how does the machine work?________[9]______________________[Technical Resolution]_____

____[9.1]_______ ___SYSTEMS DESIGN_________

____[9.2]_______ ___DETAILS___________

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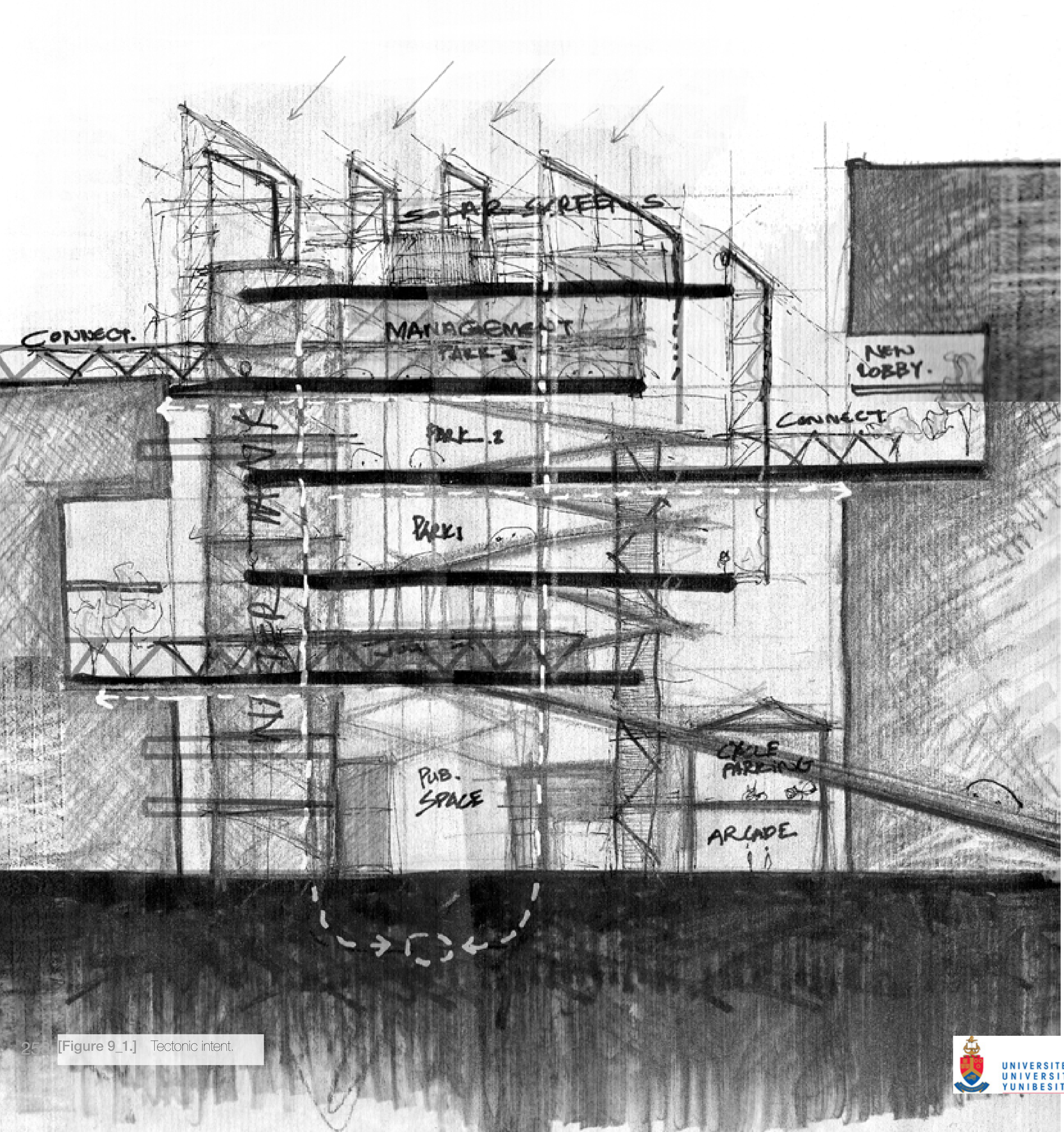
[9.1] SYSTEMS DESIGN
TECHNOLOGICAL AESTHETIC

The design answers to the site's needs, thus it is a response to the existing fabric as well a projection of the future vision. The endeavour to create space via infrastructure demands that technical systems and ultimately the **tectonic language of the building is aimed at creating space.**

New planes are staggered between existing fabric as **extensions, bridges and new adaptable surfaces**. The building exists in an in-between state, its tectonic elements connecting and supporting the existing fabric. The roof belongs to the sun and sky, the water towers belong to the earth and context, the public space and circulation elements belong to the context whilst the floors 'float' in the in-between as an adaptable almost 'claimable' entity.



[Figure 9_1.] Tectonic intent.

SYSTEMS

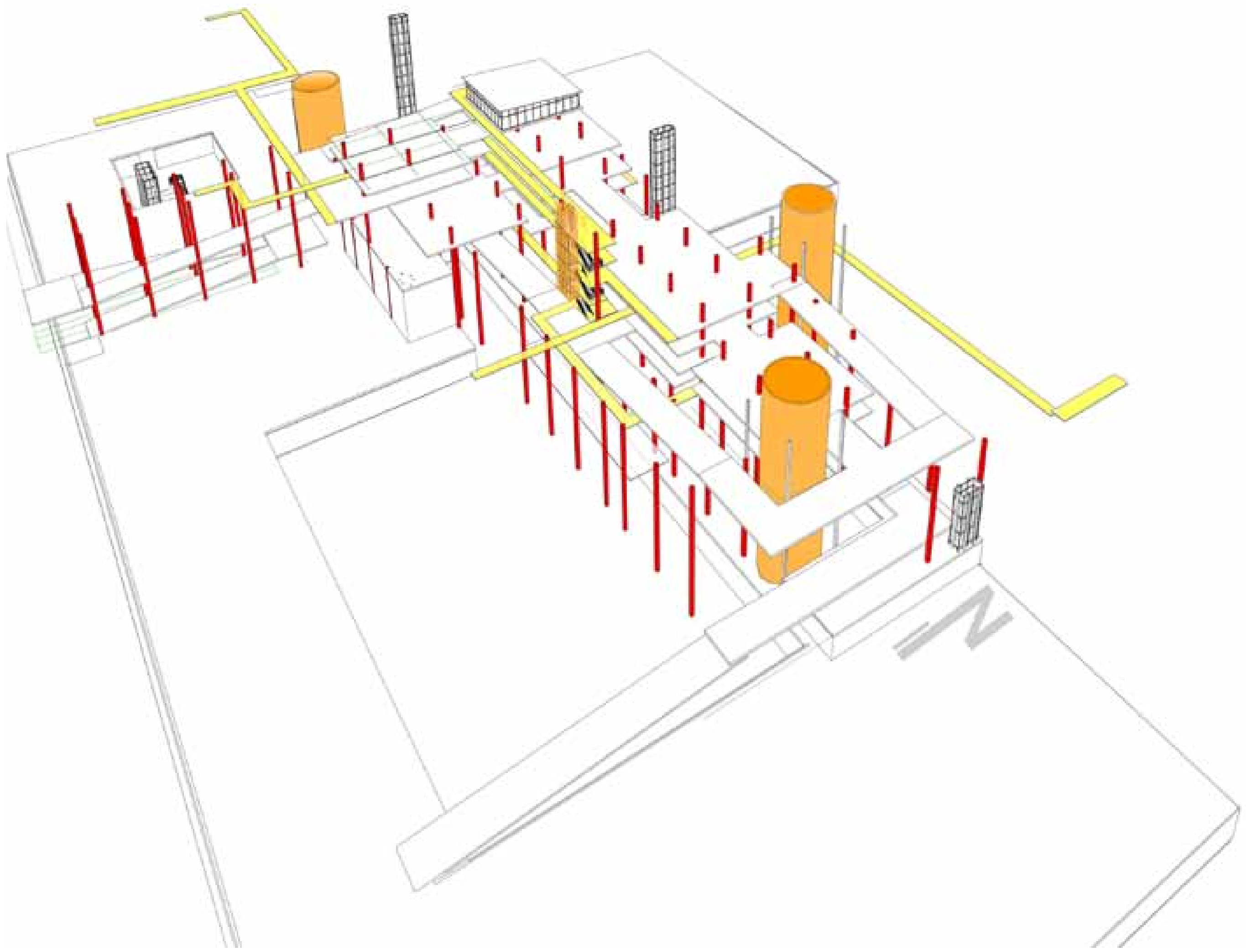
Because of the nature of the project, the systems design, as previously discussed, is the main focus. The involved systems are electrical, water, organic waste digestion, solid waste management and sewage treatment. These systems respond to the contextual demand and usage, thus the existing services, **service cores in buildings and new proposed services need to be mapped out** in order to understand their contributory behaviour and layout.

[Figure 9_2.] Existing buildings' service and circulation cores.

[Figure 9_3.] Existing municipal infrastructure around and on site.

____STRUCTURAL ELEMENTS_____

- PRIMARY FRAME STRUCTURE
- HORISONTAL BRACING
- VERTICAL BRACING

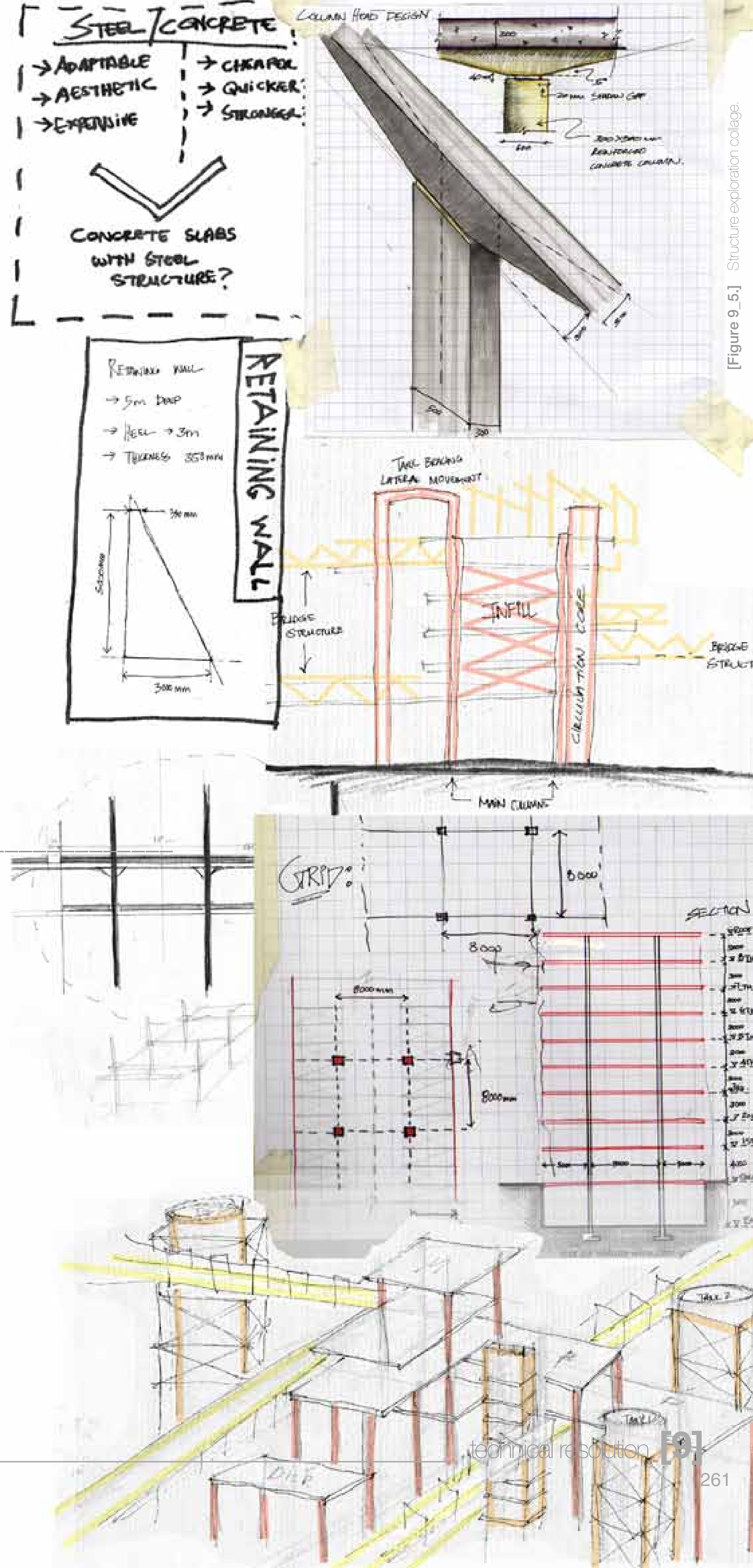


____STRUCTURAL SYSTEM____

The structure, as previously mentioned, acts as a **shell 'cupping' the space** inside. The primary structure is a **concrete column and beam structure** standing separately with the slab cast in, like an 'after thought' addition to the building.

The secondary structure is an **infill of light-weight horisontal and vertical circulation** structures, steel bracing and a ramp system.

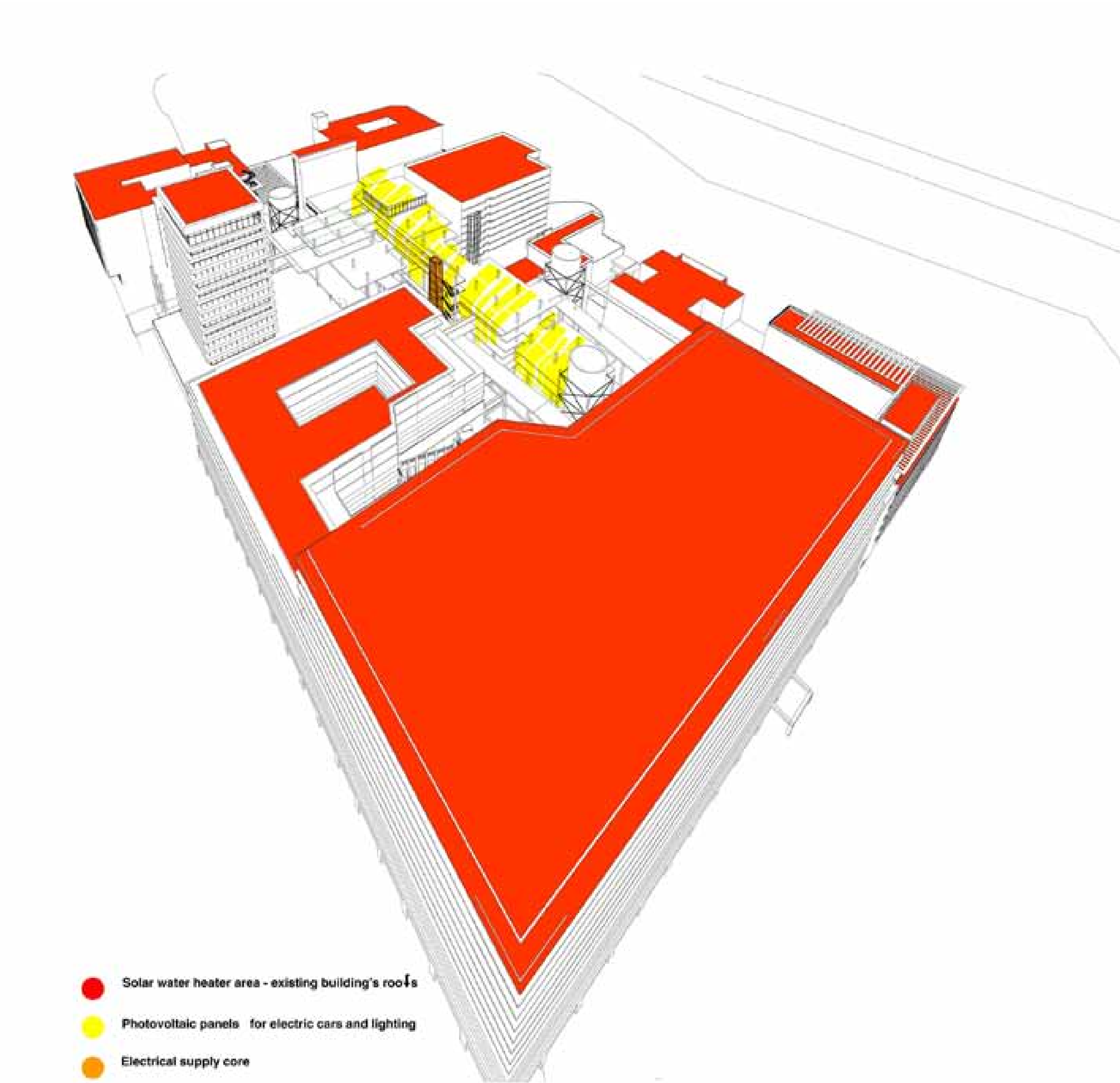
The light-weight steel elements are move-/changeable whilst the ground floor commercial structures are more **solid and 'attached' to the context.**



[Figure 9_5] Structure exploration collage.

