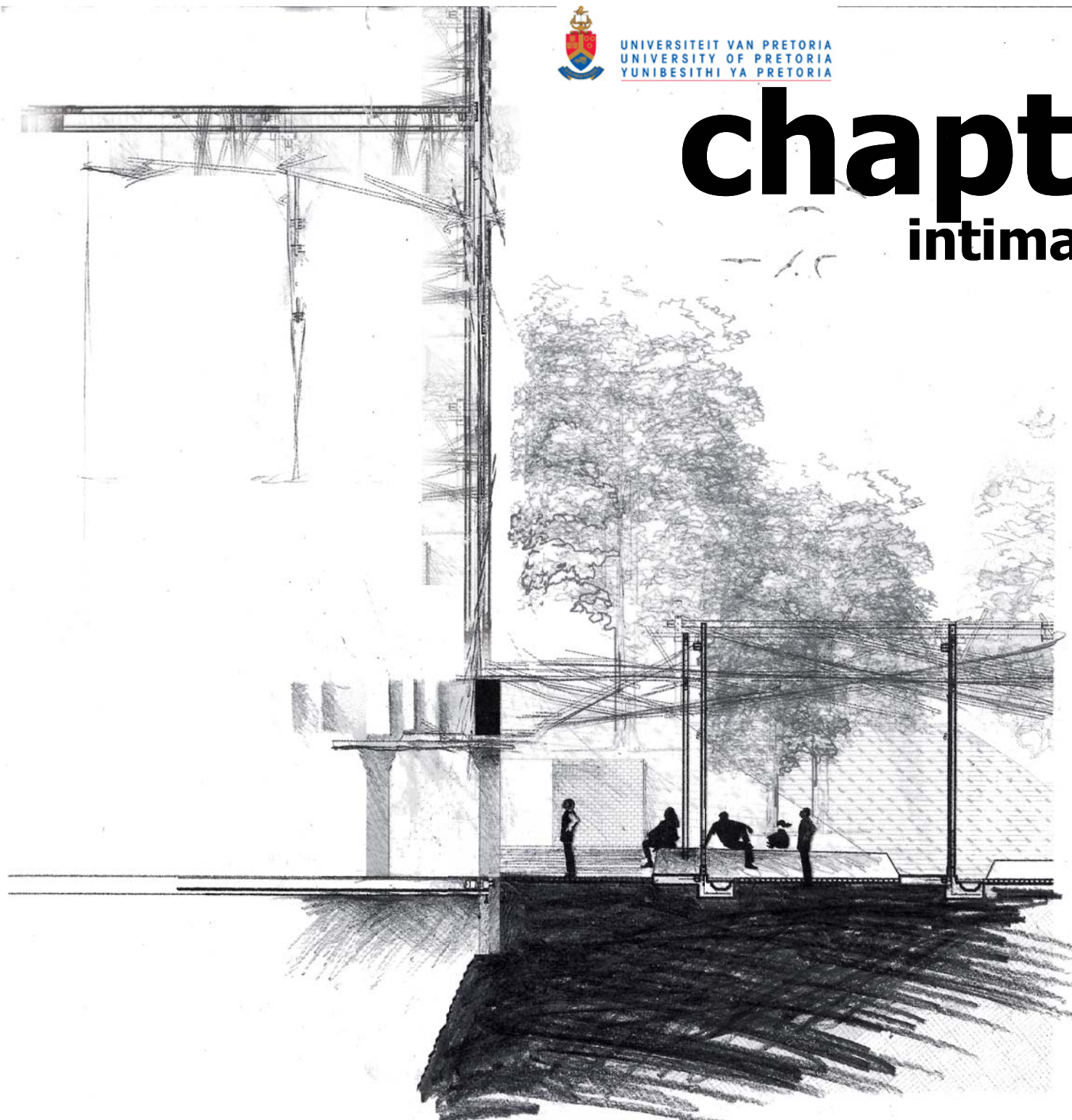




chapter six

intimate proximities



Jean Nouvel and Jean Baudrillard state that the built object is not always the ultimate purpose of architecture, but it is more the world of virtuality that it translates into new reality [Baudrillard & Nouvel, 2002:4]. In this thesis, the architecture is the means to translate a world of systems and processes from virtuality into an architectural reality - a tangible place of activity. In parallel to this theory, Michael Benedikt defines the essence of a reality of architecture to possess presence, significance, materiality and also emptiness [Benedikt, 1987:32]. This unique reality also the quality of the *Third Landscape* space. This reality for architecture encompasses two characteristics - virtuality and singularity. The essence of this design is to translate the virtualities involved in the process and intent of the program into a physical expression of a built form, as a singular object of architecture.

