

Research on Potential Disaster Risk & Countermeasures in China's Coastal Rapid Urbanization Area

(Research on potential disaster risk and Countermeasures in China's coastal rapid urbanization area——From National Level to Local Level)

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The coastal cities of China are in the fragile and sensitive zone of the interaction between sea and land. On the one hand, it is affected by sea and land complex disasters, including floods, typhoons, tsunamis, storm surges, and sand storm. On the other hand, due to rapid urbanization, urban heat island effect, the urban system lead to climate change, and take its negative effects. It is affected by haze, ecological degradation of wetland and serious waterlogging and other disasters.

The national development and Reform Commission (NDRC) introduced *The National Adaptation to Climate Change Strategy* in 2013, requiring all cities to carry out their work and strengthen risk management. To establish the mechanism of risk assessment and information sharing for climate change, to formulate measures for disaster risk management and to deal with it, to carry out the feasibility demonstration of the countermeasures and to improve the management level of climate change risk. China's coastal cities have launched a series of explorations to tackle climate change. For example, the pilot demonstration projects are carried out for the increase of extreme weather and climate events in Shanghai and the rise of sea level, with the emphasis on the revision of meteorological and marine disaster protection standards and the construction of supporting facilities, so as to promote the experience of strengthening the capacity of the large cities to strengthen the basic facilities for extreme weather and climate events. In the urban planning and construction, the climate change factors are fully considered, and the urban protection standards are revised. The meteorological disaster protection standards for Shanghai's urban flood control, drainage, power supply, water supply, gas supply and communication infrastructure are revised, and the existing and built infrastructure are reformed according to the new standard. For example, the pilot demonstration projects are carried out on the problems of typhoon and storm tide in Guangdong, which are more complex and more serious, in order to strengthen the monitoring and early warning and risk management of urban disasters, reduce the impact of disasters, and promote the experience of the emergency system construction of urban defense extreme weather and climate events. Typhoon monitoring and warning, perfect satellite, radar, marine buoy, coastal ocean station, ground meteorological station, emergency mobile observation facilities and so on, the typhoon monitoring system, the research and development of typhoon numerical forecasting and comprehensive prediction technology system, enhance the typhoon warning and forecasting ability, and strengthen the timely release of Typhoon Information. We should improve the response mechanism of typhoon emergency command and social linkage, establish a multi department cooperation emergency defense system, prepare the plan for the urban defense typhoon, and carry out to the school, street, community and so on, and popularize the prevention of typhoon knowledge to the public.

To this end, China's coastal cities adapt themselves to climate change from three aspects, alleviate internal and external troubles and increase urban flexibility. This paper takes the coastal urban of Tianjin as an example to illustrate the practice and exploration of adapting to climate change from the state to the place.

- 1. First, according to the change of coastline, we should plan and construct dike facilities, and do well in flood control planning. Design “Sponge City”, build low impact development rainwater system, enhance resilience of urban adaptation to climate change, and eliminate hidden dangers of urban waterlogging.**

1.1 To increase the sea level

1.1.1 Coastline protection and utilization management measures at national level

China's coastline from north to South stretches 18 thousand kilometers, carrying China's economic, social and ecological functions. *The 2017 China Sea Surface Bulletin* of China's State Oceanic Administration shows that China's coastal sea level changes are generally fluctuating upward trend. From 1980 to 2017, China's coastal sea level rise rate was 3.3 mm / year, higher than the global average of the same period. Under the background of global climate change, from 1980 to 2017, the coastal air temperature and sea surface temperature showed an upward trend, and the air pressure showed a downward trend, and sea level showed an upward trend. The communique will be the year-round period from 1993 to 2011. In 2017, the sea-level changes in coastal areas of China are characterized by obvious regional variations. The sea level in Bohai, the Yellow Sea, the East China Sea and the South China Sea is 42 millimeters, 23 millimeters, 66 millimeters and 100 millimeters, respectively. In 2017, the temperature and sea surface temperature in China's coastal areas were 0.90 and 0.77 degrees higher than that of the whole year. The air pressure was 40 PPA higher than that of the whole year, and the sea level was 58 mm higher than that of the whole year.

