PROVINCIAL GOVERNMENT BUILDING ANTWERP

/EP 2011

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TABLE OF CONTENT/

A / CONCEPT DEVELOPMENT

EXISTING SITUATION

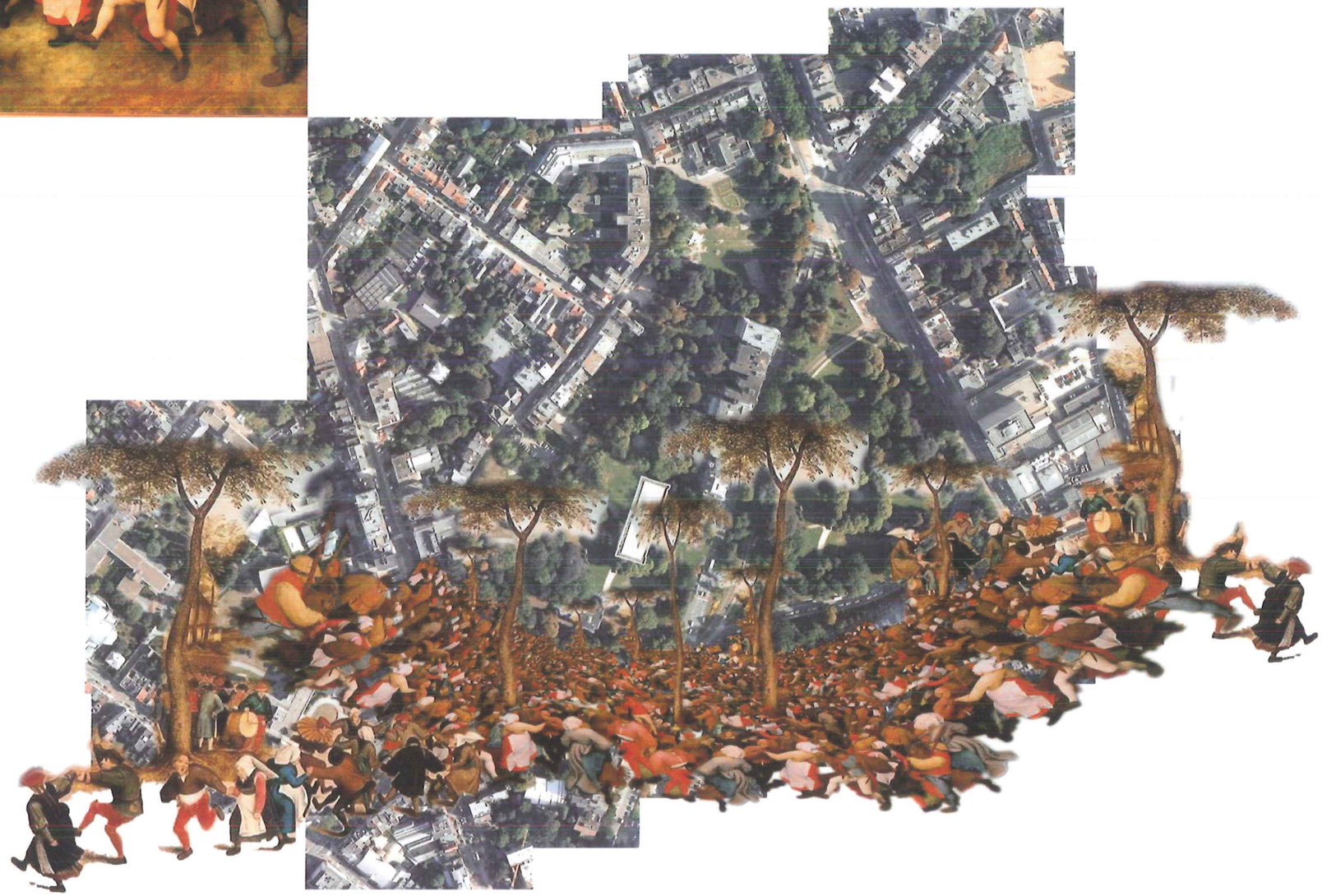
The Provincial Government Building Antwerp is scattered in the middle of an area that in parts has buildings forming a boundary and in parts is open to the street. The existing Provincial Government building is surrounded by a park, but does not take advantage of the privileged site.

The new proposal offers the possibility to rethink all of that, and to consider the state of the art sustainable aspects for the configuration of the building.

A PARK

Our project begins by imagining that the existing Provincial Government Building has been removed from the site and replaced by a park.

Our intention is to imagine the new Provincial Government building as part of the park landscape. It will take full advantage of the park by locating important facilities there which can realise the potential of the site.



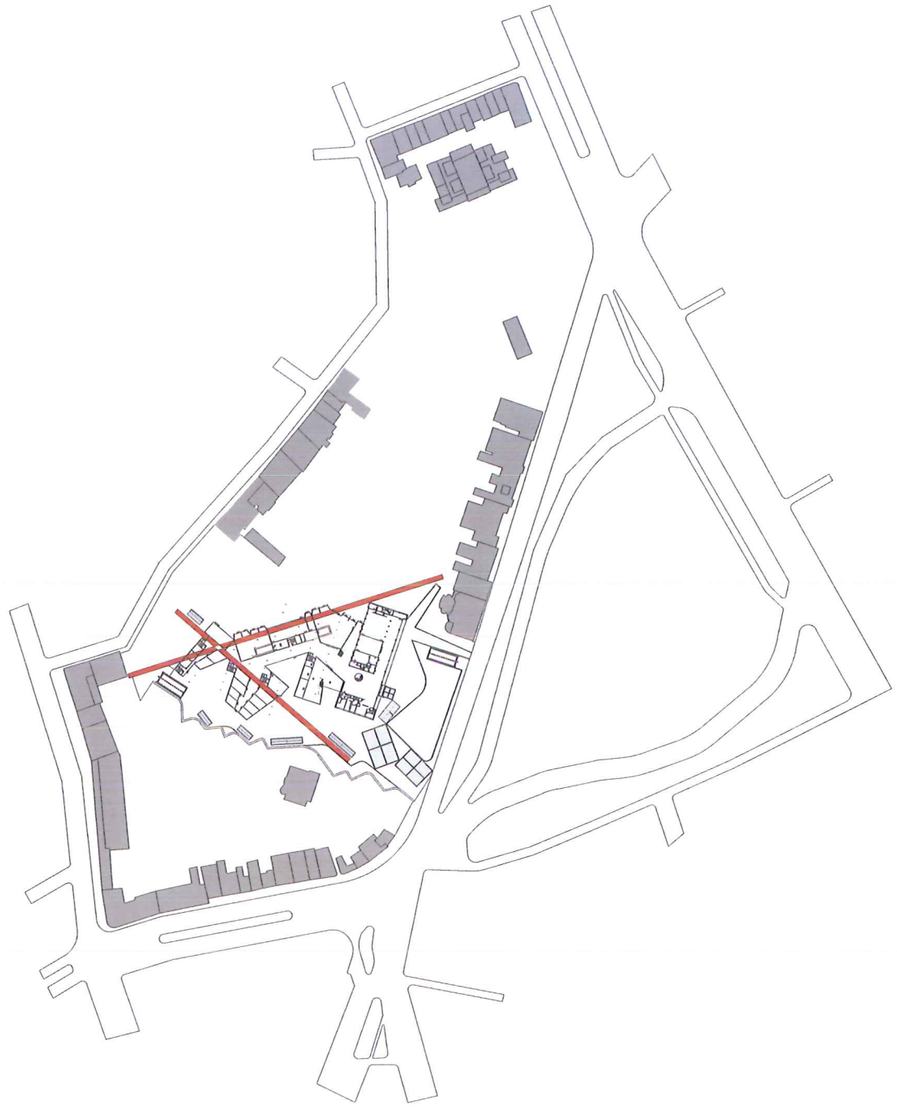
A PUBLIC SPACE

The new Provincial Government building and the park landscape offer the opportunity for the public to enter the site and participate. It could be compared to the painting by Peter Bruegel the Elders which depicts a crowd of people gathered in the forest, ´The Wedding Dance´.

A BUILDING WHICH MIXES THE LANDSCAPE, THE VISITORS AND THE STAFF

Our project for the new Provincial Government building proposes a structure that is placed in the middle of the park. It establishes a place that is a fully functioning administrative building which at the same time relates and incorporates the natural landscape. Visitors and staff are part of a shared natural environment.

