Computational Materiality for Sustainable Architectures and Comprehensive Skins

FINAL ASSIGNMENT PRESENTATION

ASSIGNMENT GUIDE 04

Architectural envelope detailed design and conceptual prototype fabrication

PROTOTYPE

πρωτο, "first in time " e τύπος, "type"

1. device to run observations and tests on project development ...mostly built by craftsmen;

2. In philology, as a synonym of archetype, to indicate the most ancient example, known or reconstructed, which can be traced back to a tradition, a narrative, illustrative vein, etc .;

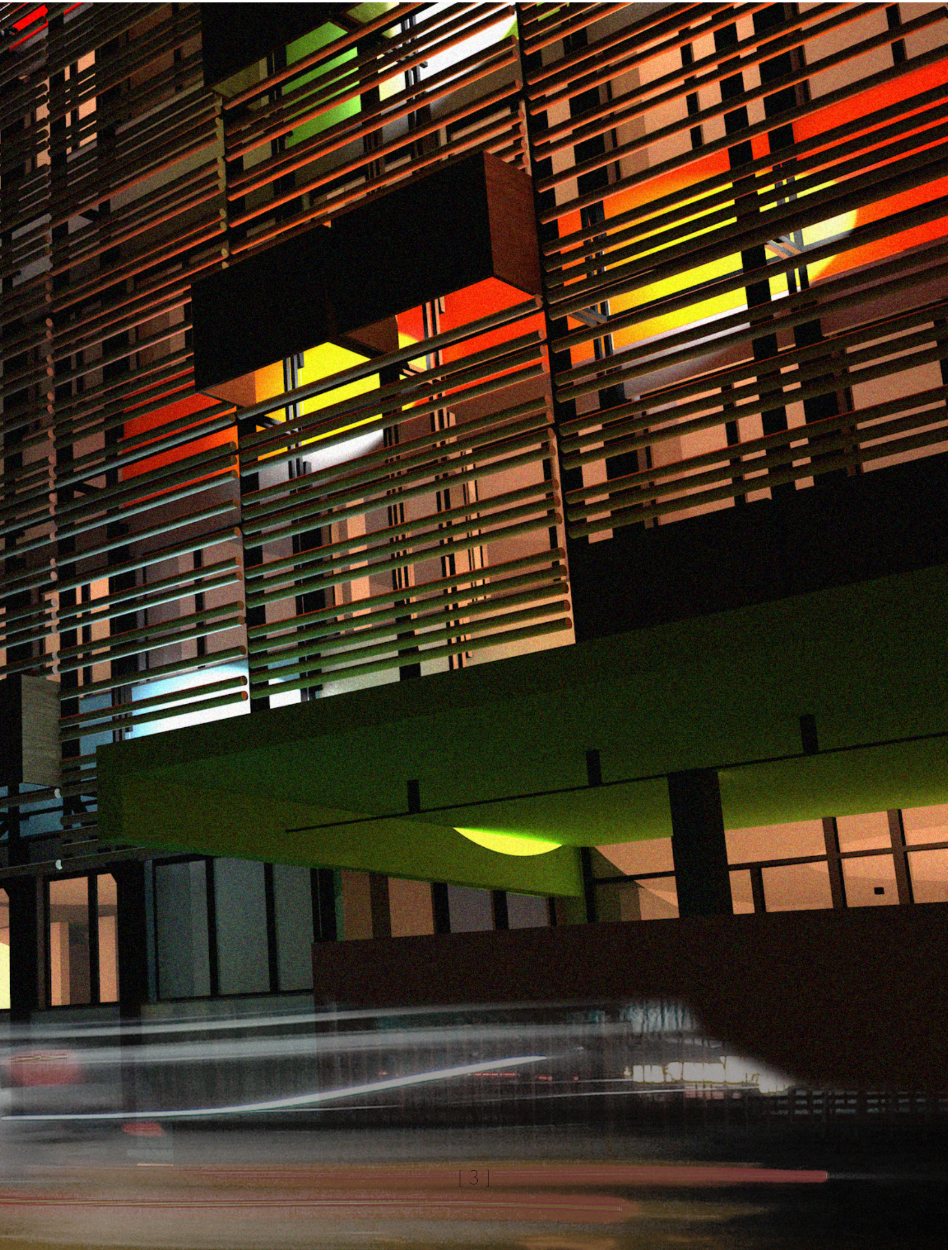
3. With hyperbolic use, who presents characteristics, qualities, defects typical of a certain category

The purpose of this final assignment is to collect and to integrate all the material of the previous assignments with the drawings and analysis produced in the other two teaching modules in order to specify the envelope technical solutions and to identify a meaningful portion (a sub-sytem, a building part, roof,..) to develope as prototype study for the last assignment.

Cover.
Antonio di Pietro Acerlino (FIlarete), Adam, 1460-64.