The communique pointed out that the coastal cities in China should strengthen the ecological and social economic problems arising from the rise of sea level from the aspects of ensuring the development of the marine economy, promoting the construction of the marine ecological civilization and participating in the global marine governance. To this end, the State Oceanic Administration issued the "coastline protection and utilization management measures". As the first coastline regulation promulgated by China, the natural coastline is clearly included in the marine ecological red line control. By 2020, the retention rate of natural coastline will not be less than 35%. The method strengthened the hard measures for the protection of the coastline. According to the natural resource conditions and development degree of the coastline, the coastline is divided into three categories: strict protection, restricted development and optimal utilization, and the requirements for classification management and control are put forward. At the same time, in order to fully implement the control target of the conservation rate of natural shoreline of the mainland is not less than 35%, the Municipal Department of marine administration has formulated the annual plan for the conservation and utilization of natural shoreline in the province. Strict red line management will strictly protect the coastline into the red line management of ecological protection.

The report points out that in the face of rising sea level, we should enhance the ability of disaster prevention and reduction. The overall layout of coastal cities, municipal and infrastructure planning and design should be one of the basis for the impact of sea level rise, and the planning and location of emergency shelter and relief materials reserve in coastal cities should be kept safe distance from the sea level rising risk area. According to the trend of coastal sea level change, it is necessary to re check coastal cities' flood control and moisture-proof capacity. At the same time, the ecological protection and restoration of the coastal zone are carried out. The ecological resources such as coastal mangroves, swamps and reeds are protected by means of land relocation and Naturalization of shore lines, and the potential risk assessment of sea level rise to important coastal ecosystems is carried out. The management of water resources in coastal zone should be strengthened to further control overexploitation of groundwater and ground subsidence in coastal areas, reduce the rise of relative sea level, and reduce the harm of salt tide, seawater intrusion and soil salinization.

1.1.2 Protection and utilization of coastline at the local level: a case study of Tianjin

According to the evaluation results of Tianjin Binhai New Area Sea Level Impact Assessment that Tianjin Binhai New Area is affected the fragile area by the rising sea levels and storm surge. With the rising of sea level, the existing levee facilities defense ability will gradually decline. In not to consider the current embankment in facilities, all kinds of water have different degrees of influence to Tianjin coastal. Rising sea levels, the existing levee facilities of Tianjin Binhai New Area can withstand mean high tide. Fewer than half of the existing levee facilities can withstand historical highest tide level and high water level of once-in-a-century. The expected future 30 years, Tianjin coastal sea level will rise than throughout the year 76 ~ 150 mm. In 2030, rising sea levels predict height and high water level of once-in-a-century for reference, in were considered existing embankment and without considering embankment, the influence of land area ratio were 19.1% and 36.4% respectively; the influence of the population were 10.74% and 47.80% respectively; the influence of GDP were 20.11% and 39.24% respectively. According to prediction results the sea level fluctuation, rising sea levels will not only aggravate storm surge disaster and the threat of flood disaster, but also increased the seawater intrusion of coastal and soil salinization degree.