Built structure of the plot



Cross - Connection within the site

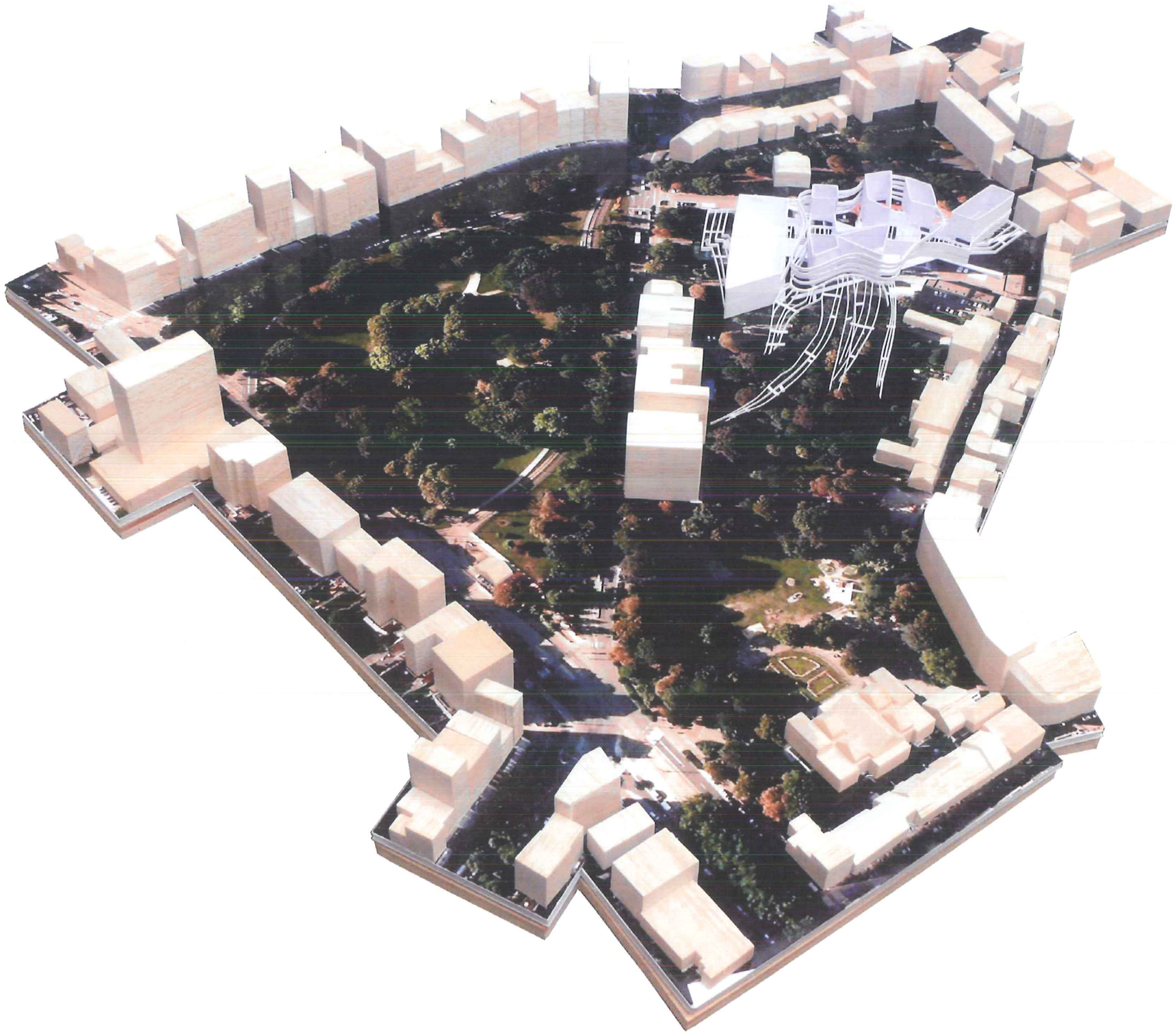
CONCEPTUAL DIAGRAMS

Connection to park

Walkway Connection /
Building - Park

(Connection element for further extension of
the Government Building.)

CONCEPTUAL DIAGRAMS



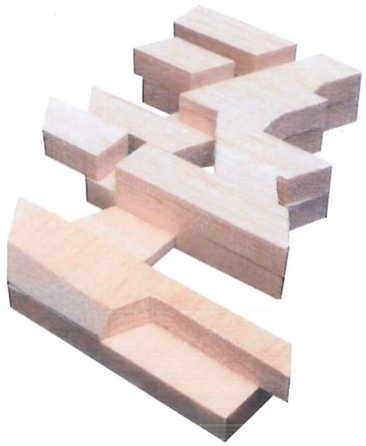
SITE MODEL

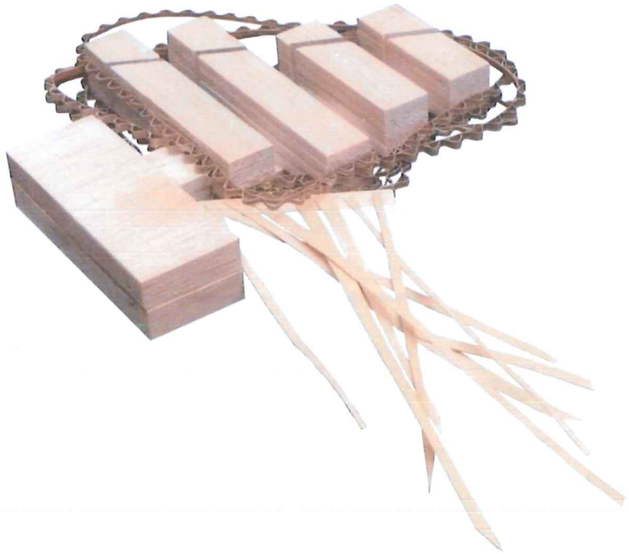
With the proposal for the new Provincial Government Building

01. Public Entrance
02. Public spaces in old structure
03. Exhibition
04. Public Restaurant
05. Staff restaurant
06. Meeting rooms
07. Walkway across the site
08. Path through the park
09. Landscape element
10. Park entrances
11. Fountain
12. Hedges

