

# INTERCEDER: THE INTERSECTION OF INTELLIGENCE AND INFRASTRUCTURE

Ar. Shivani Gaikwad

Principal Architect,

Modulus. Arch Design Studio, India

## ABSTRACT

Fulfillment of Basic needs has always played the role of accelerator for the development of human settlements. These necessities have been variable for the evolution of the settlements and affecting the morphology of the urban sprawl. The Industrial Revolution is considered as the era of change. This gave rise to new ideas, interesting art and a new meaning to the social structures. The inventions like wheel and electricity had encouraged people to delve in the search of new territories. Forcing such discoveries over their maximum limits lead to the invention of aircrafts. Different routes were explored by the humans, different combinations of transportation were tried, and trade business was initiated. Advancement and innovations in transport mediums have always aided the emergence of successful urban habitats. Conventionally metro cities consist of all means of transportation both for people and goods. With Strategic planning and use of efficient tools flawless transitions is possible in the cities like Tokyo, London etc. But they are also exposed to rapid growth results being unstable logistics. Thus, it becomes important to study the future of "Future Cities". Introducing a new element creates a response that modifies the already existing elements. Logistics is one such element that affects the economy and shapes the infrastructure of the place. The research aims at proposing a new urban sprawl in the form of an Aerotropolis. The proposed aerotropolis will not only fulfil the standard demands of an aerotropolis town but will cater global trade. The Research aims to use computational platforms and parametric logics to design a system-based program. Specific parameters from different urban components are derived which would be used as an input to generate different iterations for an efficiently working urban system. Implementation of this system is demonstrated on a site.

**KEYWORDS:** Trade Routes, Urban Sprawl, Urban System, Parametric Logics, Efficiency

## INTRODUCTION

The Initiation of a new component causes a reaction that alters existing components in an area. Logistics plays an important role in smoothing the infrastructure of a city and directly affects its economy. Since E Commerce business has been quickly growing and estimated to grow even more. It also becomes a key factor on altering the shape of global logistics industry. Even though there is advancement in technology the rate of supply of any commodity is not as rapid as expected majorly due to lack of appropriate network system in various parts of the world. Amalgamation of logistics and E Commerce with proper global network system will together act as a resolving element for enhancing delivery accuracy, delivery frequency and delivery time. The airport is where the global meets local. Considering the proximities between major transit nodes as a variable parameter, secondary nodes will be manipulated and hence the area confined between them will vary. The network system between various nodes and its intra link as well as inter link connectivity will be developed in such a way that it acts as an interceder in terms of global and local trade. The developed network system along with zones will directly affect the socio economic and socio technical aspect of the sprawl. A commodity is a basic good used in E Commerce that is interchangeable with other commodities of the same type. Goods are most often used as inputs in the production of other goods or services. The quality of a given goods may differ slightly, but it is essentially uniform across producers. When they are traded on an exchange, goods must also meet specified minimum standards, also known as basic grade. The basic idea is that there is little differentiation between a commodity coming from one producer and the same commodity coming from another producer. An oil

container is basically the same produce, regardless of the producer. On the contrary, for electronics products, the quality and elements of a product may be totally different depending on the producer. Some conventional forms of goods include grains, gold, oil and natural gas. More lately the meaning has expanded to include financial products, such as foreign currencies and indexes. Technological advances have resulted in newfound modes of goods being exchanged in the marketplace. Logistics play a very important role in acquiring these resources and transporting it to their final destination. Our Aerotropolis will act as an interceder in terms of logistics and E Commerce in order to ease the global trade.

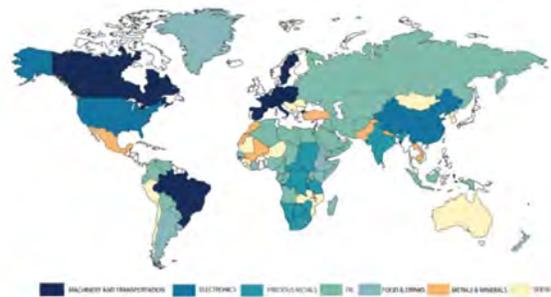


Figure 1: Major World Commodities  
(Illustration: Author)

## DISTRIBUTION NETWORK OF E COMMERCE

Considering the Evolution of Retail, it is observed that the earlier in 1900's there use to be a corner store at the chowks of the local colonies. Increase in the demands and the rise in the population gave rise to departmental and general stores.

