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Dottorato di Ricerca in Architettura e Territorio – XXXI ciclo
Urban Underground Nodes - How UUN spatial composition can affect the urban lifestyle

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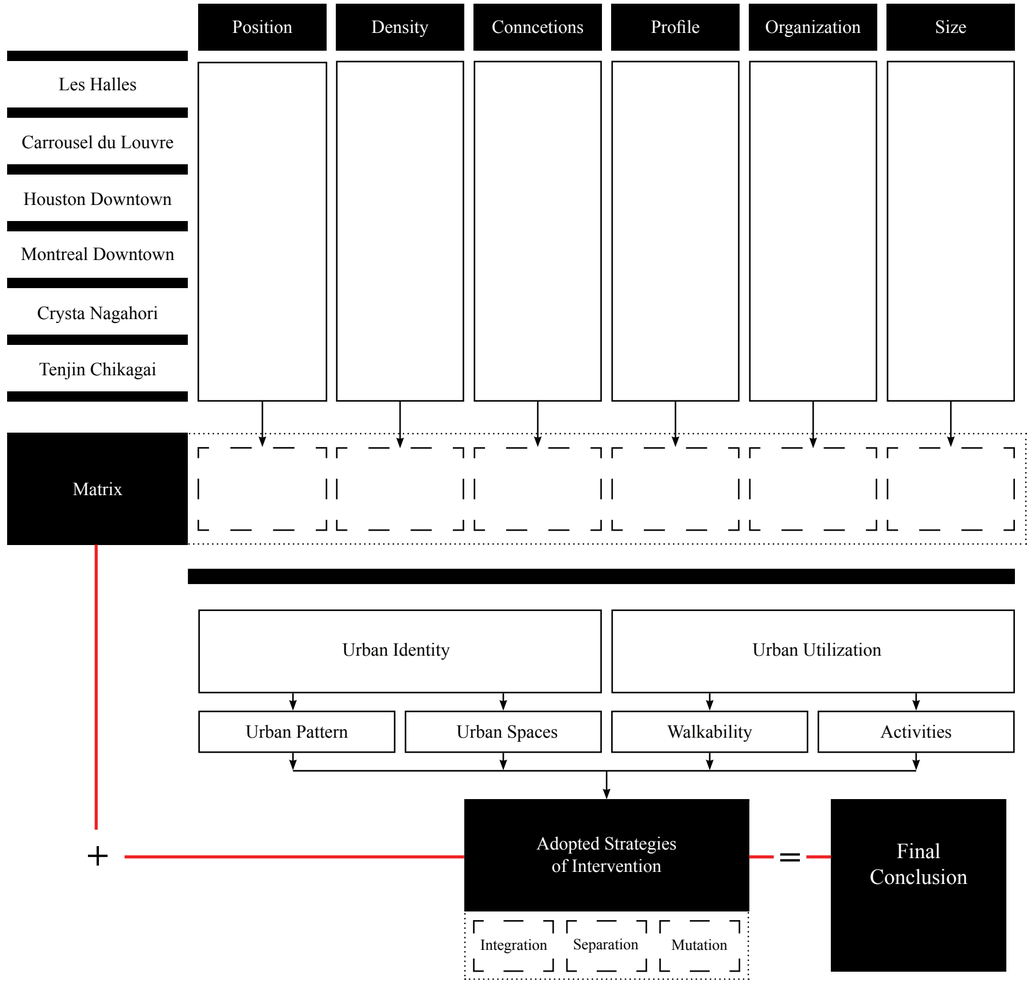

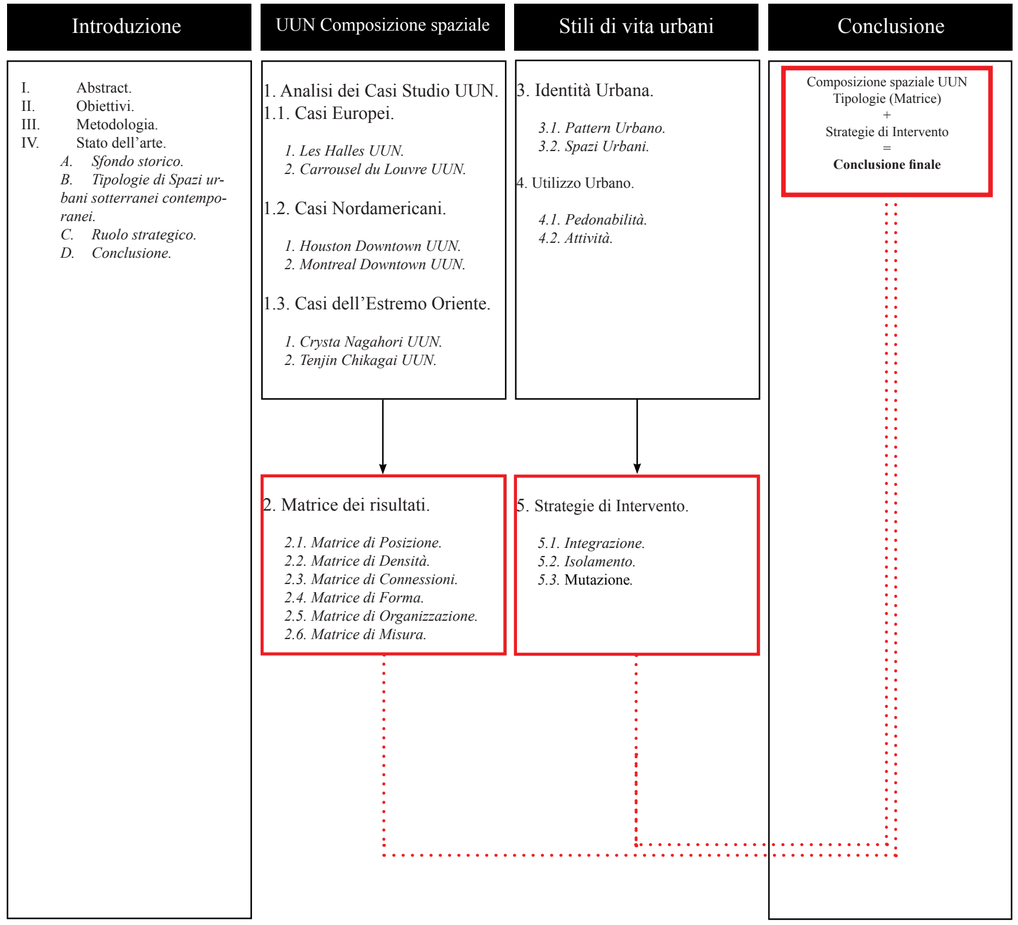
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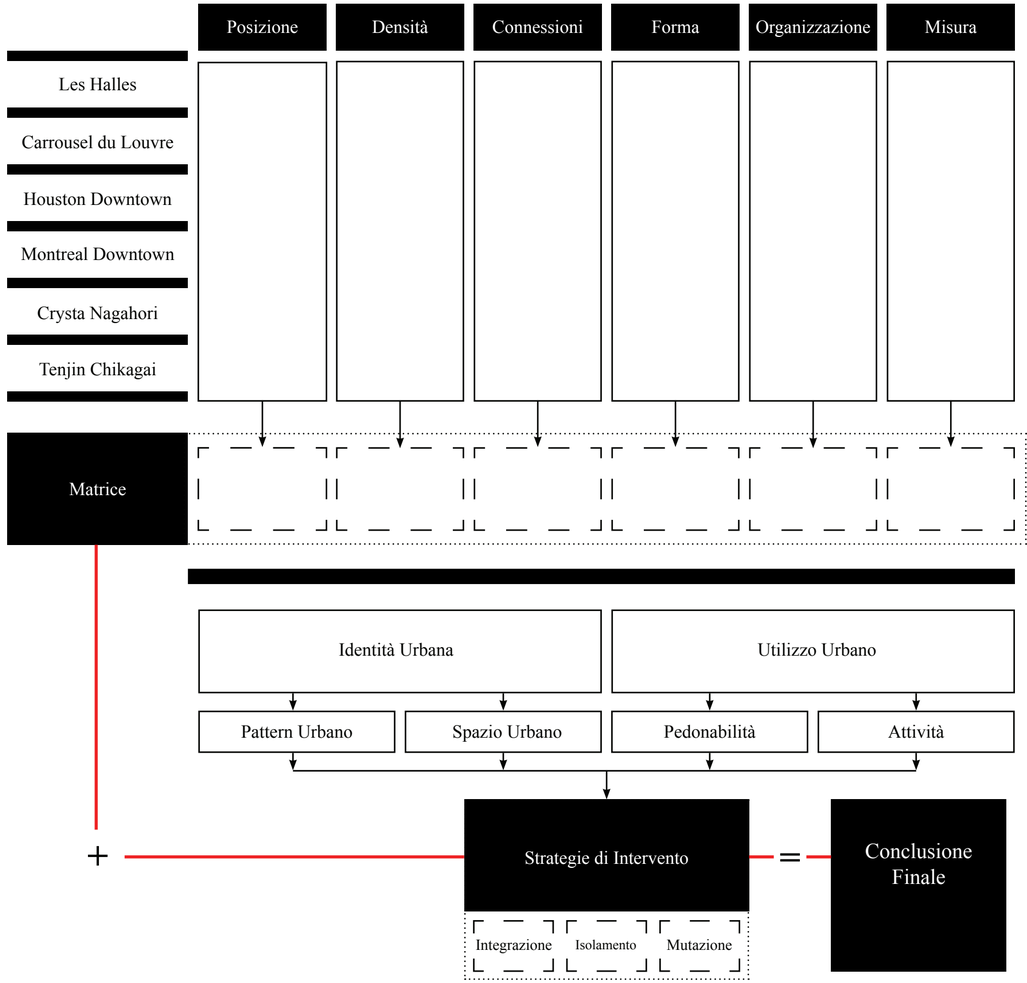
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Introduction.

I. Abstract.

The research investigates the *Urban Underground Nodes (UUN)* as special contemporary urban spaces and architectural entities with a trans-typological essence.

Those entities are critical nodes in terms of mobility and connection in the urban fabrics, however there is no connotative image or an identifiable spatial idea about them. Also, the information relative to their typological composition and structure are very limited, with the consequent difficulty of defining a way to depict them.

The goal of this research is to decode their invariants in relation with the urban life style through 6 case studies, from three different geographical contexts: Europe, North America and Far East.

Thus, the thesis is an experimental one in the conception of diagrams to be able to describe the characters, the perception, the elements of the *Urban Underground Nodes* as well as their relations with the shape of the cities over ground. This collection of studies is represented in the final matrix showing the contemporary complexity of the *Urban Underground Nodes*.

The methodology is corresponding to the repeatability, controllability and inspectability requirements of the empirical approach, therefore it is shaped up to be an “adaptable method” that can be applied to investigate others case studies.

Through this approach, the research demonstrates how the *Urban Underground Nodes* are shaped and conceived in a strong relation with the over ground cities, which is presented trough the six case studies, representing three different basic models that each corresponds to the hosting context urban lifestyle strategy.

Keywords:

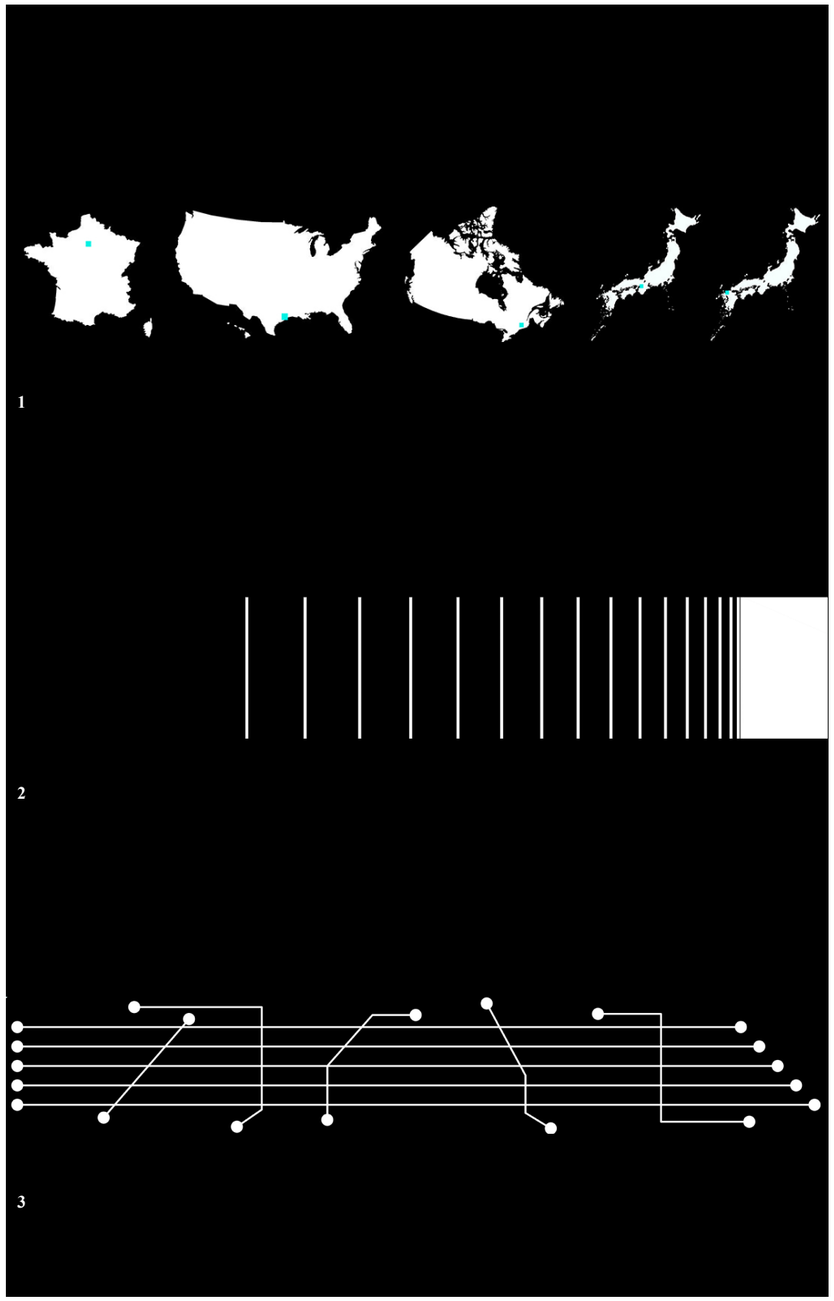
Urban Underground Nodes (UUN) – Spatial Composition – Urban Lifestyle –- Matrix.

II. Objectives.

The thesis proposes to investigate and deepen the Urban Underground Nodes, (UUN) - trying to identify their characters, perceptive elements and formal relations through comprehending their complexity by giving them a connotative image or a specific spatial idea.

After an initial study of the theories of cities in relation with the UUN, the thesis defines an analytical framework for comparing the compositional aspects in different and specific geographical conditions, through the creation of a diagrams system, with the aim of determining a possible classification “matrix” of these urban entities.

The methodological tools defines, therefore, a hypothetical vision of the possible relations between the spatial composition of the UUN, the conformation of the city on the surface and the lifestyle, attempting to provide a spatial and typological description and a possible mode of representation.



III. Methodology.

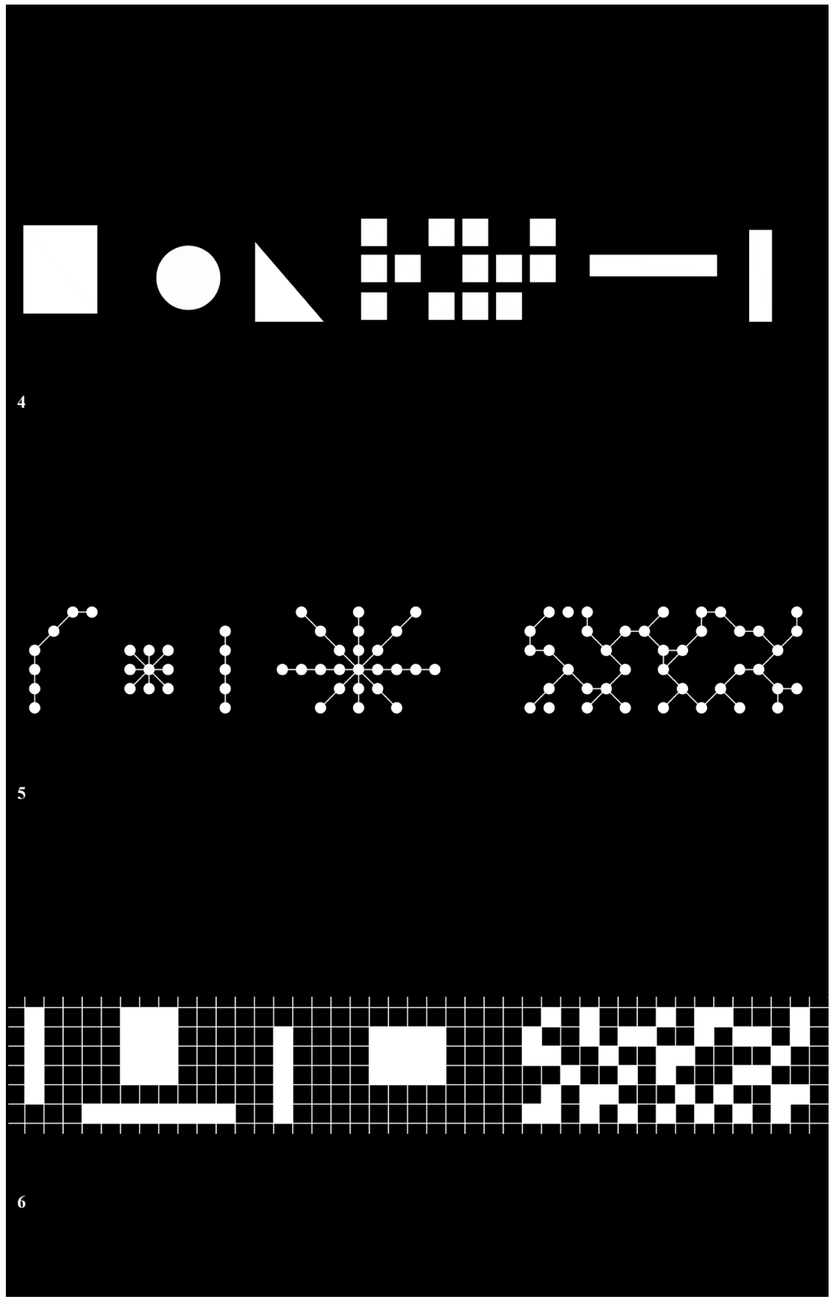
The research was developed through two methodological approaches: the first graphical analysis, with the aim of understanding the spatial composition of the UUN in different geographical contexts; the second is qualitative one that investigates the possible relations between lifestyle and underground nodes.
Through the design of a system of descriptive analytical diagrams of the case studies, the research has attempted to develop a methodology that responds to the criteria of repeatability, controllability and inspectability requirements to be applicable to different variants with the aim of determining a possible "matrix " of classification of such urban entities.

The **first part** proceeded with an abstraction of the entities characterizing the UUN and the corresponding context of the cities on the surface with the aim of identifying those descriptive variables that would allow a possible categorization. For security reasons, this phase of research has been very complex due to the difficulty in finding drawings and designs, but also to develop a photographic survey because such urban places are highly secures because of their logistic prestigious role.

Therefore, the analytical study was based on a simplification and diagramming principle that allowed decoding the complexity of the spatial composition of these nodes and their relation with the urban context on the surface. Six case studies were selected, chosen in three different geographical contexts, to try to develop an exhaustive and comprehensive survey of different urban settlement models: North America, Europe and Far East.

After an initial identification of the node with respect to the urban fabric, a series of exemplary diagrams of the characters and formal, functional and distributive relationships were elaborated, both for the underground spaces form and for their location in the urban tissue on the surface.

Therefore, a series of diagrammatic maps have been defined, conceived as the structuring instrument of the research, organized with respect to two issues: *localization and form*.
These elaborations develop a reading technique of some principles related to the position, connections and urban density, while for the formal configuration; the profile, organization and size were investigated.



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The **second part** of the thesis aims to understand the differences between the lifestyles of the different chosen geographical contexts, through the reading of those theoretical studies that investigate their relationship with the city structure. This reflection involves issues related to the local identities of urban contexts, their character, size and social impact of different settlement models. The research also focuses on two aspects considered very significant for the discussed theme regarding the urban utilization, which are the walkability and the various functional activities characterizing urban spaces in correspondence with the underground nodes.

Specifically, the diagrams that have been elaborated for each case study are listed as follows:
Diagram 1- Analysis on an urban scale with identification of the **position** of the UUN with respect to the structure of the city (center, periphery, under urban axis, etc.);
Diagram 2- Reading of the UUN with respect to the urban **density** of the city and therefore to those elements that define the space on the surface (streets, buildings, pedestrian squares, open public spaces, gardens) attempting a description of the different heights of urban constructed edifices (high-rise, medium, low-rise buildings);
Diagram 3- Identification and description of the **connections** starting from the vertical ones between the city on the surface and the underground spaces and the relative implications in the distribution of the users' movements;
Diagram 4- Representation of the UUN **profile** concerning the urban plots and the axes generated by the aboveground context;
Diagram 5- Description of the distributional and functional **organization** of the UUN space in different urban tissues;
Diagram 6- Understanding of the **size** of the UUN by drawing a grid of 100 * 100 meters that allowed to highlight the relationship with the urban scale and to understand the dimensional differences between the distribution area in the six case studies.

The graphical analytical instrument of the diagrams ends up with a spatial compositional Matrix that attempts a first classificatory description of the complexity of the Urban Underground Nodes in relation to today's urban condition.

Methodology.

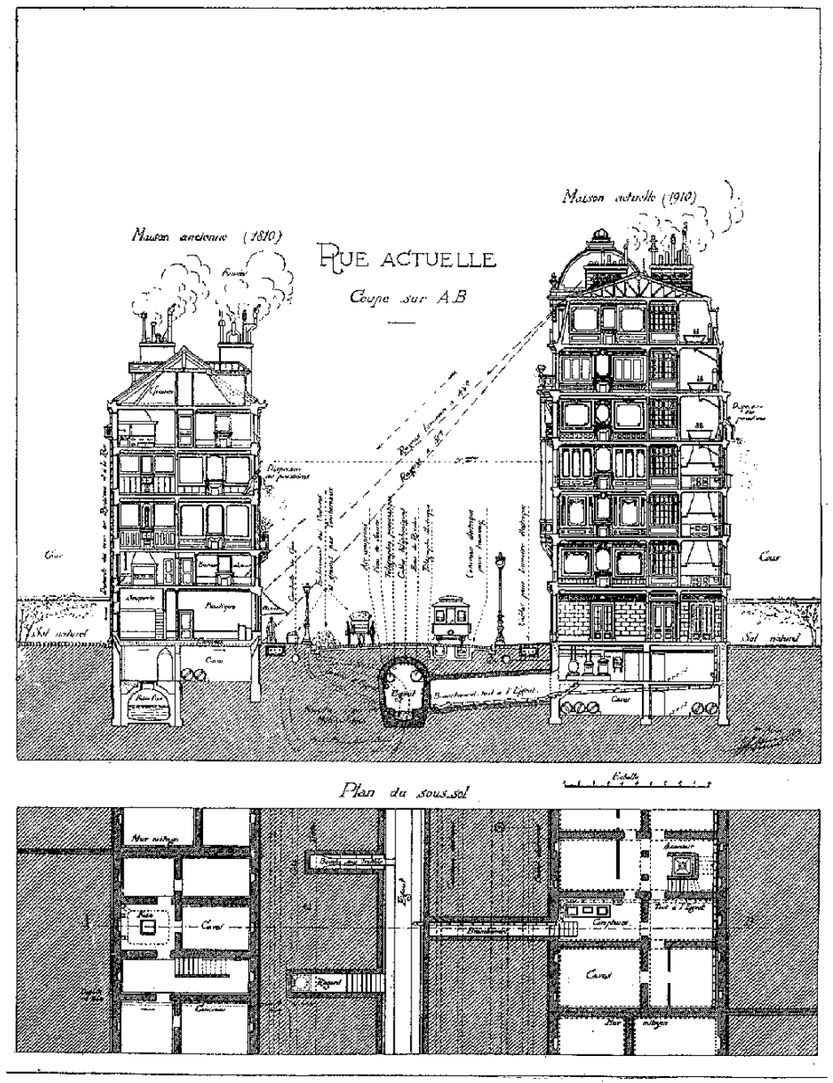


FIG. 1.

IV. State of the Art.

State of The Art:

A- Historical Background.
B- Typologies of Contemporary Urban Underground Spaces.
C- Strategic Role.
D- Conclusion.

A – Historical Background.

The Underground city is a concept that started to exist at the beginning of the last century. *Eugène Hénard* - a French architect and a highly influential urban planner - was a pioneer to have a vision and imagination for the future city. He published that in one of his most important papers "The Cities of The Future" in 1910. In that paper he introduced for the fist time the multilevel street – or as he called it, the duplicate street – showing how the future city will deal with the underground space.
The motivation of having the multilevel cities concept was attributed to the density and compactness that can happen to the cities in the future specially in the center area. *"Whatever form its future expansion may take, there will always remain, in every large urban community, a centre of intense activity wherein the buildings will always be placed close together, as they are in our cities of the present day. It is a portion of such a centre that we are about to examine*[1] *".*

As *Hénard* studied architectural engineering, he explained his point of view by sketching the difference between the actual city section by his time and his futuristic vision for "The Cities of

[1] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 349, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future. (2010): 345, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.

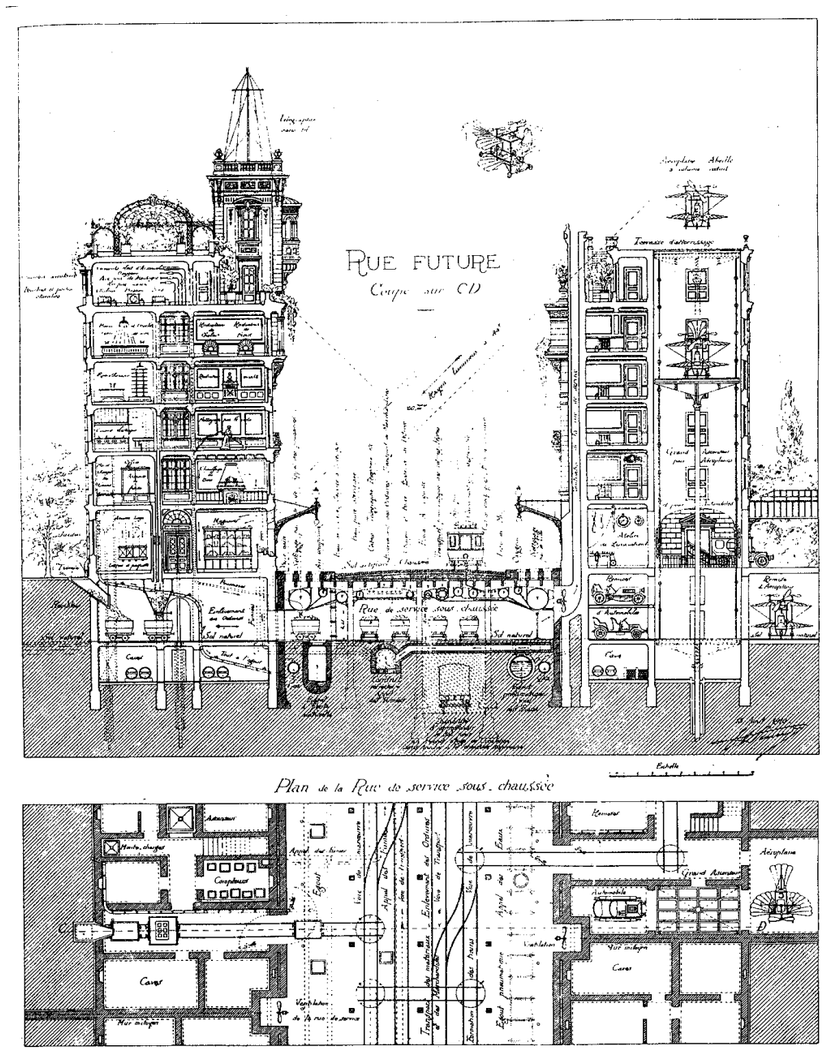


Fig. 2.

The Future" [fig. 1]. On the left side he has given a drawing of a house one century before his time and on the opposite side he placed one from his time.

Hénard criticized the one level street design. Most of the problems that the city faces are coming up because of the several functions that are applied in one level street. With the densification and complexity of the needed services that increase by time, this type will not be enough. This was the reason behind proposing new solution that targets the uses distribution in different levels.

> *"All the evil arises from the old traditional idea that "the bottom of the road must be on a level with the ground in its original condition." But there is nothing to justify such an erroneous view. As a matter of fact, if we were to establish as a first principle the idea that "the pavement and carriage-way must be artificially constructed at a sufficient height to allow thereunder a space capable of containing all the installations needed for the service of the road," the difficulties I have just pointed out would disappear altogether. This, of course, implies an additional floor underground for the neighboring houses, inasmuch as the ground floor would thus be raised to the level of the street[2]".* [fig. 2]

From the researcher point of view, one of the most important aspects that *Hénard* delivered in his proposal is that he was trying to leave the city surface for pedestrians, burying most of the machinery transportation system underground. This solution can keep the city busy and vital with the inhabitants' movement.

> *"This arrangement really means that the present street would be made into two streets: one above in the open air, solely intended for the passage of light vehicular and pedestrian traffic, and the other located below, on a level with the ground and underneath the former, which would serve as a conduit for all the pipe systems, the removal of house refuse, and the transport of heavy materials and goods[3]".* [fig.2]

[2] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 353, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.

[3] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 354, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.

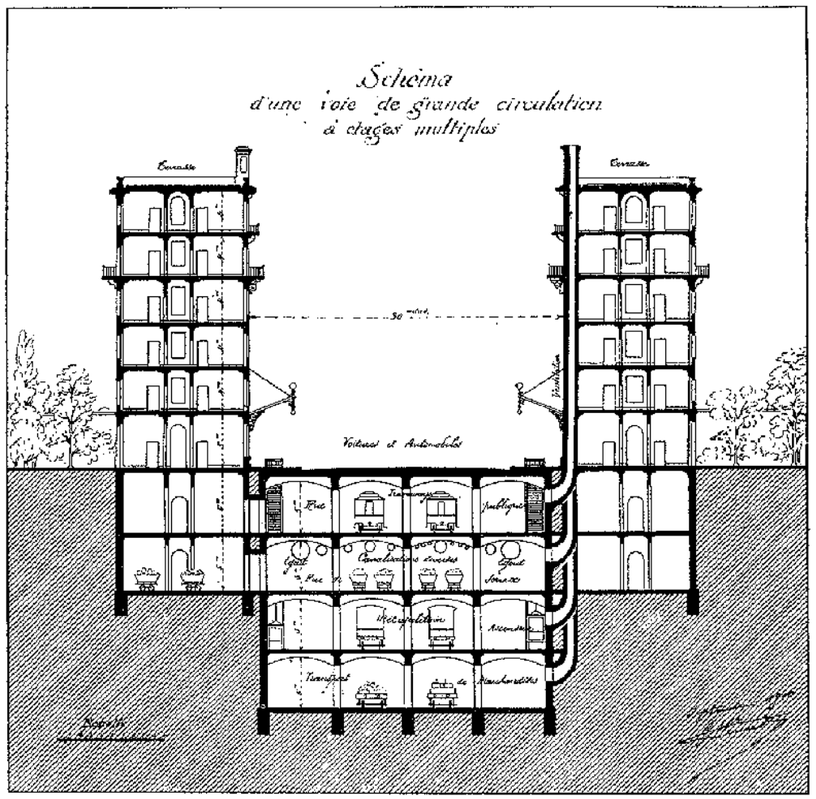


Fig. 3.

This idea of multilevel street has the potential and the ability to expand for more dense and concentrated cities. This concept can take action by adding more vertical levels in the negative direction underground. In this case they have the ability to contain more services and can also have more transportation systems that can cover and connect different urban scales.

> *"By the expansion of such a plan we are led to conceive of a city in which all the streets with heavy traffic would have--according to the frequency of the traffic--three or four superimposed platforms. The first platform would be for pedestrians and carriages, the second for the tramways, the third for the various mains and pipes required for the removal of refuse, and the fourth for the transport of goods, &c. We should thus have a many-storied street, as we have a many-storied house; and the general problem of traffic could be solved, however heavy it might be [fig. 3]. It is probable, however, that the duplicate streets I have just described would suffice, at least for a very long time, under the present conditions of urban life[4]".*

The underground multilevel section can take place in two different types of cities. Thus the development methodology would vary in each case depending if the underground entity is located in:

1- The new cities, or
2- The existing cities.

Regarding the first one, - the new cities – it is much easier to lunch the underground spaces in this city type. It just needs to be planned and designed before starting the construction process.

> *"The adoption of such a plan would be easy in a new town. With regard to the earth excavated from the foundations of houses and other buildings, instead of being conveyed at a great expense outside the town to encumber the surrounding country with rubbish heaps, this would be utilised for raising the ground-level in those parts of the town where underground streets would not be required, and in laying out parks, gardens, or public squares, which it might be desired afterwards to form. In fact it is the relative proportion between the potential quantities of excavation and filling-in which would determine the height above the ground-level to be adopted for the artificial roadway."*

The second type – in the existing cities – is harder to be applied though it is very needed in the

[4] ibid.

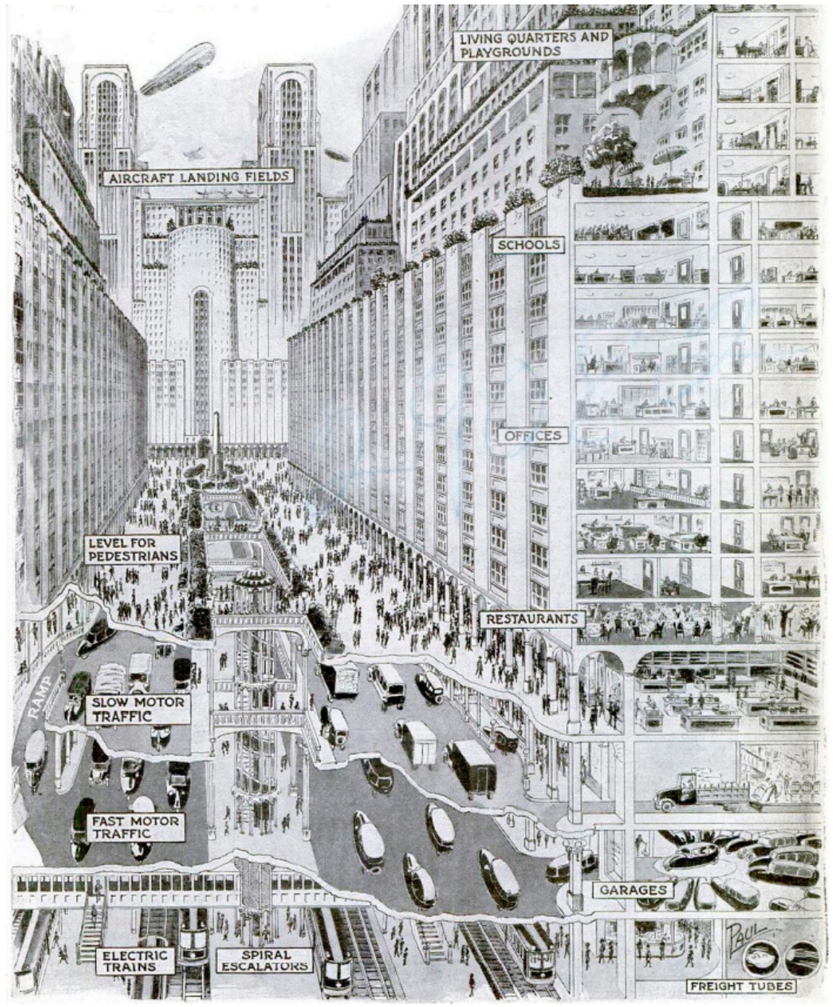


Fig: 4

contemporary era. This is due to the evolution of the cities and the polar character of some city vibrant zones such as the center area. Adding to that, the underground sometimes need to expand as well as the city center in some cases is getting higher density by time.

> *"The application of such a system to existing towns would be more difficult. The problem in this case would be the removal of large masses of earth for the purpose of excavating the lower streets, for there could be no question whatever of removing our art treasures or of interfering with our historic monuments and the time-honoured aspect of our ancient cities. Yet this is not impossible in itself. It is merely a question of money, and the amount can be calculated."*

After *Hénard,* other utopians started to think and focus on the concept of the multilevel cities. In 1925 *Harvey Wiley Corbett* [5] presented that through his future vision of New York City in *The wonderful city you may live to see* where he presented the multiple underground levels streets and basements in three dimensions. In his sketch, he tried to predict how the city in the future would look like from his point of view [6] [fig.4].

In the 1930s, a French-Armenian architect *Édouard Utudjian* [7]was influenced by *Eugène Hénard's* work. He upgraded his work and came up with a new concept, which is "**Underground Urbanism**".

Edouard Utudjian had always been stressing on the necessity of thinking the development of the city in its thickness, the subsoil and the surface being in essence linked and interdependent. The idea of underground spaces was not jut limited to multilevel streets. Instead, the concept suggested to bury the utilitarian functions of the city. *Utudjian* considered that many of the functional buildings and their required activities do not require the supply of natural light, can ideally be buried, thus freeing surface space for other uses. For example, this concept suits

[5] Harvey Wiley Corbett was an American architect primarily known for skyscraper and office building designs in New York and London, and his advocacy of tall buildings and modernism in architecture.

[6] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) pp: 24 -26.

[7] Edouard Utudjian is the founder of GECUS - Groupe d'Études du Centre Urbain Souterrain – in 1933 to be the world's first group dedicated to the study of life underground.

cinemas, swimming pools, auditoriums and theaters. It is from these reflections that the concept of the thick city was born in which a town plan must not be confined to project what will happen on the surface, but that it is necessary to work in urban sections and at the same time foresee the future of the subsoil. In this case, the city can be conceived only in the interaction of the different levels, as they have an impact on each other.
On the other hand, *Edouard Utudjian* warned of the chaos of the underground spaces that can happen, especially between the surface and -10m, in case of the informal juxtaposition of functions and services. He published these ideas later in two of his books: *L'urbanisme souterrain* (1952) and *Architecture et urbanisme souterrain* (1966).

In 1937 *Utudjian* funded the GECUS.[8] The main objective was to study and contribute better usage and development of the underground urban spaces. Accordingly, the subterranean entity existence can act as fundamental asset in the cities planning process, providing more innovative solutions in the crowded districts.

> *"Rather, underground urban development must contribute to better utilization of urban space by hiding underground the various city systems that are nuisance and an encumbrance when placed on the surface – placing them where, certainly, high-rise structures cannot be considered.*
>
> *Whenever Urban development on the surface proves to be impractical – in cities rich in historical souvenirs; where onerous exportation costs have caused project cutbacks before actual completion; where traffic moves so slowly as to adversely affect urban activities; where very high property costs rule out additions – the underground offers unlimited resources.*
>
> *In addition to the rational utilization of underground space for day-to-day, practical needs, there is, alas, the additional necessity for city security, and the protection of inhabitants and goods against possible air attacks. This raises the question of underground development for municipal and national concern[9]".*
>
> He added, *"Before going any further, it is necessary to define a discipline. Underground urban development and, generally speaking, sane underground politics, require solid technology, and by constant hygienic and aesthetic concern without, of course overlooking the social and human side of the problem[10]".*

Utudjian emphasized on the importance of the underground urbanism while considering about the human social aspect.

The GECUS then was responsible for some of the major projects such as: Air defence shelters, project plans for English channel tunnels in France. Also in Paris, some main projects were studied or lunched through it like: Deep underground express ways, underground parking facilities, Joining of the WEST freeway (autoroute d'QUEST) with the St.Cloud bridge (on the outskirt of Paris), Design competition for an underground throughway at St. Germain Des Pres and Porte de St. Quen, Underground traffic networks for La Defense, Underground shopping complex in Paris,Studies for underground semetries, and Mont St. Michel Project.

The underground urban planning importance, need and public awareness started to raise because of GECUS's work and efforts, and specifically it was spotted by Maurice Doublet [11] who paid tribute to its role and was quoted by *Renaud Heim de Balsac* [12] "The essential contribution of underground urban planning, to which GECUS has been dedicated for so many tears, is to have given a third dimention to urban development and to have emphasized the close interdependence between that which is on the surface and that which might be developed underground". He added: "Service and administrative offices may this be placed underground, restoring the surface to it's original state of equilibrium and 'joie de vivre.' By imagining cities

8 GECUS: Groupe d'Études du Centre Urbain Souterrain – was funded in 1933 to be the world's first group dedicated to the study of life underground, it's organization and the future of cities as viewed from the underground perspective

9 Renaud Heim de Balsac, "The history of GECUS: A great adventure in contemporary urban development," *Underground space* 9, no. 5 (1985): 281.
10 Ibid.
11 Maurice Doublet is a politician and a Prefect of the Parisian region.
12 Renaud Heim de Balsac is a French architect and urban planner, is a member of the GECUS Directors' Committee and Secretary General of CERUSS-CPITUS (Study and Research Center for Underground and Spatial Urbanization – Permanent International Committee for Underground Technology and Urbanization).

in three dimensions, you have multiplied tenfold the perspective offered to those having the responsibility for planning of the cities[13]". The European French concept was always to leave the joy of living and the social activities on the city surface.

On the top of the major projects that were done by GECUS is Les Halles. It was presented and designed as an Underground Urban Complex, which was first planned in 1967 and continued until 1970 by *Utudjian* and *Renaud Heim de Balsac*. This project passed through several evolutions through time until today and it will be included in the research as one of the European study cases.

In 1980**,** *Renaud Heim de Balsac* wrote down a scientific paper (*No Soul for the Heart of Paris The Operation and Architectural Quality of Les Hailes*) in which he made a very important question: "W*hat is an underground urban complex?"*

In his answer to that question he identified and illustrated some of the underground urban complex character in which the pointed out Les Halles as the first initiative project with the mentioned articulation. Simply, the idea of underground urban complex personality based on involving three-dimensional planning while including an interchange of roads, underground and/or surface mass transit systems that facilitate the movement of a large number of people across commercial, cultural, public, and private facilities, thus creating a large lively center of activity[14].

Heim de Balsac also stressed on the importance of the role that Underground urban complexes can play in the old city centers, emphasizing *Utudjian's* vision: "These urban complexes can be the foundation for restructuring or renewal of old city centers, which have tended to suffer paralysis as facilities and activities have retreated to the peripheries of the city[15]".

Adding to that, cities can get different privileges and gains as a result of having such Underground urban complexes. In fact they can encourage construction of complementary essential facilities within an already very dense urban texture. These complexes may thus coordinate diverse functions which, if separated, would be uneconomical and of dubious architectural merit, in addition to creating parking problems.

[13] Renaud Heim de Balsac, "The history of GECUS: A great adventure in contemporary urban development," *Underground space* 9, no. 5 (1985): 283.
[14] Renaud Heim de Balsac, "No soul for the heart of Paris: The operation and architectural quality of Les Halles," *Underground space* 5, no. 166 (1980): 167.
[15] ibid.

In 1985 *Balsac* wrote down a paper (The History of GECUS: A Great Adventure in The Contemporary Urban Development) in which, he explained and demonstrated the history, activities, objectives and the projects of GECUS. In that paper, he redefined the concept of Underground Urban Complex and he cited with Les Halles in Paris and it became an Underground Urban Node in the city, reflecting the principles, visions and way of thinking in GECUS.

> *"To date the complex is the following conceptions of the GECUS complex: an exchange platform integrating the various forms of transportation with parking facilities, bus stations, and pedestrians; huge open pit excavations; and spatial overlapping of the different offices and functions, to form a* ***NODE*** *of commercial and circulatory exchanges in the center of Paris".*

Based on the last concepts and articulations, the research started to identify these underground spaces as *Urban Underground Nodes (UUN*). These strategic entities play very important role in the contemporary cities according to the selected used typology.

B - Typologies of Contemporary Urban Underground Spaces.

There are different methodologies that are used to plan, design and locate the Urban Underground Spaces in the contemporary cities.

In one of *Jacqus Benser's* [16] lectures, he divided the Urban Underground city Spaces planning to two different sorts. The first is: to have a dedicated master plan for the underground[17]. In

[16] Jacques Benser is a consultant in urban underground space planning, the municipal planner that was in charge of the Montréal Underground City development and the ACUUS (Associated research Centers for the Urban Underground Space) General Manager.
[17] "D1 S1 3 Jacques Besner | Underground space (also) for people: Cities think underground," YouTube video, 40:25,

this type, the underground morphology is separated morphologically from the surface city. The underground spaces design has different priorities and approaches. It doesn't have a strong influence from the ground level city. A good example of that type is Helsinki underground master plan. It follows the methodology of Land use Planning process. That was introduced by the City of Helsinki, Real estate department, geothermal division. *Ilkka Vähäaho* [18] explained the process of Land use Planning through studies that were done by the city of Helsinki, real estate department. The idea mainly depends on the underground resources by exploring the bedrock underground areas and dig into them. The bedrock allows to host underground infrastructure and is used mostly for containing the thermal heating system for the capital city in underground tunnels then to be distributed reaching the over ground houses buildings. Among these tunnels there are some Urban Underground Spaces[19]. It's important to note what *Ilkka Vähäaho* wrote *"An initial survey examined the areas and elevation levels in Helsinki which are suited for the construction of large, hall-like facilities[20]"*. The main router in this case is geology represented in the soil type. And that is the major reason behind having a morphological segregation and total independence in the underground spaces forms.

The second way of planning Urban Underground Spaces is: A development plan of underground spaces inside the surface city master plan[21]. And that is the approach that this thesis is basically oriented to.
In this type, the underground spaces are more concerned with what's going on in the over-ground city. It's a result of way of living rhythm, and the city needs. To be included as a part of the city master plan, there are several factors that are affecting these spaces morphological design. And that is one of the themes that this research is going to argue.

posted by " COST Sub-Urban," March 28, 2017, https://www.youtube.com/watch?v=_Rts6CQkzgc.
18 Ilkka Vähäaho is the head of the division and a member of the Steering Board of the ITA Committee on Underground Space.
19 Ilkka Vähäaho, *Urban Underground Space - Sustainable Property Development in Helsinki*, (Helsinki, Recommended Oy / Niina Kummu, 2014), https://www.hel.fi/static/kv/Geo/urban-underground-space-print.pdf.
20 Ilkka Vähäaho, "Land use: Underground resources and master plan in Helsinki," in *The Society for Rock Mechanics & Engineering Geology,* Research Publishing, Singapore (2013), p: 36.
21 "D1 S1 3 Jacques Besner | Underground space (also) for people: Cities think underground," YouTube video, 40:25, posted by " COST Sub-Urban," March 28, 2017, https://www.youtube.com/watch?v=_Rts6CQkzgc.

The underground spaces have a phenomenal character to be included in the urban planning of the city composing a rhythm of vertical hybrid system of spaces with different characters and that's the fundamental asset. *Jacques Benser* wrote some recommendations for planning the urban underground space[22] in the city context. One of these recommendations was seeking the enhancement of the integration of underground spaces to the city above. He wrote

> *''The urban underground space, in the same way as other surface space, should be considered in the general planning of the city. Public and private real estate projects should be mix-uses and integrate public spaces and amenities for all the citizens, without social exclusion. Favoring a spatial continuance between outside and inside should do link with the surface[23]".*

He stressed on the importance of the relation between the over ground and the underground spaces to be integrated together. This is connected to the concept of planning the underground space inside the city master plan as it is a part influenced by the over ground.

Another way of categorization was done by *Chiara Delmastro, Evasio Lavagno, Laura Schranz* [24]. They classified the underground spaces in two types:

1- Master Plans: more general.
2- Sectorial Plans: more specific.

The fist type indicates a full master plan of all spaces that are under the city surface. It is including the infrastructure, sewage systems, technical facilities, liveable functions and others. From the authors point of view, as this type is more general. It is mostly concerned with solving the planning problems taking all factors into consideration such as the infrastructure capacity, the people's needs, the cities underground ownership policies… etc.
The second type points out just a part of the big master plan depending on the Urban Underground Space function. This type is more specific and works in a smaller scale area of the city. It is reflecting the city needs in a particular part of its context. And that's why they divided the

22 These recommendations were based on the [Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity].
23 Jacques Besner, "The Sustainable Usage of the Urban Underground Space," *Assosiate research Centres for the Urban Underground Space*, 2018, https://www.acuus.org/index.php/what-is-acuus/the-urban-underground-space.
24 The mentioned authors are working in the Energy Department, Politecnico di Torino, Italy.

second type into three kinds: Installations for commerce and leisure, Systems related to the mobility (people and goods) and Technical systems[25].
The categorisation that the authors did for the sectorial plans is not enough. It can work in the one function underground spaces. But today's city needs more complicated mixed functions and in lots of cases, it cannot accept the mono function space especially in the big size areas. Multi-function Urban Underground Space nowadays is more demanded specially in the congested areas.

On the other hand, *Monique Labbé* [26] came up with a new categorization technique. She divided the underground spaces planning method into 4 categories.
The first is the dedicated master plan for the underground separately from the city above as *Benser* wrote. But then, she gave 3 more classifications that can be dragged under *Benser's* second type.

1- Networks: metros or passageways;
2- Isolated unconnected works (Isolated structures): technical, industrial or public facilities (commercial, cultural, sports, entertainment, etc.);
3- Connected facilities: Structures connected to their environment or to other structures (industrial facilities, shopping areas, metro stations, logistics, etc.) resulting even in the overhaul of a **district**[27]**.**

This third type is one of the characters of the urban city **nodes** that are well connected to the surrounding city context, acting as a hinge to tie different city parts, providing more needed facilities. This is leading to another feature of these nodes, to provide more facilities and activities, which means that they are **mixed use**.

Monique Labbé stressed on the enhancement of mixing uses and activities in the Urban Underground Spaces and connecting them to other related activities over ground, so the city

[25] Chiara Delmastro, Evasio Lavagno, Laura Schranz, "Underground urbanism: Master Plans and Sectorial Plans," *Tunnelling and Underground Space Technology* 55 (2016), pp: 103–111.
[26] Monique Labbé is the President of: Underground Space Committee, AFTES (French Tunneling and Underground Space Association) Founder and General Director of the Ville 10D – Ville d'Idées National Research Project.
[27] Monique Labbé, "Architecture of underground spaces: From isolated innovations to connected urbanism," *Tunnelling and Underground Space Technology* 55 (2016), pp: 153–175.

levels can be functionally and morphologically connected. She also recommended not to have just technical activities in the underground but to have more livable uses - commercial, cultural, sports, entertainment - so the underground space can be humanized by hosting more visitors. That was one of the reasons of her criticizing La Defence for containing mostly technical activities under the square platform and praised Les Halles for hosting mixed livable uses.[28]

C- Strategic Role.

The underground spaces plays very important role in the contemporary city. They can provide solutions for the problematic complicated areas in the urban context and also they have the ability to enhance and emphasize them. In his paper (Urban underground space: Solving the problems of today's cities – 2015), *Wout Broere* [29] demonstrated the advantages of including underground spaces in the city urbanism and how it is positively affecting the surface city in different levels. For example, the use of underground space can help cities meet their increased demands while remaining compact. Also the underground offers to improve the factors contributing to quality of live: safety, health, convenience, and comfort by solving problems such as: traffic congestion, pollution and noise, protection against natural disaster and Utilities and infrastructure[30]. In fact, these underground spaces can have different locations and forms depending on the needed role.

That was explained by *Nikolai Bobylev* [31] who argued that the Urban Underground Space (UUS) changes relatively with the urban tissue and the strategy of development in the hosting cities as the factors in each equation do. The adopted approach is the factor affecting the method of

[28] ibid.
[29] Wout Broere is an assistant professor of Underground Space Technology at Delft University of Technology - Animateur ITA Working Group 20 Urban Problems - Underground Solutions - Member ITACUS ITA Committee on Underground Space.
[30] Wout Broere, "Urban underground space: Solving the problems of today's cities," *Tunnelling and Underground Space Technology* 55 (2016), pp: 245–248.
[31] Nikolai Bobylev from the Institute of Earth Sciences, Saint Petersburg State University, Universitetskaya nab., Saint Petersburg, Russia and a member of Saint Petersburg Research Centre for Ecological Safety of the Russian Academy of Sciences.

solving problems in each city through these UUS as the outcomes will be different as well [32].

So, for example, in the European paradigm, in the historical city center, the public squares are the Nerve center of the UUS developmental plan. *Wout Broere* highlighted that by writing: *"The underground is providing an optimal solution in the historical cities that have lack of space and preservation of heritage and environment, specially the old city centers[33]".* They also support the strategic role of the piazzas being the lungs of the traditional city as was described by Rob Krier and Michael Graves[34]. This concept is compatible with the pioneers visions regarding the layering futuristic needs in the city centers such as *Eugène Hénard* and *Édouard Utudjian.*

This European strategy aims to preserve the historical buildings and maintain the over ground level of the city for pedestrians and on foot users[35]. This is reflected in the underground nodes morphological design approach by locating them under open public spaces platforms (Concrete Platform Planning), which *Monique Labbé* discussed in the cases of Les Halles and La Defense in Paris.

On the other hand, in the Asian Far-Eastern paradigm the UUS embrace the stations role and give them the strategic support in the urban context. In 2011 an article was published by *John Zacharias* [36], *Tianxin Zhang* [37] and *Naoto Nakajima* [38] under the title: (Tokyo Station City: The railway station as urban place). In this article, the authors demonstrated how the Asian

[32] Nikolai Bobylev, "Underground space as an urban indicator: Measuring use of subsurface," *Tunnelling and Underground Space Technology* 55 (2016) pp: 40–51.
[33] Wout Broere, "Urban underground space: Solving the problems of today's cities," *Tunnelling and Underground Space Technology* 55 (2016), p: 247.

[34] Rob Krier, *Town Spaces*, (Basel: Editor Birkhäuser Architecture, 2006) pp: 6-7.

[35] Angelo Bugatti, *Underground design: In the dense city and in the landscape*, (Santarcangelo di Romagna: Maggioli Editore, 2010) pp: 15-18.
[36] John Zacharias from the Department of Geography, Planning and Environment, Concordia University, Montreial, Canada.
[37] Tianxin Zhang from the College of Urban and Environmental Sciences, Peking University, Beijing, China.
[38] Naoto Nakajima from the Faculty of Environment and Information Studies, Keio University, Fujisawa, Kanagawa, Japan.

cities tissue, and specifically in Japan uses the stations as an "important urban city center". They described the stations as the "nerve centers" of the cities developmental strategies. That transformation existed when these nodes incorporated with different mixed uses. *"The railway and metropolitan stations are in effect becoming nerve centers for the so-called 'intelligent' city, in which the transportation function plays a supportive role and no longer a central role[39]".* They also emphasized the morphological role that the station is playing by connecting the station surrounding context through underground pedestrian facilities: *"In the Japanese case, the station is enclosed by new developments and pedestrian facilities that have largely overcome the historical disconnect between the transportation facility and the surrounding environment[40]".* This decodes of the Far Eastern Japanese paradigm where the stations are the Nerve center of the UUS developmental plan. They follows the "Intelligent City" vision where the station is enclosed by the pedestrian network facilities.

Finally, in North America, the Nerve center of the UUS developmental plan is the CBD (Central Business District). Because of its large scale and the traffic congestions, this area is a problematic one for the pedestrians. The underground space in this case mainly tries to provide a solution for the mentioned problem. This is why, the strategy in this paradigm aims to have an Underground Pedestrian Network that intersects with and connects diffused activities nodes represented morphologically as underground tunnels.

Here's *Donald Reis* [41] argues that the Central Business Distract (CBD) is in need of a pedestrian system because of its expansion. This type of district usually faces congestion and conflicts between pedestrians and vehicles networks. "Pedestrian movement in the central business district is the most neglected form of transportation[42]". For that reason and also because of the climate conditions, he mentioned that the community's response to these problems is to develop

[39] John Zachariasa, Tianxin Zhangb, Naoto Nakajimac, "Tokyo Station City: The railway station as urban place," URBAN DESIGN International 16, n.4 (2011), p: 250.
[40] John Zachariasa, Tianxin Zhangb, Naoto Nakajimac, "Tokyo Station City: The railway station as urban place," URBAN DESIGN International 16, n.4 (2011), p: 251.
[41] Donald Reis was formerly program manager, Central Business District Division, Department of Urban Planning, Dallas, Texas. He worked also as a master planner with Triland International, Inc., Dallas, Texas.
[42] Donald Reis, "Public-private cooperation in developing an underground pedestrian system," *Underground space* 6, no. 166 (1982): 337.

a climate-controlled pedestrian system, both above and below grade. Though, he recommended the underground to include more functional spaces. He wrote, "Underground areas also offer possibilities for creating 'people space' that may not be appropriate at second levels in the structure[43]". This was described as the Continues Interior. It is a concept that was discussed through utopian and dystopian architects mostly by Archizoom Assosiati's No-Stop City in 1969 where the future of the city was imagined as a continuous climate-controlled interior space [44]. Lots of architects embraced it as well in their work such as John Portman[45] who clarified his openion in one of his interviews "From my office I can go all the way to Frankfurt, Germany, without putting on a coat, or getting wet. I get out and take a train into downtown. What the hell is wrong with that? [46]". This gave the opportunity to others to enhance the value of these underground pedestrian networks such as Pierre Bélanger [47]. For him, it is very essential asset that he considered it as an infrastructure to be dealt with as an urban landscape. Pierre's vision supports the importance of the pedestrian underground network in the CBD area[48].

On the other hand, others criticized this isolation of the on foot web in the underground level. Vincent James and Jennifer Yoos described this phenomena as Sectional Demographics indicating the multilevel urban environments that reinforce social and economic divisions, which was disused by Henri Lefebvre[49] and David Harvey[50] as well. They criticized the separation of the pedestrian network from the streets and public spaces as it can segregate populations along the lines of race, class, or gender [51] unlike the cases in the European or the Asian paradigms – as they don't have a large-scale underground network space.

The last part shows the difference in the provided role of the urban underground spaces in each paradigm. It is not possible to condemn any of the solutions or ideas without understanding and analyzing the surrounding urban tissue and the society's way of living background. It's important to note that the motivations and potentials for the Urban Underground Spaces are different from a context to another and from a lifestyle to another.

D - Conclusion

To illustrate, the Urban Underground Space Nodes have different ideologies and designation from lifestyle to another depending on the chosen strategic approach – Underground Complex or Underground District in Europe, Transportation Hub in Japan (Asia) and Underground pedestrian Network in North America – while they all have some common characteristics that most of the previous authors recommended and agreed on:

1- Above all one of the most important mutual features is the compactness of these Urban Underground Nodes (UUN). The compactness of the city is a factor that helps to preserve it culturally, socially and economically. This compactness is mostly needed in the city center where the demand is the highest. Therefore, the multi-layered land use is required to apply a type of complexity that integrates these different levels together[52]. The UUN have the ability to offer that role.

2- As was mentioned by *Sanja Durmisevic* that agreed with the vision of *Henard* the French pioneer who wrote that the city center will be always the busiest part and she added that it's having high demand. Also she added that if we are not taking care about developing

[43] ibid.

[44] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) p: 224.

[45] John Portman was an American neofuturistic architect and real estate developer widely known for popularizing hotels and office buildings with multi-storied interior atria.

[46] Corydon Ireland, "High art with a human touch," The Harvard Gazette, March 2013, https://news.harvard.edu/gazette/story/2013/03/high-art-with-a-human-touch/.

[47] Pierre Bélanger: Associate Professor, Department of Landscape Architecture; Co-Director, Urbanism, Landscape, Ecology Program.

[48] Pierre Bélanger, "Underground landscape: The urbanism and infrastructure of Toronto's downtown pedestrian network," *Tunnelling and Underground Space Technology* 22 (2007) pp: 272–292.

[49] Henri Lefebvre was a French Marxist philosopher and sociologist, best known for pioneering the critique of everyday life, for introducing the concepts of the right to the city and the production of social space, and for his work on dialectics, alienation

[50] David Harvey is a distinguished professor of Anthropology & Geography at The Graduate Center, CUNY.

[51] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) p: 228.

[52] Sanja Durmisevic, "The future of the underground space," *Cities* 16, n. 4, (1999) p: 235.

the city center and not apply it's demands of time, it will be deserted and the activities will move to the city peripheries. In that case the center will lose its value. So, the city center should be enriched always by the contemporary needed demands[53]. The UUN can provide that by evolving the city center with the new contemporary needed functions.

3- The UUN spaces need to be mixed use with livable activities that helps to attract and humanize these nodes. At the same time these uses should meet the people's needs.

4- The UUN spaces are well connected to the surrounding city context and not isolated from the urban tissue. It is actually fundamental for the transportation service between the different city parts.

On the other hand there were conflicts between different points of view regarding the quality of the spaces underground in relation with the over ground urban context. For example *Sanja Durmisevic* recommended to have a clear separation of pedestrians and traffic provides less confusion and better mobility of each group in different city levels. *Clément Demers* [54]supported that idea while he suggested to set the pedestrian network in the underground and to improve the urban quality as this proposal can reduce the vehicles in the city streets[55]. *Monique Labbé* criticized that and she stressed on the importance of integrating the underground space with the urban context over ground to improve the quality of both spaces underground. She emphasized the values of that integration that can help to achieve combination between the different city levels and argued that the segregation between those environments can affect the quality of both underground and over ground spaces[56].

[53] ibid.

[54] Clément Demers: General Manager of Quartier International de Montréal (QIM – now renamed AGIL), a non-for-profit organization in charge of a large-scale development and revitalization project in downtown Montréal, including the extension of the Indoor pedestrian network (known as the Underground City) and a board member of ACUUS directors.

[55] Clément Demers, "Over & underground spaces & networks integrations a case study: the international district of Montreal," *Procedia Engineering* 165 (2016) p: 728.

[56] Monique Labbé, "Architecture of underground spaces: From isolated innovations to connected urbanism," *Tunnelling and Underground Space Technology* 55 (2016), p: 154.

All these authors were having these contradictory opinions as they were referring to different cases located in diverse contexts with different urban lifestyles. These opposite opinions toke action because there are some missed factors, which are affected by other approaches and the followed development strategies. That is what *Jacques Benser* argued. He wrote: *"Planning underground space hasn't the same meaning for an engineer compared to the meaning it has for an architect or an urban planner, and today many professionals are claiming to be planners because they are doing planning. Pursuing a development plan or a project in the underground involves working with various actors as well as the traditional professional collaborators. Navigating in such context is a challenge because interdisciplinarity needs a minimal knowledge and a respect of the other professions".*

He emphasized the importance of the interdisciplinarity of studying the underground space, as it doesn't have the same meaning for an architect or an urban planner. That is why many professionals are claiming planners because that planning process that they are doing doesn't take many actors in consideration, which is affecting both over ground and underground environments. That is why, to initiate any development plan various actors should be studied from different points of views, collaborating various factors together. That needs a minimal knowledge and respect of other professions[57].

Due to that, this thesis will work on two disciplines, two approaches, spatial composition of the UUN and the urban lifestyle strategies in the hosting cities. But to achieve that, one unified analytical framework will be needed to simplify the complexity of these UUN spaces in various urban tissues to understand the differences between the different cases and to be able to decode these critical spaces. This method will be applied in the first part of the research to study the differences of spatial compositional in different study cases. Then the second part will be dedicated to understand their impact on the urban lifestyle strategies in the hosting cities to reach the final goal.

[57] Jacques Besner, "Underground space needs an interdisciplinary approach," *Tunnelling and Underground Space Technology* 55 (2016) p: 225.

Introduzione. (In Lingua Italiana)

I. Abstract.

La tesi sviluppa uno studio sui Nodi Urbani Sotterranei - Urban Underground Nodes – (UUN) assunti come quelle entità architettoniche che meglio di altre esprimono, per la loro essenza trans-tipologica, alcune particolari condizioni della spazialità urbana contemporanea.

Tali emergenze rappresentano dei nodi cruciali di mobilità e connessioni nei tessuti urbani, tuttavia non ne esiste una immagine connotativa o una idea spaziale identificabile, limitate sono le indicazioni relative alla loro composizione e strutturazione tipologica con la conseguente difficoltà di una specifica modalità di rappresentazione.

Attraverso una indagine esplorativa la ricerca si pone l'obiettivo di decodificarne codici e invarianti descrittive in relazione allo stile di vita urbano, prendendo in esame 6 casi studio rappresentativi di tre diverse condizioni geografiche: Nord America, Europa, Asia.

La tesi, dunque, trova un particolare campo di sperimentazione nella ideazione di un sistema di diagrammi capaci di descrivere i caratteri, gli elementi percettivi e le loro relazioni con la conformazione della città in superficie. Tale apparato si ricompone in una matrice finale restituendo la complessità dei Nodi Urbani Sotterranei in relazione all'odierna condizione urbana.

La struttura metodologica messa a punto, rispondendo ai requisiti di ripetibilità, controllabilità e ispezionabilità della base empirica, si configura come un vero e proprio "dispositivo di ricerca" adottabile per altri casi studio.

Tale approccio consente al dottorando di dimostrare come queste entità sono concepite in stretta relazione con la struttura urbana delle città, quindi come le differenze tra i casi studio indagati definiscono tre modelli base, ciascuno corrispondente ai diversi contesti geografici presi in esame.

Parole Chiave:

Nodi Urbani Sotterranei (UUN) – Composizione Spaziale– Stile di vita urbano –- Matrice.

II. Obiettivi.

La tesi si propone di indagare e approfondire i *Nodi Urbani Sotterranei – Urban Underground Nodes*, (UUN) – tentando di individuare quei caratteri, quegli elementi percettivi e quelle relazioni formali capaci di descriverne la complessità e di restituirne una immagine connotativa o una specifica idea spaziale.

Dopo un primo approfondimento sulle teorie delle città in relazione con i UUN, la tesi definisce un quadro analitico di confronto tra gli aspetti compositivi in diverse e specifiche condizioni geografiche, attraverso l'ideazione di un sistema di diagrammi, con l'obiettivo di determinare una possibile "matrice" classificatoria di tali entità urbane.

L'apparato metodologico definisce, dunque, una prima ipotesi sulle possibili relazioni tra la composizione spaziale dei UUN, la conformazione della città in superficie e lo stile di vita, tentando di fornirne una descrizione sia spaziale che tipologica e una possibile modalità di rappresentazione.

III. Metodologia.

La ricerca è stata sviluppata attraverso due approcci metodologici: il primo grafico analitico, con l'obiettivo di comprendere la composizione spaziale dei UUN nei diversi contesti geografici; il secondo qualitativo che indaga le possibili relazioni tra lo stile di vita e nodi sotterranei.

Attraverso l'ideazione di un sistema di diagrammi analitici descrittivi dei casi studio, la ricerca ha tentato di mettere a punto una metodologia che rispondesse ai criteri di ripetibilità, controllabilità e ispezionabilità, applicabile a diverse varianti con l'obiettivo di determinare una possibile "matrice" classificatoria di tali entità urbane.

Nella **prima parte** si è proceduto con un'astrazione delle entità caratterizzanti i UUN e il corrispondente contesto delle città in superficie con l'obiettivo di individuare quelle variabili descrittive che consentissero una possibile classificazione. Per questioni di sicurezza, questa fase della ricerca è stata molto complessa per la difficoltà di reperire disegni e progetti, ma anche di sviluppare una un'indagine fotografica poiché tali luoghi urbani sono altamente a rischio.

Lo studio analitico si è, dunque, basato su un principio di semplificazione e diagrammizzazione che ha consentito di decodificare la complessità della composizione spaziale di tali nodi e la loro relazione con il contesto urbano in superficie. Sono stati selezionati 6 casi studio, scelti in tre contesti geografici differenti, per tentare di sviluppare un'indagine il più possibile esaustiva e comprensiva di modelli urbani e insediativi differenti: Nord America, Europa e Asia.

Dopo una prima individuazione del nodo rispetto al tessuto urbano si è proceduto alla produzione di una serie di diagrammi esemplificativi dei caratteri e delle relazioni formali, funzionali, distributive, elaborati sia per gli spazi sotterranei che per quelli posti in superficie.

Sono state, dunque, definite una serie di mappe diagrammatiche, concepite come l'apparato strutturante della ricerca, organizzate rispetto a due questioni: *localizzazione* e *forma*. Tali elaborazioni sviluppano una lettura di alcuni principi legati alla posizione, alle connessioni e alla densità urbana, mentre per la configurazione formale, si è indagato il profilo, l'organizzazione e la dimensione.

La **seconda parte** della tesi si propone di comprendere le differenze tra gli stili di vita dei diversi contesti geografici scelti, attraverso la lettura di quegli studi teorici che ne indagano le relazioni con la struttura della città. Questa riflessione coinvolge le questioni connesse alle

identità locali dei contesti urbani, al carattere, alle dimensioni e all'impatto sociale di diversi modelli insediativi. In particolare la ricerca si sofferma su due aspetti ritenuti più significativi per il tema trattato e cioè quello della *pedonabilità* e delle *diverse attività* caratterizzanti gli spazi urbani in corrispondenza dei nodi sotterranei.

Nello specifico si elencano i diagrammi che sono stati elaborati per ciascun caso studio:

Diagramma 1- Analisi a scala urbana con individuazione della **posizione** del UUN rispetto alla struttura della città (centro, periferia, sotto assi urbani, etc.);

Diagramma 2- Lettura del UUN rispetto alla **densità** urbana della città e quindi a quegli elementi che definiscono lo spazio in superficie (strade, edifici, piazze pedonali, spazi pubblici aperti, giardini) tentando una descrizione anche delle diverse altezze delle emergenze urbane (edifici alti, medi, bassi);

Diagramma 3- Individuazione e descrizione delle **connessioni** a partire da quelle verticali tra la città in superficie e gli spazi sotterranei e le relative implicazioni nella distribuzione degli spostamenti degli utenti;

Diagramma 4- Descrizione del **profilo** del UUN rispetto alle emergenze urbane e agli assi generati dal contesto fuori terra;

Diagramma 5- Descrizione dell'**organizzazione distributiva e funzionale** dello spazio del UUN nei diversi contesti;

Diagramma 6- Comprensione della **dimensione** del UUN attraverso il disegno di una griglia di 100 * 100 metri che ha permesso di mettere in evidenza le relazioni con la scala urbana e di comprendere le differenze dimensionali tra gli spazi distributivi nei sei casi studio.

L'apparato dei diagrammi si conclude in una **Matrice compositiva spaziale** che tenta una prima descrizione classificatoria della complessità dei *Nodi Urbani Sotterranei* in relazione all'odierna condizione urbana.

IV. Stato dell'Arte.

Stato dell'Arte:

A- Background Storico.
B- Tipologie Contemporanee di Spazi Urbani nel Sottosuolo.
C- Ruolo Strategico.
D- Conclusioni.

A – Background Storico.

The Underground city è un concetto sviluppatosi all'inizio dell'ultimo secolo. Eugène Hénard – un architetto francese e pianificatore urbano di grande fama e influenza - fu il primo visionario in grado di immaginare il futuro della città. In uno dei suoi più famosi articoli, dal titolo "The Cities of The Future" del 1910 egli introdusse per la prima volta, il concetto di strada su più livelli – da lui indicate come "strada duplicate" – suggerendo un futuro per la città in grado di evolversi nello spazio sotterraneo.

Intraprese la sua idea motivando i vantaggi della città realizzata su più livelli: la risoluzione dell'alta densità presente nei centri urbani compatti. "Qualunque sia la forma della sua futura espansione, ci sarà sempre, in ogni grande comunità urbana, un centro di intensa attività in cui gli edifici saranno posizionati sempre vicini, così come accade oggigiorno nelle nostre città. È una porzione di questo centro che stiamo per esaminare".[1]

[1] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 349, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future. (2010): 345, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.
Nota in lingua originale: *"Whatever form its future expansion may take, there will always remain, in every large urban community, a centre of intense activity wherein the buildings will always be placed close together, as they are in our cities of the present day. It is a portion of such a centre that we are about to examine".*

Durante gli studi in architettura e ingegneria, Hénard prova a mostrare il suo punto di vista attraverso la sezione della città attuale e una bozza della sua visione futuristica per "The City of the Future" [fig. 1]. Sul lato sinistro dell'immagine viene rappresentata attraverso il disegno, un'abitazione risalente a un secolo precedente al suo, mentre sulla destra, in maniera opposta e speculare, viene collocata una abitazione appartenente al suo tempo presente.

Hénard, interessandosi alla composizione delle infrastrutture, ha individuato come la causa della maggior parte dei problemi relativi alla congestione delle città, sia dovuta alla presenza di molteplici servizi funzionali collocati su un unico livello: il livello stradale. Con la densificazione e la successiva necessità di incrementare i servizi necessari, il tipo ad unico livello risulterà non essere più soddisfacente.

> *"La causa del male risiede nel metodo tradizionale secondo cui" il fondo della strada deve essere al livello del terreno nella sua condizione originale". Ma non c'è nulla che giustifichi una visione così errata. Infatti, se dovessimo stabilire come primo principio l'idea che "la pavimentazione e il senso del trasporto debbano essere costruiti artificialmente ad un'altezza sufficiente per consentire a ciascuno di essi uno spazio in grado di contenere tutte le installazioni necessarie per il servizio del strada, le difficoltà che ho appena indicato scomparirebbero del tutto. Questo, ovviamente, implica un ulteriore piano sotterraneo per le case vicine, in quanto il piano terra verrebbe quindi rialzato fino al livello della strada* [2] *".* [fig. 2]

In accordo con l'autore, appare importante sottolineare, che la sua proposta consentiva di lasciare libera quella porzione di città garantita alla fruizione pedonale, seppellendo i sistemi di trasporto inquinanti nel sottosuolo.
Tale soluzione conferisce una certa vitalità alla città, data dal movimento fluido e dinamico dei suoi abitanti.
L'autore dichiara inoltre: *"La strada attuale sarebbe stata trasformata in due strade differenti: una al di sopra e all'aria aperta, destinata esclusivamente al passaggio del traffico veicolare e pedonale leggero, e l'altra situata al di sotto, al livello di il terreno e sotto il primo, che servirebbe da condotto per tutti i sistemi di tubazioni, la rimozione dei rifiuti domestici e il trasporto di materiali e merci pesanti ".* [3] *[Fig.2]*

[2] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 353, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.

L'idea di strada su più livelli racchiude in sé la potenzialità di una successiva espansione della città nella sua verticalità e nel suo spessore.
Inoltre, per le città più dense e concentrate, l'architetto suggerisce come tali servizi possono essere distrubuiti attraverso sistemi di trasporto su scale urbane differenti.

"Con l'espansione di un tale piano siamo portati a concepire una città in cui tutte le strade con traffico pesante avrebbero - secondo la frequenza del traffico - tre o quattro piattaforme sovrapposte. La prima piattaforma sarebbe per pedoni e carrozze, la seconda per le linee tranviarie, la terza per le varie condutture e condutture necessarie per la rimozione dei rifiuti, e la quarta per il trasporto di merci, ecc. Dovremmo quindi avere una strada a molti piani, dato che abbiamo una casa a molti piani; e il problema generale del traffico potrebbe essere risolto, per quanto pesante possa essere [fig. 3]. È probabile, tuttavia, che le strade duplicate che ho appena descritto siano sufficienti, almeno per un tempo molto lungo, nelle attuali condizioni di vita urbana".[4]

Il modo di pianificazione in sezione può avere luogo in due diversi tipi di città. Pertanto, la metodologia di sviluppo potrebbe variare in ciascun caso a seconda che l'entità sotterranea in cui vi si trovi:

1- Le città di nuova formazione.
2- Le città esistenti.

Per la prima categoria – la città di nuova formazione - l'approccio per lo sviluppo di spazi sotterranei appare al quanto semplice. Questo viene avviato attraverso un progetto di

[3] Eugène Hénard, "The cities of the future," in *Royal Institute of British Architects, Town Planning Conference London*, The Royal Institute of British Architects Press, London, 1911. P: 354, https://www.scribd.com/document/79986049/Eugene-Henard-the-Cities-of-the-Future.
[4] ibid.

pianificazione redatto a priori del processo di costruzione. L'autore, a tal proposito, scrisse: "L'adozione di un piano del genere sarebbe facile in una nuova città, […] Per quanto riguarda la terra scavata dalle fondamenta di case e altri edifici, invece di essere trasportata a fuori dalla città per ingombrare il paese circostante con spazzatura cumuli, può essere riutilizzata per innalzare il livello del suolo in quelle parti della città dove non sarebbero necessarie strade sotterranee, e nella stenditura di parchi, giardini o piazze pubbliche, da realizzare in seguito. In effetti è la proporzione relativa tra le potenziali quantità di scavo e riempimento che determinerebbero l'altezza sopra il livello del suolo da adottare per la carreggiata artificiale."

