

# Research on the Application of Space Syntax in Commercial Residential Buildings——Taking the EDF. VA IONG in Macau in the late 1980s as an example

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**ABSTRACT:** Space syntax is one of the important methods of urban analysis and calculation. Based on the theory of space syntax, this research analyzes the internal spatial structure of EDF. VA IONG, a representative commercial residence in Macau in the 1980s, as an example. And import Depthmap for calculation, combined with related topological calculation methods, by analyzing the topological values of the overall integration degree, local integration degree, global depth and selectivity of the space, quantitatively explore the structure of the space, and understand the overall space and local space of commercial residences. It found the shortcomings in the spatial structure and proposed corresponding optimization strategies to provide reference for the typical commercial residential space in Macau in the late 1980s in the future urban renewal.

**KEYWORDS:** Space syntax, commercial housing, department store space, spatial structure, Macau

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## I. INTRODUCTION

EDF. VA IONG is located in the lobby area of Macau Peninsula, which belongs to the Nam Van District of Macau's 22 official statistical areas. Surrounded by A-level office buildings, such as the Bank of China Tower, AIA Tower, and Trust Investment Center. Facing three city avenues at the same time, there are three house numbers in different directions: Praça da Amizade 6-52, Avenida do Infante D. Henrique 25-31, Avenida Doutor Mário Soares 227-259 (see Fig. 1). According to statistics from the Macau Bureau of Statistics, the total number of residential units in the EDF. VA IONG is currently 147, but 7 are vacant. The number of independent units is 313. It has a 3-story basement, and a total of 24 floors above ground, attic and above. The building age is between 25-29 years.

EDF. VA IONG was developed on the site of the old Liceu Middle School in Macau. In 1987, the Department of Construction Planning and Coordination of the Macau-Portuguese Government has selected three development consortia to undertake the construction of the old school site of the old Liceu Middle School. According to the different uses of the land granted by the development consortium, it is necessary to pay the government a grant fee of 53 to 60 million yuan, and the land grant period is 25 years. After the expiration, the development consortium can renew the contract with the government for a period of up to 10 years. Subsequently, the government leased Lot No. 1 of the former site of Liceu Middle School, with an area of 2,298 square meters, to the group consisting of Wu Fu and VA IONG (Macau) Engineering Co., Ltd. on August 14, 1987, at 3 pm, the Governor of Macau Carlos Montez Melancia signed a letter of undertaking jointly with him for the construction of a high-end commercial and residential building (see Fig. 2).

At the initial stage of planning, the total construction area of EDF. VA IONG is more than 400,000 square feet. The five underground floors are high-end luxury shopping malls, equipped with various luxury equipment. Greening flowers and plants are planted on the top platform of the shopping mall, which can be used by residents for rest and relaxation. The 20-storey high-end residences are divided into east and west buildings, each with four households on the first floor and three elevators. The residences were all practical five-bedroom, two-living, three-bedroom, two-living units at that time, each with a large curved terrace, three sides and one side, with sea views. There is a parking lot in the basement of the building with 200 spacious parking spaces (see Fig. 3).

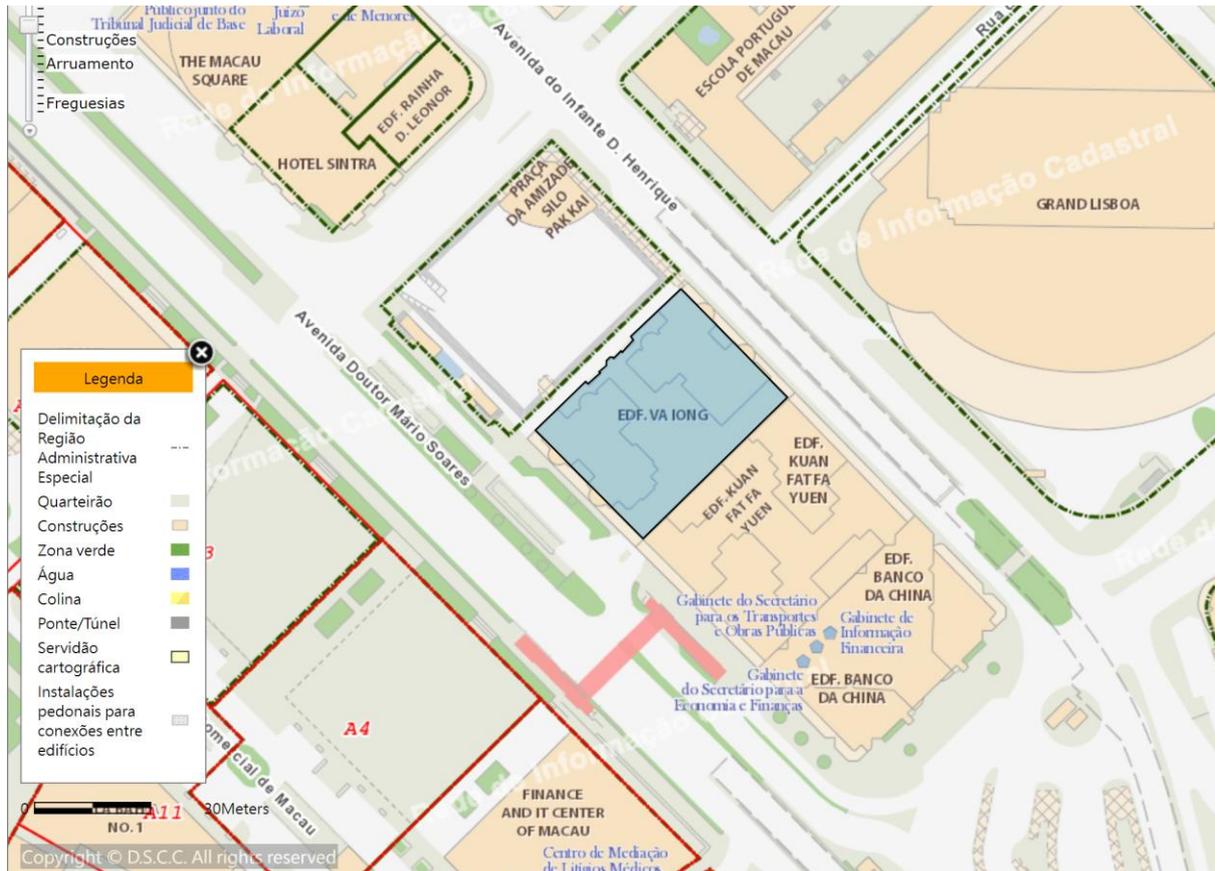


Figure 1: Location map of EDF. VA IONG (Image source: The author is intercepted from the Macau Cadastral Bureau)



Figure 2: Macau Governor Carlos Montez Melancia and businessman Wu Fu exchanged the text of the land grant commitment (Image source: Jornal Va Kio Historical Archives Database)

Figure 3: Model sand table for sales of EDF. VA IONG (Image source: Jornal Va Kio Historical Archives Database)

In Nam Van in the 1970s, there were only two buildings that stood out from the crowd—Lisboa Hotel and Lena Building. After entering the 1980s, Macau's economy began to have greater development. The most noticeable is the rapid development of the construction and real estate industry, which has greatly increased the speed of land development in Macau (see Fig. 4). In the early 1980s, the first large-scale residential buildings such as the Emerald Garden in Macau and the International Bank Building were completed, followed by the completion of large commercial and residential buildings such as Haifu Garden, Lucky Court, and Dutch Garden. In the mid-1980s, large commercial and residential buildings such as Parkway Gardens, Westland Terrace, Broadway, etc. were completed one after another. Competing for the uplifting is the completion of the industrial building in the Hac Sahuan District, the completion of the Ocean Garden Building in Taipa and the development of the new port area, as well as the completion of various commercial centers and the Bank of

China Building and its adjacent EDF. VA IONG and Quanfa Building. The appearance of the Macau city has been greatly improved, and Macau has initially assumed the embryonic form of a modern city(see Fig. 5).