During this a standard distribution network was followed in which the goods were produced by the producers then shipped to the distribution centers and then distributed to the nearest retail shops according to the need. Due to invention of internet, and advancement in technology a shift was observed from conventional retail to E Commerce. Due to this a change was seen in the distribution network where in the goods are produced by the producers then shipped to the distribution centers. These distribution networks then have a network hub and data centers which analyze the information of the consumers and then work in respect to pre shipping, prediction of failure of delivery of goods and even takes care about the automated shipment from the closet hub.



Figure 3: Distribution network before E Commerce (Illustration: Author)

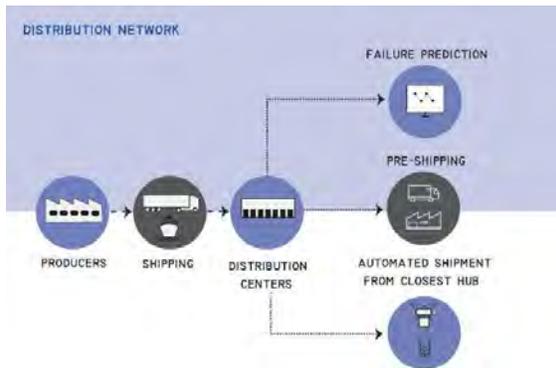


Figure 4: Distribution network after E Commerce (Illustration: Author)

**Inferences for Infrastructural Requirements**

A port is a place of exchange of goods or passengers between ships or between ships and land transport vehicle. Dundovic and Kesic have defined the port as natural or manmade harbor on the sea, river, canal or lake, where ships find shelter from waves, currents, tides and ice, shelter from hostile action or attacks, a place providing bunkering, fresh water and provisions. New function of seaports: Logistics and distribution a place for repairs on the hull, engines and gear, or for cleaning all the parts thereof, a place for safe and fast discharge, loading or re loading of cargo and passengers, and a place allowing the crew to rest and relax.

As is the case with every type of transportation, a variety of factors influence long-term success at cargo airports – employee accomplishment, technological advancements, risk management and many others. But the old motto regarding success always applies location.



Figure 5 Infrastructural Requirements (Illustration: Author)

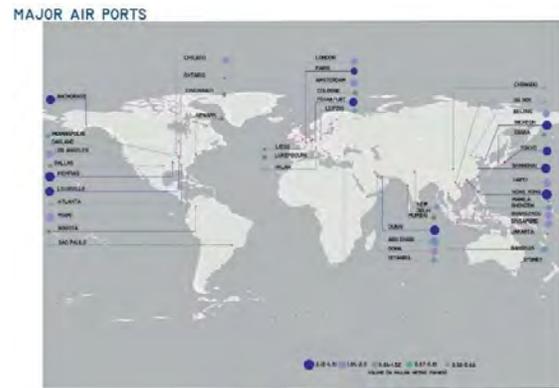


Figure 6: Major Airports (Illustration: Author)

Trade lanes are studied. There are two kinds of trade in lanes first is the mainline path which connects the countries horizontally. And diagonal paths which connects vertically.



Figure 7 Trade Lanes (Illustration: Author)

In present logistics and trade chain management, a new purpose, the logistical and distributional purpose has joined the conventional group of functions. Remarkably, the seaports are interim not only as the fact of management or refilling the things on their transportation path, but also as logistical and distributional foci, and hence the progress of the logistical and distributional purpose within the seaports goes back to the late 80’s of the previous century, when business people started to seek new formation facilities with acceptable internal infrastructure, connections with the inland territory.