____ELECTRICAL SYSTEM_____

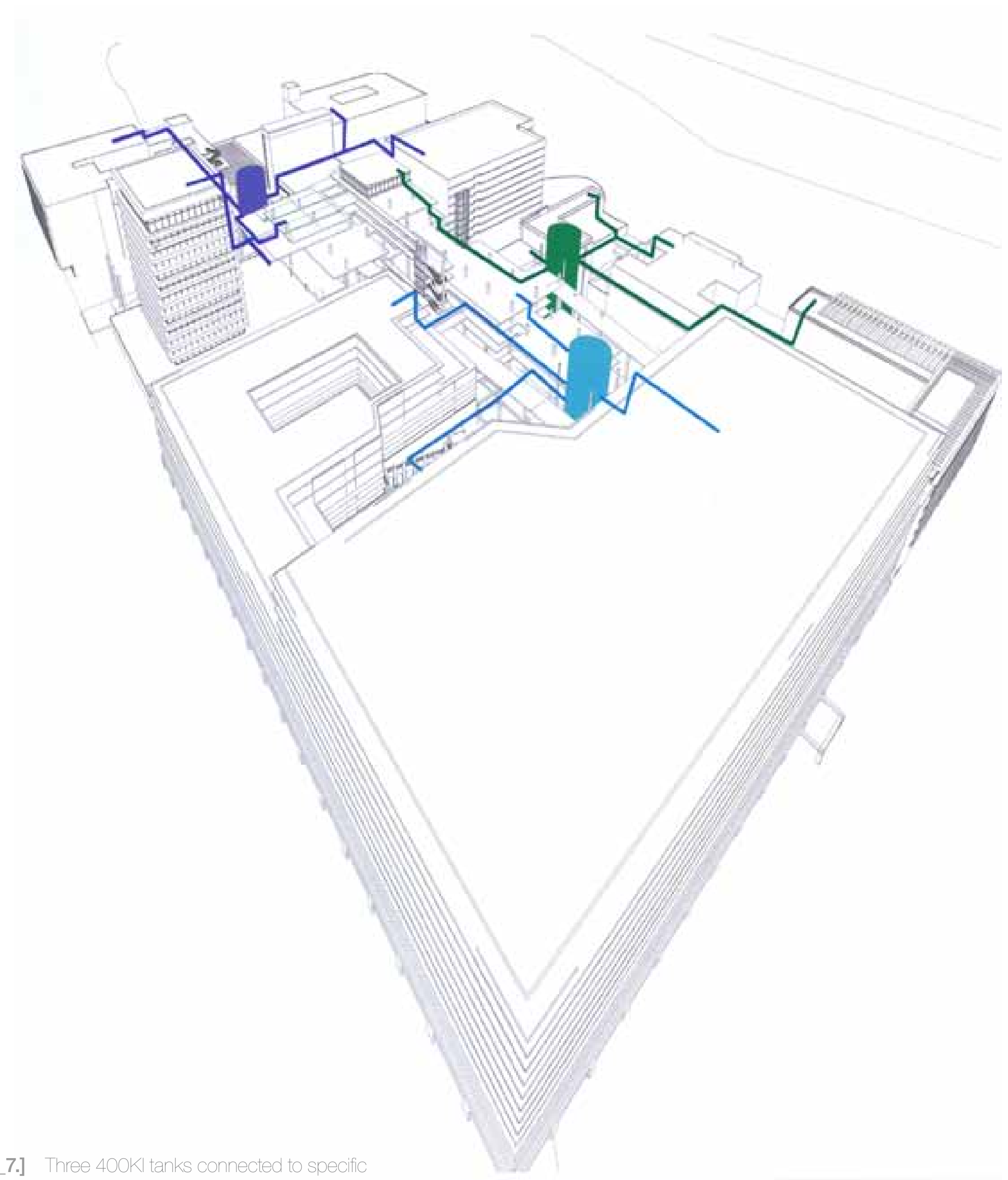
As previously discussed, the electrical system is not completely off-grid because the amount of photo voltaic panels needed to sustain the development would be too significant to deem feasible. Besides proposing that the existing buildings apply active energy saving strategies, there are two energy systems applied in the intervention. The first is **solar water heaters** via solar vacuum tubes, providing each building with warm water. The other is **photovoltaic panels** providing enough energy for the intervention's lighting and charging of the electrical cars' batteries. The solar vacuum tubes will be placed on the existing buildings' roofs and the photovoltaic panels will be fixed as a screen roof structure on the northern side of the intervention. See the detailing of the solar facade in the details section.



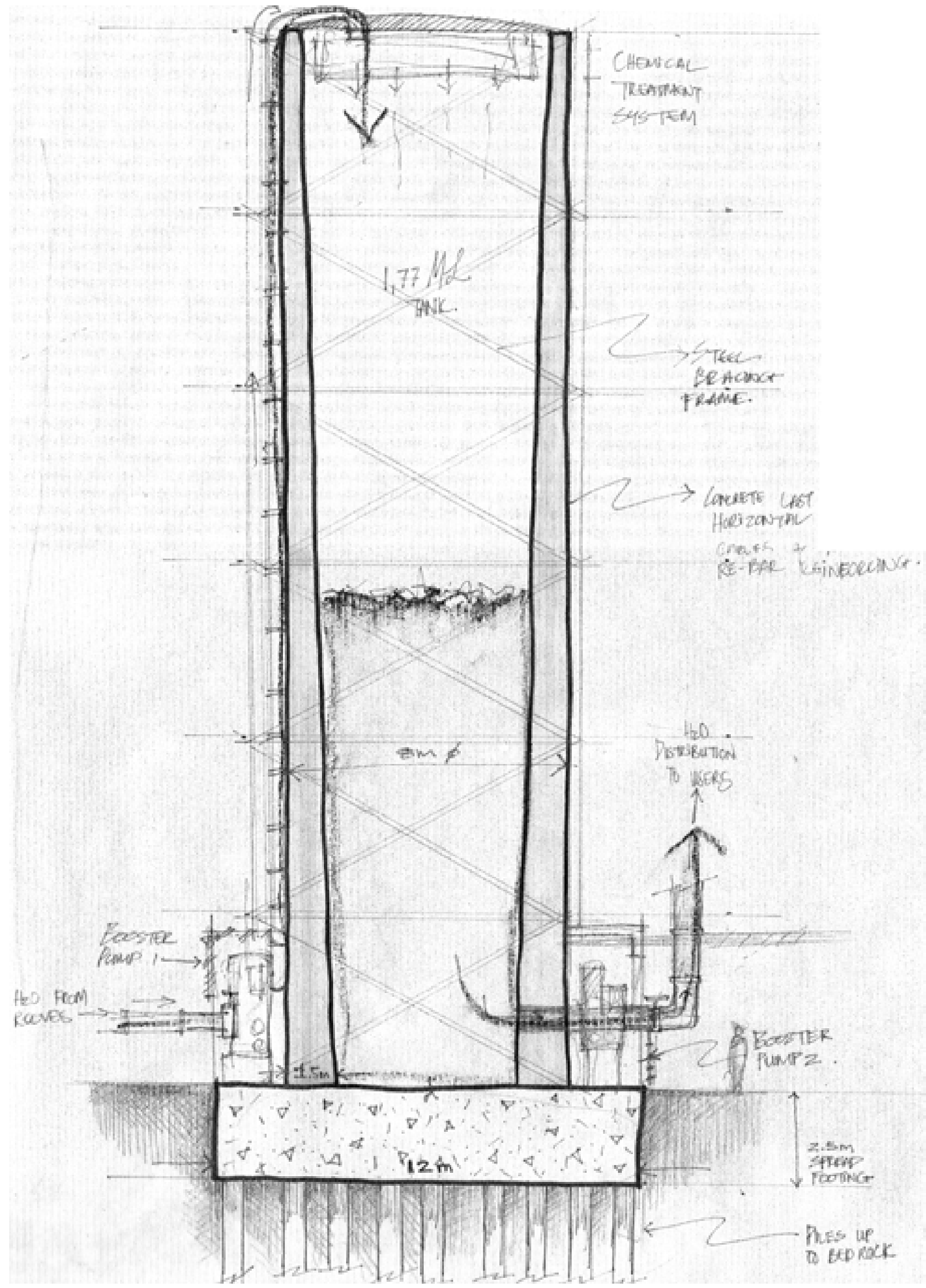
[Figure 9_6.] 'Energy planes', solar panels and pv-panels.

____WATER SYSTEM_____

The rain water collected from all the building's roofs are stored in **three 400 KL concrete tanks**. These tanks receive water from specific assigned buildings and feed cleaned drinkable water back to these buildings. The tanks cannot be load bearing (for external forces) but can be integrated into the structure as a **bracing element.** The basement level of the tank, where the water feeds in and out, has a pump room and a compact chemical treatment plant. The water is **circulated by using its presence as a water feature within the public space.** By designing a 'second skin' for the tank, creating an illusion that the tank is overflowing, the purpose of cooling the space, creating ambience and preventing the water from rotting, are achieved.



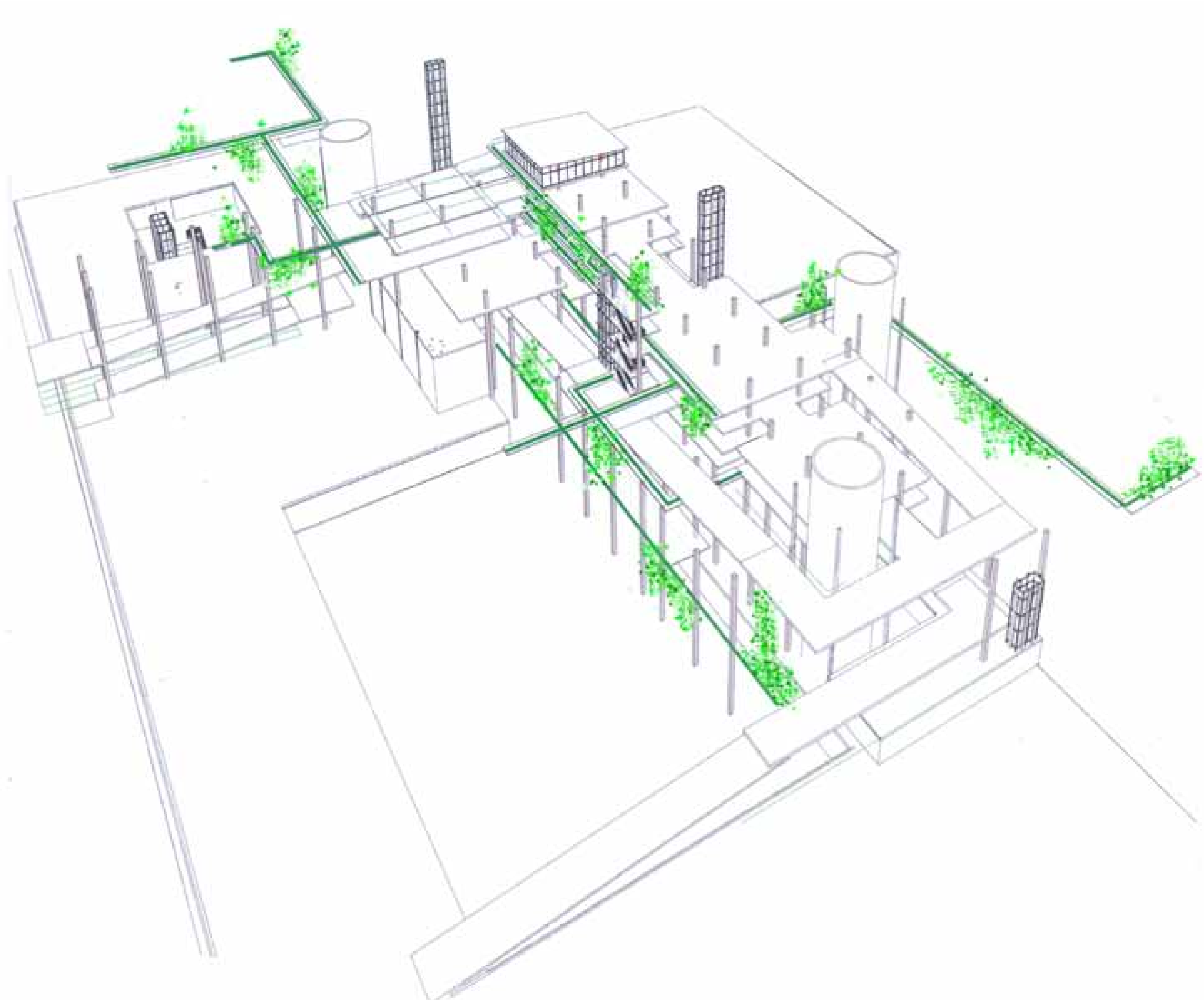
[Figure 9_7.] Three 400Kl tanks connected to specific roofs for collection and distribution .



[Figure 9_8.] Basic water tank design and circulation system.

____ORGANIC WASTE SYSTEM_____

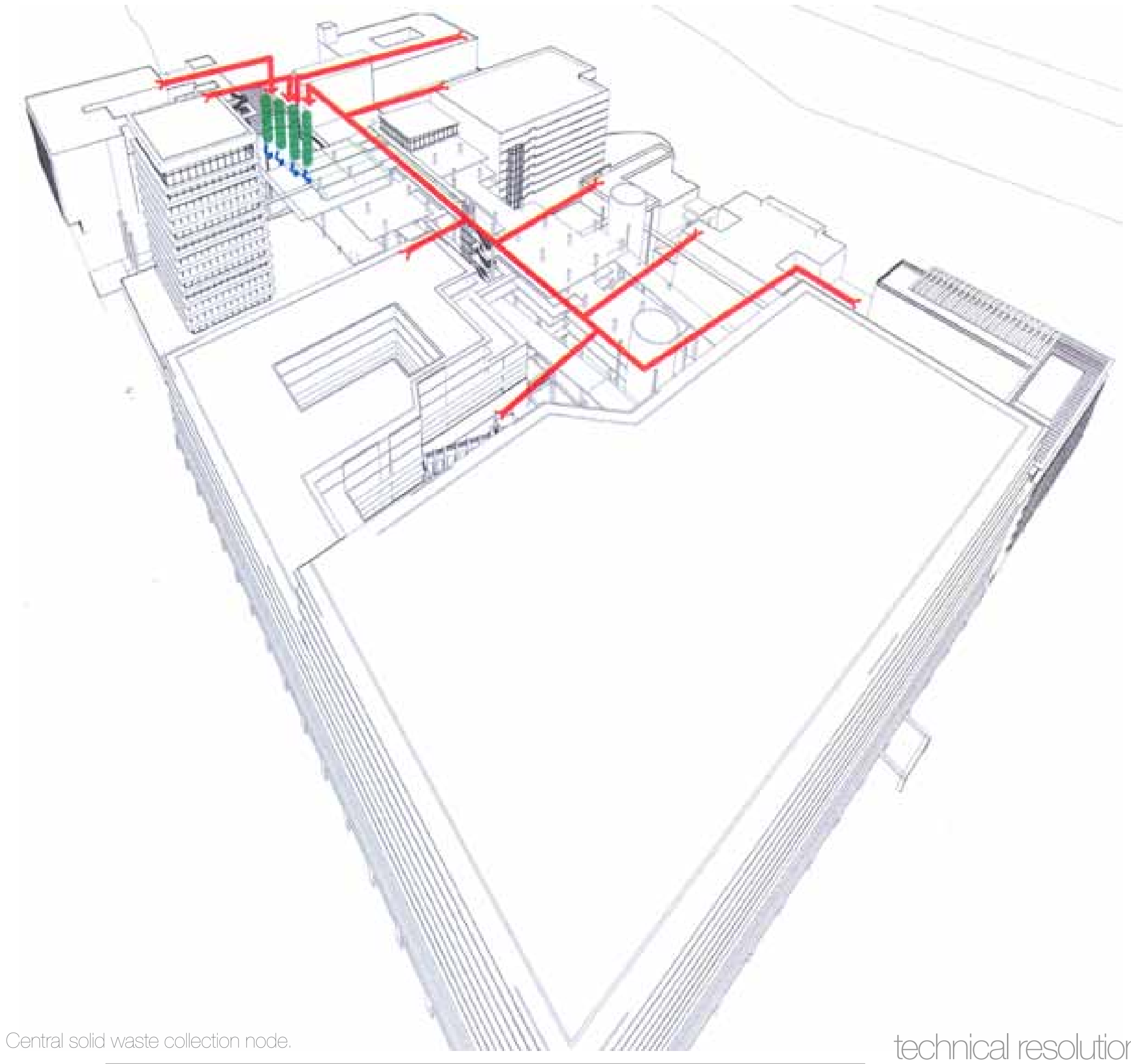
The organic waste digesters are placed **along circulation routes between buildings** and on ground floor. See the detail section for detail design of the organic digester unit.



[Figure 9_9.] Digester routes with 'green screen' system.