**Figure 4: Nam Van of Macau in the 1970s (Image source: Jornal Va Kio Historical Archives Data-base)**

**Figure 5: Nam Van of Macau in the 1994 (Image source: Jornal Va Kio Historical Archives Database)**

At that time, it was located in the prosperous commercial centre of Nam Van, facing the bay and adjacent to the park. Regardless of whether it is commercial or residential, it is the noblest and luxurious area in Macau. The appearance of the building is magnificent and graceful. The front is the government public rest garden, the southwest faces the Nam Van waterfront, and the east is the Avenida do Infante D. Henrique. It has the characteristics of prosperous business, elegant and clean residences, and luxurious style. Therefore, EDF. VA IONG was a typical representative of the renewal of vacant land plots in the core area of the built city into high-end commercial and residential buildings in the late 1980s before the return of Macau. However, over time, there have been some problems in the use of the current building, and it is difficult to meet the modern needs of rapid economic development. Therefore, this article attempts to analyze it from a spatial perspective and propose an optimized strategy(see Fig. 6-7).



**Figure 6: Early photos of planning (Image source: Prescott, J. A. (Ed.). (1993). Macaensis momentum: a fragment of architecture: a moment in the history of the development of Macau.)**

**Figure 7: Early photos of planning (Image source: Prescott, J. A. (Ed.). (1993). Macaensis momentum: a fragment of architecture: a moment in the history of the development of Macau.)**

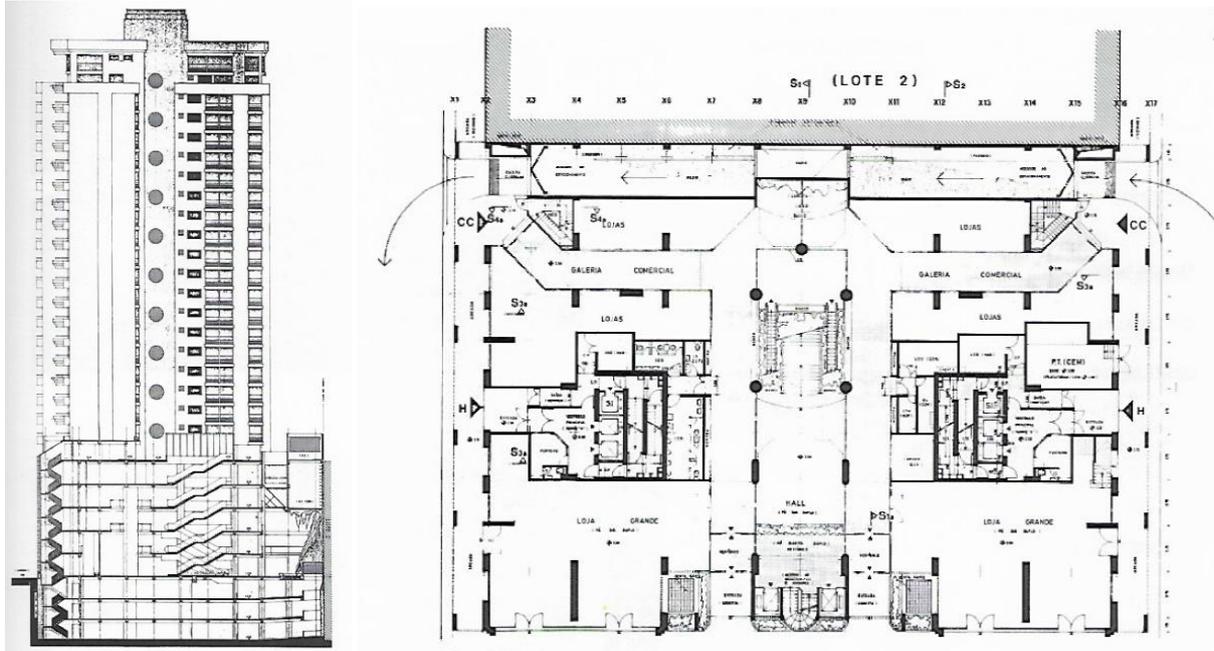


Figure 8: Side view of EDF. VA IONG (Image source: Prescott, J. A. (Ed.). (1993). *Macaensis momentum: a fragment of architecture: a moment in the history of the development of Macau.*)

Figure 9: Ground floor plan of EDF. VA IONG (Image source: Prescott, J. A. (Ed.). (1993). *Macaensis momentum: a fragment of architecture: a moment in the history of the development of Macau.*)

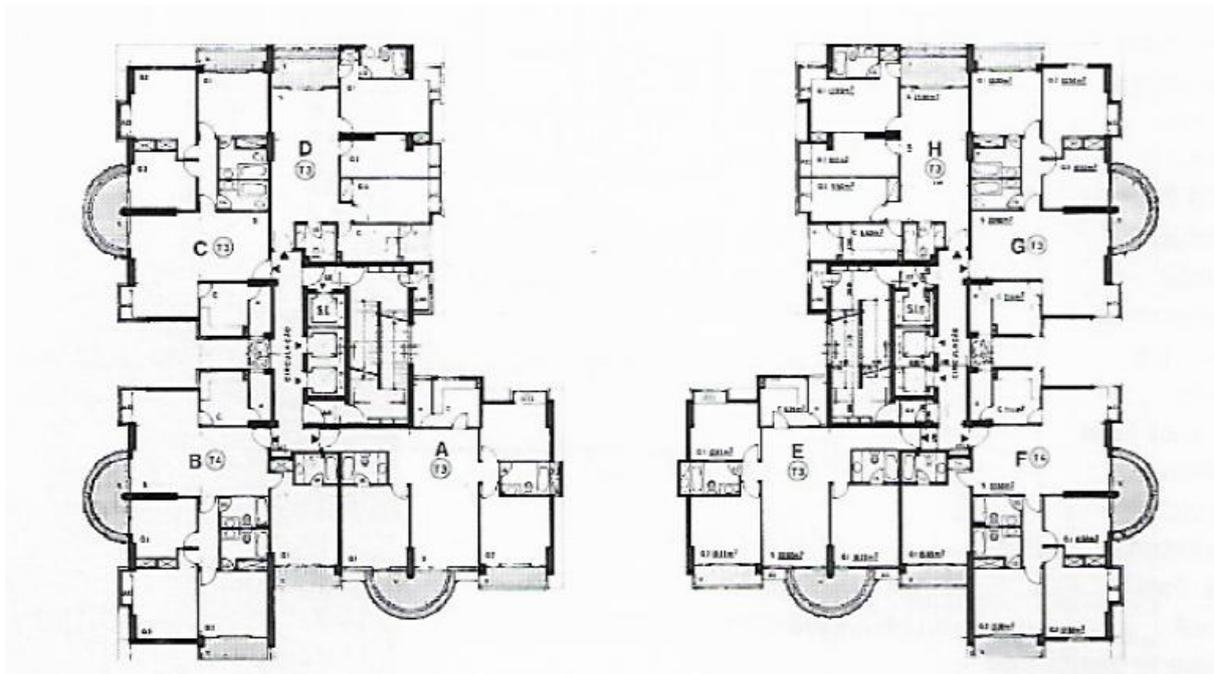


Figure 10: Layout Plan of the Twin Towers of the Residential Part of EDF. VA IONG (Image source: Prescott, J. A. (Ed.). (1993). *Macaensis momentum: a fragment of architecture: a moment in the history of the development of Macau.*)

## II. LITERATURE ANALYSIS of SPATIAL SYNTAX

This study inputs the keyword of "spatial syntax" on China HowNet, looks up recent journals, master's and doctoral theses, reads books on spatial syntax at home and abroad, and combs, summarizes and summarizes the research objects, contents, methods and conclusions of journals and papers. It is found that in re-cent years, spatial syntax has been widely used in villages and towns, historical and cultural blocks, urban and rural road

network accessibility evolution process of urban circle, subway, tourist attractions, architectural space and green space accessibility research, protection, utilization and renewal of historical cities, crime distribution environment, and the research methods are becoming more and more mature, and more high-quality papers have been published, The disser-tation is quite excellent and has great reference value.

