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+ Abstract

Do our houses really seem to belong to our contemporary times? Have them the same technological content of all other tools we use nowadays such as smartphones and latest car models?
The answer is definitively not ! We are almost resigned to consider houses as something structurally different in terms of modernity compare the other contemporary products. People probably think that what is necessary in a car or in a phone in terms of interface and flexibility of use can not be asked to a house. Therefore our general approach in perceiving the product "house" is to consider it as something structurally old, something that can can not be at the same level of modernity of all other products we use today.
But not always has been like that in the past. For instance in the twenties and thirties of the last century the modern house was the symbol of modernity and progress. At that times the most important architects in the world worked and designed outstanding new architectural figurations, and their house projects implemented the latest achievements of social, scientific and technological progress of the times.
They actually tried to imagine the housing of the future. And they succeed in it. Because we are nowadays living in the materialization of what they've thought and immagined almost 100 years ago. Another important moment of sperimentaion was during the sixties and the seventies of the last century.
We think that is again the moment for architects to think forward and imagine a new way to conceive and live the house. This because houses have been left many steps back compare to the boosted progress of our contemporary life in the last ten years. Concept like "modularity, scalability, reconfigurability, flexibility, mobility" are composing a sort of "way to think" with which we are use to deal many of our daily activities.
After a decade of Real Estate ruling the entire phenomenon of new urbanization, the room for innovation has been really small

and limited to “ecology” and “energy saving” items. In other words the main efforts to innovate housing has been concentrated on materials and technologies connected with the production phase and the life cycle of a building. Very few has been done to revolutionize the “house” as a product seen by the consumer point of view. Is enough for a consumer just to live in a house that needs less resources to be heated and cooled? What about consumer’s needs and expectations concerning the way this house fits contemporary life conditions and social needs?

For nowadays users things like “building site noise and troubles for refurbishing”, “wait for year a new house”, “stress to choose and to arrange fornitures”, “rigidity of a house in case of extension need”, have become totally unecceptable! Today we search something on internet, we take our smartphone and we order it on Amazon paying by credit card. The following day we have the thing at opur place. Of course this will change everything. It has already revolutionized the music and travel industry, tourism and hotellerie are deeply changing because of this. All the other productive fileds should face this genetic chanhe of consumers. Including housing industry of course.

In future if a family will need an extra room for their appartment they expert to take their ipad, choose and configure their new room, order it and wait some weeks for the extra room to be installed in one day time without any noise or building site troubles. This is where tecnology will lead.

Our approach has been focused exactly in this direction: try to imagine a product “house” that is able to do something that the actual houses can not do. New functions, new possibilities, a new level of involvement of the consumer into the personalization and configuration of his own house. In this post crisis decade that we are about to live consumers are waiting new products for spent thier money. If houses will not change and if real estate developer will try to sell them the obsolete leftover stock, they will

put their money somewhere else. If a new product will appear in this filed the user will pay the extra cost for the extra funtions that this new “advanced house” che provide.
Therefore the technological problem is not to find new processes to built cheeper houses. The point is conceive and put on the market housing systems that can do something new, that can provide new funtions, in zero time delivery, and ready to use without any middle man. The market will pay extra this new housing as a premium product.
We have considered the house as an hybrid scalable system composed by two elements: the mother structure that is the permanent infrastructure of the house and a modular system that is inserted into the mother structure that is configurable directly from the user, industrialized and prefabricated. The modular house can can be ordered and configured directly by the user by internet. It can be installed, extended and reconfigured in one day time.
The combination of this two elements and the possibility for the user to manage his modular house, as allowed by the new technologies, is the core of the innovation that the reseach group in university has proposed.
Scalability allows the users to extend their house according with the changes that occur in their life such us marriage, a new baby or a new activity. Even when grown kids leave the house and part of the space can be rearranged and separated to be rent becoming a source of revenues.
Afterall the main target of this thesis works is to update the concept of our houses and to fill the huge gap existing between their nature and the new lifestyle in wich we are living today. This has revolutionized our way to live and to perceive the world in the last ten years, therefore also housing should be deeply reconceived to satify a totally changed client and users expectations and needs.

Joseph di Pasquale

1 A Sociological Approach

1.1.1 Condition of change: Evolutionary Society

When trying to recognize different fundamental aspects in human development, perhaps one of the most important characteristic is its own condition of change.

A basic definition of change can be understood as: "to make or become different, or to do, use, or get one thing in place of another thing". Subsequently, if a different definition seems to be necessary for the purposes of this thesis, a different analysis should be made considering the specific relationship between the human race and society. This relationship can be defined through the conception of evolution.

Evolution can be described as "the process by which the physical characteristics of types of creatures change over time, new types of creatures develop and others disappear". Considering this, humans have developed a fundamental ability of adaptation, allowing them to live in different living conditions and environments: *..."Parents pass adaptive genetic changes to their offspring... ...As a result, the offspring inherit those genetic characteristics that enhance their chances of survival... ...Over time, genetic change can alter a species' overall way of life, such as what it eats, how it grows, and where it can live. Human evolution took place as new genetic variations in early ancestor populations favored new abilities to adapt to environmental change and so altered the human way of life"....*

Human evolution should not be understood just as an individual pro-

cess of change, but as a collective phenomenon. Human society is evolving as aA whole due to specific living conditions.

Even if the conception of evolution is mainly related to changes on physical or biological aspects, it is also fundamental to consider the parallel processes in other fields of human knowledge:

...*"the study of human evolution involves many scientific disciplines, including physical anthropology, primatology, archaeology, paleontology, ethnology, linguistics, evolutionary psychology, embryology and genetics"....*

Thus, evolution will always have consequences on the development of different matters. In this huge spectrum of topics, maybe one of the clearest representations of the human race evolution is the question of what it is that we need today to live in good conditions: Which are our needs today? Have they changed over the last years? Which of them have been permanently satisfied?

Clearly, today's needs are different from those of the eighteenth and nineteenth century societies. They are different even with the needs of the twentieth century. Thereby, the study of this changing condition is of the outmost importance to understand our actual conditions of living and how they influence and modify human life.

1.1.2 Condition of change: Changing needs

Considering the specific living conditions from diverse moments of the past, it is possible to notice that the actual needs of the population are different, representing a key point in the recognition of the human development process.

Needs have not just been changing during time, but have also gone into a process of clear complexification.

For the M.I.T. for example, the actual needs of North-American people are related to food, child care, medical care, housing,

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transportation and others (where we can include basic services like water, electricity, etc.). This research was made to define a minimum living wage that was different on every state of the country, showing the amount of money that people used to spend on these kinds of needs.

On the other hand, analyzing which are the factors inside our history that have influenced the process of change in human needs, maybe the most important role has been played by technology, due to its capacity to decrease the difficulty of tasks:

..."Technology consist in manufactured objects like tools... ... and containers. Their purpose i s either to enhance human capabilities (e.g., with a hummer you can apply a stronger force to an object) or to enable humans to perform tasks they could not perform otherwise (with a pot you can transport a larger amount of water, with your hands you cannot)"... ..."But technology does not end there... Requires a larger system including hardware (such a machinery or a manufac-

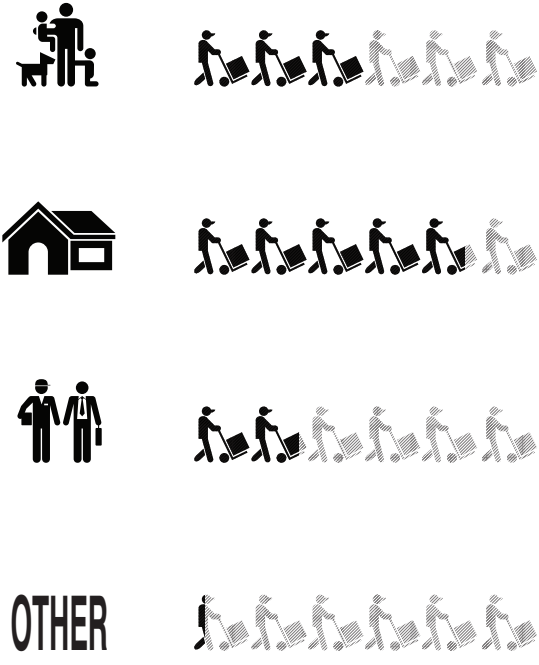
turing plant), factor inputs (labor, energy, raw materials, capital) and finally software (know-how, human knowledge and skills)"....
In fact, technology has influenced not just the change in human needs but it has also meant a huge process of change in the world:
..."Technology relates all major drivers of global change such as population change, economic development and resource use. Technology is also central in monitoring environmental impacts and implementing response strategies"....
Having this in consideration, technology is presented as one of the main reasons of the complexification process of human needs, leading to a time in which we are able to find new kinds of industries, new types of services, faster connections, smarter tools, and more flexible spaces, for example, to give new answers to new needs. In a way, all these examples have evolved from old conceptions to ensure characteristics much more related to present times. They have used different human resources to change and thus, be more accurate on solving the complex needs of our times. In this sense, the idea of flexibility (named as a specific characteristic of spaces) appears again, being extended to all the given examples and also to the own human condition: *..."The quality of being able to change or be changed easily according to the situation"....*

1.2.1 Global life - Nomadic existence

When trying to go beyond the inherent human condition of change, and looking for situations in which they express it on different ways, a good and current example is the permanent physical displacement.

Nowadays, traveling to other countries is a more and more common activity among people.

Nevertheless, this idea of permanent movement is not new. Actually, it was a fundamental activity practiced by different ancient cultures that found on



this condition a possible way of living: ...*"There was a time, not too long ago, in evolutionary terms, when our existence was based on our capacity for movement and adaptability; indeed it is to this that we owe our survival as a species. Most cultures now lead a more sedentary life, but it could be that flexibility is once again becoming a priority in human development and that technological, social and economic changes are forcing, or at least encouraging, a new form of nomadic existence based on global markets, the world wide web and cheap, fast transportation"....*

This contemporary nomadic existence can be well explained by a notion created in 1985 by Norma McCaig, founder of the Global Nomad International organization. The Global Nomad was designed to refer to people who had basically uprooted and overcome the "static patterns" of human civilization. Their presence can be recognized as icons of human history: the new world pioneers that searched a better and more autonomous life, the globetrotters of the 60's and 70's

who were looking for new experiences and spiritual research, and finally, the expatriates (diplomats, military, missionaries, multinational companies' emissaries, etc.) with their availability on the cultural uprooting, for example. For the Global Nomad the overcoming of the static patterns includes a break with the culture of origin, related basically to the fact that they leave their own land. Later, when they accept the new local culture, they maintain firmly their own reference culture, creating, for example, neighborhoods which try to reproduce their motherland. They are convinced cosmopolitans with a complex culture created by all the cultures they have come into contact.

At the same time, the appearance of the Global Nomad is related to different and subjective reasons: education, work, lifestyles, curiosity, assimilation of local customs, language learning, establishing new relations, friends or contacts, etc. They need to know new cultures and thus, enrich their personal experience through personal stimulation based on the encounter with diversity.

..."A person from whatever age and nationality that feels that is part of a worldwide community, where its members share the experience of living or have lived in different countries than their own, because they or their parents have chosen an internationally mobile career"....

Thus, the rise of the Global Nomad is not only permanently developing a new way of establishing relations between people and cultures, but also can be considered as an important factor on the definition of a globalized culture.

1.2.2 Global life - Glocality

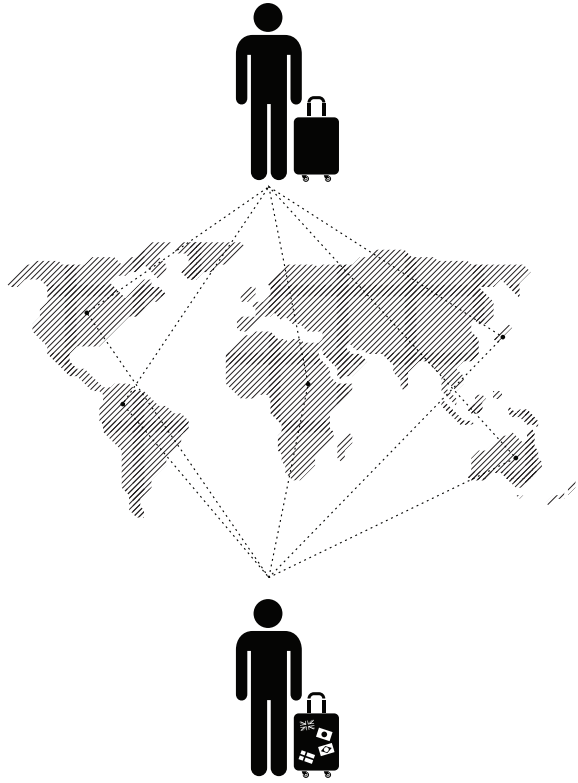
If we look for a concept to define the actual world, maybe one of the first words that seem to appear is globalized. In a way, the actual society has lived a process in which the distances have become shorter and the time faster. Changes occur more quickly. Nowadays, it is possible to recognize a space-time compression, maybe the greater in human history, developing a specific conception of the globe as a singular unit, despite a multicultural

idea based on local cultures.
For Roland Robertson, sociologist and theorist of globalization and lecturer at the University of Aberdeen in Scotland, globalization involves not just "the objectiveness of increasing connectedness" but also "subjective and cultural matters".
He also makes a specific point saying that globalization reconstructs "the production of home, community and locality" and, in this sense, glocalization can be a more precise term to define the relationship between global and local.

Thus, glocalization can be understood as the creation of different localities through different global ideas.

Nowadays, globalization has defined a clear characteristic of built environments, where most of the times they don't have strong connections with the place in which they are constructed.
The own cultural qualities of the places in which contemporary architecture takes place is being permanently altered and defining new approaches, much more related to technological aspects and global ideas of design and living.
However, when we try to understand the characteristics of globalization, it is still possible to consider a different approach about it and how this new conception can influence the development of built environments:
..."A reflexive consciousness can be cultivated that clearly comprehends the interdependence of local ecologies, economies, and cultures within the homogenizing forces of globalization. Globalization is not a singular process or simple phenomenon but actually a series of processes relating to aspects of flow, relativity, association, (en)counter, movement, and networking"...
..."Globalization is homogeneous while simultaneously exaggerating difference and promoting greater connectivity to specific places through a heightened deterritorialized global sensibility"....
Considering that nowadays globali-

zation is maybe one of the strongest forces that influence people's lives and ways of thinking, it is important to recognize that the normal perception of design and living is also rapidly changing.
Since the development of the Global Nomad idea, with which people started to permanently and rapidly move and access information, a new concept of living the own was created to actually refer to the idea of home. In fact, even if most of the people recognize the importance of contextualization for architectural design, it is still important to recognize the significance of a new concept for housing, less related to local traditions and materials and more linked to global ideas of design and living, introducing customization to fulfill the different needs of people.
This new conception doesn't have to be seen as an impoverishment of the living space but as a selection of characteristics based on personal experiences from the moving condition.



1.3.1 Design that does not fulfill the needs - Slow construction and renovation

Nowadays, an important part of the population that has access to a residence inhabit conventional buildings and have experienced, at least one time, the specific process of waiting for a new house or the moving process.

Even if there are many constructive systems that can be used for residential building construction, the actual society is accustomed to use common systems like concrete, bricks and wood.

These methods have slowly evolved during the last decades and now are being implemented with technological systems, trying to follow an advanced society that is constantly evolving, but without being really technologically advanced. In fact, conventional construction methods include a massive amount of time and resource consumption during the construction process and also in customizations and renovations that can occur during the building lifetime.

Moreover, a static building has a long and articulated life-cycle that is really similar in all traditional constructive methods. This period consist in an average time of six months for the design process, twenty four months for construction (where the owner needs to find a different accommodation during the whole period), and three months for renovation or customization (where the proprietary will probably be forced to experience the nuisance of having workers around his private space). Finally, at the end of the building life cycle (due to its oldness or to the economically inconvenient improvement of its constructive systems) the building will have to be demolished. This last process is maybe one of the most negative points on a building life-cycle due to the massive energy consump-

tion to destroy it and the minimum amount of material to be re-used or recycled.

1.3.2 Design that does not fulfill the needs - Fixed condition of housing

Analyzing the specific conditions in which an architectural project is developed, the relationship between the architect and the client seems to be one of the most important parts of the process. Normally, this linkage is based on a primary period in which the client asks for a specific program with particular characteristics, while the architect receives this information in order to make concrete and possible proposals. If everything goes well, after several meetings they will arrive to a consensus based on the client's needs and a feasible design proposed by the architect. Considering that maybe this method can be applicable for different kinds of architectural programs, this specific development process seems to be very limited for residential building projects, mainly because of the disclaiming of the inhabitant's personal approaches and needs.

In a sense, this way-of-doing is permanently trying to homogenize and limit the only habitable space that can be conceive as owned by people, losing an important opportunity in the act of appropriation and characterization of the space.

Thus, the architect ends up being the designer of the exterior and the interior of people's homes, pre-defining specific living conditions of a place that will be used everyday by others, and leaving a poor opportunity of customization based on simple elections like wall colors, furniture and interior decoration.

Moreover, this condition gets worst when the need to modify or expand a residence arrives, this may respond to two possible situations: the owner definitely recognizes the impossibility to do a transformation or the owner accepts that he/she has to spend an important amount of resources to accomplish this type of operations (including not just money and time but also expenses like moving for the complete modification period or accept workers at home).

On the other hand, this fixed condition of housing is not just related to the impossibility of real changes and concrete customizations, but also to the inability of moving and thus being part of a globalized world in which its owners are constantly moving.

This characteristic can be considered as the ultimate globalized feature of housing, by which people would have the opportunity to move to other places with their own houses, promoting a new sense of the notion of owning and also a new and deeper home conception.

Finally, this fixed condition on different matters seems to be a failure on the collective housing design of architecture due to the impossibility of the architects to recognize the inherent human condition of change that is permanently related to every scope of the human being and its society. This characteristic should be one of the first elements on the conception and idealization of housing design to recognize the fundamental importance of the space that humans normally inhabit.

1.4 A new housing conception - A contemporary trend for house design

At this point, a specific question seems to appear: In which way is it possible to develop housing solutions according to our contemporary level of progress and actual conditions of change?

Under our point of view, the actual conception and development of housing design in architecture has been using valuable resources on the implementation of new technologies, only to decrease the

monetary investment and construction times.

If we try to analyze the different housing examples defined during the twentieth century and nowadays as well, we will discover that its conceptions have been minimally modified, avoiding new designs to promote new ways of living and inhabiting our houses. This situation can perhaps be explained through the idea of the fear of the new; our incapacity to recognize the birth of new needs and how they can be solved through our homes, and finally, the monetary aspect that has destined a limited or even non-existent budget for research and promotion of new types of housing. In this sense, recognizing our task as architects of the twenty-first century, members of a society that is living probably the most extreme "space-time compression" in human history, and with a technological development that has changed even the complete conception of the world through the idea of globalization, it is our duty to start re-thinking our old definitions of what it means to inhabit a space (which are our possibilities inside of it?), especially if this space is the one we call home. Perhaps, because it is a space in which we will spend and important part of our time, but also because maybe it will be the only one we will consider as ours.

Finally, it is in our capacity as architects where we can find the definition of the limits that we can set up on these kinds of projects.

Having this into consideration, we should be able to re-define the actual vision of housing, promoting a new point of view which is much more related to our own human nature and our actual technological possibilities.

It is fundamental to acknowledge that it is not even necessary to find a specific guide of working, because it has been always there. Our inherent human condition of flexibility (or the capacity to adapt under different environments and living

situations) has been permanently establishing that we need habitable spaces that can function like us, flexible spaces that can ..."change or be changed easily according to the situation"... This is the ultimate approximation for living spaces, given to us from the abstraction of our own condition.

Moreover, the materialization of these new ideas can be applied mainly through the implementation of the main field of human knowledge that has given us concrete solutions for our problems and requirements: technology.

We are in a moment in history where we are able to use technology not just to ensure good standards of light and temperature, or to improve our constructive methods and systems. We are in a time where the implementation of technology can be the catalyst for the development of flexible and modifiable living spaces, adding a new condition where its inhabitants can customize their spaces in a more real and dynamic way.

The idea of designing flexible spaces has to be accompanied with a major responsibility based on architectural knowledge and experience, with which we can think about new types of spaces that are also possible, secure and functional. Thus, we will be able to define a real context in which the implementation of these new ideas and characteristics can be materialized to give a concrete and definitive answer to the problems of contemporary house design.

2 Advanced prefabrication

2.1.1 A brief history: Early stages of prefab

The beginning for this new method of conceiving a building as made of prefabricated pieces assembled on-site started off in the years when Great Britain's politics of colonization was at its highest peak since it was not known the presence and amount of raw material or if there was population who was aware of construing methods.

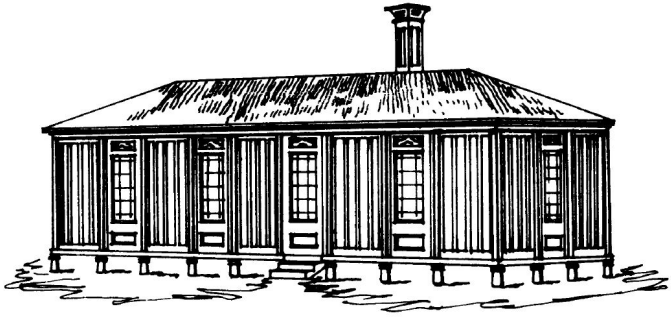
Building components started to be manufactured in the mother land to be then shipped worldwide in the british colonized territories.

Most of these examples where based on the balloon framed system that was supposed to be implemented by the addition of the finishes. The next stage in this evolution of the prefabricated home was developed by a London carpenter and builder, H. John Manning. In 1837 he designed the Manning Colonial Cottage. His project was not too far from what the previous ones were proposing apart from one main difference, it offered ease of construction.

