

## Color, Culture, and Communication

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### Abstract

Color is one of the most important keys to communication in the global market and it plays an instrumental role in attracting, capturing and retaining attention, shaping the perceptions, attitudes and opinions, and finally influencing the decision to buy or not our products or services.

Colour is architecture, object, painting, image, research, music, poetry, prose, city, landscape: it possesses physicalness, a body which requires to be analyzed both in its full shape as *res extensa* and in its inner being. It appears as a fundamental element in the representation of the nature and the territory, in its double immanent and becoming aspect. It is one of the main aspects to be considered in any communicative choice or in any action of analysis of a heritage to be taken in its multidimensionality, thanks to its various aspects of symbol, communicative element, graphic, anthropological and socio-cultural element.

Colour is radiation, energy acting positively or negatively on us, even if we are not aware of it, and its action has to be felt and understood not only as an optical event, but as a psychic and symbolic action as well: indeed, man perceives the colour and plans it, giving it in both activities a visible and (in)visible dimension. The limit between visible and invisible is just where the colour takes shape and what the observer perceives, with distinction, both as a recognition and as an inescapable destiny which connect him with what he observes or creates.

Even before the invention of the alphabet, primitive peoples and civilizations expressed themselves through images, signs, symbols and signals, usually with the help and support of colors, to which they attached precise meanings. So color is a means of connection between the world and its meaning, between the individual and the culture he belongs to and, according to the use made of it, transmits cultural and anthropological differences as well as codes and symbolism.

**keywords:** Color Culture Communication Intangible

### 1. Color/landscape

The landscape today, as it unfolds before our eyes, is complex and divided. It is difficult to represent and describe as it is articulated and disassembled on a complex network of semantic fields characterized by the coexistence of heterogeneous elements and overlapping signs and traces. This makes it difficult to display a synthetic image that can express its meaning in a clear and readable manner. The local networks that describe reality for us and are themselves networks of information overlap and create sometimes unexpected visual and symbolic relationships between objects directly produced by man and traces of natural processes preserved in the ground.

The secrets, signs of the passage of time and interpretive schemes that originate from fragments of history are layered and overlap, and, over time, each new element overlaps the other without completely erasing the earlier signs. This landscape, understood as a complex system of spaces, forms, signs, sounds, colors, symbols and traces, is the link through which we access the history and memory of places, environmental and cultural values and their inherent dynamism. Through a careful multidimensional analysis and interpretation of the elements discovered, understood as reflecting the material culture of the territory, the

past, present and future unfold before our eyes: in fact the traces of past and present events give us a glimpse of the possible futures of the places.

The earth reveals itself every day with an endless array of colors, signs, symbols and nuances. It entralls and catches our eye daily: and what our senses perceive is a mixture of feelings and emotions that are nothing more than the harmony and balance created between artifice and nature, both past and present. What we observe in fact is not a simple summation of natural, architectural and symbolic elements, but a comprehensive package of all the constituent units in our territory. Man and nature have contributed to the ongoing definition of reality, pursuing a delicate balance that has led to the articulation of the scenarios as we perceive them. This synergy between man and nature has often led to the definition of images and views as articulated and detached as frames of a single narrative; identifying and representing a very specific place.: The many aspects of a territory or a location that we investigate therefore define the identity of a place and at the same time jealously guard its memory.

## **2. Color/traces**

The tools available to individuals for communicating and interacting within the tribes and primitive forms of civilization, have always been among the most important aspects of human life and the primary requirement for survival. Even before the invention of the alphabet, primitive peoples and civilizations expressed themselves through images, signs, symbols and signals, usually with the help and support of colors, to which they attached precise meanings. Color is a means of connection between the world and its meaning, between the individual and the culture he belongs to and, according to the use made of it, transmits cultural and anthropological differences as well as codes and symbolism. Man has always used color as a symbol and in ancient times, the more a society was strong and organized the more color was used and its symbolic meanings were defined.

The indelible traces of the communication links established between individuals went beyond physical locations. They spanned geographical boundaries and established spatial-temporal relationships between seemingly distant generations. All these apparently unrelated signs, shapes, colors and these graphic traces to be collected and re-established belong to the DNA of the territory [2]. They were created in a particular environment and assume a semantic value in accordance with the evolution of the place to which they belong. They are mainly the product of a sometimes contradictory usage of land by very different social groups.

Every place is in fact an expression of a particular society that is strong there and that strongly identifies with the context in which it has evolved: this context has an identity, a material and immaterial order and symbolic meanings that reflect its norms.

Measurement, therefore, is at the root of all knowledge and representation of the physical and intangible values and the recorded traces of the location and its biological evolution based on its environmental context. Measuring and capitalizing on the infinite reasons of nature, as Leonardo suggested, is to recognize the genetic heritage, the names of places, the foundation of this continuous process of restoration and regeneration as a modification against any prospect of change. To understand, therefore, the general organization of places, but especially also to prefigure their protection and regeneration, requires an innovative methodology to study the area that, starting with the identity of places, returns to them and represents them as a homogeneous set of elements in order to restore them with a meticulous representation or discretization and measurement, capable of expressing tangible and intangible values [1].

Human beings have always regarded colours as symbols, associated as they were to the natural elements lying at the heart of the primeval conception of the universe. Ever since prehistoric times, human beings have manipulated what they were given by nature every day, mixing clays, squeezing plants, grinding stones, in the attempt to leave a coloured trace testifying their presence on earth, recording moments of their lives. The remains discovered in Altamira (Spain) and Lascaux (France) together with the parietal paintings in Hierakonpolis (Egypt) prove that ancient painters were skilful and clever at finding and blending colours. At the beginning they only collected them from the places where they settled down, but afterwards they managed to achieve a wider and wider range of colours thanks to accurate researches and experiments that slowly led to a scrupulous and refined chemical composition of pigments.

From these early experiences of the individual with nature and the environment around him, the concept of color was conceived and developed in our mind and created an image of itself. Each color adheres to unconscious themes, acting on emotion with attraction and repulsion, expressing mental and emotional attitudes in preferences or in rejection, it displays intense and ambivalent language, reflecting the individual and the image of the world and becomes a place of real and unreal. And its understanding is born of conventions dictated by experience, that the color is between two poles and stems from the tension that is generated between identity and misunderstanding. Color, in fact, originates in a particular environment and

becomes a semantic value in accordance with its evolutionary process. Depending on different cultures, the symbolic meaning of color changes on the basis of different religious philosophies and on socio-cultural factors. For this reason, based on our experience and our evolutionary process, certain colors do correspond to certain names and characteristics that endow them with a precise identity and inevitably cause misunderstanding, because in another setting, in a different context, or in different time-space conditions, our assumptions may prove invalid.

### 3. The $n$ dimension of the color

Going through city streets, passing by places where artificiality and nature get mixed up, we gaze upon more or less details depending on the level of our attention; in doing so, our gaze turns into an act meant to acquire some knowledge of the urban sceneries that surround us. In fact, at first we tend to notice the appearance of the things that catch our eye, the “skin” of buildings and objects, and then we further and skillfully analyze the beauties created by nature and human beings. Colours, like a thin veil that seems to hide objects and artefacts and is often ignored and underestimated by observers, actually contain a great deal of material and immaterial information. We are unconsciously used to believing that colours cover objects, thus concealing their essence, their core, and then fade away slowly beyond appearance (the word “colour” – “colore” in Italian from the Latin “colos” – has the same etymological root of the Italian verb “celare” meaning “to hide, conceal, cover”). Nonetheless, colours do not conceal, they actually unveil and reveal what is sometimes apparently invisible. In order to uncover the many facets of colours, we need to view them as complex systems to be represented in their  $n$  dimensions. Therefore, while regarding colours as complex systems, we also need to take into consideration every science in which they are involved: when dealing with physics, optics, chemistry, acoustics, anthropology, etymology, symbolism, psychology, digital, a methodological approach is necessary to fully understand such an articulated world. In fact, within each colour, many different semantic levels and languages coexist and interact, which we do not generally find in other visual variables: material/immaterial, analogical/digital, anthropological/biological, material/symbolic, physical/metaphysical. These elements seem to be in contrast with each other, but their interaction determines both the intrinsic and extrinsic qualities of the colour itself, in the infinitesimal space on the border between the physical and the psychical where sensations and perceptions merge into one another.

In order to distinguish a colour, we need to see it close to other colours and other elements within the visual field, but, above all, we need to view it on a(n) (in)visible conceptual background where all immaterial components converge. Indeed, colours only exist insofar as they are viewed and experienced by human beings. They originate from the synergy and synthesis between natural and physical components, the physical and material properties of objects, the observer's mood, the general conditions, the cultural context, the social status, the biological conditions, experiences and aspirations, which jointly affect the way you see and represent the world. As a matter of fact, all objects, even those that are apparently monochrome, never feature just one colour, but rather multiple colours, as many as viewpoints and spatio-temporal conditions .



Fig. 1: Clare Perkins, *drawing*.



Fig. 2: Peter Saville, *End of year*, Christmas card (2005).

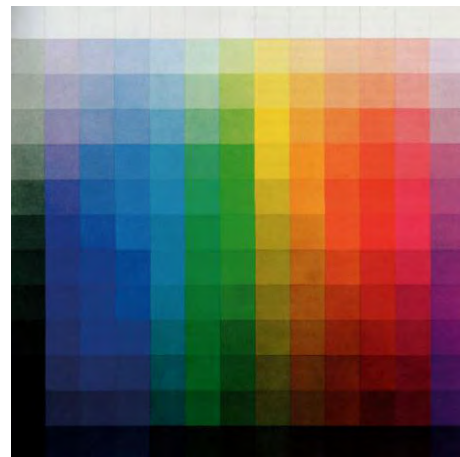


Fig. 3: Johannes Itten, range of colors.



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## [SMART]<sup>2</sup>: Sustainable Smart Innovation in Industrial Ceramics for Custom Multi-Product Design and Fabrication Strategies

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### Abstract

Ceramics as building material in architecture has been widely used for centuries, yet its speculative applications in avant-garde design are limited by either current established fabrication methods or expensive and inefficient customization techniques. The presented research explores one of the most widely used industrial production processes of bricks and tiles – the extrusion – for hacking and combining it with advanced computational methods in order to propose a new way of designing and fabricating ceramic building components. In particular, by CNC controlling the cutting process of extruded clay and by slightly modifying the wire-cutting tool, it is possible to generate custom-shape components through an efficient, sustainable, and multi-production fabrication method. In fact, ruled-geometry bricks, tiles, and shading elements can be generated in the same production line by separating extruded clay bodies with a numerically informed and specifically treated wire. The envisioned industrial scenario is here emulated through the development of a systematic workflow that starts off by digital modeling custom ceramic units and ends up by fabricating a series of prototypes with the use of robotic technologies. In virtue of this sustainable serialized mass-customization process, a variety of design and market opportunities opens up, eventually producing a new language for architecture in which innovative bricks, tiles, and shading systems are logically implemented. Tradition and innovation are thus combined under the objectives of material efficiency, industrial processes optimization, new market opportunities, and novel design strategies.

**Keywords:** Industrial Ceramics, Robotic Fabrication, Sustainable Architecture, Mass Customization

### 1. Introduction

Design customization in architecture has recently become a prominent feature, in terms of both trend- and performance-driven design. In fact, variation in architecture not only allows for achieving appealing design solutions, but also increases the building's response to environmental aspects. Although computational design techniques now substantially facilitate the customization of building components in the digital domain, their material counterpart often requires expensive and articulated methods of fabrication. In fact, the production of unique, highly differentiated elements involves the use of non-standard supportive materials and special tools, such as complex moulds or special bending machines. On the contrary, industrial production processes are characterized by production lines or highly efficient methods that allow to fabricate building units in a serialized and cost-effective manner, making customization extremely complicated though.

Production lines constraints, packing principles, and transportation systems, in fact, deeply affect the possibility of customization, often preventing design speculations that involve differentiation. In this context, the role of ceramics is emblematic, being a material widely used in architecture with a high level of standardized fabrication processes and final products. Ceramic building components are indeed deeply characterized by well established production methods that leave little room for design customization. Instead,



ceramics embed certain properties that make it an ideal material for product differentiation. In particular, as this paper demonstrates, its plasticity in the pre-firing state offers enormous possibilities for the creation of complex-shape building components – opportunities enhanced by contemporary computational design and digital fabrication techniques.

## 2. Industrial clay extrusion

Industrial clay extrusion is a process in which ceramic components are produced in a serialized and continuous linear manner. During the process a helical extrusion mechanism forces clay through a die that imposes a continuous shape on the material. The extrusion dies represent one of the only integrated mechanisms for custom shaping in industrial ceramic production, although their cost and implementation requirements make their number of different shapes highly limited. During extrusion, components are supported by a conveyor or roller system that carries the extruded elements through several automated production cells that dimension, fire, finish, and package the ceramic parts. Dimensioning of individual linear elements is often accomplished by automated and exactly coordinated wires or blades that make cuts perpendicular to the extrusion direction. In the case of bricks' production, the process is so that the extruded clay body is cut at regular intervals separating the body itself into fixed-length units, which are then separated with successive cuts creating the single elements. This row of bricks are then piled up by a robotic arm and carried on a conveyor that take them through the drying and firing rooms. Finally, the elements are properly packed for optimizing the shipping process. Most of these phases basically characterize the production of extruded tiles too.

## 3. Multi-product sustainable customization

The presented research proposes to revise the industrial extrusion process, being one of the most common and established fabrication methods of clay bricks and tiles. In particular, the study investigates two aspects of the wire-cutting mechanism: the first one deals with the way in which the wire is controlled, whereas the other speculates on particularly treating the wire itself. The objective is to demonstrate that by slightly modifying only the cutting process out of the entire production line, a remarkable series of design opportunities emerge.

### 3.1 Ruled-geometry wire-cutting

The proposed process intervention adapts the integrated dimensioning cell to incorporate a numerically-controlled wire-cutting tool designed to enable shape customization of single elements during linear processing. In this scenario robotically-guided wires are programmed to cut each component along ruled surfaces. Part dimensioning during industrial extrusion is in fact characterized by wire-cutting that, when numerically controlled, could achieve complex ruled surfaces if the wire's extreme points move vertically. By addressing differentiation in a single production cell within the larger extrusion system, this process would thus enable the manufacturing of mass-customized ceramic elements defined by ruled geometries.



Fig. 1,2: Industrial processes of clay extrusion and cutting.



In this envisioned industrial scenario the wire-cutting process would separate the extruded clay body in two different elements. One of the main assumptions of the presented research is that these two complementary elements would not be detached, but would rather maintain this same configuration till the final packing and shipping phases. In this way, the production lines principles would remain exactly unaltered: robotic arms could pick the pieces up for ordered piling, and packing mechanisms would follow the same logics of efficiency and optimization. However, in order for this process to take place, the two separated elements need to not stick during the firing phase. Although the industrial extruded clay is usually very dry, a simple cutting metal wire might be not enough for preventing the two pieces adhering to each other. For this reason, the Design Robotics Group at Harvard GSD has been elaborating several strategies for manipulating the wire to the treat the interface in such a way that sticking would not occur. In particular, one method involves the use of a hot wire that would burn the two facing surfaces sufficiently to create very dry layers of material. Whereas the other method concerns the deposition of hydra alumina powder in the interstitial surface – a technique widely used in the world of ceramics, though never applied in the wire-cutting mechanism.

### 3.2 Multi-product method

For the purpose of keeping unaltered the established industrial principles of production lines, the fact of not separating the two cut, facing elements is thus essential: customization would be easily coupled with industrial fabrication resulting in economic and efficient design variations and complex-component production. In particular, this research proposes a multi-product fabrication method that involves the use of either one or two numerically-controlled wires that would cut through an extruded ceramic element, thus producing digitally-informed, all-different units. In the imagined process, a clay body would be first cut with CNC wire/s for a fixed length, then vertically separated from the rest of the extruded body, and finally cut with traditional vertical wires for creating the different, multiple ceramic units. This series of components could be labelled either at the beginning or the end of the extruded element in order to be easily recognized during the on-site assembly process. In this way, each row of components would be identified with a clear noting system that would follow the assembly logic defined by the designer. This same assembly logic could be used for defining both the packing and shipping processes: rows of elements could be piled up in relation with the assembly order, thus defining the shipping mechanisms, times, and procedures accordingly.

As further illustrated later on, with this process different types of custom elements would be produced at the same time, exploiting the existing logics, systems, and tools of the ceramics industry. In addition, this multi-product method would embed advantages related to sustainability, economy of production, and efficiency. First, the envisioned process would not waste any material, but rather the material itself is optimized to create different products out of the same extruded element. Second, this fabrication technique would be cost-effective, because only a slight variation of the wire-cutting mechanism would be changed – the entire production process being unaltered; in addition, ease of customization would be an asset for the industry, eventually gaining more profits. Third, the combination of logics of customization and industrial principles of production would result in highly efficient ways of design variations and easy assembly on-site procedures for complex projects.

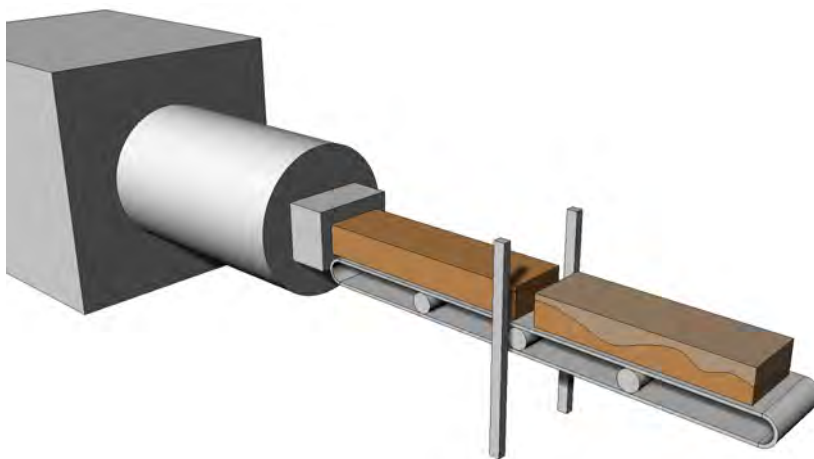


Fig. 3: Envisioned industrial method of automated wire-cutting.

#### 4. Design and fabrication robotic workflow

The envisioned industrial scenario is emulated through the development of an integrated workflow [1] that combines computational design techniques and robotic fabrication methods to foster innovative ways of conception, implementation, and production in the context of ceramics for architecture. [2] Integrating top-down and bottom-up approaches, this workflow starts off with the digital generation of the overall building system – e.g., walls, cladding solutions, shading systems. After that, a coherent logic of fabrication and assembly procedures needs already to be implemented in this design phase; in this way, consistent sequences of units can be properly organized. From the digital model, the geometric information regarding each ceramic element is then extrapolated for driving the automated wire-cutting process. In particular, for each component the developed algorithm outputs wireframe data that serves as guiding lines for the ruled-geometry wire-cutting method. The objective is to derive machine codes from the digital geometries within a *Rhinoceros*<sup>TM</sup>-based digital design platform. Industrial numerically controlled wire-cutting was simulated during prototyping by a 6-axis industrial robot used to guide a custom steel cutting wire. Automation of robotic programming was facilitated by the *Hal*<sup>TM</sup> plugin for *Grasshopper*<sup>TM</sup> which was used to generate, simulate, and optimize each of the cutting paths. In particular, for every individual component the workflow progressed by processing the input data derived from the digital model: the wireframe geometries describing the unit's edges were used to define ruling lines and generate the wire-cutting information for the robot. Once positioned relative to the robotic work cell, these lines served in the generation of cutting paths for each element. To further verify the cutting paths, each robotic movement was simulated in proprietary ABB simulation environment *RobotStudio*<sup>TM</sup>. Finally, to facilitate maximum robotic freedom, a custom steel fixture was created to support the wet clay block during cutting.

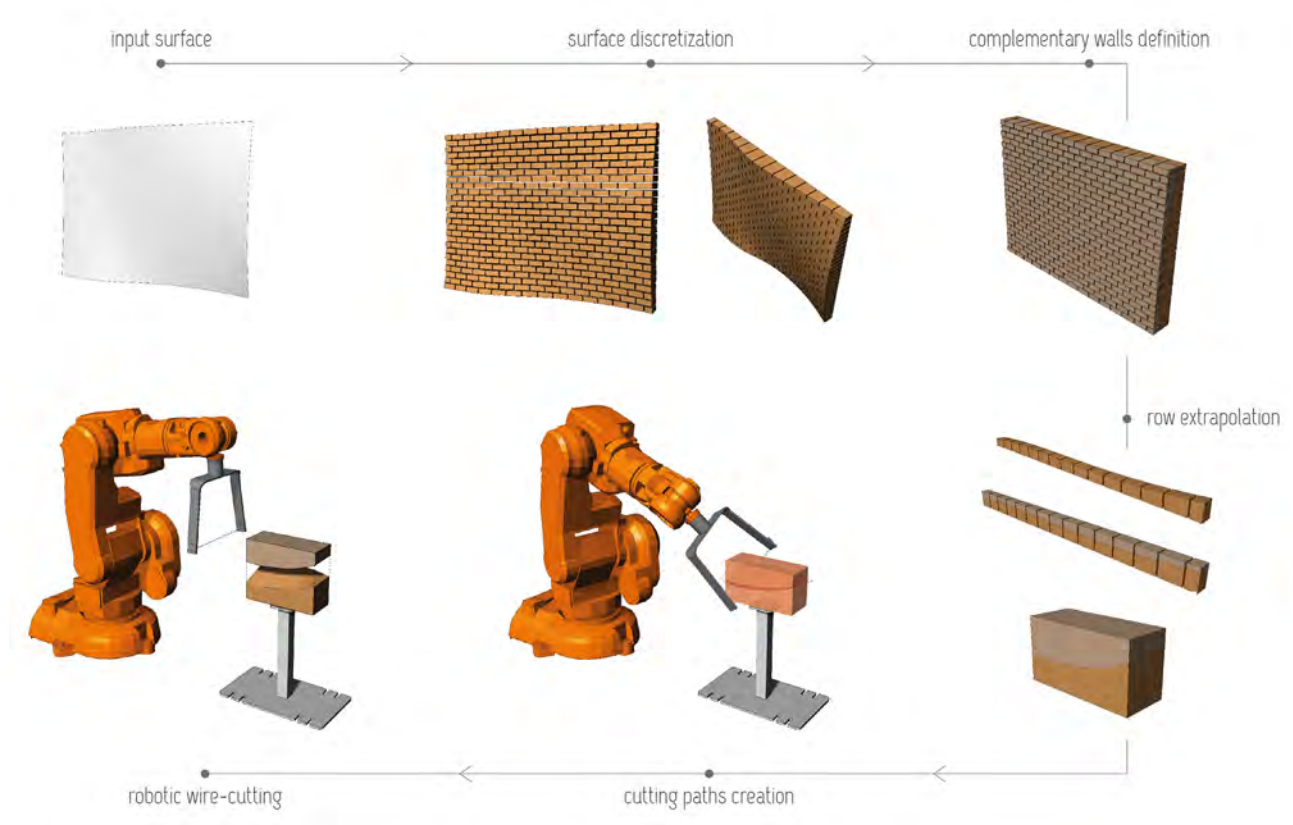


Fig. 4: Integrated robotic workflow: from design to fabrication.



## 5. Design strategies and market opportunities in architecture

The presented custom multi-product strategies in the world of ceramics open up a series of design and market opportunities in the realm of architecture and building solutions. The objective is to combine the tradition of ceramic materials with the potentials of technological innovations. In fact, if fostered by computational design and digital fabrication techniques, the tradition of ceramics could be remarkably enhanced acquiring new meanings and architectural languages. Looking at both design needs and industrial constraints, this research focuses on three different – though related – types of products for a variety of applications in architecture. The first line of research investigates new types of bricks for creating complex doubly-curved building walls. The second study proposes the design of kinetic shading systems made of curved louvers. Finally, the third application concerns building cladding and panelling with the use of complex tiles. These potential ceramic building systems were tested through the development of a series of prototypes fabricated with robotic technologies. Due to its inherent properties and aesthetic qualities, the material used was in particular terracotta.

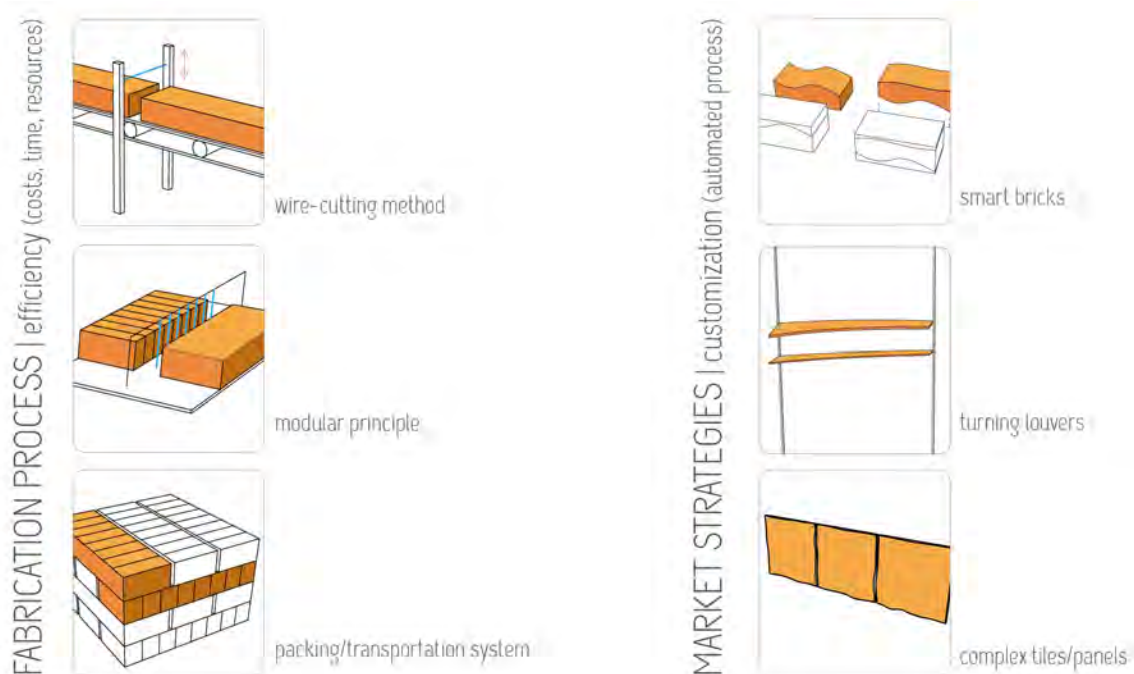


Fig. 5: Research strategy: production development + design opportunities.

### 5.1 Smart bricks for complex walls

Although their conception and digital representation has become relatively straightforward with current computational techniques, doubly-curved building walls still present inherent difficulties related to fabrication and assembly aspects. [3] This is particularly true when dealing with standardized ceramic units, whose assembly for achieving complex wall systems require either skilful craftsmanship, intricate guiding devices, or on-site robotic techniques. The presented solution aims to combine the advantages of industrial fabrication and transportation mechanisms with traditional on-site assembly methods. The result is an innovative use of ceramics through custom – though easy-to-aggregate – units for enhancing the aesthetic qualities of differentiation in doubly-curved surfaces.

For creating these complex walls, the design process starts by modelling a custom input surface, then moving to the creation of two complementary walls the share the complex surface; the thickness of the two walls is achieved based on fabrication constraints – specifically the dimension of the extrusion die; after that, the surface is discretized in the different units, following the structurally-efficient staggering principle; at this point, fabrication and assembly optimization rules are applied by selecting proper series of elements – e.g., a row-by-row principle; from these geometries, wireframe data are extrapolated for the automated process of wire-cutting; finally, the cutting process itself is performed.

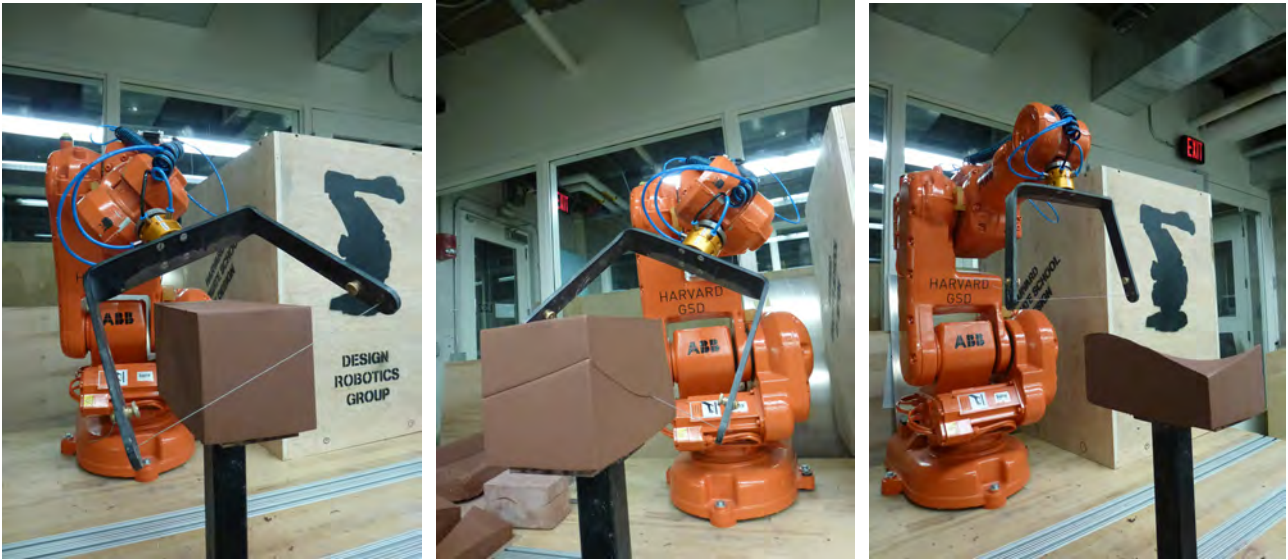


Fig. 6: Robotic fabrication of ruled-surface ceramic units for doubly-curved wall systems.