____SOLID WASTE SYSTEM_____

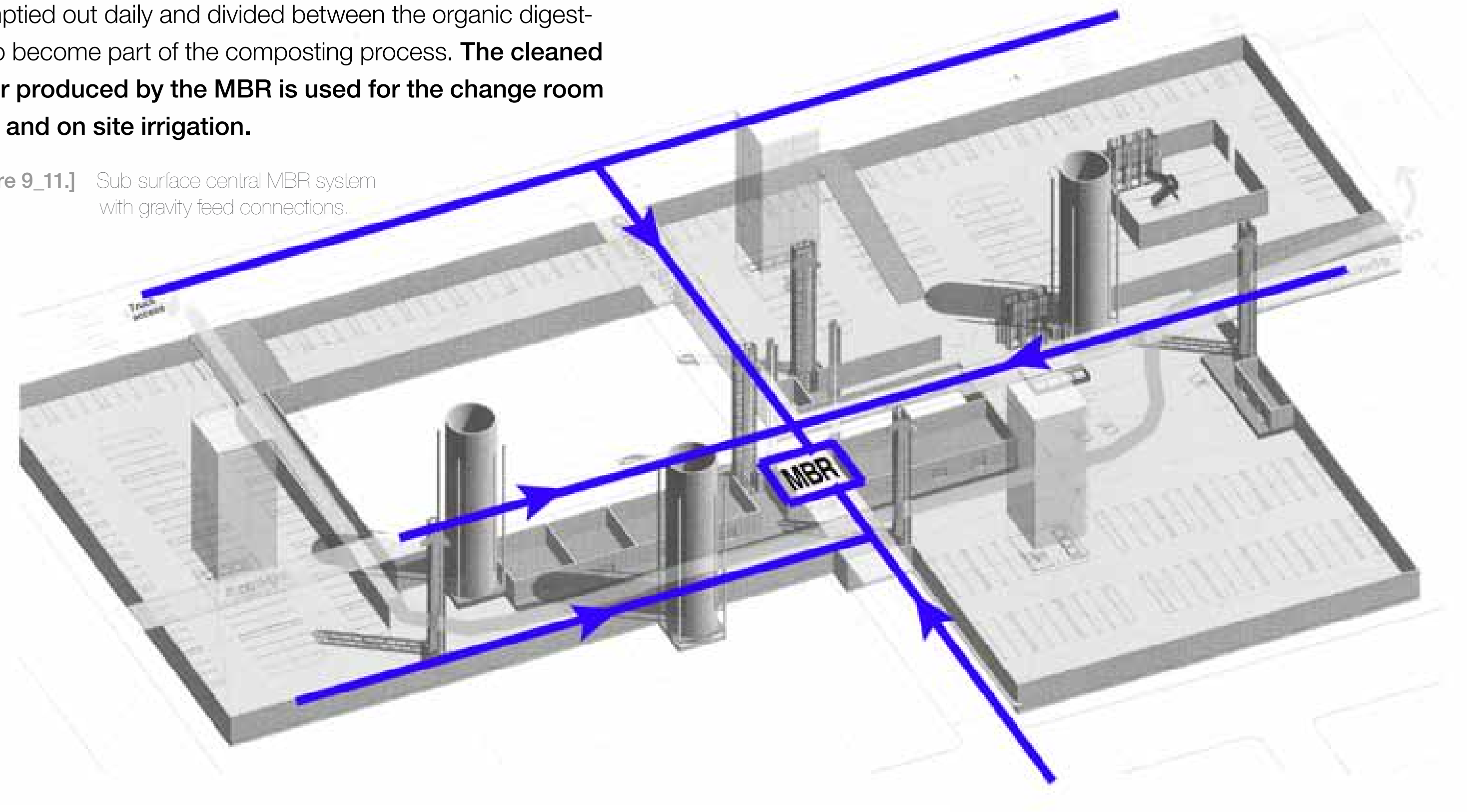
Solid waste management works on a 'separation at source' basis. Thus the parties on site are encourage to separate and group their wastes, site staff then collect the respective wastes and takes it to a **central collection depot** where it will be stored and sent to recycling factories. The collection depot is placed centrally on a circulation route so that the public can conveniently drop off their own wastes on their typical day's journey.



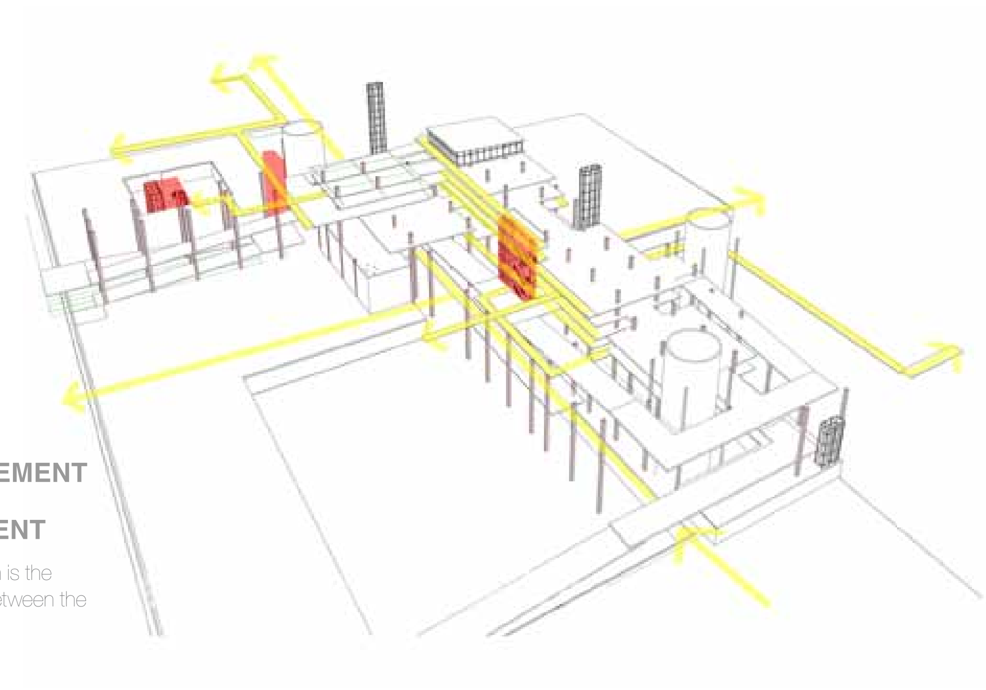
[Figure 9_10.] Central solid waste collection node.

____SEWAGE SYSTEM_____

The on-site sewage is directed towards a centrally located Membrane bio-reactor. The sludge produced by the reactor is emptied out daily and divided between the organic digesters to become part of the composting process. **The cleaned water produced by the MBR is used for the change room WCs and on site irrigation.**



[Figure 9_11.] Sub-surface central MBR system with gravity feed connections.



HORISONTAL MOVEMENT

VERTICAL MOVEMENT

[Figure 9_13.] The second system is the pedestrian movement through and between the intervention and the surrounds.

____CIRCULATION SYSTEMS_____

There are three circulation systems on site. The first system is the **vertical circulation system** which sprouts from the basement. Stairs, lifts and goods lifts feed the site with the movement from below.

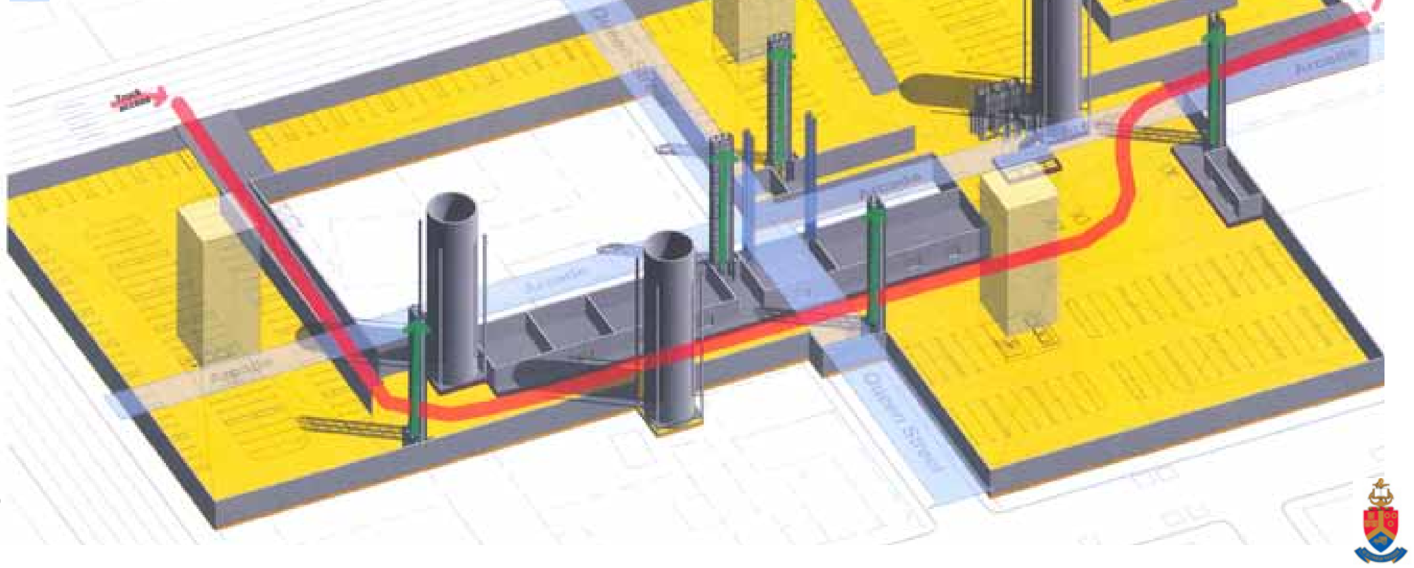
[Figure 9_12.] Basement circulation systems.

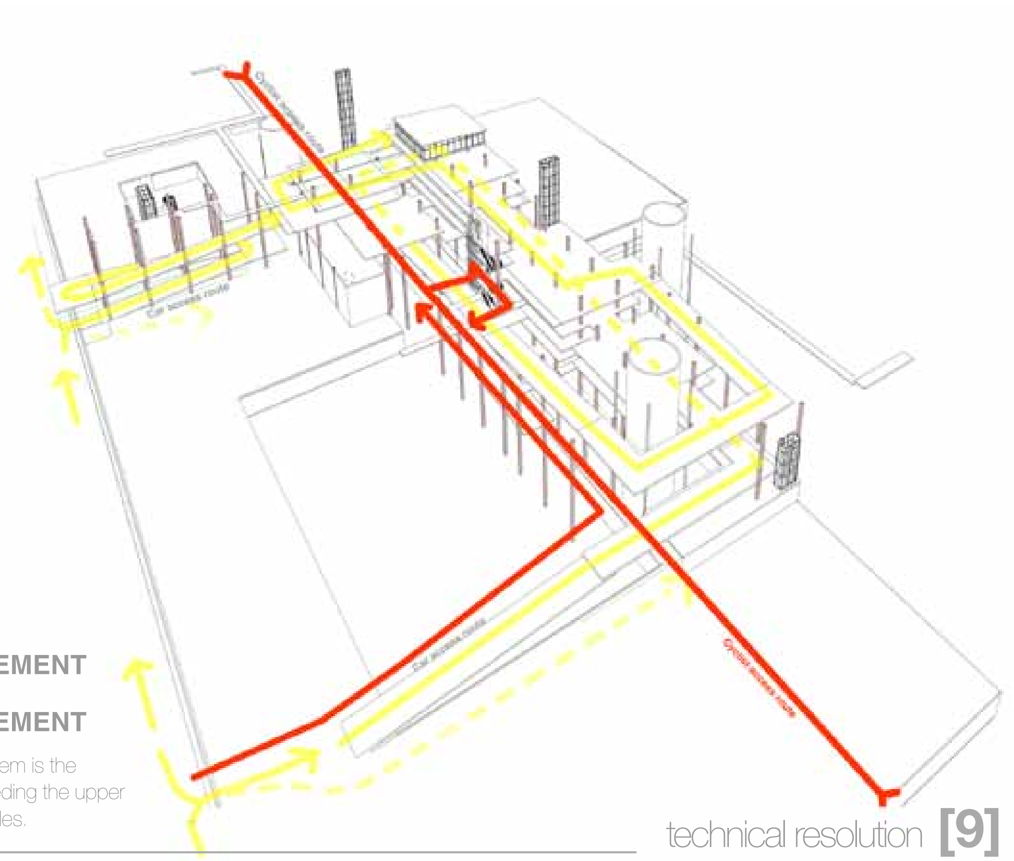
TRUCK CIRCULATION

BASEMENT PARKING

VERTICAL CIRCULATION

GROUND LEVEL CIRCULATION





VEHICLE MOVEMENT

BICYCLE MOVEMENT

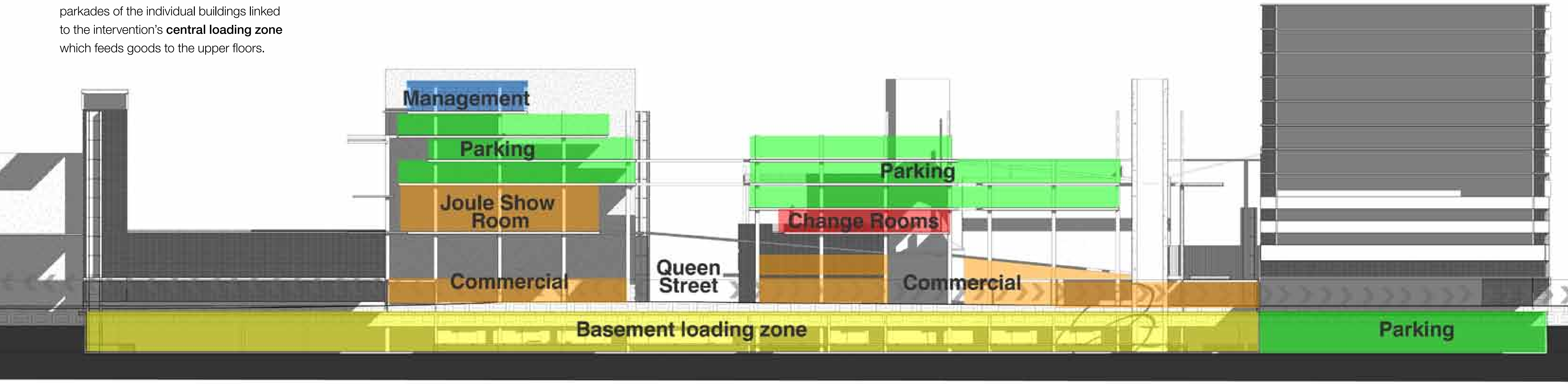
[Figure 9_14.] The third system is the vehicular movement system feeding the upper floors with cars as well as bicycles.

____VERTICAL ZONING_____

The building's vertical zoning is based on the functioning of the systems. The controlling body of the building, being the management and staff, is placed on the **top floor where their elevated position gives them a relative over view** of the whole site. The upper floors where the parking is placed are the **connective planes** where the conduit bridges exchanges energies between the buildings.

The change rooms are **central** but elevated above the public space and serves the upper cyclist parking floor and users of the context. Public bathrooms for pedestrians are available on ground floor. The Joule car garage is placed on the second floor for marketing reasons as the position of the sales rooms speaks to the public space below (via a tilted floor) and it is **positioned in the elbow of both ramps' circulation routes**.

The commercial ground floor is an unfolding space where the **energy of the existing fabric is framed by the commercial activities**. The basement floor is a combination of the existing basement parkades of the individual buildings linked to the intervention's **central loading zone** which feeds goods to the upper floors.

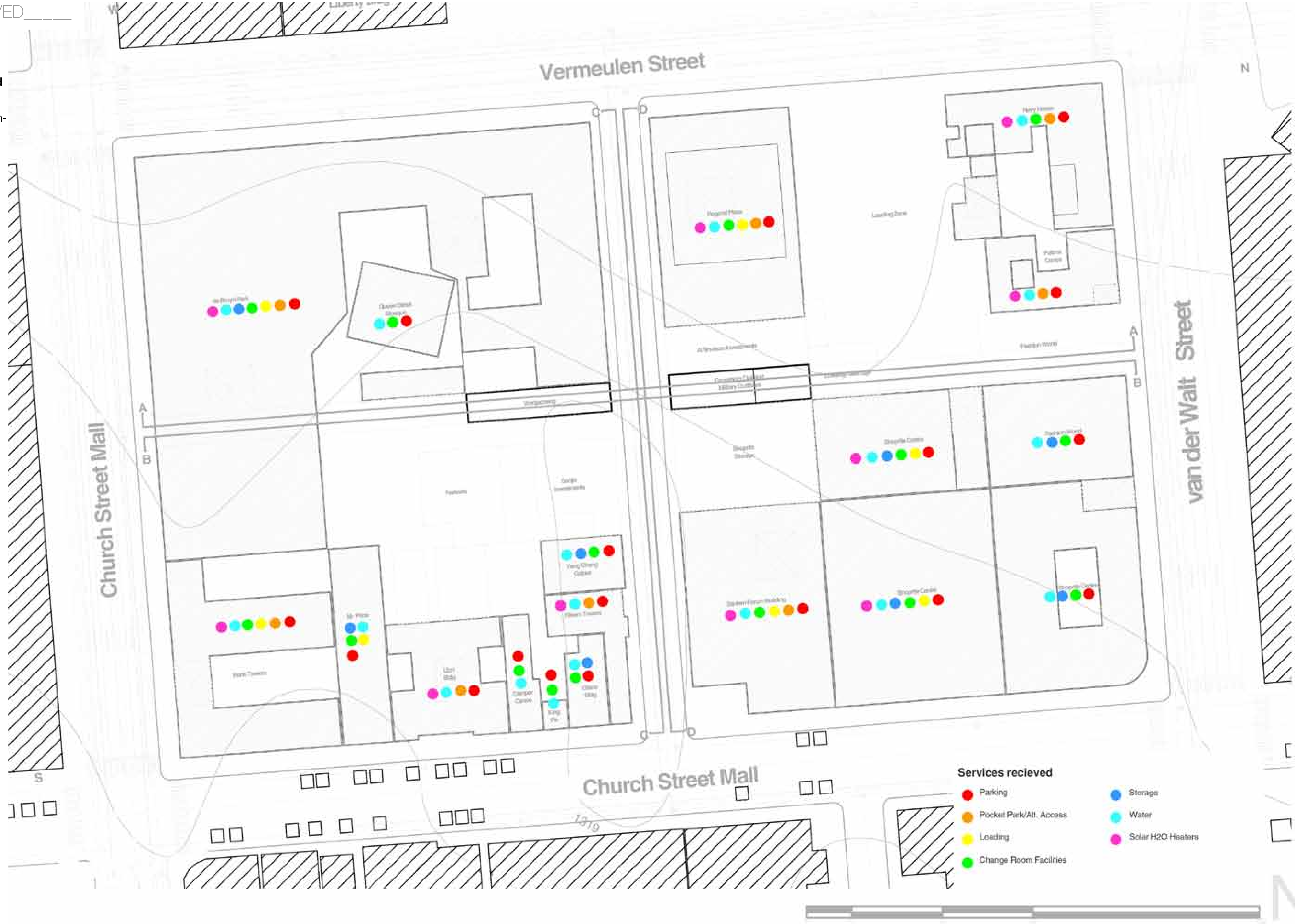


[Figure 9_15.] Vertical zoning, section A-A

____SERVICES RECEIVED______

This diagram communicates which services the **intervention supplies and which of these services are being used** by the context.