In the field of historical block space research, researchers summarize the con-tents involved in important master's papers and documents in China, which are mainly reflected in the following aspects: (1) the research on the protection and renewal of villages and towns and the spatial form of settlements based on the theory of spatial syntax; (2) Based on spatial syntax and related theories, this paper analyzes the spatial morphological characteristics of famous historical and cultural cities; (3) Cognitive and analytical research on urban street and lane system and green space based on spatial syntax theory; (4) Based on the combi-nation of spatial syntax theory and GIS, this paper analyzes the spatial features of different urban streets, and so on. In recent years, the relevant literature on large-scale space research in the block has been increasing, and the research on inter-nal architecture has been expanding. In addition to choosing qualitative research, scholars also combine spatial syntax with various research methods for quantita-tive research. Only when they collide with each other can they produce sparks, promote the academic process and make the research results more convincing, It has greater reference value for future research.

It is not entirely correct to predict that streets and alleys with large traffic in three-dimensional space-time have better spatial accessibility and are easier to be recognized by people, because three-dimensional space-time not only has angle changes and Euclidean distance, but also has many, humanistic, political, economic, cultural, social and geographical factors, Therefore, the use of spatial syntax to study the internal streets of ancient villages, large urban spatial systems and small residential spaces in two-dimensional space needs to be combined with angular distance and metric distance, and combined with local customs, ecology, philosophy and feng shui theory, so as to get different results.

Among the relevant researches based on spatial syntax in China, taking the protection of ancient villages as an example, Jiao Yanhong focused on the prob-blems of improper street management, lack of culture, loss of humanity, large spa-tial population density and serious congestion in Baoding ancient city in 2019, Using the spatial syntax theory, this paper constructs the axis and line segment models of the ancient city in different periods, discusses the relationship with Baoding historical and cultural blocks, analyzes the syntactic variables such as the integration degree and selection degree of Baoding historical and cultural blocks, finds out the problems such as poor understanding and spatial confusion, and puts forward the strategies of land layout adjustment and spatial vitality im-provement. The research methods are literature review, empirical research and spatial syntax. Yin Yi's analysis of spatial morphological features of egret histor-ical and cultural villages based on spatial syntax theory in 2018 focuses on ana-lyzing street space, node space, whole and part based on the principles of cata-lyst, integration and adaptability. In the space protection and development strate-gy, in the street space, connect the broken end road, increase the number of main streets and widen the main streets and lanes to enhance traffic accessibility, in-crease the density of road network and improve the degree of spatial integration and comprehensibility. The research method combines literature analysis and field investigation to study the morphological characteristics of villages. Li Ran, Liu Mengchen and Wei Yi, in the 2020 "quantitative analysis and Research on the spatial form of Huaihe Road pedestrian block in Hefei Based on the theory of spatial syntax", the focus of the discussion is to take the Huaihe Road pedestrian block as the center, expand the scope of the axis map by 1000 meters, and find the line nodes with high integration through the line color and relevant data, When building space, we can't make good use of the character-istics of morpho-logical agglomeration, low spatial recognition and insufficient landscape charac-teristics. Therefore, we need to activate the network space of street and lane sys-tem. The research method is spatial syntax. Liu Yixi, Ma Zhiyao, etc. in the 2020 study on the optimization strategy of protection and inheritance of Furong Vil-lage in Yongjia based on the theory of spatial syntax, the discussion focuses on the spatial form analysis of Furong Village by using the perspective and axis method of spatial syntax, and in the level of protection strategy, reconstruct the landmark historical buildings and construct the community of elements in the village; In the repair strategy, optimize the node layout, delimit the core protec-tion area, and strengthen the axis relationship between the overall and local lev-els. The research method is spatial syntax. Chen Yuwei and sun Junqiao in 2019 "quantitative analysis and Research on the street and lane morphology of qing-tongliang Anju ancient town based on spatial syntax theory", the discussion fo-cuses on the analysis of the integration, selection and intelligibility of Tongliang Anju ancient town based on Depthmap software, and the opening of shops and accommodation in densely populated areas to facilitate visitors. It is necessary to continue the spatial context of streets and lanes. The research method is spatial syntax. Wang Xinzheng and Guan Jiayi, in the 2019 study on quantitative analy-sis of street and lane space system in Guyao District, Jingdezhen based on spatial syntax theory, focused on three summary tables of overall, local integration and average depth based on spatial syntax theory, constructed R2 process, and put forward strategies such as increasing protective measures and dismantling illegal buildings. The research method is spatial syntax. In 2019, Ma Hao and others discussed the selection and wisdom of Haikou arcade

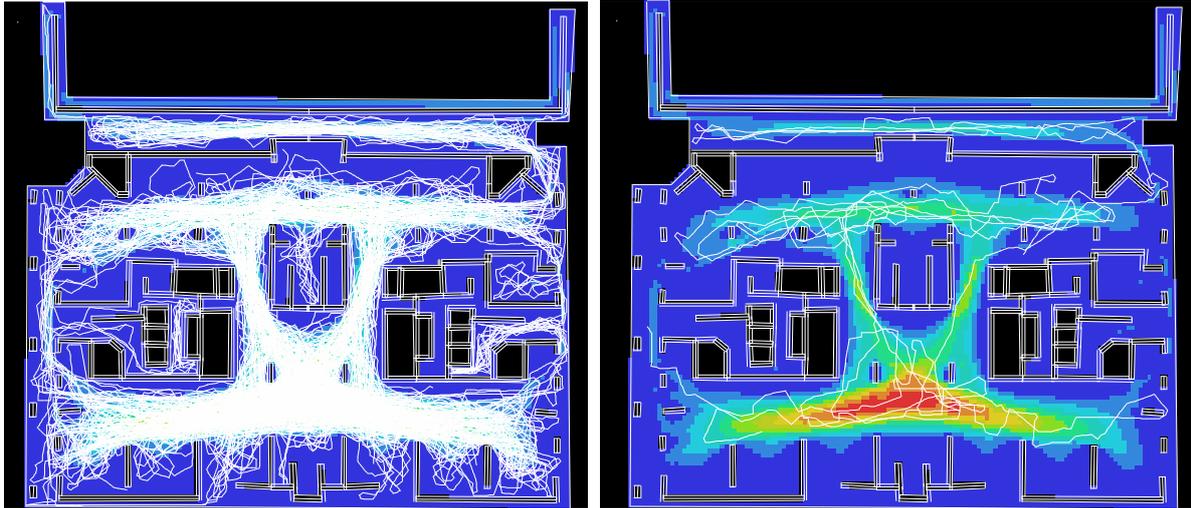
historical and cultural block based on the theory of spatial syntax, and put forward strategies such as enhancing people's perception of space, building visual corridors and integrating spatial effects. The research method is spatial syntax.