## 5.2 Turning louvers for kinetic facades

Shading systems play a dominant role in contemporary architecture morphologies, yet their design mostly relies on conventional horizontal louvers – made of a variety of materials. The proposed solution offers an innovative approach not only for screening building glass facades, but also for adding unique aesthetics values to the overall project. In fact, this system is composed by a steel vertical frame that supports curved ceramic louvers at their extremes – these joints having the possibilities to rotate around their horizontal axis. The developed design strategy begins by using an image as input for creating a certain pattern for the facade through the shading system. This image is then overlapped with the frame of the facade and processed for mapping the angle of rotation of each louver's joint. Once the angle range is set for a desired visual effect, the geometries of the louvers are then finalized. Due to the kinetic properties of the joints, a variety of different pattern solutions for the facade can be explored and dynamically changed over time. Concerning production procedures, each louver would be fabricated through an extrusion mechanism in which two CNC-controlled wires would be implemented. With the overall purpose of zero-waste production principles, the leftover material – the top and bottom elements – could then be used for panelling and cladding solutions, following the presented multi-product fabrication logic.



Fig. 7: Single components of unfired (green) terracotta and assembly simulation of a doubly-curved wall section.



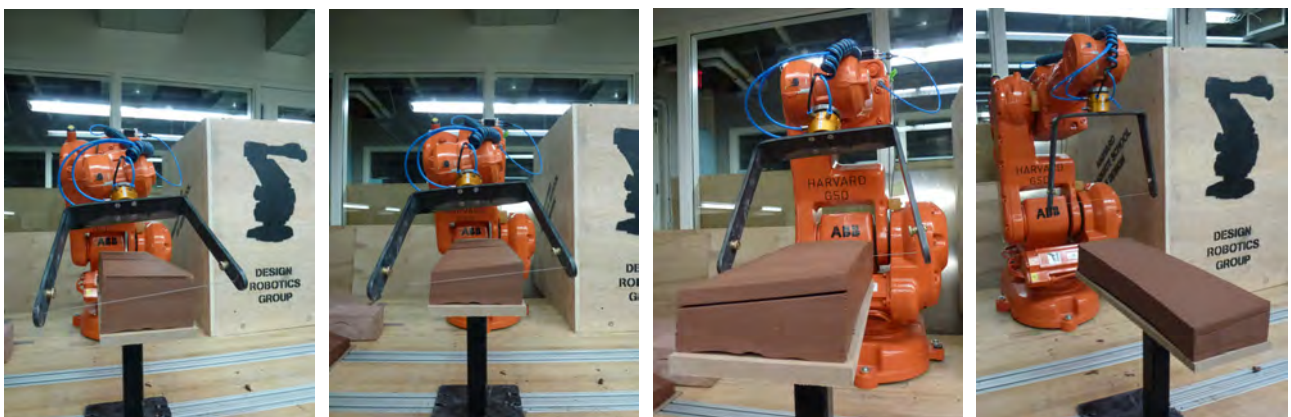
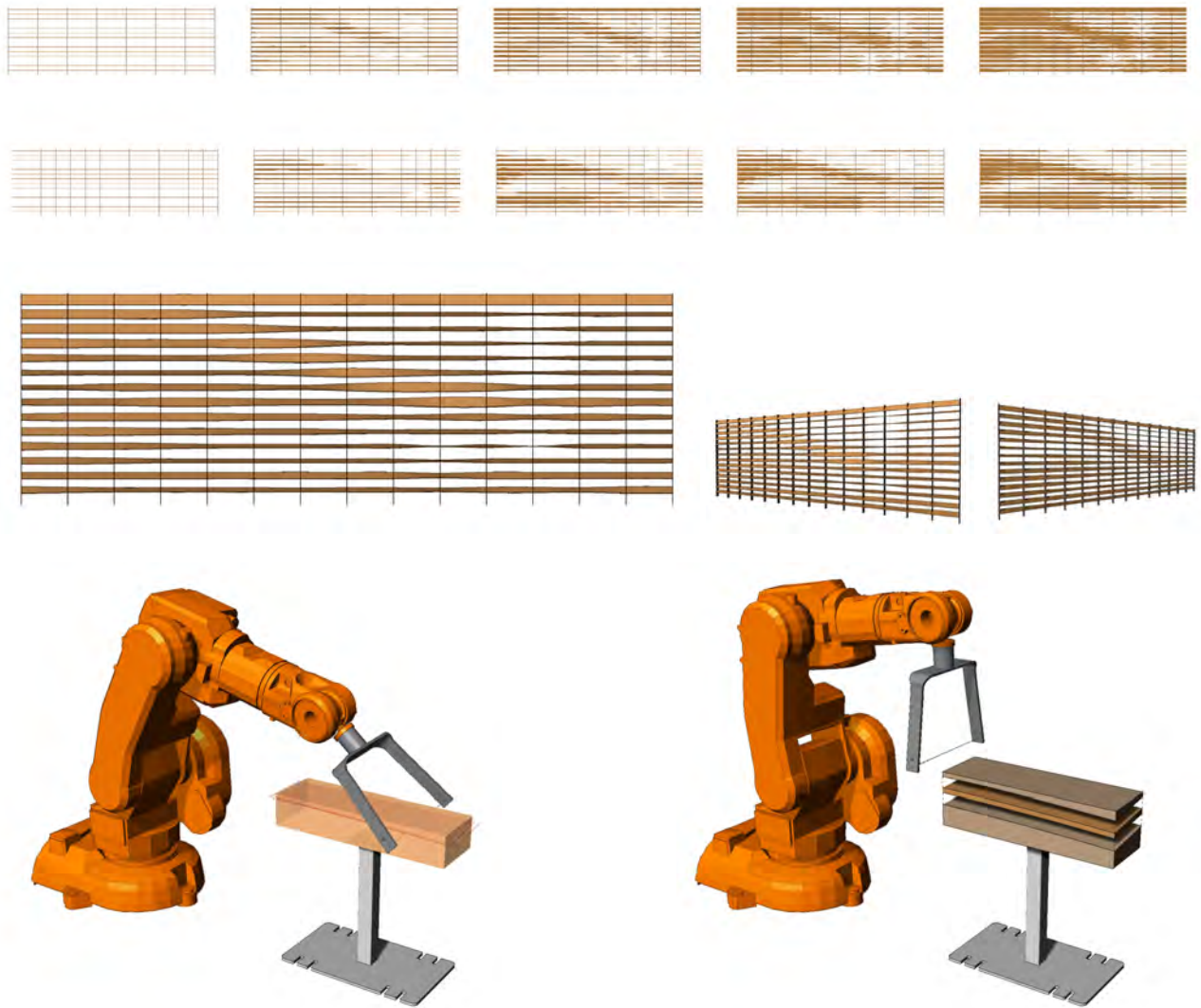


Fig. 8: Pattern design and robotic wire-cutting of curved louvers for kinetic shading systems.





### 5.3 Waving tiles for cladding systems

Ceramic tiles have a long tradition as cladding material, with an almost infinite range of solutions offered by the market. However, the ubiquitous flat tile is here innovated by adding complexity in the shape of its exterior surface. By applying the same principle of wire-cutting through an extruded element, it would be in fact possible to produce tiles that, once assembled, create a continuous pattern. In this way, for example, an ordinary space could achieve unexpected spatial qualities by adding “vibrating” elements to its wall’s surfaces.



Fig. 9: Design speculations and robotic fabrication of complex terracotta tiles.

## 6. Conclusion

The presented research investigated one of the most widely used industrial production processes of bricks and tiles – the extrusion – for a meaningful integration with computational and numerical methods in order to devise innovative solutions for designing and fabricating ceramic building components. In particular, an automated cutting process of extruded clay implemented in the production line would generate ruled-geometry components through an efficient, sustainable, and multi-production fabrication method of mass-customization. This envisioned industrial scenario was emulated through the development of a systematic workflow that linearly linked design conception and digital fabrication, resulting in the development of a series of terracotta prototypes with the use of robotic technologies. In the logics of this sustainable serialized mass-customization process, three different lines of research have been investigated: smart bricks for complex walls, turning louvers for kinetic facades, and waving tiles for cladding systems. Pursuing design technology research in the world of ceramics in architecture, tradition and innovation are thus combined



under the objectives of material efficiency, industrial processes optimization, new market opportunities, and novel design strategies.

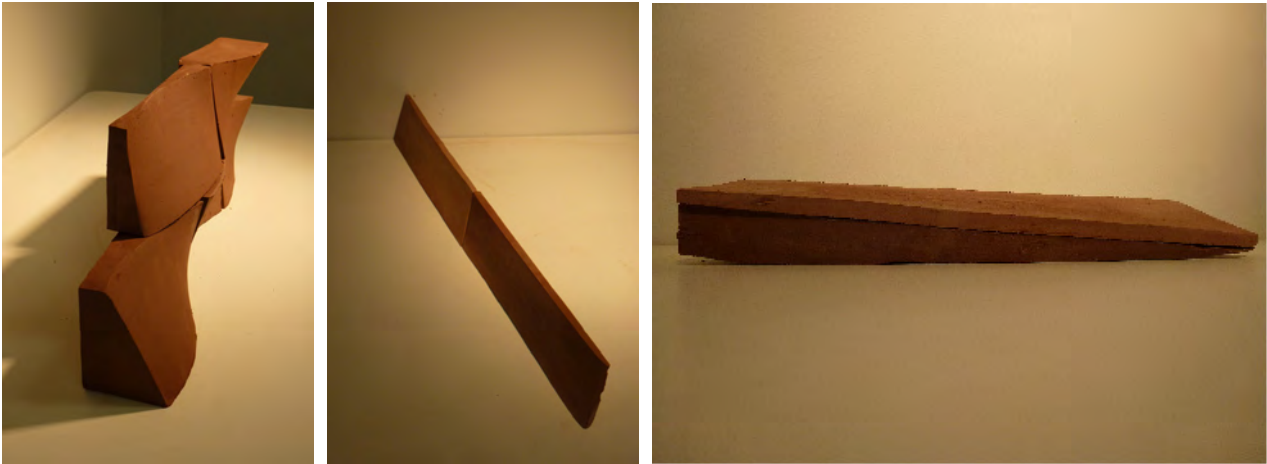


Fig. 10: Prototypes of a doubly-curved wall section and curved louvers made of wire-cut green terracotta.

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- Harvard Ceramics Program.

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## “PLUVIOGRAMMI” WITH HIGH TIME RESOLUTION

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### Abstract

The knowledge and variability of rainfall system, fundamental for the catchment management and planning, of an agricultural crops, of the civil and industrial water requirements and of hydroelectric energy production, are strictly linked to the climatic variations. The climatic system, not only, is affected by environmental factors: solar radiation, volcanic ash and aerosol, but also by anthropogenic factors, as greenhouse gases emission and the improper usage of the ground with intensive farming, urbanization and waterproofing. Any change of the statistical distributions of the weather variables can have a significant impact on the nature and humanity. Between most important weather variables for the water balance, plays a fundamental role the space-time of the precipitations, fundamentally, in characterized areas by a complex topography such as the Italian. Among many aspects, related to the observation and modeling of the hydrological cycle phenomena, is particularly interesting the definition of the appropriate critical “pluviogrammi” for the drainage networks design. In design practice, in fact, except for the occasional cases, it is assumed uniform spatial-time distribution of the critical precipitation and, respect to it, it is possible to do the sizing of the network hydraulic manifolds. The present work develops an experimental study of “pluviogrammi” with high time resolution, obtained by processing the observation recorded by a specific weather station, installed at Aversa (Caserta) on March 2006. This station is capable to acquire various information on various weather conditions: including, rain height, temperature, humidity, atmospheric pressure, wind direction and its speed. In this study have been analyzed, principally, data of the rain heights, acquired with a sample time of two minutes.

**Key words:** rain; pluviogrammi

### 1. Introduction

As it is well known in the literature, the term "precipitation" is indicated all liquid and solid products of the water vapor condensation that reaches the ground falling from the clouds. The precipitation, once started, is supplied by the contribution of water vapor, with an ascending movement, that rises to high altitudes and condenses in the form of small drops, reconstituting the cloud. The dynamics of rainfall is therefore linked to the movement of large air masses. The precipitations, in fact, occur when the air rises and it cools adiabatically below dew point, generating not only clouds, but, also, rain, snow and hail.

## 2. Measurements of the height of precipitation

The quantity of water that reaches the earth's surface can be valuating, locally, with measurers capable of detecting the height of rain or precipitation. In the time interval  $t$  can be defined as the ratio between the rain volume  $H_{t,S}$  precipitate in  $t$  on a portion of the Earth's surface and the area  $S$  of the horizontal projection of this surface area:

$$h_{t,S} = \frac{H_{t,S}}{S}$$

This measure is, in practice, the height of the liquid layer that would be to deposit on the ground, where all the downfall water remain stagnant without being subject to evaporation, infiltration and outflow.

The precipitation height has dimensions of a length and is measured in mm or m. During a rainfall event the height of rain punctual varies in space and time:

$$h = h(x, y, t)$$

where  $x$  and  $y$  are spatial coordinates and  $t$  is the duration of the rain event.

The readings of the height of precipitation can be performed with the aid of two different instruments, the rain gauge and pluviograph.

The intensity of average rain is the ratio between the precipitation height  $h$ , expressed in mm/h (or m/h), and the corresponding duration  $t$ :

$$i(x, y, t) = \frac{h(x, y, t)}{t}$$

The instantaneous intensity of rain is the limit which tends to average intensity when the time  $t$  goes to zero:

$$i(x, y, t) = \lim_{t \rightarrow 0} i(x, y, t) = \frac{dh(x, y, t)}{dt}$$

For a given duration of observation the histogram that represents the height or the average intensity of precipitation in each elementary time interval  $\Delta t$  is said "ietogramma".

## 3. Elaboration methodology of rainfall observations and acquisition data

The rainfall data acquired with a weather station are used for the analysis of rainfall with small time scales, concerning the Aversa territory. The work has been developed in two following phases: the acquisition and subsequent data processing. The observation period and data acquisition is lasted about three years; the records have been made every two minutes.

Data processing has been carried out by determining, in the first phase, the number of rain events; the identification of these events has been carried out by selecting, as a criterion, to match each rainy day with a single event of rain. Within each event has been identified the different showers, which, have been characterized with appropriately chosen parameters.

In the next diagram (Figure 1) is shown the daily Aversa pluviogramma. It is important to underline that, in the period under study, have been registered 143 significant rain events. The most significant event has registered a rain height of 45 mm, occurred on 01 November 2006, followed by the event registered on 27 September 2007 with 42 mm of rain. In particular circumstances most significant rainfall has been registered, for example, from 15 September 2006 to 18 September 2006, or, from 24 January 2009 to 27 January 2009. Thereafter for each individual event will be detected showers that compose it. For every shower will be route the diagram of accumulated rain heights and to ietogramma with high temporal resolution.



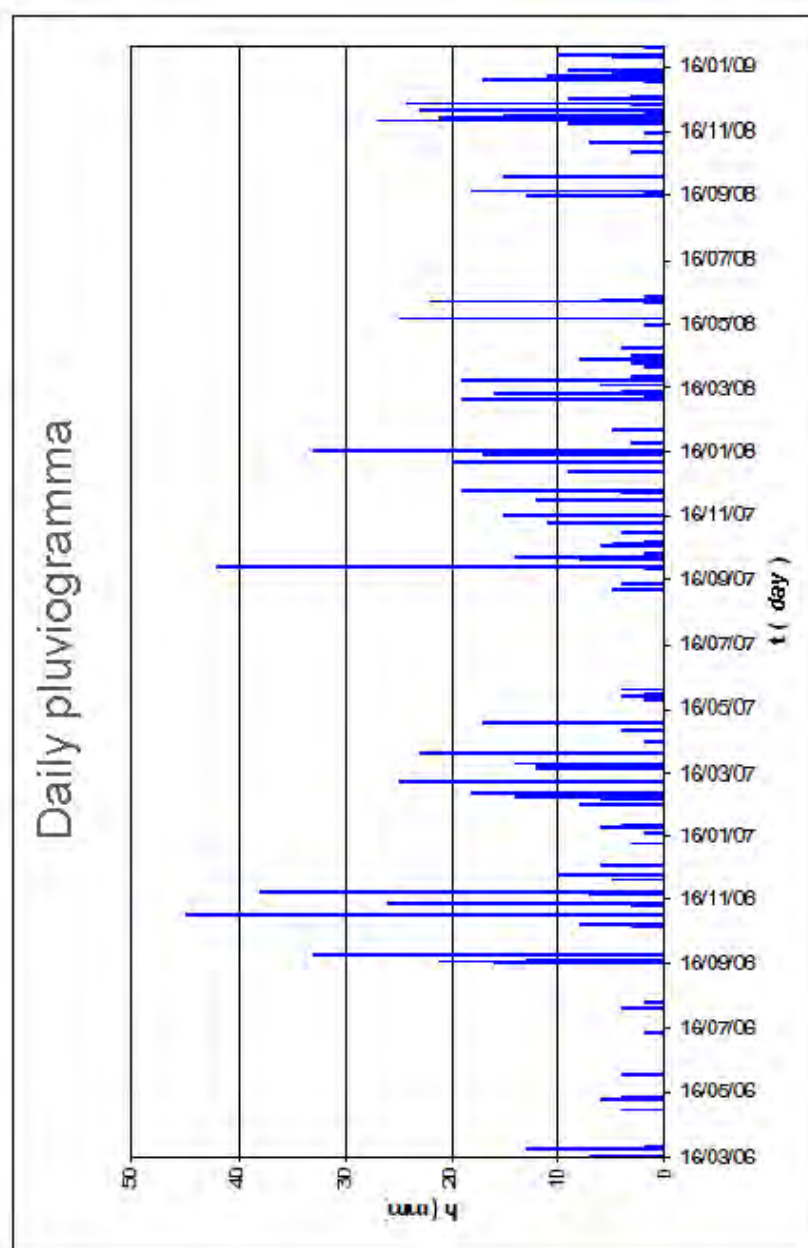


Figure1. Aversa daily pluviogramma

#### 4. Showers selection

Identified rain events, successively it has gone in search of the showers to analyze. This phase has been, preceded by a preliminary work performed on the returned data from the station. In fact, it has created a table (Table 1) where are inserted only the date column and the absolute height.

Data	Absolute height [mm]
17/09/2009 14:32	1759
17/09/2009 14:34	1760
17/09/2009 14:36	1760
17/09/2009 14:38	1760
17/09/2009 14:40	1760
17/09/2009 14:42	1760
17/09/2009 14:44	1760
17/09/2009 14:46	1760
17/09/2009 14:48	1760
17/09/2009 14:50	1760
17/09/2009 14:52	1761
17/09/2009 14:54	1761

Table1 – Rain height data

Regarding the minimum duration of a dry interval ( $i_{dm}$ ) between two consecutive showers it has been established to consider the following cases:

Case A with  $i_{dm} = 15$ , ie, with a dry interval of 30 minutes;

Case B with  $i_{dm} = 30$ , ie, with a dry interval of 60 minutes;

Case C with  $i_{dm} = 90$ , ie, with an interval of 180 minutes dry.

For the other thresholds, it has been decided do not vary them, in order to highlight the dependence of the minimum number of showers in a dry period.

## 5. Data processing

Each shower has been characterized by plotting both the height of rain  $h$  [mm], as a function of time  $t$  [min], and the rain intensity [mm/h].

To examine the diagrams above depicted, it has been calculated a number of parameters properly selected (Cernesson et al., 1995).

The calculated parameters are:

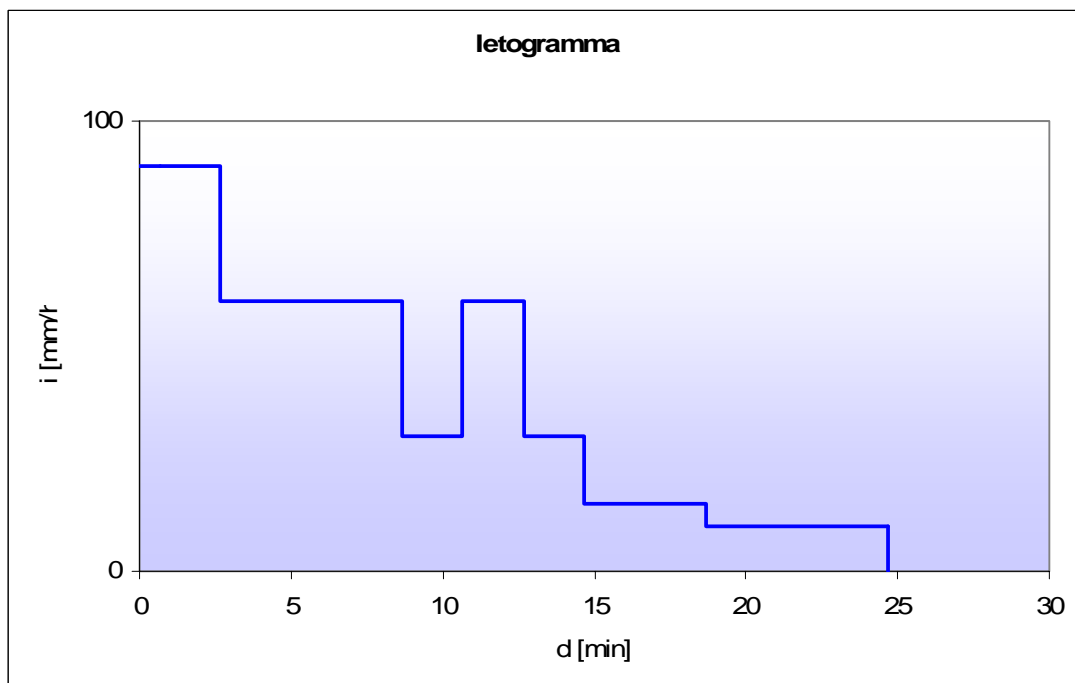
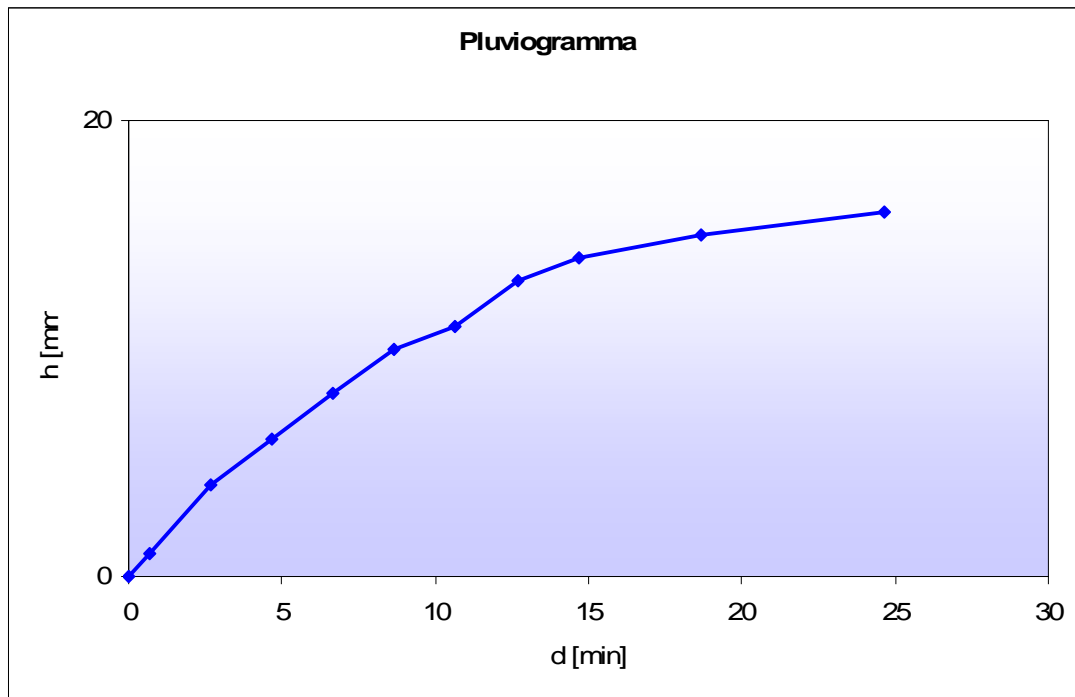
- number of peaks of each shower [peaks number];
- total height of rain -  $h_{tot}$  [mm];
- total duration of each shower -  $d_{tot}$  [min];
- average intensity -  $i_m$  [mm/h];
- maximum peak intensity -  $i_{max}$  [mm / h];
- IMAX/ $i_m$  ratio;
- maximum peak duration -  $d_{maxpeak}$  [min];
- ratio between the duration of the peak and total duration of each shower  $d_{maxpeak}/D_{tot}$ ;

- the position of the peak (minutes) and the total duration ratio of each shower  $-t_{\text{maxpeak}} / D_{\text{tot}}$ .

In the case, where more than a shower is present on two or more successive peaks of equal intensity, has been conventionally considered the second peak. The processing was carried out for all the three identified cases.