La seconda invece – per le città esistenti – richiede un metodo di più difficile applicazione nonostante l'urgenza della stessa per l'era contemporanea. Ciò è dovuto all'evoluzione delle città e al carattere polare di alcune zone vitali della stessa, come l'area centrale. A tal proposito, ad espandersi è il sottosuolo, in grado di diventare denso nel tempo, così come accade per la città sovrastante: *"*L'applicazione di un tale sistema alle città esistenti sarebbe più difficile. Il problema in questo caso sarebbe la rimozione di grandi masse di terra allo scopo di scavare le strade inferiori, perché non ci si può chiedere di rimuovere i tesori artistici o di interferire con i monumenti storici e l'aspetto storico delle città antiche. Eppure questo non è impossibile di per sé. È solo una questione di spesa e l'importo può essere calcolato*."*

Dopo *Hénard* un altro utopista cominciò a pensare al disegno di città su più livelli. Nel 1925 *Harvey Wiley Corbett* [5] presentò la sua visione per il futuro di New York City in *The wonderful city you may live to see.* L'autore mostrò nei suoi disegni, diverse strade e spazi sotterranei rappresentandole nelle tre dimensioni. Nei suoi schizzi, predette come la città del futuro, sarebbe stata vista dal suo punto di vista. [6] [fig.4].

Nel 1930, un architetto franco-americano di nome *Édouard Utudjian* [7]fu ingluenzato dal

[5] Harvey Wiley Corbett was an American architect primarily known for skyscraper and office building designs in New York and London, and his advocacy of tall buildings and modernism in architecture.

[6] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) pp: 24 -26.

[7] Edouard Utudjian is the founder of GECUS - Groupe d'Études du Centre Urbain Souterrain – in 1933 to be the world's first group dedicated to the study of life underground.

lavoro di *Eugène Hénard*. Egli sviluppando le idee del suo maestro, creo un nuovo concetto: **Underground Urbanism**".

Edouard Utudjian ha sempre creduto nella necessità di pensare allo sviluppo delle città nel loro spessore: il sottosuolo e la superficie, collegati tra di loro in maniera interdipendente.
Considerando che molti degli edifici funzionali non richiedevano l'utilizzo della luce naturale per lo svolgimento del loro uso, era possibile spostarli nel sottosuolo, seppellendo così tutte quelle funzioni utilitarie della città. Questo concetto, può essere liberamente utilizzato per i cinema, piscine, auditorium e teatri. Da queste riflessioni viene sviluppato il concetto di spessore della città.
L'autore credeva che un piano urbano non poteva essere confinato al progetto di ciò che accade soltanto nella superficie, ma bisogna lavorare in sezione prevedendo contemporaneamente il futuro del sottosuolo.
La città doveva essere concepita solo nell'interazione dei suoi differenti livelli, e su come questi ultimi abbiano un impatto l'uno sull'altro.
L'autore pubblicò successivamente la sua idea, in due dei suoi testi: *L'urbanisme souterrain* (1952) and *Architecture et urbanisme souterrain* (1966).

Dopo aver fondato il GECUS[8], nel 1937 *Edouard Utudjian* ha chiarito gli obiettivi del movimento sin dal suo inizio. Egli scrisse:

> *"Piuttosto, lo sviluppo urbano sotterraneo deve contribuire a una migliore utilizzazione dello spazio sovrastante nascondendo sottoterra i vari sistemi cittadini che sono fastidi e un ingombro quando vengono posti in superficie - ponendoli dove, certamente, le strutture a molti piani non possono essere considerate.*
>
> *Ogni volta che lo sviluppo urbano sulla superficie si rivela impraticabile - in città ricche di reperti storici; dove gli esigenti costi di esportazione hanno causato tagli ai progetti prima del completamento effettivo; dove il traffico si muove così lentamente da influire*

[8] GECUS: Groupe d'Études du Centre Urbain Souterrain – was funded in 1933 to be the world's first group dedicated to the study of life underground, it's organization and the future of cities as viewed from the underground perspective

negativamente sulle attività urbane; dove i costi di proprietà molto alti escludono aggiunte – il sottosuolo offre risorse illimitate.

Oltre all'utilizzo razionale dello spazio sotterraneo per le esigenze pratiche quotidiane, vi è, ahimè, la necessità aggiuntiva per la sicurezza della città e la protezione degli abitanti e delle merci contro possibili attacchi aerei. Ciò solleva la questione dello sviluppo sotterraneo per le preoccupazioni municipali e nazionali[9]".

Egli aggiunse: *"Prima di andare Avanti è necessario definire una disciplina. Lo sviluppo urbano sotterraneo e, in generale, la sua politica, richiedono una solida tecnologia e una costante preoccupazione igienica ed estetica senza, ovviamente, trascurare il lato sociale e umano del problema[10]".*

Enfatizzando sull'importanza dell'urbanizzazione nel sottosuolo nel considerare anche gli aspetti sociali e umani.

Il GECUS fu anche responsabile di alcuni dei più grandi progetti come: rifugi di difesa area, piani progettuali per il canale del tunner inglese in Francia. In modo particolare a Parigi: Intersezioni sotterranee profonde, parcheggi sotterranei, ingresso dell'autostrada WEST (autoroute d'QUEST) con il ponte St. Cloud (alla periferia di Parigi), Concorso di design per una metropolitana sotterranea a St. Germain Des Pres e Porte de St Quen, reti di traffico sotterranee per La Defense, complesso commerciale sotterraneo a Parigi, studi per i seminterrati sotterranei e il progetto Mont St. Michel.

L'importanza della pianificazione urbana sotterranea, la necessità e la consapevolezza dell'impatto sul pubblico e sulla società, sono aspetti individuati da Maurice Doublet [11] citato da *Renaud Heim de Balsac* [12] *"Il contributo essenziale della pianificazione urbana sotterranea,*

[9] Renaud Heim de Balsac, "The history of GECUS: A great adventure in contemporary urban development," *Underground space* 9, no. 5 (1985): 281.
[10] Ibid.
[11] Maurice Doublet is a politician and a Prefect of the Parisian region.
[12] Renaud Heim de Balsac is a French architect and urban planner, is a member of the GECUS Directors' Committee and Secretary General of CERUSS-CPITUS (Study and Research Center for Underground and Spatial Urbanization – Permanent International Committee for Underground Technology and Urbanization).

è di aver dato una terza dimensione allo sviluppo urbano e di aver sottolineato la stretta interdipendenza tra ciò che è in superficie e ciò che potrebbe essere sviluppato sottoterra ". Egli aggiunse: "*Il servizio e gli uffici amministrativi possono essere collocati sottoterra, ripristinando la superficie al suo stato originale di equilibrio e "gioia di vivere". Immaginando città tridimensionali, moltiplicate di dieci volte nella prospettiva offerta a coloro che hanno la responsabilità della pianificazione delle città[13]".* Il concetto francese/europeo prevedeva il rilascio di quelle attività prettamente di svago sulla superficie della città.

Uno dei principali progetti realizzati dal GECUS è Les Halles. Un complesso urbano sotterraneo pianificato per la prima volta nel 1967, e concluso nel 1970 da *Utudjian* e *Renaud Heim de Balsac*.

Nel 1980**,** *Renaud Heim de Balsac* scrisse in un suo articolo scientifico (*No Soul for the Heart of Paris The Operation and Architectural Quality of Les Hailes*) ponendosi la seguente questione: "che cos'è un complesso urbano sotterraneo*?"*

Nella sua risposta a tale questione, egli identificò e illustrò alcuni dei caratteri dei complessi urbani sotterranei portando come esempio il progetto per Les Halles realizzato mediante una articolazione urbana sotterranea complessa basata sul coinvolgimento di una pianificazione tridimensionale includendo allo stesso tempo uno scambio di strade, sistemi di trasporto pubblico e / o di superficie che facilitano il movimento di un gran numero di persone attraverso la fruibilità di strutture ad uso commerciale, culturale, pubblico e privato. Si viene così a creare un centro attivo e vivace. creando così un grande e vivace centro di attività*[14]".*

Sottolineando l'importanza del ruolo che i complessi urbani possono rivestire nei confronti dei centri storici abitati, enfatizzando la visione di Utudjian: "Questi complessi urbani possono essere la base per la ristrutturazione o il rinnovo dei centri storici, che hanno avuto la tendenza a

[13] Renaud Heim de Balsac, "The history of GECUS: A great adventure in contemporary urban development," *Underground space* 9, no. 5 (1985): 283.
[14] Renaud Heim de Balsac, "No soul for the heart of Paris: The operation and architectural quality of Les Halles," *Underground space* 5, no. 166 (1980): 167.

subire la paralisi mentre strutture e attività si sono ritirate nelle periferie della città[15]".

Nello stesso articolo, *Heim de Balsac* chiarì alcuni dei privilegi e dei guadagni che le città possono ottenere dalla presenza di tali complessi urbani sotterranei:

> *"I complessi sotterranei possono incoraggiare la costruzione di strutture essenziali complementari all'interno di una trama urbana già molto densa. Questi complessi possono quindi coordinare diverse funzioni che, se separate, sarebbero antieconomiche e di dubbia valore architettonico, oltre a creare problemi di parcheggio."*

Il progetto sopracitato, complesso per la sua evoluzione temporale, sarà incluso nella ricerca come uno dei casi di studio europei.

In aggiunta a ciò, le città possono ottenere diversi privilegi e guadagni dalla presenza dei complessi urbani sotterranei. In effetti, questi ultimi promuovono la costruzione di strutture essenziali complementari all'interno di una trama urbana già molto densa. Questi complessi possono pertanto coordinare diverse funzioni che, se separate, sarebbero antieconomiche e di dubbia valore architettonico.

Nel 1985 *Balsac* scrisse in un articolo (The History of GECUS: A Great Adventure in The Contemporary Urban Development) nel quale affermava e dimostrava la storia, le attività, gli obiettivi e i progetti del GECUS. Nell'articolo, egli riscrisse a proposito del concetto di "Underground Urban Complex". Citando Les Halles a Parigi introdusse il concetto di Underground Urban Node per la città, riflettendo quelli che erano stati I principi, le visioni e i modi di pensare del GECUS.

> *"Ad oggi il complesso è la seguente concezione del GECUS: una piattaforma di scambio che integra le varie forme di trasporto con parcheggi, stazioni degli autobus e pedoni; enormi scavi a cielo aperto; e spaziale sovrapposizione dei diversi uffici e funzioni, per formare un NODO di scambi commerciali e circolatori nel centro di Parigi".*

[15] ibid.

Sulla base di queste articolazioni, la ricerca ha iniziato a identificare questi spazi sotterranei come nodi urbani sotterranei (UUN). Queste entità svolgono un ruolo molto importante nelle città contemporanee per quanto riguarda la tipologia utilizzata.

B - Tipologie Contemporanee di Spazi Urbani nel Sottosuolo.

Esistono differenti metodologie utilizzabili per pianificare, progettare e localizzare gli spazi urbani sotterranei nelle città contemporanee.

In una delle lezioni di *Jacqus Benser's* [16], egli separò gli spazi urbani sotterranei pianificando due differenti classificazioni. La prima suggerisce l'utilizzo di un masterplan per il sottosuolo.[17]. Così facendo, la morfologia sotterranea è separata da quella della superficie della città. Lo spazio sotterraneo disegnato ha differenti priorità e approcci. Non presenta una forte influenza dal livello sovrastante della città. Un esempio di tale tipologia è il master-plan per la città sotterranea di Helsinki.

Segue la metodologia del processo di pianificazione dell'uso del territorio introdotto dal dipartimento immobiliare, di divisione geotermica della città di Helsinki. *Ilkka Vähäaho* [18] ha spiegato il processo di pianificazione territoriale attraverso studi svolti dal dipartimento immobiliare della città di Helsinki. L'idea dipende principalmente dalle risorse sotterranee esplorando le aree sotterranee rocciose e scavando in esse. Il substrato roccioso consente di ospitare infrastrutture sotterranee e viene utilizzato principalmente per contenere il sistema di riscaldamento termico della capitale nelle gallerie sotterranee da distribuire, raggiungendo gli edifici delle case fuori terra. È tra questi tunnel che vi si trovano alcuni degli Urban Underground Spaces[19]. Importante è la nota che *Ilkka Vähäaho* scrisse a tal proposito: "un primo sondaggio

[16] Jacques Benser is a consultant in urban underground space planning, the municipal planner that was in charge of the Montréal Underground City development and the ACUUS (Associated research Centers for the Urban Underground Space) General Manager.

[17] "D1 S1 3 Jacques Besner | Underground space (also) for people: Cities think underground," YouTube video, 40:25, posted by " COST Sub-Urban," March 28, 2017, https://www.youtube.com/watch?v=_Rts6CQkzgc.

[18] Ilkka Vähäaho is the head of the division and a member of the Steering Board of the ITA Committee on Underground Space.

[19] Ilkka Vähäaho, *Urban Underground Space - Sustainable Property Development in Helsinki*, (Helsinki, Recommended Oy / Niina Kummu, 2014), https://www.hel.fi/static/kv/Geo/urban-underground-space-print.pdf.

esamina l'area e i livelli di elevazione ad Helsinki adatti alla costruzione di grandi strutture a spazio aperto[20]". La rotta principale seguita in questo caso è stata la geologia rappresentata dal tipo di terreno. Questa è la causa principale dietro una morfologia di segregazione e di totale indipendenza nella forma dello spazio sotterraneo.

La seconda metodologia di pianificazione degli Urban Underground Spaces è data da: uno sviluppo del piano dello spazio sotterraneo inclusa all'interno della superficie della pianificazione del master-plan della città[21]. Questo approccio è quello che la tesi condivide.
In tale tipologia, gli spazi sotterranei sono più interessati a quanto accado nella città fuori terra. Si tratta del risultato di quelli che sono i bisogni della città e del suo ritmo urbano. Per essere inclusa come parte di master-plan, ci sono diversi fattori che influenzano la composizione degli spazi morfologici. Questo è uno dei temi che la ricerca si propone di argomentare.

Gli spazi sotterranei hanno un carattere fenomenologico nell'essere inclusi nella pianificazione della città, componendo un ritmo di sistemi verticali di spazi ibridi con differenti caratteristiche e con assetti fondamentali.
Jacques Benser ha scritto alcune raccomandazioni per la pianificazione dello spazio sotterraneo urbano [22] nel contesto urabno. Una di queste raccomandazioni era la ricerca del miglioramento dell'integrazione degli spazi sotterranei nella città sopra. Scrisse:

> *"Lo spazio urbano sotterraneo, allo stesso modo degli altri spazi, dovrebbe essere considerato nella pianificazione generale della città. I progetti immobiliari pubblici e privati dovrebbero essere ad usi misti tramite l'integrazione di spazi pubblici e servizi per tutti i cittadini, senza esclusione sociale. Favorire una continuità spaziale tra l'esterno e l'interno dovrebbe garantirebbe l'eventuale collegamento con la superficie[23]".*

[20] Ilkka Vähäaho, "Land use: Underground resources and master plan in Helsinki," in *The Society for Rock Mechanics & Engineering Geology,* Research Publishing, Singapore (2013), p: 36.
[21] "D1 S1 3 Jacques Besner | Underground space (also) for people: Cities think underground," YouTube video, 40:25, posted by " COST Sub-Urban," March 28, 2017, https://www.youtube.com/watch?v=_Rts6CQkzgc.
[22] These recommendations were based on the [Agenda 21, the Rio Declaration on Environment and Development, the Statement of Forest Principles, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity].
[23] Jacques Besner, "The Sustainable Usage of the Urban Underground Space," *Assosiate research Centres for the Urban Underground Space*, 2018, https://www.acuus.org/index.php/what-is-acuus/the-urban-underground-space.

Ha sottolineato l'importanza della relazione tra il terreno e gli spazi sotterranei da integrare insieme. Questo è collegato al concetto di pianificazione dello spazio sotterraneo all'interno del piano generale della città in quanto è una parte influenzata dal terreno.

Ulteriore modo di categorizzazione fu ideato da *Chiara Delmastro, Evasio Lavagno, Laura Schranz* [24]. Loro classificarono gli spazi sotterranei in due tipologie:

1- Master Plans: generale.
2- Sectorial Plans: specifico.

Il primo tipo indica un piano generale completo di tutti gli spazi che si trovano sotto la superficie della città. Comprende l'infrastruttura, i sistemi fognari, gli impianti tecnici, le funzioni vivibili e altri. Dal punto di vista degli autori, poiché questo tipo è più generale, si occupa principalmente di risolvere i problemi di pianificazione prendendo in considerazione tutti i fattori come la capacità di infrastruttura, i bisogni della gente, le politiche di proprietà della metropolitana ... ecc.
Il secondo tipo indica solo una parte del grande piano generale a seconda della funzione dello Spazio urbano sotterraneo. Questo tipo è più specifico e funziona in un'area più piccola della città. Riflettendo le esigenze della città in una particolare parte del suo contesto. A tal proposito il piano è diviso in tre sottocategorie: installazioni per commercio e tempo libero, sistemi relativi alla mobilità (persone e merci) e sistemi tecnici[25].

La categorizzazione che gli autori hanno fatto per i piani settoriali non è sufficiente. Può funzionare negli spazi sotterranei di una funzione. Ma la città di oggi ha bisogno di funzioni miste più complicate e, in molti casi, non può accettare lo spazio delle funzioni mono in particolare nelle aree di grandi dimensioni. Oggi lo spazio urbano sotterraneo multifunzionale è richiesto specialmente nelle aree congestionate.

[24] The mentioned authors are working in the Energy Department, Politecnico di Torino, Italy.
[25] Chiara Delmastro, Evasio Lavagno, Laura Schranz, "Underground urbanism: Master Plans and Sectorial Plans," *Tunnelling and Underground Space Technology* 55 (2016), pp: 103–111.

In altre parole, *Monique Labbé* [26] ha inventato una nuova tecnica di categorizzazione. Ha diviso il metodo di pianificazione degli spazi sotterranei in quattro diverse categorie.
Il primo è il piano generale per il piano del sottosuolo, separato dalla città sopravrastante, come indicato da Benser. Successivamente vennero però stilate tre nuove classificazioni che possono essere ricondotte al secondo tipo di Benser.

1- Reti: metropolitane o passaggi;
2- Opere isolate non connesse (strutture isolate): strutture tecniche, industriali o pubbliche (commerciali, culturali, sportive, di intrattenimento, ecc.);
3- Strutture collegate: strutture collegate al loro ambiente o ad altre strutture (strutture industriali, aree commerciali, stazioni della metropolitana, logistica, ecc.) Che hanno portato anche alla revisione di un **distretto**[27]**.**

Questo terzo tipo è uno dei caratteri dei **nodi** urbani della città ben collegati al contesto urbano circostante, fungendo da cerniera per legare le diverse parti della città, fornendo le strutture più necessarie. Ciò sta portando ad un'altra caratteristica di questi nodi, per fornire più strutture e attività: quella dell'uso misto.
Monique Labbé sottolinea come il miglioramento degli usi e delle attività di miscelazione negli spazi sotterranei urbani avviene attraverso il collegamento ad altre attività correlate sul terreno, in modo che i livelli delle città possano essere congiunti funzionalmente e morfologicamente. Ha anche raccomandato di evitare la sola presenza di attività tecniche nel sottosuolo, introducendo così spazi più vivibili - commerciali, culturali, sportivi, di intrattenimento - in modo che lo spazio sotterraneo possa essere umanizzato ospitando più visitatori. Questo fu uno dei motivi di critica nei confronti del progetto per la La Defense caratterizzato dalla presenza per lo più attività tecniche sotto la piattaforma quadrata e viceversa lodato il Les Halles per aver ospitato, invece, usi misti e vivibili.[28]

[26] Monique Labbé is the President of: Underground Space Committee, AFTES (French Tunneling and Underground Space Association) Founder and General Director of the Ville 10D – Ville d'Idées National Research Project.
[27] Monique Labbé, "Architecture of underground spaces: From isolated innovations to connected urbanism," *Tunnelling and Underground Space Technology* 55 (2016), pp: 153–175.
[28] ibid.

C- Ruolo Strategico.

Gli spazi sotterranei giocano un ruolo veramente importante per le città contemporanee. Possono suggerire soluzioni per le aree problematiche nel contesto urbano e presentano l'ulteriore capacità di enfatizzarle.
Nel suo articolo (Urban underground space: Solving the problems of today's cities – 2015), *Wout Broere* [29] dimostrò quelli che sono i vantaggi dell'inclusione degli spazi sotterranei nell'urbanismo della città e come questi ultimi influenzino la superficie della città su differenti livelli. Per esempio, l'uso dello spazio sotterraneo aiuta le città nell'aumento della domanda garantendo la compattezza. L'offerta sotterranea, offre inoltre, lo sviluppo di fattori contribuenti alla qualità della vita quali: sicurezza, benessere, convenienza, comfort, risolvendo problemi come: congestione del traffico, inquinamento e rumore, protezione contro i disastri naturali, e usi e infrastrutture[30]. Infatti, questi spazi sotterranei possono avere differenti luoghi, forme o dipendere da differenti ruoli.

Questo fu spiegato da *Nikolai Bobylev* [31] che scrisse come i Urban Underground Space (UUS) cambiano realtivamente al tessuto urbano e alla strategia di sviluppo della città in questione, così come avviene per i fattori nelle equalizioni.
L'approccio adottato è il fattore che influenza il metodo di risoluzione dei problemi in ogni città attraverso questi UUS poiché anche i risultati ottenuti saranno differenti[32].

Quindi, per esempio, nel paradigma europeo, nel centro storico della città, le piazze pubbliche rappresentano il centro del sistema nervoso degli UUS.

[29] Wout Broere is an assistant professor of Underground Space Technology at Delft University of Technology - Animateur ITA Working Group 20 Urban Problems - Underground Solutions - Member ITACUS ITA Committee on Underground Space.
[30] Wout Broere, "Urban underground space: Solving the problems of today's cities," *Tunnelling and Underground Space Technology* 55 (2016), pp: 245–248.
[31] Nikolai Bobylev from the Institute of Earth Sciences, Saint Petersburg State University, Universitetskaya nab., Saint Petersburg, Russia and a member of Saint Petersburg Research Centre for Ecological Safety of the Russian Academy of Sciences.
[32] Nikolai Bobylev, "Underground space as an urban indicator: Measuring use of subsurface," *Tunnelling and Underground Space Technology* 55 (2016) pp: 40–51.

Wout Broere sottolineò questo scrivendo: "il sottosuolo rappresenta una soluzuone ottimale nelle città storiche che presentano una mancanza di spazio e la necessità di presenrvare il patrimonio e il paesaggio, specialmente nei centri più antichi[33]". Supportando il ruolo strategico delle piazza, descritte come i polmoni della città tradizionale, da Rob Krier and Michael Graves[34]. Questo concetto è compatibile con quello delle visioni pionieristiche riguardanti la necessità dei livelli futuristici nei centri urbani, si rimandano come esempi gli interventi di *Eugène Hénard* and *Édouard Utudjian.*

Questa strategia europea mira a preservare gli edifici storici e a garantire l'utilizzo del livello fuori terra della città principalmente per i pedoni[35]. Questo si riflette negli approcci di composizione morfologica dei nodi sotterranei localizzati al di sotto di grandi piattaforme a spazio aperto (Concrete Platform Planning), che *Monique Labbé* discusse nel caso del Les Halles e La Defense di Parigi.

D'altra parte, nel paradigma dell'estremo oriente asiatico, gli Stati Uniti abbracciano il ruolo delle stazioni e danno loro il supporto strategico nel contesto urbano. Nel 2011 venne pubblicato un articolo di *John Zacharias* [36], *Tianxin Zhang* [37] e *Naoto Nakajima* [38] sotto il titolo di: (Tokyo Station City: The railway station as urban place). Con il loro contributo scientifico, gli autori dimostrarono come il tessuto urbano delle città asiatiche, specialmente in Giappone, è caratterizzato dall'utilizzo delle stazioni intese come "centri urbani di importanza". La stazione viene qui descritta come "nervo centrale" delle strategie di sviluppo della città. Questa trasformazione esiste quanto questi nodi vengono incorporati a differenti usi misti. "Le stazioni ferroviarie e metropolitane sono in effetti centri nevralgici della cosiddetta città "intelligente", in cui la funzione di trasporto svolge un ruolo di supporto e non ha più un ruolo centrale[39]". Enfatizzando il ruolo morfologico che la stazioni offrono tramite la connessione di quest'ultima con il contesto circostante: "Nel caso giapponese, la stazione è racchiusa da nuovi sviluppi e strutture pedonali che hanno ampiamente superato la storica disconnessione tra l'impianto di trasporto e l'ambiente circostante[40]". Questo decodifica del paradigma giapponese dell'estremo oriente in cui le stazioni sono il centro nevralgico del piano di sviluppo UUS. Segue la visione di "Intelligent City" in cui la stazione è chiusa dalle infrastrutture della rete pedonale.

Ultimo modello è quello del Nord America, dove il centro nervoso del piano di sviluppo UUS è il CBD (Central Business District, Distretto Centrale Finanziario). A causa della sua larga scala e delle congestioni del traffico, quest'area è problematica per i pedoni. Lo spazio sotterraneo in questo caso cerca principalmente di fornire una soluzione per il problema menzionato. Questo è il motivo per cui la strategia in questo paradigma mira ad avere una rete pedonale sotterranea che intersechi e connetta i nodi di attività diffusa rappresentati morfologicamente come tunnel sotterranei.

Donald Reis [41] afferma che il Central Business Distract (CBD) ha bisogno di un sistema pedonale a causa della sua espansione. Questo tipo di distretto di solito si trova di fronte a congestioni e conflitti tra pedoni e reti di veicoli. "Il movimento pedonale nel quartiere centrale degli affari è la forma di trasporto più trascurata [42]". Per questo motivo, e anche a causa delle condizioni climatiche, ha affermato che la risposta della comunità a questi problemi è lo sviluppo di un sistema pedonale controllato dal clima, sia al di sopra che al di sotto del livello di terra. Tuttavia, raccomandò l'inclusione di più spazi funzionali nel sottosuolo. Egli scrisse: "Le aree sotterranee offrono anche la possibilità di creare "spazi per le persone" che potrebbero non essere appropriati

33 Wout Broere, "Urban underground space: Solving the problems of today's cities," *Tunnelling and Underground Space Technology* 55 (2016), p: 247.

34 Rob Krier, *Town Spaces*, (Basel: Editor Birkhäuser Architecture, 2006) pp: 6-7.

35 Angelo Bugatti, *Underground design: In the dense city and in the landscape*, (Santarcangelo di Romagna: Maggioli Editore, 2010) pp: 15-18.

36 John Zacharias from the Department of Geography, Planning and Environment, Concordia University, Montreial, Canada.

37 Tianxin Zhang from the College of Urban and Environmental Sciences, Peking University, Beijing, China.

38 Naoto Nakajima from the Faculty of Environment and Information Studies, Keio University, Fujisawa, Kanagawa, Japan.

39 John Zachariasa, Tianxin Zhangb, Naoto Nakajimac, "Tokyo Station City: The railway station as urban place," URBAN DESIGN International 16, n.4 (2011), p: 250.

40 John Zachariasa, Tianxin Zhangb, Naoto Nakajimac, "Tokyo Station City: The railway station as urban place," URBAN DESIGN International 16, n.4 (2011), p: 251.

41 Donald Reis was formerly program manager, Central Business District Division, Department of Urban Planning, Dallas, Texas. He worked also as a master planner with Triland International, Inc., Dallas, Texas.

42 Donald Reis, "Public-private cooperation in developing an underground pedestrian system," *Underground space* 6, no. 166 (1982): 337.

ai livelli secondari della struttura [43]". Tale descrizione, intesa come l'"Interno Continuo", è un concetto discusso attraverso le utopie e le distopie di numerosi architetti. Un esempio è rappresentato dalla No-Stop City del 1969 degli Archizoom Assosiati. Il futuro della città rappresentata nei loro disegni, era la visione di uno spazio interno controllato climaticamente. [44]

Molti furuno gli architetti che influenzati da tale concetto, come *John Portman*[45] che in una delle sue interviste affermo: "Dal mio ufficio io posso attraversare tutta Francoforte in Germania, senza indossare il mio cappotto, o bagnarmi. Io esco fuori e prendo un treno nella città sotterranea. Cosa diavolo c'è di svagliato in questo?[46]". Una tale affermazione suggerì, anche ad altri, quelli che sono le potenzialità e i valori degli spazi pedonali sotterranei, come accadde per *Pierre Bélanger* [47]. L'autore crede che sia davvero essenziale considerare queste infrastrutture come parte insita e inscindibile del paesaggio urbano. La sua visione concorda con l'importanza dell'uso pedonale nel sottosuolo per favorire i collegamenti con l'area del CBD[48].

D'altra parte, altri hanno criticato questo isolamento della rete pedonale nel livello sotterraneo. Vincent James e Jennifer Yoos hanno descritto questo fenomeno come "Demografia sezionale" indicando come gli ambienti urbani multilivello rafforzino le divisioni sociali ed economiche. In accordo anche con Henri Lefebvre[49] eDavid Harvey[50]. Hanno criticato la separazione della rete pedonale dalle strade e dagli spazi pubblici in quanto possono segregare popolazioni lungo le linee di razza, classe o genere [51] eccetto per quanto accade nei centri europei o asiatici – a causa dell'assenza di uno spazio di rete sotterraneo su larga scala.

L'ultima parte mostra la differenza nel ruolo fornito degli spazi sotterranei urbani in ogni paradigma. Non è possibile condannare nessuna delle soluzioni o idee senza comprendere e analizzare il tessuto urbano circostante e il modo di vivere della società. È importante notare che le motivazioni e le potenzialità degli spazi sotterranei urbani sono diverse da un contesto all'altro e da uno stile di vita all'altro.

D - Conclusion

Gli "Urban Underground Space Nodes" presentano differenti ideologie e designazione dallo stile di vita a un altro a seconda dell'approccio strategico scelto - Underground Complex o Underground District in Europa, Transportation Hub in Giappone (Asia) e Underground Network in Nord America - mentre tutti hanno alcune caratteristiche comuni che la maggior parte degli autori precedenti ha concordato:

1- As was mentioned by *Sanja Durmisevic* that agreed with the vision of *Henard* the French pioneer who wrote that the city center will be always the busiest part and she added that it's having high demand. Also she added that if we are not taking care about developing the city center and not apply it's demands of time, it will be deserted and the activities will move to the city peripheries. In that case the center will lose its value. So, the city center should be enriched always by the con1- Come è stato accennato da Sanja Durmisevic che concorda con la visione di Henard, il pioniere francese che ha scritto che il centro città sarà sempre la parte più attiva e ha aggiunto che sta avendo una forte domanda. Inoltre ha aggiunto che se non ci occupiamo dello sviluppo del centro città e non applichiamo le sue richieste di tempo, sarà deserta e le attività si trasferiranno nelle periferie della città. In tal caso il

[43] ibid.

[44] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) p: 224.

[45] John Portman was an American neofuturistic architect and real estate developer widely known for popularizing hotels and office buildings with multi-storied interior atria.

[46] Corydon Ireland, "High art with a human touch," The Harvard Gazette, March 2013, https://news.harvard.edu/gazette/story/2013/03/high-art-with-a-human-touch/.

[47] Pierre Bélanger: Associate Professor, Department of Landscape Architecture; Co-Director, Urbanism, Landscape, Ecology Program.

[48] Pierre Bélanger, "Underground landscape: The urbanism and infrastructure of Toronto's downtown pedestrian network," *Tunnelling and Underground Space Technology* 22 (2007) pp: 272–292.

[49] Henri Lefebvre was a French Marxist philosopher and sociologist, best known for pioneering the critique of everyday life, for introducing the concepts of the right to the city and the production of social space, and for his work on dialectics, alienation

[50] David Harvey is a distinguished professor of Anthropology & Geography at The Graduate Center, CUNY.

[51] Vincent James, Jennifer Yoos, *Parallel cities: The multilevel metropolis*, (New York, USA: Walker art center publications, 2016) p: 228.

centro perderà il suo valore. Quindi, il centro città dovrebbe essere arricchito sempre dalle esigenze contemporanee necessarie[52]. Gli UUN sono in grado di fornire l'evoluzione del centro città con quelle nuove funzioni necessarie alla contemporaneità.

2- Gli spazi UUN devono essere mescolati all'uso con attività vivibili che aiutano ad attrarre e umanizzare questi nodi. Allo stesso tempo questi usi dovrebbero soddisfare i bisogni della gente.
3- Gli spazi UUN devono essere ben collegati al contesto urbano circostante e mai isolati dal tessuto urbano. Risulta essere fondamentale per il servizio di trasporto tra le diverse parti della città.

D'altra parte presente erano anche alcuni conflitti tra i diversi punti di vista. Questi riguardavano principalmente la qualità degli spazi sotterranei in relazione al contesto urbano fuori terra. Ad esempio, *Sanja Durmisevic* sosteneva la netta separazione tra pedoni e traffico, fornendo meno confusione e una migliore mobilità di ciascun gruppo per i diversi livelli di città. *Clément Demers* [53] ha sostenuto questa idea mentre suggeriva di impostare la rete pedonale nel sottosuolo migliorando la qualità urbana in quanto tale proposta può ridurre i veicoli nelle strade della città [54]. *Monique Labbé* critica invece tale punto di vista, sottolineando l'importanza di integrare lo spazio sotterraneo con il contesto urbano sul terreno per migliorare la qualità di entrambi gli spazi sotterranei. Ha enfatizzato i valori dell'integrazione che può aiutare a raggiungere la combinazione tra i diversi livelli della città sostenendo che la segregazione tra questi ambienti può influenzare la qualità sia degli spazi sotterranei che di quelli fuori terra[55].

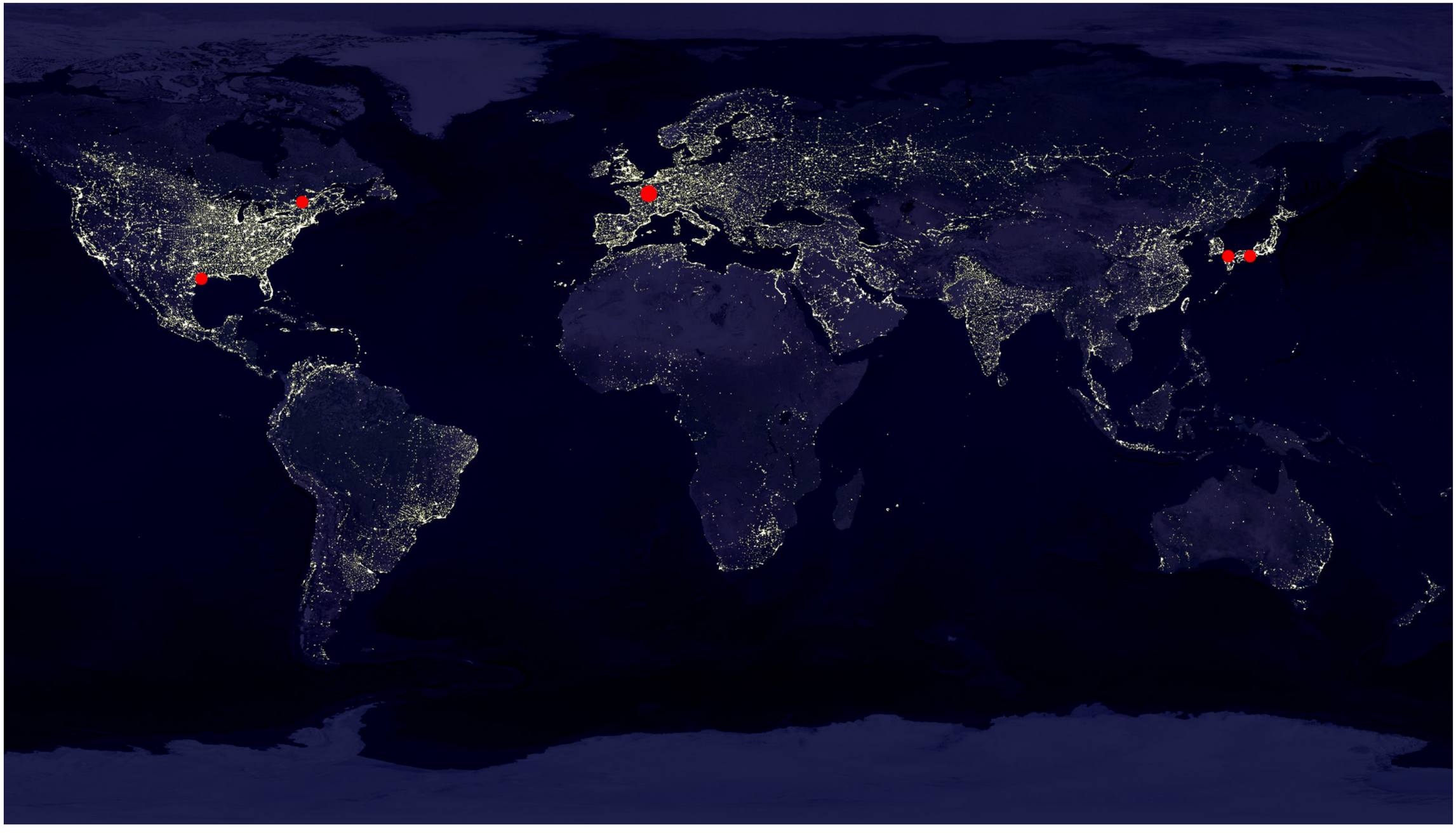
Tutti questi autori hanno avuto opinioni contraddittorie in quanto si riferivano a casi diversi situati in diversi contesti con stili di vita urbani diversi. Le opinioni discordanti sono sviluppate

[52] ibid.
[53] Clément Demers: General Manager of Quartier International de Montréal (QIM – now renamed AGIL), a non-for-profit organization in charge of a large-scale development and revitalization project in downtown Montréal, including the extension of the Indoor pedestrian network (known as the Underground City) and a board member of ACUUS directors.
[54] Clément Demers, "Over & underground spaces & networks integrations a case study: the international district of Montreal," *Procedia Engineering* 165 (2016) p: 728.
[55] Monique Labbé, "Architecture of underground spaces: From isolated innovations to connected urbanism," *Tunnelling and Underground Space Technology* 55 (2016), p: 154.

a causa della presenza di alcuni fattori mancati, influenzati da altri approcci e dalle strategie di sviluppo seguite. Questo è ciò che sosteneva Jacques Benser. Egli ha sottolineato l'importanza dell'interdisciplinarità nello studio dello spazio sotterraneo, in quanto non ha lo stesso significato per un architetto o un urbanista. Questo è il motivo per cui molti professionisti stanno sostenendo i pianificatori in quanto quel processo di pianificazione attuale non prende in considerazione molti attori, il che sta influenzando sia gli ambienti superficiali che quelli sotterranei. Ecco perché, per avviare un piano di sviluppo, vari attori in maniera collaborativa, dovrebbero essere coinvolti. Ciò richiede una conoscenza minima e il rispetto delle altre professioni[56].

Per tale motivo, questa tesi lavorerà su due discipline o per meglio dire due differenti approcci: la composizione spaziale degli UUN e le strategie per lo stile di vita urbano nelle città ospitanti. Ma per ottenere ciò, sarà necessario un quadro analitico unificato per semplificare la complessità degli spazi UUN nei vari tessuti urbani per comprendere le differenze tra i diversi casi e per essere in grado di decodificare eventuali spazi critici. Questo metodo verrà applicato nella prima parte della ricerca per studiare le differenze di composizione spaziale nei diversi casi di studio. La seconda parte, invece, sarà dedicata a comprendere l'impatto sulle sullo stile di vita urbano nelle città ospitanti per il raggiungimento dell'obiettivo finale.

[56] Jacques Besner, "Underground space needs an interdisciplinary approach," *Tunnelling and Underground Space Technology* 55 (2016) p: 225.



Character of Urban Underground Nodes (UUN).

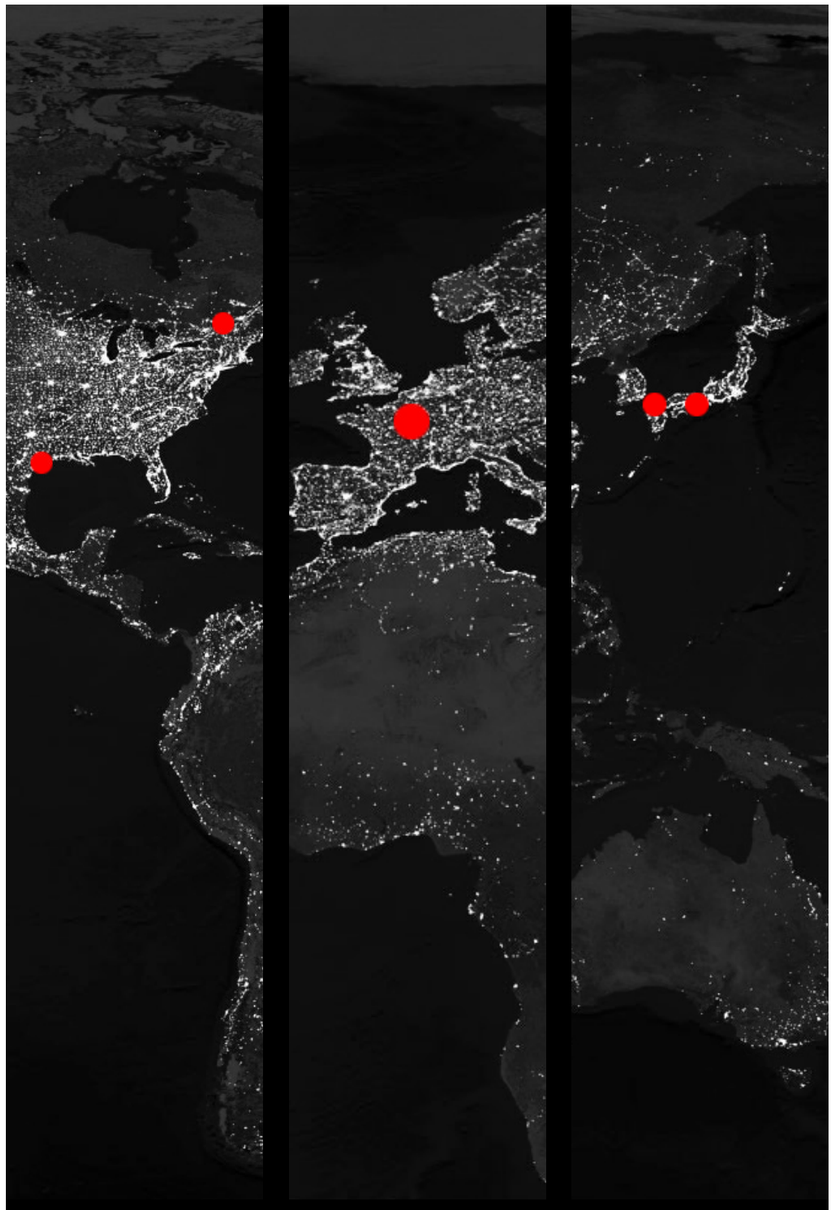


Figure: A

Figure: B

Figure: C

A. UUN Spatial Composition.

1. UUN Study Cases Analysis.

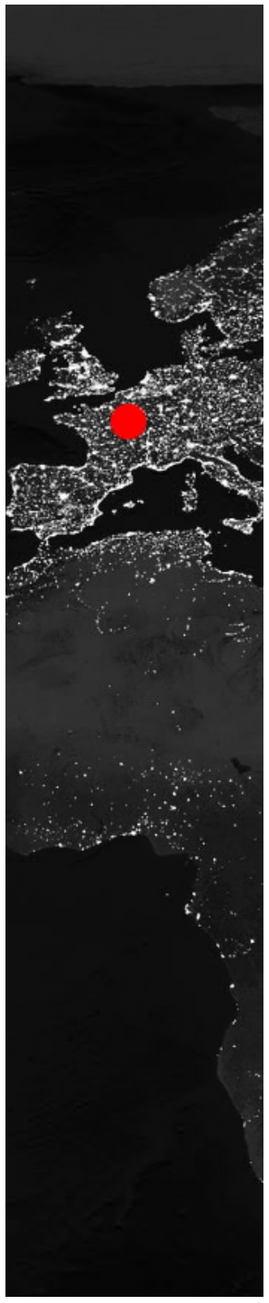
Character of selected UUN cases.

The research is working on six cases that are located in three different parts of the world, Europe, North America and the Far East. The base of choosing the study cases is the complexity of the included functions and the variety of spaces that are exceeding the size of the architectural context in each area, trying to provide public services and activities that the city needs in a condense urban tissue, which is located in metropolitan cities. The role of the chosen UUN is to facilitate the inhabitants' lifestyle through adding this underground space, which is providing various uses and activities that the city is deprived of. These spaces also are having a strong connection role in the urban context either to pedestrians, cars drivers or the metropolitan users through an underground pedestrian network or underpasses to pedestrians, parking lots to cars drivers or direct metropolitan connections with underground metro stations.

The first two cases are Les Halles and Carrousel du Louvre. Both of them are located in Europe, the French capital city of Paris. Both cases are positioned in the historical center of the European capital.
From North America, Houston underground located in Texas state on the east coast of the United States of America. This case is positioned in the downtown of the city known also as Houston Tunnels System. Adding to that, from the Canadian territory the research is including Montreal underground city, known as RESO located in the downtown of Montreal where the Central Business District is. On the other hand, from the Far East, two examples were chosen to be analyzed and both are located in the Japanese territory. One is located in Osaka which is Crysta Nagahori and the other is Tenjin that is placed In Fukuoka. Both Japanese cases are inserted under main boulevards in the urban context of the hosting cities.

The diversity of location regarding the chosen study cases is aiming to find out the different used typologies in different parts of the world with dissimilar context and diverse lifestyles. This is taking place through an analytical framework that is obtaining categorization of the spatial composition of the UUN through the reading of different compositional aspects such as location, density, connections, form, organization and size.

Character of Urban Underground Nodes (UUN).



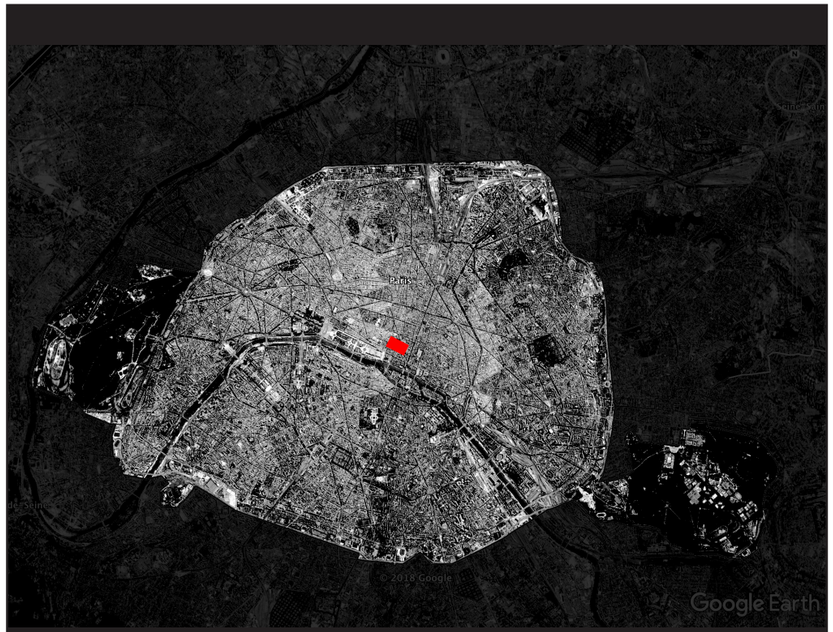
1.1.European Cases.

1.1.1. Les Halles UUN.

Paris, France, Europian Territory.

48°51′44.41″ N, 2°20′41.05″ E

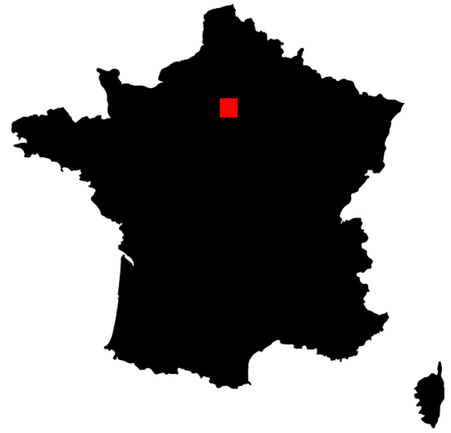
The Les Halles underground project was one of the pioneers regarding the underground complexes. It was planned by Utudjian and Renaud Heim de Balsac in1967 and continued until 1970. Now the intervention with the over ground is under construction through establishing the Forum de Les Halles – designed by Patrick Berger and Jacques Anziutti - and the public spaces is under construction to be redesigned. This area is considered one of the most important ones regarding the metropolitan transportation network, as it is a meeting point between the metro and RER system underground. Adding to that, it is including several functions like sports area with underground swimming pool, cinema complex, triple height exhibition open area, commercial center and underground parking lots.



Map: 1

Map: 2

Position.



Position

Density

Connection

Profile

Organization

Size

UUN Location

UUN Form

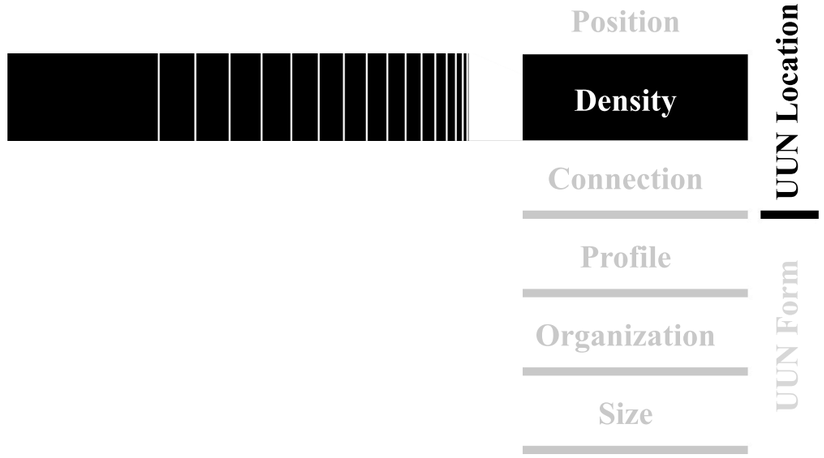
The UUN space in this case is located in the old historical center of Paris or as it is called “the belly of Paris” in the French European territory (Map 1). It is noticed that it is placed between historical urban context of buildings. In the light of that, the UUN space itself is positioned exactly under the public space of the main square where an old market existed, surrounded with the cultural historical buildings such as Bourse de commerce building and Saint-Eustache church.

The urban context of Paris is having a transformation specifically in this area. As it can be seen in (Map 2) the urban tissue is consisting of compacted close up buildings with very tight strait streets, while between all that, there is the open public space of the urban squares that are diffused in the city layout. The UUN is replaced in this vibrant area, which is representing a mutation node in the city’s urban consolidated context where the rhythm is changing by having a large inbuilt area in the urban plan.

Les Halles Urban Underground Node, Paris, France, European Territory.

7 - The over ground urban context of Les Halles area, abstracted and presented to show the density and compactness of the built up area aside with the open public squares in less density of horizontal lines.

Density.



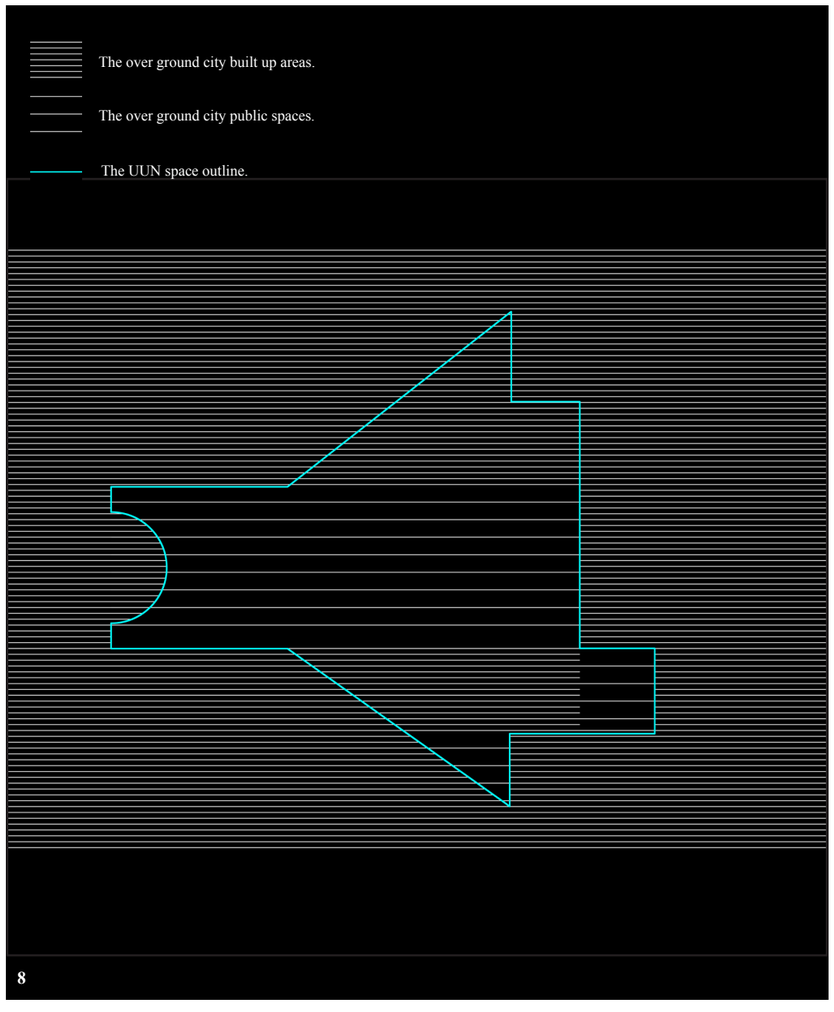
Regarding density of buildings in the case study Les Halles (Diagram 7) the city is having very compact context of buildings with narrow streets, while the main lung is the shapes with less density. These areas are the public spaces in this urban zone's tissue. The biggest dimension area in the middle is the Jardin Nelson Mandela (Ex-des Halles), and the square is the Fontaine des Innocents, while the triangle down is the new public space where Bouche de métro Guimard was placed as an entrance to the underground and the metropolitan station and the small square on the right is where Fountain of the Innocents is located.

The UUN space is positioned mainly under the low-density space. There are some parts that are expanding under the surrounding streets or some built up areas around Jardin Nelson Mandela and Chatelet les Halles, but the underground space is mainly laying under the mentioned open public spaces in a compact urban tissue at the underground level (Diagram 8). That is demonstrating the strategy of locating the UUN space under the lowest density area in the city lay out.

In (Diagram 9) the underground space is abstracted in a way to expose the type of context on the top of the UUN. The vertical lines are referring to the streets, the uncondensed horizontal lines are pointing out the open spaces, squares and gardens, while the condensed horizontal lines are referring to the built up areas on the top of the UUN. This is decoding the relation between the underground location in parallel with the over ground covering context. The public open space is the dominant covering type over Les Halles UUN.

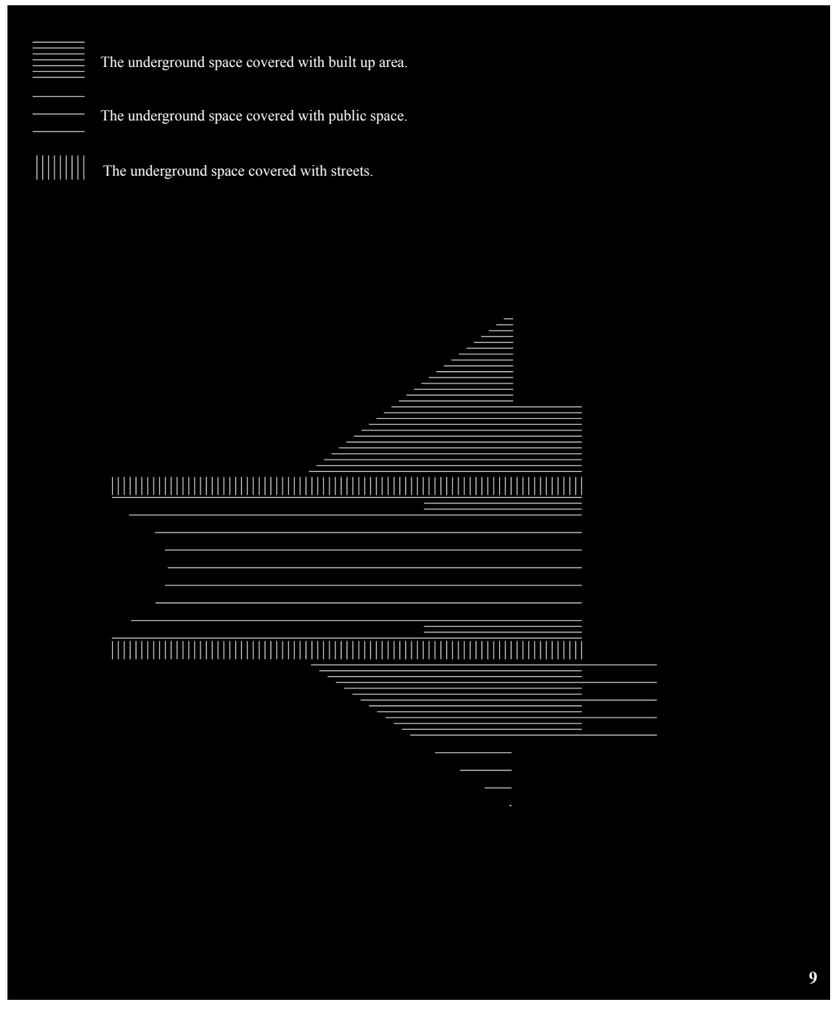
Les Halles Urban Underground Node, Paris, France, European Territory.

8 - The over ground urban context of Les Halles area, abstracted and presented to show the density and compactness of the built up and open spaces areas. In light blue line, the abstracted outline of the UUN.



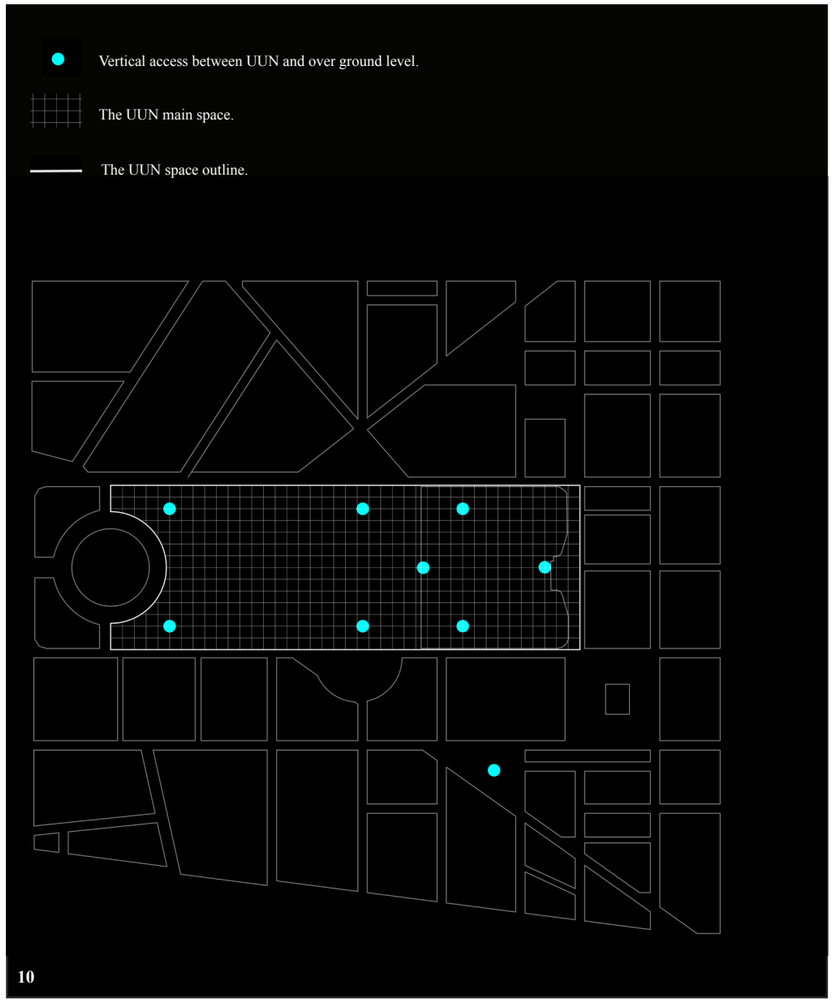
Density.

9 - The UUN form presented with different lines directions that referes to the covering type of context: streets, built up or open space area.

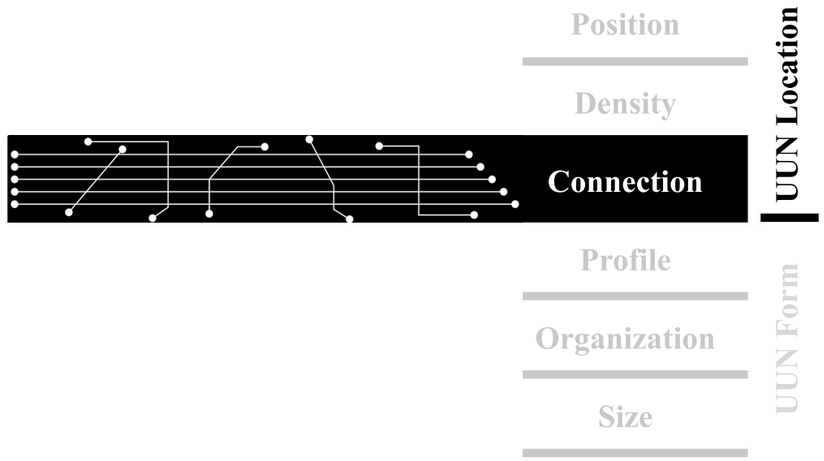


Les Halles Urban Underground Node, Paris, France, European Territory.

10 - The vertical access points between the over ground and the underground level, demonstrated in light blue dots in the urban context, which is represented with white lines.



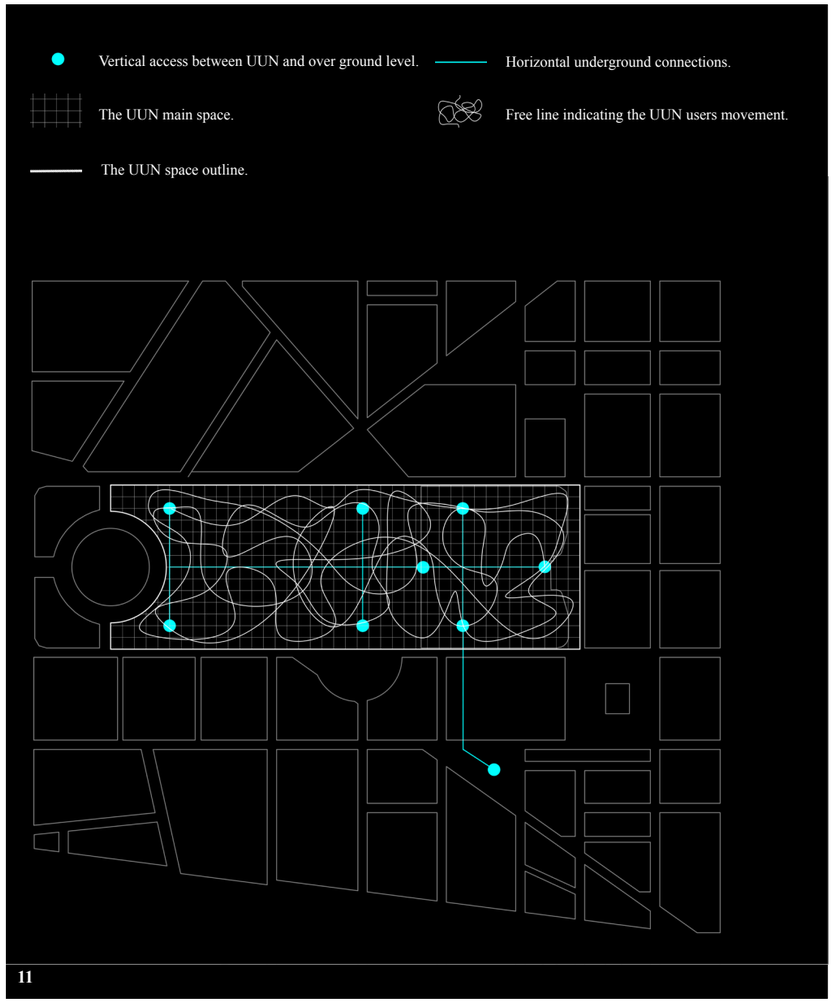
Connection.



The UUN space in Les Halles is connected to the pedestrian network through vertical connections where most of the arriving points and access thresholds are all located on the edges covering public spaces. Porte du Jour is the access on the border between Rue Coquillière and Terrain d'Aventure du Jardin Nelson Mandela, from the north, Porte du Louvre from the south on the border between Terrain d'Aventure du Jardin Nelson Mandela and Rue Berger. Another two access are on the border of Espace Enfants, Porte du Saint-Eustache from the north with Rue Rambuteau and Porte Pont-Neuf from the south with Rue Berger and an access from Rue Pierre Lescot on the right also under the shade of the forum which is Porte Lescot. There are two main access subtracted from the strait built up area under the shade which are Porte Rambuteau from Rue Rambuteau on up right the figure and Porte Berger from Rure Burger on the buttom right of the figure. There is another access to the underground open exhibition under the forum shade from the garden and there is a separated one in Rue des Halles, which is Porte Marguerite de Navarre - Sortie 1. It is important to note that most of these vertical accesses to the UUN node of Les Halles are located in open public spaces, either gardens or urban squares (Diagram 10).
All these accesses are in a direct contact with the over ground urban context as they are all having strong relation with the surroundings streets. For example Porte du Jour between the trends of Rue du Jour with Jardin Nelson Mandela. Also Porte du Saint-Eustache is the intersection point between Rue de Turbigo and the Les Halles Piazza while from the south, the Porte Pont-Neuf is the intersection of Rue du Pont-Neuf with the Piazza. Also Porte Lescot, which is positioned in the extension of Rue de la Cossonneire and Porte Berger in the extension of Passage des Lingeres. All of these accesses points are connected in the united space underground (Diagram 11).
On the other hand the underground space of the UUN is united combined one in the city context (Diagram 12). Thus, the space under is not used as a pedestrian connection because of the small scale and isolation of the node in this case. Though, this node is connected to the city vehicular network by having cars parking underground. Also it is having direct connections from the underground space to two of the main metropolitan stations in Paris, which are Gare de Châtelet and Les Halles. These connections are linking the on foot user of the UUN with horizontal direct connections to the vehicular and metropolitan systems from underground level – through the parking and metro stations - and vertical connection with the Pedestrian Square and gardens over ground.

Les Halles Urban Underground Node, Paris, France, European Territory.

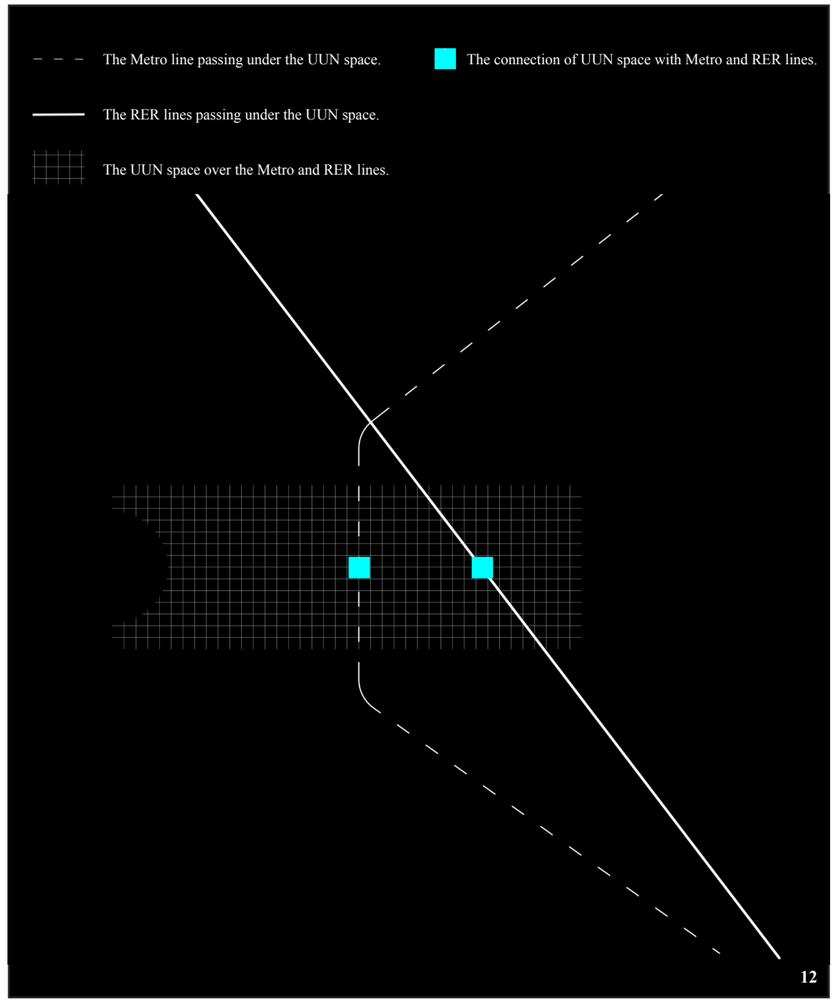
11 - The vertical access points between the underground and over ground levels, in light blue dots and the horizontal accessibility between them in the underground level through the light blue lines. And all these vertical and horizontal accesses are represented in parallel with the urban context.



11

Connection.

12 - Connections between the UUN space and the underground metropolitan transportation systems.

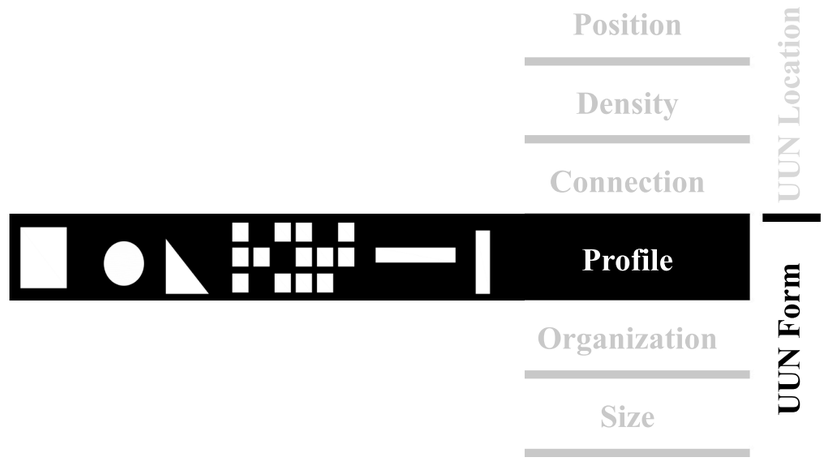


12

Les Halles Urban Underground Node, Paris, France, European Territory.

13 - The UUN space profile abstracted in light blue line that refers to the outline of the underground space .The urban context of the city over ground is simplified and represented in white lines.

Profile.



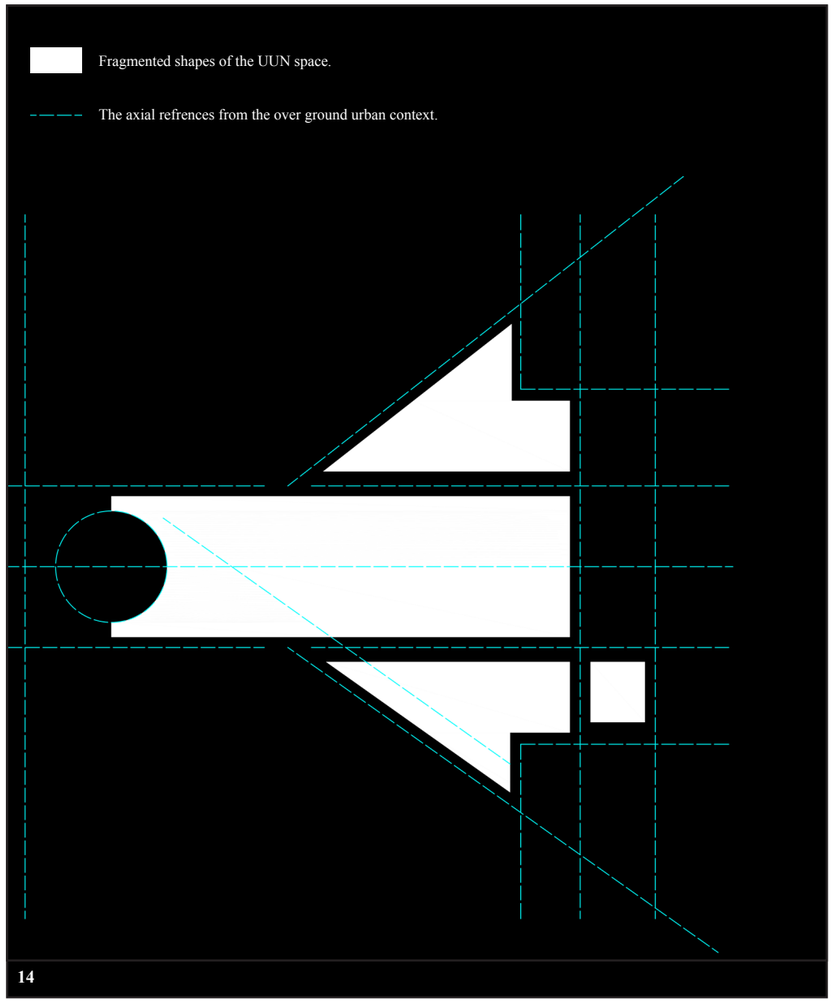
The UUN space of Les Halles is influenced by the upper urban context part. The covering city is consisting of irregular urban figures plots (Diagram 13). Thus, the UUN final shape is a result of several urban shapes, attached together from the city plan shape, creating and producing its final pattern. It is also following the city axis as it is shown in the axial study in (Diagram 14) that is explaining how the final form is based on the city references lines that are an outcome of traces, signs of streets and morphological configuration.

The streets and pedestrian paths that define the over ground area's morphological shapes are representing the city axes (Diagram 14), which are the main factor to influence the underground form to present the final profile as a united void influenced by all the fragmented urban plots over ground (Diagram 15).

The void in this case can be described as a present one in the city context. This presence is coming out of the action of the evident subtraction happening to establish an open underground piazza and punctual skylight system distributed in the covered area and both interventions are attached to the over ground one. The subtracted intervention specifically is very conspicuous to the city user, which is creating a strong visual connection between different levels users, the over ground piazza and the underground new established one. This is enhancing the concept of the underground void presence in the city master plan.

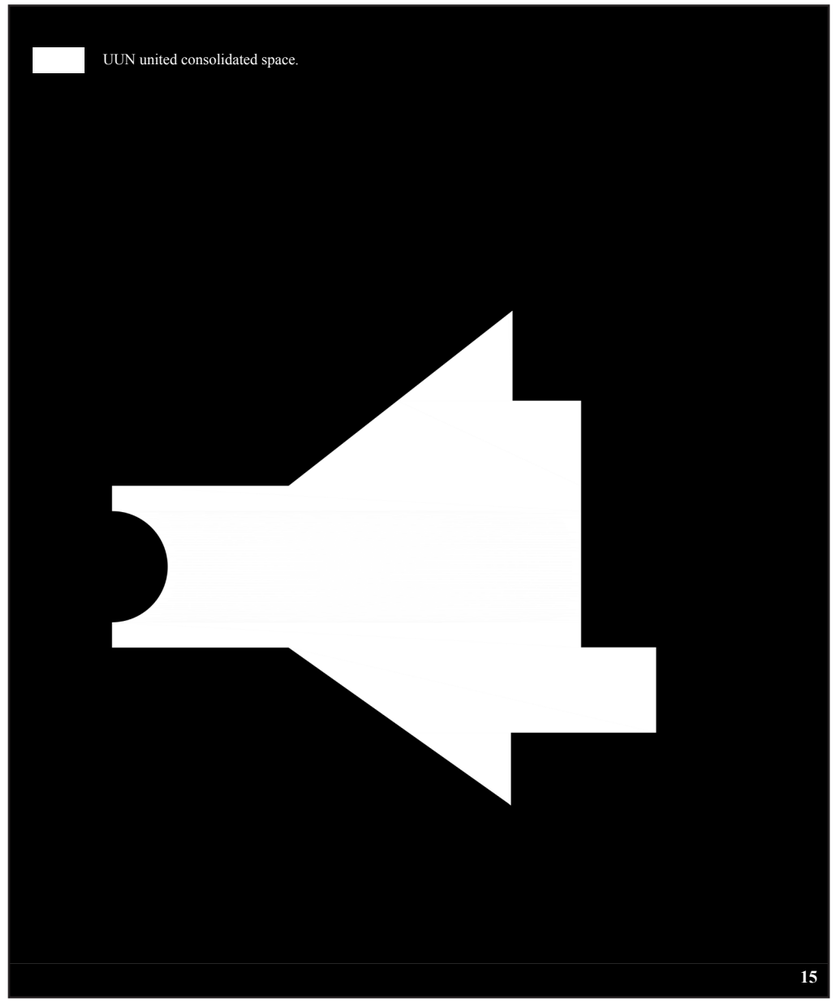
Les Halles Urban Underground Node, Paris, France, European Territory.

