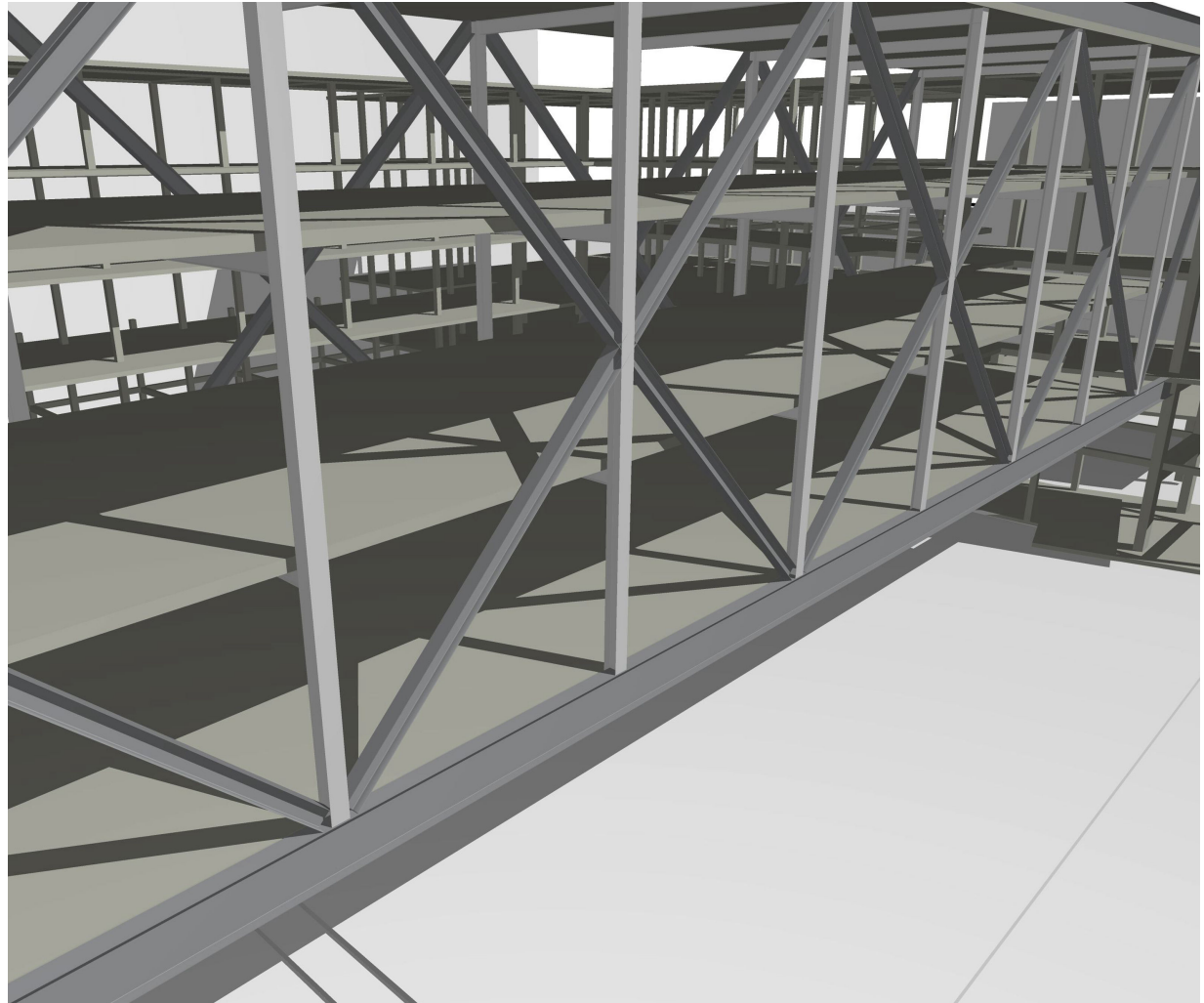


Fig 2. Steel bridge with hollow block floor system

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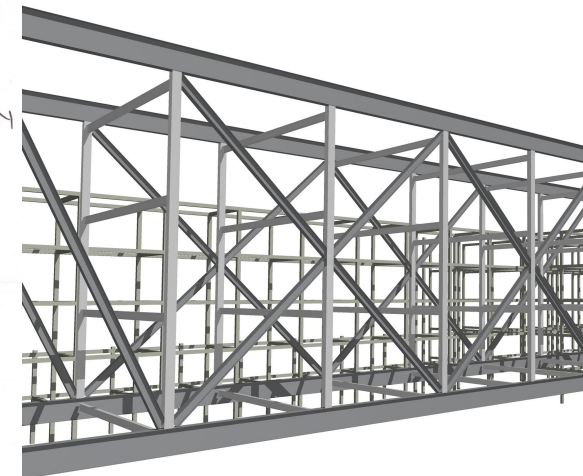
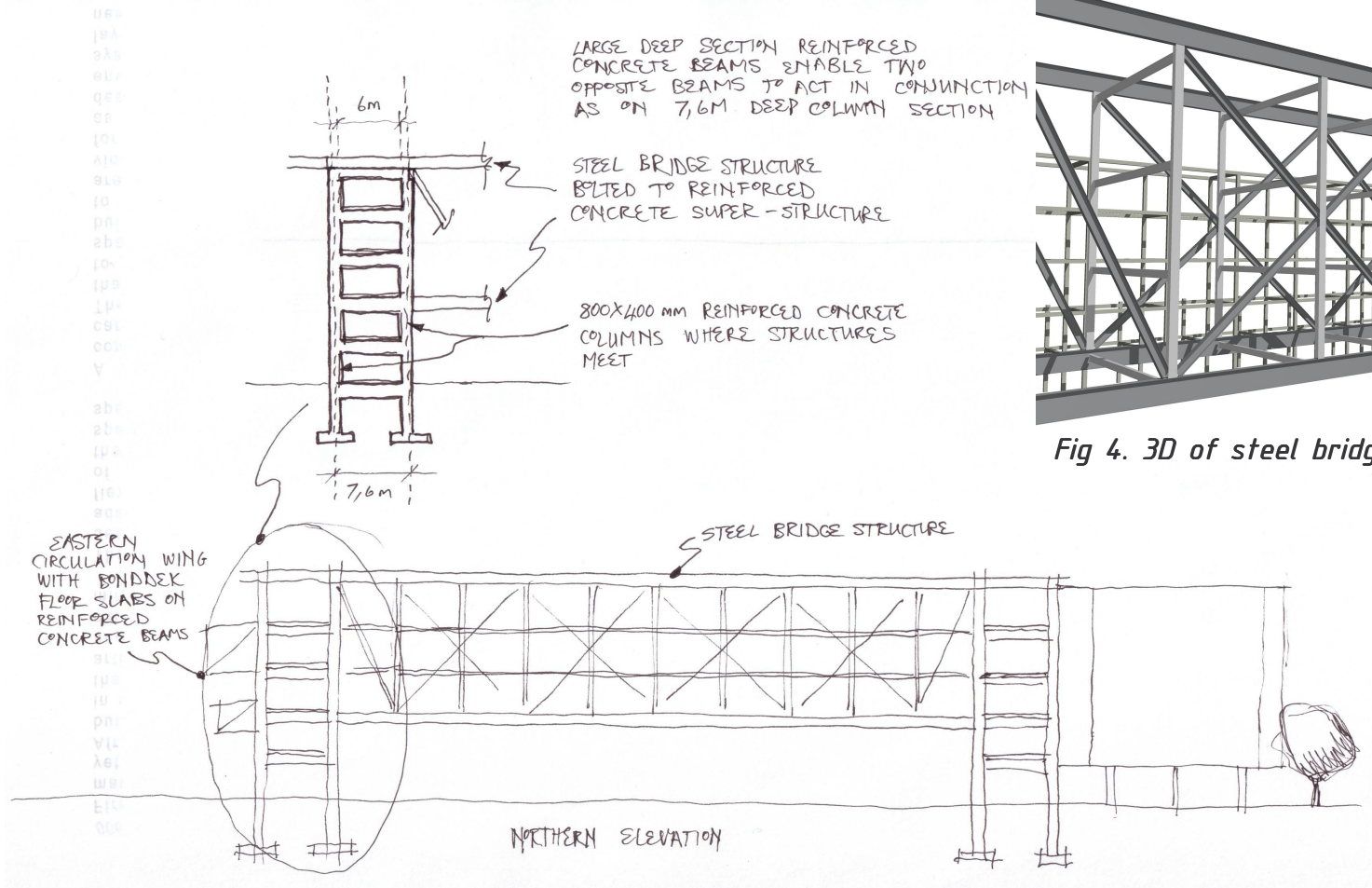
Figure 1 shows the **reinforced concrete frame**, consisting of 350X350 columns throughout the building. These columns are too slender to take the loads from the steel bridge connection. For this reason, the eight concerned columns that carry the

direct loads from the bridge are increased in size to 800X400mm. This principle is illustrated with Figure 2 where the effective depth of the columns on opposite sides of the bridge structure is increased in section. In addition, the columns are joined with

*technical evolution*

deeper section reinforced concrete beams; this changes the effective depth of each end support from 400X800mm individual columns to 400mmX7.6m composite columns, refer to sketch details in Figure 3 and 3D presentation in Figure 4.

**Fig 3. Sketch of effective column design for carrying steel bridge**



**Fig 4. 3D of steel bridge structure**

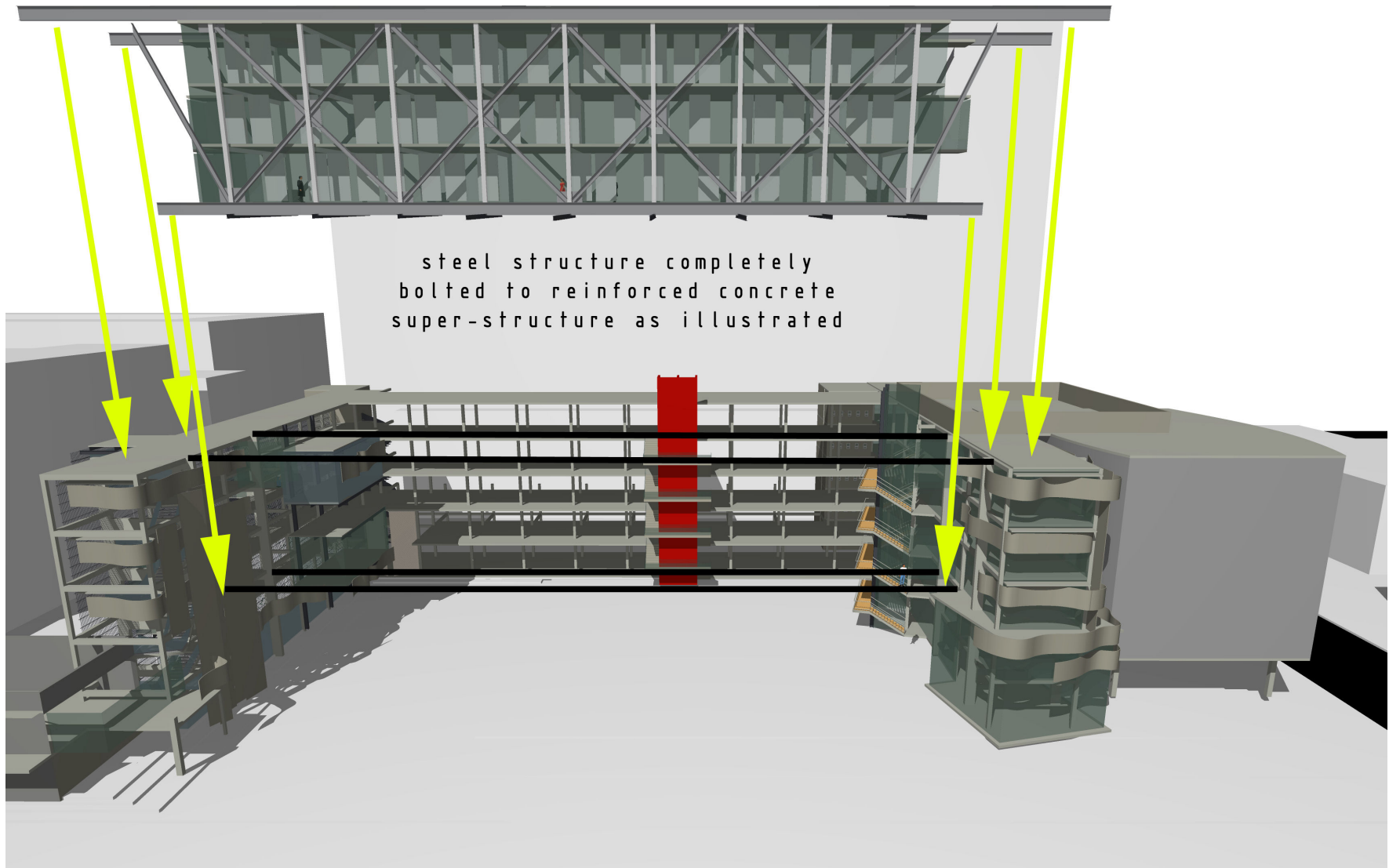


Fig 5. Placement of bridge onto concrete super-structure

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The **steel bridge structure** consists of two primary overhead GR. 300W 305X914X201 Welded I-sections and two lower secondary GR. 300W 305X914X201 Welded I-sections (refer to Figure 2). Connecting these two sets of beams are vertical GR.300W 305X305X137 I-section members. Cross-bracing is provided with back-to-back GR.300W 381X102X55 channel sections bolted in double shear to pre-manufactured gusset plates. To support the hollow block concrete floors are GR.300W 406X178X61 I-section beams fixed to the vertical steel columns.

**Exhibition pod structure:**

As part of the idea of creating spaces that have an industrial feel and presence, the design of the exhibition pods is an important link to the theory. The pods are designed as 'clip-on' steel structures that create pockets of space along the interior of the eastern circulation wing.

Referring to Figure 6 and 7, these spaces form part of the exhibition spaces of the building and deliberately intend to provoke inquisitiveness amongst users.

Each pod consists of 260x90x38 mild steel channel sections bolted to the concrete structure. These channels are connected to similar steel channels beams as support for Bonddek floors.

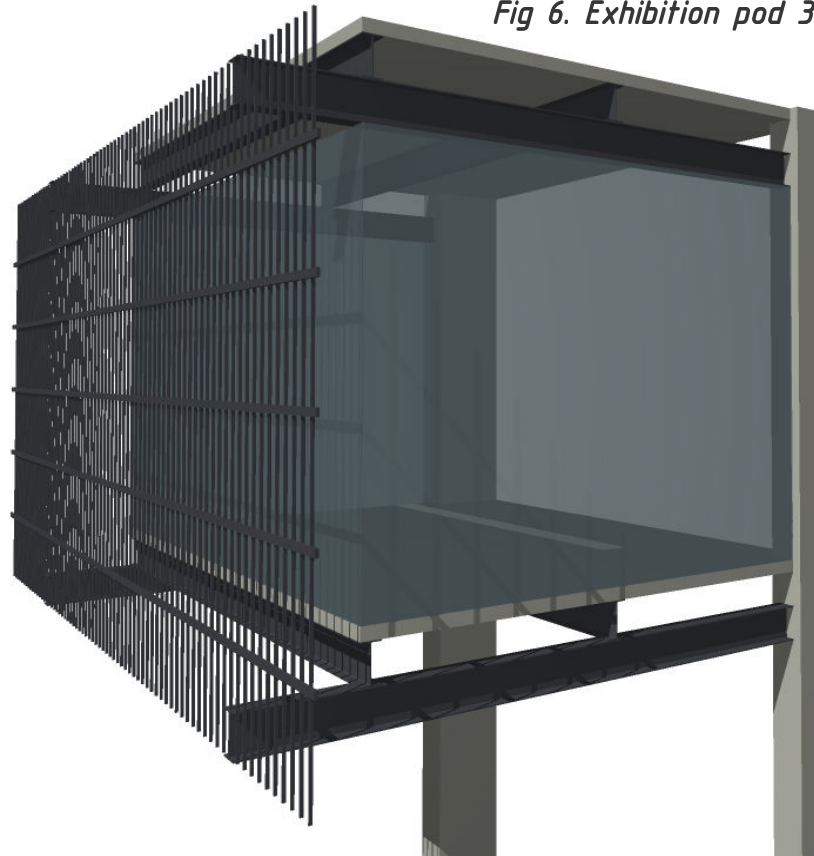
200x75x20x2.5 cold-formed steel lipped channels are used as purlins for roof sheeting that covers each pod. All steel used is of GR.300W and treated for corrosion.