SITE PLAN

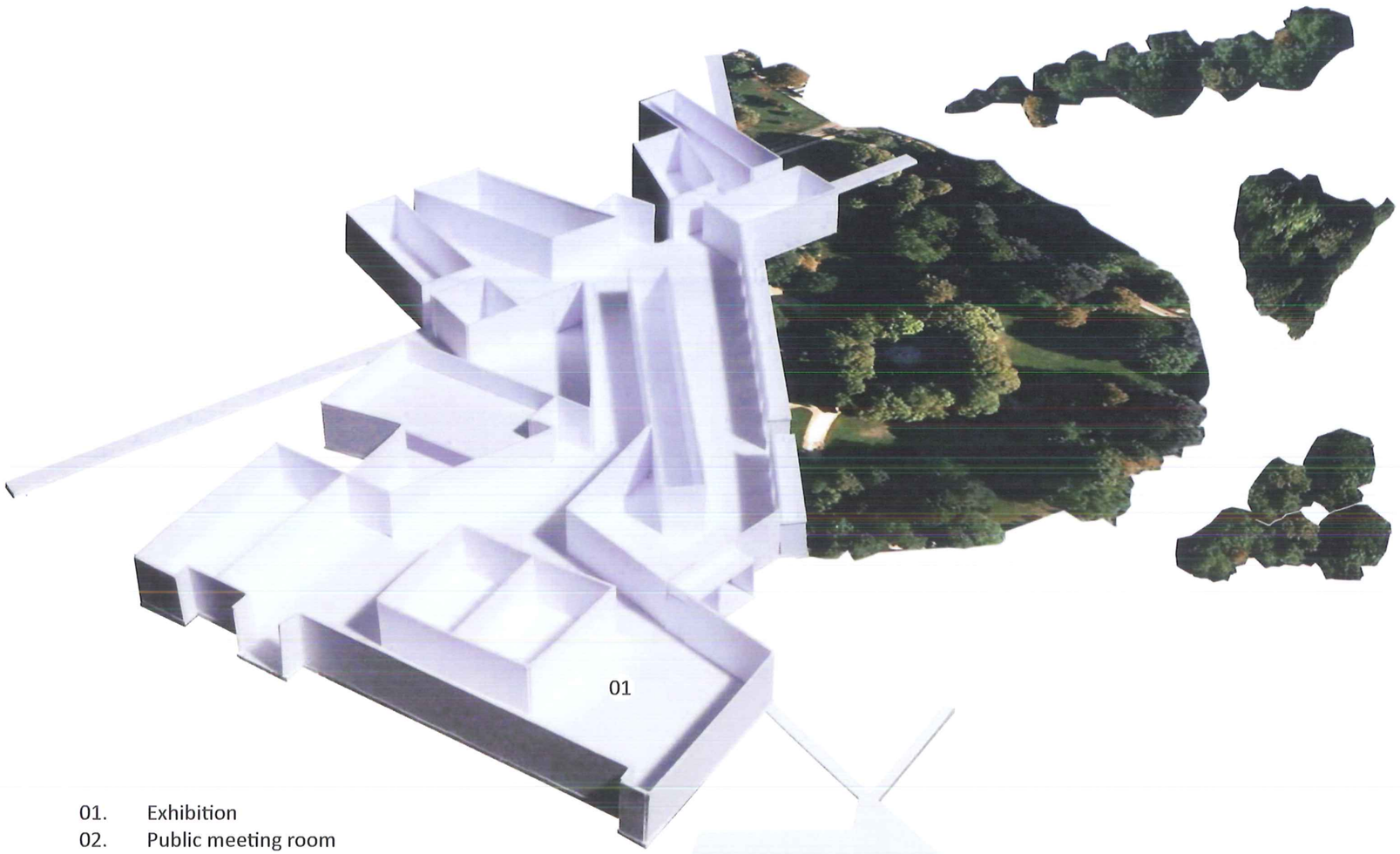
B / PROJECT EXPLANATION





ORGANISATION

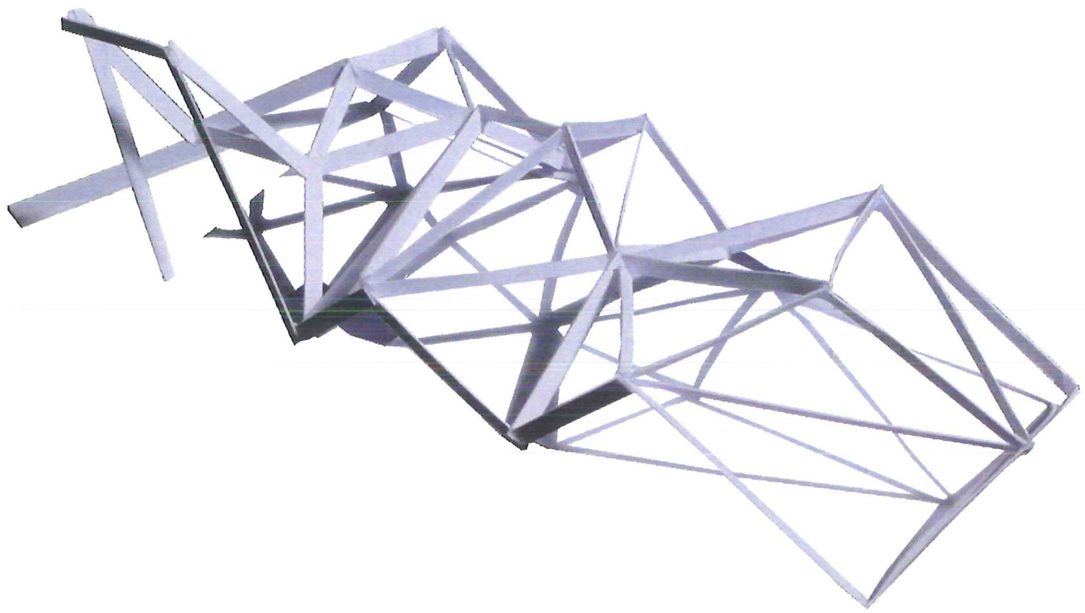
The different departments / offices are organised in a clear series of linear elements. The governor has a modified unit orientated towards the park.



01. Exhibition
02. Public meeting room
03. Public restaurant
04. Library
05. Staff restaurant
06. Internal meeting rooms

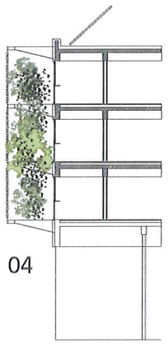
GROUND FLOOR

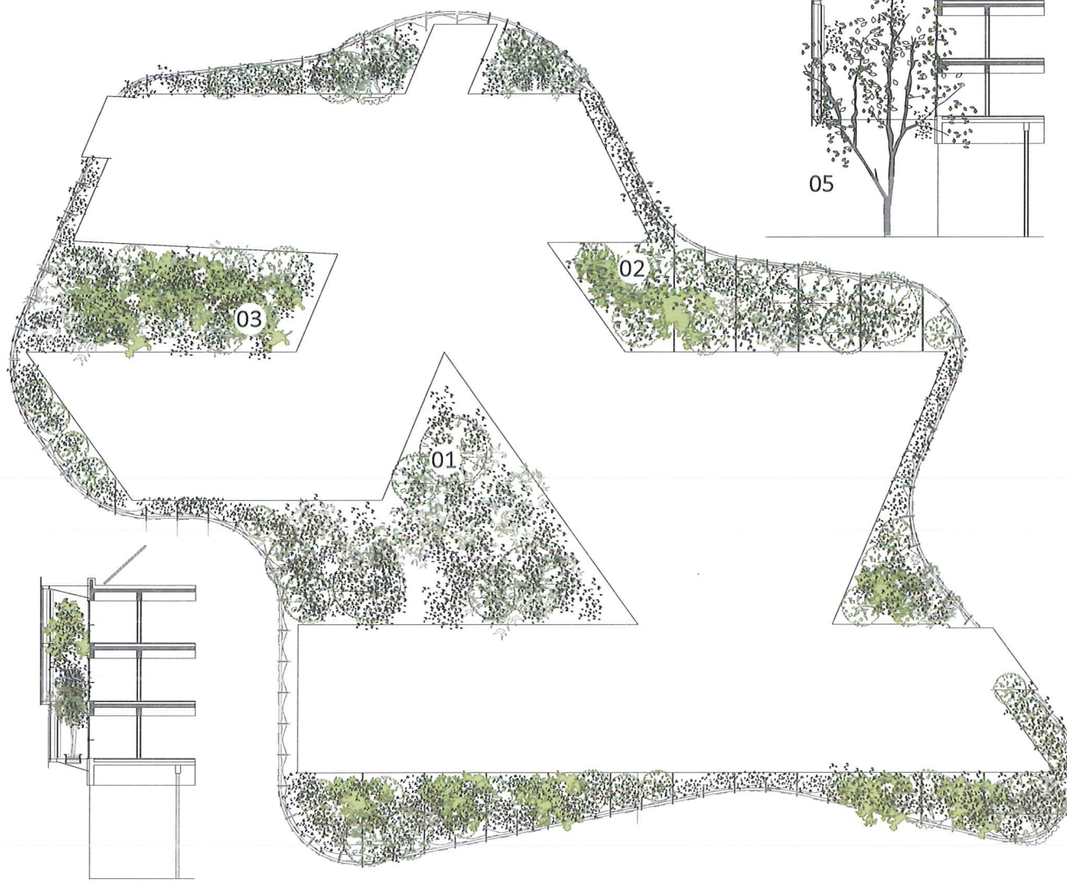
The offices are situated on the upper floors in order to preserve the maximum continuity of the park.
The old structure contains the rooms which will be preserved. These rooms will be used by the public as exhibition and meeting room spaces.
The public zone of the new building contains library and public restaurant.
The other part of the ground floor contains internal meeting rooms and staff restaurant.

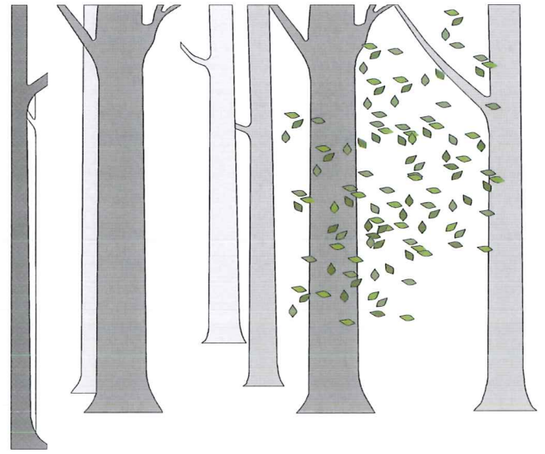


ENTRANCE TOWERS

The entrance of the new Provincial Government Building is marked by a flag tower that provides the space for representation of all of the communities.

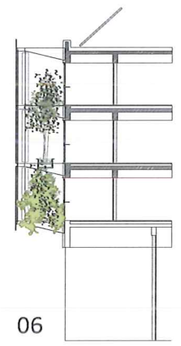


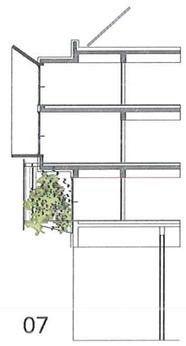




01. Tree Courtyard
02. Green buffer zone
03. Garden
04. Façade with ventilation louvres
05. Façade with panels, glazing and trees
06. Façade with panels, glazing and green buffer zone
07. Façade with bay window, glazing and green buffer zone

FAÇADE PANELS





SUSTAINABILITY

The layered façade is designed to reduce the energy loses of the building and to offer a natural green inhabitable space.
The green façade will diffuse the limits between the built structure and the natural environment.

Facade Design

The facade design is the result of an optimization calculation of the temperature of the empty building (the average temperature which is established without active cooling, but taking into consideration the sunscreens and the heat accumulating mass, indicated in red in the graph). The goal of the optimization calculation was an adjustment of the temperature at a vacuum to the desired optimum temperature by varying the parameters of volume, glass surfaces, heat accumulating mass, orientation, sunscreen systems and cooling at night. The more the temperature of the vacuum building is close to the actual desired temperatures, less energy is needed to heat or cool the building. The thermal insulation of facades will be very efficient to minimize the loss. All elements of the translucent facade are equipped with an outside sunscreen system which is operated depending on the basis of real sunshine, although a manual use is always possible. The office facades are equipped with ventilation windows that provide natural ventilation at night using the chimney effect of the atria. Heat accumulating masses that have warmed during the day are discharged by natural ventilation at night.