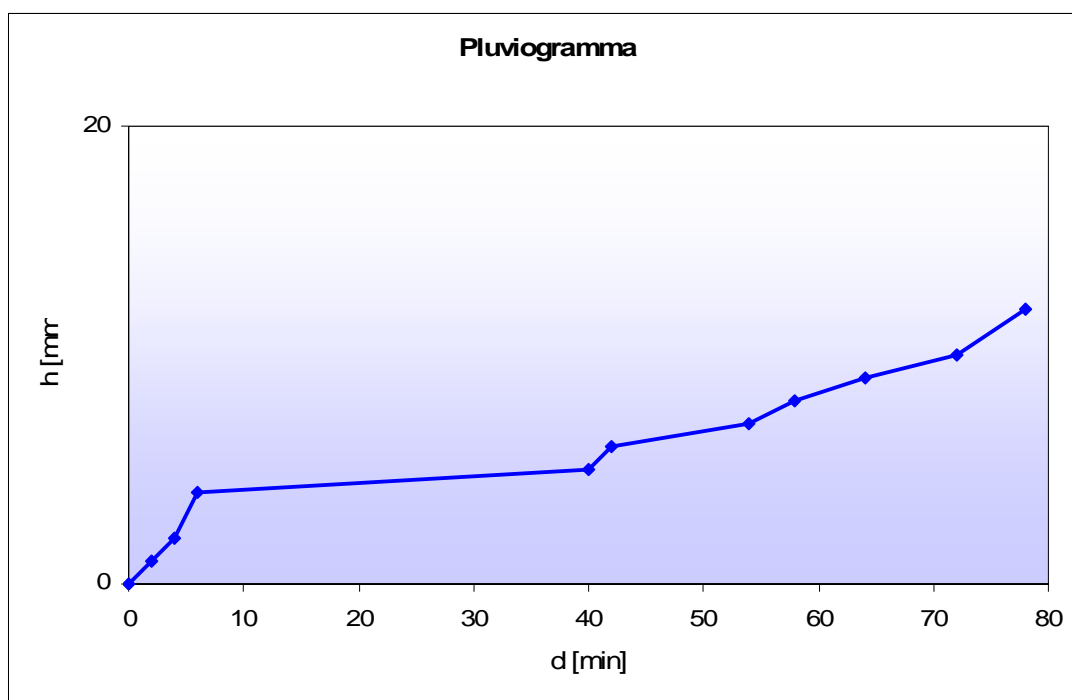
**Case A**  
**15.09.2006 Shower**



n° picchi	$h_{TOT}$ [mm]	$d_{TOT}$ [min]	$i_{MAX}$ [mm/h]	$i_{media}$ [mm/h]	$i_{MAX}/i_{media}$	$d_{picco\ max}$ [min]	$d_{picco\ max}/d_{TOT}$	$t_{piccomax}/d_{TOT}$
2	16	25	90,009	50,501	1,782	3	0,108	0,054

Figure 2 – Pluviogramma, ietogramma and shower parameters: 15.09.2006

➤ **Case B**  
✓ **17.09.2006 shower**





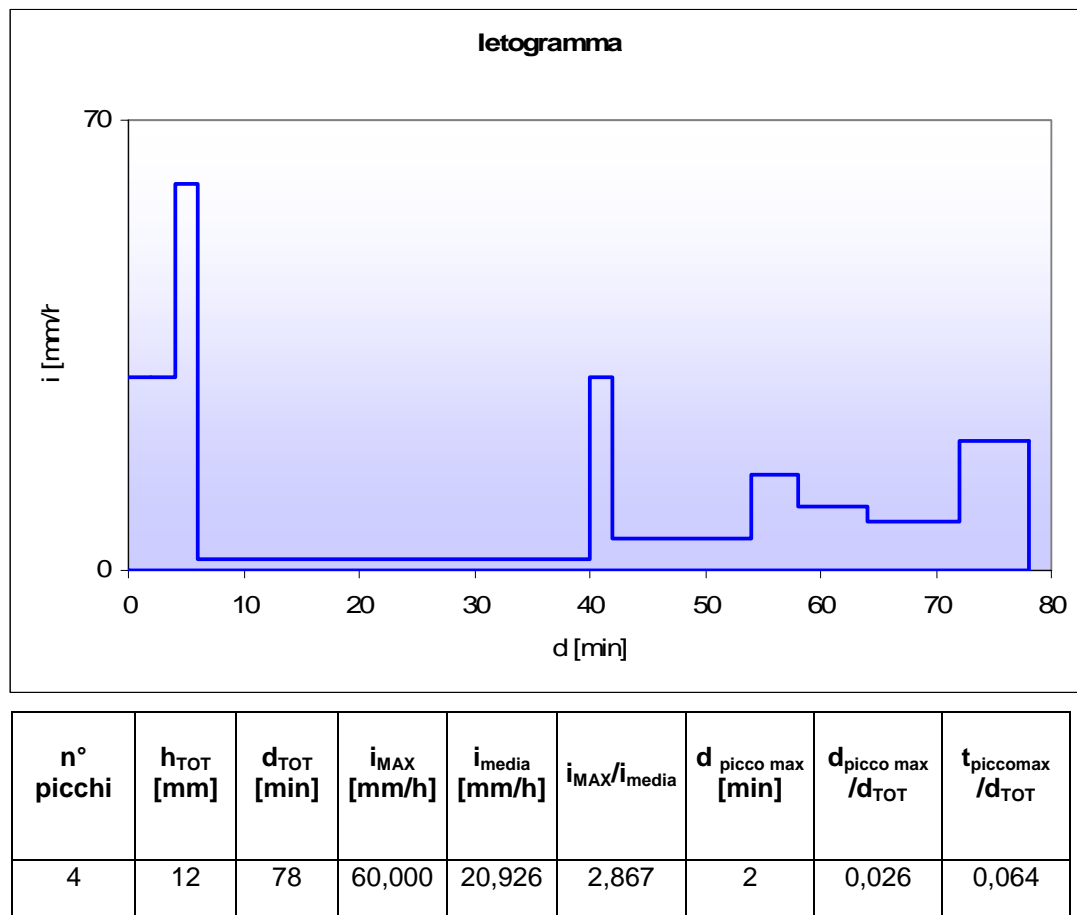
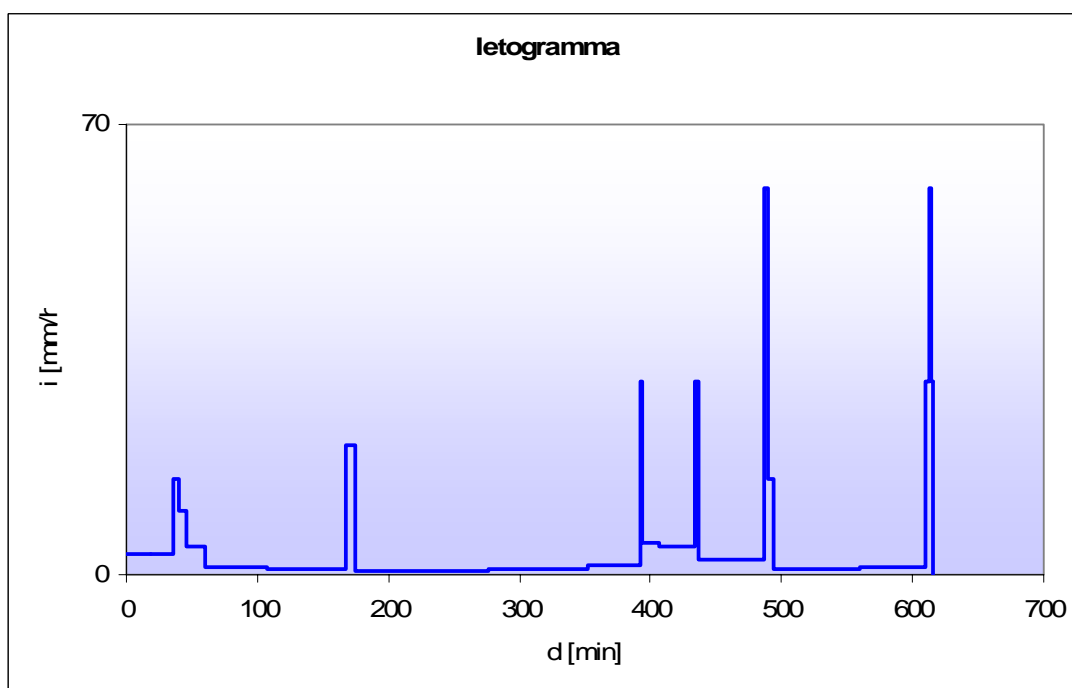
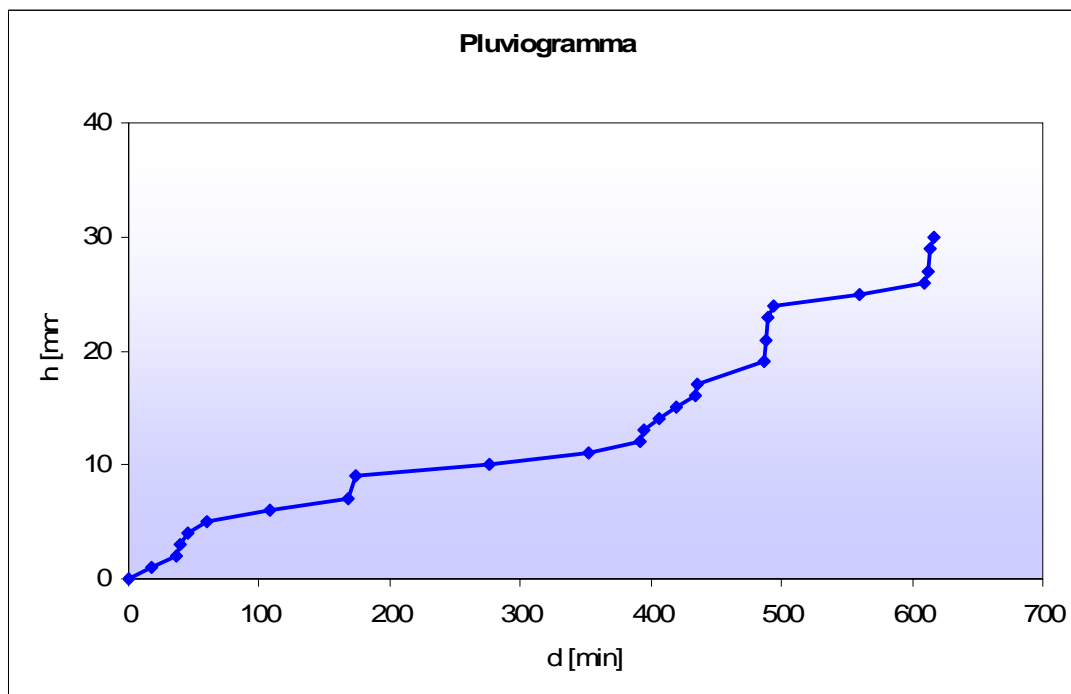


Figure 3 – Pluviogramma, ietogramma and shower parameters: 17.09.2006



**Case C**  
**12.11.2006 shower**



n° picchi	$h_{TOT}$ [mm]	$d_{TOT}$ [min]	$i_{MAX}$ [mm/h]	$i_{media}$ [mm/h]	$i_{MAX}/i_{media}$	$d_{picco\ max}$ [min]	$d_{picco\ max}/d_{TOT}$	$t_{piccomax}/d_{TOT}$
6	30	616	60,000	15,766	3,806	2	0,003	0,995

Figure 4 – Pluviogramma, ietogramma and shower parameters: 12.11.2006

## 6. Conclusions

In the first analysis have been considered rain events of the whole registration period through the tracking of a daily pluviogramma, have occurred totally 2425 mm of rain.

Identified rain events, successively has been searched the showers for the analysis. This phase has been done, with a preliminary work performed with the returned data from the station. It has been necessary to fill any periods in which data were missing with the zeros. This operation has been necessary to know, precisely, the date and time corresponding to each height value of the rain, from a predetermined starting point that, in the following case, is represented by 10:20 on 09 March 2006.

For the minimum duration of a dry interval between two consecutive bursts it has been considered three cases:

Case A with  $idm = 15$ , ie, with a dry interval of 30 minutes;

Case B with  $idm = 30$ , ie, with a dry interval of 60 minutes;

Case C with  $idm = 90$ , ie, with an interval of 180 minutes dry.

For the case A are present 706 showers, but from this quantity must be eliminate 443, which are preceded by showers or a hole. They do not to allow the knowledge of how the rain falls, or, the showers having duration less or equal of the data scan time acquisition that produce 1 mm of rain in two minutes: have been analyzed 263 showers.

For the case B are present 540 showers, but from this quantity must be eliminate 292, which are preceded by showers or a hole. They do not to allow the knowledge of how the rain falls, or, the showers having duration less or equal of the data scan time acquisition that produce 1 mm of rain in two minutes: have been analyzed 248 showers.

They are either the showers that are unchanged compared to the previous case, both those arising from the sum of several showers, first, separate from one another. The cause of this union is the increase the dry between consecutive showers.

For the case C are present 351 showers, but from this quantity must be eliminate 136, which are preceded by showers or a hole. They do not to allow the knowledge of how the rain falls, or, the showers having duration less or equal of the data scan time acquisition that produce 1 mm of rain in two minutes: have been analyzed 215 showers.

They are either the showers that are unchanged compared to the previous case, both those arising from the sum of several showers, first, separate from one another. The cause of this union is the increase the dry between consecutive showers.

For the case A, the values of the parameters of the 263 showers allow to make two observations:

1) from examination of the assumed values by the ratio between the intensity of the maximum peak and the average intensity of the same shower. It is possible to observe that in three circumstances (22.03.06, 19.03.07 and 03.05.07) the intensity has occurred more of 4 times of the one average. In 80% of cases, this ratio varies between 1.00 and 2.00, the examination of the assumed values by the ratio between the maximum peak duration and the total duration of the shower. The 78% of the precipitations, object of study, have of the maximum peak duration less than 20% of the total duration. In 18 cases the peak lasts for the half or more of the shower;

2) from examination of the assumed values by the last parameter taken into consideration. The ratio represents the position of the maximum peak intensity of rain respect to the total duration of each shower. It has been observed that 62% of the precipitation, object of study, had the maximum intensity at rain beginning, precisely less than or equal to 25% of the total length, while only 8% of the showers had the highest intensity at the end of rain, greater than or equal to 90% of the total duration.

For the case B, the values of the parameters of the 248 showers allow to make two observations:

1) from an examination of the assumed values by the ratio between the intensity of the maximum peak and the average intensity of the same shower. It is possible to observe that in 8 circumstances the assumed density is more than 4 times of the average intensity. In two circumstances the density is more 5 times of the average and in one case is more than 7 times (16.01.2008). In 70% of cases, this ratio varies between 1.00

and 2.00. The examination of assumed values by the ratio between the maximum peak duration and the total duration of each shower, shows that 82% of the precipitations, object of study, have a duration of the maximum peak less than 20% of the total duration. In 16 cases the peak lasts for the half or more of the shower;

2) from an examination of the assumed values by the last parameter taken into consideration. The ratio represents the position of the maximum peak intensity of rain respect to the total duration of each shower. It has been observed that 60% of the precipitation, object of study, had the maximum intensity at rain beginning, precisely less than or equal to 25% of the total length. Only 9% of the showers had the highest intensity at the end of rain, greater than or equal to 90% of the total duration.

For the case C, the values of parameters for 215 showers allow to make two fundamental observations:

1) from an examination of the assumed values by the ratio between the intensity of the maximum peak and the average intensity of the same shower can be seen that the intensity in 11 observations occurred is more than 4 times the average, in 3 circumstances more than 5 times, in 2 over 7 and 1 more than 9 times (27 January 2009). In 54% cases this ratio oscillates between 1.00 and 2.00. The examination of the assumed values by the ratio between the maximum peak duration and the total duration of each shower, shows that 85% of the precipitation, object of study, the duration of the maximum peak is less than 20% of the total duration, while in 8 cases the peak lasts for half or more of the shower;

2) from the examination of the assumed values by the last parameter taken into consideration, the ratio indicating the position of the maximum peak intensity of rain with respect to the total duration of each shower. The 56% of the precipitation, object of study, had the maximum intensity at rain beginning, namely less than or equal to 25% of the total duration. Only 15% of showers has had the highest intensity at the end of rain, specifically greater than or equal to 90% of the total duration.

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## Amman's Land Typology: The Importance of Site Characteristics on the Delivery of Sustainable Buildings

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### Abstract

Amman's land typology is characterized by hilly slopes, and this presents challenges and opportunities for architects and designers aiming at delivering sustainable buildings. The research focuses on the importance of any site's given criteria; mainly its slope and topography on the delivery of sustainable buildings.

Amman city consists broadly of two main types of buildings; apartment buildings and villas, by studying each type of building with regard to its environmental context on a given site in the city; the research seeks to identify the sustainable variables that site topography delimit or facilitate, using a set of attributes for each building type.

The main objective of this research is to highlight the sustainable approach for building on sloped sites throughout the building project life-cycle in general, and to set a sustainability framework for designers during the initial design phase in particular. A number of case studies for both types of buildings are studied and analysed, and conclusions are given based on syntheses of available data from literature review or case analysis.

At the end, the research provides a mechanism for the development of guidelines for sustainable and passive viability on preferred buildings orientation in hilly areas with regard to local climatic data..

**Keywords:** Sustainable Building, Topography, Slopped Sites, Sustainable Design Guidelines.

### 1. Introduction

Sustainable development issues and environmental concerns continue to gain interest as demand within Jordan's residential construction industry escalates. Current construction practices adhere to traditional methods of construction, with inherent weaknesses such as high labour costs, negative environmental impact during and after construction, and minimal technological advancement.

Sustainability in buildings and urban design is a regional issue, and quite specifically site- related. In this regards, Amman is a city characterised by its hilly topography. The slopes represent challenging constraints for designers, especially when considering sustainable building measures. Therefore, to construct and maintain a sustainable building is to choose the suitable site and to allocate the building

to site correctly. Design decisions in the initial phase would affect the building layout, and eliminate negative impacts associated with negative construction practices.

This research deals with designing and building residential buildings in Amman, the capital of Jordan, with emphasis on two types of building, the apartment building and the villa. The research seeks to outline a framework designing residential buildings, especially, villas and apartment buildings, for designers in the early stage of the design process on the best layout, orientation, and functional layout on sloping sites in Amman city.

### **1.1 What is Sustainability**

Oxford Dictionary defines sustainability as the ability “to be maintained at a certain rate or level: sustainable economic growth or conserving an ecological balance by avoiding depletion of natural resources: our fundamental commitment to sustainable development”

The most common definition comes from „Our Common Future“, also known as the Brundtland Report: „Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs“ [1]. This definition contains three key ideas: development, needs, and future generations. According to Blowers (1993); development should not be confused with growth. Growth is a physical or quantitative expansion of the economic system, while development is a qualitative concept: it is concerned with cultural, social and economic progress. The term „needs“ introduces the ideas of distribution of resources: „meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life“[1]. Moughtin (2005) thinks that the pursuit of a sustainable future for the human race will require the design of effective policies and programmes which directly address the related problems of unsustainable activities and environmental degradation. Any sustainable development at the building and neighbourhood level should ensure that the needs of the current users are met without compromising resources or the quality of built environment on the long term.

### **1.2 Sustainability in Buildings**

Buildings account for 40% of global warming emissions [2]. Sustainable building management has received much attention in recent years. Many communities throughout the world are struggling to develop efficient and effective tools for assessing sustainable buildings. However, there is no universal method or tool yet. Sustainable buildings are at the core of any sustainable development, for the sustainable building, the objectives of decreasing both adverse environmental impact and cost are in conflict. In addition, even though both objectives may be satisfied, building management systems may present other problems such as convenience of occupants, flexibility of building, or technical maintenance, which are difficult to quantify as exact assessment data.

In Jordan, sustainability is a new concept still, and many of the very few aiming-to-be sustainable buildings are not quite mature yet. With the first building to gain a LEED silver certification in 2010, figure 1, Jordan is still long way away from developing a strategy for sustainable building industry.



Fig. 1: Dutch Embassy Building- First Green Building in Amman- Jordan with LEED Silver Certificate (www.archined.nl, 2012) .

### 1.3 How is Sustainability Measured

To some, sustainability is a matter of numbers, scores and graphs. The ESI clearly probate that we live in an era of numbers. In many realms, decision making has become increasingly data-driven. But the environmental domain has curiously lagged in this regard [3].

On the large scale, there's the ESI, see figure 2. The 2005 Environmental Sustainability Index (ESI) provides a composite profile of national environmental stewardship based on a compilation of 21 indicators that derive from 76 underlying data sets. The ESI offers a tool for shifting pollution control and natural resource management onto firmer analytic underpinnings. In this regard, the heart of the ESI is not the rankings but rather the underlying indicators and variables. By facilitating comparative analysis across national jurisdictions, these metrics provide a mechanism for making environmental management more quantitative, empirically grounded, and systematic [4].

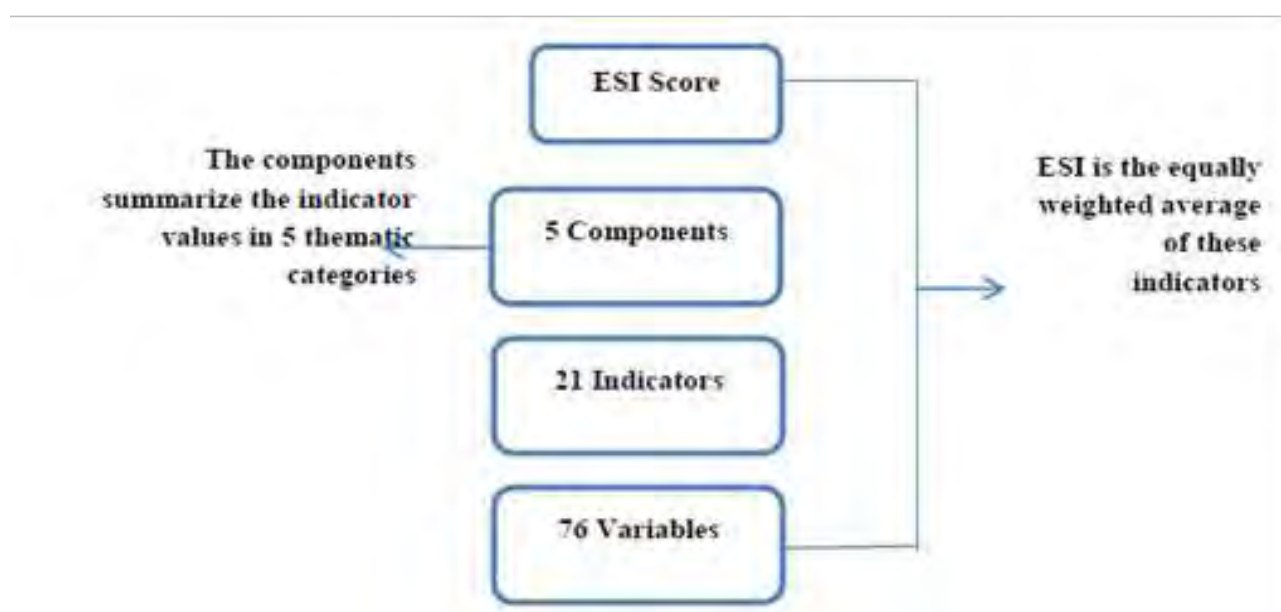


Fig. 2: Constructing the ESI Score [4].

The higher a country's ESI score, the better positioned it is to maintain favourable environmental conditions into the future. The five highest-ranking countries are Finland, Norway, Uruguay, Sweden, and Iceland – all countries that have substantial natural resource endowments and low population density.

Table 1 shows Jordan's position on the 2005 (ESI) world score. Almost two points lower than world median and behind leading countries like Finland. Jordan is a world standard performing country when it comes to energy resources and impacts on the environment. As a developing country, large part of its residential building activity contributes to the country's overall performance on the ESI scale.

ESI Rank	Country Name	ESI Score
<b>1</b>	<b>Finland</b>	<b>75.1</b>
<b>45</b>	<b>United States</b>	<b>52.9</b>
<b>55</b>	<b>Tunisia</b>	<b>51.8</b>
<b>65</b>	<b>United Kingdom</b>	<b>50.2</b>
<b>75</b>	<b>Indonesia</b>	<b>48.8</b>
<b>83</b>	<b>Oman</b>	<b>47.9</b>
<b><u>84</u></b>	<b><u>Jordan</u></b>	<b><u>47.8</u></b>
<b>136</b>	<b>Saudi Arabia</b>	<b>37.8</b>
<b>World MEDIAN</b>	<b>-</b>	<b>49.7</b>

Table 1: Jordan on the (2005) ESI World Score [5].



### 1.3.1 How is Sustainability Measured in Buildings

There are many tools developed in the field of the performance assessment of the buildings sustainability. Starting from the 90s, many different evaluation systems and tools of environmental performance assessment for buildings have been developed, as BREEAM in the United Kingdom, LEED in the United States (prompted by the US Green Building Council, Energy rating in Denmark, ECOPROFILE in Norway, ECOEFFECT in Sweden, ESCALE in France, TOTAL QUALITY in Austria and the DGNB procedures in Germany [6]. These tools are applied for different purposes like combining the energy problems with economic and social concerns; enhancing relationships with urban plans; applying the appraisal procedures in the different stages of the building life-cycle; including the urban context and site features in the evaluation and involving different stakeholders and shareholders (as designers, evaluators, users, investors and researchers) in the evaluation process while promoting the performance approach.

### 1.4 Sustainability in the Arab World

The Arab world is faced with many urban challenges; in “The Revolving Arab City”, [7] suggests that regional policies (pan-Arab unity) and social security are not a priority anymore. Rather, the private management of public property is becoming more prominent. The creation of private development companies backed by banks or hedge funds, like Al-Abdali in Amman, figure 3, Solidere in Beirut, Saphia and Bou Regreg in Rabat, Tunis” Lake are examples of the new globalised spaces that aims to provide high returns on investments for firms like Sama Dubai, Emaar, Saudi Oger and other national developers (Mawared in Jordan and Caisse de Depot et de Gestion in Morocco) [8].



Fig. 3: Al-Abdali represents a new vision of High-rise development in Amman ([www.abdali.jo](http://www.abdali.jo), 2012).

Arab cities demonstrate multiple layers of development through history. Over long periods of development, land uses have been adapted to suit inhabitants. Conventional urban configurations were based on densities, mixed uses and bottom-up urban growth, reflecting people's daily needs. Modern Arab cities demand an accelerating increase in transportation mobility pursuant to inappropriate land use distribution. These requirements do not consider the current spatial morphology of the urban fabric, nor its role as a stimulus in successful locations. The differences between traditional and modern extensions for Arab city centres on the basis of sustainable land use location

should be re-assessed to evaluate current land use distribution and forecast the success of any future intervention.

The traditional methods of sustainable buildings in traditional Arabic context were mainly focused on techniques that enhanced indoor quality in hot and arid climates. Hassan Fathy was a pioneer in incorporating traditional methods of building into rural areas of Egypt. However, these traditional methods do not solve today's problems for buildings. Many modern day architects have used successful symbolic precedents in modern architecture by means that convey nostalgic reference rather than careful study of these symbols as effective sustainable solutions. The works of Rasem Badran and Abdelwahed Al-Wakeel bear witness to such attempts.

The Arab region geographical typology varies extensively from east to west, and so is the building technology used in every region. In Jordan a variety of geographical typology is also present, and that also adds to variety of building techniques.

### 1.5 Sustainability in Jordan

The scientific community expects that the world will start to face critical shortages in its supply of fossil fuel in the near future, with the expectation for most oil resources to vanish within the next 50 years [9]. During the past decade, and as a result of the significant increase in the population in Jordan, multi-apartment buildings became the most dominant building format, especially in Amman the capital. The lack of well-developed passive heating, cooling and energy saving solutions, made the reliance on central heating in winter and air conditioners in summer the prominent choice for residents [10]. Jordan is a developing non-oil producing country. Jordan imports 95% of its energy from neighbouring countries. In general, large cities in Jordan are comprised of multi apartment buildings, usually about four storeys high. Energy consumption for residential purposes accounted for 18% of the total consumed energy in 1999. By 2009, energy consumption for the residential sector jumped to 30% [11], and is projected to increase if energy saving techniques are not implemented.

#### 1.5.1 The City of Amman

Amman, the capital of Jordan, is experiencing a significant urban and economic growth. The fast increase in population and the growing economic demand for business growth have increased the need for comprehensive planning agendas, see table 2.

Census	1994	2004	Increasing %
Buildings	504,000	636,000	26.2
Housing Units	832,000	1204,000	44.7
Households	672,000	946,000	40.8
Persons	4,139,000	5,323,000	28.6

Table 2: Population and Housing Census in Jordan in 1994 and 2004 [5].

Amman as a city has developed 8000 years ago, due to its suitable climate and availability of water. In the year 1200 B.C it became the Ammonite's capital, and ever since then it has been in the central attention of many civilizations, until the time it became the capital of Trans-Jordan in 1921 [12]. Amman now is a city of nearly 2 million inhabitants, see table 3 - it is becoming a mega-polis. With the city aspiring to grow and advance - in a world of many environmental concerns like climate change and sustainability - the challenges facing city planners, architects, designers and decision makers are overwhelming. Globally, urban population have increased much faster than rural populations [13]. The ecological footprint of a city can be many times larger than its physical size. Urbanised areas cover 2% of the earth's land surface, but account for 78% of carbon emissions. Similarly 60% of water use and 76% of wood used industrial purposed occur within urban areas [14].



Governorate	1994				2004			
	No. of Buildings	No. of Housing Units	No. of Households	No. of Persons	No. of Buildings	No. of Housing Units	No. of Households	No. of Persons
Amman	144491	337071	271604	1576238	182961	498085	382674	1939405
JORDAN	503894	831799	672472	4139458	636088	1204398	945806	5100981
Amman's Percentage	29%	41%	40%	38%	29%	41%	40%	38%

Table 3: Population and Housing Census in the City of Amman Compared to the Total in Jordan [5].

### 1.5.2 Residential Buildings Types in Amman

Amman's typology is defined by hilly slopes; the topography of the city consists of a series of steep hills and deep and sometimes narrow valleys. Most of the districts of Amman take their names from the hills or jabals on which they are situated, figure 4. Whilst initial development was principally on the upper slopes and crests and the lower slopes of this hill-valley system, the upsurge in urban development over the last sixty years has involved extensive development on the frequently steeper mid-slope locations.



Fig. 4: View of the Old City – Jabal Amman Hill.

The original site of the city of Amman occupied seven hills or „jabals“ around the Wadi „Ras el Ain“ which flows north-east from the plateau towards the River Zarqa basin. The original central part of the city was at an altitude of between 725 and 800 meters, figure 5.

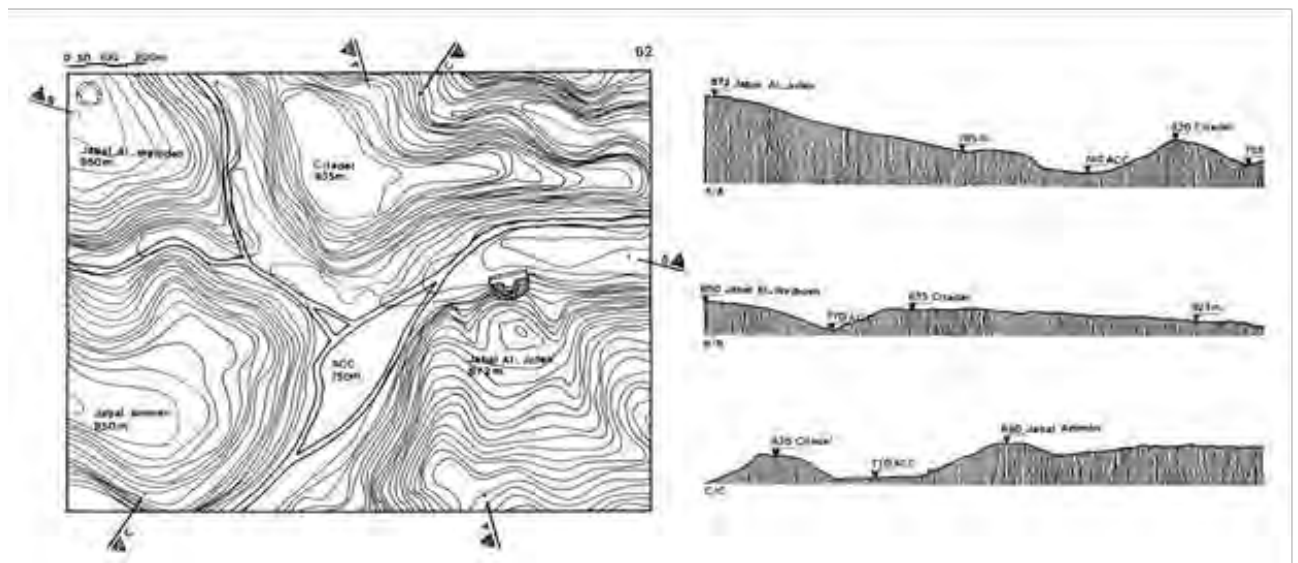


Fig. 5: Topography of Amman City Centre (ACC) and surrounding hills or Jabals [15].