In the relevant research of foreign spatial syntax, propoito, D., Santoro, S., in 2020, agent-based analysis of urban spaces using spacesyntax and spatial cogni-tion Approvals: a case study in Bari, Italy, reflected on the wisdom based on in-telligence in urban spatial environment through the comparison of formal quali-tative experiments based on spatial syntax and spatial cognitive methods, There is a great correlation between the results of the analysis and the prediction of spatial syntax. Xu, Y., Rollo, J., Jones, D.V., Esteban, Y., Tong, H., & mu, Q. in 2020, the article tries to explore the correlation between spatial syntax and environmental psychology in towards Sustainable Heritage Tourism: a space syntax based analysis method to improve tours' spatial cognition in Chinese historical districts, Through the analysis of spatial syntax, improve tourists' cognition of the historical block of Nanyang canal ancient town, make a better combination of urban tourism development and urban spatial form, promote the sustainability of the historical block, and put forward feasible suggestions for the existing tourism heritage. Zhang, X.J., & Yang, Z.W. in 2019, a study on the evolution of morpho-logical vitality of ancient city along the Silk Road Based on space syntax Taking Zhangye as an example, based on the theory of spatial syntax, analyzed the changes of the spatial structure of the ancient city of Zhangye in different years, taking it as the core position of the overall spatial structure of the city. At the same time, the public space system, road network structure and spatial elements of Zhangye historical district are analyzed and discussed. Especially the internal relationship between traditional architecture, landscape and commerce. On this basis, this paper puts forward specific strategies to enhance the vitality and at-traction of Zhangye historical space, so as to provide a research basis for the protection and sustainable development of historical cities in the future.

From the existing research content, the research of spatial syntax is basically the research of urban medieval villages, basically focusing on the protected his-torical blocks with relatively complete historical village form, clear current situa-tion and relatively high historical value. There is more research on the applica-tion of spatial syntax in commercial and residential buildings, such as Huarong Building in Macau in the late 1980s,once commercial and residential buildings are established, they have strong representativeness. Together with the surrounding residential buildings, green landscape and urban streets, they have witnessed the historical development pro-cess of the whole city. Using space syntax to study, let people better understand the relationship between the overall and local space of commercial and residen-tial buildings, find the deficiencies in the spatial structure of buildings at this stage, and put forward corresponding optimization strategies, hoping to uphold the important concept of "people's city, people's city and people's city for the people", In the future, buildings will be modernized according to the relevant research results of space syntax, so as to achieve the objectives of resource shar-ing, effective utilization of resources, Project Co-Construction and environmental co-governance,contribute to the future urban development of the Macau Special Administrative Region.

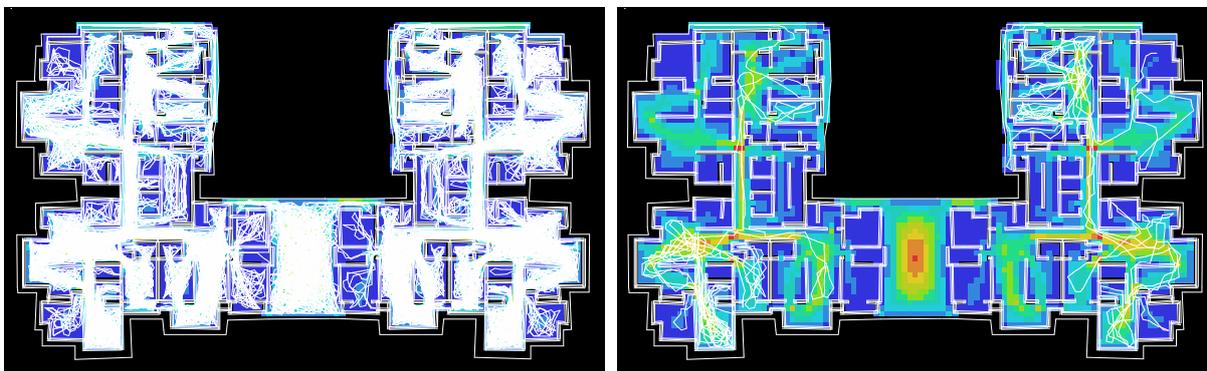
### **III. ANALYSIS of AGENT ROBOTS of EDF. VA IONG**

First, perform proxy robot analysis on the attic floor of EDF. VA IONG. Red represents the most number of paths passed, and blue is the least. As can be seen from the figure 8-9, there is a core tube at the entrance of the floor and a large staircase leading to the second floor in the middle. On the two sides connected by the stairs, there are ascending straight ladders respectively, and there is a core tube on the left and right sides respectively, and there are three core tubes in to-tal. The high-traffic areas in the plane are concentrated: starting from the en-trance of the building, to the large staircase in the middle behind the entrance and the corridors on both sides of the two straight staircases next to it, the internal space of the four berths, and the external corridor area. In the areas on both sides of the exit, there are more "back" characters in these areas, and the number of people "turning around" in this corridor also increases. Through field investiga-tion and analysis, the types of shops include jewellery stores, Japanese DAISO department stores, Sun Star lifestyle department stores, etc., which usually attract more mainland tourists and residents to go shopping and experience the fun of life. On the whole, The flow of people on the attic level is relatively large, and the concentration is relatively high. In contrast, compared to the middle area of the plane, the places with less pedestrian traffic are in the corridors on the left and right sides of the plane. People who come to shop and shop are also less likely to walk in the direction of both sides, making both sides of EDF. VA IONG The crowd gathering effect is reduced.



**Figure 11:** Analysis of the plane agent robot on the first floor of EDF. VA IONG (Image source: Drawn by the author)

**Figure 12:** Analysis of the plane agent robot on the first floor of EDF. VA IONG (Image source: Drawn by the author)

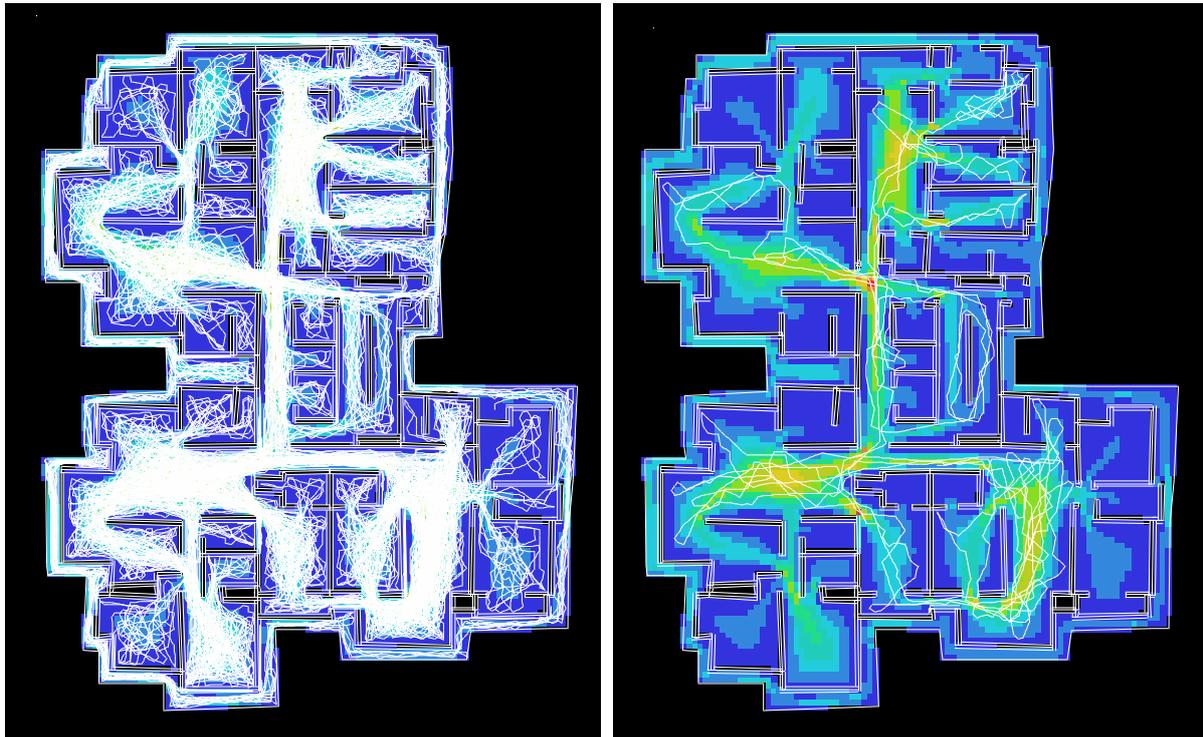


**Figure 13:** The overall analysis of the twin towers connected building of EDF. VA IONG (Image source: Drawn by the author)