Each pod needs protection from direct eastern sunlight and a steel frame and **louvre screen system** is employed to fulfil this task. Transverse channel

*technical evolution*

sections that are bolted to the concrete structure extend 400mm past the edge of the concrete floor. These channels sections are provided with mild steel 5mm end plates to which the steel louvre and frame system are bolted.

*Fig 6. Exhibition pod 3d structure*



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technical evolution

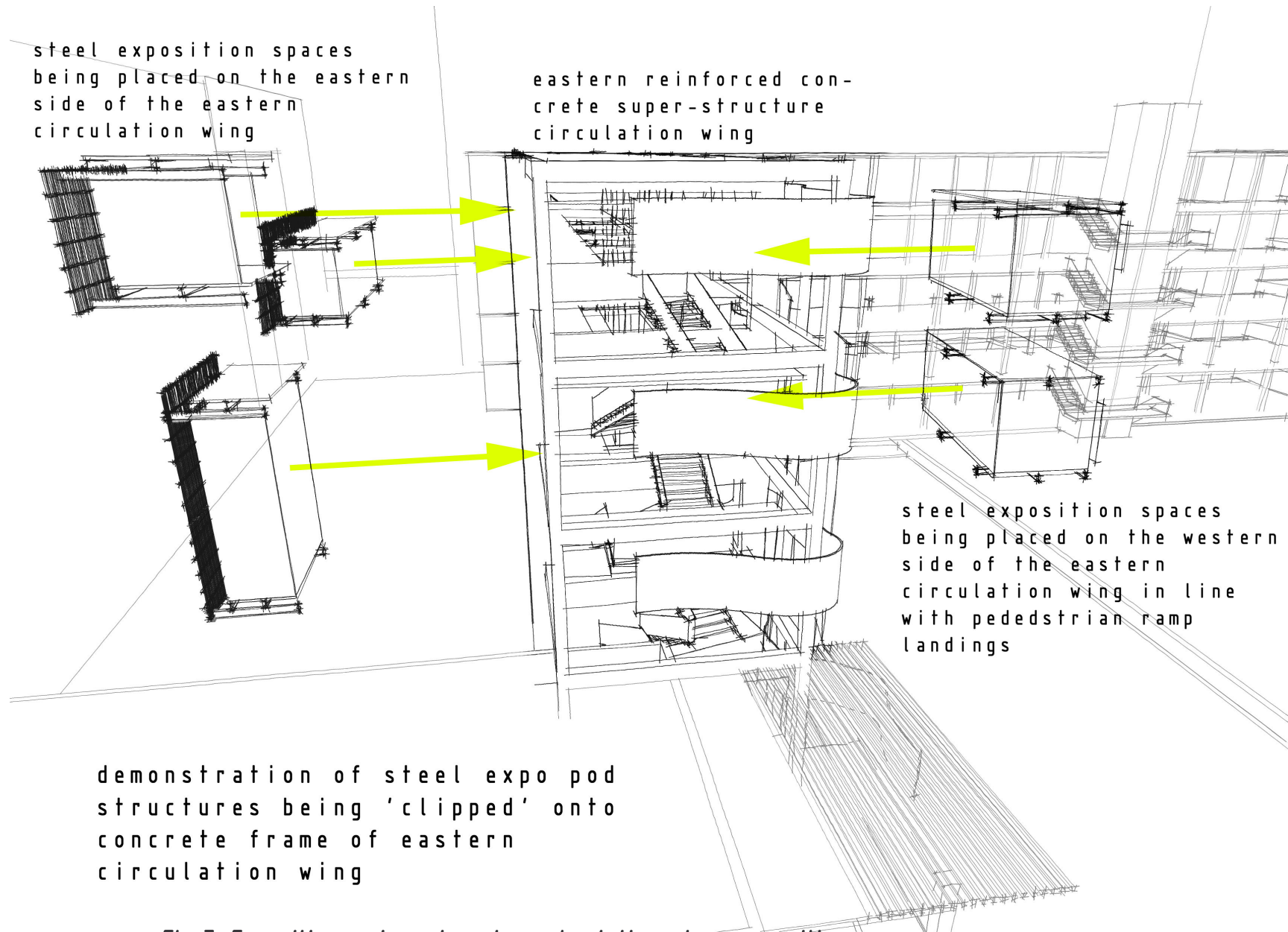


Fig 7. Exposition pods and eastern circulation wing composition

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To keep the elements out, each pod is protected with a skin of 6mm **polycarbonate sheeting**, being used instead of glass panes to reduce weight. This skin is used as a translucent sheeting rather than a glass curtain wall thus eliminating direct glare and diffusing the light into the space. Advantages for using polycarbonate screens are less expensive and lightweight when compared to glass; also, polycarbonate sheeting does not radiate absorbed heat like glass panes of the same section.

The principle of '**clip-on-spaces**' becomes important for the appearance and relevance of these pods as exhibition spaces. Adaptation and flexibility is associated with these spaces because these structures can be demounted or added to the building as required therefore making the building more adaptable for functional spaces. Variations of these pods are designed and therefore the pods offer flexibility of space.

### Eastern circulation space:

Referring to Figure 7 and the exposition pods, the eastern circulation wing consists of several key components. Firstly, the most important function is circulation, there is a staircase moving from ground level to fourth floor as well as a ramp at a gradient of 1:12 going

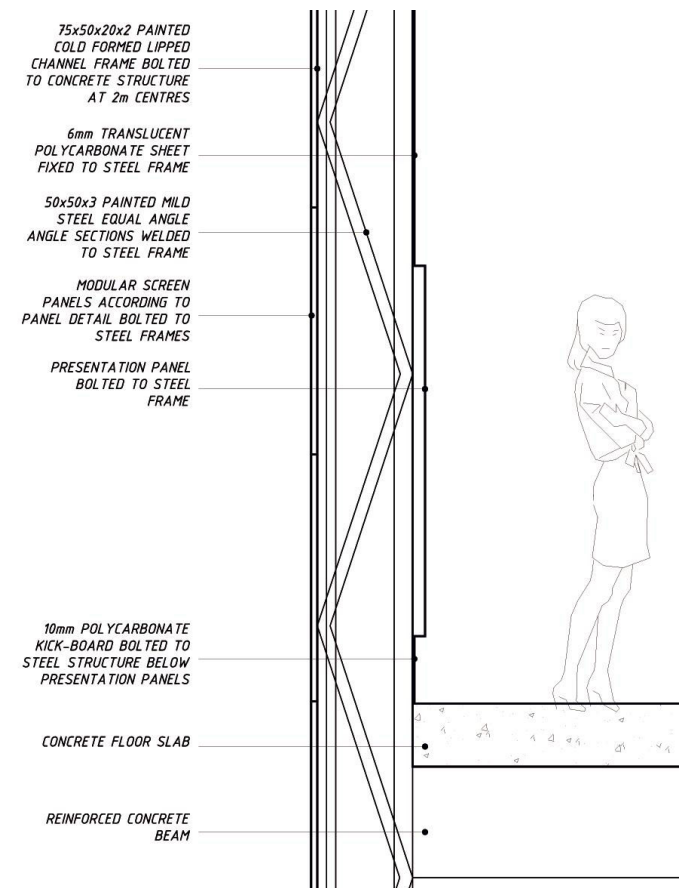
up the same levels. There are exhibition pods that extend the wing into an exhibition space for the centre. The wing creates support for the steel bridge structure that becomes studio space for the centre (explained in Figure 3 under reinforced concrete frame).

To make the space available for exhibitions meant that pin-up panels were required. Parts of the eastern side of the wing are provided with pin-up panels as walls but not the entire wall. The eastern side of the wing has horizontal floor slabs and the skin is intended to be transparent in order to respect the neighbouring building façade. This constraint led to the design of a 100X100mm mesh steel-screen system that provides a vertical support for a creeper plant.

This screen is fixed to the main structure with a lightweight steel frame that is bolted to the concrete super-structure, refer to Figure 8. An evergreen Flowering-ivy (*Sencio macroglossus*) creeper was introduced to eliminate as much direct eastern sunlight along with the screen itself.

*technical evolution*

**Fig 8. Detail of steel creeper screen fixed to lightweight steel frame and bolted to concrete structure on the eastern wing**



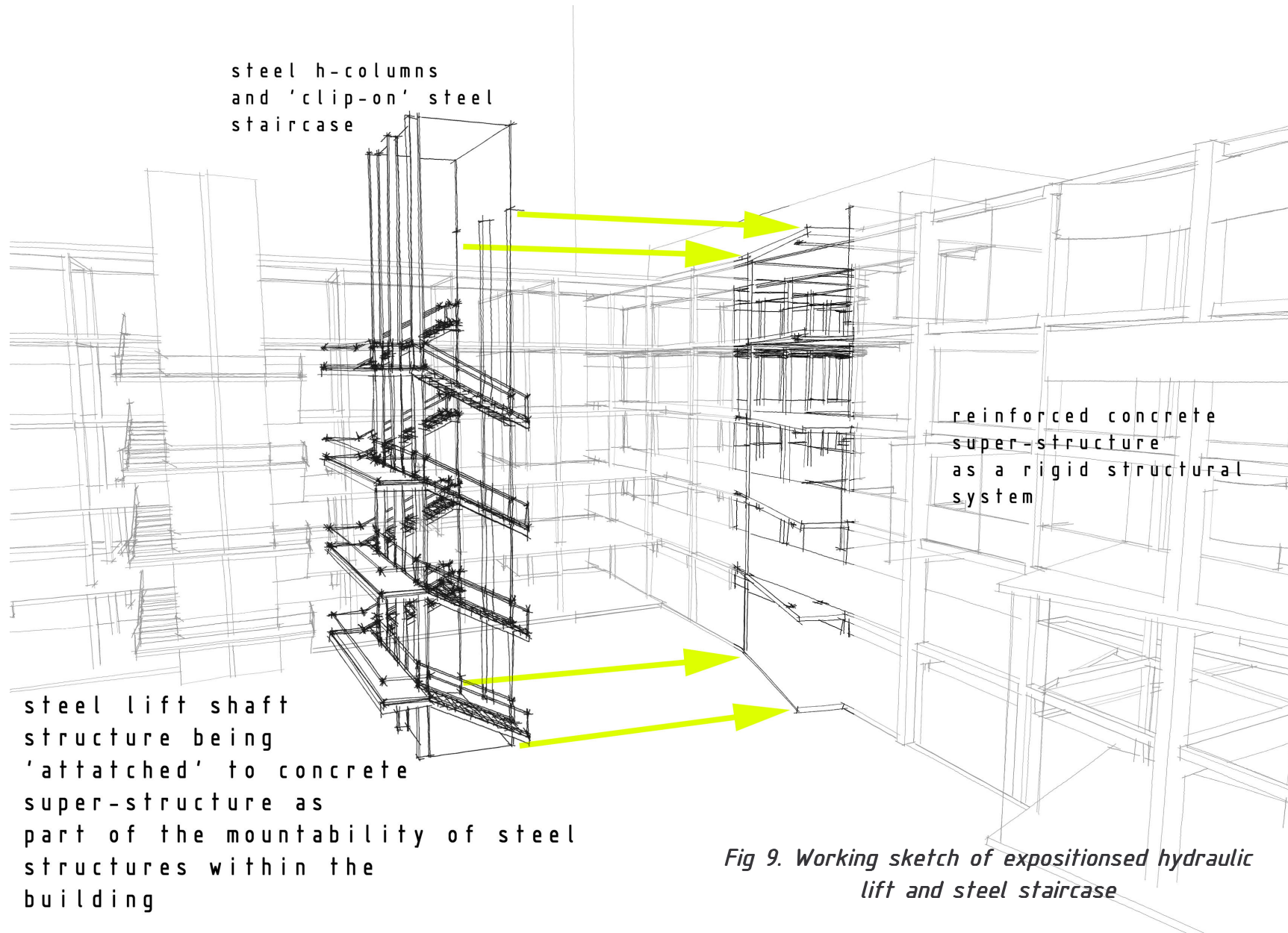


Fig 9. Working sketch of expositioned hydraulic lift and steel staircase

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*technical evolution*

**Hydraulic lift shaft:**

Accompanying the 'clip-on' steel exposition structures is the hydraulic lift shaft. Not as adaptable and flexible as the exhibition pods, this shaft is put together much the same as the exposition pods (Figure 7).

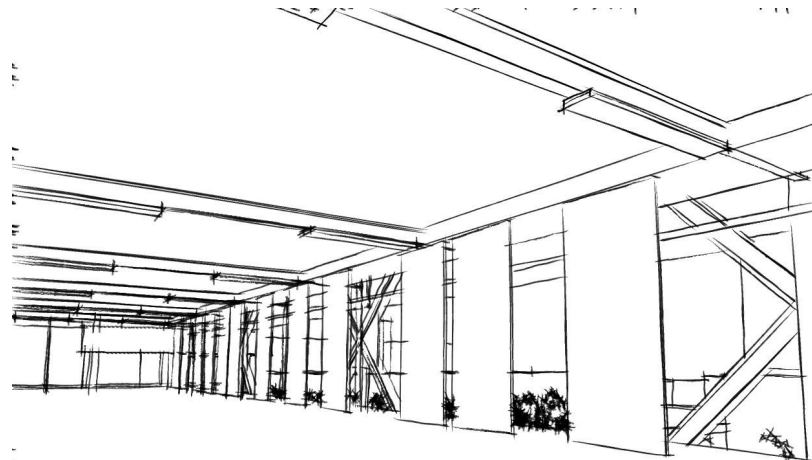
Pre-manufactured steel beams, columns and braces form the basic structure responsible for all forces exerted by the twin lift system and the staircase attached to the shaft. The shaft is designed as a separate structure that can be bolted onto the main concrete structure to provide vertical circulation.

Attached to the shaft structure are expositioned twin hydraulic lifts with clear-glass panels, an expositioned steel staircase wrapping the structure, and the expositioned supply and return ducting from the on-roof air-conditioner plant.