[Figure 9_16.] Services provided and usage chart.



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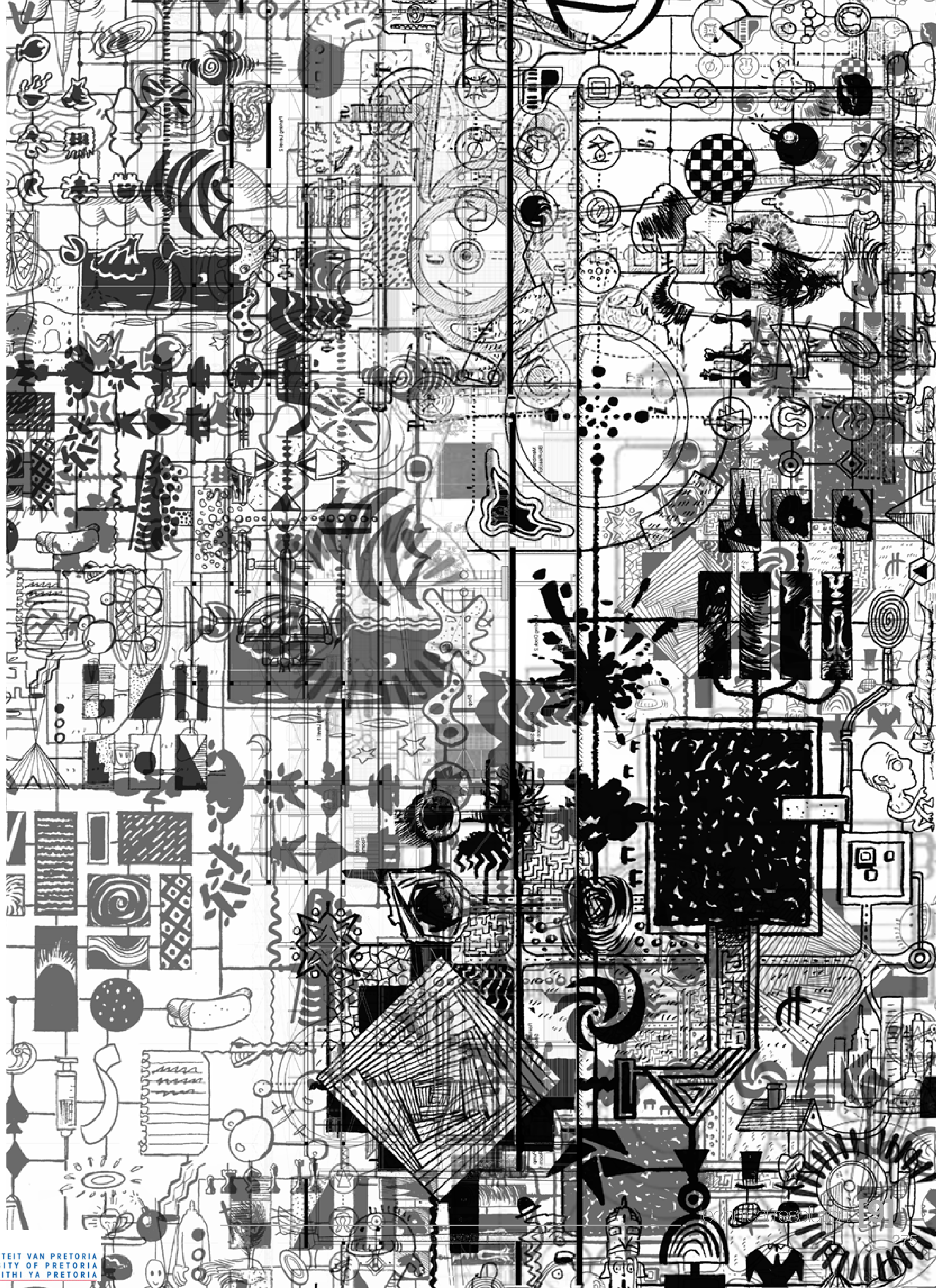
[9.2] DETAILS

TECHNICAL EXPLORATION

Four detail focus areas will be discussed in this detail section. Each detail exploration is **linked to one of the infra-structural systems** in the intervention. The following details will be discussed:

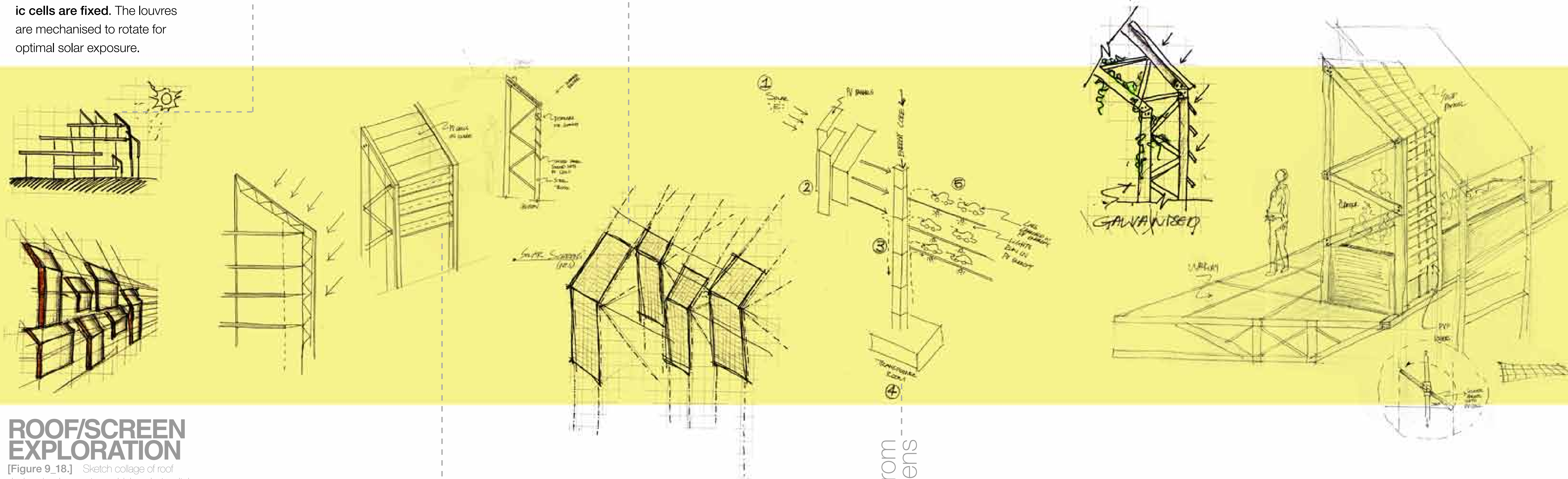
- **Roof and solar screen design.**
- **Conduit bridges**
- **Organic digester seating**
- **Slab edge and balustrade connection.**



[Figure 9_17.] 'Small things'

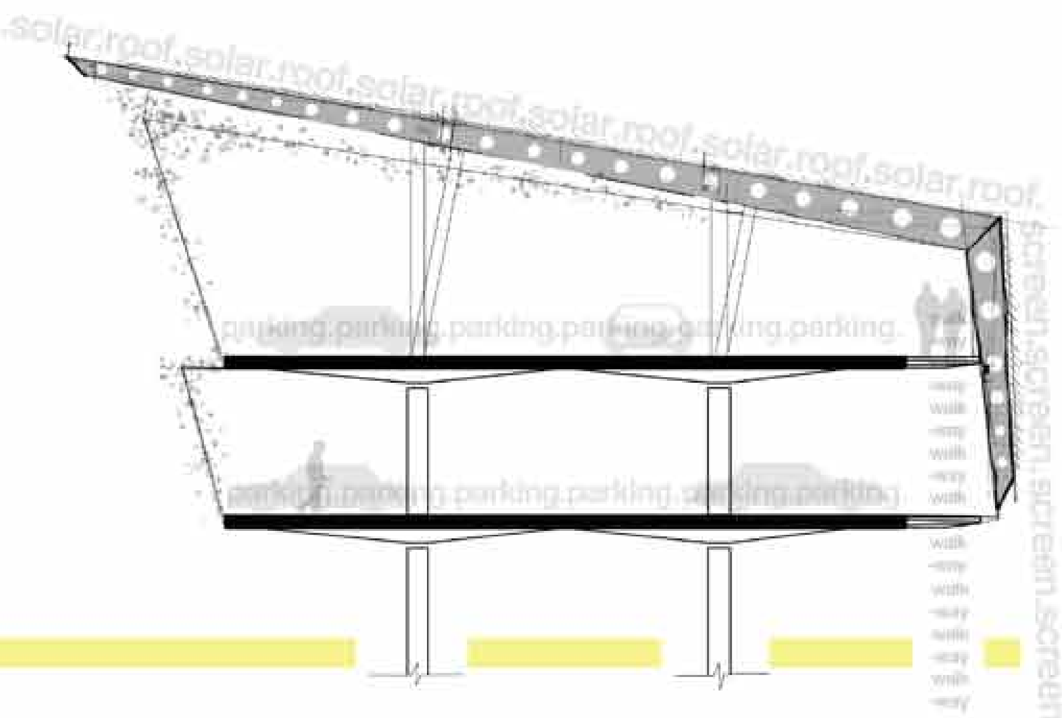
ROOF DESIGN

The roof structure is a light steel structure which links the sun and sky to the building. The **roof wraps over the northern facade to become a screen device.** The roof and screen structure is **'clad' with a louvre system on which photo voltaic cells are fixed.** The louvres are mechanised to rotate for optimal solar exposure.

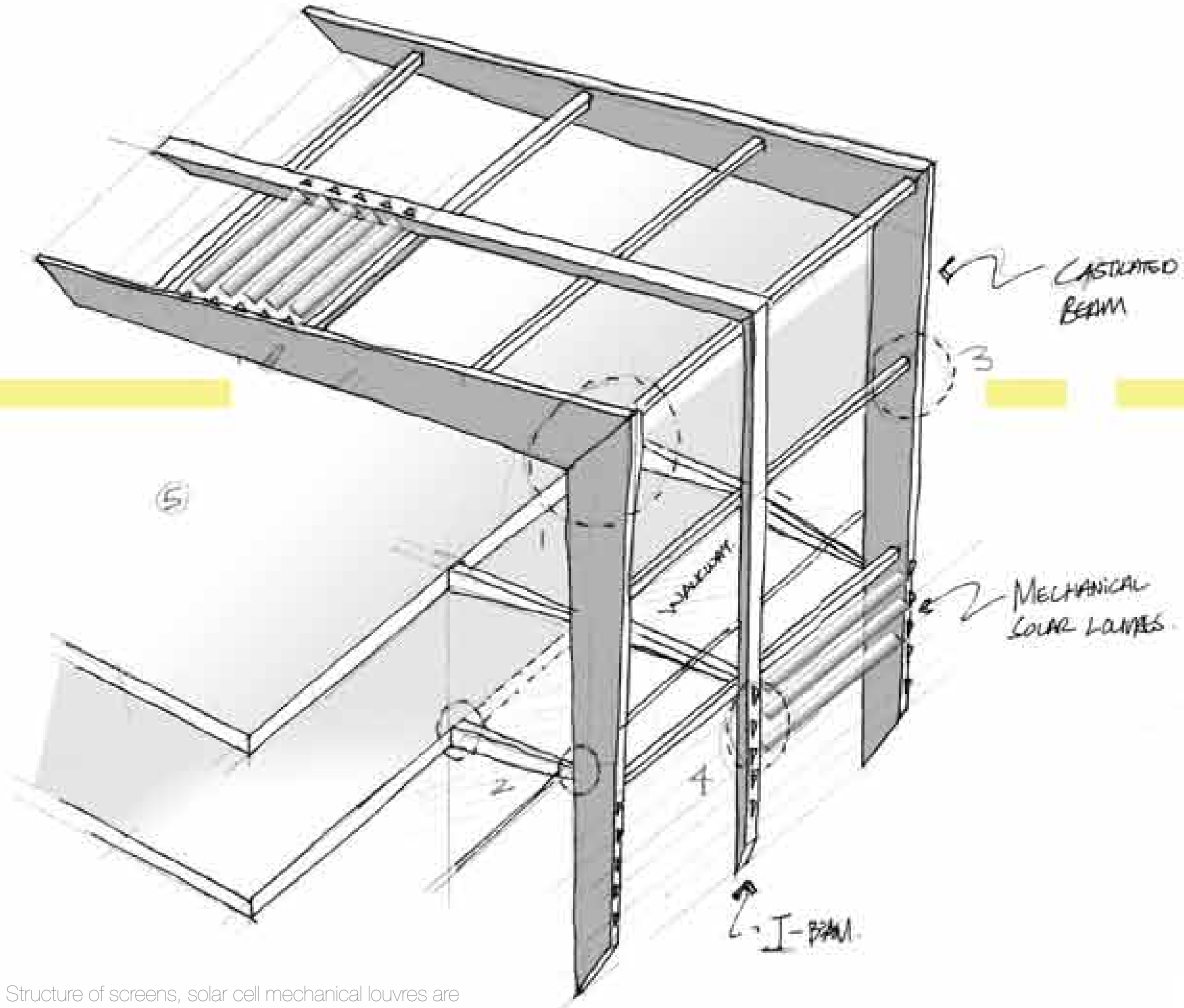


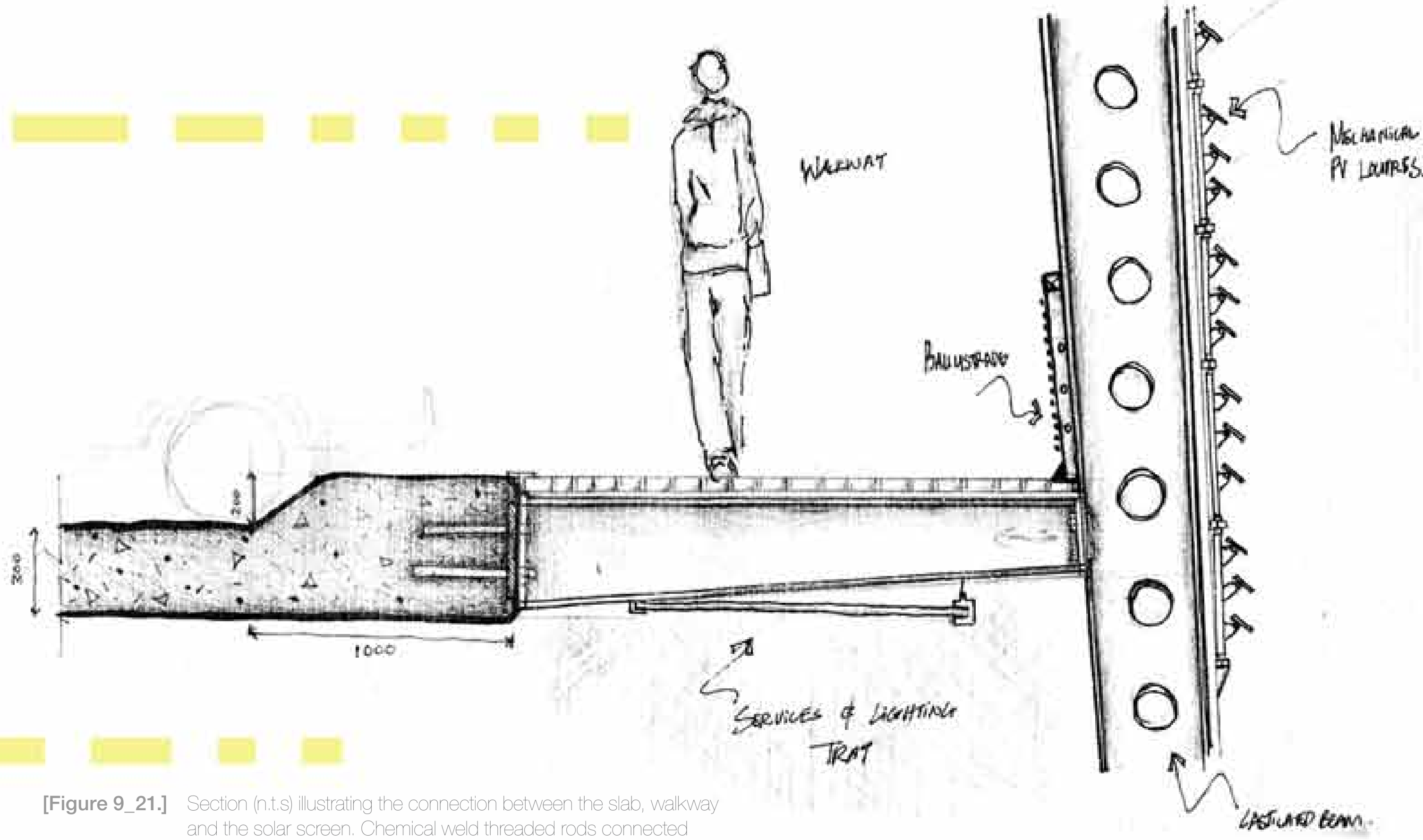
ROOF/SCREEN EXPLORATION

[Figure 9_18.] Sketch collage of roof design development, combining photovoltaic technology and a louvre system for shading and energy harvesting.