The cottage was designed to be mobile and easily shipped. Each piece could be transported by a single man for miles avoiding the need of eventual transportation infrastructure.

The entire building could be mounted with a standard wrench and thanks to its constructing easiness

any unskilled emigrant could build it by himself.
Only one decade after, the same country gave birth to a global event that is still nowadays an occasion for the building sector to show the new technologies available. It was 1851 when in London the "Great Exhibition" was hosted inside the Crystal Palace. The building, designed by Joseph Paxton was thought around the concept of prefabricated and dismountable modules. It was developed on a surface of 75.000 sqm and it was built in only 9 months thanks to the speed construction methods that its steel and glass structure allowed. The building is important because it represents a shift in the modern architect's understanding of what is beautiful, suggesting that beauty may be as simple as the functional means of production. In the following decades the industrial revolution shifted from England to all the other western countries. The United states are those that developed the most in these years and they owe a lot to the strength of an industry based on the assembly line. This system of production was developed by Henry Ford for his automobile Ford T and it was allowing higher quality products at a lower cost. It didn't take too long for this economic and social system to affect the housing industry

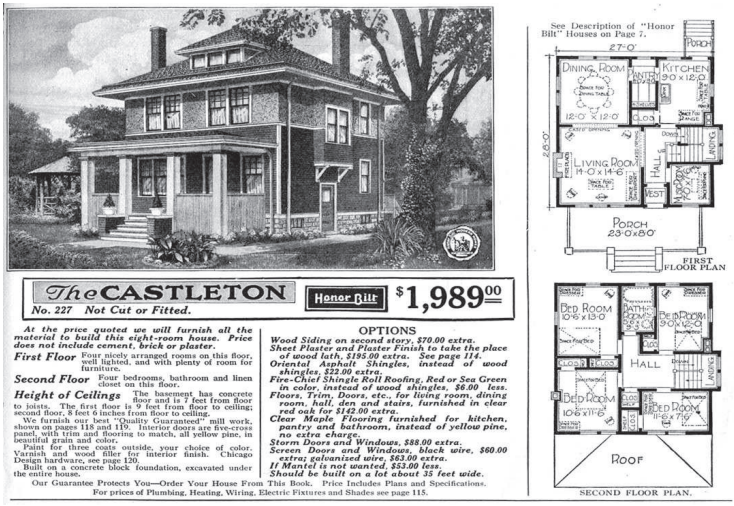


Manning Colonial Cottage. prespective drawing showing it as built.

as well. From the beginning of the 20th century it's possible to see the first examples of mass production and kit homes in America.

The expansion of the US population to the west requested a model of affordable and easy to build home.

Many companies established on the market but among all, the one that introduced real innovation was the Sears Roebuck and company. Their success was that they could offer a wide variety of housing from a catalogue, which ranged from one room structures to multifamily units. The system of constructing was traditional, as much as the look of these project. None of these participated actively in the pages of



The CASTLETON — Honor Bilt — $1,989.00
No. 227 Not Cut or Fitted.

At the price quoted we will furnish all the material to build this eight-room house. Price does not include cement, brick or plaster.

First Floor Four nicely arranged rooms on this floor, well lighted, and with plenty of room for furniture.

Second Floor Four bedrooms, bathroom and linen closet on this floor.

Height of Ceilings The basement has concrete floor and is 7 feet from floor to joists. The first floor is 9 feet from floor to ceiling; second floor, 8 feet 6 inches from floor to ceiling.

We furnish our best "Quality Guaranteed" mill work, shown on pages 118 and 119. Interior doors are five-cross panel, with trim and flooring to match, all yellow pine, in beautiful grain and color.

Paint for three coats outside, your choice of color. Varnish and wood filler for interior finish. Chicago Design hardware, see page 120.

Built on a concrete block foundation, excavated under the entire house.

Our Guarantee Protects You—Order Your House From This Book. Price Includes Plans and Specifications.
For prices of Plumbing, Heating, Wiring, Electric Fixtures and Shades see page 115.

OPTIONS

Wood Siding on second story, $70.00 extra.
Sheet Plaster and Plaster Finish to take the place of wood lath, $195.00 extra. See page 114.
Oriental Asphalt Shingles, instead of wood shingles, $22.00 extra.
Fire-Chief Shingle Roll Roofing, Red or Sea Green in color, instead of wood shingles, $6.00 less.
Floors, Trim, Doors, etc., for living room, dining room, hall, den and stairs, furnished in clear red oak for $142.00 extra.
Clear Maple Flooring furnished for kitchen, pantry and bathroom, instead of yellow pine, no extra charge.
Storm Doors and Windows, $88.00 extra.
Screen Doors and Windows, black wire, $60.00 extra; galvanized wire, $63.00 extra.
If Mantel is not wanted, $53.00 less.
Should be built on a lot about 35 feet wide.

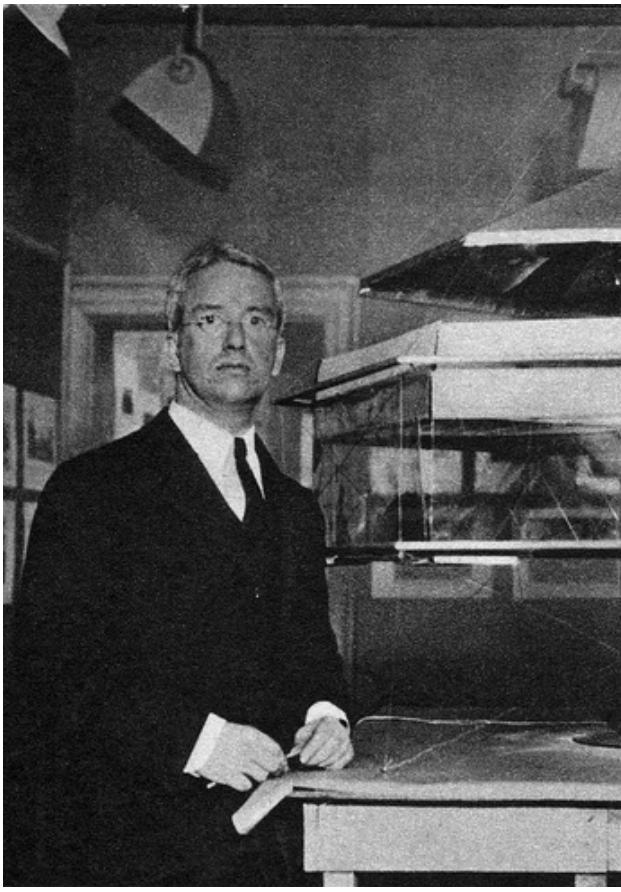
SECOND FLOOR PLAN.

Sears Roebuck cathalogue, a page showing one among the 370 deisgned kit homes.

architecture's history but they started a trend in construction that soon was to be considered by academic architects as well.
The first renown american architect who investigated prefabrication was Richard Buckminster Fuller. In 1927 with his project for the Dimaxion House he didn't only conceived a new system of building but he designed a house for the life of tomorrow.

His design was rethinking the lifestyle but it was so advanced that people rejected it, perceiving it as an experiment.

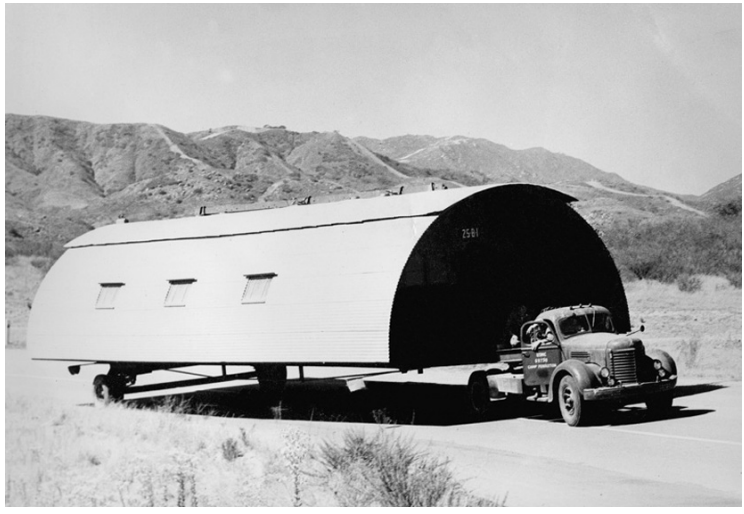
Few years later he re-proposed the same idea but with a more domestic aspect in the project for the Whicita house.
The project was again a failure and is still nowadays a proof of the distance between the architectural community and the normal population.



In Europe many prefabricated projects were developed in the 20's; especially by exponents of the bauhaus and modern movement. Walter Gropious together with Adolf Meyer designed the Baukasten, Le Corbusier was writing about mass production and designed his famous Masion Citroan, and many other came along but never with great success.

2.1.2 A Brief History: Early Advancement

It's only at the beginning of the WorldWar II that it's possible to see another prefabricated project that was developed and shipped all around the world.
Simple to manufacture and easy to assemble the US Navy Quonset hut was designed in 1941 by George A. Fuller Company.
Due to the world war the navy ap-



house the facade is made of bricks and leather for the good of the spirit.

pointed the company to design a prefabricated, portable structure easy to build and ship to military outposts.
The arch shape was thought to give strength and the open internal space was made to serve a variety of purposes.
The Quonset hut was used all around the world and after the war Fuller Company tried to sell it on the private market through a big advertising campain that failed in its attempt. It is still possible to see around the US and pacific islands some examples of the hut but most of the time they are used as storage place or are left abandoned.

During the war the architectural society understood that at the end of it there would have been a big request of houses.

Marcel Breuer in 1943 developed a first prototype of his Plas 2 Point house together with his students of the Harvard University. The project innovation consisted in the design of the foundation, in fact the structure touched the ground only in two points. The double foundation blocks eliminated the need for any expensive grading or full foundation work decreasing the amount of time necessary to assemble the house.
When the war ended, what was expected to happen became reality and the prefabricated housing market experienced a strong growth.
Many companies started to industrialize more and more their project that started to be delivered on site on one single truck.
The first company to do so was the Lustron Company introducing the concept of a packed house. This idea was developed by many others but the most interesting examples was realized between 1947 and 1951 and it consisted in a whole town built by the Levitt father and sons.
Levittown, so called, is a project realized in 4 different community builded after the war to cover the request of extra housing. These

community were built at very high speed and with extremely low costs thanks to the repetition of the same typology alla along the community. William Levitt who assumed control of Levitt and Sons in 1954, is considered the father of modern suburbia in the United States.
If in the US the most developed typology was the single storeys family house, the housing problem has been addressed in a completely different way in soviet countries.
Communist countries in eastern Europe needed to reduce the cost and time of building construction. Supervised by Khrushchev, soviet architects declared low-cost and quick technologies the objective of their study. The result is a concrete masonry wall system composing buildings that never passed 5 storeys height so that they could avoid the presence of elevators.

Levittown, all the pieces needed to compose a house are delivered on site and built within 3-4 days.

The prefabricated walls were composed to define 3 sizes of apartment from the small (30 sqm) to the big (60 sqm) units. The house is considered as the sum of single units supported by one service room that connects them. It's then possible to analyze this project as a repetition of two kinds of modules. A structural module, the prefabricated concrete wall, and a living module, the single unit.

In facts, these are the first years when a new interest start to support the prefabrication industry, the research of modularity.

This new sector will be developed in the years following the 60's and will give life to some interesting project that will be analyzed in the following chapter.

Khrushchyovka, frame of a documentary showing the contructing system with the help of a crane.

2.2 Case Studies

To better investigate the concept of prefabrication the easiest way is to analyze few case study. In fact through examples it's easy to describe the many kind and level of depth that prefabrication can reach:

1. Prefab Element
Its the simplest way to think of a building as a prefabricated project. When the designer knows which are the available material on the market and fits it's project to the standard that are available.

2. Prefab Components
It is the case where a project is turned into prefabricated after or during the deign process. Usually all the pieces are built specifically for the project but needs still to be assembled on site.

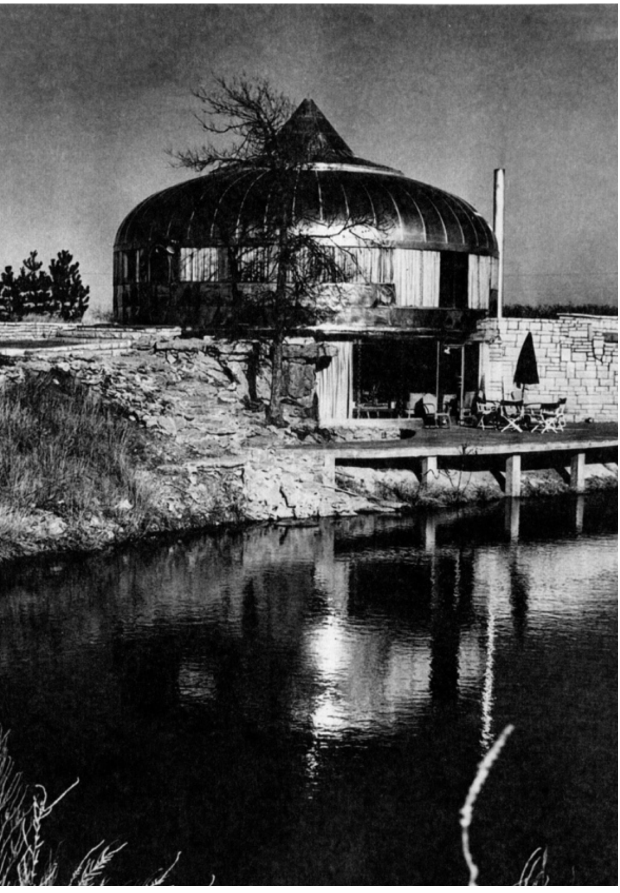
3. Panelized Structure
It is commonly used with precast concrete or nowadays with timber walls and it consist of projects where the structural part is made of wall panels that comes onsite and completed. These are then mounted with different techniques and finished with the elements that are missing, such as windows, doors, interior finishes.

4. Advanced Prefab
It is mainly represented by those examples where the project comes on site as a volumetric shape and it form a completed part of the building or it is a complete building itself. It usually involves more then one trade and it is comes on site finished both in its interior and exterior

2.2.1 Prefab elements

CASE STUDY HOUSE No 8
Charles and Ray Eames

Charles and Ray Eames began designing the house in 1945 for the Case Study House Program in Los Angeles' Arts and Architecture Magazine published and built these case study homes that had to focus on the use of new materials and technologies developed during World War II. The intention was for the house to be made of prefabricated materials that would not interrupt the site, be easy to build, and exhibit a modern style.



2.2.2 Prefab components

WHICHITA HOUSE
Buckminster Fuller

Charles and Ray Eames began designing the house in 1945 for the Case Study House Program in Los Angeles' Arts and Architecture Magazine published and built these case study homes that had to focus on the use of new materials and technologies developed during World War II. The intention was for the house to be made of prefabricated materials that would not interrupt the site, be easy to build, and exhibit a modern style.

2.2.3 Panelized Structure

KHRUSHCHYOVKA

Charles and Ray Eames began designing the house in 1945 for the Case Study House Program in Los Angeles' Arts and Architecture Magazine published and built these case study homes that had to focus on the use of new materials and technologies developed during World War II. The intention was for the house to be made of prefabricated materials that would not interrupt the site, be easy to build, and exhibit a modern style.

2.2.4 Advanced prefab

QUONSET HUT
George A. Fuller Company

Charles and Ray Eames began designing the house in 1945 for the Case Study House Program in Los Angeles' Arts and Architecture Magazine published and built these case study homes that had to focus on the use of new materials and technologies developed during World War II. The intention was for the house to be made of prefabricated materials that would not interrupt the site, be easy to build, and exhibit a modern style.

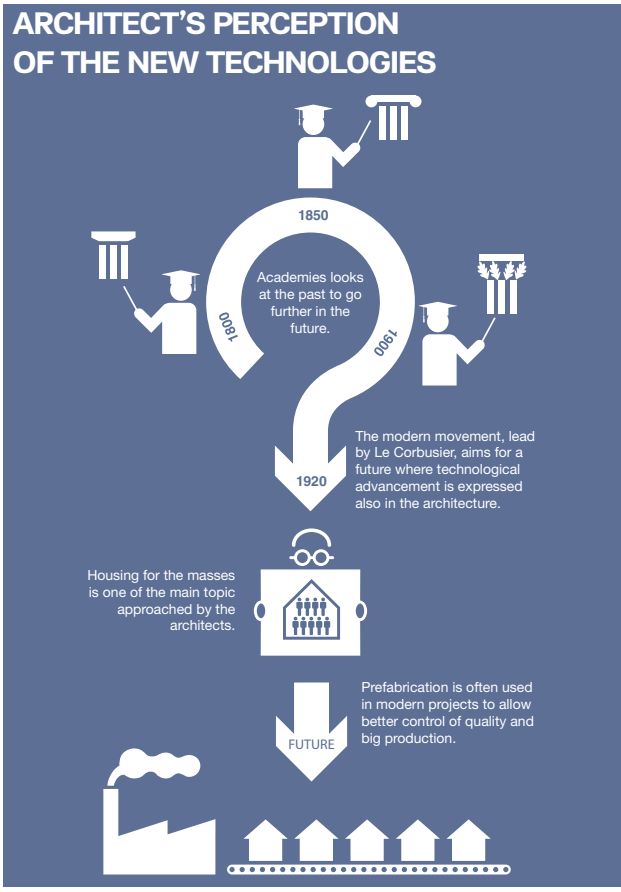
2.3.1 Common thoughts on prefab: Architect's perception

Prefabrication is nothing new. As shown in the previous chapters it started off few centuries ago and it has been studied and analyzed for the following decades until now. Despite its long term development this process of construction has been slight from the architectural community since its first decades of development. In facts, architects of the 19th century have always seen this process as necessary to reduce constructing times but they never accepted to go beyond the simple prefabrication of windows, doors ad so on.

"In the academies they were fighting the new methods of construction looking back to the times when "We used to build forever"

(J. Ruskin)

The theoretician of those times agreed that, what we define now



to be the incipit of the society of consume, would have led architecture towards a disposable future due to the lack of lasting material and good technical execution. The birth of the modern movement signed the entrance of the academic world into the discovers and researches related to prefabrication. In the main book of Le Corbusier "Towards a new architecture" the architect defines how the new architecture should approach the problem of shape, of constructing systems, of a new aesthetic, and the last chapter face the problem of he "Mass production". Here the architect approach what was at that time becoming the main problem of the housing industry: provides affordable housing to the mass of people that needed it.

Solution for LeCorbusier is to "arrive at the House-Machine", a house that is efficient as a machine.

2.3.2 People's perception

After the Second World War prefab homes started to be produced and people got more and more used to them. During the 50's and 60's many architects have been involved in the design of prefabricated houses and in those years, particularly in the US, the market reached good results.

There was a dual perception of the topic by the mass. On one side, housing project like the Sears catalogue or Levittown survived until the 70's even thou people perceived them as cheap and repetitive housing.

On the other side architect's projects were considered experimental due to their futuristic and, often, over-designed look.

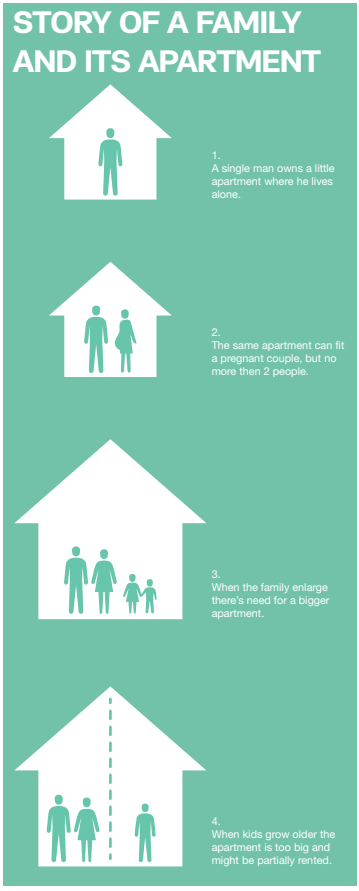
Only few pioneers understood the value of the prefab home and took the best out of it.

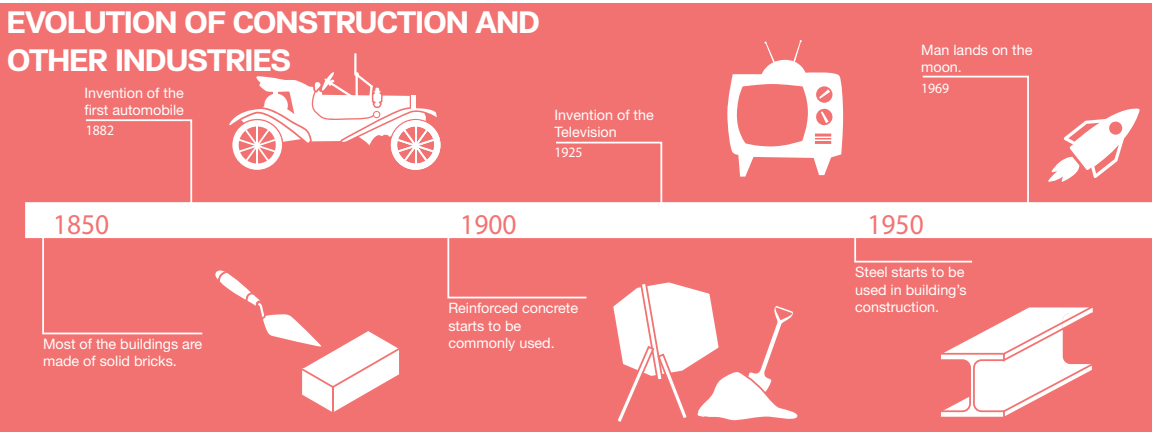
The economic liberalization of the 80's define an end to research and construction of prefabricated architecture. These are the years where people mainly moved into suburban areas and this was mainly driven by the increase of wealth and a quest

for a new life style, where the individual wants to stand out of the mass. In architecture, a direct response to this, is generated by the de-constructivism that together with Post- Modernism stated the failure of the utopian ideas of the modern movement. The few projects that survived until the new millennium became topics of discussion when weather disasters strongly damaged prefab building and the prefab market has moved into the business of movable homes.