The design has already drawn closer virtual proximities by turning a dead passive object, passive space and passive heritage into a active, living, future-orientated reality. The questions posed by site and program governs the design decisions on scale and materiality and reveals the remaining intimate proximities between system, building and the human experience.

structure

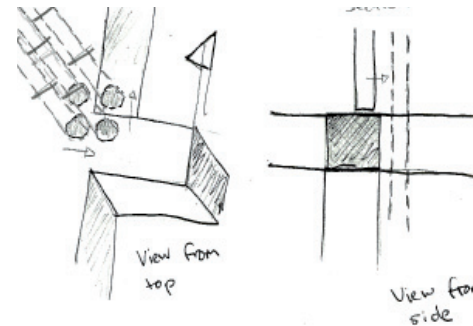
The decision was made to enhance the integrity of the concrete frame of the bunker by reducing any additional impact that the new design will have on the existing structure. The experience of the building is in its verticality and this is achieved by exaggerating the slenderness of the vertical elements and contrasting them with horizontal character of the massive concrete bunker.

The design aims to reduce the use of steel members and replace where possible with bamboo as a structural building element.

Bamboo is considered a “foreign” material, though ironically it is a native plant in every continent except Europe; grows practically anywhere and has been used in a range of contemporary construction applications from impressive bridges to monumental buildings and structures. According to Bereis and De Boer, bamboo is an incredibly strong fibre with double the compressive strength of concrete and almost the same strength to weight ratio of steel in tension [Bareis & De Boer, 2002:3]. The only real weaknesses

are at the joints and connections, but even here, architects like Simon Velez and Renzo Piano have almost perfected bamboo structural connections. Bamboo members are called culms, and the most efficient way so far to design large structures is by reinforcing the bamboo ends with steel or cement. One method involves drilling the ends of the bamboo culm and inserting a threaded rod or cable, and then fill the culm with cement or mortar. Epoxy or other glues can also be used. The similar method is to bolt

right through the culm and the use a steel strap to fix the culm to the next structural member. Both methods create very strong connections and transmits the forces from the different parts of the bamboo equally. These methods are the recommended connections from all the individual resources that were researched and will be adopted by the new design also. From this research, it is clear that bamboo works at its best in composite with other structural elements, especially steel connections. By replacing major steel elements with bamboo, the design can greatly reduce its embodied energy and carbon footprint.



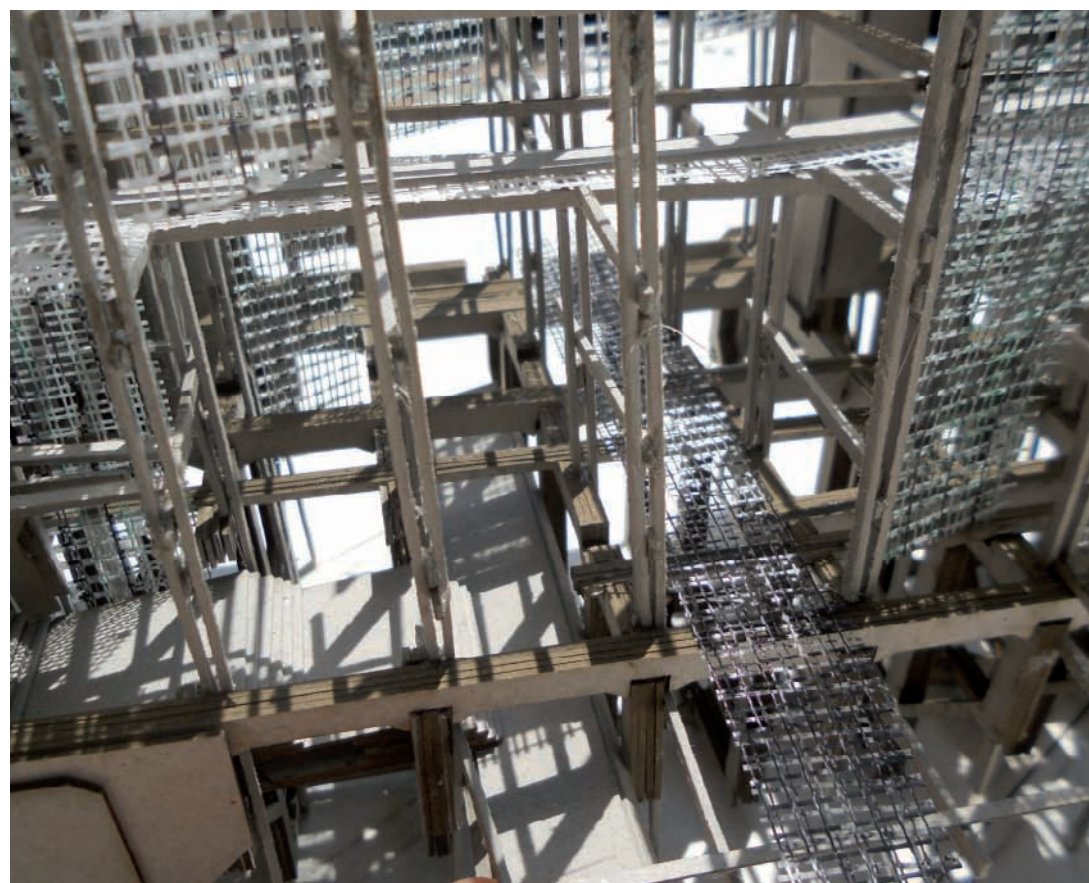
Figures 131 (top): off-set [author, 2010]. Slightly off-set the new frame structure on plan and on section.