Sea Level Rise Scenario Simulation

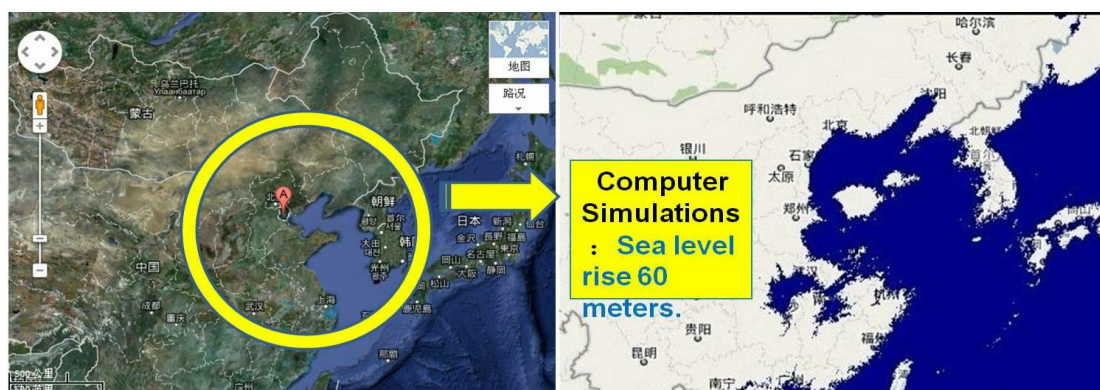


Figure 1: Sea Level Rise Scenario Simulation

The coastline of Tianjin belongs to the typical muddy coast. Its characteristics are: the coast is straight, the slope is gentle, the landform type is relatively simple, the tidal flat is broad and flat. In the past hundred years, the coastal zone of the west coast of Bohai Bay has been relatively active due to natural and human activities. Although this change remains a "slow change" category, the potential deterioration of the geological environment in this zone will reduce the ability to resist the impact of storm surge, sea surface rise, ground subsidence and so on. According to the research, the coastal dikes will continue to sink in the future. By 2050, the levee in the Hangu District of Binhai New Area will lose the ability to resist the storm surge and become a potentially serious dangerous dike.

According to Tianjin coastal sea level change affects characteristics, it is advisable to take the following measures. In the further strengthen land subsidence monitoring, strengthening wai reclamation domain land subsidence monitoring, reasonable planning layout, effectively reduce the amplitude of ground settlement. According to the shoreline changes to planning and construction of embankment facilities, strengthening circumference fill coast section of the coast protection, rising sea levels and reduce the influence of storm surge disaster, such as, guarantee the sustainable economic and social development.

Tianjin land subsidence monitoring system

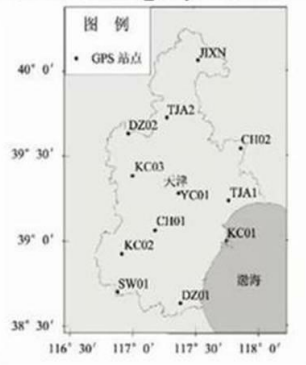
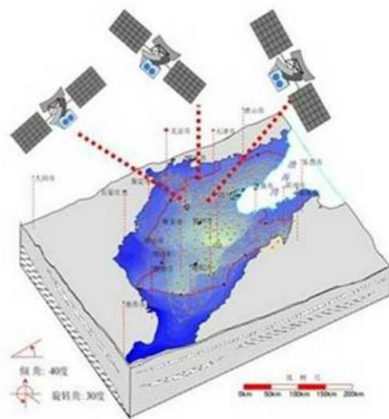
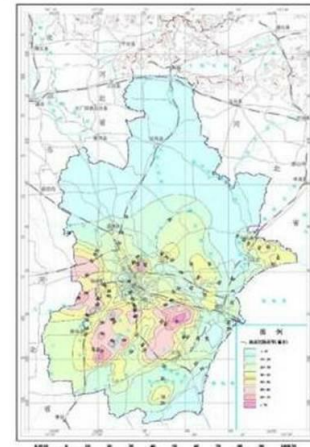