This page: Nikos Karatolios, Environmental Design A.A. 2013-14

Antonio Averlino o Averulino detto 1400-1469 ca



What to do

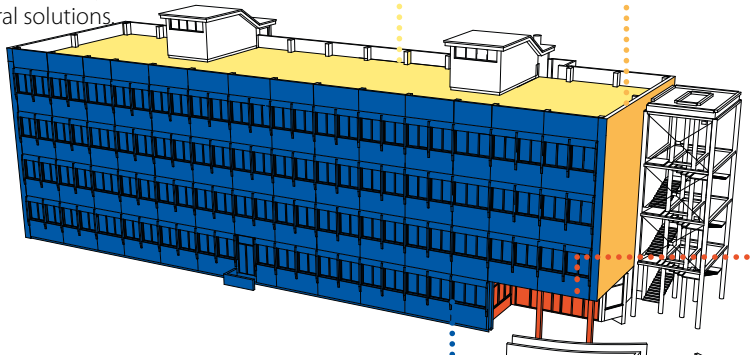
To carry out this assignment each group, is required to elaborate tecnical proposals of the building envelops according with solutions studied in the previous assignment and with the architectural design and environmental analysis carried out in the other two teaching modules. Those proposals have to be developed at a conceptual and at a detailed level as well in order to describe materials, their performance, dimensions, and assembly logic. Furthermore, it is required to highlight a significant part from the experimental point of view (therefore, not a standardized solution) for the realization, in the final assignment, of a conceptual prototype. This part can concern the roofing system, a specific type of façade, or an experimental passive device.
In this studies a particular attention should be dedicated to the quality of natural illumination and how to mediate this aspect with thermal comfort and outdoor views.

ROOF

How to do

First, students should have to describe all the different requirements affecting the envelope design showing the relationships between the environmental determinants and the architectural solutions.

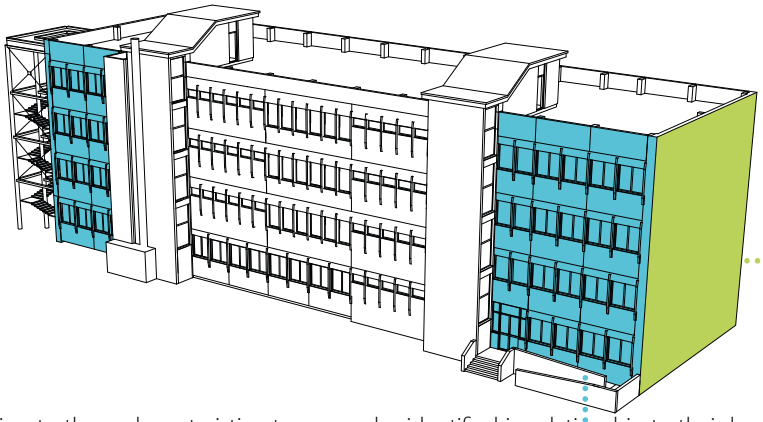
WEST FACADE



ENTRANCE

Some of the features to be considered are: type of activities and the consequent internal environmental needs (illumination, thermo-hygrometric comfort, etc.): exposure (wind and sun), different thermal load s on exteriro surfaces, views of the outdoor landscape, accessibility. Consistently, students will have to:
- identify specific envelope types and create a kind of scheduling list ;
- specify, for each of them, their technological solutions
– indicate their positions on the project.

NORTH FACADE



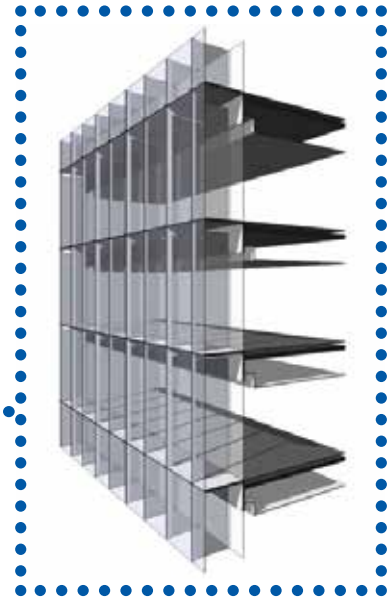
EAST FACADE

According to these characteristics, types can be identified in relationshio to their location and/or as:

- double skin facades and sun screen devices
- double roof and pergolas
- massive wall or other device for thermal lag
- natural ventilation and/or other devices for stack effect.

SOUTH FACADE

Proposed solutions can be represented using drawings, photos, and images of existing buildings or commercial solutions. This specification has to be integrated with brief description and diagrams/ideograms in order to give evidence of the positive and negative aspects for each of the proposed solutions.

WEAKNESS	PROPOSAL	REFERENCES
HIGH INSOLATION	ADD A NEW VENTILATED COVERING ON THE EXISTING ROOF	
EMPTY SURFACE_ EMERGENCY STAIRS	ADD A NEW VENTILATED COVERING ON THE EXISTING ROOF	 "Hedge building" pavilion IGA, RostocK 2003_Germany
NOT CLEAR	ADD A DISTINGUIBLE ELEMENT	
LOW DIRECT SUN LIGHTING	REMOVE THE WALL AND CREATE A TOTAL GLASS DOUBLE SKIN FACADE	 University of New Hampshire research 2012_USA
EMPTY SURFACE	ADD A "NEW ARCHITECTURE" TO INCREASE SPACES	
HIGH DIRECT LIGHTING_ ABSORBING SUN RADIATION WHERE ARE NO TREES	ADD A "NEW FACADE" TO CREATE SHADOW	 Valode & Pistre biopark 2006_Paris

DECISION MAKING PROCESS

	NORTH	SOUTH	EAST	ROOF
PROBLEMS	Poor natural light in winter	High directs sun light during the day	poor natural light	high direct sun light Thermal Problems
GOALS	increace sun light	decrease direct sun light	providing more sun light	decrease sun light

-increse day light for class-rooms
by removing existing facad and provide glass facad we can in-crese
light inside building

- Adding Green facad to the south providing more shadow during the day
new facad should be transparent.flexible , modular system.