SITE MODEL

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/EP 2011

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/EP 2011

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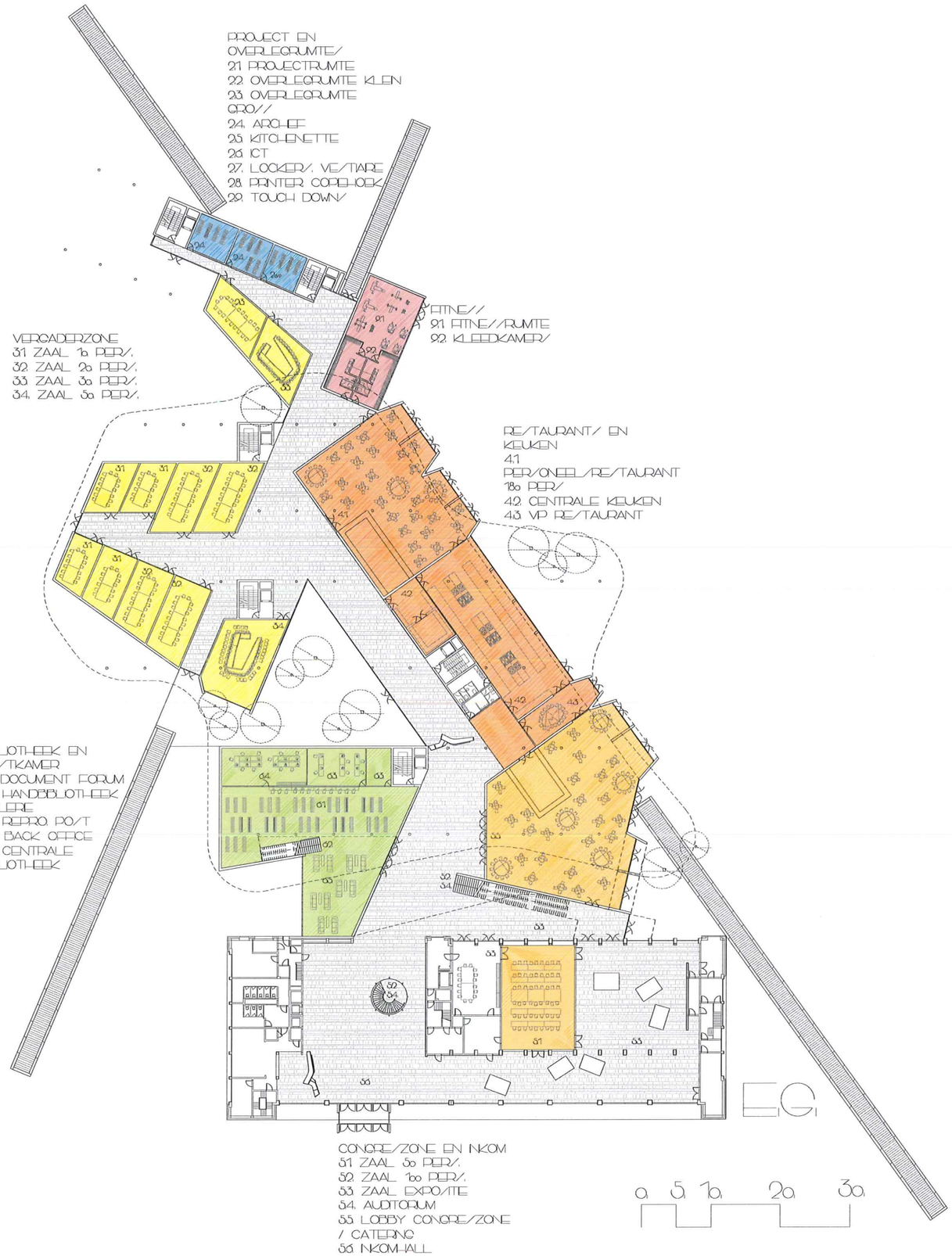
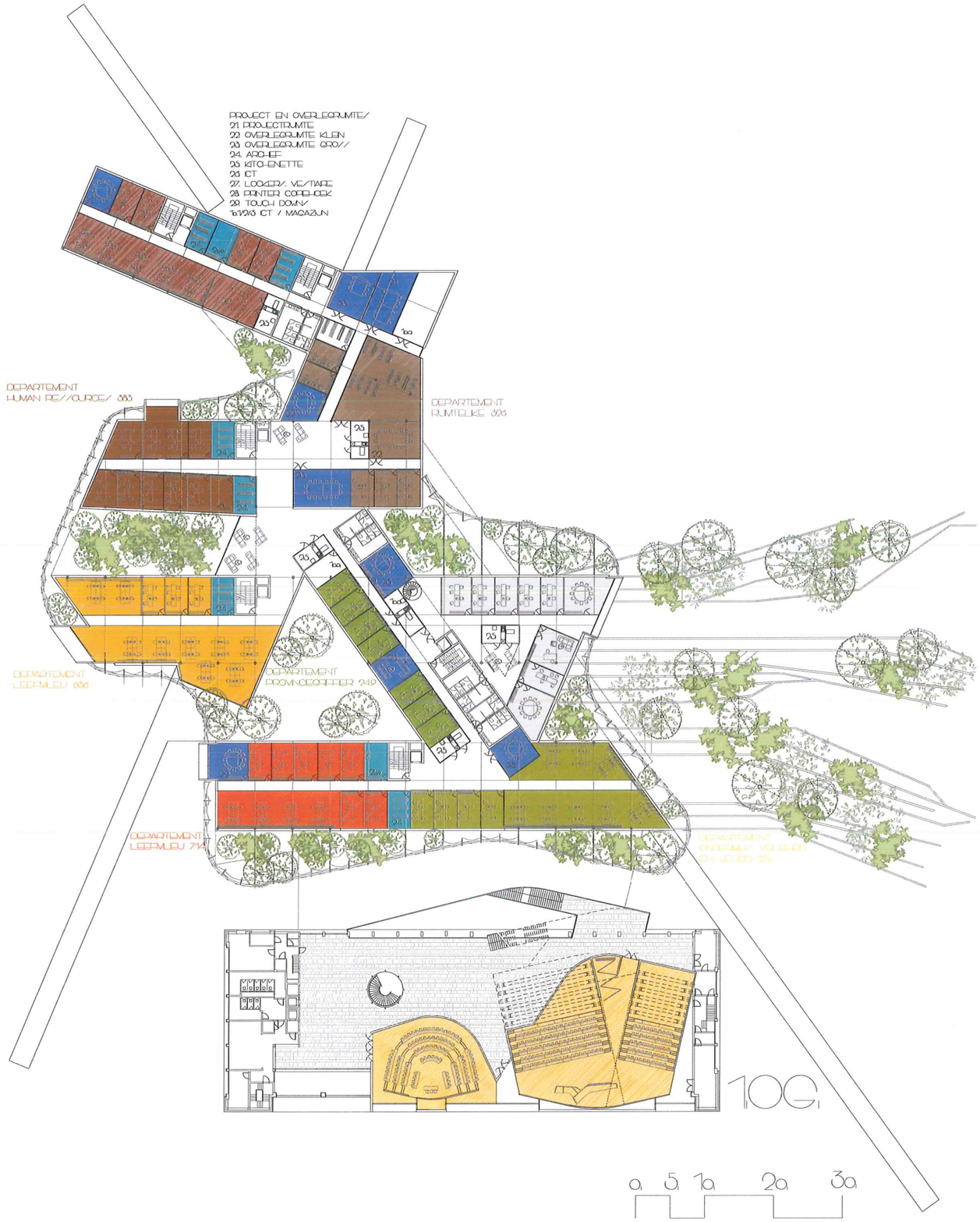