**Figure 14:** The overall analysis of the twin towers connected building of EDF. VA IONG (Image source: Drawn by the author)

From the overall analysis diagram 11-14, it can be seen that the intermediate virtual space agent robot has taken more paths, followed by the corridor position in the core tube area. A building has four households A, B, C, and D, and they want to enter their own home. You must exit from the core tube area and enter your own home through the corridor, which is the only way to go. Three elevators and one fire-fighting staircase are arranged in the core area. Therefore, more people are passing through the corridor area. Then there is the area after the four households A, B, C, and D enter the door. The color of this location is the same as the color of the virtual space and the corridor, showing a reddish state, indicating that this place is the same as the corridor, where people walk in the "back" front. The number of times is higher, and people's activity is higher. After analyzing a single building, we can find that the places where the flow of people is relatively large are the bedrooms, living rooms, and balconies. People usually move in the living room and several bedrooms at home, where the "back" front is more frequent in the flow of people, and the area where the flow of people is less active is in the bathroom. It shows that the living room is the most important activity space for daily life. Compared with the bedroom, the space is more spacious, giving people a relaxed and happy mood. Family members can drink tea, watch TV, meet up, and meet together. The bedroom is the core requirement of every family's life, giving residents a space to sleep, rest and engage in sexual activities. The bedroom is divided into a master bedroom and a second bedroom. There is a toilet inside the master bedroom, which is the place where the owner of the house lives. The internal privacy is strong, and the sound insulation is good. It is also a resting area for the owner. There is a public restroom for the two-second sleepers for the use of guests. As a leisure space for each household, the balcony is an extension of the building's interior. It is connected to the outside and is the best

place for lighting functions in each house. Flowers can be grown here and a few pots of green potted plants can be placed. The green potted plants can photosynthesize and absorb Carbon dioxide releases oxygen. The scenery outside the building can be observed, which makes people happy both physically and mentally. Here you can also place a washing machine and a rack for drying clothes. Let people hang out here after washing their clothes, and they can also dry the quilt at ordinary times, which brings more convenience to people's daily life and study.



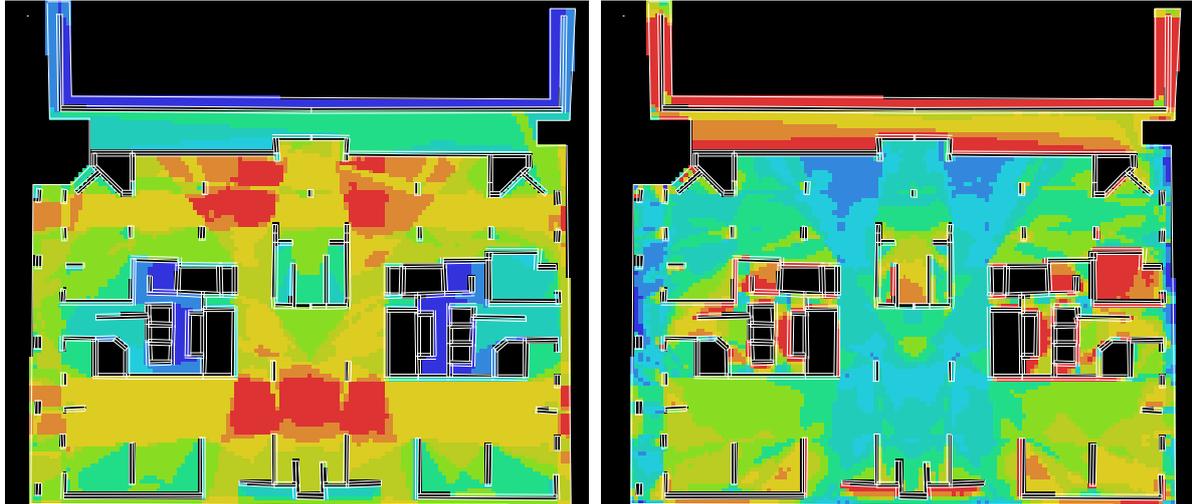
**Figure 15: Analysis of Single Buildings in Residential Buildings of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 16: Analysis of Single Buildings in Residential Buildings of EDF. VA IONG (Image source: Drawn by the author)**

Then from the east and west housing planes, As shown in Figure 15-16, because the east and west buildings are designed to be symmetrical to the central axis, and the layout is the same, the overall analysis is carried out first, and then the individual building analysis.

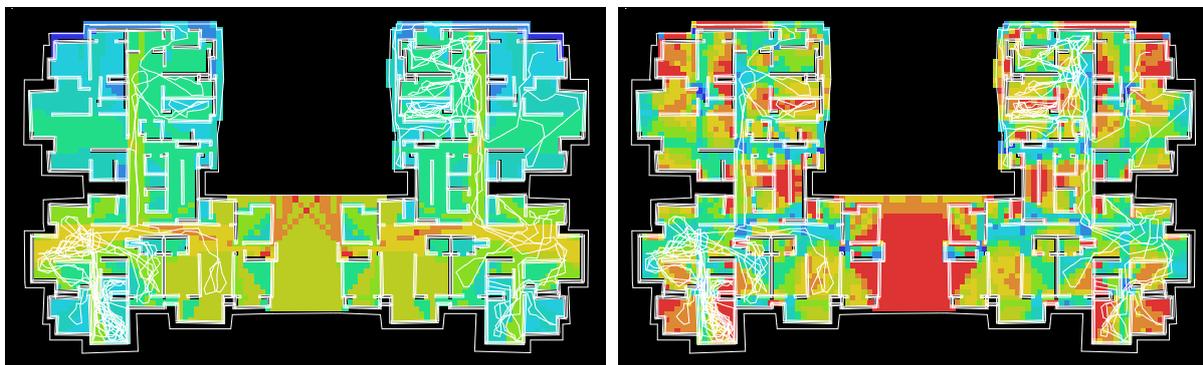
#### **IV. ANALYSIS of HORIZON INTEGRATION DEGREE and HORIZON CLUSTER COEFFICIENT**

Horizon integration is a combination of the perspective of the crowd to analyze the degree of possibility of being observed by people. It can well reflect the potential in the space. The value can be expressed by colour. The warmer the colour, it represents the integration value of the space. The higher the value, the stronger the agglomeration effect of the flow of people. The same is true for the axis analysis. The warmer the colour, the higher the integration of the space, which attracts more people to gather. The colder the colour, the lower the integration of the space, and the harder it is to attract people to the space. The agglomeration coefficient of the field of view is a judgment on the visual limitation effect of the space boundary. The agglomeration coefficient is judged and distinguished by analyzing the cold and warmth of the colour of the picture. The warmer the colour, the higher the agglomeration coefficient, indicating the interface between it and the surrounding space. The less limited the vision, the weaker the occlusion in the system. The colder the colour, the lower the value, the lower the aggregation coefficient, and the more obscuration in the system, that is, the more intense the line of sight is oppressed in the space.