In the past decade prefab is getting back in newspaper and magazines due to the new need of solution that allows more flexibility in the urban context.

People are still suspicious regarding this topic, but hopefully the next projects and research will prove them wrong.





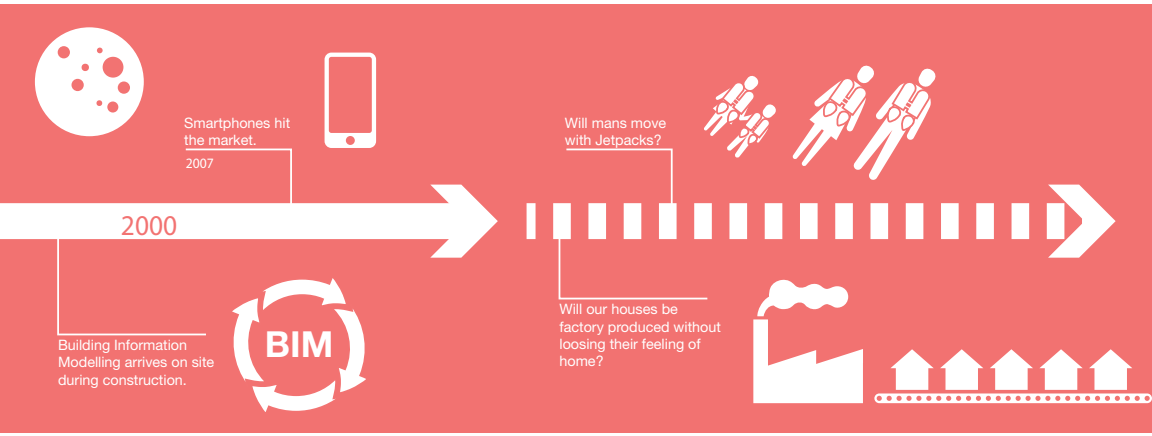
2.4 Why did prefabrication failed?

Objects in our homes are mostly coming out from a factory. These are often mass produced and standardized and people change them when there's a new model. The industrial revolution influenced our lifestyle and our economy to the point that 90% of the tools that we use, of the things that we own are prefabricated. This cannot be said about products of the construction sectors. If the infrastructures's and factories's construction is often optimized thanks to the use of new and advanced technologies the residential sector is still working with the same old techniques.

In the past century new systems and materials have been discovered, but only few affected the residential contructing sector.

Prefabrication is one of them. As shown in the history of it, prefabrication has been developed in the construction sector nearly for the past two centuries but this is not as visible in our lifestyle as much as it is for other sectors. Is it then possible that prefabrication failed in changing the construction of the new housing? Why is the market still relying on the old techniques when it could be more advanced? Is the cause social or is it a problem of effectiveness of the process for big construction?

As visible in its history, prefabrication started to be used in housing only to cover needs of emergency and special cases when there was no time or no specialized labour. It was often considered a temporary solution and the population has always perceived it as something



cheap and poor. Most of the producers were emphasizing the time saving aspects but not the better quality controls. In the US, where the number of prefabricated home is much higher then in Europe, people still perceives them as dangerous houses where to live in case of Tornado or other weather catastrophies. The brick house still provides a higher feeling of safety.

In other industry sectors prefabrication and the industrialization processes have been lined to an idea of future, higher performances and exclusive products.

In the building sector this didn't happen and of course it has affected the income of money that are spent for it. The building sector has always been of top of the pyramid of new investments and developments but because of the perception of prefab as a cheap sector the real estate market never invested time and money in it.
A second reason for the "failure" of the prefabricated house is that the common idea of home is in contrast with the mass production that prefabrication need to be industrialized. Nowadays, more then ever, people wants to express their identity through items, clothes, cars and others; the house, with it's furniture, it's material and finishes becomes a symbol of what the citizen wants to say about himself. Due to the economy of scale required by industrial-

ization process, standardization is becoming more and more important in the production of housing not leaving enough space to the customization and personalization of the final product. What allowed the Sears Catalogue to become the most common prefab home seems like it has been forgotten by those that are now creating the "copy/paste" housing unit.

The more prefabrication systems force standardization in order to get larger economy of scale, the more the resulting buildings appears alienating and boring.

It's then possible to state that prefabrication failed if compared to other industrialized sectors but tried it's best to stay on the market against people's distrust. Architects didn't manage to control the industrial production of housing often due to the distance that there is between the academic community and the mass. In conclusion the real estate market has taken distance from the prefab sector considering it as a cheap product and never trying to push for it to be perceived as a high quality one. Prefab future is radiant and full of potential, if correctly leaded the housing industry will surely move in this direction because the times and the new needs requires it.

3 Modular Architecture

3.1 Implication

In modern history society has increasingly become more sophisticated and global, these advancements have also affected the methods of construction. Quality and time are equated to the Scope and Cost of a building. These variables need to stay in balance no matter which is of highest importance for a project. The Construction Industry however as compared to the automobile, shipbuilding and aerospace industries has not changed much. The complexity in customization and scale of these has also exceed that of architecture. Design in Architecture has not managed to re-invent itself to meet the ever-growing demand for innovation. Architects largely rely on an uncoordinated and disconnected product supply chain. This in many cases does not ensure uniformity of quality throughout all projects.

Modularity in Architecture incorporates building elements that have been prefabricated off-site with more accurate specifications. This helps streamline the supply chain and make it more efficient. The Future of Modular design with the use of Integration Modeling and Building Information Modeling will help Architects and constructors manage materials more efficiently for reuse and ensure minimal wastage. Customization options and quality standards will also heightened. The ultimate goal would be to provide the end user will be provided with a more superior and personal housing solution.

Definition:
1) Modularity in Architecture refers to the construction of individual building Units that eventually come together to form a part of a larger assembly of a complete building. In many cases it also refers to volumetric components that may sometimes be a complete building or part of a larger system that form a complete building. Exterior and Interior finishes can be included in the aforementioned Modules.
2) Modular structures are volumetric offsite fabrications that form an enclosed usable space. Modules are structurally independent and include more than one building trade. This category can be broken down further based on size. Larger modules are shipped by themselves and generally comprise more than one room of the final building. The term 'pod' refers to one-room modules; the most common applications today are bathroom pods for site built high-rises. 'Interstitial modules' are non-inhabitable spaces including finished roof components or floor and ceiling plenums.

3.2 Case Studies

To improve the categorization of the case studies modularity can be looked at in three different levels. The criteria for this classification is an increasing level of modularity.

Modular elements:
This deals with the modularity of repetitive elements in a building. Normally these elements are of a relatively smaller dimension and used severally in a building.

Modular Configuration:
In this category an assembly of building elements (mainly flooring, walls and roofing) are used as a component in a variation of configurations that form a larger living unit. In some cases some specific spaces in a building are made into modules and dropped into a structural frames of conventional buildings.

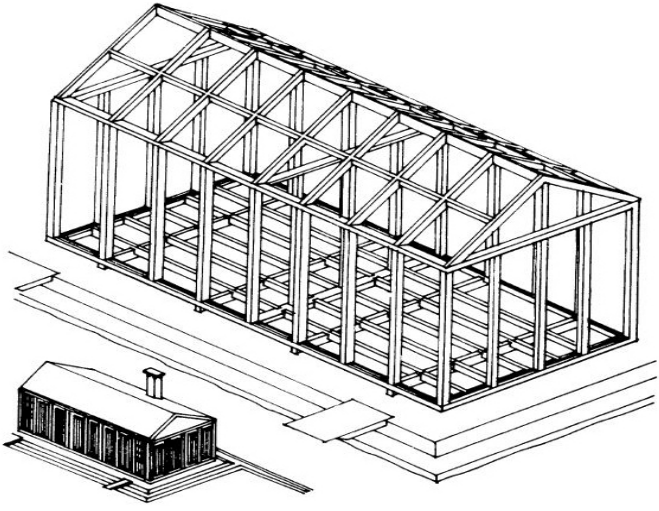
Modular Unit:
The highest level of modularity is considered as a complete living unit which is ready for use as soon as it is mounted to a mother structure.

This deals mainly with providing a fast living solution which contains all technical elements and material finishes on both the exterior and interior of the Module. In some cases immovable furniture is incorporated into the module. The more sophisticated the modules are designed internally the more efficient they are in meeting time constraints associated with construction.

Modular Elements

Manning Portable Colonial Cottage 1833

The Cottage was designed by H. Manning for his son who was emigrating from Australia to Europe. It captures the earliest idea of a home that could be shipped and assembled on a site far from where it is produced. The cottage consisted of grooved wooden posts embedded and bolted into



Manning Portable Colonial Cottage, 1883, axonometrical view

a continuous floor plate carried on bearers. The posts carried a wall plate with supported simple triangulated trusses. Various wood panels of standard size clad the frame.

Modular Configuration

Habitat '67, Moshe Safdie, 1962

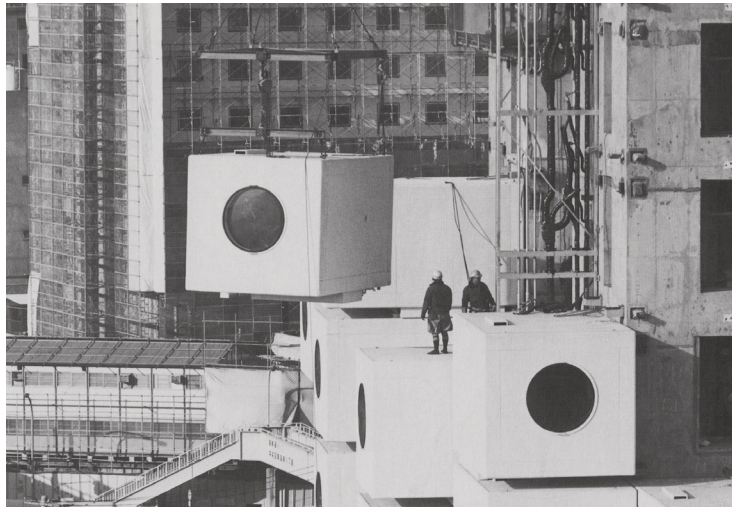
Habitat 67 is a residential complex built for the 1967 International and Universal Exposition in Montreal, Canada by a then freshly graduated Moshe Safdie. It was one of the first projects of its scale and typology to successfully tackle urban context. The complex consists of an arrangement of a series of identical precast concrete volumes in a number of different arrangements. A variation of five different shaped module structures were used to create a variety of living units.

Habitat '67, Moshe Safdie, 1962.

Modular Unit

Nagakin Capsule tower by Kisho Kurokawa(1968)

In the early 70s in Kisho Kurokowa was very innovative in his creation of the Nakagin Capsule Tower (1972), It was the very first capsule architecture design. The module was created with the intention of housing traveling businessmen that worked in central Tokyo during the week. It is a prototype for architecture of sustainability and recycleability, as each module can be plugged in to the central structure and replaced or exchanged when necessary. All modules were 4x 2.5 meters just enough space for one person. A total of 140 capsules are stacked and rotated at different angles. A central core acts a mother-structure for the 14-floor building.



Nagakin Capsule Tower by Kisho Kuyrokawa, Tokyo, 1968,.

3.3 The limits of Modular Architecture

There can be a stigma of poor building quality associated with modular construction due to a history of cheap manufactured buildings. This public perception was overcome by German manufactures through quality certification schemes, consistent promotional marketing of the benefits of offsite construction, and the standardization of components (increasing efficiency and productivity) (Lu 2007, 47).

Improvements in technology used in the modular construction industry is leading to an increased levels of overall built quality of projects.

There are numerous companies pushing for innovation and higher quality of modular buildings.

A study carried out in 2000 by the University of Clemson Graduate School established that the use of modular construction leads to numerous benefits:

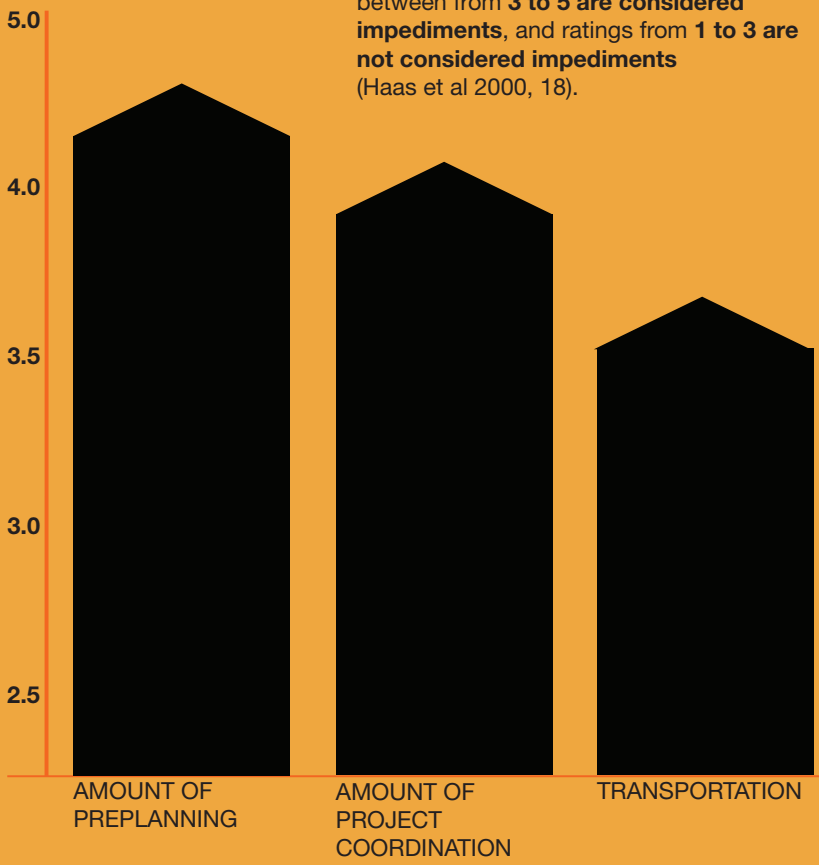
- An overall reduction in construction time and efficient scheduling.
- Increased Labour productivity and safety.
- Increased Labour productivity and safety.
- Minimal environmental impact.

There is however no denying that there are still problems associated with Modular Architecture. Among a range of problems and limitations associated with this method of construction the following are considered as impediments to the proliferation of Modular Architecture:

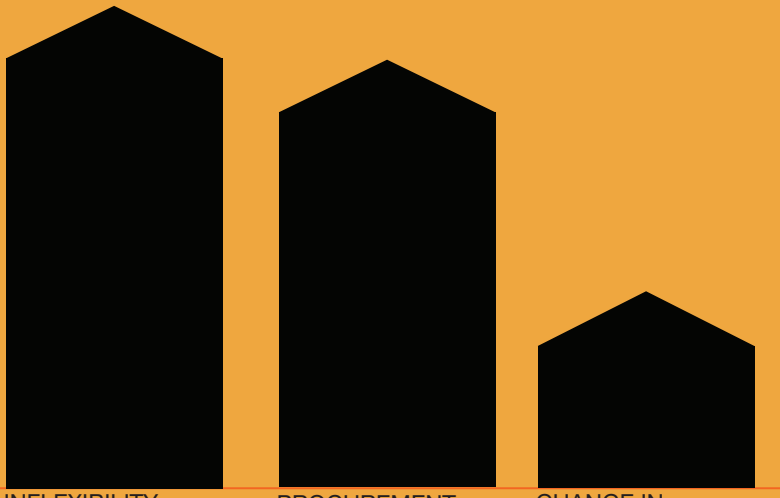
1. Amount of Pre Planning (Planning construction before it begins)
2. Amount of Project-coordination
3. Transportation
4. Inflexibility
5. Procurement

THE **LIMITS** OF MODULAR ARCHITECTURE

Perceived constraints to modular construction: Figure is based on a study using a 5-point Likert scale where ratings between from **3 to 5 are considered impediments**, and ratings from **1 to 3 are not considered impediments** (Haas et al 2000, 18).



138 practicing architects, engineers, and general contractors in the U.S. were surveyed on the constraints of pre-fabrication and modular design.



4 Prefabrication + modular

4.1 Hybrid trends - Implications
Prefabrication is on government and commercial sector agendas across Europe, Japan, the US, New Zealand and Australia, where it is seen as an important way of improving quality and value within the slow changing construction industry. Australia has been slower to embrace prefabricated construction than Europe and the UK – regions that have used the technology effectively for more than a century. Population, extreme weather conditions and constrained manufacturing conditions have meant that there have not been sufficient economies of scale to justify major ventures into prefabrication.
The degree to which quality control and greater efficiency can be achieved is limited by the conditions and methods used on-site. There is an increase in construction products manufactured in factories off-site and brought to the site for assembly.

This enables better quality control, improved and more efficient site processes, more environmentally friendly manufacture and reductions in cost.

These facilities demonstrate a trend away from conventional site manufacture to assembly from components manufactured off-site. The demand for prefabrication and modular construction is growing

together with its complexity. Where you would typically see prefabrication and modular construction used in temporary housing and accommodation, it is now being used to create advanced projects with a much longer lifespan. There are a number of projects incorporating modular design Constructions which intend to source preassembled components including bathrooms and balconies. Companies and industries now a days are trending to have such experience which extends to retail where modular systems are built and cut into pieces for shipping with services, finishes and fitments complete upon delivery.

Prefabrication now facilitates the building of large-scale apartment complexes with cost savings and timeframes which were previously unattainable. This is likely to assist housing shortages in both the private and public sectors, such as for public housing projects. It can also be constructed as a green option, which is likely to encourage governments to increase their use of this approach to construction. Just to mention not yet seen in Australia the architectural feature houses being done by prefabrication, as in some areas in Northern Europe and America, but it is certainly beginning to gain popularity in housing and also in apartment design all over the globe.

Any construction method that promises to deliver high quality housing, and which is as fast and simple to build as prefabricated modular construction aims to be, holds potential for the future.

There is enormous potential for growth in relation to apartments, public sector housing and student accommodation, with offices, hospitals, hotels and other industrial building options widening as technology advances.

What are the advantages of

Prefabrication + modular?
(Construction projects being manufactured in factories off-site and brought to site for assembly)
Prefab-Modular construction moves the construction site to manufacturing facility for a major part of the building and, in this way, improves its predictability, increases productivity, and reduces the risks inherent in construction.

Modular buildings also generate great cost saving opportunities as a result of compressed construction schedules. usly unattainable.

Quality

- Computer controlled fabrication processes
- Unique structural systems
- Pristine factory environments
- Pre-qualified compliance of components with Building Codes

Guaranteed completion & fast construction timelines

- Prefabricated modules manufactured off-site in factory environments
- Structured fabrication and inspection processes ensures accuracy in deliverables
- Easy transportation
- Modules are complete upon arrival to site
- Minimisation of on-site construction procedures
- Unique locking systems ensure structural integrity
- Simple processes

Quantifiable sustainability

- Reduce carbon footprint
- Time savings
- Reduce overall water and energy use
- Reduction in material wastage
- Transport efficiency
- Minimal effect on environment
- Reusable structures – Relocatable

Are there disadvantages to this?
Tighter and longer periods of co-ordination are required for design to be co-ordinated with modular formats and products.
Transportation is likely to be a primary constraining factor for the module size and manufacturing location.
In most cases, logistical considerations for modular construction mirror that of traditional construction. However, storage for large components and the handling and assembly of heavy precast members are important considerations.
Quality assurance becomes critical especially when large amounts of precast components are used structurally.

* CitizenM Hotel Bankside London

project	citizenM Hotel Bankside London, UK
client	citizenM, Voorschoten, NL
architect	concrete architects
project location	20 Lavington Street, SE1 0NZ
city	London
country	United Kingdom

DESIGN

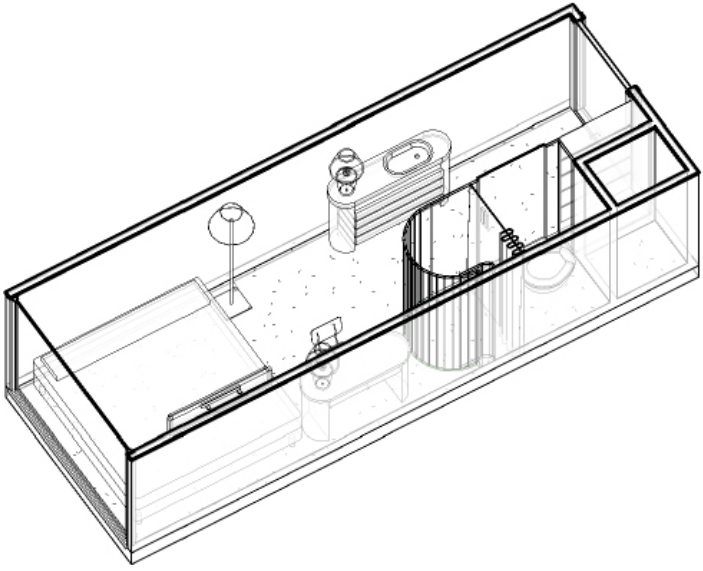
The building has landed in the upcoming neighbourhood of Southwark. An area that traditionally has been dominated by industrial warehouses. This reference was used to create a building that refers to the past by using a colour and material that is a reinterpretation of the sand coloured London stock bricks, formerly used to construct warehouses. This modular build citizenM hotel is carefully covered with custom-made brick patterned concrete panels.

façade Sand coloured stone panels with special designed brickwork pattern are referring to the warehouse architecture of the neighbourhood.

public life The public areas of this hotel are the first in a new generation for citizenM. The space is divided in several areas where you can find the environments you need to work, socialize, relax or have a drink.

citizenM Hotel
Bankside London,
UK, street view

view CitizenM_ London
plan typical bedroom floor plan



plan CitizenM_ London_Plan Interior view
elevation CitizenM _London_Elevation Interior view
axonometry CitizenM _London_ Module axonometry

* CitizenM Hotel Paris

project	citizenM Hotel Paris
client	citizenM, Voorschoten, NL
architect	concrete architects
project Location	Rue de Rome
city	Roissy, Charles de Gaulle Airport
country	France

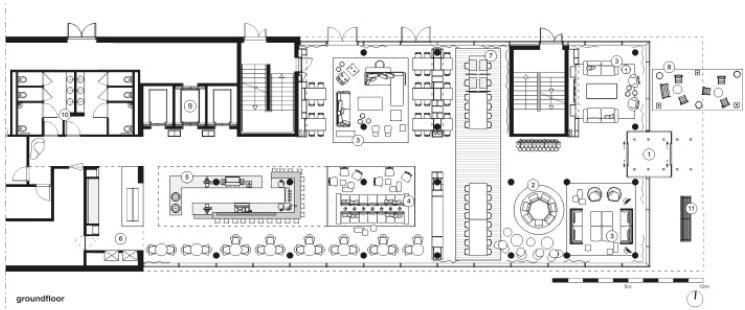
DESIGN

The building appears as a solid block of black basalt, consisting of six stories, sloping back to five in the direction of the landing strip. It has the potential for a future four-storey extension in that direction. The black basalt cladding is perforated with a series of black aluminium window frames, denoting the individual rooms. The various depths of the windows create a subtle architectural play and express the fact that every room accommodates a unique individual.

façade Sand coloured stone panels with special designed brickwork pattern are referring to the warehouse architecture of the neighbourhood.