[Figure 9_19.] Castellated beam roof structure @ 8000mm centres with infill bracing fixed to steel I-sections on concrete slab.





[Figure 9_21.] Section (n.t.s) illustrating the connection between the slab, walkway and the solar screen. Chemical weld threaded rods connected to slab to which custom I-section walkway beams are fixed and then fixed to the castellated beams.

technical resolution **[9]**

 [Figure 9_20.] Structure of screens, solar cell mechanical louvres are fixed to the castellated beams for optimal solar exposure.

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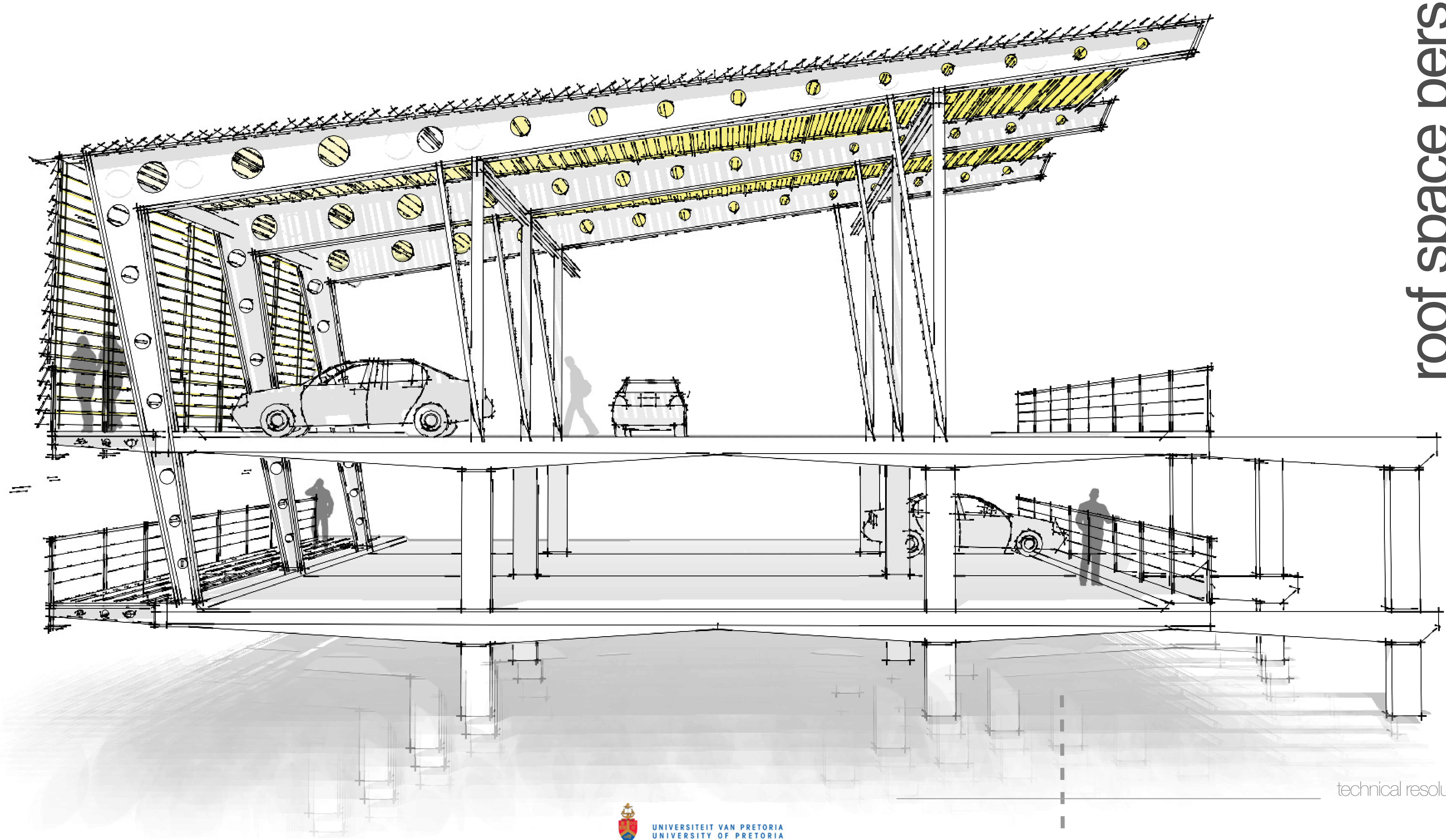
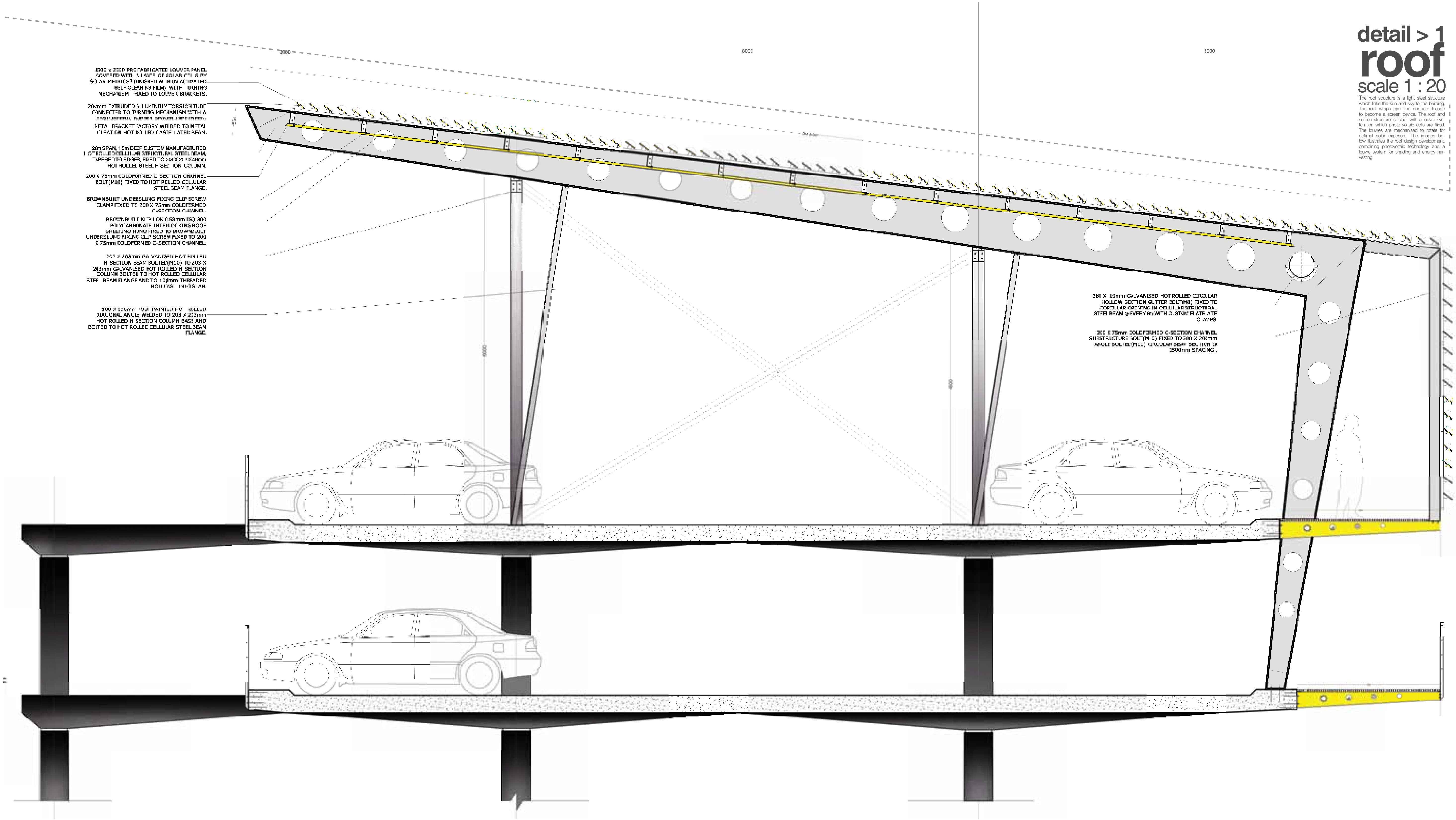
roof space perspective



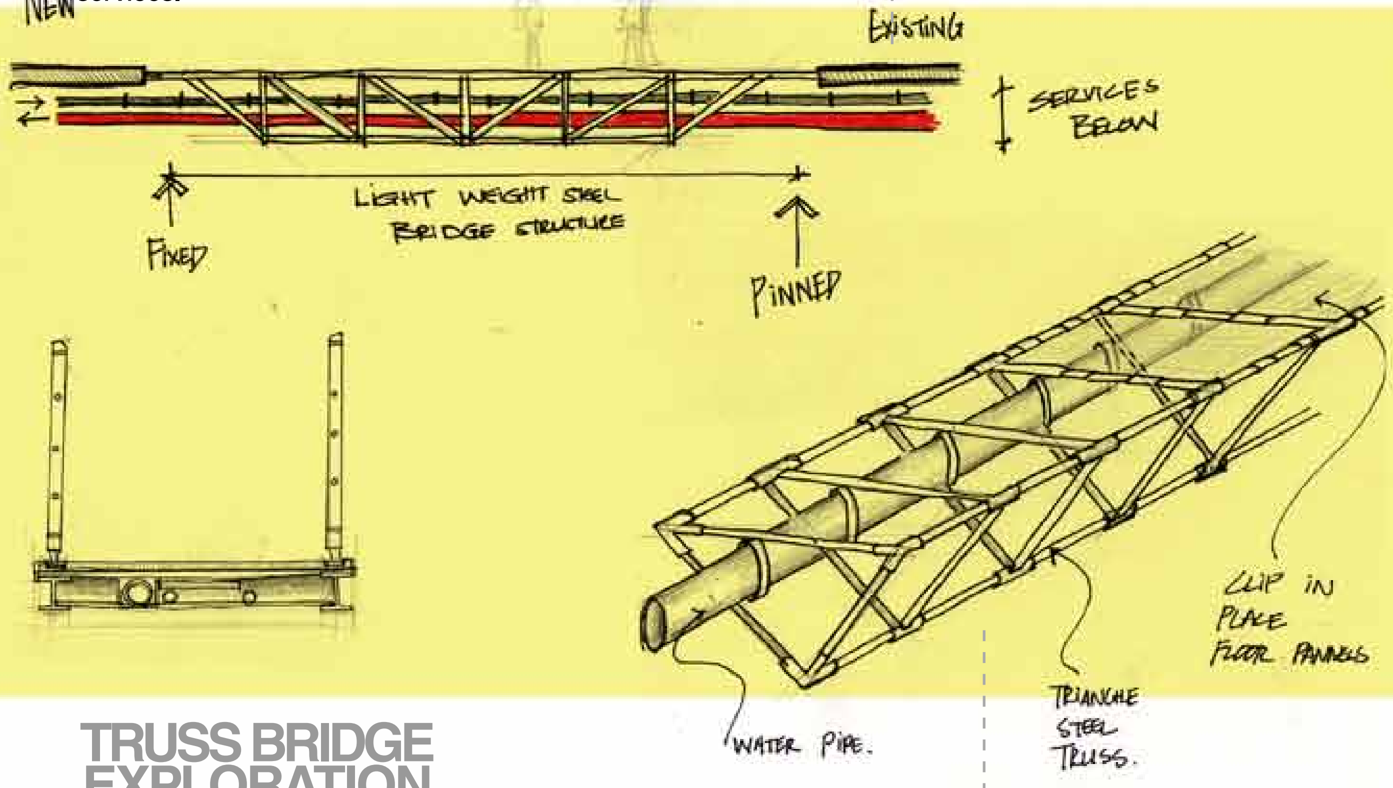


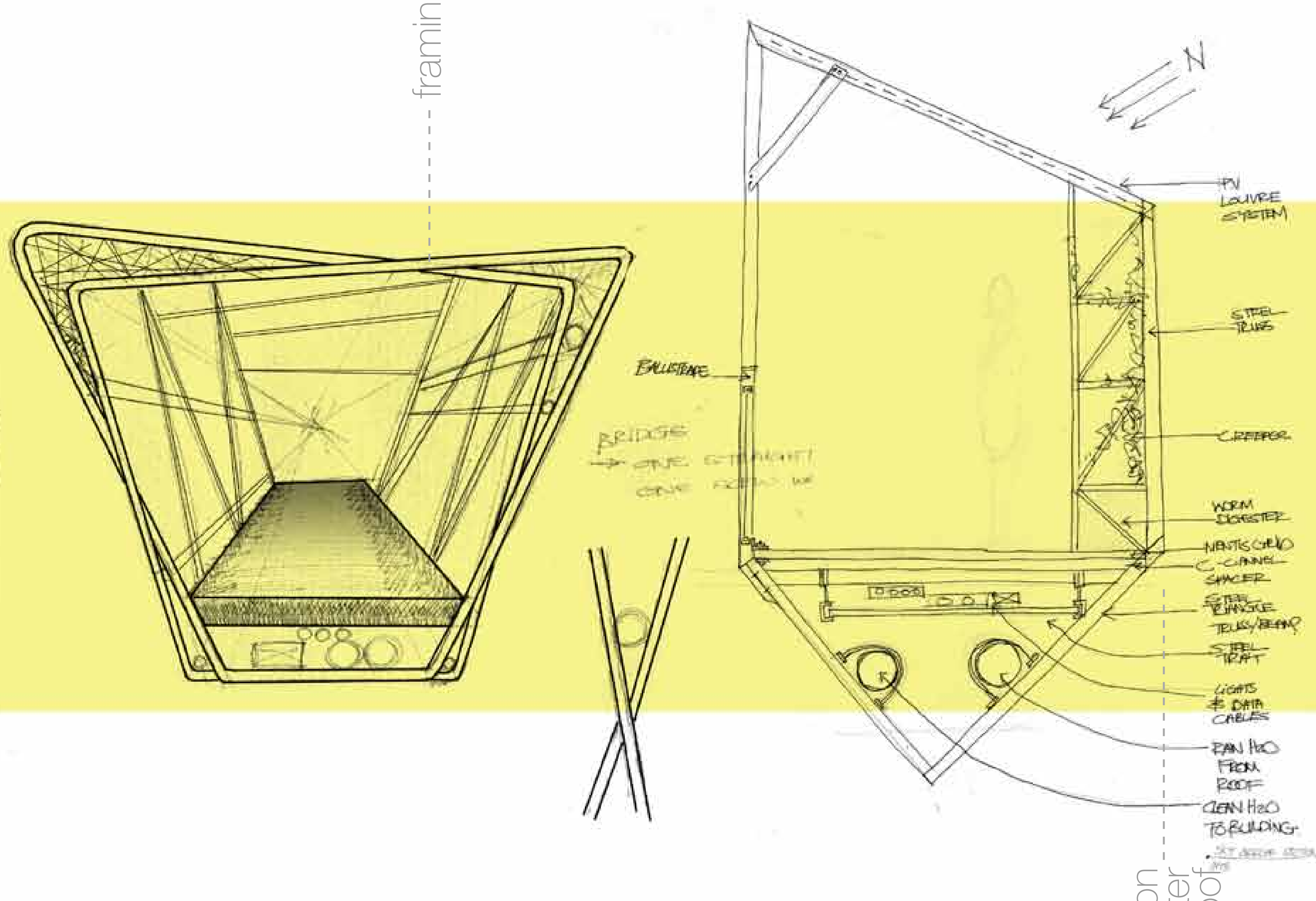
detail > 1
roof
scale 1 : 20

The roof structure is a light steel structure which links the sun and sky to the building. The roof wraps over the northern facade to become a screen device. The roof and screen structure is 'clad' with a louvre system on which photo voltaic cells are fixed. The louvres are mechanised to rotate for optimal solar exposure. The images below illustrates the roof design development, combining photovoltaic technology and a louvre system for shading and energy harvesting.

BRIDGE DESIGN

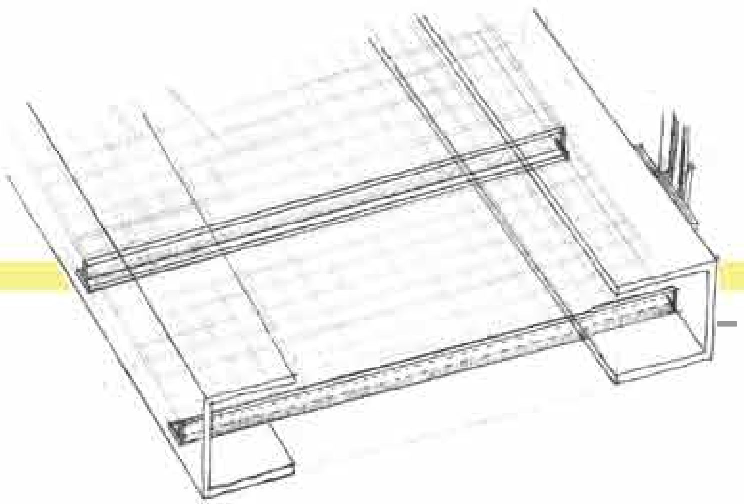
The conduit bridges act as the building's 'fingers' weaving into the existing fabric. The bridges not only enable water flow between the buildings but serves as an **alternative access way for the user.** The bridges are light weight steel structure trusses which can achieve large spans, clad with a mentis grid walkway. The piping, electrical cables and lighting are fixed in the void space under the bridge, thus the **bridge acts as a conduit for these services.**



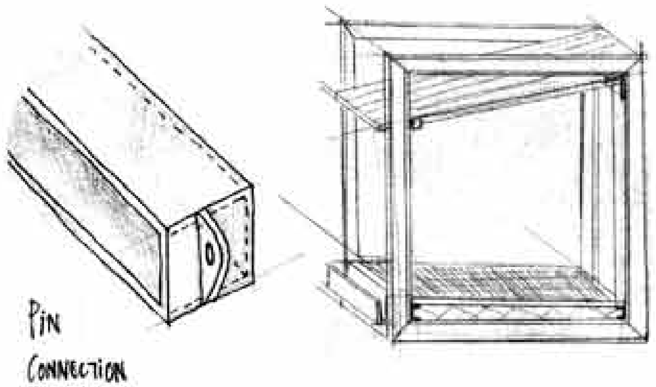


TRUSS BRIDGE EXPLORATION

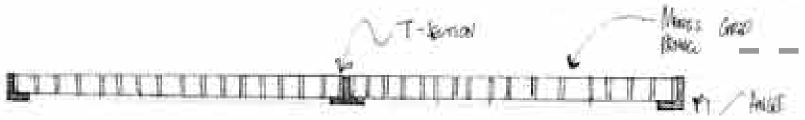
[Figure 9_22.] Sketch collage of connection bridges, lightweight steel and mesh construction, pinned fixing on both support ends. Cavity mesh floor with services placed inside for easy access.