14 - The diagram abstracts the axis and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures responding to the overground refrences. The study shows the correspondence in the UUN form to the over ground axial refrences.



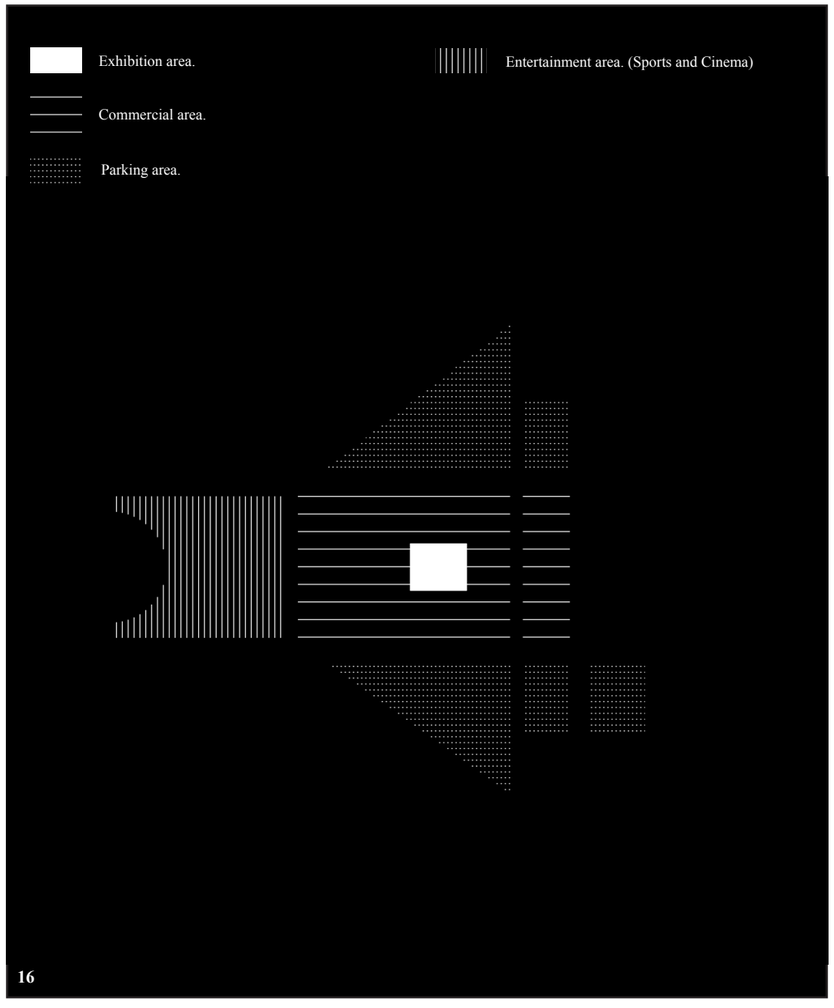
Profile.

15 - The white consolidated shape is the abstraction of Les Halles UUN profile.

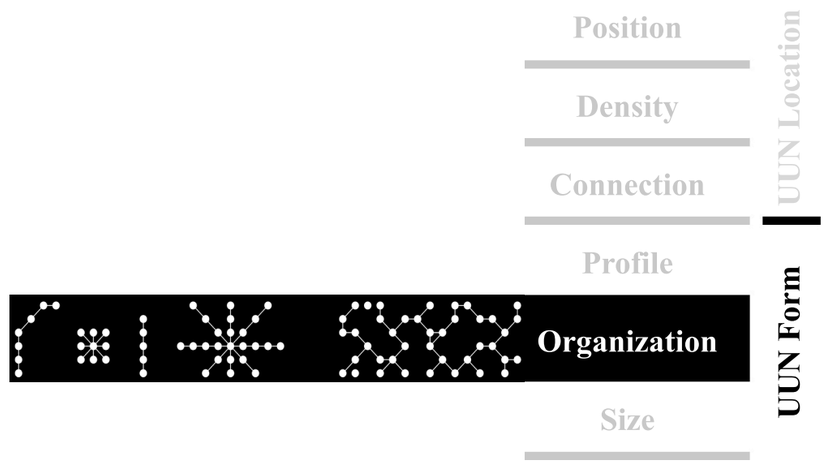


Les Halles Urban Underground Node, Paris, France, European Territory.

16 - The organisation of the UUN different functions spaces.



Organization.



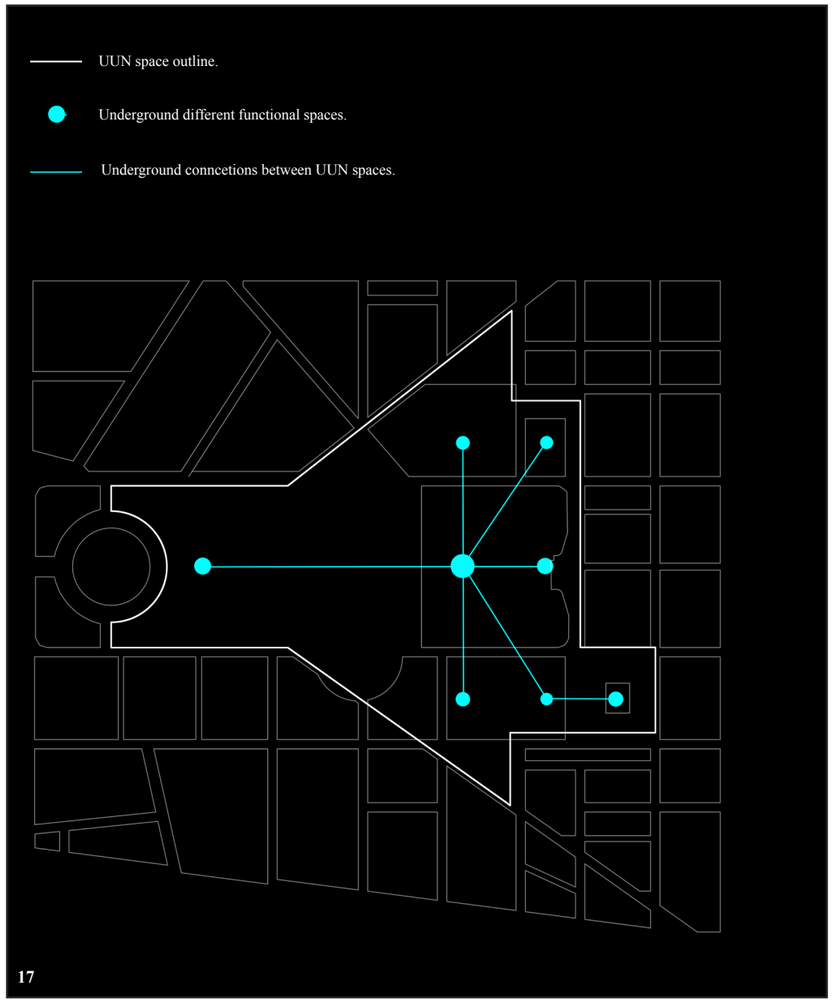
The UUN space in Les Halles is organized as a central way. It is designed as one united space that is containing several functions. It is also a focal point in the urban context as it is a gathering urban spot of different activities, acting as a pivotal node (Diagram 16) that is having essential roles in one multiuse junction. The UUN is containing different functions such as the sports, commercial, entertainment, parking and open exhibition areas in the underground, while all of them organized to be settled together in this one space.

The underground collective areas of the UUN are concentrated in one consolidated space. This unity of space can be noticed also with the over ground urban context and how they are all surrounding this UUN, making it the center of gravity in the covering urban tissue area (Diagram 17). The UUN space is enhancing the role of the above public space by adding more needed contemporary functional spaces in the underground level.

To illustrate, the UUN of Les Halles is considered as a concentrated urban space in the city master plan while the internal different functional spaces inside are united and arranged in a central way around the open exhibition space (Diagram 18).

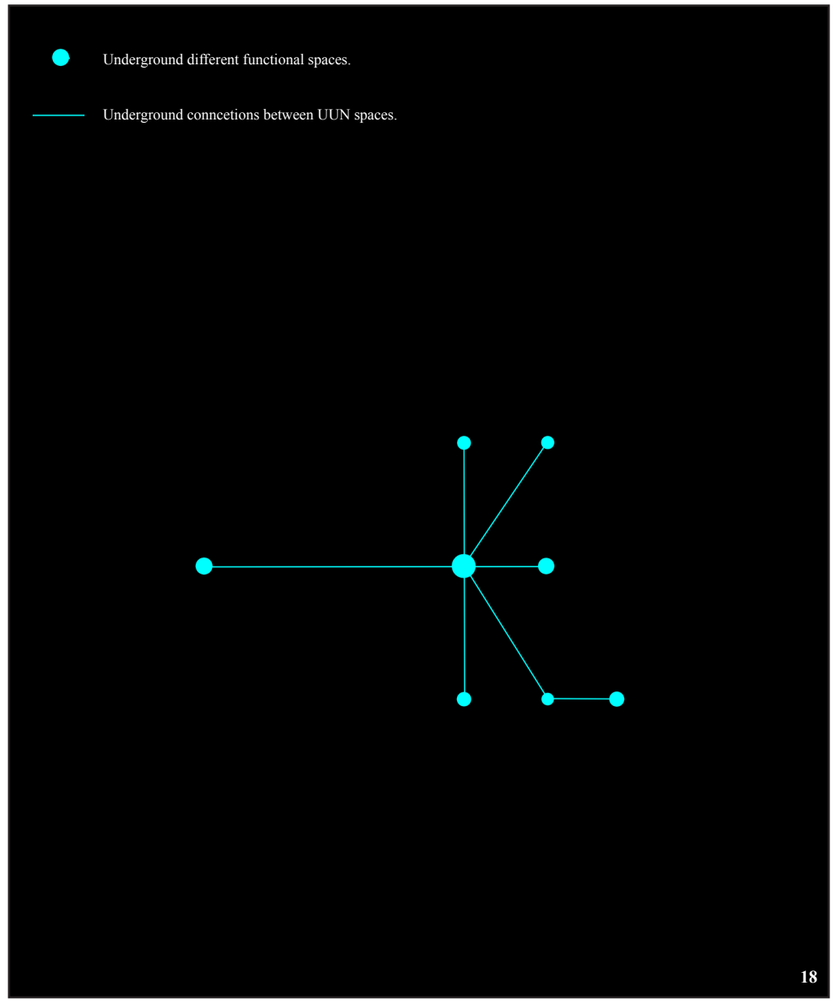
Les Halles Urban Underground Node, Paris, France, European Territory.

17 - The relation between the organization of the UUN space in the urban context of the city over ground and the organization of the internal space itself underground. The light blue dots indicate the several UUN spaces and the light blue lines demonstrate how all-internal spaces are attached and united.



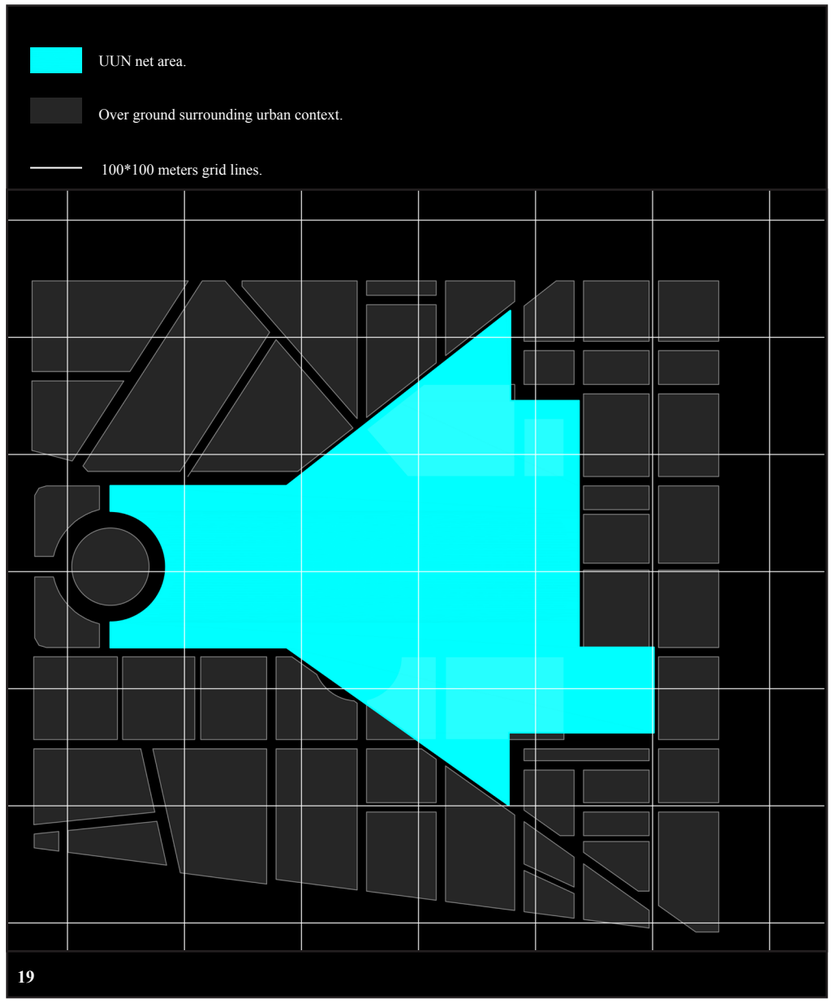
Organization.

18 - The organisation of the internal spaces of the UUN. The light blue dots represent the underground different functional spaces.

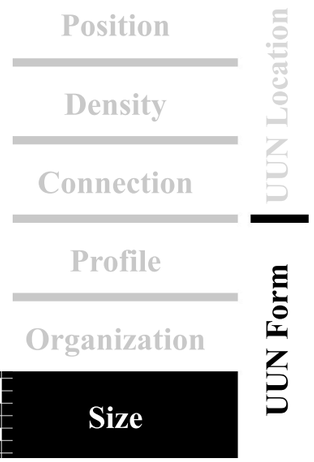


Les Halles Urban Underground Node, Paris, France, European Territory.

19 - A diagram showing the size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.



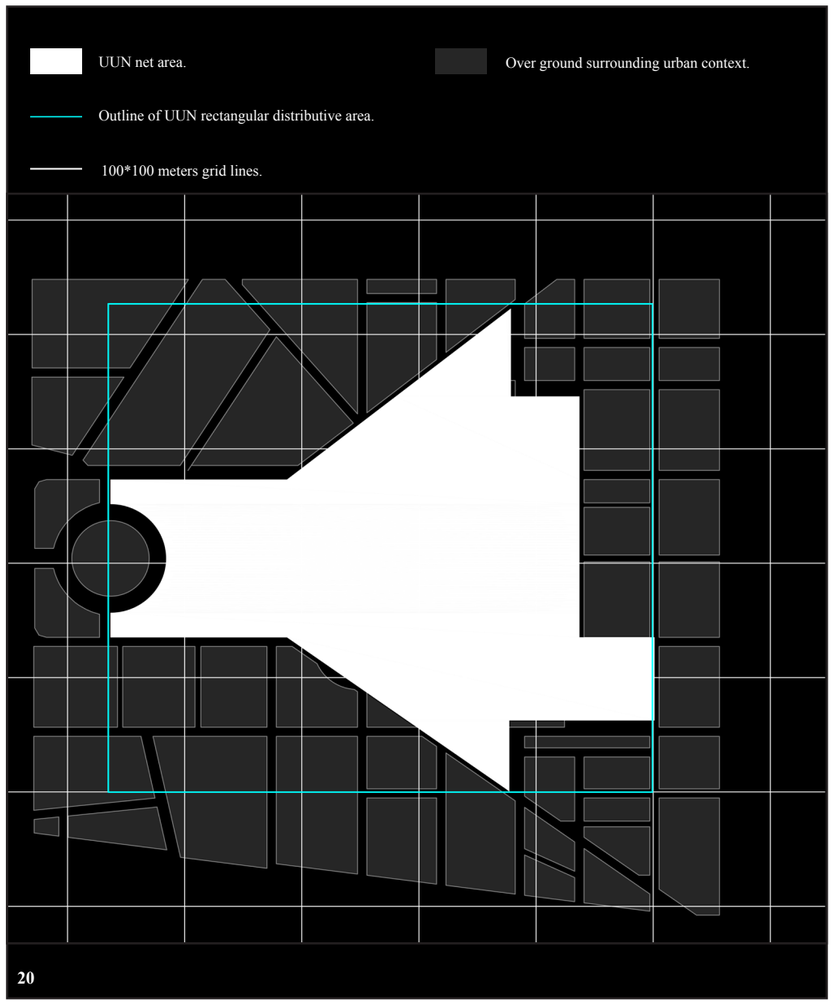
The UUN space in Les Halles site is almost 88000 sqm. This net area is very concentrated in one limited area while this area is much bigger in size than the surrounding built up areas and plots in the urban context (Diagram 19). In the same sketch, this area is stretching on a hypothetical grid of 100*100 meters to show that difference in size, categorizing it as an urban node.

The UUN is expanding in a distributive rectangular area, which is almost 470 meters width and 345 meters length (Diagram 20). This concentration of space in a relatively small size area is because of the limitation of the available area where the UUN can take place. The site is very critical and different historical buildings surround the open public square, which is making it hard to have a bigger scale area underground.

Ina comparison with all six study cases' distributive areas, Les Halles UUN space have a micro size one relatively with the others (Diagram 21) although it is not having the smallest net area. This is due to the concentrated organization of the space that was explained before.

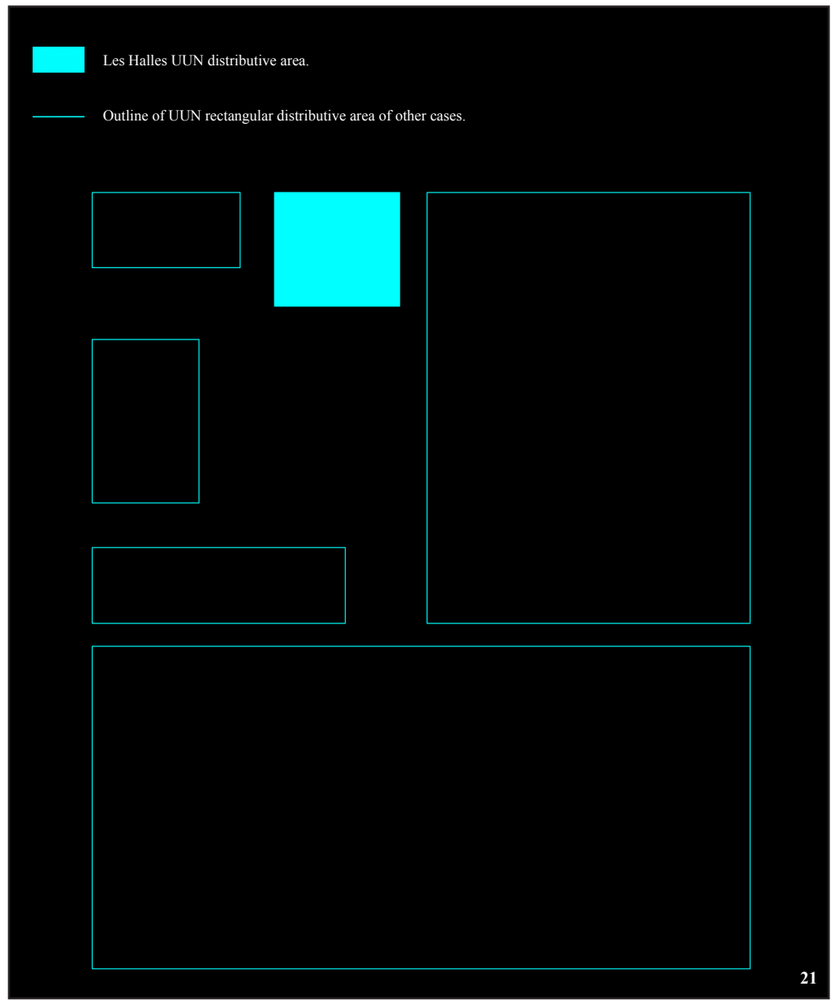
Les Halles Urban Underground Node, Paris, France, European Territory.

20 - A diagram showing the size of the UUN in a light blue color rectangle that represents the distributive area where the UUN is expanding in.

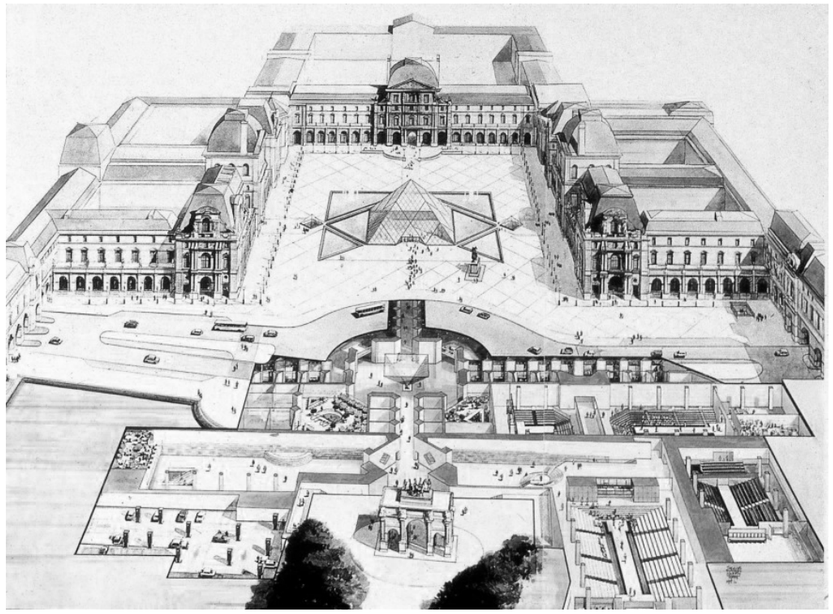


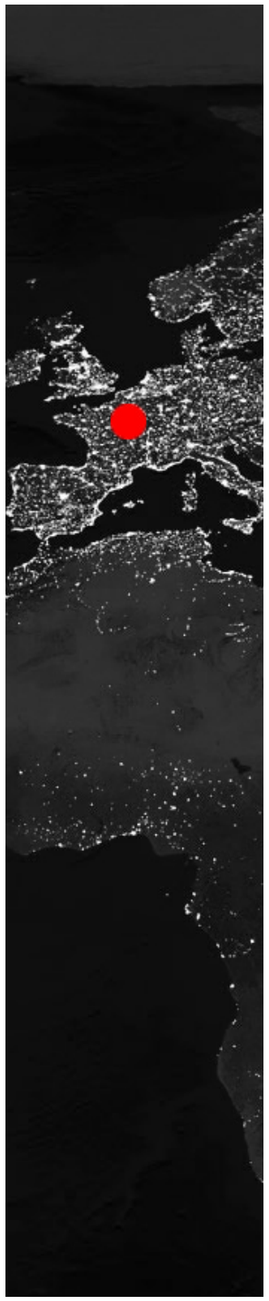
Size.

21 - A diagram of all study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Les Halles case.



Les Halles Urban Underground Node, Paris, France, European Territory.



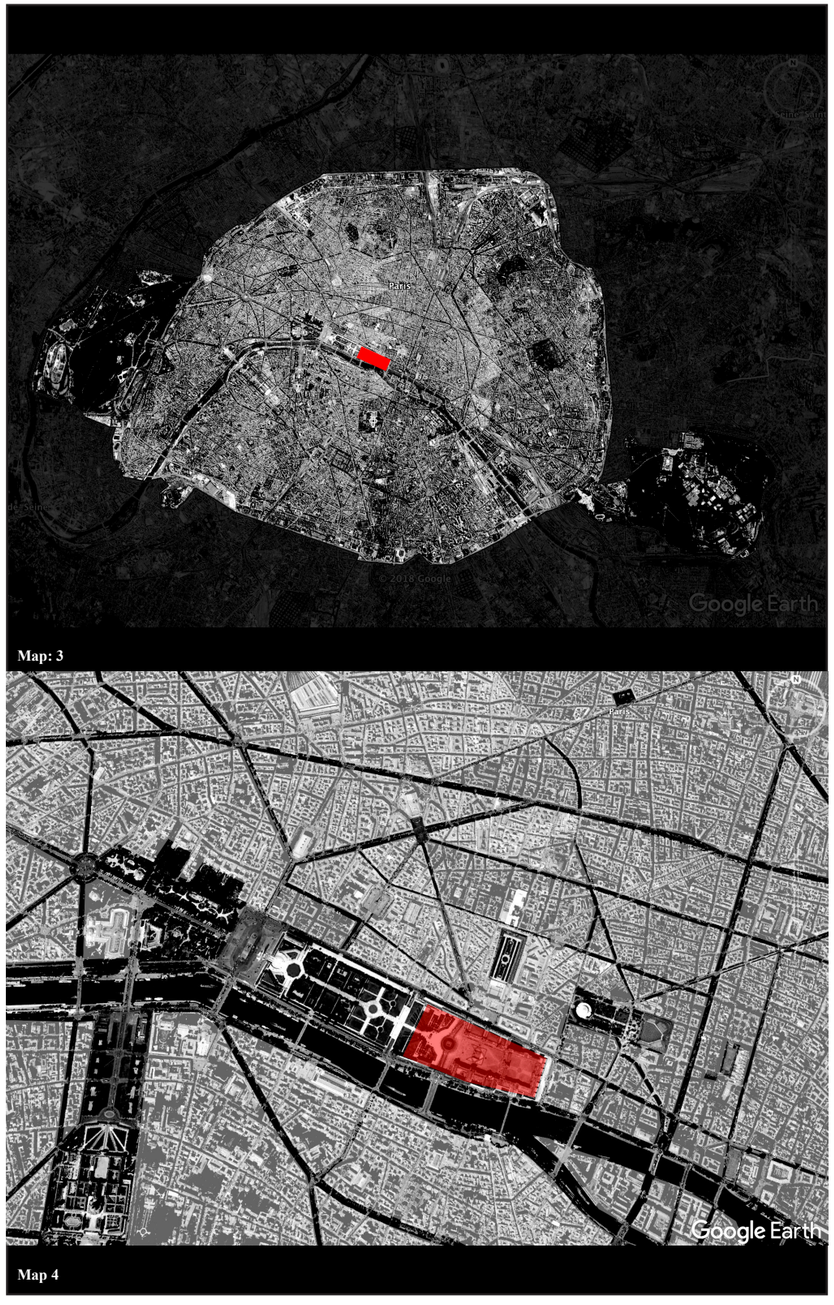


1.1.2. Carrousel du Louvre UUN.

Paris, France, Europian Territory.

48°51′45.42″ N, 2°20′06.06″ E

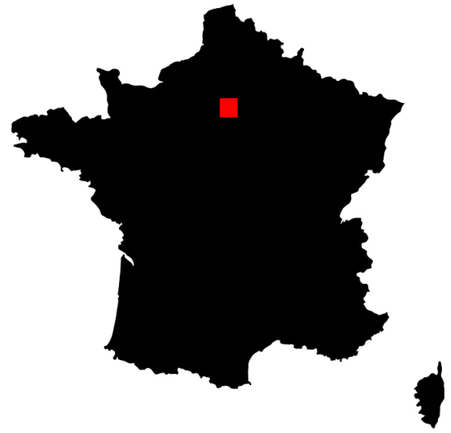
The Carrousel du Louvre area design initiated in 1989 by I.M Pei and then decision was made to expand and be connected to the metropolitan station of Palais Royal. This area is considered as one of the landmarks of Paris through the glass pyramid architectonic intervention between the underground area and the over ground Louvre Square and located on the main axis of Grande Arche de la Défense, Champs-Elysées street and Arc du Triomphe. The UUN area is containing several functions that are needed in the contemporary era such as the museum extension, the commercial area, the multi-use halls and the parking lots of the Louvre area.



Map: 3

Map 4

Position.



Position

Density

Connection

Profile

Organization

Size

UUN Location

UUN Form

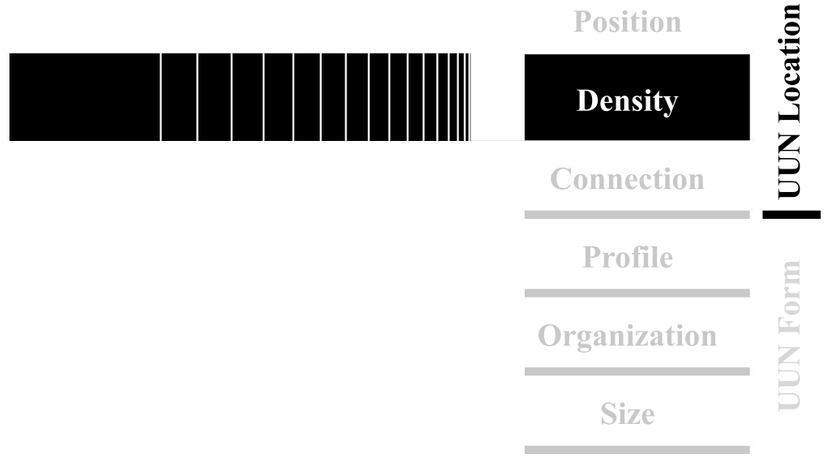
The UUN study case of Carrousel du Louvre has a similar character regarding the location of the space underneath in the city context with the case of Les Halles. It is also located in the historical center of Paris in France (Map 3). Historical buildings and monuments surround it from all sides. The Louvre Palace encircles it from three sides while the Arc de Triomphe du Carrousel acts as a limit from the forth one. The UUN here is positioned in the center of a historical city in a very important post where the castle was built before on the north side of the Seine River.

This site is a mutation spot in the urban tissue of the city. It can be noticed in the (Map 4) where the city is having compact blocks in the north of the site while the open space in the Louvre square and the Carrousel Garden are representing a transformation area in the compact built up context. Adding to that it includes some of the most prestigious cultural and historical buildings in the city.

Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

22- The over ground urban context of Carrousel du Louvre area, abstracted and presented to show the density and compactness of the built up area aside with the open public squares in less density of horizontal lines.

Density.



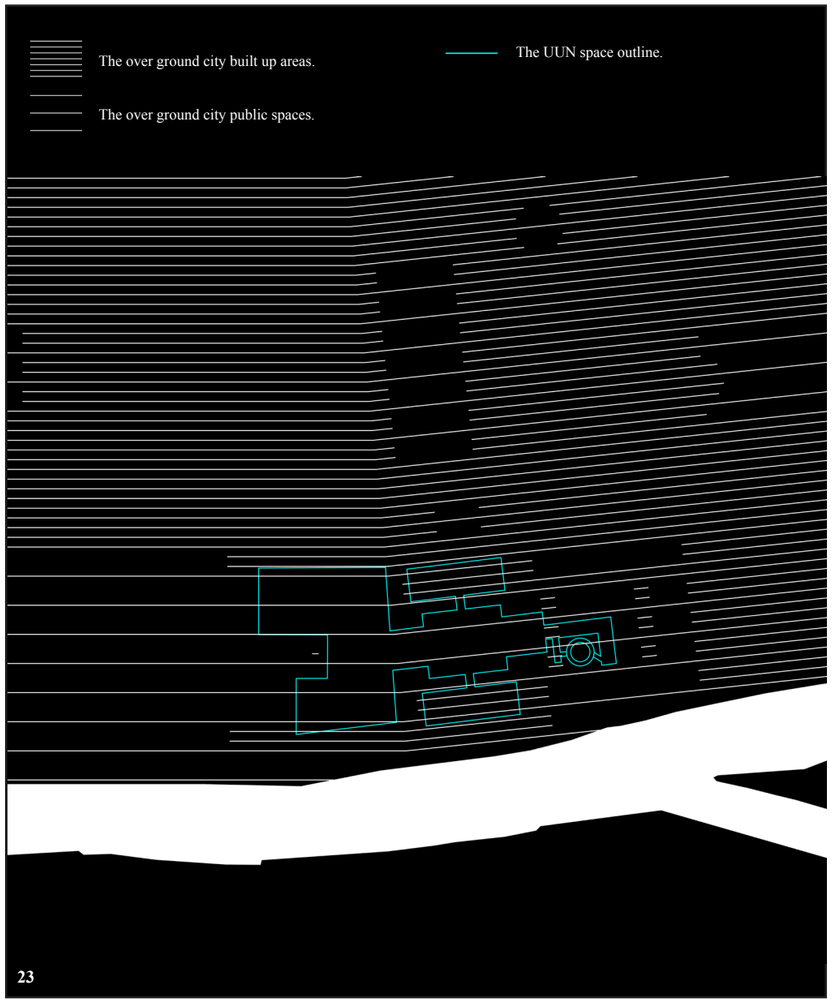
The Parisian urban tissue in the historical center area is very compact while the city is balancing that through some diffused low density spaces spread in different parts of the city interfering with the urban tissue Furthermore, there is a big area of open spaces of gardens and piazzas on the sure the Seine river such as the piazza di Louvre, the Carrousel and Tuileries gardens, which are all located in that part. On the other hand, the Palais du Louvre is also located on the north side of the river surrounding the Louvre square area and Carrousel garden (Diagram 22)..

The UUN in this case of Carrousel du Louvre is located under the low-density area, which is referring to the open public squares and gardens. It is also having some underground expansions under the Palais du Louvre to connect the underground old ruins of the old Louvre castle that are already under the internal courtyard of Palais du Louvre. The UUN space composition continues to expand under the Piazza di Louvre and the Carrousel garden (Diagram 23). That is demonstrating the strategy of locating the UUN space under the lowest density area in the city lay out.

The method of locating the underground space regarding the type of covering object here is having the same concept of the last case study of Les Halles UUN that is locating the it under lower density lines area, which is the open spaces, away from the high dense built up areas in the city master plan. This is drafted in (Diagram 24) in a way to expose the type of context on the tope of the UUN. This draft shows the relation between the over ground urban context content and the UUN space location regarding the density of the built up areas in the city lay out.

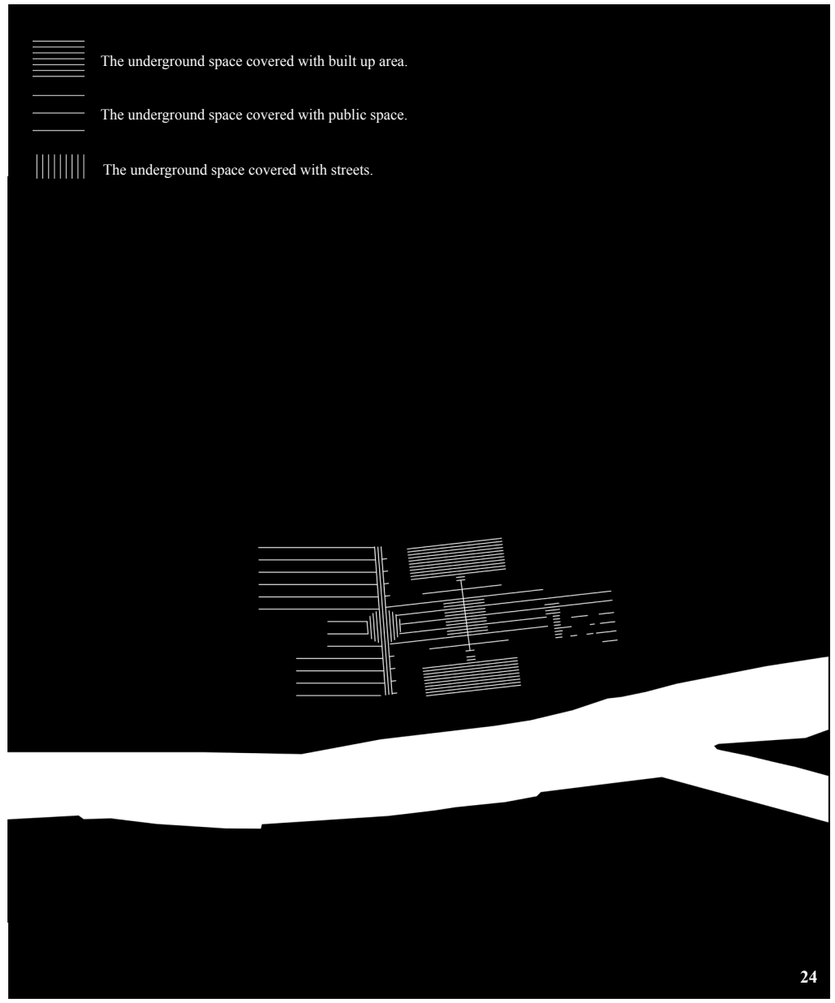
Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

23 - The over ground urban context of Carrousel du Louvre area, abstracted and presented to show the density and compactness of the built up and open spaces areas. In light blue line, the abstracted outline of the UUN.



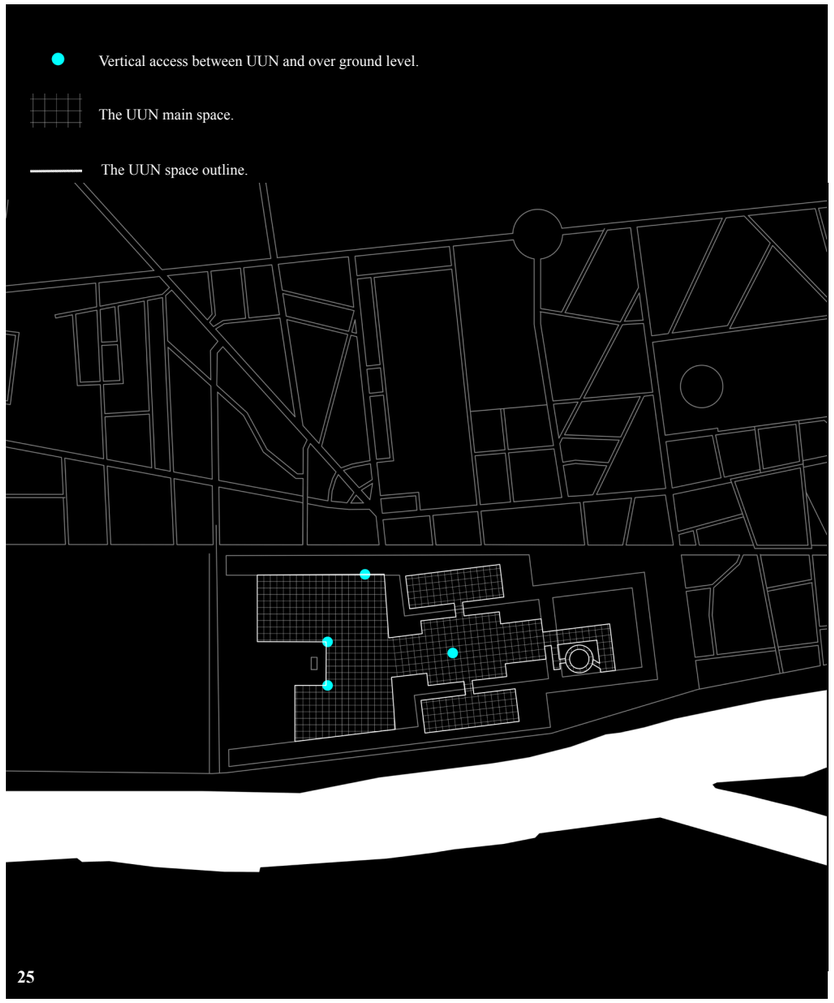
Density.

24 - The UUN form presented with different lines directions that referes to the covering type of context: streets, built up or open space area.

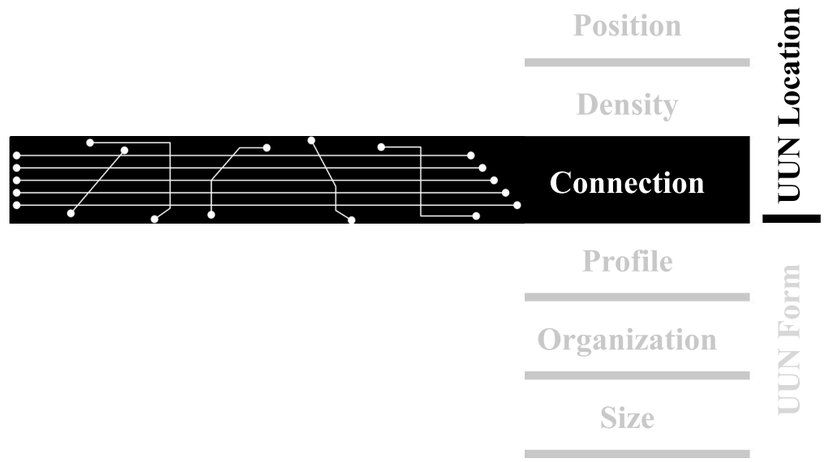


Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

25 - This diagram is showing the vertical access points in light blue dots in the urban context.



Connection.



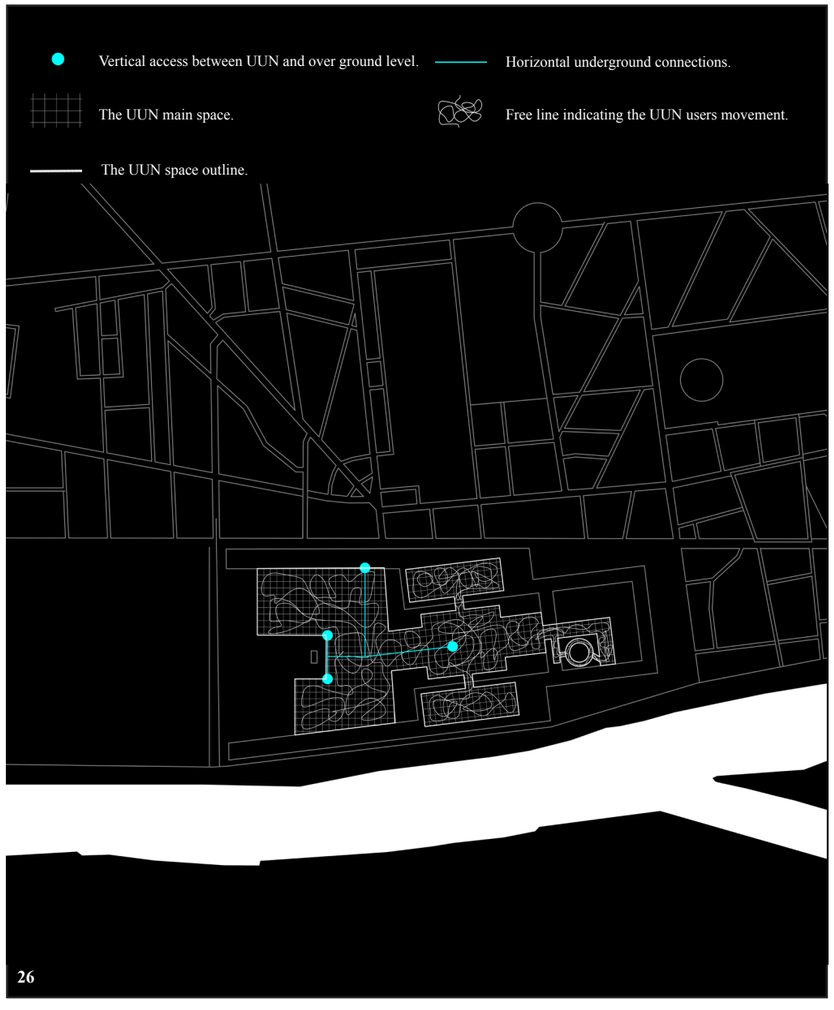
The UUN space of Carrousel du Louvre is connected to the pedestrian network and the public space of the square and gardens up through vertical connections. One of the main vertical accesses is the pyramid of Louvre museum, creates an important landmark and gives importance and more value to this access point. There are also two main access points from the Carrousel Garden, aligned with the Arc de Triomphe du Carrousel. Adding to that, there is one more access to the underground Carrousel du Louvre through the north part of Louvre Palace on the Rue du Rivoli (Diagram 25).

The UUN complex in this case has all the vertical connections in public spaces either the Louvre square or the garden, except for the access from the cultural building of Louvre Palace, which is one of the entrances to Palais Royal – Musée du Louvre metropolitan station. These connections are the main ones from the urban context for pedestrians to utilize the space underneath that provide different activities. These access points have strong relation with the urban context. The pyramid adds new contemporary value to the Louver square in parallel with the garden accesses which are located on both sides of Arc de Triomphe du Carrousel (Diagram 26).

On the other hand, in the underground space of Carrousel du Louver UUN is united combined one as the last example of Les Halles. Thus, the space under is not used as a parallel pedestrian network from a city part to another because of the compact form, the small scale and isolation of the node in this case from any other underground nodes. Though, this node is connected to the city vehicular network by having underground cars' parking in the north east of the UUN that serves all the Louvre area. Also it has a direct connection from the underground space to one of the main metropolitan stations in Paris, which is Musée du Louvre metropolitan station (Diagram 27). These connections connects the on foot user of the UUN with horizontal direct connections to the vehicular and metropolitan systems from underground level – through the parking and metro station - and vertical connection with the Pedestrian Square and garden over ground.

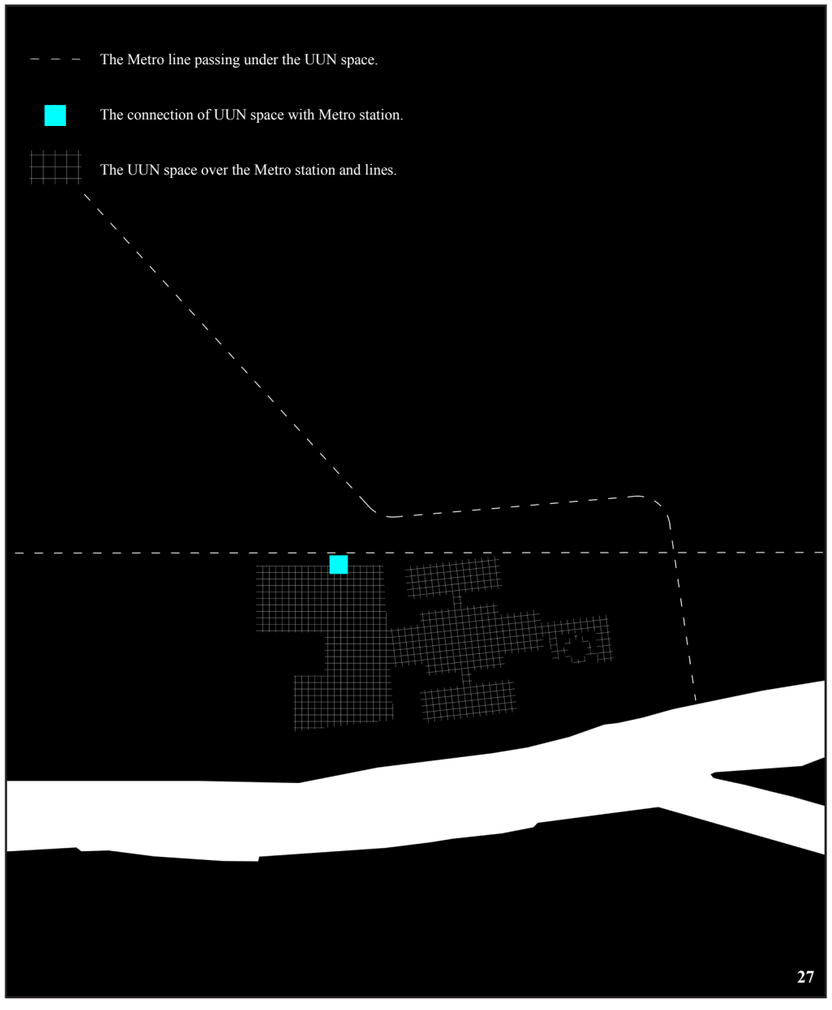
Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

26 - The vertical access points in light blue dots and the accessibility between them in the underground level through the light blue lines. The diagram is also exposing the vertical access points in relation with the urban context.



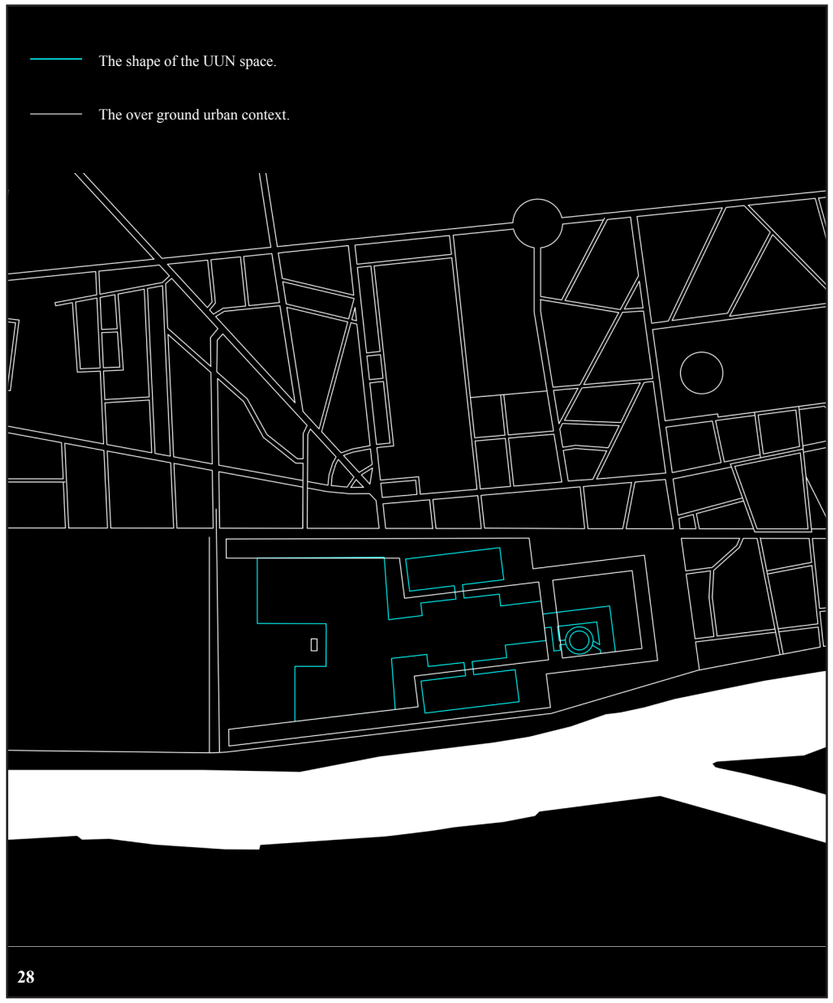
Connection.

27 - The connection between the UUN space and the underground metropolitan transportation system.

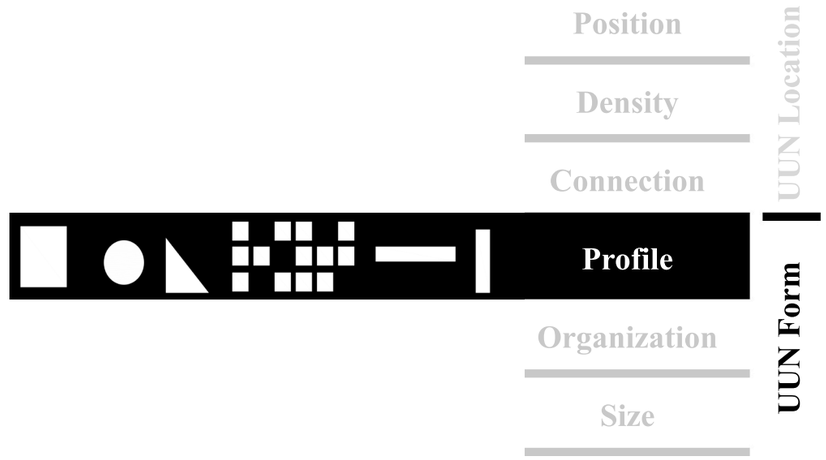


Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

28 - The UUN space profile abstracted in light blue line that is refering to the outline of the space with the urban context of the city overground is abstracted in white lines.



Profile.



The Carrousel du Louvre UUN's void composition, articulation references and generation have lots of similarities with the Les Halles case. The over ground context is also somehow fragmented and consists of punch of irregular shapes as it is located in the historical center of Paris. It is an outcome of over ground urban forms, united all together through one underground space, producing the final composition of the UUN. The UUN morphological configuration is influenced by the urban context of the over ground (Diagram 28).

This final irregular shape of UUN is consisted by references taken from the over ground context. It starts from the old castle ruins in the east then the Louvre palace with the in-between open public square until the carousel garden and limited by Avenue du Général Lemonnier in the west. These traces and signs in parallel with the extensional axes of the urban streets, which are the main elements that shaped the UUN final profile shape (Diagram 29). This explains the irregular form that the UUN takes in this case. In the light of that, the UUN final profile is a united shape of void collecting all these fragmented pieces shown before in one united space (Diagram 30).

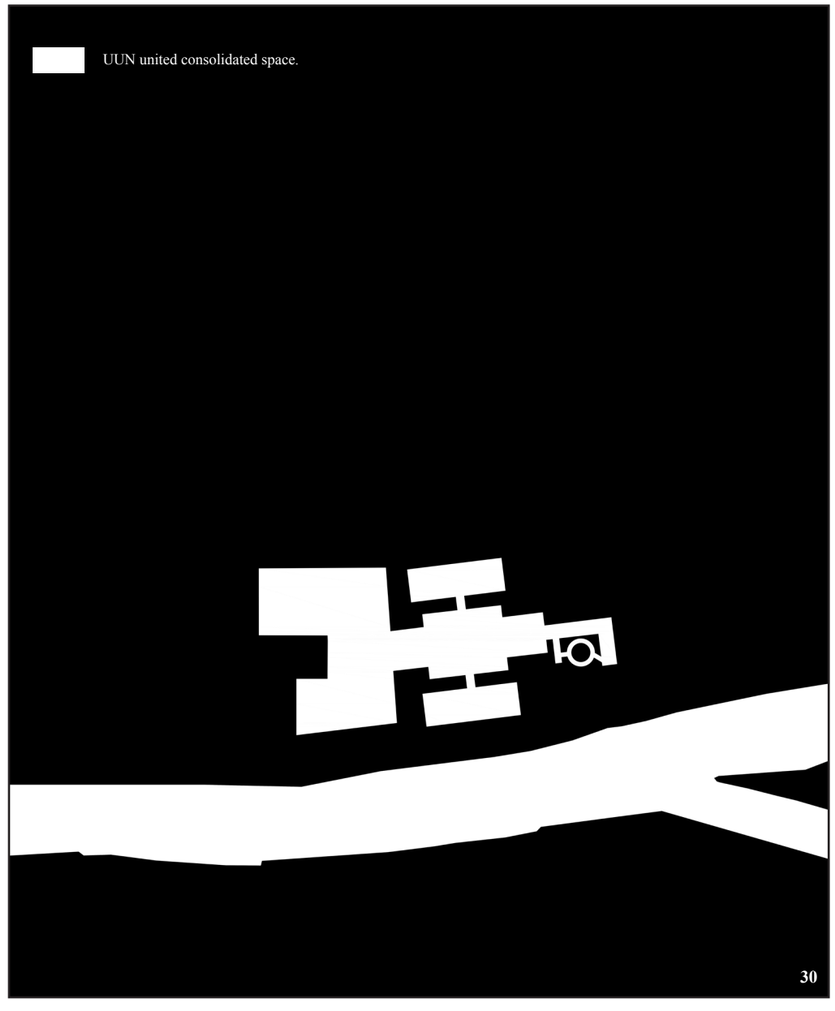
The void in this case gives the presence concept in the urban context. This is a result of the evident intersection between the above and down spaces through the glass pyramids skylight systems, being an obvious transparent landmark that gives a strong indication of the underground existence through the Louvre museum pyramid entrance to the over ground public space users. Adding to that, the upside down pyramid in the Carrousel area that indicates a different interpretation of the over ground environment in the underground space to the UUN users.

Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

29 - The diagram is abstracting the axis and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures responding to the overground refrences. The study is showing the correspondence in the UUN form to the overground axial refrences.

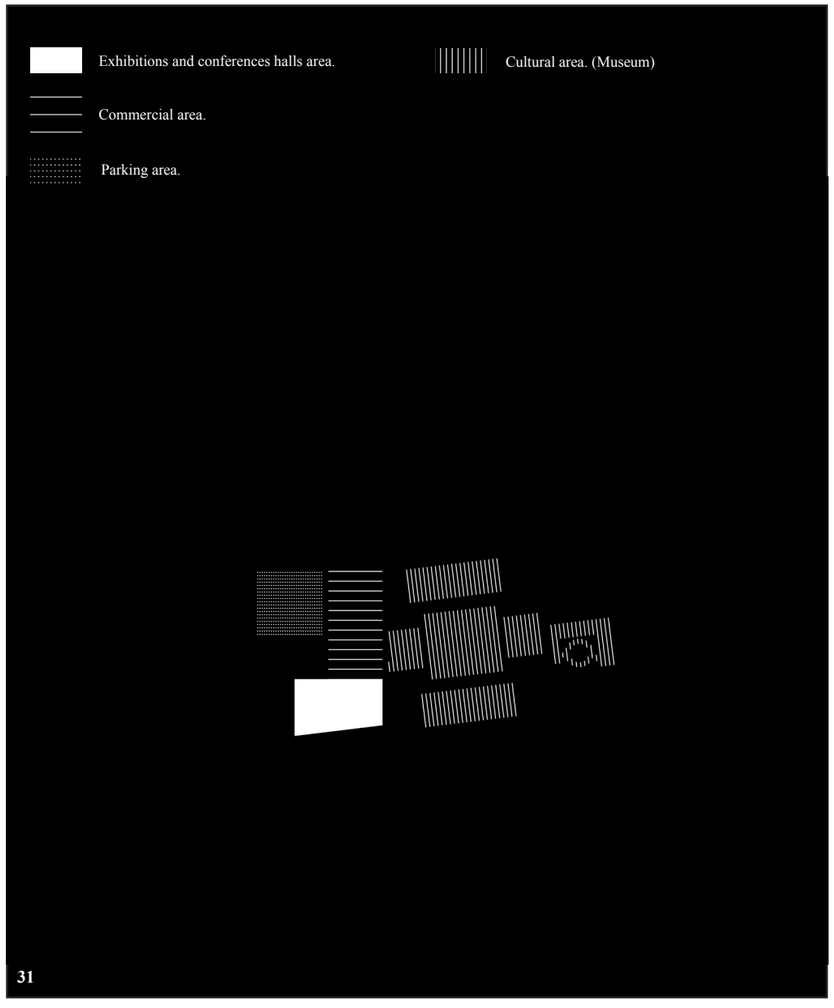
Profile.

30 - The white consolidated shape is the abstraction of the UUN profile.

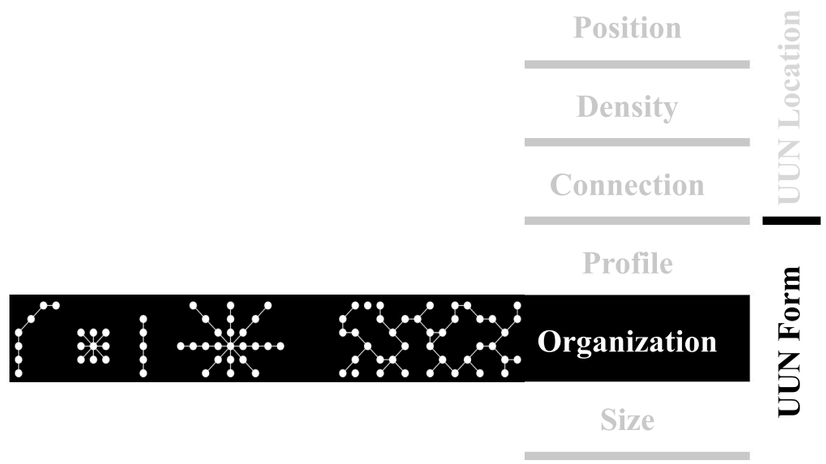


Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

31 - The organisation of the UUN different functions spaces.



Organization.



The UUN space of Carrousel du Louver is central and condensed with functions (Diagram 31). It is organized in a very focal way, makes it like an urban core in the urban context. It also acts as a pivotal area to the surrounding urban context while it is also having a vital role connecting the museum different halls leading all to the main hall under the pyramid. It is also linked to the commercial area, the exhibitions halls, the conference halls and the parking area all together all in one united underground void. The UUN space here provides new functions that are needed in the contemporary era, solving the problem of the limited space in the over ground urban context.

The underground collective areas of the UUN are all connected internally through the underground area to form a central consolidated space. The triple height area under the Louvre museum pyramid seems like the main hall and the pivotal area where all other spaces are arranged around and connected to. On the other hand, the open space above is also a focal collective space in the urban context (Diagram 32).

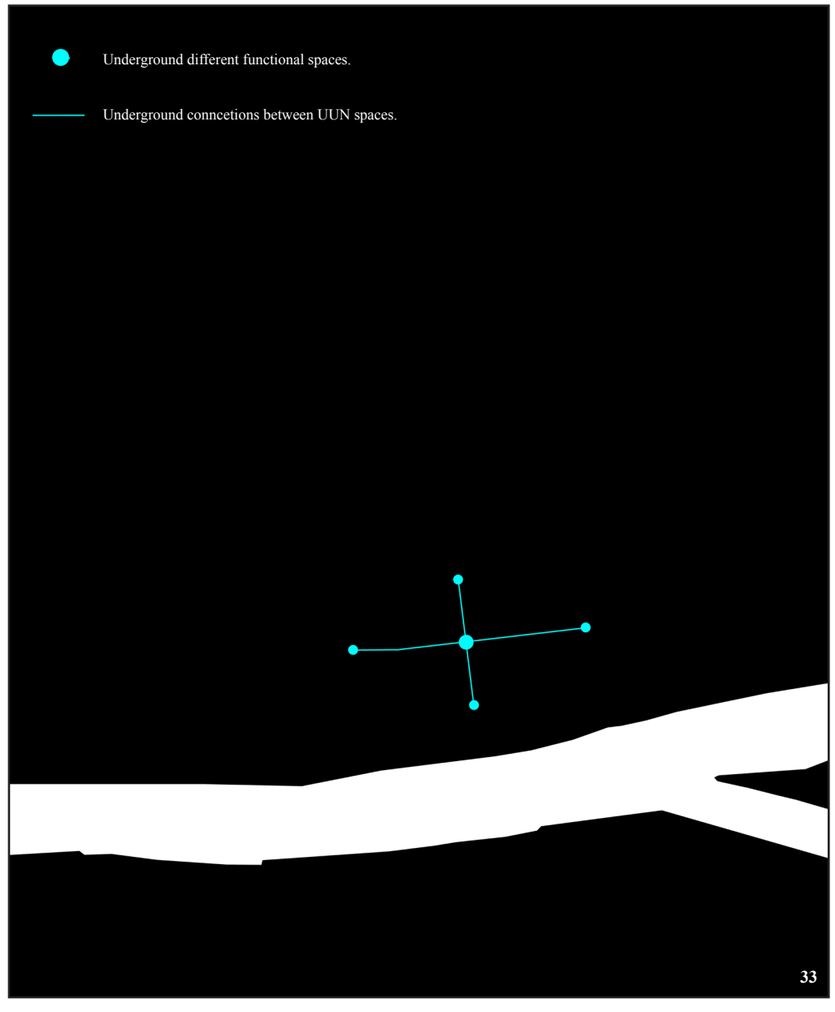
To paint the final picture, the space organization of the UUN in the case of Carrousel du Louver is concentrated in one area in the urban master plan. The internal spaces are arranged, connected and united in a central way around the Louvre glass pyramid, making it the pivotal landmark over ground and underground (Diagram 33).

Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

32 - The relation between the organization of the UUN space in the urban context of the city over ground and the organization of the internal space itself underground. The light blue dots are indicating the several UUN spaces and the light blue line is demonstrating how all internal spaces are attached and united.

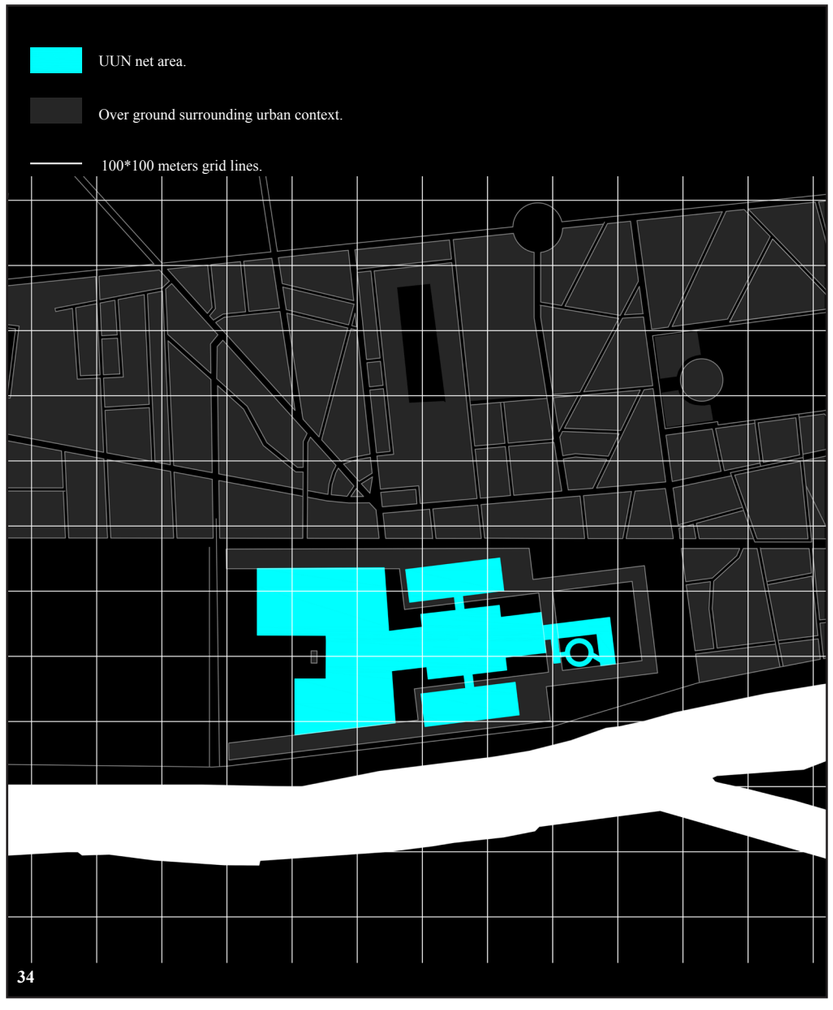
Organization.

33 - The organisation of the internal spaces of the UUN. The light blue dots represent the underground different functional spaces.



Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

34 - The size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.

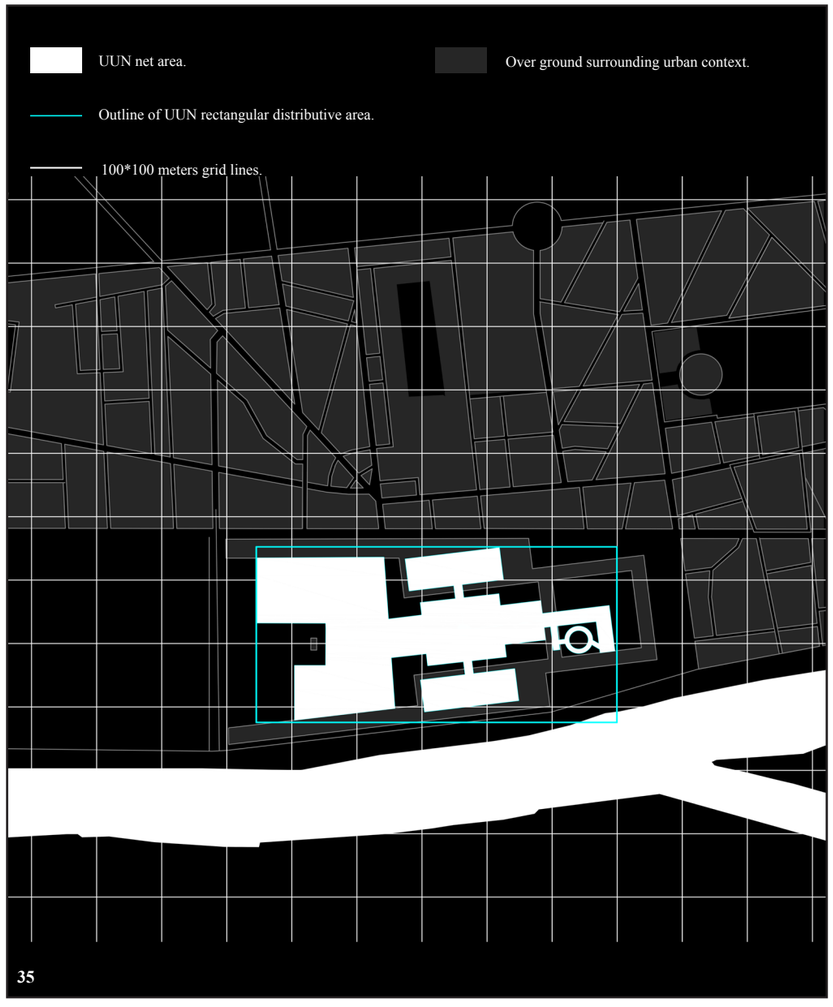
The UUN space in the Carrousel du Louvre is almost 72618 sqm. These square meters are concentrated in one area. The net area of this open public square space is much bigger compared to the surrounding built up plots area in Paris. The UUN space in light blue with the context built up areas and open spaces are presented together with a hypothetical 100*100 meters grid in white to show the difference in scale between the urban node respecting the size of the city built up smaller areas reinforcing its role to be an urban node (Diagram 34).

The UUN in this case is expands in a distributive rectangular area, which is almost 555 meters width and 265 meters length (Diagram 35). This concentration of space in a relatively small size area is because of the limitation of the available area where the UUN can take place. The site is very critical and different historical buildings surround the open public square, which makes it hard to build over ground to save the historical look of the city context.

Ina comparison with all six study cases' distributive areas, the Carrousel du Louvre UUN space have a micro size one relatively with the others (Diagram 36) although it is not the smallest regarding the net area. This is due to the concentrated organization of the space that was explained before.

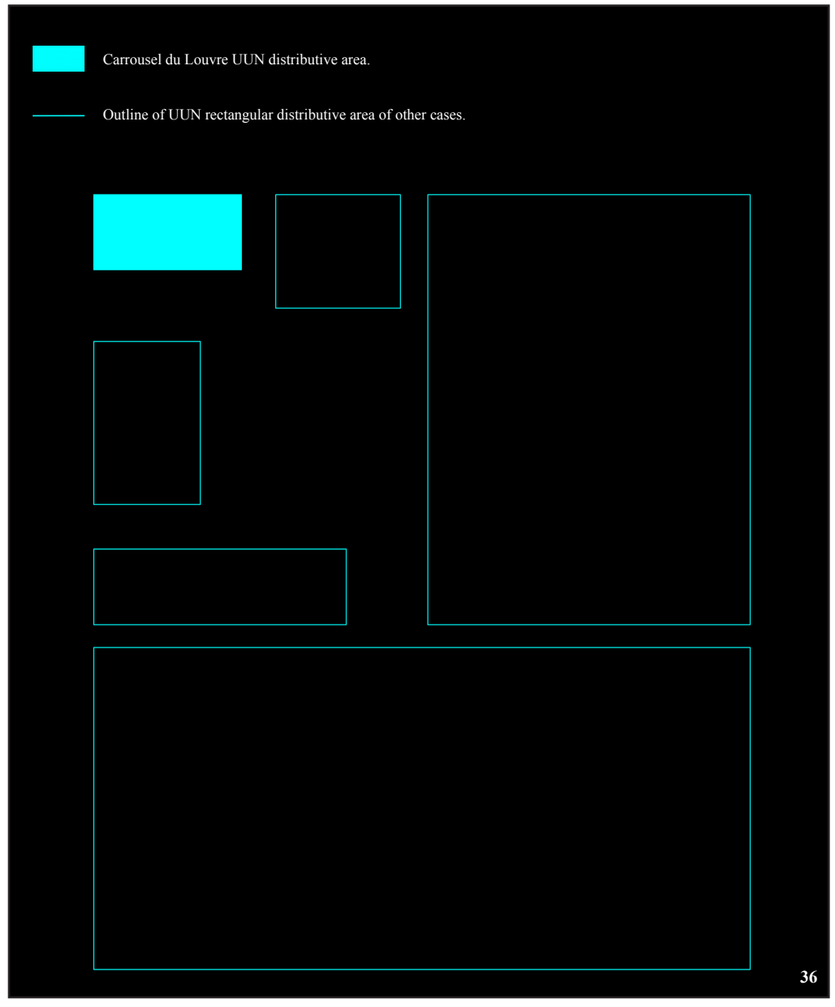
Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.

35 - The net area of the UUN represented in white mass color and the size of the distributive area where the UUN is expanding in, represented as a light blue color rectangle.

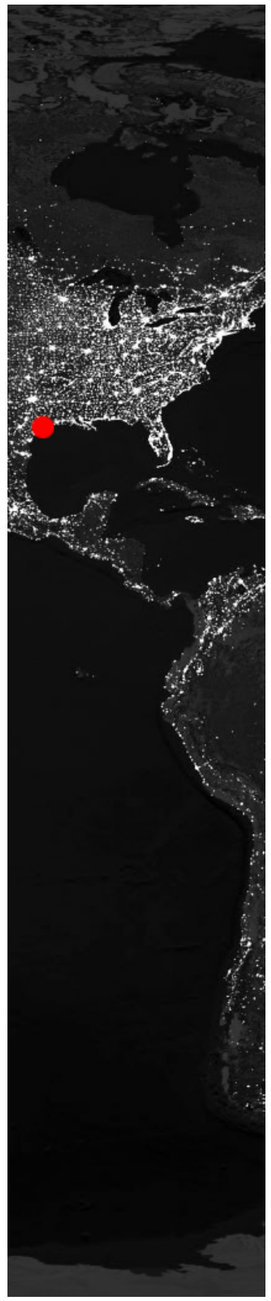


Size.

36 - A diagram of all study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Carrousel du Louvre case.



Carrousel du Louvre Urban Underground Node, Paris, France, European Territory.



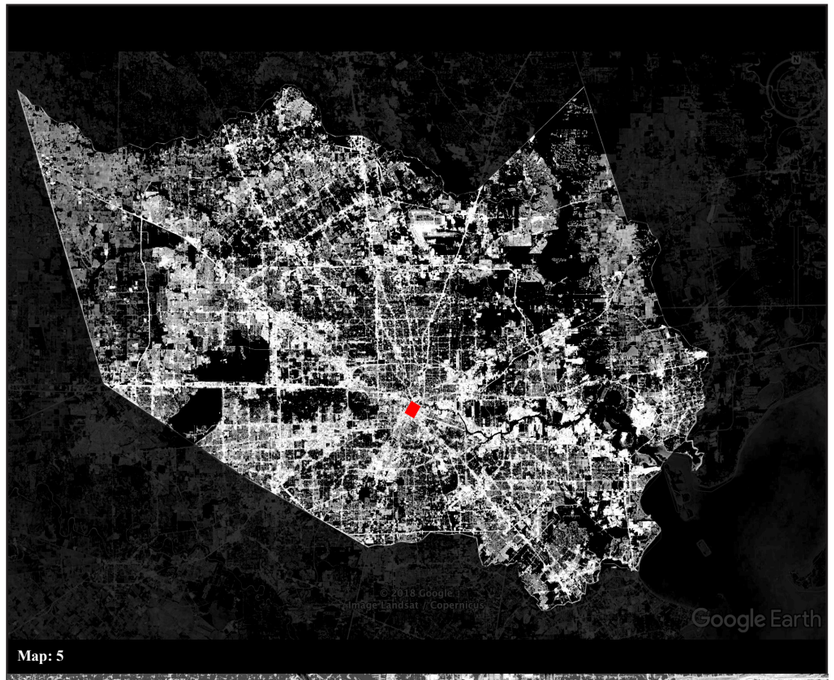
1.2.North American Cases.

1.2.1. Houston Downtown UUN.

Texas, USA, North American Territory.

48°51′44.41″ N 2°20′41.05″ E

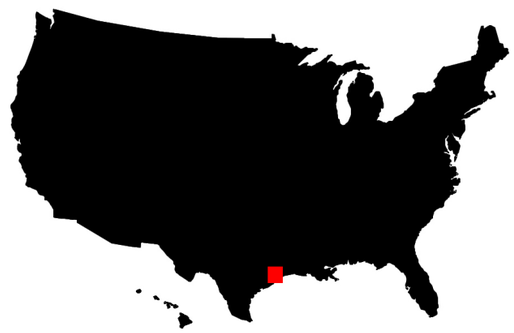
This study case is located in Texas State in USA. The UUN spaces in this case are diffused under several buildings that are diffused in the city downtown area. Each space is considered as the basement of the covering building above and this is why various architects did the underground part. On the other hand, these spaces are connected together through established underground pedestrian tunnels network to move from a space to another. Although the large scale of the distributive area where the UUN spaces expand in, they establish two main dominant functions, commercial one and underground parking areas.



Map: 5

Map: 6

Position.