图1 天津市 GPS 连续站分布图
ig.1 Distribution of continuous GPS stations in Tianjin

Tianjin land subsidence rate chart



requirement of the construction of the city is strictly controlled in the examination of the construction drawings, the construction license and the completion and acceptance; the third point is to improve the standard standard. We should pay close attention to revising and perfecting the standards and standards related to the construction of sponge cities; the fourth point is to promote the construction of sponge cities in new and old cities. Since 2015, the new urban area should fully implement the requirements for the construction of the sponge city. The old urban area should combine the shanty area and the urban and rural housing reform, the old district organic renewal and so on, in order to solve the urban waterlogging, rainwater collection and utilization, the control of the black odor water body as the breakthrough, promote the regional overall governance, and gradually realize the rain, no water, heavy rain and no inside. The waterlogging, the water body is not black, the heat island is relieved. The establishment of a project reserve system should be avoided; the fifth point is to promote sponge type building and related infrastructure construction. Spongy building and community, spongy road and square should be promoted, the construction of waterlogging prevention and waterlogging facilities in urban areas and the renovation of waterlogging points are promoted, and the rain and pollution diversion is carried out, and the rainwater storage facilities are scientifically laid out; the sixth point is to promote the park green space construction and natural ecological restoration. Spongy parks and green spaces should be promoted to absorb their own rainwater and provide space for stormwater storage in surrounding areas. To strengthen the protection and ecological restoration of water bodies in urban ponds, rivers, lakes and wetlands.

1.2.2 The exploration of “sponge city” design at the local level - Tianjin Binhai New Area as an example

First, we should build an ecological network and build a good circulation water system. A number of ecological corridors are planned in the Binhai New Area, and the construction and improvement of the greenway and river channels make the original relatively independent ecological protection areas and reservoirs organically integrated. Through sewage interception, filtration, ecological bank laying, water biological cultivation, construction of artificial wetlands and other technical means to purify the water body, relying on the dredging and dredging of river channels to communicate with the water system.

Second is the special plan to reflect the low impact development. Including green space system, transportation system, water system, environmental protection, comprehensive disaster prevention, infrastructure planning and so on. All the special departments do their jobs and cooperate with each other to build a "sponge city". For example, water system planning involves elements such as water supply, water saving, sewage, drainage, blue line and so on. Green network planning should construct green network to permeate, store, purify and circulate the rainwater runoff in the green space itself and its surrounding area, and connect with the urban rainwater irrigation system.

Third is rainwater utilization and circulation. The rainwater collection is mainly used in green roof and permeable ground, and the utilization rate of water in urban area is greatly improved through purification as a living water, fire water and emergency water. The planning and design of urban water environment, the arrangement of surface runoff, the construction of linear landscape ecological corridor, the construction of ecological control facilities for rainwater quality, such as rainwater garden and detained land, and the construction of diversified ecological treatment and transmission systems, such as grass gully and ecological drainage belt.

Pattern and functional zoning of sponge in central Tianjin and Binhai New Area



Figure 3: Pattern & Functional Zoning of Sponge in Tianjin Central & Binhai New Area

2. Second, by delineating the urban ecological control line, planning the growth boundary of cities, establishing the control area between two cities, and so on, so as to curb the disorder of urban sprawl and wetland degradation.

2.1 Delineate the urban ecological control line and plan the growth boundary

The first specific measures is the delineation of urban growth boundary, reducing the total loss of urban ecological land, especially to prevent the loss of natural ecological land. From 2005 to 2010, the Tianjin ecological land 64% dropped to 61% accounted for the total land area. Among the artificial ecological land increases 153.3km², however, the natural ecological land decreases 499.6km², loss of mostly lands are wetlands. Loss of land is mostly used for urban development and construction. In order to reduce the impact of urban development, human disturbance of the ecological land, as well as to coordinate the conflict between conservation and development we propose to urban build land area must not exceed 45% of the total land area in 2020.



Figure 4: Plan The Urban Ecological Control Line and Plan The Growth Boundary

2.2 Planning and control between two cities and building a green barrier

The middle area of Tianjin Binhai New Area and central urban area is close to the core area of Binhai New Area. It is about 6 kilometers from the outer ring line of the central city, and the area is 736 square kilometers. The regional natural landscape is unique and the human characteristics are rich. It is an important corridor of two parts of the north and South ecological areas connected to the seven Li sea - Dahuang fort and the League of the League of the north port water reservoir. Area. However, with the acceleration of urbanization in our

city, the contradiction between ecological protection and urban expansion is becoming increasingly apparent. To this end, the "Shuangcheng intermediate planning control program" has been compiled, and the middle zone of Shuangcheng is divided into three levels of control and control, of which 61% area is divided into the first level control area, emphasizing the strict prohibit of construction. The "control plan" has realized the green space of the two cities in Binhai New Area and central city, expanding the green space of the city, strengthening the planning and control of the middle area of the Binhai New Area and central urban area, avoiding the blind expansion of the city, and improving the ecological environment of the urban.