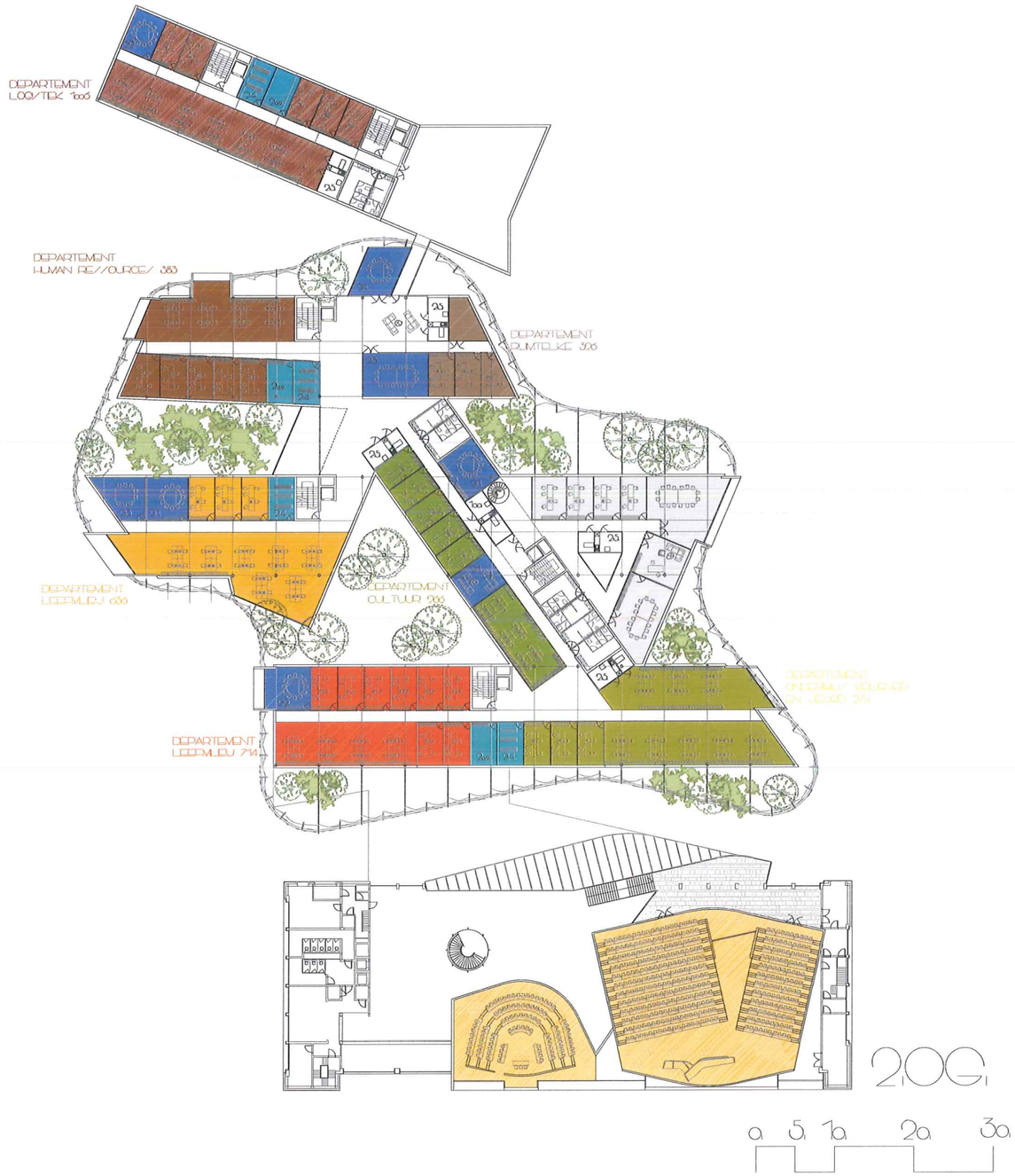
FUNCTIONAL SCHEME

GROUND FLOOR



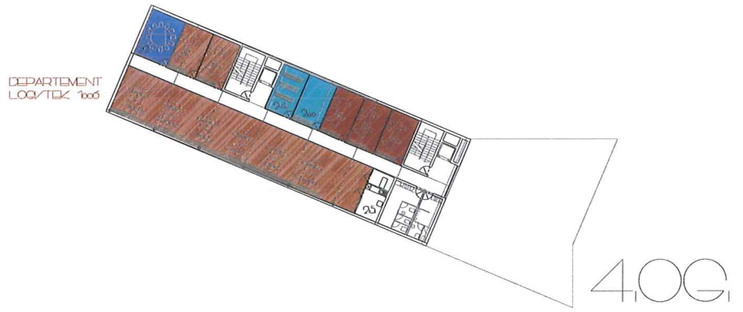
FUNCTIONAL SCHEME

FIRST FLOOR



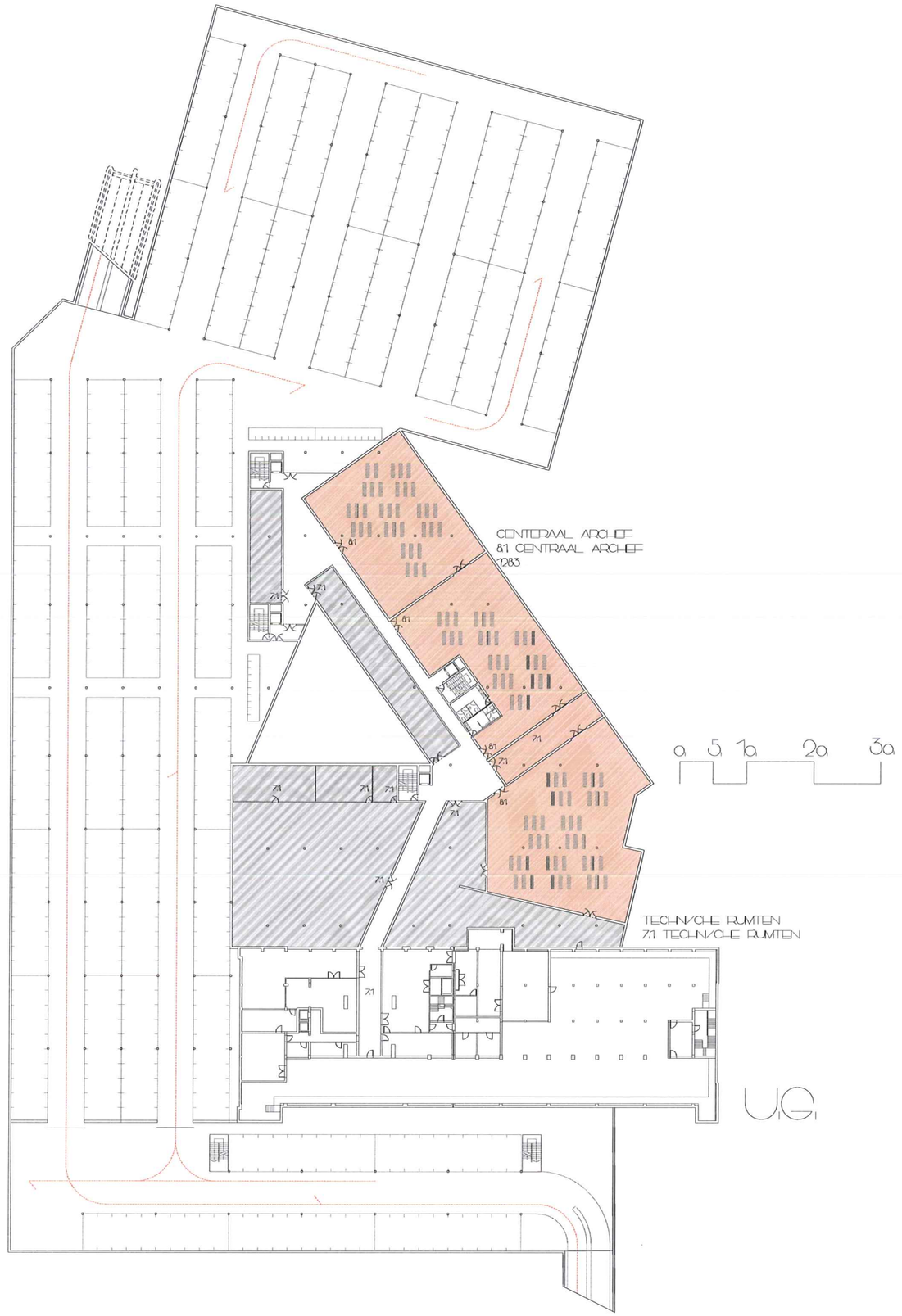
FUNCTIONAL SCHEME

SECOND FLOOR



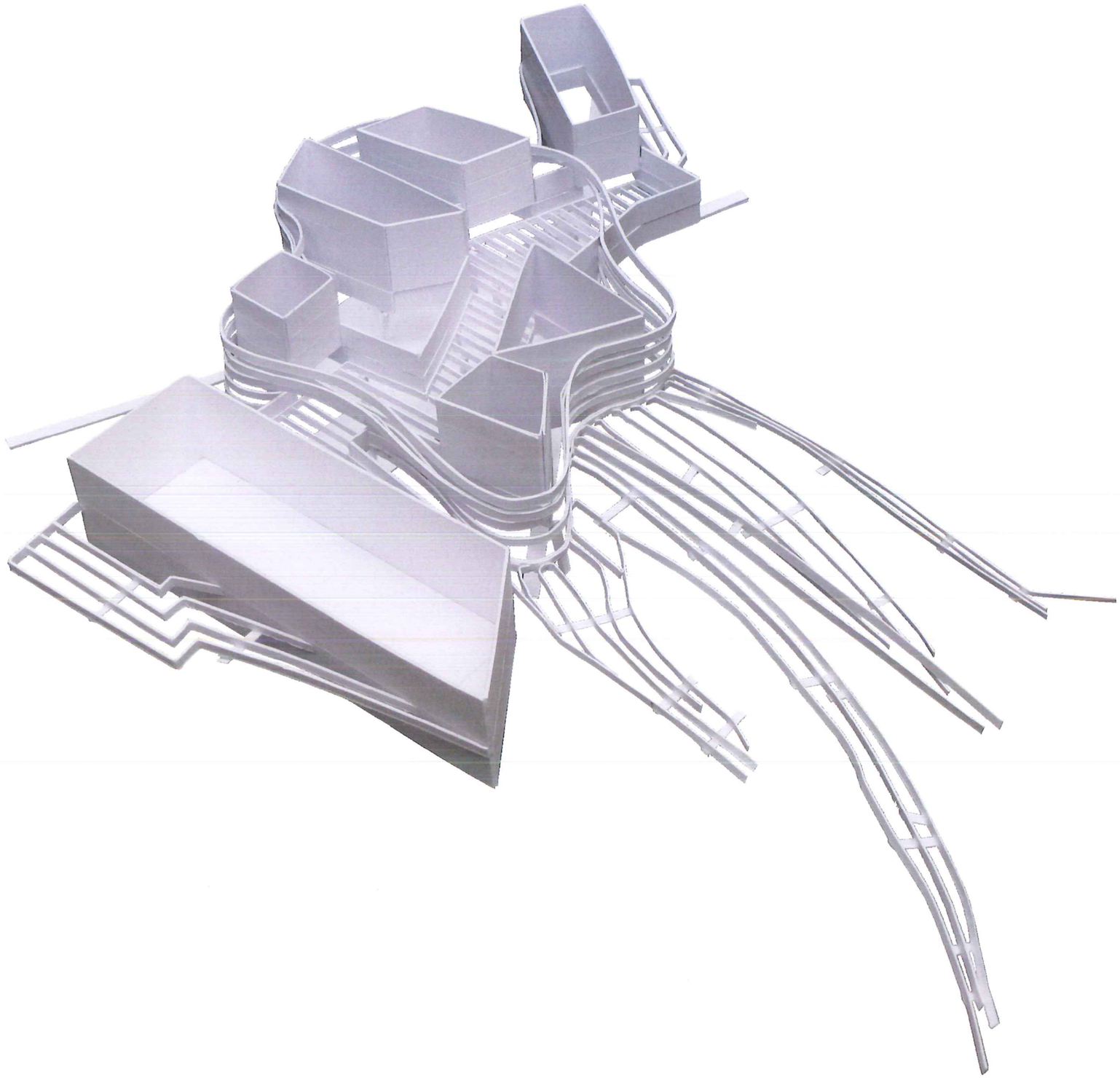
FUNCTIONAL SCHEME

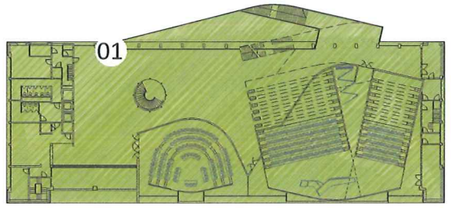
THIRD FLOOR /