MAJOR SEA PORTS

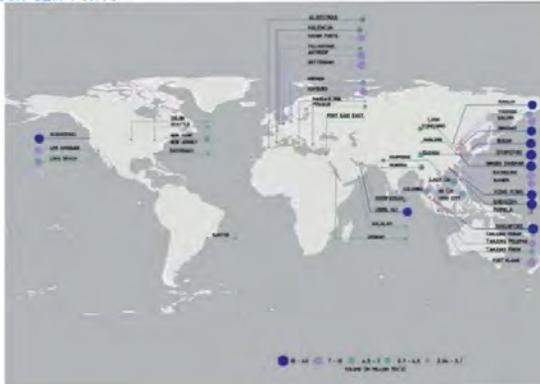


Figure 8 Major Sea Ports (Illustration: Author)

Such logistical and distributional centers are organizations coordinating the activities or services for one or several supply chains from the point of origin to the point of destination, adding new value to the commodities in this process. Distance between major nodes and their proportion is extracted and a threshold is derived for generating an algorithm. The interconnectivity of secondary nodes with respect to major nodes and their respective areas are taken into consideration for generation of algorithm expression. Major Connectivity is between seaport, airport and railways, secondary networks are formed between major nodes and secondary nodes. Further tertiary networks are formed between remaining secondary nodes. Major nodes are further categorized considering the basic programmatic distribution.

PROGRAMMATIC DISTRIBUTION

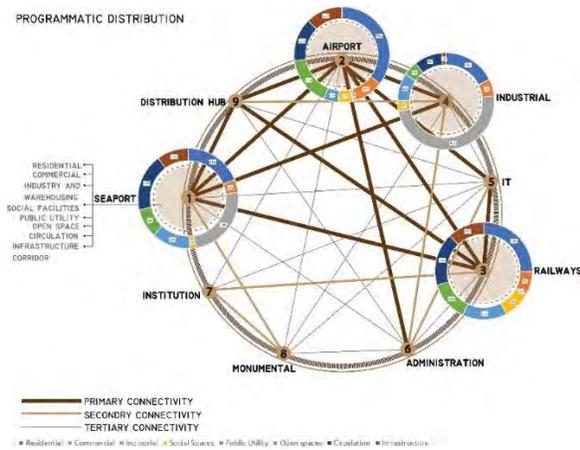


Figure 10: Network Pattern (Source: Author)

**Development of Algorithm**

Airport, Seaport, Railways are considered as the major nodes of the city. Proximity between airport and seaport is considered as a variable X a triangular geometry is generated with these three nodes proximity between railway station and seaport as well as railway station and airport is in a particular proportion with respect to proximity between airport and seaport. In circle hence formed between the major nodes is dedicated to CBD. Node for distribution hub is a secondary node which is placed in such a way that it connects the major nodes. Industrial node lies in the close proximity to the airport

and distribution node. Node for the information technology is positioned such that its proportion lies in a close proximity to the railway station. The administrative node lies in a close proximity to airport, so as to develop an easy transport network for the officials. Since the city is acting as an interceder network pattern was studied for flow of goods. From Hong Kong goods are exported to Singapore and Busan. They are further exported to other countries and hence such decentralized network is formed. After studying the network pattern Singapore was chosen in terms of import and export of goods. And it was observed that Singapore imports maximum goods from Asian countries. Asian countries also lead in terms of exports followed by Europe and US.

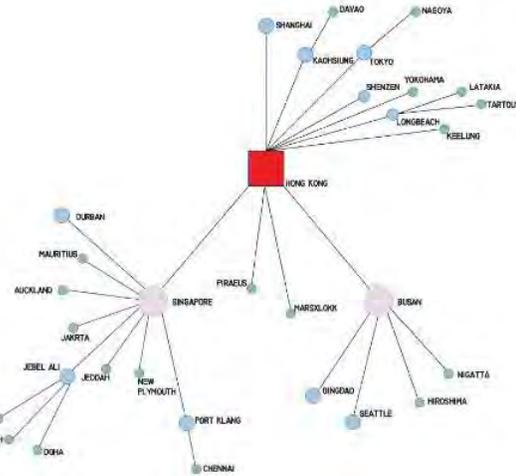


Figure 11 Network Pattern (Source: Author)