Position

Density

Connection

Profile

Organization

Size

UUN Location

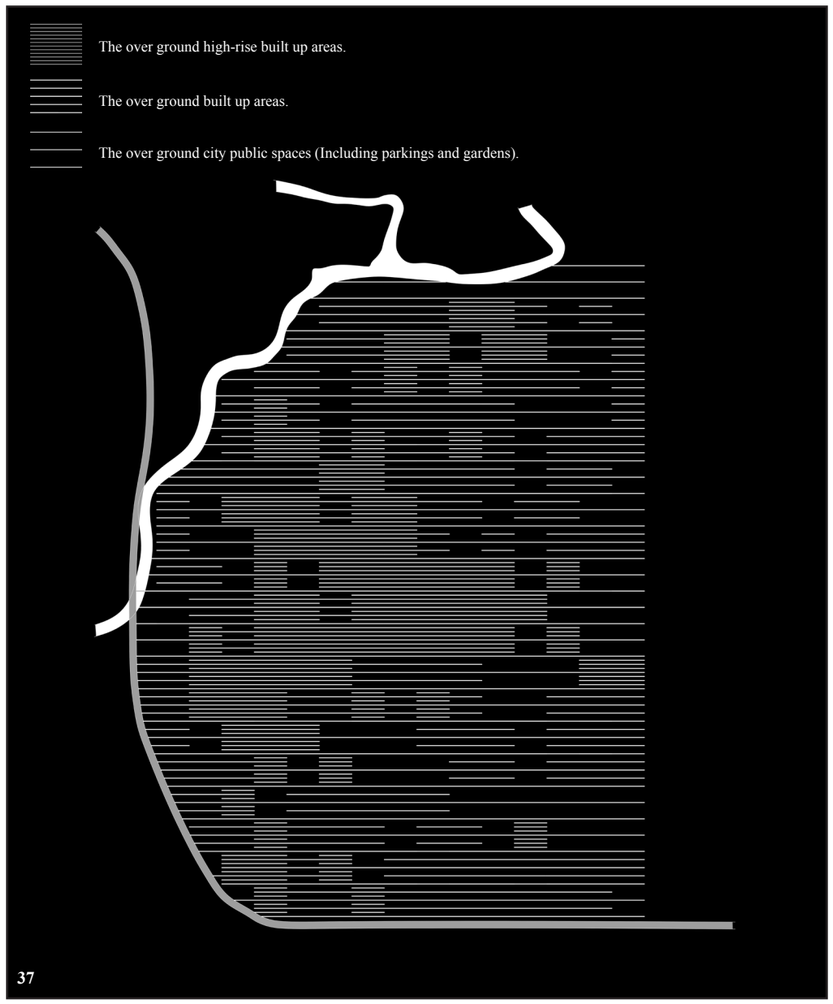
UUN Form

The UUN spaces in this case are positioned in the oldest center of Huston, the state of Texas in the United States of America. This location is the downtown area where the high-rise towers are located today, which gives different character in the central area content than all the built up parts around it (Map 5). Buffalo Bayou River, Gulf Fuy Highway and Eastex Fwy highway limit this central area. Although the UUN spaces are diffused in a large area, they are not crossing the mentioned boarders of the downtown area, making them all the scattered underground spaces in the downtown zone.

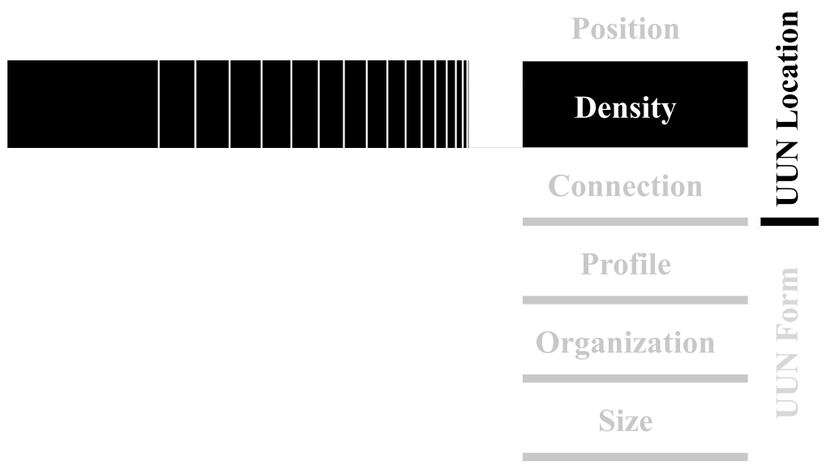
In this central area the urban context mutates as well but not as the last two cases in Paris, but in a different way. The city in general is consisting of different building heights while the towers are all concentrated in the city center where the downtown is, leaving all the other parts of the city without any of these high-rise buildings or skyscrapers, monopolizing all of them in just one area that is different than all the city parts. This gives the uniqueness to the central zone over all other city locations. The UUN here is located under big part of the Central Business District (CBD) which expands in the downtown central area, giving it different quality than the European French cases that were located under open external public spaces, while here in this case, the spaces are set under a hall district area (Map 6).

Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

37 - The over ground urban context of Houston Downtown CBD area, abstracted and presented to show the built up areas aside with the open public squares. There are 3 different intensities of lines in this diagram. The highest is referring to the high-rise buildings and towers. The middle ones are indicating the buildings with low or middle heights. And the least intensive lines are signifying the non-built up areas such as gardens and parking lots.



Density.



In Houston downtown, there are different types of buildings density due to the difference of heights of high-rise towers, medium and low height buildings beside the open gardens and parking lots in this area. Mostly all the high-rise ones concentrated in this area specifically. This is due to the regulations and policies that allow the extra height buildings only in the city center (Diagram 37). That paints the picture of the character of the buildings heights in the city downtown, making it unique and different than any other parts of the city.

The UUN spaces are diffused under the downtown area built up plots, which are located mostly under the high-rise towers (Diagram 38). The UUN has some underground spaces that are diffused under middle height buildings or open spaces, but the used strategy in this type is targeting the basement of the high rise buildings. These plots are connected to each other through an underground tunnels network.

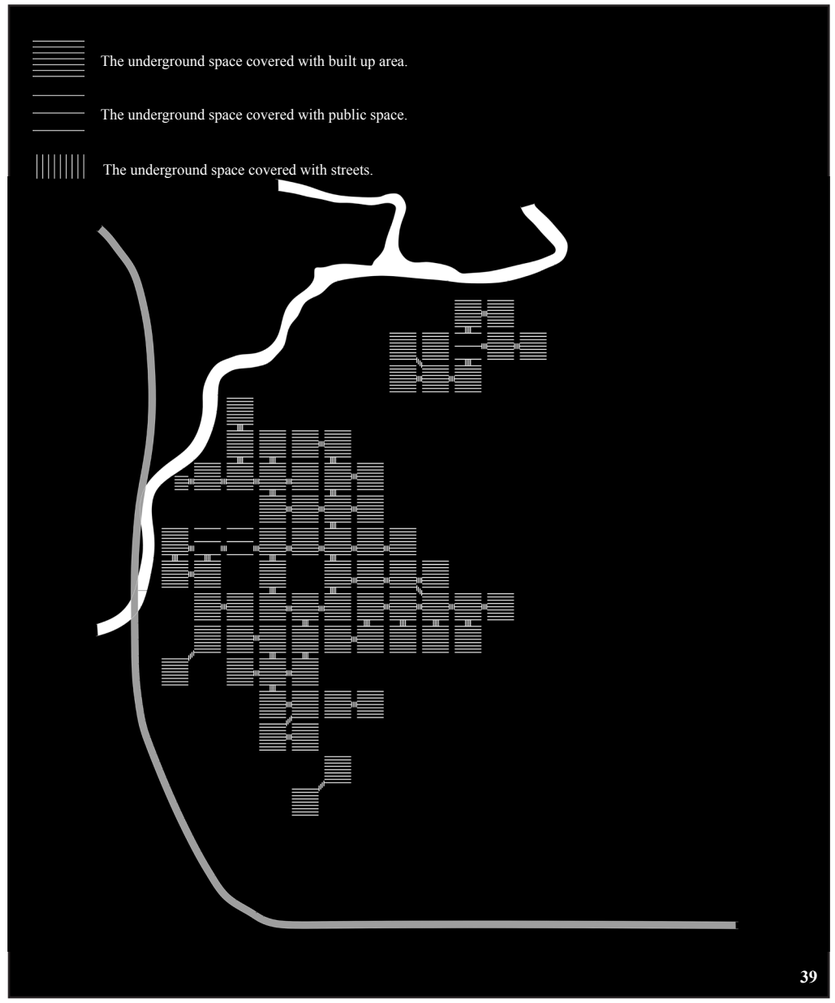
The method of locating the underground space regarding the type of covering object here is totally different than the followed concept in the last two European cases. In fact it is the opposite of it as the UUN spaces are allocated under the built up towers. This is exposed in the (Diagram 39) where the UUN shape is abstracted and drawn in a way to show the type of the covering context. The high-rise towers are the dominant covering type over the UUN diffused spaces.

Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

38 - The over ground urban context of Houston Downtown CBD area, abstracted and presented to show the density and compactness of the built up and open spaces areas. In light blue line, the abstracted outline of the UUN spaces demonstrating now they are mostly located under the high-rise buildings.

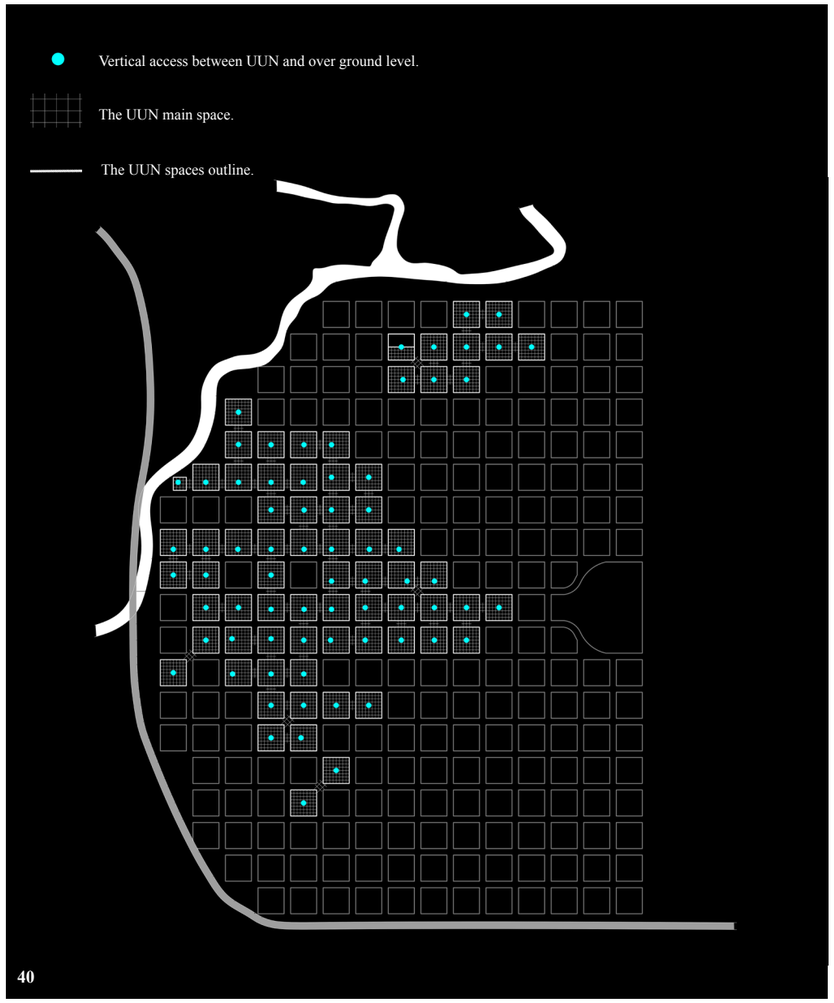
Density.

39 - The UUN form presented with different lines directions that refers to the covering type of context: high-rise, low-rise built up, streets or open space area. The vertical lines are referring to the streets, the condensed horizontal lines are pointing out the high-rise towers while the uncondensed ones are pointing out the open spaces, gardens and parking lots on the top of the UUN space.

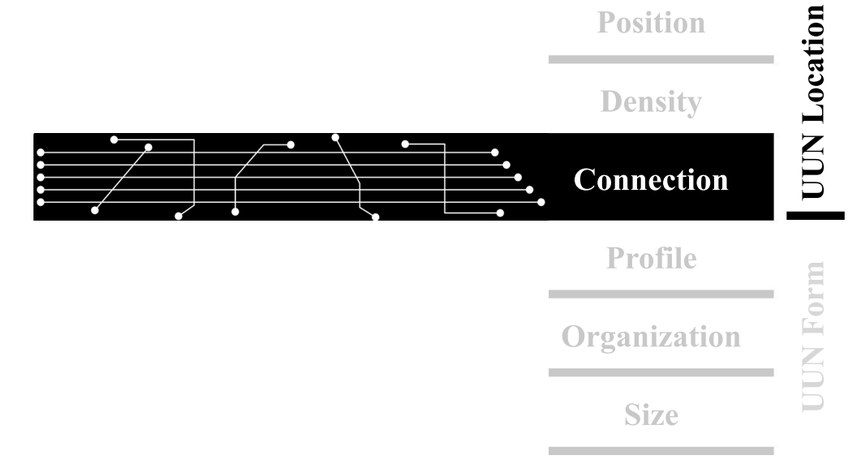


Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

40 - The vertical access points in light blue dots in the urban context.



Connection.



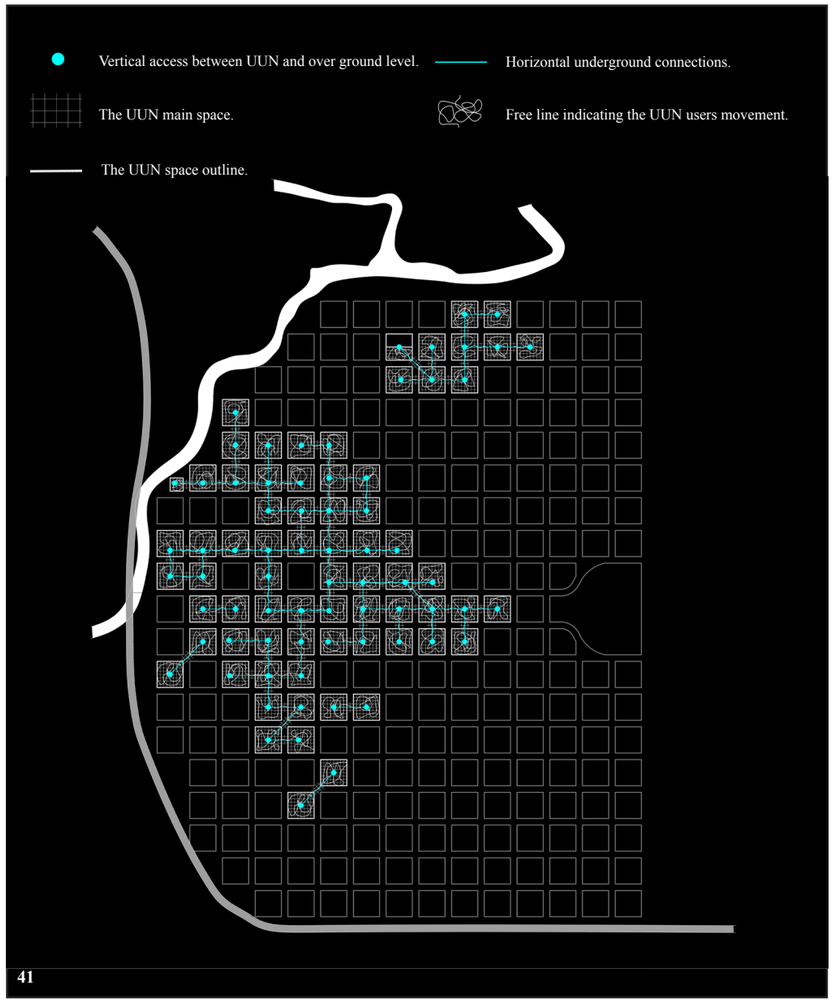
The UUN spaces in Houston are not connected vertically to a pedestrian urban network like the last study cases in Paris. Instead, each space of the diffused ones is connected to ground floor of the building on the top of it. This means that it is connected to an internal closed private space instead of an external one like a garden, square or even a sidewalk, which makes the access to go to the underground hidden inside those buildings located on the top of the underground spaces. The ground floor of these buildings in this case acts as a lobby or a mutation space between the underground and the external environment. The vertical underground entrances are not evident in the urban context to the pedestrian as the European study cases as it is inside private entities (Diagram 40).

The UUN in this case is not a united compact space but consists of diffused spaces linked together. This linkage takes action through an established underground pedestrian horizontal network that connects the diffused spaces. This network embodied in the underground master plan through linkage tunnels under the city streets network. The underground in this case can be used as a pedestrian network to move from a point to another as long as it establishes an underground pedestrian network system separated from the urban streets web (Diagram 41).

Moreover, the UUN spaces are connected also to the over ground vehicular streets through some underground parking spaces, which are a part of the UUN. On the other hand, although the large scale of the distributive area where the UUN spaces are diffused in, there is no metropolitan underground network that the UUN spaces are connected to directly, but there is an over-ground tram public service that passes in the downtown area over the underground pedestrian tunnels (Diagram 42).

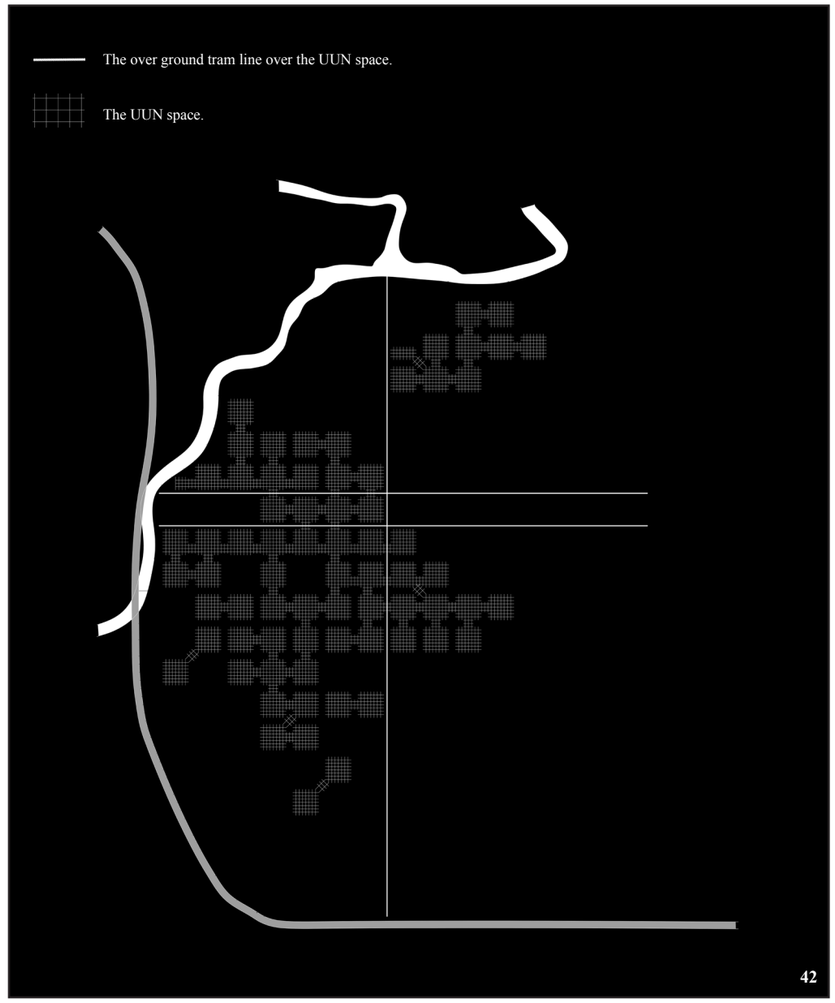
Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

41 - The vertical access points in light blue dots and the accessibility between them underground through the light blue lines in relation with the urban context. Also, the underground network that is connecting different spaces internally from underground level is presented in light blue color lines.



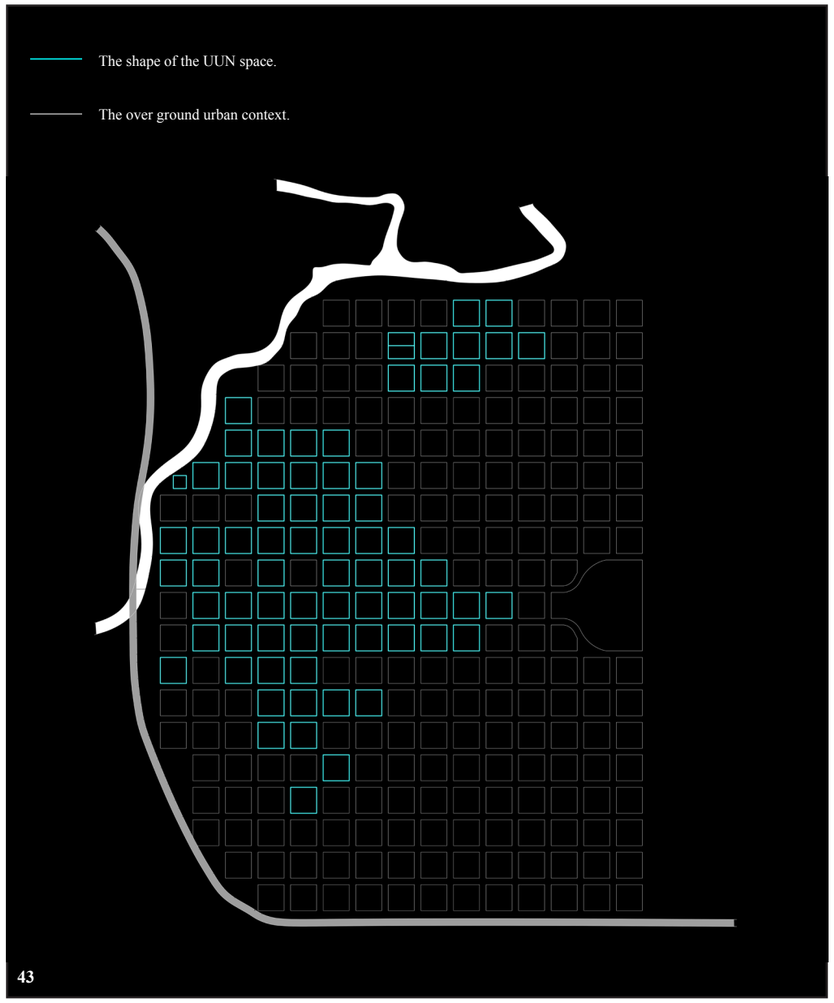
Connection.

42 - An absence of the underground metropolitan system, so the UUN spaces are isolated in another level from the over ground tram public transportation service.

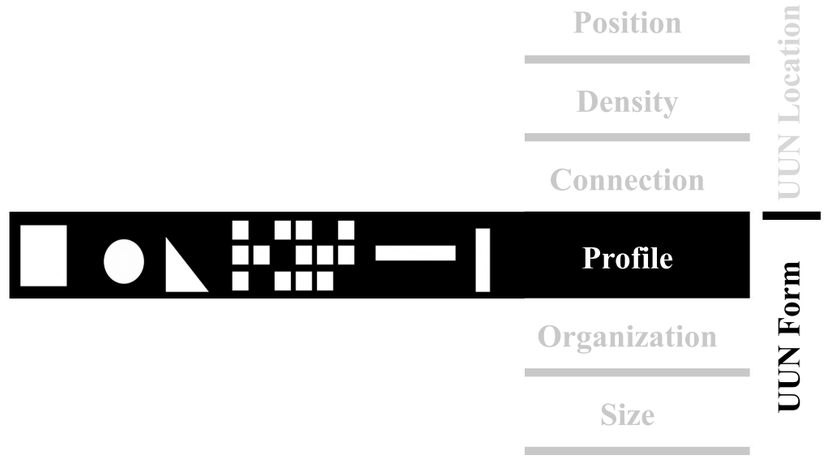


Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

43 - The UUN space profile abstracted in light blue line that is refering to the outline of the space inbetween the urban context of the over ground city, which is abstracted as gray lines refering to the over ground plots.



Profile.



The methodology of shaping the underground void in this case in Houston is different than the irregular forms in the two cases studied before. The over ground urban tissue consists of a very identified regular urban grid pattern that includes constructed buildings or open spaces in the downtown area. Under some of the built up plots, there is an extension of the upper building and this is the urban grid square shape to the UUN spaces form. Thus, the UUN formed by different basements blocks that are divided under the constructed buildings, diffused in the urban tissue then connected to each other with underground tunnels network (Diagram 43).

The regular split squares and half squares shapes in the underground are created as an outcome of the urban context references. The city up has a very clear grid that is considered as the base of the urban fabric in the downtown area. Thus, the underground also follows the same grid to distribute the UUN spaces in the bottom of the city-constructed blocks respecting the axis that were settled to initiate the downtown urban planning grid (Diagram 44). Therefore, the underground main spaces has the final form of diffused squares that respect the urban collected and connected together to give the final profile of the UUN (Diagram 45).

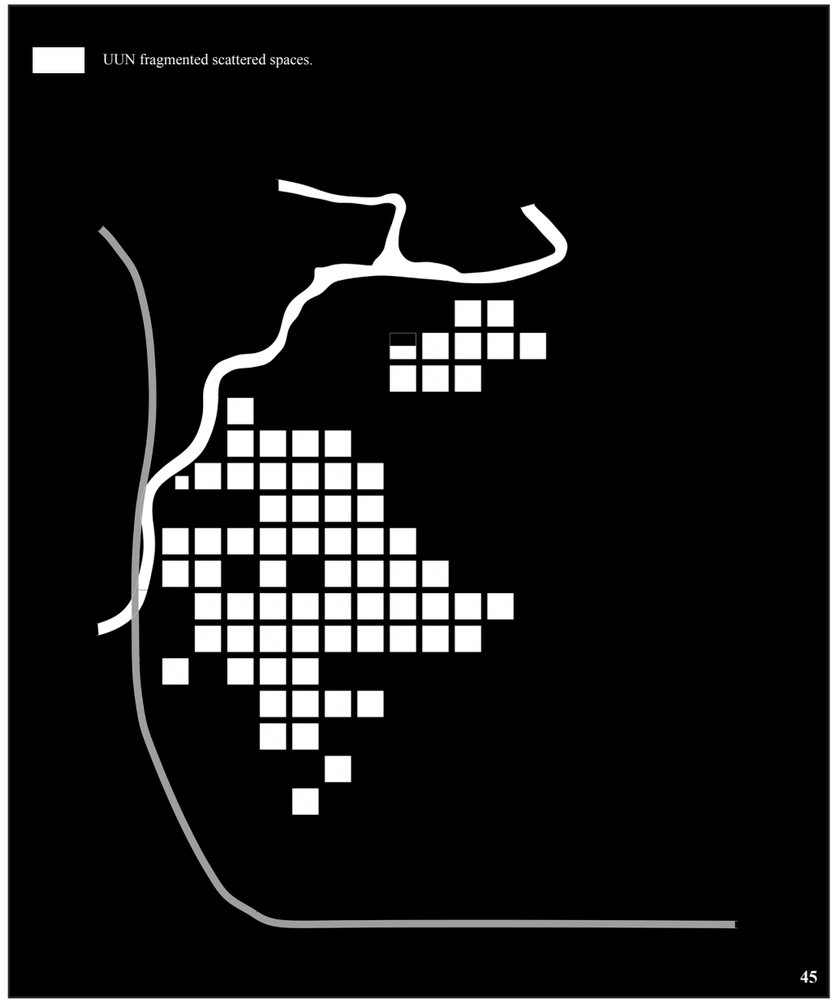
The void in this case is having the absence concept from the urban context. It is totally hidden under the built up areas, which eliminates the testimonial present intervention with underground space. The passenger who uses the public city space such as streets or open gardens cannot realize that there is another space underground except for those who enter to the buildings. This result is due to the absence of any visual contact – such as excavated subtracted space of glass landmark or sky lighted part as in Louver and Les Halles - between over ground public spaces and the underground nodes.

Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

44 - The diagram is abstracting the axis and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures responding to the overground refrences. The study is showing the correspondence in the UUN form to the over ground axial refrences. The axial references of the urban grid are represented in light blue dashed lines and the UUN spaces are demonstrated in white regular shapes,

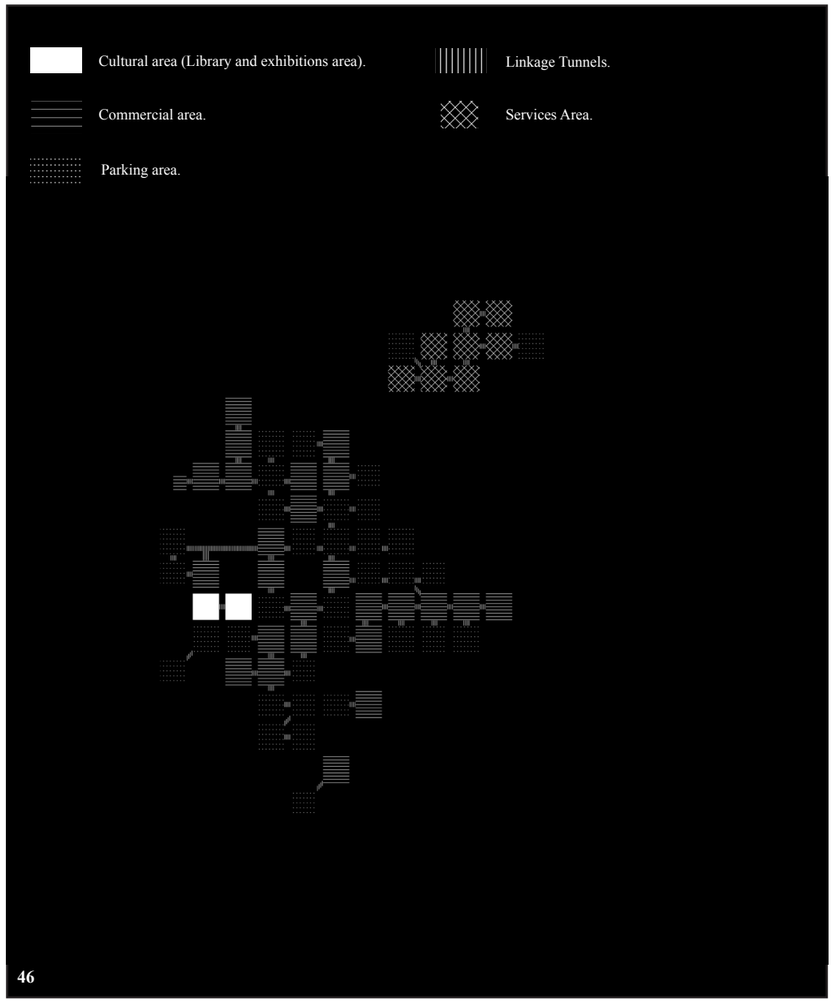
Profile.

45 - The white fragmented shape is the abstraction of the UUN profile.

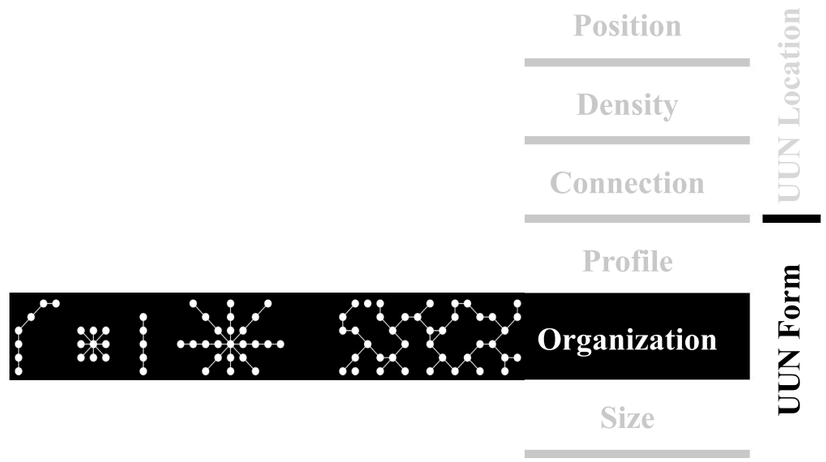


Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

46 - The organisation of the UUN different functions spaces.



Organization.



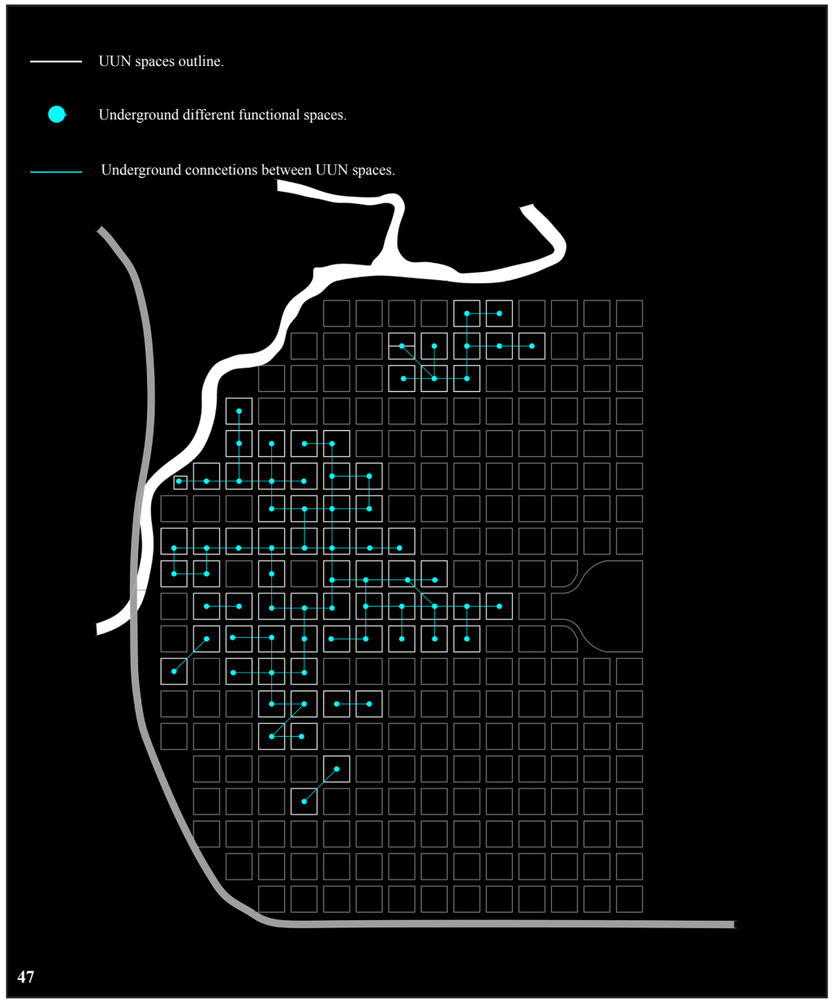
Concerning the UUN space organization in Houston, it is following totally different method than the last two European ones. The underground space as a whole is not united as it is in Les Halles or Carrousel du Louvre, but it is consisting of multi spaces that are distributed in the urban context, while being connected to each other from the underground level. This kind of organization of the space is giving a new perception of fragmented voids of diffused shapes in the urban context. Each gap of those is not multifunctional as the concentrated ones in the last tow examples, but as a group, they are giving the variety of uses. The dominant uses of the UUN spaces are commercial of parking lots while including also a separated part linking between Houston metropolitan research center and Houston Public Central Library (Diagram 46).

The UUN collective spaces in the city downtown are not all connected from the underground level together but mostly the similar functions are the ones linked together. Thus the cultural buildings like Houston metropolitan research center and Houston Public Central Library are having a direct link between them from the underground located in the east. On the north, there is services that are positioned in the basement between the hotels. In the middle most of the commercial centers with the parking are located under the towers in positioned in the middle part of the downtown where the biggest part of the underground network is established. It can be noted that the UUN spaces are fragmented and diffused in the city context. Another note is that in this case, the underground spaces are following a grid organization that is shaping an arranged net of joints, which is almost having the same rhythm between each dot and the other (Diagram 47).

To illustrate, the UUN spaces are scattered in the city downtown area in the case of Houston. The similar functional spaces are connected together with underground tunnels to establish parallel pedestrian networks that connect these diffused spaces together (Diagram 48).

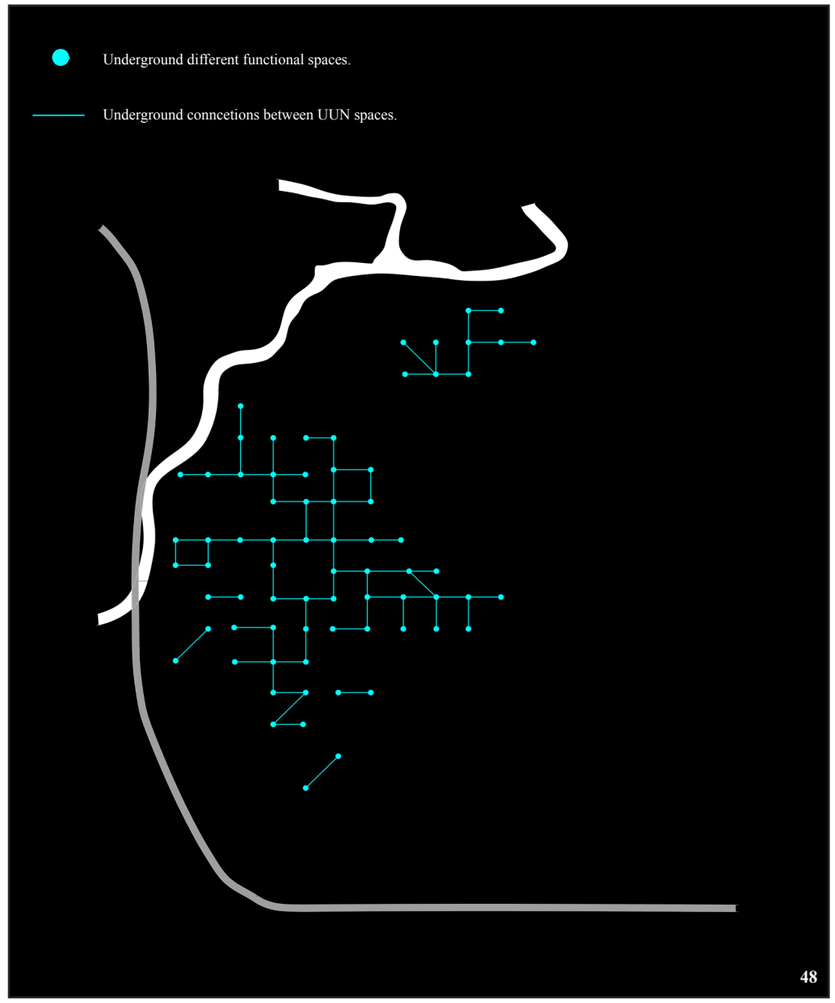
Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

47 - The relation between the organisation of the UUN space in the urban context of the city overground and the organisation of the internal space itself underground. The light blue dots are indicating the several UUN spaces and the light blue line is demonstrating how all internal spaces are linked together.



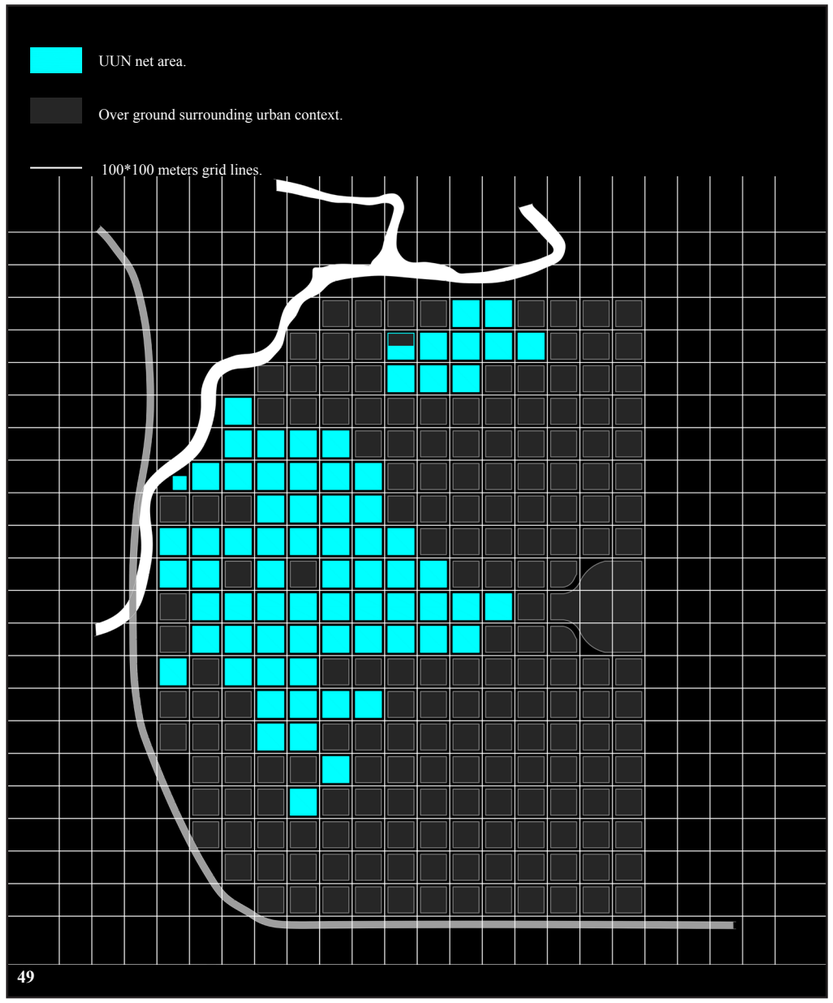
Organization.

48 - The organization of the internal spaces of the UUN. The light blue dots are representing the distribution of the various spaces, while the light blue lines are referring to the underground tunnels that are connecting them together to unite the underground-diffused spaces.

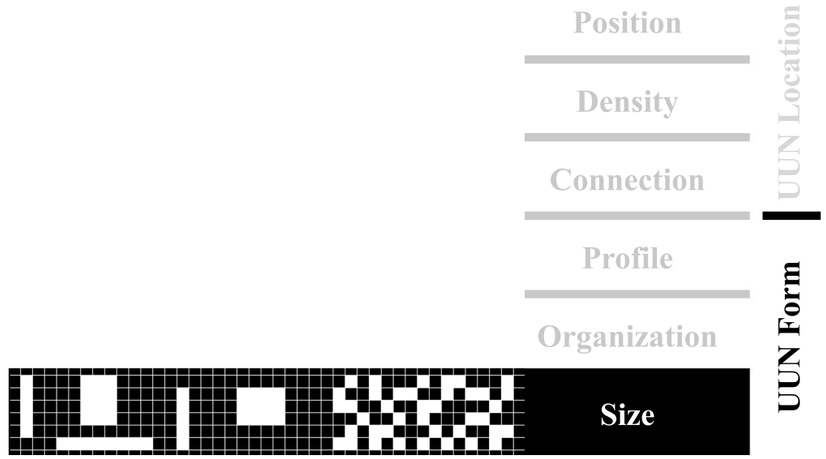


Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

49 - A diagram showing the size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.



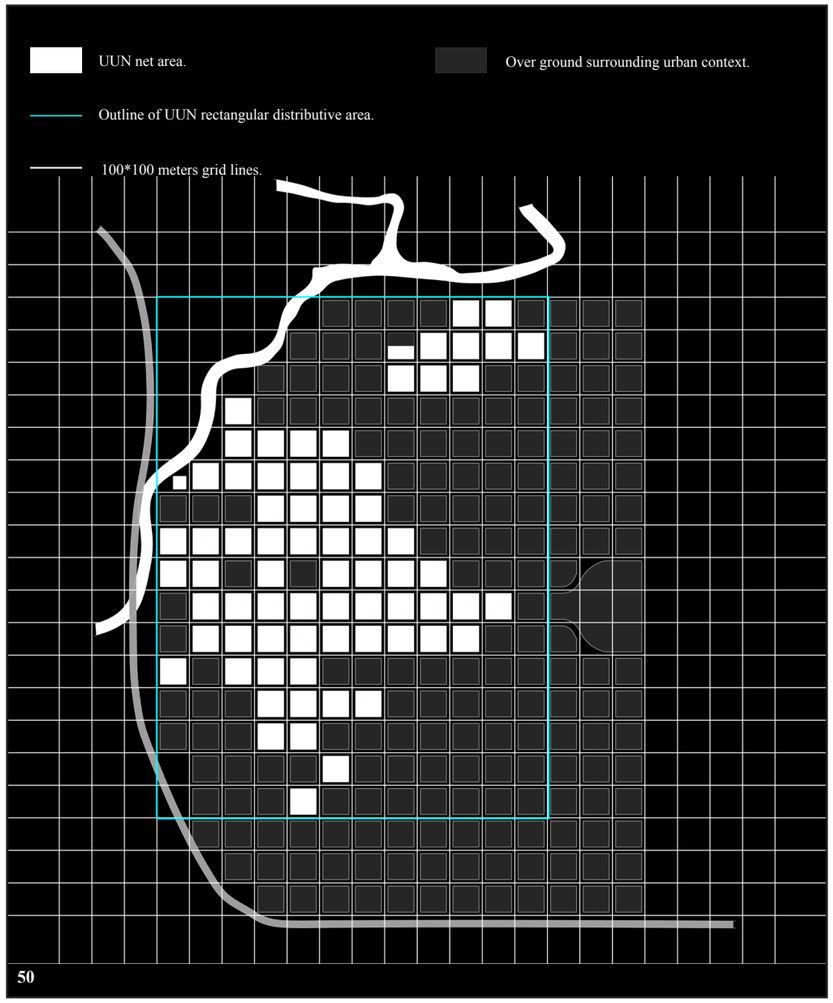
The UUN space in Houston is connecting urban plots in the city context with a net area of almost 720000 sqm, which is approximately 8 times the UUN net area in Les Halles and 10 times the UUN area of Carrousel du Louvre. This huge macro area of square meters is diffused under the downtown CBD area. The UUN diffused spaces are highlighted in light blue color among the urban context that is presented in grey color (Diagram 49). Both are presented with a hypothetical 100*100 meters grid on the top of them demonstrated with white lines. In this diagram, the ratio of the UUN area can be conceived in parallel with the context of the downtown area.

The UUN diffused spaces expands in a distributive rectangular area stretching between 1410 meters length and 1180 meters width (Diagram 50). In this macro size distributive area, there is an underground separated pedestrian network that is needed to connect all these scattered spaces. It also helps to connect between the towers in the downtown area internally without need to go out in the city streets for the on foot users.

The final scheme (Diagram 51) gives a comparison between the distributive areas in all the six study cases that the research is working on. The Houston example expands in a macro size area, which is a consequence of the diffused organization of the internal spaces of the UUN in the urban tissue in the downtown area.

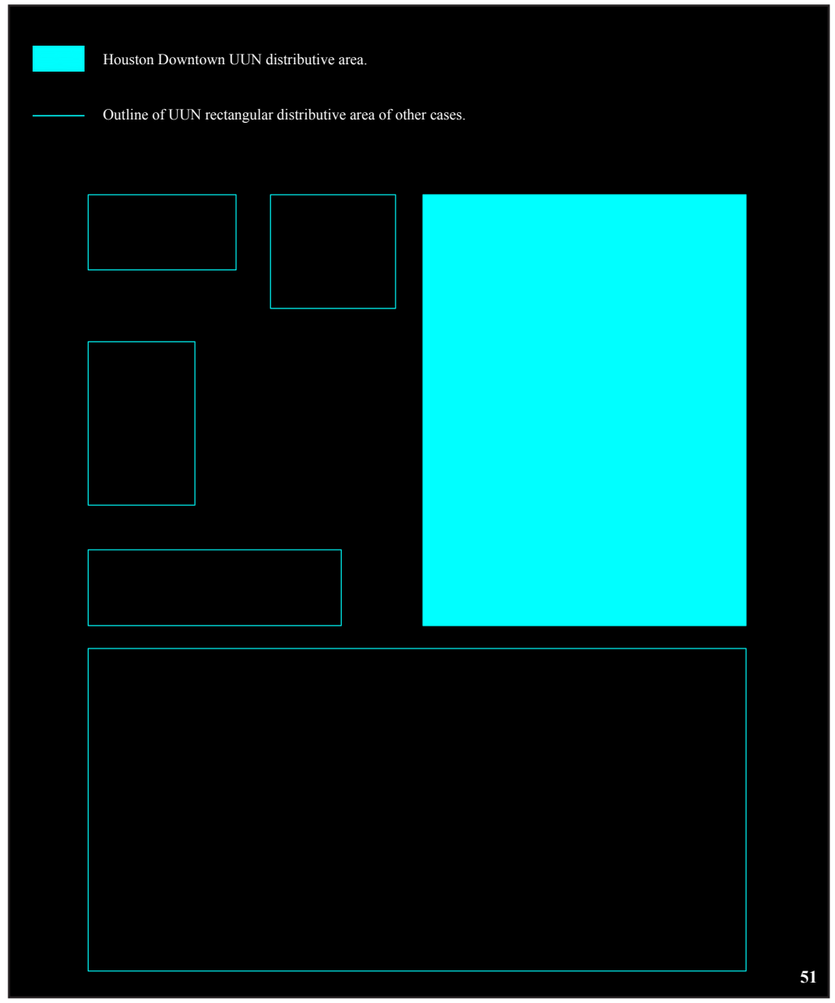
Houston Urban Underground Nodes, Texas, United States of America, North American Territory.

50 - A diagram showing the size of the UUN in a light blue color rectangle that represents the distributive area where the UUN is expanding in.

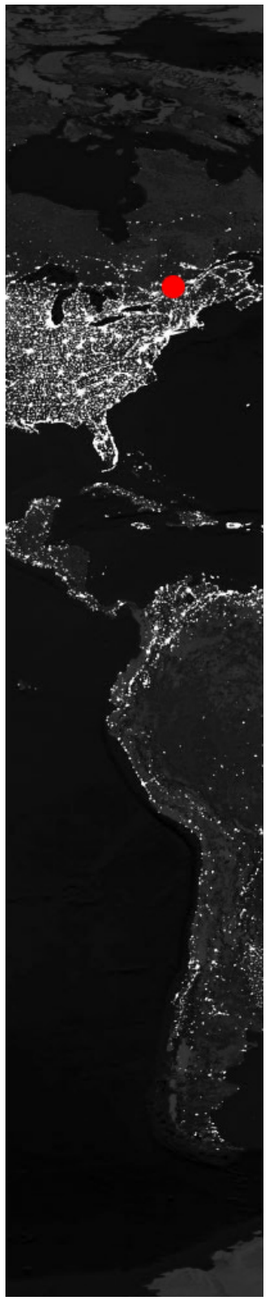


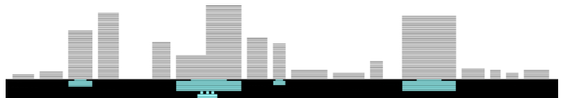
Size.

51 - All study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Houston Downtown UUN case. This scheme is illuminating the Macro size of the distributive area in this case relatively to the others.



Houston Urban Underground Nodes, Texas, United States of America, North American Territory.





1.2.2. Montreal Downtown UUN.

Quebec, Canada, North American Territory.

45°30′06.15″N 73°34′02.12″W

This case study is located in the east of Canada. The UUN spaces are diffused under several buildings in the city downtown area. Most of these underground-scattered spaces are counted as the basements of the covering buildings. These spaces are connected together through a parallel underground pedestrian network where the on foot user can move freely between the different downtown parts through an internal spaces underground without the need to go up in the urban external spaces or streets. On the other hand these spaces are linked with the metropolitan system underground. The UUN spaces have commercial dominant function while they contain other types in a relatively smaller scale like cultural, educational, sports or exhibitions area.

Map: 7

Map: 8

Position.

Position

Density

Connection

Profile

Organization

Size

UUN Location

UUN Form

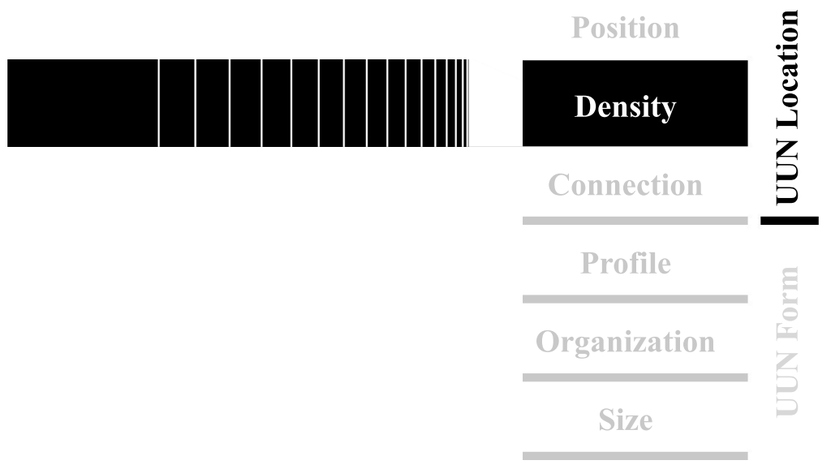
The UUN in the case of Montreal is very similar to the one in Huston. First of all, it is positioned in the Canadian territories at Québec province in the North American continent. The spaces of UUN are mainly located under the downtown high-rise buildings where the CBD is placed (Map 7). Montreal downtown area is an extension of the old part of the city close to the old port. The UUN in this case gave the opportunity to pedestrians to move between both areas – the CBD downtown and the old town – through the underground space by established linkages between the diffused spaces underneath the buildings positioned in both parts.

Like the case in Downtown Huston American example, the UUN spaces here also take place where the vibrant evolution existence of different context character is existed. The downtown part contains most of the towers and high-rise buildings that the city has and this is where the UUN spaces are distributed underneath. It is still counted as the place where the urban tissue is having new figure in the city skyline, which is making it unique and different regarding all city parts (Map 8). The UUN is positioned also here in this case, in the area where this transformation takes action in the city section by installing uncommon type of buildings that are the high-rise towers in the downtown part.

Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

52 - The over ground urban context of Montreal Downtown CBD area, abstracted and presented to show the built up areas aside with the open public squares. There are 3 different intensities of lines in this diagram. The highest is referring to the high-rise buildings and towers. The middle ones are indicating the buildings with low or middle heights. And the least intensive lines are signifying the non-built up areas such as gardens and parking lots.

Density.



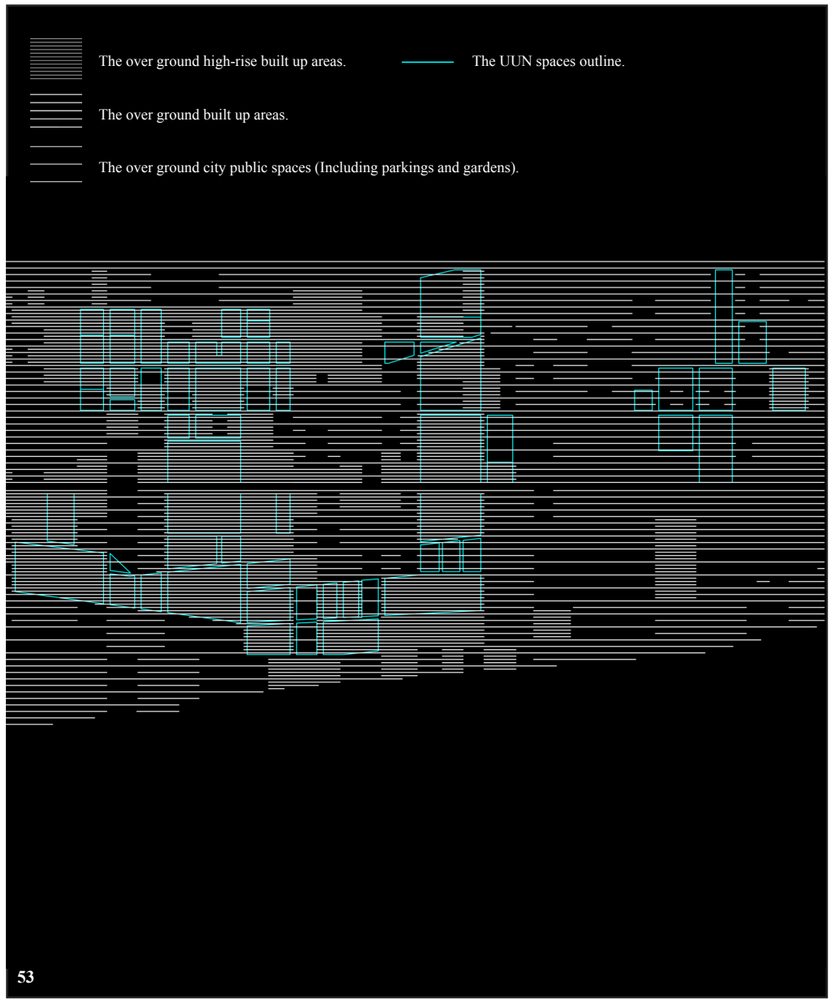
Concerning the constructed buildings density theme, Montreal UUN case study is similar to the one in Huston. The downtown here also has a variety of buildings regarding the density of heights while being only city part that monopolizes the presence of the high-rise towers (Diagram 52). This is because of the city regulations and policies that allow constructing high-rise towers in this city part. These policies are one of the factors that helped to give a special and exceptional character and identity to the downtown area regarding the buildings heights and scale.

The UUN spaces are mostly located under the high-rise or middle height buildings. They take place in their basement, while all the underground spaces are connected together through an underground pedestrian network. (Diagram 53). This study is demonstrates the followed method of placing the UUN spaces mostly under the high-rise buildings in the city.

The method of locating the underground space regarding the type of covering object here is totally very close to the followed concept Houston case while it contradicts the European way. This is exposed in the (Diagram 54) where the UUN spaces and underground linkages are drawn in an abstracted way to show the covering type of the urban context. As can be conceived from the mentioned draft, the major covering urban objects are the high-rise then the medium height buildings.

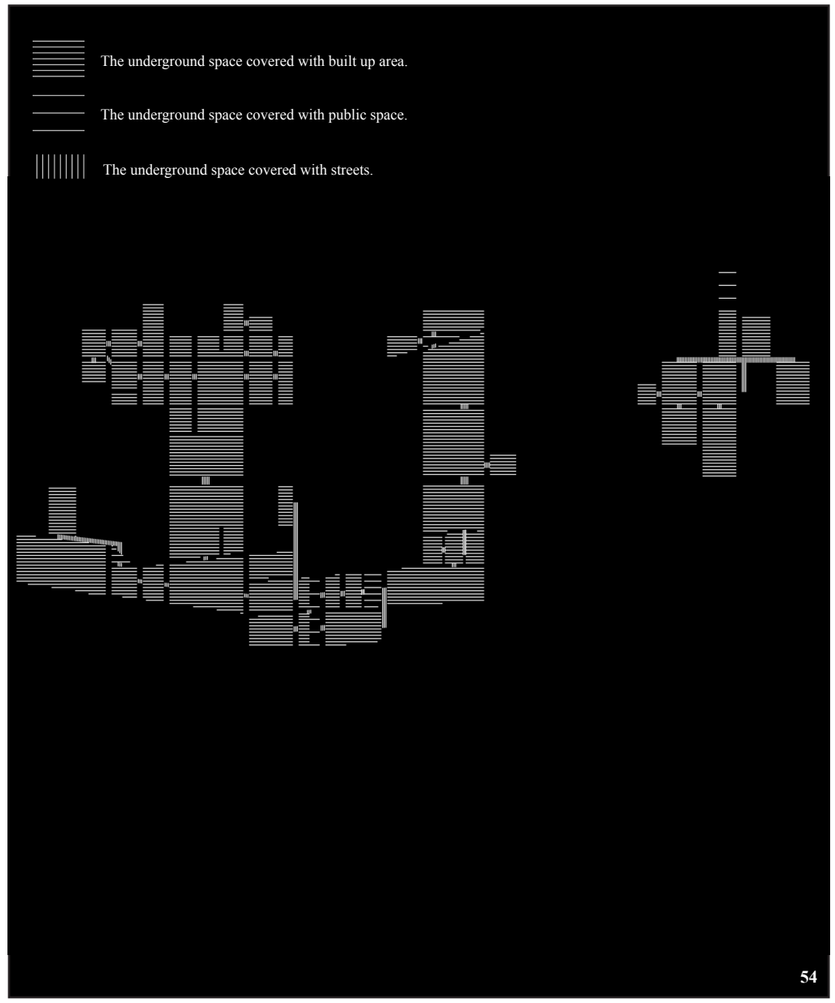
Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

53 - The over ground urban context of Montreal Downtown CBD area, abstracted and presented to show the density and compactness of the built up and open spaces areas. In light blue line, the abstracted outline of the UUN spaces demonstrating now they are mostly located under the high-rise buildings.



Density.

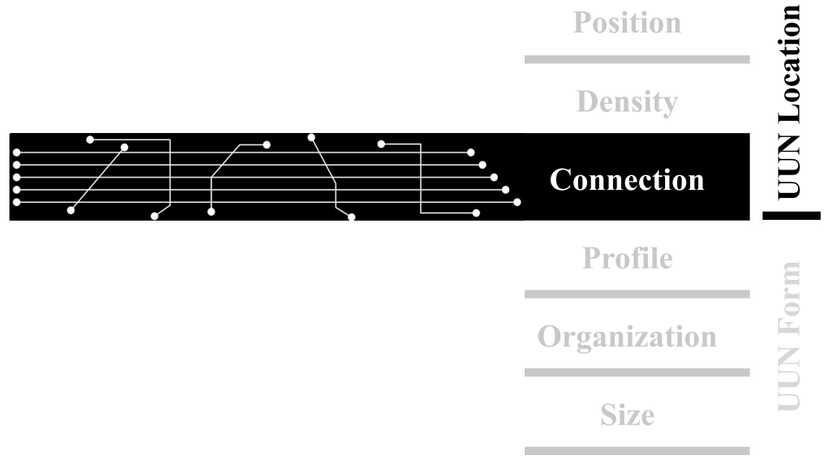
54 - The UUN form presented with different lines directions that refers to the covering type of context: high-rise, low-rise built up, streets or open space area. The vertical lines are referring to the streets, the condensed horizontal lines are pointing out the high-rise towers while the uncondensed ones are pointing out the open spaces, gardens and parking lots on the top of the UUN space.



Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

55 - This diagram is showing the vertical access points in light blue dots in the urban context.

Connection.



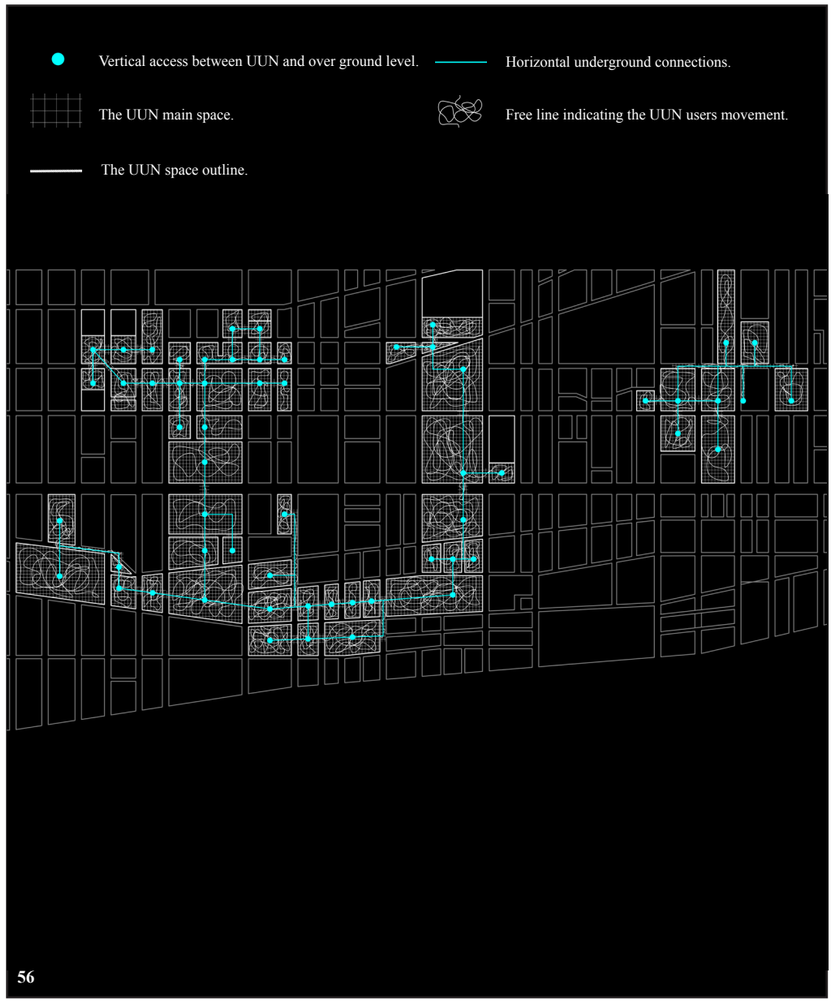
In the case study of Montreal, the majority of UUN diffused spaces are connected vertically to some of the pedestrian urban sidewalks network but mainly these scattered spaces are connected to the ground floor of the building on the top of it, which makes these spaces connected to an internal space – the covering building - instead of an external one - like a garden, square or even a sidewalk. This means that the main accesses to go to the underground is out of sight, inside the covering buildings on the top of the underground spaces (Diagram 55). The ground floor of these buildings in this case acts as a mutation area between the underground and the external environment. The vertical underground entrances are not visible in the urban context in this case to the external public spaces users, as they should enter to the buildings, so they can have the access to go down to the UUN different spaces.

The UUN here in this case is composed by diffused spaces that are jointed together horizontally through an underground pedestrian network of tunnels that connect them under the name of PATH. As the spaces are positioned under the buildings, the established linkage tunnels are positioned under the city streets network. The UUN here offers a new system of underground network for the on foot user, connecting different parts of the city but in another level. It can be noticed that most of these spaces are placed in different parts of the city, which gives it the advantage of connecting these parts together through the offered underground pedestrian network (Diagram 57).

Moreover, the UUN spaces are connected to different transportation systems. This is because in one hand, they contain parking spaces that are in a direct contact with the vehicular urban streets over ground. On the other hand, there are several access points to almost seven underground metropolitan stations, which are located under the UUN different diffused spaces (Diagram 58).

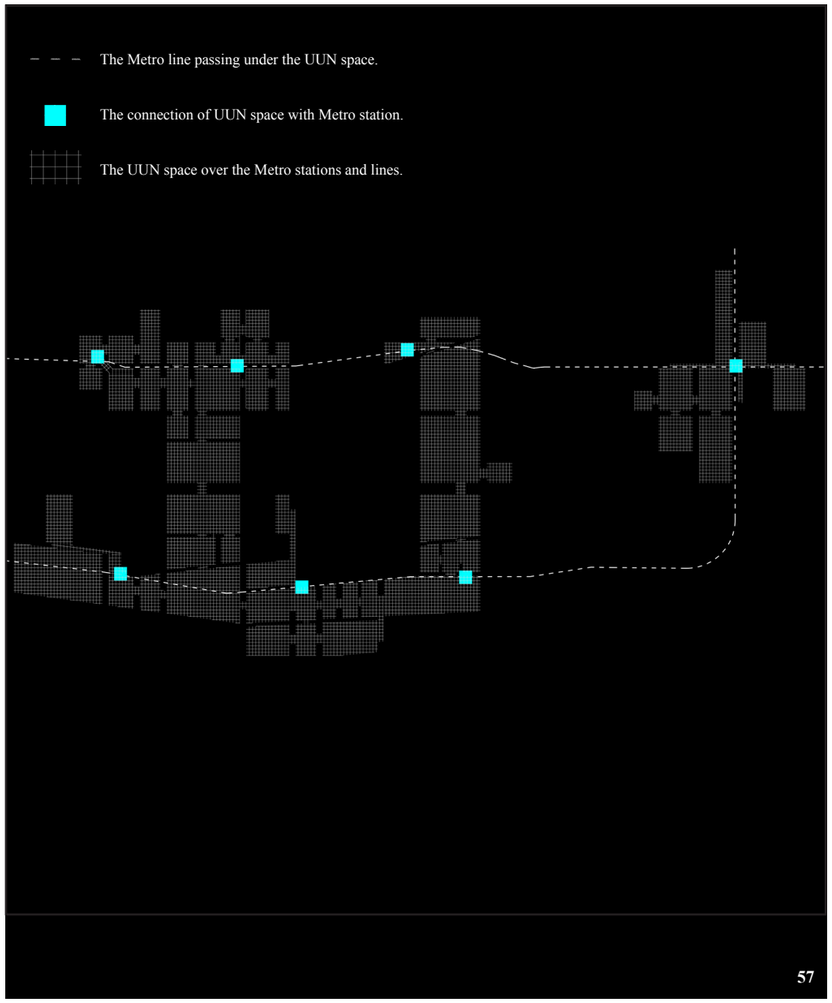
Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

56 - The vertical access points in light blue dots and the accessibility between them in the underground level through the light blue lines that represents the underground linkages between the different UUN spaces. All these are shown in parallel with the urban context to understand the relation between all elements together.



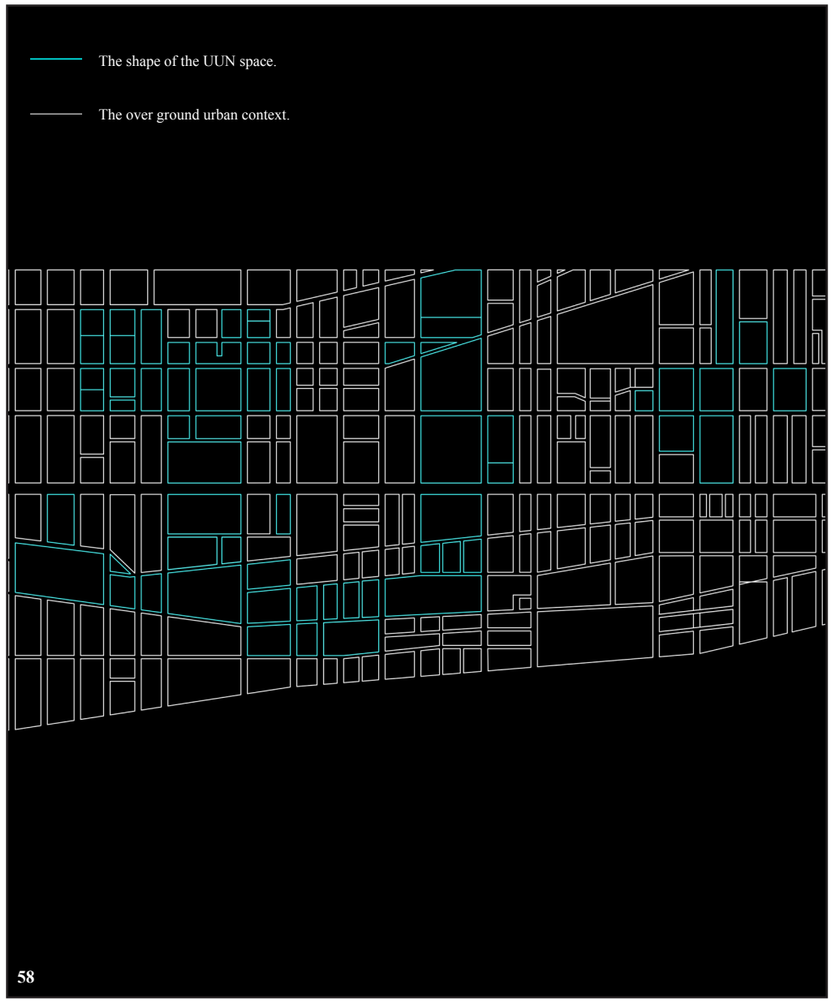
Connection.

57 - The connections between the UUN spaces and the underground metropolitan transportation system.

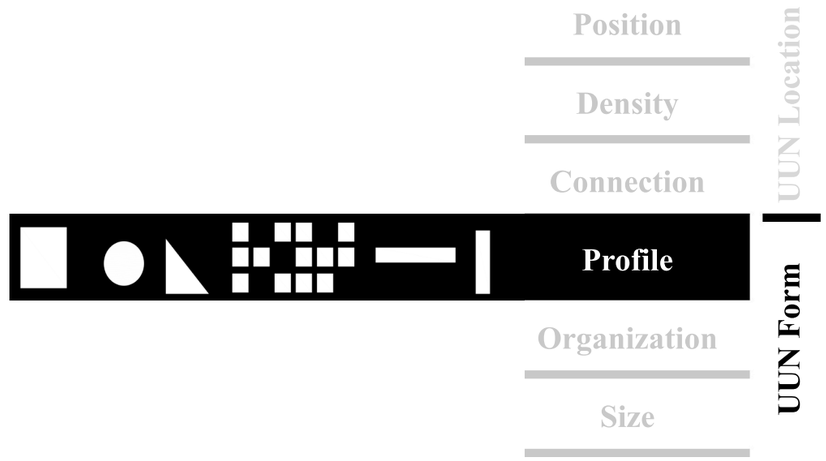


Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

58 - The UUN space profile abstracted in light blue line that is refering to the outline of the space inbetween the urban context of the over ground city, which is abstracted in white lines.



Profile.



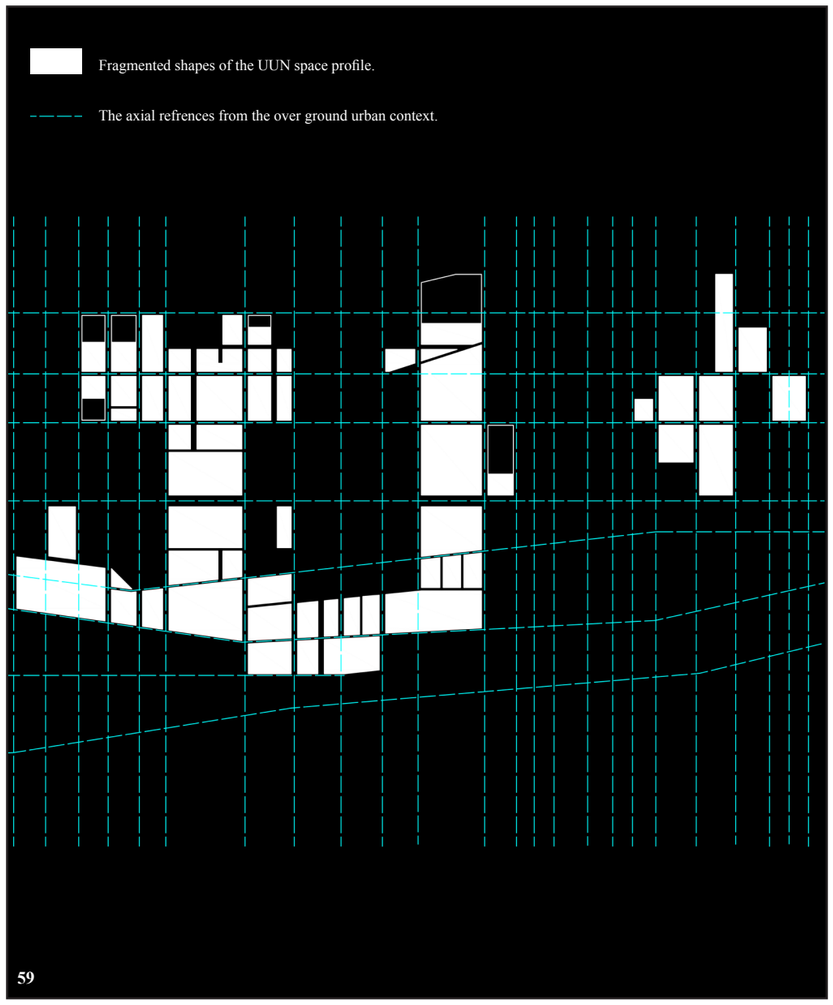
The profile theme of Montreal UUN is a lot similar to the last one in Huston. The underground void also consists of several diffused regular shapes done by the grid used to plan the city downtown. The UUN diffused spaces pattern is influenced by the city plan above, following the plots figure to present it in the underground void plan. The basements of the downtown buildings – which are considered as vertical negative extensions – are used to compose the map of the UUN final shape, consisting by a collage of these connected underground spaces. Thus, the UUN is consisting of different basements blocks that are divided under the constructed buildings in the urban tissue then connected to each other with underground tunnels network (Diagram 58).

The clear regular figures in the underground correspond with the references of the city urban grid, which formed the urban context over ground as well. The underground nodes are having very clear identification formed by the streets network. The final profile of the underground is composed of scattered voids divided by the city urban axes that give them a new articulation of single spaces stitched and patched together to create the final underground profile (Diagram 59). As a result, the underground main spaces are diffused respecting axial grid to give the final form of the UUN (Diagram 60).

The underground nodes here are also categorized under the absent void type. The spaces doesn't have a clear direct visual connection with the over ground spaces such as an underground open subtracted space or an obvious glass landmark like in Louver example. The only visual contact they have with the over ground is through the above covering buildings which are again separated from the city streets and public urban spaces. It is hard to perceive this underground space from above.