-providing shelter on the roof

EAST

SOUTH

ROOF

STRATEGI

DESIG

MODI

REMO

PORCELAIN PA

GREEN MATERIALS

GIES
GREEN INTE

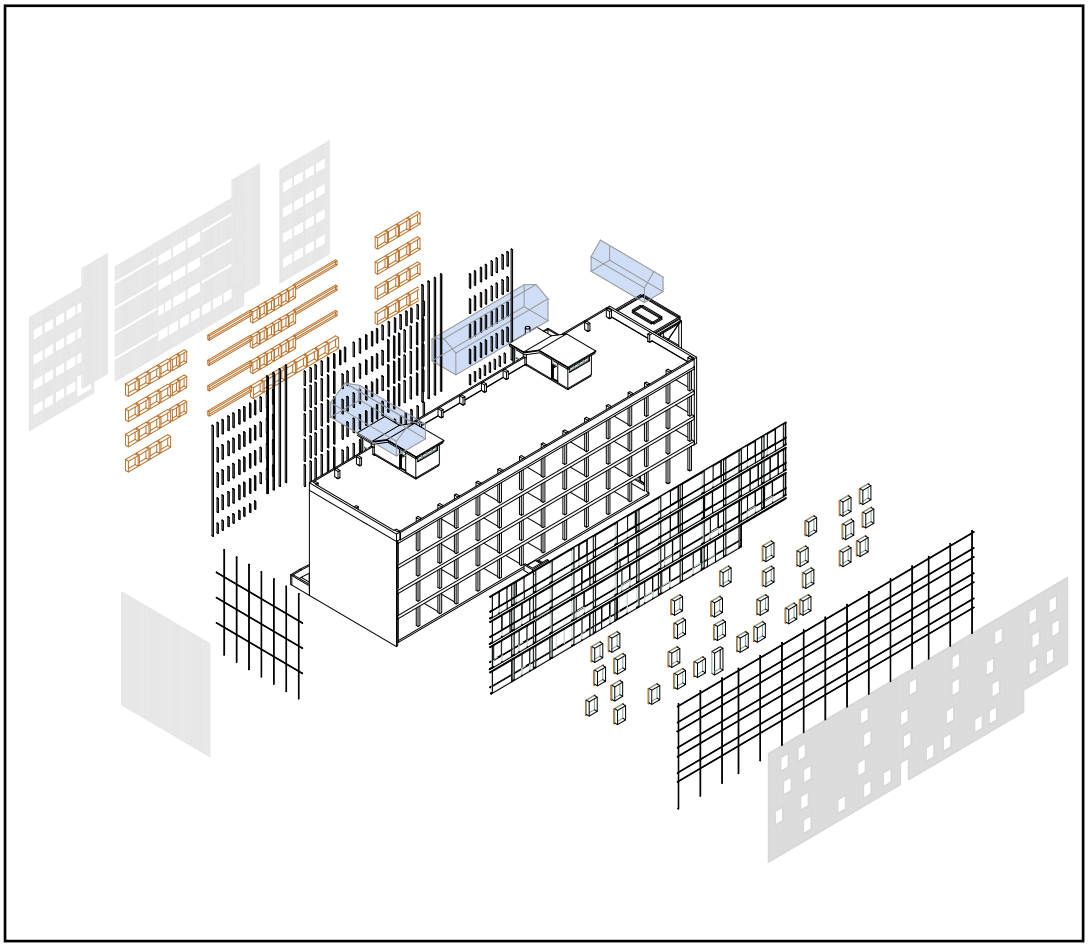
ALUMINUM PERFORATED PANELS

Previous page:
Marta Vannucci, Environmental Design, A.A. 2013-14

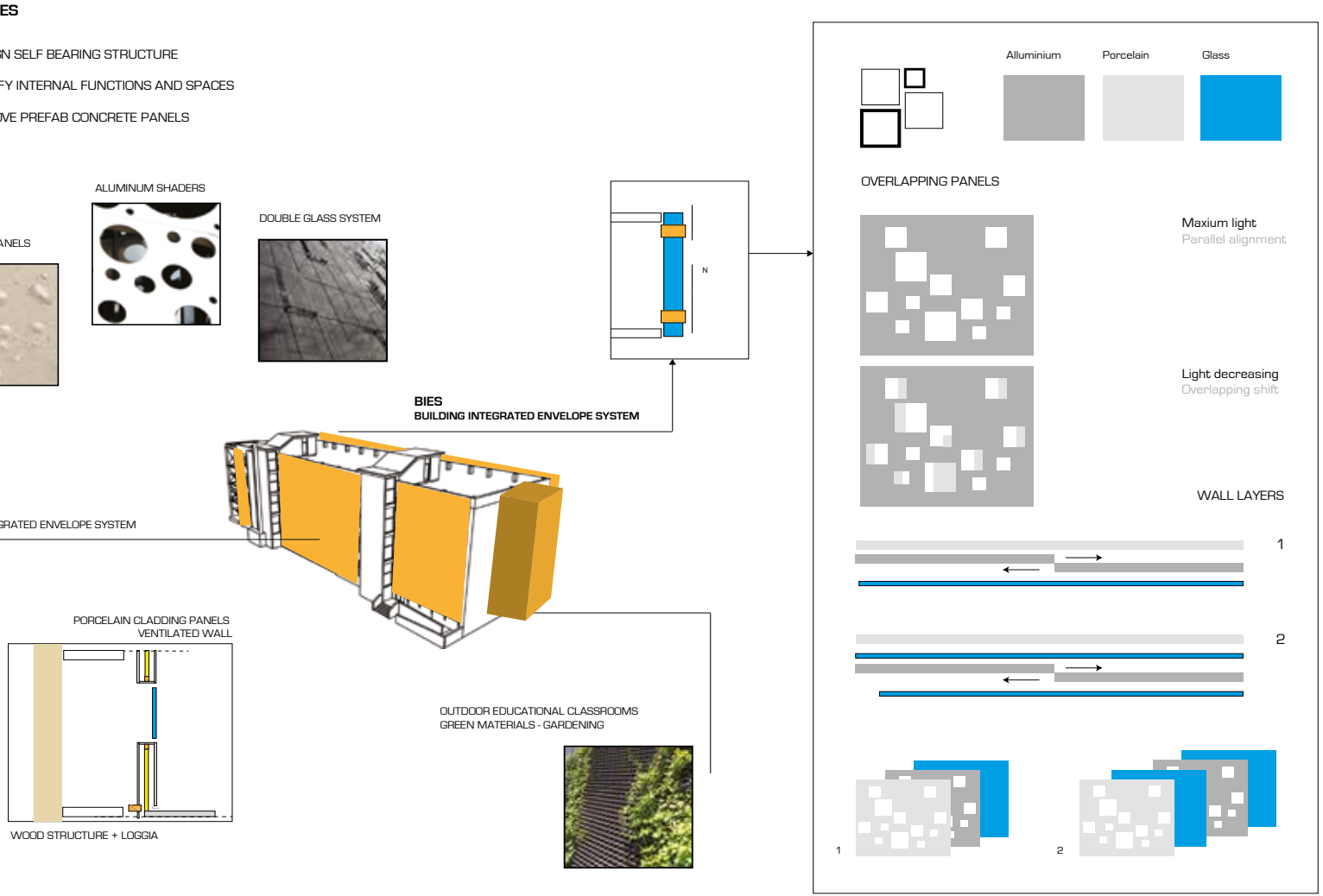
Left:
Tamara Ghanbari, Environmental Design, A.A. 2013-14

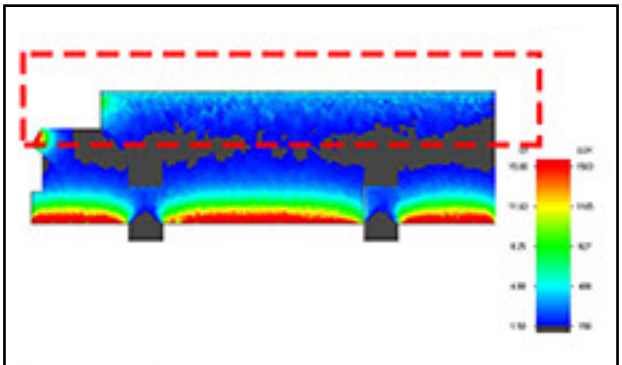
Right:
Olivia Gori, Environmental Design, A.A. 2013-14