2.3 Connecting city landscape

Another specific measure is to determine the landscape elements of urban central and suburban areas, their landscape connectivity, and optimize the specific objectives of landscape ecology. It aims to plan the most effective landscape pattern to solve the problems of safety and health, and to maintain the ecological process of the land, the historical and cultural process, and the recreation process of the limited land area. The basic structure is composed of patches, corridors and Malik. Landscape connectivity refers to the spatial structure relationship among landscape elements. By connecting and extending patches, corridors and matrixes in space, and continuously enhancing the relationship between the functions of various landscape elements and ecological processes. Combined with the characteristics of urban natural resources, we plan to build six country parks. Each park is planned to have an area of about 500 hectares. Intertwined together, relying on the main rivers and lakes, forming five wedge-shaped corridors, planning annulus ecological zones and four ecological zones. Control the adjacent development of the city, guide the formation of the surrounding ecological groups, and promote the construction of the landscape ecological security pattern.

3. Third, through the ventilation corridor planning, planning around the city park and country parks, encourage the sharing of bicycles and low carbon travel, "fresh air action", construction of wind break and sand fixation forest and other measures to adjust the urban microclimate, reduce fog and haze, reduce carbon emissions and reduce dust.

3.1 To set up a list of greenhouse gas emissions

Based on the analysis of the composition of greenhouse gases in Tianjin, the data of greenhouse gas emissions in 2005, 2010 and 2015 were collected, including carbon dioxide (ten thousand tons), methane (ten thousand tons), Nitrous Oxide (ten thousand tons), fluorocarbon (10000 tons), perfluorocarbon (ten thousand tons), six sulfur fluoride (ten thousand tons), and greenhouse gas (10000 tons). Ton equivalent) etc. The emission of greenhouse gases in Tianjin shows that fossil fuel combustion is the main source of greenhouse gas in our city, while carbon emissions per capita and carbon emissions per unit of GDP are also significantly higher. According to the data, the proportion of industrial carbon dioxide emissions accounts for about 85% of the direct emissions. Transportation is the second major source of carbon dioxide emissions in our city, accounting for about 10% of the direct emissions, and 10.2% of the direct emissions. The amount of forestry carbon absorption in our city accounts for only 0.3% of the total amount of greenhouse gas emissions in the city. Therefore, by changing the way of energy utilization and improving the efficiency of energy utilization through the way of urban development, it is of great practical significance to increase the carbon sequestration by improving the land use mode and expanding the affore station area to reduce the carbon emission level of the city through the development of low carbon traffic.

3.2 Visual analysis of spatial distribution of greenhouse gas emissions

Combining the development of Tianjin built-up area, population density of Tianjin, building density, two or three industry energy consumption and greenhouse gas emission data, transportation greenhouse gas emission, forestry carbon sequestration and other factors, using satellite remote sensing and GIS and other technical means, the visualization analysis of Tianjin city space greenhouse gas emission grid is analyzed and researched. Study. According to the analysis results, the estimation hypothesis of greenhouse gas emission is established, and the target of Tianjin zoning emission reduction is put forward: the carbon emission control targets are determined by 2020, and the carbon emission intensity in Binhai New Area, Dongli District, Xiqing District, Jinnan District, Ninghe area and Jinghai area decreased by 22% respectively, Beichen District, Wuqing area, Baodi area and Ji Zhou District respectively. Down 21%, Heping District, Hedong District, Hexi District, Nankai District, Hebei District and Hongqiao decreased by 20% respectively. The total amount of carbon emissions is effectively controlled. The energy and industrial structure have been further optimized. The emission of greenhouse gases in key areas, such as industry, agriculture, urban and rural construction, transportation and transportation, has achieved remarkable results. By 2020, the carbon dioxide emissions per unit area of GDP decreased by 20.5% than in 2015, and the carbon emissions of the whole city reached their peak value in 2025 and so, steel and electric power and other lines. The industry is the first to reach the peak.