Expansion of the city in the past twenty-five years has resulted in the occupation of some nineteen hills in total with an altitudinal extension to above 875 meters. Given all information about Amman typology and geography, it is inevitable that builders and designers in Amman are faced with many challenges. Sustainable building design places significance importance on site, and the relation between building and site that best serves aesthetic, climatic and economical sustainability values. In Amman, construction practices that adhere to traditional methods are obsolete when it comes to serving environmental issues. They are mainly based on wrong design choices at the beginning of the design process. They are also neglecting building orientation and functional layout that contribute to effective passive design.

#### 1.5.2.1 Apartment Buildings

Up to the 1970s, it was very common for people in Amman to build freestanding, one-story, single-family houses. Such houses most often would later be expanded vertically to reach two or three stories. The owner of the house would build these additions for the use of his or her children (usually sons) for when they grow up and have their own families, or to rent out as a source of additional income.

During the late-1970s, the apartment building emerged as a more prominent residential building type in Amman. By the 1990s it became the predominant building type. In fact, of the 2.18 million square meters of construction permits granted in Jordan during the first four months of this year, 1.8 million square meters were for apartment buildings [16].

The impact of the spread of the apartment building has been tremendous on Amman. It definitely has raised the density of habitation in the city, figure 6.



Fig. 6: Computer Visualization of an Apartment Building in Amman.

The typical four-story apartment building, which usually includes two apartments on each floor, will have about eight families inhabiting it. Of course, there are the more luxurious apartment buildings with one apartment per floor, but there also are apartment buildings that have additional living units because of their location on a sloping site. Many apartment occupants, especially in western Amman, have cars, and the construction of each additional apartment building puts further pressure on the movement of traffic in adjacent streets and on the availability of parking spaces. Also important is that with the exception of ground floor apartments, the inhabitants of apartment buildings do not have access to gardens. At the same time, apartment buildings in Amman are too small to support communal open recreational spaces. The problem is exasperated by the fact that Amman still suffers from a shortage of public neighbourhood parks, see figure 7.





Fig. 7: Apartment Buildings Occupying a Hill in a North Ammani Neighbourhood.

#### **1.5.2.2 Villas**

Villas represent the high-end single family dwelling option for buildings in Amman, especially in its western part; they usually comprise one or two floors, figure 8.



Fig. 8: A Modern Villa in Western Amman.

### 1.6 Sustainable Design Criteria

Site selection and building orientation come at top priorities in any sustainability assessment tool. Therefore, the site typology - especially its slope and natural topography is of great importance to the sustainable design decision. If a site is flat, the topography may not influence the location and layout of the building, but on a sloping site, the topography is likely to be a significant design factor. The slope of a site or the slope of adjacent sites may affect access to sun and views; the need for excavation or fill – as well as increasing costs [17]. Large-scale earthworks increase the risk of erosion by altering soil stability and water run-off patterns, and significantly affect natural biodiversity by removing soils and plants.

The significance criteria lie in the fact that when designing in Amman, designers cannot overlook the typology of its most vacant sites. The hilly slopes of Amman are challenging sustainable design by delimiting passive cooling and heating for buildings if the building is not correctly placed on site [18]. Construction works that are contributing to negative environmental impact can be minimized if more site consideration was done during the initial design phase, and the building layout, orientation, etc. was based on more sustainable decisions.

Design should foresee that during construction the amount of site work and disruption is at minimum, the visual impact of the building form on the landscape is not disturbing and the orientation of the building is optimizing the passive heating and cooling of the building [19]. Non-sustainable current construction practices in Amman have visual and cost-related negative impacts on the environment, see figure 9. The excessive use of retaining walls to solve severe slope cuts is very common, see figure 10- a practice rendered sustainably nonviable, besides its failure with regards to visual and aesthetic aspects.





Fig. 9: Current Practices of Building on Slopes in a North Ammani Neighbourhood.

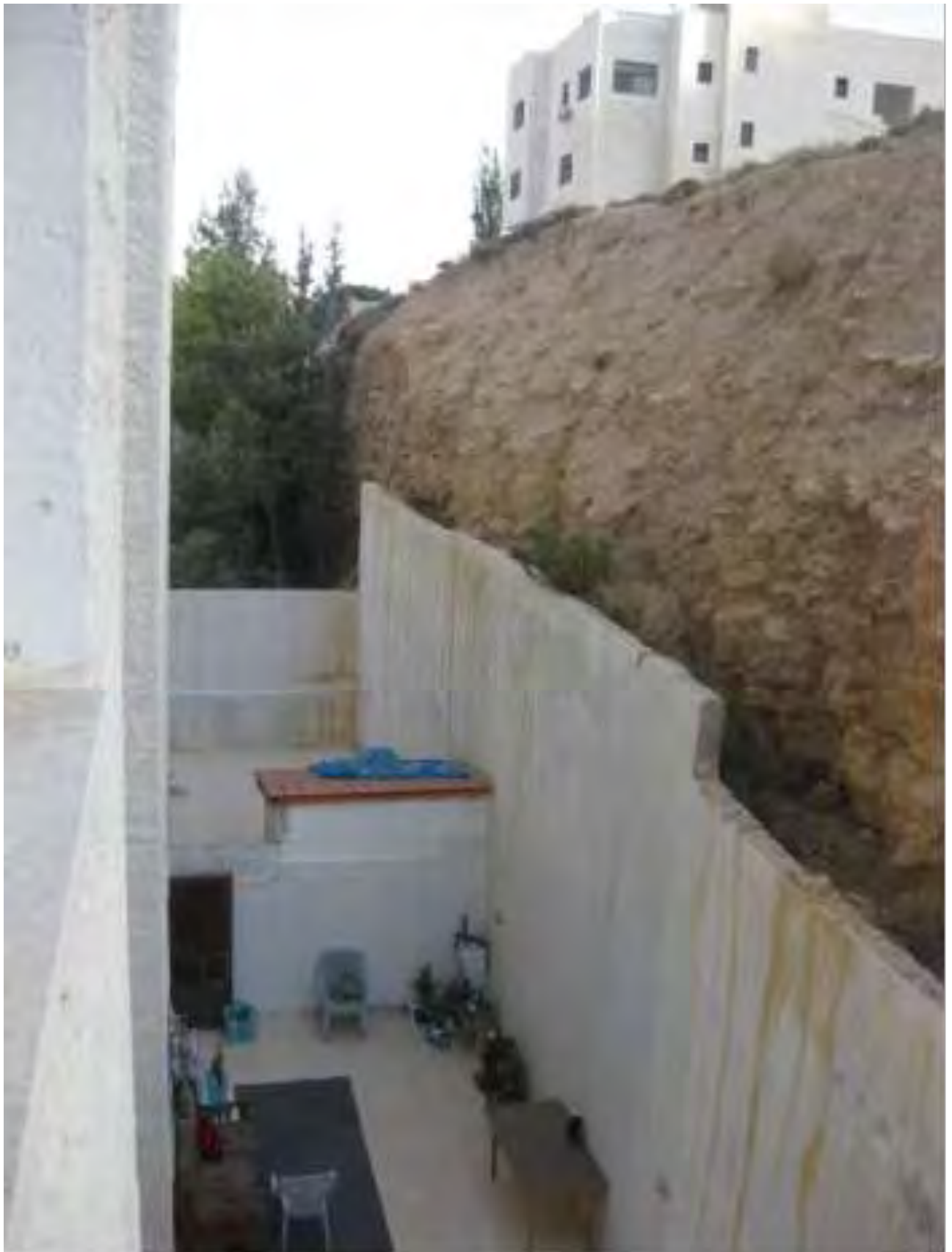


Fig. 10: Retaining Walls on Severely Cut Slopes.

## 1.7 Conclusions

The paper addressed several issues, and these issues are:

Analysed the challenges and opportunities provided by land topography in Amman and its effect on delivering sustainable buildings.

Provided recommendations about how the outcome of this research can help planners and designers in the early stages of the design process to have an insight into best strategies for passive housing layouts on sloped sites.

Provided a mechanism for the development of guidelines on preferred buildings orientation in hilly areas with regard to local climatic data.

Outlined major disparities between the two main residential building types in Amman, the Apartment Building and the Villa, and the best design guidelines for sustainable and passive viability on sloped sites.

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## Minhocao Multiples Interpretations

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### Abstract

The paper discusses the 'top down' planning approach used nowadays on urban redevelopment projects in São Paulo versus spontaneous manifestations regarding the meanings of the space of the city, using the new Urban Operation Lapa-Bras brief document and Minhocão's demolition plan as a case study. Minhocao is an elevated express avenue that crosses the center of the city dividing districts and neighbourhoods, causing a huge impact on the landscape. However, unexpectedly, it also has a different meanings and interpretations – apart from being an equipment of road infrastructure– for the different groups that lives in its surrounding areas. For them the space is seeing as a park, an art gallery, a market and many other functions, as it is spontaneously appropriated in different ways during the moments of the day and night when it is closed for cars.

The paper debates different meanings from different stakeholders involved in the project for the area. Its shows how do the surrounding inhabitants live and relate to this specific space of the city, apart from the planners point of view, and, most important, how do they transform it, from a heavy and aggressive piece of urban infrastructure to a public space, an important social infrastructure that is part of their daily life.

Minhocao is, in one hand, from a 'top down' perspective, a terrible loss of value for the land and building owners and a damaging and replaceable urban infrastructure for the planners. Meanwhile, for others, from a 'bottom up' point of view, it can also be considered as a social infrastructure for the inhabitants of its surroundings that, due to its appropriation, claim the space as their "place".

A "non-place" (Auge, 1995) or generic space for some, a part of their "piece" (Magnani, 1996) for others. These are the multiple interpretations that Minhocao has and this paper aims to discuss.

**Keywords:** *Urban Development, Infrastructure, Public Space, Sao Paulo.*



## 1. Introduction.

During the late 60's and along the 70's, a period of important economical and geographical growth in São Paulo, a decade in which the city's number of inhabitants grew 56% , strategic planning was used for the first time in a cohesive way, to organize the city's expansion.

One of São Paulo's master plan was being discussed and a number of road interventions took place in order to control the chaotic congestions that started to appear, due to lack investments on public transport, increasing incentives for private transport – in order to promote the car industry, back then the main economic driving force of the region on the 50's, 60's and the 70's - and an uncontrolled urban sprawl, causing an expansion of the urbanized area not predicted and never foreseen.

One of these interventions is the objective of this analysis. Commonly known as Minhocão , it is an elevated express way that passes thru the center, responsible for improving the car connection between the west and east part of the city.

It was part of a series of interventions at the center that did not aim to improve its urban space, only establish connections between the city's different zones, using the central region as a crossing point, without any mechanism that could attract people or economical activities to the area. In this process, a fragmented and disjointed region was left behind, with very few private or public investments with the aim to enhance its urban environment.

Within this context, Minhocão is one of the most discussed interventions of the period. It is a 3,5 kilometres, 4 track express elevated avenue that crosses 3 central and highly 'verticalized' neighbourhoods of São Paulo. Constructed passing over existing avenues, in which high rise buildings were already placed without any retreat, it passes only 5 meters distant from some of the facades. Due to its size and profound impact on the urban landscape, it calls the attention of the public ever since its construction in 1970, during the military dictatorship.

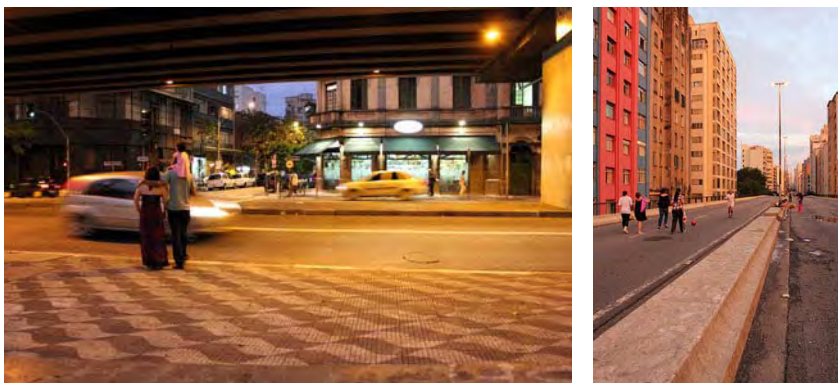


Fig. 1,2: Minhocão views from below and above. Images from the author.

In its 40 years, several proposals were made in order to minimize its negative impact on the surrounding area, and since the 80's, after Peter Hall has chosen it as one the "positive great planning disasters" , its demolition it has been discussed.

In 2006, the municipality and its urban development agency EMURB, announced a plan to bulldozer the elevated express way. A range of discussions took place, many of the main actors involved were listened to – except the population that lives on the surrounding area – and a competition was launched by the municipality to generate design proposals, in order to envision different solutions for the area.

The designers could propose anything, as long as the structure was not thrown apart or completely disassembled, neither the use as a car connection should be disregarded. The brief of the competition was questioned by the participants, the actors and the Brazilian Architects Institute (IAB), that ceased supporting it, causing many architects to cancel their application. Nevertheless the competition continued.

The final design proposal, through an extensive analysis of the region and the daily life of the surrounding neighbourhoods, took advantage of the 'informal' uses and people's spontaneous social, economic and artistic appropriations of the site, making them the starting point of the design process.

This detailed and considerate look showed that Minhocão, apart from being a road, has another very important function. Since 1976 it is open only from Monday to Saturday, from 6h00 am to 10h00 pm, in order to minimize the noise effects on the adjacent buildings. This resolution, however, brought an unexpected use for this unpleasant urban infrastructure, that could not be disregarded. The lack of an adequate public space in these neighbourhoods triggers a surprising appropriation of its four tracks during the night and weekends. As soon as the tracks are closed for cars, they become available for the surrounding building's residents.

### 1.1 Minhocão's informal uses

**Artistic Interventions:** Both the spaces above and below the elevated are used by street artists, putting up temporary installations (as seeing in the two first images) and graffiti panels.



Fig. 3,4: Artistic Interventions on Minhocao. Images from the author.

**Economical activities:** Street sellers often occupy the space on the weekends, taking advantage of the floating population. Bike rent and fix “shops”, foods and drinks tents, along with arts and crafts tends are the most common informal economical activities during the weekends.

**Public events:** A range of public events take place at the site. An open movie session, a path of a street race and a runway fashion show are some of the events that it hosted in the last few years.

**Linear Park**

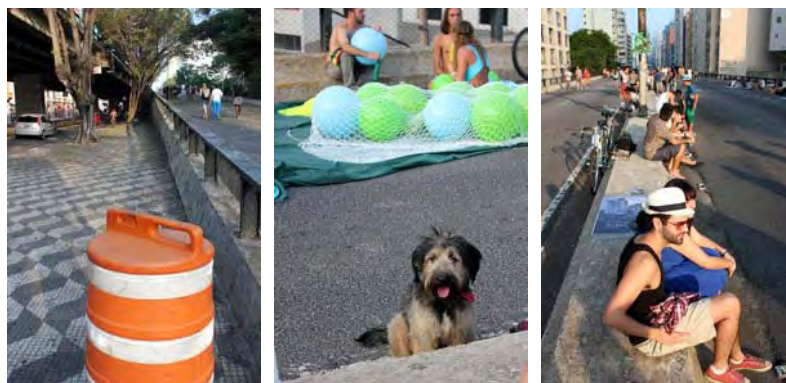


Fig 5,6: Minhocao as a Linear Park. Images from the author.



Fig 7,8: Minhocao hosting Baixo Centro Festival. Images from the author.

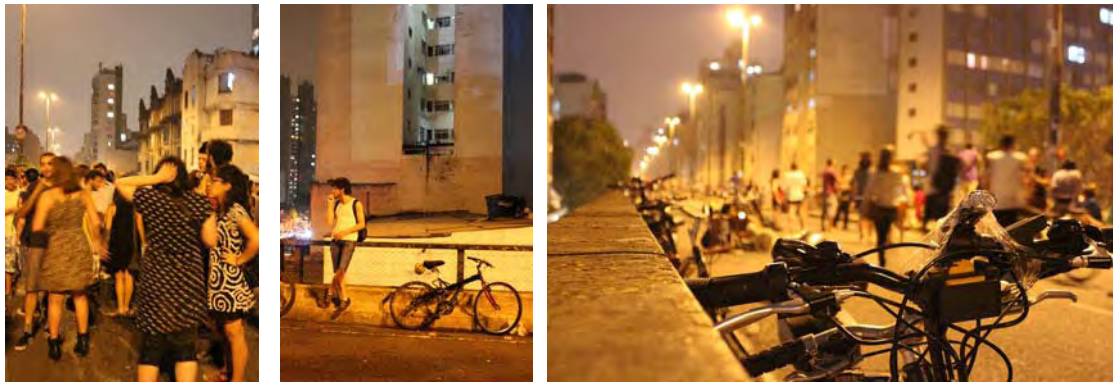


Fig 9,10,11: Minhocao hosting Vodoowoop party. Images from the author.

Taking advantage of these informal uses, the proposal kept the elevated tracks and covered them. The space above was turned into a linear park open every day for the population. On the spots that Minhocão faces existing squares and open spaces, glass-made extensions were put, functioning as the entrances of the park (through lifts and stairs), as well as art galleries and popular shops for the users.  
Final Design Proposal by Frentes Arquitetura - Sections:

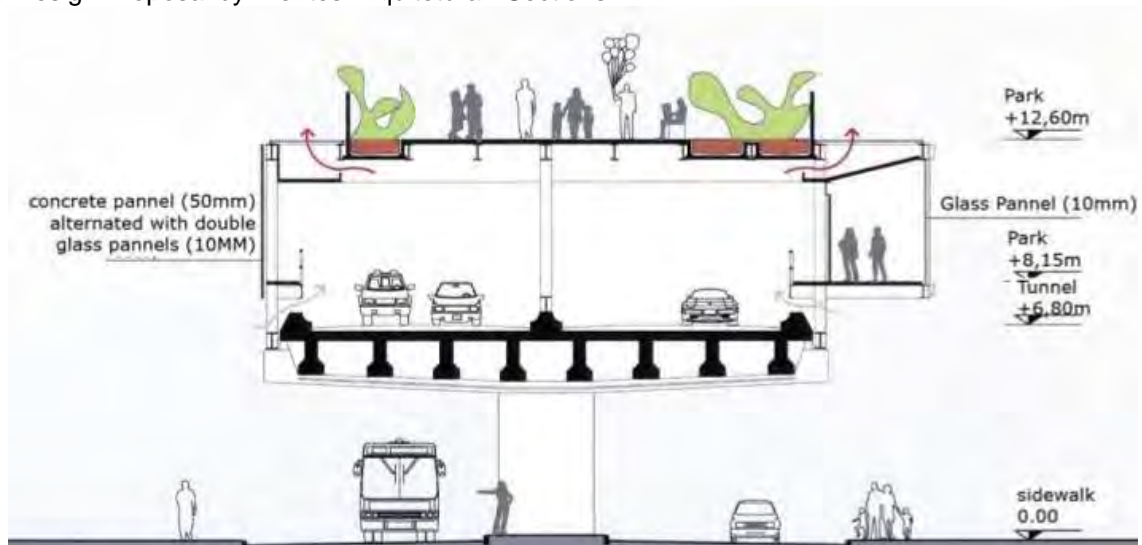


Fig. 12: Generic Section of the project, showing the tunnel with a gallery on one side. Source: Frentes Arquitetura.



Along the 3,5km of the park the section adapts itself, according to its urban insertion, the height and occupation of the surrounding buildings.



Fig. 13: Photomontage of the project. Source: Frentes Arquitetura.

The design also won the first prize of the 7<sup>a</sup> International Architecture Bienal of São Paulo in 2007, and was shown in the 10th Venice Biennale of 2006.

Time passed by, the municipal administration changed – from a right wing party to a centre-left party – but maintained its neoliberal orientation. Now, the master plan is being revisited and some special areas are being stimulated, in order to organize the spatial development of the city, with the aim of increase density in the sectors and districts that already have urban infrastructure, generating new dwellings and job opportunities.

Part of this process, the brief for a new plan of redevelopment was launched on May of 2010, containing an adjacent neighbourhood of the elevated highway. The plan consists on creating a new road and a linear park along the existing rail line, as a way of increase its density and stimulate real estate development of the area. This way, once the new road system is finished, there will be no need for the elevated express way as a car connection between the west and east zones. Therefore the plan suggests to destroy it, at the estimated expense of R\$80 million (approximately 35,5 million euros).

This paper intends to discuss, crossing the different interpretations of this place, if this demolition is really necessary as part of the new redevelopment plan and if all Minhocão's functions (formal and informal) are being taken under consideration.

It is, in one hand, from a 'top down' perspective, a terrible loss of value for the land and building owners and a damaging and replaceable urban infrastructure for the planners. Although, for others it has different meanings. From a 'bottom up' point of view, it can also be considered as an opportunity to some less wealthy inhabitants to live in a gifted area of the city and a social infrastructure for the inhabitants of its surroundings that, due to its appropriation, claim the space as their "place".

A "non-place" (AUGE, 1995) or generic space for some, a part of their "piece" (MAGNANI, 1996) for others. These are the Minhocão's multiple interpretations.

## 2. Top down: The owners and planners point of view.

Minhocão is often seen as a negative urban externality. Considered as a necessary infrastructure to avoid urban chaos when it was conceived, it immediately caused evasion of the middle class, until then predominant, of its surrounding blocks, due to its degrading factors (noise, pollution, visual barrier, among other). The process itself induced a downfall of rent prices, which eventually caused major property devaluation. Many of the buildings remained empty for some years, until the market value was balanced, at a

point when many owners had put their properties “on sale”, allowing people from different social backgrounds to rent and buy apartments, beginning to live in the area.

Since its proximity to the center, to Paulista Avenue and to several wealthier – but saturated – neighbourhoods, the area still has the potential to become attracting again to the private investors, but Minhocão has always been ‘standing in the way’.

Now, with the real estate market acting frenetically all around the city, in some cases developing housing and office buildings in areas that are not as well provided with urban infrastructure as this, the site called again the attention of the planners.

The current master plan of the city was approved by the city council in 2002 and it specifies several areas to be improved and stimulated – redeveloped – by public and private investments, through the offer of differentiated parameters of construction.

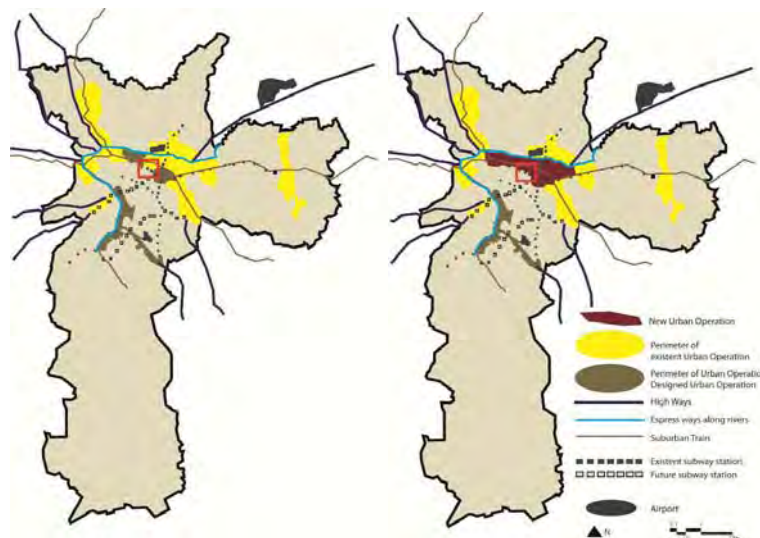


Fig. 14, 15: Urban operations and New Urban Operation. Maps from the author. Source: EMURB.

These areas share a lot in common: they are relatively well located in within the city, are close to existent urban infrastructure and have a history of being occupied mainly by industrial facilities, an economic sector that is decreasing its importance inside the city since the 80's, in a process similar to the European and North American experiences, but with a slower rhythm.

In a system of public auctions, an amount of extra squares meters are offered to real estate developers and land owners, in order to increase density and collect private money, applied latter in urban renewal and infrastructure enhancement and construction. It is supposed to be, according to the city planners, a virtuous cycle:

“(generates) more investments, increasing value, increased value attracts private investments, more private investments generates more resources and more public investments in that region of the city” .

Ten Urban Operations were established by the plan of 2002 and until today, only four were developed. Changes in the political administration, the lack of sufficient staff members in the urban development agency and secretary to develop new specific plans, the necessity of the approval by the city council of these specific plans and an economic crisis in 2002 – leading to a Real Estate crisis – are some of the reasons why none of the other Urban Operations got off the ground. Meanwhile, the real estate business - mainly on the housing and small offices sector – experienced an expansion cycle after 2006, due to some federal resolutions and economic policies, process that not even the 2008's global economic crisis was able to break.

Many critics have being made to this planning system, mainly by academics – some planners, architects and urbanists - regarding its tendency of increasing social exclusion, the lack of public participation and the control of the urban redevelopment process by the private investors, along with the European-north American mainstream urban geography and sociology analyses that highlights that the renewal schemes in developing countries are, in practice, “undertaken for commercial reasons rather than for social-welfare objectives” (PACIONE, 2001. Pg.539).



In this panorama, a new area called Lapa-Brás was proposed, adding three existing Urban Operations, summing up around twelve linear kilometres. The main goals of the new operation are:

“achievement urban transformation, structural and social improvement, environmental enhancement, especially enhancing public spaces, arranging transport, deployment social housing programs and improvements in infrastructure and road system in a given area, the optimization of areas involved in urban interventions, divide and recycle areas considered underutilized, recovery and creation of environmental heritage, historical, architectural and cultural landscape, and stimulation of areas in order to generate jobs” .



Fig. 16: Perimeter of the new Urban Operation - Lapa Brás . Map from the author. Source: Google Earth.

The aims are very bold. If accepted by the city council, this will be the bigger urban intervention of the city's history, especially considering the size of the project and its strategic position. Proposed to be the unification of several interventions and plans, its brief document contains the parameters of the studies to be hired, that eventually will put the plan together in order to be approved by city council.

The necessary studies for the new plan, according to the brief document, concern urban design, mobility infrastructure capacity, economic evaluation, environment studies and communication plans.

Public participation is not intended to be part of the process. Some public meetings, as a bureaucratic requirement, are planned at the end of each study, to show the results to the population, in a scheme of informative session, not participative construction.

Two major interventions are already determined: The necessity of changing the level of the rail line, allowing the north and south parts of the neighbourhoods to be reconnected and the demolition of the elevated highway – Minhocão – to be yet confirmed by traffic and mobility simulations studies.

The first resolution can easily be connected to the major aims listed above. These areas between the rail line and the river's express way are disconnected from the urban fabric, suffering of an island effect, causing massive damages to the urban environment and landscape. The main functions existent are soft industrial uses and logistics facilities. Due to its proximity to the center and valued neighbourhoods, eliminating the border set by the rail line is an important step towards achieving a better use and occupation of the area, attracting more coherent functions as residential, commercial and service.

Aiming to become eventually, instead of an isolated “in between” zone, a sequence of the existing urban fabric. According to its main goal, it aims to:

“Overcome the barrier of the rail line and the redevelopment of its edge, presented as an important structural element to order the territory, covering improvements of mobility and accessibility, the restoration of the urban fabric, the continuity of the circulation system, the possibility of occupying empty or underutilized areas, the induction of the occupation of areas already urbanized with new standards based on the increase density of population and built areas, balancing the supply of housing and jobs, the increase of soil’s permeability, vegetation, and public spaces for socializing and leisure.

(...)

Starting from the complementary concepts of Landscape – set of natural and built elements that are seeing from a certain area of the territory) and Space ( the accumulated result of society’s actions – such as production, dwelling, leisure, or, summing up, the life that animates the objects that composes the landscape), the improvement of urban conditions and environmental quality may be understood as measures to diversify uses and functions, increasing built and demographical density consistently with the existent and planned infrastructure, increasing green areas an public spaces, improving drainage, adapting typologies, accessibility, mobility, properly converted in spatial terms and translated in urban form.”

Regarding Minhocão’s sector, the aims seem different from the main goals. The following sentences, withdrawn from the brief document, set the tone of what is intended by the project:

“[The removal aims] to promote the urban and landscape recovery of the areas close from the elevated avenue. (...)Recovering the urbanity of Amaral Gurgel avenue and Padre Olímpio da Silveira(...) Recovery of vast well located areas.”

“[The removal] should allow the sprawl of the Higienópolis’s qualities to this [Santa Cecília] region (...) shall provide the reinsertion of the blocks along its path. This re-qualification should be seeing on Vila Buarque and Barra Funda, besides it can, potentially, bring new features to public spaces of great meaning to the city, as República Square, Arouche, Santa Cecília and Marechal Deodoro Squares.”

Apart from mobility, there is no consideration about the other functions – mainly as a social infrastructure – of the elevated high way. There is also no explanation on how to propitiate the urban “recovery”, “reinsertion” and “requalification” desired neither the project of new areas that could possibly replace its social use. The existent blocks are already connected, since the Minhocão does not interrupt mobility between its surroundings, as the rail line does.



Fig. 17: View from Rosa e Silva Street. Image from the author.