**INFERENCE FROM MAPPING**

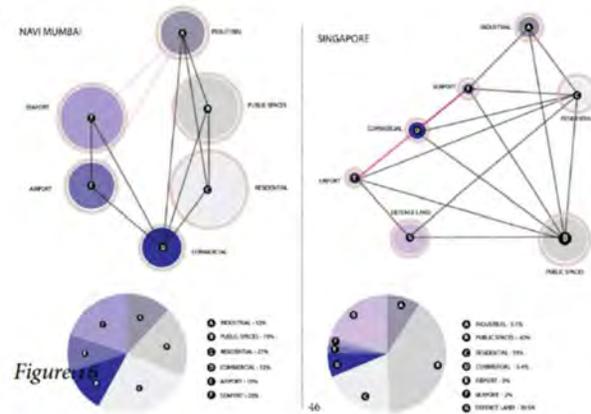


Figure 12: Interconnectivity (Source: Author)

After Studying the network pattern of Singapore in terms of import and export of goods. While Navi Mumbai was studied for the network connectivity and infrastructural requirements for E- Commerce. After Mapping of Singapore and Navi Mumbai some parameters were extracted, area of major connecting nodes, proximity between major connecting nodes and their interconnectivity.

PROPORTION OF SIZES	DIAGRAM	AREA OF CBD (A1)	AREA OF INDUSTRIAL ZONE (A2)	AREA OF IT (A3)	AREA OF ADMIN (A4)	AREA OF INSTITUTIONAL ZONE (A5)	AREA OF PUBLIC ZONE (A6)	AREA OF RESIDENTIAL ZONE (A7)	AREA OF MIXED USE DEVELOPMENT (A8)
0.8A		0.18	0.4	0.55	0.08	0.05	0.078	0.08	0.03
0.8A		0.21	0.4	0.54	0.09	0.06	0.082	0.082	0.07
1.2A		0.16	0.4	0.64	0.08	0.09	0.4	0.07	0.03
0.6A		0.25	0.4	0.54	0.09	0.08	0.09	0.07	0.05
0.6A		0.34	0.4	0.49	0.07	0.12	0.09	0.05	0.05
0.6A		0.24	0.4	0.56	0.09	0.08	0.09	0.07	0.07

Figure 13: Catalogue (Source: Author)

A boundary condition of 3.8 sq. kms is assumed along the coastline. Also, airport lies in the range of 0-15 kms. Seaport and airport are considered on the adjacent side. The distance between them varies. The intervention of these areas within the site varies. The zone of seaport is 10% within the site, whereas airport lies at a certain distance. By the implementation of Algorithmic zoning the zones are formed. Various iterations are generated in this case as well.

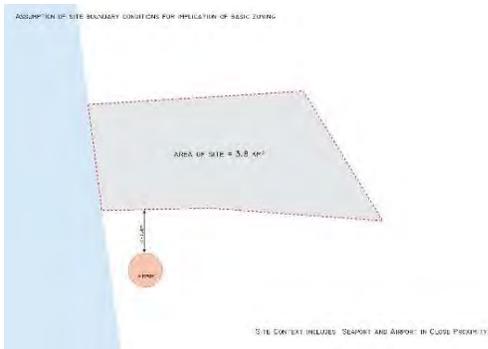


Figure 14: Boundary Conditions (Source: Author)