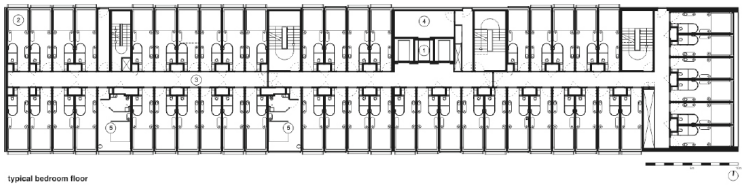
public life The public area/lobby on the ground floor forms the social heart of the hotel. Fully glazed windows on all sides create an open and transparent atmosphere with plenty of daylight.

CitizenM Hotel
Paris



groundfloor

1. entrance
2. check-in area
3. living room area
4. bookcase bench
5. bar
6. kitchen & buffet
7. working area
8. terrace
9. elevator
10. restrooms
11. swing bench



typical bedroom floor

1. elevator
2. rooms
3. corridor
4. linen room
5. ADA room

view CitizenM_ Paris
plan ground floor plan
plan typical bedroom floor plan

view CitizenM_ Paris_Interior view
view CitizenM_Paris_Ground floor common living room

* CitizenM Hotel Amsterdam

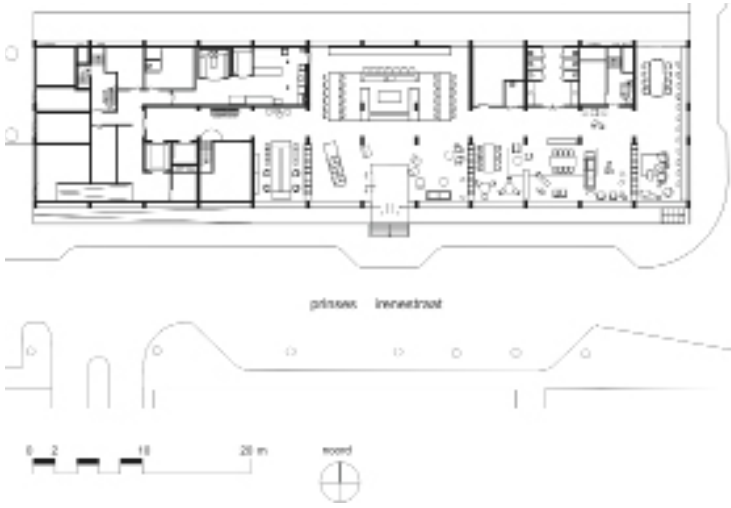
project	CitizenM Hotel Amsterdam City Centre
client	citizenM, Voorschoten, NL
architect	concrete architects
project Location	Prinses Irenestraat 30, 1077 WX
city	Amsterdam
country	The Netherlands

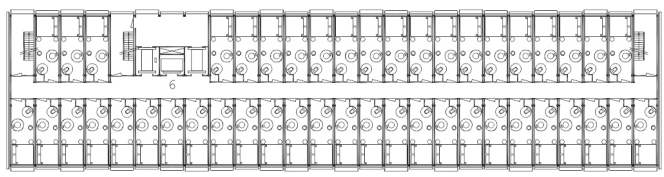
DESIGN
The total building is lowered because of the developmentregulations in the environment (the roof-height of the building is the same as the adjacent building blocks). As a result of that the ground floor is 90cm below street-level. Therefore there is a concrete areaway in front of the hotel with two stairs and a ramp for disabled people to give access to the building.

façade The building is a black metal box, dominated by the pushed out big glass windows of the rooms. The various depths of the aluminum frames and the angled glass give an individual twist to the rigid façade.

public life The public area of the ground floor is divided in several areas that we like to call living rooms. Our purpose is to create a home-environment, by designing working areas, dining areas and sitting areas. It creates a second home away from home for the visitors. The rooms are designed in cooperation with Vitra, using their furniture collection only.

CitizenM Hotel
Amesterdam





view CitizenM_ Amesterdam
plan ground floor plan
plan typical bedroom floor plan

view CitizenM_ Amsterdam_ Internal lobby
view CitizenM_Amsterdam_Manufacturing Plant

* CitizenM Hotel, Schiphol Airport

project	citizenM Hotel, Schiphol Airport
client	citizenM, Voorschoten, NL
architect	concrete architects
project Location	Jan Plezierweg 2,1118 BB,Schiphol Airport
city	Schiphol, Haarlemmermeer
country	The Netherlands

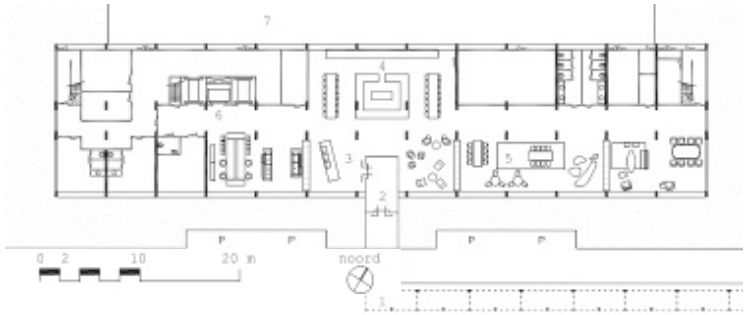
DESIGN

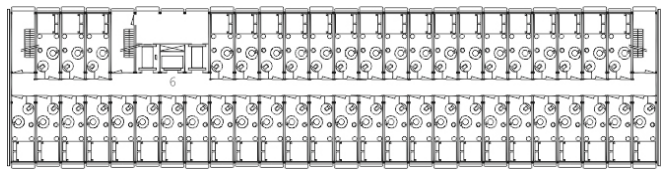
The concept of the hotel is to cut out all hidden costs and remove all unnecessary items, in order to provide it guests a luxery feel for a budget price. The hotel exists of 230 rooms of 14 sq. m, all prefabricated produced in citizenM's own factory and easy to transport.The rooms are stacked on a ground floor with a dynamic lobby / livingroom space, creating rooms and F&B functions.

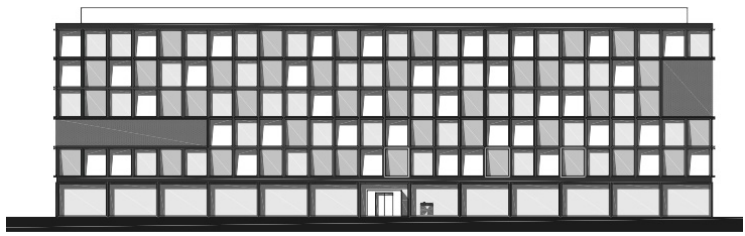
façade Two huge art works, printed on pvc mesh fabric are placed on the façade. The works are made by a local talented artist, but within a few years they will travel from one hotel facade to the other.

public life The public area of the ground floor is divided in several areas that we like to call living rooms. Our purpose is to create a home-environment, by designing working areas, dining areas and sitting areas. It creates a second home away from home for the visitors..

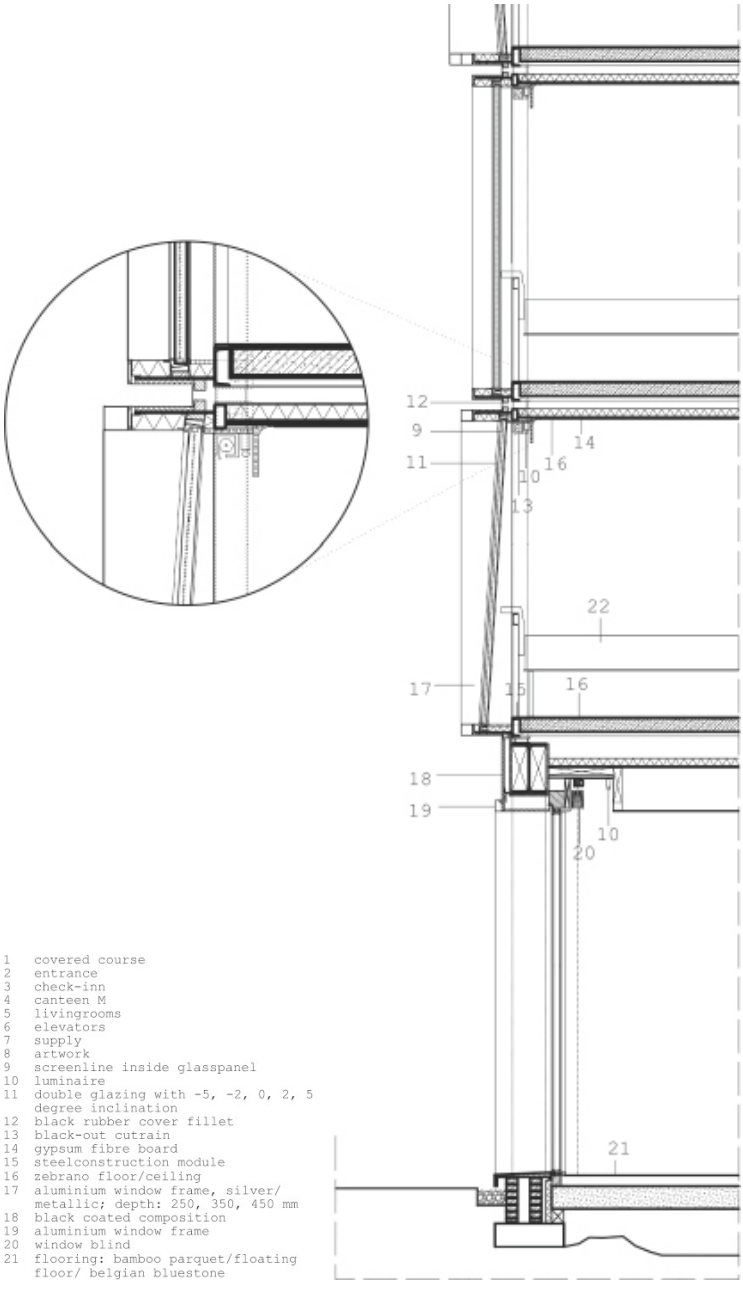
CitizenM Hotel
Schiphol Airport







view CitizenM_ Schiphol Airport, entrance
plan ground floor plan
plan typical bedroom floor plan
elevation front elevation



1 covered course
2 entrance
3 check-inn
4 canteen M
5 livingrooms
6 elevators
7 supply
8 artwork
9 screenline inside glasspanel
10 luminaire
11 double glazing with -5, -2, 0, 2, 5 degree inclination
12 black rubber cover fillet
13 black-out cutrain
14 gypsum fibre board
15 steelconstruction module
16 zebrano floor/ceiling
17 aluminium window frame, silver/ metallic; depth: 250, 350, 450 mm
18 black coated composition
19 aluminium window frame
20 window blind
21 flooring: bamboo parquet/floating floor/ belgian bluestone

detail CitizenM_ Schinpol_ typical section and materials

* CitizenM Hotel Glasgow

project	citizenM Hotel Paris
client	citizenM, Voorschoten, NL
architect	concrete architects
project Location	JHopestreet - Renfrewstreet
city	Glasgow
country	Scotland – United Kingdom

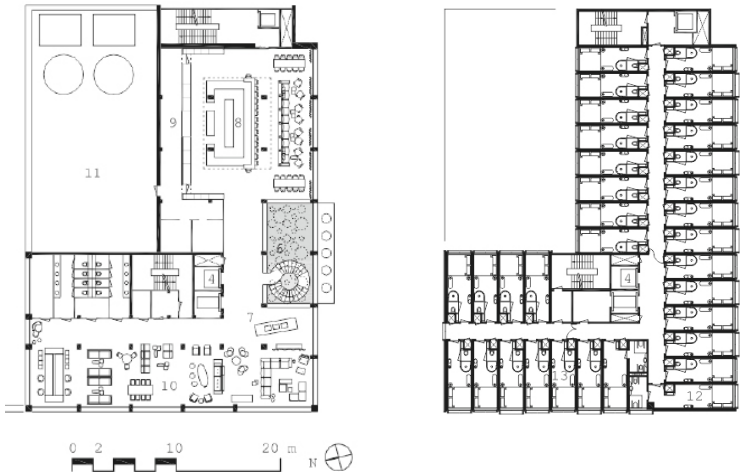
DESIGN

CitizenM wants to contribute also to it's cultural environment. Two huge art works, printed on pvc mesh fabric are placed on the façade. The works are made by a local talented artist, but within a few years they will travel from one hotel facade to the other. In Glasgow, the artist Alex Dordoy expresses the open way of living of the mobile citizen in combination to the restless spirit of the city of Glasgow.

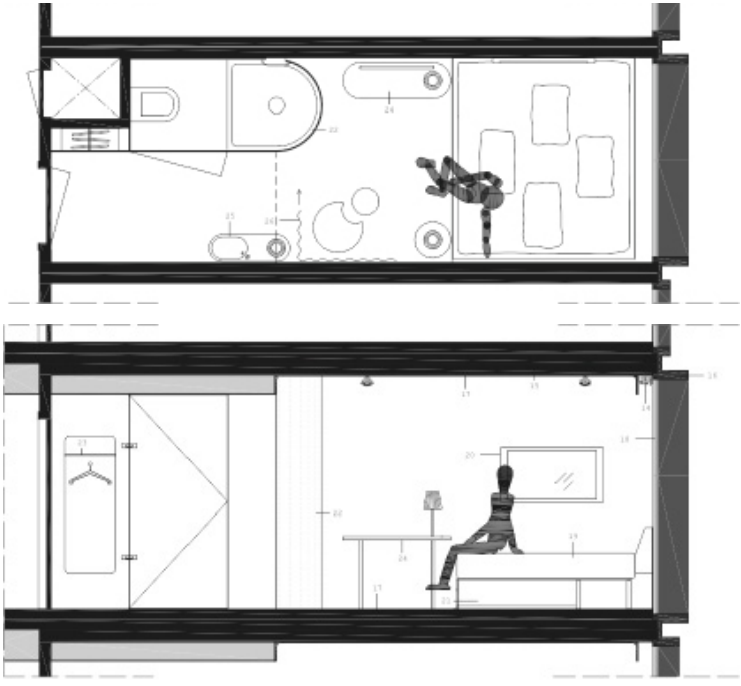
façade The building is located on the corner of Hopestreet band Renfrewstreet in Glasgow's city centre. Robust granite natural stone form a 8 storey building. The height, mass and firm appearance of the building are in close harmony with the context.

public life The public area of the frst floor is divided in several areas that we like to call living rooms. Our purpose is to create a home-environment, by designing working areas, dining areas and sitting areas.

CitizenM Hotel
Glasgow



view CitizenM_ Glasgow
plan ground floor plan
plan typical bedroom floor plan
elevation front elevation



view CitizenM_ Glasgow_Interior view
plan CitizenM_ Glasgow_Typical room
section CitizenM_ Glasgow_Typical room

* CitizenM Hotel Rotterdam

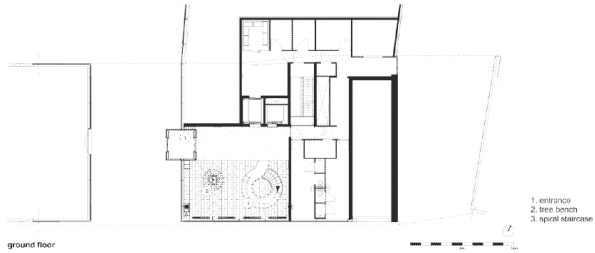
project	citizenM Hotel Rotterdam, nl
client	citizenM, Voorschoten, NL
architect	concrete architects
project Location	Gelderse Plein 50
city	Rotterdam
country	The Netherlands

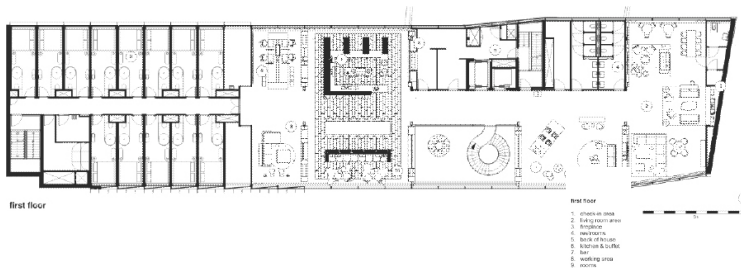
DESIGN

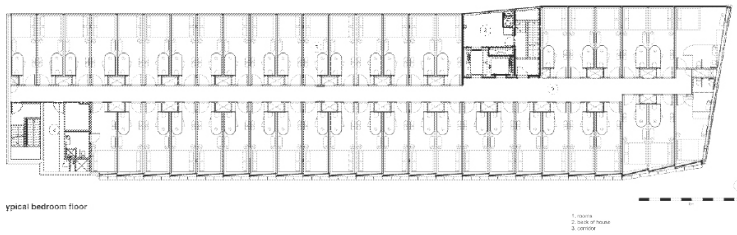
citizenM has arrived in the vibrant area of 'De Oude Haven' on the south side of Rotterdamdams city centre.The building complex has a commercial space on the ground floor with an office wing on the north side and the hotel on the south side. A passage through a courtyard underneath the buildings connects the Blaak station with De Oude Haven, one of the few remaining historic areas in Rotterdam. The hotel building overlooks this monumental area, which includes the old harbour.

public life The public area is located on the first floor and forms the social heart of the hotel. Large windows on two sides create an open and transparent atmosphere with a great view of the old harbour ('De Oude Haven'). The space is divided in several areas that offer environments to work, socialise, relax or have a drink. Choose a living room with a cosy fireplace or go for a more cafe style environment.

CitizenM Hotel
Rotterdam







view CitizenM_ Rotterdam
plan ground floor plan
plan typical bedroom floor plan
elevation front elevation

view CitizenM_ Rotterdam_ Common area staircase
view CitizenM_ Rotterdam_ Underpass

* CitizenM Hotel New York

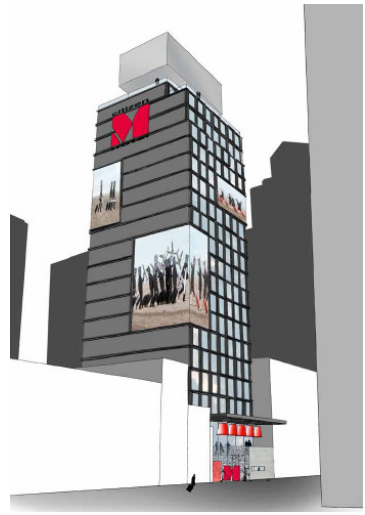
project	citizenM Hotel New York Times Square
client	citizenM, Voorschoten, NL & BCRE, NY
architect	concrete architects
project Location	218 West 50th Street, New York
city	New York
country	USA

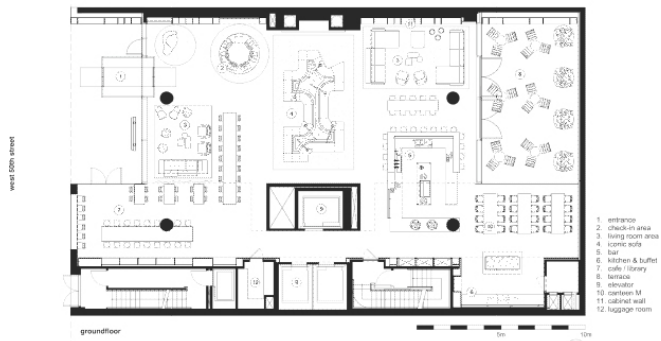
DESIGN
The building is formed naturally by stacking the individual guestrooms on top of each other,creating a tower with a series of large bedroom windows. Combined with the setback of the tower from the street, it creates a small plaza. The citizenM living room plaza on the ground floor, and the bar on the rooftop, are designed as recognisable glass volumes that are almost carved out of the mass to accentuate the distinctive social function they have within the hotel.