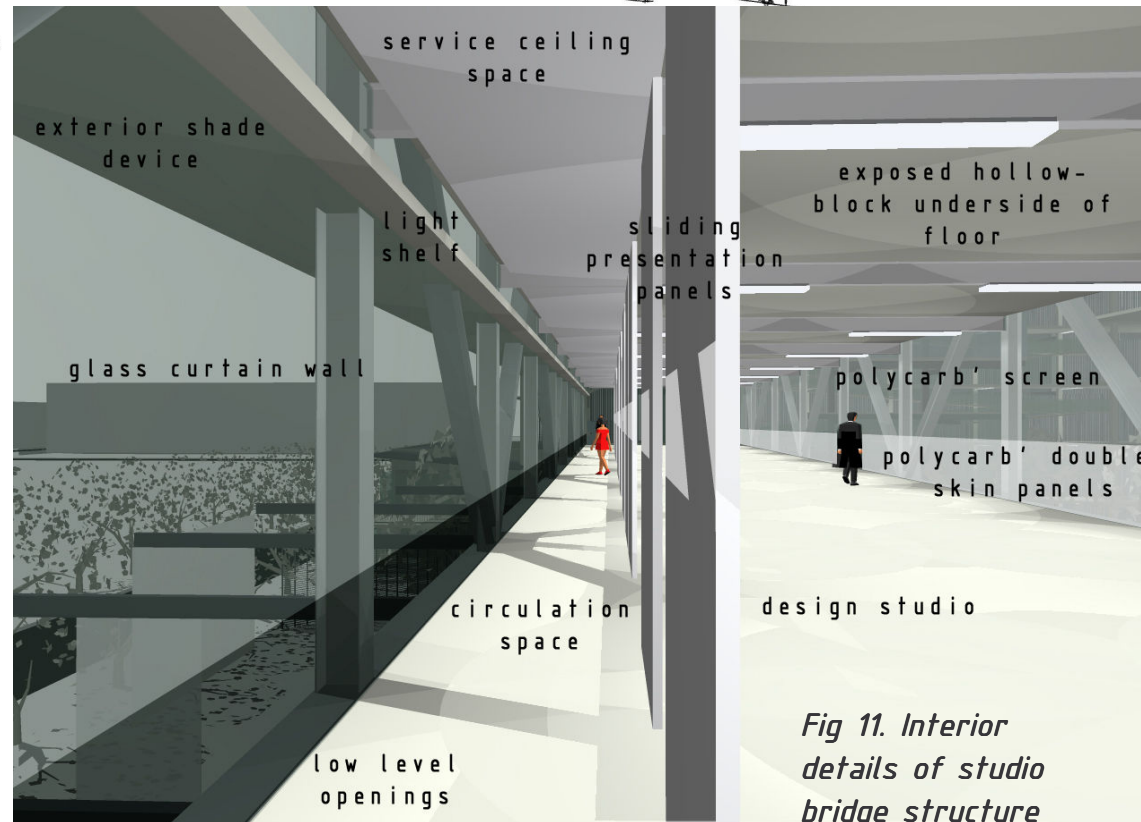
To enhance the industrial feeling of the building, this shaft is designed as a service duct bearing expositioned ducting as explained and being a raw steel structure with rather elementary steel details.

**Studio interior spaces:**

One of the most important designs within the centre was the design studios. These spaces need maximum natural lighting during the day and good ventilation in order to promote positive working conditions for design students.

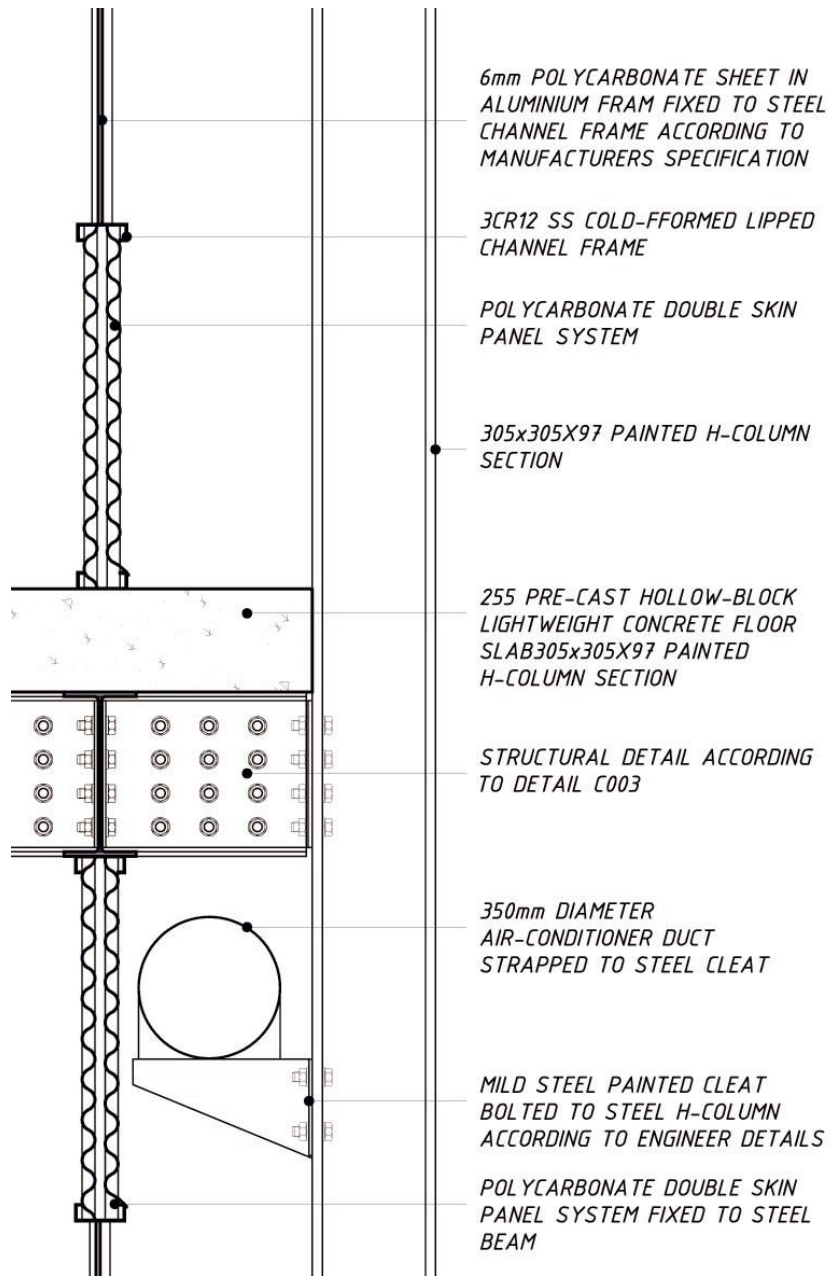


*Fig 10. Sketch of interior towards northern facade*



*Fig 11. Interior details of studio bridge structure*

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**Fig 12. Section through southern skin of studio space**

### *technical evolution*

Firstly, the studio bridge structure faces north and south and thus makes efficient potential for using natural lighting. A glass curtain wall is provided for the northern skin for several reasons. Firstly, this is a skin of tinted heat-absorbent glass intended to radiate absorbed into the space to heat the space in winter only. This glass also eliminates a most of the direct glare from outside. The southern side is provided with composite double polycarbonate sheeting panels on the lower level and 6mm transparent polycarbonate screens above this.

### **Tinted heat-absorbent glass**

poses a potential problem causing radiation of heat during hot days. For this reason, horizontal shade devices (explained later on) are provided at each level on the outside of the façade. Low-level openings provide passive ventilation operated by users as required.

Using **polycarbonate** panels (refer to Figure 12) becomes more sensible in the studio space; these panels are lightweight and provide insulation against heat loss. Polycarbonate panels cost less than equivalent double-glazing, and weigh considerably less. A 6mm screen is provided above the double sheet panels instead of

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clear glass; these screens have an 82% light transmittance. This saves weight and does not compromise lighting levels within the space, making full use of the southern light. Screens are installed by manufacturer, braced and supported to the manufacturer's specification.

Furthermore, the studio space is divided into two, namely; a circulation space on the northern side and the design studio on the south. A sliding panel system defines these two spaces and is used as pin-up boards for the students.

### **Northern façade sun-shade device:**

In order to use solar gain for passive heating within the north facing spaces, a shade device was designed that allows only limited amounts of sun into the space during specific times throughout the year.

This shade device is designed as a multi-purpose composite sun-shade. Firstly, it is intended to stop direct sunlight from shining onto the glass façade during summer days while allowing limited sunshine into the glass façade during winter. Secondly, this shade structure doubles as a solar water heater.

Being expositioned to sunlight during winter days, it makes sense to use this

solar gain to heat water panels; the shade device allows for use as a solar water-heating element. On the bridge structure there are three levels where the shade structure is required, on each shade structure a water heating system is employed. The water is heated when the sun shines onto the panels and may reach up to 60°C. This is achieved by using solar heating water panels joined together as specified by the manufacturer. These panels are supported on a frame and suspended with steel ropes to the main bridge structure. The water in the panels is circulated through a closed loop system at a specified velocity for each level by means of a computer controlled electric pump, as per Figure 14. Heat is generated in the fin heaters within the space. In summer, the velocity of the system is speeded up to prevent too much solar gain when the panels are expositioned to sunlight. The top solar panel system is hot-water supply because these panels are expositioned to direct sunlight all year round; this creates hot water supply for the geysers during the months when the heater system becomes redundant. In addition, the top set of solar panels provide shading for the lower panels.

### **Environmental Performance:**

The prevailing wind in Pretoria comes from a northerly direction and even on still days, there is a slight breeze

*technical evolution*

moving through the city spaces. This wind is used as a feature for the courtyard space of the building; refer to Figure 15. Facing towards the north the courtyard is in the direct path of the prevailing wind. The large mature Jakaranda trees act as a windbreak for high velocity winds and allows air to pass underneath the crowns of the trees. Air moving into the space is forced up into the open volume due to a high-pressure pocket together with a low pressure created by wind moving over the top of the building.

This allows the courtyard ventilation throughout most of the year provided there is a light to moderate breeze. Wind is generally no more than moderate with few days of the year being wind-still.

All windows opening onto the courtyard do so at a high-level. The reason for this is that warm air escapes through these openings and is drawn out with the aid of the updraft illustrated in Figure 15. This principle allows **natural ventilation** to work well within the spaces surrounding the courtyard.

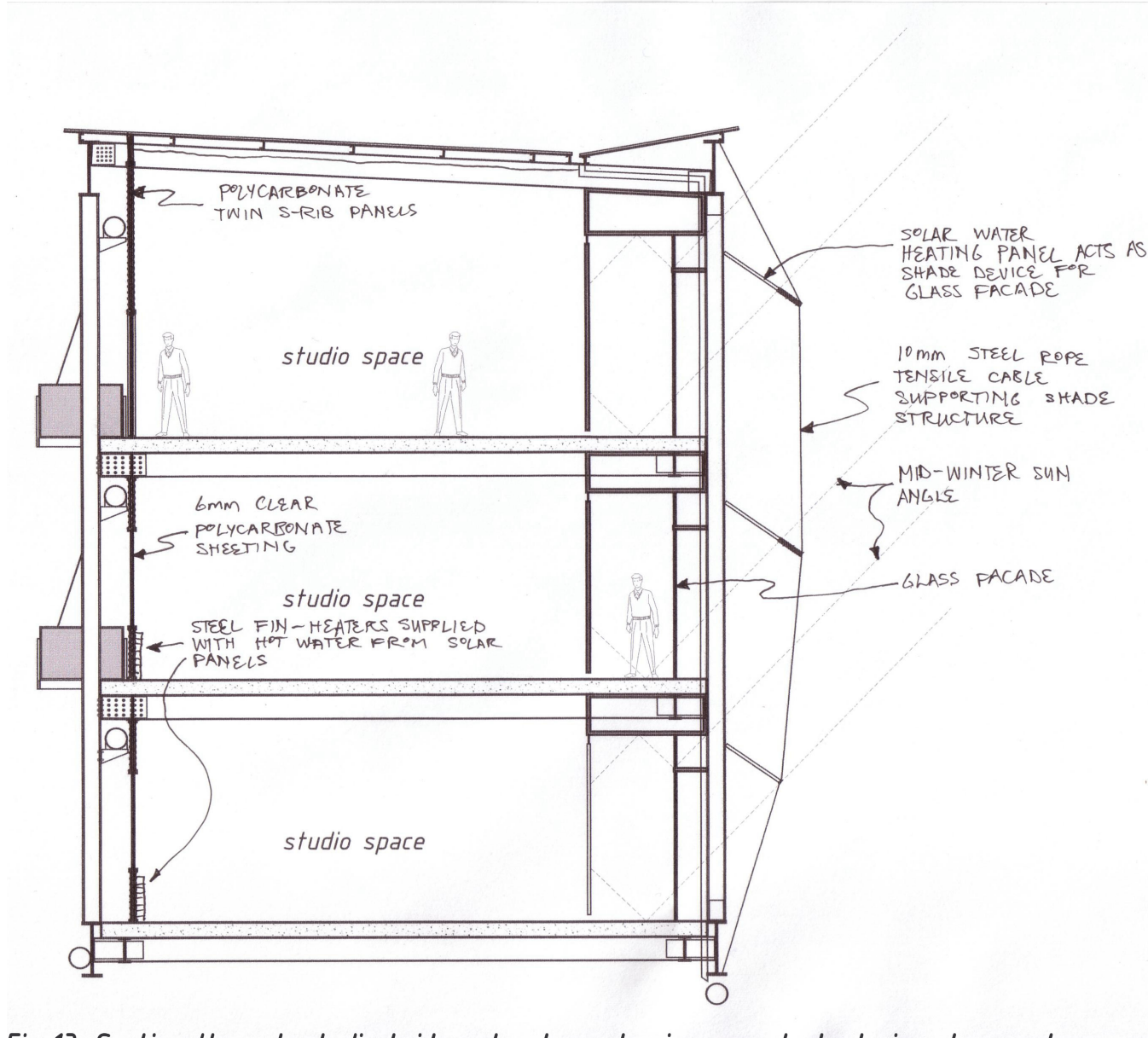
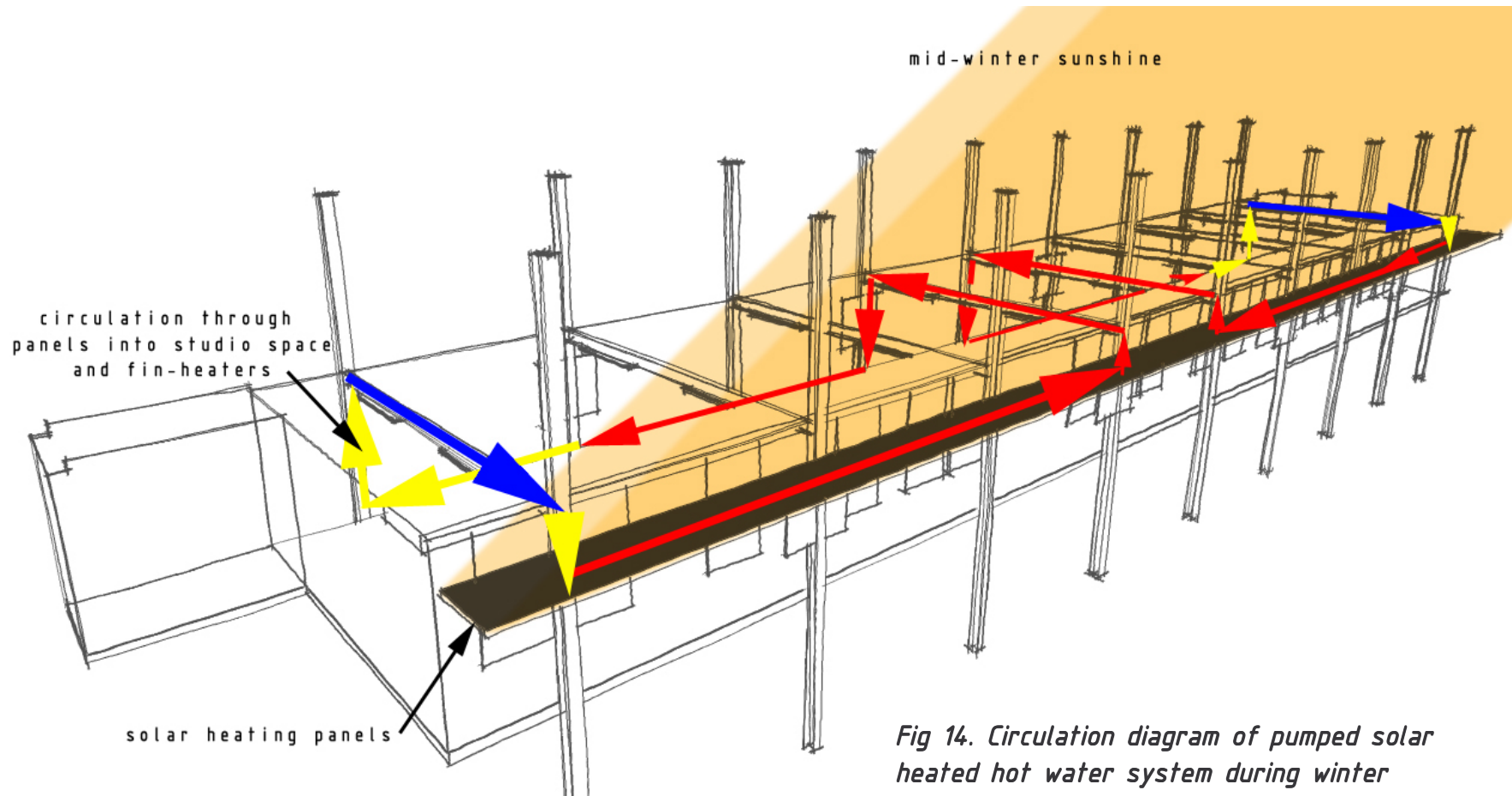


Fig 13. Section through studio bridge structure showing sun-shade device placement



*Fig 14. Circulation diagram of pumped solar heated hot water system during winter*

**Thermal Performance:**

Having mass structures such as concrete and brick absorb heat during the day and radiating this heat in the evenings, creating the flywheel effect. This leads to a more stabilised interior temperature and results in a greater temperature lag.