Down:
Lornezo Antinori, Environmental Design, A.A. 2013-14



INTERVENTION STRATEGIES

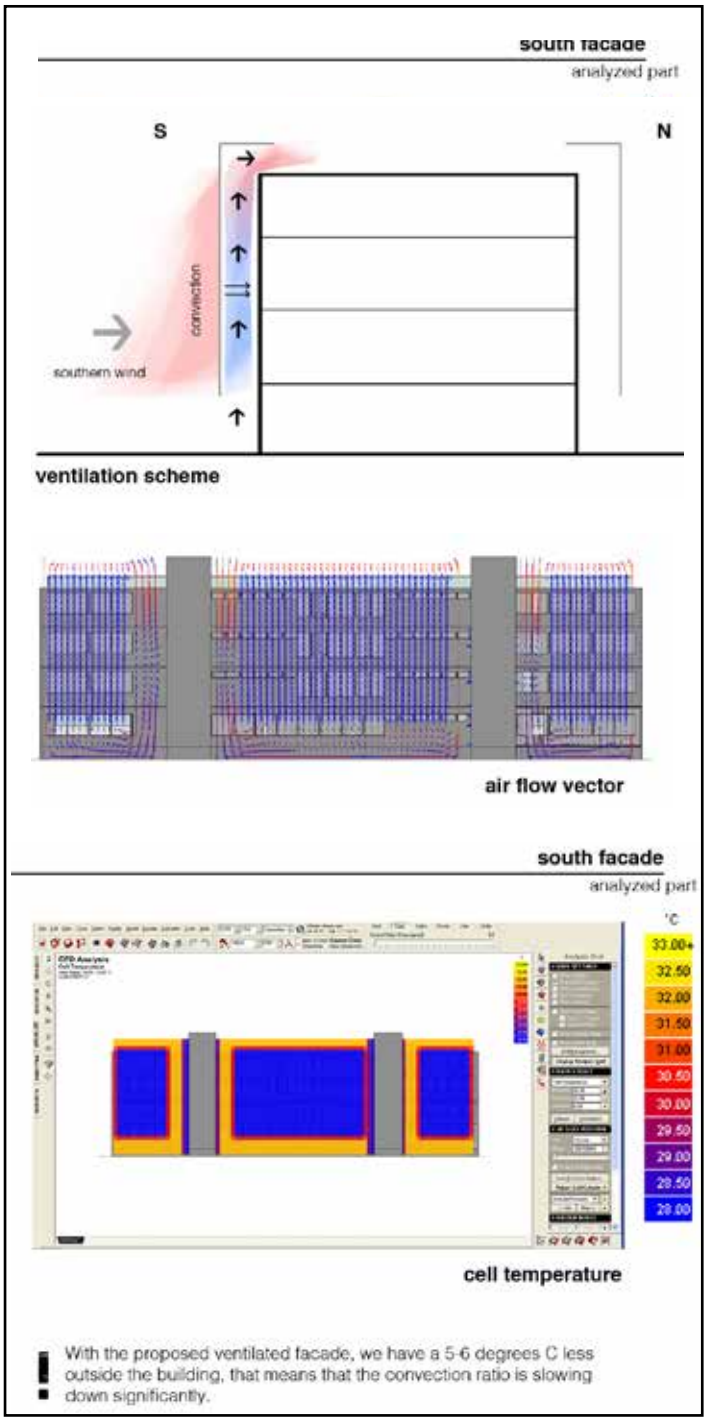




Right:
Arman Saberi, Environmental Design, A.A. 2013-14

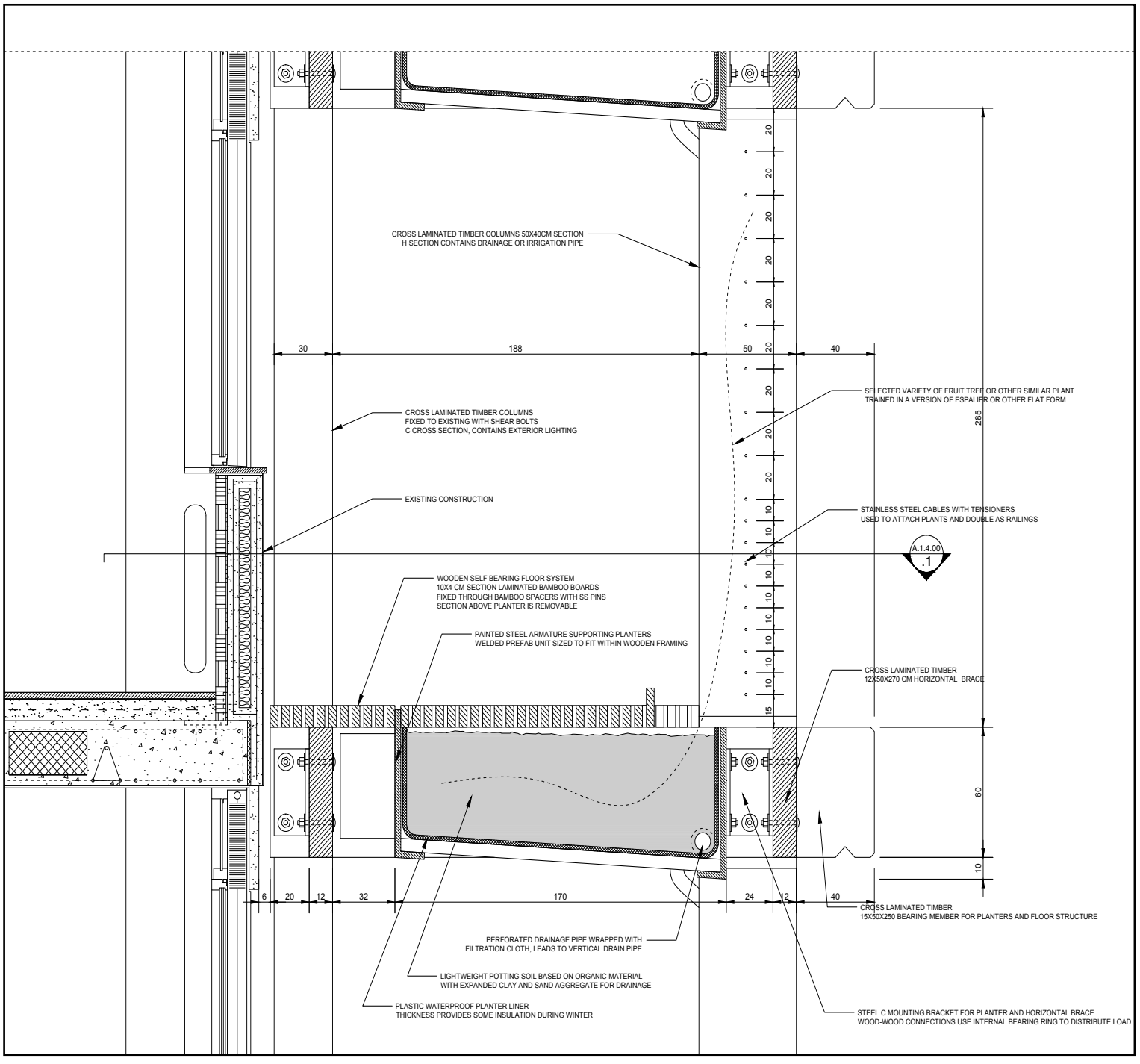
Down:
Nikos Karatolis, Environmental Design, A.A. 2013-14