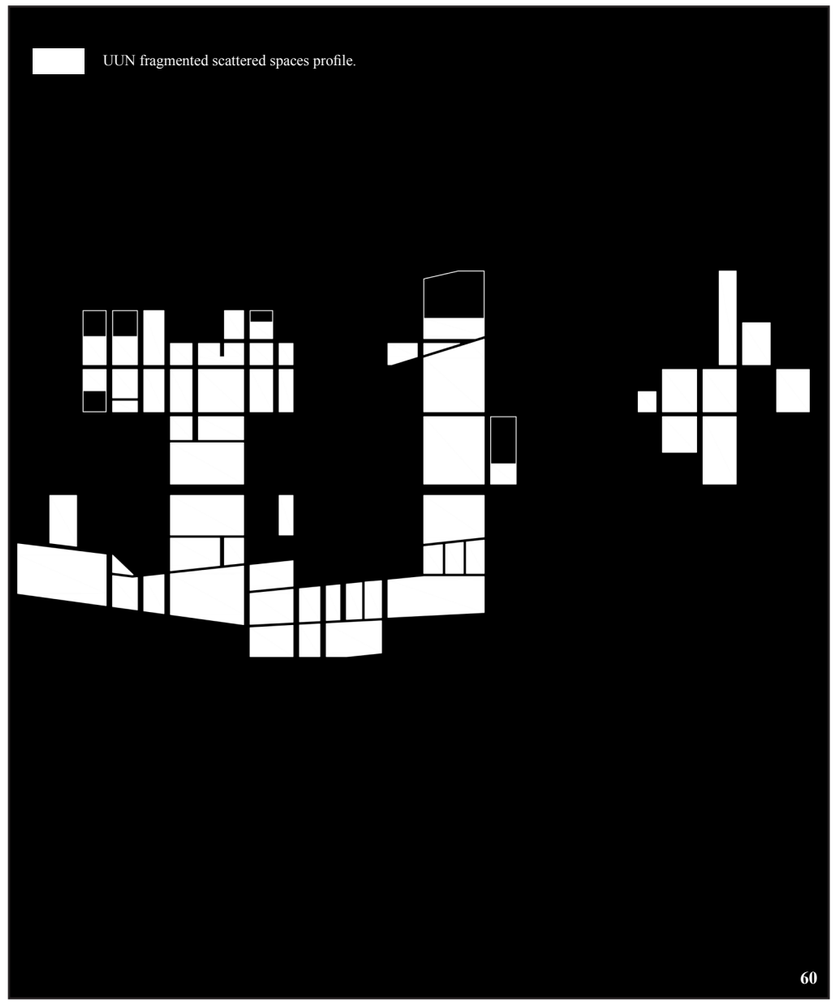
Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

59 - The diagram is abstracting the axes and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures corresponding to the overground refrences. The study is showing the correspondence in the UUN form to the over ground axial refrences.



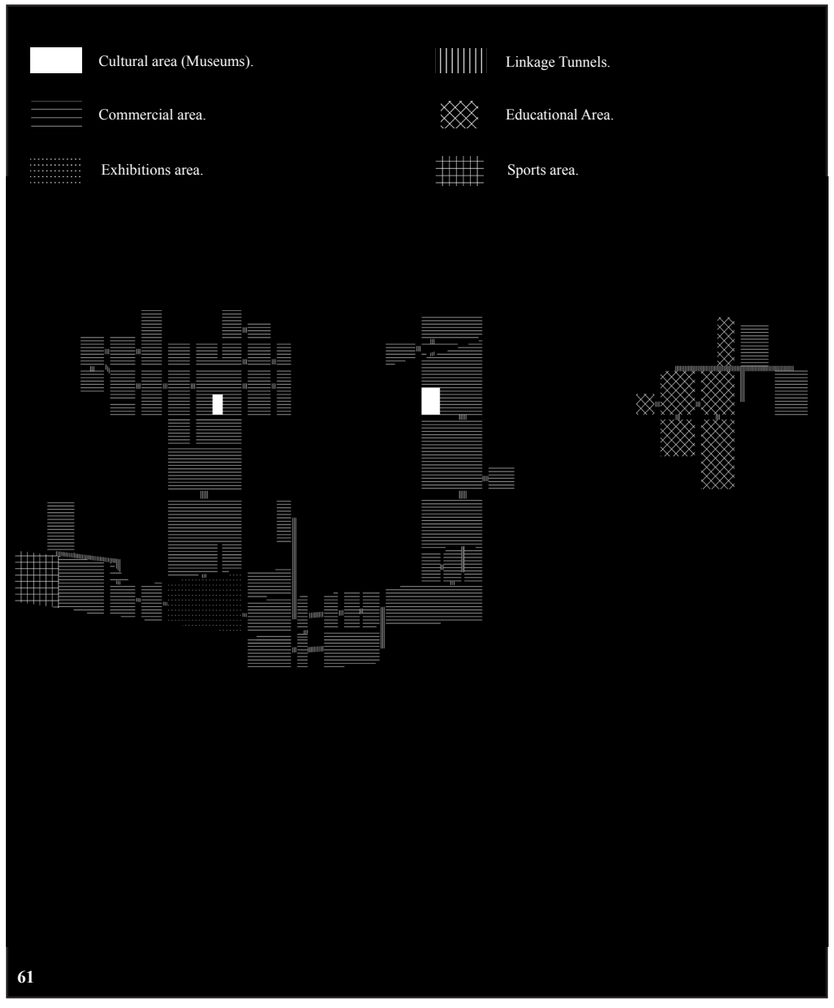
Profile.

60 - The white fragmented shape is the abstraction of the UUN profile.

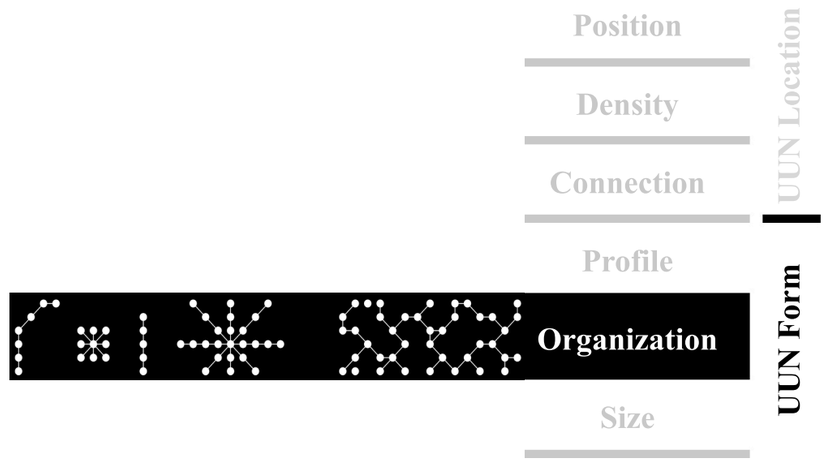


Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

61 - A diagram showing the organisation of the UUN different functions spaces.



Organization.



The organization concept of the UUN in Montreal leans towards decentralization of the scattered spaces as the last one in Huston. The UUN is represented in diffused spaces that are spread out in the urban context (Diagram 61) connected to each other through underground links. Each space offers new character or a new identity through the various functions or the different articulation of spaces from one to another for the consumers or the passengers. The dominant function in the UUN spaces is the commercial one while there are spaces that have different types of functions. For example, there is the sport function represented in the Centre Bell where the hockey games are held. There are also cultural uses such as Grévin Montréal museum and MAC Musée d'art contemporain de Montréal. Adding to that, there are the exhibition areas of Place Bonaventure and underground linkages and spaces that connect different parts of Université du Québec. All these spaces with their included different functions are connected directly to seven underground metropolitan stations.

As it can be noticed, the diffused voids seem to be distributed randomly in the city plan, while the big main part on the left it takes a decentralized organization creating an underground on foot network in the city layout like a mega U shape. From this U shape trunk, the other sprouts are branching out of it. On the right side where the Université du Québec is located, there is small separated part of the UUN spaces that also follows the same concept by having an axial organization of a main trunk, from where the smaller branches depart to connect other diffused spaces (Diagram 62). Both parts are connected from the underground through the metropolitan lines.

To illustrate, the UUN spaces are very diffused in the downtown part of Montreal city. These spaces are connected together from the underground level through a parallel pedestrian underground network that links them together (Diagram 63). On the other hand, there are seven metropolitan stations that have direct internal access from these UUN spaces.

Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

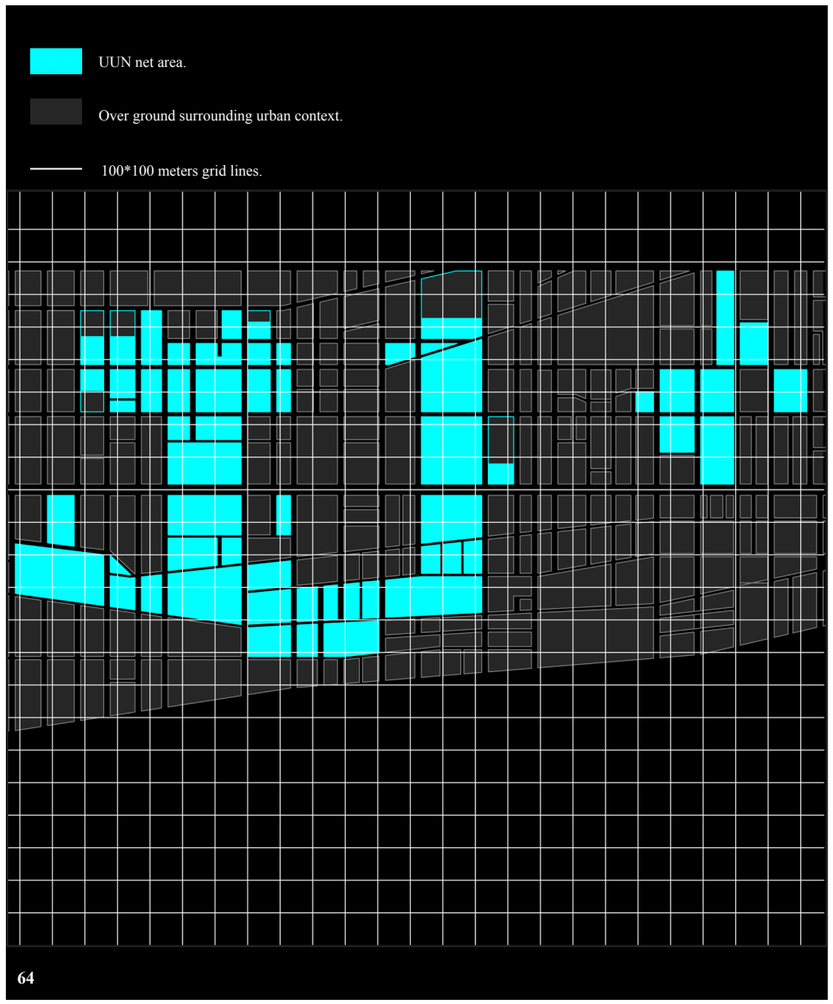
62 - The relation between the organisation of the UUN space in the urban context of the city overground and the organisation of the internal space itself underground. The light blue dots are indicating the several UUN spaces and the light blue line is demonstrating how all internal spaces are linked together.

Organization.

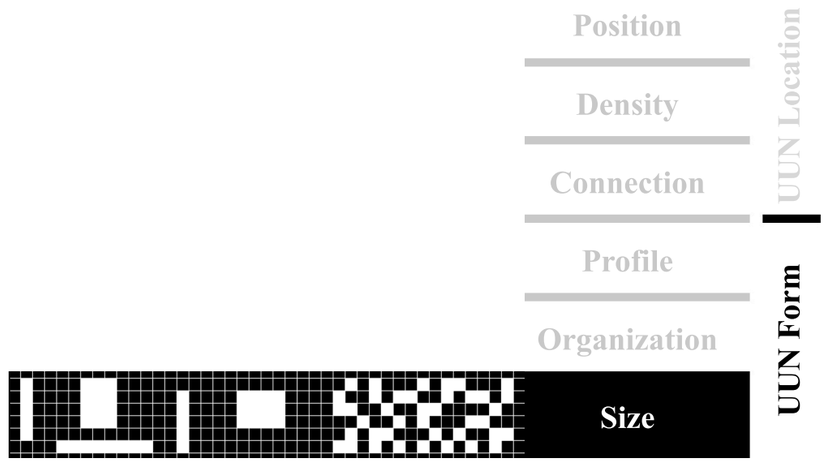
63 - The organization of the internal spaces of the UUN. The light blue dots are representing the distribution of the various spaces, while the light blue lines are referring to the underground tunnels that are connecting them together to unite the underground-diffused spaces.

Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

64 - A diagram showing the size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.



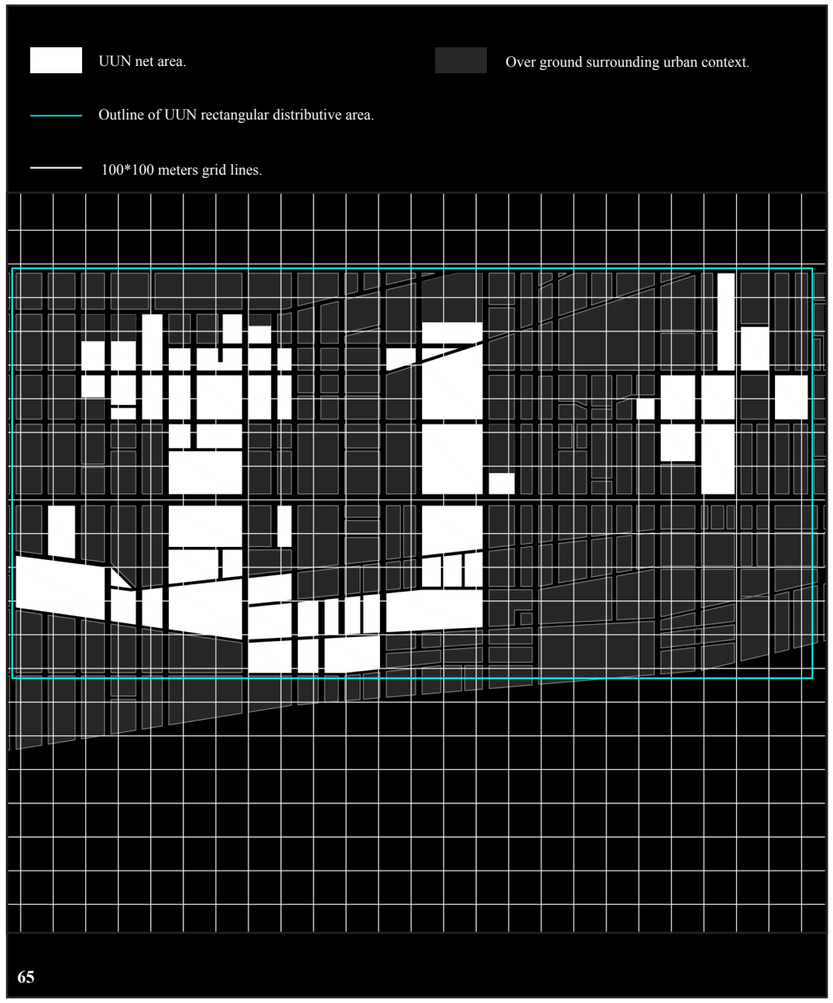
The UUN spaces in Montreal are connecting urban plots in the city context with a net area of almost 595412 sqm. This is another macro size area regarding the size of all other study cases. This established huge underground area is distributed under the downtown CBD area. In the simplified (Diagram 64), the UUN diffused spaces are highlighted in light blue color among the urban context that is presented in grey color. Both are presented with a hypothetical 100*100 meters grid on the top of them demonstrated with white lines. In this diagram, the ratio of the UUN area can be conceived in parallel with the context of the downtown area.

The massive net area of the UUN diffused spaces here stretches in a distributive rectangular area between 2500 meters length and 900 meters width (Diagram 65). In this macro size distributive area, there is an underground separated pedestrian network that is needed to connect all these scattered spaces. It also helps to connect between the towers in the downtown area internally without need to go out in the city streets for the on foot users.

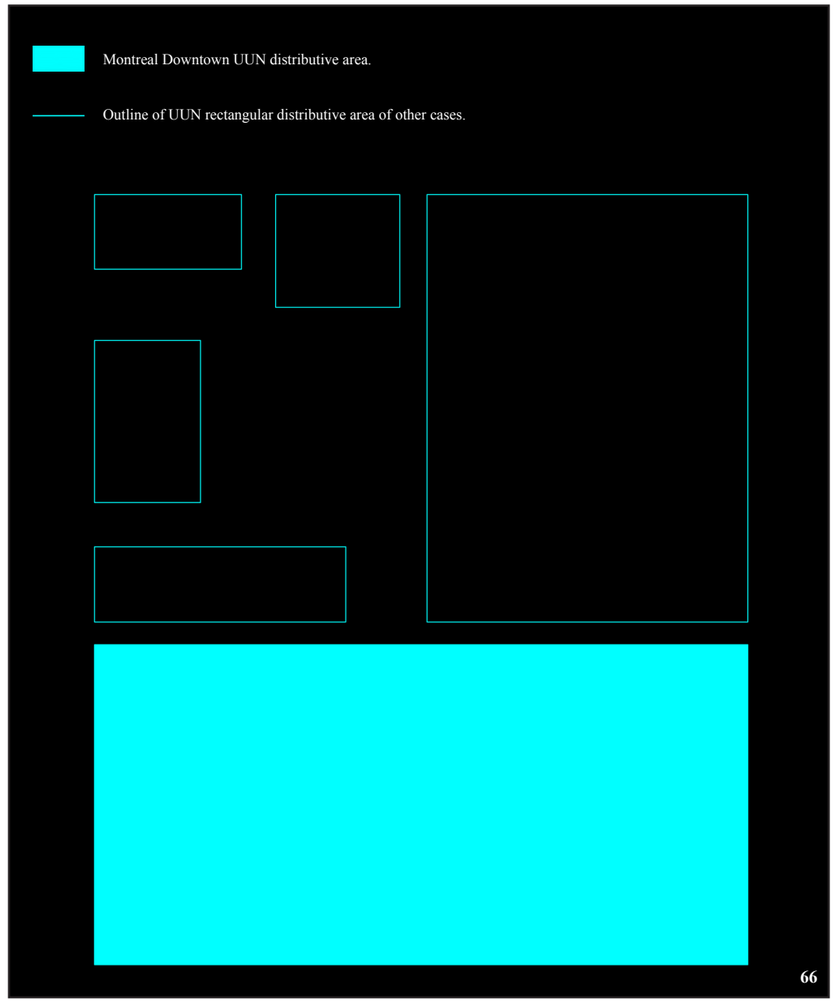
The final (Diagram 66) gives a comparison between the distributive areas in all the six study cases that the research is working on. The filled light blue rectangle is the one indicating Montreal UUN case study's expanding area. This scheme illuminates the huge Macro size of the distributive area in this case relatively to the others.

Montréal Urban Underground Nodes, Québec, Canada, North American Territory.

65 - A diagram showing the size of the UUN in a light blue color rectangle that represents the distributive area where the UUN is expanding in.

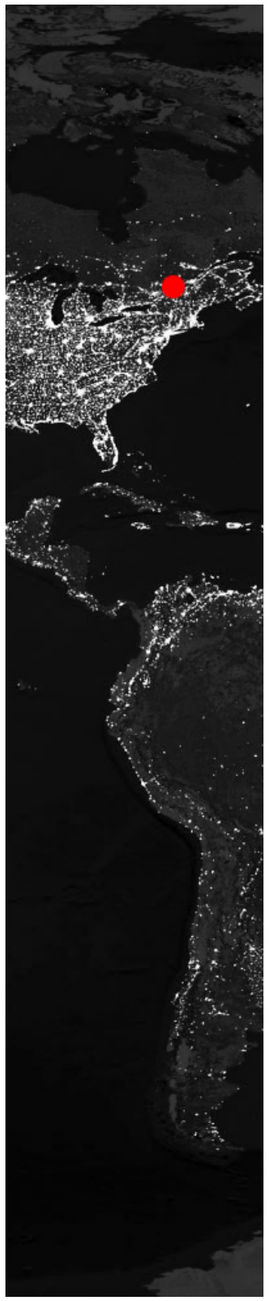


66 - All study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Montreal Downtown UUN case. This scheme is illuminating the Macro size of the distributive area in this case relatively to the others.



Size.

Montréal Urban Underground Nodes, Québec, Canada, North American Territory.



1.3.Far Eastern Cases.

1.3.1. Crysta Nagahori UUN.

Osaka, Kansai, Japan, Far-Eastern Territory.

34°40′29.72″N 135°30′07.86″E

In this case study the UUN space is taking place under the one main urban vehicular streets. The UUN space offers several entrances that provide multi-underpasses from a sidewalk to another where they are located. The on foot passenger can overcome the vehicular flow in the principle large streets through these offered underground spaces. On the other hand, the UUN connects three different metropolitan stations that are located as well under the city transportation route' principle streets. The UUN space has two main uses, commercial ones and the established metropolitan stations.

Map: 9

Map: 10

Position.

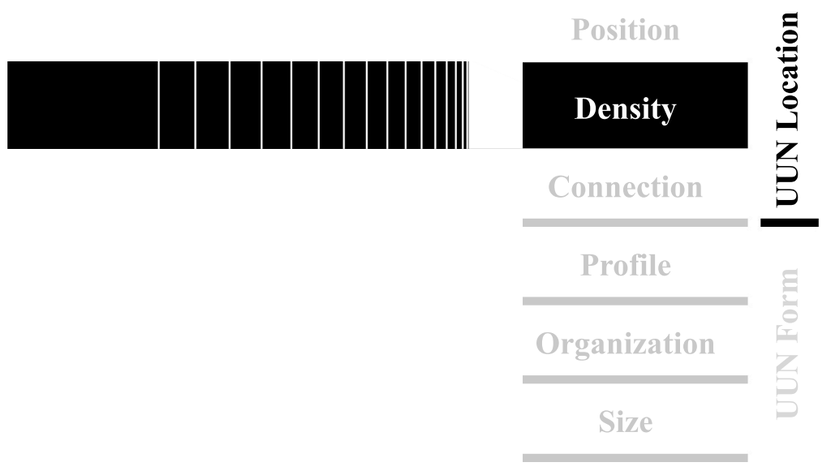
In the Case study of Crysta Nagahori, the UUN space is located in Osaka city in the Japanese territories at the Far East. The city here is having a system of main streets that are including different types of transportation systems as the underground metropolitan stations and lines. These main streets are having larger width than the others in the urban plan of the city. The UUN space is positioned under one of these main axial boulevards that contains a complex of transportation systems (Map 9).

The UUN here is a linear space that is located in a strait margin limited by buildings from both sides. This margin is Nagahori-dori street that is covering the UUN space and is considered as one of the main streets in the city plan, as a part of an axial system that is defining the city layout (Map 10). This street is wider than the other streets, which is breaking the compact built up rhythm of buildings in the city context with this wide boulevard. This musical pause location is a transformation point in the urban volume, creating a void break in a continues urban solid tissue. The UUN is positioned here in this case, in the area where this mutation is happening in the city section.

Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

67 - The over ground urban context surrounding Crysta Nagahori UUN area, abstracted and presented to show the built up area aside with the vehicular streets. There are 2 different intensities of lines in this diagram. The intensive horizontal lines are pointing out the built up constructed buildings in the urban blocks at the different city zones while the less intensive ones are referring to the primary city streets that are dividing the urban tissue into zones.

Density.



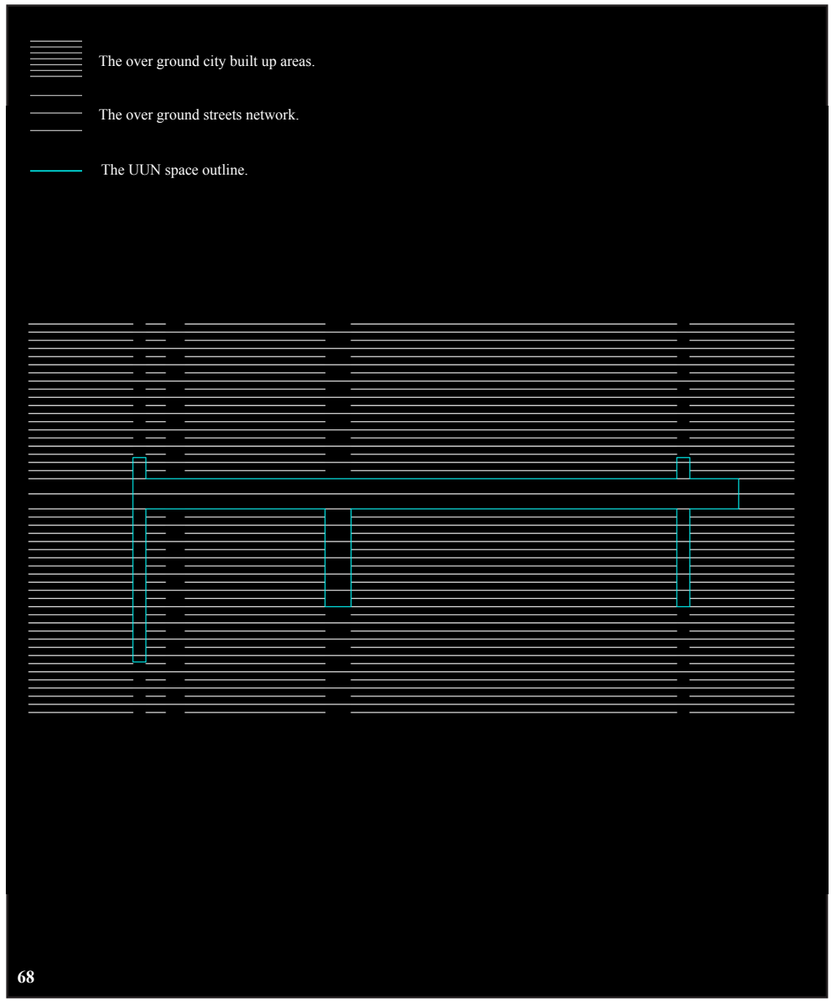
Crysta Nagahori example establishes a new methodology regarding the placement of UUN in relation with the density of the covering urban tissue type. The city context is very compact while it is divided into different zones. In the urban tissue, the vehicular streets are responsible for these urban divisions between each zone and the other (Diagram 67). The Nagahori-dori street is one of the main principle streets that plays the role of a principle transportation route in the city master plan. It is also one of the widest streets in the city lay out.

The UUN in this case is positioned under the main wide vehicular route in the city context, which is Nagahori-dori street. This is due to its larger width compared to the other streets in this part of the urban tissue. This vast wideness helps this street to work as an urban linear public space boulevard for the city users and this is where the UUN is allocated (Diagram 68). That demonstrates the strategy of locating the UUN space in the city lay out under the main primary street, between the urban blocks.

To illustrate, the method of locating the underground space regarding the type of covering object here is totally different than the followed concept in the North American or the European model. This is exposed in the (Diagram 69) where the UUN is drawn in a way to show the covering type of the context. In this draft there is only one type of line used, the vertical lines, which refers to the above streets that are the only urban object that covers the UUN in the case of Crysta Nagahori.

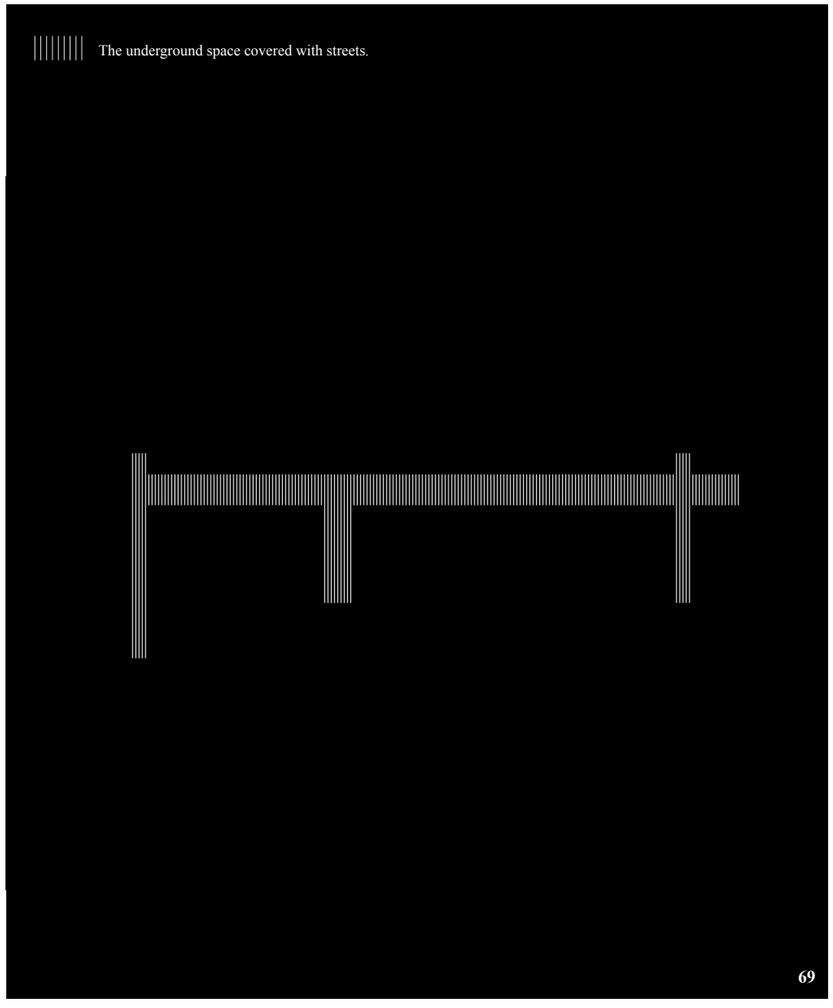
Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

68 - The over ground urban context of Crysta Nagahori area, abstracted and presented to show the built up areas and boulevard streets. The shape in light blue line is demonstrating the UUN space and its location regarding the city context. In this case it is different than all the last case studies. The UUN is positioned only under the least intensive lines in this draft, which means it is away from the built up blocks, placed under the main primary street, between the urban blocks.



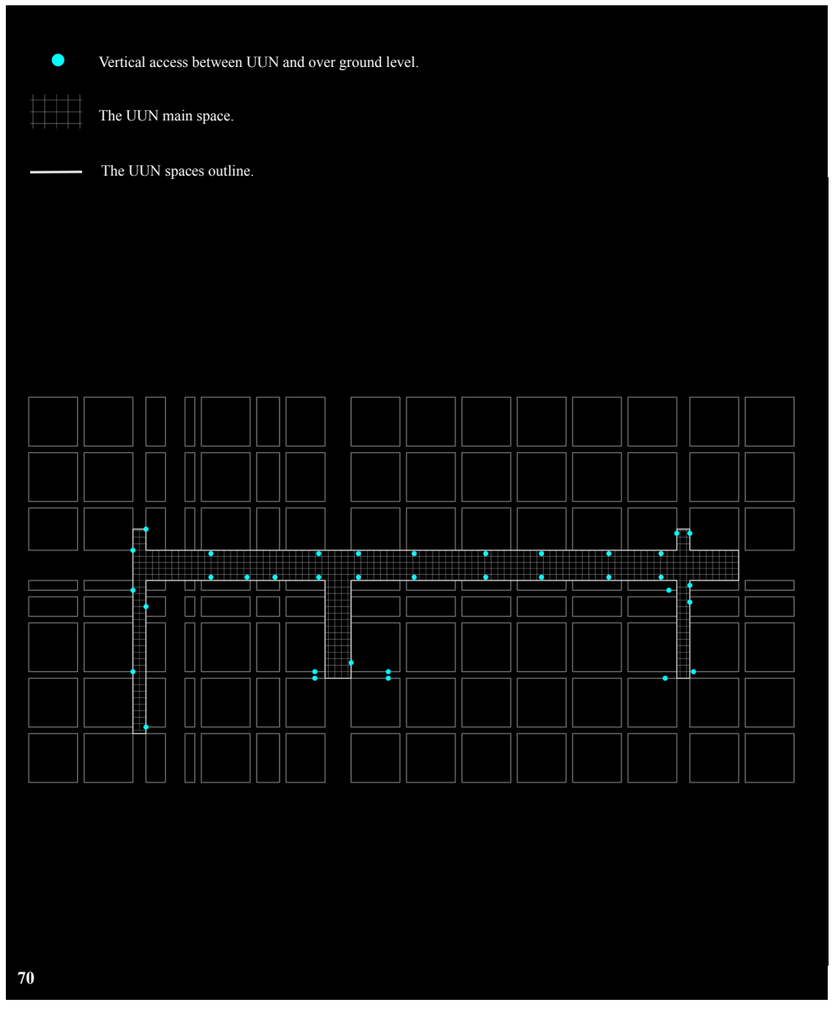
Density.

69 - The UUN form presented in a way to show the urban tissue covering type of the context. In this draft there is only one type, the vertical lines, which refer to the covering urban streets type.

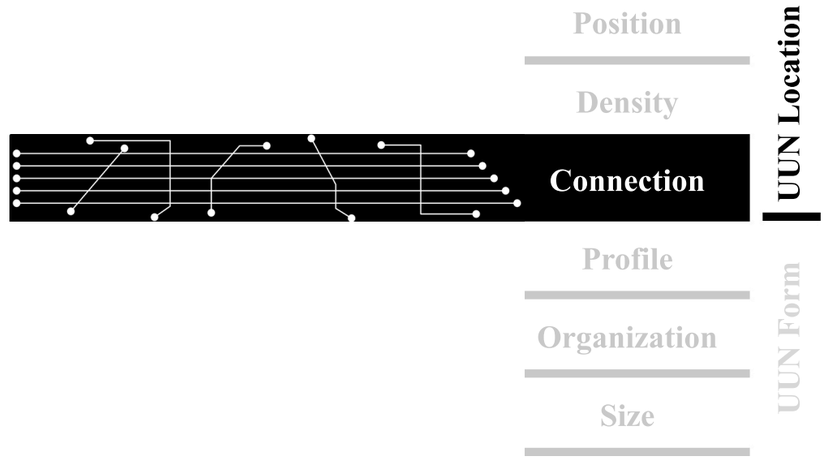


Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

70 - The vertical access points between the UUN space and the over ground. The vertical asscess are presented in light blue dots in the urban context.



Connection.



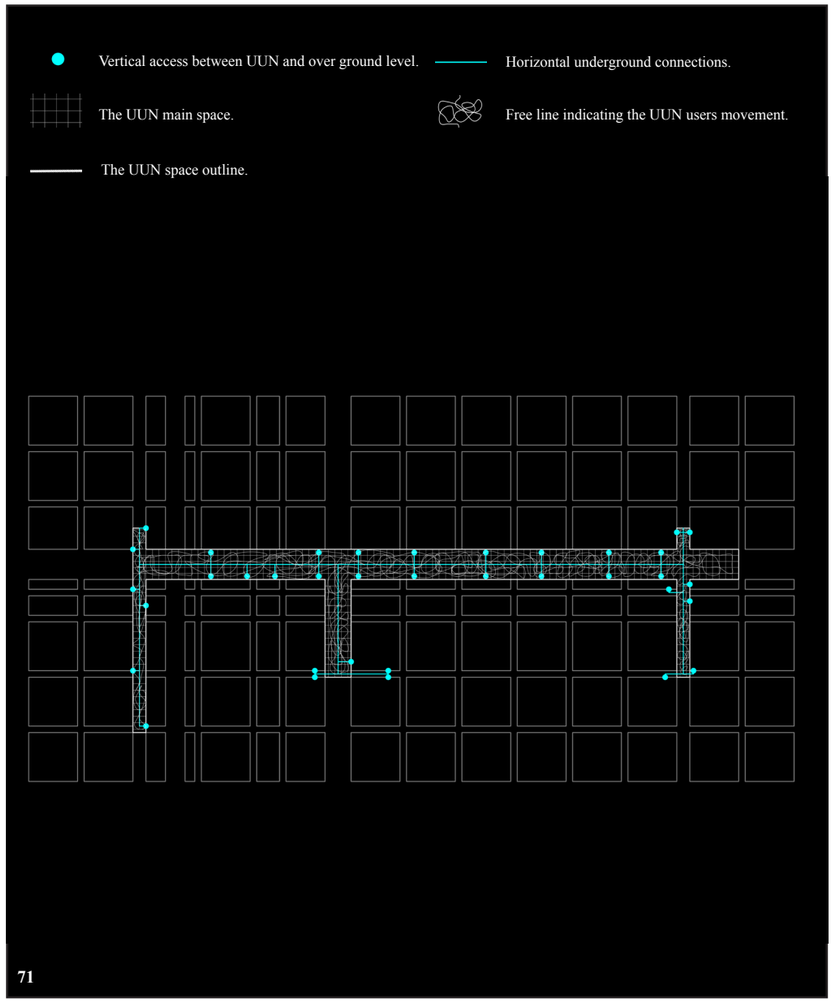
Regarding the connection theme in this case, the UUN space is connected to both sidewalks on the sides of the covering street. The vertical accesses between upper street level and underground are organized in this case mainly along the sidewalks on both sides of the principle Nagahori-dori street. These access points are located in the external public space unlike the study cases of Montreal and Huston. The UUN space in this case provides a new system of underpasses that connects both pedestrian sidewalks of the covering Nagahori-dori street. Adding to that, the UUN space has accesses from other perpendicular streets like Sakai-suji Ave. - as it has the entry to Nagahoribashi metropolitan station- , Mido-suji Ave. – as it has entries to Shinsaibashi metropolitan station – and Yotsubashi-suji Ave. – as it has the entries to Yotsubashi metropolitan station (Diagram 70).

The vertical access points in the urban context with the linear organization here, give the advantage to the UUN as it is the linkage space for pedestrians to move feely, away from the urban vehicular streets through an underground isolated space. Though, the UUN is not considered as a horizontal pedestrian underground network like in Huston or Montreal but it leans more towards the underpasses concept especially for those who traverse through the wide urban principal street of Nagahori-dori. In this case the pedestrians have the opportunity to move between pedestrian streets and sidewalks in different city zones without being interrupted by cars movement in the principle wide vehicular streets (Diagram 71).

The UUN in this case offers a complex place for users in one united space with various roles of connections in a linear space. It is connected to different transportation systems as it is including parking lots in the underground space that are connected directly to Nagahori-dori street. On the other hand, it also links three stations of Nagahoribashi, Shinsaibashi and Yotsubashi metropolitan stations through linear underground passage that is only for pedestrians (Diagram 72).

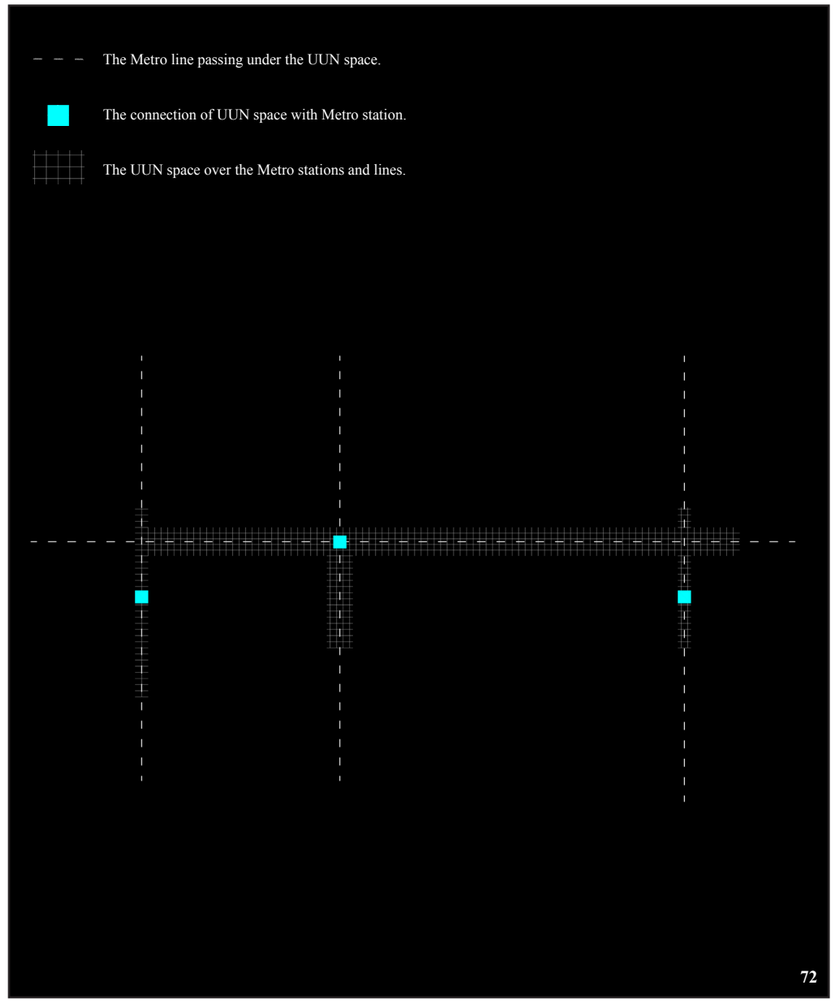
Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

71 - The vertical access points in light blue dots and the accessibility between them in the underground level through the light blue lines representing the underpass usage. The free line on the grid is referring to the free movement of users in the UUN area. All that is presented in relation with the urban context.



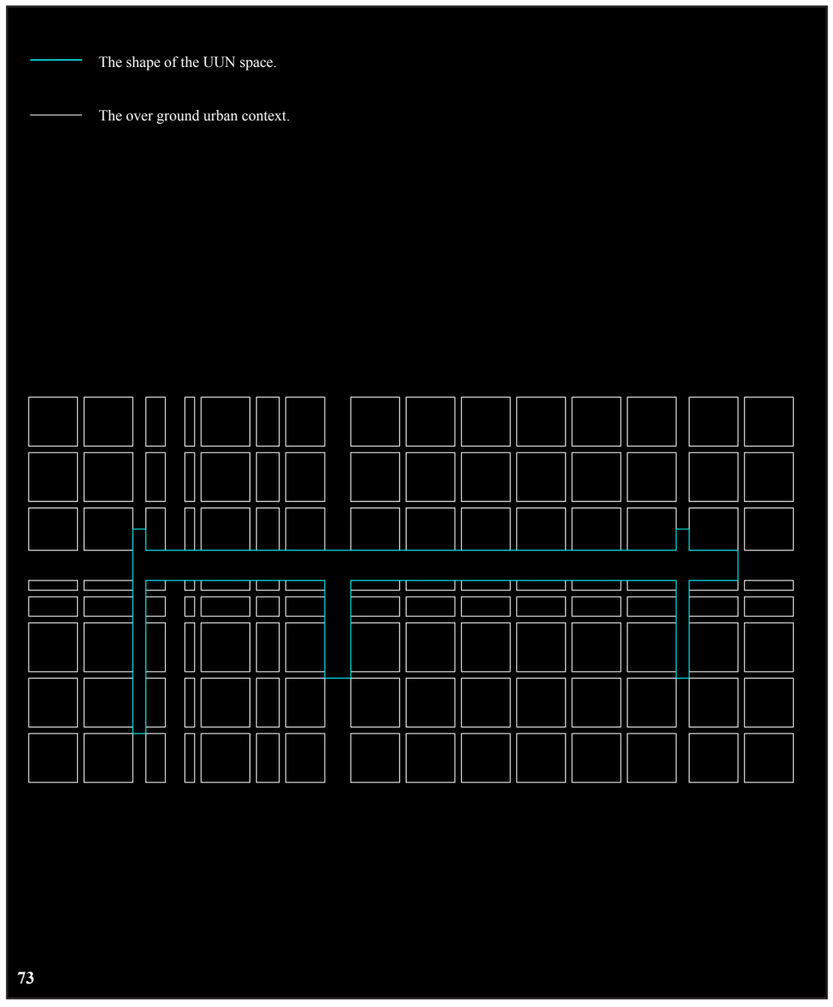
Connection.

72 - The connection between the UUN space and the underground metropolitan transportation system.

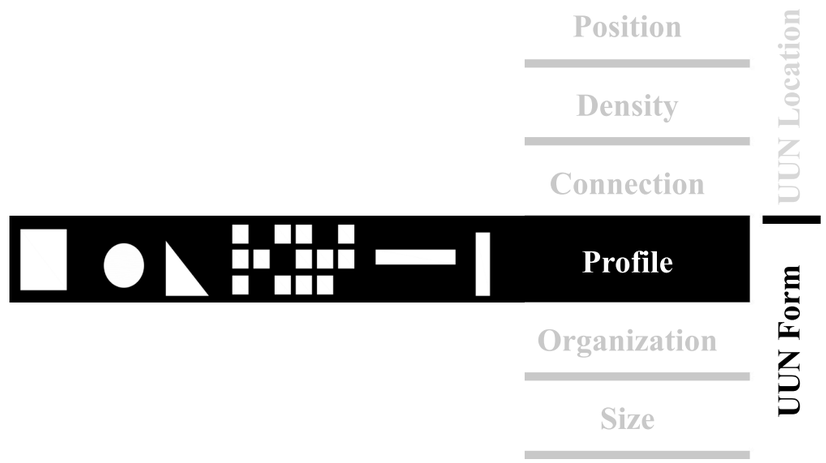


Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

73 - The UUN space profile abstracted in light blue line that is refering to the outline of the space inbetween the urban zones in the context of the over ground city, which is abstracted in white lines.



Profile.



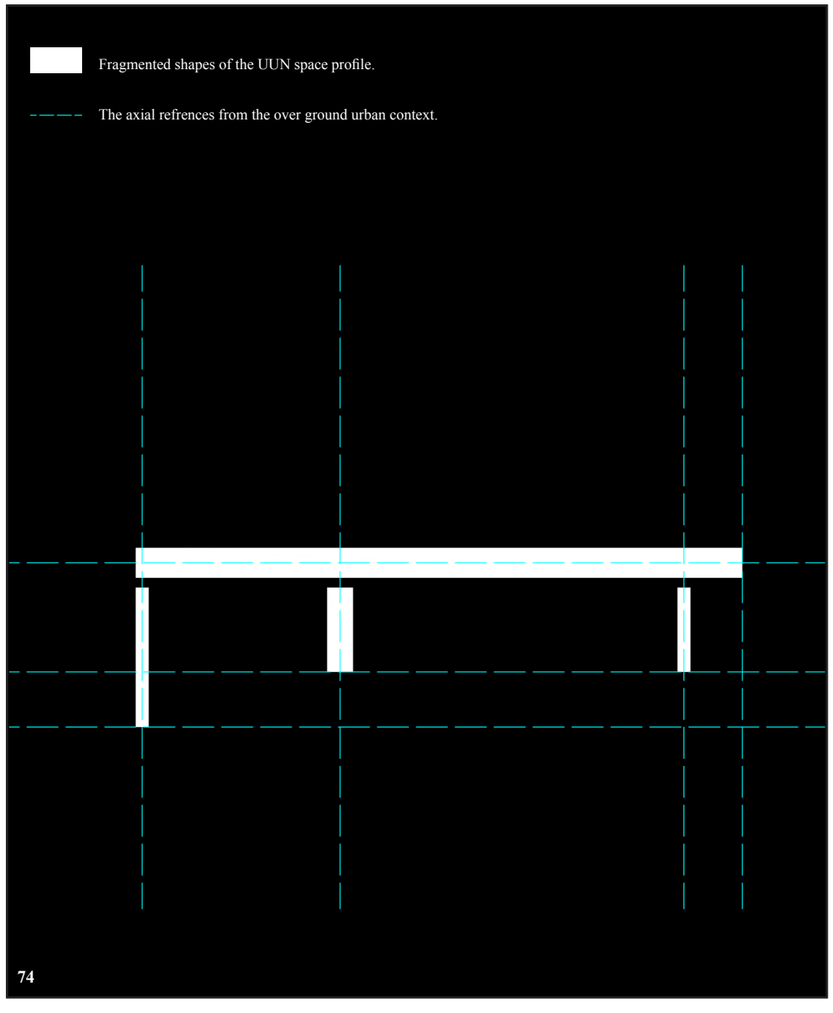
Concerning the profile theme in this case, the UUN space has the influence from the upper urban context, taking the form of the covering primary infrastructural street. The space of the UUN in this example is confined between the buildings on the border of Nagahori-dori main street with its sidewalks, creating the main regular axial shape of the space of the underground void (Diagram 73). This space with the linear finger shapes attached to it is all following the upper city axial references.

The UUN's void unlike the study cases in Europe or North America, is taking place under the urban axis itself, not an outcome space formatted between several urban ones. Though, the shape is still limited by other streets perpendicular axes and underground metropolitan stations. The main linear space of Crysta Nagahori UUN is under the axis of the Nagahori-dori street while it is limited from the east with the Nagahoribashi Metro station – which is the intersection between Sakai-suji Ave. with Nagahori-dori street – and Yotsubashi metropolitan Station from the west – which is the intersection between Yotsubashi-suji Ave. with Nagahori-dori street – linking also the Shinsaibashi metro station in the middle – which is the intersection between Mido-suji Ave. with Nagahori-dori street. The axes themselves are transformed into UUN spaces and limits (Diagram 74).

The final space profile is a united one formed by linear regular figures attached together, though the main space is the linear one under the primary widest street of Nagahori-dori Ave (Diagram 75). The void in this case is in between the absence and the presence concept from the urban context. The presence still exists through the linear strait skylight element, creating this contact between up and down, while it doesn't have the same presence in the over ground context. It is an absent intervention because of the position of it in the median strip between the different directions of the high velocity covering vehicular street of Nagahori-dori. The result is a strong visual connection for the underground users with the upper environment, though the over ground city users have very weak visible element over the ground, hidden in the traffic island at the middle of the vehicular street.

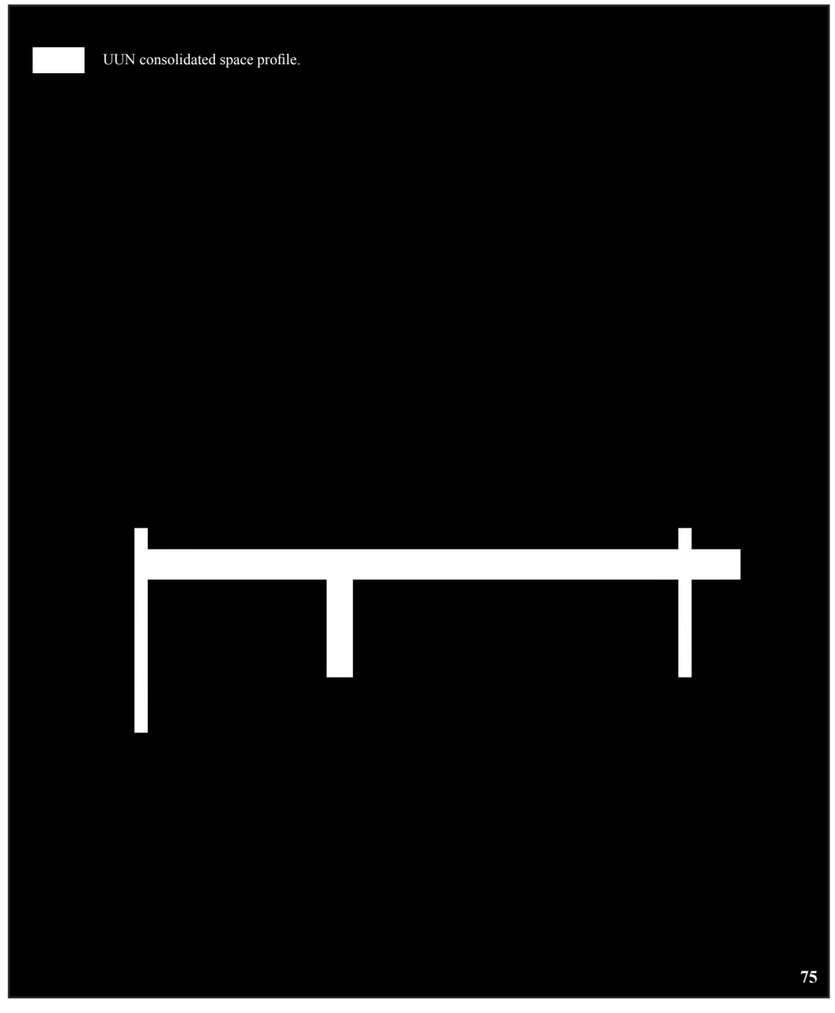
Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

74 - The diagram is abstracting the axis and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures responding to the overground refrences. The study is showing the correspondence in the UUN form to the over ground axial refrences.



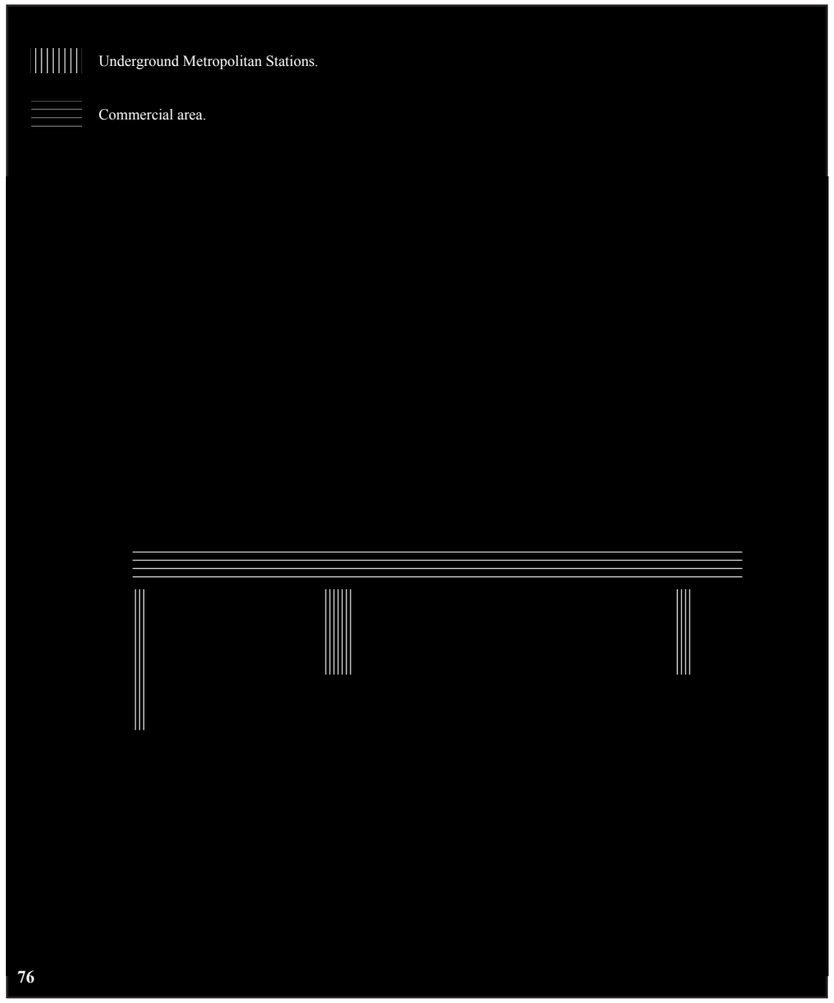
Profile.

75 - The white consolidated shape is the abstraction of the UUN regular linear profile.

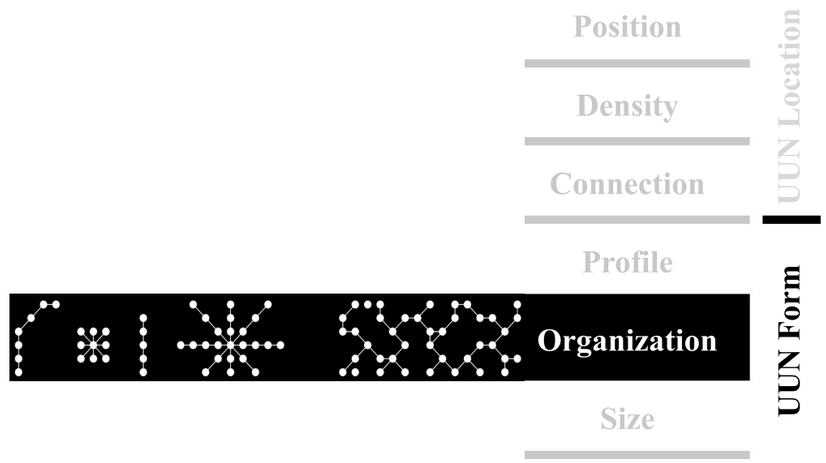


Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

76 - The organisation of the UUN different functions spaces.



Organization.



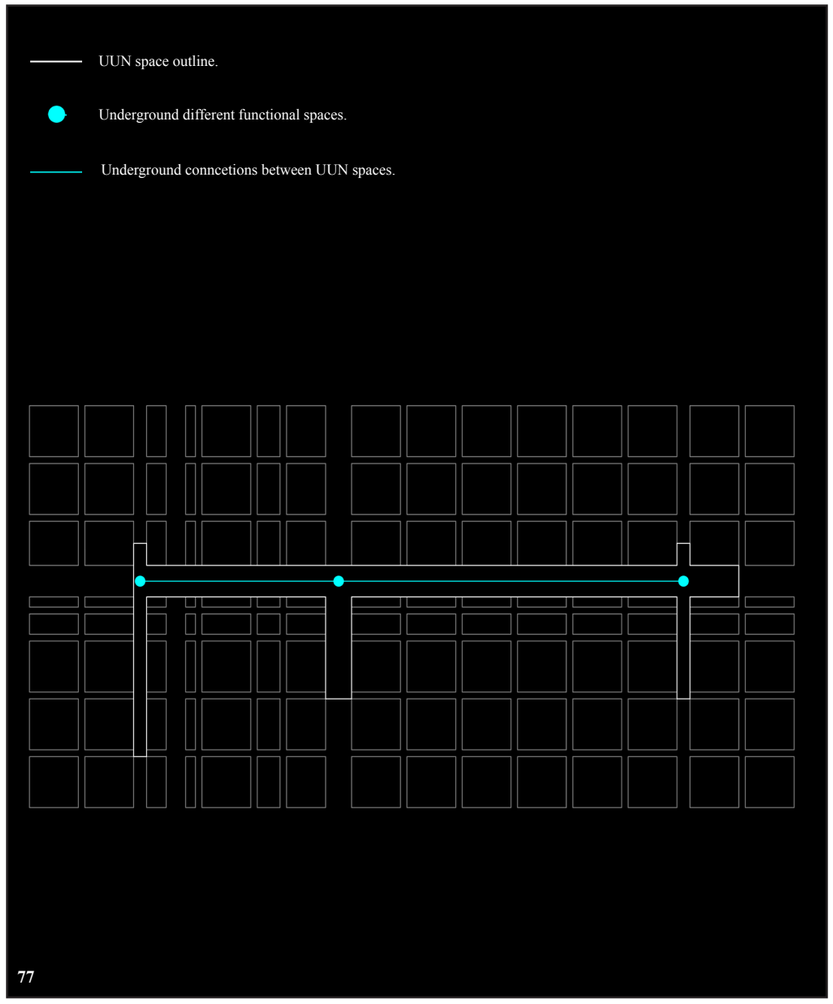
The UUN space here in the case of Crysta Nagahori does not have the same variety of functions as the European examples nor one dominant use like the North American ones. In this case the UUN space can be considered as dual functional one as there are tow main uses, the commercial and the underground transportation one. The commercial area acts as a lobby for the metropolitan stations as well (Diagram 76). On the other hand, there are some available parking lots in a different floor of the UUN.

In regard to the space organization theme, Crysta Nagahori UUN is completely different than all the cases before. This is due to the urban context arrangement and the location as well. The urban zones are consisting of attached buildings and narrow internal streets. Between each zone and the other, there are the wide streets that divide each district from another. As the UUN is located under that type of margin streets, the UUN void in this case has a very clear axial linear organization that is taken from the covering Nagahori-dori principle street. On the other hand, the underground metropolitan stations expand from that main axe in a perpendicular direction like fingers (Diagram 77). The internal space applies the unity concept, which was presented before in the European cases of Les Halles and Carrasoul du Louver but in a very linear arrangement. It is also contradicting the distributed divided spaces strategy that was present in the last two North American study cases.

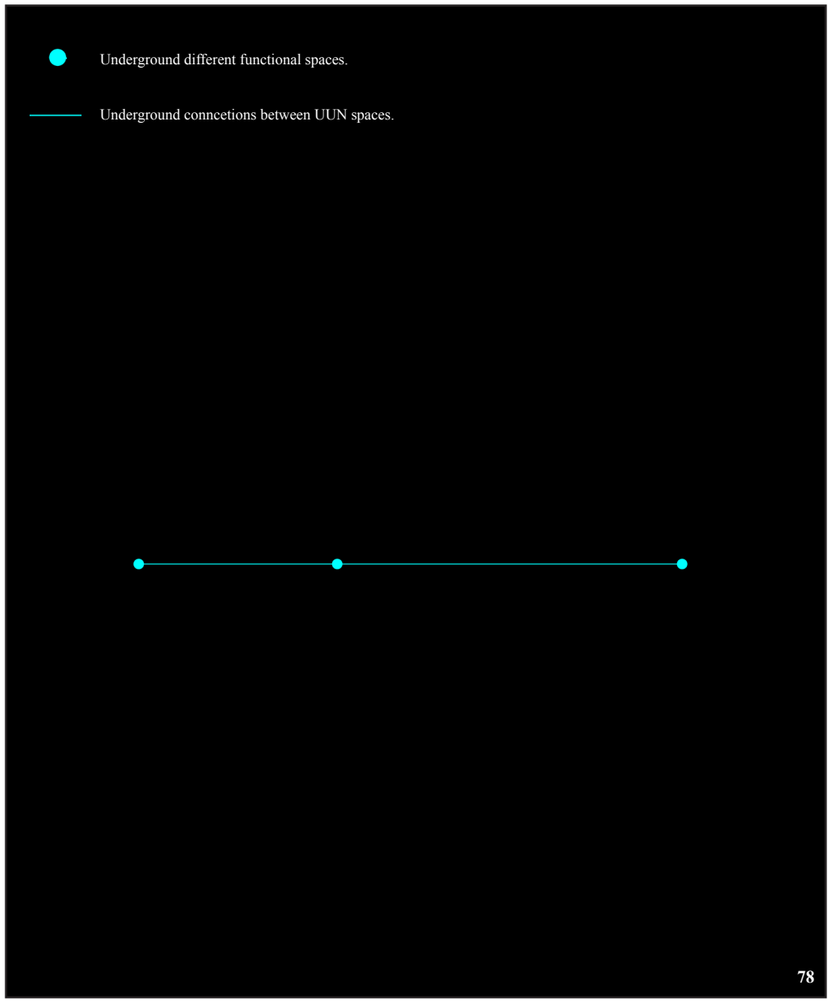
To illustrate, the UUN space has a linear organization that corresponds to the covering axial street. The metropolitan stations intersect perpendicularly on the main space, which still has one linear form that collect them all together (Diagram 78).

Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

77 - The relation between the organisation of the UUN space in the urban context of the city overground and the organisation of the internal space itself underground in an axial way. all spaces are attached and united, expanding linearly in the city urban context. In there, the correspondence of the available space is demonstrated with the city tissue organization, located under Nagahori-dori principle street.

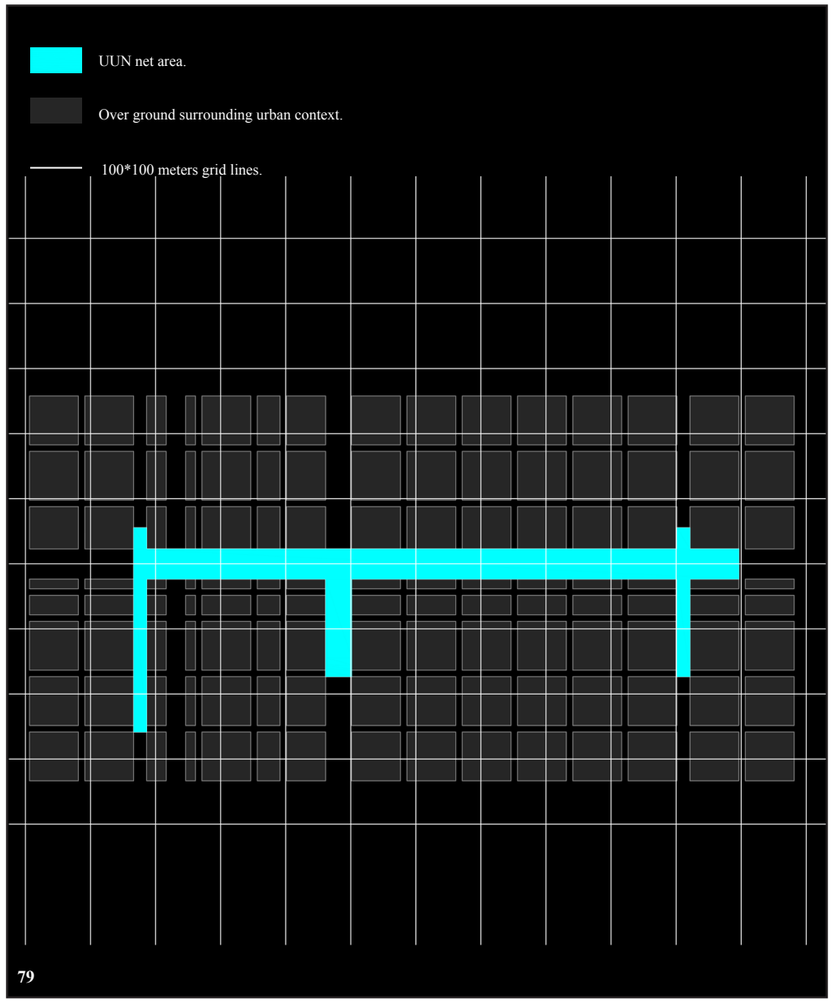


78 - The ideogram in is representing separately in a simplified way the linear axial arrangement of the UUN space in this case.

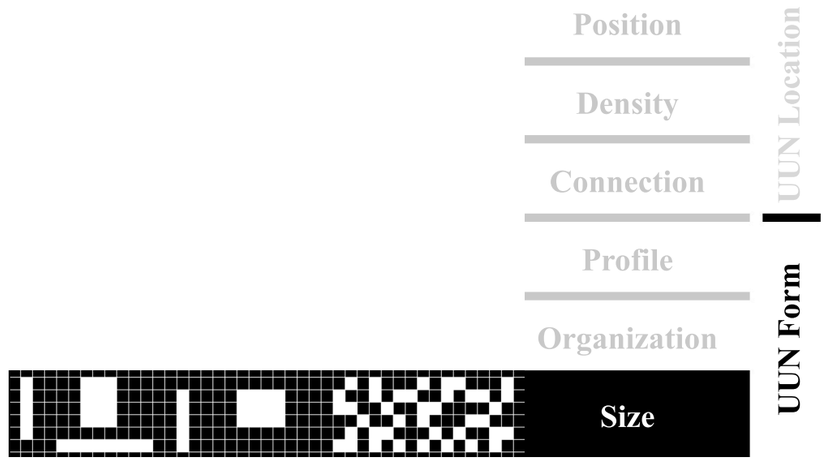


Organization.

79 - A diagram showing the size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.



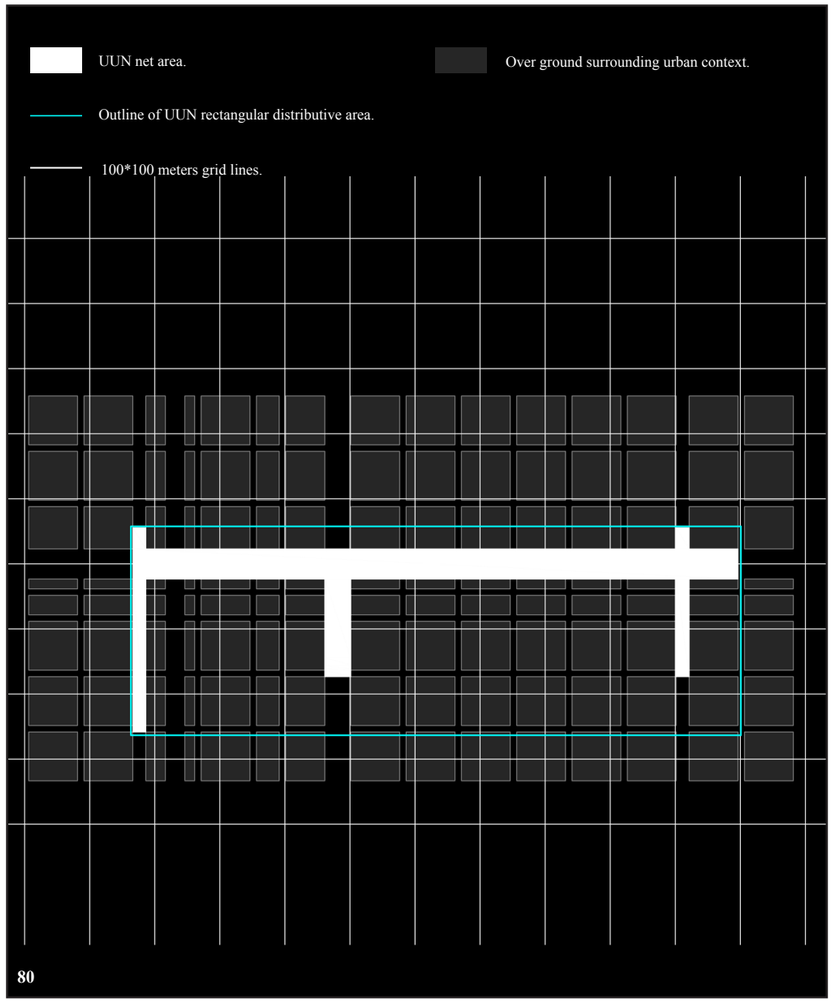
The net area of the UUN space of Crysta Nagahori is almost 61078 sqm. The area here is smaller than all the last cases in North America and European ones. In the simplified (Diagram 79), the UUN space is highlighted in light blue color among the urban context that is presented in grey color. Both are illuminated with a hypothetical 100*100 meters grid on the top of them demonstrated with white lines. In this diagram, the ratio of the UUN area can be conceived in parallel with the context of the surrounding urban tissue.

Although the small net area of the internal space of the UUN here in this case, the main space stretches in 950 meters lenght and 320 meters width on the hypnotized grid which is shown in light blue rectangle outlining the UUN area (Diagram 80). The united underground space here expands in a very linear way – close to the same width of the distributive area in Huston which is almost 12 times the net area of Crysta Nagahori UUN - while having very narrow strait dimension in the other direction. It is not concentrated in a micro urban area as Les Halles and Carrousel du Louvre, nor macro urban zone as Huston and Montreal, but in a Meso space, which is a middle size area to cover larger area in the city master plan.

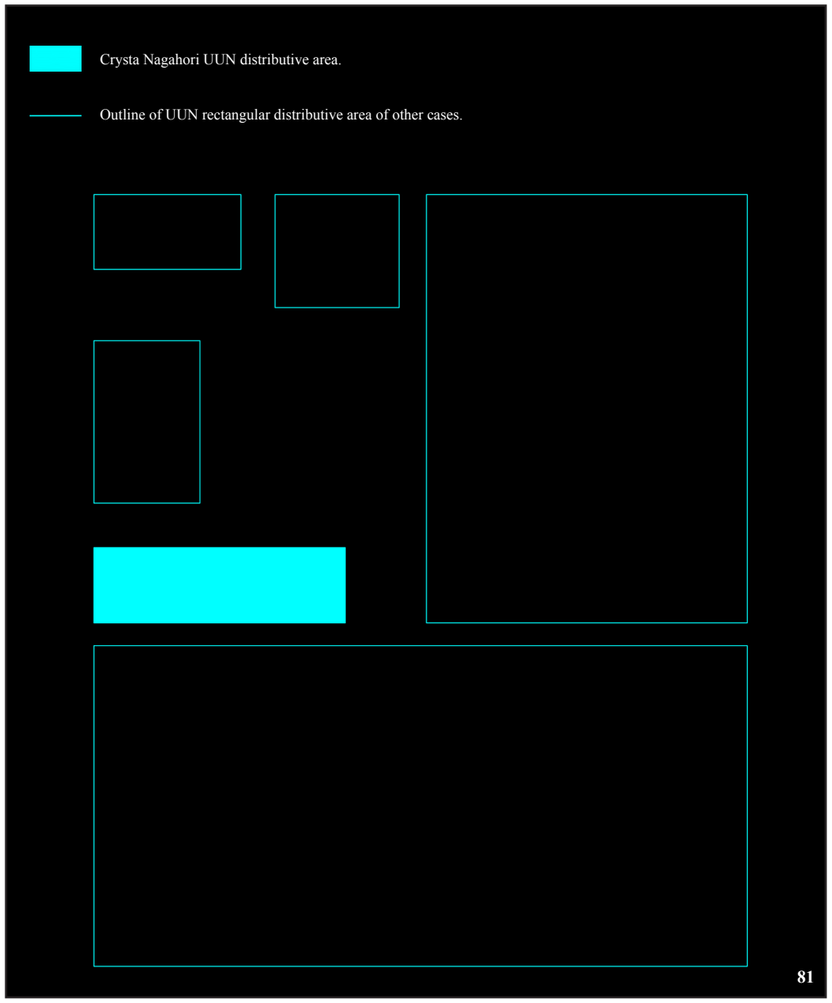
The final (Diagram 81) is giving a comparison between the distributive areas in all the six study cases that the research is working on. The filled light blue rectangle is the one indicating Crysta Nagahori UUN case study's expanding area. This scheme illuminates the Meso size of the distributive area in this case relatively to the others.

Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.

80 - A diagram showing the size of the UUN in a light blue color rectangle that represents the distributive area where the UUN is expanding in.

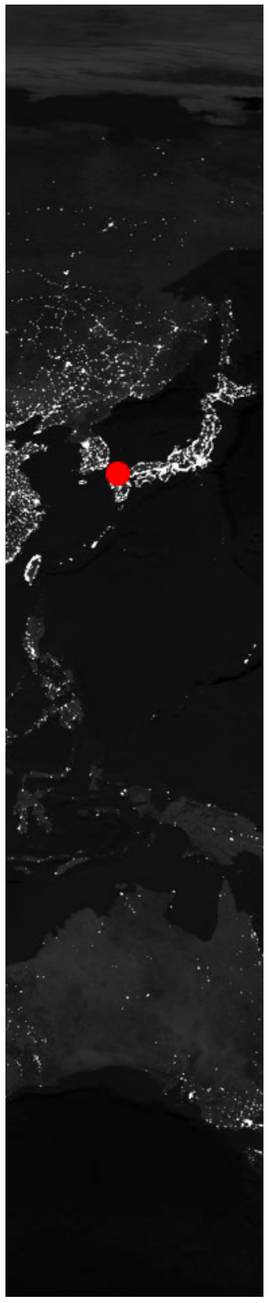


81 - All study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Crysta Nagahori UUN case. This scheme is illuminating the Meso size of the distributive area in this case relatively to the others.



Size.

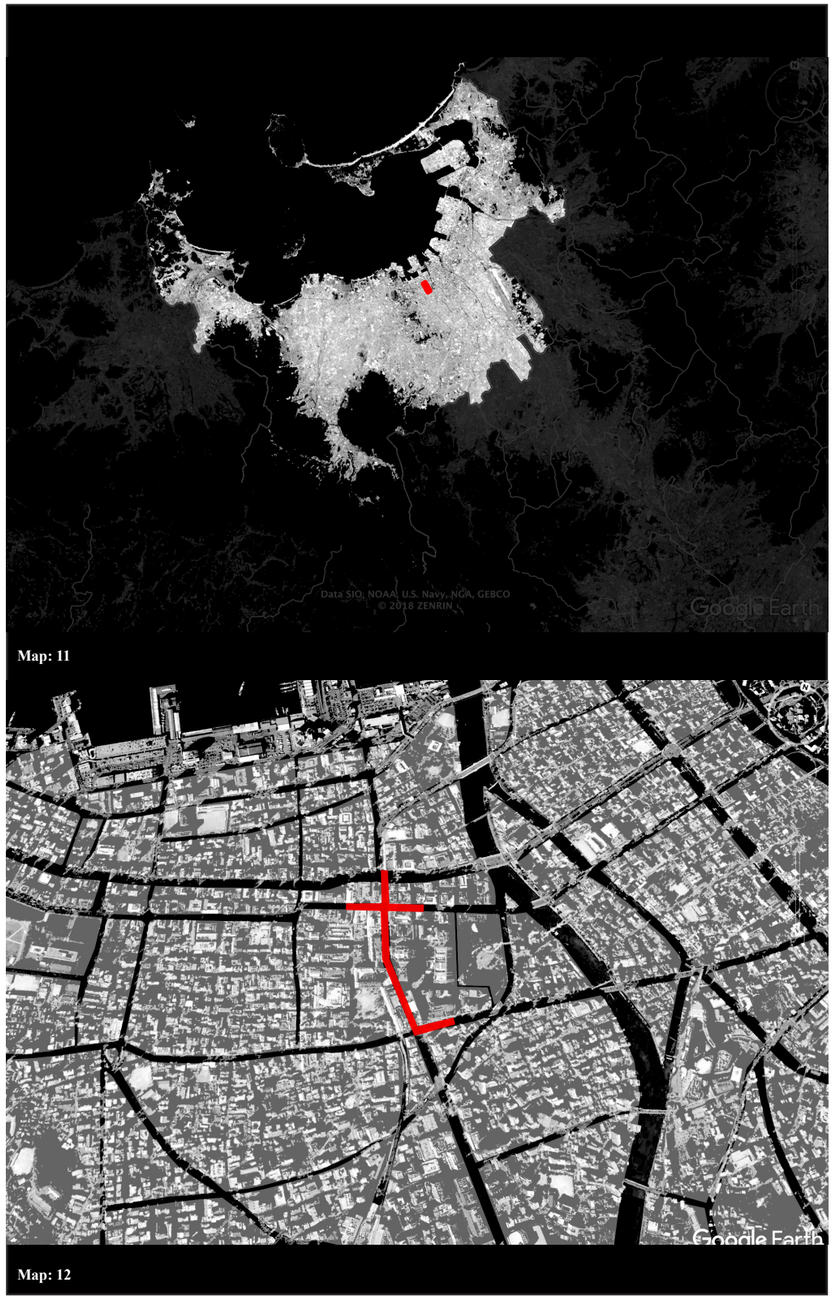
Crysta Nagahori Urban Underground Node, Osaka, Japan, Far Eastern Territory.