This principle is used in the design of the studio space where the concrete floor acts as the mass element for the space. In the office and training space, the brick wall infill work and concrete floors radiate gained heat during the evenings, refer to Figure 16.

The interior roof space is not provided with suspended ceilings due to the requirement for radiated heat from the expositioned and painted concrete floor slabs. In the studios, the same treatment is given except that a service ceiling space is provided above the

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circulation space, this makes the waste of design studio ceiling space redundant, refer to Figure 13.

### Mechanical ventilation:

This is a critical design consideration. When designing for a multi-purpose building, the requirement for ventilation

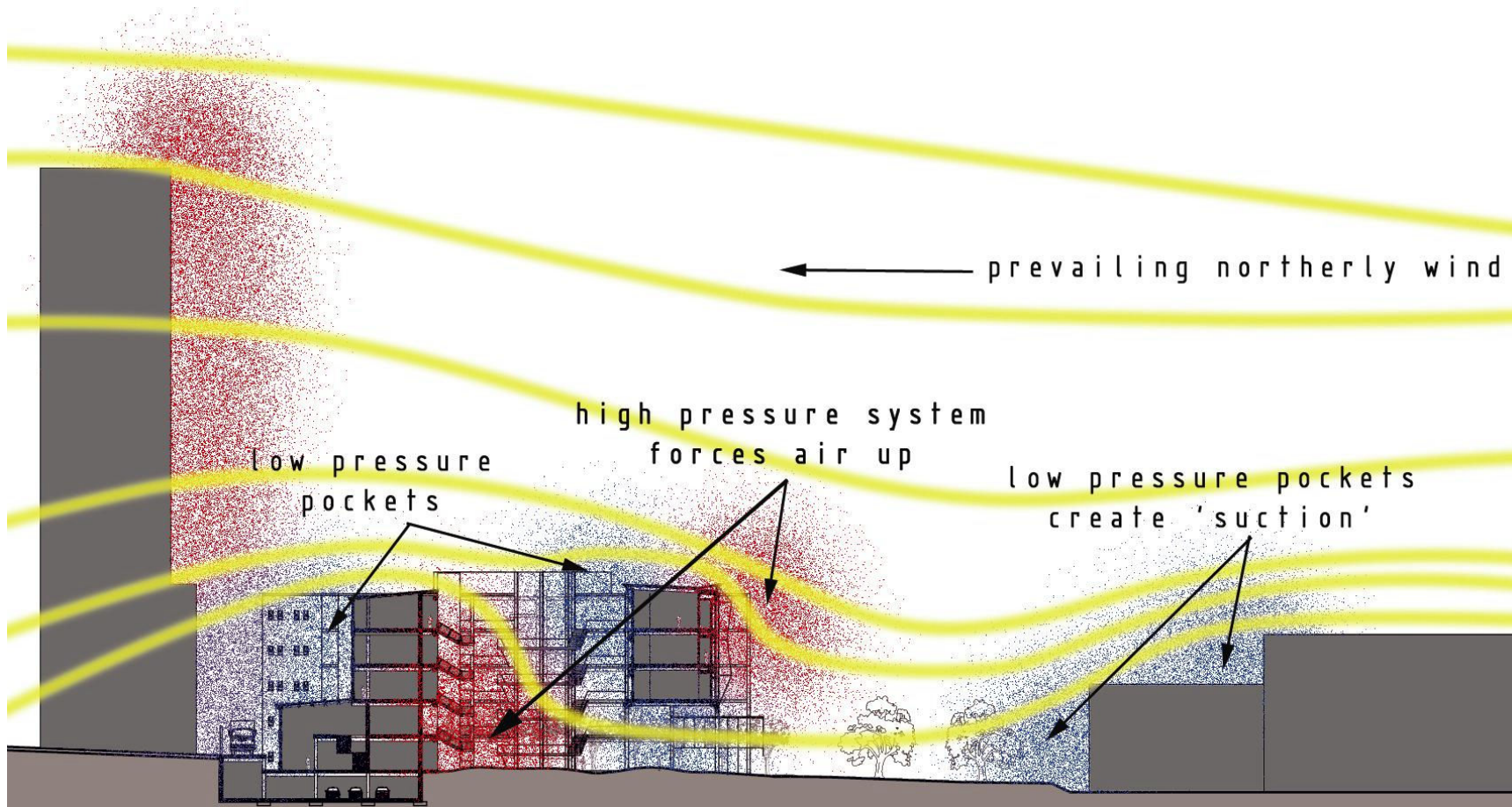
is important. There are many different spaces throughout the building and not all necessarily require mechanical ventilation. However, computer rooms, auditoria and studio spaces are high priority for mechanical ventilation.

Computer rooms need to be kept at around 21°C and dust-free. Also this

*technical evolution*

system will remain at a positive pressure to insure minimal dust infiltration.

Fig 15. Airflow diagram



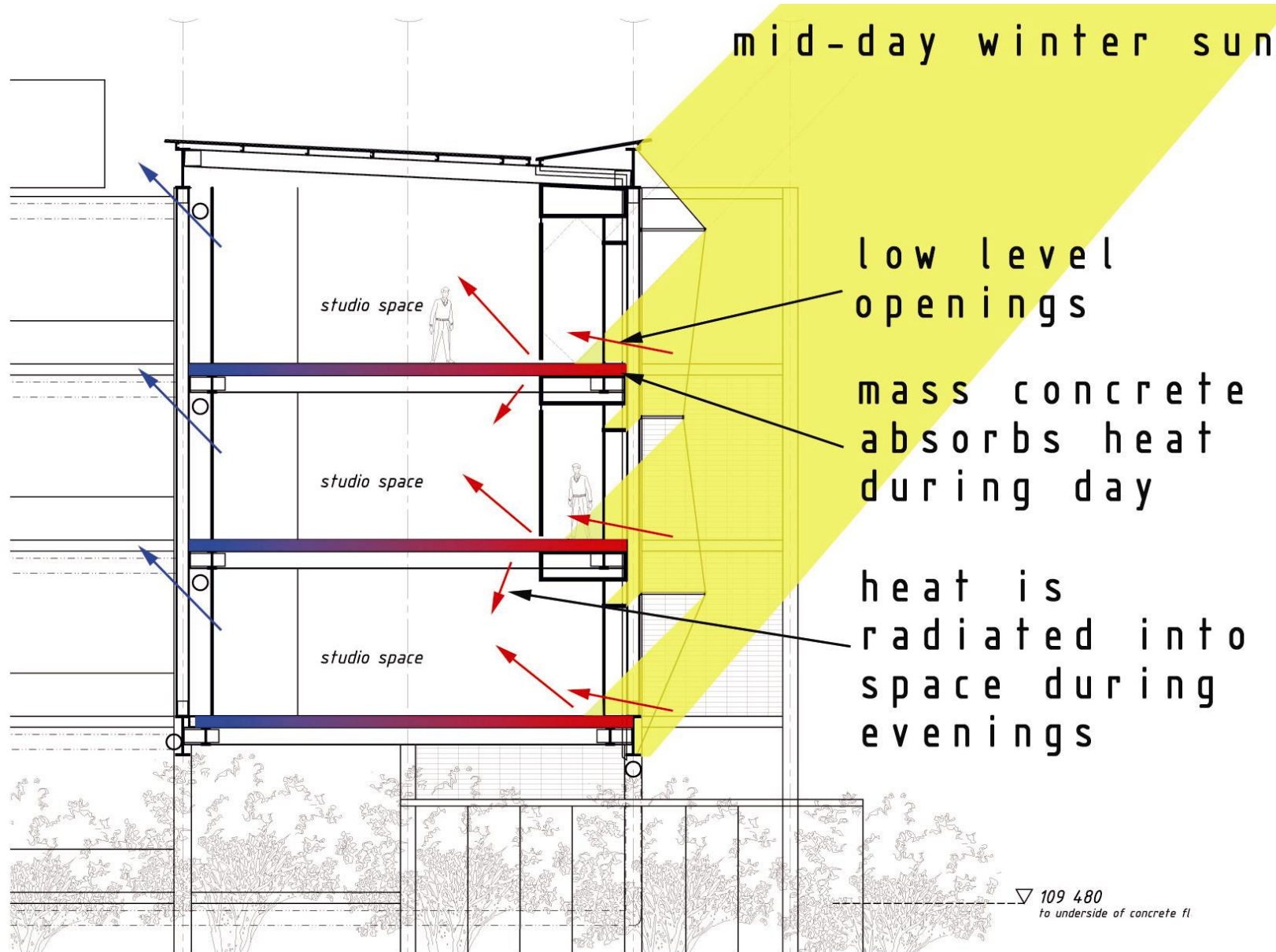


Fig 16. Air movement through natural ventilation within studio spaces

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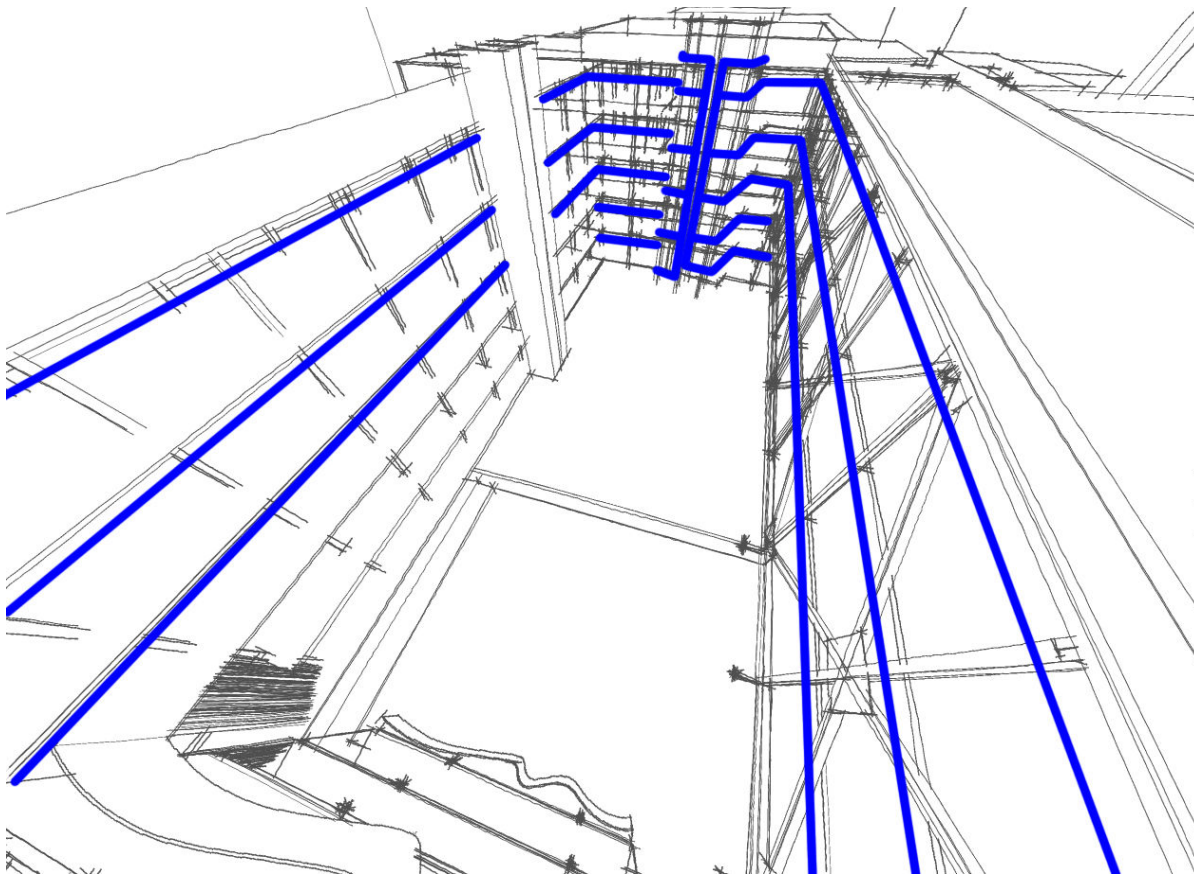
*technical evolution*

To keep the studios at around 22°C for optimal comfort may be required to employ the secondary mechanical system is to regulate the interior temperature. The advantage of having this system available is to also minimise dust that may enter when natural ventilation is used. User participation is required to close all openings to allow the system to operate efficiently.

The auditoria are closed spaces that require mechanical systems to ventilate and regulate the interior comfort zone.

To meet these requirements “chilled water fan-coil units” are introduced. This system allows for a central chiller plant that supplies the entire building with chilled (6°C) water. This water is then supplied to individual fan-coil units that provide ventilation ducted to air-conditioned zones.

This system is used as an aesthetic element (Figure 9) within the building. All piping from the central chiller plant is ducted vertically along the hydraulic lift shaft to each floor and then makes a loop around that floor back to the return piping. Each fan-coil feeds off of loop and this system allows for adaptability and flexibility within the building.