Next page
Robert Kane, Environmental Design, A.A. 2013-14



Solutions must also be supported by thermal analysis of the external surfaces in order to highlight the different loads due to sun radiation, winds analysis, and simulations aimed at verifying the amount of natural lighting and / or the need for shading to prevent glaring phenomena. Following the conceptual description students are required to detailed each types and solutions providing materials and their positions in the assembly stratification. In addition, for each solution glaser diagrams and themal compliance with the national technical regulation developed in the Environmental Control Technique module is also required.

For the second part students need to select a significant portion of the envelope system in order to 'fabricate' , in the next assignment, a conceptual prototype model. The conceptual prototype should be a physical scaled model showing each part of the system and, above all, the assembly process.
Therefore, it is advisable to choose solutions that allow feasible execution: a non-minor and unamendable aspect of building architectures.
In this assignment and in order to prepare the 'fabrication' phase of the model, students are required to present technological-constructive details referred to foundation, structural parts, sub-structure, bracing devices, opaque cladding, glazing & shading elements, ...
Considering that is mandatory required the use of digital technologies (laser cutting, 3D printing, etc.) for model fabrication these detail drawings



should even include elements and aspects of the model itself In other words detailed designs have to describe the real building and the materiality and the model constructability.

The model scale is free, to be defined in relation to the thickness and size of materials available on the market.
The use of adhesives for the assembly of the various components is very limited therefore the main purpose of the model implementation will be the study of the junction systems.
If dynamic and/or adaptive systems are to be implemented, the necessary technical and material support will be provided during class activity.

Outcomes & Evaluation

Students are asked to submit a three UNI A1 boards (vertical pagination) articulated in the following sections:

• PART 1 - General enveleopes definition to peresent as a scheduling containing the following information:

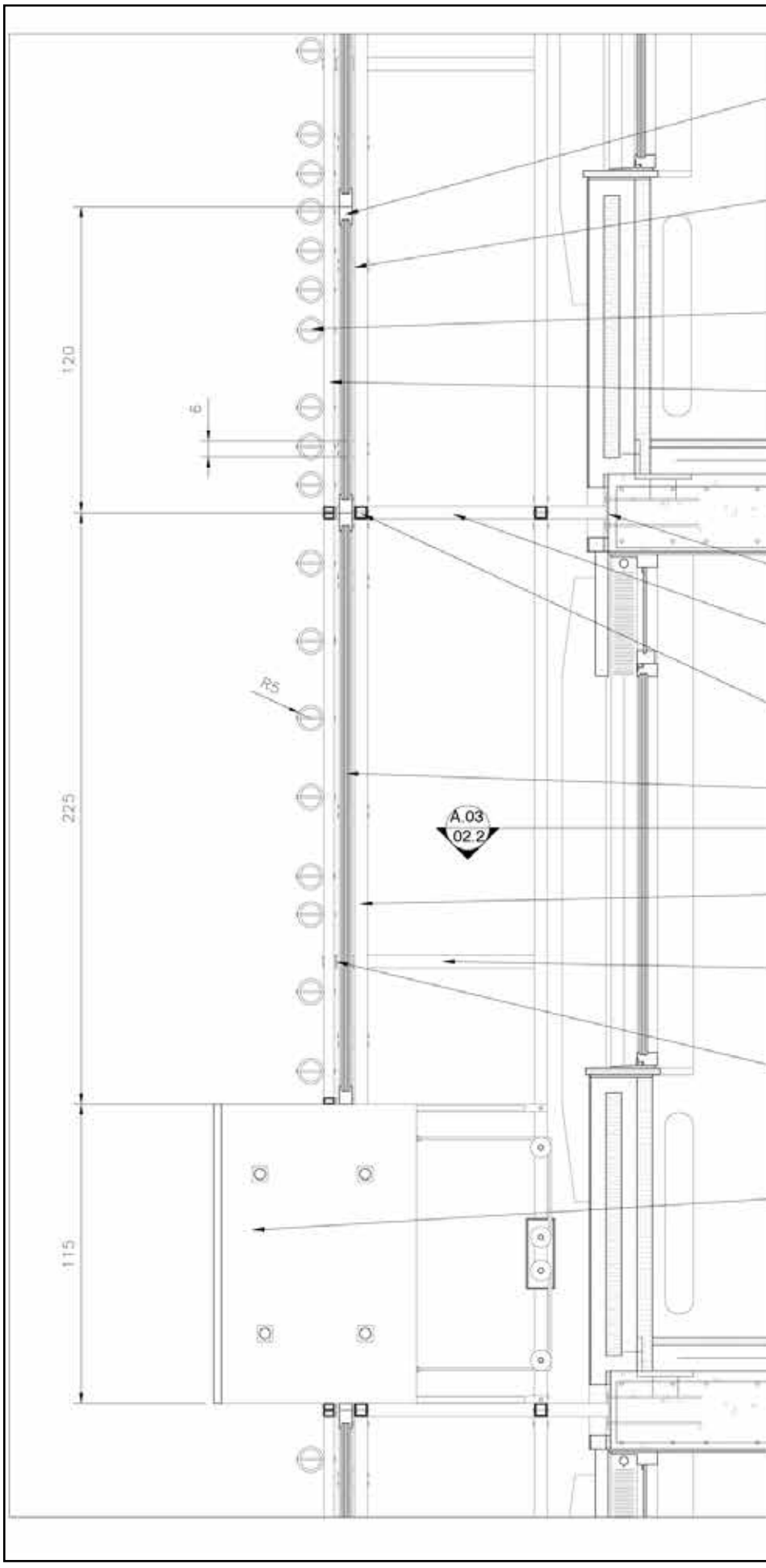
1. requirements, considerations and environmental performances required;
2. identification of types and types localization organized as a scheduling;
3. general descriptions of each types or families developed at a conceptual design level presented as schemes, ideograms, and references taken from commercial solutions and/or architectural examples