1.3.2. Tenjin Chikagai UUN.

Fukuoka, Kyushu, Japan, Far-Eastern Territory.
34°40′29.72″N 135°30′07.86″E

Tenjin Chikagai is established as a commercial underground area under one of the principle transportation streets in Fukuoka city. The UUN space does not just include commercial services but it is also containing two metropolitan stations that are linked through the commercial underground area. The UUN space has lots of vertical accesses between the underground space and both sidewalks of the covering street to establish a new needed use, which is underpasses system for the city pedestrian users to overcome the main wide vehicular street that acts as an obstacle for the on foot user.



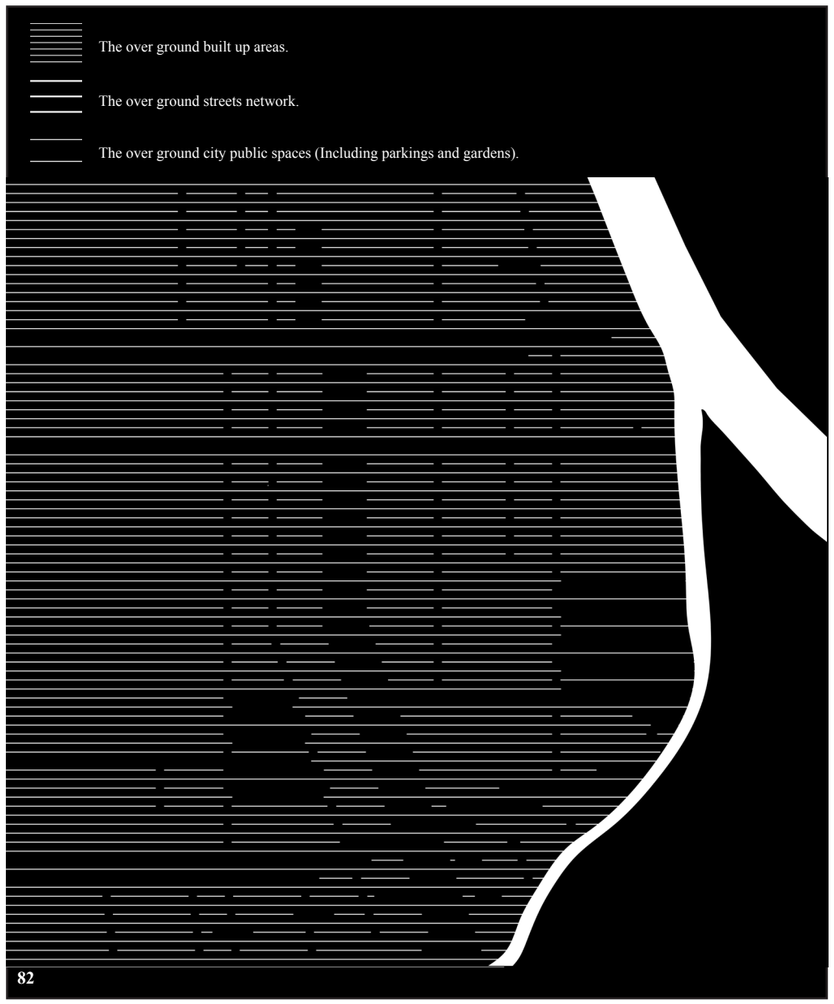
Position.

In the example of Tenjin Chikagai, the UUN is located in Fukuoka city in the Japanese territories at the Far East. It is very similar to the last case study of Crysta Nagahori in Osaka, being in a similar urban context. The city here has a network of main streets that provide a combination of different transportation systems such as the underground metropolitan stations, the vehicular roads over ground and the pedestrian sidewalks on both sides of these principal axial boulevards. Therefore, these main streets have larger width than the others in the urban plan of the city. The UUN space is positioned under one of these main axial boulevards that contains a complex of transportation systems (Map 11).

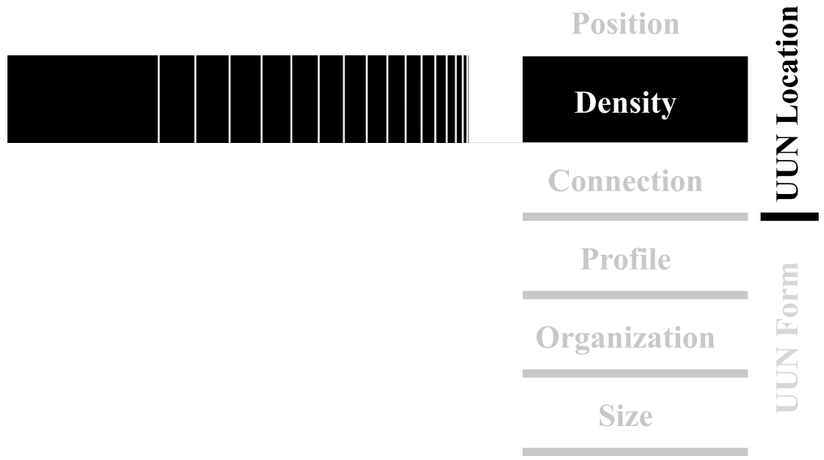
The linear UUN shape is located in a tight margin between different city zones where a flow of different transportation systems takes action. This margin is Watanabe-dori Ave., which is on the top of the UUN, being one of the main streets in the city plan. It is one of the main axes, which defines the city layout. As this is a main primary axis with multi transportation system, it is wider than the other secondary streets in the city master plan, cracking the compact solid of built up districts in the urban context (Map 12). This boulevard is like a mutation space in the city urban condensed volume, adding a new melody to the urban rhythm. The UUN is positioned here in this case, in the area where this mutation happens in the city section.

Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

82 - The over ground surrounding urban context of Tenjin Chikagai area, abstracted. There are 3 different intensities of lines in this diagram. The high intensive horizontal lines are pointing out the built up constructed buildings in the urban city zones while the medium intensive ones are referring to the primary city streets that are dividing the urban tissue into zones and the least intensity of lines indicates the open public squares and gardens.



Density.



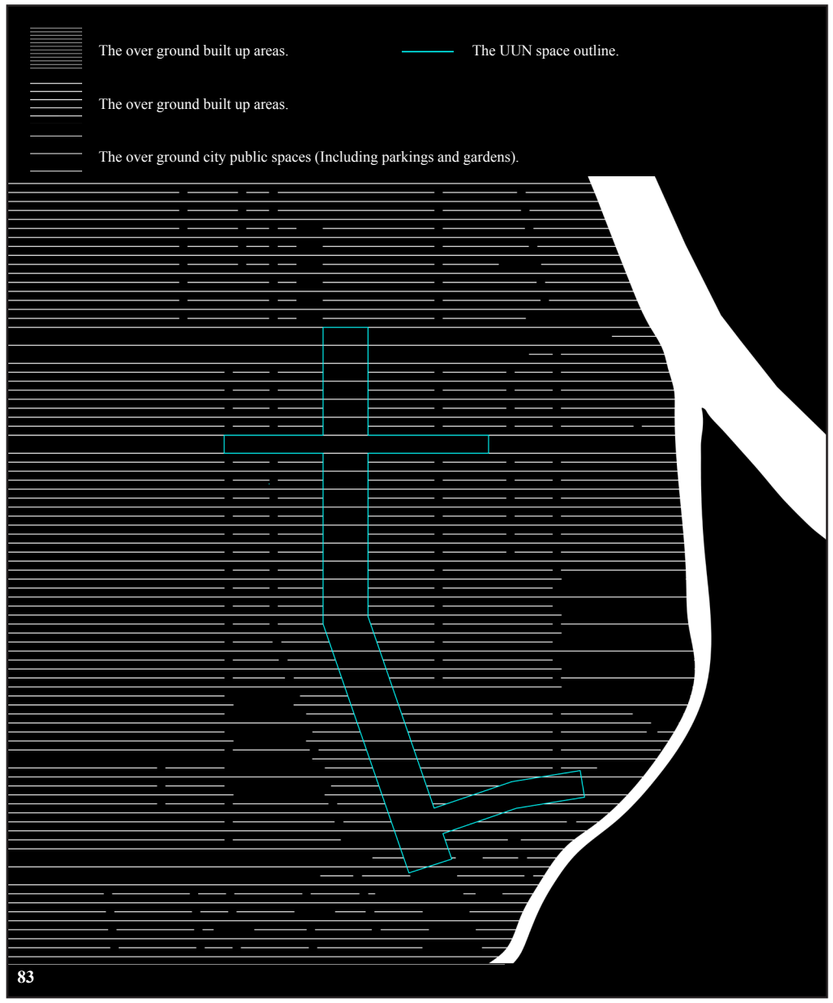
In Tenjin Chikagai, the UUN also follows the same methodology that was used to place the underground space in the urban context in relation with buildings density principle in Crysta Nagahori. This is due to the similar spatial composition of the urban context of the surrounding in both cases Crysta Nagahori at Osaka and Tenjin Chikagai in Fukuoka. The surrounding urban tissue is a compact one while it is divided by wide primary streets into different zones. These main streets have wider dimensions compared to the others and counted as cities linear spaces boulevards (Diagram 82).

The UUN here is placed under one of the mentioned the main streets, which confirms that they do not take place under the buildings like American examples in Huston and Montréal, or public spaces like the European examples of Les Halles and Carrousel du Lover, but they have independent character by locating them under the main streets between different city zones although the availability of the open public spaces in the selected area (Diagram 83). Watanabe-dori Ave. is one of these main transportation routs in the city context and this is where the UUN is set in the underground level of that street.

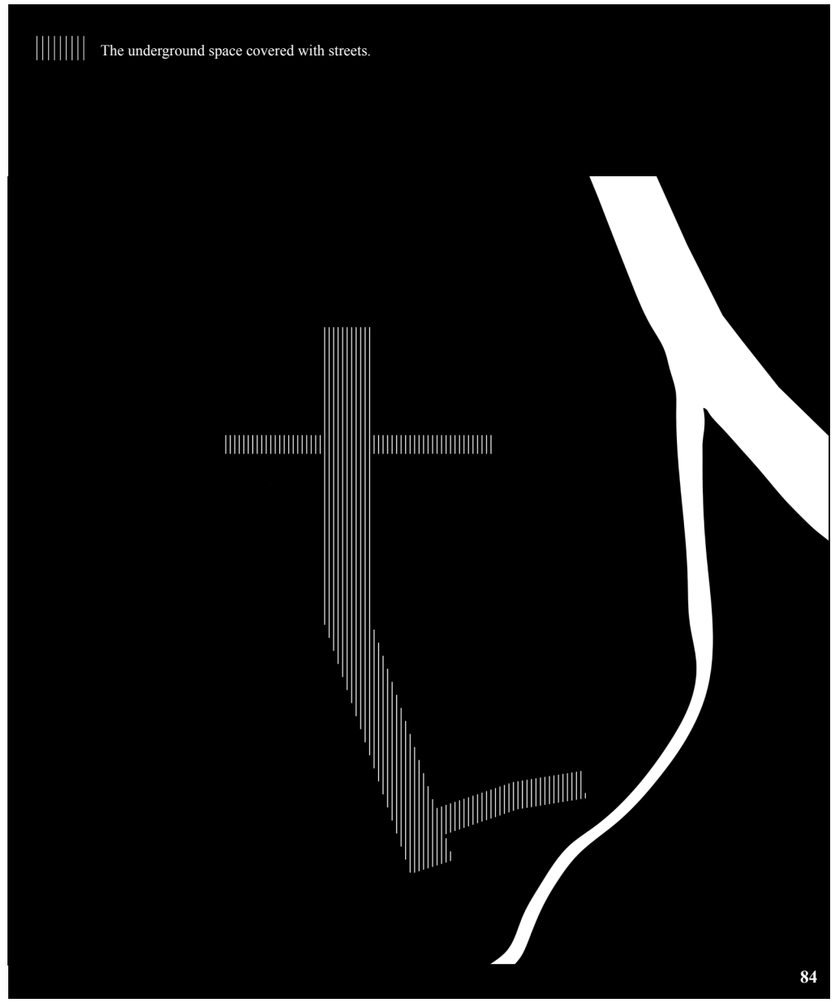
To paint the final picture, the method of locating the underground space regarding the type of covering object here is very similar to the Crysta Nagahori in the Far East while it is totally different than the followed concept in the American or the European model. This is exposed in the (Diagram 84) where the UUN is drawn in a way to show the covering type of the context. In this draft there is only one indication type that is used, the vertical lines, which refer to the streets covering object, the only urban object that is covering the UUN in this case.

Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

83 - The over ground urban context of Tenjin Chikagai area, abstracted and presented in paralel with the UUN space. The shape in light blue line is demonstrating the UUN space and its location regarding the city context. In this case the UUN is positioned only under the medium intensive lines in this draft, which means it is away from the built up blocks, open public squares and gardens, but placed under the main primary street, between the urban blocks.



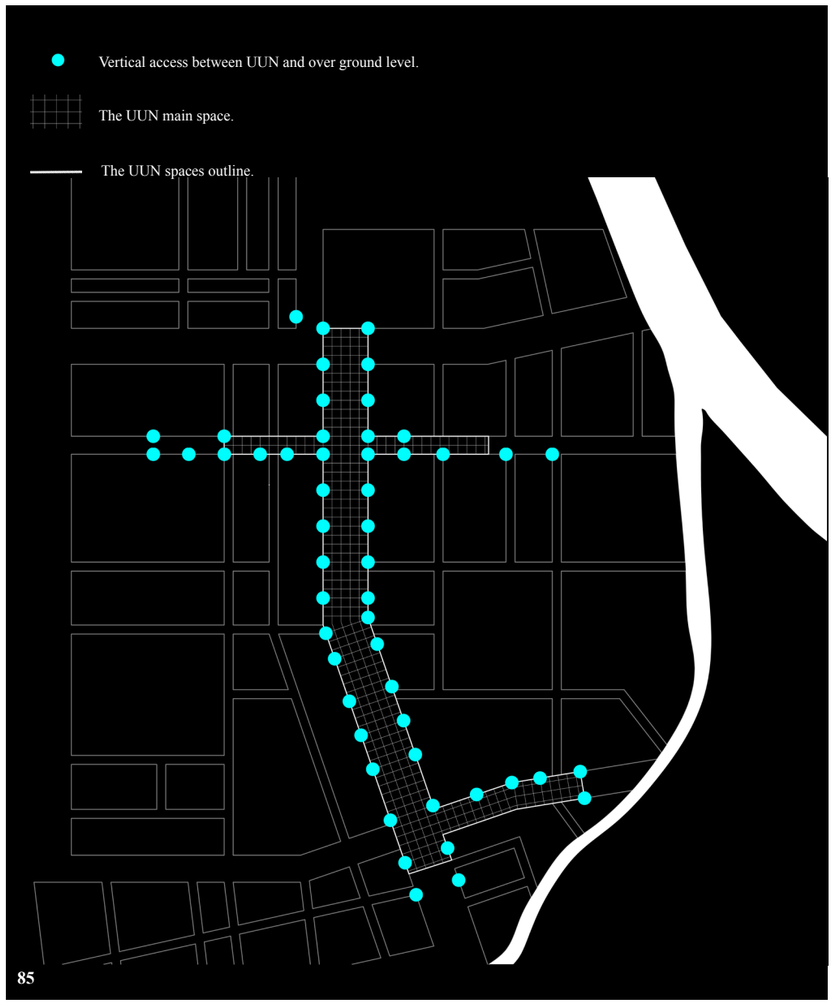
84 - The UUN form presented in a way to show the urban tissue covering type of the context. In this draft there is only one type, the vertical lines, which refer to the covering urban streets type.



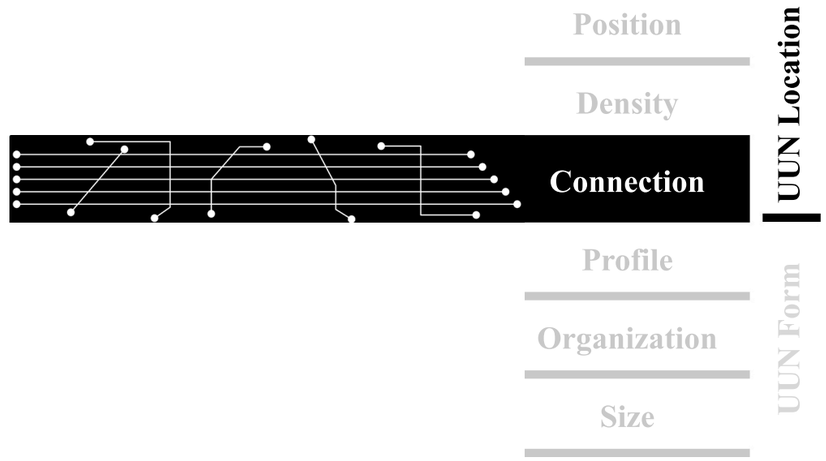
Density.

Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

85 - The vertical access points between UUN and the over ground are presented in light blue color.



Connection.



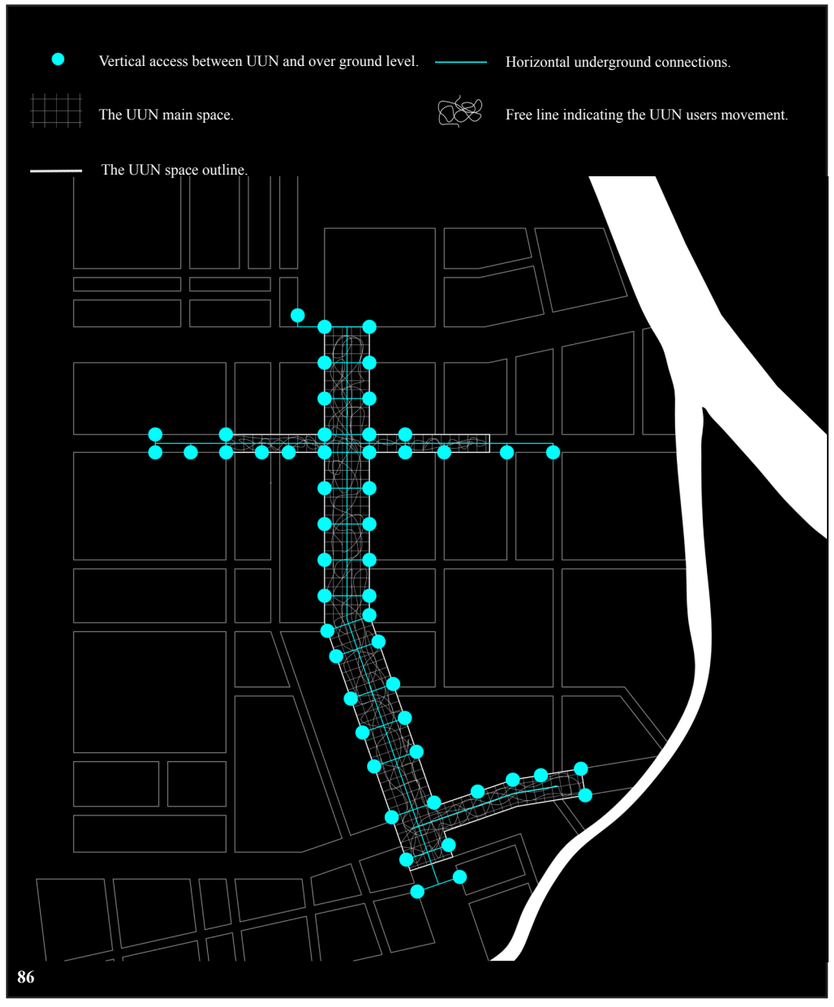
In the example of Tenjin UUN, the space underground is connected to both sidewalks on the side of the covering street as the last study case of Crysta Nagahori. The principle covering street of Watanabe-dori Ave. has most of the vertical accesses between upper street level and underground organized along both sidewalks in a linear axial way. These vertical access points are located in the external public space unlike the study cases of Montreal and Huston. On the other hand, they are positioned on the sides of the principle vehicular street so they are neither like Les Halles nor Carrousel du Louvre in Europe. The UUN space in this case is establishing a new system of underpasses that connects both pedestrian sidewalks of the covering Watanabe-dori Ave. Adding to that, the UUN space has accesses from other perpendicular streets like Kokuti-doro Ave. - as it is having the entry to Tenjin-minami metropolitan station – in the south part and Meiji-dori Ave. – as it has entries to Shinsaibashi metropolitan station – in the north side of the UUN space extending to right and left of Watanabe-dori Ave (Diagram 85).

The UUN gives the opportunity to the pedestrians to move freely, connecting them to different transportation systems, all through the underground space. The UUN space does not provide an underground pedestrian network like the American examples while it is mostly oriented towards establishing multiple underpasses through many vertical accesses on both sidewalks. In this case the on foot users have the opportunity to move between pedestrian streets and sidewalks without being interrupted by cars movement by using the vertical connections specifically along Watanabe-dori Ave. (Diagram 86).

The UUN in this case provides a complex place for users in one united space with various roles of connections in a linear space. It connects all different transportation systems such as the over ground sidewalks with two metropolitan stations: Shinsaibashi and Tenjin-minami metropolitan stations (Diagram 87). On the other hand, it has direct access to the vehicular system through the underground parking area that is connected to Watanabe-dori Ave.

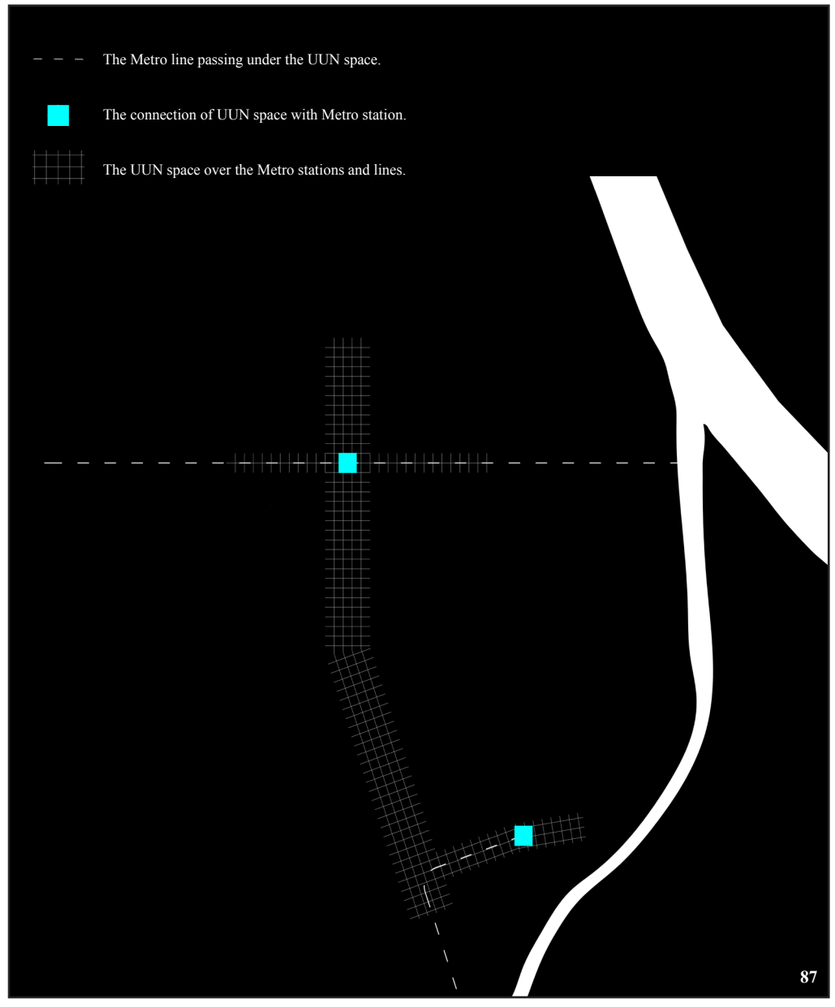
Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

86 - A diagram exposing the vertical access points in light blue dots and the accessibility between them in the underground level through the light blue lines that are showing the traversal connections between the two sidewalks mostly along the Watanabe-dori Ave.



Connection.

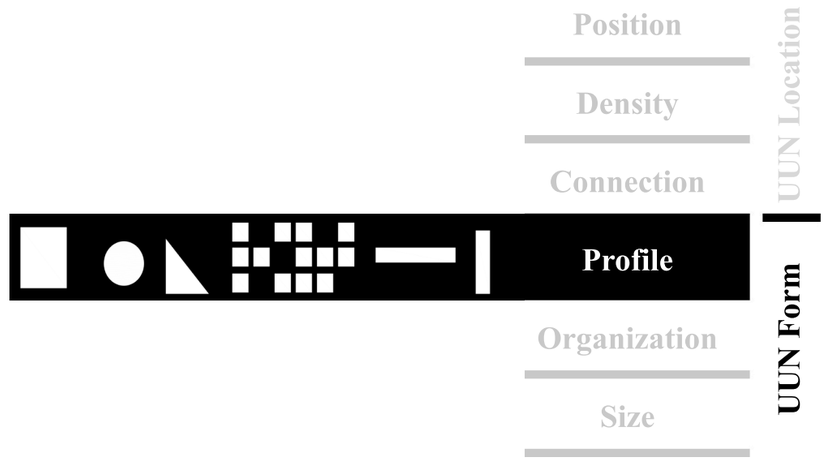
87 - The connection between the UUN space and the underground metropolitan transportation system.



Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

88 - The UUN space profile abstracted in light blue line that is refering to the outline of the space inbetween the urban zones in the context of the over ground city, which is abstracted in white lines.

Profile.



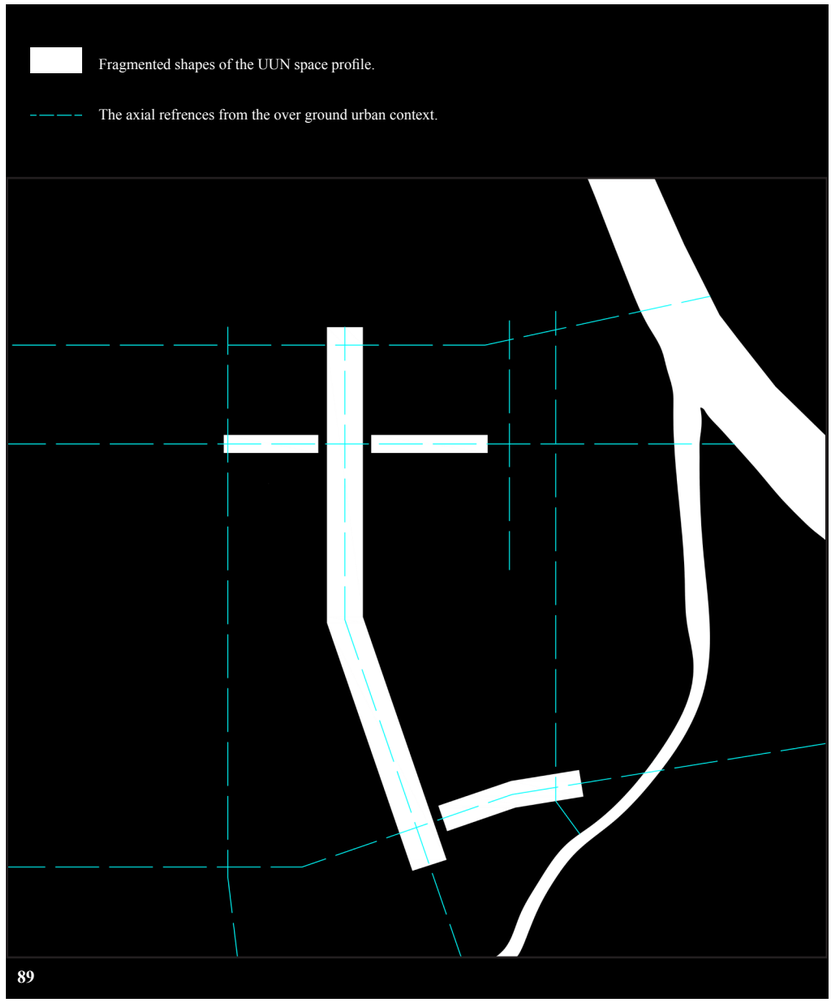
In the case study of Tenjin Chikagai the underground profile follows the linear regular shape strategy like the last example of Crysta Nagahori UUN. The covering infrastructural wide primary street forms it. The main space of the UUN here is confined between the buildings on the border of Watanabe-dori Ave. creating the final profile of it (Diagram 88).

The linear UUN profile is a consequence of over ground urban axial references. It takes the shape of the upper urban axis itself. The main underground void has the profile of the street and sidewalks of Watanabe-dori Ave. It is limited from the north by the Showa-dori Ave. and from the south by Tenjin-Minami metropolitan station – which is the intersection between the axis of Kokuti-doro Ave. and Watanabe-dori Ave. In this the linear space, there is the Tenjin metro station in the intersection between Meiji-dori Ave. with Watanabe-dori Ave. expanding in a perpendicular way on the main space (Diagram 89). It is notable that in both Far East UUN examples, the metro stations are located in the intersections perpendicular on the main underground space.

As the last example, the final space profile is formed by linear regular figures attached together, while the main space is the linear one under the primary widest street of Watanabe-dori Ave (Diagram 90). The void here is also counted as in between the absence and presence, though it leans more towards the absence concept. The space void has some diffused skylights along its linear figure while it is not obvious in the city context from the above. These skylights are hidden in the median strip between the two directions of the covering vehicular street. That is why they are having the presence concept to the UUN users who are having visual contact with the environment up, while it has the absence perception in the over ground urban context as these skylights are not obvious to the cars users or the sidewalk pedestrian.

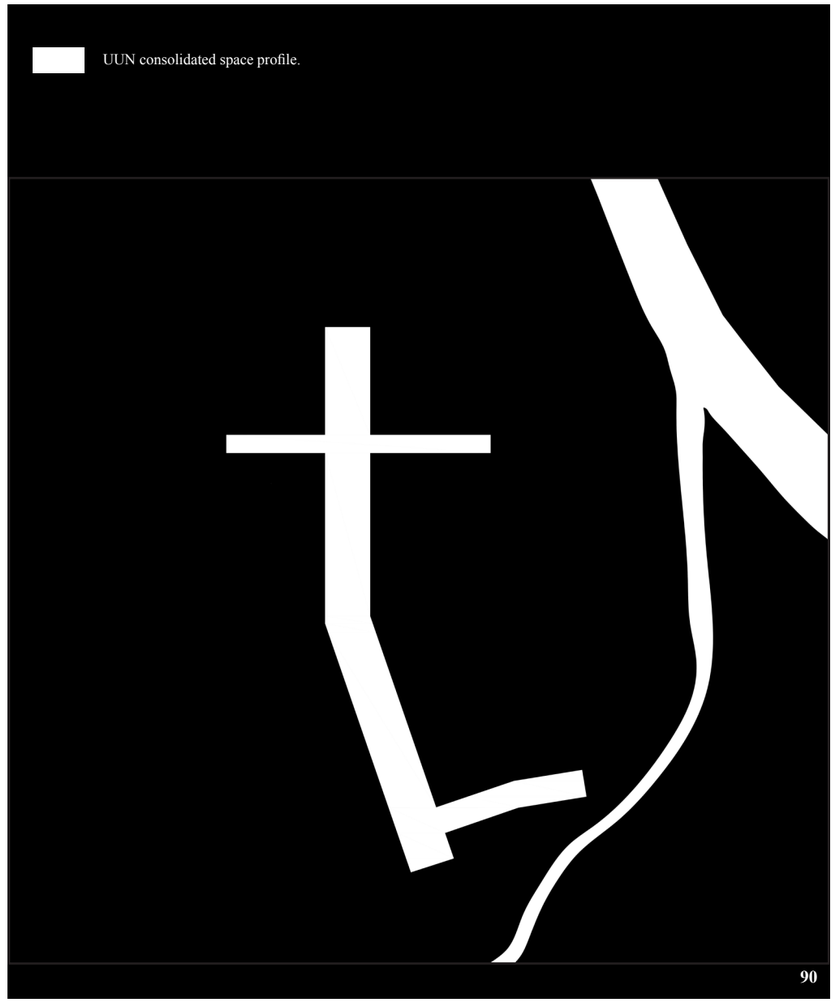
Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

89 - The diagram is abstracting the axis and refrences coming out of the over ground urban context in light blue dashed lines. The shapes in white are fragmented figures responding to the overground refrences. The study is showing the correspondence in the UUN form to the over ground axial refrences.



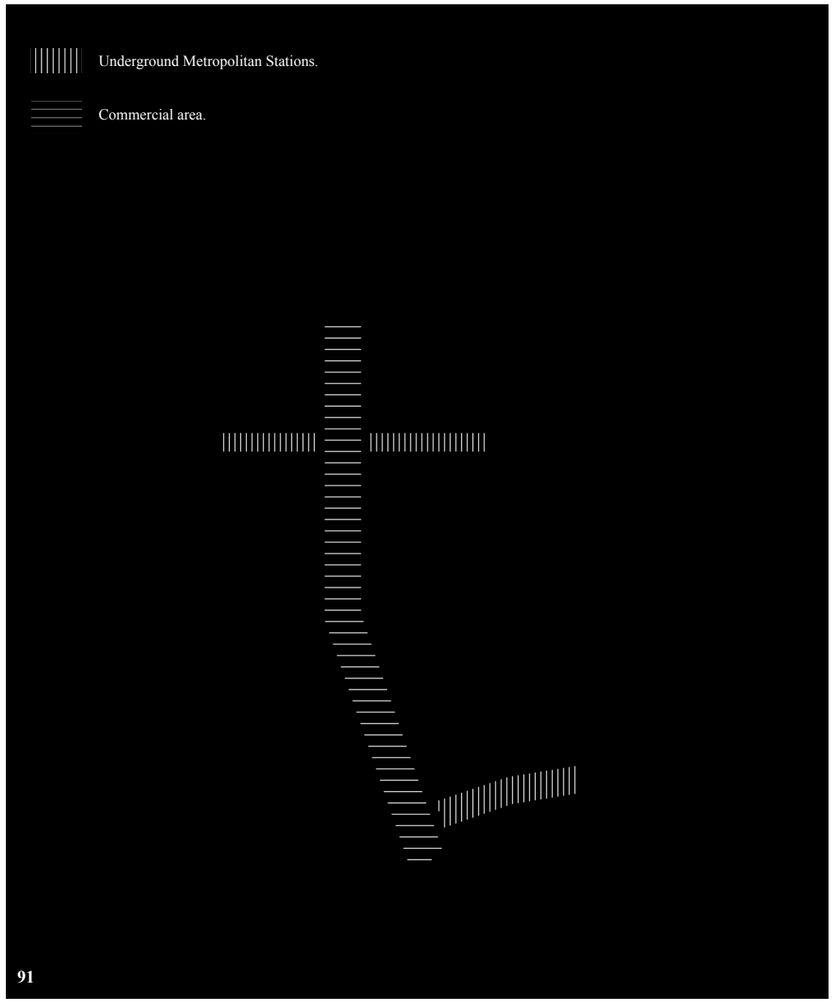
Profile.

90 - The white consolidated shape is the abstraction of the UUN regular linear profile.

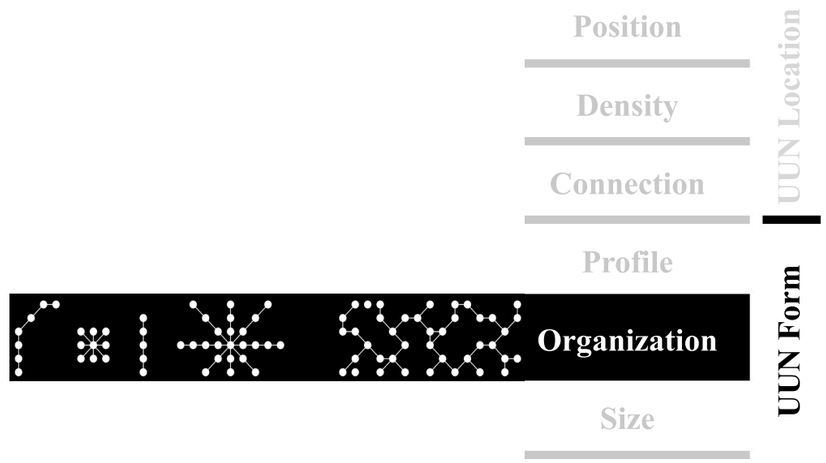


Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

91 - The organisation of the UUN different functions spaces.



Organization.



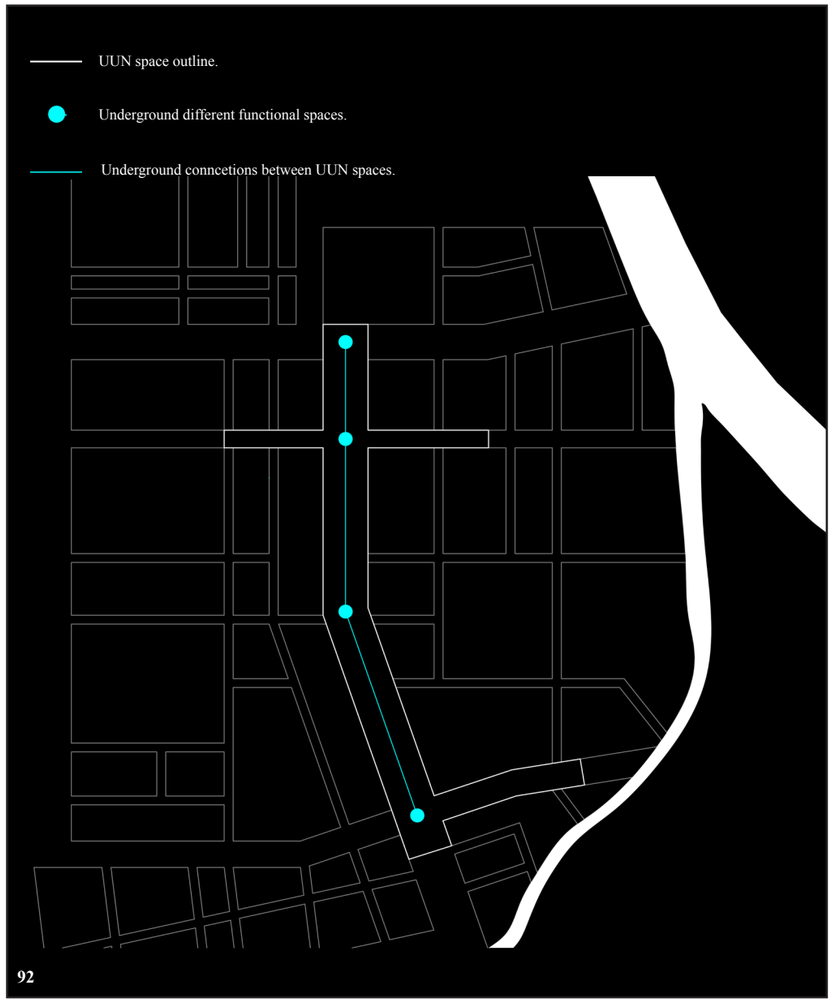
The UUN space here in the case of Tenjin Chikagai can be considered as dual functional one as the last example of Crysta Nagahori. There are tow main uses, the commercial and the underground transportation one. The commercial area acts as a lobby for the metropolitan stations as well (Diagram 91). On the other hand, there are some available parking lots for bikes, motorcycles and cars in a different floor of the UUN.

In Tenjin Chikagai case, the UUN space organization is very similar to the used method in Crysta Nagahori example. The urban context structure is consisting of condensed buildings in blocks that are configuring the city zones. Between these zones, Watanabe-dori Ave. is located as a void between this solid, like a strait. This strait has a linear shape, which gives its reflection on the organization of the UUN space that follows the covering street arrangement. On the other hand, the underground metropolitan stations expand from that main axe in a perpendicular direction like fingers (Diagram 92). In here, the UUN space is established as united combined one like the first two European examples while it has an axial organization that configures the underground void like Crysta Nagahori case.

To illustrate, the UUN space has a linear organization that corresponds to the covering axial street, Watanabe-dori Ave. The metropolitan stations intersect perpendicularly on the main space, which still has one linear form that collect them all together (Diagram 93).

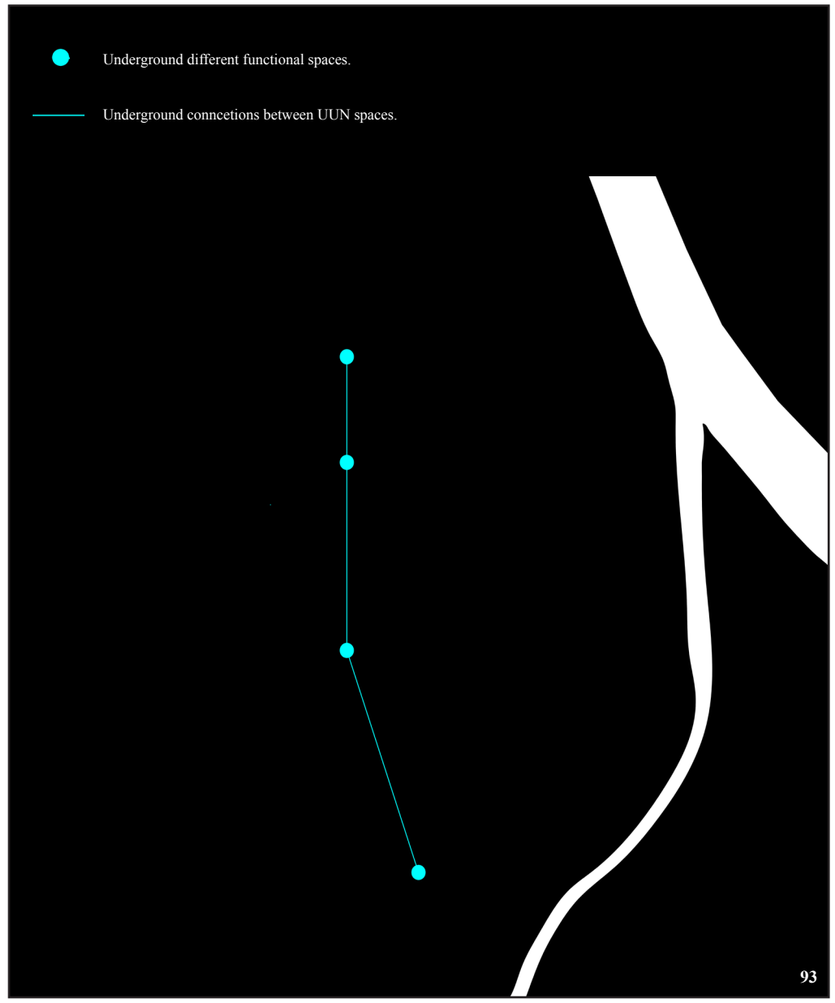
Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

92 - The relation between the organisation of the UUN space in the urban context of the city overground and the organisation of the internal space itself underground in an axial way. all spaces are attached and united, expanding linearly in the city urban context. In there, the correspondence of the available space is demonstrated with the city tissue organization, located under Watanabe-dori Ave.



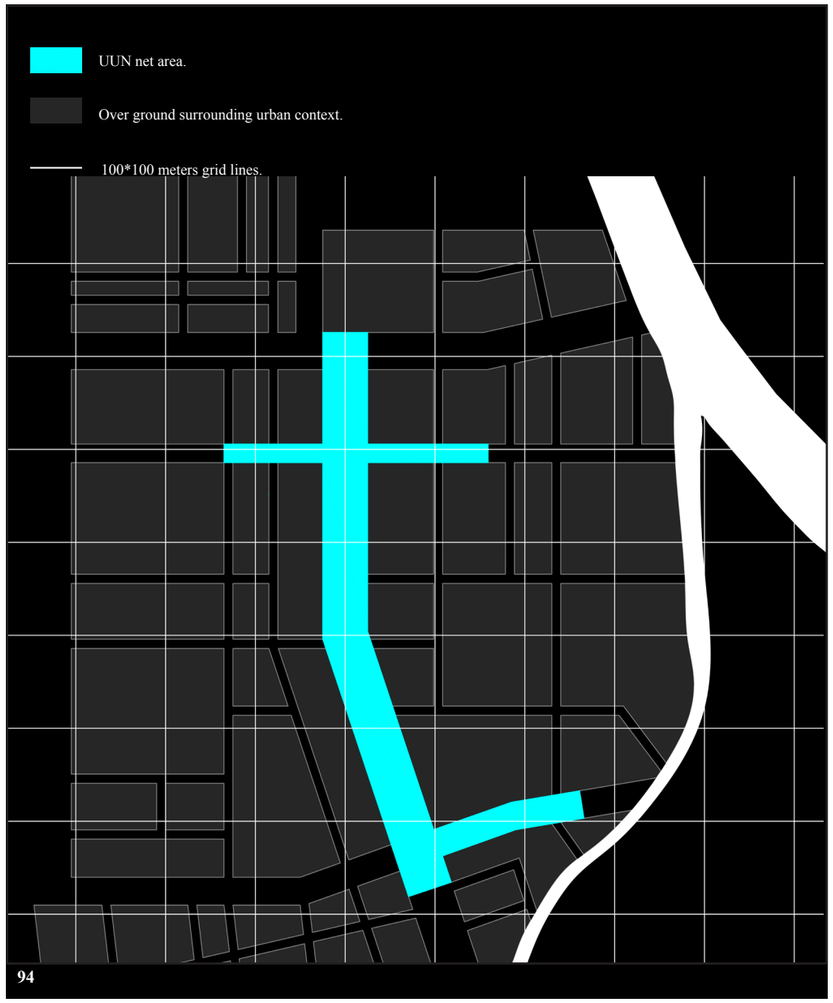
Organization.

93 - The ideogram in is representing separately in a simplified way the linear axial arrangement of the UUN space in this case.



Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

94 - A diagram showing the size of the area of the UUN space in light blue color, in correcpondence with over ground urban context presented in gray color. Both are demonstrated in parallel with white lines hypothetical grid of 100*100 meters.



Size.

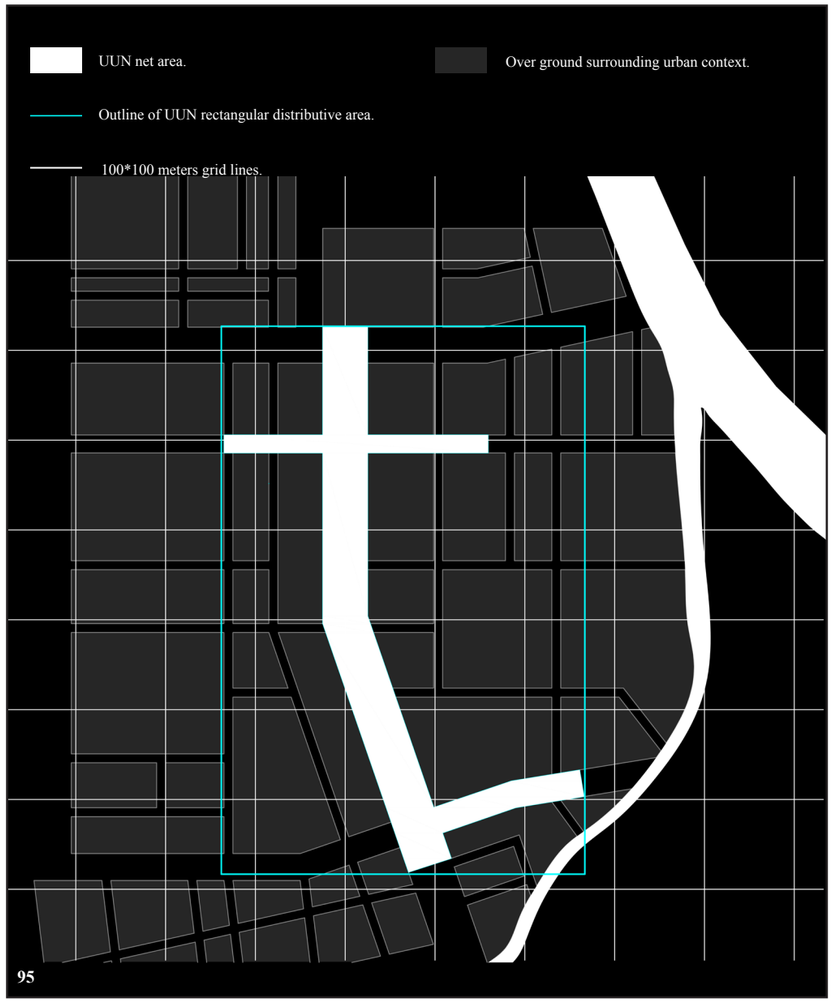
In the case study of Tenjin Chikagai, the UUN is having a net area of almost 42150 sqm making it the smallest example regarding area between the 6 studied cases that the research is analyzing. In the simplified (Diagram 94), the UUN space is highlighted in light blue color among the urban context that is presented in grey color. Both are presented with a hypothetical 100*100 meters grid on the top of them demonstrated with white lines. In this diagram, the ratio of the UUN area can be conceived in parallel with the context of the surrounding urban tissue.

Although the relatively small net area of the UUN space in this case, the main underground space here expands in a rectangular area of 666 meters length and 410 meters width indicated in (Diagram 95) with light blue color rectangle. This united underground space here extends in a linear way to cover longer dimension with almost 1.4 times than the Les Halles case even if the French case is twice it's area. The distributive length also is almost half of the width of the Huston case even if the American case's area is almost 17 times the net area of Tenjin Chikagai UUN. This makes this case not macro expanded in the city master plan – as the American cases - neither having micro expansion – as in the European French cases – but a Meso extended one in the urban plan of the city.

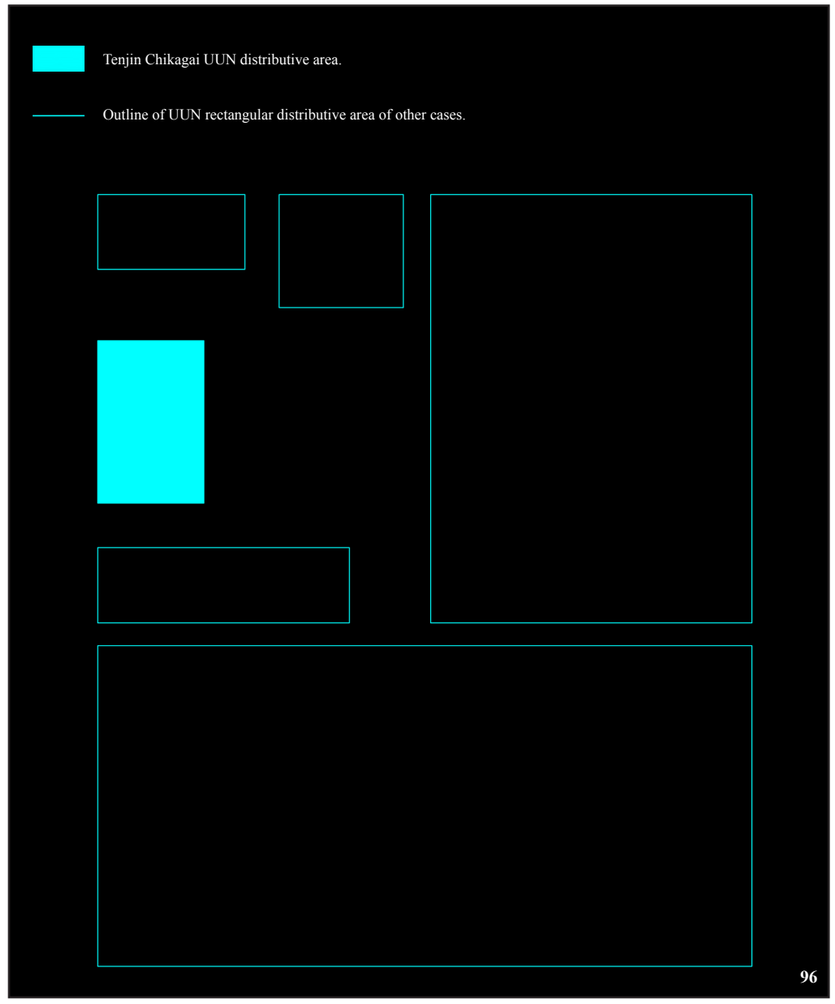
The final (Diagram 96) is giving a comparison between the distributive areas in all the six study cases that the research is working on. The filled light blue rectangle is the one that indicates Tenjin Chikagai UUN case study's expanding area. This scheme illuminates the Meso size of the distributive area in this case relatively to the others.

Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.

95 - A diagram showing the size of the UUN in a light blue color rectangle that represents the distributive area where the UUN is expanding in.

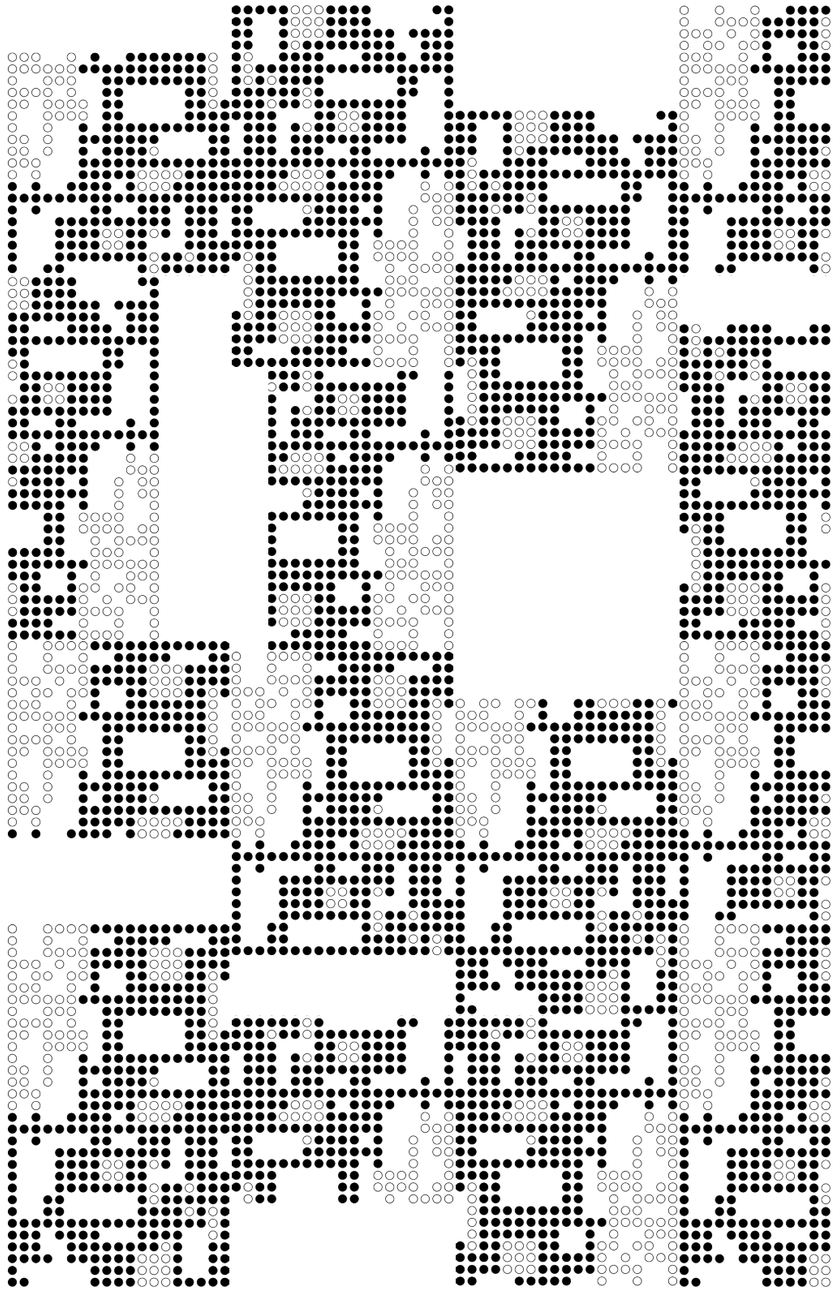


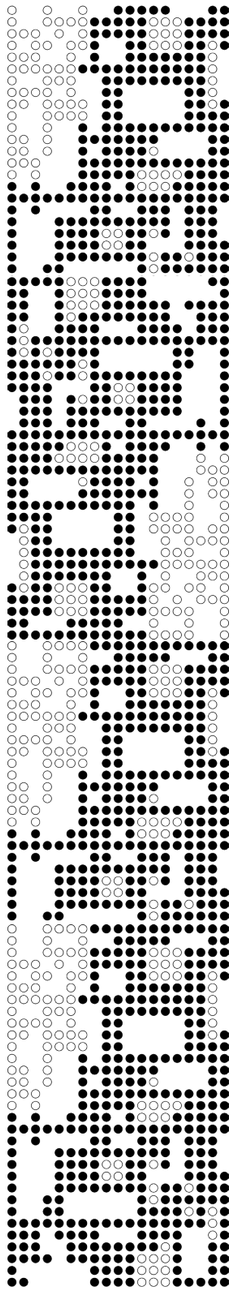
96 - All study cases distributive rectangular area to understand the difference in size of each case relatively with the others. The light blue filled rectangle is pointing out the Tenjin Chikagai UUN case. This scheme is illuminating the Meso size of the distributive area in this case relatively to the others.



Size.

Tenjin Urban Underground Node, Fukuoka, Japan, Far Eastern Territory.



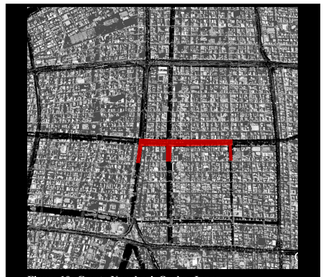


2. Matrix of Results.

This chapter is concluding the spatial composition of the UUN by designing an interpretative matrix to synthesize the last analysis for all the studied six study cases. It is working as an asset that clarifies the established types of UUN in different parts of the world.

In this part, the UUN spaces are categorized in regards to the themes that were mentioned before and structured the analytical frame for the six study cases. These themes are: Position, Density, Connections, Profile, Organization and Size.

Study Cases

Europe	North America	Far East
		
Figure 2: Les Halles, Paris, France.	Figure 6: Houston downtown, USA.	Figure 10: Crysta Nagahori, Osaka, Japan.

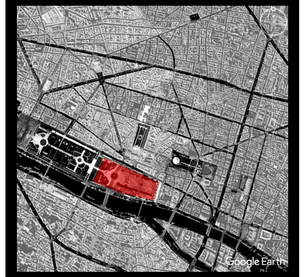
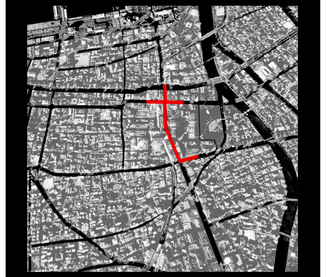
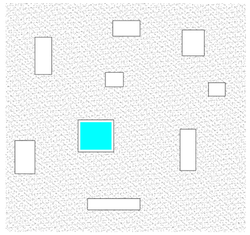
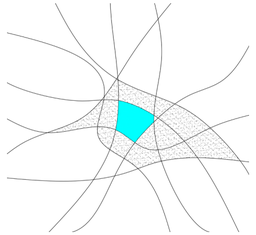

		

Figure 4: Carrousel du Louvre, Paris, France.	Figure 8: Montreal downtown, Canada.	Figure 12: Tenjin Chikagai, Fukuoka, Japan.

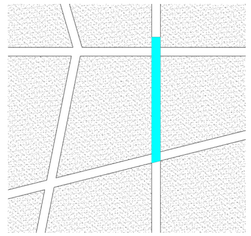
Results



97 - UNN Located in Historical Center under main city square



98 - UNN Located in Downtown CBD area under the high-rise towers.



99 - UUN located attached to Transportation Route system under one of the city main streets.

2.1.Matrix of

UUN Location

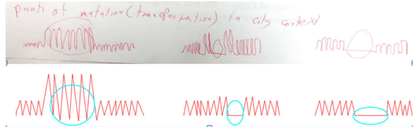
UUN Form

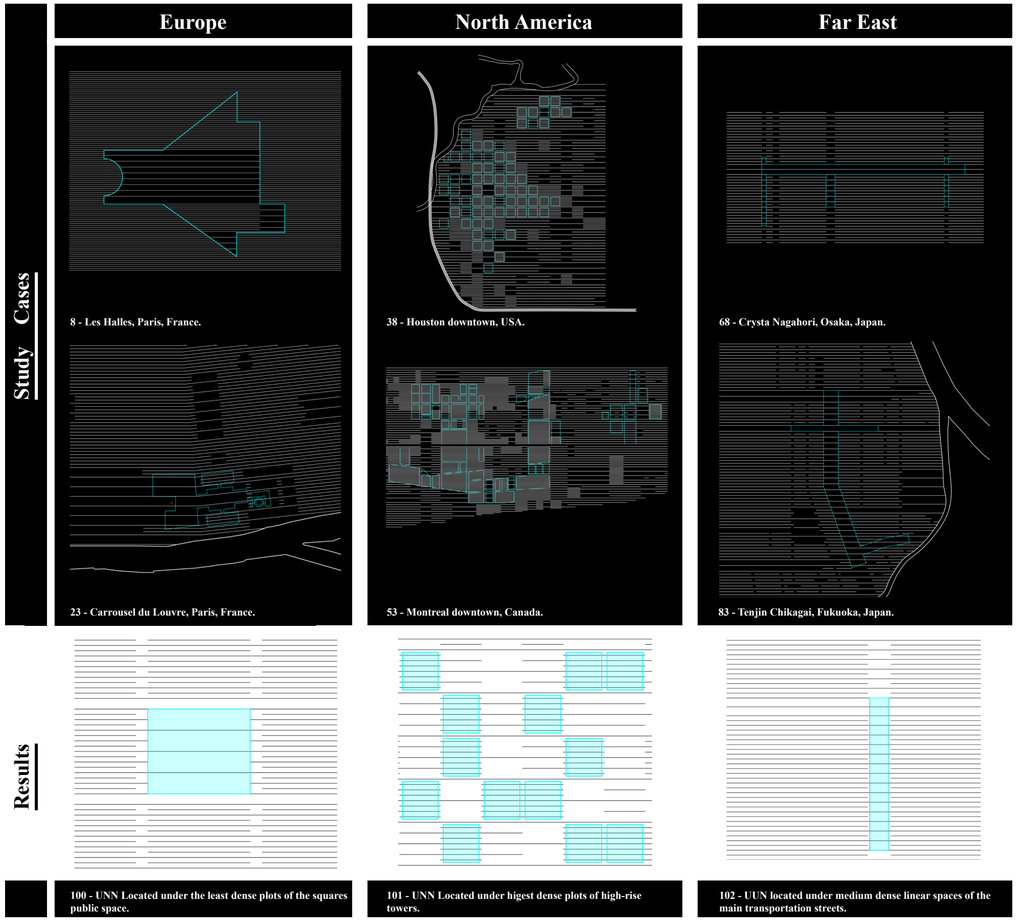
The Urban Underground Nodes are taking different positions in each city of the study cases. In this part, the research is trying to reveal the various locations of each UUN case in its city context. During the position studies, something remarkable was perceived, which is that the UUN is always positioned where the urban tissue is establishing new character in the city section (Figure 0). Therefore, three different city locations were noticed:

1- Historical Centre: in this type, the UUN space is located in the historical center of the city. This is the first type that can be observed in the in the ideograms for the first two European study cases in France, Les Halles (Figure 2) and Carrousel du Louvre (Figure 4) where they are positioned in the historical part of Paris. A simplified ideogram (Diagram 97) is pointing out the typology of locating the UUN inside this historical center part under one of its historical squares.

2- Downtown Central Business District: in this type, the UUN space is mostly located in the downtown area where the CBD exist. This second type can be perceived through the ideograms of the North American examples, the American case in Huston (Figure 6) and the Canadian case in Montreal (Figure 8) where the UUN is positioned under big area of the city downtown, covering as much as possible of it's buildings. A simplified ideogram (Diagram 98) is demonstrating the typology of locating the UUN in the downtown CBD area.

3- Transportation routes: in this type, the UUN space is always located under one or more of the city main transportation axis. This third type can be detected in the ideogram of the Far Eastern cases, Crysta Nagahori (Figure 10) and Tenjin Chikagai (Figure 12) at Japan where the city is having main boulevards that contain different transportation systems in different levels. The ideogram (Diagram 99) is showing the third typology of locating the UUN respecting the city main transportation routes.





2.2.Matrix of

Density

UUN Location

UUN Form

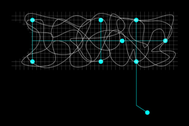
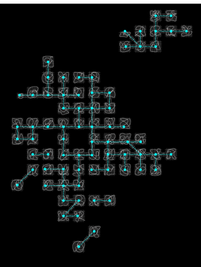
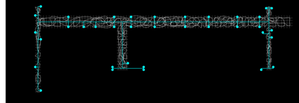
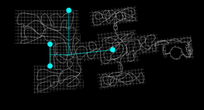
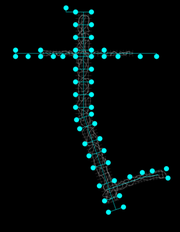
The Urban Underground Nodes are located in different places in each city. In this part, the research is trying to understand and decode the relationship of the location of each case in parallel with the density of the built up object on the top of it. The result was coming out in 3 different categories:

1- Low Dense (Public spaces): in this type, the UUN space is located under open external public spaces such as squares and gardens. This is the first type that can be observed in the in the ideograms for the first two European study cases in France, Les Halles (Diagram 8) and Carrousel du Louvre (Diagram 23). A simplified ideogram (Diagram 100) is pointing out the typology of locating the UUN respecting the lowest built up density.

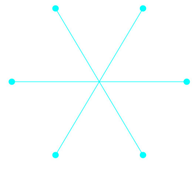
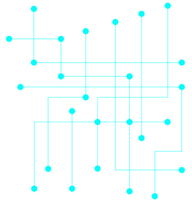
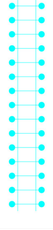
2- High Dense (High-rise towers): in this type, the UUN space is mostly located under closed internal spaces such as high-rise buildings and towers. This second type can be perceived through the ideograms of the North American examples, the American case in Huston (Diagram 38) and the Canadian case in Montreal (Diagram 53). A simplified ideogram (Diagram 101) is demonstrating the typology of locating the UUN concerning the highest built up density.

3- Medium Dense (Streets): in this type, the UUN space is totally located under one or more of the city main streets network. This third type can be detected in the ideogram of the Far Eastern cases, Crysta Nagahori (Diagram 68) and Tenjin Chikagai (Diagram 83) at Japan. Down in the final result, a conceptual ideogram is showing the typology of locating the UUN respecting the middle built up density, which is referring to streets (Diagram 102).

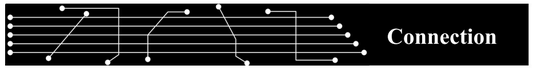
Study Cases

Europe	North America	Far East
		
11 - Les Halles, Paris, France.	41 - Houston downtown, USA.	71 - Crysta Nagahori, Osaka, Japan.
		
26 - Carrousel du Louvre, Paris, France.	56 - Montreal downtown, Canada.	86 - Tenjin Chikagai, Fukuoka, Japan.

Results

		
103 - UNN Pivotal connection.	104 - UNN Network connections.	105 - UUN Underpasses connections.

2.3.Matrix of



Connection

UUN Location

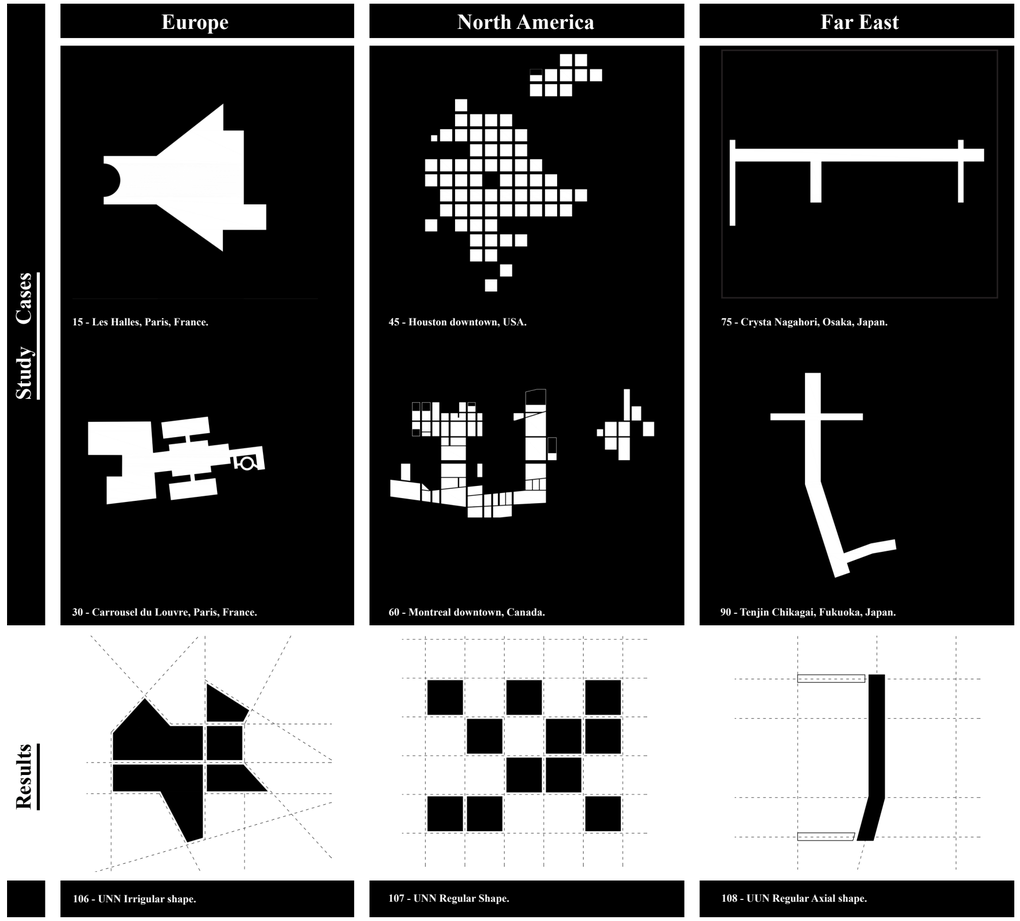
UUN Form

The research is mostly concentrating on the pedestrian user vertical and underground horizontal connections regarding their location. From the studied cases, three different types can be noticed regarding the connections of the UUN space:

1- Pivotal connections: in this type, the scale of the UUN is small and concentrated while it is mainly connecting pedestrians to metropolitan transportation systems underground and public spaces over ground. This is the first type that can be observed in the in the connections ideograms for the first two European study cases in France, Les Halles (Diagram 11) and Carrousel du Louvre (Diagram 26). An abstracted ideogram of the UUN pivotal organization method of this type is presented in (Diagram 103).

2- Network connections: in this type, an established underground pedestrian network is provided between the diffused spaces of the UUN as it is expanding in a very large area while these spaces are connected vertically to the covering buildings over ground internally. This second type can be perceived through the ideograms of the North American examples, the American case in Huston (Diagram 41) and the Canadian case in Montreal (Diagram 56). A simplified ideogram (Diagram 104) is demonstrating the UUN network connections typology.

3- Underpass connections: in this type, an established underground passes are provided through a strait linear space underground with lots of vertical connections on both pedestrian sidewalks of the covering street. This third type can be detected in the ideogram of the Far Eastern cases, Crysta Nagahori (Diagram 71) and Tenjin Chikagai (Diagram 86) at Japan. Down in the final result, a conceptual ideogram is pointing out the UUN underpasses connections typology (Diagram 105).



2.4.Matrix of

UUN Location

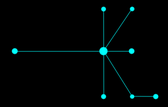
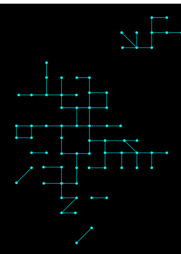
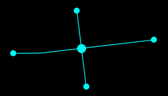
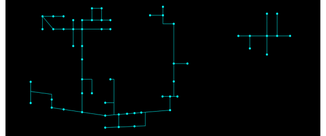
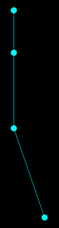
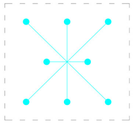
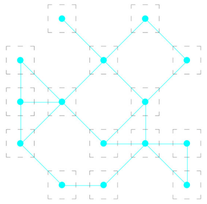
UUN Form

The Urban Underground Nodes are a very live example of the void presence in another city level. Each one is acting as a pause in the rhythm of continues music track in the city context, stitched in the urban tissue with different forms. They are taking their profile from the over ground city context morphology through axial references established in the urban tissue. The shape of the void in the selected case studies can be categorized into three different types:

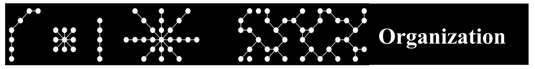
1- Irregular shapes: it is an outcome void consisted by uniting different irregular uneven shapes and this is the first type that can be observed in the in the ideograms for the first two European study cases in France, Les Halles (Diagram 15) and Carrousel du Louvre (Diagram 30). An abstracted ideogram of the UUN irregular shapes profile method presented in (Diagram 106).

2- Regular fragmented shapes: The UUN in this type is consisting of fragmented divided regular voids of squares or rectangular shapes connected with underground tunnels system. This second type can be perceived through the ideograms of the North American examples, the American case in Huston (Diagram 45) and the Canadian case in Montreal (Diagram 60). A simplified ideogram (Diagram 107) is demonstrating the UUN regular fragmented shapes typology.

3- Regular Axial shapes: The UUN in this type is consisting of united regular linear shapes coming out of the covering streets shapes. This third type can be detected in the ideogram of the Far Eastern cases, Crysta Nagahori (Diagram 75) and Tenjin Chikagai (Diagram 90) at Japan. Down in the final result, a conceptual ideogram is pointing out the UUN regular axial shapes typology (Diagram 108).

	Europe	North America	Far East
Study Cases	 18 - Les Halles, Paris, France.	 48 - Houston downtown, USA.	78 - Crysta Nagahori, Osaka, Japan.
	 33 - Carrousel du Louvre, Paris, France.	 63 - Montreal downtown, Canada.	 93 - Tenjin Chikagai, Fukuoka, Japan.
Results	 109 - UNN Central organization model.	 110 - UNN Diffused organisation model.	111 - UUN Linear organisation model.

2.5.Matrix of



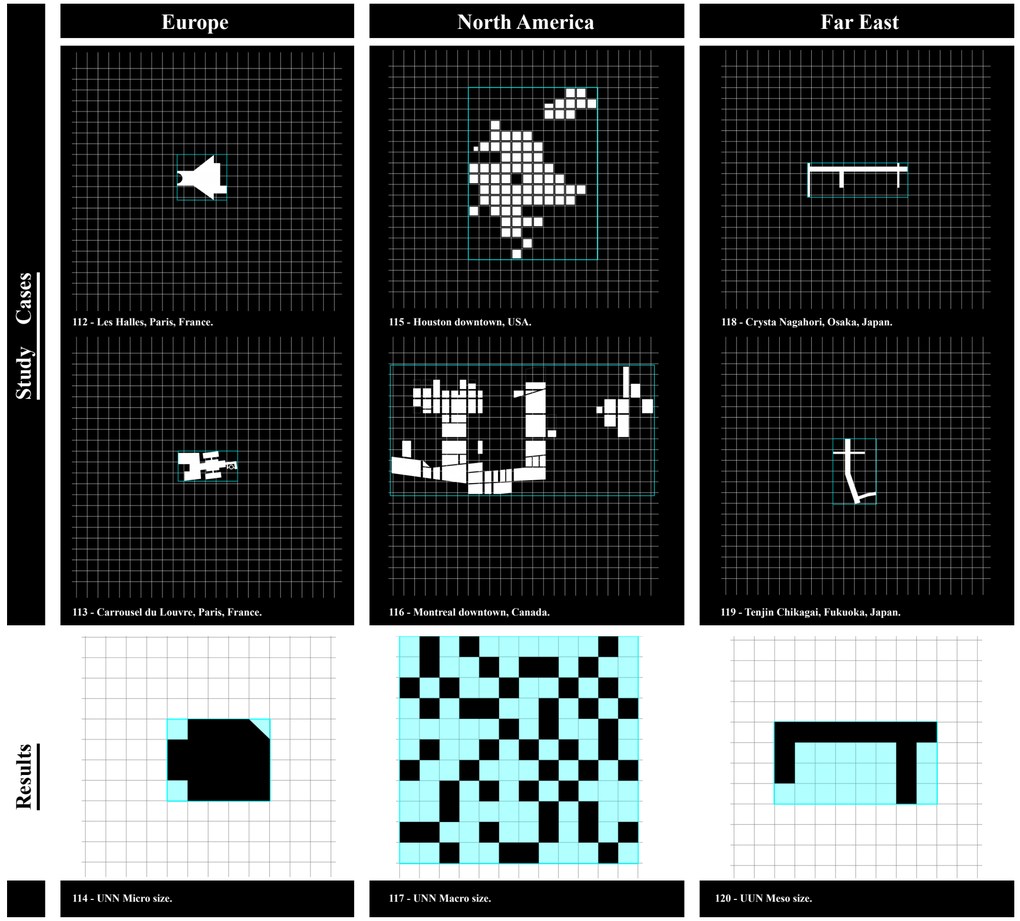
UUN Form

This study is concentration on the organization of the internal space of the UUN and also its arrangement in the urban context of the hosting city. From the studied cases, three different types can be noticed regarding the organization of the UUN space:

1- Central: In this case the space is all united and arranged as a core in a focal way in the urban tissue. This is the first type that can be observed in the in the organization ideograms for the first two European study cases in France, Les Halles (Diagram 18) and Carrousel du Louvre (Diagram 33). An abstracted ideogram of the UUN central organization method of this type is presented in (Diagram 109).