Figures 132 (left): working model [author, 2010]. Slightly off-set the new frame structure to respect the structure of the existing bunker.

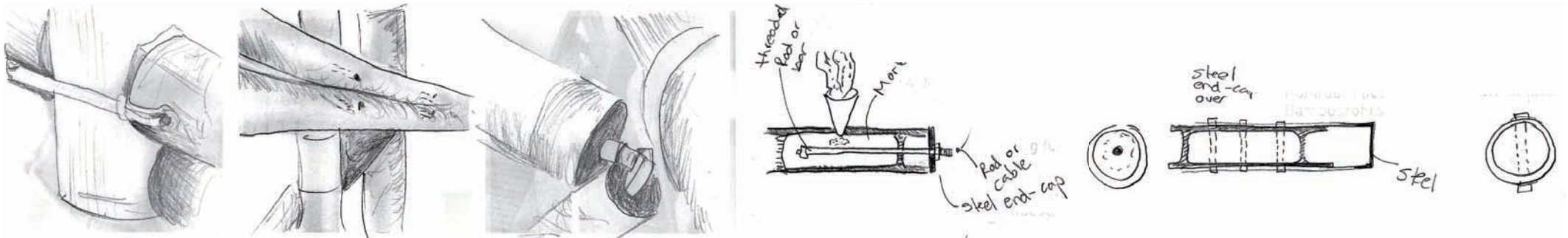
Figures 133 i -v (opposite): Current methods of bamboo connections [author, 2010]. Other diagrams: exploring possible connections for bamboo members.

Bamboo can be used extensively as exterior material, but when bare bamboo is overexposed to the direct sunlight without treatment, it can sometimes crack. Although, bamboo works well in humidity. This means that it is a perfect substitute for almost all steel or aluminium elements that would have been used in interior of the hydroponic greenhouse spaces. As a new building of frame and light, the design decision is to not disregard the use steel as framing element, but to encourage a composite structure. By replacing the “indoor” steel with bamboo, the amount of steel structure can be reduced significantly. Furthermore, by using steel, a direct reference to the industrial heritage is made. Steel can be visibly found in every building on site as a major framing element. Steel as structure also references

proximities structure



the railway on site and the legacy of the steel industry left by Iscor. Steel is therefore a golden thread element that keeps the bigger picture together, but it is not by itself the bigger picture. Cecil Balmond, the engineer for Rem Koolhaas, states that in the matter of structure, simultaneity matters, not hierarchy [Balmond, 2002:23] and that a structure is a whole system, not one element on holding out on its own. With this in mind, together with the weaving character associated with bamboo construction, the new building frame is designed with an intertwined quality, closing the proximity between traditional autonomy of structural steel to the contemporary hybridity of structural bamboo.