*Fig 17. Air conditioner chilled water ducting as architectural feature*

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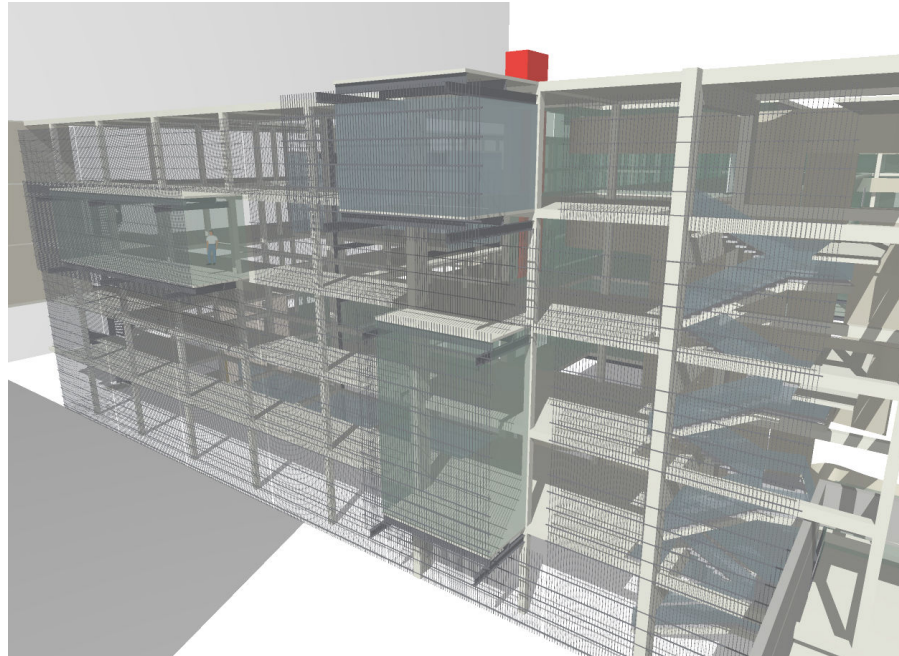
More units can be fitted as required to the loop and may also be removed, depending on the demand for mechanical ventilation.

All piping from the plant room is expositioned along the building in order to illustrate this system to all participators. This adds to the human interaction component of the design, relating back to elementary design of machines for industry. Adaptability and flexibility have been explained, but contribute to the significance of using and expositioning this mechanical system.

### Skin Design:

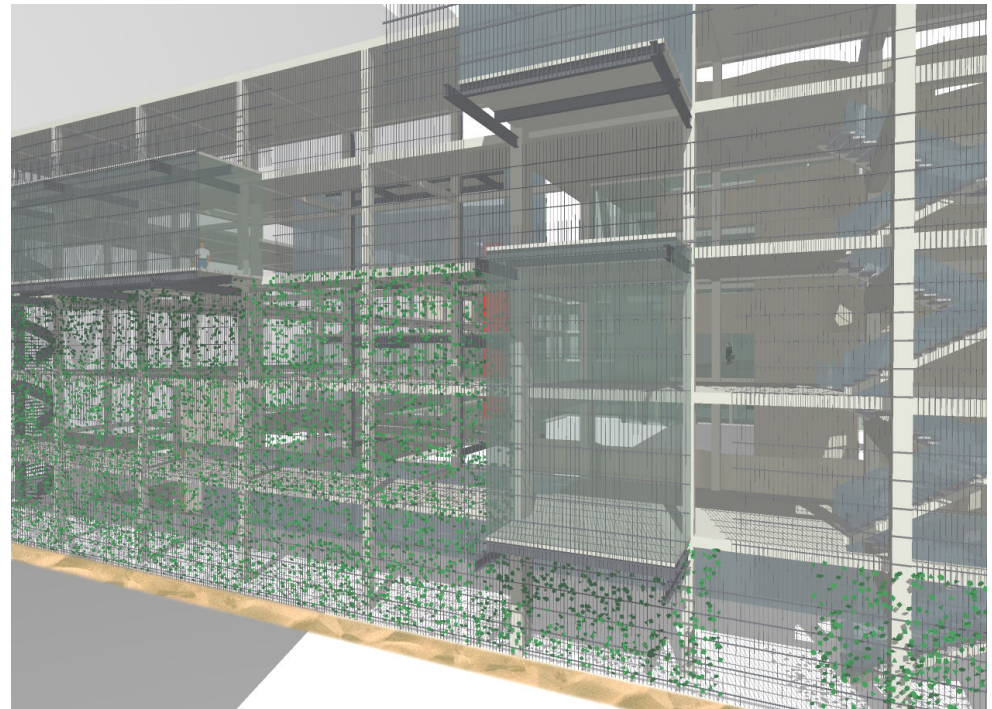
#### Screen system

On the eastern side of the eastern circulation wing, steel screens (as explained earlier) are fixed to the main structure as per Figure 10. These screens are designed to accommodate the growth of an indigenous evergreen creeper. The creeper creates a natural filter and buffer from the elements and the screens act as balustrades as well as a wall system for the circulation and exposition space.



*technical evolution*

**Fig 18. Steel screen structure fixed to steel frame on concrete super-structure**



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**Fig 19. Steel screen with evergreen Flowering ivy creeper**

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**Creeper system**

Two different systems are designed for the building, one for the above mentioned eastern wing and a separate creeper system for the northern façade of the internal courtyard. This creeper is deciduous and offers the dynamics of nature because it filters direct sunlight in summer and allows direct solar heat gain in winter on those mass materials named earlier.

The indigenous evergreen creeper on the eastern wing:

Senecio macroglossus (Flowering ivy), fast growing and hardy, grows in sun and semi-shade.

Deciduous creeper inside the courtyard: Gloriosa superba (Flame lily), Hardy deciduous perennial creeper grows well in semi-shade.

The plants proposed are watered with an installed irrigation system as recommended by landscape architect.

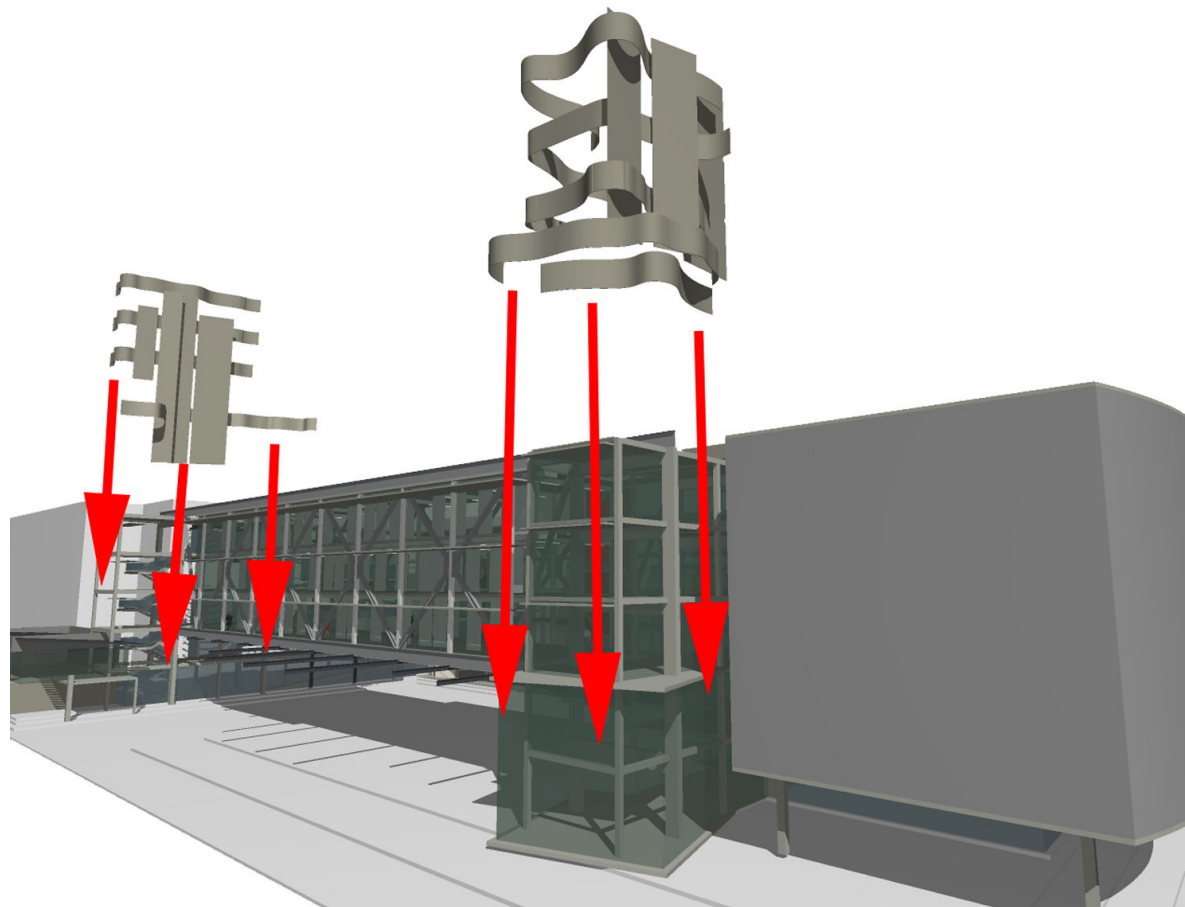
**Polycarbonate panels**

To reduce cost, translucent polycarbonate s-rib wall panels are used instead of glass curtain walls.

These panels are made up of two s-rib skins of polycarbonate sheeting placed next to one another with a 25mm cavity specified inside a steel profile frame as per Figure 12.

These panels help to diffuse light and in so doing eliminates glare that may cause undesired effects within the exhibition spaces.

*Fig 20. 3D placement of plywood screens*



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### **Secondary exterior skin**

A secondary exterior skin cuts out direct sunlight and solar gain that may create uncomfortable spaces.

machining and production of the skin is marginalized. The steel supports for this skin system are provided on the superstructure during construction.

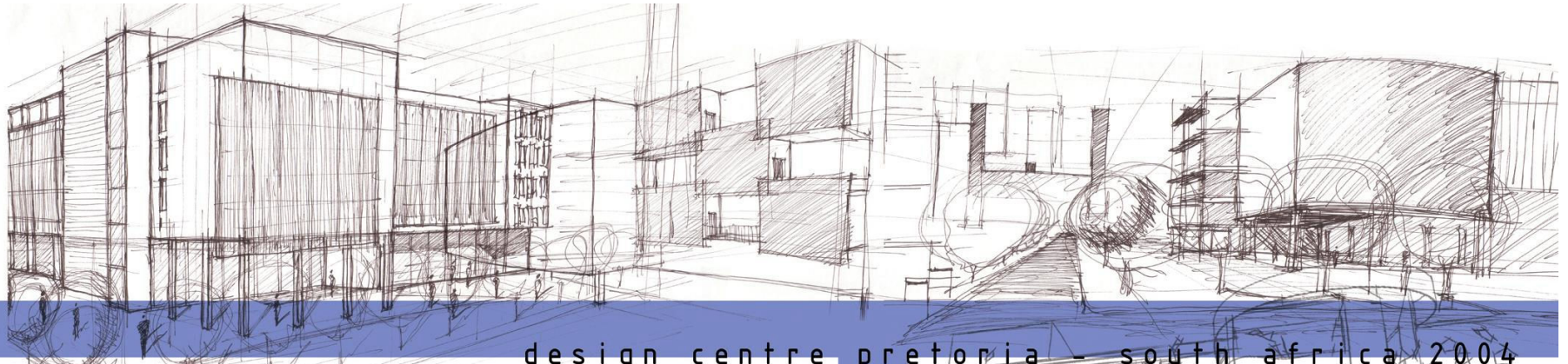
This system is designed to address the technological progression of the building and its adaptability for new technologies. A skin of unprotected 1.5m high exposed bent steel sheets becomes a secondary skin to the building with the implication that it must be replaced when it deteriorates to an unacceptable level.

The skin consists of 1.6mmX1.5mX2.4m sheets of steel bolted to a lightweight steel structure fixed to the building super-structure as in Figure 20. Each panel is 1.5m in height and fixed with galvanised screws. The aim of this construction is to keep the skin away from the main skin as a secondary solar restraint and provide a lightweight solution that is exposed.

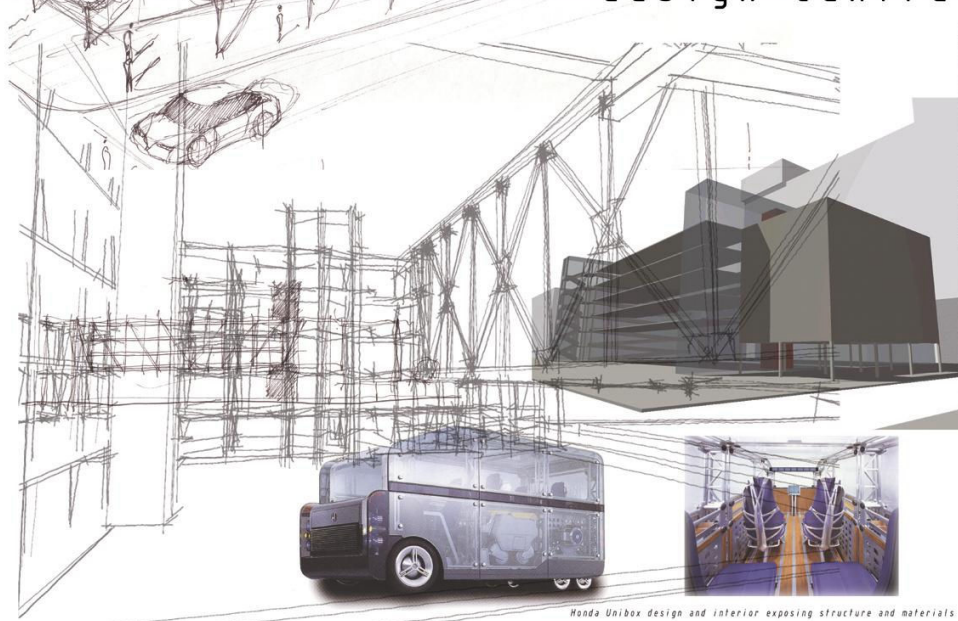
It is designed to weather and degrade, to be replaced with time, thus keeping the facades of the building dynamic in terms of colour and materials. The main objective of the screens is to minimise direct sunlight onto specific spaces.