2- Diffused: In this type, the UUN is consisting of several spaces that are scattered in the city zone while these spaces are close enogh to each other as they are connected together with underground tunnels. This second type can be perceived through the ideograms of the North American examples, the American case in Huston (Diagram 48) and the Canadian case in Montreal (Diagram 63). A simplified ideogram (Diagram 110) is demonstrating the UUN diffused spaces typology.

3- Linear: In this category, the UUN space is consisting of strait tight linear united space. This third type can be detected in the ideogram of the Far Eastern cases, Crysta Nagahori (Diagram 78) and Tenjin Chikagai (Diagram 93) at Japan. Down in the final result, a conceptual ideogram is pointing out the UUN linear space typology (Diagram 111).



2.6.Matrix of Size

This study is concentration on the size of the distributive area of each UUN case in which the net area is expanding in. From the studied cases, three different types can be noticed regarding the distributive size of the area where the UUN is expanding in:

1- Micro Size: and this can be observed in the first two European study cases in France, Les Halles (Diagram 112) and Carrousel du Louvre (Diagram 113). They are both very concentrated and compact in a relatively small area at the city urban context although they have middle measure regarding the net area. But because of this compact arrangement of the space in the urban tissue, the distributive area is small. A conceptual ideogram (Diagram 114) is pointing out the UUN micro distributive area.

2- Macro Size: and this can be perceived at North American examples, the American case in Huston (Diagram 115) and the Canadian case in Montreal (Diagram 116). Both cases are relatively huge regarding the net area and the distributive area because of the diffused spaces typology of the UUN in the covering almost all the downtown area. This is why the distributive area in both American examples are much bigger than all the other cases. A conceptual ideogram (Diagram 117) is demonstrating the UUN Macro distributive area.

3- Meso Size: and this can be detected in the Far Eastern cases, Crysta Nagahori (Diagram 118) and Tenjin Chikagai (Diagram 119) at Japan. Both cases are having the smallest net area compared to European and North American cases. Though, both cases are expanding in a middle size distributive area, bigger than Les Halles and Carrousel du Louvre, while they are smaller than Houston and Montreal UUN cases due to the linear strait form they are following. A conceptual ideogram (Diagram 120) is showing the UUN meso distributive area.

B. Urban Lifestyle.

3. Urban Identity.

3.1. Urban Pattern.

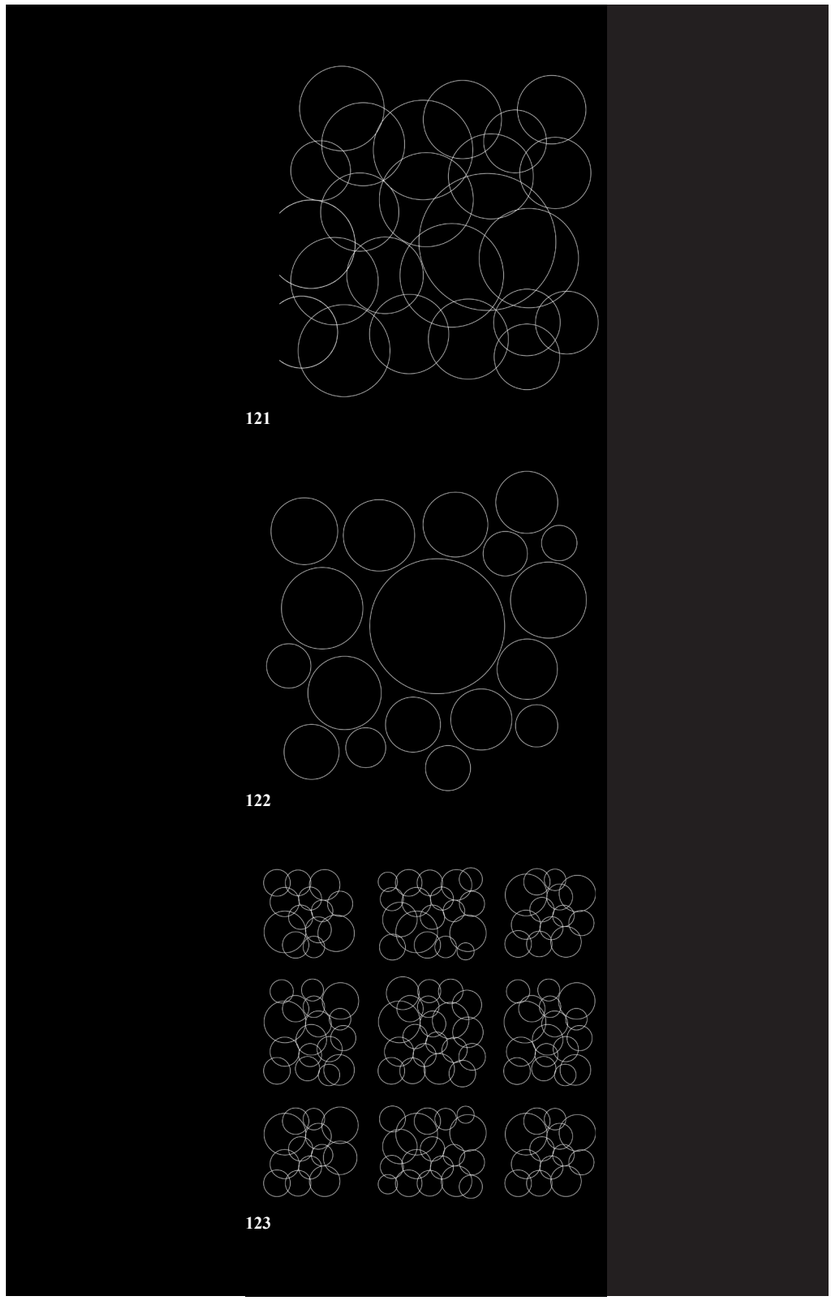
3.1.1 Types and Characters of Different Urban Contexts.

Once giving a look at the history of cities, we can find clearly that the human behavior is totally influenced by the adopted urban planning approach. For example, the city structure during the Roman Empire had a specific character presented in the regimented plans of streets, squares, public buildings, landmarks and barracks that were enhancing the military role. Or the medieval cities, that were having the squares serving as a market place to support the function of trade and craftsmanship. Down to the strategic urban proposal that was established by Haussmann for Paris after 1852. It was supporting the military to control the population while giving a new platform for a new cultural wide boulevards providing cafes promenades[1].
The development of such traditional cities was mostly relying on the needed uses. They were not planned in a true sense. So the city was developing spontaneously with regarding to the use over form as inhabitants, step by step, built it. The city was not the goal itself but a tool formed by the needed use. It is a result of a slow process of continual adjustment and adaptation of the physical environment and city functions.
With regarding to form, the two main periods witnessed main variations when city started to track an urban plan during the renaissance era in which streets were enlarged for the carriage movement priority. Secondly, the functional city that existed after the industrial revolution. The city was deforming to accept and host the automobile vehicles as a main transportation element. These two movements were the reason behind a radical change to the city activities in public spaces and streets[2].

In his essay, Christopher Alexander explained the difference between the self developed cities and the ones that were designed by urban planners.

I want to call those cities which have arisen more or less spontaneously over many, many

[1] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 9.
[2] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) pp: 39-41.



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123

years natural cities. And I shall call those cities and parts of cities which have been deliberately created by designers and planners artificial cities.[3]

The idea of Alexander is that the city is consisting of a bunch of sets – the set is a collection of elements that for some reason belonging together - which are the representing the city components. The way to deal with these sets are the way to categorize them .In the natural type, the sets are *interacting* between each other which is producing more activities in the cities (Diagram 121) while the artificial cities type is eliminating the sets intersections and giving results based on a *separation* action between them (Diagram 122). A third type appeared after that as a combination between the natural and the artificial models especially in the Far East cities that were reconstructed after war. The main infrastructure was planned and designed by professionals to divide the city into zones, while these zones were developed naturally piece by piece in a spontaneous way regarding needs. Though, the sets are segregated where the city main transportation route axis are located (Diagram 123).

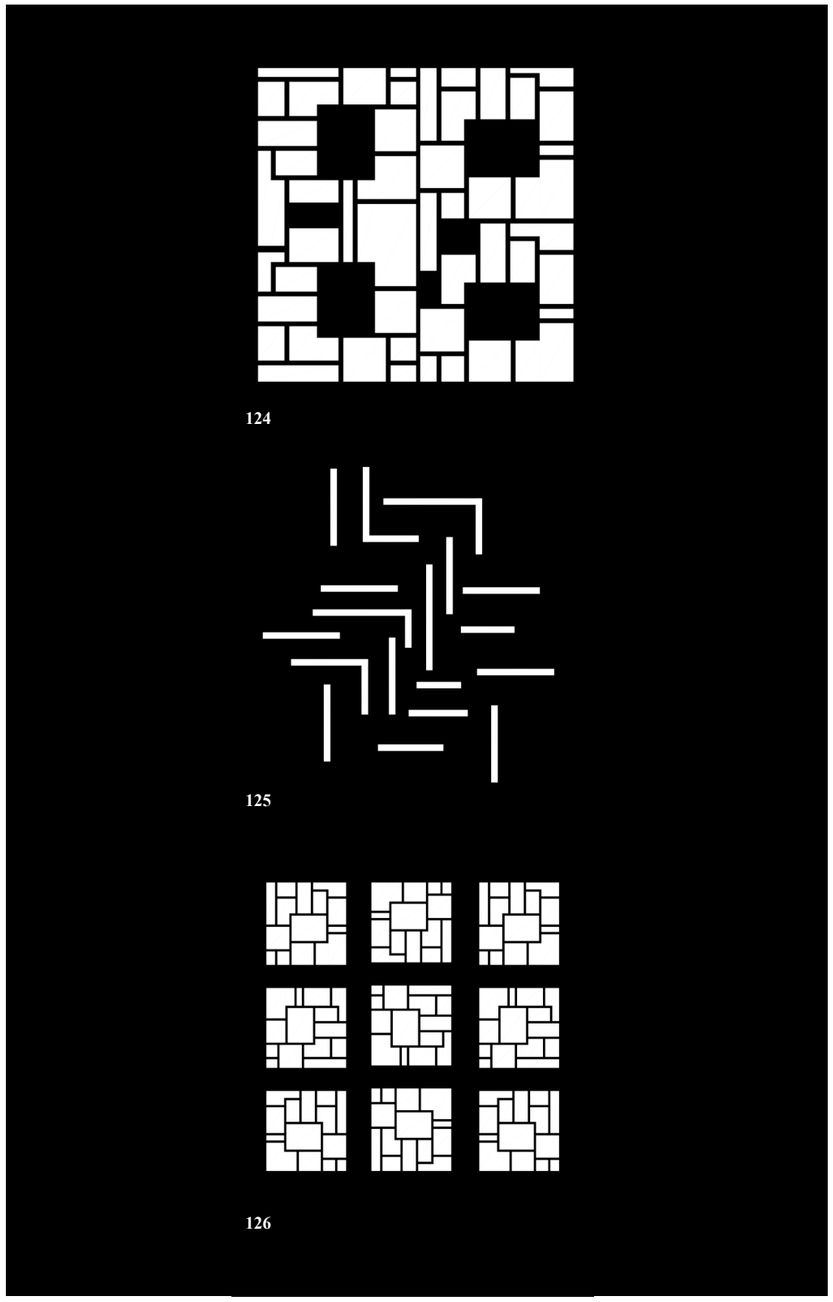
On the other hand, Rob Krier categorized the cities spatial arrangements into two types, traditional and modern cities.

Traditional spatial arrangement of cities: If we look at the spatial continuum of a cohesive urban structure from a distance and in somewhat simplified terms, it can be compared to the barriers, which channel pedestrian movement. If there is a gap in the barrier we will have to cope with shortcomings in the system of orientation.

The modern City: Extending this metaphor to our present day situation, it could be said that from a spatial point of view, our towns are composed of forlorn and isolated sections of "barrier". Battered on all sides by every conceivable stream of activity and with no margins left for meaningful activity or orientation. This contradicts the urban architecture as defined by Sitte and is nothing more than jumble of buildings.[4]

[3] Christopher Alexander, "A city is not a tree," in *Architectural Forum*, Vol 122, No 1, April 1965, p: 58.

[4] Rob Krier, *Urban Spaces*, (London, UK: Academy Editions,1979) p: 81.



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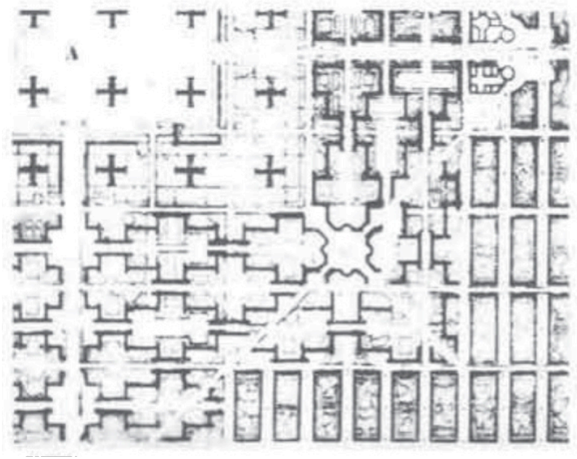
126

Fig: 5



The traditional cities are very consolidated and its character is mainly perceived from the strait streets and open squares that acts as the collective spaces in this city model (Diagram 124). The urban spaces are very well identified in this type of urban tissue. On the other hand, the modern cities are not having the same identified spaces as the last example. The city is consisting of a collage of unrelated buildings that are producing random unidentified urban spaces (Diagram 125). This concept of modern city spatial arrangement was abstracted and simplified in Le Corbusier's proposal of "Ville Radieuse" (Figure 5) for the contemporary city in 1922, conforming Howard's Ideas. in all his proposed town plans until the sixties he repeated the grid system (redents) while isolating towers area from the superblocks areas for residents. The character of that proposal is the wide streets for cars, mega city blocks, isolation of towers that are laying in a delirious inhuman urban spaces scale.[5] If we have a close look at the city of Huston and Montreal, It is obvious that they are following the same method isolating the towers of the CBD (Central Business District) area or in the city center, presenting the downtown area in the modern cities or the new financial economical zone outside the historical center in the case of the traditional cities such as London with the Canary Wharf district.
And finally the far eastern model that is a mix of both traditional and modern city concept. It is having the integration and the consolidated urban context inside each district while it is facing the division problem where the urban transportation route is located (Diagram 126).

On the other hand, Cedric Price made another argument to explain the cities urban deformation over time. He hypothesized the city pattern evolution as an egg (Figure 6) but cooked in different ways. In each case, it is referring to different period. For example, the ancient city consisted of the main monumental building or the major piazza or both in the city center surrounded by residential and functional areas then the city wall. The city was totally separated from the countryside. If we took a deeper look, the egg is consisting of the yolk surrounded by the whites and covered by the eggshell.
The second case is the cities that existed in the 17th to 19th century, which had the amoeba shape. The cities gave up the surrounding walls and started to expand horizontally to have bigger scale. By that time the city was still reserving the idea of the main city center as a city core and

[5] ibid., p: 74.

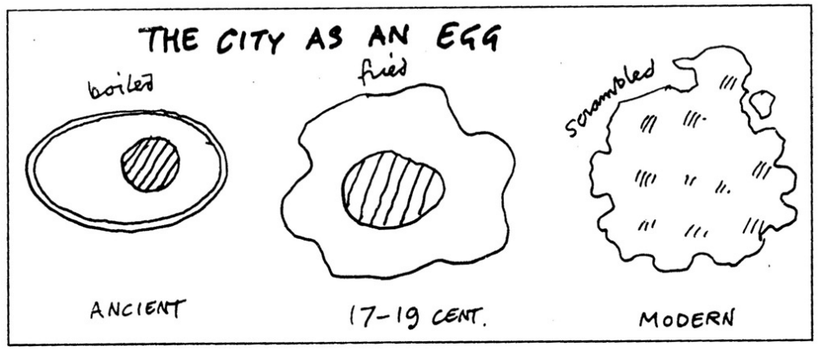


Fig: 6

extended to include residential periphery. This is very similar to the fried egg form. Once being cooked, it spreads out to have a very central and condensed golden yolk in the middle while being surrounded by the fried whites. This model can be observed in most of the European cities with historical centers.
The third case is the scrambled egg as the yolk is being cooked and mixed with the whites, which is pointing out the modern city that also applied on most of the Asian and some American metropolitan contemporary cities. Kevin Lynch described it as the polycentric cities. In this type, there is no one main center to the city but multicenters that are diffused, forming the city fabric, having no traditional hierarchy. This type is representing most of today's mega cities, specially in the far east.[6]

Later on, Price's method was developed and reformed by The Young Planners with new identification. The hard-boiled –egg city pattern was represented under the name, the "Archi Città" (combining Archi, meaning primary in Greek with Città means city in Italian). It was still referring to the prime city that was built and separated from the countryside with the ancient walls. The fried egg pattern was described as "Cine Città" (Cine mean motion in Greek and città means city in Italian). They explained the city expansion as a response to the industrial revolution with all the factories started in the cities suburbs, encouraging the inhabitants to flow outside the city center. The suburbs hosted and started to absorb the immigrants and workers who came to improve their living standard. The city had a strong motivation to lost it's boarders. And finally, the scrambled egg pattern, corresponding to the network and informational revolution. This modes was named, "Tele Città" (tele means communication over a distance and Città means city in Italian). *Tele Città "*is added by information technology now. It is an even faster reality of direct online exchange of information and interaction, the world of cyperspace, the reality of timeless time and distance-less space*"*[7]*. Technology is the main effective factor in this city character.*[8]

[6] David Grahame Shane, *Recombinant urbanism: conceptual modeling in architecture, urban design and city theory*, (Chichester, West Sussex, England: Wiley, 2005) pp: 71-72
[7] Cedric Price, *Opera,* ed., Samantha Hardingham (London, England: Wiley, 2003) pp: 92-93.
[8] David Grahame Shane, *Recombinant urbanism: conceptual modeling in architecture, urban design and city theory*, (Chichester, West Sussex, England: Wiley, 2005) pp: 71-72.

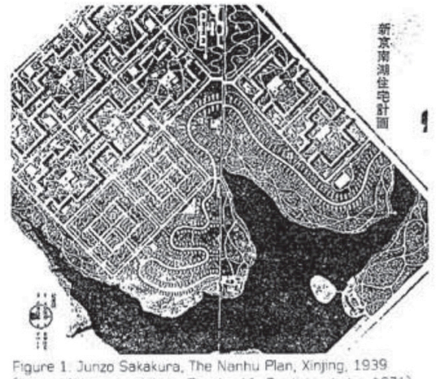


Figure 1: Junzo Sakakura, The Nanhu Plan, Xinjing, 1939
(Gendai Nihon Kenchikuka Zenshu 11, San'ichi-shobo, 1971)

Fig: 7

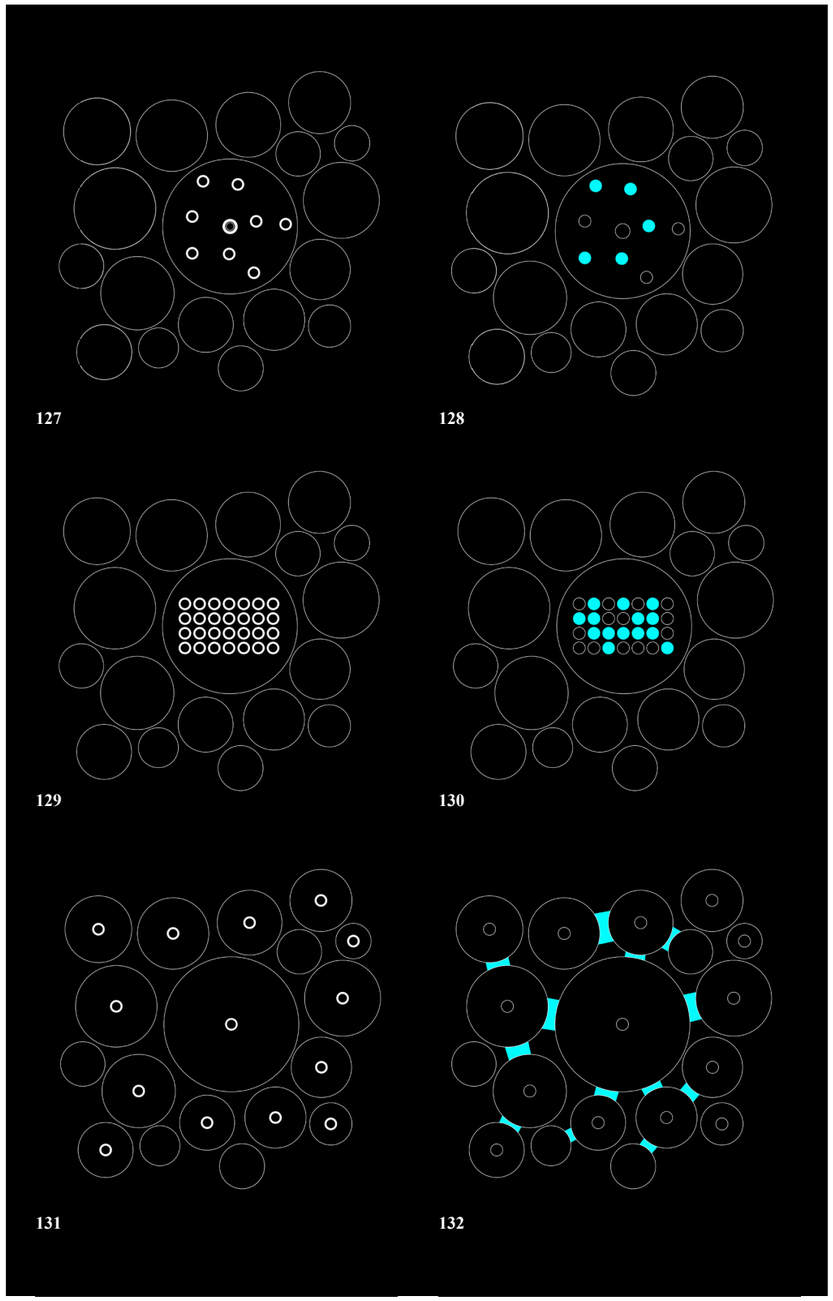
Figure 4: Kenzo Tange, A Plan For Tokyo 1960, 1961
(KENZO TANGE & URTEC, Kajima Institute Pub. Co, 1982)

Fig: 8

Development of today's cities:
Although most of the contemporary metropolitan mega cities are now following the scrambled egg model, but the intervention of this model is variable and depending on the historical essence of the city planning. For example, the traditional cities were following the central city model, so when they were developed, they still conserved the historical center character, adding more centers around it (Diagram 127). This is evident in some of the European cities like the old center of Paris or London.
In the case of the modern artificial cities, they were mostly built in the era of modernism based on the functional zooning plan. So each patch of the city is having it's own character based on the function like, CBD or residential areas or shopping areas or entertainment zones, ect (Diagram 129). This can be found inmost of the North American cities like Huston and Montreal. It can be noticed also in the new zones located in the peripheries of the traditional cities such as Canary Wharf in London or La Defense in Paris.
On the other hand, the Far East Asian cities were not following old traces of an old city context, instead they were following the circular system. The city is divided into circles that symbolize different districts, segregated by wider and bigger scale infrastructural streets between them like Osaka and Fukuoka (Diagram 175). The total destruction of most of the cities in that part due to wars was one of the main reasons to adapt new approach for the city urbanization. Some urban planners who returned back to Asia from Europe after the war were already influenced by modernism movement like Junzo Sakakura who transposed the very image of the Ville radieuse (1930) into his own Nanhu Plan (Figure 7) and kenzō tange's Tokyo proposal in 1961[9] (Figure 8).

The ideology of planning development in contemporary era is interpretation with the city type. In the traditional cities, UUN are merged with the city context in a natural way being added piece by piece regarding the city demand to be *integrated* with the existing city sets in a bottom up method (Diagram 128) like the two cases in Paris, Les Halles and Carrousel du Louvre. In the artificial modern cities, UUN are considered as sets that are not interpreting or intersecting

[9] Hajime Yatsuka, "The alter ego and id "machines" of modernist architecture," in *ArchiLab's Urban Experiments: Radical Architecture, Art and the City*, ed., Marie-Ange Brayer, Frederic Migayrou and Nanjo Fumio, (London, UK: Thames & Hudson Ltd, 2005) p: 123.

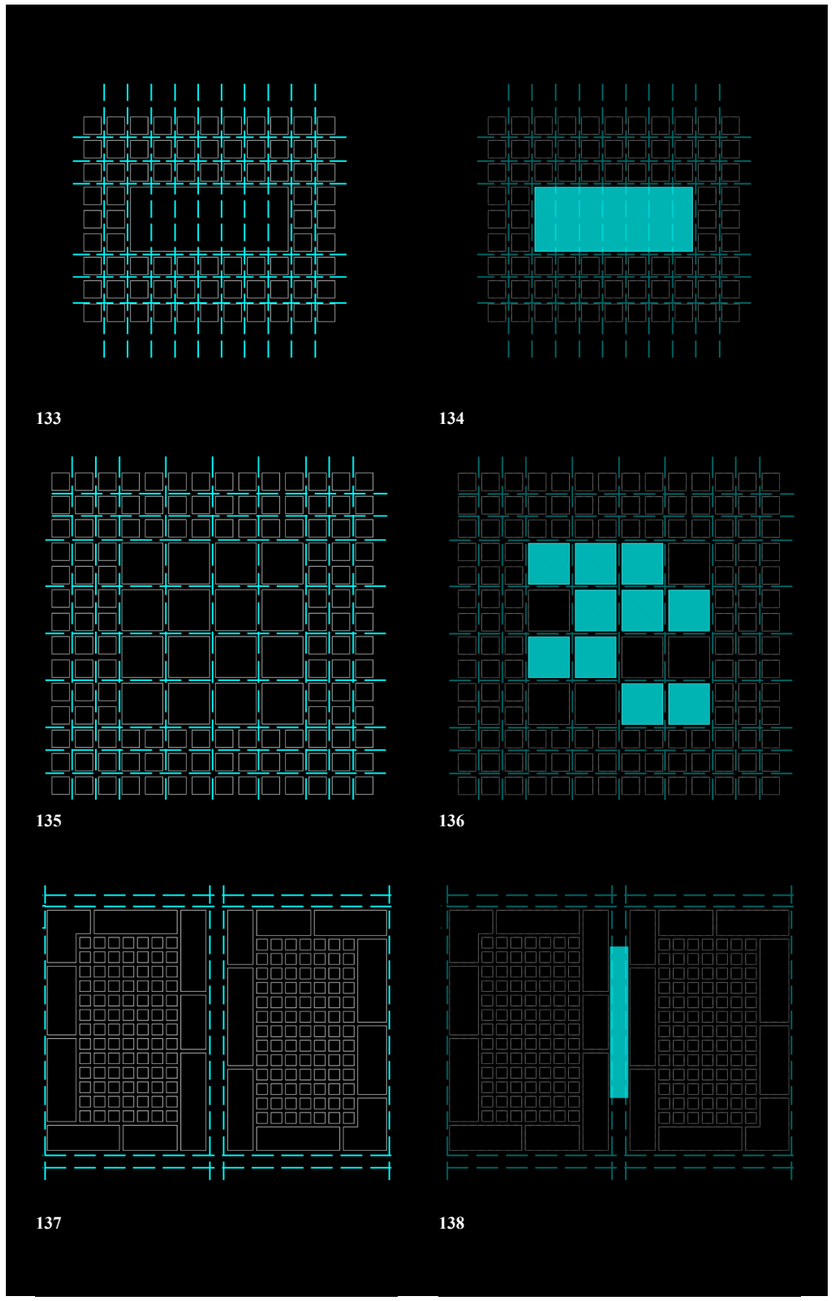


with other city sets as the first type while they are mostly planned following top down method being added to the city master plan in a way to be *segregated* from the other city sets and the surrounding context (Diagram 130) like the two cases in Houston and Montreal. On the other hand, in the Far Eastern urban system, the metropolitan stations are laying in the margins between the separated districts, which is explaining the reason of locating the UUN in the same margins under the wide roads located between the different city districts in a linear form to act as a *mutation* point where the sets can overcome the segregation problem (Diagram 132).

These ideograms are a reflection of the *position* theme of the *UUN* study cases in each city type either in the historical center under one of the main squares, the downtown CBD area under the high-rise towers or attached to the transportation route system under one of the main city streets – which was categorized in the final results of the analytical matrix of the *spatial compositional* part.

3.1.2 Scale.

Traditional organic cities are having *small-scale* as it was designed above all for pedestrians. They were constructed based on everyday integrated activities. Moving inside and traveling between cities was mostly on foot. This important factor was an important asset for a city that is designed for human scale and respecting the slow mobility velocities. The building are having very small size plots while the public spaces are having relatively bigger spaces in the city layout. (Diagram 133).
Once urban planning decisions started to be done on drawing boards, city stared to lose the human scale especially after *industrial revolution*. The *scale* started to get *bigger* as the factories started to be built outside the city center and workers moved to the cities' periphery where the factories are located. Adding to that, the transportation facilities like the trains made it easier to move from a place to another, saving more time and raising the speed of transportation. Thus, that was reflected on the city and buildings scale that started to get bigger and higher so the city can host more inhabitants as it was the place to provide more



opportunities.
While the construction technologies were developing, the city became a field test for planners. They started new ideology based on new advanced technologies, followed by introducing huge distances, tall buildings and cold architecture to keep up with the new city velocity and scale. The bigness became the new landmark theme. As Daniel Burnham argued, planners were "making no little plans". They rejected the 1920 and 1930 cities ideologies and character of the narrow streets, close fitting blocks and open urban public spaces. Instead they introduced functionalism as the new ideology dividing the city into zones consisting of widespread tall buildings between freeways. And as the city was constructed to contain more population and be denser with people, each zone was having big unwalkable scale. That is when the cars and vehicles occupation to the city was not an option. The car was a basic need for anyone to move from one zone to another[10].
Because of that, the different city zones started to break down into incoherent fragments especially in the downtown high-rise buildings with *bigger scale* plots (Diagram 135), where the CBD is usually located. This part frequently is owned by private sectors. Thus, each proprietor started to develop his own part in a separated competitive way. That broke the downtown of the city into a collage of unrelated settings and spaces as a result of the grand plans and *large-scale* urban models were the dominant tools for architects and urban planners in modernism.
To solve the problem of this isolation in the city, planners came up with new proposals that were established to beat this *segregation* between buildings and different city parts such as the linkages between blocks, skywalks in the city center to connect the high-rise towers or the paving and planting in the street-level connections that are provided to unify the hall. That can convert the broken city to a uniform master plan that can be shaped and controlled in an overarching manner[11].
On the other hand, the far eastern city model is still providing the both last mentioned scale character but distributed in a different way. Inside the districts, the buildings are mostly having small-scale plots while the bigger scale plots are located on the outline of the districts positioned on one of the main cities transportation axial routes (Diagram 137).

[10] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) pp: 55-56.
[11] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) pp: 45-46.

The Underground nodes are following the same adopted approach in the cities they are located in regarding scale and size.
In the *traditional natural cities* they are having *small-scale* buildings, as the city is not in need of large scale areas to add the needed functions. So the UUN spaces are established in a small-scale size, diffused in the city master plan such as Les Halles and Carrousel du Louvre in Paris. Adding to that, the city morphological context covering them is not having huge scale. Thus, the underground nodes are just an extension of these urban plots scale, having almost the same form and measure, consisting of irregular small shapes (Diagram 134).
On the other hand, in the modern cities or the CBD areas, the Underground Nodes are located under the high rise-towers where they have the *big scale* built up plots, taking the same form from the covering buildings as most of them are having the underground basement where the UUN are located. In this proposal, the underground nodes are laying under most of the built up towers in large plots, consisting of regular diffused shapes, all concentrated only in the downtown area covering as much as possible of the downtown zone where these towers exist. This can be found in Huston and Montreal cases (Diagram 136).
In the mixed cities like the Far East ones, the underground nodes are having linear shape, as they are located under the primary streets. They are taking their scale and form from the covering streets. So the width is already limited by the streets measure while it is important to have a long length so they can establish as much connections as possible along these axis between different urban zones and districts which is giving it a small scale while being distributed in a *middle size* one . Both Examples of Crysta Nagahori in Osaka and Tenjin Chikagai in Fukuoka were fixed in the same method (Diagram 138).

These ideograms are decoding one of the reasons behind the categorization of *size* of the distributive area theme – which was analyzed in the *spatial compositional* part – of the *UUN* cases typologies as *macro, micro and mezzo* according to the according to the scale and position of the built up areas, open spaces and axial transportation streets in different cities.

3.1.3 Social Impact.

The extent and character of outdoor activities are greatly influenced by physical planning.[12]
From this quotation of Jan Gehl in his book *Life between buildings*, I would like to start explaining how the people's activities are being affected by the city planning.
As the natural city before had small scale with high quality spaces, it acted as a meeting place for it's inhabitants, which increase the social life interactions between residents. For example the midlevel cities' dimension and proportion were a clear motivation for collecting people and activities in the urban spaces as streets and squares, encouraging pedestrian traffic and outdoor stays[13]. That is by the cause of narrow streets and small spaces, so the passengers are having the opportunity to see the buildings details and the people around, close to the range. The humans perceive such scenes in an intimate way, feeling them warm and welcoming. Another contribution to such model is the security of the city. Most of the traditional cities plans were basing on visual contact with streets for military defensive reasons. In the contemporary era, there is no longer the same motivation but the city has sustained the visual contact with the outdoor urban spaces and the human scale. These are important aspects that also helped in symbolizing and shaping the way of living[14]. As the German sociologist Ferdinand Tönnies depict societies living in these city types as a family or a kin with strong community ties. The people n this community are caring for each other and looking out for one another[15]. The inhabitants of such cities are having social character based on the integration and corporation between them in the city outdoor streets and urban spaces where they can enjoy different social activities.
In this case, the *UUN* form and composition are having small scale as the character of the above city elements. A parallel underneath environment with a big scale will not be needed as the city is providing a good condition well designed urban spaces, which formed their *lifestyle* as they got used to enjoy and use it in a daily way. This is why the need is for a *UUN* model that is *integrated* with this way of living. Also if we looked closely, we can see that in such models of *nodes*, there is usually a strong direct visual connection between *UUN* and over ground represented in a symbol like the pyramid of Louver or the forum of Les Halles and it's underground open exhibition.

[12] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 31.
[13] ibid., p:47.
[14] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 53.
[15] Steven Barkan, *Social Problems: Continuity and Change* (Minneapolis, MN: University of Minnesota Libraries Publishing, 2015), p: 634, https://doi.org/10.24926/8668.2301.

On the other hand, the new functional designed artificial cities and some of the suburban areas are frequently based on functional segregation, which is leading to an exact opposite result. These areas and cities types reinforced the reduction of outdoor activities, hence the social conditions[16]. The cities urban contents of urban spaces and buildings are having huge scale and inhuman dimension, lacking of any details that can attract the city user. Thus, there are just few people who are able to participate in outdoor activities, as this type is perceived in impersonal cold place. Passengers loose the feeling of intimacy since the urban scale is inhuman represented in the high towers, large buildings and wide streets. That's why in this case, the inhabitant or passenger prefer to live in a separate world, an indoor one. This is being presented in the indoor spaces such as shopping malls and commercial areas instead of having a walk in an outdoor spaces or streets[17].. In such cities or areas, we can find the society classifying different urban residents in terms of wealth or color, etc. Thus, there is segregation between different categories, specially poor and rich publics. And that is the reason behind the segregation between indoor and outdoor citizen, or as was termed by Steven Barkan, the conflict theory[18].
In that case, the underground nodes form is following the surface city built up blocks, being attached and located under them. The *UUN* are linked vertically to the over ground towers which is making them consequently *segregated* from the city public spaces users. They are established as indoor spaces, extending from the city indoor living internal ones that are forming the citizen's *lifestyle*. The residents in such cities are used to live and interact in inside spaces instead of outside city urban spaces or streets. Therefor, the underground in this case is presenting a parallel city with better qualities regarding the scale and the pedestrian type of users following the city lifestyle criteria.
Furthermore, the Far-East Asian cities' main problem is the separation in the main wide primary streets between different districts, which give the pedestrians and inhabitants the feeling of alienation from one to another. The *UUN* in this case are trying to overcome that feeling by contributing underpasses to rebound the broken interactions between different urban areas acting as a social *mutation* joint to achieve the social integration between all city parts.

[16] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 48.
[17] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 53.
[18] Steven Barkan, *Social Problems: Continuity and Change* (Minneapolis, MN: University of Minnesota Libraries Publishing, 2015), pp: 635-636, https://doi.org/10.24926/8668.2301.

3.2. Urban Spaces.

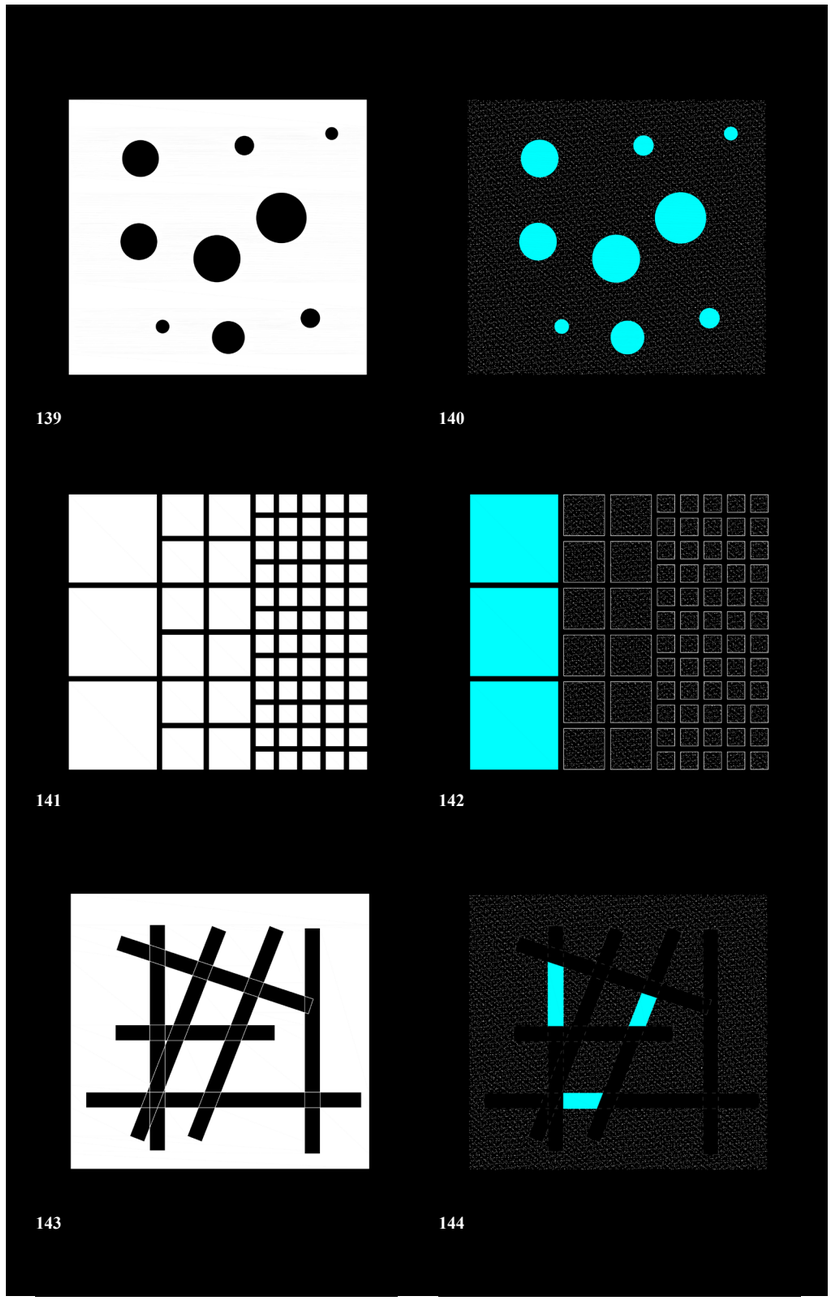
3.2.1 Types and Characters of Different Urban Spaces.

As urban design, this analogy implies a purposeful shaping of public space by manipulating the forms of the building solids. In a traditional city, the enclosing gestures of building facades define urban space as a series of contained figural voids. In the modern example, the space is an open-ended void and the objects are the figures. Although portrayed here as a polemic for sake of illustration, the concepts of figural solid and figural void - or object-building and object-space - are not mutually exclusive in a city that evolves over time.[19]

In terms of the urban space organization, Michael Graves explained the different scenes in both models, Traditional and Modern cities. It is very well identified in the traditional city. In this type the city seems like a solid block Interspersed with blanks of clear voids. The buildings are having continues appear and the urban space is caved from a cohesive masonry mass. Those gaps that permeate the mass are representing the urban spaces such as the Piazza element in the mediaeval or roman cities.
The concept of the closed Piazza started to change with Haussman plan of Paris. The space power started relocated once he proposed the concept of boulevards. His proposal was to attract the people and some commercial and entertainment functions to these wide streets. That concept was exported to the Far East Asian mega cities. We can see it in the proposal of (Kenzō Tange) for Tokyo. And that is why, after war during the cities were reconstructed with identified linear urban spaces embodied in main wide primary streets with wide sidewalks and a strait garden or passage dividing the cars track in the middle.

On the other hand, the modern city's urban spaces are very ambiguous and delirious. If the urban spaces looks like sculptured graved in a solid mass in traditional cities culture, the modern city

[19] Michael Graves, "The Figural City," in *Town Spaces,* ed., Rob Krier (Basel, Swezerland: Birkhauser Architecture, 2006) p: 6.



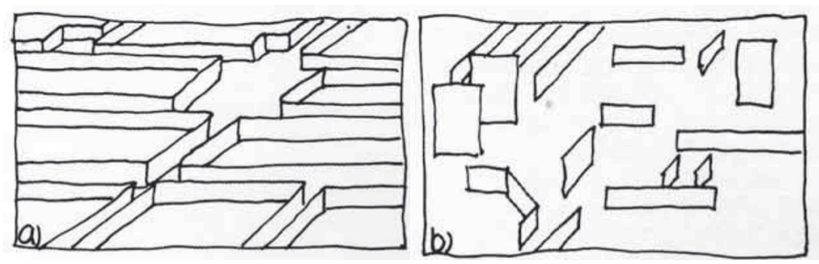


Fig: 9 **Fig: 10**

is the exact contrast. It is adding built up solids in an indefinite undefined space, which was abstracted and idealized in Le Corbosier's proposal of Ville Radieuse as a series of point block towers in the landscape. He pictured the city as a continues ground plane, a spacious garden filled with object buildings.[20]
Most of the North American cities are representing this type. The downtown with the high rise towers are in the city center with no clear well recognized urban space. This ambiguity and lack of good quality for living and interacting with public space led the private sector to offer interior ones in these high-rise buildings. The commercial center was the equivalent or the alternative to the urban public space such as the traditional piazza or the later boulevards. It also appeared as a needed urban identified space with human scale to make up of the lack of figural urban spaces in the cities.[21]

Rob Krier also clarified the difference of special arrangement of both, traditional and modern cities.
He simplified the first type's special continuum of consolidated urban structure from distance. He describe it as a channel of pedestrian movement flowing through gaps in between barriers of cohesive built up structure.(Figure 9). The second type was abstracted as a forlorn segregated sections of barriers, diffused in an open-ended void, making an anonymous undistinguished space. In this case no clear margins were left for meaning or orientation (Figure 10). Sitte also expressed it as "nothing more than jumble of buildings."[22]

Berlage' Amsterdam plan is a true evidence of the way of thinking during the beginning of nineteenth century that he was trying to obtain by introducing variety of different size winding streets, piazzas and internal spaces, while in the later proposals, building were separated and diffused in a vast scale which gave no configuration of urban spaces.[23]

The Far Eastern adopted the linear boulevards concept of Haussman and established it to

[20] Rob Krier, *Urban Spaces*, (London, UK: Academy Editions,1979) p: 74.
[21] Michael Graves, "The Figural City," in *Town Spaces,* ed., Rob Krier (Basel, Swezerland: Birkhauser Architecture, 2006) p: 7.
[22] Rob Krier, *Urban Spaces*, (London, UK: Academy Editions,1979) p: 81.
[23] ibid., p: 73.

introduce the cities main public spaces in a linear way.

In all case studies that the research included - located in different sorts of cities - the *UUN* are always positioned under the urban spaces in various forms and sizes, taking them from the over ground urban space. They are counted as an expansion of the covering urban space. This extension is taking action respecting the same adopted approach that each city is applying in terms of location and form of the urban space.
For Example, in the traditional cities, they are an extension to the piazza that is acting itself as the urban space in the city context. The form that the *UNN* is taking is also influenced by the figure of the Piazza (Diagram 139), (Diagram 140) and that is what can be identified in both cases of Les Halles and Carrousel du Louvre in Paris.
While in the case of the modern cities and the CBDs where the financial district is, the *UUN* are located under the high-rise towers, adding spaces to the internal private space in those buildings' basement that are acting as a parallel equivalent urban spaces (Diagram. 141), (Diagram142) such as Houston and Montreal cases. On the other hand, in the case of the mixed approaches Far East Asian cities where the boulevards are acting as the main urban spaces, *UUN* are located under those primary urban axis, taking the linear shape from the covering wide streets to unite that grand space divided by cars roads (Diagram 143), (Diagram 144) like in the case of Tenjing Chikagai and Crysta Nagahori.

The public space type and character is affecting the *UUN location* regarding the *density* of the covering object, either low in the case of the open public squares or high density of built up towers covering it in case the public space was interior one located under high-rise tower or medium dense incase a main street is on the top of it. It is also influencing its profile weather it can be consisting of united irregular shapes - in the case of the public spaces generated in the traditional cities - , regular shapes – in case of the interior public spaces generated under the towers of the modern cities – or regular linear shapes – in case the public space is represented as an axial boulevard in the urban tissue. It is also impacting the *size* of the *UUN,* whether *micro, macro or meso*.

3.2.2 Private and Public Ownership of Urban Spaces.

During the sixties the American government in USA started new modern movement of privatization after the recession that hit the market and the declining of the physical resources. The economy needed resuscitation with new innovative visions to keep up with capitalism and neoliberalism that changed the imperatives as it was introducing new economical strategy that was established by Milton Friedman in the University of Chicago which is connected also to transfer the artificial cities planning ideas globally and this is why we can find the same concept in the peripheries of some traditional cities such as Canary Wharf in London and La Defense in Paris or the developed centers and downtowns in the North American cities to be the new CBD area. Privatization strategy is based on finance, marketing and rendering of personal service, making them the cornerstone of economic activities. The active state involvement declined in favor of the increased role and significance of the private sector. Most of the improvements and amenities started to rely on the private sector, while the role of the municipalities was to attract investors and businessmen.[24]
The extreme reliance on private initiative and investment led to uneven development of many downtowns as the designers also shifted from public to private sector. The design concepts were mostly done by the designers hired by private sector regarding the established regulations set by the public sector. Private developers became the actual city builders who determine what to build and where it should be located. It became very rare when the public sector is taking action towards the public realm of the city, thus the public spaces. Though, the quality, the number and the location of spaces privately produced are not meeting up with the needs of the public anymore. In fact, privatization was a reason for weaking the public domain in the downtown even if the established open spaces that are presumed to be public; it is hazy and unclear if they actually are.
The location also of the urban vital spaces was done by planners not regarding the city need, but according to the market research men who are following the private investors and corporates' desire to achieve the highest possible profit. Planners had no alternatives than providing the

[24] "Alsh Khanah | 5 syasah - Neolibralism," YouTube video, 15:46, posted by "Alshakhanah Alshangy," April 30, 2018, https://www.youtube.com/watch?v=erLGURblgdA. Translated by the Author.

demands of their clients. And in that way, the real controllers and decision makers were not the planners, but the private entities that shaped and controlled the urban living leaving no other options to the urban planners[25].

> *Downtown urban design, because it is determined by private interests, has become reactive and opportunistic rather than proactive. The public sector reacts to the initiatives of the private sector for downtown building.*
>
> *The developers' actions are opportunistic, predicated upon their expectations of market response. Their objectives are profit and good business—which are not always congruent with good city form and urban design. This philosophy is quite different from earlier urban design philosophies that relied on the strategic location and investment of public projects and improvements to stimulate civic pride, sense of community, and private investment in a desired pattern*[26]

This is proving that the privatization doesn't give much care to achieve a good city form, but the priority is for the individual interest of the investor even if it is against the public benefits.
As policymakers turned into market based solutions, the main aim of the cities turned to attract the corporate investments. In that case, the competition would turn between investors to provide the best quality of space so they can attract and maintain the people inside their properties, as financial profit is the main goal. This was enough reason to bring the signature buildings in cities centers and downtowns so they can be able to contain equivalent urban spaces to attract more people inside them. That was represented in the big scale marketplace, convention centers and entertainment facilities. Because of that, the city started to mutate, giving a new skyline to most of the major American downtowns, having high-rise glass boxes buildings owned by investors from the private sector.[27]

For the sake of the lack of the urban public spaces in the modern cities and peripheries, the private sector was encouraged to stared investing and developing private urban spaces that can be equivalent to the piazzas and boulevards in traditional cities. It tried to provide a space that can suit the human scale and deliver better quality for fitting with the pedestrian activities. In this way the internal large scale space will enrich the building's functions with a needed space where the people can hang out which is adding more value to the building, functionally and spatially[28].
This can be seen in different types of buildings in the modern cities and attached peripheries that were constructed in the modern era like commercial centers or the hotels' internal spaces and halls providing *segregated indoor squares*. All these examples are trying to introduce seemingly public space but in a private building - unlike the urban public *integral open outdoor space* in the traditional cities nor the public *mutating external boulevards* in the Far Eastern cities.
This concept is interesting from a developer point of view as it is making profits, orienting costumers towards using the established private space, though it is affecting the city negatively making it deserted from any social activities, unpopulated and empty from any interesting attractions. Thus, the city public spaces become duller and unsafe unlike the closed in parallel populated and secured private ones[29].
The spaces established by the private sector are mostly inward oriented, are blocked from the city public streets isolated and detached. That means that the main benefit is already set for the proprietor and renters instead of the general public[30]. The public space in the traditional city had a main role, which is to connect different parts of the city while supplying it with the activities to populate the city with different activities. All that was gone in the interior segregated private space.
This American concept of enormous indoor urban spaces was established in the North American cities- which can be observed in Houston and Montreal - and then was exported to different parts of the world – such as Canary Wharf financial district in London - as other researchers have documented the same socioeconomic process that led to similar results regarding the special outcomes in cities centers and downtowns affecting the city urban fabric such as (Fainstein

[25] Rob Krier, *Urban Spaces*, (London, UK: Academy Editions,1979) p: 82.
[26] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) p: 46.
[27] ibid., p: 45.
[28] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 57.
[29] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 125.
[30] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) p: 46.

1994; Sudjic 1992; Grönlund 1993; Deben, Musterd, and van Weesep 1992)[31].

Privatization movement affected the underground nodes as it did in the city surface. That is due to their location under the city private massive buildings in the downtown established in their basement. Thus, as these nodes are a part of building above, they are private property that either attached to the *segregated inside private* urban space located in the upper level. They are representing the urban space itself but in an underground level, developed and managed by the private sector. In fact the underground in this case is an extension to the over ground adopted strategy of the interior urban space. It is emphasizing it by adding enough space with better qualities for human scale in another level being populate, hosting more human activities and safer than the city public spaces. This can be seen in the study cases of Huston and Montreal.
In contrast, the *UUN* that are covered with city external public space are usually public owned. An example of that is the underground urban node of Les Halles and Carrasoul de Louver in Paris where both are laying under public square or public gardens, which are *integrated* with *public* streets network, being a part of it.
Also, in the Far East cities, the *UUN* are located under the main principle public streets. These locations are belonging to the public municipality of the city and mostly connected to underground metropolitan stations like the case of Crysta Nagahori in Osaka and Tenjin Chikagi in Fukuoka. Another reason is that the municipalities are adding those *UUN* under the public properties of the primary streets mostly connected to the metropolitan stations that were developed by them as well. The underground of the constructed buildings is considered as private entities to the buildings owners.

To illustrate, the privatization theme of the urban spaces is mostly affecting the vertical connection theme of the *UUN* as they are connected to the above space type, public or private. If it is located under *outdoor public square or linear boulevard*, then the *UUN* is public itself and connected to it, while if it is covered by *private indoor urban space* positioned in a building or a high-rise tower, then the *UUN* is private itself as it is vertically connected to it.

[31] ibid., p: 43.

3.2.3 Role in Urban Context.

The classic city form had a semantic unity; it was organized around a center within which the social practices of politics, religion, business, and culture were exercised (Gottdiener 1986). As the urban center progressively lost its role in daily life (Jackson 1980), and as its primacy ceased to be the important prerequisite for many activities, the downtown lost its significance as the unifying heart of the metropolis. Later, in response to a restructuring in the early 1970s (Soja 1989), the downtown tried to resurrect its original importance. The center became the command post of a global economy (Abbott 1993) dedicated to power, money, and modern technology (Jackson 1980).[32]

The historical city center in the old natural cities and the downtown in the modern ones, are playing the main powerful role in the contemporary city today. Regarding the position studied in all studied cases, *UUN* are also concentrated or diffused specifically in those areas. They are enhancing their role and giving more importance to these city parts by adding new vertical extension to their spaces.

(Social) space is a (social) product [...] the space thus produced also serves as a tool of thought and of action [...] in addition to being a means of production it is also a means of control, and hence of domination, of power[33]

The public space had always played a main role in the cities. It is representing the heartbeat of the city movement, activities and power as mentioned by Henri Lefebvre. Though, its role and use had always been changing overtime and in different places. And that is what will be discussed in the next part.
In the traditional cities, the public space had always been represented in squares that act as

[32] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) p: 43.
[33] Henri Lefebvre, *The Production Of Space*, (Padstow, Cornwall, Great Britain: Blackwell, 1991) ,Translated by, Donald Nicholson Smith p: 26.

collecting points to the streets that are attached and connected to them. That joint had played the role of the open urban public space collecting people for a purpose being a city meeting point. For instance, in the old roman cities, the urban space was attached to the church as the religion had the main power to collect and unite the people. Some of the piazzas were also attached to political or municipal building where it had a political character. It was the place where the ruler can reach and talk to the citizens. On the other hand, the cities streets and piazzas special composition had a military reason behind while positioning them. That was also the main role in the Haussman proposal of the boulevards in Paris, which then was exported to the Far Eastern cities, while today they are playing another role representing the main open public spaces in the cities master plan.
Sometimes the public space was established in front of the city church and municipal building together so it can have the religious and political personality together. Though, the main performance of the space that was maintained over time is the commercial use, which is the traditional city open market. This role is stand still until today in most of the European cities' open public spaces.
After the industrial revolution, there's new urban space that was born out of the new established transportation systems. The stations are one of the most important and active city nodes that is instituting very active and busy joint coming out of connections in different scales. Today, stations are mixed with the commercial function to provide a contemporary multifunctional public space integrating different users together in a transit point.

In all the case studies that the research is working on, we can find that the Urban Underground Nodes are always attached to train stations or metropolitan stations or underground parking garages that are acting as a transit points between different transportation systems – from trains, metros or cars to pedestrian network and on foot activities. In the contemporary city, the underground nodes are adding new role to the urban spaces, which is the new direct connections with different city parts in a bigger scale to deal with the new city size.

The role of the urban spaces that they are playing today has changed through time because of the cities and cultural evolution through time and that's what we can see if we can give insightful look to the contemporary city today. For example, in the cities with traditional old roots, the piazzas are now attached to the churches or the municipal buildings that most of them are now listed as cultural historical buildings, which is giving new historical cultural role to the Piazza. The boulevards that were imported from Haussman proposal for Paris when he designed them for military reasons, while today they were transformed to be the linear public spaces in different cities context, establishing new roles of commercial function or transportation one like in the metropolitan far east cities.

The underground nodes are giving new extended space of the existed one above for adding new roles, located under the most populated and livable urban city spaces. That is why we can find them placed under the above-mentioned vibrant city spaces to be *integrated* with the social lifestyle of the users. They are enhancing and empowering those city nodes and at the same time they are a way to emphasize the role of the above city space by having a negative vertical extension of the space above, adding new services and uses that can keep up with the contemporary city demands.

On the other hand, the private spaces in the modern cities is presented in commercial centers had always been a fundamental use for the city citizens. This concept was born with the privatization movement. These commercial centers are being considered as a parallel city controlled by the private investors who are the ones holding decision of the role of their own space. That is why such inward private spaces are usually apolitical and mostly oriented towards profit coming out of the buying and selling activity. It is actually *separating* the users from the political and unnecessary social activities that are taking place in the city, while orienting them towards the commercial function that they want to enhance. All this besides decorating the downtown elements with shiny commercial advertisements is directing customers towards specific use of the space to obtain the profit.
It is a cut off, *separated* and enclosed space so it can be easily secured. This type of space is not integrated in the city fabric as the traditional public space. Instead it is isolated from the city public spaces rhythm. It is also segregating the space from the poor, unpleasant or homeless people, which is sorting the city people into categories of welcomed and unwelcomed in the space. A hyperreal environment based on attractive elements is added to the city context[34]
In such model, the underground nodes are taking their power, constituting their role from the

[34] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) pp: 44-45.

proprietor as they are also a part of his property which means he is the one also to set the role and function of these underground nodes to enhance the role of his own urban space, which is increasing the quality of the private space, being a motivation to attract more users while being segregated from the public city spaces and their users.

4. Urban Utilization.

4.1. Walkability.

4.1.1 Dominant Transportation Types.

There are tow main different typologies in the contemporary cities, pedestrian city and cars city. Starting with the first type, the city was established for pedestrians, especially in the traditional natural cities that there are lots of them in Europe. Cars were not able to concur them out of different reasons like topography, narrow streets, or even where the economical and the social network are both based on walking[1]. Many countries in Europe, North America and Asia experienced the car invasion and witnessed the downturn of the life quality, which affected the city livability. Some of them felt the danger of it as an indicator for a complete different lifestyle. There have been a lot of counter reactions to rescue the foot traffic and reorient planning strategies towards pedestrianism.

In lost of countries, especially in Europe, the planning discipline way of thinking completely changed in the 21st century than 30 or 40 years back. The pedestrian principle became more important, concerned with health, nature, traffic problems and the increasing rates of accidents. All that produced late movement and awareness for using new planning tools. An escape of the traffic that was done by cars, the horns and cars sounds and noise.

In a city that was planned and providing high quality for walking, it's easier to live with no cars, as there's more room for social activities based on foot mobility to walk or to stay in the city streets and cars. The flow of people is more accessible than the cars one. Public transportation is an important asset to rely on in case of far destinations. In this case, it's efficient and has advantages of saving time of driving, searching for parking lots and enhances the social life[2].

In such example, the city doesn't need a parallel network for pedestrians as it already has a good one established for public who are already using it during practicing their activities. Walking is a *lifestyle* in those cities, a part from their inhabitants mentality. The *UUN* here are playing a role of a needed extension of the meeting joint and the most crowded urban ones such as

[1] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 12.

[2] "The general theory of walkability | Jeff Speck | TEDxMidAtlantic," YouTube video, 18:46, posted by "TEDx Talks," May 13, 2014, https://www.youtube.com/watch?v=uEkgM9P2C5U.

active public squares or gardens that are collecting people in the established pedestrian system, reinforcing these urban points of integration with contemporary functional demands. This can be seen in the European cases in Paris.

On the other hand, the second type, which is the cars city was established after the industrial revolution and the Fordism. Cities and specially North American ones were mainly designed in the modern era to host cars. It became a fundamental part of the American culture that affected the way of living, the urban planning, the habits and the social life. Also out of the long distances between city parts and it's large scale, the cars use became one of the living basics. As more cars started to fill the streets, politicians, planners and urban designers started to focus on making more room for cars inside the city. Even in some European and old cities, developers started to transform the city to be able to host cars network and needed parking lots. In some areas, full blocks were removed to be able to host the increasing number of cars as a symbol of luxury and a tool for making easier life.
In such cities the sidewalks narrowed down that they disappeared in some streets[3]. And if they still exist, they are the place where to put the traffic signs, parking meters, bollards, street lambs, that they took place in the remaining space. All that is not to have any obstacles that can face the cars users in the vehicular streets.
The priority in this model is for the motorized traffic. Besides that, the allowed pedestrian network is interrupted by roads intersections and controlled by stoplights that cut the walking rhythm. The reason behind all that is to provide better driving conditions over walking that is less attractive in this type.
To illustrate, the character of this brand is a fattened roads, emaciated sidewalks, deleted trees and large parking lots[4]. The needed area for a person walking is a lot less than vehicle lot, which completely changed the streetscape.
In a city like that, there is no place for pedestrians. All city objects are designed for cars owners who have the priority, while the on foot user should keep struggling with the low quality pedestrian network. This is why in such cities; we can find that there is a need for a parallel pedestrian network that inhabitants can use while dong the basic on foot activities. That is the reason of having sky bridges and underground walkable network that is connecting the *UUN* spaces in this model, making up what the city needs. This is decoding the existence of the parallel underground network in the study cases of Montreal and Housten to offer what the city is deprived of.

However, in some other cases, there is a third type that is considered as a mix between the last two models. A type where the city is offering good quality pedestrian network inside different districts while there is a vehicular priority streets are located between different zones. These cars streets in this model are acting as a barrier between the two pedestrians sidewalks and districts. In this case the on foot user is struggling, as such large infrastructural streets are being obstacles in the pedestrian network. That is why the *UUN* is acting as the missed puzzle piece to mutate and connect both sides with underground passes, providing what the city needs to overcome that problem. This can be perceived in the Far Eastern cases.

4.1.2 Scale and Velocities.

The city scale is playing a huge role in choosing the adopted approach, either pedestrian or vehicular one.
In the pedestrian model, substantially relies on the walking acceptable distances. Though, this range is different from a person to another. Some people are happily walking kilometers unlike others from children, disabled or old aged.
Walks of 500 m/0.3 miles are mentioned frequently as a distance most people are willing to walk. Of course this route is affected by the quality of the environment that the passenger is passing by. If it has better quality of pavement and more activities going on, it can be longer as there's life going on. Conversely, it drastically reduced in the streets with less quality. It becomes boring and unattractive for users. In the modern mega cities that are trying to apply pedestrianism strategy, like London and New York, developers are trying to include most of necessary needed functions within this range. So, the city is divided into multiple centers and districts with an average of the 1 km[5]. This is why cities in this case is do not need connections and parallel pedestrian networks but integration functional spaces that can serve specific range, like Les Halles and Carrousel du Louvre.

[3] Jane Jacobs, *The death and life of great American cities*, (New York, USA: Random House, 1961) p: .
[4] Jeff Speck, Walkable city, (New York, USA: Farrar, Straus and Giroux, 2012), ibook e-book, 19.
[5] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 121.

Fig: 11

Fig: 12

In the other type of the cars city, the scale is too big to be walkable. This is also explaining the enormous unidentified spaces, which permeates the city in an amorphous way. The high buildings with high density, wide streets with fast moving cars, broad areas for parking lots and large spaces are a clear explanation of the city scale. This size is making it very hard to any human activity to take place in this inhuman proportion. A parallel network with proper scale for pedestrians can be needed in such cases. This is explaining the *UUN* diffused spaces and connecting underground linkages established in human walkable scale like in the cases of Houston and Montreal.

Scale is in direct proportion with velocity. Based on a cornucopia of sensory impressions, the 5 km/h (3 mph) scale has small spaces, small signals, many details — and people close by. A street journey offers a wealth of experiences and sensory impressions. Though, the 60 km/h (37 mph) scale has large spaces, large signals and no details. At that speed it is not possible to see details — or people[6].
At speed of walking or running, the human have high chances to see and perceive more details. Old cities were designed with lots of details and ornaments that can enrich passengers voyage at 5 km/h (3 mph). There are better opportunities to realize the walking paths, seating areas, surrounding buildings and spaces. It is also easier for pedestrians to maneuver any obstacles at this speed in the city narrow streets. In this way people have time to enjoy and study the small details in close and large details from far away.

On the other hand, driving a car at 50, 80 or 100 km/h (31, 50 or 62 mph) is making it hard to realize any small details. Neither there is time to have the sensory experience for recognizing people. Instead, it is easier to grasp large signals and vast billboards.
In the large scale city which is formed by the 60 km/h (37 mph) car speed, buildings expanded to bigger scale, details were canceled and mostly focused on the cars perspective. Thus, it is exhausting, tiring and not interesting for a person to take a walk between architectural buildings

[6] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 43.

that were made for 60km inhuman speed[7]. That's another reason for tehe pedestrian in such cities to loose the interest of walking in the city streets, increasing the need for a human scale environment with better quality that can go on with his walking speed velocity. The *UUN* is offering that segregated space with a proper velocity for the on foot user (Figure 11), (Figure 12).

The velocity of a place is an important factor that affects its livability. The slower it is, the more livable it gets because once slowing down, it is better to read the surrounding. So, walking is better than running, running is better than cycling, cycling is better than motor biking and motor biking is better than cars driving. The slow speed is offering time to have social activities like meeting, talking, setting, standing, which is attracting more people to get involved.

The *UUN* doesn't need a pedestrian network as the city is already offering a good one with a proper scale and velocity for pedestrians. Thus, the *UUN* in this case are just need for adding functions in the collective and connective points in the existed over ground human slow mobility web to support their role and attracting more people keeping the city spaces alive. Having that said, the contemporary city of today still needs to be connected to a higher speed transportation system that can reach different parts of the city in a faster way. This is why in both European and far eastern cases *UUN* are connected to the metropolitan system.

However, if the city traffic is fast, there is no chance for the cars riders to interact with passengers or to have a proper societal activity. On 60 km/h (37 mph), the picture of the people on the sidewalk is so fragmented to recognize who is moving. But also, the pleasure of watching cars is limited, so people would prefer to be in cars rather than walking in deserted unlikable sidewalks.

A place that can host people away from this fast movement would be interesting in this case. This is explaining the increasing shopping malls in the rapid traffic cities. Commercial centers are an example to provide a human scale environment with slower movement and high quality to users, segregating them from the high-speed cars traffic in the city streets. It is offering a parallel livable human scaled environment, a place to serve and introduce the missed social human activities.

[7] Ibid., 44.

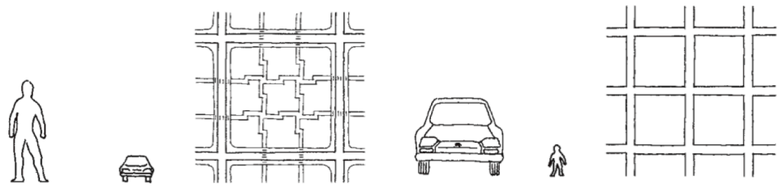


Fig: 13

Fig: 14

The UUN are following the same role, having the same protective concept from the city scale and the high-speed velocity of cars in the streets of the cars cities. While doing that, they are offering a full underground network with suitable distance for walking between UUN and an isolated pedestrian network from the high velocity vehicles streets in the ground surface.

4.1.3 Integration and Separation of transportation systems.

In 1961, Jan Gehl categorized the different methodologies to deal with the contemporary city overlaying transportation systems. There are 2 main classifications, integrated or separated transportation systems.

In Europe, there are a modest number of traditional cities that they follow the integration method on terms of slow moving traffic (Figure 13). The idea is to merge the different traffic systems of walking, biking and motorizing together while giving pedestrians the priority in the city network. Therefore, the vehicles are obliged to slow down because of the narrow streets design and the pedestrian slow movement that reduce the general speed of streets movement rhythm. It is a result of the history of these cities lifestyle, which has been always on foot. The automobiles are forced to respect the bikers and walkers speed. It is hard to break these limits unless having wide enough streets or doing fundamental change in the urban morphology. This system is healthier to cities as it is increasing interactions between different riders types on slower speed that is adding new value to the city social activities.

This type of integration of transportation is a factor that affect the underground nodes scale, making them small size ones as the users are not suffering to find a proper network. Instead, city spaces are mostly oriented to be the public spaces for walking, sitting and socializing, which is shaping the residents life being always in direct contact with the city spaces (Diagram 145). The *UUN* in this case is integrated with the over ground urban network, enhancing the priority of the pedestrian over the cars users and not offering any paralell pedestrian network underground to work as a connection between different urban spaces as it is not needed and the city is offering

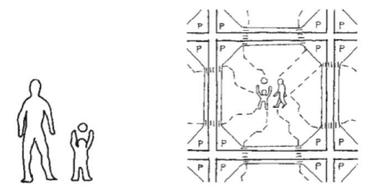


Fig: 15

good quality pedestrian web (Diagram 146).

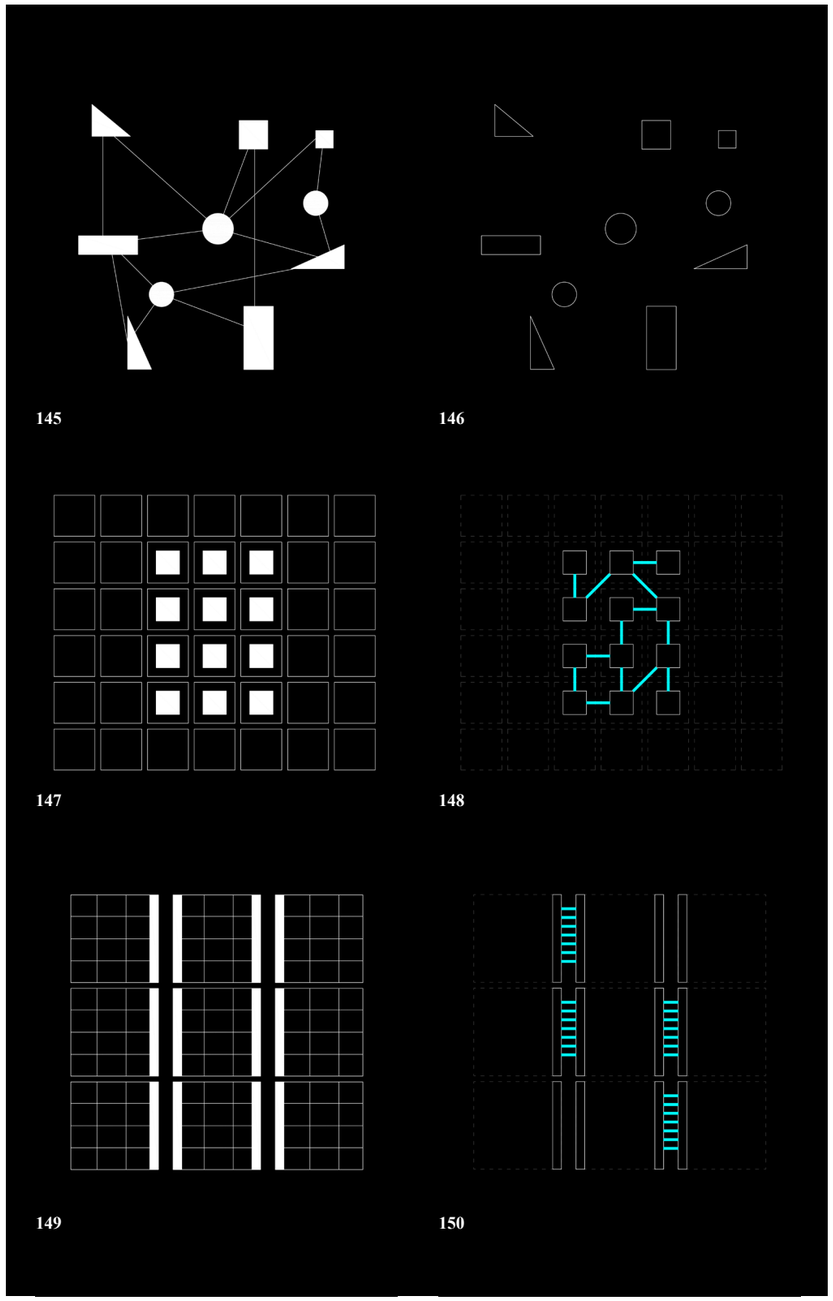
The other type of integration is on terms of fast movement traffic (Figure 14). In mixed streets each transportation system is having its own route. The priority in this case is to the high-speed vehicles. Streets in this case are wider and are acting as barriers of fast flow movement between different blocks giving the priority to the cars riders like most of North American cities (Huston, Montreal) (Diagram 147). In this case, streets are usable mostly by the vehicular traffic.

This type is making it hard for pedestrians and slow mobility users to use the city network. This is making the city in need for other network to make up this urban problem. This is when a new underground network is established between the urban underground nodes, being isolated from the city streets and external spaces (Diagram 148), which is shifting this type more towards the transportation separated system[8]. The segregation here is not for the vehicular users as it is in the historical cities like Venice[9] (Figure 15) , but the division is happening in different levels by locating the pedestrian underground and keep prioritizing the cars users in the city streets. In this case, traffic is divided in different transportation systems. Each one has its own route isolated from the others to achieve a complete division between them. This is sorting people in categorizations divided by their riding. It becomes duller to walk, to bike or to live in the city urban streets. As a result, the significant number of people meets in the transits are separated from the cities various activities._Consequently, segregating the different activities attached to each type, which drastically reduce the social cohesion during the movement in city streets.

In some contemporary metropolitan mega scale cities, there is a mix between the last two types. Streets are categorized hierarchically to primary wide higher speed roads - with large side walks aside - dividing the city to different districts that are having a network of secondary slower, less wide streets. In this case, the city is following the integration in terms of slow moving traffic inside districts and in terms of fast movement traffic on their edges that are limiting these

[8] This is agreeing with the ideas of Donald Reis and Sanja Durmisevic when they stressed on the need for a parallel segregated pedestrian network as a solution to that problem. Though, it is against the opinion of Monique Labbe that criticized that solution and called for enhancing the integration of transportation systems while giving the priority to the pedestrian user.

[9] As was described by Jan Gehl, the users are obliged to leave their cars out of the city and go just on foot in the city streets.



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districts. This type exists in most of the Far Eastern mega cities - like Osaka and Fukuoka. The problematic part in this type is the large-scale primary roads that are making it hard for pedestrians to use those linear limits. In these rapid streets, it is very hard to have any social life cause they are acting as segregation edges. Though, the social activities are more effective inside districts out of the better integration of transport facilities. (Diagram 149)

This dual character is giving the opportunity to the *UUN* to offer the role to reunite the city parts by offering underpasses connected to the metropolitan stations that are located under the primary roads. In this case the underground is not offering a full isolated pedestrian network, but a system of mutation points, segregating the on foot user only under the high velocity streets while being connected to the integrated secondary streets that have pedestrian priority network. (Diagram 150).

To illustrate, the city urban spaces' livability and social activities are depending on how much prioritized pedestrians in the mixed traffic system

4.1.4 Social Impacts.

Feeling safe is essential to encourage people to embrace city spaces. It can be achieved in cities by inviting people to walk, to run or to bike. Slow traffic is enhancing the feeling of reassuring and tranquility as there is a direct correlation between both of them. This is why in the pedestrian city or the integrated slow moving traffic, users are loosing the danger feeling, which is confirms the no need for a parallel network. In fact if it will be provided, maybe it will create a problem by deserting the city streets from people, as it will deprive it from the livable dynamism of the human factor in the city urban spaces.
That is opposing the integrated fast moving traffic model. People are feeling unsafe because of the high velocities of vehicles. It is tough for pedestrians or bikers just to cross the road as the priority is for cars. And the more penetration of unsecured roads in the city, the greater need for safe bigger scale slow mobility network. This is explaining the city users need for a safe separated network away from the city streets high velocity danger. It is also clarifying the interpretation of the private sector in the modern vehicular cities to offer a parallel network that

can give safety feeling to the users. This is leading towards the separation solutions by making sky bridges or underpasses to escape the road hazard. These underground web or flying sky bridges can expand to a large network, providing the city what it needs for inhabitants and users while it is deserting the city from the on foot users.
On the other hand, in the mixed system cities, the danger feeling is relying in the main primary wide streets, as they are the ones having priority for cars movement and having higher velocities. This is the reason to establish underground passes connection between the two divided sidewalks aside the cars road, just to overcome this problematic part in the urban master plan.

