

Case Study of “ Tegel Circulation Loop” by Technical University Berlin, Germany

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Abstract. Along with the accelerated development of urbanization process, makes many airports originally located in the outskirts begin to be gradually surrounded by city. How to renovation and reuse of the old airport effectively and reasonably, and alleviate the contradiction between the airport and urban development, will become an important problem needs to be solved of many contemporary urban designs. The paper applying “Tegel Circulation Loop” airport renovation project as an example, considers the various problems faced by the modern city comprehensively, and uses the radial structure of “Laboratory of City Construction“, which mixed concept and technique of smart city and combined with the airport infrastructure, in order to put forward beneficial enlightenment for the problem, and provide feasibility of airport reconstruction paradigm of other cities.

The Tegel Airport (Berlin-Tegel Flughafen) is located in the northwest Berlin, Germany, due to its capacity limit, will be closed in the next few years. To transform the airport area and promote the urban development, Germany launched its “Future Tegel - The Urban Tech Republic” design contest in August 2011, which aims to establish a research and production comprehensive park to gather residents, students and researchers, so as to approach the urban planning of Berlin in the future and create an unsurpassable ideal metropolis.

As the launched group stated: *“Any academic field is an universe for itself, but when together will provide a galaxy for human beings.”* (Original: *Jeder einzelne Bereich ist ein kosmos für sich. Aber zusammen bieten Sie galaktische Möglichkeiten.*) It’s not overly difficult to see: how to attract and gather all kinds of professional and not professional by planning to develop this region is the important foundation of this project. On top of this, it will build on the city through integrating different techniques from energy, transportation, water recycle and resources; and strengthen urban effect from new material and intelligent information and communication technology. The technology, information, people and so on will interweave in the project, thereby forming the city as a whole network, to improve and promote the urban development.

Specifically, this design project more emphasizes on developing new and renewable natural energy to reduce carbon dioxide emission and alleviate urban pollution; developing and promoting electric vehicles to reactivate traffic system; developing the water recycle system to save water resource; testing and developing material circulatory system to save all kinds of resources and reduce waste costs; introducing and developing information and communication technology and smart grid to monitor traffic and energy flow; developing hardware and software network, to promote the development of smart city in a more effective and ecological way in the future.

The Sustainable Urban Planning and Urban Design in Architecture, Environment and Planning Institute, Technical University of Berlin opened design studio in winter semester 2012 with the theme of this renovation project, which sets out from gist and requirements of the competition, to discuss how to blend the smart city concepts and technologies into the actual urban renovation project. And “Tegel Circulation Loop“ is more prominent design in the studio, which focuses on the transformation in and around Tegel area, while through its core design “Laboratory of City Construction“ reforms and develops Tegel area, to attract and gather all kinds of people; sets up

new energy system, to change the whole energy environment; strengthens and improves urban structure from water purification, resource circulation, electric vehicle, smart traffic and information network. Meanwhile it expands view to the whole Berlin, to change it from deep. Here, the transformation of Tegel area will serve as an incubator for cities in the 21st century, to reactivate the original airport infrastructure and surrounding forgotten areas. Thereby, it tries to reform Berlin as the new hot spot for the European capital city and be a representative work of international urban development.

Basis of “Laboratory of City Construction“

Nowadays movement is the biggest characteristic of people’s lifestyle, as well as people are also the biggest carrier of the city movement. Different people have different lifestyle, so they will take different choices, accumulate different experience and create only their own tiny cities. These tiny cities can be same or different or mixed; city is a complex that based on tiny cities that a minimum unit in the city; in this complex system, can also produce many crossing points, that is, the gathering point of different people. (Fig.1)

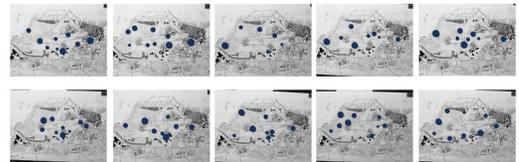


Fig.1. Analysis of residents’ activities in different time in Berlin Tegel

Using youth Mr. as an example: he gets up at 7:00 everyday; 9:30 goes to fitness; 13:00 to the library; 15:00 discusses with professors about the work; 16:00 exercises in the football club; 18:00 to the exhibition ... His life is his own tiny city which will at the same time interweave with tiny cities of fitness enthusiasts, students, professors, athletes, academics and so on. These mixed tiny cities will together form a complex system, and then the city.