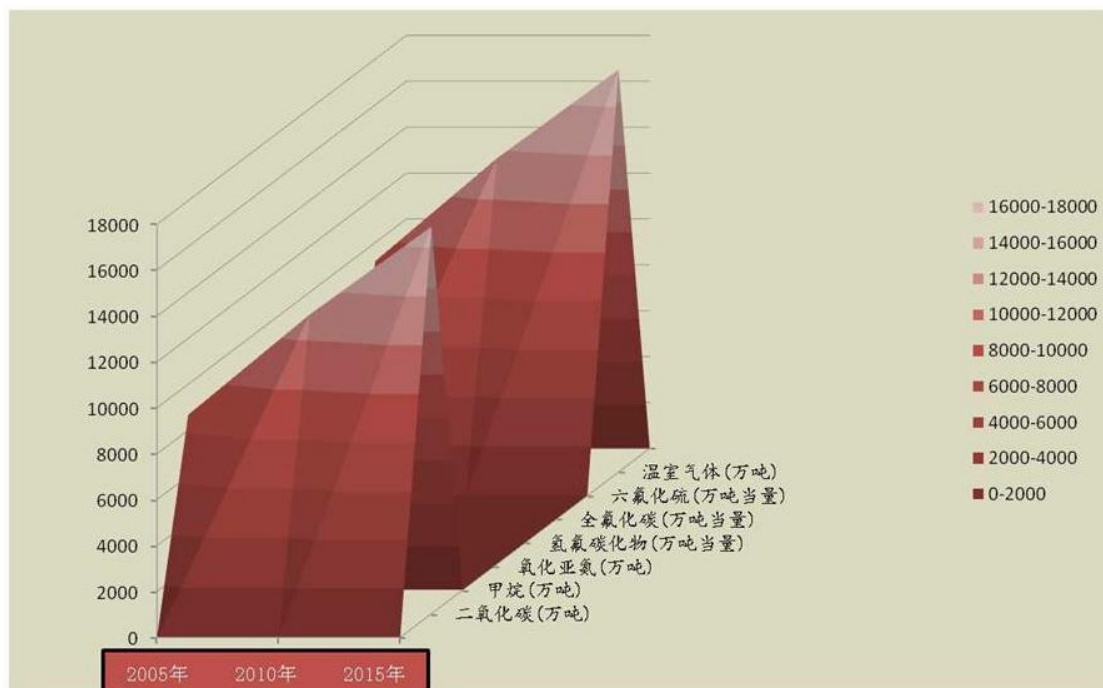


Figure 5: Analysis of Greenhouse Gas Emission in Tianjin

3.3 Slow traffic system planning combined with the internet sharing bicycle and real-time bus positioning query system.

"Slow traffic system" refers to the slow travel mode as the main body of urban traffic such as the pedestrian, the sharing bicycle, etc. To guide residents use the travel ways by "walk/bicycle + bus/ subway" to relieve the traffic congestion situation and reduce vehicle exhaust pollution. In China's first tier cities, with the acceleration of the pace of life, the demand for understanding when the bus will arrive is increasing. As the largest bus public transport facilities, has become one of the indispensable tools for people to travel, and join the real-time concept, to enable the public to improve travel efficiency, avoid long time waiting at the bus station. The real-time bus location query system is combined with bicycle travel to better optimize the commuting time of the public. Subway and bus system of the

urban is perfect, but the "last mile" problem can not be solved perfectly. Bicycles that are excellent in short distance travel just make up for defects at the end of the traffic. In the past one or two years, sharing bicycles has gained rapid popularity, especially in large and medium cities. Sharing the bike ride into four categories, it can be seen that most cyclists are separated by a distance from the bus stop, so they choose to share the bike. For example, the dynamic display of cycling hot spots by shared bicycle, in May 26, 2017, Tianjin, China. Early, medium and late, three car peak hours, sharing bike trip, much public trust. It has played an active role in solving the "last mile" of residents travel and promoting green travel. According to statistics, after sharing the bike, the number of car trips decreased by 55%.