These panels can be built in the centre's workshops and be installed by local contractors. By offering this procedure to the centre, the costs of

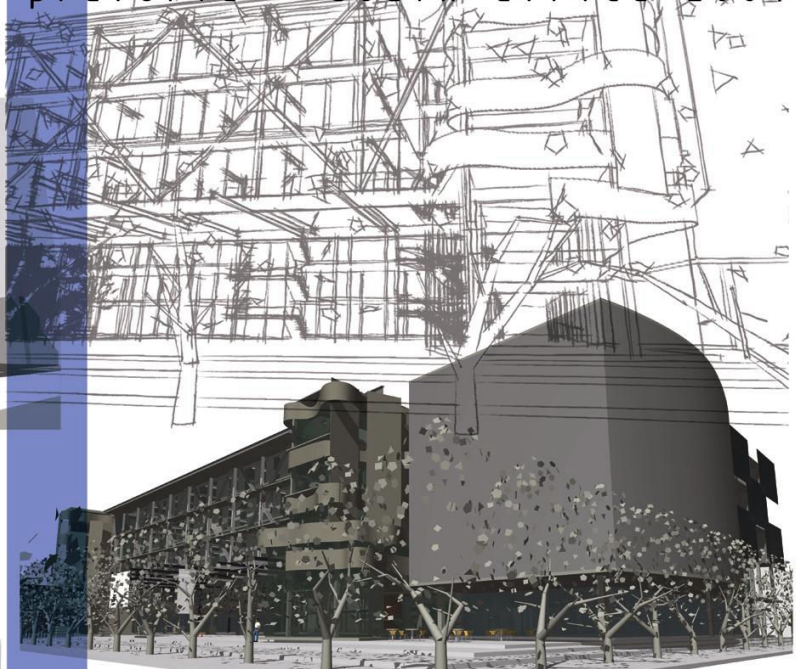
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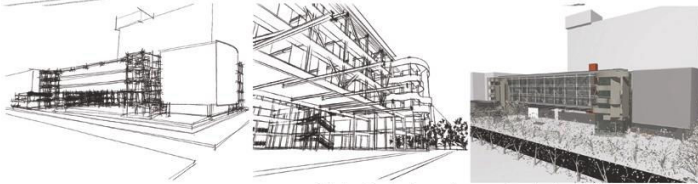
design centre pretoria - south africa 2004



Honda Unibox design and interior exposing structure and materials

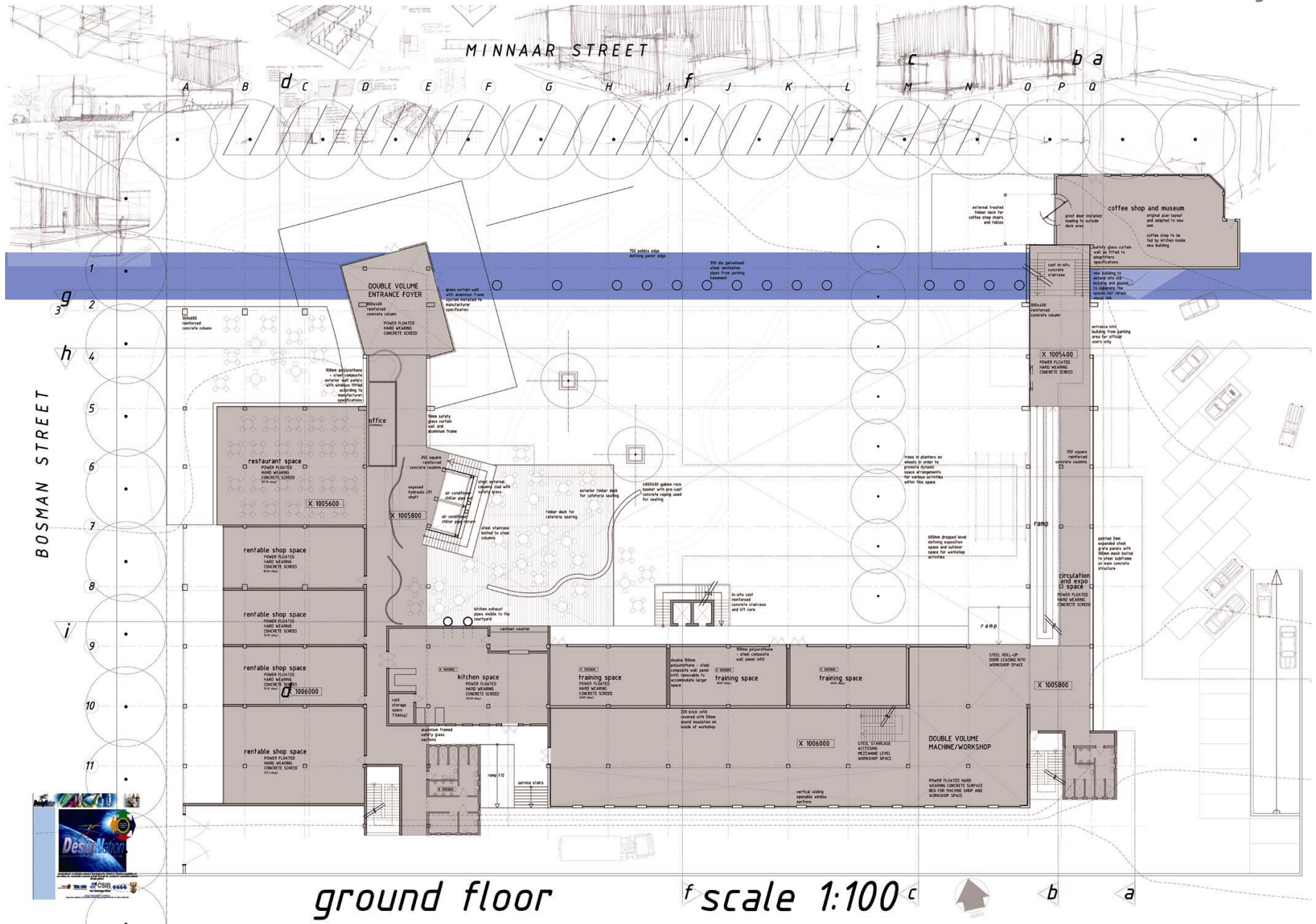


A study of space making through the interpretation of contemporary car design and product design. A centre is created for use by students and professionals of industrial and product design. People who wish to improve the quality of locally designed goods can achieve through the training offered at this centre. An initiative indorsed by government and the CSIR. - H.P.Perks

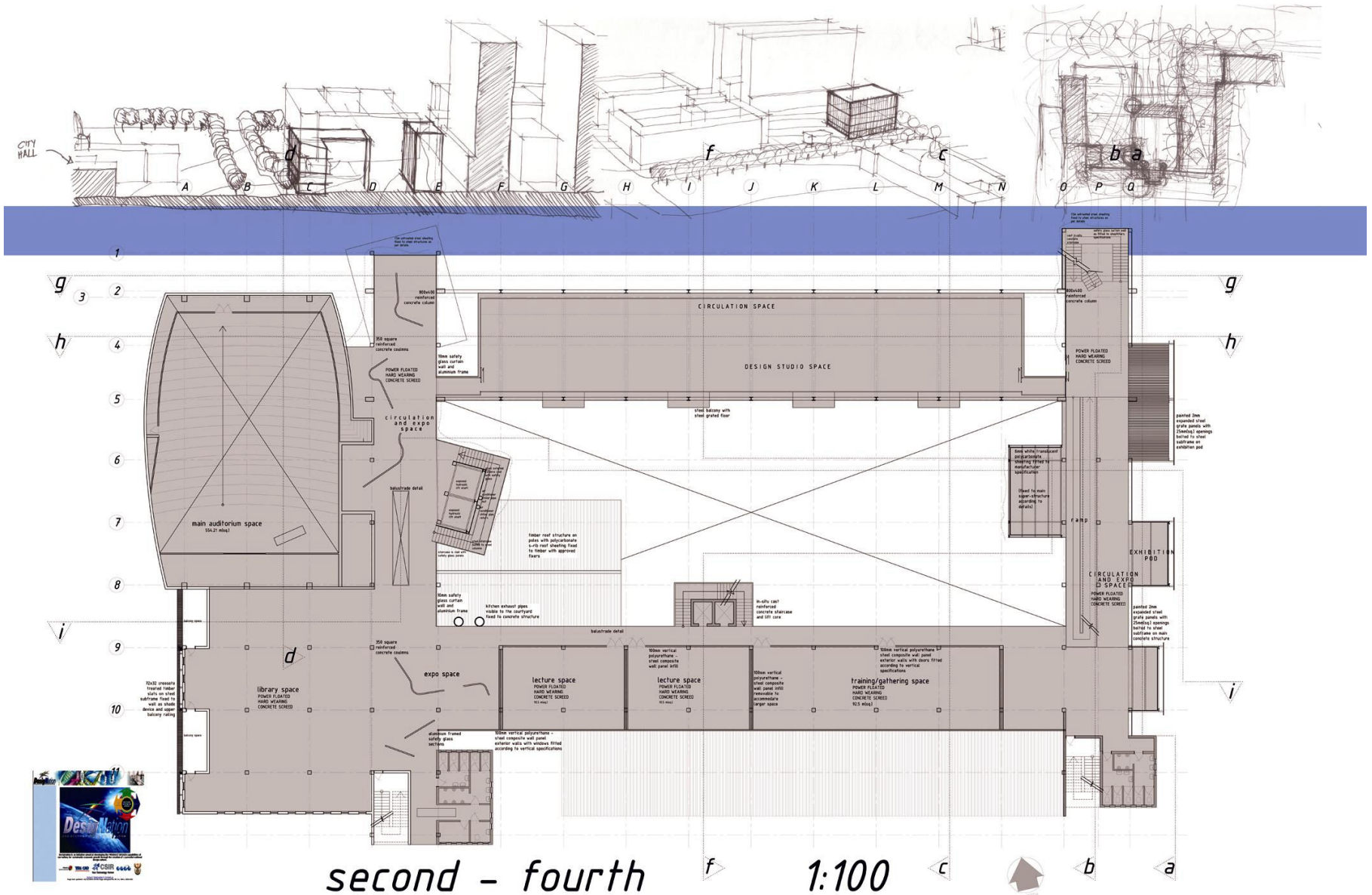


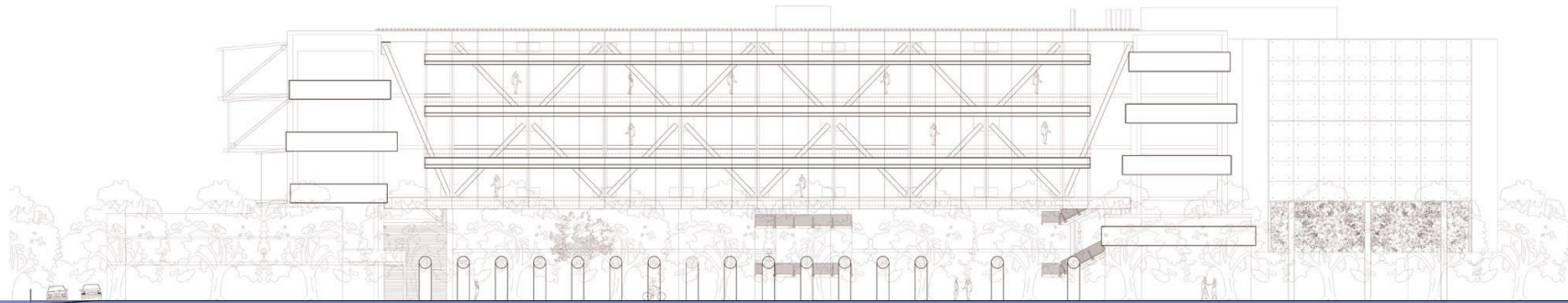
Sketches for design centre exposing structure, form and materials







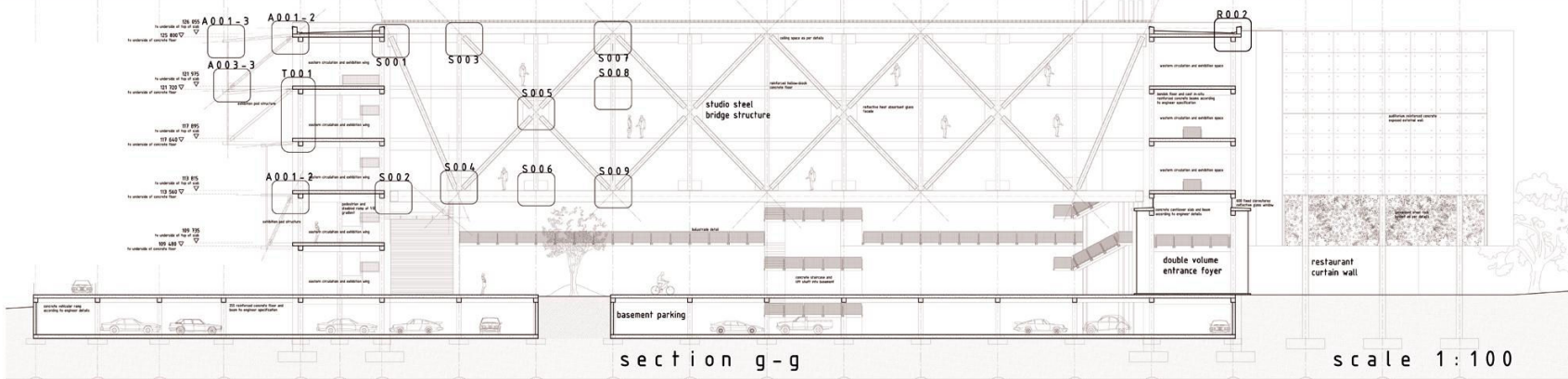




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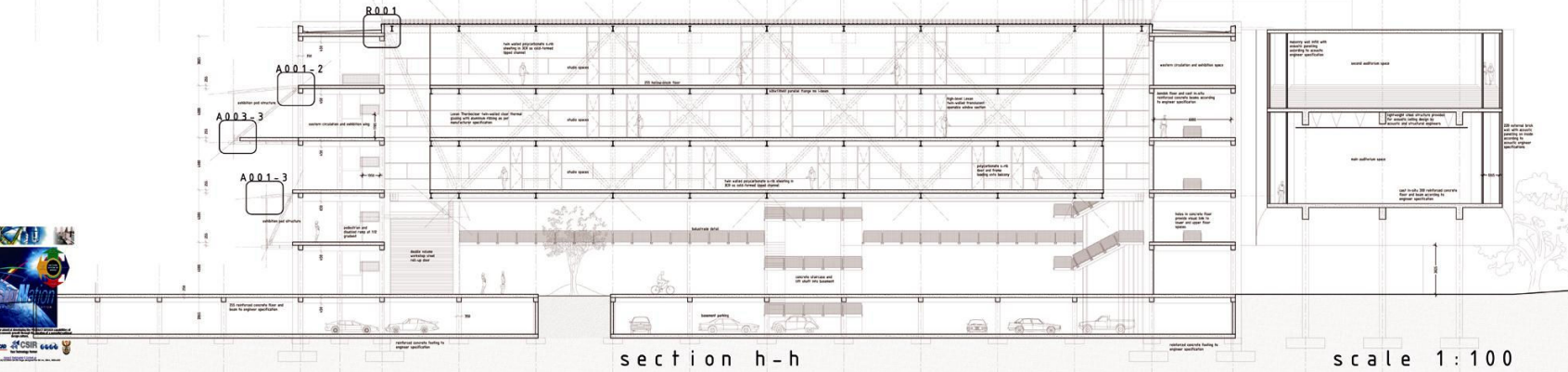
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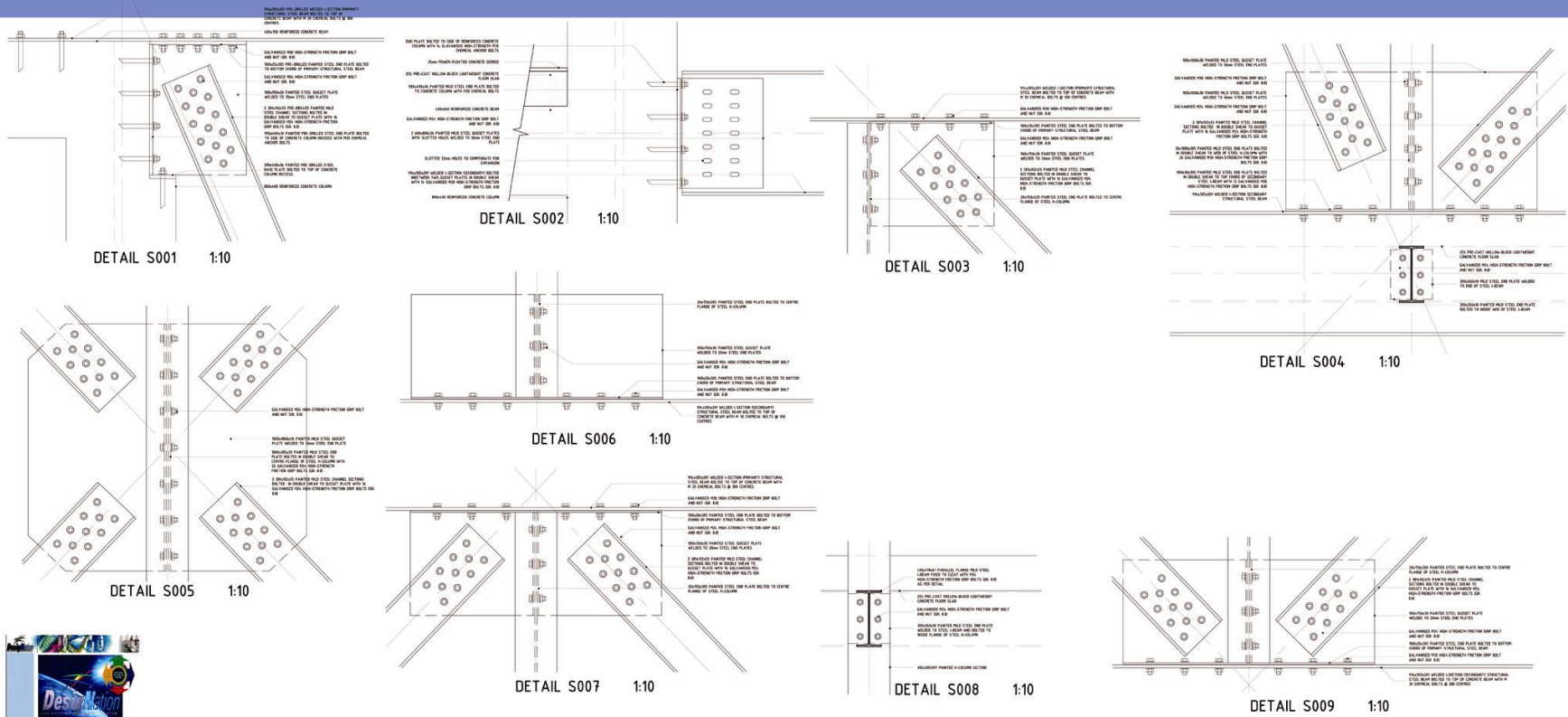
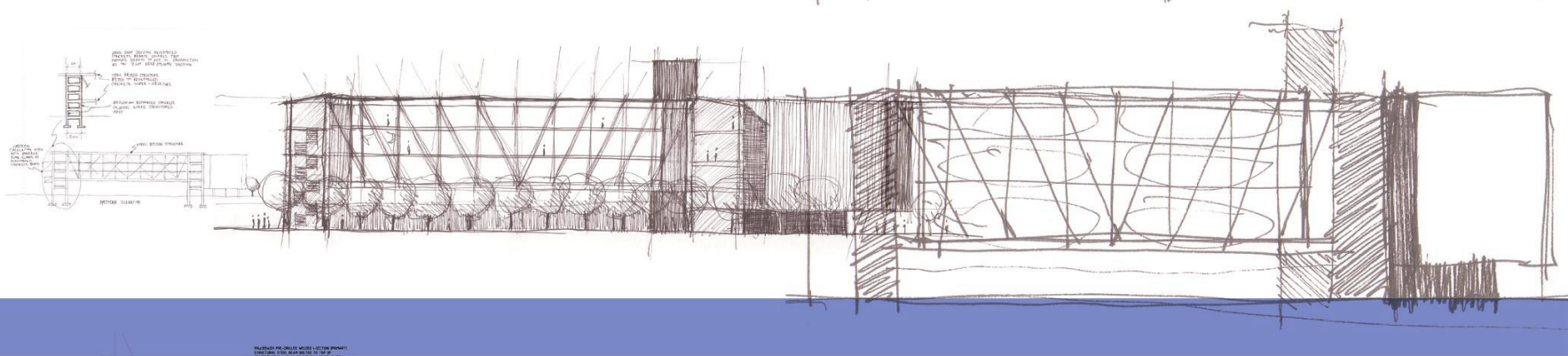