• PART 2 Detailed specification of the solutions adopted containing the following information:

1. sections, joint details, assembly logic and dimensions
2. computational simulation outputs to verify compliance with national regulations related to thermal aspects and daylight benchmarks
3. render and visualization of some envelopes types applied on the project showing its integration inside the architectural context.

• PART 3 Identification of a significant portion of the envelope system to be prototyped containing the following information:

1. comparison of evaluable alternatives through appropriate energy modeling (expecially daylight analysis)
2. detailed design of the seleted solution



Nikos Karatolis, Environmental Design,
A.A. 2013-14

GL01-ALUMINUM FRAME,
2 PANE LAMINATED GLASS

SP01-10MM STEEL MOUNTING PLATE
FOR GLASS ELEMENTS

50MM RADIUS
BAMBOO CANES FOR SHADING, PART OF THE
PREFABRICATED ELEMENT-PE05

40X40MM SQUARE HOLLOW SECTION
FRAME FOR BAMBOO SUPPORT,PART OF THE
PREFABRICATED ELEMENT-PE05

SP02-10MM STEEL PLATE JOINT
WELDED ON THE PREFABRICATED
BEAM ELEMENT-PE01 FOR CONNECTION WITH
THE CONCRETE FLOOR SLAB

50X50MM SQUARE HOLLOW SECTION
STRUCTURAL BEAM, PART OF THE
PREFABRICATED ELEMENT-PE01

S301-40X40MM SQUARE HOLLOW SECTION
STEEL USED AS SECONDARY STRUCTURAL BEAMS

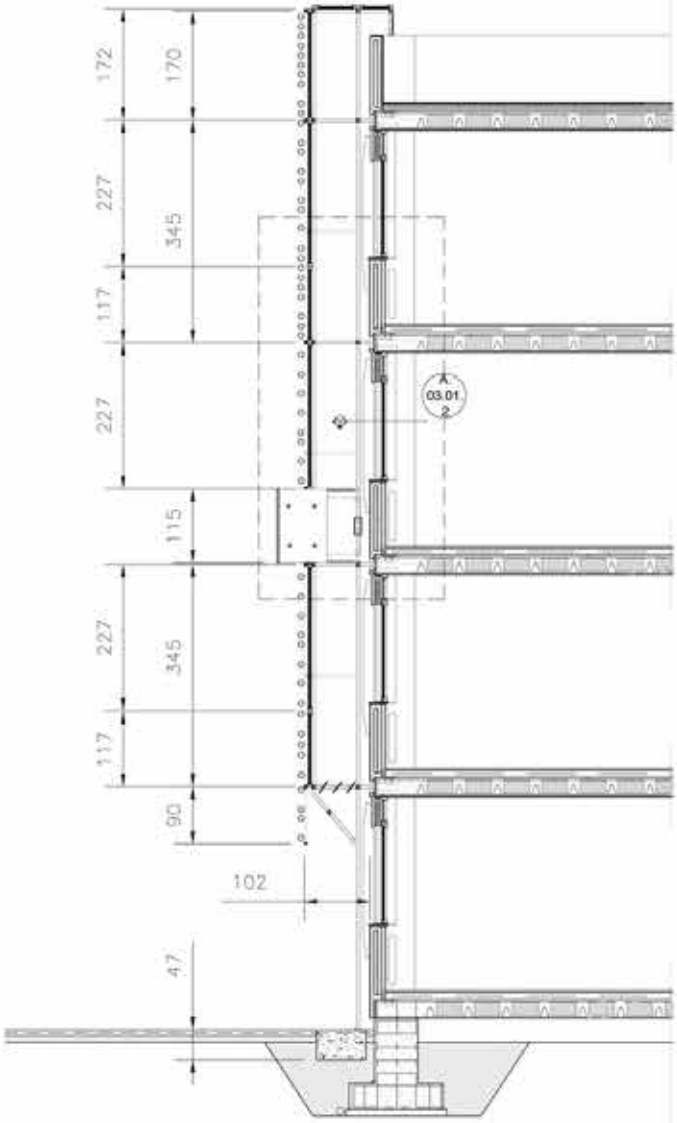
GL02-ALUMINUM FRAME,
2 PANE LAMINATED GLASS