Two of the sentences listed above, however, begin to explain the intentions behind the removal. When the municipality’s plan mentions “sprawl Higienópolis qualities” and “new features to [existent] public spaces” it does not only implies its spatial characteristics, but also social and demographical. Higienópolis is one of the richest neighbourhoods in the city. Its typologies are not the same as the ones in its surrounding neighbourhoods. This innocent qualitative sprawl means, in practice, erasing and upgrading existent housing typologies, without creating conditions to keep the inhabitants in the region, a process similar to what already happened in other Urban Operation’s areas.

Different from the other underused areas that need “improvement of urban conditions and environmental quality” as the plan aims, the mentioned neighbourhoods and adjacent blocks of the elevated already presents “urbanity” enough.

What could be the problem? Which kind of “recovery”, “reinsertion” and “requalification” are really aimed?

The humanist approach on Urban Geography, according to PACIONE (2001), recognizes two different structures in which urban space occur: Physical and Cognitive. If so, the same urban space can be seen in different ways, according to its individual and personal meanings, its users life styles and different background. To be able to construct or - using the planning term - develop urban space it is necessary to recognize both realities of the city: “the city as a concrete construction (thing) and as an abstract representation (idea), and examine how each influences the form of the other”. (PACIONE, 2001. Pg. 22)

The author distinguishes the significance of “space” and “place”, emphasizing the importance of the “construction of places” while restructuring contemporary cities, differentiating top down approaches as the ones that construct “generic spaces” and bottom down approaches when the attempt is to construct, develop, keep and transform “places”.

The Structuralist approach relates the production of space to the economic relations, rooted in Marxist thought and class antagonism. According to this stream an important distinction has to be made between “representations of space” or “conceived space” made by planners and designers and “spaces of representation” or “perceived spaces”, when they become appropriated by people, similar to the Humanist notion of “space” and “place”. Therefore, part of the inability of São Paulo’s planners to acknowledge the fact that Minhocão is a “perceived space” in the city originates on the fact that it was never a “conceived” social space.

Still through this stream, the different interpretations of city space rely on the antagonism of public and private space along with “city life”. From one side one can find, on the public realm, “public culture”, a space to socialize with others and where “shared citizenship is created”, and in the other the “fear of other”. According to Pacione, some contemporary urban groups (mainly middle and upper classes) don’t usually appreciate the “encounter with difference”, replacing open public spaces by closed and “sanitized” spaces, where “out of place” individuals can be excluded (PACIONE, 2001).

Architecture and planning are, according to structuralism, a product of dominant social groups. They reveal the power of these groups influencing the urban structure. In a way, the absence of recognition of Minhocão’s area vitality comes from the fact that it’s inhabited by those considered “out of place”, a different interpretation from its users.

The post-modernist approach however differs from this perception:

“The different urban landscapes are the result of this dialectic relationship between social practices and the physical. The same urban space can therefore have a different meaning for different social groups, a situation that can lead to conflict over the appropriate use of land (...) the urban landscape is the product of both culture and economy, and a proper understanding of urban environments must be based on explicit acknowledgments of this complexity” (PACIONE, 2001. Pg.162).

A point of view similar to the social science’s regime theory:

“regime theorists represent something of a synthesis of the two outlooks (Pluralist -liberals and Marxist-structuralists), control of capital outweighs other sources of power, but development process cannot be understood simply through examining a ‘logic’ of capitalism, since that logic is itself fabricated through human activity, including the resistance by other groups to capitalist aims.” (FAINSTEIN, 1994. Pg. 264).

According to these two streams, in order to understand the urban environment in the proposed Lapa-Brás diagnosis and contradicting its traditional top down planning approach, it is necessary, as much as the economic study, a broader social study, identifying – not assuming – the region’s inhabitants needs, their “perceived spaces” and the existent urban spaces’ meanings and potentialities, in order to include them in the master plan and projects.

Not exactly an easy task for a neo-liberal oriented Urban Development Secretary. The discussion of “urbanity” – as the plan refers – or “liveability” – the equivalent urban geography term – should be employed in both objective and subjective evaluations: “the city on the ground and the city on the mind” (PACIONE, 2001. Pg 397). This accomplishment São Paulo’s city planners are apparently still far from achieve.

### **3. Bottom up: Urban infrastructure appropriation and the making of urban Piece and Place.**





"The one actor in the urban development process not yet considered is, in some settings, the most influential" (PACIONE, 2001. Pg.161)

Elevado 3.5 is a documentary wrote and directed by the architects João Sodré and Paulo Pastorelo; and the politic scientist Maíra Bühler, first prize winner of "É tudo verdade" Film Festival of 2007.

Alternating a sequence of images and scenes of Minhocão and its surroundings; with personal testimonials of twenty characters, inhabitants of its adjacent buildings, from different ages, social and demographical backgrounds and living in different positions in relation to the elevated high way: first floor, middle floors and last floors of the buildings, but all with something in common: a window or a terrace door facing the Elevado. The delicate film reveals the complexity of the area's figures, but also several different typologies, building densities and possible urban relations and interpretations. To each of them, the elevated high way has a different meaning, with multiple relations between their urban space and "place". The words "pride", "life", "need", "leisure", "place", "home", "memory", "happiness", "sadness", "dream", among others permeate their imaginary, in contrast with the asperity of "recovery", "reinsertion" and "requalification", the planning terms mentioned.

When asked about what the window (or terrace door) facing the elevated high way means to them, many related the view with positive sensations. About the demolition, none of the characters that addressed the subject were in favour.

The close relation of the surrounding inhabitants with Minhocão as their "piece" and "place", along with the appropriation of it by, not only them, but by all the surrounding neighbourhoods residents, and – through the popular events, street art manifestations and happenings – by the whole city, raises an inevitable question: demolition for whom?

#### 4. Conclusion

"The struggle over collective urban spaces and the representation of differences in them are indispensable elements for the advancement and spatialization of democracy. They introduce new political subjects and new rules into cultural and social life, and create possibilities for widening the exercise of citizenship, from the abstract realm of nation-state to the concrete realm of urban spaces" (PALLAMINI & LIMA, 2007)



Fig. 18: Minhocao and its users. Images from the author.

The present paper, through alternating São Paulo's current planning statements and resolutions towards urban redevelopment, with different theoretical approaches on Urban Studies (Urban Anthropology, Geography and Sociology) and a record of its inhabitants' testimonials, discuss the "top down" character of planning policies historically applied in the city and, in spite of it, the creativity of its population concerning urban informal and unexpected appropriation.

By architects, urbanists and planners Minhocão is, by consensus, an urban aberration. Product of an authoritarian act that "privileged the circulation of cars over pedestrians, and efficiency over socialization", its construction by no means could be considered a good solution for the area.

But the city embraces the good and the bad planning practices. It forgives drastic design proposals and overbearing approaches; it adapts, copes with it and eventually accepts it as its own piece. People transform and appropriate urban space in unexpected ways that, in urban renovation processes, cannot be disregarded.

As a final revenge, what was a negative externality for some – the formal actors, land and building owners – became a positive externality for many – accidental figures that, because of Minhocão's existence, have the meanings to live in one of the most well served areas of the city in terms of job offer, public transport, educational and health facilities, overcoming decades of territorial exclusion and "peripherization". A spontaneous demographical process caused by economic dynamics, that the new plan itself intends to induce: the increase of inhabitants in the central area.

"While many cities and citizens are linked into an electronic 'non-place urban realm', place – based relational networks that rely on propinquity and physical interaction – the key characteristics of urban places – remain central to the experience of human social, economic and cultural life" (PACIONE, 2001. Pg.24).

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## Drawings for Engineering

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### Abstract

In the representation of knowledge can not miss all those geometric, static, functional, and specialized notions in infrastructures that characterize the shape of a Civil Engineer. We take this opportunity to show how complex the representation of a hydraulic overflow, how bold is the company wanting to bring the cross sections, the view from above, the longitudinal section. And, yet how essential is the knowledge of descriptive geometry to determine the intersections of complex surfaces, the application of engineering has great feedback.

An engineer must know how to read and know how to make a drawing, must learn to identify the main characteristics, must be able to focus on the goals and be able to identify the reading of the representation of another author. An engineer must be able to express in terms of own project idea without has any limits of freedom of thought. Sometimes, in fact, a drawing doesn't have the fundamental informations about the representation and that is the limit of the project.

This study intends to show some drawings of civil works project requiring the knowledge and understanding of the fundamentals of descriptive geometry, without which the expressive potential of the author would inevitably be compromised.

**Keywords:** Civil Engineering, drawings, homology, sections

### 1. Introduction

Within the Civil Engineering and Environmental and Territorial Engineering training, the area of the Representation have sometimes a sacrificed and marginal role. Only from few years, in the Civil and Environmental Engineering Degree of Palermo has led the Drawing from 3 to 9 credits giving back to the graphic area a more suitable and dignified cultural position. In the educational difficulties of approach to class of students foreign to representation techniques, results essential to place the Drawing as primary tool for the divulgation of the project idea and not, like fundamental language in the professional engineering sector, as starting base in the communication of complex realities and structural integrations.

The professional approach predisposes the learners to a more careful listening, sure of relapse in qualitative terms of their figure of Engineers in the field work. The potentialities offered by different representation techniques become, in this way, a not only divulgative tool but also cognitive, of analysis and survey which completes either the moment of the reproduction of the real either the ones of design of the virtual. Appropriate the graphic restitution methods, confers to the learner the skill to be able to express the results of a study executed with diligence and attention, and with the mastery of the graphical means is possible to transmit to who will use that heritage as knowledge, as service fruition, as community heritage.

The applicative experience of a project material enthusiasms the learner which had to find himself to must possess the representation methods to tell that project of which isn't author, but of which could potentially be.

### 1.1 Representation of an hydraulic overflow

It's reported below the experience of an hydraulic overflow, of which the learner had to interpret the constructive and functional values for then translate them in graphics that would consider the different intersections, the different projections of the complex surfaces that make it up.

The overflow in hydraulic engineering is a particular artwork, which is being used to move away, or otherwise to separate part of the water from a canalization to an opportunely identified direction.

In general way its operation is in relation to a threshold, above which begins the water conveying to another conduit.

Exists different types of overflows: the weir overflows, the dischargers subject to saturation (chalice, etc.), the siphon dischargers and the dischargers with floodgates.

In the case of the exercise we had available documentary for a chalice overflow.

The flood drainage should be entrusted the predominant part to the surface dischargers, which will be arranged out of the body of the barrage.

The profile of the top of the facing downstream of the overflowable dam must be chosen so that the overflowing vein clings to it, without depressions, on all the height, namely that detach oneself after the summit threshold, providing in this case, with adequate devices, the ventilation below. In any case have to do, usually with the aid of models, the protective provisions from erosions at the base of the structure.

As a rule is to exclude the overflowability. If, in special cases, it is considered of having to have recourse, shall not be allowed the free fall of water among the buttresses, to support the overflowing vein for all the height the fall and it will be followed by the energy dissipation devices, protective from erosions of the bedrock.

The maximum flow rate to unload for the heaviest flood event expected must to be evacuated only by the surface dischargers. They may be constituted by one or more free thresholds or by thresholds equipped with automatic floodgates. In this second case, considered the hypothesis of non-operation of the floodgates, the flow rate of at least half the maximum that is provided to unload for the most burdensome flood event, must be evacuable with the free thresholds, provided, however, that in this condition the sharp clearance is reduced to values less than half of those listed above, subject to minimum of one meter. Where such surface overflows is meant to take the chalice type or similar, subjected to saturation, the size of them must be such that the level of saturation was higher than the maximum flooded increased by two-thirds of the net franc. Overflows of this latter species will be subject to specific tests on model.

In any case must be equipped with large ducts for the air supply to the passage of current from the vertical or subvertical shaft to the subhorizontal gallery and to any other point of singularity of the current.

The project flood flow rate of the surface discharges and all other associated works is assumed equal to the sum of natural flow and maximum flow into the reservoir from any waterworks in its tributaries (gutters, etc.). The natural flood flow of the basin underlying the barrage is assessed by reference to a return period of not less than 100 years ( $T \geq 100$ ) for barrages with a height up to 10 m, giving rise to total volumes of reservoir up to 100,000 m<sup>3</sup>, and with reference to a return period of not less than 500 years ( $T \geq 500$ ) for the barrages with a height greater than 10 m (and up to 15 m) or that give rise to total volumes of reservoir above 100,000 m<sup>3</sup> (and up to 1,000,000 m<sup>3</sup>).

The possible effect of lamination played by the reservoir should not be taken into account for the purpose of determining the said project flow rate, except for the reservoirs made specifically for the flood lamination.

The dischargers of surface must be made with fixed thresholds appropriately shaped, without moving parts of interception or regulation. The dimensioning of the overflows must be such as to permit disposal of the project flood flow rate with a maximum load (defined as difference between the height of maximum flooded and the top of the overflowing edge) with respect the prescribed clearance. For new designs are not allowed dischargers of the chalice type, autoluring siphon type or any other type however subject to saturation (operating in pressure).

The barrages in loose materials must be non-overflowable and their surface dischargers must be made of masonry construction independent from the survey; in case they are adjacent to it or interconnected, must be made with linking techniques to the survey such as to prevent the triggering of siphoning along the contact surfaces.

For the masonry barrages the surface discharge can be made on the same body of the barrage (barrage partially overflowable).

If however, applying this criterion, the length of the overflow proves more of the same length of the crowning, it may be assuming that the barrage is fully overflowable; in this case the maximum hydraulic load on the overflow must present a clearance from the intrados of any service walkways equal to half the prescribed clearance. It's still to be aware of the danger of clogging due to the floating bodies, also in relation to the particular characteristics of the vegetation existing in the basin directed upstream of the barrage.

The overflow artefact must in any case be dimensioned so as to avoid that downstream of the threshold arise current depression phenomena and/or cavitative phenomena, also for the maximum values of the flow discharged.

The restitution of the discharged flows must be studied in order to avoid underminings or however not correct dynamic behaviours of the current to the foot of the barrage body, as well as dangerous erosions of the bed or of the downstream evacuator channel.

All these considerations of specially typological nature of operating and design are of fundamental importance for the realization of a graphic paper in which doesn't appear substantial geometrical differences compliance with the rules that serve as guide.



Fig. 1: View of an overflow in full-water condition.

From the Fig. 1 one can infer the importance of this hydraulic element always placed near close to a dam. It would be more opportune to speak about fundamental element of operation of a dam in the check of the water progress for a proper water operation of the natural landscape and man-made environment.

The operating conditions must to ensure a proper effectiveness both in the summer and in the winter. The temperature change undergone by the overflow, require a careful analysis of the elasticity range of the material deformation and the effort resistance of the safety valves and linking structures more generally. In this view, results of fundamental importance an accuracy in the representation, a precision in the sizes indicated and in the sections individuated in order to make some tests of seal which ensure a proper operation of the overflow. The responsibility, therefore, of the representation rises to a primary role in which cannot separate from the scientific both analytic-mathematical and geometric-physic. The representation become communication, but at the same time surveying and intervention tool, if necessary.

In the view from above of a graphic paper is of fundamental importance the apparent contour of the artefact. In fact, thanks to the representation of its view on a horizontal reference plane, we perceive the maximum

encumbrance and, particularly, being the inlet of the overflow an horizontal circumference, the apparent contour will be given just by its representation along the radius (Fig. 2). To make graphically that it is a “clove” surface, from a well-defined section profile, would enough to subdivide the profile curvature, made by the cross section of the artefact, and projecting in first projection the references for the representation of concentric and equidistant circumferences. These, in first, would closer and closer as you approach to the vertical inlet, up to be superimposed.

The longitudinal section in Fig. 3 is made at the height in which the overflow run through the underwater layer indicating, therefore, the behaviour of the underground waterworks of discharge and charge of the waters.

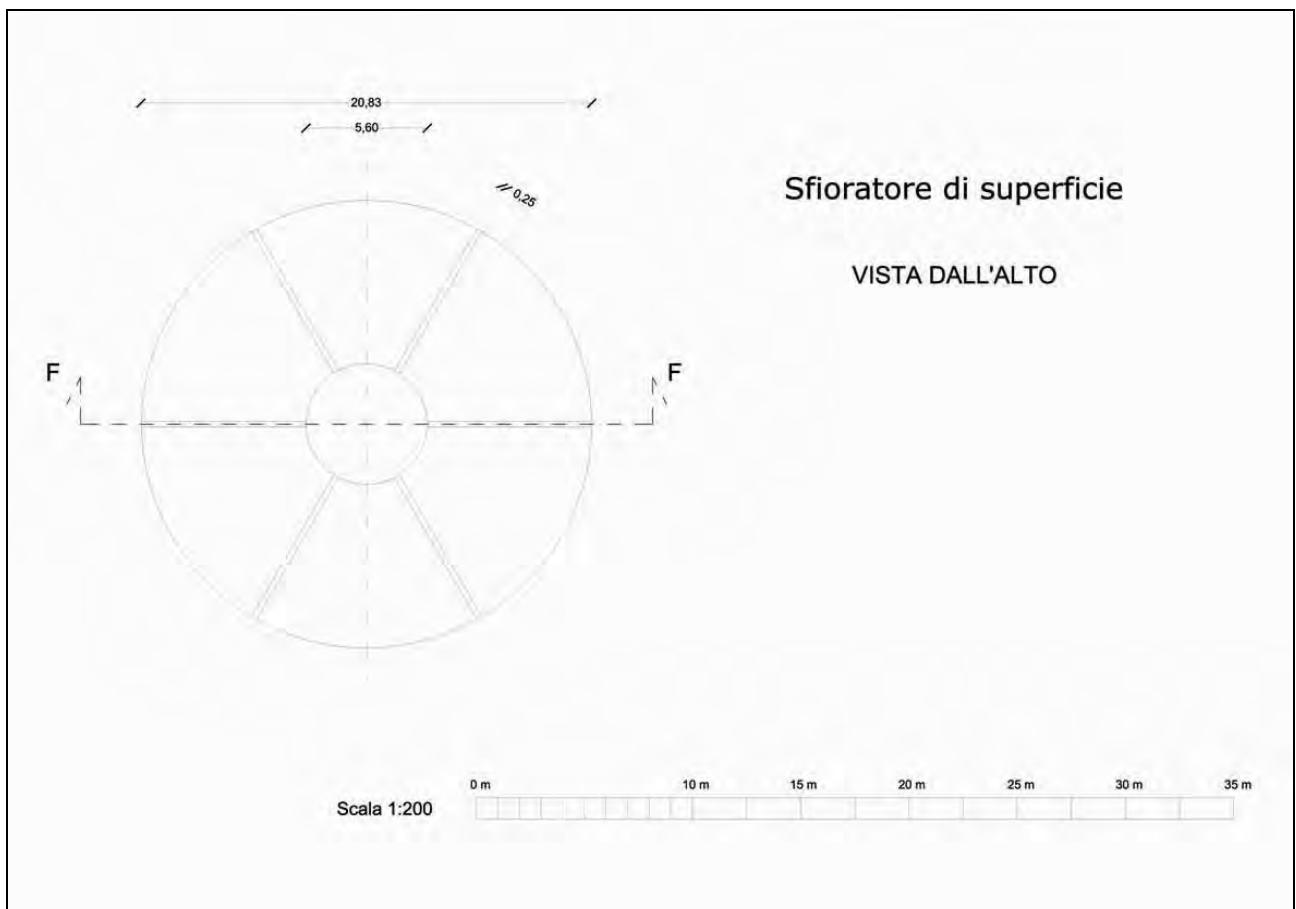


Fig. 2: Surface overflow: view from above

In reading the graphic paper evinces the projection of the apparent contour of the inlet of the overflow. This view turns out to be indispensable for a proper read of the artefact to comprehend both the proper structural and water operation and to read the correspondence of representation. Just for what was said, it reads the projection of the view from the above, as projection of something that is above the plane of section.

The tunnel for inspection, along which is made a cross section, is connected to the walls of the principal collector and this determines a connection of the section lines which does not permit the presence of triple points that would denounce a lack, under the knowledge profile of the science of the representation, unacceptable though frequently found.

Often, in fact, we witness to approximates sections, in which the section line is suddenly interrupted by others section lines, in which the planes of section are inexplicably staggered over other planes, in which the passage from material to empty space is fictitious and where the mix between projection and section is state of the art!







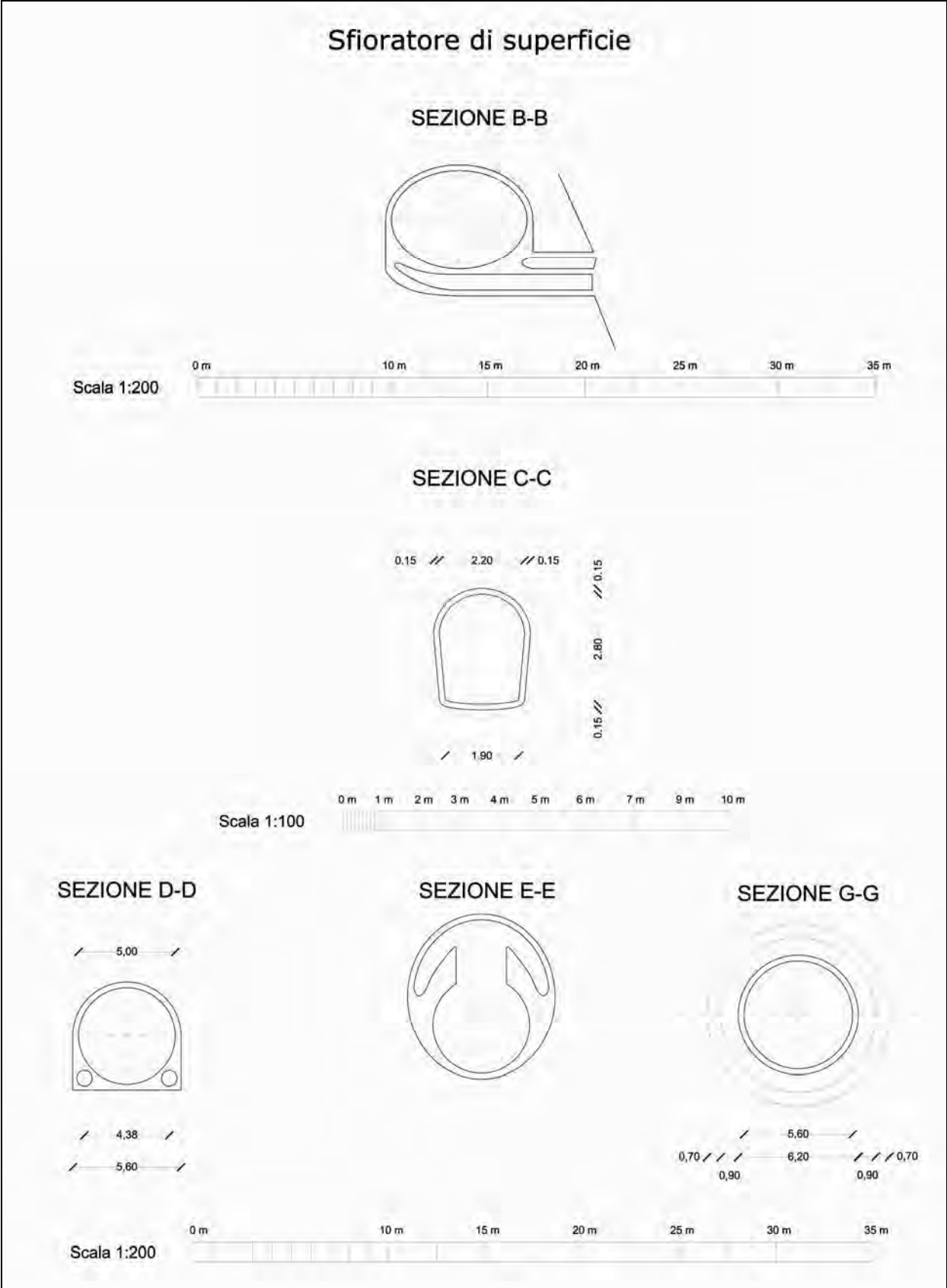


Fig. 5: Surface overflow: cross sections



Cannot miss in a representation of an artefact the three-dimensional view that males, more than multiple orthogonal ones, to an untrained eye, the overall geometry of the element.

The orthogonal axonometric view well lend itself when one represents a graphic paper of relative size like ours, in which one doesn't want to give a visual impact established in the territory, impact that would instead require the use of the perspective.

But, as in every representation, it's important to know to do but also know to read. In Fig. 6, for example, it's clear that we put with the upper inlet on a plane parallel to  $xy$  and the upper circumference becomes, in projection, an ellipse whose major axis is parallel to the  $t_{xy}$  track, and the minor axis is affected by the shortening of the maximum inclination line of the  $xy$  plane. Read this, it's easily reconstructible the belonging homological relationship of the  $xy$  plane and, consequently, it's possible to trace the real form and size of the geometrical forms also not having them in the multiple orthogonal projection graphic papers.

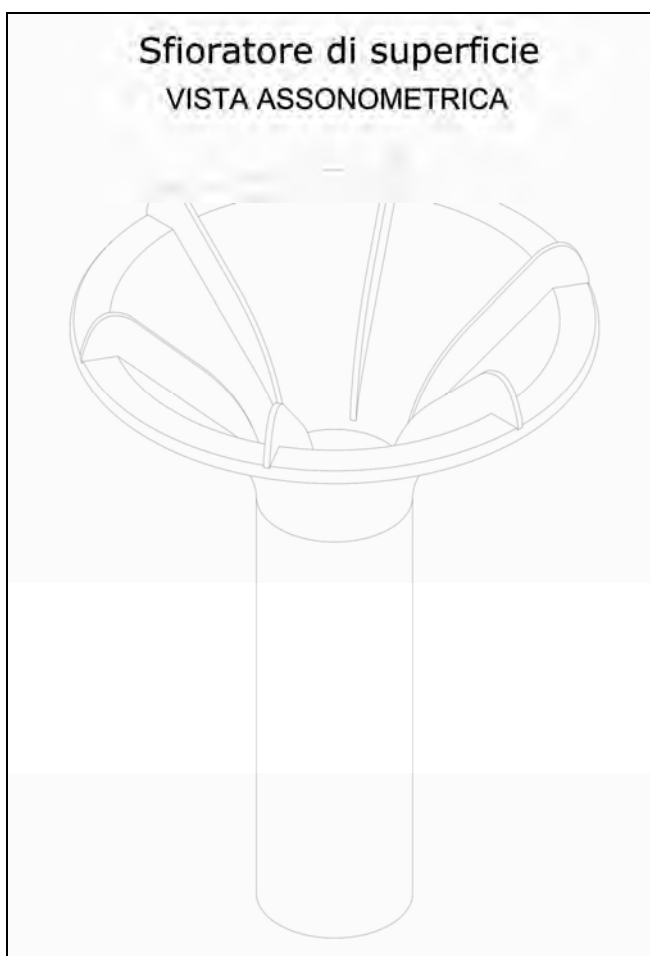


Fig. 6: Surface overflow: orthogonal axonometry





## Conclusions

We can conclude that the representation of an artefact is the more complex the more detailed and articulated is composed in its own externalization, the more complex is the artefact geometry, the deeper is the knowledge of the discipline. The absence of an objectification that makes it universalizable, on the contrary, the subjectivity of the choices that distinguish it, gives to the science of the representation a difficulty more and more extensive as the largest are the irresponsibilizing behaviours. Since from the choice of the representation technique rather than another, the scale rather than another, views, rather than others, the sections rather than others, makes the drawing a versatile and sometimes hostile discipline, but more than ever fascinating and of primary need, when one knows from deep, within the professions of engineers and architects.

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## Environmental Planning: Case Study for Cocoa Coast Tourism Area – State of Bahia - Brazil

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### Abstract

This paper is intended to present an environmental planning methodology for small and medium scales based on the presuppositions set forth in Federal Decree No. 4.297 of July 10, 2002, which establish criteria for the Brazilian Ecological-Economic Zoning– EEZ.

The compilation of social-economic data related to the determination of the potential and emerging environmental fragility, in addition to the legal regulations, renders possible the performance of an ecological-economic zoning considering abiotic, biotic, social and economic variables (ABC method) intended for the ordering and development of any given region.

From this interdisciplinary point of view, the environmental planning precedes and supports the Brazilian municipalities upon the performance of their Master Plans, as its more comprehensive view of the set of variables of a territory for that specific municipality corrects any distortions and promotes the compatibility between development and environmental conservation.

To exemplify the method, we will work with the South coast of state of Bahia like case study. This region is a touristic zone called Cocoa Coast, near Salvador city, the capital of Bahia. These cities are tourism hot spot in Brazil and they are target of real estate speculation. The ABC method turns possible to define areas to the touristic use as well other land uses and preservation.

**Keywords:** environmental planning, economical-ecological zoning, sustainable development.

### 1. Introduction

Territorial planning in Brazil is considered something new, and even nowadays is considered as part of a general plan. Planning, through this point of view, is also considered as one of the subjects connected to the growth of the cities, even under a strong ideological content, and it explains the revitalization of the theme. For Villaça (1999), between 1940 and 1990 - the Brazilian Urban Planning, which had the idea of a master plan, hasn't minimally achieved the proposed goals.