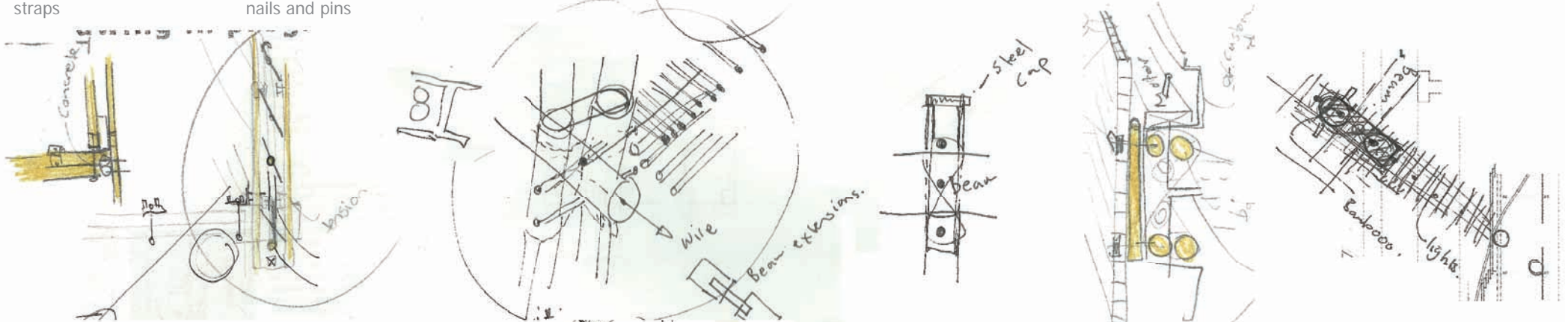
i - traditional connection
straps

ii - traditional connection
nails and pins

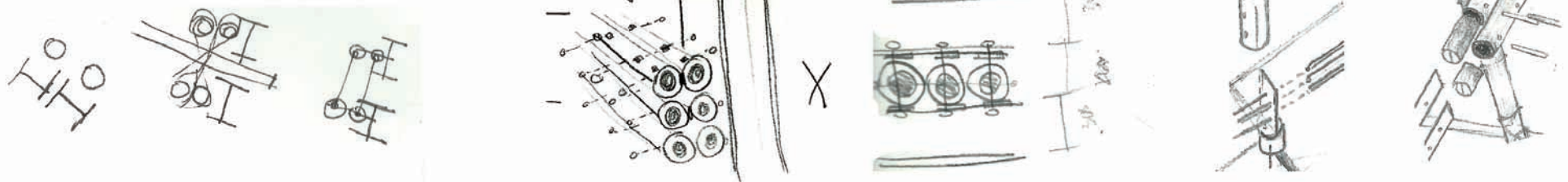
iii - steel end plates and joints

iv - mortar and threaded rod

v - washer and bolt with steel straps



connections and formations
exploring bamboo connections or configurations



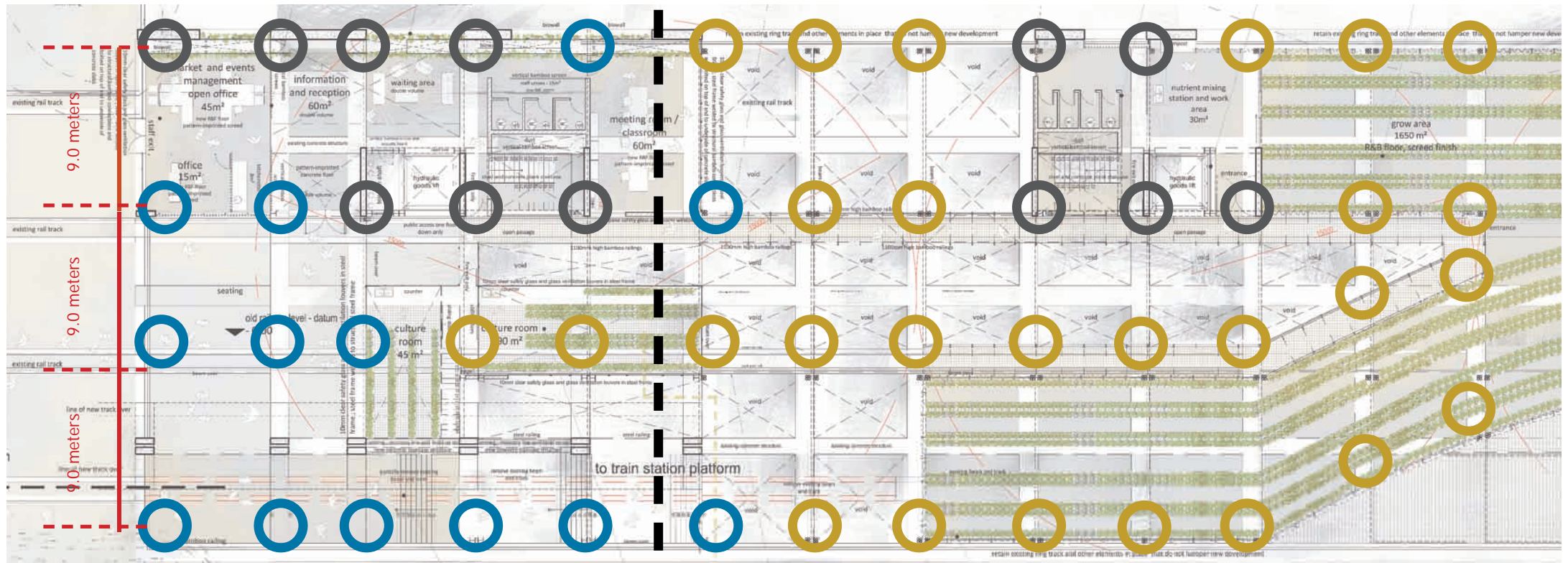


- concrete
- steel
- bamboo

concrete core shafts

concrete core shafts

6.0 meters

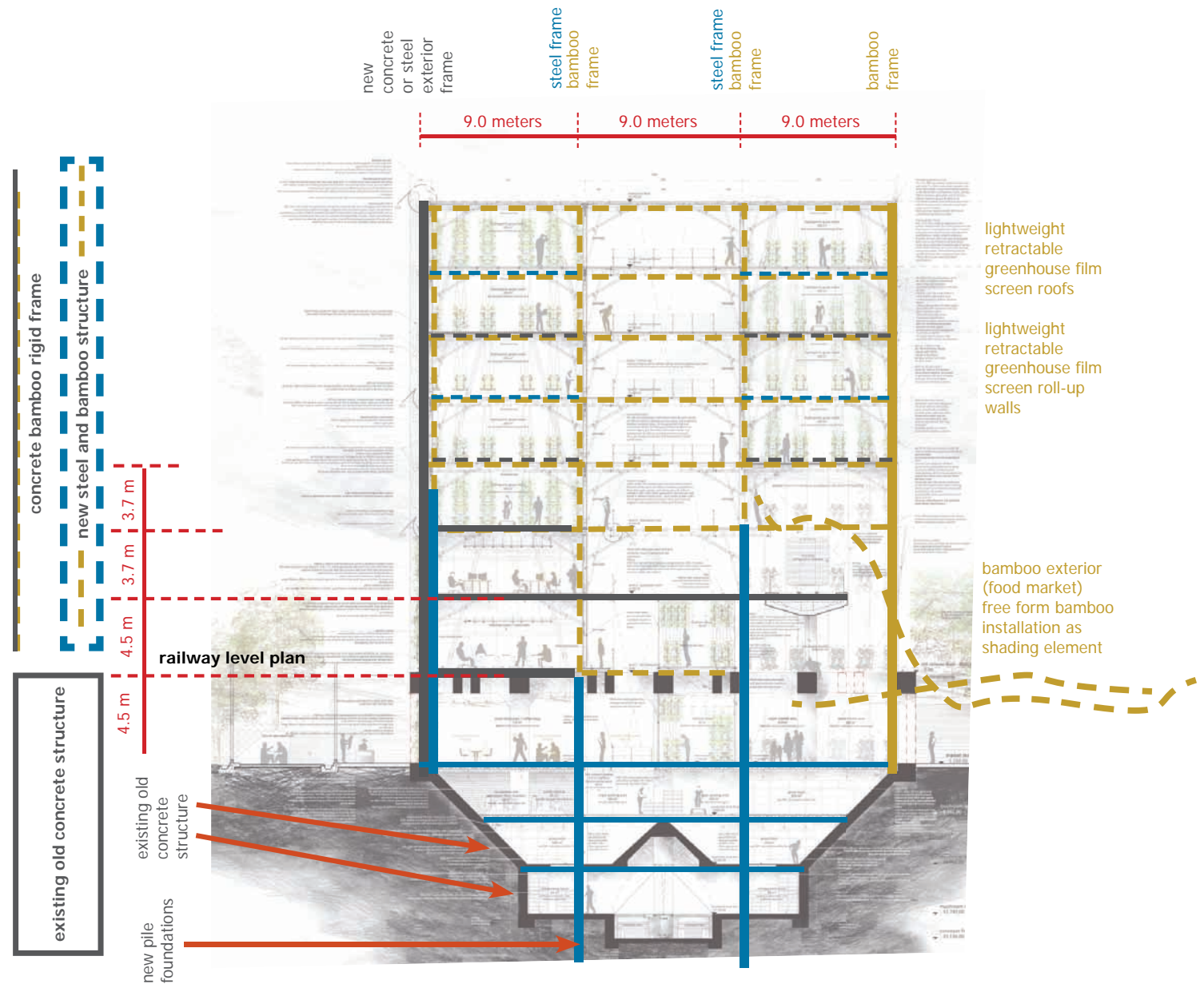


plan^{n.t.s.}

Figure 134: concept for structure [authorm 2010]
typical plan (on existing railway level).

structure

Mr. Mike Mahant and his firm of Luit Nirman Engineering Design, Contracting and Systems (India) has over 30 years experience in the bamboo industry. After correspondence with Mr Mahant, he suggested that for a residential building, it would be possible to reach 6 storeys with only structural bamboo, given a light-frame design. According to in-house tests done by his company, a single dia 100mm bamboo culm has a compressive strength of 20 tons, or 200 kN [Mahant, 2010], so when grouped in four or more, the columns can resist to 800 kN or more. The new building components are lightweight - with a retractable greenhouse film roof and polycarbonate or greenhouse film walls. Skipping a beat, every other level becomes a composite concrete floor, with the intermediate floors being a steel/bamboo and mentis grid light-weight floor. Also, most of the heaviest elements (compost and organic storage, water and nutrient tanks) are grouped together or around elevator and service shafts. Furthermore, the hydroponic production method is soilless, and therefore plants will only reach a maximum dead load of 50kg/m² or 0.5 kN (tomatoes) in the fruit that they produce at harvest time and with the heavies of methods (the Dutch Bucket Method) greenhouse occupation is estimated to reach a dead load of 100kg/m² - pipes and water included. With composite bamboo concrete floors, the estimated loads reach a maximum of 130kg/m². No heavy machines are required either. It is suggested that the building rather start off with steel and phase into bamboo towards the roof. This means that a weaving process of materials can begin, where the three different elements of mass - concrete, steel and bamboo - grow closer in their proximity to each other and be perceived as a single unit of structure.