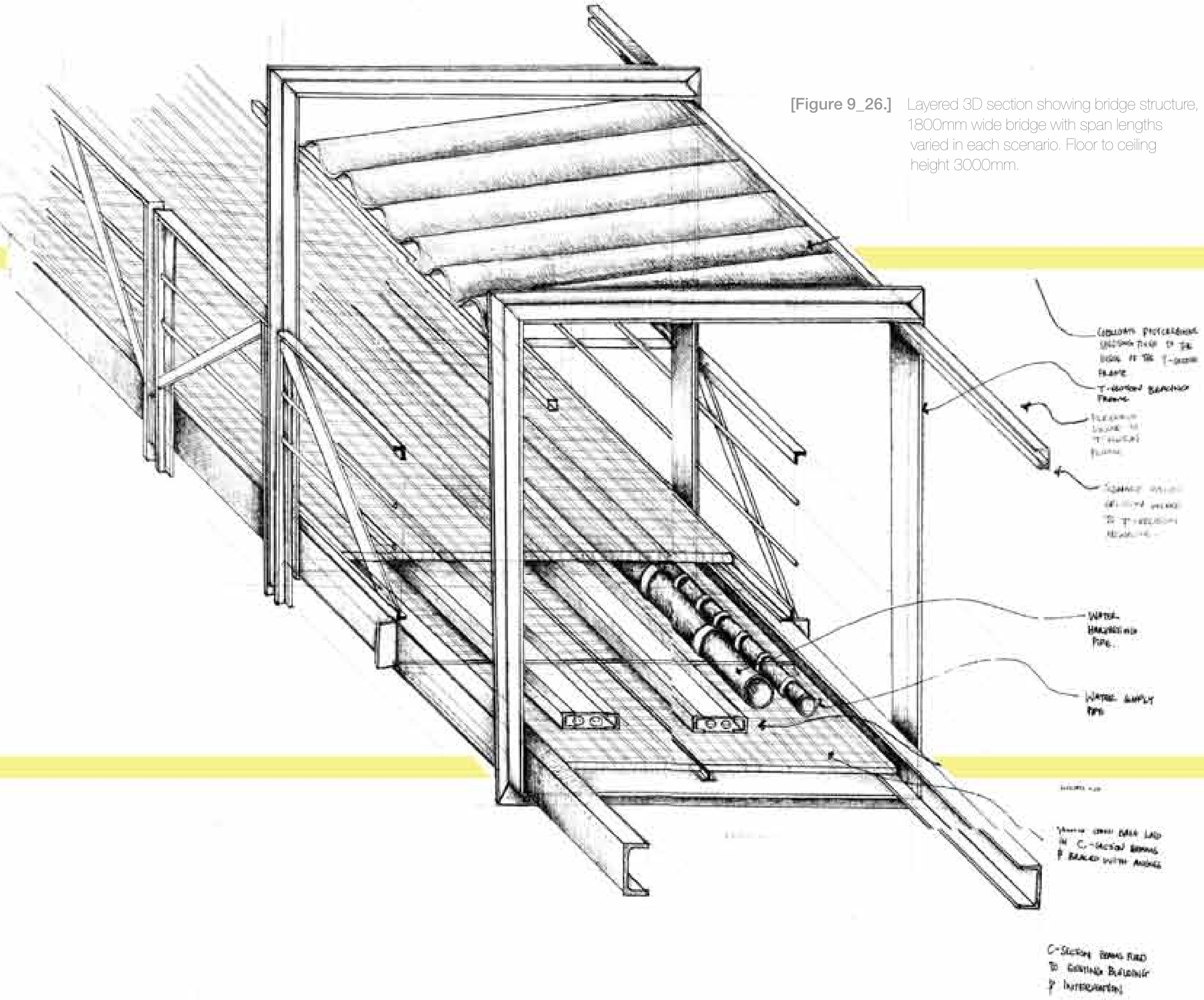
[Figure 9_23.] Mentis grid laid in steel channel beam to create flooring surface for services.



[Figure 9_24.] Pin connection on channel edge and 3D section portion of bridge showing slanted roof.



[Figure 9_25.] Mentis grid laid in steel channel and T-sections.



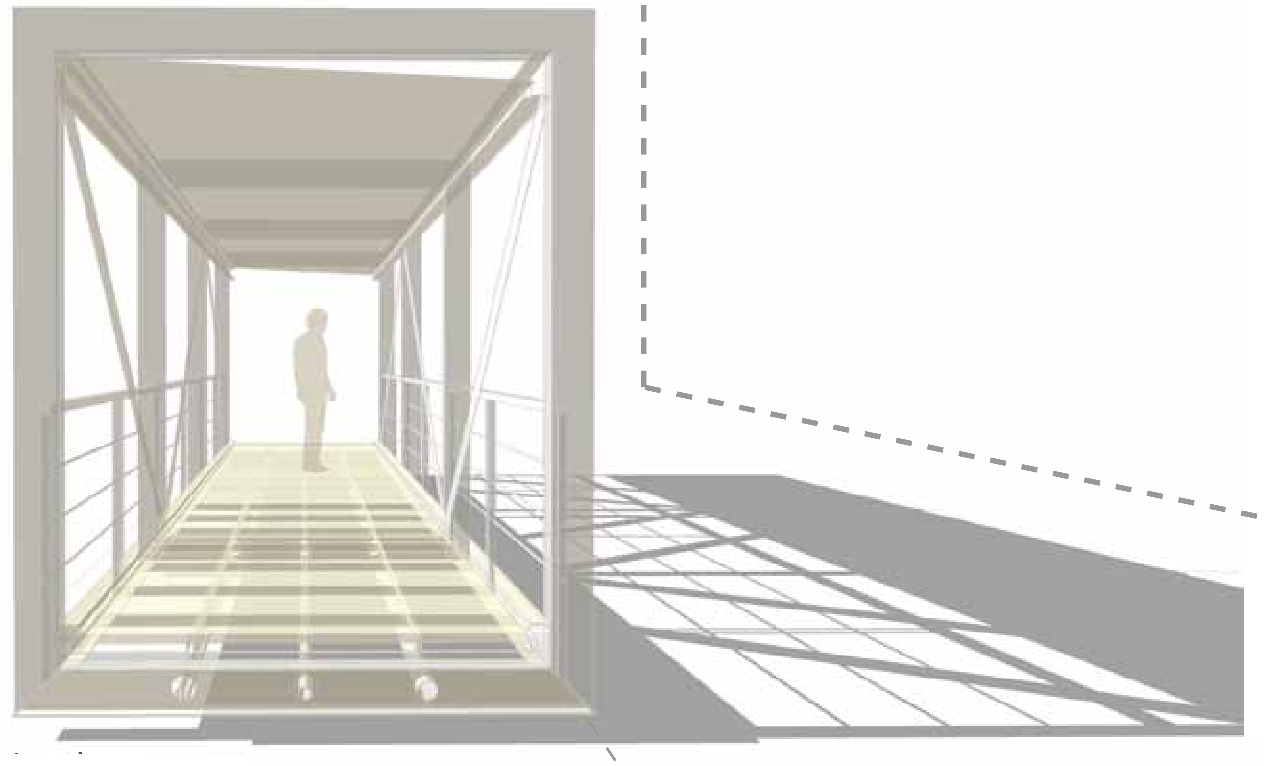
[Figure 9_26.] Layered 3D section showing bridge structure, 1800mm wide bridge with span lengths varied in each scenario. Floor to ceiling height 3000mm.

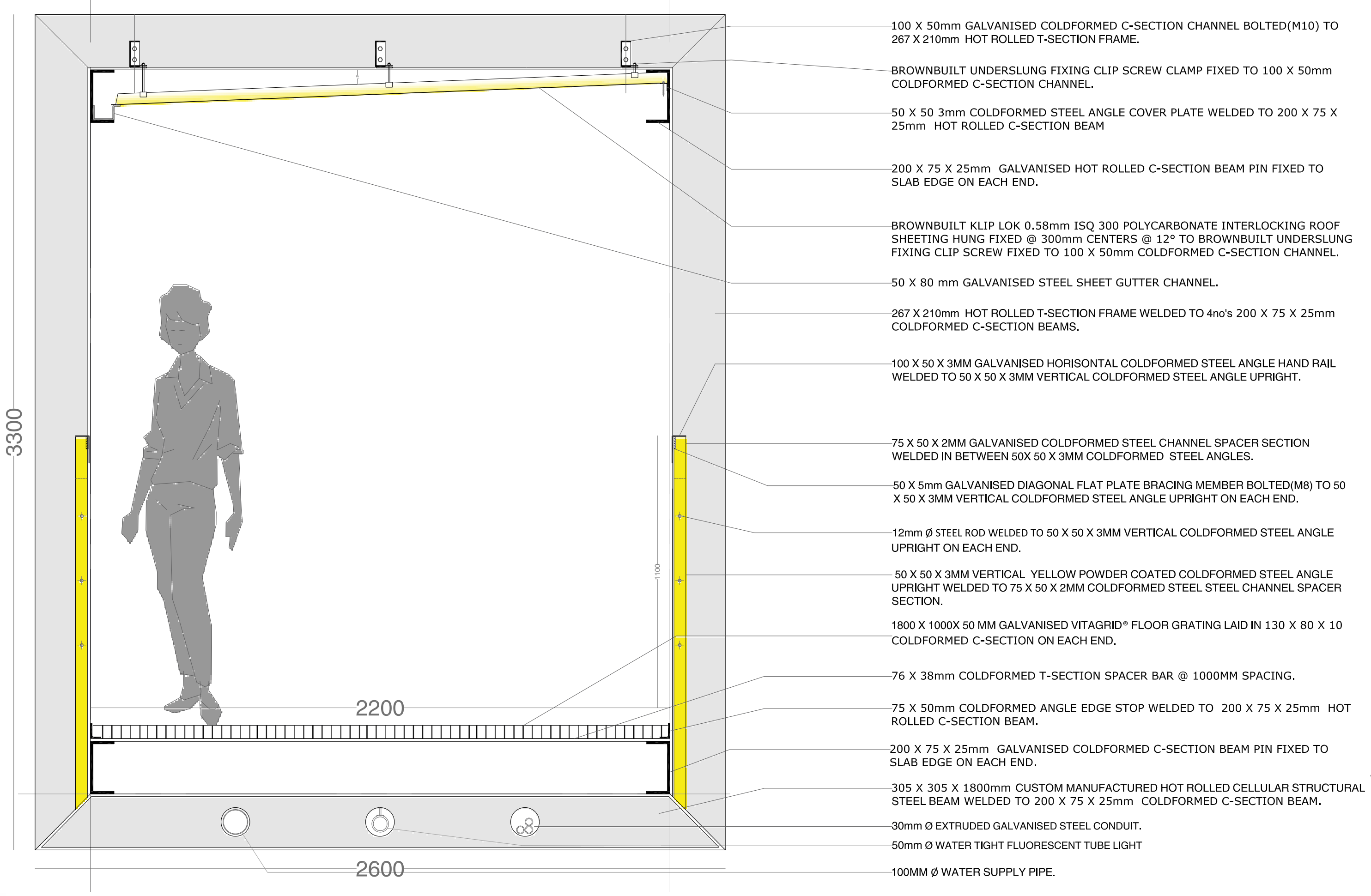
> > detail > 2

bridge

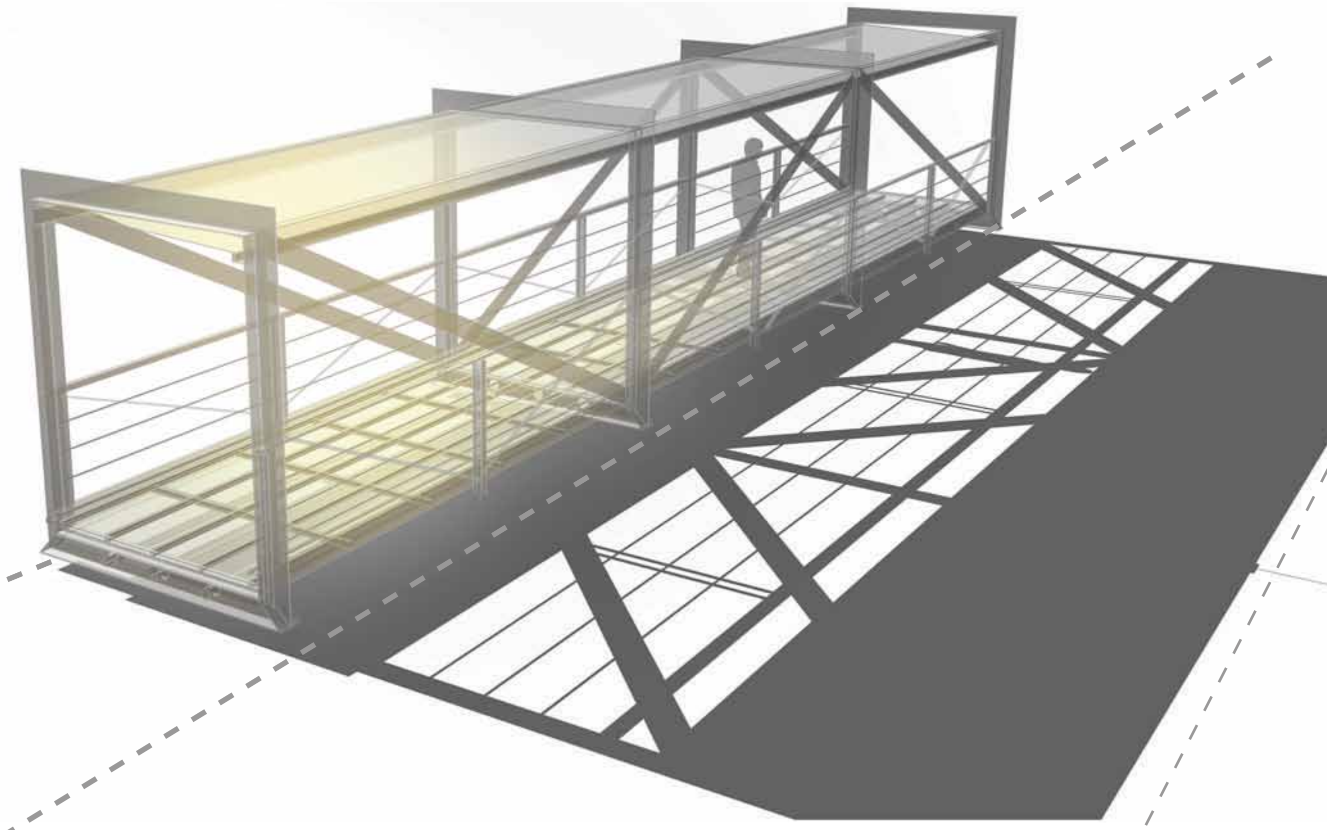
scale 1 : 10 & 20

The conduit bridges act as the building's 'fingers' weaving into the existing fabric. The bridges not only enable water flow between the buildings but serves as an alternative access way for the user. The bridges are light weight steel structure trusses which can achieve large spans, clad with a mentis grid walkway. The piping, electrical cables and lighting are fixed in the void space under the bridge, thus the bridge acts as a conduit for these services.