Essentially agricultural until the 50s, Brazil would experience large urban and industrial outbreak due to the Fordism expansion of industries all over the world. Countries like Brazil at that time had an intensive industrialization as well as a national redesigning of territory, much because of Cepal (Latin America Economical Commission) recommendation, created in 1948 by UN (United Nations), which had as its main objective the economical diagnose the causes of economical delay in Latin American countries. Industrialization had been the alternative proposed, in a unanimous decision, aiming to accelerate development.

In this context, the Federal Government was responsible for the infrastructure implementation and legislation to make industrialization possible. Under the slogan "50 years in 5" President Juscelino Kubitschek (1955-

1961) implemented the "Plan Goals for Brazil," and thus, the Brazilian process for road constructions was undertaken in the following decades as the automobile industry was implemented. It was the replacement of an agro-export model for an industrial model in association with foreign capital, which would let worldwide companies enter into the country. It was through this developmental and structuring plan of spaces that the Brazilian cities started becoming more and more urban and needing regulation and discipline for land use, housing problems, clandestine subdivisions, sanitation, transportation, etc. Until the 30s, the planning of cities represented only beautification and the opening of avenues, during the 60s the urban problems would get more serious with the population growth. The Brazilian population rose rapidly from 41 million in 1940 to more than 190 million in 2010.

Considering those aspects, two questions should be clarified: the inclusion of environment as a parameter for the planning and the order of planning, gaining a connotation, from the national to the municipal vision. It's this way that after one year the Ecological-economic Zoning Decree was approved, introducing a new planning and land order concept, totally opposite to what was adopted earlier in the century, when the cities used to have their development from the city center to the outskirts, forming, pretty often, a patchwork like territory.

### **1.1 The Ecological- Economic Zoning as an instrument for an Environmental Planning**

If Urban Planning in Brazil was just known by its ideological meaning, the Environmental Planning would only exist as a new vocabulary by the end of the XX century. This new nomination of planning was a result of the new environmental wave, which since Stockholm Conference, in 1972, started gaining a new format and media space on territorial design planning speeches. The apex of discussion would only happen when definition of sustainable development had its classical definition: "sustainable development is the one that provides the needs of the present time without impairing the possibilities of future generations to provide their own" (CNMAD, 1991). The concept introduced by Brundtland Report, in 1987, became the preparation stage for the United Nations Environment and Development Conference, known as Eco 92, which took place in Rio de Janeiro.

Eco 92 contributed for a greater diffusion of the environmental problem and introduced new planning paradigms involving the adoption of environment into the planning processes and territorial order. Through out this view, spaces would not be managed by anthropic interventions, but considering the interaction between biotic and abiotic and the human presence.

Many laws in Brazil were approved to ratify state actions with the adoption of an environmental sense and public policies. The 6938/81 Federal Law, which established the National Environmental Policy was certainly the first step in this direction (as part of the result of the Stockholm Conference, in 1972) which brings in its 9th Article the definition, that years later, would come as law regulations, establishing quality environmental standards and evaluation mechanisms of environmental impact (Conama Resolutions - which publications started in 1986) or through the creation of protected territories (National System of Conservation Units - Law 9.985/2000) or through the Ecological Economic Zoning - ZEE - promulgated by Decree 4.297/02.

ZEE brought some news in its planning conceptions and territorial ordering, starting by the obligation to be followed when implementing plans, constructions, public or private activities (2° Article). In its sole paragraph of the same Article it is stated that the ecosystem limitation and fragilities must be considered while distributing space for economical activities, which means an enormous space intervention advantage.

The contents, that contemplates the definition of each area, data for diagnosis as well as general and specific guidelines is expressed in Chapter III of the referred Decree. However, the lack of obligation in considering ZEE as a planning instrument in public, federal, district, state and municipal institutions make this powerful tool still neglected as a primary instrument for territorial zoning. This assertion finds support when consulting the Ministry of Environment electronic page it's possible to find out that the ZEE development process, in its macro or state scale, is moving ahead slowly and that there are hard difficulties to prepare the technical diagnosis, to get to general and specific guidelines and then transform the entire contents in a decree.

In short, we can ensure that understanding the environmental planning through an Ecological-Economical Zoning is extremely important so that we can get to a turning point in the Brazilian planning history; which means understanding the territory through out the interaction of its abiotic, biotic, social, economical and cultural attributes that are essential for sustainable territorial development.

## **2. Methodology**

The area named Costa do Cacau (Cocoa Coast) lies in the south coastline of the State of Bahia, Brazil. The region concentrates the municipalities of Itacaré, Uruçuca, Ilhéus, Una and Canavieiras. It's the region that most preserved the Atlantic Forest, the most threatened tropical forest in the world due to anthropic action.

This happened, in part, because of the cocoa plantation (*Theobroma cocoa*), typical plantation of the region, that grows in the shades of big native trees. Because of natural beauty and its landscape value, the region is considered one of the Brazilian coastal tourist poles. For the preparation of the ecological-economic map of the region, the “ABC” methodology was used, considering the biotics, abiotics and socioeconomic variables, which are focused in this study.

## 2.1 Building the potential fragility chart – the variable A of environmental planning.

The methodology to determine the potential fragility of its natural environment and/or modified by human action was made by Ross (2001) about the morphological dynamics of its landscape, considered as eco-dynamic units, seen through the understanding of its natural dynamic between the environmental variables: climate, topography, rock formation, soil, vegetation, land use, etc.

Starting from these assumptions, building the potential environmental fragility chart on this study, we considered an overlay from the geomorphological mapping, as well as from the soil types organized by the Radam Project Brazil, in 1988, in which it was as possible to identify homogeneous areas with types of topography and soil, assigning scores and weights according to the classification proposed by Ross (2001). After this mapping, we proceed to the classification of environmental units that resulted from the geographical processing of cartographic information in SIG (Geographical Information System), and the completion of the potential fragility chart, which brings, for each polygon, presents two different indexes: firstly for topographic variables and secondly for the soil variables. Through these information it's possible to value the fragility, if hard or light, of the units that make up the Cocoa Coast (figure 1).

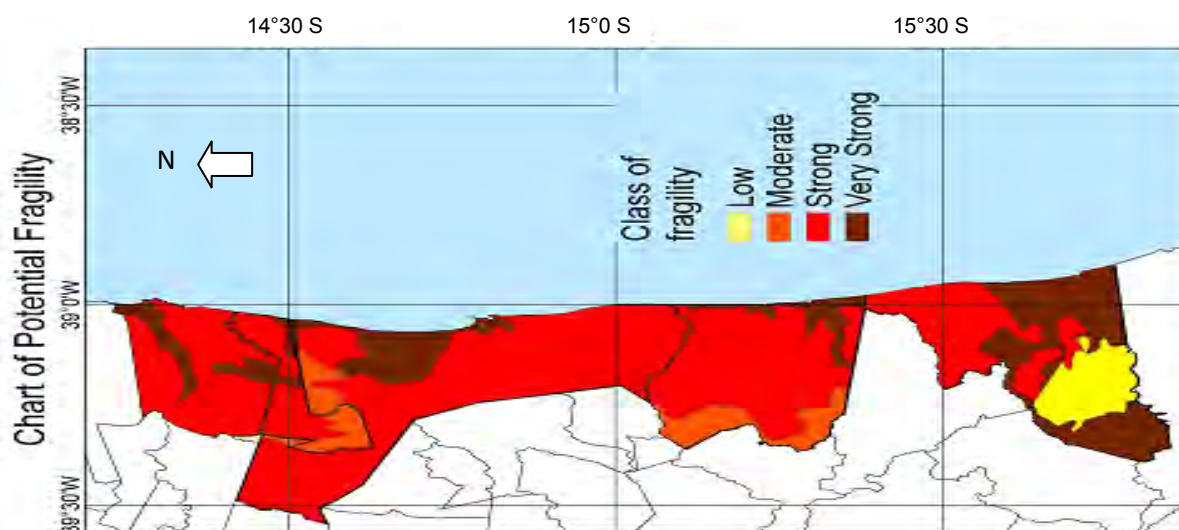


Fig. 1: Potential Environmental Fragility of the Tourist Zone of Cocoa Coast, Bahia, Brazil – produced by overlapping images of the geo-morphological and exploration of soil maps.

## 2.2 Understanding biotics data and legal regulations - variable B of the environmental planning

Understanding the biotic variables that involve planning and the creation of protected areas in a territory, aims biological diversity conservation and its ecological interactions, as well as the maintenance of ecosystem for ensuring human welfare and effective participation of society in the process of creating and managing these areas.

Especially in Brazil, where its possible to find various kinds of biomes and an ample diversity of fauna and flora, which characterizes the country with mega biodiversity, planning becomes fundamental for protecting its biological and ecosystem services in local and global scale. However, human activities, particularly the ones related to economical and political subjects, exert strong pressure on ecosystems, that results in environmental degradation and human welfare reduction.

The variable B of the environmental planning involved the principles of the conservation biology. The basic principles of this science are based on important theories, like island bio-geography, geometry of the landscape, population and community ecology and, particularly the landscape ecology (Forman and Gordon, 1986) which allows understanding the spatial patterns of landscape and landscape scales. This science also

considers development and spatial heterogeneity dynamics as part of the biotic and abiotic processes and the management of its spatial heterogeneity for the benefit and survival of society (Odum and Barret, 2008; Risser et al., 1984).

Using SIG tools and the official data of vegetation (and its successive levels) of the focused area, we also created a map that provides the understanding of distribution of the landscape biotic constitution. As we are able to understand the scientific guideline aspects for the protection of natural environment, particularly the Forest Code – Federal Law 4771/1965 and the The National System for Units Conservation – SNUC – Federal Law 9985/2000.

It's important to mention that it's being discussed, in the National Congress and in the Chamber of Deputies in Brasilia – Capital City – changes to be introduced to the Federal Law 4771/1965, considering the aspects brought in 1999, with participation of the National Federation of Agriculture, which proposes flexibilization of use for Permanent Preservation Areas, as well as in some percentage of the Legal Reserve. However, both the Brazilian Society for the Progress of Science and the Brazilian Academy of Science, consider the proposals “without a solid scientific basis”, as their proposal goes against planning and conservation principles, the main subject of this Case Study.

### 2.3 Building the socioeconomic diagnosis – variable C of the environmental planning

The historical and socioeconomic survey comes from the demographic census issued by IBGE – Brazilian Institute of Geography and Statistics. Through data compiling it was possible to get to the diagnosis of potentials and fragilities, from the socioeconomical point of view, for this group of municipalities. Here are the statistic information considered for this research. (Table 1)

Subject	Information	Goal	Possible Actions
Synthesis of Information	Population in 2010 Territorial Area Unit	Checking the population growth Population density Urban and rural population	Public policies of population control
Population and Housing	Income Years at school Age group	Population percentage with a formal working contract Educational level of the population Age pyramid	Educational public policies for the generation of employment and income
Agricultural Census	Area destined for rural zone	Percentage of useless or degraded land at countryside	Management of land use capacity and function and environmental fragility
Gross National Product - GNP	GNP by sector	Municipal economy predominance (primary, secondary or tertiary)	Incentive for highlighted activities



Healthcare services	Beds and hospital facilities	Comparison of existing beds in hospital facilities with the number established by World Health Organization (WHO)	Investment in hospital network and health equipment
Education	Enrollment	Comparison of school-age population with the number of enrollments by level of education	Creation and management of vacancies in different educational levels.
Civil registration statistics	Infant mortality	Comparison with reference numbers published by World Health Organization (WHO)	Sanitation actions and breastfeeding
Temporary and Permanent crops Vegetation and forestry extraction Sylviculture	Municipal Production	Identify municipal primary production and its production value	Management of production according to the Environmental Fragility
Poverty e inequality map	Gini Index	Check the level of inequality	Employment and income generation

Table 1: Parameters analysed for socioeconomic data of variable C of the Ecological-economic Zoning and considered for this Case Study - Cocoa Coast – Bahia.

### 3. Results and Discussion

By the analysis and the overlapping variables A, B and C of the environmental planning, a Map of Ecological-economic Zoning ( Fig 2) was produced in SIG environment for the Tourist Zone under this analysis. By doing that, five different zones were established for the information framing: (i) zone 1: maximum protection zone – with the frame in which the diagnosis had already pointed out the existing conservation units of high protection, permanent preservation units or areas that were considered with fragility strong and very strong (the variable A). They were considered bio-diversity priority areas; (ii) zone 2: buffer zone or transition zone between a maximum protection zone and a zone for other uses, as established by Federal Law 9985/2000; (iii) zone 3: for rural use of the municipality, due to its rural production, as well as for possible management according to the capacity of land use, where its prioritized for this kind of use the eutrophic soil, mentioned by the Chapter of Environmental Fragility; (iv) zone 4: consisted by urban zone expansion, or controlled use zone through the proposal of APAs (Environmental Protection Areas, under Federal Law 9985/2000), a very common strategy in case of coastal areas, where it's necessary urban expansion control over intensive environmental fragility; (v) zone 5: consolidated urban area, demarcated on map of existing city. The characteristics, permitted use, guidelines and target for the Ecological-economic Zoning proposal is described on Table 2.

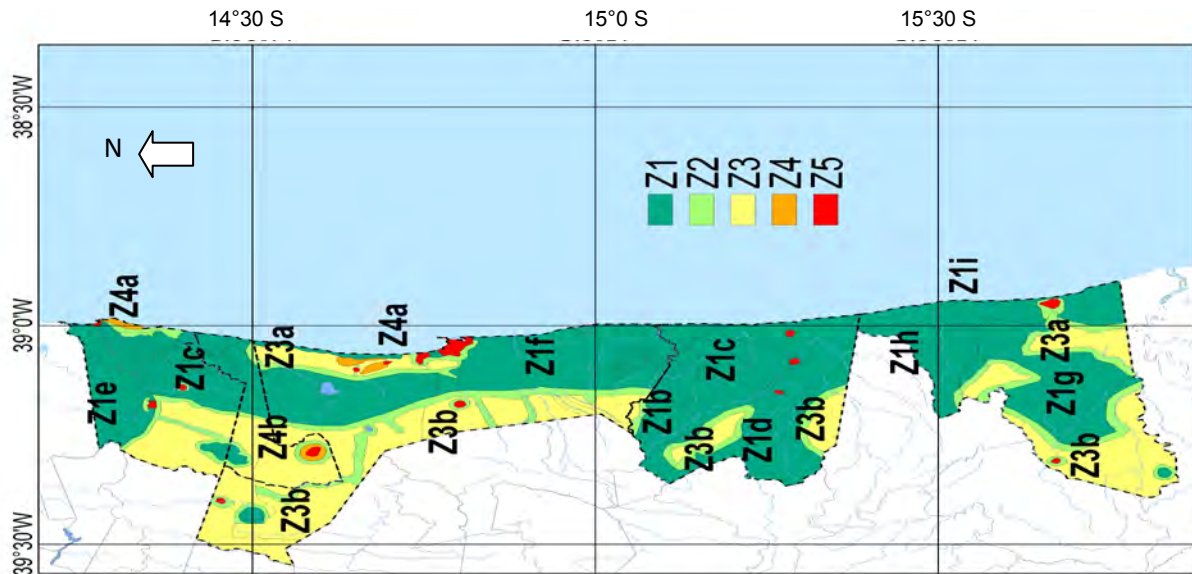


Fig.2: EEZ Map proposed for Tourist Zone of Cocoa Coast, Bahia Brazil.

Zone	Socioenvironmental	Guidelines	Permitted Use	Goals
Z1	<p><i>Variable A</i> Coastal tableland – Pre Coastal; Red, Yellow Podzolic Soil.</p> <p><i>Variable B</i> Ombrophilous Forest, from dense in advanced stage to medium in regeneration; Restingas (natural coastal vegetation) Mangroves.</p> <p>Presence of endemic species, which have restrict geographic distribution, like <i>Bradypus torquatus</i>.</p> <p><i>Variable C</i> Small human pression due to tourism in the region.</p>	<p>1. Maintenance and extension of Conservation Units aiming the preservation of beauty and nature ecosystem of ecological relevance, defragmenting forest areas and increasing habitat for rare species or the ones being threatened by extinction.</p> <p>2. Coastal Ecosystem Maintenance in its integrity.</p> <p>3. Ensure and protect the style of living and the culture of traditional inhabitants, guaranteeing sustainable use of natural resources.</p>	<p>1. Achieve scientific research.</p> <p>2. Development of environmental education and ecological tourism in accordance with the management plan and the conservation unit category (Federal Law 9985/2000)</p>	<p>1. Expropriation of plantation and rural housing areas with payment of indemnities and in connection with an incentive program for relocating people who live on palm fiber production (<i>Attalea Funifera</i>).</p> <p>2. Elaboration a management plan.</p> <p>3. Full Integrity maintenance of biodiversity and ecosystem.</p> <p>4. Defragment the Atlantic Forest generating ecological aisles in the landscape.</p>

Z2	<p><i>ABC variables</i> Zone that presents alterations in its original ecosystem functional organization, but it is able to keep the balance of a group of organisms in different degrees of diversity, even with the occurrence of human activities with low environmental impact.</p>	<p>1. Vegetation recovering and enrichment in Permanent Preservation Areas. 2. Allow the connection between fragments and Conservation Units. 3. Protection and recovering of Permanent Preservation Areas</p>	<p>1. Housing and economical activities are under specific rules and restrictions according to the objectives of Conservation Units.  2. Family farming with agroforestry systems;  3. Restrict the vegetation edge effect.</p>	<p>1. Promote the recovering of the area.  2. Avoid edge effect in agricultural areas that use agroforestry systems.</p>
Z3	<p><i>Variable A</i> Soil type Alic Latosol sites belong red and hydromorphic sites belong.</p> <p><i>Variable B</i> Remnants of native vegetation due to agroforestry activities for cocoa production (<i>Theobroma cacao</i>) and fiber palm (<i>Attalea funifera</i>).</p> <p><i>Variable C</i> Rural population</p>	<p>1. Increase the agricultural GNP (Gross National Product) and incentive perennial production.  2. Keep the population into rural areas.</p>	<p>1. Agricultural activities with incentive for Agroforestry system.</p>	<p>1. Development of rural cooperatives</p>
Z4	<p><i>Variable A</i> High potential fragility.</p> <p><i>Variable B</i> Remnants of native vegetation</p> <p><i>Variable C</i> Human settlements in expansion and not well structured. Touristic use.</p>	<p>1. Promote tourist urbanization along the coastal highway through the creation of an environmental protection area (APA) in accordance with Federal Law 9985/2000.  2. Home construction for low population density  3. Provide this zone with sanitation conditions.</p>	<p>1. Use for residential, commercial, service providers and hotels.  2. Touristic urbanization</p>	<p>1. Doing the project about management plan of this area (an APA) considering aspects of conservation between the other land uses, specially for hotels and resorts.</p>

Z5	<p><i>Variable A</i> Topography: coastal plain. Soil: quartz sand and hydromorphic soil.</p> <p><i>Variable B</i> Vegetation: full suppression of native forest</p> <p><i>Variable C</i> Consolidated urban area</p>	<p>1.Expansion of the healthcare chain.</p> <p>2. Expansion of school and college opportunities.</p> <p>3.Expansion of treated water supply and sewage for the whole urban area.</p>	<p>1.Shops, residences, factories, institutions and parks</p>	<p>1. Improvement in health services, education and sanitation.</p> <p>2. Generation of job and income for local population.</p>
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Table 2: Characteristics, Guidelines, Permitted Use and Goals to the ZEE proposal for the Tourism Area of Cocoa Coast, Bahia, Brazil.

#### 4. Conclusion

ZEE is a powerful instrument for territorial order and planning of medium and small sized areas, however, the lack of an adequate cartographic scale, in association with the lack of updated information from census, allows just a planning project which needs research and visits to the focused area. We understand that, for its accomplishment, not only the Federal Government, but State and Municipal as well, would need a considerable mobilization, in consortium operations with private initiative to prepare the basis for a cartographic material which would enable knowledge, in SIG environment, for definitely provide information about the area preconized by regulations for ZEE in the Federal Decree. Every four years, updated data from socioeconomic census will bring more clear information about the socioeconomic dynamics that the country is experiencing.

It is time now to achieve that the Brazilian Government consider Environmental Planning as a priority, because Ecological-economic Zoning, as an instrument for territorial order, becomes more and more indispensable for the achievement of sustainable and well-balanced development.

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## IN THE SHAPE OF A HOUSE. Recycling the wastes of the city on the Neapolitan coast

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### Abstract

This contribution refers to a design research on discarded landscapes and buildings in the Neapolitan area carried on within the Laboratory of Architectural Design 1, prof. F. Ippolito, at the Faculty of Architecture of the Second University of Naples [1], on the basis of some previous researches on these issues and place [2]. Testing ground is the Domitian littoral zone, field of inquiry is the urbanization of the coastal landscape and its being mainly made of houses. As in Italy urbanization advances on the coast 30% faster than on the rest of our territory, as 60% of this urbanization is due to houses, as - on the other side - 20% of these houses is empty, testifying that the building process and the consumption of the land are not commensurate with the real inhabiting demands, and 10%, particularly in the South, is illegal, testifying the distance between the planning and the reality of the territory, to work on this city of houses, from the perspective of recovery and recycle, seems to represent an urgency for the requalification of the landscape and for the culture of design. In Varcaturò, Giugliano in Campania, in the past decades a city of houses was born, an urban landscape where every building is in the shape of a house. In such a place, where the nature dissolves itself into built areas and the public space into private space, where an uninterrupted edification produces landscapes of waste, a design-oriented look deals with the houses and urban wastes. A three steps project – project of description, project of strategy, project of architecture – works at reinterpreting this territory and these materials, recognizing the value of waste and imagining actions of recycle and techniques of reinvention. Starting from the houses and getting in-between the houses, sprawl projects work at subverting the sense of what is here.

**Key words:** sprawl town/illegal housing; urban/architectural waste; public/private; description/project; strategy/tactics

### 1. Sprawl. The city of houses

Varcaturo, on the domitian coast, is a ghost of urban sprawl. The town of houses that has grown since the 80s from a freeway junction up to the sea is crumbled, interrupted, partially abandoned, and new presences fill in its interstices. After the advance of the cement and the movement of the population from the dense cities towards this coastal town, the territory seems to be in a shrinking phase [3]. Still latent, the city is getting empty, while in what is left from the withdrawing of urban life a landscape of uncertain spaces, uncultivated lands, residual activities and precarious inhabitants is advancing. It's the landscape of remains that urban culture is discussing in these years [4]; it's the mirror of a destiny that many Italian sprawl urbanizations share, blighting expectations and showing original faults; most of all, it's the result of a sum of daily building tricks, which reveal obtuse visions in the long time. If for some years we have been relying on the city of houses, which was born as a satellite of the main urban centres, depending on highways, resulting in a landscape of widespread individualisms counting on their supremacy on everything else, today this city shows its limits and its contradictions. Along with the crisis of an urban form that wastes the land by means



of infrastructures and buildings, there come the crisis of a way of living that produces marginalization and separation by means of enclaves, and the crisis of an urban system that is founded on occasional individual interest, on deregulation, on private appropriation of public space and landscape. Around here, the issues on which the diagnosis of the suburban crisis [5] is founded all over the world acquire specific connotations, traceable in the features of these places.

Varcaturo has nothing special if compared to other neighbouring sites, which are more resounding for better or for worse. It is a common piece of this coast, urbanized starting from a junction, marked out by an axe leading to the sea through the plain, the pinewood and the beach, crossing the Domitiana and Coastal roads and the ruins of the ancient Appia Road. Nothing to do with Coppola Pinetamare Village nearby, well-known as an eco-monster, built for the Americans of the NATO in Bagnoli, protagonist of a complex affair of building speculation and legal battles that went on between permissions and prohibitions up to a symbolic intervention of demolition, emptied of the inhabitants, the locals after the Americans, today committed in buildings again, for the construction of a new port [6]. If a reference for the investigation of these landscapes may be ordinary landscapes studies, Varcaturò stands to Villaggio Coppola as Levittown stands to Las Vegas [7], and for this reason it may have a more general relevance.

This research proceeds from an investigation that was carried out on this same place ten years ago, when urban sprawl, whose devices of growth are set out by a multitude of individual enterprises, was still under exploration in the Italian territory, and when its declension in the Neapolitan places could contribute to demonstrate the false generic of sprawl town and its dependency from site specificities. Around here the town of houses is mostly illegal, it deals with a landscape of dunes and special vegetation, with archaeological ruins, with the sea, with the presence of American settlements and radars. Around here in the 80s there was the expectation that the way of inhabiting that produced the sprawl town would sediment, within a city which was made of sum of houses, fed by the displacement of Neapolitans to north-west, but also by the economic growth, the investment in buildings and the effect on concrete's entrepreneurship of the post-earthquake extraordinary funding. Around here many houses were built outside of the procedures of the Municipality Plan, which is dated to 1981, they passed through three amnesty for infringement of local building regulations, moved through the constraints of building regulations, protection laws, regional landscape plan and military security. Around here, within the game plan of the territory, the matches of the inhabiting took places, being played by variations on a few main moves concerning the construction, the widening, the adaption of the only element of the house. In a game time that is the daily progressive time, which insinuates in the long time of planning, a variety of private players matched against the only public player, slower and more distracted, playing parallel matches, pursuing individual interests, sometimes looking for alliances in order to maximise the advantages. Every so often the game is interrupted for the breaking of rules, the player is eliminated or, paying forfeit, returns with the amnesty. The game moves concern the five steps of the building process, the delimitation, the foundation, the elevation, the covering, the wrapping, and the five correspondent elements, the fence, the ground, the skeleton, the roof, the envelope, being declined in lots of ways, influenced by compromises between specificity and standardization, capable of innovation and rebellion. Every so often some help is needed, such as the imitation of the neighbourhood, the memory of a material culture, the suggestion of an imaginary drawing from time to time on local, modern, exotic or ancient examples, the instructions of the do-it-yourself magazines. The result of the matches' sum is a town made of houses, where the house is the shape of every building, available for hosting any use, delegating to additional signs any specification [8]. To describe the construction of the city as a game, focusing on the house, aims at schematizing the moves of the everyday inhabiting, revealing its tactics [9], in the hypothesis that in this landscape the house can be read starting from the tactics and the territory starting from the house [10]. For effect of daily tricks, the fences are devices of appropriation, of both the ground and the pinewood, devices of aggregation of many houses along a private road, devices of shielding of buildings growing behind the walls; the ground is excavated, increased, moulded to gain cubage, drawn by gardens; the skeleton is prepared for elevations and raisings, it's turned into generic architectures, in the shape of a house, or it's naked, in stand-by; the roof is inhabited, under the pitches or over the floor; the envelope is articulated with fillings of balconies, addition of volumes, variations on a cluster structure reflecting the expectations of growth of the family.

Today these expectations seem to be contradicted. Here and elsewhere these devices, after being investigated, revealed, vivisected and then summarized in the portrait of the landscape of a multitude busy earning cubic metres on nature and on empty spaces, show an unexpected sterility. Here and elsewhere, the territory shows the contradiction of the sprawl model – exemplified by Los Angeles in the literature [11] –, the limits that are implied in the superimposition of an interpreting model to the territory. Here and elsewhere in the South Italy, the effect of a building that went on outside from rules and plans show the ineffectiveness of both a consenting and law-abiding approach – submitted to a revision in the literature –, the limits of an only

legal approach to the territory as it is. While in the last years the urban investigation was engaged in searching for points of view and narrative ways that could be suitable for representing the landscapes of sprawl, being grown in Italy without any care, these landscapes kept on transforming, imperceptibly dissipating as imperceptibly they had grown. The observation, satisfied with itself, risked to get stuck in a mannerism of description, to forget its object and its very reason: catching the mutation in the city [12]. Yet that investigation had the merit of unhinging the interpretation of the territories by zones and quantities, of catching the devices and phenomena beyond the urban form, of promoting a lateral look which is capable of overcoming the pretension of objectivity of both zenith visions and data. Today the same approach, which produced among its side effects the falling in love with sprawl and self-construction, can exercise the same look in following new mutations.

### **1. Fading. The landscape of wastes**

To go back to Varcaturo, and to Italian sprawl town, years after its revelation, discloses a new condition, and maybe also newly oriented interpreting eyes. After the sprawl, the issue of economic and environmental crisis, the urgency of an inversion of tendency and of a project of recycle affect, in their many declensions, the urban debate. The paradigm of sprawl is replaced with that of shrinking, the model of Los Angeles with that of Detroit [13], and the suburbs are indicated as the place of evidence of the crisis and of necessity of repair. The view from inside the inhabiting dynamics catches the processes of abandonment, disuse, and the residual materials of these mutations. The view from above returns overall pictures of the suburbs at their tipping point, succeeding the previous close view's detailed pictures of the materials of the sprawl town in its making [14]. The going across places shows houses for sale, disaster houses, wild gardens and abandoned productive and commercial buildings. The statistics report data about loss of inhabitants, extinction of productive and commercial activities, pollution, consumption of ground. In Italy the warning includes the degradation of the landscape and, especially in the South, the unauthorized building. In this framework sustainability and recycle [15] replace development and expansion, and the densification of the built areas and the protection of empty spaces are suggested as a recipe to stop the sprawl.

In Varcaturo the tangle of unheard expectations and not programmed, in great measure illegal, choices, along with the protracted distraction for this littoral zone, which has been excluded from both a local and a wider planning vision, show their effects. A common destiny binds Varcaturo to its territory, wasted landscape and mass of wastes, place of speculation and illegal actions, of short-lasting visions whose outcomes are already implied in their assumptions. If this landscape can be interpreted, through the houses, on the basis of the inhabiting tactics, the long-lasting vision is excluded from its beginning: the tactics respond to occasional demands and circumstances; they're deep-rooted into the present and don't look at the future, so that even in the most immediate future they find their intentions exhausted. Today the inhabiting tricks that animated the matches of building the city of houses stop, suspending the game, in front of their own contradictions.