The monumental node is positioned in such a way that it connects railway station and seaport. Industrial zone is confined between airport, seaport, distribution node and industrial node. Zone for IT is confined between railway station, IT Node and also lies in the close proximity to CBD. Institutional Zone is confined between railway station, institutional node and this zone lies in the close proximity to monumental node. Admin zone is developed near airport. Public promenades are developed on the periphery of the waterfront and is confined between monumental node and seaport. Residential zones are developed and distributed in such a way that they serve all the other major zones. Mixed use development happens between the three major nodes and periphery of CBD. These are the iterations generated by manipulating the proportion of the proximity between railway station and seaport as well as railway station and airport with respect to airport and seaport. Accordingly, the proportions of areas are variable. On the bases of the ideal range a particular iteration was selected so as to demonstrate on site. The areas of these zones fall into the ideal range that were extracted from the mapping of two cities. Thus, the width of highways is 36 meters, that of

primary road is 30 meters and secondary roads is 24 meters. Strategy for further sub dividing that resulted in formation of tertiary networks is similar to major zoning which is the radian pattern so as to ease the connectivity.

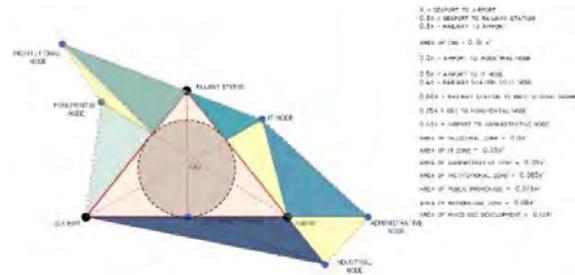


Figure 15 Generated Algorithm (Source: Author)

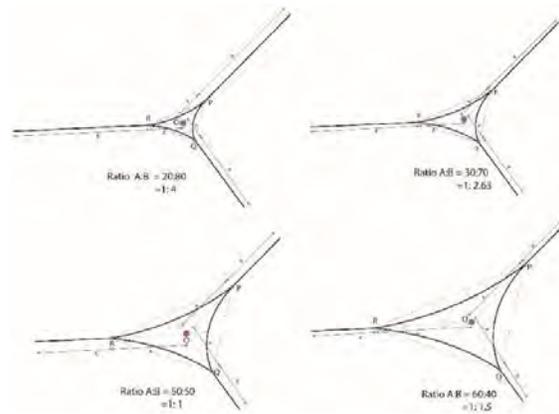


Figure 16 Development of Nodes (Source: Author)

The secondary roads and various junctions are formed considering the turning radius. At several nodes radial links are diverged and are further segmented in a particular proportion. A central triangle is formed by joining these midpoints and the length of the curves formed is always greater than the length of its side. Various options were generated for enhancing the spatial qualities at the junctions. Tertiary roads are developed on the basis of walkability distance.

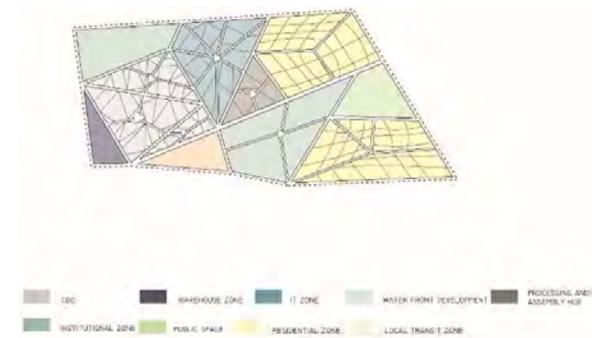


Figure 17 Zoning and Road Network (Source: Author)

Multiple iterations were generated of the system. Out of which option three is selected on the bases of the areas

confined by different zones herewith. Warehouse is placed between seaport and airport which also connects to the local transit node so as to ease the trading of oil as our major commodity. Major import and export of oil take places through seaport, and then it is stored in the warehouses which is further exported via roadways and railways that lies on the major periphery of the site boundary. Now through warehouse a vertical link is set for the export E Goods, which connects to automated tracks. Hyper loop is proposed for passengers on level one for intercity linkages. Vehicular movement is through roadways on level zero. Level minus one is dedicated for metro as an intracity connectivity for the passengers. This level also consists of pedestrian from metro station to centre node between major zones.