connection bridge section



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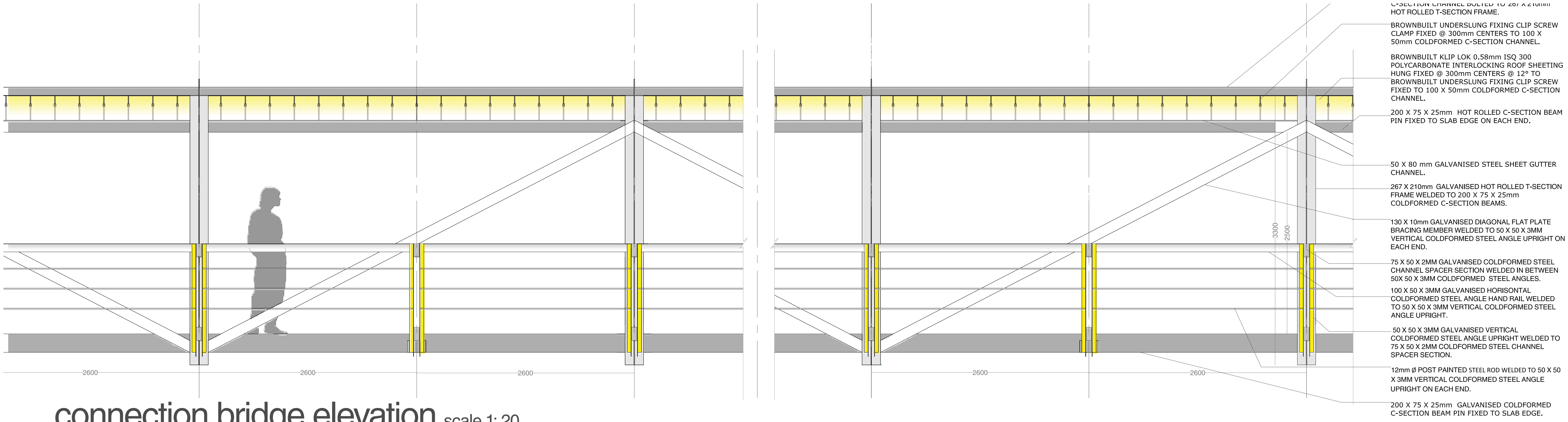
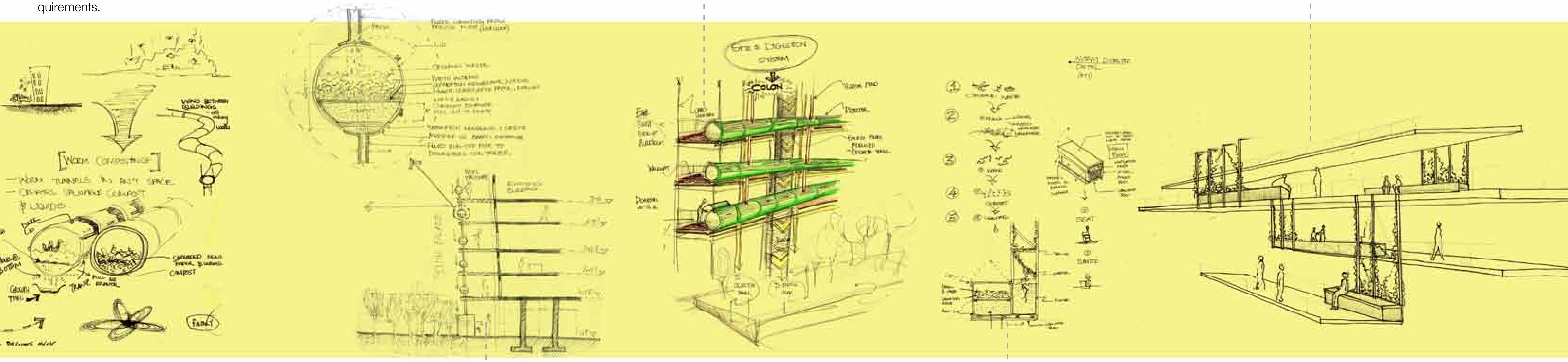


connection bridge elevation scale 1: 20

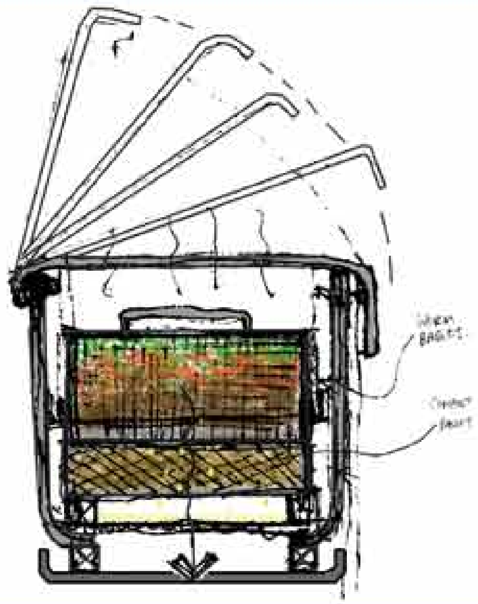
DIGESTER DESIGN

The digester detailing is more like a product design attempt, for the digester can be seen as **street furniture; a planter – dustbin – seating combination**. The digester needs to have a comfortable seating surface of wood or composite recycled timber resin slats. A sturdy digester base in which the worms are housed and the planter combined could be of steel or of composite recycled timber resin slats as well. The trellis on which the plants grow can be a light-weight steel structure which varies in length and width dependant on the creeper screen requirements.

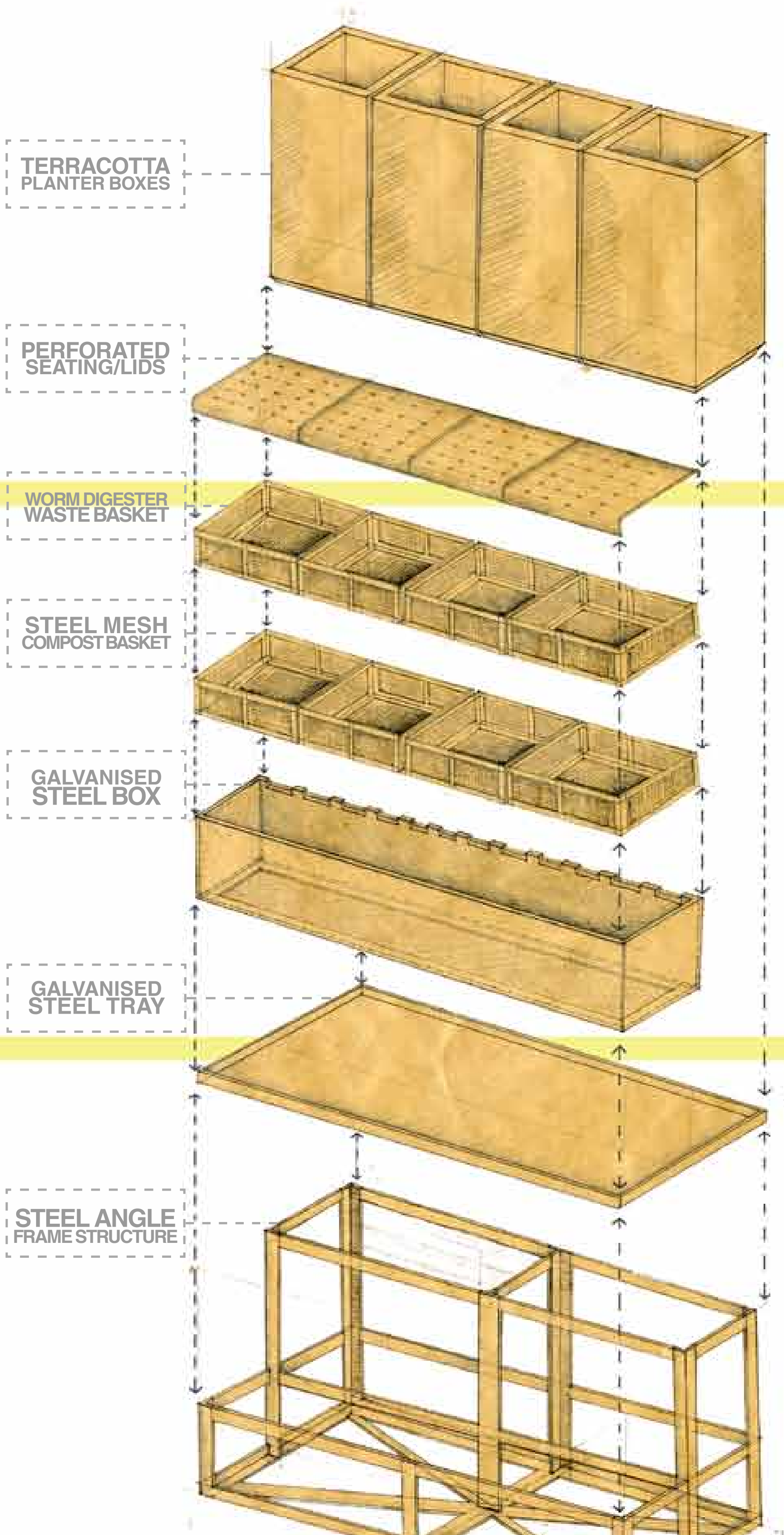


WORM DIGESTER EXPLORATION

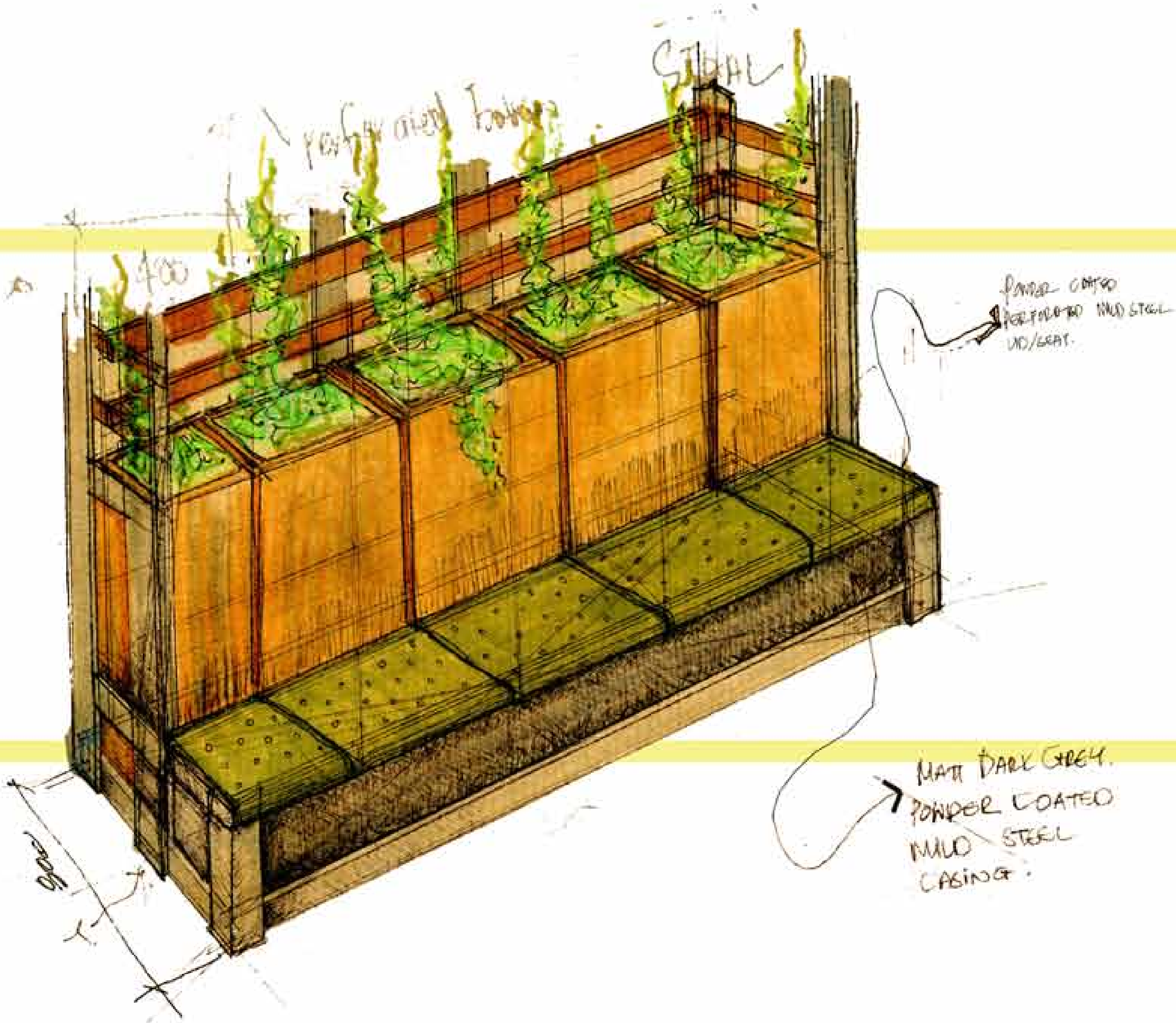
[Figure 9_27.] Sketch collage of earthworm digesters, combining seating, organic waste digestion and planters in one system.



[Figure 9_28.] Digester box, galvanised steel box with, perforated, powder coated hinged seating lid, steel mesh organic basket on top of steel mesh compost basket, on top of a galvanised steel tray.



[Figure 9_29.] Digester design and component assembly.



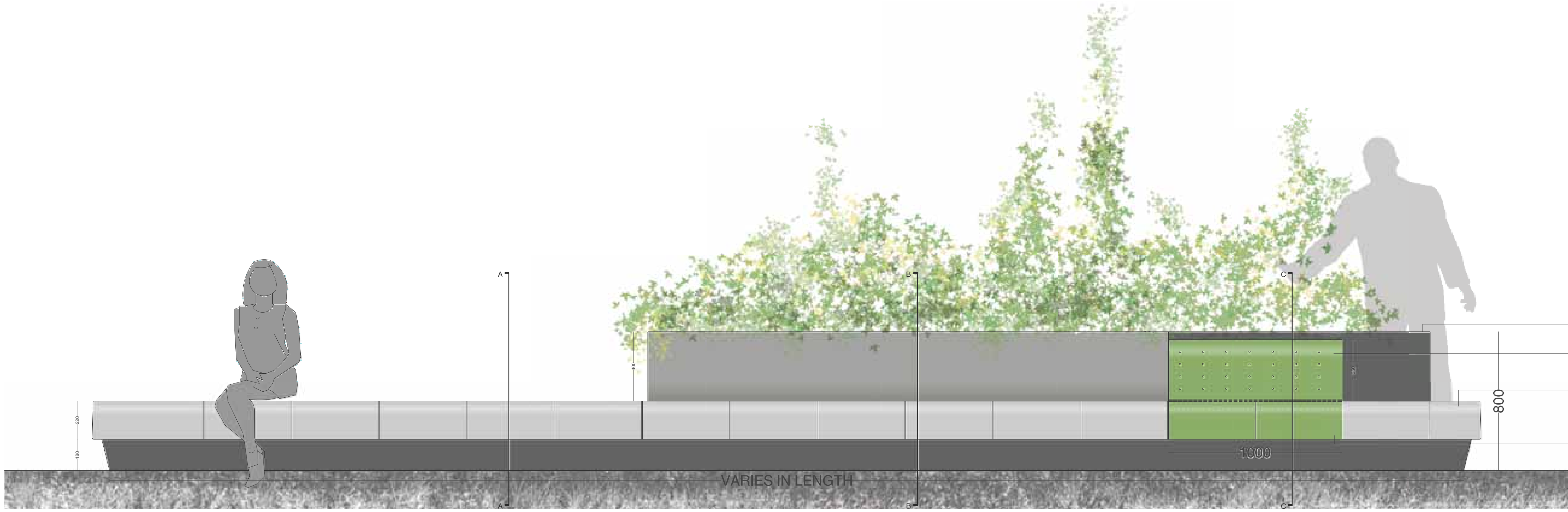
[Figure 9_30.] Organic digester design, terracotta planters are placed behind the digester boxes to make use of the leachate liquid produced by the digesters to feed the creepers growing in the digesters. The planters also serve as a backing to the seating.

> > > > detail > 3

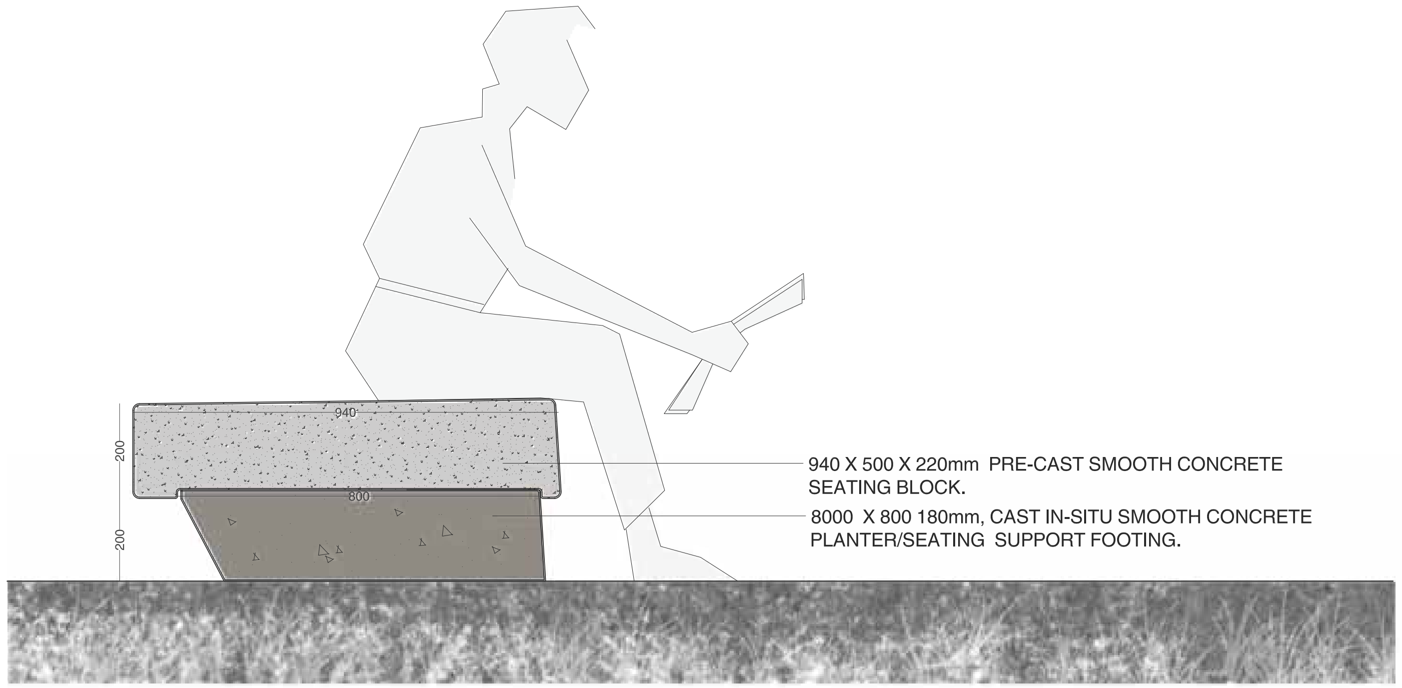
digester

> > > > > scale 1 : 10

The digester detailing is more like a product design attempt, for the digester can be seen as street furniture; a planter – dustbin – seating combination. The digester needs to have a comfortable seating surface of concrete. A sturdy digester base in which the worms are housed and the planter combined could be of steel or of composite recycled timber resin slats as well. The trellis on which the plants grow can be a light-weight steel structure which varies in length and width dependant on the creeper screen requirements.