The houses, which have grown bypassing rules and plans, adopting expedients to conquest ground and volume, are depreciated, penalized by the quality of the contest and the lack of permissions, and turn out to be illusions of real estate goods – two levels single family houses, between 200 and 300 square meters surface, garden, medium-price 1500 euro for square meter, building permission as not granted surplus value, a more and more declining market, besides the crisis because of the uncertainty of amnesty for illegal building and the recent judicial attachments and demolitions [16]- ; the town, which has grown taking advantage of empty spaces, inventing building lands, privatizing roads and hiding behind walls, reports the absence of infrastructures and services, and turns out to be a simulacrum of a real town – lack of primary urbanization works, electricity, hydraulic and gas network; lack of garbage collecting and road maintenance; insufficient services, 1 nursery school, 1 police station, 1 church, 1 bank, 1 postal office, for the number of inhabitants, around 6,000 registered in Varcaturo, around 30,000 on the coast; polluted grounds belonging to the nature reserve of the domitio-flegreo coast, one of the 6 polluted areas on 55 Italian nature reserves [17]; the population, which has grown by individual movements, some of which are clandestine, complains about administrative negligence and asks for local autonomy, turning out to be the latent form of a real community – in July 2009 the Municipality of Litternum citizens' Committee was born, with the goal of a referendum for the autonomy from the Municipality of Giugliano in Campania of Licola, Varcaturo and Lago Patria hamlets, to be merged into the Municipality of Litternum; in the September 2009 the proposal was presented, with more than 5,000 signatures, Regional Council's favourable opinion, Town Council's negative opinion and following swing of opinions; the referendum, which is scheduled for the next Spring, will not be binding [18]-. While the urgency of an urban reparation emerges, the buildings depreciate, the fabric crumbles and the inhabitants bring themselves into question: the houses are available to other uses; the town vanishes

towards another condition, the community goes through abandonments and replacements, and new tactics activate new imperceptible transformations.

In a three steps project, the first step, project of description, collects these observations in a critical map of the places, including spaces, materials, people and uses and representing the fading in its many variations. Some images can work as examples: in the urban core the public space disappears among the fences of the houses; on the main road the density of the commercial street vanishes into the hinterland and coastal landscapes; in the agricultural plains the green dissolves under the buildings, in their turn dissolving into the uncultivated green; the pinewood is eroded at the borders, as well as the Mediterranean scrub, by buildings being engaged in compromises with vegetation; the Roman road, appearing for a stretch, disappears among the houses of a village, which crumble in front of it; the public beach vanishes among the private lidos, themselves disintegrating from North to South, and it's populated with evanescent inhabitants, who follow the seasonal and daily cycles of use of the coast. If fading, by definition, is the effect of a progressive disappearance or appearance of images, the fading, even more than the waste, can be the landscape's interpreting key, which leads to include in the project the wasting process.

Kevin Lynch's interpretation of the wasting as part of the urban life resurfaces, along with his representation of the world without wastes and the world flooded with wastes as two opposite and extreme nightmares [19]. In that interpretation the sprawl town, more easily than other urban forms, can regenerate from its end, thanks to the quantity of open spaces, the fragmented quality of the buildings, the incidence of the connections. This vision, probably more than those of the new regeneration manuals for the suburbs in crisis [20], looks at this town in a perspective of mutation. Another perspective is the reparation, meant as an opportunity for innovation rather than as a re-establishment of lost functions [21]. Densification, rarefaction, grafting, re-naturalization are some techniques of intervention, which work on the existing subverting the relations, re-inventing the form and the sense of town and architectures. The design debate moves between the two opposite intentions of fighting or accepting the sprawl, by turning it into urban centres or dissolving it in landscapes. Re-edition of public spaces and monuments introduce cores of recognition and resistance in the suburban generic [22]; multitudes of additions extensively densify the sprawl town [23]; the ground is a plot for new urbanities that can be obtained by grafts of public micro-spaces in the private town, contaminations of urban fabric with agricultural one, land reclamation turned into landscape design [24]; urban residues and buildings in abandonment are ground for not codified projects and actions from below [25]; interrupted works are monuments, in memory of mistakes [26]. Named *drosscape*, *junkspace* or *third landscape*, the landscape of waste finds its way through the urban culture [27]. Yet the waste is still uncanny in a world that claims for recycle, for an ecological third industrial revolution [28] and a design process that resets to zero the production of discards [29]. The contemporary global call for sustainability seems to go closer to the Lynch's cacotopia, setting against the present world of wastes a future no-waste world.

In Varcaturò, the landscape's weak traces raise questions on its future, which refer to the debate on repairing sprawl, but most of all refer to low definition as a condition of this place [30]. If this territory is neither city nor countryside nor nature, demonstrating the fading of these notions, according to the urban debate, this condition could be a focus for the consideration on the site. And, what is more, if this city is illegal and it is grown up with no common perspectives, illegal housing is a feature that specifies the low definition here. The different perspectives of turning the latent city into a modern one, of working on it with a weak and sprawl approach, of accompanying its wasting away, which have been stated by recent studies on the illegal town [31], could as well concern the sprawl town, which is going through a crisis all over the world, and could all the more concern such a place like this, where sprawl and illegal town are joint. Whether the hypothesis of self-government for this coastal city is approved or not, the hearth of the matter concerns its character and its vision: if it is named city, which idea of city it represents. In this sense the population's internal debate, to be carefully evaluated, may be significant: whereas the demanding of infrastructures and services to the administration fits with the idea of distance between politics and practices that produced the illegal city, the shifting of the debate from the demand of facilities to the proposal of self-government may turn the reflection to an intermediate level between politics and practices and to a much more complex interpretation of the relationship between public and private space.

Within the design research, the strategic design phase, applied on some sample areas, takes as a background the fading of the territory at its different degrees and works on intermediate levels between politics and practices, public and private, open and closed space, nature and building, recognizing fraying, dissemination and contamination as opportunities for the project. Therefore, if to provide with the basic facilities the inhabited core of the town is a necessity, to infill with sprawl public spaces the porosity of the settlements and the textures of agriculture and nature, or to accommodate the lacking services in the abundant abandoned buildings, or to include ancient ruins and new discards in landscape plans, or to relate with each others the residual public spaces of the privatized shore or, finally, to consider the dissolution of

part of the building, imposed by the demolition ordinances, as a process in progress and an occasion to accompany the wasting away are all possibilities to get indications from the existing, giving form to a collective space which can house the fragments of the sprawl town and the desires of the multitude that gave birth to it. In such a frame, the centrality for the urban core, the respect zone for infrastructures, the total preservation for agricultural, natural and archeological areas, set as imperatives, seem to be outdated and, above all, the urban categories they refer to seem to be obsolete. Their fading away, both in the reality of the territory and in the theory of the city, suggests a design scenery where rare high-definition points allow wide low-definition areas.

The low definition concerns architectural design as well as urban design, when architecture deals with variability, incompleteness, lack of means, when it works on time, on accidents, on possibilities, trying to make the most of the least. Recent design experiences suggest an adaptive attitude, which everyday inhabiting landscape unwittingly exemplify [32]. From that landscape, all the more in the face of abandonment and crisis, architectural culture learns the pragmatic and subversive approach, the aptitude for doing with what it has got, imagining what it could become. The project works by steps, bets on a few main things, foresees progression and variation; it feeds on the existing, forces its uses and forms, gaining new spaces and functions by small moves, taking advantages of the spaces of open-endedness of the rules and uncertainty of the plans; it intercepts bottom-up actions, recognizing population as an active multitude. Keeping away from any rhetoric, participation as well as recycle, it faces their issues through the action. It is a tactical project, either not being able to establish strategies, or accepting that strategies are carried out by not prearranged steps.

In Varcaturo the skeletons, the waiting frame structures, the houses that are available for other uses anonymously ask design questions about interrupted work, progressive project, relationship between denotation and connotation, within a context of sprawl uncertainty. In Varcaturo, the city that has been produced by private actions asks questions about public space and landscape, within a conflicting context. In such a context, the tactical aptitude for deviation, dispensation, exception, which allowed the private city to advance at the public city's and landscape's expense by sums of individual moves, could turn into a last resource for the public city itself, constrained to regain terrain by sneaking into the buildings, forcing the fences, occupying disused and empty spaces, aiming at total transformations by sums of single actions.

Within the design research, the architectural design phase goes along with the strategies through punctual interventions, which gather from inhabiting practices the aptitude for varying elements and moves, according to necessities and intentions, so as to restart the interrupted game of the territory's construction with opposite goals. Therefore, the fence, the soil, the skeleton, the roof, the envelope, which were the protagonists of the houses' composition, reappears in countless versions in the composition of spaces and architecture, which, starting from the houses and getting in-between the houses, trace a collective frame. The fence is confirmed, broken, cancelled, as to manipulate the boundaries between open and closed or public and private spaces, by delimiting rooms in the landscape or fluidifying the intervals between the buildings; the terrain is reclaimed, asphalted, cultivated or re-naturalized, worked in its depth, turned into spaces of hybridization between city and nature; the skeleton is naked, partially or completely filled in, repeated, magnified, taking advantage of its elementary structure and its condition of open work in order to accommodate systems of services within architectures turned into a system; the roof is base for controlled additions, container of interiors, last floor, providing habitable spaces and additional viewpoints on the landscape; the envelope is articulated, pierced, shaped, as to insert spaces and performances, converting existing buildings through carrying mutations parasites. Once uncovered the game, the public city looks for its revenge on private city by borrowing its moves.

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## The documentation of cultural information used as vehicle for regional sustainable development: the case of olive culture

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### Abstract

This paper is about a three- year research program funded by European Union and partly by Greek funds under the title: "The documentation of cultural information used as vehicle for regional sustainable development. The case of olive culture". The research is carried out by the author and hosted by the University of Peloponnese, School of History, Archeology and Cultural Management in Greece. It will be realized by the end of 2014.

Olive culture has been part of the Mediterranean culture for centuries and part of the global culture, as well. Olive oil has been a wealth - producing factor of the areas where olive grows. Unfortunately, through time the rest of olive's culture elements seem to vanish, knowledge, practices and techniques of hundreds of years are likely to be lost. Also, the olive cultivation areas face severe financial problems and seek for solutions. The reuse of the elements of olive culture in a new perspective has the potential to give to these areas the solution they look for.

The project's aim is the recording and documentation, in accordance with existing standards, of the whole of the scientific information of olive's culture (recording and documenting traditional and modern methods of cultivation, the olive groves, production techniques, products, production facilities, tools, and written testimonies, local traditions related to olive) in the prefectures of Messinia and Corfu (which includes the island of Paxos and Diapontia Nisia), oil producing areas of the past and present with different socioeconomic backgrounds, and using its results by their representation in electronic environment with open access for the public via Internet and by various methods such as seminars, workshops, study visits to strengthen social and economic development of local communities, but also to their use in areas with similar socio-economic characteristics. As far as it concerns the project's originality, it is the first attempt to document all the cultural elements associated with olive culture in Greece and abroad. It is not only confined to the documentation and promotion of technical culture but combines folklore and intangible heritage with cultural landscape heritage to promote regional growth. Although, the culture of olive is attached to Mediterranean culture, in the World Heritage List no olive oil cultivation areas are included as cultural landscape heritage although vineyards and other cultivations are. So far, across Europe and especially in countries where olive is cultivated, the documentation of cultural elements associated with it is limited to a partial or patchy record of the technical culture of olive such as machinery and production tools, and factories, mills, soap factories as architectural monuments of modern heritage. The olive museums in the Mediterranean countries have documented the technical olive heritage and some of them also offer educational programs for the traditional methods of oil cultivation and production and have historical archives, library and art departments specialized in olive culture. There are also recordings of archival material relating to oil production and the traditional olive oil soap. Occasionally, the production techniques of olive oil and traditional olive oil soap are documented as intangible cultural heritage by official government agencies and scientific instruments. The cultivation methods of olive trees, traditional and contemporary, have not been documented as intangible cultural heritage and the olive groves have not been documented as cultural landscape heritage according to scientific documentation standards, techniques and practices.

This project intends to suggest how areas of these local economies could improve with the help of the total documentation of olive culture. It is the first time that cultural documentation aims at enhancing local economy and proposes development models.

#### **TECHNICAL / SCIENTIFIC OBJECTIVES**

- Recording and documentation of all cultural goods associated with the olive in these areas, in accordance with international standards of documentation for each category of cultural goods. The recording will be done through field research.
- Evaluation of the documented cultural information. Methods' design for its dissemination in society.
- Promoting the documented cultural information to society, via Internet. Organizing the documented cultural information in an electronic environment (databases, electronic directories, multimedia, etc.) which will be accessible via Internet for users' information and education.
- Application of cultural information promoting methods (except for Internet) to a variety of socioeconomic groups in order to educate and improve local economies. Possible methods are: seminars, workshops, study visits, conferences, contributing to the content of courses at all levels of education
- Review of the first results from the transfer of knowledge to users

**Keywords:** documentation of cultural heritage, olive groves' cultural landscape, Mediterranean region

#### **Section**

Olive culture has been part of the Mediterranean culture for centuries and part of the global culture, as well. Olive oil has been a wealth - producing factor of the areas where olive grows. Unfortunately, through time the rest of olive's culture elements seem to vanish, knowledge, practices and techniques of hundreds of years are likely to be lost. Also, the olive cultivation areas face severe financial problems and seek for solutions. The reuse of the elements of olive culture in a new perspective has the potential to give to these areas the solution they look for.

This research aims to record and document the whole olive civilization and its use as a factor of social and economic regional growth. It is a long lasting, multilevel and interdisciplinary research which involves information, social, economic and environmental sciences. It also includes tangible, intangible and cultural landscape heritage.

The first innovative element of this research is that it will attempt to record and document, as cultural goods, in terms of cultural landscape heritage, the olive groves of two Greek regions, Corfu (which includes the island of Paxos and Diapontia Nisia) and Messinia, the local olive tree cultivation, production of olive oil and traditional olive oil soap methods as intangible cultural heritage. In 1992 the World Heritage Convention became the first international legal instrument to recognise and protect cultural landscapes. The Committee at its 16th session adopted guidelines concerning their inclusion in the World Heritage List. Although, the culture of olive is attached to Mediterranean culture, in the World Heritage List no olive oil cultivation areas are included as cultural landscape heritage although vineyards and other cultivations are, like the Lavaux Vineyard Terraces in Switzerland, the Alto Douro Wine Region and the Landscape of the Pico Island Vineyard Culture in Portugal, the Rice Terraces of the Philippine Cordilleras, the Agave Landscape and Ancient Industrial Facilities of Tequila in Mexico, the Tokaj Wine Region Historic Cultural Landscape in Hungary and the Viñales Valley in Cuba.

The olive groves of Corfu- Paxos and Messinia have a long history. In Corfu region, their first appearance is lost in time but in the time the island was under the occupation of D' Anjou (1267-1386) the island's olive groves were highly appreciated by the regime although they had not yet acquired the importance they had under Venetian rule (1386-1790) which encouraged the planting of olive trees and rewarded with twelve golden coins anyone who planted one hundred olive trees and so, in the last years of Venetian rule, the island had two million olive trees. Today, it has about four million olive trees. In Messinia region olive groves have a long history, as well. They have been cultivated from ancient times until nowadays but most of the contemporary olive groves of Messinia were replanted after a disastrous fire put by the Ottomans, in the time of the Greek revolution of 1821. Olive groves have been a wealth- producing source for both regions. Unfortunately, in the case of Corfu, a large percentage of the olive groves have been neglected due to the region's tourist oriented economy over the last three decades. Protection of cultural landscapes can contribute to modern techniques of sustainable land-use and can maintain or enhance natural values in the landscape. The continued existence of traditional forms of land-use supports biological diversity in many

regions of the world. The protection of traditional cultural landscapes is therefore helpful in maintaining biological diversity.

It will also be the first time that totally the pre- industrial and industrial heritage related to olive oil, local traditions related to olive and the written documents, such as archival material, will be recorded and documented in these two regions. So far, across Europe and especially in countries where olive is cultivated, the documentation of cultural elements associated with it is limited to a partial or patchy record of the technical culture of olive such as machinery and production tools, and factories, mills, soap factories as architectural monuments of modern heritage. The olive museums in the Mediterranean countries have documented the technical olive heritage and some of them offer also educational programs for the traditional methods of oil cultivation and production and have historical archives, library and art departments specialized in olive culture.

The second innovative element is that the results of this research will be used to promote social and economic growth in these two regions. It will be the first time that documented cultural information will be used to improve regional economy.

The total recording of the cultural goods which constitute olive civilization will be fulfilled with on the field research in the regions of Corfu and Messinia. Information will be retrieved from formal authorities related to the olive cultivation, Technical Chambers, Historical Archives Repositories, private and public, libraries but also from local administration services. The recording and documentation of olive oil mills, soap factories, their machinery and other equipment will be fulfilled according to the international documentation standards for architectural and industrial heritage and with the aid of architects where that will be needed. The recording and documentation of olive cultivation methods in these two regions, as cultural intangible good, will be done with the support of scientific evidence which is provided from authorities such as the Olive Institute in Corfu, from bibliographic and archival material and from the recording of olive tree cultivators' and workers' interviews and the recording of their field work on video.

The recording and documentation of the olive groves will be done with information from formal scientific authorities of the Ministry of Agricultural Development, the Prefectures but also with photographic, topographic and multimedia documentation and the addition of oral testimonies of olive tree cultivators and workers.

The recording and documentation of local traditions related to olive tree will be carried out with the use of archival and bibliographic material but also with the recording of oral testimonies and video recordings of folklore happenings.

As far as it concerns archives, until now, there have not been located olive oil mills' historical archives in these regions but only the historical archive of a traditional 19<sup>th</sup> century soap factory in Corfu. This research will probably bring to light new archival material but it will surely include archival material produced by authorities related to olive cultivation and exploitation.

The collected material will be classified and catalogued. After that, the methods for its dissemination to society will be named and scheduled. The first step for its promotion will be realized with the creation of an electronic thesaurus which will be available through Internet and a second step will involve educational and information actions.

The collected documented cultural information will be organized in electronic environment in data bases, electronic catalogues, multimedia, etc. according to the international standards for the representation of documented cultural data in electronic environment, which will be available through Internet and in other media such as DVD-R.

This thesaurus will have an immense usability for various user groups such as farmers, scientists, students, researchers, businesspeople and its usability will be multiplied by its electronic form which will be accessible through Internet from the node of the University of Peloponnese. Users will have the chance to search in it with the use of word- keys, by subject, alphabetical, chronological search and have full access to the whole of the recorded and documented material.

The aim for this thesaurus is to be first available in Greek and English and in the future in the languages of the peoples of the Mediterranean as it is estimated that this material will be valuable for them.

A close range educational and information approach of all possible user groups, which can be benefited from the total documented information of olive tree civilization, is vital as it will give them the chance, apart from becoming familiar with the collected material- which can be done through the Internet- to be trained by the team, which conducted the research, for the possible ways they could use this material for the educational, social and economic benefit of each group.

These actions will probably be: seminars, galas, congresses, educational visits, and educational programs for formal authorities which are related to olive tree on how they could use the collected material in benefit of the users, participation at the educational procedures and the teaching material of all educational levels in the regions where the research took place.

Priority will be given to information and training through seminars to the authorities which are related to olive tree and olive oil scientifically and commercially, such as the formal authorities of the Ministry of Agricultural Development, the Commercial and Industrial chambers, the Agricultural cooperatives to inform and train their staff and members, and also to farmers, olive cultivators and producers, olive oil soap producers and all the people working in these fields. In addition, there will be seminars for the authorities of local governments.

The thesaurus' use gives the possibility for the enhancement of activities of enterprises active in agricultural tourism in these regions but it can also suggest the development of new forms of agricultural and cultural tourism in them and in other regions with common socioeconomic features in Greece and in the Mediterranean region, as well. Therefore, educational and information actions will take place, concerning businesspeople of this field.

Besides user groups which are directly involved with olive tree civilization, there is a broader audience to be informed and potentially benefited, in various ways, from this information.

The economies of these two regions have changed their orientation through time and several mistakes have been made on the implementation of new economic activities. In the case of Corfu region, agricultural production and local industrial activity have been vivid until the 80's when there was a sudden turn to a mass and completely anarchist tourist economy. But as, tourist activity has noticed continuous decline since the mid 90's, a demand for change has arisen, to take advantage of the neglected wealth- producing sources of the islands of Corfu and Paxos, which are their olive groves and culture. Tourism as monoculture resulted into the vanishing of local industries, agricultural professions and neglecting the creation of job positions for the maintenance and promotion of the many centuries, rich region's civilization.

The case of Messinia region, has, up to a point, many common features with Corfu- Paxos region. In that region, agricultural production, an intense commercial and industrial activity and also a mild tourist development have taken place until recently. Agricultural production is still vivid and region's olive oil is famous all over the world as it is exported. However, small scale producers face severe financial problems, the region has a quite high unemployment rate and it cannot develop totally its capabilities through various forms of entrepreneurship.

Having in mind this situation in these two regions, the information and training on the research's results of a polymorphic audience such as, new scientists, entrepreneurs seeking to change their business activities, unemployed people, can be inspiring for them and lead to the creation of new economic activities. Proposed information and training methods for these groups are: seminars, galas, and educational visits to olive groves, olive oil mills, and soap industries with the participation of people involved in these fields.

Possible users coming from all educational stages form an audience which has the potential to contribute, in the future, to the change of development policy and is open to information stimulus when these are clearly communicated. Therefore, the proposed research program aims to target to school and university students' user group. Apart from the organization of seminars and educational visits, there will be an attempt to incorporate parts of the research into the teaching material of school and university courses of schools and universities which are based in the regions of Corfu and Messinia, to establish a permanent contact of young people with olive culture.



In the context of the information and training of a broader audience, international scientific congresses will be organized by the University of Peloponnese.

It is presumed that in long time scale, users' information and training will have the substantial results. Therefore, the proposed research aims for a continuous interactive relation with users for a potential improvement of their information and training and the research's results exploitation methods in socio-economic level.

An evaluation process of the first results on how users estimate they have been benefited from the research's results and how they could use them will follow the information and education actions. A recording of these first results will be done via printed and electronic/ on line questionnaires and galas where users will have the chance to present their impressions. This early evaluation is considered of high importance on how the research's results could be used by new user groups, if there will be a changing need in information and educational methods and on how they could be useful for other regions in Greece and in the Mediterranean region

## Subsection

### Photographic Material



Fig. 1: Olive grove in northern Corfu



Fig.2, : Olive grove in Messinia



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## Testing Urban Landscapes

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### Abstract

In this paper I will analyze the tactical potential of small-scale architectural interventions in urban landscape and illustrate it with the collection of installative projects that have been realized in Tallinn during last ten years.

As dutch architecture theoretician Hans Ibelings has pointed out, adaptive re-use, sustainability and building for demographic decline are the strategies for the coming years in western countries. In Estonia the ultra-liberal governmental policy is combined with the left-wing democratic planning structure. The mismatch of private-public interests has produced a hectic planning practice. While there are no clear big-scale planning visions, several creative people have found other ways to test urban potentials. This small country - with moderate natural resources, small number of inhabitants and harsh climatic conditions, where even simple solutions need more effort - works well as a flexible 'test-field'.

I would like to show how small delicate architectural interventions in abandoned places have changed the atmosphere of the places and created new physical and mental links in urban context. These small material changes bring along much bigger changes in people's values and habits. We may imagine renewing the planning system so it could be more viable when considering with the small successful tactical tests.

**Keywords:** urban landscape, installation, planning, test-field

### 1. Marking as spatial practice

Marking places with the installations can be interpreted as our natural biological behaviour. Marking the territory is well known among animals, in order to protect their home territories and food sources. Territorial behaviour aims to avoid more serious battles among representatives of the same species. Sophisticated rituals are carried out daily according to the needs. For human beings the marking has also complex reasons: invitation or restriction, highlighting, surprising, warning statement of the power. Marking is the tool for communication. The fence around the building announces about the territory for the selected persons, white lines on asphalt are regulating the traffic flows, red-and-white tape refers to a danger zone, flag on the moon acknowledges the completion of the mission impossible...



Fig. 1: Marking act of Man on the Moon

The complex structure of the cities produces besides the "normal" marking behaviour also another kind of manifestations. Graffiti is one of the alternative indications, where next to the message there is also important the territorial factor. Norwegian architect Sverre Fehn has written that graffiti is the reaction to anonymity and illustrates his argument with an example from architecture: when modernism cleaned the facades from the ornament and left behind the empty surfaces - buildings "without the faces", then, by the theory of Fehn, urban artists started to cover these surfaces in order to give back the identity to the buildings. The earliest graffiti artists were probably professional sailors who tattooed their bodies: since they didn't have home in the traditional meaning, they marked their bodies as homes. Urban graffiti works also as a social valve - it is an alternative manner to signalize about certain problems, a media form where the author of the message is difficult to identify and for what reason it is possible to express oneself incisively.

## **2. Strategical planning versus tactical interventions**

As many authors have indicated the traditional urban planning system is in crisis and there is need to look for new methods to react adequately to the rapid urban and environmental changes in our cities. Of course there are different local actors in different countries and regions. I will shortly speak about Estonia - a small ex-soviet country that has worked itself up to an equal member of European Union.

On one hand Estonian successful economy has been driven by right-wing liberal policy after the liberation from the soviet occupation, that means less taxes, less administrative obstacles and governmental supervision that has promoted the economical growth. The strategy of "less government" has been working well during the years of transition for the young state and brought along a remarkable economical jump. Former soviet time has been left behind and has become a distant history.

On the other hand many other areas of the society are underdeveloped in the condition of the economical hegemony. Culture, education, social welfare as well as the urban life has not taken part of the blooming, with some exceptions they rather operating in survival mode. Coming closer to the subject - the planning process has been delegated to private developers who can fluently realize their business-plans. This has been stimulating the building market but at the same time brought along greater fragmentation of the cities because of the lack of overall visions. Private developers naturally follow their own purpose to make profit and very often they just ignore the other needs of the city.

Planning system, like the economy, meets the political strategy of "less government". Here that means a constant shortage of well-educated specialists in administration. The system that has been taken over from northern countries requires a large high-level planning office that we simply don't have. At the same time the amount of bureaucratic structures, standards and requirements grows and therefore there is always a risk that the original objective and content will become confused in the supervision of the respective project. Ever more energy is expended in plans as well in architecture to achieve the predescribed standards and exact conformity with procedure, whereas the aspect of content often does not even seem to interest anyone anymore. There are number of institutions that set the rules of the game in their sphere as well as the other interested parties, who argue among themselves to come to the solution that suits to everyone. This is often the content of the planning and the more detailed design that follows. It is as if none of them aspire to a broader and more general view, to building the country and the city. Ideally the municipal planning department should do this but mostly this remains a positive ambition without sufficient institutional power.

[1]





Fig. 1: Street festival in Uus Maailm



Fig. 2: Open air concert in Uus Maailm

After twenty years of independence, we have to ask ourselves: where are the visions of how the state and the city should be built and developed for its people. As a reaction on urban level many grass-root organizations and communities have been activated and started different initiatives of vitalizing the city life. First communities started clearly as reactionary - they were formed mainly for fighting against some arrogant development plan. Later the communities changed to a more proactive groups, started positive programs like for instance the community of the quarter named Uus Maailm ("new world"), formed by the inhabitants of the old wooden buildings' district, mainly younger generation, who are promoting ecological lifestyle, bicycle culture, organizing public events like street market, street festival, open air concerts, etc.

Parallely with communities' human-scale activities there has been always alive the will to promote the visionary spatial thinking at general level among professionals. Content-rich city planning is utmost objective during the education of architects and urban planners and therefore the processes of urban fragmentation have been frustrating to observe. Few years ago the Tallinn's planning department promoted the political vision to turn the city's face towards the sea. That is still the only spatial declaration that has not yet realized but it has brought along many interesting phenomena.



Fig. 3: Map of Tallinn's underdeveloped waterfront



The abandoned coastline in the city has been a unique "polygon" for non-planned activities far before the official statement to broaden the city centre towards the sea. During the soviet time the waterfront was mainly closed. It was the restricted zone, occupied by military structures, prison, heavy industries and closed harbours. When the soviet industries left, the territory got a status of no-man's-land and therefore filled soon with new kind of self-organized life. Local people started to use the wild beach for grilling, promenading, fishing, drive-in sunbathing, dog-bathing - all these were so-called illegal activities but the local government didn't intervene much since the land belongs actually to private owners. In addition the area was also observed and used by artists. Naturally the waterfront has been the subject of studies for architecture students for many years. On this polygon one could observe the viability of the non-planned city-life. Small social groups formed their own territorial rules: fishermen took an old half-drowned wooden shipwreck as their "private" territory and didn't let anybody else on board when they were fishing. Another group - dog owners - gathered there to swim their pets. People themselves stayed at the beach while their dogs were bathing. Naturally some homeless people set their homes in the small caves near the beach and had their fireplace in front of their "door" - this area was also "privatized" like the fishermen's deck.