**Figure 17: Analysis of the Horizon Integration of the Ground Floor Plan of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 18: Analysis of the Clustering Coefficient of the Horizon of the Ground Floor Plan of EDF. VA IONG (Image source: Drawn by the author)**



**Figure 19: Analytical diagram of the overall view field integration of the two buildings of the twin towers of EDF. VA IONG (Image source: Drawn by the author)**

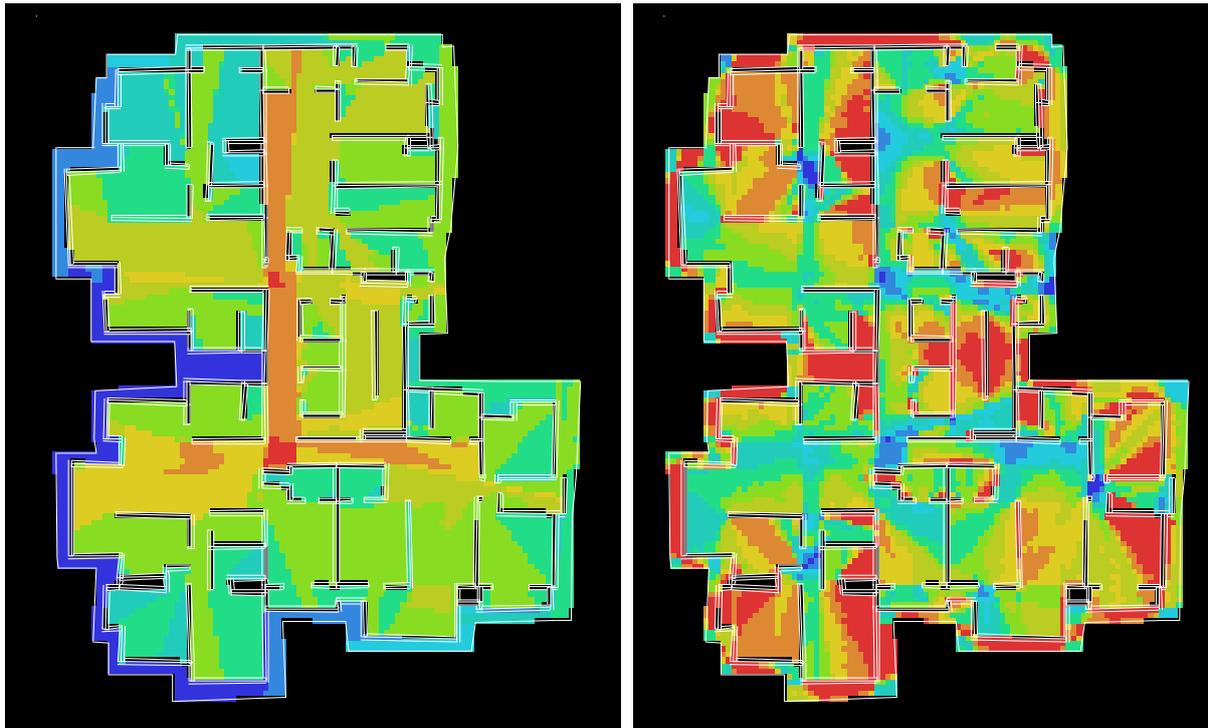
**Figure 20: Analysis of Clustering Coefficient of Horizon of Two Buildings of Twin Towers of EDF. VA IONG (Image source: Drawn by the author)**

Analyzing the integration degree of the EDF. VA IONG, it is found that in the first-floor plan, As shown in Figure 17-18, the areas with a higher degree of integration are concentrated in the upper left and right sides of the middle staircase and the fourth entrance area at the entrance. Tools are the only way for foreign tourists and local residents. Followed by the location of the five shops, the color is yellow, indicating that there are also more tourists in normal times. The color of some areas of the corridors on the left and right sides also showed a red state, indicating that there are occasional crowds here, but the ratio is not large, and the impact on the overall plane is minimal.

Analyzing the visual integration of the two buildings in the residential part of EDF. VA IONG, As shown in Figure 19-20, it can be observed that the areas with high visual integration are concentrated in the virtual space, the entrance corridors of units A, B, E, and F, the living room, and the external corridors of the elevator shaft. D and H living room, where most people go down from the elevator to the first floor during the peak hours of get off work, so there are more people gathering, the living room is also the only way for people to get out of the house.

In addition, the analysis of the concentration degree of the view field is carried out on the EDF. VA IONG. In the first floor plan, the places with a higher degree of view field concentration are concentrated on the left and right sides of the stairs and the entrance of the store. These four places are connected with the surrounding space. The fewer the visual restrictions, the weaker the shielding in the system. It is one of the places where people gather during peak periods. The places with low visual field concentration are in the five shops, and the color distribution is more uniform, indicating that these five

in this area is not strong, the degree of dispersion is high, and the trajectory of the flow of people is not too concentrated.



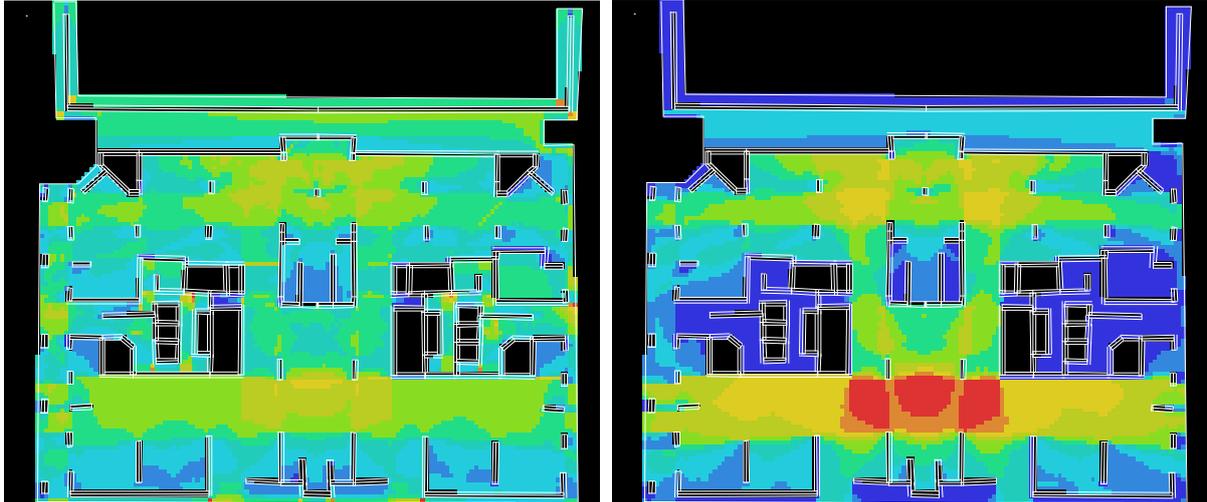
**Figure 21: Analytical diagram of the integration degree of the single building in the residential part of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 22: Analysis on the Coefficient of Horizon Clustering of Single Buildings in Residential Build-ings of EDF. VA IONG (Image source: Drawn by the author)**

The two buildings of EDF. VA IONG have a high concentration of sight in the middle virtual space, As shown in Figure 20-21, the elevator shaft and stairs of the core of the building, the main bedroom area on the south side of the B and F units, and the master bedroom area on the north of the C and G units and their respective areas. The area of apartment-type toilets. And the second bedroom area of D and H units. There is an external balcony in the main bedroom area of the apartment, which has better lighting. When people study and live in the bed-room, they are more willing to go to the balcony to watch the external scenery and breathe fresh air. In the exterior of the apartment, the elevator entrance area, due to work and school, there will be more crowds during peak periods. From the point of view of a single building, the place with the highest concentration of sight is still in the elevator entrance corridor, and extends into each apartment space to the door of the four households. The areas with a higher degree of inte-gration are concentrated in the living rooms of each household, and the color distribution is more uniform. The places with the highest concentration coefficient of view are concentrated in public elevators, fire stairs, and the main and secondary bedrooms of each household. These areas gather more people, and the line of sight in the space system is less oppressed.

## V. ANALYSIS of CONTROL VALUE and CONNECTIVITY of HORIZON

The visual field control value is used to analyze the visual connection degree and the external space characteristics of the dormitory. The public space is used as the research object, the closed area of the building is taken as the boundary, and the spatial connection degree within a certain area is measured as a measure, which can reflect the EDF. VA IONG. The accessibility of the overall interior space. The viewing area control value is roughly the same as the axis control value, and the area of the current neighbourhood relative to the total area of the immediate neighbourhood is calculated. The field of view control value helps to highlight the area where the observer can see the larger view of the spatial layout.