PROPORTION OF ZONES (M <sup>2</sup> )	DIAGRAM	AREA OF CBD	AREA OF WAREHOUSE ZONE	AREA OF IT ZONE	AREA OF PUBLIC PROMENADE	AREA OF INSTITUTIONAL ZONE	AREA OF PUBLIC ZONE	AREA OF RESIDENTIAL ZONE	AREA OF LOCAL TRANSIT ZONE
1.4 1.2		0.28 50.00 m <sup>2</sup>	0.07 10.00 m <sup>2</sup>	1.01 10.00 m <sup>2</sup>	0.16 10.00 m <sup>2</sup>	0.18 10.00 m <sup>2</sup>	0.12 10.00 m <sup>2</sup>	0.06 10.00 m <sup>2</sup>	0.02 10.00 m <sup>2</sup>
1.2 1.2		1.0 50.00 m <sup>2</sup>	0.9 50.00 m <sup>2</sup>	0.16 10.00 m <sup>2</sup>	0.03 10.00 m <sup>2</sup>	0.41 50.00 m <sup>2</sup>	0.27 10.00 m <sup>2</sup>	0.80 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>
1.0 1.2		0.0 10.00 m <sup>2</sup>	0.0 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.03 10.00 m <sup>2</sup>	0.03 10.00 m <sup>2</sup>	0.24 10.00 m <sup>2</sup>	0.18 10.00 m <sup>2</sup>	0.17 10.00 m <sup>2</sup>
1.0 1.0		0.0 10.00 m <sup>2</sup>	0.0 10.00 m <sup>2</sup>	1.04 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.03 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.07 10.00 m <sup>2</sup>	0.07 10.00 m <sup>2</sup>
1.0 1.0		0.04 10.00 m <sup>2</sup>	0.0 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.04 10.00 m <sup>2</sup>	0.07 10.00 m <sup>2</sup>	0.07 10.00 m <sup>2</sup>

Figure 18 Iterations of zoning on the selected site. (Source: Author)



Figure 19 Secondary Road Networking (Source: Author)

At the centre of every major zone a transit terminal is placed that is the vertical link between level minus one and zero. From these transit terminals secondary networks are diverging radially, then each zone are sub divided into different number of divisions that gives minimum and maximum areas of each zone after sub dividing, the area acts as selection criteria for the sub dividing strategy.

**FINDINGS**

**Site selection**

Considering the two topmost commodities that were studied and mapped the five major producers of oil where in Russia and Abu Dhabi. Russia has a total area of 17.1 million sq. kms, and it produces 80% of oil. Where in it

exports 45% and consumes up to 35%. Abu Dhabi produces 60% oil out of which 15% is consumed and rest is exported. Thus, the seaport which export maximum amount of oil to different countries like China, Japan, Korea etc. Major export of oil from Abu Dhabi takes place through Jebbel Ali seaport to other major cities. These are the major trade lanes of oil. Through which the major areas of oil trading were mapped. Similarly, the five major producers of electronics were mapped in which China is the major producer of electronics and import good to other major cities. Then the major areas of selected commodity were thus mapped and overlapped. Then future megapolis were mapped. Considering the requirements of our system which is a coastal line, two areas were selected which are Lagos in Nigeria and Dar-es-salam in Tanzania.



Figure 20 Site Selection (Source: Author)

Seaport and airport are considered on the adjacent side. The distance between them varies. The intervention of these areas within our site varies. The zone of seaport is 10% within the site, whereas airport lies at a certain distance. By the implementation of Algorithmic zoning the zones are formed. Various iterations are generated in this case as well.