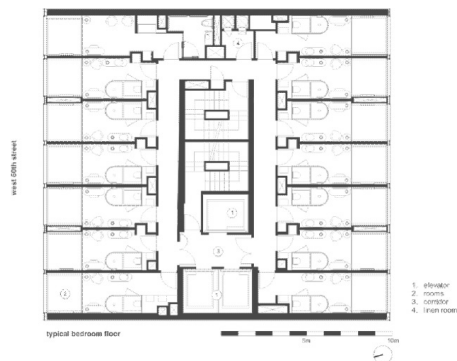
façade The most striking feature is the bespoke artwork in the middle of the space by artist Julian Opie; walking people are carved out the granite cladding of the elevator core and filled with gold leaf.

public life The public area continues into an outside courtyard. A green patio walled with a retained brickwork wall that continues into the canteenM to once again link the exterior to the interior.

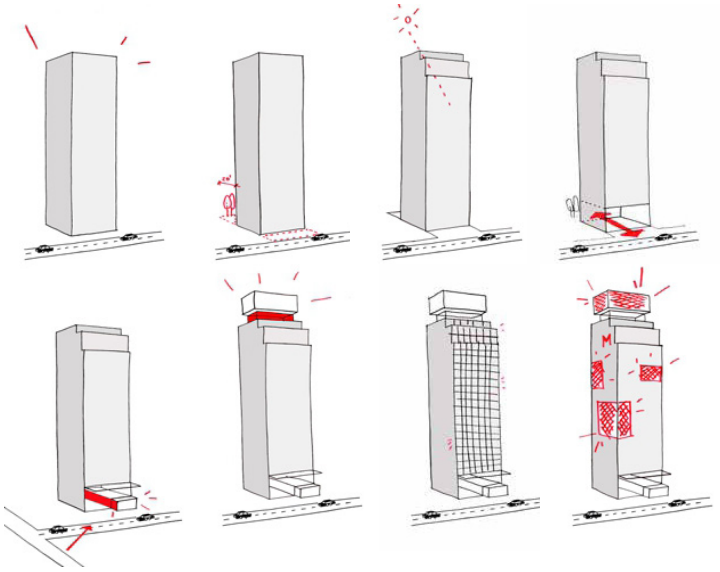
CitizenM Hotel
New York







view CitizenM_New York
plan ground floor plan
plan typical bedroom floor plan



concept CitizenM_ New York_Concept development
view CitizenM_New York_Entrance Facade

* My Micro NY New York

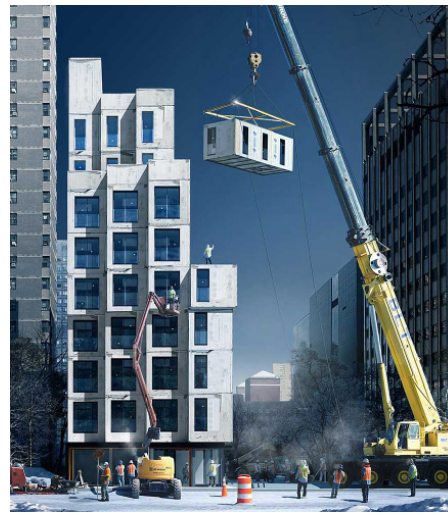
project	My Micro NY
client	Monadnock Development
architect	n-architects
project Location	335 E 27th Street, Kips Bay, Manhattan
city	New York
country	USA

DESIGN

The adAPT NYC competition was created as part of the administration's New Housing Marketplace Plan to introduce additional choices within New York City's housing market and accommodate the city's growing population of one- and twoperson households. My Micro NY will be the first micro-unit apartment building in New York City, one of the first multi-unit Manhattan buildings using modular construction, and at the time of writing, the tallest modular building in New York City. The project focuses on quality and livability through features that highlight the use of space, light, and air, such as 9'-8" floor-to-ceiling heights and juliet balconies.

public life Shared amenities will include a gym at ground floor level, a small lounge, den, community room and public roof terrace, bicycle storage, tenant storage room and separate storage lockers dispersed throughout the building, and a small garden.

My Micro NY
New York



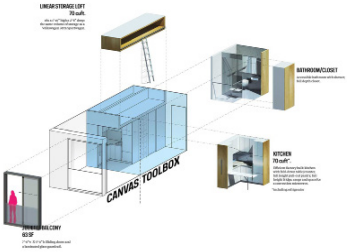

APT. #3A - DAY

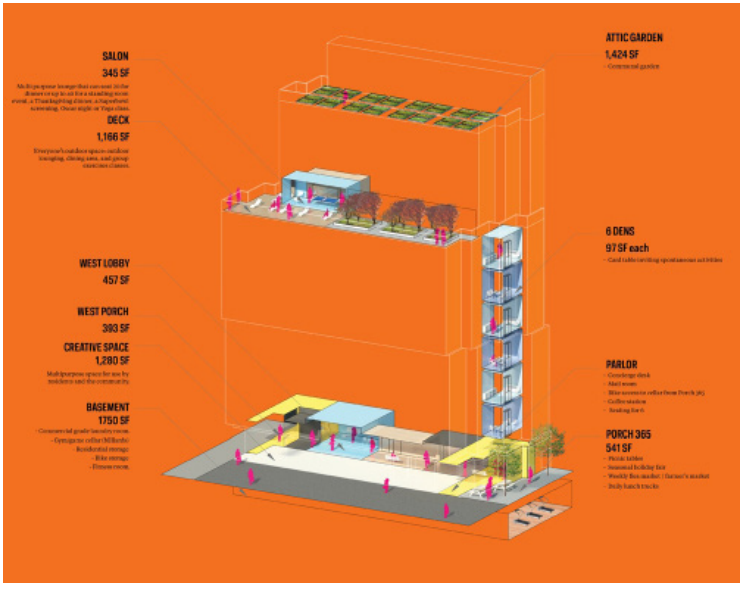

APT. #4D - DUSK


APT. #3A - NIGHT


APT. #4D - NIGHT

view MY Micro NewYork_New York
plan typical bedroom floor plan
plan typical module plan





view My Micro NY_ New York_Interior Living Environ
view My Micro NY_ New York_Interior Party Environ
concept My Micro NY_New York_ Module Exploded view
concept My Micro NY_New York_ Public Areas

* The Stack 4857 Broadway

project	The Stack 4857 Broadway
client	Gluck+
architect	Gluck + Architects
project Location	NYC Storm Zone 6
city	New York
country	USA

DESIGN

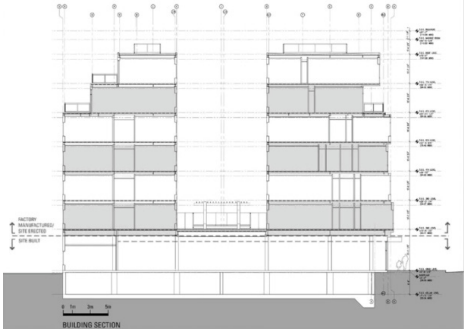
THE STACK addresses the need for moderate-income housing in Manhattan. It finds opportunity on a small, difficult urban site through the alternative method of offsite construction. Offsite construction offers an accelerated schedule and shorter ennancing period, turning sites that might otherwise be considered risky and turning them into opportunities. It is a pilot project for developing a quality and economically viable housing solution to strategically rebuilding and filling gaps in outmoded housing infrastructure in the city.

Although not necessary to its construction methodology, the design of this 7-storey residential building expresses its offsite modular construction as well as a diverse selection in the kinds of layouts for tenants.

The building consists of 56 modules, completed offsite andshipped for construction and assembly to the northernmost tip of Manhattan, where a crane lifts the modules into position. Over the course of four weeks, the 12-foot-wide parallelepipeds were stacked and secured together by bolts.

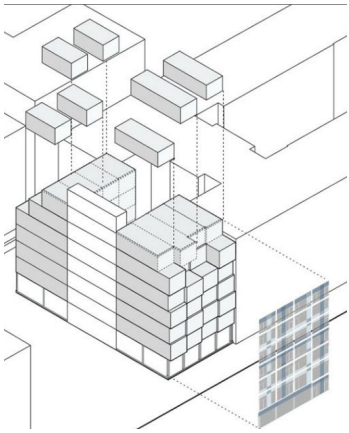
The Stack
New York

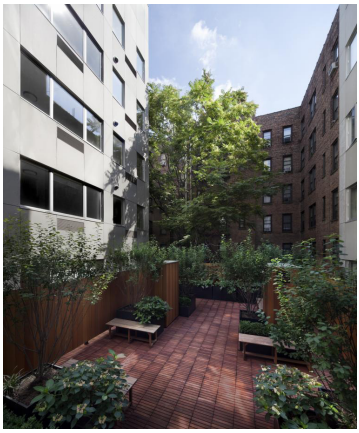
TYPICAL FLOOR PLAN



BUILDING SECTION

view The Stack_ New York
plan typical bedroom floor plan
plan 3BHK type1
plan 3BHK type2
plan 2BHK
section building section





view The Stack_ New York_Module clubbing
view The Stack_ New York_Internal Courtyard
view The Stack_ New York_On Site Stacking process
view The Stack_ New York_Interiors

* The Shelf Hotel China

project	The Shelf Hotel
client	Renhe Estate (Shaanxi Weizhi Group)
architect	3GATTI, Francesco Gatti
project Location	Keji Road, Gaoxin district
city	Xi'an
country	China

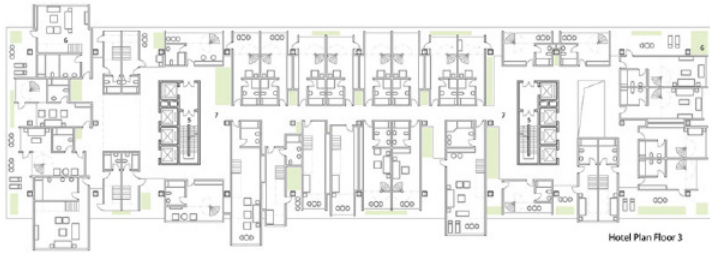
DESIGN

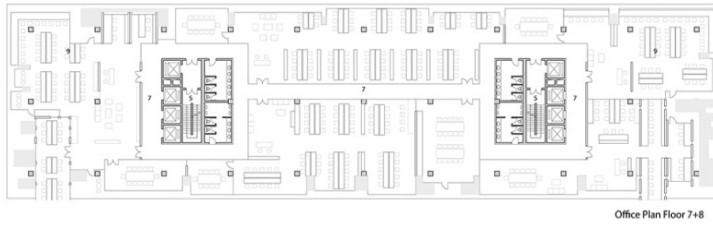
One main purpose of this design is to follow the needs of different inhabitant without loosing the power of a strong landmark building in the cityscape. In the common buildings the design is a dam imposed by the architect to the mutating needs of the people and of the developing history of the city. This building wants to be an open matrix to be filled during time with the mutating expectations from a growing culture and society.

Most of the houses actually will not be completely autonomous volumes but will be aggregate together and divided only by apparent front gaps so not to waste habitable square meters. In the ground floor the houses volumes will extend to the front area creating small plazas together with green walls of bamboo.

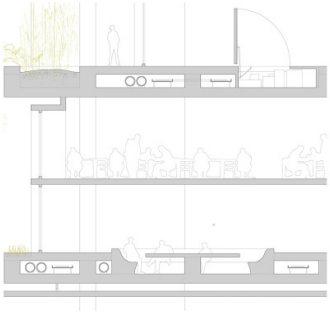
public life Large green gardens will be the location for special function related with the exhibition and research about Chinese traditional cultural activities such as calligraphy, tea and taiji together with Buddhist meditation and learning areas.

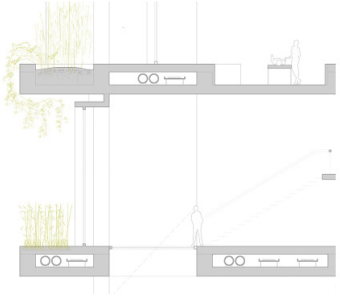
The Shelf Hotel
China

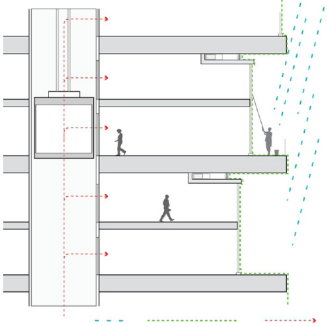


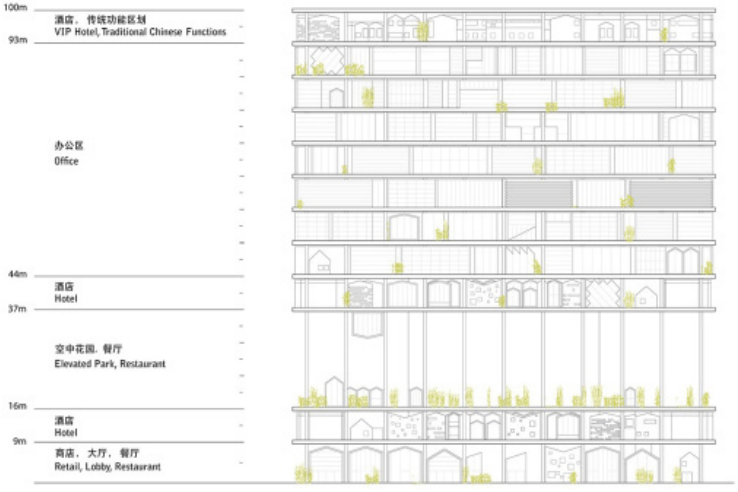


view Shelf Hotel_ China_Functional elevation
plan typical bedroom floor plan
plan typical office floor plan









details Shelf Hotel_China_ Functional details
elevation Shelf Hotel_China_ Functional elevation

* B2 Tower Atlantic Yards(FAIL)

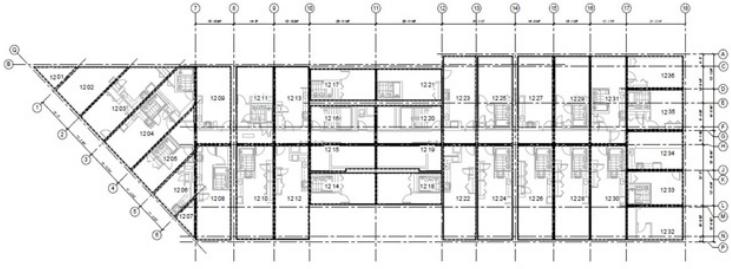
project	B2Tower , Atlantic Yards
client	Forest City Ratner Companies
architect	SHoP Architects
project Location	612 Atlantic Ave
city	New York
country	USA

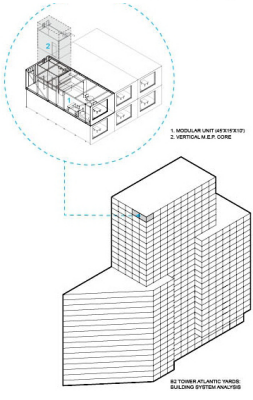
DESIGN

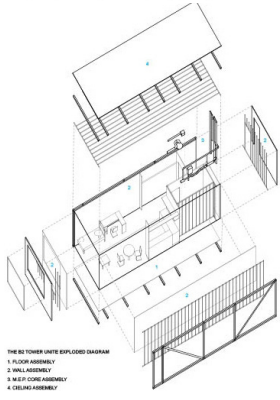
To create adorable housing, AY Affordable Housing Program created by FCRC & Mutual Housing Association of NY (MHANY) 50% of Units are Affordable= 181 UnitsAffordable rental units will be spread throughout the entire building• Studios, 1BR and 2BR units; 20% of total affordable units will be 2BR, Tenants selection through a City-administered lottery process.

- Tallest Modular Building in the World,
- 32 Floors, 322' tall, 346,000 Gross Square Feet
- 363 Rental Units: 50% Affordable / 50% Market Rate
- 4,000 SF of ground floor retail,15,000 SF of Arena Storage
- Designed to achieve LEED Silver certification
- 146 Parking Spaces Amenities include:24-hour doorman, Fitness Center, Lounge, Game
- Room, Yoga/Dance Studio, Children's Play Room,
- Roof Terrace, Bike Storage, Washer & Dryers inevery apartment

B2 Tower
USA

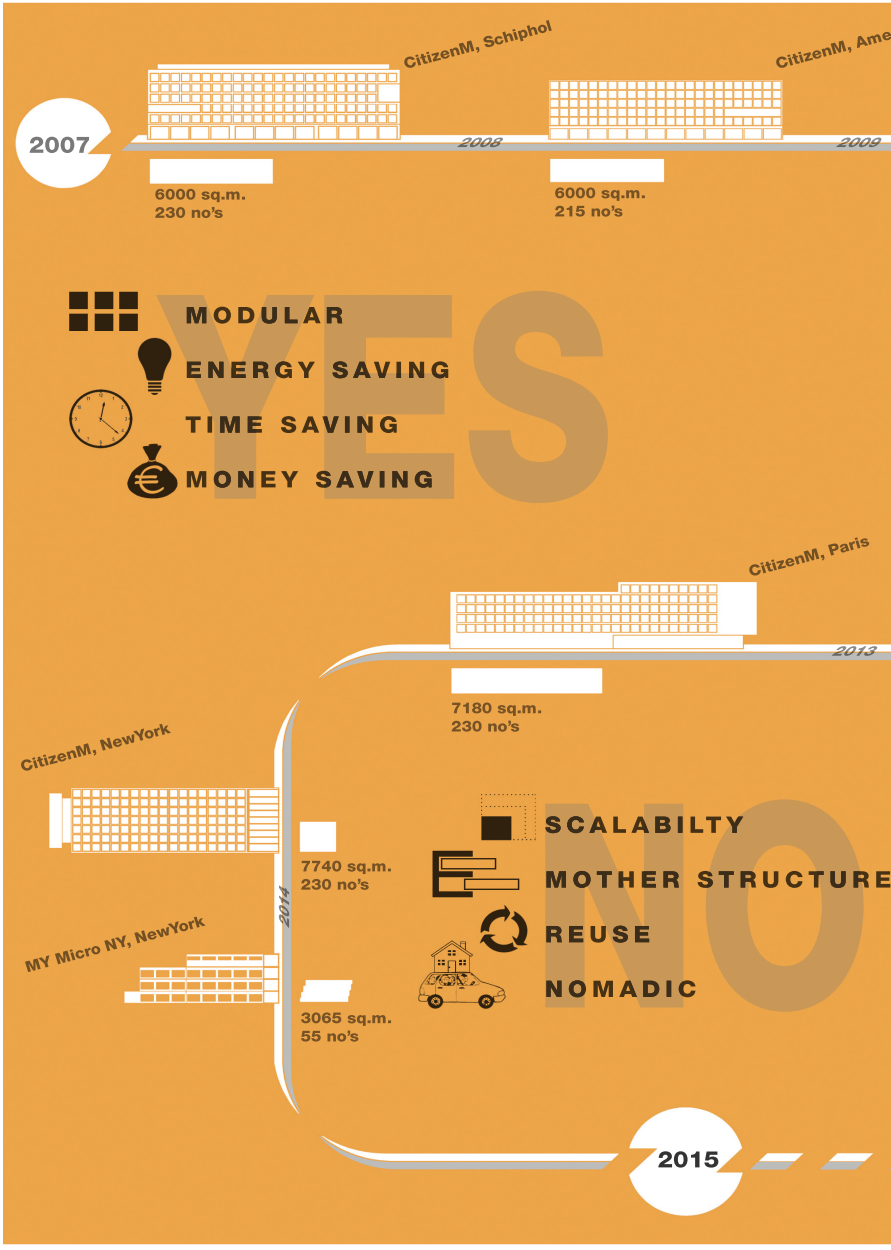


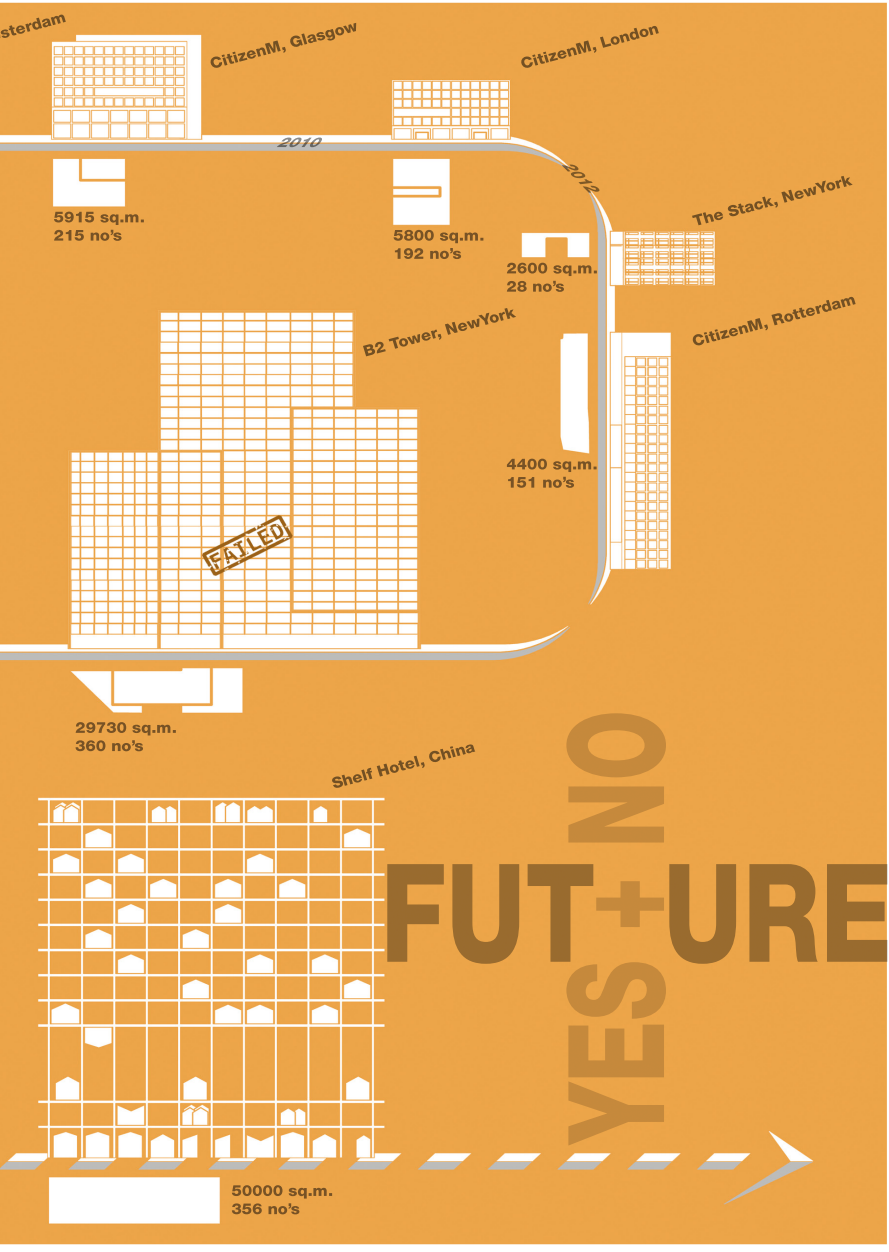




view B2 Tower_ New York
plan typical bedroom floor plan
concept building system analysis
concept exploded view of module

view B2 Tower_ New York_Dinning Interior view
view B2 Tower_ New York_Living Interior view