The future Tegel area will be based on the gathering of different people to reform and develop, so studying the tiny cities of all kinds of people constitutes the foundation of “Laboratory of City Construction“. The “Laboratory of City Construction“ can not only provide corresponding facilities for the residents in the future, such as energy and traffic systems; but also support and help people to choose their own lifestyles and then form unique tiny cities. While it promotes to develop a new free, equal, open and interconnected new urban strategy, in order to propel the further development of the urban construction in the 21st century forward.

Overall architecture of “Laboratory of City Construction“

The future urban development should not start from easily filling the planning with construction, but structure it through a new system that built by countless “small parts”, which come from the deconstruction of the city. The “Laboratory of City Construction“ is an urban structure based on the mentioned idea of urban planning. (Fig. 2)

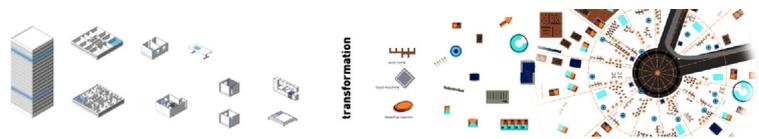
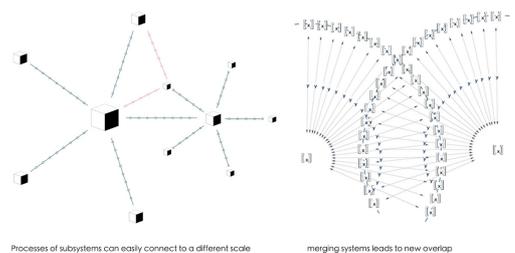


Fig.2. Concept of Laboratory of City Construction

The “small parts” in the “Laboratory of City Construction“ come through deconstructing the functions and components of city and architecture. So it can be a window, a wall; a generator, a water purifier; a room, a functional combination; green space, square ... However, these successive parts are not suitable for modern smart city, they need to merge with new materials, new energy and new technology to improve themselves, and then through new combination (e.g. the building facades use photosensitive material to regulate the room climate) to form new system.



Processes of subsystems can easily connect to a different scale merging systems leads to new overlap

Fig.3. Relationship among the systems in „Laboratory of City Construction“

Many “small parts” in the traditional city often form single scale buildings with single function, and scatter everywhere in the city; while the future cities need fast and efficient lifestyle. As a result,

smart city that can at the same time meet all demands of different people will be the development tendency in the future. The “Laboratory of City Construction“ develops new buildings with different scale and functions by free combination, in order to provide selectivity as much as possible for all kinds of people, which can increase the crossing points of their life tracks and improve gathering possibilities in architecture.

Building parts and their combination need a reasonable city structure for its placement to better coordinate the urban space. But the Tegel airport has a closed hexagon structure, which limits its communication with the surrounding space and the traffic convenience so that the gathering possibility greatly reduces and seriously influences the urban development. The “Laboratory of City Construction“ should find a more suitable structure to change this condition. In many types of urban structure, radial form is just the most suitable structure to meet the demand. So the “Laboratory of City Construction“ uses this radial structure to organize architecture and traffic system, which can increase traffic convenience through radial and ring road system; the public space that people need as the core, the building scale and functions raise gradually from center to outside. However, it cannot only depend on the radial structure to completely realize the connection and communication between different buildings, urban space and so on; in addition, building parts need to combine with the new material and technology, the city should also be introduced a variety of systems and increase connection from deep (Here means the loop of information, water, energy, etc. in the building and public space.) This is not only for a single radial structure, but also the connection among some radial structures. Based on repeated growth of this structure, the city will gradually be being perfected. (Fig.3)