Fig. 4: Fishermen on the shipwreck



Fig. 5: Unofficial "dog bathing beach"

### 3. Waterfront landscape as test-field

In earlier years the urban landscape interventions have been mainly small-scale "wild" tests. As one example KAVAKAVA architects arranged a landscape installation named "Found Pleasures" at Kalarand's waterfront. This place offers different pleasures that are not officially proposed but the waterfront is actively used as described above. To see the hidden beauty of the wasteland, visitors have to use their imagination and senses. The area that used to be a fishing factory in soviet time now waits for the new development plan. Until the new developments start to be realized the place continues its wild life as a test-field.



Fig. 6: Fragments of landscape installation "Found Pleasures" 2002 in Kalarand ("fishermen's beach").  
Authors Katrin Koov, Kaire Nõmm, Siiri Vallner, KAVAKAVA architects

Last year brought along the shift in the scale and the span of the promotion of urban installations. Tallinn carried the title of European Cultural Capital 2011. During the other activities city government launched the festival of urban installations LIFT11 that turned out to be utmost popular. An open competition held in autumn 2010 resulted in 129 projects, of which 10 works were selected to be set up in summer 2011 as part of the festival. These site-specific works created at various locations in Tallinn highlighted the specific sites and angles in contrast with the 'postcard' image of Tallinn, addressing local residents as well as visitors. On a wider scale, LIFT11 attempted to break down prejudice towards public art in Tallinn and draw attention to the ample array of opportunities for using city space. [2]

Not very surprisingly a large amount of proposals were offered for the waterfront area. That was even easier to arrange since the city's transportation department had been built a temporary pedestrian road after removing the old rails from the coastline. The new "culture kilometre" gathered together many potential places and buildings: former power plant that is under reconstruction to be transformed into a culture factory, squatted alternative museum for modern art, former hangars for waterplains - now maritime museum, former prison - now unofficial prison museum, former ship-building yard - now temporarily used for modern operas. And between those solid large-scale buildings small and smart human-scale installations were built and several events took place. As follows some examples of the installations will be described that were built along the waterfront.



Fig. 7: Pier installation. Before and after. Summer 2011. Authors Siiri Vallner and Indrek Peil

### Pier

The pier located by the Culture Kilometre has weathered and deformed over decades and become unfit for landing boats. However, it would be perfect for sitting, relaxing and having a good time. It can be made usable in its present condition with just a few touches, by conserving and reinforcing the slanting concrete faces and covering them with terrace boards. The boarded surfaces will reflect the shapes of concrete slabs created upon disintegration. This way, a derelict and crumbling object can be revived as part of the modern city space, opening up the seaside area of Tallinn for local people and for visitors. [2]



Fig. 8, 9: Fishermen's Beach installation. Summer 2011. Authors Toomas Paaver, Teele Pehk and Triin Talk





## Kalarand

Fishermen's Beach is located on a stretch of shore between the Linnahall and the Patarei fortress, is an improvised beach which has become a popular bathing spot among local people. Regardless of the widespread assumption that the site is polluted, practice has shown the water to be clean and the location naturally suitable for bathing. This is the closest bathing site to the city centre of Tallinn.

In summer 2010, the authors of the installation did a pilot test, setting up a changing cubicle at Kalarand. This marked the place out as a bathing site and the bathers began to use the cubicle right away.

In summer 2011, this urban intervention in public space was repeated on a somewhat grander scale by building a more solid cabin and adding some other elements of a beach, like bench and terraces. The beach area was cleared and the scrub trimmed. Dustbins were provided for the summer season. The seabed of the bathing site was cleared of rubbish and pieces of concrete; water samples were taken and analysis results were posted on a notice board. Regardless of the refurbishments, Kalarand was not listed as an official beach, and people going into the water there were doing so at their own risk. There was no lifeguard service.

These urban interventions like 'sit-or-swim-at-your-own-risk' attempted to draw attention to the plans that concern the entire area and are aimed at developing a large residential and port area there. The residents of Kalamaja contested the proposed plan and it has not been adopted so far. The use of seashore as a beach and public space will not preclude the development of residential buildings or port facilities because that area of land and sea is quite large and holds various opportunities. The use of city space as a beach could also enrich and revive the development plans and help the owner of the property improve the image of the area, the quality of its future environment and its use. [2]



Fig. 10: Linnahall in the year 1980



Fig. 11: Installation "To the Sea". Author Tomomi Hayashi

## To the sea

The Linnahall, built for the Tallinn Olympic Regatta held in 1980, was the first and only place offering common people access to the sea within the centre of the city during the Soviet era. The area by the Linnahall used to be closed, and therefore people had to walk across the roof. Nowadays the sea is also accessible from elsewhere in the city centre but the unique location of the Linnahall combined with its architectural design produce a viewing platform for unforgettable experience along with a system of stairs and areas for strolling. The low mastaba-like structure of the building was so designed to preserve a view of the Old Town from Tallinn Bay. The design of the Linnahall, by Raine Karp and Riina Altmäe, still appears fresh and modern.

However, because of poor construction quality and some functional peculiarities, such as the absence of an orchestra pit and the fly tower being too low, the concert hall is in hibernation today, waiting for the winds of change and for investments. The stairs and the roof are still open to the public and the Linnahall continues to be a popular meeting place, especially in the warm season. [2]

#### 4. Different scales and materials

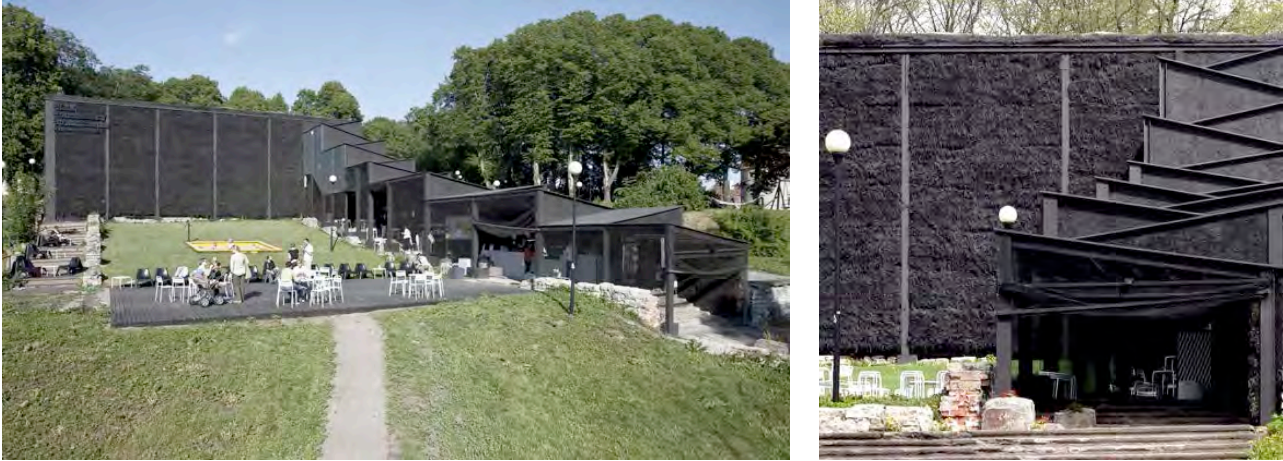


Fig. 12, 13: Temporary Straw Theatre NO99 at Skoone bastion. Summer 2011. Authors SALTO architects

At the same time with installation festival another temporary object was erected not far from waterfront - on top of the Skoone bastion. A relatively small theatre called NO99 built a quite large theatre hall from straw for just one summer. Theatre hall that was built for a specific purpose, programme and location, operated from May to October, worked as a landmark and catalyst for the former military area that has been abandoned for years. The idea of building a theatre-installation that has a meaning not only by its function but also by the idea and material, has been floating in many heads but this time the young leaders of the alternative theatre Ene-Liis Semper and Tiit Ojasoo made it real. The project was conducted by young architecture office SALTO. The rectangular main volume of the theatre is situated exactly on the same spot as the former navy summer theatre, and one descending flight of stairs of the latter is used as a covered walkway and entrance area to the Straw Theatre. The dramatic appeal of the building stems from its contextual setting on the site and its black, uncompromisingly mute main volume contrasting with a descending „tail“ with an articulate angular roof. And of course one cannot escape the effect of the material – uncovered straw bales, painted black. The Straw Theatre is a unique occasion where straw has been used for a large public building and adjusted to a refined architectural form. [3] For the initiators the outdoor activities were as important as indoor program: the bastion was full of life daily due to the cafe and different playgrounds. This temporary complex wisely made use of the given manmade landscape form.



Fig. 14, 15: Light installation "Garden of Eden". Wilhelm Kühnert's forgotten dendropark in Tallinn. Authors Yoko Alender and Indrek Leht. Tallinn Light Festival 2004

If to look back to the independence years we may see that the tradition of installations has been most vital in the immaterial area: light installations have been built during the yearly Light Festivals for more than 10 years already. The darkest time of the year has been marked with magical light, bringing people outdoors to defy the freezing weather in order to explore the city's hidden values. As one example here is presented the



lighting project named "Garden of Eden" where the passers' eyes are turned towards the old rare trees, that date back to 19th century, a lost garden of Wilhelm Kühnert who was one of the establishers of Estonian forestry culture. With delicate lighting this valuable historical layer of this particular city quarter was revealed. Light has the magical power to change the atmosphere and besides it has distinctive survival meaning for the northern people - it gives light and warmth in the cold darkness.

## 5. Conclusion

Ideally the cities should be developed in both ways: top-down (by visionary planning) and bottom-up (by local initiatives and temporary interventions) simultaneously. By doing so, there is hope that plans and needs could meet in real life. It is almost impossible to make field tests for the big-scale planning proposals in order to check the solution's durability or the social impact. At this point small-scale installations could be suitable tactical tools for testing some specific part of the planning proposal in minimized or concentrated form. Temporary interventions have proved itself to be especially good in testing the social acceptance. Installations are also economically highly efficient: they can test social, environmental or economical potentials of the particular place by mostly very low cost of the installation itself. On the other hand installations can still remain as independent landmarks that embody the urban freedom. Urban installations are either objects of art, architecture, landscape architecture or design, which are, in conjunction with their surroundings, intended to offer a spatial experience or to comment on the urban environment in a critical or humorous manner. Derelict urban landscapes are perfect test-fields for the site's future potentials and therefore temporary interventions could be used more courageously next to the visionary planning. Only within the continuous dialogue of different methods the content-rich and human-scale urban spaces can be developed.

I would like to end up this paper with landscape ecologist Anne Whiston Spirn's poetical words: the language of landscape is our native language. Anyone with a keen sensibility can recover that language. We are architects of our environment and we need work with people as well as with natural processes to create places that are functional, sustainable and meaningful. [4]

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## Technical and architectural integration of a solar cooling system in a historical building

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### Abstract

Solar heating and cooling technology is a plant engineering technique which uses hot water of solar collectors for building air conditioning during both winter and summer. Recently the interest for this technology has grown constantly especially due to the fact that it allows to reduce carbon dioxide emissions, save energy, and assure a local supply of energy thus more reliable.

A critical point of discussion begins when solar collectors are installed in historical buildings because the protrusion formed by solar panels and mounting structures transforms the shape of the building, thereby altering its architectural aspects. In these cases, respect for historical heritage, protection of the landscape and the employment of renewable energy must be conciliated. As a consequence the design of the installation must be performed in order find out a good balance between technical and aesthetical requests.

In this paper a solar heating and cooling plant designed for the Architecture Faculty of Second University of Naples with the aim to promote solar cooling and heating installations that facilitate the discovery of visual integrations and good compromises between technical and architectonic features is depicted in detail.

**Keywords:** solar cooling, historical building; architectural integration.

### 1. Introduction

The energy demand in the residential and tertiary sector represents the 36% of European final energy: 25% for households and 11% for services [1]. This amount of energy is mainly used for air conditioning indoor spaces, heating water, electrical appliances and lighting. The energy demand for heating is projected to increase until 2030 and then stabilize. In contrast, energy demand for cooling is projected to increase rapidly over the current century due to the climate warming [2].

These world energy demand trends are the catalysts calling for the creation of new models in energy conversion; encouraging strategies with renewable energies and higher levels of efficiency to reduce the energy input and pollutants emissions.

With regard to renewable energy sources, a number of innovative renewable technologies are emerging. For example, new building-integrated wind turbines [3], cogenerative solar photovoltaic collectors [4], solar heating and cooling systems [5-8] are currently under investigation both by industry and academia.

Among these emerging technologies, solar heating and cooling (SHC) is probably one of the best choices. A great advantage of such technology lies in the possibility of using solar radiation to provide space heating during the winter and space cooling in the summer, by using a heat-driven chiller. SHC systems are very profitable particularly in summer operation mode, when the maximum demand for cooling coincides with the maximum availability of solar radiation. SHC may significantly contribute to achieve the goals in terms of energy savings, greenhouse gas emissions reductions and increase of use of renewable energy sources, including those goals stated by EU in the Directive 2009/28/EC [9].

A solar heating and cooling system has been designed for conditioning during both summer and winter the nineteenth-century portion, called in Italian “Corpo Ottocentesco”, of the Architecture Faculty of Second University of Naples, located in Aversa, a municipality 20 km far from Naples (Italy). The project has been performed also with the aim to facilitate the discovery of visual integrations and good compromises between technical and architectonic features.

The Architecture Faculty of Second University of Naples is located within the Abbey of San Lorenzo ad Septimum. The abbey complex has been built at the end of tenth century along the consular street named “Via Campana” and represents the result of three centuries of history. The church has been raised around 1080: it has a nave and two aisles and shows several stratifications. The bell tower has been rebuilt around mid-fifteenth century as a consequence of the earthquake of 1456. The main renaissance cloister has several round arches positioned over doric columns; it acts as the connection among the different parts of the abbey complex: towards the north there is the church; the garden is located towards the south; westward there are the minor baroque cloister and the eighteenth-century portion at the hands of the architect Ferdinando Fuga; eastward there is the nineteenth-century portion that has been completed during the time when the abbey has been designed as College and Real School of Arts (Figure 1). Additional details regarding the Abbey of San Lorenzo ad Septimum can be found in [10].



**Fig. 1:** Plan of the San Lorenzo ad Septimum abbey (on the left). View of the nineteenth-century portion of the Architecture Faculty of Second University of Naples (on the right).

In a SHC plant the solar energy required for heating (winter season) or for operating the heat-driven chiller (summer season) is recovered by installing several solar collectors. In case of historical buildings the protrusion formed by solar panels and mounting structures transforms the shape of the building, thereby altering its architectural aspects. The design of the air conditioning for the Architecture Faculty of Second University of Naples has been carried out in order find out a balance between technical and aesthetical requests.

The main aim of the project is to emphasize the respect of local biological cycles adding environmental value thanks to the production of clean energy. The design concept is then developed through the study of natural organisms and their life cycles by integrating all the elements of the SHC system. In this paper the architectural solutions adopted to achieve the best compromise among respect for historical heritage, protection of the landscape and the employment of renewable energy are illustrated and analyzed in detail.

## 2. Solar cooling and heating plant description

The portion of the Architecture Faculty of Second University of Naples, named in Italian “Corpo Ottocentesco”, is a three levels building containing three classrooms, with a total volume equal to 4533 m<sup>3</sup>

and a total surface area of 842 m<sup>2</sup>. This portion of the building is currently heated by using both hot water and hot air, while chilled water is currently used as the cooling medium during warm season:

- hot water is produced by an oil fired boiler with a nominal capacity equal to 349 kW;
- chilled water is cooled by an electrically driven vapour compression refrigerating system, with a nominal capacity of 79 kW using R407C (a mixture of greenhouse gases) as refrigerant;
- air is heated up by means of an Air Handling Unit (AHU) with 6500 m<sup>3</sup>/h as nominal volumetric flow rate.

Water is heated up by the boiler up to a preset temperature and circulated throughout the building by means of a pumps by way of fan-coils, while air distribution into the three classrooms being air conditioned is performed by using air vents at high level.

A new air conditioning system has been designed with the main aims to save energy and reduce greenhouse gas emissions. The design of the system has been carried out in order to get the best integration between the plant components and the architectural constraints. The new proposed air conditioning system is composed by two main subsystems:

1. a solar cooling and heating plant with absorption chiller;
2. a solar cooling plant whit desiccant wheel.

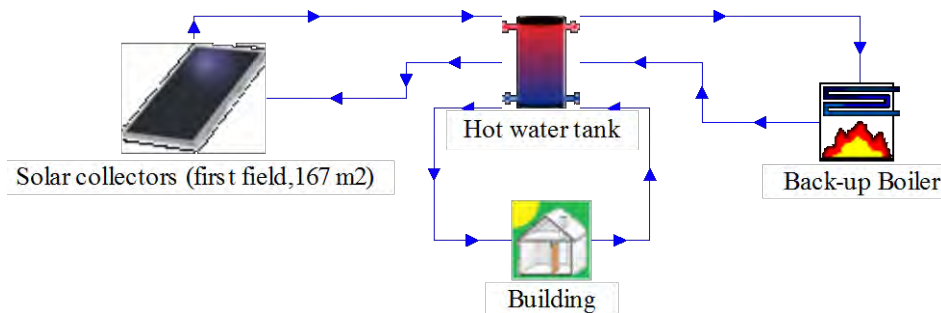
The main components of these two subsystems are:

- two fields of flat-plate solar thermal collectors with evacuated tubes (the first one with an open area of 167 m<sup>2</sup> and the second one with an open area of 130 m<sup>2</sup>), horizontally installed on the roof of several hexagonal cells positioned in the garden of the faculty;
- a single-effect LiBr /water absorption chiller of 70 kW cooling capacity;
- an air handling unit with desiccant wheel;
- a peak-up boiler fuelled by oil (one of the three already installed for heating the faculty);
- two hot water storage tanks with different volumes (the first one of 4000 liters and the second one of 2000 liters);
- a cold water storage tank of 1000 liters.

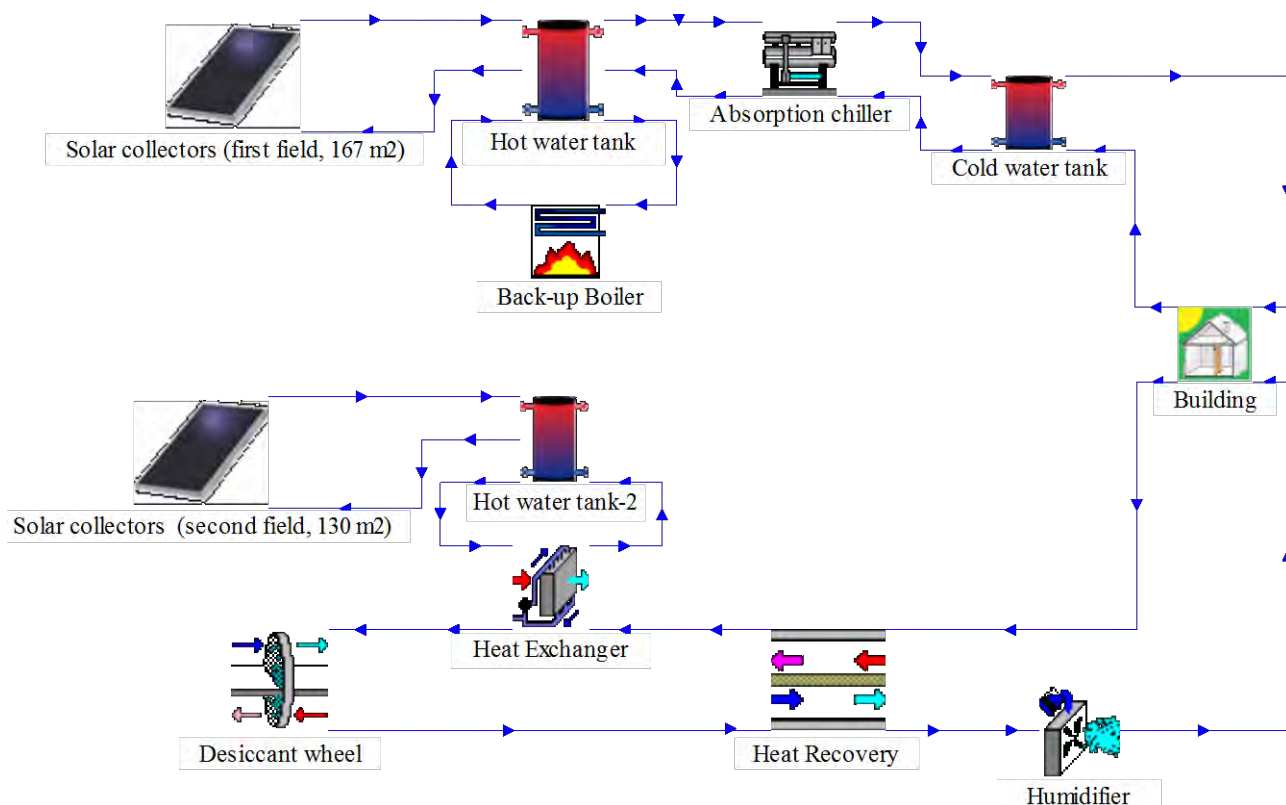
Nominal cooling capacity of the absorption chiller has been defined by estimating the cooling load of the "Corpo Ottocentesco". This estimation has been performed by using the software Thermus [11].

The number of solar collectors has been defined by assuming a value of 0.7 as coefficient of performance for the absorption chiller and an average solar irradiation equal to 900 W/m<sup>2</sup>.

In figure 2 a schematic view of the system during winter operation is reported, while Figure 3 shows the main components of the air conditioning plant during summer operation.



**Fig. 2:** Schematic view of the system during winter operation.



**Fig. 3:** Schematic view of the system during summer operation.

During the winter the heat recovered from the first field of solar collectors is stored in the 4000 l tank till reaching a preset hot water temperature; due to the fact that the solar energy striking the Earth's surface is poor during the cold season, a peak up boiler has been considered in order to guarantee at any time the desired water temperature in the hot storage. The hot water stored in the tank is then used for heating the building. During the winter both the absorption chiller and the solar cooling plant with desiccant wheel do not operate.

During the warm season, the sensible cooling load of the building is balanced by the solar cooling plant with absorption chiller, while the solar cooling plant with desiccant wheel balances the latent cooling load of the building. System operation during the summer can be summarized as follows:

- heat recovered from the first field of solar collectors and stored in the hot water tank (4000 liters) is transferred to the absorption chiller; when supplied with hot water, the absorption chiller is a system able to provide cold water; the provide cooling power coming from the absorption chiller is transferred to the cold water tank (1000 liters) and then used for balancing the sensible cooling load of the building;
- heat recovered from the second field of solar collectors is used to regenerate the desiccant wheel (regenerating the desiccant wheel consists in removing its humidity). The outside air is dehumidified in the desiccant wheel; it is then cooled in the sensible heat regenerator by the return cooled air before being further cooled in an evaporative process; finally, it is introduced into the building. The operating sequence for the return air is as follows: it is cooled by evaporative cooling and then it cools the fresh air in a rotary heat exchanger. It is then heated in the regeneration heat exchanger by solar energy recovered from solar panels and finally regenerates the desiccant wheel before exiting the installation.

Compared to electrically driven vapour compression bivalent heat pump system, the proposed system can be considered environmentally friendly thanks to the fact that electricity is only used in the auxiliaries (pumps and fans), heat is obtained from solar energy and water is exploited as refrigerant. An energetic, economic and environmental analysis has been performed in order to compare the designed system with the system currently installed and so to better highlight the advantages of the proposed air conditioning plant [12]. The analysis showed that the solar cooling and heating plant with absorption chiller allows to reduce the primary energy consumption by 18364 kWh, the operating cost by 7981 €/ year, and the carbon dioxide emissions by 17685 kgCO<sub>2</sub>. Similar results have been gathered by performing the same kind of analysis in relation to the solar cooling plant with desiccant wheel: 47428 kWh as primary energy saving, 5702 €/ year as operating cost saving and 12010 kgCO<sub>2</sub> as reduction of carbon dioxide emissions.



### 3. Solar cooling and heating plant integration

The new air conditioning system designed for the nineteen complex of San Lorenzo Abbey is located within the rear yard, between the existing ortho and an arboretum quadrangular.

The environmental and perceptual integration with the monument was evacuate: for this purpose a new hexagonal frame structure in a lightweight and precast material has been defined in order to minimize the impact with the ground. The hexagonal structure has been designed with particular attention paid to the environmental and perceptual integration with the abbey and has been made with dry, reversible prefabricated elements, to be assembled on site. In particular, the frame structure of the hexagonal cell is in cold rolled steel mounted in place, ballasted with the ground. Its structure allow avoiding concrete foundations, without any impact on the soil resources devoted to the cultivation of the garden.



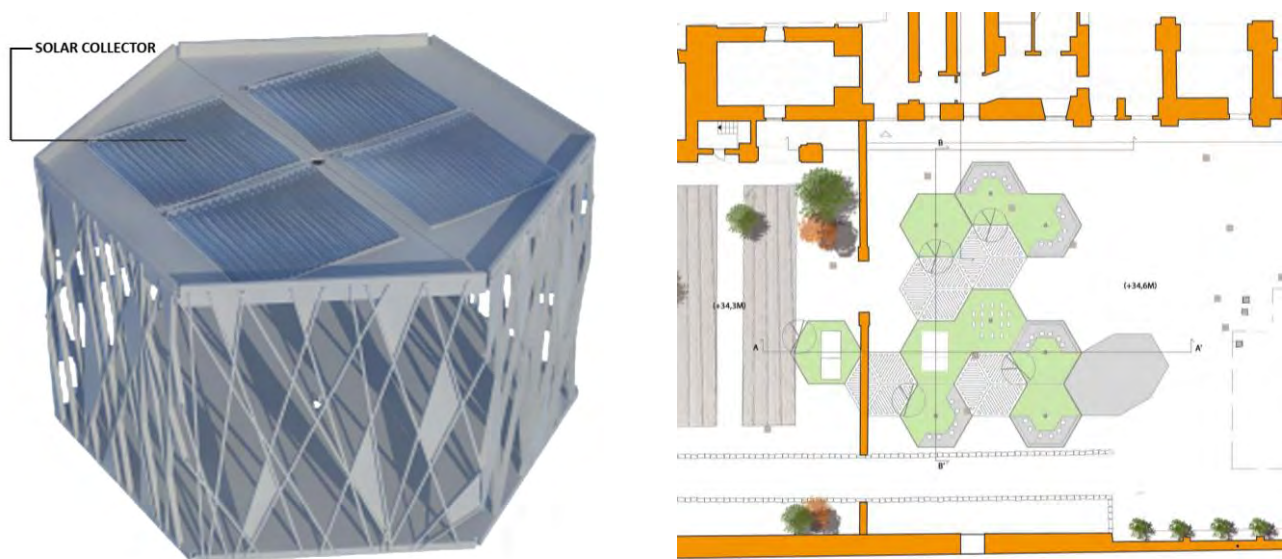
**Fig. 4:** View in context of the hexagonal cells.

The plan of the new system consists of multi-cellular aggregation in hexagonal matrix that runs along the sides of the hexagonal base. In this way it is possible to see pieces of the historical pre-existing building alternating between full and empty spaces. The whole project is designed in order to avoid any obstruction of the view of the abbey, so the texture of the new forms provides a complete visual permeability.

A structure, shaped like a honeycomb, establishing a reciprocal relationship between ancient and modern has been so realized.

The perimeter walls of the hexagonal cells have been made of glass and branch. They allow to glimpse the votive lights in order to weld the religious origin of the ancient building complex with the actual scientific destination of the place. The single hexagonal element consists of a wooden platform placed on the perimeter walls anchored on cement block buried in the ground for a depth of about 40 cm. A hollow central pillar for the collection of the rainwater works with the statically perimeter system. Solar panels have been placed inside the ceiling: in this way they aren't visible from the garden.

One cell has dimensions greater than the other ones because it accommodates the machines composing the solar cooling and heating system.



**Fig. 5:** 3D model of the hexagonal cell (on the left). Plan of the new multi-cellular aggregation inside the Garden (on the right).

Each cell has a three meter high walls. They are suspended from the ground of about 10 cm. These modular elements can be easily reproduced in other contexts for promoting the adoption of solar cooling and heating systems within historical building.

Finally it can noticed that the project is fully compatible with the historic-artistic monument complex pursuant to art. 20 par. 1 of Decreto Legislativo 22 January 2004 Number 42. It don't damage the distinctive character and material of the site.

#### 4. Conclusions

Solar cooling and heating technology is a solar energy based technique for building air conditioning which is potentially able to reduce carbon dioxide emissions, save energy, and assure a more reliable local energy supply.

In this paper the design of a solar heating and cooling plant for the Architecture Faculty of Second University of Naples located in a abbey complex built at the end of tenth century is depicted in detail.

Taking into account the historical and architectural content of the building hosting the faculty, the air conditioning plant has been designed in order to conciliate the employment of renewable energy with both respect for historical heritage and protection of the landscape. The main aim of the paper is promoting solar cooling and heating installations that facilitate the discovery of visual integrations and good compromises between technical and architectonic features.

Several solutions has been adopted to achieve a good balance between technical and aesthetical requests as the development of a new hexagonal frame structure installed in the garden made of a lightweight and precast material; solar panels have been installed on the roof of each hexagonal cell in order to avoid its view from the garden itself. The whole project is designed in order to avoid any obstruction of the view of the Abbey, so that the texture of the new forms provides a complete visual permeability.

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