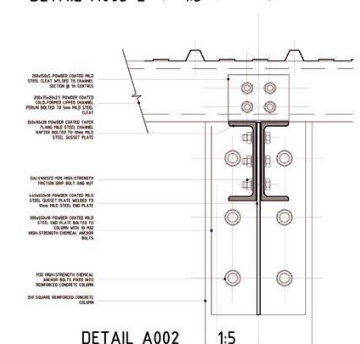
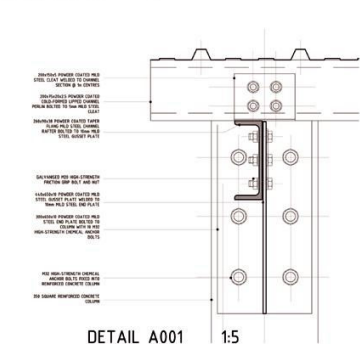
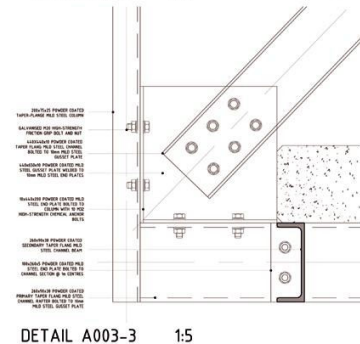
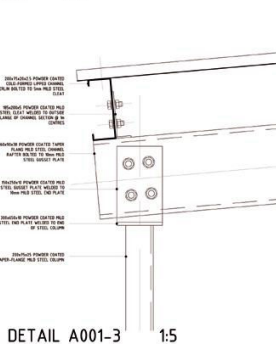
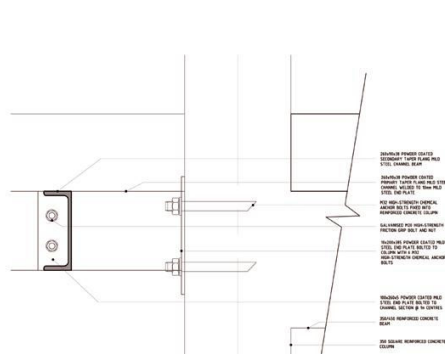
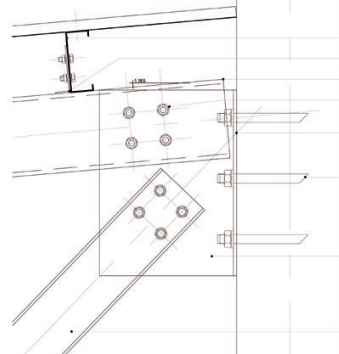
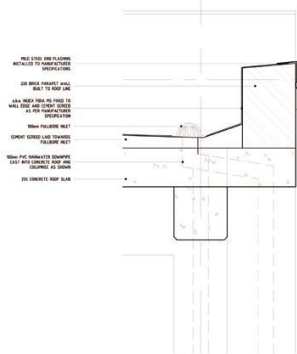
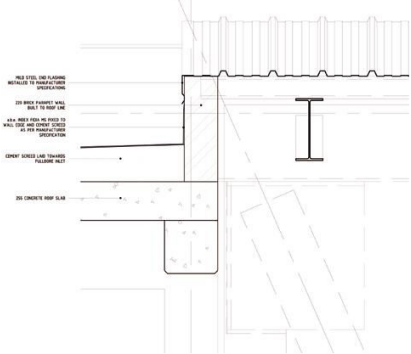
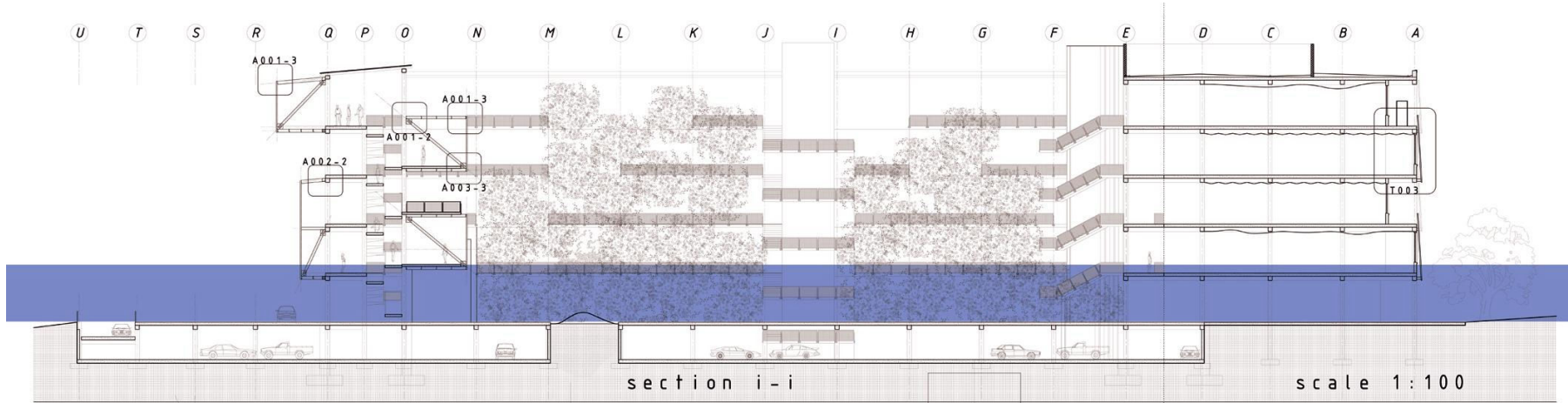
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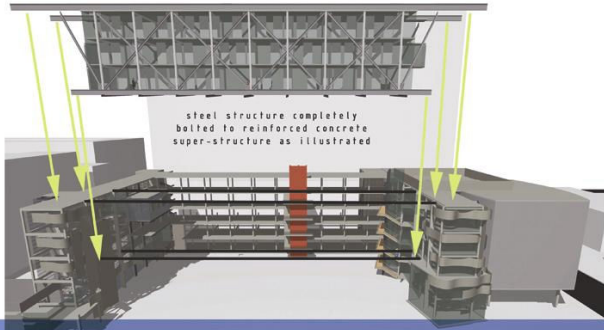
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U T S R Q P O N M L K J I H G F E D C B A



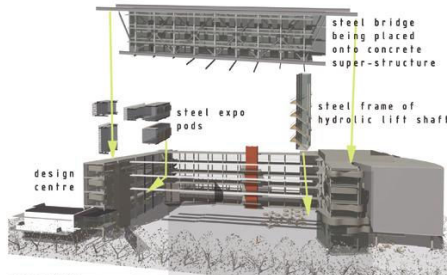




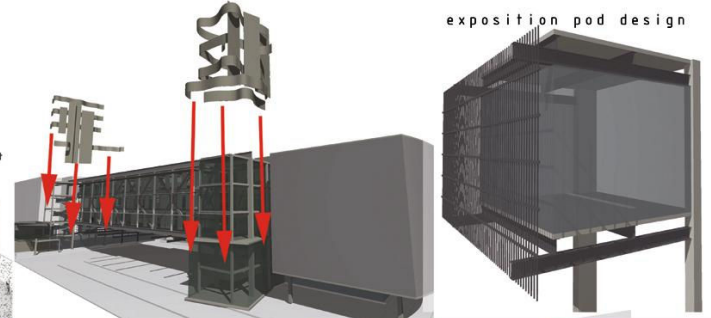


bridge onto concrete structure

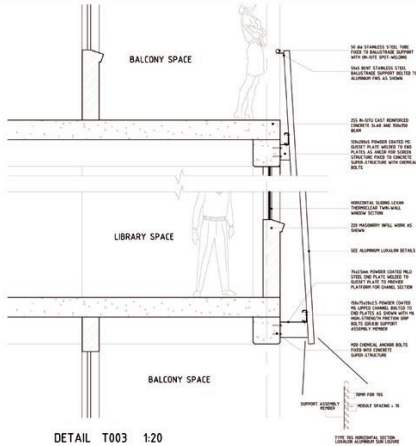
all steel components under investigation in their placement within the design centre



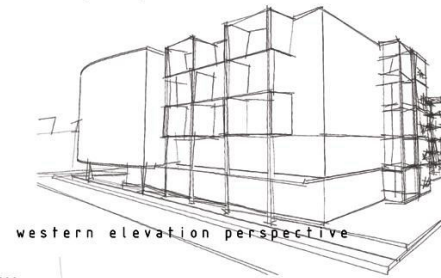
building composition



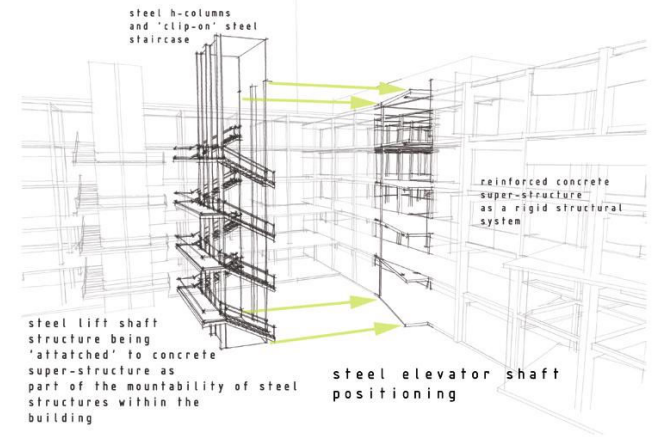
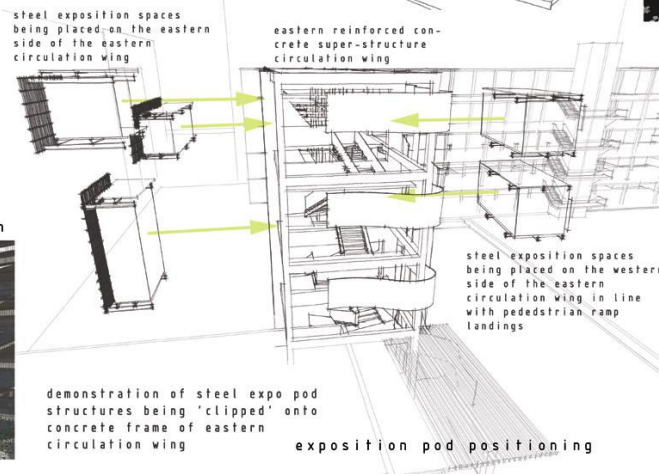
secondary steel skin positioning