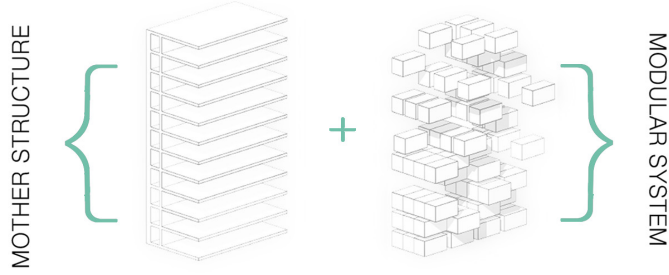

2007
CitizenM, Schiphol
2008
6000 sq.m.
230 no's
CitizenM, Ame
2009
6000 sq.m.
215 no's
YES
MODULAR
ENERGY SAVING
TIME SAVING
MONEY SAVING
CitizenM, Paris
2013
7180 sq.m.
230 no's
CitizenM, NewYork
7740 sq.m.
230 no's
2014
MY Micro NY, NewYork
3065 sq.m.
55 no's
NO
SCALABILTY
MOTHER STRUCTURE
REUSE
NOMADIC
2015

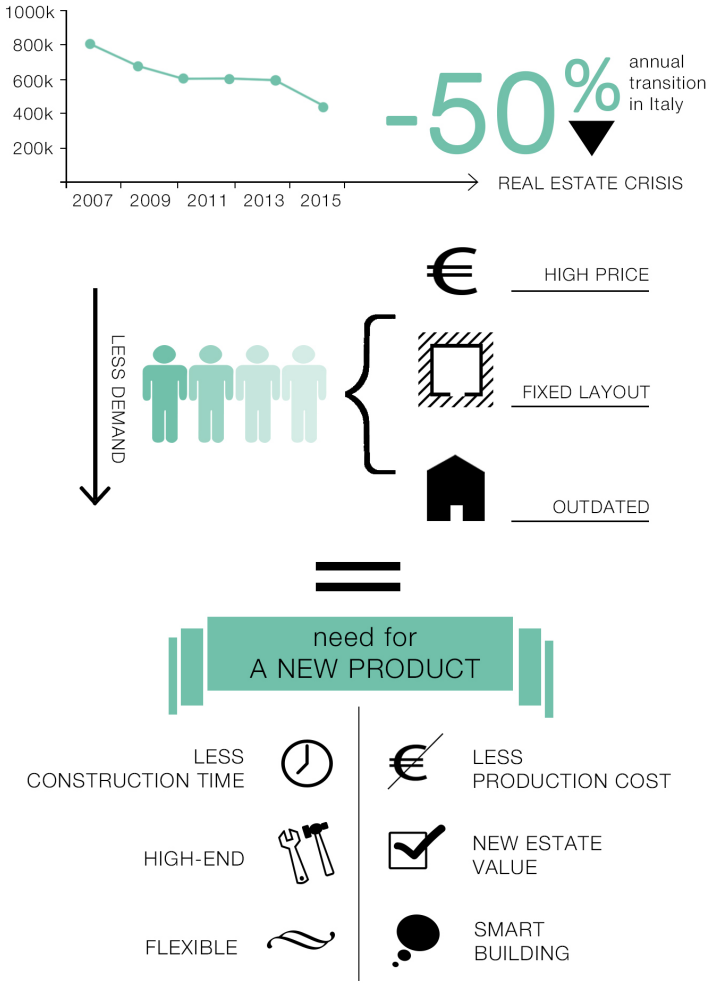

sterdam
CitizenM, Glasgow
CitizenM, London
2010
2012
5915 sq.m.
215 no's
5800 sq.m.
192 no's
2600 sq.m.
28 no's
The Stack, NewYork
B2 Tower, NewYork
CitizenM, Rotterdam
4400 sq.m.
151 no's
FAILED
29730 sq.m.
360 no's
Shelf Hotel, China
YES + NO
FUT+URE
50000 sq.m.
356 no's

5 Hybrid Systems: Modular Industrialized Architecture

5.1 Hybrid system: a techno-typological innovation

Nowadays the real estate market in Italy is paralyzed as elsewhere in Europe. There is almost 50% less of annual transition from 2007 to 2015. Nevertheless, there exists a large demand of houses with a lower price than the one available on the current market. This generates an excess in the offer of high price houses which meets a diminishing number of customers. Moreover the "product" house is nowadays incredibly outdated compared to the era in which we live.




1000k
800k
600k
400k
200k
2007
2009
2011
2013
2015
-50%
annual transition in Italy
REAL ESTATE CRISIS
LESS DEMAND
HIGH PRICE
FIXED LAYOUT
OUTDATED
need for
A NEW PRODUCT
LESS CONSTRUCTION TIME
HIGH-END
FLEXIBLE
LESS PRODUCTION COST
NEW ESTATE VALUE
SMART BUILDING

In our opinion, the real problem of the actual paralysis does not lie in the cost of the "product" house but in the lack of the right product on sale. The issue is therefore to think about a new product, which is able to meet the expectations of future customers, by responding to the changing contingencies of the households, of the market and the trends.

We individuate into the "hybrid trend" the path to follow in order to revolutionize the entire construction industry and as a possible layout to finally trigger industrialization in the building construction process.

The hybrid approach allows to conceive the building as a sum of two subsystems with different roles and life time. One more durable and another one more temporary. The first subsystem will establish the real estate value of the building and it will be built using traditional technologies. The second subsystem will constitute the consumer market product part, with a shorter life-cycle, and it will be modularized and produced using an industrialized processes. Thou the building will be divided into a matrix, or better a mother structure and the modules installed in it.
These two subsystems foreshadow ours as a product which is flexible, scalable and directly configurable by the customer. With large numbers the hybrid approach would create economies of scale and therefore costs reduction, construction time schedules compression and innovation in the "product" house use.

5.2 The four "P": Put in Place, Plug & Play

The innovation of the house as a market product is first of all procedural. Schedules are compressed and more possibilities of usage are given.

Four stages make the industrialized modular hybrid system up.

We can summarized them as Put, Place, Plug and Play.

PUT
First the innovation lays in fabrication and transportation: modules are fabricated at off-site locations and manufacturing plants in a controlled environment. Once completed, the modules are shipped to a construction job site by trains or trucks for installation into the mother structure. This procedure allow for a potentially quicker construction delivery time.

PLACE
The second key point in the modular hybrid system is the place itself. Mother structure can be settled in different places allowing users to move their own home from one city to another. Mother structure is also designed in order to allow future expansion of apartments. In that sense with place we mean the space into the mother structure that users rent, or buy. Each user will have an empty space to be fill.

PLUG
The plugging system is the third innovative feature. The modules are designed to be easily plugged into the mother structure without much additional on-site work. Modules can be also plugged between themselves, made future expansion possible.

PLAY
Last but not least user can "play" with modules. Users can chose the units with a web application that allow them to customize everything, from colour of wall till technological systems inside. The industrialized modular hybrid system allows for a new level of involvement of the consumer into the personalization and configuration of his own home.

Procedural innovation...

PUT in **PLACE** ,

Fast process

- off-site fabrication
- truck shipping
- lift
- Insert

First your space, then your home

- city
- mother structure
- your floor
- empty space to be

PLUG & PLAY

Modules rady to use

- smart design
- pre-integrated hvac system connections
- no additional on-site work
- instant house

Expand life style possibilities

- custumize
- add
- adapt
- replace

5.3 Real estate value

Relators are used to say that there exist three things which determine the value of a property: LOCATION, LOCATION, LOCATION.
The location, namely the place, the settlement of the property, is considered the dominant factor in the determination of the desirability of a house. This means that similar properties may have an higher or lower market value depending on the position. In fact though renovating or restructuring is always possible, moving the house is not likely, making the land one of the most incident factor in determining the property's value.
In our opinion a way out could be obtained by splitting the market value from the land value of a property, thus returning it its intrinsic quality.
This is viable with the hybrid approach. In fact, once the structure is separated from the modules, the latter are no longer constrained to the land and can be easily relocated to another structure situated in different places. The apartment, defined by the modules, thus becomes a factual product, and its price can eventually be brought back to the real costs of production, reducing the surcharge or depreciation arising from the location. Only the mother structure will hold the land value resulting from the position.
Then in the hybrid approach

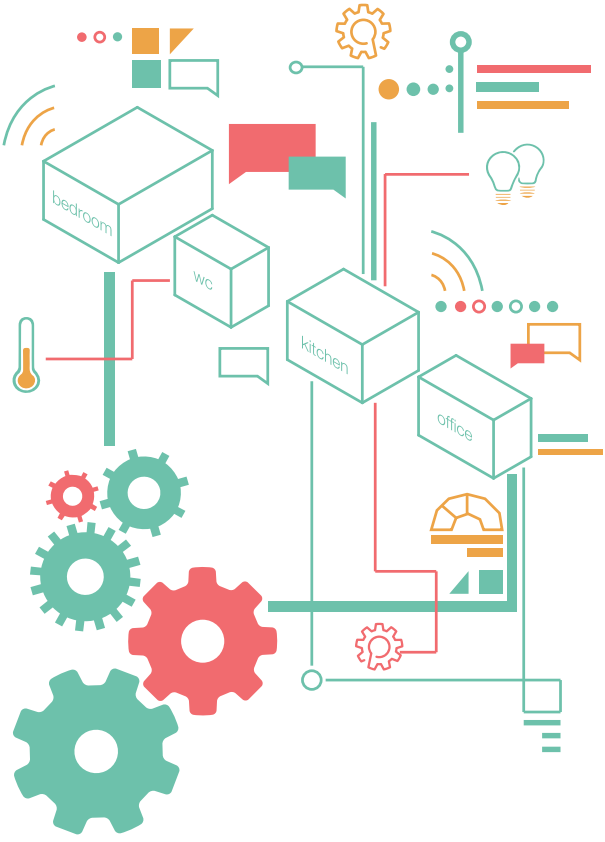
the mother structure holds the "location" value of the house, and the modular system holds the house value as an industrial "product"

This frees the construction system from the jail of the real estate praxis

5.4 Augmented technology

Hybrid system means technology to an upper level, adding new and revolutionary feature to the house.
Houses unlike other goods are im-
the
mother structure holds the "location" value of the house, and the modular system holds the house

value as an industrial "product" proving slowly in terms of technology. If we think about phones, for instance, they have changed enormously during last decades following new trends and needs: from devices for calling and sending texts, to multifunctional devices to learn, play , have fun.
Manufacturer tried to make their products more attractive for customers by introducing more and more applications, making users able to easily customize their devices. Phones market analysis teach us that better retail experiences depend on technology integration: high-end phones are hitting the market, revealing that technology is appealing for users, who will pay more to get it. (2)
Costumers nowadays demand more choice, more opportunities to enjoy a good or to customize it, thus manufactures provide value-added content to their products. This is what we pursue: add value to housing through technology.
How? The answer is thought "industrialization". The hybrid system allows to apply industrial



processes to the construction of the "product" house. That means primarily permitting new possibilities and introducing new functions, rather than drive down the costs!

The hybrid system approach aims to a different way to present technology applied to the house, in comparison to the previous ideas of "prefabrication". As seen in previous chapters, it is the prefabrication approach to be mistaken, not the system itself. In the prefabrication approach, as conceived so far, the purposes of advanced technology was just reducing costs and providing cheap houses for a larger number of people.

In the hybrid approach augmented technology is used to give more and new way to enjoy and use the house.

Hybrid construction augmented technology totally revolutionize the way to conceive at the house: not anymore a rigid and unchanging physical structure, but a real modifiable and self-configurable system that can be scaled up and down, divided and even totally substituted in real time without building site operations. It also makes customization likely and easy. The modular houses can be ordered and configured by web applications. Not only would be possible to choose the colours of walls, model of doors or windows, but also to implement the living experience through other means. Home automation will be integrated, saving time and money. No need to retrofit the system, fixing problems that may occur in doing it, design a diverse project that fits each different house in the market or for installers with an high technical knowledge. Modular industrialized hybrid system push home automation further ahead.

Modules should be seen as sort of devices with their apps that one can implement or not.

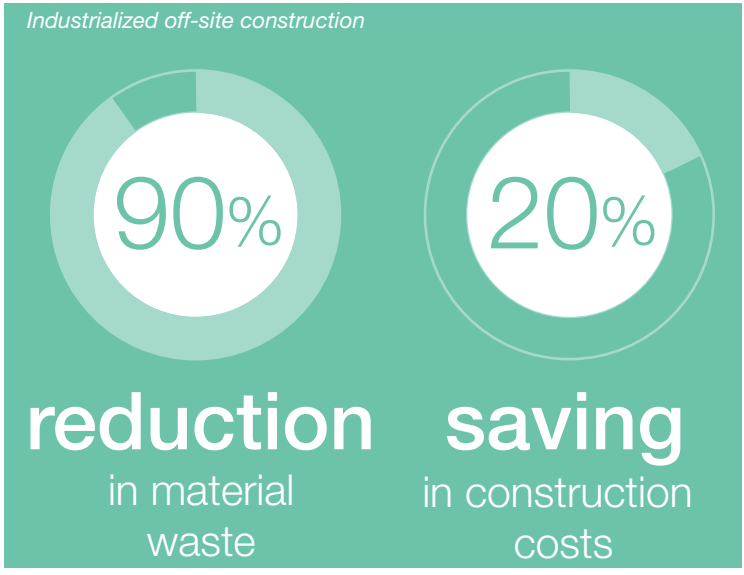
We conceive then industrialization as a tool for doing more and new things with the house, as well as better and faster, not just cheaper.

5.5.1 Smart building: Labour Efficiency

Studies by U.S Federal Facilities Council, focusing on construction efficiency, have documented:

- 25 to 50 percent waste in coordinating labour and in managing, moving, and installing materials
- Money losses due to the lack of interoperability
- Huge transactional costs to resolve disputes and claims associated with construction projects.

As a result, the NRC, National Research Council of U.S.A in 2010 published a report on potential ideas and practices that have significant impact on the construction industry efficiency and productivity, were among others,



listed “Greater use of prefabrication, preassembly, modularization, and off-site fabrication techniques and processes”. It affirm that

“Manufacturing building components off-site provides for more controlled conditions and allows for improved quality and precision in the fabrication of the component.”

This is possible as the slow unproductive site activities are replaced by more efficient and faster processes.

Modules are made by a smart, fast, industrialized process, that reorganize in a better way the labour cycle.

On site operation are bounded just to the construction of the mother structure and to the installation of the modules, following the four “P” approach (Put in Place, Plug and Play).

Going into details, the modular industrialized hybrid system allows for the following:

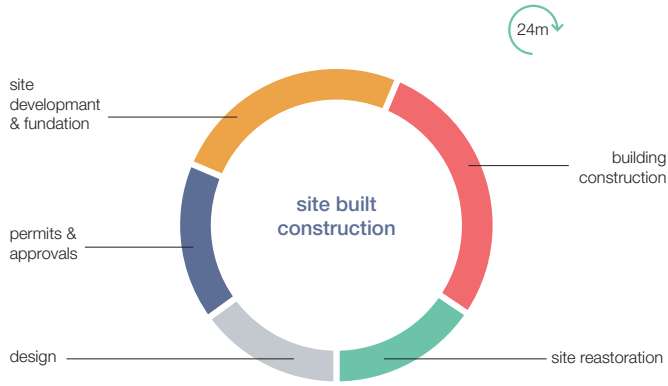
- **More controlled conditions for weather**
  indoor air quality issues in on-site construction resulting from high moisture levels can be avoided in modular structure that is completed in a factory-controlled setting using dry materials.
- **Less site disturbance**
  reduction of vehicles and equipment needed at the site.
- **Fewer job**
  site environmental impacts - reductions in material waste, air and water pollution, dust and noise.
- **Increased workers safety**
  workers less expose to inclement weather, extremes temperature, and hazardous operations.
- **Time schedule compression**
  There are several means that cause time saving compared to a site-built construction, as:
  - Fast tracking construction in factory, with site work send

back only to assemblage
- Simultaneous activities of on-site development and off-site building construction
- Assembly of precast modules versus field assembly
- Sequencing of trades minimized
- Design and engineering disciplines as part of the same manufacturing process.
- Minimized weather related delays
- Assembly line installation versus constant movement of trades to each installation site in a purely on-site project

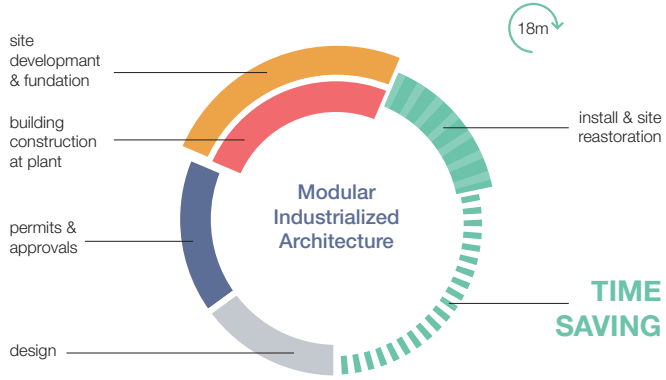
- **Cost effectiveness**

Labour efficiency is also evident considering costs. With an industrialized process is possible to acheave:
- Reduced interest carry on construction loan resulting from reduced construction time
- Reduced labour cost
- Reduced requirements for on-site materials storage, need to store raw materials on site versus carry cast finished modules
- Fewer losses or misplacements of materials
- Project scale impact cost savings
- Transportation of modules versus much more transportation of materials and products

Thou efficiency improvements and productivity are both related to time saving and cost effectiveness, as well as better working condition.
For a more complete understanding of the labour efficiency means is important to focus more on the cost analysis. As we have seen above, in a modular building, where the construction schedule is shortened, the financial and supervision costs are reduced. Additionally, the abbreviated construction schedule allows the investor to get a return on the investment sooner, while minimizing the exposure to the risks commonly associated with protracted construction schedules. Furthermore, is important to understand from where the labour cost reduction derives. Here a list of the main factors:



CONSTRUCTION SCHEDULE



- Less skilled labour vs experienced trades
- Cheaper labour markets of the manufacturer
- Controlling many trades within one manufacturing company
- Increased job safety and lower insurance premiums

However should be said that infrastructure for factory production requires grater investment in fixed manufactory facilities, grater production volume to achieve an economy of scale and energy dispend for production. A better financial analysis will be done in the next chapter.

Finally labour efficiency allows increasing the quality of the product. Proceeding and planning all the construction operations in the factory, using industrial procedures concur to quality control. Factors mentioned above, like less site disturbance, control condition of weather, need for less skilled craftsman and others, are significant in this sense.

5.5.2 Smart Building: Resource efficiency

The impact of construction and demolition debris on the environment is stunning.

Environmental Protection Agency (EPA) helps in understanding the magnitude of construction and demolition waste. A typical new building generates an average of 19 kilograms of waste per square meter of building area, that for a mid-size suburban office building means almost 100 tons of waste. The figures increase dramatically in demolition, with a result of almost 4,000 tons of waste.

Less material waste is possible with prefabrication. A report published by the U.K. group WRAP shows that there is the potential to make a significant difference to the amount of waste the industry produces; 5% waste streams in packaging, 25% timber, 36% in plasterboard. Up to a 90% reduction can be achieved by increasing the use of off-site manufacture and modern methods of construction.

Modular construction methods result advantageous in this sense

for several factors:

- Optimize construction material purchases and usage - On-site waste is minimized and a higher quality product is provided. Bulk materials are delivered to the manufacturing facility where they are stored in a protected environment safe from theft and exposure to the environmental conditions of a job site.
- Renovation versus demolition - The answer of hybrid modular system to demolition debris lays in renovation. The possibility to have a fixed mother structure and a interchangeable modules makes renovation easy. Old modules can be disassembled and new ones can be ordered and relocated into the mother structure, reducing the demand for raw materials and minimizing the amount of energy expended to restructure the apartment. In essence, the entire building can be potentially recycled.
- Flexibility – The hybrid system, contrary from most of the existing modular building, it is designed to easily change in time and space. New modules can be quickly add, allow to change or enlarge the asset of the home without demolish any wall. The process is fast with less dispend of energy and waste of material. The mother structure is designed in order to host different configuration of modules, fits the needs of the users.
- Design for reuse – In a scenario where several mother structure are located in different cities a flat can be transported and moved to another location. Users can take with them their own home wherever they go. Usually move to a new home means renovate it, changing the asset, fitting it whit own taste, dispending energy. With modular system everybody can enjoy his own home wherever.

Modular industrialized system also integrate the house's systems into walls along the construction line where recycled, technological, new material are used. Studies that examined the relationship between changes in material technology and

construction productivity based on 100 construction–related tasks found that:

- Labour productivity for the same activity increased by 30 percent where lighter materials were used;
- Labour productivity improved when construction activities were performed using materials that were easier to install or were pre–fabricated.