section^{n.t.s.}

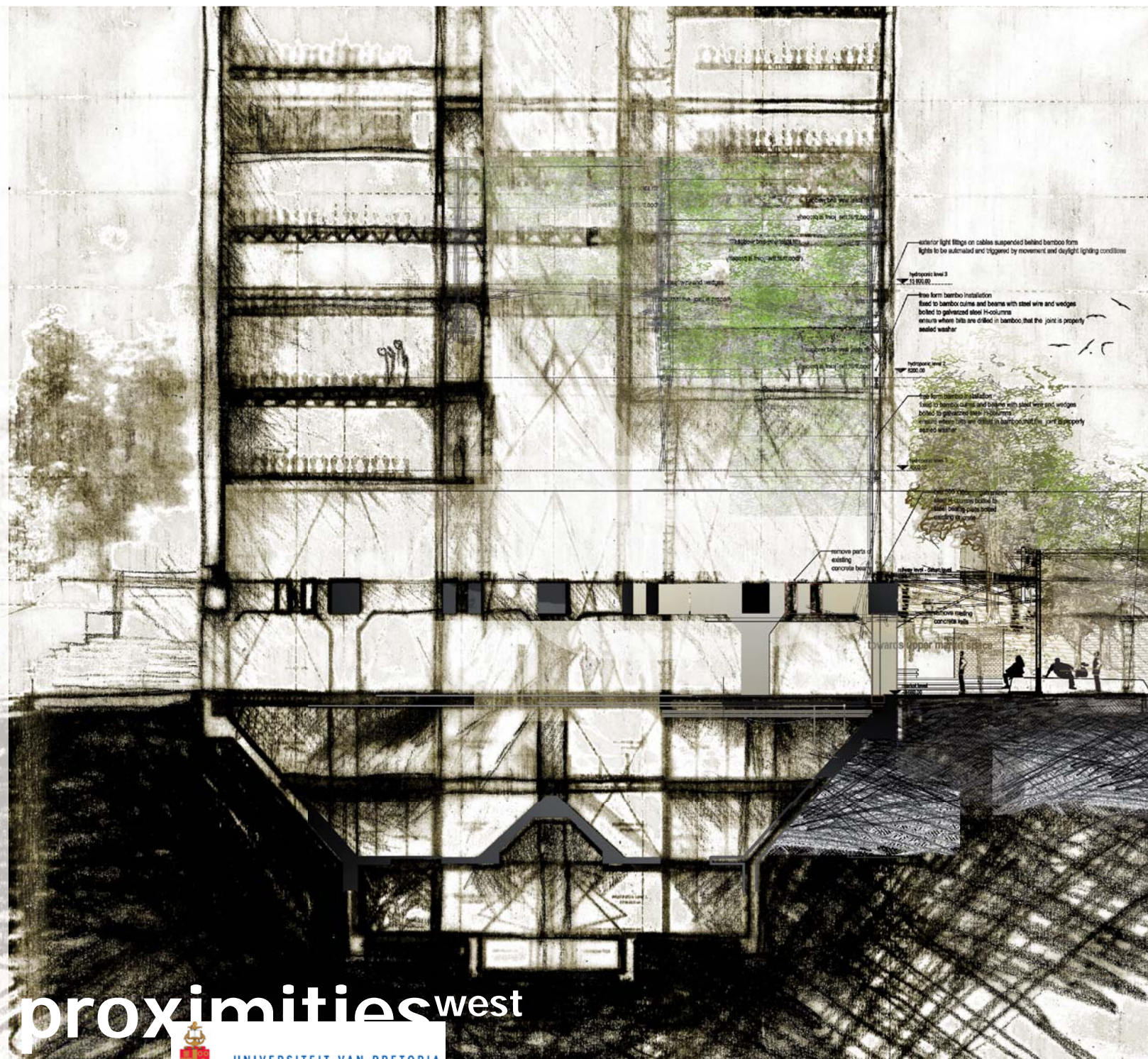
Figure 135: concept typical cross-section [author, 2010].

u n r a v e l

The virtuality of the architecture is expressed by creating spaces that are not immediately legible, spaces that are “a mental extensions of sight” [Baudrillard & Nouvel, 2002:6]. This is done by physically creating a dissolving materiality in the composition of building elements and creating a network of materials of mass and materials of light. As the aim of the thesis is to remove the edges between industry and urban living, the new building extends itself into the urban landscape, making it unclear where the building begins, where street ends and where the boundaries of the urban landscape actually are. Just as the structure of the old coal bunker is freed from its confinement, the new design will also be extricated. This is expressed through the unravelling of the building structure into the streetscape.