The Travel Ways From The Community To The Workplace

Bicycle + Bus/Subway



Bicycle



Bus + Bicycle + Bus



Bus/Subway + Bicycle



Figure 6: The Travel Ways From The Community To Workplace

In May 26, 2017, Tianjin, China, the dynamic display of cycling hot spots by shared bicycle

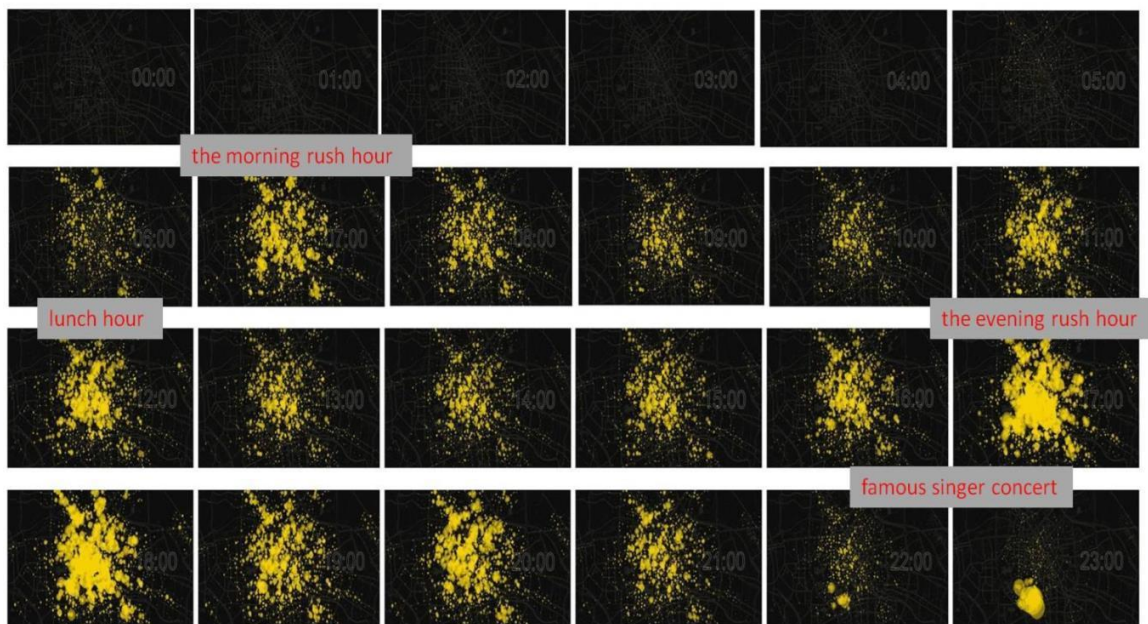


Figure 7: Cycling Hot Spots by Shared Bicycle

3.4 Fresh air action

Since 2013, Tianjin has launched a clean air campaign and formulated the clean air action plan. The first plan is that by 2017, the annual average concentration of PM_{2.5} in Tianjin decreased by 25% on the basis of 2012. Two, coal consumption decreased by 10 million tons in 2012 over five years. So far, the effect is remarkable. On the one hand, coal control is the main action of Tianjin. Coal gas is the basic idea of coal control in Tianjin. The first step of the coal cutting plan in Tianjin is to build the largest gas heating unit in the country and move all the coal-fired power plants in the urban area to a new gas power plant. 163 boiler houses in Tianjin will be completed to coal to gas. In addition to coal control, vehicle control, dust control, industrial environmental pollution control and control of environmental access are also important aspects of haze control in Tianjin. On the other hand, in urban planning, in order to adjust the urban microclimate, the ventilation corridor planning, the planning of the city park and country park, the construction of wind and sand and sand fixation forest



Figure 8: Ventilation Corridor Planning and Circular Park and Country Park Planning