Leadership in Energy and Environmental Design (LEED) for Homes rating system includes a credit specifically for off-site fabrication – MR 1.5. MR 1.5 states "this credit should only be awarded if the walls, roof, and floors are

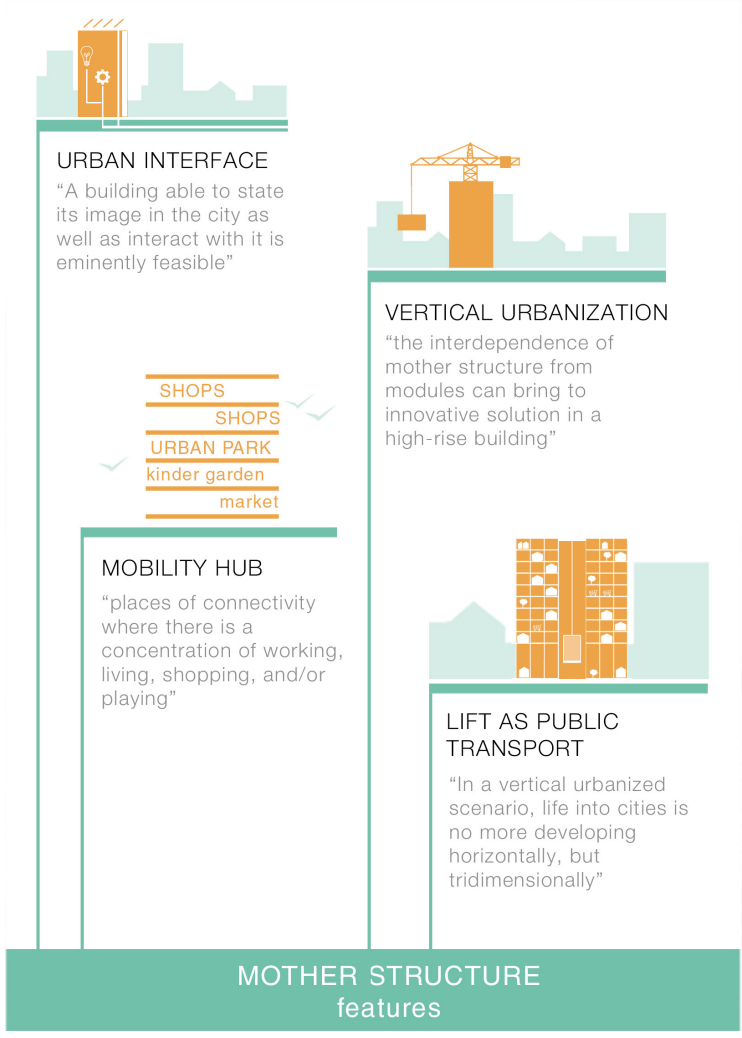
The modular industrialized hybrid system is then a resource efficient, off-site delivery method to construct buildings in a quality-controlled setting

5.6.1 Mother structure features: Urban interface

Today, there are two typology of modular buildings that are used: Moving Modular Buildings and Permanent Modular Buildings. If MMB are used mostly as emergency housing for catastrophe or as temporary construction, PMB sets in urban contest, functioning as hospitals, offices, education buildings and in some rare case also as commercial residence.

Then the question is, are PMB the best configuration suitable for multi-story residential project in a urban context?

We can surely state that in large-scale, multi-story construction projects, it can be beneficial to incorporate both onsite and permanent modular construction because each are particularly suited for different aspects of a project. First for static and functional reason. The nature of PMB is such that the modules are clustered around a core or stabilizing system, holding elevators, staircases and services. The structure is also meant for hosting all the other system, like


URBAN INTERFACE
“A building able to state its image in the city as well as interact with it is eminently feasible”
VERTICAL URBANIZATION
“the interdependence of mother structure from modules can bring to innovative solution in a high-rise building”
SHOPS
SHOPS
URBAN PARK
kinder garden
market
MOBILITY HUB
“places of connectivity where there is a concentration of working, living, shopping, and/or playing”
LIFT AS PUBLIC TRANSPORT
“In a vertical urbanized scenario, life into cities is no more developing horizontally, but tridimensionally”
MOTHER STRUCTURE
features

HVAC system or RES systems, envisioning for a Nearly Zero energy Building. In such a configuration, geothermal energy or photovoltaic one can be implemented into the building creating a link with the ground and the place, interfacing the building with the urban level. Our hybrid system does it too, but if PMB mostly have a fixed layout, our system doesn't.
Fixity is not what we are aiming. In a built environment which is the reflection of urban rhythm, with its slow, fast, calm or intermittent flows of element as people, cars, activities a new appearance is required. We think that a building able to state its image in the city as well as interact with it is eminently feasible. We are witnessing an image that can be subversive as well as sensitive, amusing as well as appropriate.
The building asset should have an urban interface, able to respond to context demand. A fix matrix playing with urban level onto which modules can move. The mother structure provides the users with mobility and flexibility, which will make time tangible and visible, and drastically change the way of urban growing.

5.6.2 Vertical urbanization

High density urban areas are the settlement for the system we are proposing.
Focusing on ephemerality as the only brand-new image to be bring into the traditional urbanization, no matter for horizontally sprawling building or vertically growing, the system can adapt to different urbanization. But there are other figures that have to be taken into consideration: land shortage, high population density, ground rent are just some of those. Verticality, became then the better solution to pursue.

Which implications vertical urbanization has with modular buildings?

The additional structural challenges of high-rise construction make modular construction in this settings more challenging, but the

high-rise construction costs also make any saving in time and hard cost worth consideration. Furthermore the interdependence of mother structure from modules can bring to innovative solution in a high-rise building.

For instance a crane can be install on top of the building, allowing modules installation without using any additional external machine.

The same would happened installing into the core a lifting mechanism sets for higher loads.

5.6.3 Lift as public transport

In a vertical urbanized scenario, life into cities is no more developing horizontally, but tridimensionally. Rem Khoolas in Delirious of New York says "less and less surface has to represent more and more interior activities". High-rise buildings are seen as containers for undetermined activity, public are mixed with private one, till the idea to use high-rise building stories as land for agriculture. If death residential areas are not suitable, in a tridimentional life scenario also multi-stories buildings should be activated. Furthermore in today's society, dominated by service industries and information technology, the distinction between private and public spheres is increasingly blurred. As would be better explained in urban context chapter, co-spaces will have a key role in the dynamic urbanism that modular buildings provide.

Moreover with the activities that have been brought higher, the street level congestion result diminished. Khoolas also point out how high-rise buildings are means to avoid congestion: all the movement that concur to congestion are substituted with vertical movement into buildings. Thus lifts can be compared to public transports – even more sustainable and efficient than normal transport: they use less energy and they are not causing pollution.

5.6.4 Mobility hub

As we've seen in the first chapter, we are facing a nomadic era. People move for traveling, working, or just decide to settle in a different place. Modular hybrid system tries to respond to this changing need. Allowing home displacement and hosting public function and co-spaces, its mother structure can be comparable to a mobility hub.

In urban terms mobility hubs are a transit access point with frequent transit service, high development potential and a critical point for trip generation or transfers within the transit system.

They serve a critical function in the regional transportation system as the origin, destination, or transfer point for a significant portion of trips.

They are places of connectivity where different modes of transportation – from walking to riding transit – come together seamlessly, and where there is a concentration of working, living, shopping, and/or playing.

Moreover the mother structure can be constructed in several location, creating a system of connected mobility hubs, were user can move easily from one to another.

The future logistic network, that modular hybrid system envisions, can cover more and more urban areas, and the mobile living situation will be arrived together with the coming of nomadic age.

5.7.1 Main features of scalable modular system: Flexibility

In a built environment that is more and more affected by rapid change a form of architecture that is flexible has great value. Flexible is what is capable of being adjusted to meet particular or varied needs or able to change for coping with variable circumstances.

A flexible architecture then consists of a building designed to change throughout lifetime, with a minimal impact on sites,

and responsible to new technological and aesthetic opportunities.
Assembling and disassembling, folding and unfolding, adjusting, combining, transporting are some of the possibilities that the industrialized modular hybrid system allows, making it a flexible system.
High-end modules are designed with innovative feature: light and performative material - that make transportation possible and faster - Plug-in systems – walls can be removed, additional surfaces insert – Movement provider tools – for instance wheels that can make modules rotate- and others, making flexibility feasible.

5.7.2 Expandability

The modular hybrid system can expand and contract. Home can change shape, space or appearance by add, subtract or substitute space units according with users' needs along the years.
This is possible since modules are not structural, but inserted into a mother structure with the spatial possibility to add extra modules in future.
The users should buy a starting set, the minimum composition of modules. For instance a single man would buy a living room, a bathroom and a bedroom, while a couple a double bed room and maybe a an additional room.
In a future, if the family expand inhabitant would not be obliged to move to a bigger house, but they will have the possibility to order other modules, that in few weeks will be ready and attached to the first smaller apartment.

5.7.3 Adaptability

Build-to suit house is viable.
A flexible building is one designed to adjust to different functions, users and market changes.
As Robert Kronenburg state in Portable Architecture "it would undoubtedly take a revolution in commercial practice to change most house builders' current practice away from providing fixed plans to which occupants must adapt, towards infinite variety in plans to which the builder must adapt."
With the introduction of specific feature, as described before, the modular hybrid system makes this

possible.
We are foreseeing a scenario where society needs will shape the world's environment.

5.7.4 Customization

Modular doesn't mean standard. Modular means the opposite: configurable system that fits own taste. Modular construction is not necessary a barrier to creativity, instead modular rooms – to be personalized - can be used to create a variety of units layouts.
In modular construction costumers are able to order modules on line, personalizing them using a configurator to define set ups, furniture, tech equipment or colours of walls. Modular architecture can be utilised to fulfil all of the tasks that are usually demanded of static architecture, adding new ones.

5.7.5 Transportability

Modules are designed in order to be easily transported by train or track:

- Light weight material are used
- The dimensions fits the transportation medium. This doesn't mean the final apartment will be small. Ones attached to each other, modules create a living space comparable to one of traditional dwellings.
- Modules are structurally stable, in order to avoid any static problem during transportation or when they are lifted to be inserted into the mother structure.

5.7.6 Instant house

The last feature to be pointed out is the opportunity to have an instant house. First assemblage is fast, modules are designed in order to make assemble and disassemble easy without much additional work on-site.
But above modules arrive ready to use on site and are installed in few hours. The "product" house than become rally comparable to a market good: to choose, pay and enjoy.

6 Economics and Real Estate Market Considerations

6.1 Financial Considerations of the modular construction

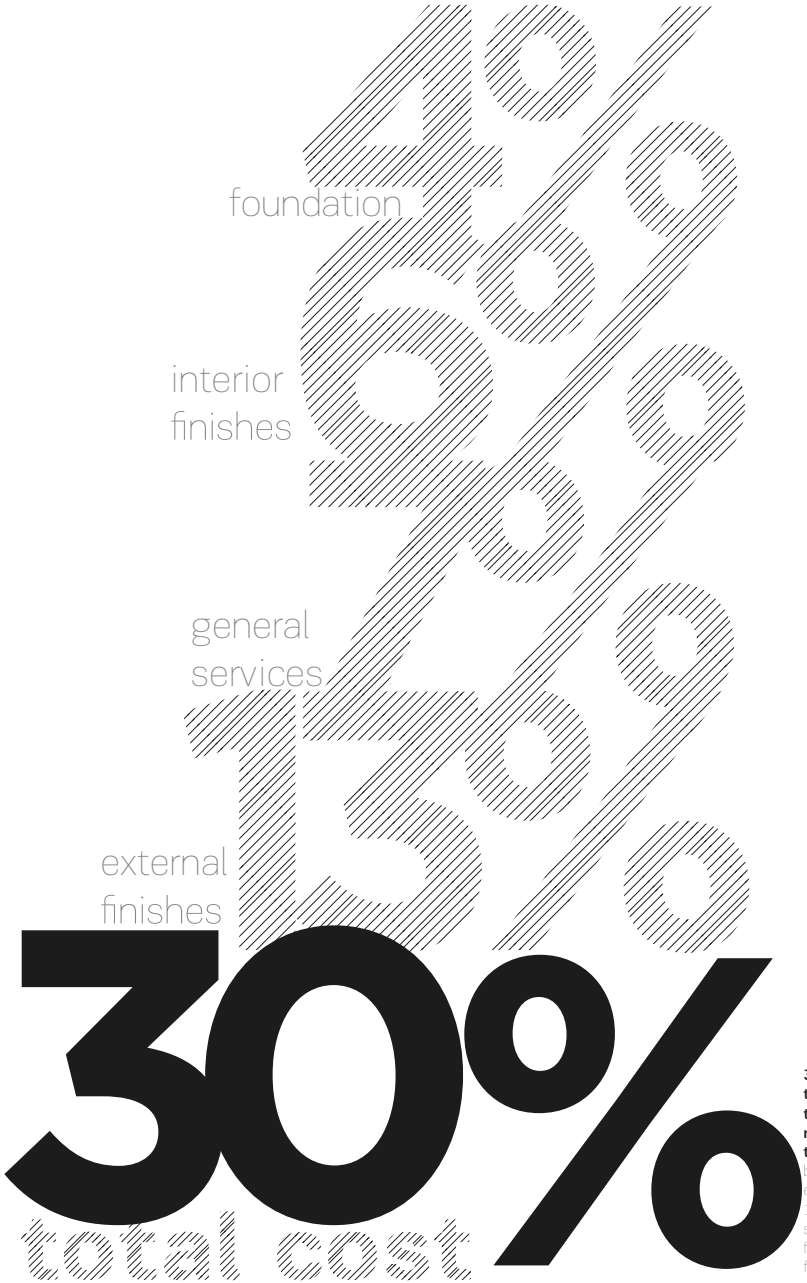
With the modular construction, faster factory processes replace slow unproductive onsite activities.

On the other hand, the infrastructure for factory production require greater investments in both fixed manufacturing facilities and the designing process itself, which has to be repeatable in its output in order to achieve economy of scale in production.

Hence, to make the modular construction an economic model, several factors such as production volume, proportion of on-site construction, transport and installation costs, benefit in speed and savings in site infrastructure have to be taken into account.

The amount of material used and the wastage produced with traditional on-site process are appreciably reduced whilst the productivity is highly increased but, conversely, the fixed costs of the manufacturing facility can be as high as 20% of the total built cost. Even in a highly modular project, a significant proportion of additional work is done on-site.

Even if there are limited data available on multifamily modular construction, the UK government report on modular home construction can provide some guidance.



30% of the total cost of the building is represented by the on-site work broken down into exterior finishes 13%, general services 7%, interior finishes 6% and foundation 4%.

The report estimates that about 30% of the total cost of the building is represented by the on-site work, broken down into exterior finishes 13%, general services 7%, interior finishes 6% and foundation 4%.

However, advanced modular prefabrication processes can significantly drown down those costs by manufacturing delivery-ready modules and prefabricated finishes for the common areas which just need to be installed, leaving foundation and general services (as well as cores and safety outputs) to be done on-site.

Modular construction also saves on commission and change order costs that can be as high as 2% in traditional construction.

Furthermore the interests carry charges are reduced as well as the improvement of construction timing lead to an earlier inception of rental incomes.

The tangible benefits due to reduced interest carry can be 2 to 3% over the shorter building cycle. The UK report estimates that the total financial savings when using modular construction are as high as 5.5%. (Lawson R. M., 2011). Additionally, this will also stem the overgrowth of the cost due to weather delays which represent, in certain climate zones, a huge timewaster.

Modular construction also saves on commission and change order costs that can be as high as 2% in traditional construction.

(Lawson R. M., 2011)

But, above any quantifiable difference between advanced modular prefabrication and traditional construction costs, the accelerated realization schedule makes the market changes less harmful as real estate's trends can be more easily foreseen in a short time and, at the same time, the developer can more efficiently meet just in time market demand.

6.2 Financing

The current equity and debt communities are developing an even more conscious awareness of modular construction although they still remain reluctant about the risk factors.

It is perceived among the lenders the necessity to mitigate the exposure in this technology and industry. Investors will provide terms based on the liability of the contractors and the quality of the projects but might will not change financial underwriting terms if modular construction is utilized.

However, projections and risk-analysis are supportive and determinant elements for the success of the negotiations until these will not become more confident with the method.

De facto, the skepticism is due to the possibility to stumble across an insolvent manufacturer, that is, a constructor which become financially troubled leading the project completion to an endless end. Mostly, this is because of the few contractors able to take over the unfinished construction, as well as the financial and manufacturing implication that this will might lead to.

Additionally, a lender may require additional interest reserves or other considerations to satisfy their uncertainty from the sponsor and a Letter of Credit or other credit enhancements form the modular manufacturer.

These requirements will likely atrophy as modular becomes more accepted within the lending community. This is decidedly a first mover disadvantage.

Issues may arise when a manufacturer wants payment upon delivery but prior to the modules being set but the lender or the developer resists.

Project Savings

The projected material cost is 5.98 percent and a labor cost is 9.69 percent lesser compared with the conventional CHB construction.

A manufacturer typically would want payment at this time to avoid the conversion from personal property to real property that occurs as soon as the module is set as this can add a significant amount of additional legal complications to a manufacturer's recourse if there are payment disputes. A lender typically wants the module set first so that their disbursement to the developer as the financial and manufacturing implication that this will might lead to. Additionally, a lender may require additional interest reserves or other considerations to satisfy their uncertainty from the sponsor and a Letter of Credit or other credit enhancements form the modular manufacturer.

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Issues may arise when a manufacturer wants payment upon delivery but prior to the modules being set but the lender or the developer resists. A manufacturer typically would want payment at this time to avoid the conversion from personal property to real property that occurs as soon as the module is set as this can add a significant amount of additional legal complications to a manufacturer's recourse if there are payment disputes. A lender typically wants the module set first so that their disbursement to the developer goes towards real property that they could perfect a lien on. Its possible to find a solution to this problem by splitting payments up or holding a sufficient retainage to ensure the set goes smoothly.

The research concluded that markets do exist for innovation in housing where tangible improvements can be demonstrate and backed up by suitable underwritten guarantees.

6.3 Economics and the Value of the House

The housing industry and the real estate are very concerned to market advanced prefabricated properties, although buyers are still little reticent to the new design and new building methods.

It is very rare how housing industry works, mostly because the overwhelming majority of houses are, by themselves, prototypes. This trend would be unthinkable in other industries producing expensive products, such as the car industry. Prototypes are, in general, case studies used to point out issues, such as time-related delays or increased costs, and used to argue against further development. But, somehow, it seems to be the preferred choice of end users.

An analysis carried out by the Robert Gordon University - "Housing the future" - points out concerns and commentaries on the receptiveness of people to innovative design.

The study was based on the premise, strongly held by sections of the construction industry, that house buyers are so strongly influenced by negative perceptions of the post-war 'prefab' that they will resist any innovations in house construction which affect what a 'traditional' house looks like.

It pointed out, almost unanimously, that they would not pay more now to reduce costs in the future, as houses are not perceived as products deteriorating over time.

Furthermore, it is shown that people have clearly understood the asset value of houses, indeed almost all

Conversely to conventional wisdom, new design process and advanced prefabricated housing attract more the niche market, which is less interested in financial deals but in customization and expandability.

the interviewed agreed with pay more to ensure higher value in the future.

Therefore, avoiding future maintenance costs, in particular, are not considered to be important for the deal, as new houses don't require for a very long time. If any maintenance is required it is thought to be because the original house was below the acceptable standard.

The cynicism about offers made by builders and developers runs deep, to the extent that there is a large difference between the attractiveness of nearly identical offers made by developers and banks or building societies.

However, aside from such concerns, people are very sensitive to several factors which lead them overcome any resistance to prefabrication. These reasons are cost saving – which include also saving in construction time – quality improvement and improvement made by using money saved to benefit buyers in other ways.

The most attractive option is gaining more space with no or little cost penalty, as well as capital cost and energy savings. Indeed, saving in energy bills seems to be preferred reason above the environmental improvements.

So as to say that comfort and further changes are – to a certain target – more important than savings.

Industry experts believe this technology will grow 20-25% annually.

(Modular Building Institute, 2011)

Although the hypothesis that it is economic guarantees which will allow the introduction of innovative housing is shown to be partly correct, it is not clear that the best mechanisms are always purely financial ones. The study has shown that architectural and design variables may be equally important in encouraging the uptake of unconventional forms of housing which can be shown to offer certain advantages to purchasers.

6.4 Labor Markets

Even if modular design and prefabricated realization have taken place all over in the production process, international companies specialized in modular construction have not gained hold yet, especially in the US, where only 1% of all commercial construction have adopted this method, while other markets around the world have an average rate of 2-3% in the construction activity.

In particular, Scandinavian countries have long seeded histories with similar technology, where firms as IKEA and Skanska have applied the modular prefabrication to real estate. It certainly requires countries where incubators and/or government support to foster this technology as well as the foresight to understand that production is possible even overseas, significantly dislocating the construction industry.

The Broad Group in China has been a leading adopter of this technology and has pushed the limits of construction by building a 30 story hotel in 15 days and announcing plans to building the world's tallest building in a mere 90 days.

Construction-related labor is typically local, and supports communal economies, however, the advance modular prefabrication system requires high specialized workers which can be a limit for the settling of the industry but, at the same time, limits the need for workers, allowing the centralization and the mass production for the labor force.

The greatest obstacle to this process to take hold are unions which will be reticent to allow local jobs to be shifted away.

By reducing labor hours on the site, advance modular prefabrication improves project safety. Modular project delivery may also reduce costs by transferring labor to lower cost centers.

Laubor Cost
The going rate for a union carpenter in NYC is $85 versus $35 for a factory union worker. (Bagli, 2011).