With the concept of intertwined structural elements, an unravelling process can begin in an attempt to infiltrate the physical building into the streetscape (or if you will, the streetscape into the building). Also, the need for transparency and the needs of a living organic interior program of crop production encourages a building of light and frame. Lastly, the patterns of production and consumption of energies shows that the building needs a stable system to feed from and drain into.

The western elevation becomes this concrete reality of the building, emphasising the materiality of the concrete bunker, referencing heritage of the power station in a series of strong tower elements and finally acting a the host for essential building services. The towers and the vertical circulation shafts are heavy concrete elements, hosting the buildings composting requirements, gas distribution, nutrient supply and rainwater distribution.



proximities west

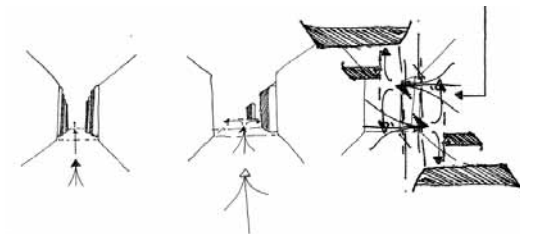


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The compost towers take on a stereotomic character to protect the hosted infrastructure from heat: compost and gas are particularly sensitive to heat gain. From here, the building dissolves into tectonic resolution towards the streetscape as it embraces the market [downwards and outwards] and the hydroponic frame [upwards]. This informs a hierarchy of material use. From the solid concrete towers, steel beams and columns escape to form the primary structural steel frame. This steel frame is to safely support

the higher scale of the building on the south (7 storeys high). As the design terraces down towards the north the steel structure is mimicked and taken over by a structural bamboo system and filters out into the urban park landscape and also the urban market streetscape to the south and east. This dissolving composition of materials forms part of the experience of the building. It illustrates the proximity of built object to landscape object, as well as the proximity of the program of a formal industry (agriculture) to an informal urban experience (markets, bus stops and streets).

The building presents itself illusive at first, layered by cross-programming and composite structure. As one enters it and moves through the spaces, the building progresses towards a more tangible object, revealing the functionality of the productive program and its interactive proximities to the urban experience. The architecture tries to create an experience in the user of being proximal to something virtual, something illusive - a virtuality that only explains itself upon exploration.



Figures 136 (top): edgeless city
Diagram illustrating the removal of boundaries between street and building [author, 2010]

Figures 137 (left): edgeless building
Using an unravelling structure to draw closer the proximity of the exterior experience of the streetscape (right) to the interior experience of production (left) [author, 2010]

proximities^{east}



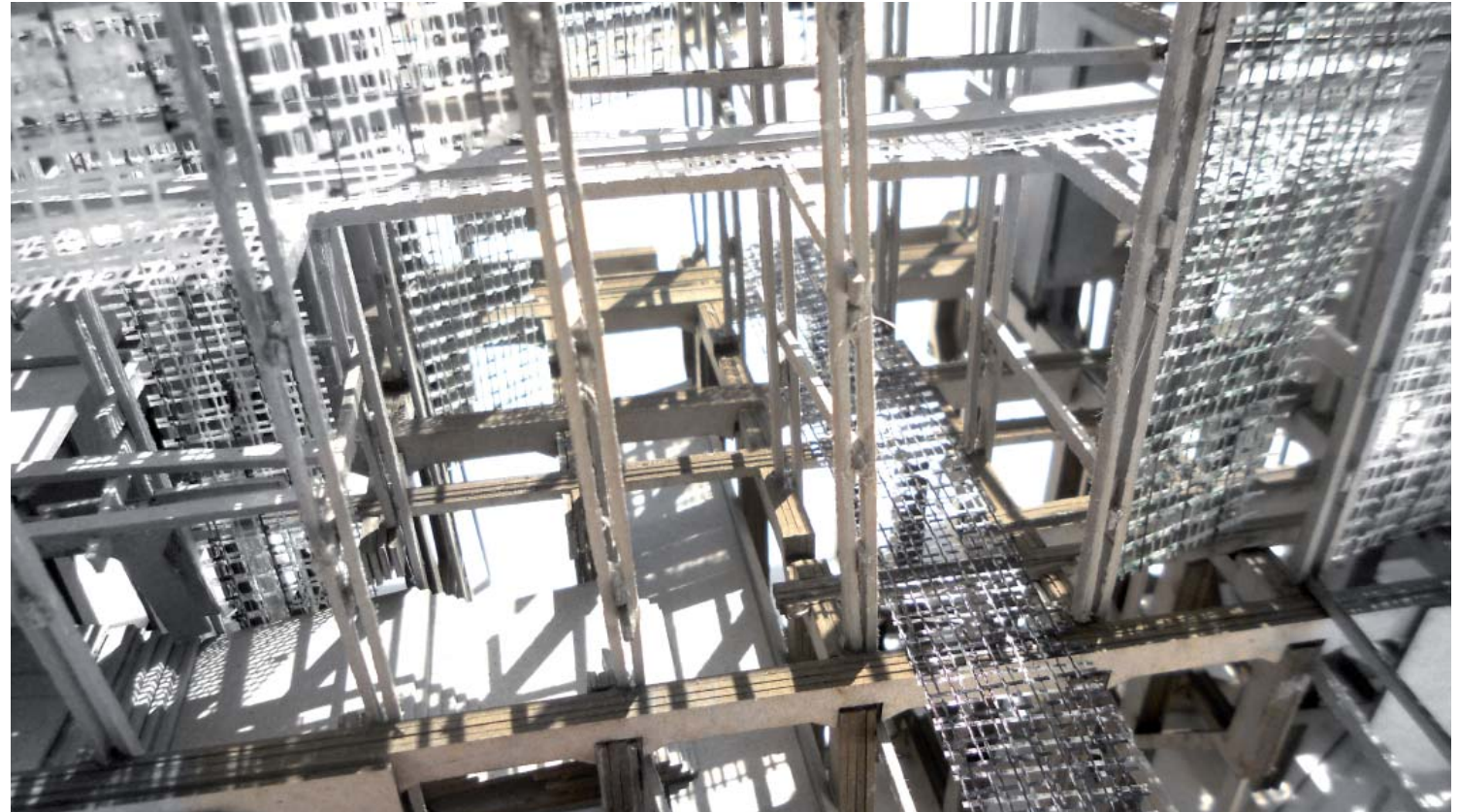
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breath e