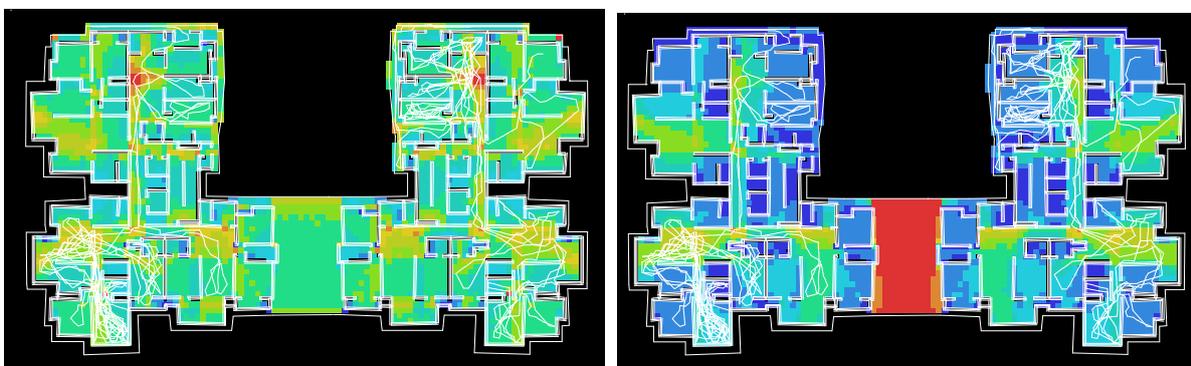


**Figure 22: Analysis of the control value of the horizon of the first floor plan of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 23: Connection analysis of the first floor plan of EDF. VA IONG (Image source: Drawn by the author)**

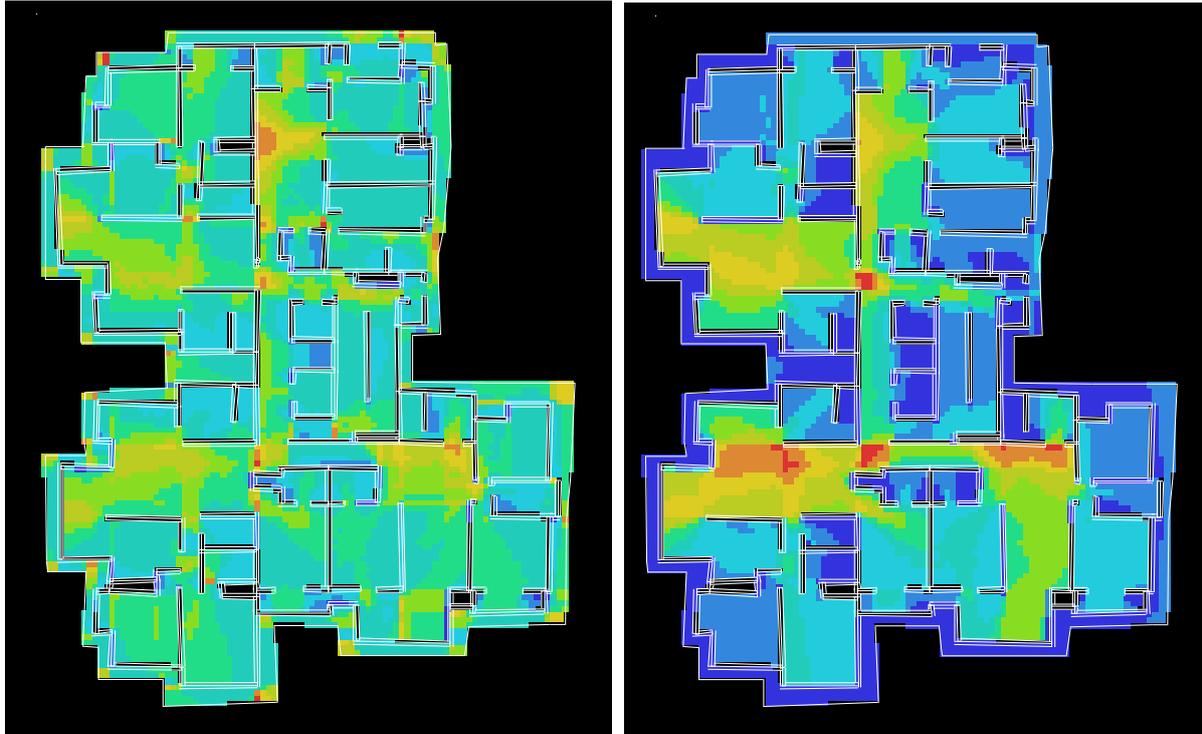
From the analysis, it can be seen 22-23 that the trend of the control value of the viewing area and the change of the viewing area connection degree in the first floor plan is basically the same, only the spatial changes are slightly different. In terms of the overall view control value, the first-floor level of Huarong Building has a relatively close spatial connection, a relatively spacious space, a larger area of each shop, and higher accessibility. The highest area is at the fourth entrance of the south entrance of the plane, the area on the north side of the escalator, the location of the shops on the south side, and some locations in the corridors on the left and right sides. In terms of the overall view connection, the highest position is at the fourth entrance of the south entrance, and the higher position is at the fourth entrance, extending to the shops on the left and right sides. Side shops extend. The accessibility of these places is strong, and there are more people passing through in a certain period of time.

In the residential part of EDF. VA IONG, As shown in Figure 24-25, the areas where the control value and the connection value of the visual field of the two buildings are higher are in the corridor of the core tube, the location of each hall, and the north and south sides of the virtual space. From the standpoint of a single building, the place with the highest view control value and view connection value is at the entrance of each household, and the higher place is still in the core tube corridor, A, B, C, D, The living room where E, F, G enter the home. The changing trend of the single building is the same as the changing trend of the two building aggregates.



**Figure 24: Analytical diagram of view control value of two buildings in twin towers of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 25: Analytical diagram of the view connection degree of the two buildings of the twin towers of EDF. VA IONG (Image source: Drawn by the author)**



**Figure 26: Analytical diagram of view control value of Single Buildings in Residential Buildings of EDF. VA IONG (Image source: Drawn by the author)**

**Figure 27: Analytical diagram of the view connection degree of Single Buildings in Residential Buildings of EDF. VA IONG (Image source: Drawn by the author)**

Therefore, in the future update of the plan, As shown in Figure 26-27, some conspicuous signs can be set up at the entrance of the store, and the colour matching and graphic design should also follow the principles of "people-oriented" and "adjusting measures to local conditions". "Adapt to local conditions" means to make a LOGO suitable for the store itself according to the nature of the business. Corresponding display panels are set up on the walls of the two sides of the corridor near the store to introduce the business scope of the store itself, face to the crowd, business hours, etc., to attract more people Understand the nature of shops, produce items that meet people's "taste" and "taste", satisfy more consumers, enhance the commercial value of shops, and create more benefits for people. For the upper-floor units, in areas with high control value of the visual field outside the units, such as corridors, we can set up signs here to walk in different directions to prevent residents from walking the wrong way. We can also set up a bulletin board here to change news every day so that more people can learn about local news. Set up a comment column next to it, and you can also put forward some of your own opinions on the property in the community. In the living room inside the space, the residents themselves can renovate their living room according to their conditions, turning their home into a warm family.

## VI. VISUAL DEPTH ANALYSIS of EDF. VA IONG

The visual depth represents the accessibility between one element and other elements in an open space. The total number of times the line of sight needs to be turned. The lower the visual depth value, the less the line of sight in this space can see the space system. The other elements in, the more it can attract people's attention in this direction, and vice versa, it is not easy to attract people's attention. The analysis reflects the relevant characteristics of the public space on the commercial floors of EDF. VA IONG.