In order to overcome the unions' reluctance, companies might need to consider hiring union labor as a mechanism to support developer's interests and thus increase their operating costs.
There is even a steep difference in wages between onsite construction union workers and manufacturing union workers. The going rate for a union carpenter in NYC is $85 versus $35 for a factory union worker. (Bagli, 2011)

6.5 Modular makes sense

In summary, modular project delivery that does not take a cookie-cutter approach to every project offers a number of significant advantages both for new construction, plant renovations and expansions.
From a schedule perspective, performing activities in parallel can reduce overall project duration and make a very favorable impact on the critical "time from decision to delivery."
Modular prefabrication design reduces disruption to the site as well as lay down and waste area.
Fabrication in the industries rather

than the field results in higher quality work and, ultimately, better quality of the final facility.
Throughout it all, a team experienced in technical construction can save a lot of headaches and help make sure that the owner sees benefits related to schedule, quality, safety and cost.

6.6 Interview with Mike Adel

Interview with Mike Adel, director-supply chain at Access Midstream, in the occasion of the 4th Annual Modular construction & prefabrication summit Canada 2015. Where he discusses how the recent economic downturn affected Access Midstream's decision to modularize; the metrics that are most important to determining the market factors affecting the energy & construction industries today and the benefits of pre-planning a project and how to mitigate imposing factors as much as possible.

What are the most ideal market conditions for adopting modules and prefab buildings?

Since every firm is struggling for getting the same resources in a time where those material have been less accessible (due to the contraction of the market, the decreasing number of employers etc.) the modularization process, which have developed its own design, its own process, its own modular component that can be moved to the building site for – maybe – the final assembly only will guide this stagnation to a end.

"It is a good time, in a down time, to invest."

(Mike Adel , 2015)

"They might cost us a little money and it's harder in the return of this investment right now, but if I put it aside, spending next year and a half developing some modular design, standardized design, then when the work comes back I can utilize this to really drive some economies when I execute my projects."

7 Urban Context

7.1 Urban Context

Whatever their functions are, buildings do not exist in a vacuum—relations keep lingering around: reciprocity, indifference, or confliction. After the Industrial Revolution, the city, despite of the feminine statement by psychoanalysts, has not only witnessed unprecedented changes on the practical typology of human settlement, but also been through numbers of futuristic plots, peaking into a complacent atmosphere during the 60s and the 70s—either the avant-gardes in the western world or the triumph of ideology in the communist side.

Constantly, humans have been revising the built environment by all means; once the term of time is put into the tool box of people, both buildings and cities will embrace a totally new phenomenon, and the context will become an intriguing balance between the patch and the matrix, demonstrated by spontaneous compositions and dynamic images.

7.1.1 A Brief History of the Collective Settlements: The Mid-19th Century

With the deterioration in the condition of citizens' life in the early-industrialized urban areas, some people started to compose the anticipated equal and unitary future for human being during the mid-19th century—the Utopian Socialism. Their thought of collective living system is a reflection of the human society entering the industrial age, which pronounced it inevitable to be collective for the high efficiency of social production

and management. But their early attempts and living models have long-lasting impact on the architects and urban planners of following generations. And their initiative of putting housing as an important part of the social welfare system even can see its shadow on the social housing projects of the Soviet Union and today's China.

Charles Fourier, as the main figure of the Utopian Socialism, raised the idea of Phalanstery, a type of building designed for a utopian community to integrate urban and rural features. According to him, this kind of buildings consisted of 500-2000 inhabitants each, working together for mutual benefit. He took the shape of the Palace of Versailles, with the manifesto of the common right to live in ideal conditions. The collective and united image inspired Le Corbusier for his later work—

Familistère de Guise, 1896. Ecoliers dans la cour intérieure du Palais social du Familistère

Rue Franklin Apartments, Bruxelles, Auguste Perret

Unité d'Habitation.
In reality, Andre Godin applied the thoughts of Charles Fourier to into a successful community—the Familistery (Social Palace) in the French city, Nice.

7.1.2 The Late 19th Century to the Early 20th Century

During the second half of the 19th century, the development of reinforced concrete and steel structure gave the brand-new opportunities for the collective housing.
The 8-storeys-high Rue Franklin Apartments, which Auguste Perret established his reputation, "is to be regarded as one of the canonical works of 20th-century architecture, not only for its explicit and brilliant use of the reinforced concrete frame (the Hennebique system) but also for the way in which its internal organization was to anticipate Le Corbusier's later development of the free plan" (Frampton, 1983). Although the references of the classical French architecture can still be found in this work of Perret, the new building system indeed

gave a deep impression on the young Jeanneret, who working in Perret's office around 1908, when the system of the Dom-ino House found its root.

During the same period, Peter Behrens and the Deutscher Werkbund was expanding their ideas of the industrialized architecture, which referred to the logical standardization with the high design quality. The thinking of standardization and massive production in the social scale with new building technologies incubated the collective building ideas of the three young architects working there: Ludwig Mies van der Rohe, Le Corbusier and Walter Gropius.

Compared to what happened in Europe, the new high-rise residential building in Chicago, regardless the words of Louis Sullivan "form follows function", the evolution of housing typology closely followed the progress of the building structure—intriguingly, the main measurement for the high-rise residential buildings changed from the human scale to the limits of the new technologies, e.g. the strength of the steel, the possible height of the elevator.

7.1.3 The Early 20th Century to the Present

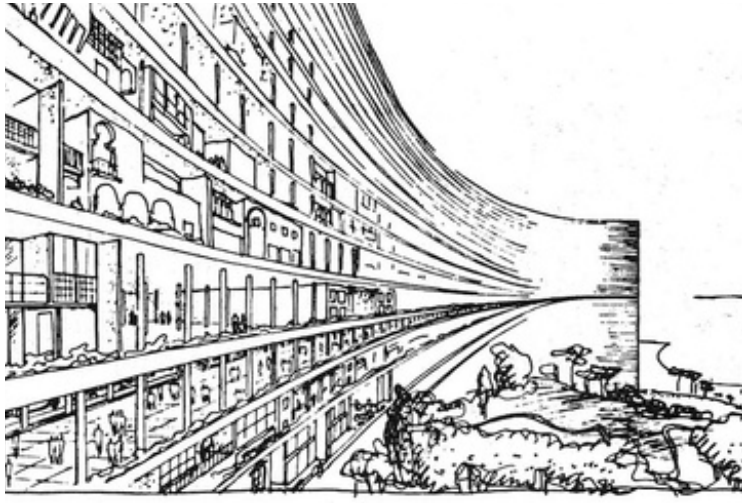
Following some congresses of the Congrès International d'Architecture Moderne, the collective housing has been regarded as the most important part of the modernism since the early 20th century. During the conferences focusing on Collective Housing of the CIAM, the concept of "Taylorism" (later "Fordism") can be found as the core spirit, which is the industrial economic term.

The standardization and industrialized production were pushed to the centre concern of architects.

Some early proposals from Le Corbusier stated the future city and residential image under the influence of modern technologies

with the collective building typology, e.g. Immeubles Villas, Ville Contemporaine. In 1933, the Plan Obus for Algiers demonstrated Le Corbusier's dream of a collective modern city. Later, the Unité d'Habitation realized his thoughts in some terms. The modular attempt and the function composition resulted from all his experiences in the early career. Meanwhile, it is pertinent to admit the influence from the Soviet's constructivism, e.g. the Narkomfin building in Moscow. Similar impacts did not only happen on Le Corbusier, but also Victor Bourgeois, a socialistic housing pioneer and once the vice chairman of the CIAM.

From the early research of the minimum subsistence dwelling to the packaged-house system Walter Gropius (the space-frame of Konrad Wachsmann, the



Plan Obus for Algiers, 1933, Le Corbusier.

cooperator of the packaged-house system, also inspired the late megastructures) was always a more practical protagonist in the field of the collective housing system and high-rise building research. The similar standardization obsession also rooted in the mind of Ludwig Mies van der Rohe, but different from both Le Corbusier and Walter Gropius, Mies imaged the free space resulting from the new structure could give more possibilities to users to arrange the space, rather than design every detail by architects.

As the huge construction demands, the period after the Second World War pulled the trigger of many architectural envisioning and practicing.

Happening during the same period of the suburbanisation, the movement of the Urban Renewal showed how the collective housing typology could overthrow the existing urban context. With the authorization of the Housing Act of 1949, in New York, for instance, several high-rise collective buildings were erected up on the old land of 18 blocks, providing 9000 living units. And the large scale of the modernism urban redevelopment ended with the explosion of the Pruitt-Igoe.

With the descending of the modernism movement, some more groups or individuals emerged to propose different futures for the city.

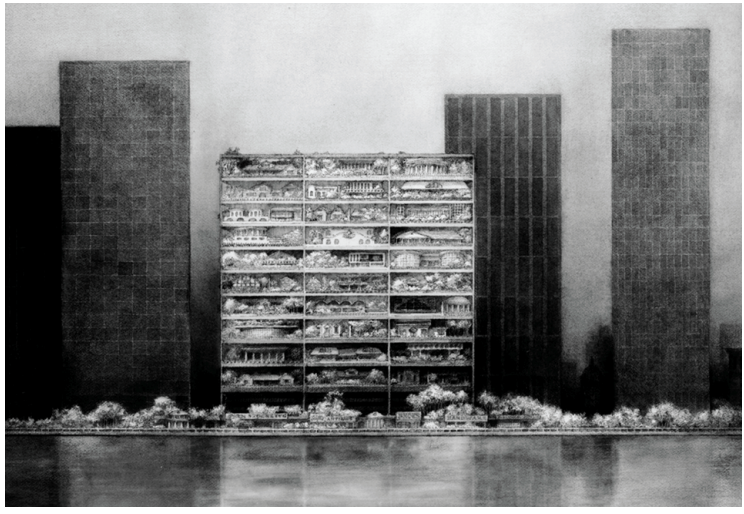
"A flexible, infrastructure-based, ever-changing city environment: Buckminster Fuller and Archigram propose it; Kisho Kurokawa and Richard Rogers tried to build it"

(Kronenburg, 2008)

Standing for the avant-garde movement of Metabolism, Kisho Kurokawa used his capsule buildings and Rhizome city model to demonstrate the image of mobility. The Lloyd's Building of Richard

Rogers has the deep connection with the concept of Served and Servant Space raised by Louis Kahn when he designed the Richard Medical Research Laboratories.
It is intriguing to find the common content among different groups about dividing the collective building into infrastructure part as the support, and living part functioning as the unit for users with high mobility.

Meanwhile, the High Rise of Homes located in a densely populated urban centre, a more artistic proposal by James Wines in 1981, became the prototype of many following attempts.
With the development of the contemporary building technology, more and more new proposals for the collective settlements can be seen nowadays.



High Rise of Homes, 1981, James Wines.

9.2 The Dynamic Urbanism

Should the city stay in a static status? The transportable and modular architecture gives a negative answer to that. Instead of eternal monoliths representing the powerful figure of human, the physical world of urban areas will be put under the eternal flux resulting from the human movements and activities. Time is becoming part of the physical dimensions, and users will be included as creators of the cityscape, neck and neck with designers and planners, and the true democracy can be achieved in the scale of the dynamic urbanism, which will bring about the changes in all of scales: urban, neighbourhood, and individual. Nothing is interminable, and everything is ephemeral.

9.2.1.1 An Ever-Changing City Environment: The Fourth Dimension

In the urban scale, Time is never as tangible and substantial as what mobile architecture manifests. The ideology of the Roma Aeterna has been stored into the past, the city environment becomes a visible demonstration of time elapsing and events happening—it is the reflection of users' need in different periods of time in a substantial way. Concerning the description of the cityscape, years or seasons will no longer be precise enough to be used, and weeks even days will be the pertinent measurement for depicting the urban area; the time effects has been so considerable.

With the ambitions to reshape the whole city, some of the avant-garde proposals articulate the flow of time. To ensure the mobility and flexibility of living environment for capricious humans, a common ground of different theories and attempts can be found: introducing a megastructure or a mother structure into the environment for bearing the living modules. Compared to the constantly changing living units, the matrix is relatively static. But the growth of the group forms just happens at a lower speed, rather than be absolutely fixed. Time can be witnessed by not only clocks, but also the transformation of the city.

Plug-in Capsule home tower,

The megastructure-based utopian city "New Babylon", together with the Plug-in city, demonstrates the dynamic image strongly. "New Babylon", known also as nomadic town, is a utopian anti-capitalist city, where the socialistic influence can still be found. A series of linked transformable megastructures ensure the man's freedom of movement in society above all limits. Responding to social mobility, the rigid megastructure can give flexibility to smaller scale components in the city with great networks of collective services. All assembly projects need the normalization of the module and the standardization of production. This becomes the whole world that future nomads, flexible, transformable, but collective at the same time. When it comes to the Plug-in City, more attention is paid on detailed compositions. An evolving megastructure that incorporates residences, transportation and other fundamental services can be moved by giant cranes and grow and expand constantly. Modular and prefabricated components can be

"plug in" to a central infrastructural mega machine. Even the life-span of each element of the city is detailed planned: average of megastructure would be 50 years, transportation infrastructure 20 years, location of house units 15 years, living rooms and bedrooms in the houses 5-8 years, bathrooms and kitchens 3 years, etc. Each part of the system has been industrialized and clarified; once coming into function, it will keep running until the planned very end.

7.2.1.2 A Homogeneous and Heterogeneous City

A building or a newly plotted urban area rarely exists in the situation of tabular rasa. Obviously, the introduction of the dynamic urbanism based on the mobile-modular architecture will surely have great a conversation with the exiting built or natural environment. The mother structure it relies on will become a strong visual presentation, sprawling within the environment with the standardized function units. Due to the attribute of industrialization, a homogeneous built macro environment However, the capability of high mobility derived from the standardized and industrialized building system endows the users with possibilities to express and meet personal requirements at low cost but with high efficacy—a diverse and heterogeneous micro environment will be achieved. In other words, the homogeneous possibilities of heterogeneous expressions will be the core of the dynamic urbanism.

Standing as a protagonist of the avant-garde movement of Metabolism, Kisho Kurokawa's project of Agricultural City Plan (1960) stroke directly on the subject of the site context based on the theory of the Network and Rhizome, a long-lasting thinking about urban propagation. Natural growth of the agricultural city is provided by an elevated grid system of streets containing the utility pipes underneath. While each of the square units composed of several households is autonomous, linking these units together creates a village. The living units multiply spontaneously without

any hierarchy. Meanwhile, Yona Friedman's project of the Spatial City gives a similar mobile system, which is hovering above exiting urban areas—a homogeneous megastructure becomes the shelter for the dynamic built environment inside.

The whole human settlement is separated from the natural matrix by the modern structure, so are human daily activities.

Pay respect to the exiting lands for achieving the reciprocity, at the same time, contain the highly free building possibilities inside the system to maintain the ability of self-contextualization.

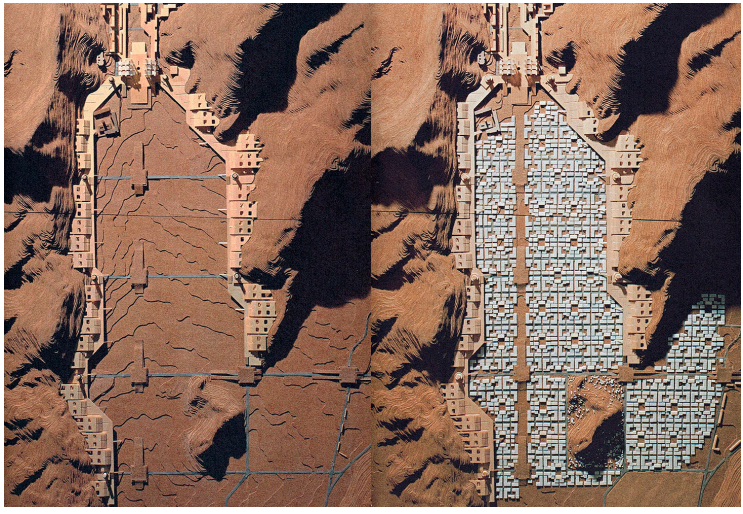
7.2.2.1 A Dynamic Tribe: The Instant Neighbourhood

As the interface of individuals and the city, the neighbourhood conditions will be no longer the same as before. The built environment is the reflection of constant flows of people and activities in the physical world—in the dynamic urbanism, more neighbourhoods will be temporary and instable, particularly in the areas regularly holding events, where the existence of the whole neighbourhood will be like the flower—only blooms in the right season, and will bring a brand-new image to the existing background.

In 1974, Mecca, a holy and historic name, once gave the world a glimpse of the future instant neighbourhood. Commissioned by the king of Saudi Arabia, Kenzo Tange and Kenji Ekuan proposed a temporary living neighbourhood in a 635-hectare valley of Mecca for the two million pilgrims on the Hajj each year. Instead of megastructure, Tange and Ekuan place supporting facilities around the edge for the valley, mainly for storage of all the standardized living equipment. Each year, the living units can be rolled out for four days before going into hibernation again. It seems like the whole neighbourhood is unpacked from the mountainside.

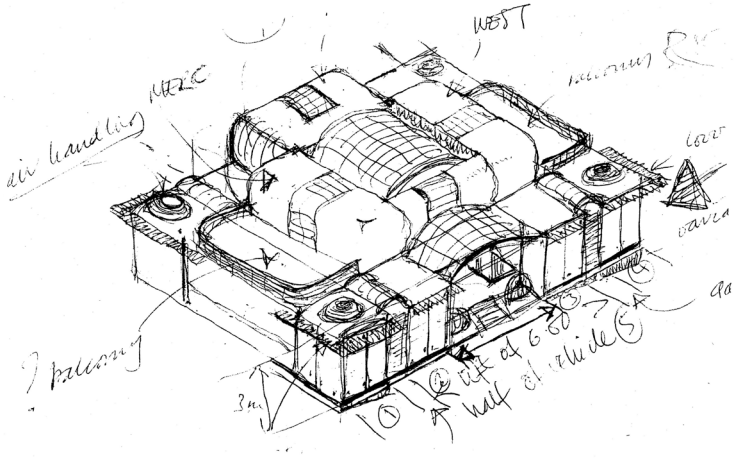
7.2.2.2 A Dynamic Tribe: Temporary Co-space

As the transformation of the whole neighbourhood is very much related with the particular events and the relatively high expense of constructing, another softer way of mobility is dedicated to one important element of the neighbourhood: shared space, or community centre. Different from living areas, which are more private and introvert, the public space of the neighbourhood function as the cohesion symbols. The modular and transportable technology will also set the co-space of the neighbourhood free to be part of the flux against the backdrop of the dynamic urbanism—the mobile hub, which doesn't always have to be community centre, can be regarded as a potential growing core for attracting the flows of people for



Temporary Hajj Village, 1960, Kenzo tange.

spontaneous urban aggregation. Thanks to the advanced engineering technology support, the tour grand prix of the Formula One realized this vision at an early stage. The tour matches require every team to build their temporary operation centers, each of which plays as a complex for all the managing and daily activities for the team, guests, and media. Instead of conventional motor homes. The TAG McLaren group has achieved a mobile community complex, consisting of 10 transportable components transported by six dedicated lorries, following the whole team traveling around Europe every two weeks throughout eight months of the year. It takes 12 hours of six drivers and two technical engineers to handle the whole erection process of the "cabins", so does the dismantlement process.



TAG McLaren group, mobile community complex.

Whatever it goes, the community complex provides complete daily services for every visitors, becoming a temporary gathering point within the paddock.

7.2.3.1 The Future Nomad: Inhabitants as City Creators

After entering the era of the massive industrial production, the identity of creators has been mostly separated from the identity of users—this division is one of the most influential aspects of social transformation where individuals have been resigned for a pre-set unitary identity, peaking in the socialistic collective housing. The development of modernism both in urbanism and architecture is the embodiment of this social trend. But, with the coming of a consuming society, the personality of ordinary individuals has been raised up to the central concern again. Unlike the rear customized projects, the modular industrialised architecture, with the averagely affordable cost, provides the users with the considerable opportunities to decide their own habitats, which will compose the whole cityscape. Based on the rational framework, the individual figures will be expressed and amplified. Once again, the users have been pushed to the frontier of urbanization.

The Nakagin Capsule Tower was designed with the possibility of adding, removing and refreshing the living units.

The project itself has become an amplifier of individuals' actions—every private decision of changing would occurred noticeable influence on the urban image—the distance of users and creators is shorten.

The original plot of the metabolist was even bolder: the dynamism should be the network covering a broader range, and users could

take their units with them to other destinations.

7.2.3.2 The Future Nomad: New Living Situation

Besides the possibility to modify details of the unit's appearance, the flexibility for users derived from the transportable modular architecture system significantly means the capability of self-aggregation (in the same place for different needs) and mobility (to different places), both of which are the fundamental of the dynamic urbanism.As the change of typical needs happening along one's life, the living place will never be a static and deadpan spectator. The structure becomes an instant reactor to the different demands during different periods. The Sky House is a strong demonstration of this potential, which Kiyonori Kikutake displayed with his own family spanning more than half a century. During the period, modular parts (a kid room, a kitchen and a bathroom) were added and detached under the 6.6m elevated slab. Variations of function compositions in different times were physically represented by the modular system. Meanwhile, when the dynamic urbanism endows the mobility of living space, one of the most crucial considerations about the modular architecture is the standard measurements, which are connected directly with ways of transportation and flexibility of installation—that is the true point of making the whole flow work. Based on the current industrial products and the logistics, the New York design firm LOT-EK raised a grand proposal called the Mobile Dwelling Unit (MDU). Every unit is in container shape, shipping is chosen as the transportation method of the living units. And at any of the world's ports, there exists a specially made infrastructure, which the shipped container unit will be slotted into once it arrived its destination. However as the development of transportation technology, the future logistic network can promisingly cover all the urban areas, and the mobile living situation will be arrived together with the coming of the new nomadic age.

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