building composition showing courtyard



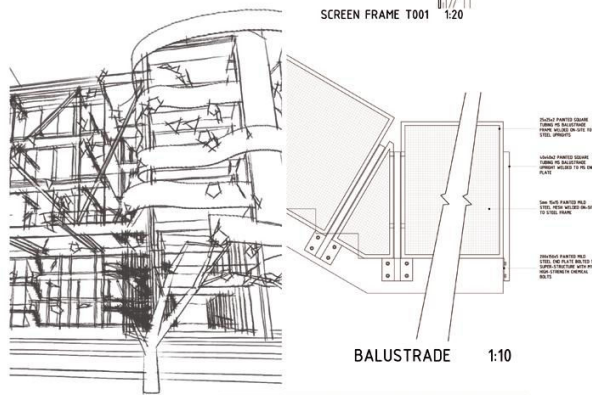
eastern wing creeper system



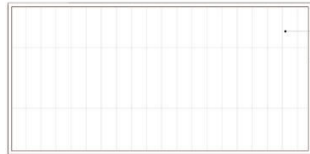




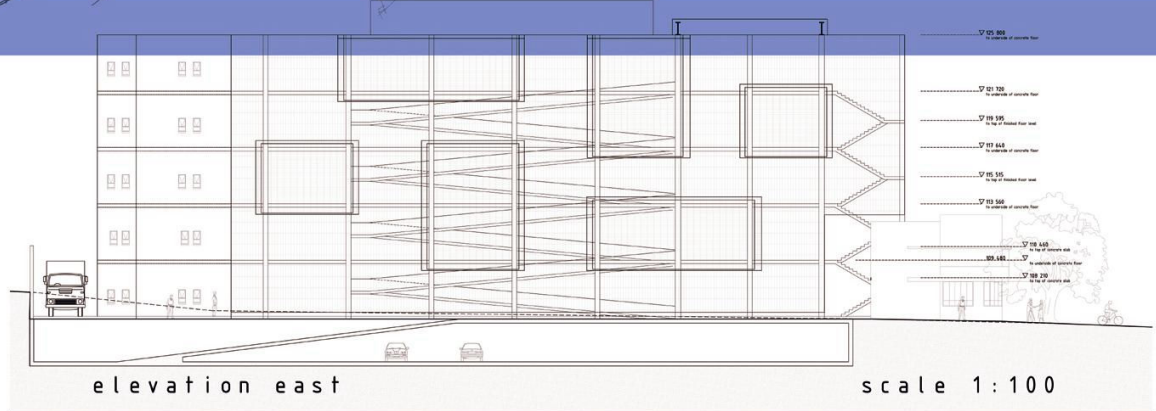
SCREEN FRAME T001 1:20



BALUSTRADE 1:10

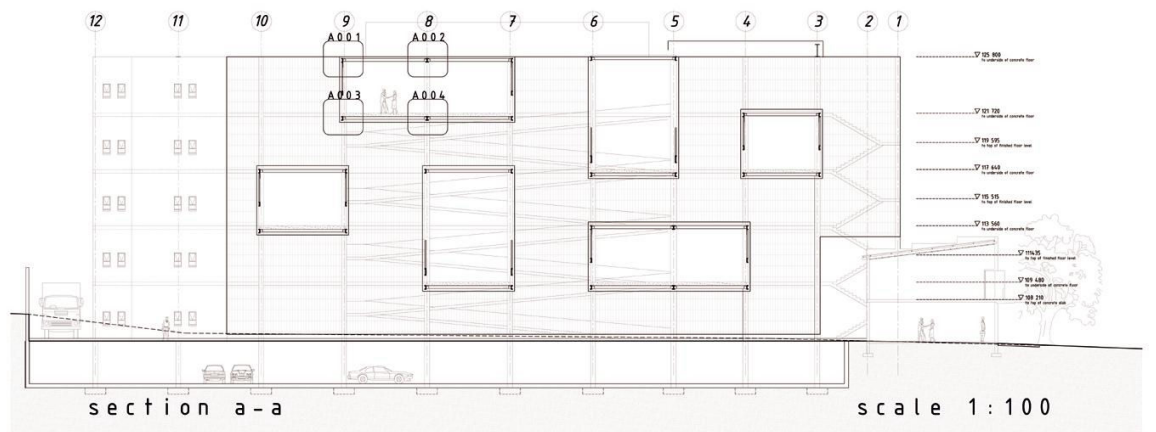


MODULAR SCREEN DETAIL 1:10



elevation east

scale 1:100



section a-a

scale 1:100



012

*design resultant***Design resultant:**

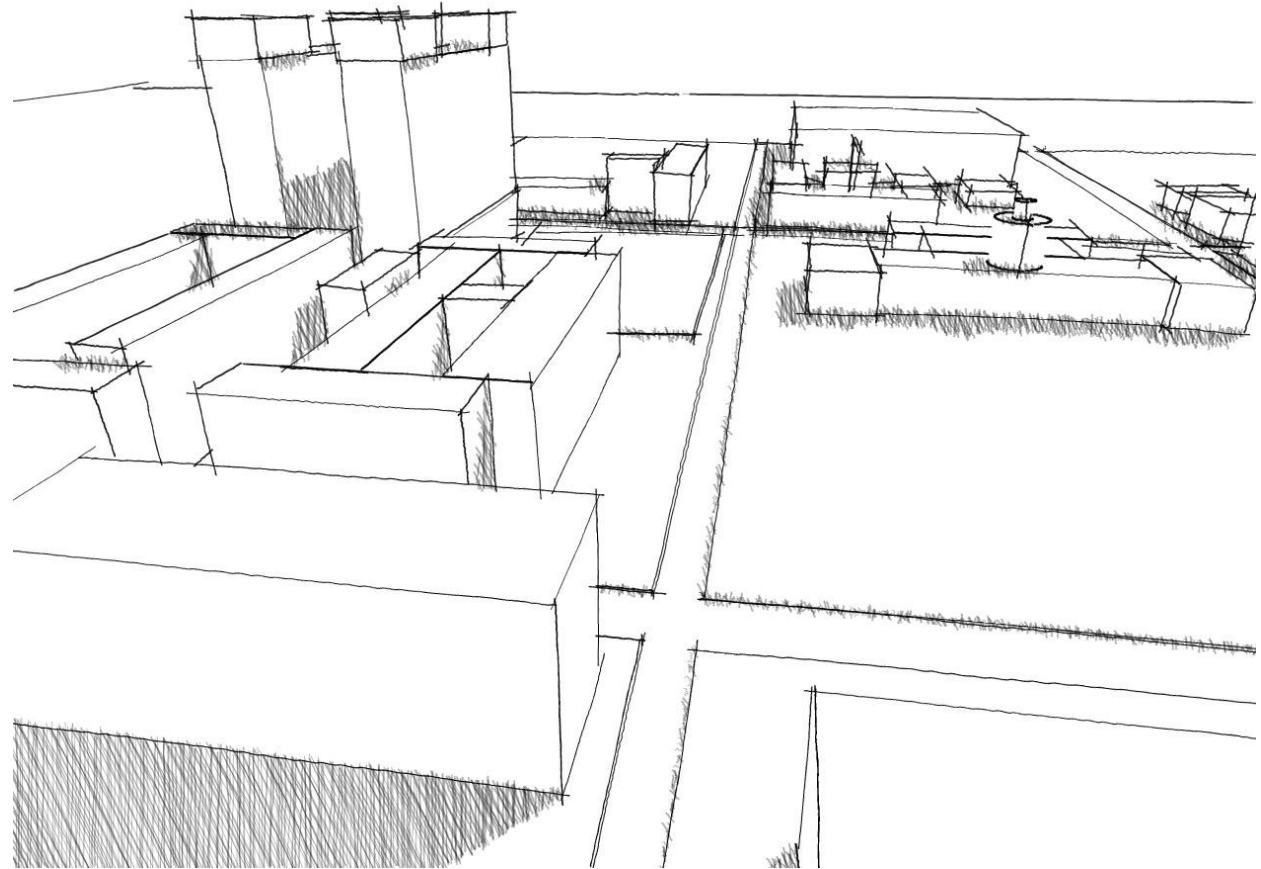
Industrial design: the conception and planning of products for multiple reproduction, using instrumental factors such as engineering, technology, materials and aesthetics to create machine reproducible solutions to balance all needs and desires within technical and social constraints. This is the essence of industrial design as defined by Fiell 2000, pg 6.

An example of the above statement is car design. A result of creative conception and physical restraints, having an end result that performs a basic transportational means. All cars are different in appearance due to multiple social, economic, environmental, physical and financial criteria. These restrictions are found in all spheres of design resolution.

The design centre uses these informants discussed throughout the project of industrial design in its formulation and realisation.

Herewith follows the instrumental thrusts leading to the end product, an architecture that fulfils the requirements for an industrial design centre within an urban landscape:

- Urban response
- Industrial design response



*Fig 1. The urban room view towards west*

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1. Urban response:

In the absence of any built form in the south-western corner of the City Hall precinct, the design centre attempts to resolve key urban issues:

The stately frame is interrupted where a lack of built form exists. The design centre addresses this issue by following the frame line on the southern side of City Hall, using it as a build-to line. Continuing the line through to Bosman Street allows a boundary line to create an urban corner to be designed according to the line generated.

Architecturally this makes urban sense, by creating a spatial divide that defines the boundary between verticality and horizons. Creating the build-to line allows the building to fit into the precinct without neglecting the importance of the entire precinct composition, refer to Figure 2.

On an activity level, the centre provides activities for most of the day. Being primarily a design school means that the space will be activated during the day by students and visitors as they move about inside and out the building. The housing component allows night activity and passive surveillance.

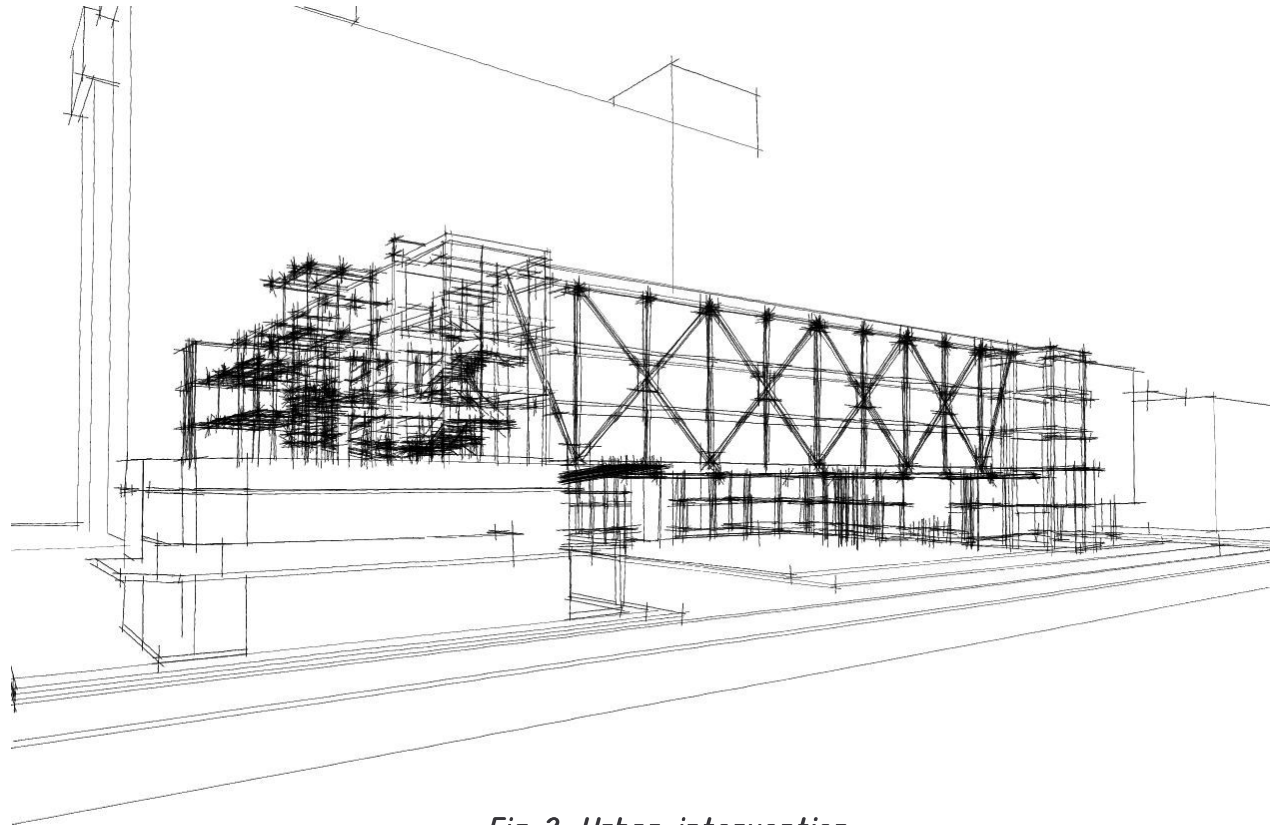
Students and visitors become active participators within the building space and the urban landscape wherein the centre is located, refer to Figure 1.

The overarching success lies in the fact that the centre appropriately uses the under-utilised space and addresses key urban issues while respecting the precinct structure.

A dialogue is formed between the centre and the fire brigade across Bosman Street where the urban corner of the centre mirrors the form-follows-

*design resultant*

function approach used by the fire brigade building. On ground level, the centre opens into the public realm by offering an open internal courtyard that generates a continuous flow of movement and energy between the centre and the gardens of City Hall, thus enhancing the urban landscape of the precinct.



*Fig 2. Urban intervention*

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## 2. Industrial design approach:

A centre to understand industrial design:

Point of departure: to understand the art of making mass-producible artefacts with the influence of design

Intentionally, the building relates to mass production and rapid manufacture and construction. This means that certain construction elements and components can be pre-manufactured in a factory with the result of transporting the ready-to-be-installed components to site where these can be erected in short periods of time. This process allows certain components to be manufactured while slower construction continues un-interrupted on site.

The main steel structural bridge is the result of the above-mentioned objective. While the concrete super-structure is created, the steel members of the bridge can be manufacture off-site and ready when the super-structure is completed. While being architecturally designed to appear raw and robust, the structure is refined to be functional and exposes the way in which structures can be assembled in simplicity.

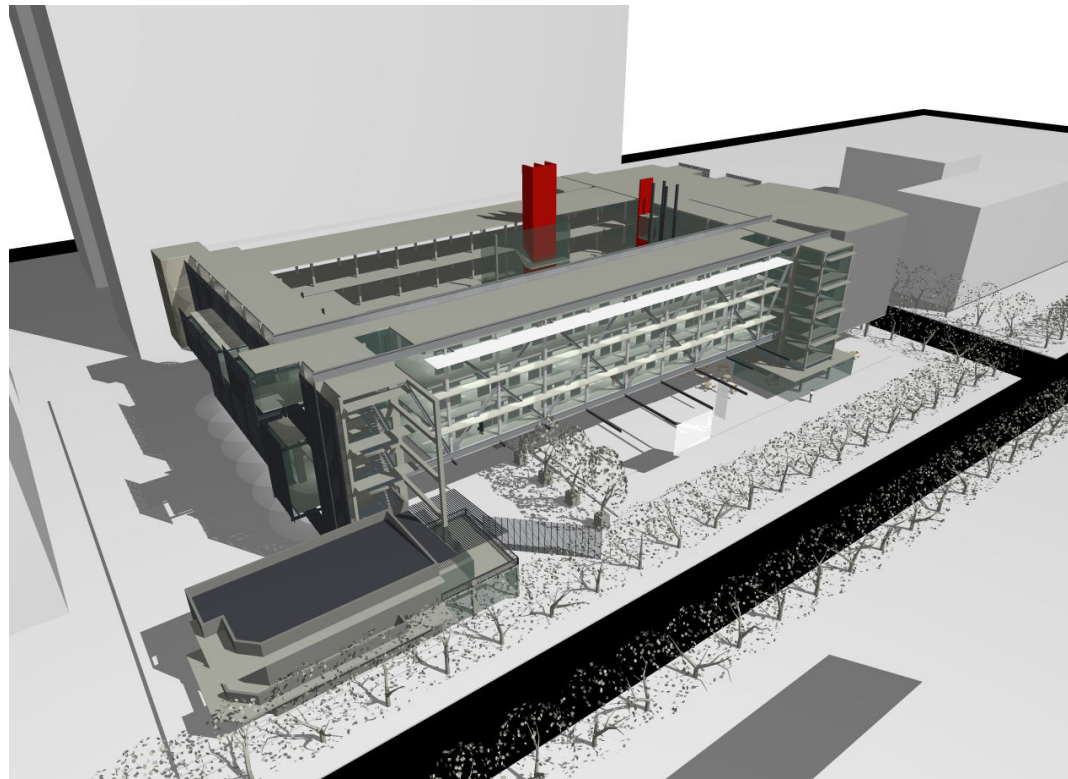
*Fig 3. The final product.*

Furthermore, this objective of pre-made components is illustrated in the exposition pod structures. Here, the structures illustrate the simplicity of mountability and possibility for recycling. The structures attach to the concrete super-structure with relative ease and more pod structures can be added when required, or, taken away. Mass production of components, made possible with simple detailing, means that these structures are an off-the-shelf kind of construction similar to tables or chairs.

## *design resultant*

The above-mentioned structures illustrate a small component of industrial design that can be used in the approach to designing a building.

Space has been created using two basic constraints, urban design and industrial design. The final product is an expression of how architecture can fit into an urban room with its resolution being driven by a different discipline in design (Figure 3).



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