Figure 21 Site Demonstration (Source: Author)

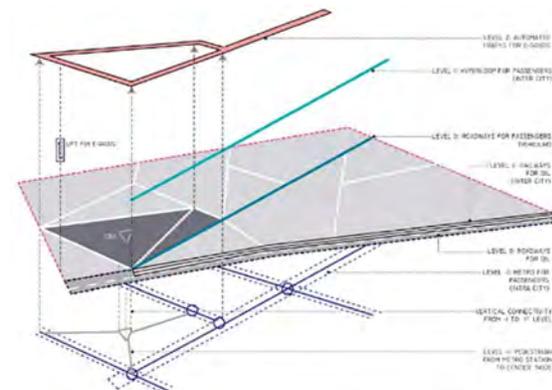


Figure 22 Vertical Connectivity (Source: Author)

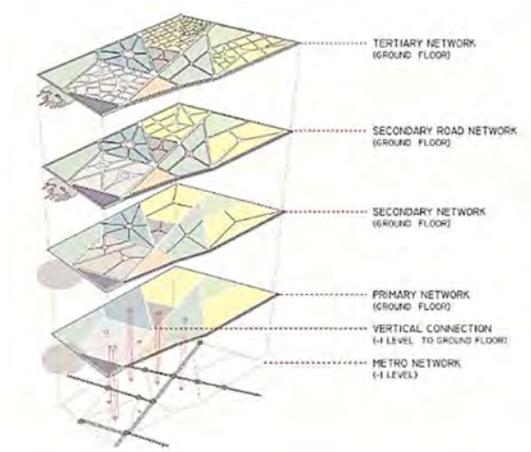


Figure 23 Network Connectivity (Source: Author)

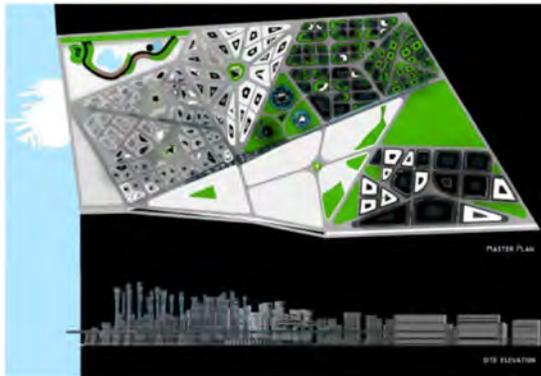


Figure 24 Master Plan (Source: Author)

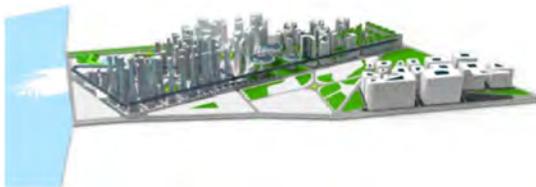


Figure 25 Site View (Source: Author)

REFERENCES

- <https://planningtank.com/settlement-geography/aerotropolis>
- <https://www.investopedia.com/terms/c/commodity.asp>
- <https://atlas.media.mit.edu/en/profile/country/chn/>
- <https://www.forbes.com/sites/jaysondemers/2016/04/18/7-predictions-for-how-the-internet-will-change-over-the-next-15-years>
- <https://www.bloomidea.com/en/blog/types-e-commerce>
- [https://www.tutorialspoint.com/e-commerce/e\\_commerce\\_b2b\\_.htm](https://www.tutorialspoint.com/e-commerce/e_commerce_b2b_.htm)
- [https://en.wikipedia.org/wiki/Internet\\_of\\_things](https://en.wikipedia.org/wiki/Internet_of_things)
- *Promet-traffic-traffico*, Vol. 15, 2003, No. 1, 1-5 I. Jakomin: *New Function of Seaports: Logistics and Distribution*.

CONCLUSION

In the project the attempt was to answer the questions on what the infrastructural requirements of E-Commerce are. The methodology suggested was a system thinking, a quite new approach. Learnings from the overall process were the basic tool of system designing by mapping the areas and the city environment with the scope to understand the complexity of the urban system, and the major co relations among the wide range of components. We agree in the fact that this method suits well for analyzing the behavior or urban sprawl, because it includes tools very useful to understand the paradigm of the system, the mindset, and the flow of its components. The combination of all range of interventions such as urban growth limit, major infrastructural transport changes, increasing density, connectivity and mixed land use within existing districts, neighborhoods, society management of the nearest urban environment etc. Would improve the quality of life and the overall sustainability.