FOURTH FLOOR

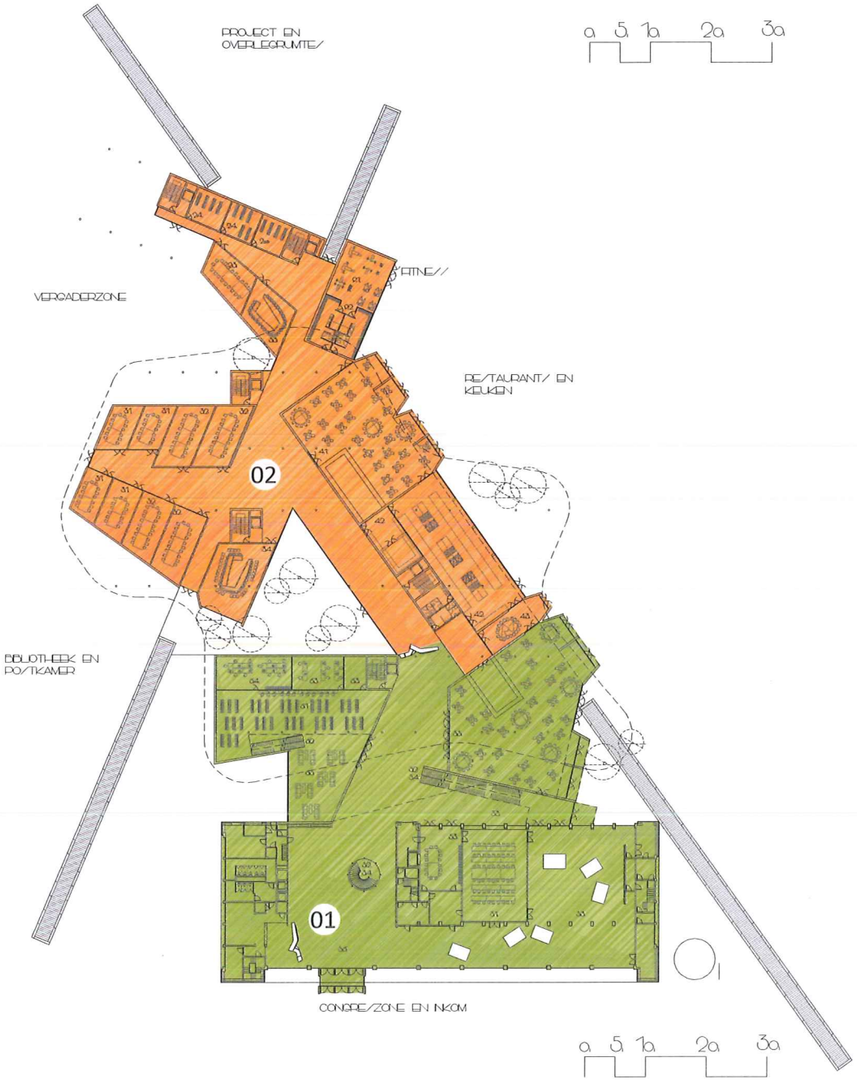


FUNCTIONAL SCHEME

UNDER GROUND







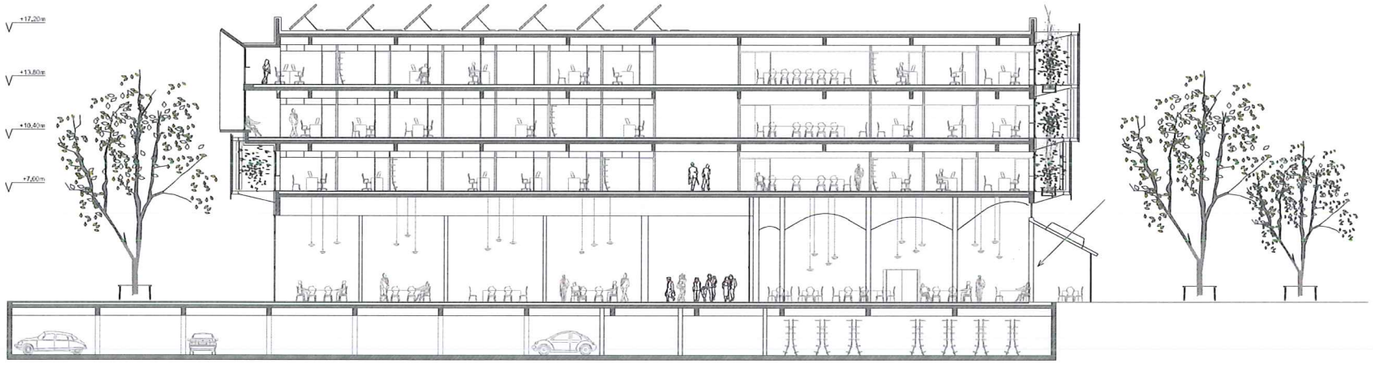
PUBLIC / SEMI PUBLIC ZONE

01. Public zone
02. Semi public zone

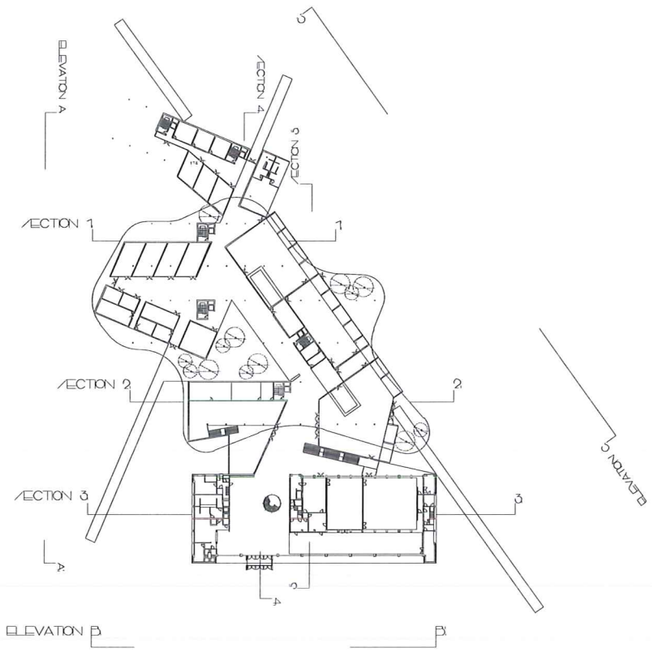
SITE ACCESS

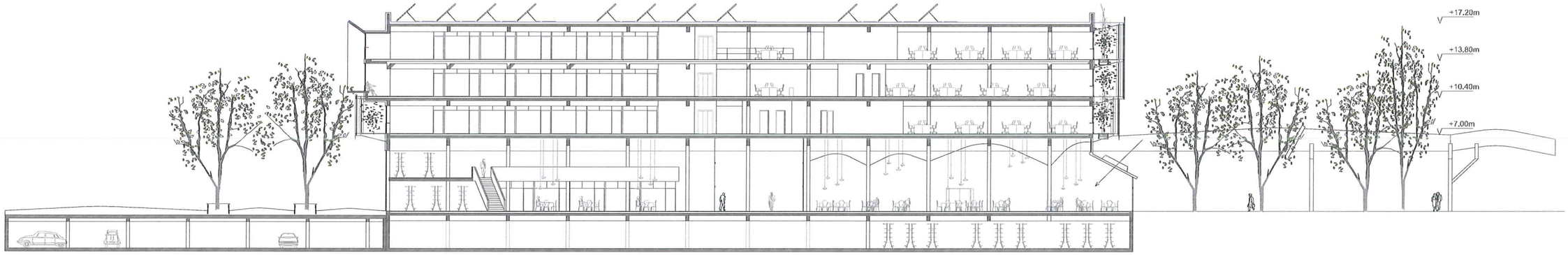
01. Main access
02. Parking access