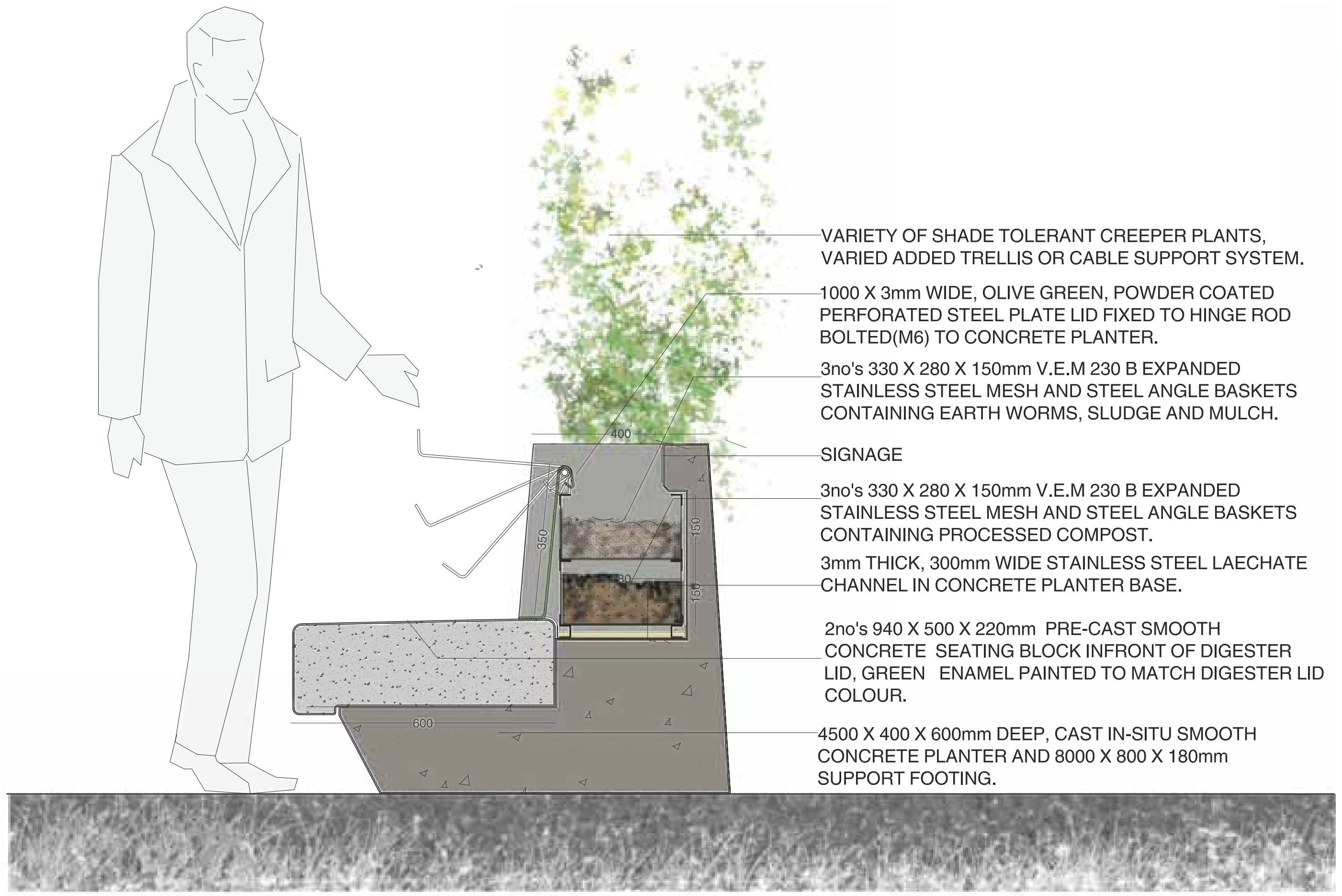


digester seating-planter elevation scale 1: 10



section A-A scale 1: 10

section B-B scale 1: 10



section C-C scale 1: 10

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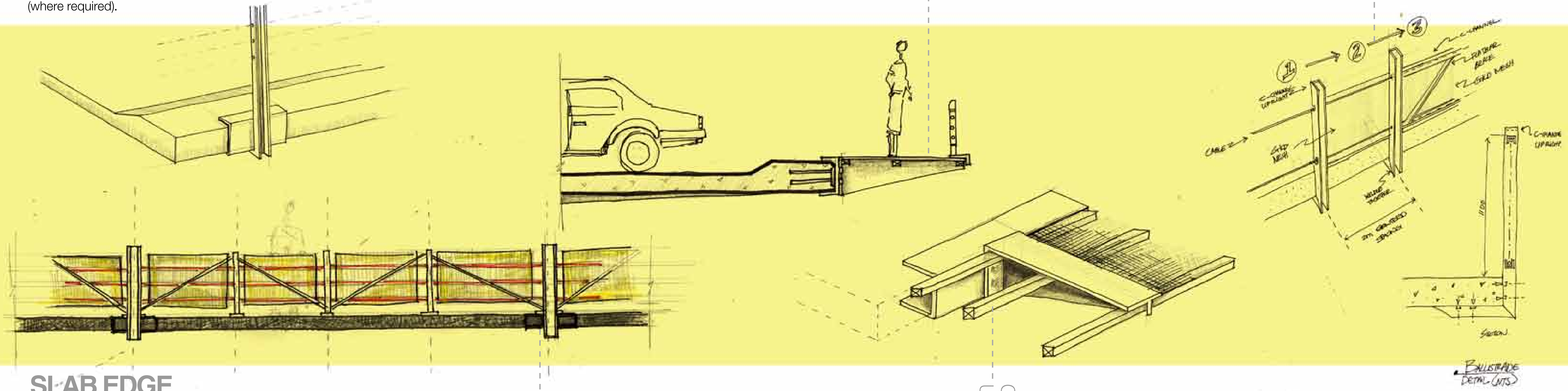
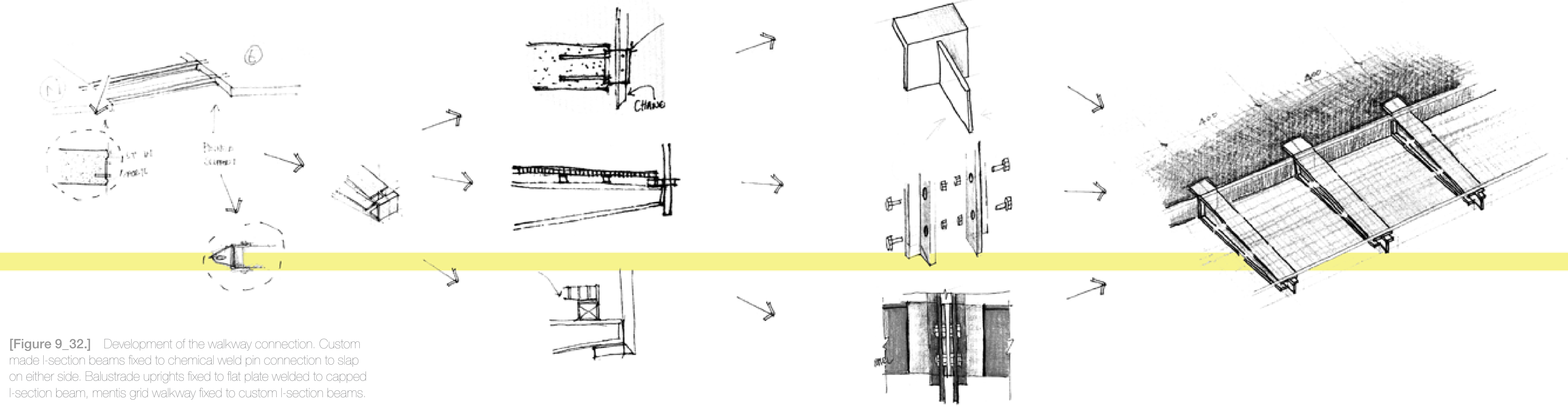
SLAB EDGE DESIGN

The slab edge houses the **conduit balustrade** which includes the electrical wiring for the charging of the electrical cars, as well as the cable structure for the safety buffer which prevents the cars from driving over the edge. Thus the **slab edge is thickened with reinforced upright balustrade supports** with tensioned cables and a GKD mesh cladding (where required).

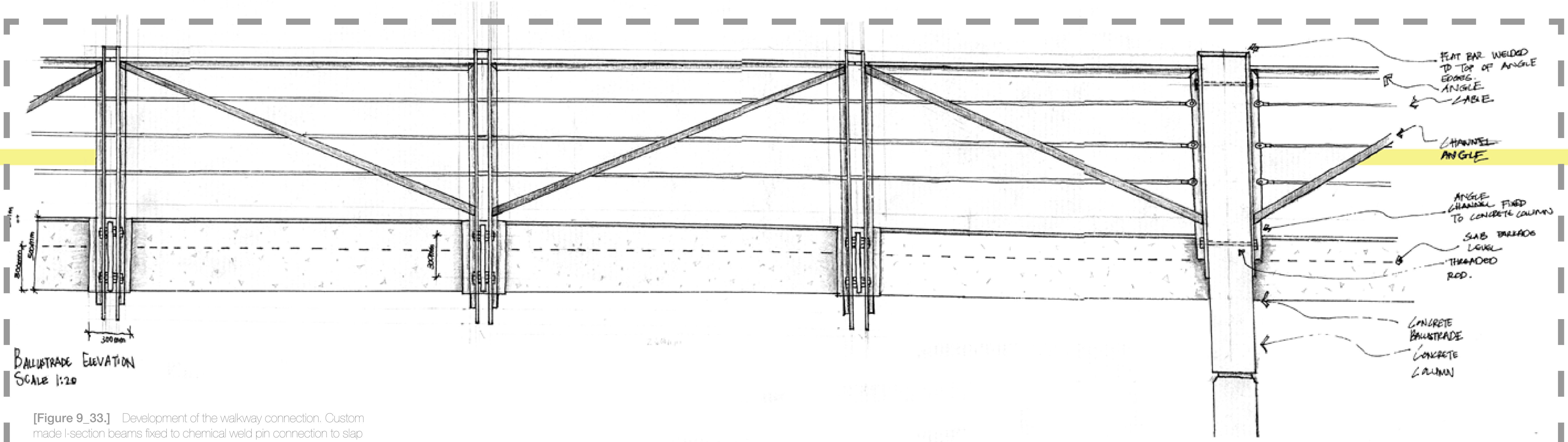


SLAB EDGE EXPLORATION

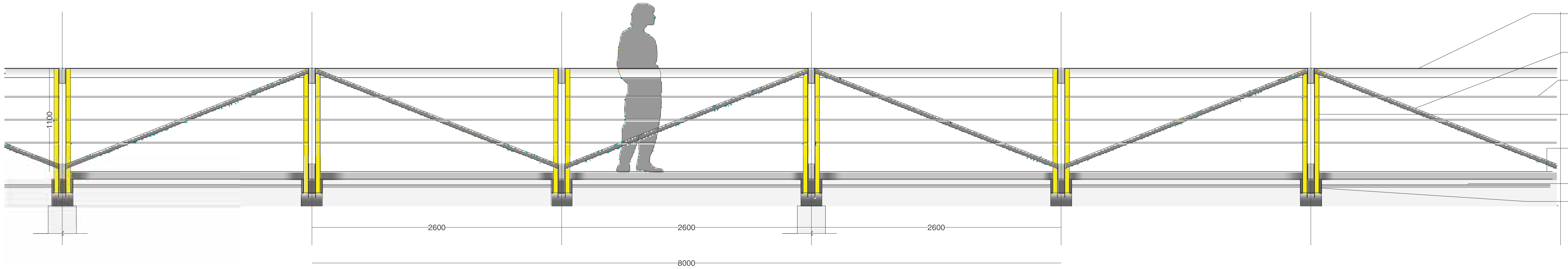
[Figure 9_31.] Sketch collage of slab edge, thickening concrete edge to create buffer stop for cars. Balustrade fixed to slab edge supporting a cable structure spanning between the concrete column supports.



[Figure 9_32.] Development of the walkway connection. Custom made I-section beams fixed to chemical weld pin connection to slap on either side. Balustrade uprights fixed to flat plate welded to capped I-section beam, mentis grid walkway fixed to custom I-section beams.



[Figure 9_33.] Development of the walkway connection. Custom made I-section beams fixed to chemical weld pin connection to slap on either side. Balustrade uprights fixed to flat plate welded to capped I-section beam, mentis grid walkway fixed to custom I-section beams.

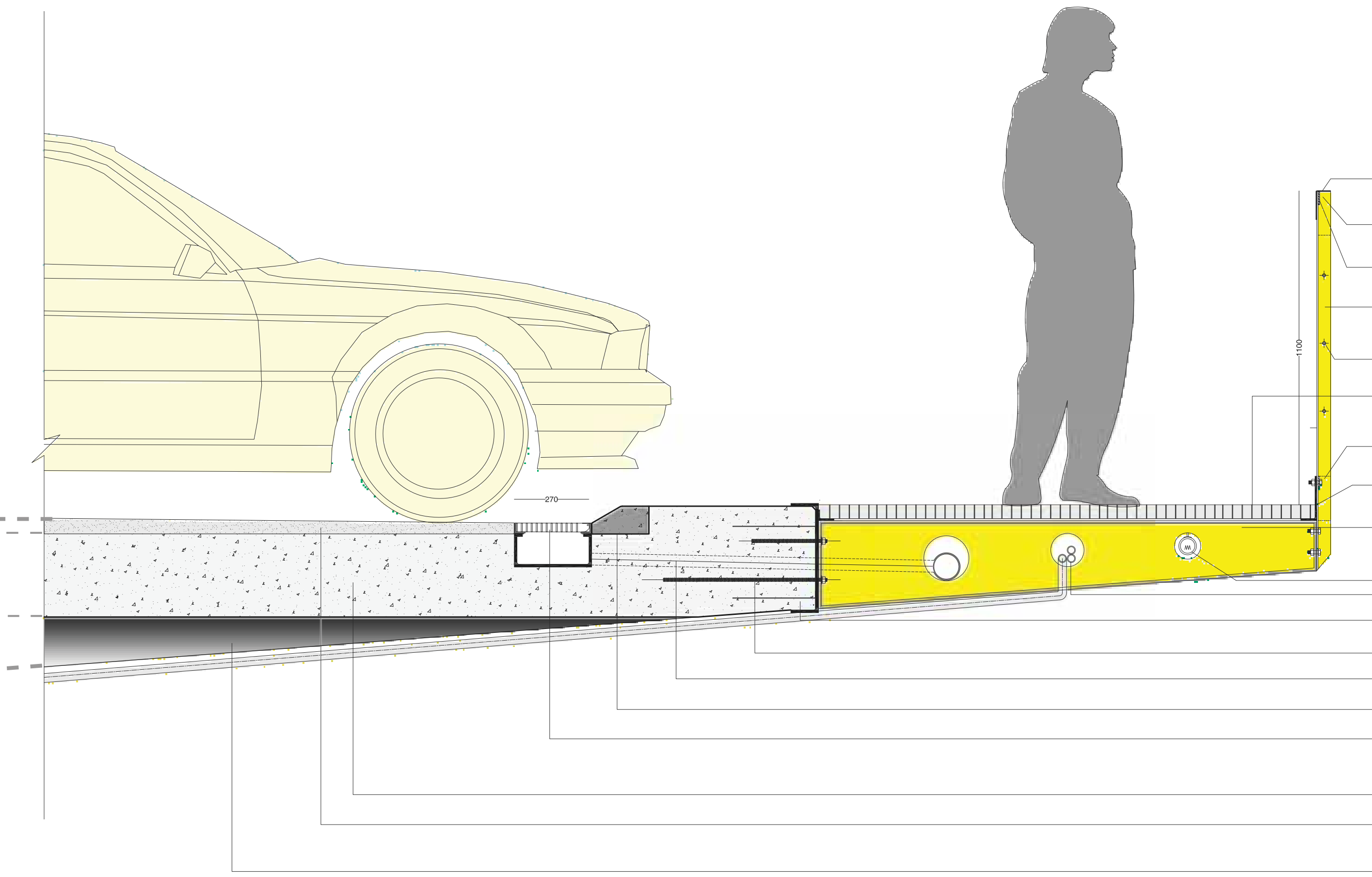


balustrade and slab edge elevation scale 1: 20

> detail > 4 slab edge

scale 1 : 10/20

The slab edge houses the cable/rod structure for the safety buffer which prevents the cars from driving over the edge. Thus the **slab edge is thickened with reinforced upright balustrade supports** with tensioned cables/rods.



balustrade and slab edge section scale 1: 10