50X50MM SQUARE HOLLOW STEEL SECTION
STRUCTURAL COLUMN,
PART OF THE PREFABRICATED ELEMENT-PE02

50X50MM SQUARE HOLLOW SECTION
STEEL USED AS SECONDARY STRUCTURAL BEAM,
PART OF THE PREFABRICATED ELEMENT-PE02

96X100MM HEA PROFILE
STEEL JOINT, PART OF THE
PREFABRICATED ELEMENT-PE01

WB01-WOOD PLASTIC COMPOSITE LUMBER
BOXES, USED FOR REGULATING THE
WIND PRESSURE INSIDE THE CAVITY



A.03.01.1 DOUBLE SKIN FACADE SECTION 1:50

A.03.01.2 DOUBLE SKIN FACADE DETAIL 1:10

UNIVERSITA' DEGLI STUDI
DI FIRENZE_DIDA
Dipartimento di Architettura
ICad International Course
Architectural Design

Environmental Lab

prof.Giuseppe Ridolfi
a.y. 2013/2014

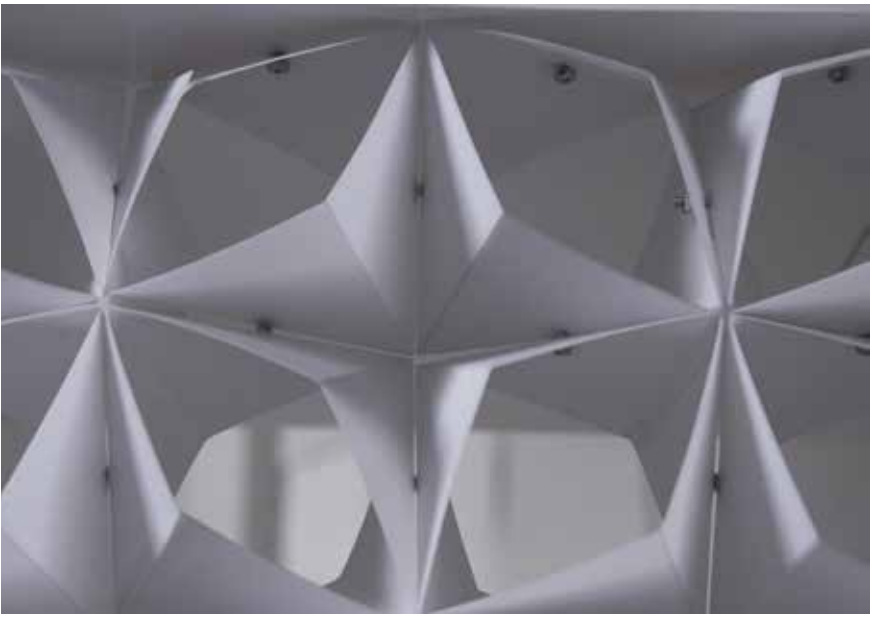
TECHNOLOGICAL ANALYSIS
OF THE DESIGN PROPOSAL
Assignment C

Nikos Karatolios

A.03.01 DOUBLE SKIN FACADE
VERTICAL SECTION AND DETAIL

A.03.01

Project:
MIDDLE SCHOOL
MALAPARTE
VIA BALDANZI, 18
PRATO



3. scketches, preliminary mock-up, 3d studies, examples and same detaild design for the model fabrication

Optional video must be realized in a full HD -1080p ((1920x1080 24fps - 72 dpi) and can be introduced by a preliminary description of the architectural building but, in any case , it will have to be closely focused on the envelope system and the model making process.

Evaluations of this assignment will take place through class critique where the main evaluation criteria will concern, in addition to the quality and level of detail of the solutions adopted, the clear and coherent illustration of the processes. These concern the reasons for the choices to be made through the formulation and evaluation of alternatives based on performance simulations

This Page:
Diego_Detassis, Structural Design, A.A. 2013-14

Alessio Gasbarro, Environmental Responsive Skins, International Workshop 2016

Giuseppe Laudante, Environmental Responsive Skins, International Workshop 2016

Next Page:
Tomas Usovas, Structural Design, A.A. 2013-14

Ettore Catani, Erica Passavinti, Structural Design, A.A. 2013-14

References

- **Students' Examples**

http://www.mailab.biz/portfolio_page/w11_form/

http://www.mailab.biz/portfolio_page/from-origami-to-architecture/

http://www.mailab.biz/portfolio_page/lighting-facade/

http://www.mailab.biz/portfolio_page/from-origami-to-architecture/

https://vimeo.com/199699060

- **Environmental References**

https://issuu.com/artichoc/stacks/e9c428624cfb4c148f0055371df06620

https://it.pinterest.com/mailab_/environmental-design/

- **Envelope examples**

https://it.pinterest.com/mailab_/pattern-tessellation-parametric/

https://it.pinterest.com/mailab_/parametric-and-kinetic-envelopes/

- **Envelope technologies**

http://www.mailab.biz/wp-content/uploads/LECTURES/_04. THE BUILDING ENVELOPE .pdf

http://www.mailab.biz///wp-content/uploads/2015/01/04.-JOINING-STRUCTURES-.pdf