03. Drop off point
04. Delivery

TRAFFIC DIAGRAMS



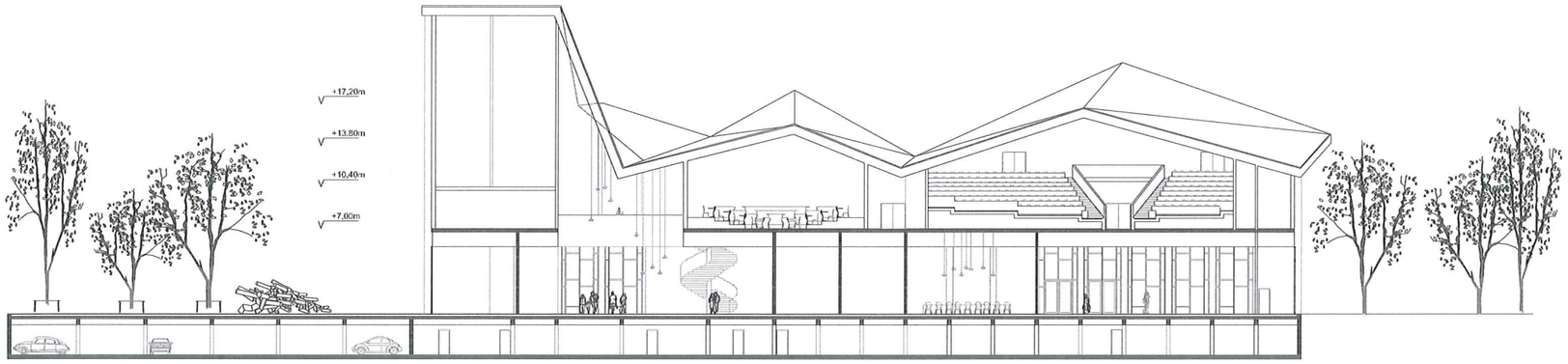
SECTION 1



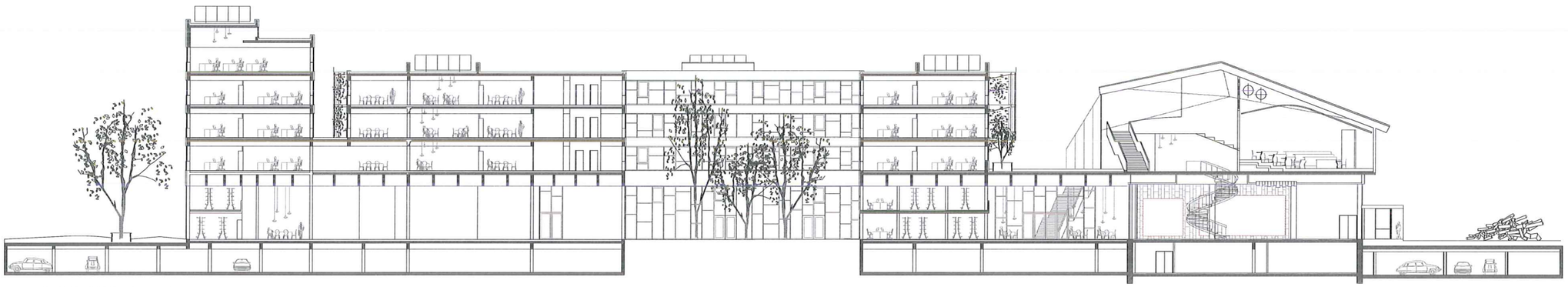


SECTION 2

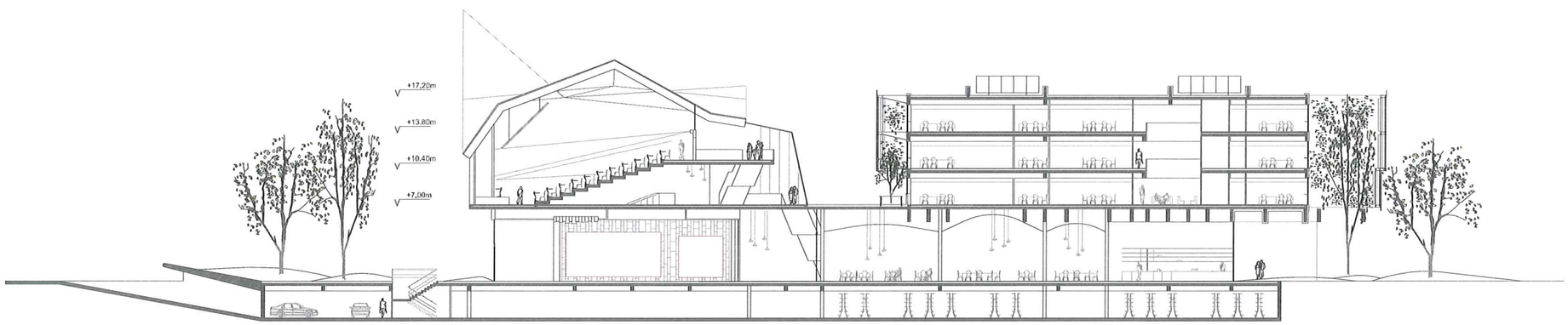
SECTIONS



SECTION 3.



SECTION 4.



SECTION 5.

SECTIONS

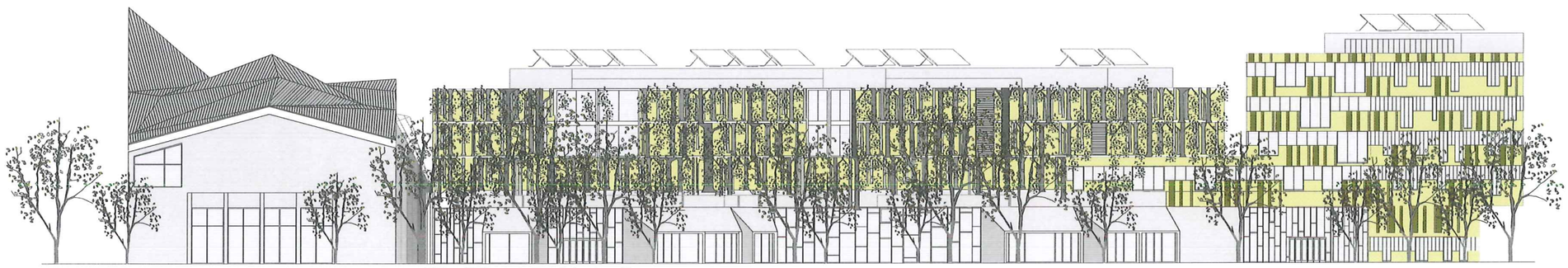
SOUTH FAÇADE

ELEVATION A.