It can be seen Figure 28 from the plane of the first floor that the visual depth is generally low, and the places with higher visual depth are in the corridors and stairs of the core tube area on the left and right sides, which means that the line of sight can see the space system after less turning in the plane. Other elements in the shop include five shops and the corridor area outside the shops. These areas are highly interconnected, with four shops having a larger area and one shop having a smaller area. At the same time, the corridor also has a wider width, people can observe a wider range of things in any position of these areas, and there are more elements. The places with higher visual depth are concentrated in the corridor of the core tube. The area is small. People can observe a narrow range here. There are fewer types of elements observed. The line of sight is divided by the walls on both sides and the corners on the front side. Restrictions, so no more things can be observed.

On the other hand, As shown in Figure 29-30, the two buildings of EDF. VA IONG have low visual depth in the middle virtual space, the core tube corridor, the entrance of the apartment and the living room. The living room is the area with the largest area of the whole apartment, and the internal space is more accessible. The scope of observation is wider and more elements than the master bedroom, secondary bedroom and bathroom. For a single building, the value calculated by the space syntax is basically the same in color as the two buildings. The area with a lower visual depth is based on the core tube corridor and the living room, and the outer balcony is added. For the master bedroom of the A and E types, the master bedroom and the second bedroom of the D and H types, there are more space elements observed in these areas, and the space accessibility is stronger.

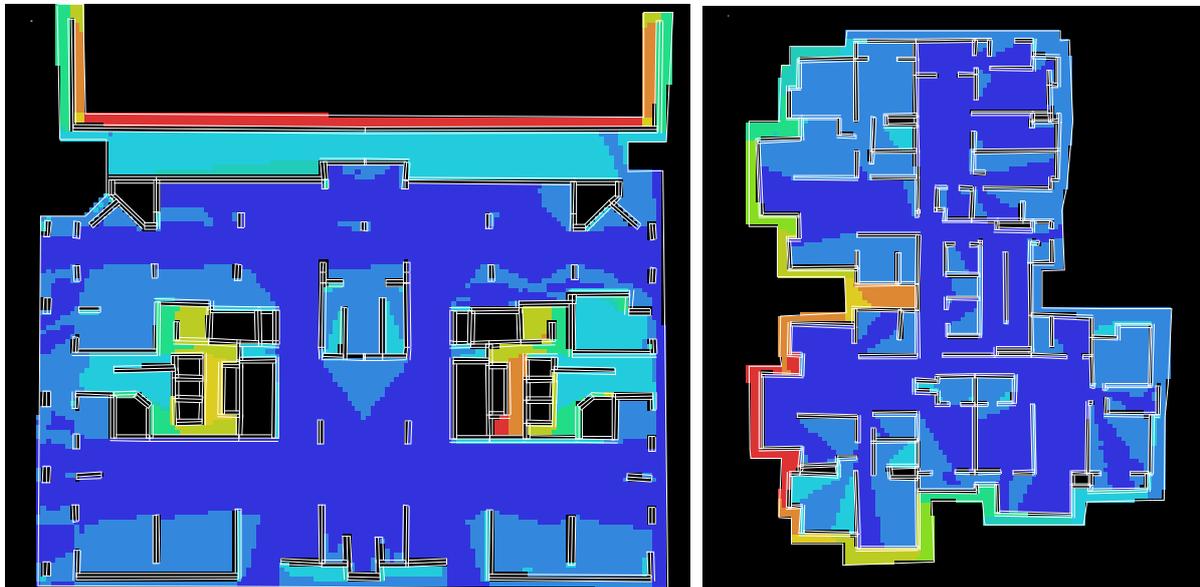


Figure 28: Visual depth analysis of the first floor plan of EDF. VA IONG (Image source: Drawn by the author)

Figure 29: Visual depth analysis of Single Buildings in Residential Buildings of EDF. VA IONG (Image source: Drawn by the author)

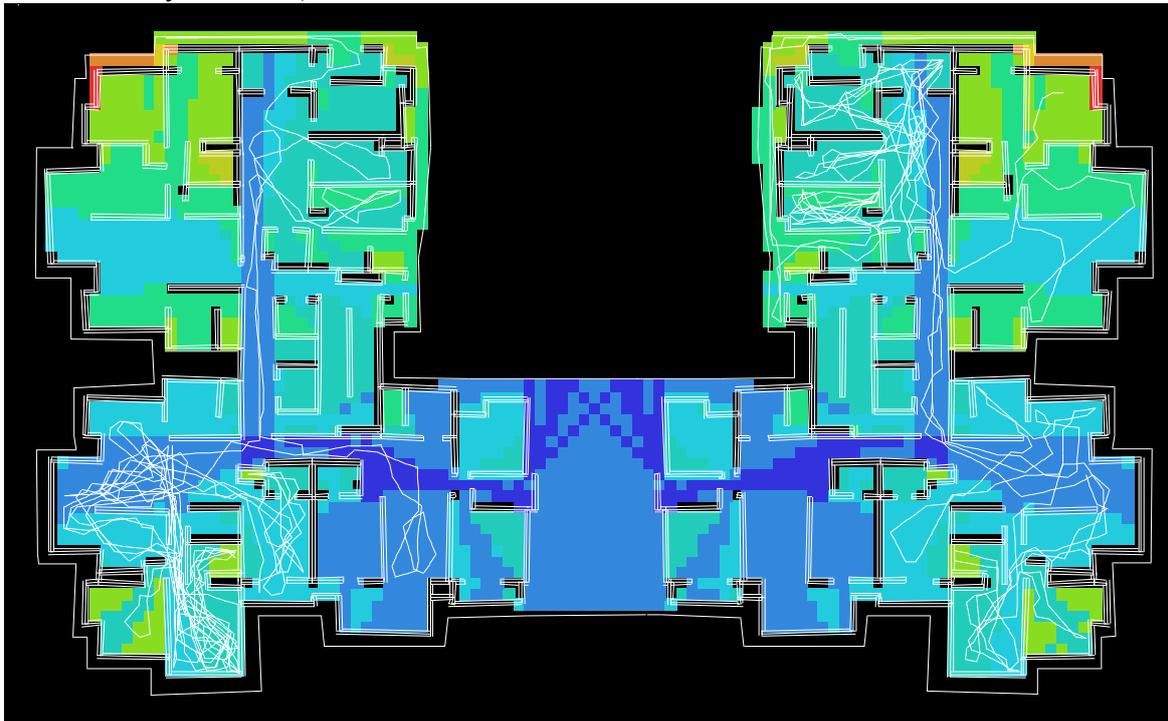


Figure 30: Visual depth analysis of of the two buildings of the twin towers of EDF. VA IONG (Image source: Drawn by the author)

## VII. CONCLUSION

EDF. VA IONG represents a typical commercial and residential building in Macau in the late 1980s, and it has had certain defects since its use. Analyze the topological values of the building's overall integration degree, local integration degree, global depth and selectivity through the technical means of space syntax. It is recommended that the places with the highest concentration coefficient of view are concentrated in public elevators, fire stairways, and main bedrooms of each household. And in the secondary bedroom, pay attention to regular maintenance and improvement of the disaster prevention system, pay attention to the evacuation of the flow of people, and at the same time enhance the indoor identification system for navigation. In the residential part of the two buildings, the area where the control value and the connection value of the view are higher is in the corridor of the core tube. In the future plan update, some conspicuous signs, colors and planes can be set up at the entrance of the store. The design should also follow the principles of "people-oriented" and "adjusting measures to local conditions". According to the nature of the business, make LOGO suitable for the store itself, and set up corresponding display panels on the walls near the shops on both sides of the corridor to introduce the business scope of the store itself, facing the crowd, and operating hours, so as to further enhance the commercial value of the store and provide people Create more benefits.

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