Systems of “Laboratory of City Construction“

The core of “Laboratory of City Construction“ is new energy system, and the information network as the auxiliary, so as to coordinate the energy production and demand in the whole area, to reduce the carbon dioxide emission and alleviate the greenhouse effect. The future Tegel area will give up traditional energy forms, instead, solar and biological energy as basic energy resources. The solar umbrellas are located in the central public space, which collect and convert the sunlight into electricity that supplied through the smart grid to all buildings. The biogas for domestic use is unified supplied by biogas production facility. The radial structure has CHP system, which can almost not release carbon dioxide, meanwhile coordinate and control the conversion between heat and electricity. Every building is equipped with heat pumps, which can provide 70% of heat in a whole year. The heat pumps use solar energy in summer; the cooling system and CHP system combine with each other and are controlled by heat pumps. Among the radial structures can find the smart grid that feeds back and coordinates energy production and demand at any time (Fig. 4).

In the “Laboratory of City Construction“, the new traffic system is established on the existing roads and the “Drive-in Airport” traffic system, with radial and circle roads to develop bicycle rental and dedicated high-way; the electric cars and charging points are set in the converge points, aim to reduce automobile exhaust; combine with social network and carpooling system to promote green travel. The whole urban structure through reasonable and complete traffic system can increase the communication among the urban space and traffic convenience, so as to make same reachability in every different urban space and effectively promote gathering of all different people.

In addition, “Laboratory of City Construction“ also set up urban agriculture system to guarantee food safety; rainwater collection and treatment system to save water resource; green ecological corridor to regulate urban environment and climate; material study and recycle system to save resources and so on. All kinds of systems connect and coordinate with each other to form a complete facilities network and promote a complete and reasonable urban development.

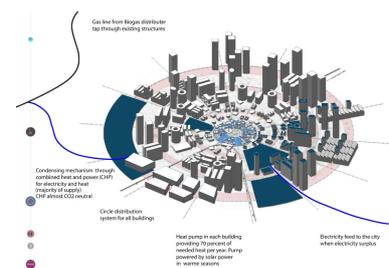


Fig.4. Energy system in Laboratory of City Construction

“Laboratory of City Construction” as an incubator of Berlin development

Tegel area, which developed through “Laboratory of City Construction“, will grow up with a basic unit that constructed by radial structure of “Laboratory of City Construction“. The solar umbrellas that located in the center, urban public spaces and public buildings play as the starting point of the construction of this radial structure unit; and then part of radial structure begins to construct, including residential buildings and infrastructure (roads, bus stations, smart grid, etc.); after that, take the constructed part for example, to gradually complete other parts of radial structure.

On the basis of unit construction and analysis of situation about Tegel airport and surrounding areas, the radial structure unit with special function as a core will be gradually implanted at the same time in three direction: north, west and south. And the core function can be culture, education, production, research... Meanwhile, all radial structures are connected by infrastructure, to expand from center to outside continually. The implanted radial structure will be an incubator of Tegel renovation, to promote function transform and continue the regional charm.

“Laboratory of City Construction“puts the Tegel airport and surrounding areas as experimental area that as an incubator of Berlin in the future, to expand in the whole city. This includes not only the development of radial structure and systems in unconstructed area, but also in completed areas, where should referring to new buildings, energy and traffic system to renovate and rebuild. In this way, it can reactive those forgotten areas and stimulate vitality of urban development in the future.

Conclusion

The design “Tegel Circulation Loop“ of Architecture, Environment and Planning Institute in Technical University of Berlin, at the theme of airport renovation, reforms and develops Tegel area through its core design “Laboratory of City Construction“, to attract all kinds of people; it sets up energy, traffic, water and other kinds systems, to change the whole energy environment in Tegel area; also enhances and perfects urban structure from other aspects, such as water purification, resource recycling, electric transportation, smart information network and so on. Meanwhile “Laboratory of City Construction“ as an incubator expands the development to the whole Berlin, to increase city vitality and development from deep. Through the analysis about “Tegel Circulation Loop“, it helps to provide a feasible guide to other old airports renovation; to provide experiences and references to release contradictions between airport and urban development; in addition, to promote reasonable and effective urbanization in the future.

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