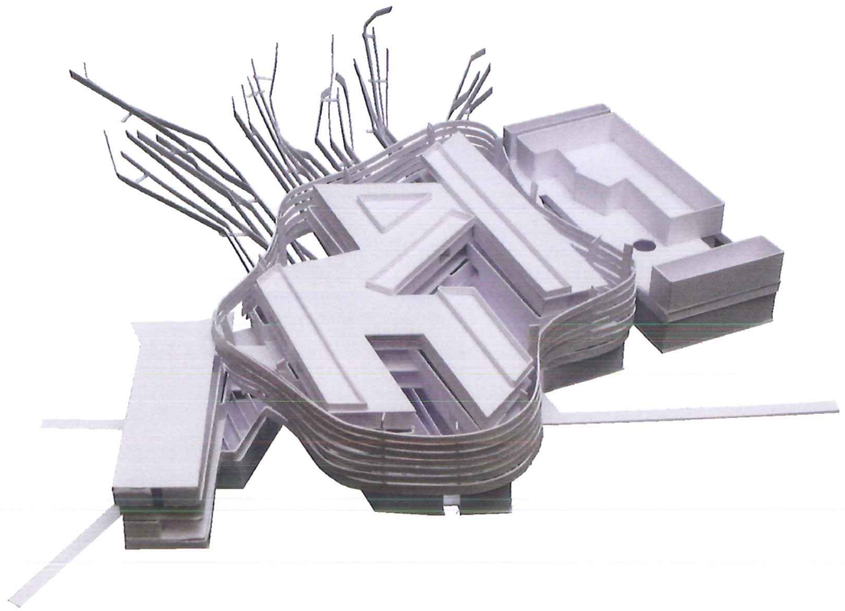
ENTRANCE FAÇADE

ELEVATION B.

NORTH FAÇADE



ELEVATION C.



Structure

The supporting structure of the building is a framework of armoured concrete that permits a realization of an enduring structure. The slabs are flat and permit a high flexibility with regard to the exploitation of the locations and the implementation of the technical equipment.

The vertical structure is composed of vertical columns of armoured concrete or mixed columns which are completed with walls of reinforced concrete that assure the horizontal stabilization of the different parts of the building. The parking floor in – 1 can be realized of prefabricated concrete elements, thus achieving the simplification of interventions in situ, the achievement of vertical elements with a minor size, the improvement of the return of the building site and the simplification of the disassembly of the structure at its end of life.

The floors of the auditorium and conference rooms can be realised with prestressed or poststressed concrete beams or slabs.

Long-lasting structure

The use of concrete that is composed of blast furnace cement and aggregates of the adjacencies allow a high reduction of CO2 compared to normal concrete. The secondary constructions are made of recycled concrete which is a supplementary trump. A part of the excavated material are crushed and used again for filling up. A soil campaign should be realised in order to check the best method of the foundation system of the new building (piles and depth).

Loads

For the lower part of the existing building that has to be preserved a first analyse shows that in terms of economy the new upper parts (+1, +2, +3) will not bring more loads so that the existing walls and foundations are able to support them.

The underground structures (perimetrical walls) are water-protected and insulated with a long-life material (such as foam glass, which is very resistant and is made of recycled materials).

The slabs of the roof are dimensioned to support the loads of the superstructure (green roof and photo voltaic panels), according to EN 2991-1-3 and loads of 2 kN/m2. The office floors support a normal load of 5 kN/m2 inclusive separation walls. The auditorium and the conference rooms as well as the restaurant and other public areas are dimensioned for 5 kN/m2, and finally the library for 10 kN/m2.

Economic and ecological sustainability

Every part of the project is designed to answer the targets of a high environmental quality regarding to investments and long-life use. The structure permits a large configuration possibility of working areas and a flexible subdivision. Environmentally friendly materials and a technical concept, which refers to renewable energy, reduce maintenance costs. Building design, material selection and technical concept are conform to the evaluation of office building – on the road to sustainable accommodations for the Flemish Government and, if needed, with BREEAM, HQE or other certificate.

Ventilation

In order to reduce energy consumption of ventilation systems, flows are reduced to a hygienic minimum. For office space, a simple ventilation is provided. The proposed concept focuses on a cascade use of fresh air, within the possibilities of space and fire separation of the building. The drive of the air in the main living quarters is achieved by air distributors; this air will be extracted from the secondary rooms, after having crossed traffic areas and corridors, thereby increasing somewhat the effect of the blast. The total ventilation is divided in two groups of ventilation for the office areas, one group for the purposes of the restaurant and one group for the conference rooms. The flow rates are variable and an individual regulation of the flow rates of locals and areas via a system of motorized valves is planned. It is understood that the ventilation units will be equipped with heat recovery at high efficiency (> 85%).

The pressure drop equivalent to a loss of energy, ventilation ducts are tailored to the speed of the air. The electrical energy consumption of ventilation systems and their noise is reduced by a judicious design of the sections and an appropriate choice of the route of the ducts.

Activation of the thermal mass of the building

Apart from the large conference rooms and the auditorium, the key element of the heating and cooling concept is the activation of the thermal mass of the solid concrete slabs. The heating and cooling effect is obtained by a radiation over the entire ceiling surface. The large radiation surfaces and the very low temperature difference thus give the heating and cooling system a guaranty of a high comfort. Due to large areas of radiation and very low temperature differences, the heating system ensures a high level of comfort. T

For the proper functioning of the system reduced solar facades are required. The easily accessible active heat storage masses (absence of suspended ceilings) serve as a buffer for the heat loads, which cause a reduction in peak load and a straightening of the load curve. Especially in cooling mode, this potential phase shift can concentrate the production of cold at night time.

At the next stage of planning, construction and technical constraints will be coordinated and optimised in detail, based on a calculation of dynamic simulation.

Heating and cooling system

Activated slabs also provide the distribution of heating, hygienic ventilation supports the energy of the exhausted air released by the ventilation units is recovered by a heat exchanger that recycles 85% of thermal energy and moisture to the air supply. The total thermal power of the building corresponds to 25 W/m² net.

The server rooms have a constant need of cooling energy. The most effective and most environmentally friendly method in order to cover this need is the free-cooling by cooling towers, without the production of mechanical refrigeration.

The energy concept of the cooling relies on a renewable resource use. The activated bottom slab of the parking lot will be used as a source of summer cooling and winter preheating. This concrete slab is equipped with a collector of absorbent irrigated tubes. In summer, the constant low temperature of the soil will be used for cooling, in winter this temperature level will preheat the ventilation air. This bivalent use of the soil avoids a unilateral solicitation and allows the seasonal regeneration of the energy parameters.

The flow temperature of cold water is provided with about 18 °C. In combination with an optimised heat exchanger and a hybrid cooling tower, the free-cooling is performed up to outdoor temperatures of 19.5 ° C. The concept of combining free-cooling tower for hybrid cooling at night, blocks activated and using the raft as the parking floor register produces 65% of annual consumption of cold without resorting to mechanical refrigeration. In order to cover the missing 35%, a cluster to produce cold water had to be installed.

The design includes a group of production of cold water via absorption. The system uses as a motive power the solar thermal energy feeding the absorption group during the summer sun. During the mid-season, the backup is provided. A collector area can produce an important cooling capacity. The concept that includes free-cooling and solar cooling thus allows production of a cold with a maximum input of renewable energy and a minimal consumption of primary energy.

Energy: the most important factors

With the aim of reducing the consumption of thermal energy, priority is given to enhancement of passive solar energy. A key factor in this context is the percentage of the glass surface. The sunlight through the windows is absorbed by the construction and dissipated as heat. Solar and internal gains help to cover the thermal needs of the building.

If demand exceeds the level of earnings recoverable, the deficit should be compensated by an external supply of heating energy. If contributions exceed the needs, the building is in excess of thermal energy. To avoid overheating, the thermal non-recoverable energy must be dissipated by ventilation or by the production of cold. Optimising the balance between energy gains and consumption of external compensation energy requires an accurate concept. Simulation calculations establish the optimum window area to 60% of the total facade area, taking into account gains and losses caused by the glass. In order to reduce power consumption to a minimum it is essential to use a high-performance outdoor insulation. By applying the optimization measures identified, an index of thermal energy by 18.9 kWh/m2 is feasible.

Electric lighting

Effective use of natural light reduces the power consumption and internal loads, while ensuring maximum visual comfort. This is achieved by optimizing the geometry of the building, with adequate sunshade systems and clear colours in each piece. When natural lighting is insufficient, artificial lighting of the most frequented rooms is dosed according to the natural light available and the actual needs in terms of work. Thus, the electricity consumption for lighting and cooling during summer are reduced simultaneously (synergies). The glass elements of the doors ensure natural lighting of the surfaces of internal circulation. In order to effective regulation of artificial lighting, the building will be equipped with motion and brightness sensors. Types of lighting with a maximum efficiency (back-up strips with reflector made of anodized aluminium and electronic ballast) ensure the lighting required for office spaces (500 Lux) for a specific power of less than 11 W/m². For the building (without parking) the estimated average energy index for the lighting of the building will be approximately 12.4 kWh/m2 net a.