To illustrate, the more priority vehicles are having in the city streets, the less secured the people feel and the more chances they will have the feeling of need to have an isolated on foot network to protect them from the city high velocity roads danger.

To sum up, the city livability and lifestyle are in direct correlation with adopted walkability approach. If the city is having an integrated strong slow mobility system, as an integrated slow traffic mobility system, it will be safer which will attract people to participate into social activities such as walking, sitting, meeting, talking and enjoying the city details. In this case the city is not in need of a parallel network to solve the on foot connections between different city parts problems while public transportation can be used incase of large size cities. This is decoding the small scale of *UUN* spaces that are added in the city lay out to keep the same development approach by keeping the social integrated lifestyle in the city over ground urban spaces like the European cases in Paris.
On the other hand, the integrated fast mobility system is designed for vehicles preferences. It is neither safe for pedestrians nor suitable for the human scale. Thus, it is hard to obtain a good livable city spaces or network as they are not counted as social meeting places. So, the city is in demand for a slow mobility network that can solve the pedestrian connections problems and can make up the short of city social life by providing spaces where people can interact and have they social livable activities. Though it is monopolizing the social activities in this segregated underground spaces and pedestrian network underground and enhancing the social segregation between people that will be distributed in different city levels spaces like in Houston and Montreal.

In the case of the Far Eastern Cities, the *UUN* underpasses are helping to mutate the segregation that is taking place in the main wide transportation streets to achieve the social integration in these problematic margins.

4.2. Activities.

4.2.1 Types.

The city historical center or modern downtown where the *UUN* are usually located can contain different kind of functions such as, commercial, cultural, educational, administrative, political, industrial, residential or entertainment ones. Sometimes, there are dominant functions in the city center or the downtown of the city when zooning method is the adopted planning approach. For instance, in the North American cities, the CBD - Central Business District – and the commercial building are representing the majority of the functional projects in the downtown as it has been always one of the primary uses in there. Though, the cultural, historical buildings and the city public squares are more preeminent in the city center in Europe. In both cases, downtown and historical centers were characterized by their public nature. They often served as places for social encounters and as forums for public life and political activities. Adding to that, the hosted functions are having different interactions with people. Thus, they are affecting the type of life in different ways and shapes[10].
In his book Jan Gehl divided these interactions into three categories, necessary, optional and social activities.
Necessary activities are the ones in direct relation with the city functions. Going to work, to school, shopping, waiting for the bus, running errands are all included under this umbrella. These are the activities, participants are obliged to do for reaching destinations. People will have to do these activities in all cases and under all conditions like bad weather or low quality

[10] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) p: 48.

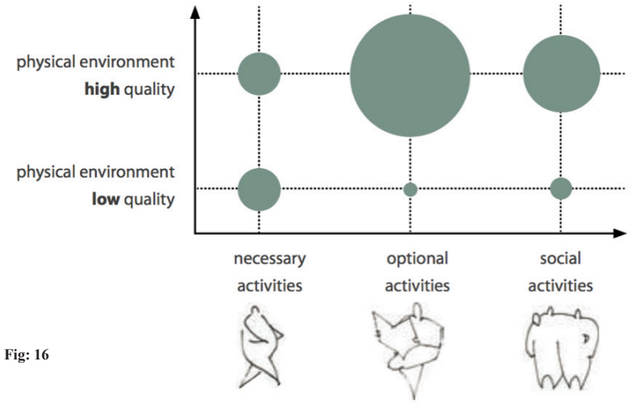


Fig: 16

of physical environment.
Optional activities are more degreed to entertainment and pleasure. These are the ones that participants do if they have the time and the wish. They are not obliged but choose to spend their time doing these activities. Like taking a walk in the city streets, sitting, staying in a piazza or even taking a sunbath. The person is doing these activities to let off steam. Those activities are in direct relation with the city quality which means if the city public spaces are in a high quality, then optional activities will increase and if not, it will decrease that sometimes they vanish from the cities public spaces or move to internal private spaces. This type is relying fundamentally on how attractive is the space for people.
Social activities are the result of people interaction to each other, like meetings, talking, hearing, greetings and playing. Those are the result coming out of the previous two types together. As the necessary activities are invariable, so social ones are counting more on the optional activities. They increase substantially with the raise of the optional activities. [11]

So, if we have a necessity scale in the city, on one end the necessary activities that should be done, no matter the environmental quality is good or bad. And on the other end of the scale, there are the unnecessary optional activities. Those are the ones relying the most of the quality of the spaces and the ability to attract people (Figure 16).

The scale of the functional project is very important. It is reflecting the adopted strategy that the city is following regarding the different services that are provided for the inhabitants.
In the traditional cities, the different functional buildings don't have big scale. Mono-functional buildings usually don't have an enormous scale. It is hard to find a huge shopping mall or big parking area in the historical central area. The underground nodes are following the same method as there is no space to add enormous solo function as the city is having human scale. The provided services are keeping up with the scale and lifestyle of the city.
On the other hand, the modern cities are adding enormous scale mono-functional buildings in cities downtown. Thus, to obtain the complixity of functional services, *UUN* are extending in an enormous urban space. People are used to live in this big scale areas, using massive big buildings, thus the *UUN* spaces are following the same scale. This is explaining the enormous scale of *UUN* in the modern cities as it is a following the adopted urban lifestyle of the city trying to provide the optional activities that the city is deprived of.

[11] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) pp: 9-11.

The hosted types of functions are affecting the velocity and movement of the people. This can be recognized by the time they are stopping to participate at any activity. For example, financial and office buildings are having a few stops in front of them. Conversely, there are others who are having lots of stops and slower movement in front of them like shops and exhibits that are more attractive to people, giving them the time and opportunity to meet, talk and interact socially with each other. The more stops happen, the more livable and social the city gets. As was mentioned previously, the slower the city gets, the more livable it is. This theory applies to the optional and social activities as well. For example, sitting is better than walking is better than running respecting the city livability. So, if the city is providing the space and needed landscape to serve these activities, people will be encouraged to live the city in this tranquil way. An example for this is the European cities, which are providing public spaces that are furnished with chairs or stairs where people can sit and enjoy the weather or the surrounding environment. This is why the UUN spaces in this case are usually having fundamental necessary activities such as cultural – like Louvre museum or the conference halls or the exhibition areas – transportation stations, sports areas and cinemas – like the ones in Les Halles – to add new value to these spaces.

It is very important to note where these interactions between people are happening. If they are integrating together in the city streets and urban spaces, then the city gets the privilege out of them. On the other hand, if these functions are included inside closed building such as shopping malls, then the advantage goes directly to the inside segregated spaces away from the city urban spaces and public streets, leaving them with no stops to generate optional or social activities as the users in this case are having more stops which means slower velocity.
City stops are also in direct relation with the soft edges of the buildings as was described by Jan Gehl. He identified soft edges as an indication to the connections between the buildings and the streets or the sidewalks. In this part the research is referring to the buildings ground floor's function and interaction with the city. If the ground floor is open to the attached sidewalk or the street, it is a way to invite people to slow down, to look, to interact and to go inside shops, cafes or restaurants, depending on the space use. Unlike the long closed walls or the sterile

glass sections that raise the sign to “move on”, giving inhospitable impression to the passengers which will affect their velocity by increasing it as there is no interesting activity to slow down or to stop for. This type can be found mostly in the modern glass tall buildings cities[12].

Because of all that, the natural cities with traditional roots are more alive cause the city streets and urban spaces are having slow rhythm movement of users. They are trying to achieve more stops from the urban users as the city is inviting them for that by having shops and cafes and chairs in the urban soft edges. Also the idea of the soft edges themselves can be observed in the visual contact between over ground and underground space of the *UUN*. This can be translated in landmark icons like the Pyramids of Louvre or an open double height space between both levels like the open exhibition area under the forum of Les Halles. Adding to that, the people don’t need another parallel place to practice the mentioned optional activities. Thus, the *UUN* are not designed as a parallel segregated environment, but an integral space with needed functions in these specific city nodes.
In contrast, artificial modern cities don’t have that much stops, as the city velocity is moving in a fast rhythm. This is why they need a parallel place where the people can have slower rhythm that can give live to the city where also the people can meet and socialize as it is hard to be done in the city urban spaces. This can be noticed in the Huston and, Montreal study cases.
On the other hand, in the mixed model, presented in the far Eastern cities, the primary wide streets are the ones with the fast velocity movement of users as they are presenting the fast network routs in the city because of the vehicular streets overground and the metropolitan stations located under them. Thus, in those parts the *UUN* are trying to provide more functions and services that can slow the rhythm of the users down to make the people do more stops such as commercial uses or restaurants in the UUN spaces so these linear urban elements can be more alive with users. This is like the case study of Crysta Nagahori and Tenjin Chikagai.

4.2.2 Functional Distribution.

In his essay, *a city is not a tree*, Christofer Alexander emphasized that the city is working as a

[12] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 81.

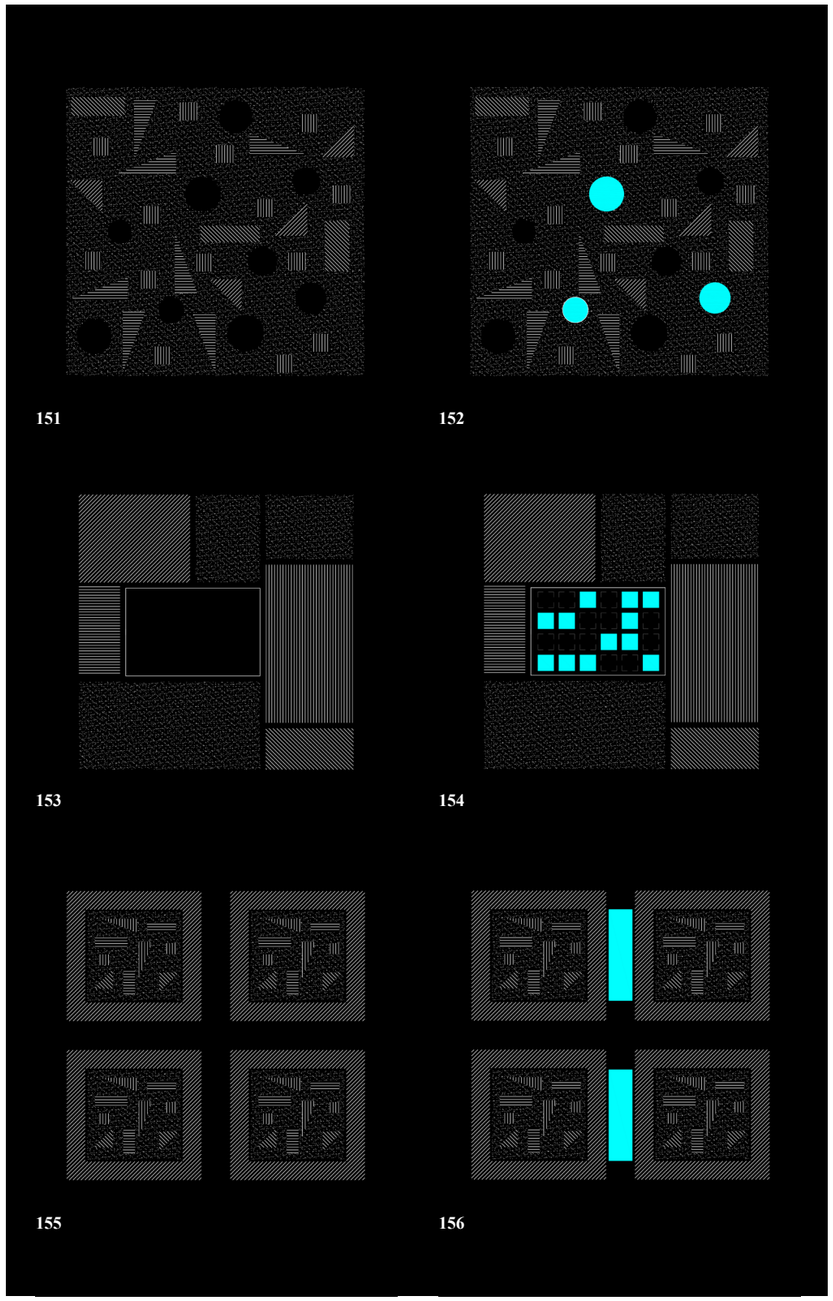
hall of sets not just as an individual function. Though, there are two main approaches when it comes to the cities function distribution, zoning and mixed-use systems.
To describe that, he translated his vision to the contemporary cities into two possible ways regarding the functional distribution the semilattice axiom and the tree one.

> *The semilattice axiom goes like this: A collection of sets forms a semilattice if and only if, when two overlapping sets belong to the collection, the set of elements common to both also belongs to the collection.*
>
> *The tree axiom states: A collection of sets forms a tree if and only if, for any two sets that belong to the collection either one is wholly contained in the other, or else they are wholly disjoint.*[13]

Most of the old cities especially the historical city centers in Europe were growing spontaneously based on the needed activities and functions. That’s why it was originated in a mixed-use system respecting the functional prerequisites (Diagram 151). Living, recreation and working areas were all incorporated together in the city, inclined by the public spaces that enhanced the social life. This was one of the main factors to describe the cities as natural ones in his essay, *A city is not a tree*.

The *UUN* in this city type is containing a mix of various activities while these strategically focal points are distributed in the city center parts (Diagram 152). For example, in the study case of Carrousel du Louvre, there is not one dominant function in the underground part. It is a mixed-use space integrated with the over ground spaces and cultural buildings. There is the Louver Museum, shopping area, underground parking and some multiuse halls and all these are connected to the metropolitan station in the lower level and the covering piazza and the Jardin des Tuileries. Also Le Halles case study there is a mix of use including the shops, parking area, sports complex, entertainment facilities and underground open space for exhibitions while again all this is connected to two different underground transportation systems , the metro stations and the RER network. Adding to that, it is linked directly to the covering open public space. The concept is an extension of the old city way of living and way of building as the facilities and

[13] Christopher Alexander, “A city is not a tree,” in *Architectural Forum*, Vol 122, No 1, April 1965, p: 58.



functions were added one by one in all different parts of the city, not just concentrated in only one of them[14].

On the other hand, zoning system started after the industrial revolution and the Fordism movement. The car invention had a big role for changing the city structure. Thus, in the twentieth century, the city planning methods were revolutionized to be more vehicular dependent. This movement affected the functional distribution that similar functions were collected together in an isolated city zone providing an individual function[15] which C. Alexander referred to as the tree axom or the artificial city. By this era, the urban structure grew in a very intolerable complexity. Disentangling of the city despite the urban functions was the fundamental asset that shaped the city character. The whole was parceled out into functional units as, living, recreation or working areas. An illustration of this approach was represented by Le Corbusier's "Ville radieuse" in 1930[16]. This zoning method is one of the main characters that articulate artificial cities that were deliberately by designers and planners[17] (Diagram 153).

The designers' idea was to accumulate each zone with similar functions. And so institutions tend to cater to mass rather than to individual requirements. The individual thus comes effective only as he acts through organized groups, which can enhance the social life as each zone is having the same interest, hence the chances of interacting can increase. Though, this heterogeneity was criticized cause it tends to break down grid social structures and to produce increased mobility, instability, and insecurity, and the affiliation of the individuals with a variety of intersecting and tangential social groups with a high rate of membership turnover.[18]

The *UUN* distribution in this model is supporting the same concept of zoning. They are concentrated in only one area, which is the city downtown or the CBD (Diagram 154). Also they don't have that much diversity regarding the included functions, taking into consideration that they are also segregated from the other city parts and from the city urban public streets and

[14] This is folwoing the openion of Monique Labbe that was discussed before in the introduction as she stressed on the importance of mixing uses in the underground spaces.
[15] Cristofer Alexander, *A city is not a tree*, (Portland, USA: Sustasis Press, 2015)
[16] Rob Krier, *Urban Spaces*, (London, UK: Academy Editions,1979) p: 82.
[17] Cristofer Alexander, *A city is not a tree*, (Portland, USA: Sustasis Press, 2015)
[18] Louis Wirth, "Urbanism as a way of life," *The American Journal of Sociology* 44, no. 1 (1938): 1-24, http://www.jstor.org/stable/2768119

spaces. They are mostly connected to the buildings on the top of them. In the cases of Huston and Montreal, we can see that the underground nodes are having almost one dominant function, which is the commercial one beside their parking areas – also to serve the CBD towers users. In some cases like Huston, some of the Underground Nodes are having connections to the metropolitan stations in lower levels like in Montréal case.

In the mixed type city, like the Far East ones, the main axis of the primary wide streets are the location where most of the financial office buildings are positioned attached to the city main transportation route network, making them mono-functioned. Though inside the divided zones, the functions are mixed like the first explained model, which is making the transportation main streets margins are the mono-functional ones (Diagram 155).

Here it comes the role of the *UUN* that breaks the concentration of mono-functional rhythm of the main streets by supporting them with new functions that can achieve this functional variety. The *UUN* are composed in the city master plan to work on melting the segregation problem between different city zones in different areas, by establishing the needed connections and adding more functions. This is why they are spread out along the main city axis where the primary streets are (Diagram 156).
UUN are having mostly commercial use but it is not as dominant as the last type cause it do not have the same scale. They are mostly containing metropolitan stations, underpasses, garages and the commercial and entertainment areas. It is important to note that the size of the *UUN* in this model is not as big as the second one. This can be noticed in the case study of Crysta Nagahori and Tinjin Chikagai.

4.2.3 Social Impact.

Planning models for functional integration and segregation are obvious in the difference between the old traditional cities and the modern cites.
In the first type, the compactness with the close interwoven pattern of activities are the main identity of the city. This mix is a way to merge the different types of people with no categorization. Merchants and craftsmen, rich and poor, young and old, necessarily had to live and work side by side. Such cities embody the advantages and disadvantages of an integration-oriented city structure.[19] It is implying that different activities and categories of people are able to live together and side-by-side. This is leading to a necessary social interaction, which is a potential in this type[20].

The *UUN* in this type are not designed to host social activities that the city is deprived of but to enhance their action in the over ground urban spaces. The optional and social activities are taking place in the city public spaces. Therefore, the *UUN* is not a place to sit, talk and spend a day. It is a place urgently needed to add some essential functions for the community that don't have the space to be placed in the over ground because of the compactness of the city. The *UUN* is supporting the city role and strategy, keeping the functional variation in the city public spaces.

In contrast, is the modern highly specialized functional city, which is illustrating the separating model of people and events in connection with physical planning. It is oriented towards the segregation of different functions in which the isolation of the unlinked functions was the goal. The result was a city divided into mono-functional areas and groups that differ one from another[21]. That practice of functional separation is promoting a social disintegration as it is treating the city in an abstracted systems way[22].This is leading to unequal society isolating the unlinked people from different financial or cultural segments[23]. About that, David Harvey argued that the real social problems of the city are relying behind the mask of the shiny glass facades and fancy looking bindings[24].

The *UUN* in here are fundamental to achieve isolated social integration as the city is already ripped into parts with the adopted zoning methods. It is still segregating the people from the public spaces and streets users while they are getting to meet, talk and socialize in the internal

[19] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 101.
[20] Rob Krier, *Town Spaces,* (Basel, Swezerland: Birkhauser Architecture, 2006) p: 9.
[21] Jan Gehl, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 101.
[22] Rob Krier, *Town Spaces*, (Basel, Swizerland: Birkhauser Architecture,2006) p: 9.
[23] Brooke Jarvis, "Why Everyone Suffers in Unequal Societies," *Yes Magazine*, March 2010, http://www.yesmagazine.org/happiness/want-the-good-life-your-neighbors-need-it-too
[24] David Harvey, The condition of post modernity, (Cambridge, Massachusetts, USA: Blackwell, 1989) p: 88.

spaces, including the *UUN* in this case where the optional and social activities can take action.

The mixed system cities are having both concepts of integration inside the districts and the segregation in the main boulevards. The *UUN* in here are working as a mutation joint where people from different districts can meet and interact while practicing the necessary or optional activities together in these urban joints.

In the first chapter of The Death and Life of American Great American Cities, Jane Jacobs explained the importance of safety in the city streets and urban spaces. She emphasized the importance of mixing uses in the city plan to prevent or at least decrease the crime rates as the residents act as "street watchers" from their habitation and "eyes on the street" from city urban spaces and streets[25]. Adding to that, mixing functions in the urban areas means providing more activities in and around buildings.
Housing for example is giving safe feeling to the street users during night as it has a direct contact with the city spaces. So, even if the streets are deserted, the lights from windows are sending signs that the people are close around. And vice-versa the shops and street activities are playing a role in the building safety as they are watching them and also the city's activities participants.
The city is not in need for a segregated safe space such as *UUN* to isolate people from the city spaces or other category of city users. Instead these added spaces should be integrated with the over ground users. This is also explaining the direct visual contact between over ground environment and the UUN in the design of the surface between both. In Louvre area, the museum pyramids and the inverted un side down one are giving a direct contact between the external environment and the internal underground one. Also in the case study of Les Halles, the underground open exhibition is open and connected to the city ground zero space. These examples are showing the integral added functions in the city context with having direct visual relations to increase the safety feeling for all users by integrating all of them together.

Conversely, the modern artificial cities that follow the zoning method are having lack of safety

[25] Jane Jacobs, *The death and life of great American cities*, (New York, USA: Random House, 1961) p: .

and higher rates of crime[26]. The feed back of this vision application was that the city faced lots of problems because of the functional segregation. The city centers and downtowns that were containing nothing but shops and offices were virtually deserted outside working hours. Subsequently, the city residential outskirt zones were turned into dreary dormitory suburbs. The people don't have the chance to participate all of them together in different and various activities unless they are in the same city part in the same time. Hence, society is loosing trust and closeness, which is leading to gates, walls and more police in the streets[27]. This is because the city is having lack of common spaces to meet people from various society groups in the city everyday routine while contributing in necessary or optional activities.
The city inhabitants are in need of a populated space where they can see others so they can feel safe. *UUN* are offering that place, giving the opportunity to the users to participate and practice optional and social activities in another part that is establishing other functions than the buildings above them. In this case, the people in this city zone are having the opportunity to meet and socialize in these spaces underground, isolated from the streets over ground. The problem in this model is that the environment where the people can socialize is internal one, clinically separated from the city spaces, which is increasing the social division between people. It is giving safety feeling to the internal private spaces users though it is increasing the social problem between the same city inhabitants and making the city public spaces themselves, unsafe and deserted from people.
In the Far East cities where both concepts are mixed, the environment inside the districts are safe because of the integration of functions and thus the people there. While the mono functional method is used where main axis of the primary wide streets are. This is where most of the financial buildings are concentrated along these axes. This is one of the reasons to make these linear elements less safe that the mixed use districts. The *UUN* are providing other uses and functions that can enrich these axes and populate them with more people. They are offering a safe place where the people can use as it is populated most of the day time as it is connected to the underground metropolitan stations, that are transferring users all day long. Apart of that, they are having other services such as garages and commercial and entertainment areas where the people can meet and socialize together having safer mixed

[26] Brooke Jarvis, "Why Everyone Suffers in Unequal Societies," *Yes Magazine*, March 2010, http://www.yesmagazine.org/happiness/want-the-good-life-your-neighbors-need-it-too
[27] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) pp: 28-29.

use populated surrounding.

For all the last reasons, the cities with mixed integrated functions are providing a better environment regarding the livability principle, due to the different activities resulting from the functional merge. People are having more chance to meet and socialize while doing different activities.
On the other hand, the clinical separation of spaces that relies on functional zoning is having temporary deserted streets. It doesn't give the chance to the city inhabitants to head different places in different times. It is a reason behind phenomena of amplifying city downtown after working hours and residential areas in the daytime.
To illustrate, the city urban spaces and streets are in direct correlation with the functions mixing so the users can participate and get involved together in various urban activities.

5. Strategies of Intervention.

The UUN are considered very critical affective urban joints while the way of their interpretation in the city layout is different. Three ways of interpretation were pointed out that are reflecting the lifestyle in each case regarding their urban pattern and ideology: integration, separation and mutation.
This chapter will explain how the adopted strategy of lifestyle is manipulating the UUN spatial compositional form and location to obtain the chosen one through urban development, densification and targeted social approach.

5.1. Integration.

5.1.1 Urban Development Strategy.

Development Strategy / Planning/ Priorities/ Role:
The integration way of living is often adopted in the *traditional cities centers* where the urban development strategy relies a lot on the evidence of the elements connecting and uniting the society. Public spaces have this important role in cities to support the integrated way of living. These spaces' force is coming from the historical role they played in the previous era politically, commercially or for religion. They represent the way these cities were developed along paths, trails and market place[1]. The traces that were done in cities over years were also the main engine for development in such *organic cities*. In general, public squares are the lungs in the urban context, while streets are the nerves to connect and enhance the integration process in the mentioned cities being the meeting points for people. Urban decision makers try to approach highly united areas to create a unified interconnected master plan. Buildings are well connected to different public spaces, including streets and piazzas that are the respiratory system in the urban tissue.
This is reflected in the *UUN position* that follows the same strategy established in the upper level, being located under those strategic nodes in the general master plan. Strategically, the underground entities locations are selected to support this respiratory structure of public

[1] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) pp: 198,199.

spaces by adding new extensions that are *connected* to them vertically, working on enhancing their *pivotal* collective role. Furthermore by adding metropolitan transportation services and uses, they become urban stopovers and each node becomes a pause in a larger scale public transportation system. This new public duty, which is also needed today, empowers the city urban spaces by combining new contemporary public uses to the existing one, following and supporting the adopted strategy. Adding to that, they take their *profile* from the covering public space and urban morphology as they are lined up with them, thus they have relatively *micro size* to be *organized centrally* in the city layout while they provide contemporary public services in another level[2]. This concept can be found applied in the European case studies, Les Halles and Carrousel du Louvre.

Development Velocity / Scale:
The development velocity in the historical center where the case studies are placed is slow. The transformation process takes action softly by selecting very effective complicated nodes then reintegrates them with the urban tissue, carrying on the adopted way of living strategy that is established there. These traditional areas were built piece by piece consisting of small-scale buildings and human scale spaces depending on the public needs[3]. The evolution that happens today to these cities is taking place in small human scale joints that can host more uses in new extended spaces while keeping the same lifestyle concept. This clarifies the relatively *micro size*, complexity and *central condensed organization* of the *UUN* space in such model while locating them under the largest possible areas and the most strategic ones in the urban context, under the piazzas and open public squares. This is due to the limitation of the available city spaces that are valid for such evolution as well.

Walkability:
Traditional cities have very strong network for pedestrians and slow mobility transportation. This is due to the small scale of the city, the high quality of spaces, the human size of the urban

[2] Marina Tornatora, lecture, 15th March 2018 : According to her, the underground spaces establish new role to the contemporary metropolitan city, being the new urban public spaces. It is the equivalent space to the piazza in the historical cities as it is the meeting junction of the city users and inhabitants like the train stations, metro stations and the airports.

[3] Jan Gehl, *Cities for people*, (Washington DC, USA: Island press, 2010) p: 56.

spaces and buildings. All these features beside the planning development strategy, helped to keep the high quality network for passengers. Of course with the expansion of the city in parallel with the industrial evolution, more transportation systems were established but integrally with the pedestrian primary system. The city in this model succeeded in maintaining the on foot web, while adapting all other systems respecting the pedestrian priority.
This plan has strong impact on the underground entities form and content. Once having a good network over ground, there is no need for another one underground. Which means, spatially the city doesn't need a parallel net to make up a lack of a proper one over ground. The real integration between people takes action in the over ground city public spaces and streets, while the underground nodes are complementary to the over ground integration structure.

5.1.2 Urban Densification.

Densification of buildings and spaces:
The densification strategy of the cities in this type counts on important concept of increasing the integration between people. This is why the cities evolution approaches the maintenance or increment of the public spaces that identifies the character of the city such as piazzas, squares and pedestrian streets where the social activities take action to keep up with the population growth in these polar cities, thus preserving the integral lifestyle.
While doing that, the developers face a problem of the lack of available spaces, which limits their chances to add new urban voids. Another problem is that this type of cities does not have the possibility to extend vertically, as it is forbidden to have high-rise buildings especially in the historical center because of the strict policies.
Therefor, besides the sustainment of existing public spaces, developers are left with only two options, eliminating built up blocks and replace them with new integrated open spaces or the underground extension. These are convenient solutions to obtain the final objective to conserve or amplify the amount of public spaces in the city context. So, the strategy of development is to keep equilibrium of densification the urban solid and void, the built up blocks and the open public spaces.

This plan is clear in the European study cases. For example, in Les Halles area in Paris, the old market was removed to create the open piazza for the city, and then the facilities and the needed functions were replaced in the underground node attached to one of the main metro stations in Paris. It is also clear in the area of Carrasoul di Louver and Louver Museum, where the aim is to preserve the over ground piazza and Tuileries garden, sustaining that public void in the historical center of the city. The idea was applied by adding all needed functions with the museum' new intervention under the ground surface, to reinforce the integral lifestyle, letting people to enjoy their social live in the open public spaces.

Densification of functions and activities:
Densifying the city with new functions is not enough. It is fundamental to understand that the distribution of these functions affects the way that the people live in the city. To obtain the integration concept in lifestyle, uses should be mixed and functions have to be distributed in different urban districts. This helps different persons from diverse categories and interests to meet in various places, which keeps the city vibrant with people's movement in all parts of it. All that is a consequence of the activities variety that inhabitants are involved in because of the mixed-use functions attached to the public spaces where the people can meet and socialize. The strategy starts with study the city nodes that need to be supported with new functions, and then apply them regarding the context demands of new necessary services or open spaces in the city. There is also no need for large-scale functional concentrated zones as the city adopts the concept of various uses distribution in its master plan, which enhances also the idea of multi-functional integration that is being followed. The underground nodes in this case contain fundamental and necessary activities that have no chance or space to exist over ground but there is no way to miss it in the contemporary era, like the underground metropolitan stations that became essential now. The *UUN* have small *micro size* but *organized* to be condensed with multi types of functions. This is opposing the zooning concept in the modern cities or the new built up parts.

Densification of people:
The densification of people is healthy as it is stimulating the city. This is why the integration lifestyle cities work on increasing the quantity and the quality of spaces that can host and attract humans so they can interact together. The offered optional activities in such spaces such as walking, standing, sitting and talking are all motivations for inhabitants to support the integration lifestyle. Noting that the research focuses on the mega metropolitan cities where all the *UUN* cases are located, these are already polar cities for people because of the opportunities that are offered there. This gives the motivation for the people to invite others and that is how the mega cities expand obtaining higher human density. Here's Jan Gehl explains the importance of the activities and how its densification is inispiring and energizing the social life.

> *Wherever there are people – in buildings, in neighborhoods, in city centers, in recreational areas, and so on – it is generally true that people and human activities attract other people. People are attracted to other people. They gather with and move about with others and seek to place themselves near others. New activities begin in the vicinity of events that are already in progress.* [4]

While the cities host more people, there will be more needs for necessary activities and optional activities again to sustain and increase the social activities and that's how the integration concept is being applied to implement the development strategy regarding density.
To illustrate, interpretation and socialism action between people takes place in the public spaces, so the city in this case targets keeping or adding new public spaces with high quality such as piazzas and pedestrian streets to host people who densify these strategic urban areas, which upholds the city vibrancy and livability. And here it comes the role of the *UUN* in this model to provide spaces that can host more people in these focal points. The presence of the multifunctional *UUN* in this case support the social integration process of people in the public space by giving more room to host and attract more uses and utilizers.

5.1.3 Social Impact of Urban Integration Lifestyle.

Social Relations between people and with city:
Because of the integration of collective public spaces with the pedestrian network in this model, there is no differentiation between the city users. They all have the right to use the urban spaces to interact together. The followed strategy enhances the social bonds by giving inhabitants with different interests the opportunity to get involved in social events together. The city in this case

[4] Jan Ghel, *Life between buildings*, (Washington DC, USA: Island press, 2011) p: 23.

raises the quality of the public spaces to be good and livable.
People are not subjected or discriminated socially or even economically to participate in the different urban activities. Instead, most of public spaces such as piazzas, gardens, pedestrian streets and even the underground entities are open for everyone. In this case, the society members get closer to each other and feel more trust, which reduces the social divisions. This is a healthy phenomenon cause it reduces the racism and hate crimes as the society members feels equality. The main aim is to share spaces and activities between public to obtain the highest social incorporation result. This is why the *UUN* in this model has relatively micro *size* scale and not offering that much entertainment services that can steal the thunders from the over ground urban public spaces.

Social Security (safety):
As a result of people combination that happens in the city spaces, citizens have the chance to know each other and this makes the city more secured. The small city scale, the human scale buildings, the slow transportation systems either on foot or biking, are all factors that give benefits to the society to feel safer. For example, the people in houses have a proper distance to observe what is happening in the city streets and vice versa. People act as eyes on the streets and on houses. Adding to that, the mixed uses and function distribution with the social houses in different zones emphasizes the safety feeling and keeps most parts of the city populated with passengers in all different hours of the day.
In fact, the integration in social way of living for the city inhabitants is in a direct relation with the security levels as it grows by keeping different parts of the city active during different hours of the day. The absence of big or huge scale of *UUN* in this case and the consolidated central arrangement in the urban tissue are assistant factors that help to keep the city public spaces and streets vibrant with people for the longest time. It actually prevents the city from being deserted from people in specific day or nighttime, which helps to conserve the safety feeling between inhabitants.

Social livability:
The main base in this type of lifestyle is the integration in all different levels to improve the livability and the city performance. The hierarchical priority here is for social life, shared spaces then the individual buildings. This is why the *UUN* is considered as shared space to serve and

to be owned by public, not being classified as private individual belonging that welcomes only specific category of people with higher economical or social situation.
The social integration between people is giving the city new spirit. It is making it more livable, energetic and dynamic. And if the last factors are rechecked, such cities' strategies of development target this result through controling the *UUN* spatial composition' location and form regarding position, *densification* of people, open spaces and built up area, urban *pivotal connections* with covering public spaces to support their role, *irregular profile* with relatively *micro size* and consolidated *central organization* in the city lay out.

5.2. Separation.

5.2.1 Urban Development Strategy.

Development Strategy / Planning/ priorities:
This way of living is often adopted in the *modern cities'* downtown or the modern parts that were built as extensions to the old organic cities. This model' strategy is oriented towards the individuality and therefore the mega buildings with their internal separated private spaces develop independently from the city external public ones. Hence, the city consists of a collage of incoherent fragments, composing an installation of unrelated settings and spaces. Buildings in this case create a self-sufficient environment. In fact, this method was used as a promotion for some American cities mega structure buildings as a city inside the city. Consequently, this led to a disjointed episodic and fragmented city model that includes isolated built up blocks from the rest of the city context. "Street-level retail used to enliven the cities spaces and streets while after these functions converted to be inside spaces, the city lost this advantage. The downtown became a collage of commercial islands*"*[5].
In this model, the city urban spaces are considered as segregated environment inside the buildings to have the concept of internal area in private property, which have strong commercial orientation as a role. The power of the place is coming from the city lack of urban spaces.

[5] A. Madanipour, A. Loukaitou-Sideris and T. Banerjee, "Postmodern urban form," in *Urban design reader,* ed., Matthew Carmona and Tiesdell, Steve (Amsterdam: Architectural Press, 2007) p: 48.

The private sector collaborates in this case to provide what is missed, while orienting it's role towards something more profitable over the social or political role. As the private sector has the property of the towers and the internal spaces, they also own the *UUN* that are set under their buildings, being a part of them as a basement. The underground entities accommodate services and provide the human scale space that the city is deprived of. They give a new type of space that the city didn't offer in a proper quality, where inhabitants can meet, socialize and practice the human activities inside that segregated environment away from the outward one supporting the privatization trend.
This is reflected in the *UUN* location following the same strategy established in the upper level, being *positioned* under those strategic inwards spaces nodes in the city *downtown* area. Consequently the underground entities take their regular *profile* and form from the covering vertical towers. On the other hand, they extend in a *macro size* distributional area to cover and connect as much as possible of the CBD district' buildings internally, which clarify the *diffused organization* of the underground spaces in the urban lay out. Thus they are considered as essential urban nodes in the city context.
This type can be noticed in the American cases in Huston and Montreal Downtown where most of that area was developed by the private sector including the underground part.

Development Velocity / Scale
After the industrial revolution, the evolution in society, economy and buildings have gradually resulted the need for a faster construction technology, thus the city expands faster than before. Adding to that, the buildings scale grows to correspond to the faster tempo. The buildings size got out of the human scale and the downtown became a group of high-rise towers. An edifice with that measurement acts as a city itself, which makes it hard for the people inside to go out and interact with the outdoor public city spaces or maybe even with the other buildings. This is evidencing the segregation that took place because of the fast large-scale concrete jungle that the downtown transformed to in the modern era.
From this point on, the *UUN* are concentrated in the downtown zone under the bigger scale buildings' internal spaces, providing a human scale urban space for the inhabitants, which is missed in the external ones. They support the CBD buildings, being are negative vertical extension not on top but underground to give a new dimension to the indoor urban spaces in the city context to be the most vital zone.

Walkability:
Modern cities usually have strong network for vehicles and fast mobility transportation. The development strategy in such model of cities is usually oriented towards enhancing the cars network, as it is hard to cover the entire city on foot or by bike. Instead, they face lack of pedestrians and slow mobility web as the priority is for the vehicles. This is due to the big scale of the city and the inhuman walking distances. On the other hand, there are rare or no identified spaces that are qualified to host on foot activities. The problem of this city type is that the pedestrians do not have the opportunity to get a nice walk in the streets as they are designed mostly to host vehicles, being the dominant transportation system and all the other slow types should be adjusted to it.
The *UUN* in this case offer new human scale of livable spaces *connected* through pedestrian underground parallel *network* that make up the absence of equivalent one in the over ground city streets while being segregated from the vehicular prioritized streets and low quality urban public spaces. Adding to that, they also link the downtown towers internally without the need to go out and use the city streets, solving the isolation problem between the different towers.

5.2.2 Urban Densification.

Densification of buildings and spaces:
The densification strategy in the downtown city or the CBD zone with urban inwards spaces can be described as adding solid volumes that contain urban voids while this expansion of internal spaces and pedestrian network with livable quality is happening separately from the urban external environment. Thus, the cities evolution in this model approaches the increment of the large-scale buildings.
So, basically the amount of solid buildings in the city master plan increase while virtually the internal urban voids are offered inside to keep up with the population growth in these polar areas to deliver their needs of urban spaces with good qualities.
This strategy is clear in the American cases of Huston and Montreal downtown underground area. That zone is filled with high-rise dense buildings where the internal urban spaces attached with the *UUN* ones are *positioned* under, internally. Those underground entities keep increasing following the same separation adopted approach.

Densification of functions and activities:
The distribution of functions is an aspect that shapes the citizens lifestyle. In the modern cities, the land use master plan usually follows the zoning method to allocate the functions. The downtown area or specifically the CBD part of the urban tissue is where the high-rise office buildings and commercial centers exist. This concentration of similar uses in one area divides the city into different zones that relies on each other functionally. In this model, cities develop with a top down methodology, so they do not correspond to the public need as much as targeting profit achieved from users. As a consequence, the inhabitants should move between different city parts to do the necessary activities like going to residential areas or heading work or buying goods in different urban zones. This decreases the opportunity of people interacting with each other, as there is no mixing action between the different uses in various city sections except for those who participate in the same act.
This leads to classification process between the city users regarding their specific needs. Which creates a fence between inhabitants regarding their interests.
The *UUN* spaces correspond to the same established methodology in such cities. Although the *macro size* of the distributive area of the underground entities in this model, they do not provide much variety in the offered functions, still following the zooning method. This is why there is usually one dominant function for the entire underground domain.
On the other hand, one of their main uses is to provide a walkable human scale space that people can use on foot. The tunnels between the *UUN* diffused spaces also add new function that the city need, which is a pedestrian network, to connect the downtown buildings together. Is network can extend to new added buildings which is giving new future dimension to the underground web.

Densification of people:
The downtown in the modern city is the main magnet for people as it includes the internal vital daytime spaces with good quality to use. The actual popular concentration and densification of people takes action in the internal urban spaces. Instead, the city streets and public spaces are discharged from that human density as they host mostly the vehicular users. The segregation between the two different environments is obvious as the internal one belong to the private sector that targets to increase the number of users, so the proprietor can achieve more profit. The external ones instead don't have high quality as the inwards private ones, which is the reason

behind the emptiness of people in city streets and public spaces.
As the *UUN* spaces are included as a part of the internal urban spaces in this case, they aim to rais the density of on the foot utilizers inside opposing the outwards ones.
While the cities host more people, being polar ones, there will be demand for more spaces to add functions that help to create necessary and optional activities to grow the social interaction in the internal private spaces. And this is how the densification cycle strategy takes place in this model.

5.2.3 Social Impact of Urban Separation Lifestyle.

Social Relations between people and with city:
Except for cases that are required to apply the isolation due to compelling circumstances or natural effects such as bad weather conditions, the separation strategy is reducing the community social bonds. The city here failed to provide the inhabitants an opportunity to do different activities together in the outdoor public city spaces, as there is lack of them. On the other hand, the vibrant urban spaces are inwards segregated from public external users, which is making discrimination between two main types of people, the ones inside internal private entities - who are categorized mostly as shoppers - and the external public environment utilizers. The *UUN* spaces consequently targets mainly one type of users in this condition, which is the customers as well - except for the spaces that include public functions like underground metropolitan station like in Montreal case– enhancing the human classification and separation strategy. In most cases, security men can be found in the entrances of these internal private entities to select the indoor areas users with acceptable appearance.

This discrimination between consumers is a factor that leads to social division regarding the economical or social standard, which raises the unequal feeling between inhabitants in the same community. The integration that can happen takes action separately between the people from the same class, as they will be isolated from the other categories. Hence, this case trust loosing issue between the one-society members, as they are not all invited to interact together in the same activities neither optional nor social.

Social Security (safety):
The isolation of the vital spaces internally, away from the city public external ones affects the citizens' feeling of security. The inhabited indoor urban spaces are the busiest parts in the downtown while the outside ones are not as hospitable for the human activities as the first one due to the less quality. This deserts the outwards environment from the people who act as eyes in the streets that give the safety feeling to passengers. Adding to that, the tall glass buildings with inhuman heights break the contact between the streets utilizers, and the inside buildings inhabitants, which again reduce the safety feeling.
On the other hand, the operational segregation between different functions in the urban layout divides the city to zones where the people goes to work at daytime and others where they residence by nighttime. This separation decreases the feeling of social protection in each part whenever it is empty of people. Furthermore, the economical and social discrimination is also a motivation for the increment of the hate crimes and racism in those communities. All these are factors that frequently can cause reduction of safety feeling in this model.
The *UUN* increase the problem of deserting the city spaces as they monopolize lots of vibrant vital social activities inside a macro size space, segregating the people from the urban external spaces and keeping the city outdoor ones deserted from the passengers who intensify the safety feeling in the city to the users.
To illustrate, the separation concept between society members and the city parts is in inverse relationship with the safety feeling of inhabitants.

Social livability:
The development strategy that the city follows in this model obtains to keep the separation between the livable internal places with good quality and the external environment with lower features. The main base in this type of lifestyle is the division between various types of users, trying to offer a specific one better quality and livable spaces inside the investors' buildings. The hierarchical priority here is for individual buildings, shared spaces then social life. This is why the *UUN* in this case is considered to be a shared space but for specific category of utilizers inside the private individual buildings.
In this type, investors and corporates compete to host users inside private built up internal entities by raising the established spaces quality to increase the number of people and activities which is absorbing social livability inwards over the city external public spaces.

The UUN spatial composition character shows the dedication to this strategy through their *position* in the *downtown* CBD area under the high-raise *density* buildings and their vertical *connections* to their internal private urban spaces while establishing parallel underground pedestrian *network* horizontally underground. On the other hand, they are *organized* of *diffused* scattered spaces in a *macro size* distributive area so they can host and monopolize as much as possible of the commercial and entertainment functions, thus users can find places with proper quality inside where they can interact and socialize.

5.3. Mutation.

5.3.1 Urban Development Strategy.

Development Strategy / Planning/ priorities:
This strategy is often adopted in the Far East metropolitan cities that were built newly after wars. The city in this type consists of incoherent fragments of urban integrated zones that are separated by boulevards, where the primary streets are composed. Each zone contains a group of buildings that are almost sufficient like a mini-town in the large context. For that reason, the city master plan mesh seems like a collage of segregated towns. The mentioned zones or mini towns include smaller scale secondary streets, which form different urban element than the large-scale ones on the borders. These margins are placed where the principal axes transportation exist. This leads to disjointed ripped city model that comprise patches, which are isolated from each other in the urban tissue by these axial wide roads.
The primary streets network interrupts the narrow streets inside the different districts while these wide boulevards takes the *linear* shape public spaces. Despite that, they are not a gathering space as much as being a separation space between different city parts. Taking this into account, the boulevards' sidewalks themselves are divided by the high velocity big scale vehicular streets.
The city development strategy try to fix the separation dilemma between different city zones by locating the *UUN* space under the primary streets, linking both sides of the upper public pedestrian sidewalks and support their role as collective axes. Those underground entities

represent urban mutation joints beneath the linear margins being *positioned* in an urban rhythm that is usually composed by the metro stations location, trying to re-stitch the city' ripped context while adding a new extension of underground internal public space between two public over ground footpaths. The *UUN* have *linear profile* form to keep up with the upper street morphology and direction while establishing multi *underpasses connections* accesses along the underground space like both study cases in the Far East, Crysta Nagahori in Osaka and Tenjin Chikagai in Fukuoka. More important these underground areas add new space type with a new character, which is a closed interior one between two exterior promenades. In this case, they provide the continuity to passengers from zone to another while giving new variety of space type across the axial boulevard.
On the other hand, these spaces are reinforced with more activities established by private sector like commercial functions in parallel with the public ones like the metropolitan stations to encourage the people to keep the axes vibrant with their movement, while the private sector can make a profit as well.

Development Velocity / Scale:
The city development method takes action in two parallel directions. The first element is the zones. They evolve softly and integrally piece by piece because of the small-scale buildings plots and internal secondary streets. The second element is the main transportation axial route system being the infrastructural nerves in this city model, including their contents of primary streets network, wide sidewalks, underground metro lines and stations.
Then comes the phase of pursuing transformation on these axes that occurs by adding *UUN* spaces in a rhythm depending on the urban need. They reinforce the role of these principle axes as the urban spaces, connecting and arranging different zones in the city context.
Taking into account the underground entities location, their scale is limited by the context. The width is narrowed by the distance between buildings located on both sides of the covering boulevard and the length is defined between underground metro stations or urban built up block. In the light of this, the underground nodes are *organized linearly* in account of the city urban tissue and expanding in a *medium size* distributive area in a *strait long profile*.

Walkability:
The city in this model has different categories of streets respecting their width. The principle

ones that form and divide the city to different zones and the secondary ones with smaller scale which are located inside each area. The pedestrian network is continues in the zones while the high velocity wide principle streets interrupt them. The pedestrian suffers in these specific axes from the high velocity of vehicles and the sudden break in the walking web.
As the city is in need for an element that can help pedestrians to cross these wide streets, the *UUN* establish the solution of underpasses along these margins to continue the walking rhythm without facing this break. The underground entity acts as transit space (spazio sosta) to different types of transportation systems users as it is including metro stations and *connected* to the pedestrian network over ground through the crossing *underpasses* and includes some parking areas as well. By its nature, underground node is like a mutation pause in the melody of urban transportation system.

5.3.2 Urban Densification.

Densification of buildings and spaces:
The evolution in this model approaches the densification of identified public spaces that connects different zones, which is also increasing the meeting points in the city tissue.
The *UUN* space is an equivalent space to the piazza or square in the traditional city while in this case, it is the collective stripe of mutation between different types of transportation facilities where they all intersect together. In addition to that, it is a way to increase the voids density that can host public in those joints where they can meet, integrate and interact during practicing different activities.
By adding these underground entities, the problematic axes of segregation between city zones become the strategic uniting collective spaces, supporting and raising the quality of the pedestrian sidewalks along the axial routes, so the problematic segregation city streets converts to collective mutation linear boulevards with connective junctions. The densification of the city axes with those knots is one of the adopted strategies in the Far East metropolitan cities, giving a new dimension for the wide streets sidewalks. This type can be seen in the Japanese study cases where the underground nodes are located under the primary city streets connecting the opposite sidewalks.

Densification of functions and activities:
As was explained before, the distribution of functions in the city is a fundamental factor that affects the inhabitants' way of living. In this model, each zone evolves piece by piece according to the need, while the city primary streets are where most of the office buildings are placed. This creates a linear CBD located along the city main axes, which take place on the outer border of different zones. On the other hand, the functions inside of the urban districts are mixed and added regarding inhabitants needs, which causes integration between people in the same zone as they meet while doing different activities.
That means that again the problematic part is the main axial margins where the zooning method is applied. For breaking that paradigm, more various functions should be added to this linear part.

Here it comes the *UUN* functions densification. These nodes are being added in a rhythm regarding their need so they can insert some services and commercial areas thus the people can meet, interact and socialize in these parts. The underground entities contribution is the transformation from mono-functional to mixed-use with *axial organization*, aside with the main transportation routes. Therefore, that middle public space increase the opportunity of people integration with each other while participating in different activities in those mutation junction strips. This is because of the transportation, commercial and entertainment uses so the people can meet, talk and socialize.

Densification of people.
The densification of people strategy in this type is directed to take action partially. This is due to the functional zooning and concentration of the office buildings aside the linear boulevards. These axes are the destination for the people in the morning time, while usually these districts are deserted by night. So, to obtain the densification and integration between people in these linear spaces and keep them busy with people the longest possible time during the day, cities should work on attracting them by raising the quality of spaces and activities.
By adding new *UUN* spaces with good quality, the axial margins convert to polar attraction points to people almost all day long, not alive by day and deserted empty by night. On the other hand, they offer new space type, which is internal one that can take advantage of their connection to different transportation networks and host more users during hard weather conditions time.

5.3.3 Social Impact of Urban Mutation Lifestyle.

Social Relations between people and with city
The way of living in this model has both concepts of social integration and segregation together. The first one takes place between inhabitants who live in the same zone as they have the pedestrian network, public spaces, human scale buildings and diverse functions while the second one occurs between different districts inhabitants due to the wide streets margins dividing the mentioned areas.
Here it comes the need for the integration of different neighbor zones' dwellers. The strategy is to mutate the segregation margins by creating urban common public spaces with good quality, where people from neighbor zones can meet, interact and be together. Thus, the *UUN* space is *positioned* to support that role.
In these strategic underground entities, users are not subjects by the zones they belong to. They are mixing in those junctions that bond the different regions' inhabitants together. They represent neutral areas that overcome the social feeling of alienation in the primary streets and boulevards network, targeting to melt the social barriers in those joints. The *UUN* spaces in this case repopulate these urban axes with people, make it easier specifically for pedestrians – who are the real factor of social integration - to move freely between different city zones without having obstacle of cars road that limits their living and integration area. This is why the underground entity in this model has small net area while *organized linearly* to extend in a relatively *middle size* distributive area, not to offer that much entertainment services that can steal the thunders from the over ground linear external public space and become segregated independent environment.

Social Security (safety):
As the integration typology exists inside the city zones and districts, these parts are secured and safe. Frequently, the inhabitants know each other, the buildings have a human scale, the urban spaces quality is high, the pedestrian network is evident, functions are mixed and distributed regarding the required needs, thus common activities takes action between residents. All these factors lead to the integration lifestyle, which leads to security feeling increment in these city

parts.
On the other hand, as the separation takes place at the urban axial major wide roads in the city tissue, *UUN* spaces are established as urban mutation points to obtain a social presence that is cropped off by the existence of these streets. They also help to keep the main axis busy with people all day long instead of having deserted parts in the city, which can lead to crime rates increment and convert that area to be unsafe. In contrast, by adding these underground entities with the included functions, the streets become safer as they have the boulevards' passengers in the street for longer time of the day. In fact, the absence of big or huge scale of the underground entity in this case and the consolidated linear strait arrangement in the urban tissue are assistant factors that helps to keep the city external linear public spaces of sidewalks over ground vibrant with people in different times of the day instead of spending longer time in the subterranean spaces. It actually prevents the city from being deserted from people in specific times of the day or night, which helps to maintain the safety feeling between city inhabitants.
To illustrate, the *UUN* add value to the security and safety subject in this model, as they assist to overcome the social feeling of insecurity by keeping people in the primary streets in various hours of the day at the urban axial margins of transportation routes without any discrimination regarding which zone they belong to or comes from.

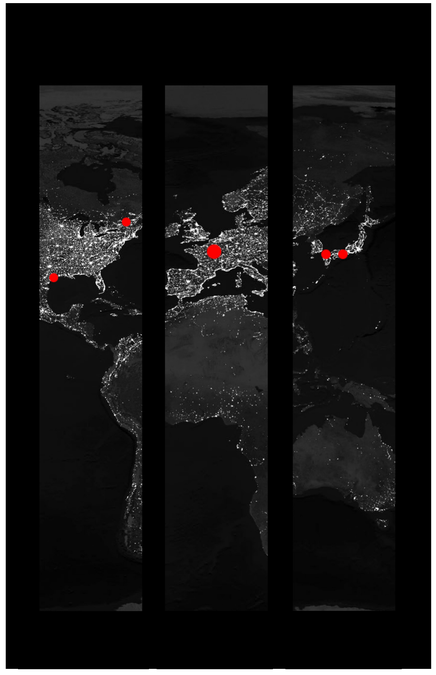
Social livability:
While there is a mix between the segregation and integration lifestyles in this city model, the strategy is to obtain an integral society. Though the dilemma is the urban wide streets that are dividing the city to different parts and categorizing the inhabitants regarding the zones they live in.
In this context, neutral *UUN* spaces exist to motivate the people to flew and mix with other zones inhabitants in such middle areas, trying to turn the problematic axis of segregation to a strategic attractive one for the human presence and activities. They become the boulevards that provide proper linear public external spaces materialized in the sidewalks and internal underground connective ones, which are the main elements responsible for linking the different zones inhabitants and disjointed walking network users.
The social mutation that takes action in these junctions helps to beat the segregation problem and to make these axes more livable, as they are adding value to the space quality and increasing the social activities that the people can participate in together. The UUN spatial composition character is set to support this purpose through their *position* under the problematic wide *streets* below the *dense* transportation nerves, establishing new *underpasses* to *connect* both opposite sidewalks and neighboring zones in a *linear profile* that is influenced from the covering street form and *organized* in an *axial* way with small net area but extend in a long strait *middle size* distributive area with lots of access points so the users can spread along it and turn the division margins into vibrant and alive boulevards with human movement.

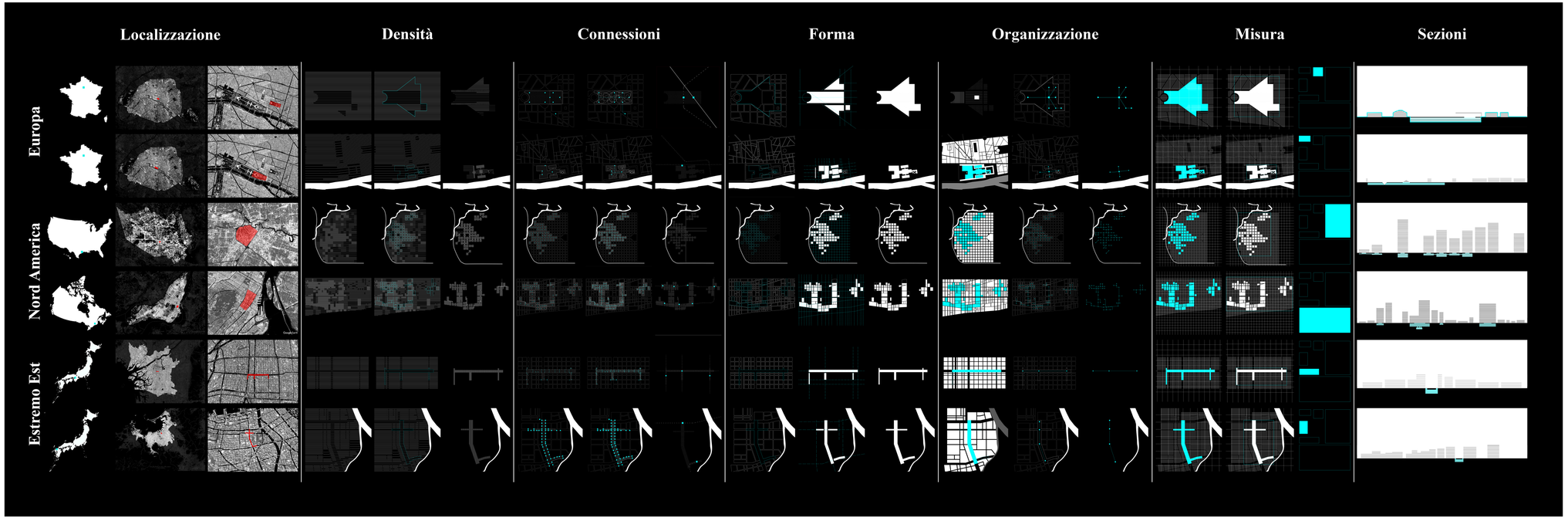
6. Conclusion.

The system of diagrams developed to investigate the UUN defined an analytical framework of reference that allowed to compare the case studies and to elaborate a possible hypothetical classification.
This graphical instrument makes it possible to highlight how these nodes are strategic urban places with an important economic, cultural and political value, which despite their relative size in the urban settlement system, are considered as “accumulation” points of urban dynamics.
These nodes represent real polarities, present in the most populated and economically rich metropolitan cities, which can also be considered crucial places for the development of specific urban strategies.
The developed survey, which focused on some specific aspects - position, density, connections, profile, organization and size - allowed to bring the study cases examined into three models: integrated, separated or mutated with the tissue of the cities - corresponding to the three geographical areas examined (Europe, North America and Far East).

Position - is one of the determining factors in the description of the UUN that are generally found in the central areas of the city, in particular:

- - In European cities in the historical center where lifestyle is strongly integrated with public spaces, squares and streets.
- - In the North American model in correspondence with the central business districts at the city center, where the skyscrapers and their users are separated from the urban public spaces. In this case the UUN allow the internal separated direct connections between different autonomous buildings on the surface.
- - In the Far East, in the transformation areas, it takes place in correspondence of the main transport arteries that often are configured as interruption elements, not allowing the crossings to urban scale. In these cases the UUNs represent mutation spaces that connect and integrate the neighboring areas.



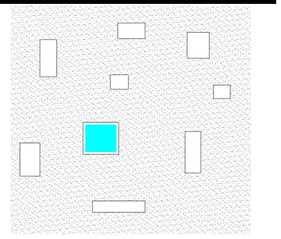

Localizzazione
Densità
Connessioni
Forma
Organizzazione
Misura
Sezioni
Europa
Nord America
Estremo Est

Position

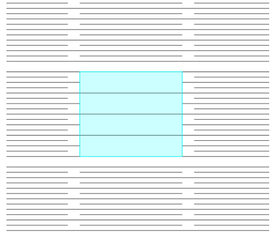
Density

Connections

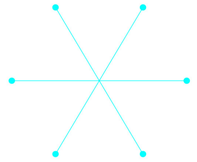
Europe



97 - UNN Located in Historical Center under main city square

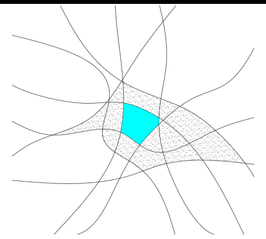


100 - UNN Located under the least dense plots of the squares public space.

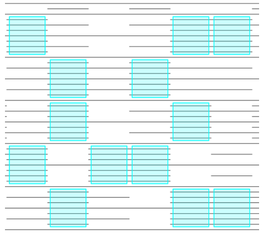


103 - UNN Pivotal connection.

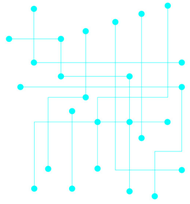
North America



98 - UNN Located in Downtown CBD area under the high-rise towers.

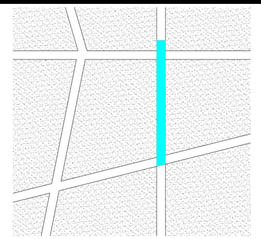


101 - UNN Located under higest dense plots of high-rise towers.

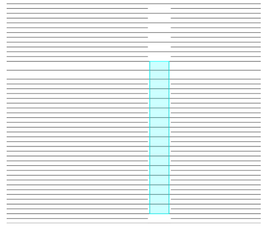


104 - UNN Network connections.

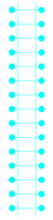
Far East



99 - UUN located attached to Transportation Route system under one of the city main streets.



102 - UUN located under medium dense linear spaces of the main transportation streets.



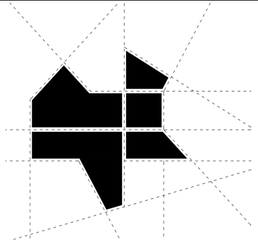
105 - UUN Underpasses connections.

Profile

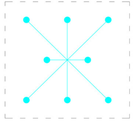
Organization

Size

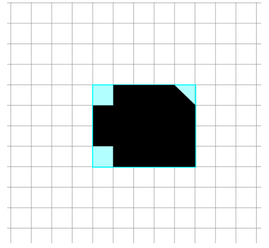
Europe



106 - UNN Irrigular shape.

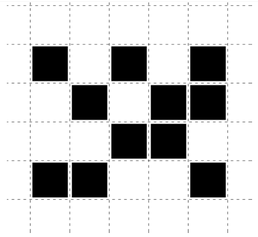


109 - UNN Central organization model.

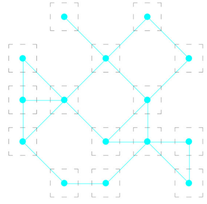


114 - UNN Micro size.

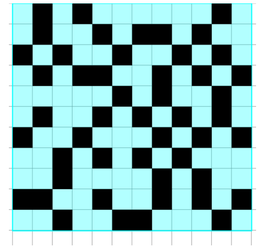
North America



107 - UNN Regular Shape.

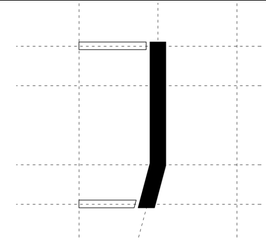


110 - UNN Diffused organisation model.



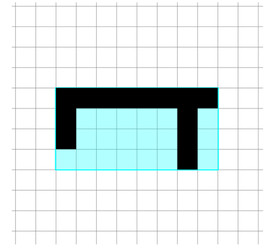
117 - UNN Macro size.

Far East

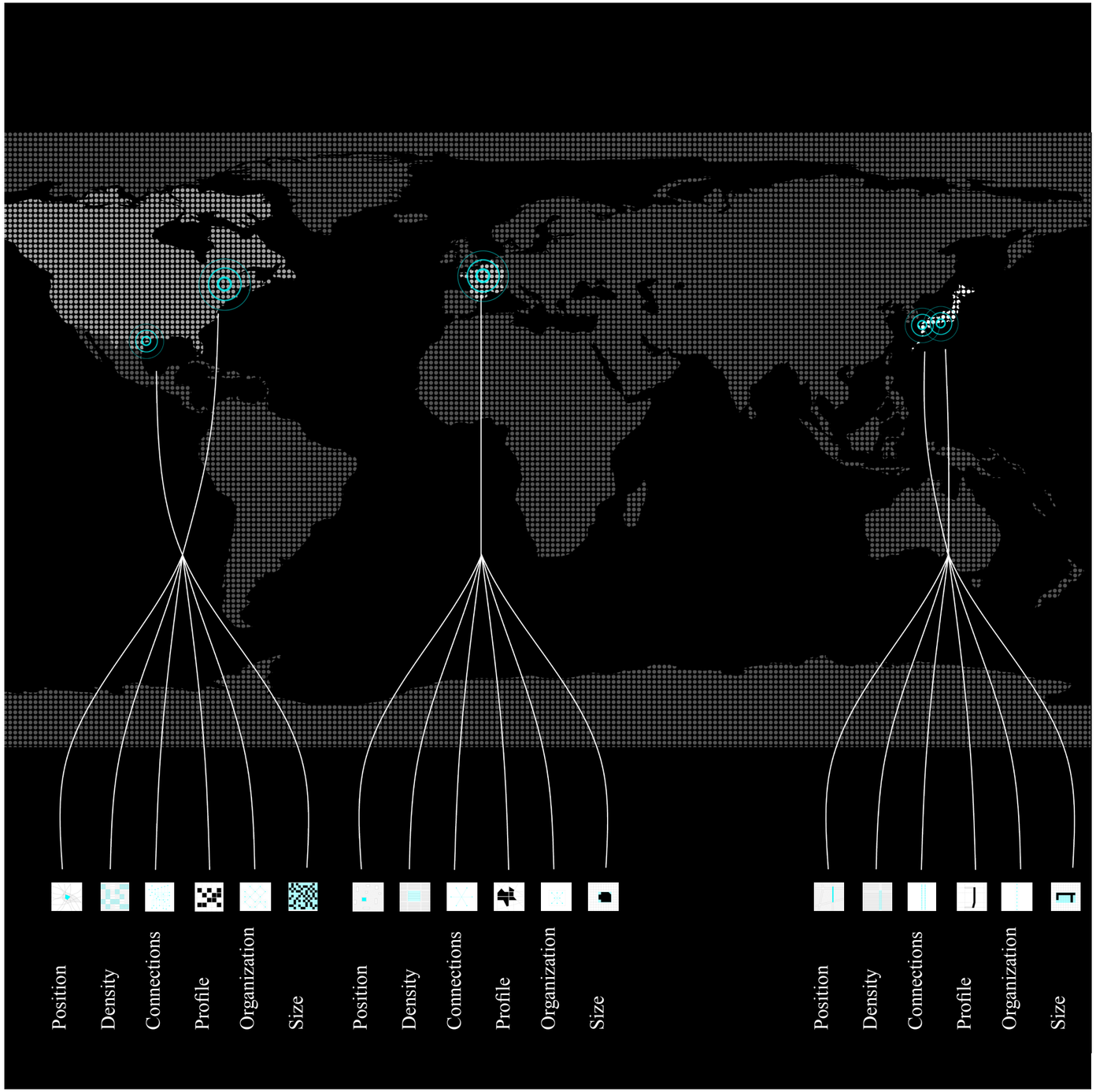


108 - UUN Regular Axial shape.

111 - UUN Linear organisation model.



120 - UUN Meso size.



Density - describes the characteristics of the surface areas in correspondence with the UUN, existing mainly in the most populated areas of the city, in strategic points where they become an underground extension of the urban space reinforcing the collective role.

- - In Europe, UUN can be located under open spaces such as public squares and gardens, where they offer new dimensions and functions that play a role of social integration.
- - In North America, the UUN spaces are located mostly under the skyscrapers where they maintain their autonomy from the over ground public spaces of the city, configured as separated private entities.
- - In the Far East, UUN are generally located under the busiest urban transportation route axes. These spaces are adjusted to change such barriers by connecting adjacent areas separated by the infrastructural street.

Connections - Identifies both the vertical connections with the over ground on the surface, the underground pedestrian spaces and metropolitan joints.
As for the first kind, the UUN have direct connections with the covering squares, gardens, buildings or avenues.

For horizontal underground connections, it is possible to recognize different situations:

- - When the UUN define a central space in which the different functions and connections converge, providing a physical pivotal condition that reinforces the social integration of the urban public spaces of the city on the surface.
- - When the UUN offer an internal pedestrian network that provides users with the possibility of using underground connections linking the covering buildings, which have independent character on the city surface. In this case a separation is created between the external public network and the internal underground private one.
- - When UNN allow the connection between urban zones divided by road arteries that are configured as underpasses, trying to obtain social integration between the separated urban parts on the surface, with a positive impact on the different areas of the city.

Profile - This refers to the planimetric configuration of the UUNs, which is generally presented as an underground projection of the urban lots of the city context and can be defined as a single entity or several separate entities depending on the case:

- - The UUN can be made up of combined, regular or irregular shapes, which being strongly integrated with the surface area, have the same urban DNA.
- - The UUN have distinct regular forms with their own individual character, placed at the buildings' basement and connected by an underground tunnels system. Mostly these spaces are private.
- - The UUN present a linear structure parallel to the road system, interrupted by perpendicular transverse crossing underpasses.
-

Organization - describes the distribution of functions that can be:

- - *Central* and multifunctional type, including cultural, entertainment, transportation and services like museums, exhibition halls, sports areas, cinemas, underground stations and commercial activities, extending the city's surface and reinforcing the collective role of the covering space.
- - *Diffused* type, composed of sprinkled separated private underground spaces. Though they have dominant use, which is mostly commercial and entertainment making them mono-functional spaces.
- - *Linear* type that takes linear organism in the city master plan while mainly contains metro stations and commercial activities.

Size - refers to the extension of the different UUN, compared by drawing on a grid of 100 * 100 meters, which highlights the dimensional distributive area, identifying three different scales for the analyzed case studies:

- - The *MICRO* in the European cases where the UUN present a relatively small size and are configured as an extension of the public space above on the surface adding new volume integrated with it not as a parallel environment of the city.
- - The *MACRO* like in the North American examples where the underground spaces are settled as a parallel, private segregated entity distributed in a large scale area of the city that has rare or no interactions with public spaces and their users.
- - The *MESO* in the Far Eastern model, where the UUN space have linear strait distribution that does not allow the performance of social activities in the subsoil, but establishes interactions along the urban margins of the surface road system to integrate the adjacent over ground city parts.

The examined case studies highlight how the UUNs are architectural entities with a strong *trans-typological* essence that manage to translate in shape some particular conditions of contemporary urban spatiality.

In conclusion it is possible to affirm that these units represent crucial nodes of mobility and connections in the urban tissues, for which the thesis has tried to provide a proposal on the possibility of defining their connotative image and a spatial idea, regarding their composition and typological structure through a suggested mode of representation.

In result of the schematization of the study cases analysis and through the thesis the final matrix that decodes the complexity of the Underground Urban Nodes, it comes to identify the three frequent patterns - integrated, separated or mutated with the city fabric, which represent not only spatial situations but also define possible intervention strategies with strong implications on urban dynamics and lifestyles.

Conclusione. (Italiano)

Il sistema di diagrammi elaborato per indagare i UUN ha definito un quadro analitico di riferimento che ha permesso di mettere a confronto i casi studio e di elaborare una possibile ipotesi di classificazione.

Tale apparato consente di mettere in evidenza come questi nodi sono luoghi urbani strategici con un importante valore economico, culturale e politico, che nonostante la relativa dimensione nel sistema insediativo delle città, si configurano come punti di “accumulo” delle dinamiche urbane.
Tali nodi rappresentano delle vere polarità, presenti nelle realtà metropolitane più popolate ed economicamente più ricche, che possono anche configurarsi come luoghi cruciali per lo sviluppo di specifiche strategie urbane.
L’indagine sviluppata, che si è focalizzata su alcuni aspetti specifici – posizione, densità, connessioni, profilo, organizzazione e dimensioni – ha permesso di ricondurre i casi studio presi in esame a tre modelli: integrato, isolato o in mutazione con il tessuto della città – corrispondenti alle tre aree geografiche prese in esame (Europa, Nord America e Asia).

Posizione – è uno dei fattori determinanti nella descrizione dei UUN che generalmente si trovano nelle aree centrali della città, in particolare:

- nelle città europee nel centro storico dove lo stile di vita è fortemente integrato con gli spazi pubblici, le piazze e le strade.
- nel Nord America in corrispondenza dei quartieri d’affari del centro della città, dove i grattacieli e i loro utenti sono separati dagli spazi pubblici urbani. In questo caso i UUN consentono il collegamento a una diversa quota tra edifici autonomi in superficie.
- in Asia nelle aree in trasformazione, collocandosi in corrispondenza delle principali arterie di trasporto che spesso si configurano come degli elementi di interruzione, non consentendo gli attraversamenti a scala urbana. In questi casi i UUN rappresentano degli spazi di mutazione che collegano e integrano le zone vicine.

Densità – descrive le caratteristiche delle aree in superficie in corrispondenza dei UUN, presenti principalmente nelle zone più popolate delle città, nei punti strategici dove diventano un'estensione sotterranea dello spazio urbano rafforzandone il ruolo collettivo.

- in Europa, i UUN possono essere localizzati sotto gli spazi aperti come piazze e giardini pubblici, dove offrendo nuove superfici e funzioni svolgono un ruolo di integrazione sociale.
- nel Nord America, i UUN sono localizzati sotto i grattacieli dove mantengono un'autonomia rispetto agli spazi pubblici della città, e si configurano come entità private.
- in Asia, i UUN collocandosi in genere sotto le arterie urbane più trafficate si configurano come quelle entità che mutano questa barriera connettendo zone contigue separate dall'infrastruttura in superficie.

Connessioni - Individua sia le connessioni verticali con l'area in superficie, che quelle sotterranee orizzontali pedonali e metropolitane.

Per quanto riguarda le prime, i UUN presentano collegamenti precisi con piazze, giardini e viali.

Per le connessioni orizzontali sotterranee, è possibile individuare diverse situazioni:

- quando i UUN definiscono uno spazio centrale nel quale convergono le diverse funzioni e connessioni, fornendo una condizione fisica che rafforza l'integrazione sociale degli spazi pubblici urbani della città in superficie.
- quando i UUN offrono una rete pedonale interna che fornisce agli utenti la possibilità di utilizzare connessioni sotterranee di collegamento tra i grattacieli, autonomi alla quota della città in superficie. In questo caso si crea una separazione tra rete pubblica esterna e quella privata interna sotterranea.
- quando i UNN consentono la connessione tra parti urbane divise da arterie stradali che si configurano come dei *bypass,* svolgendo un ruolo di integrazione sociale tra le parti in superficie, con un impatto positivo sulle diverse zone della città.

Profilo – Si riferisce alla configurazione planimetrica dei UUN che generalmente si presenta come una proiezione interrata dei lotti urbani alla quota della città e può definirsi come un'unica entità o più entità separate a seconda dei casi:

- i UUN possono essere costituiti da forme combinate, regolari o irregolari, che essendo fortemente integrate con l'area di superficie, presentano lo stesso DNA urbano.
- i UUN presentano forme regolari distinte con un proprio carattere individuale, poste in corrispondenza degli edifici e collegate da un sistema di tunnel sotterranei. In genere questi spazi sono privati.
- i UUN si presentano una struttura lineare parallela al sistema stradale, interrotta da sottopassaggi di attraversamento trasversali.

Organizzazione – descrive la distribuzione delle funzioni che può essere:

- di tipo centrale e multifunzionale comprendendo musei, sale espositive, zone sportive, cinema, stazioni metropolitane e attività commerciali, andando a ampliare la superficie della città e il ruolo collettivo dello spazio.
- di tipo diffuso, composto da spazi sotterranei privati separati. Sebbene abbiano un uso dominante, che è per lo più commerciale e di intrattenimento che li rende spazi monofunzionali.
- di tipo lineare che richiede un'organizzazione assiale nel piano generale della città, mentre contiene stazioni della metropolitana e attività commerciali.

Dimensione – si riferisce alla estensione dei diversi UUN, messi a confronto attraverso il disegno di una griglia di 100 * 100 metri, che ne evidenzia le relazioni dimensionali, individuando per i casi studio analizzati tre scale differenti:

- la MICRO nel caso europeo dove i UUN presentano dimensioni relativamente piccole e si configurano come estensione dello spazio pubblico in superficie e non come un ambiente parallelo della città.
- la MACRO nel caso americano dove si definisce una città parallela, privata che non ha

interazioni con gli spazi pubblici e gli utenti.

- la MESO in Asia, in cui lo spazio UUN ha una distribuzione lineare ristretta che non consente l'esecuzione delle attività sociali nel sottosuolo, ma stabilisce interazioni lungo i margini urbani del sistema stradale di superficie per integrare le parti adiacenti della città.

I casi studio presi in esame mettono in evidenza come i UUN sono quelle entità architettoniche con una forte essenza *trans-tipologica* che riescono a tradurre in forma alcune particolari condizioni della spazialità urbana contemporanea.
In conclusione è possibile affermare che tali emergenze rappresentano dei nodi cruciali di mobilità e connessioni nei tessuti urbani, per i quali la tesi ha tentato di capire e fornire una proposta sulla possibilità di definire una immagine connotativa e una idea spaziale, sulla loro composizione e strutturazione tipologica, su una possibile modalità di rappresentazione.
Rischiando una eccessiva schematizzazione la tesi attraverso la matrice finale che restituisce la complessità dei *Nodi Urbani Sotterranei*, arriva a individuare i tre modelli ricorrenti - integrato, isolato o in mutazione con il tessuto della città - che rappresentano non solo delle situazioni spaziali ma anche definiscono possibili strategie di intervento con forti implicazioni sulle dinamiche urbane e sugli stili di vita.

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