Plants need air as much as we do. This means that the building must be able to open up, to let in as much fresh air as desired. Fresh air is not only needed for the growing the plants, but also helps in controlling moisture. Though the hydroponic method itself doesn't require traditional sprayed irrigation (plants are drip-fed), the humidity in the greenhouse spaces can create unwanted moisture. Ventilation is required to reduce humidity and consequently the formation of undesired droplets that gather on the ceilings or walls, which fall back onto the crops. This can cause disease in the plants as the droplets become contaminated by dust or other chemicals before they fall back onto the crop. Many greenhouses use varying combinations of ventilation, but the most effective and cost-efficient is clearly natural ventilation.

Ventilation is achieved by a simple method of retractable walls and roofs. The screens are automated, adjusting to the needs of the crop and environment. The retractable screen is a motorised system comprising of two layers of 200 micron clear polyethylene plastic (or similar) with separate dust screen, fixed to bamboo intermediate supporting poles. When closed, it will be possible to pump air between the two layers, creating an insulated wall. This is effective especially during winter, as most crops need a minimum temperature of around 16 degrees Celsius to grow. The roof has a similar strategy and is also a retractable system. It is a flat retractable automated greenhouse screen, but with opaque greenhouse film, to reduce the risk of the plants being scorched in the summer. Being retractable, it is also easier to service the roof from the inside, reducing any need for dangerous exterior roof access

on the higher levels. For added control and conditioning during winter or raining spells, smaller reversible fans are located in the open joists. The hydroponic factory can be divided into grow rooms of approximately 200m² each to ventilate and control the environments on a smaller scale. Not only does this help to contain any risk of disease and so lose an entire crop, but also to gives more options if the factory wants to change crop production strategies and require more variations in environments. The "smaller" greenhouses are divided by a clear 25 millimetre interlocking polycarbonate wall panel system, which is easy to disassemble and move about to adapt to any changing needs.



proximities having outside inside

live and work

Building for air and vegetation is a contemporary strategy for energy efficient buildings and an opportunity rises to construct a bio-wall for the spaces occupied by humans in the building. A bio-wall is a structure that uses vegetation to filter air to be issued to an interior environment. The bio-wall is constructed by using two 50 millimetre porous substrates (cork, rock wool or similar) fixed in steel and bamboo grid frame that is bolted to concrete walls slabs and walls. Within the frame is small reversible fan, aiding in drawing air through the wall. The plants are placed in the porous substrate and fed hydroponically. A concrete catchment channel and pipe is placed at the bottom of the wall guiding excess water to the water recycling system.

From the dissolving structure concept, it was decided to have free-form bamboo shading system over the lower market area. It is proposed to halve some of the bamboo culms and also fit them with a substrate, feeding the shading system with vegetation from the factory. In this way, the hydroponic factory literary creates a growing urban environment.

Figures 139 (opposite top): breathing building [author, 2010]. Working model showing operable screen walls and roofs.

Figures 140 (opposite below): flat retractable greenhouse roofs [www.gothicarchgreenhouses.com].
Applications of flat retractable greenhouse roofs

Figures 141 (right): bio-walls as part of working spaces [author, 2010].
Using steel-framed bio-walls to clean air for the office spaces.

